

KHVT 0110 Basic Diesel

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Competencies and Learning Objectives

1. Describe operation principles of a diesel engine.
 - Distinguish between motors and engines
 - Classify various diesel engine types
 - Describe the four-cycle engine operating principle
 - Describe the two-cycle engine operating principle
 - Describe the Miller cycle engine operating principle
 - Explain the 2-combustion process used in diesel engines
 - Differentiate between diesel and gasoline engine designs and construction characteristics
2. Demonstrate disassembly of a diesel engine.
 - Prepare engine for disassembly
 - Drain oil and coolant from engine
 - Remove major components
 - Perform complete disassembly
3. Determine reusability of diesel engine components.
 - Identify component specifications from manufacturer service manuals
 - Determine if components meet manufacturer's guidelines using a micrometer
4. Reassemble a diesel engine.
 - Reassemble diesel engine using manufacturer's service manuals
 - Evaluate gear timing for proper alignment
5. Restore diesel engine to running condition.
 - Move engine to running/shipping stand
 - Set valve lash using feeler gage
 - Time injection pump
 - Fill engine with oil

- Attach fuel lines
- Wire starter
- Run engine
- Check oil pressure

Course Description

This course will provide theory and practical experience disassembly, inspection, and reassembly of both 2 and 4 cycle diesel engines; subassemblies for different engine systems; running and tuning-up engines from different manufacturers. Safety will be stressed.

Competencies

Upon completion of the course, you will be rated as MC (Mastered Competency) or NM (Not-Mastered Competency) based on ability to demonstrate the established competencies for the course. You will:

- Describe operation principles of a diesel engine.
- Demonstrate disassembly of a diesel engine.
- Demonstrate disassembly of a diesel engine.
- Reassemble a diesel engine.
- Restore diesel engine to running condition.

Assessment

During the course you be given written and performance exams.

Written Exam 1

Written Exam 2

Lab Final 1

Lab Final 2

Lab Final 3

You must pass with at least a score of 80% or higher on each summative assessment to be considered Master Competent and complete the course.

Course work

The course work for this class will be available partially online and partially in the lab. You will need to complete both the online and classroom portions to obtain the all of the course information.

Safety

In this course, you are expected to utilize safe behaviors and safety equipment when working around heavy duty vehicles. Safety will be evaluated in all performance exams.

Flexibility

If you feel that you are ready to do the lab final or exams without completing the course modules, please contact your instructor.

Contact and Assistance

If you need additional assistance with course material, you may consult with your instructor during open lab times.

If you have questions about coursework outside of lab hours you may contact your instructor via text/voice or email.

If you have technical issues with Internet access, computer labs, applications, BruinMail, Printing, or software navigate to <http://www.slcc.edu/student/help.aspx>

If you have technical issues with Canvas, navigate to <https://faculty.slcc.edu/elearning/canvas.aspx>

Syllabus and Textbook *(Note: Books and materials required for this course are listed below. Instructor uses instructional materials from the publisher, including presentations, videos, and other learning materials.)*

Read the syllabus to understand the expectations for this course. The instructor will go through the syllabus and review the textbook with you on your first day of class.

Required Textbook: The textbook for this course is the Fundamentals of Medium/Heavy Duty Diesel Engines, Jones & Bartlett Learning Systems, ISBN 978-1-284-06705-7.

CDX Resources - There are videos, animations, activities and more used throughout this course. You will need to register to get access to the content.

CDX Support

If you experience any difficulties or technical issues, call Customer Support Team at 1-844-273-7537 or send an email to cdxsupport@partnerinpublishing.com to submit an issue to Technical Support Team.

Course Navigation *(Instructions for learning management system)*

In the left navigation bar is a Course Tools menu. It provides information about what tools you need for the course, and how to navigate in Canvas. Start the course with the first module below. You can also click on the Modules link in the left navigation bar to navigate through the course.

Modules

Module 1: Diesel Operation Principles

Module 1: Overview

Introduction to Module: This module will cover operation principles of diesel engines. You will have access to learning materials including a PowerPoint presentation, reading assignments, and videos. You will also complete activities online and in the shop. Assessment of competencies in this module will take place in Exam 1 at the end of this module.

The course work in this module, combined with class sessions should prepare you to:

Describe operation principles of a diesel engine.

1. Distinguish between motors and engines
2. Classify various diesel engine types
3. Describe the four-cycle engine operating principle
4. Describe the two-cycle engine operating principle
5. Describe the Miller cycle engine operating principle
6. Explain the 2-combustion process used in diesel engines
7. Differentiate between diesel and gasoline engine designs and construction characteristics

Module 1: PowerPoints *(PowerPoints are from the publisher's resources.)*

The PowerPoint presentation below, will give you a summary of chapters 6 and 8 on the operating principles of diesel engines. It may be helpful to review the Medium/Heavy Duty Diesel Engines book as you view the PowerPoint presentation.

Click the links to get started.

1. Presentation Chap 6
2. Presentation Chap 8

Module 1: Readings *(Note: If you use the book, there is a ebook that can be made available to students.)*

Reading Assignment

The purpose of these learning resources is to introduce you to the operating principles of diesel engines. While you are reading, think about the diesel engine as prime mover. You also want to know how the different systems relate to each other. Your goal is to learn how to keep the engine running properly.

You can complete the readings for this module in your textbook CDXDE: Chapter 6 pages 172-196, and Chapter 8 pages 218-243. You can also access a digital copy of the text using the link below.

Module 1: Videos (Note: The videos are part of the student resources made available through the publisher for this course.)

Watch the videos about diesel operation principles.

Ch 6

1. 2 Stroke Diesel
2. Diesel Engine
3. 2 Stroke Diesel Cycle
4. Engine
5. Cam and Valve Timing
6. Engine Scavenging
7. Induction Difference

Ch 8

1. Basic Injection System
2. Diesel Ratings
3. Combustion Chamber Designs
4. Direct and Indirect Injection
5. Diesel Engine Passages
6. Pressure
7. Diesel Fuel
8. Pressure vs Volume
9. Diesel Operation

Module 1: Homework (Note: Interactive activities are through the publisher's resources for this course.)

Anatomy of an Engine: Basic Engine Terminology and Operating Principles

After you have reviewed the learning materials about the operating principles of diesel engines, complete some or all of the assignments.

1. Engine Components
2. Identifying Valve Train Components
3. 4 Stroke Cycle

Module 1: Shop Activity 1

Now that you have completed the learning materials and online activities for Module 1, check in with your instructor for information about Shop Activity 1- Diesel Engine Parts and How They Relate.

Module 1: Knowledge Check

Once you have reviewed the learning resources and activities for this module, take the module quiz to see what you have learned.

Module 1: Exam

Review the learning materials and activities for module 1. When you feel you are ready, contact your instructor to set up your Exam in the computer lab.

Module 1: Check in

Now that you have completed Module 1, check in with your instructor for exam results, or if you have questions. If not, move on to module 2.

Module 2: Disassembly of a Diesel Engine

Module 2: Overview

Introduction to Module: This module will cover disassembly of diesel engines. You will have access to learning materials including a PowerPoint presentation, reading assignments, and videos. You will also complete activities online and in the shop. Assessment of competencies in this module will take place in Exam 2 at the end of this module.

Demonstrate disassembly of a diesel engine:

Describe operation principles of a diesel engine.

1. Prepare engine for disassembly
2. Drain oil and coolant from engine
3. Describe engine components
4. Remove major components
5. Perform complete disassembly

Module 2: PowerPoints

The PowerPoint presentation below, will give you a summary of chapters 9 and 10 on disassembly of diesel engines. It may be helpful to review the Medium/Heavy Duty Diesel Engines book as you view the PowerPoint presentation.

Click the links to get started.

1. Insert Presentation Chap 9
2. Insert Presentation Chap 10

Module 2: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the operating principles of diesel engines. While you are reading, think about how cylinder components work. You also want to

know how pressures and temperatures affect these components. Your goal is to learn how the different systems of an engine protect these components.

You can complete the readings for this module in your textbook CDXDE: Chapter 9 pages 246-272, and Chapter 10 pages 273-308. You can also access a digital copy of the text using the link below.

Module 2: Videos

Watch the videos about diesel operation principles.

Ch 9

1. Connecting Rod Construction
2. Piston Rings
3. Controlling Piston Expansion
4. Pistons
5. Installing Connecting Rod
6. Removing the Pistons

Ch 10

1. Alloys
2. Cylinder Sleeve Types
3. Crankshafts
4. Grey Iron
5. Measuring Cylinder Bore
6. Measuring Clearance
7. Removing a Liner
8. Measuring Counterbore Depth
9. Replacing Main Bearings

Module 2: Homework

Anatomy of an Engine: Cylinder Components

After you have reviewed the learning materials about the disassembly of an engine principles of diesel engines, complete some or all of the assignments.

1. Identifying Cylinder Components
2. Identifying Piston Features
3. Identifying Piston Types
4. Piston Cooling
5. Piston Ring Location
6. Features of a Connecting Rod
7. Taper Wear in a Cylinder

Module 2: Shop Activity 2

Now that you have completed the learning materials and online activities for Module 2, check in with your instructor for information about Shop Activity 2- Disassembly of a Diesel Engine.

Quiz: [Module 2: Knowledge Check

Knowledge Check

Once you have reviewed the learning resources and activities for this module, take the module quiz to see what you have learned.

Module 2: Exam

Review the learning materials and activities for module 2. When you feel you are ready, contact your instructor to set up your Exam in the computer lab.

Module 2: Check in

Now that you have completed Module 2, check in with your instructor for exam results, or if you have questions. If not, move on to module 3.

Module 3: Reusability of Components

Module 3: Overview

Introduction to Module: This module will cover reusability of diesel engine components. You will have access to learning materials including text resources and videos. You will also complete activities in the shop. Assessment of competencies in this module will take place in a Shop Exam at the end of this module.

The course work in this module, combined with class sessions should prepare you to:

Determine reusability of diesel engine components.

1. Identify component specifications from manufacturer service manuals
2. Determine if components meet manufacturer's guidelines using a micrometer

Module 3: Text Resource

Reading Assignment

As you are working on the shop activity for this module, you will refer to the service manual. You may use copies in the shop or access it online by clicking the link below.

The purpose of these learning resources is to introduce help you determine reusability of diesel engine components. While you are reading, think about close tolerance you will encounter. You also want to know how to convert your readings from metric to SAE. Your goal is to learn how to determine if parts can be reused.

Module 3: Videos

Watch the videos about reusability of diesel engine components.

- 1.

Module 3: Shop Activity 3

Now that you have completed the learning materials and online activities for Module 3, check in with your instructor for information about Shop Activity 3- Reusability of Diesel Engine Components.

Module 3: Shop Exam 1

Now that you have completed the learning materials and online activities and shop activity for Module 3, check in with your instructor for information about Shop Exam 1- Reusability of Components.

Now that you have completed Module 3, check in with your instructor if you have questions. If not, move on to module 4.

Module 4: Reassembly of a Diesel Engine

Module 4: Overview

Introduction to Module: This module will cover reassembly a diesel engine. You will have access to learning materials including reading assignments, and videos. You will also complete activities online and in the shop. Assessment of competencies in this module will take place in a Shop Exam at the end of this module.

The course work in this module, combined with class sessions should prepare you to:

Reassemble a diesel engine.

1. Reassemble diesel engine using manufacturer's service manuals
2. Evaluate gear timing for proper alignment

Module 4: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to reassembly of diesel engines. While you are reading, think about how components are installed in the engine. You also want to know how to use the service manual while assembling components. Your goal is to learn how to reassemble and engine properly.

You can complete the readings for this module in your textbook CDXDE: Chapter 11. You can also access a digital copy of the text using the link below.

Module 4: Videos

Watch the videos about reassembly of a diesel engine.

1. Valve Train

2. Checking Valve
3. Measuring Head Warpage
4. Measuring Valve Recession
5. Replace Valves

Click this link to view the video.

Module 4: Activities

Anatomy of an Engine: Basic Engine Terminology and Operating Principles

After you have reviewed the learning materials about the operating principles of diesel engines, complete some or all of the assignments.

1. Camshaft Operation
2. Tensile Force and Bolt Tension
3. OHC Camshaft Timing Gears
4. Valve Rotator

Module 4: Homework

Anatomy of an Engine: Cylinder Heads and Valve Train Mechanisms

After you have reviewed the learning materials about the operating principles of diesel engines, complete some or all of the assignments.

5. Major Engine Components
6. Features of a Diesel Cylinder Head
7. Replacing Valve Guides and Seats
8. Camshaft Followers
9. Reusing Cylinder Head Bolts

Module 4: Shop Activity 4

Now that you have completed the learning materials and online activities for Module 3, check in with your instructor for information about Shop Activity 3- Reassembly of Diesel Engines.

You will use the form linked below to complete the lab.

Module 4: Shop Exam 2

Now that you have completed the learning materials and online activities and shop activity for Module 4, check in with your instructor for information about Shop Exam 2- Reassembly of Diesel Engines.

Module 4: Check in

Now that you have completed Module 4, check in with your instructor if you have questions. If not, move on to module 5.

Module 5: Restore Engine to Running Condition

Module 5: Overview

Introduction to Module: This module will cover how to restore an engine to running condition. You will have access to learning materials including reading assignments, and videos. You will also complete activities online and in the shop. Assessment of competencies in this module will take place in a Shop Exam at the end of this module.

The course work in this module, combined with class sessions should prepare you to:

Restore diesel engine to running condition.

1. Move engine to running/shipping stand
2. Set valve lash using feeler gauge
3. Time injection pump
4. Fill engine with oil
5. Attach fuel lines
6. Wire starter
7. Run engine
8. Check oil pressure

Module 5: Readings

Reading Assignment

The purpose of these learning resources is to help you to restoring diesel engines to running condition. While you are reading, think about what is required to get an engine running properly. You also want to ensure that there are no fluid leaks. Your goal is to learn how rebuild engines.

You can complete the readings for this module in your textbook CDXDE: Chapter 4 pages 110-11 and the service manual. You may also access a digital copy of the readings using the link below.

Module 5: Videos

Watch the videos about restoring diesel engines to running condition.

- 1.

Assignment: Module 5: Shop Activity 5

Now that you have completed the learning materials and online activities for Module 5, check in with your instructor for information about Shop Activity 5- Restoring Diesel Engines to Running Conditions.

You will use the form linked below to complete the lab.

Module 5: Shop Exam 3

Now that you have completed the learning materials and online activities and shop activity for Module 5, check in with your instructor for information about Shop Exam 3- Restoring Diesel Engines.

Module 5: Check in

Now that you have completed Module 5, check in with your instructor for exam results and for completion of the course.

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Module 2

Engine Disassembly

25 points

Name _____ Date _____

1. Engine Manufacture _____
 2. Engine Model _____
 3. Engine Serial Number _____
 4. Disassemble your engine down to a bare block following the information listed below.
 - a. Keep a clean work area.
 - b. Disassemble engine into subassemblies.
 - c. Organize subassemblies on your parts rack.
 - d. Organize hardware into neat, clean bags.
 - e. Clean block with pressure washer as needed
- i. _____Instructors Approval

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Module 3

Engine Precision Measuring

Detroit Diesel 53, 71, 92 Series

25 points

Name _____ Date _____

1. Engine Manufacture _____

2. Engine Model _____

3. Engine Serial Number _____

4. Using engine service manual measure the following:

a. Crankshaft main bearing journals:

1. _____

2. _____

3. _____

4. _____

5. _____

ii. Are the above in spec? _____ What is the spec? _____

b. Crankshaft rod journals:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

ii. Are the above in spec? _____ What is the spec? _____

c. Camshaft bearing journals:

1. _____
2. _____
3. _____
4. _____
5. _____

d. Piston skirt diameter:

6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____

ii. Are the above in spec? _____ What is the spec? _____

d. Cylinder bore/liner bore: _____

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Module 4

Engine Assembly

50 points

Name _____ Date _____

1. Engine Manufacture _____
2. Engine Model _____
3. Engine Serial Number _____
4. Install crankshaft in engine torque bearing caps to spec.
 - a. Spec _____
5. Measure crankshaft end thrust using dial indicator
 - a. Spec _____
 - b. Actual _____
6. Install camshaft and install retaining plate, and torque to spec.
 - a. Spec _____
7. Install timing gears and time gear train.
 - a. Instructors approval _____
8. Install flywheel housing and flywheel and torque to spec.
 - a. Spec _____
9. Check piston ring end gap on top compression ring.
 - a. Spec _____
 - b. Actual _____
10. Install cylinder liners in block, checking liner protrusion.
 - a. Spec _____

- b. Actual _____
- 11. Install pistons in cylinders using piston ring compressor.
 - a. Instructors approval _____
- 12. Install cylinder head using torque pattern found in service manual.
 - a. Head bolt torque _____
- 13. Install valve operating system and adjust the valves.
 - a. Spec intake valves _____
 - b. Spec exhaust valves _____
 - c. Adjust unit injectors _____
- 14. Install Exhaust and intake manifolds
 - a. Bolt torque intake manifold _____ ft lbs
 - b. Bolt torque Exhaust manifold _____ ft lbs
- 15. Install Vibration damper and front pulley
 - a. Torque spec. _____
- 16. Install misc water manifolds, covers.
- 17. Time injection pump if used on engine.
 - a. Instructors approval
- 18. Insure that engine is securely attached to stand before moving engine outside to run.
 - a. Instructor approval _____

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Module 5

Running Engine

50 points

Name _____ Date _____

1. Engine Manufacture _____
2. Engine Model _____
3. Engine Serial Number _____
4. Starter wired correct? _____ Instructor Approval
5. Fuel system correctly installed. _____ Instructor Approval
6. Air purged from fuel system. _____ Instructors Approval
7. Start engine:
 - a. Does it run on all cylinders _____
 - b. Does it have oil pressure? _____ What is it? _____ PSI
 - c. Does engine smoke out the exhaust? _____
 - a. Instructors Approval _____
 - d. Disconnect electrical wires, fuel connections, and drain lube oil. Return engine to storage and request a different engine from your instructor.
Instructors Final Approval _____