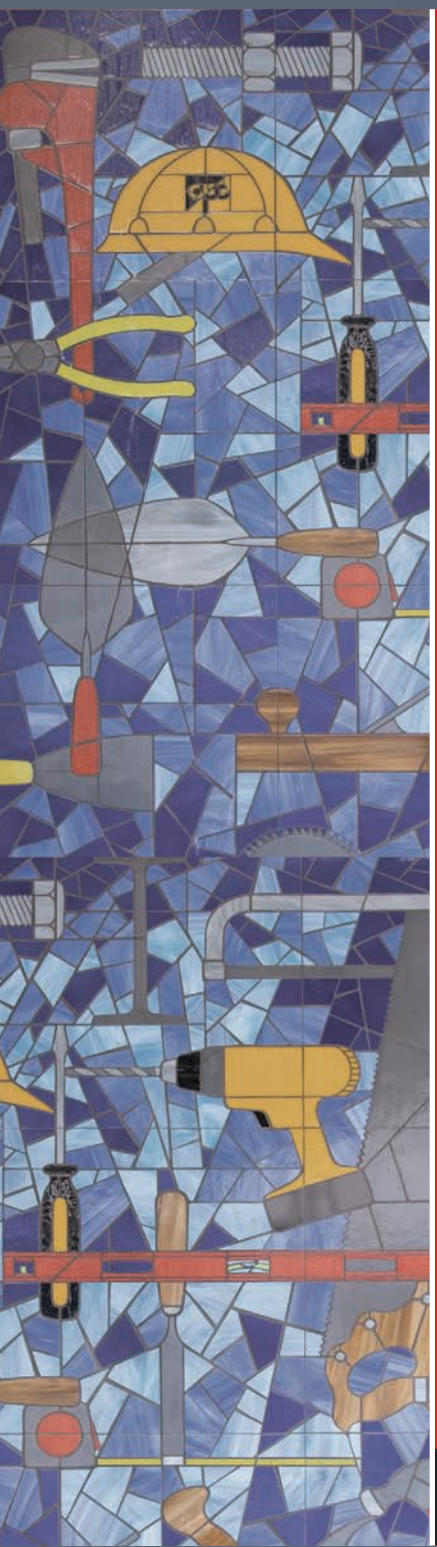
00109-15

Introduction to Material Handling



Core Curriculum

Lesson Plans for Instructors

Module Nine

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Lesson Plans for Module 00109-15
Introduction to Material Handling

Module Nine (00109-15) provides safety guidelines for workers handling materials on the job site. It covers proper procedures and techniques to use when lifting, stacking, transporting, and unloading materials. It also introduces basic motorized and non-motorized material-handling equipment commonly found in the construction environment.

Objectives

Learning Objective 1

- Describe the basic concepts of material handling and common safety precautions.
  a. Describe the basic concepts of material handling and manual lifting.
  b. Identify common material-handling safety precautions.
  c. Identify and describe how to tie knots commonly used in material handling.

Learning Objective 2

- Identify various types of material handling equipment and describe how they are used.
  a. Identify non-motorized material-handling equipment and describe how they are used.
  b. Identify motorized material-handling equipment and describe how they are used.

Performance Tasks

Performance Task 1 (Learning Objective 1)

- Demonstrate safe manual lifting techniques.

Performance Task 2 (Learning Objective 1)

- Demonstrate how to tie two of the following common knots:
  – Square
  – Bowline
  – Half hitch
  – Clove hitch

Teaching Time: 5 hours

(Two 2.5-Hour Classroom Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites

Core Curriculum Modules 00101-15 through 00105-15; 00107-15; and 00108-15.

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 time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from **www.nccerirc.com**. The passing score for submission into NCCER's Registry is 70% or above for the written examination; performance testing is graded pass or fail.

Safety Considerations

During the course of this module, trainees may be in the vicinity of electrical energy sources and potentially hazardous tools, equipment, and materials. In those instances, trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to the hazards associated with the energy sources, tools, equipment, and materials.

Classroom Equipment and Materials

Whiteboard/chalkboard

Markers/chalk

Pencils and paper

Core Curriculum PowerPoint® Presentations

DVD player

LCD projector and screen

Computer

Internet access during class (*optional*)

Copies of the Module Examination and Performance Profile Sheets

The following items are optional:

- Video resource(s) on proper lifting techniques
- A safety harness and positioning belt with lanyard
- Video resource(s) demonstrating how to tie common knots

Equipment and Materials for Laboratories and Performance Testing

Appropriate PPE:

- Standard eye protection
- Work gloves

Objects for manual lifting

Several pairs of rope sections of suitable length and equal diameter for tying knots

Common objects (rings, bars, posts, poles, etc.) around which knots can be tied

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Materials Handling Handbook, The American Society of Mechanical Engineers (ASME) and The International Material Management Society (IMMS), Raymond A. Kulwiec, Editor-in-Chief. 1985. New York, NY: Wiley-Interscience.

Manufacturing Facilities Design & Material Handling, Matthew P. Stevens, Fred E. Meyers. 2013. West Lafayette, IN: Purdue University Press.

Knots: The Complete Visual Guide, Des Pawson. 2012. New York, NY: DK Publishing.

Simple Solutions Ergonomics for Construction Workers. US Centers for Disease Control, National Institute for Occupational Safety and Health. Last modified August 2007. **http://www.cdc.gov/niosh/docs/2007-122/**

There are a number of online resources available for trainees who would like more information on safety practices, guidelines, and requirements related to material handling and material handling equipment. 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 teachable moments in 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.

Videos focusing on proper lifting techniques are available from National Safety Compliance, Inc. (**www.nationalsafetycompliance.com**), Wimbus Corporation (**www.wumbus.com**), and Safety Video Direct (**www.safetyvideodirect.com**). Suggested online sources for videos and still images related to knot tying are: 20-20 Site (**www.2020site.org/knots**), and I Will Knot! (**www.iwillknot.com**). Instructors are encouraged to review these resources and incorporate any that they choose into the classroom presentations.

Instructors are also 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.

Session Outline for 00109-15

Introduction to Material Handling

The Lesson Plan for this module is divided into two 2.5-hour sessions.
This time includes 10 minutes for administrative tasks and a 10-minute break per session.

Session One

Session One discusses basic material handling concepts and safety precautions. It reviews various types of motorized and non-motorized material handling equipment and describes how the equipment is used.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to introduce the subjects that will be covered in this module and stimulate trainee interest in the topic.
3. Discuss the basics of performing pre-task planning, using PPE, and following proper procedures for lifting and lowering materials.
4. Describe safety guidelines that apply to stacking and storing materials, and working from heights.
5. Explain when to use and how to tie a square knot, a bowline, a half hitch, and a clove hitch.
6. Describe the basic features and use of non-motorized material-handling equipment.
7. Describe the basic features and use of motorized material-handling equipment.
8. Introduce hand signals that are commonly used to communicate with forklift operators.

Session Two

Session Two begins with a laboratory devoted to practice and completion of Performance Tasks 1 and 2. The laboratory is followed by a comprehensive module review and written examination.

1. Note that there is no PowerPoint® presentation associated with this session.
2. Have trainees practice and/or complete the tasks associated with Performance Tasks 1 and 2.
3. Have trainees complete the Module Review and Trade Terms Quiz. Review the correct answers to both in class prior to the exam and answer any questions that the trainees may have.
4. Have trainees complete the written examination. Any outstanding performance testing must be completed during this session as well.
5. Record the testing results on the Registration of Training Modules Form, and submit the report to your Training Program Sponsor.

Materials Checklist for Module 00109-15, Introduction to Material Handling

Equipment and Materials					
Personal protective equipment:		Objects for manual lifting			
Standard eye protection		Several pairs of rope sections of suitable length and equal diameter for tying knots			
Work gloves					
Whiteboard/chalkboard		Common objects (rings, bars, posts, poles, etc.) around which knots can be tied			
Markers/chalk					
Pencils and paper					
Core Curriculum PowerPoint® Presentation Slides					
DVD player					
LCD projector and screen					
Computer					
Internet access during class (*optional*)					
Copies of the Module Examination and Performance Profile sheets					
The following items are optional:					
Video resource(s) on proper lifting techniques					
A safety harness and positioning belt with lanyard					
Video resource(s) demonstrating how to tie common knots					

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Safety Considerations

The following safety consideration should be emphasized when introducing trainees to the construction environment:

Remind trainees that some forms of PPE may be required any time they are in the shop or on a job site.

Safety Equipment

The use of specific safety equipment is not anticipated during this session.

Classroom and/or Lab Equipment

The following items are optional:

Video resource(s) on proper lifting techniques
A safety harness and positioning belt with lanyard
Video resource(s) demonstrating how to tie common knots

Resources

No specific resources are required for this session.

Kickoff Activity

Ask trainees to identify basic aspects of material handling that have changed relatively little over time as well as those that have changed a great deal. Record their answers on a whiteboard/chalkboard. Retain the list and refer back to it to check off items as they are covered during the classroom session.

Possible answers for relatively unchanged aspects include the following:

Equipment powered by the human body
Use of knots to secure materials
Importance of safe lifting techniques
Physical hazards (crushing, falling, etc.)
Basic principles of physics (levers, ramps, etc.)

Possible answers for greatly changed aspects include the following:

Mechanical advances in equipment design (wheels, pneumatic tires, etc.)
Advances in equipment power sources (motorized equipment, sophisticated hydraulics, fuel cells, etc.)
Equipment constructed of new types of materials (steel, plastics, etc.)
Additional safety hazards associated with electricity, lead acid batteries, etc.
Advances in safety precautions and PPE

Material Handling; Material Handling Equipment

Session Objectives

When trainees have completed this session, they should be able to do the following:

1. Describe the basic concepts of material handling and common safety precautions.
   a. Describe the basic concepts of material handling and manual lifting.
   b. Identify common material handling safety precautions.
   c. Identify and describe how to tie knots commonly used in material handling.
2. Identify various types of material handling equipment and describe how they are used.
   a. Identify non-motorized material handling equipment and describe how they are used.
   b. Identify motorized material-handling equipment and describe how they are used.

Session Performance Requirements

Trainees will not complete a Performance Task during this session.

Instructional Outline

Research has shown that varying instructional methods periodically throughout class sessions helps to engage and hold trainees' attention. The *Core Curriculum* PowerPoint® presentation that you received with this lesson plan is keyed to the sections of the Trainee Guide indicated below and has been designed for use with this lesson plan.

Classroom: Sections 1.0.0–1.1.0

Explain what a load is and talk about why proper material handling on a job site is important.

Identify the four basic aspects of material handling that will be covered in the following sections.

Classroom: Sections 1.1.1–1.1.3

Talk about why mentally planning a material-handling task is important. Review the bulleted list of steps for assessing the situation before attempting to lift any material.

Emphasize the importance of wearing the proper clothing and using the appropriate PPE when handling any material. Review the bulleted list of safety guidelines for dressing properly to perform material-handling operations.

Describe proper techniques for lifting and lowering loads. Point out when a worker should ask for assistance with lifting or lowering a load. Talk about how to handle long or cumbersome loads. Discuss dangers and precautions specifically associated with lowering overhead loads. Talk about ways to prevent back injuries when lifting and lowering materials.

Teaching Tip

Show a brief video on proper lifting techniques.

Classroom: Sections 1.2.0–1.2.2

Introduce the importance of making sure that the workers, materials, and equipment on a job site are safe from unexpected movement.

Talk about the benefits of storing and stacking materials correctly. Describe negative results that can occur when materials and equipment are not stored properly. Review the bulleted list of guidelines for stacking and storing materials.

Describe safe practices for material handling when working from heights.

Teaching Tip

Have a safety harness and a positioning belt with lanyard available for trainees to examine or try on.

Classroom: Section 1.3.0

Explain the difference between knots and hitches. Identify the four types of knots that will be covered in the sections that follow. Define the following knot tying terms: *standing end*, *working end*, *standing part*, and *capsize*. Point out the need to be aware of differences in knot-tying techniques.

Classroom: Section 1.3.1

Describe a square knot, applications for which it is suitable, and applications for which it is not suitable. Explain how to tie a square knot. Point out the dangers of mistakenly tying a granny knot instead of a square knot.

Teaching Tip

Show a video of how to tie a square knot.

Classroom: Section 1.3.2

Describe a bowline, applications for which it is suitable, and applications for which it is not suitable. Explain how to tie a bowline.

Teaching Tip

Show a video of how to tie a bowline.

Classroom: Section 1.3.3

Describe a half hitch, applications for which it is suitable, and applications for which it is not suitable. Explain how to tie a half hitch.

Teaching Tip

Show a video of how to tie a half hitch.

Classroom: Section 1.3.4

Describe a clove hitch, applications for which it is suitable, and applications for which it is not suitable. Explain how to tie a clove hitch using the threading the end technique, the stacked loops technique, and the two half hitches technique.

Teaching Tip

Show videos of tying a clove hitch using any or all of these techniques: the threading the end technique, the stacked loops technique, and the two half hitches technique.

Classroom: Sections 2.0.0–2.1.0

Identify the two types of material-handling equipment and talk about why they are used.

Review the bulleted list of the types of manual material-handling equipment that will be covered in the sections that follow.

Classroom: Sections 2.1.1–2.1.3

Describe the basic features and uses of material carts. Review the bulleted list of safety guidelines for using material carts.

Describe the basic features and uses of hand trucks. Talk about how to inspect and use a hand truck.

Describe the basic features and uses of cylinder carts. Review the bulleted list of guidelines for transporting gas cylinders. Stress the dangers associated with a compressed gas cylinder that ruptures or cracks during transport.

Classroom: Sections 2.1.4–2.1.6

Describe the basic features and uses of drum dollies and drum carts. Review the bulleted list of guidelines for using a rotating drum cart.

Describe the basic features and uses of roller skids. Describe inspection and use guidelines for roller skids.

Describe the basic features and uses of wheelbarrows. Describe inspection and use guidelines for wheelbarrows. Talk about the use of proper lifting techniques when moving a loaded wheelbarrow.

Classroom: Sections 2.1.7–2.1.9

Describe the basic features and uses of a pipe mule. Describe proper lifting techniques for loading and unloading a pipe mule.

Describe the basic features and uses of a pipe transport. Emphasize the information listed in the warning about pinch points, overloading, and maintaining control when using a pipe transport.

Describe the basic features and uses of a pallet jack. Review the bulleted list of safety guidelines for using a pallet jack.

Classroom: Section 2.2.0

Describe motorized material handling equipment. Emphasize the training requirements for operators of motorized material handling equipment. Talk about how to avoid accidents when using motorized material handling equipment. Review guidelines for handling materials with a machine. Review the bulleted list of equipment that will be covered in the sections that follow. Identify the information that must be listed on the nameplate of a material-handling device.

Classroom: Section 2.2.1

Describe the basic features and uses of a powered wheelbarrow. Talk about how to inspect a powered wheelbarrow before using it. Review the bulleted list of safety guidelines for using a powered wheelbarrow.

Classroom: Section 2.2.2

Describe the basic features and uses of a concrete mule. Talk about how to inspect a concrete mule before using it. Describe safety precautions to follow when refueling, discharging concrete mix from, and operating a concrete mule.

Classroom: Section 2.2.3

Describe the basic features and uses of an industrial forklift. Review the bulleted list of safety guidelines to follow when working in the vicinity of a forklift. Talk about traffic safety rules and general safety precautions that forklift operators must follow. Review the bulleted list of items that should be inspected each day before using a forklift. Describe good driving practices and pedestrian safety concerns for forklift operators. Explain why modifications should not be made to forklifts without obtaining consent from the manufacturer or a mechanical engineer.

Classroom: Sections 2.2.4–2.2.5

Describe the basic features and uses of a rough terrain forklift. Explain why tipovers are common accidents for rough terrain forklifts. Review the bulleted list of safety guidelines for preventing tipovers.

Describe the basic features, uses, and safety hazards of a freight elevator. Talk about how to use freight elevators safely.

Classroom: Section 2.2.6

Explain why hand signals are used to communicate with the operators of motorized material-handling equipment. Emphasize that there is no globally accepted standard for hand signals. Review the meanings of the common hand signals depicted in the figure that is provided. Talk about how to make sure that you are using the correct hand signals and communicating effectively with the equipment operator.

Wrap Up

Ask trainees to identify the approach that would be best for each of five material-handling scenarios. Discuss the correct answer for each scenario as it is presented. Allow for discussion of additional correct answers that trainees may provide beyond those identified on the slide.

Homework

Have trainees complete the 1.0.0 and 2.0.0 Section Reviews. Assign a review of the complete module to prepare for the upcoming laboratory session and module exam. It is further suggested that trainees be assigned the Module Review and Trade Terms Quiz as homework. Inform trainees that the next session will begin with a laboratory devoted to safe manual lifting techniques and tying common knots. The laboratory work will be followed by the written exam.

This session includes a brief review of the module, administering the module examination, and any incomplete performance testing.

Safety Considerations

The following safety consideration should be emphasized when introducing trainees to the construction environment:

Remind trainees that some forms of PPE are required any time they are in the shop or on a job site.

Safety Equipment

The following safety equipment will be needed during the lab portion of this session:

Standard eye protection
Work gloves

Classroom and/or Lab Equipment

Objects for manual lifting
Several pairs of rope sections of suitable length and equal diameter for tying knots
Common objects (rings, bars, posts, poles, etc.) around which knots can be tied
Copies of the Performance Profile Sheets and Module Examination
Have the Module Review and Trade Terms Quiz answer keys available for review prior to administering the module exam.

Resources

No specific resources are required for this session.

Session Objective

This session is intended to support and emphasize Learning Objective 1.

Session Performance Requirements

By the end of this session, trainees should have completed, or be able to complete, the following Performance Tasks under the supervision of the instructor:

Demonstrate safe manual lifting techniques.
Demonstrate how to tie two of the following common knots:
- Square
- Bowline
- Half hitch
- Clove hitch

Instructors are reminded that trainee performance during practice and laboratory sessions can be used for verification of Performance Task completion.

Instructional Outline

This laboratory is devoted to the practice and completion of Performance Tasks required for this module. As a result, no PowerPoint® slides have been developed for this session. Throughout these activities, ensure that trainees wear the proper PPE and exhibit safe working habits.

Review

Review the answers to the 1.0.0 and 2.0.0 Section Reviews.

Demonstration

Show trainees the proper technique for safely lifting several different objects manually.

Laboratory/Performance Task

Under your direct supervision, have each trainee demonstrate safe manual lifting techniques for one or more objects. Ensure that the weight of the materials is not significant; it is best to focus on trainee technique rather than strength. Trainees should also practice while wearing gloves. This activity corresponds to Performance Task 1.

Demonstration

Show trainees how to tie each of the following types of knots:

- Square
- Bowline
- Half hitch
- Clove hitch using the threading the end technique
- Clove hitch using the stacked loops technique
- Clove hitch using the two half hitches technique

Laboratory/Performance Task

Under your direct supervision, have each trainee tie any two of the following types of knots:

- Square
- Bowline
- Half hitch
- Clove hitch (using any one of these techniques: threading the end, stacked loops, or two half hitches)

This activity corresponds to Performance Task 2.

Review

Ask the trainees if they wish to review any particular information from the module. Have the trainees complete the Module Review and Trade Terms Quiz. Alternatively, if the Module Review and Trade Terms Quiz were assigned as homework, have them retrieve their answers. Review the correct answers prior to administering the module exam. Ask again if the trainees need clarification on any particular knowledge areas.

Examination and Performance Testing

Administer the Module Exam. As they begin, remind trainees that they must answer at least 70 percent of the questions correctly to pass the module exam.

Administer any outstanding performance tasks and complete the Performance Profile Sheet for each trainee.

Wrap Up

Ask the trainees if there were any problem areas on the exam and to identify a favorite and least favorite part of this module. As an alternate or if time allows, briefly introduce the next topic in your planned teaching sequence.

Instructor

Record the testing results on the Registration of Training Modules Form, and submit the report to your Training Program Sponsor.

SECTION REVIEW ANSWER KEY

SECTION 1.0.0

Answer		Section Reference	Objective
1.	a	1.1.1	1a
2.	c	1.2.1	1b
3.	d	1.3.1	1c

SECTION 2.0.0

Answer		Section Reference	Objective
1.	d	2.1.2	2a
2.	c	2.2.2	2b

Answer Keys

ANSWERS TO REVIEW QUESTIONS

	Answer	Section Reference
1.	d	1.1.2
2.	c	1.1.3
3.	b	1.1.3
4.	a	1.2.1
5.	d	1.2.2
6.	a	1.3.0
7.	b	1.3.2
8.	b	2.1.1
9.	c	2.1.2
10.	d	2.1.5
11.	d	2.1.8
12.	c	2.2.0
13.	a	2.2.2
14.	b	2.2.3
15.	c	2.2.6

ANSWERS TO TRADE TERMS QUIZ

1. Work zone
2. Bowline
3. Pipe transport, pipe mule (in that order)
4. Spotter
5. Clove hitch
6. Powered wheelbarrow
7. Capsize
8. Cylinder cart
9. Square knot
10. Drum dolly
11. Rough terrain forklift
12. Freight elevator
13. Working end, standing end (in that order)
14. Roller skids
15. Half hitch
16. Material cart
17. Hand trucks
18. Industrial forklift
19. Pallet jack
20. Drum cart
21. Wheelbarrow
22. Concrete mule
23. Standing part

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