



## COURSE OUTLINE: CVC615 - FUEL SYSTEMS

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	CVC615: FUEL SYSTEMS
<b>Program Number: Name</b>	6080: COMM VEHICLE-COMMON
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semesters/Terms:</b>	22S, 21F, 22W
<b>Course Description:</b>	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.
<b>Total Credits:</b>	3
<b>Hours/Week:</b>	0
<b>Total Hours:</b>	24
<b>Prerequisites:</b>	There are no pre-requisites for this course.
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>Essential Employability Skills (EES) addressed in this course:</b>	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.
<b>General Education Themes:</b>	Science and Technology
<b>Course Evaluation:</b>	Passing Grade: 50%, D  A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	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

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2021-2022 academic year.



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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:**

<b>Course Outcome 1</b>	<b>Learning Objectives for Course Outcome 1</b>
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"> <li>- engine theory</li> <li>- thermodynamics</li> <li>- heat energy/calorific value</li> <li>- combustion ratios</li> <li>- fuel chemistry</li> </ul> <p>5.1.2 Identify the functions, composition, and properties of fuels. [3/0]</p> <ul style="list-style-type: none"> <li>- diesel fuel</li> <li>- volatility</li> <li>- cetane number</li> <li>- viscosity</li> <li>- additives</li> <li>- sulphur content</li> <li>- gasoline</li> <li>- octane ratings</li> <li>- additives</li> <li>- compressed natural gas</li> <li>- propane</li> <li>- alternative fuels</li> <li>- bio-diesel</li> </ul> <p>5.1.3 Describe the combustion principles of fuels. [1/0]</p> <ul style="list-style-type: none"> <li>- oxidation reactions</li> <li>- products of combustion</li> <li>- air/fuel ratios</li> </ul>
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
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"> <li>- hydraulics</li> <li>- engine operating principles</li> </ul>

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

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- 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

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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

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- 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:**

<b>Evaluation Type</b>	<b>Evaluation Weight</b>
practical application testing	25%
theory testing	75%

**Date:**

September 17, 2021

**Addendum:**

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

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