



COURSE OUTLINE: CVC615 - FUEL SYSTEMS

Prepared: Josh Boucher

Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	CVC615: FUEL SYSTEMS
Program Number: Name	6080: COMM VEHICLE-COMMON
Department:	MOTIVE POWER APPRENTICESHIP
Academic Year:	2022-2023
Course Description:	Upon successful completion the apprentice is able to describe the fundamentals of diesel fuel, is able to inspect engine fuel systems, is able to recommend repairs to diesel fuel sub-systems, is able to recommend repairs to injectors - all according to manufacturers recommendations.
Total Credits:	3
Hours/Week:	0
Total Hours:	24
Prerequisites:	There are no pre-requisites for this course.
Corequisites:	There are no co-requisites for this course.
Essential Employability Skills (EES) addressed in this course:	EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication. EES 3 Execute mathematical operations accurately. EES 4 Apply a systematic approach to solve problems. EES 5 Use a variety of thinking skills to anticipate and solve problems. EES 6 Locate, select, organize, and document information using appropriate technology and information systems. EES 7 Analyze, evaluate, and apply relevant information from a variety of sources. EES 10 Manage the use of time and other resources to complete projects.
General Education Themes:	Science and Technology
Course Evaluation:	Passing Grade: 50%, D A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.
Other Course Evaluation & Assessment Requirements:	Grade Definition Grade Point Equivalent A+ 90 100% 4.00 A 80 89% B 70 - 79% 3.00 C 60 - 69% 2.00 D 50 59% 1.00 F (Fail) 49% and below 0.00



CR (Credit) Credit for diploma requirements has been awarded.
 S Satisfactory achievement in field /clinical placement or non-graded subject area.
 U Unsatisfactory achievement in field/clinical placement or non-graded subject area.
 X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
 NR Grade not reported to Registrar's office.
 W Student has withdrawn from the course without academic penalty.

Books and Required Resources:

Medium/Heavy Duty Truck Engines, Fuels and Computerized Management Systems by Sean Bennett
 Publisher: cengage Edition: 5

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
Upon successful completion, the apprentice is able to describe the fundamentals of diesel fuel following manufacturers' recommendations.	<p>Upon successful completion, the apprentice is able to:</p> <p>5.1.1 Explain the purpose and fundamentals of fuels. [2/0]</p> <ul style="list-style-type: none"> - engine theory - thermodynamics - heat energy/calorific value - combustion ratios - fuel chemistry <p>5.1.2 Identify the functions, composition, and properties of fuels. [3/0]</p> <ul style="list-style-type: none"> - diesel fuel - volatility - cetane number - viscosity - additives - sulphur content - gasoline - octane ratings - additives - compressed natural gas - propane - alternative fuels - bio-diesel <p>5.1.3 Describe the combustion principles of fuels. [1/0]</p> <ul style="list-style-type: none"> - oxidation reactions - products of combustion - air/fuel ratios
Course Outcome 2	Learning Objectives for Course Outcome 2
Upon successful completion, the apprentice is able to inspect engine fuel systems following manufacturers'	<p>Upon successful completion, the apprentice is able to:</p> <p>5.2.1 Explain the purpose and fundamentals of fuel systems. [1/0]</p> <ul style="list-style-type: none"> - hydraulics - engine operating principles



	<p>recommendations.</p>	<ul style="list-style-type: none"> - the Diesel and Otto cycle - cylinder combustion dynamics <p>5.2.2 Identify the functions, composition features, types, and application of fuel system components. [1/0]</p> <ul style="list-style-type: none"> - fuel system circuit layout - fuel sub-systems - pressure injection apparatus - combustion chamber types - indirect injection - direct injection - hydromechanical engine management - electronic engine management - identifying fuel systems by type <p>5.2.3 Describe the combustion principles of fuels. [2/0]</p> <ul style="list-style-type: none"> - types of low and high pressure pumps - indirect injection - direct injection - ignition timing, cylinder pressure, and crank throw mechanics <p>5.2.4 Perform inspection and testing procedures following manufacturers` recommendations for fuel systems. [0/1]</p> <ul style="list-style-type: none"> - identify fuel circuit components on different engines - demonstrate the external differences between mechanical and electronic engine fuel systems <p>5.2.5 Recommend reconditioning or repairs following manufacturers` recommendations for fuel systems. [0/1]</p> <ul style="list-style-type: none"> - identify different OEM engines and fuel systems - use OEM service information systems
	<p>Course Outcome 3</p>	<p>Learning Objectives for Course Outcome 3</p>
	<p>Upon successful completion, the apprentice is able to recommend repairs to diesel fuel subsystems following manufacturers` recommendations.</p>	<p>Upon successful completion, the apprentice is able to:</p> <p>5.3.1 Explain the purpose and fundamentals of diesel fuel sub-systems. [1/0]</p> <ul style="list-style-type: none"> - hydraulics - diesel fuel injection - the Diesel cycle <p>5.3.2 Identify the construction, composition, types, and application of diesel fuel sub-systems. [2/0]</p> <ul style="list-style-type: none"> - diesel fuel classification

- fuel tanks
- venting apparatus
- pick-up tubes and sending units
- primary fuel circuit and primary fuel filters
- anti-siphon valves
- water separators
- transfer pumps
- secondary (charge) fuel circuit and secondary fuel filters
- fuel manifolds
- fuel return circuit
- leak-off pipes
- fuel hose types and grades
- crossover plumbing
- bleeding devices
- fuel heaters
- water in fuel sensors (WIF)
- charge pressure sensors
- fuel temperature sensors
- fuel coolers

5.3.3 Describe the principles of operation of diesel fuel sub-systems.

[1/0]

- heat exchangers
- primary and secondary filters
- vane, plunger and gear type pumps
- pressure relief valves
- vent valves
- rollover check valves
- coolant and electrical fuel heaters
- priming fuel sub-systems

5.3.4 Perform the inspection and testing procedures following manufacturers' recommendations for diesel engine fuel sub-systems.

[0/1]

- inspection and testing procedures for:
- identifying deteriorated fuel
- testing primary circuit restriction to specification
- testing secondary (charge) circuit pressure to specification
- testing a fuel sending unit

5.3.5 Recommend reconditioning or repairs following manufacturers' recommendations for diesel engine fuel sub-systems.

[0/1]

- service procedures:
- fuel filter replacement
- prime a fuel sub-system

Course Outcome 4

Learning Objectives for Course Outcome 4

Upon successful completion, the apprentice

Upon successful completion, the apprentice is able to:
5.4.1 Explain the purpose and fundamentals of diesel engine



is able to recommend repairs to injectors following manufacturers' recommendations.

injectors.

[1/0]

- high pressure fuel injection
- hydraulics
- pressure and sectional area
- requirements for combustion of liquid fuels
- combustion characteristics
- indirect injection
- direct injection

5.4.2 Identify the functions, construction features, composition, types, and application of diesel engine injectors.

[1/0]

- electro hydraulic nozzles
- electronic unit injectors (EUI)
- common rail
- hydraulic nozzles
- poppet nozzles
- pintle nozzles
- multi-orifii nozzles
- mechanical unit injectors (MUI)
- electronic unit injectors (EUI)
- hydraulic electronic unit injectors (HEUI)
- high pressure pipes
- leak-off lines
- fuel manifolds

5.4.3 Describe the principles of operation of diesel engine injectors.

[2/0]

- electro hydraulic nozzles
- soft opening control
- solenoid actuators
- piezo actuators
- pintle nozzles
- multi-orifii nozzles
- hydraulic nozzles
- mechanical unit injectors (MUI)
- electronic unit injector (EUI)
- hydraulic electronic unit injectors (HEUI)
- nozzle flow area and pressure
- atomization requirements of engine by type
- nozzle differential ratio
- variable control orifice nozzle principle
- pressure wave reflection

5.4.4 Demonstrate the inspection and testing procedures following manufacturers' recommendations for diesel injectors.

[0/2]

- nozzle body service
- nozzle opening pressure (NOP) testing



- nozzle opening pressure (NOP) adjustment
- testing for forward leakage, back leakage, and spray pattern geometry
- identifying the effects of nozzle malfunction on engine components

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
practical application testing	25%
theory testing	75%

Date:

August 15, 2022

Addendum:

Please refer to the course outline addendum on the Learning Management System for further information.

