KHVT 0120 Basic Engine Performance

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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 in troubleshooting and repair of both 2 and 4 cycle diesel engines. Parts nomenclature, hydro mechanical fuel-injection system design and operation, and engine maintenance will also be covered. 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 diesel fuel injection principles
- Perform minor maintenance on low pressure diesel fuel injection systems
- Troubleshoot high pressure fuel injection systems
- Perform maintenance of a diesel engine lubricating system
- Perform maintenance of a diesel engine cooling system
- Perform maintenance on the engine breathing systems
- Adjust and maintain engine brakes and retarder devices according to service manual specifications
- Explain the exhaust emissions principles for compliance to emission standards

Assessment

During the course you be given written and performance exams.

Written Exam 1

Written Exam 2

Shop Exam 1

Shop Exam 2

Shop Exam 3

Shop Exam 4

Shop Exam 5

Shop Exam 6

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 *(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.)*

The expectations for this course are described in detail in the course syllabus.

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 -If you took KHVT-0100 course, you have already registered for access to the resources.

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 *(Note: Instructions for the 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 Fuel Injection Principles

Page: Module 1: Overview

Introduction to Module 1: This module will cover operation principles of diesel fuel injection systems. 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 diesel fuel injection principles.

1. Describe the chemical properties of diesel fuel
2. Describe the chemical properties of biodiesel fuel
3. Describe the pro and cons of fuel additives
4. Describe the different types of diesel fuels

Page: Module 1: PowerPoint

The PowerPoint presentation below, will give you a summary of chapter 14 on the operating principles of fuel injection systems. 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: Chapter 14 of CDXDE

Module 1: Readings *(Note: All readings are from the book listed in the syllabus and includes an electronic copy for students to use.)*

Reading Assignment

The purpose of these learning resources is to introduce you to the operating principles of fuel injection systems. While you are reading, think about the how the fuel system meters and times fuel injection. You also want to know how high pressure is achieved in the fuel system. Your goal is to learn how the fuel system operates, and to troubleshoot issues.

You can complete the readings for this module in your textbook CDXDE: Chapter 14. You can also access a digital copy of the text using the link below.

Module 1: Videos

Watch the videos about the principles of fuel injection.

Ch 14

1. Biodiesel Characteristics
2. Diesel Fuel
3. Biodiesel Use
4. Diesel Ratings

Module 1: Homework

Anatomy of an Engine: Diesel Fuel Properties and Characteristics

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

1. Fuel Auto-Ignition Temperatures
2. Gel and Cloud Point
3. Ignition Quality

Module 1: 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 1: Written Exam 1

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: Low-Pressure Fuel Injection Systems

Module 2: Overview

Introduction to Module 2: This module will talk about how to perform maintenance on low-pressure diesel fuel injection systems. 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 performance assessment at the end of this module and a written exam at the end of module 8.

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

Perform minor maintenance on low pressure diesel fuel injection systems

1. Describe components of low pressure diesel fuel systems
2. Describe the operation of low pressure diesel fuel systems
3. Evaluate low pressure engines

4. Perform maintenance on low pressure fuel systems

Module 2: PowerPoints

The PowerPoint presentation below, will give you a summary of Chapter 15 about performing maintenance on low-pressure diesel fuel injection systems. 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 CDXDE Chapter 15

Module 2: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the basics of performing maintenance on low-pressure diesel fuel injection systems. While you are reading, think about the how the system provides clean, cool fuel to the engine. You also want to know how water is removed from the fuel. Your goal is to learn how to troubleshoot issues with the low-pressure fuel system.

You can complete the readings for this module in your textbook CDXDE: Chapter 15. You can also access a digital copy of the text using the link below.

Module 2: Videos

Watch the videos about low pressure fuel injection systems.

Ch 15

1. Diaphragm Lift Pump
2. Plunger Lift Pump
3. Fuel Filter Types
4. Types of Lift Pumps
5. Fuel Filters
6. Checking Fuel for Air
7. Replacing Cartridge Filter
8. Filter Restriction Test
9. Replacing Spin on Filter

Module 2: Homework

Anatomy of an Engine: Low Pressure Fuel Systems

After you have reviewed the learning materials about the operating principles of diesel engines, complete the assignment.

1. Fuel Circuits

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: Shop Activity

Now that you have completed the learning materials and online activities for Module 2, check in with your instructor for information about Shop Activity 1- Tear Down Engine.

Module 2: Shop Exam 1

Now that you have completed the learning materials and online activities and shop activity for Module 2, check in with your instructor for information about Shop Exam 1- Maintaining low pressure diesel fuel injection systems.

Module 3: High-Pressure Fuel Injection Systems

Module 3: Overview

Introduction to Module 3: This module will talk about how to perform maintenance on high-pressure diesel fuel injection systems. 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 performance assessment at the end of this module and a written exam at the end of module 8.

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

Troubleshoot high pressure fuel injection systems

1. Describe components of high pressure diesel fuel systems
2. Describe the operation of high pressure diesel fuel systems
3. Evaluate engines for issues using diagnostic equipment and skills

Module 3: PowerPoints

The PowerPoint presentation below, will give you a summary of Chapter 16 about performing maintenance on low pressure diesel fuel injection systems. 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 16 CDXDE

Module 3: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the basics of performing maintenance on high-pressure diesel fuel injection systems. While you are reading, think about the importance of clean fuel, dues to tight tolerance of the plunger and bushing. You also want

to know how the destructive properties of water damage in a fuel system. Your goal is to learn how to troubleshoot a high-pressure fuel system.

You can complete the readings for this module in your textbook CDXDE: Chapter 16. You can also access a digital copy of the text using the link below.

Module 3: Videos

Watch the video about high pressure fuel injection systems.

Ch 16

1. Advances in Fuel Injection

Module 3: Homework

Anatomy of an Engine: High Pressure Fuel Systems

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

1. Types of High Pressure Injection
2. Injection Profiles
3. Rate Shaped Injection

Module 3: 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.

Assignment: Module 3: Shop Activity 2

Now that you have completed the learning materials and online activities for Module 3, check in with your instructor for information about Shop Activity 2- Tear Down Engine.

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- Pop Test Fuel Nozzles

Module 3: Shop Exam 2

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 2 - Maintaining high pressure diesel fuel injection systems.

Module 4: Diesel Engine Lubricating Systems

Module 4: Overview

Introduction to Module 4: This module will talk about how to perform maintenance on diesel engine lubricating systems. 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 performance assessment at the end of this module and a written exam at the end of Module 8.

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

Perform maintenance of a diesel engine lubricating system

1. Describe components of diesel engine lubricating systems
2. Describe the operation of diesel engine lubricating systems
3. Evaluate lubricating systems for issues
4. Perform maintenance and repairs on diesel engine lubricating systems

Module 4: PowerPoints

The PowerPoint presentation below, will give you a summary of Chapter 12 about performing maintenance on low pressure diesel fuel injection systems. 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 12 CDXDE

Module 4: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the basics of performing maintenance on diesel engine lubricating systems. While you are reading, think about the functions the lubricating system provides to the engine. You also want to know how the lube system provides a seal between moving parts and helps to remove excess heat. Your goal is to learn how to diagnose and troubleshoot issues within a lubricating system.

You can complete the readings for this module in your textbook CDXDE: Chapter 12. You can also access a digital copy of the text using the link below.

Module 4: Videos

Watch the videos about diesel operation principles.

Ch 12

1. Lubrication system
2. Oil Coolers
3. Oil Additives
4. Oil Pump

Module 4: Homework

Anatomy of an Engine: Diesel Engine Lubricating Systems

After you have reviewed the learning materials about the operating principles of diesel engines, complete the assignment.

1. Basic Oil Circuits

Module 4: 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 4: Shop Activity 4

Now that you have completed the learning materials and online activities for Module 4, check in with your instructor for information about Shop Activity 4- Reassemble Engine.

Module 4: Shop Activity 5

Now that you have completed the learning materials and online activities for Module 4, check in with your instructor for information about Shop Activity 5- Cut open oil filter.

Module 4: Shop Exam 3

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 3 - Maintaining high pressure diesel fuel injection systems.

Module 5: Diesel Engine Cooling Systems

Module 5: Overview

Introduction to Module 4: This module will talk about how to perform maintenance on diesel engine cooling systems. 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 performance assessment at the end of this module and a written exam at the end of module 8.

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

Perform maintenance of a diesel engine cooling system

1. Describe components of diesel engine cooling systems
2. Describe the operation of diesel engine cooling systems
3. Describe coolant types
4. Evaluate cooling systems for issues
5. Perform maintenance and repairs on diesel engine cooling system

Module 5: PowerPoints

The PowerPoint presentation below, will give you a summary of Chapter 13 about performing maintenance on low pressure diesel engine cooling systems. 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 13 CDXDE

Module 5: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the basics of performing maintenance on diesel engine cooling systems. While you are reading, think about what functions coolant provides in an engine. You also want to know how coolant does not freeze and prevents rust. Your goal is to learn how to test specific gravity of coolants.

You can complete the readings for this module in your textbook CDXDE: Chapter 13. You can also access a digital copy of the text using the link below.

Module 5: Videos

Watch the videos about diesel engine cooling systems.

Ch 13

1. Centrifugal Force
2. Radiators
3. Coolant Recovery
4. Temperature Indicators
5. Cooling System
6. Thermostat
7. Electrolysis
8. Water Pump
9. Pressure vs. Boiling Point
10. Pressure Testing Cooling System
11. Using Coolant Refractometer

Module 5: Homework

Anatomy of an Engine: Diesel Engine Cooling Systems

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

1. Coolant Circuits
2. Coolant Flow through a Blocking Type Thermostat
3. Fan Control Circuit

Module 5: 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 5: Shop Activity.6

Now that you have completed the learning materials and online activities for Module 5, check in with your instructor for information about Shop Activity 6- Reassemble Engine.

Module 5: Shop Activity 7

Now that you have completed the learning materials and online activities for Module 5, check in with your instructor for information about Shop Activity 7- Test Specific Gravity of Coolant

Module 5: Shop Exam 4

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 4- Maintaining high pressure diesel cooling systems.

Module 6: Diesel Engine Breathing Systems

Module 6: Overview

Introduction to Module 6: This module will talk about how to perform maintenance on diesel engine breathing systems. 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 performance assessment at the end of this module and a written exam at the end of module 8.

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

Perform maintenance on the engine breathing systems

1. Describe components of diesel engine breathing systems
2. Describe the operation of diesel engine breathing systems
3. Evaluate breathing systems for issues
4. Perform maintenance and repairs to diesel engine breathing systems

Module 6: PowerPoints

The PowerPoint presentation below, will give you a summary of Chapter 28 about performing maintenance on low pressure diesel engine breathing systems. 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 28 CDXDE

Module 6: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the basics of performing maintenance on diesel engine breathing systems. While you are reading, think about the need for clean cool air entering the engine. You also want to know how turbochargers and other engine breathing system components work. Your goal is to learn how to learn how to maintain and troubleshoot engine intake components.

You can complete the readings for this module in your textbook CDXDE: Chapter 28. You can also access a digital copy of the text using the link below.

Module 6: Videos

Watch the videos about diesel air induction and exhaust principles.

Ch 28

1. Diesel Induction

Module 6: Homework

Anatomy of an Engine: Air Induction Systems

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

1. Air Intake System
2. Crankcase Filter System
3. Crankcase Ventilation System

Module 6: 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 6: Shop Activity.8

Now that you have completed the learning materials and online activities for Module 5, check in with your instructor for information about Shop Activity 6- Reassemble Down Engine.

Module 6: Shop Activity 9

Now that you have completed the learning materials and online activities for Module 5, check in with your instructor for information about Shop Activity 7- Determine if Charge Air Cooler is Leaking

Module 6: Shop Exam 5

Now that you have completed the learning materials and online activities and shop activity for Module 6, check in with your instructor for information about Shop Exam 5 - Maintaining diesel breathing systems.

Module 7: Diesel Engine Brakes and Retarder Devices

Module 7: Overview

Introduction to Module 7: This module will talk about how to perform maintenance on diesel engine brakes and retarder devices. 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 performance assessment at the end of this module and a written exam at the end of Module 8.

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

Describe engine brake components and operation

1. Describe the components and operation of engine brakes

Module 7: PowerPoints

The PowerPoint presentation below, will give you a summary of chapter about diesel engine brakes and retarder devices. 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 34 CDXDE

Module 7: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the basics of performing maintenance on diesel engine brake and retarder devices. While you are reading, think about the operation of a compression brake. You also want to know how transmission and driveline retarders operate. Your goal is to learn how to troubleshoot and maintain these systems.

You can complete the readings for this module in your textbook CDXDE: Chapter 34. You can also access a digital copy of the text using the link below.

Module 7: Animations

Try out the animations showing diesel engine retarders.

1. Engine Compression Braking
2. Engine Exhaust Brake

Module 7: Homework

Exhaust Systems and Engine Retarders: Activities

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

1. Flashcards
2. Crossword

Module 7: 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 7: Shop Activity 10

Now that you have completed the learning materials and online activities for Module 7, check in with your instructor for information about Shop Activity 10- Reassemble Engine.

Module 7: Shop Activity 11

Now that you have completed the learning materials and online activities for Module 7, check in with your instructor for information about Shop Activity 11- Determine if Charge Air Cooler is Leaking

Module 7: Shop Exam 6

Now that you have completed the learning materials and online activities and shop activity for Module 7, check in with your instructor for information about Shop Exam 6 - Maintaining diesel breathing systems.

Module 8: Exhaust and Emissions

Module 8: Overview

Introduction to Module 8: This module will cover exhaust emission principles and compliance standards. 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 performance assessment at the end of this module and a written exam at the end of module 8.

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

Explain the exhaust emissions principles for compliance to emission standards

1. Describe classifications of emission types
2. Describe emission standards
3. Describe emission control and monitoring systems

Page: Module 8: PowerPoints

The PowerPoint presentation below, will give you a summary of Chapter 7 about diesel engine emission principles. 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 7 CDXDE

Module 8: Readings

Reading Assignment

The purpose of these learning resources is to introduce you to the basics of performing maintenance on diesel engine emission principles. While you are reading, think about the purpose and legal obligation regarding emission standards. You also want to know how DPF, DEF, SCR all work together to make truck exhaust compliant. Your goal is to learn how to maintain the exhaust system so that the vehicle remains compliant.

You can complete the readings for this module in your textbook CDXDE: Chapter 7. You can also access a digital copy of the text using the link below.

Page: Module 8: Videos

Watch the videos about diesel engine emissions.

Ch 7

1. Carbon Dioxide
2. Oxides of Nitrogen
3. Carbon Monoxide
4. Particulates
5. Classification of Emissions

Click this link to view the video.

Page: Module 8: Homework

Anatomy of an Engine: Diesel Engine Emissions

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

1. Opacity Measurement

Module 8: 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 8: Written Exam 2

Review the learning materials and activities for modules 2-8. When you feel you are ready, contact your instructor to set up your Exam in the computer lab.

Module 8: Shop Activity 12

Now that you have completed the learning materials and online activities for Module 8, check in with your instructor for information about Shop Activity 12- Emission System Cutaways.

Module 8: Check in

Now that you have completed the learning materials, online activities, shop activities and exams for Module 1-7, check in with your instructor for exam results and for completion of the course.