



COURSE OUTLINE: HET815 - FUEL SYSTEMS

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	HET815: FUEL SYSTEMS
Program Number: Name	6086: HDE TECH LEVEL III
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	20W
Course Description:	Upon successful completion the apprentice is able to recommend the testing and servicing procedures for diesel fuel injection partial-authority engine management systems, is able to recommend repairs for diesel fuel injection full-authority engine management systems and is able to interpret the exhaust emissions produced by diesel engines following manufacturers' recommendations.
Total Credits:	5
Hours/Week:	5
Total Hours:	40
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:	<p>EES 1 Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.</p> <p>EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication.</p> <p>EES 3 Execute mathematical operations accurately.</p> <p>EES 4 Apply a systematic approach to solve problems.</p> <p>EES 5 Use a variety of thinking skills to anticipate and solve problems.</p> <p>EES 6 Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>EES 7 Analyze, evaluate, and apply relevant information from a variety of sources.</p> <p>EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others.</p> <p>EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</p> <p>EES 10 Manage the use of time and other resources to complete projects.</p> <p>EES 11 Take responsibility for ones own actions, decisions, and consequences.</p>
Course Evaluation:	Passing Grade: 50%, D
Other Course Evaluation & Assessment Requirements:	<p>Grade</p> <p>Definition Grade Point Equivalent</p> <p>A+ 90 - 100% 4.00</p> <p>A 80 - 89%</p> <p>B 70 - 79% 3.00</p> <p>C 60 - 69% 2.00</p>



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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.

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
<p>Upon successful completion the apprentice is able to recommend the testing and servicing procedures for diesel fuel injection partial-authority engine management systems following manufacturers` recommendations.</p>	<p>5.1.1 Explain the fundamentals of partial-authority, electronic diesel engine management systems. - purpose, function, types, styles, and application inline system electronic engine management controls distributor systems - fundamentals enhancement transducers thermister negative/positive coefficient potentiometers magnetic engine timing requirements o static o electronic advance - overview of inline and distributor pump systems adapted electronic engine controls</p> <p>5.1.2 Identify the construction features of partial-authority, electronic diesel engine management systems and components. - inline system rack actuators rack position sensors brushless torque motors (BTM) transducers - distributor systems inlet metering sleeve metering timing controls hydraulic head controls - electronic controls servo controls pulse wheels linear magnet variable timing control electronic governor hall effect sensor - hydraulic injectors hydraulic nozzle holders pintle nozzles multi-orifii nozzles</p>

- high pressure pipes
- leak- off lines
- fuel manifolds

5.1.3 Describe the principles of operation of partial-authority, electronic diesel engine management systems and components.

- inline system
- rack actuators
- rack position sensors
- brushless torque motors (BTM)
- transducers
- distributor systems
- inlet metering
- sleeve metering
- timing controls
- hydraulic head controls
- electric controls
- servo controls
- pulse wheels
- linear magnet
- variable timing control
- electronic governor
- hall effect sensor
- hydraulic injectors
- hydraulic nozzle holders
- pintle nozzles
- multi-orifii nozzles
- high pressure pipes
- leak- off lines
- fuel manifolds

5.1.4 Demonstrate inspection, testing and diagnostic procedures following manufacturers' recommendations for partial-authority, electronic diesel engine management systems and components.

- identify components and their location
- recommended tests on system input sensors and output devices
- reader/programmer/personal computer software diagnostics on the inline systems

5.1.5 Recommend reconditioning or repair procedures following manufacturers' recommendations for partial-authority electronic diesel engine management systems and components.

- outline the recommended repair procedures for fuel injection systems
- electronic connections
- wiring harness
- connector repairs
- circuit resistance tests
- pump replacement



	Course Outcome 2	Learning Objectives for Course Outcome 2
	<p>Upon successful completion the apprentice is able to recommend repairs for diesel fuel injection full-authority engine management systems following manufacturers' recommendations.</p>	<p>5.2.1 Explain the fundamentals of diesel fuel injection full-authority engine management systems.</p> <ul style="list-style-type: none"> - applications - types - strategy - emission legislation <p>5.2.2 Identify the construction features of full-authority electronic control diesel fuel injection systems and components.</p> <ul style="list-style-type: none"> - sensors <ul style="list-style-type: none"> speed <ul style="list-style-type: none"> o crankshaft o camshaft o turbocharger o driveline pressure <ul style="list-style-type: none"> o engine oil o exhaust o intake manifold o atmospheric o fuel o injection actuation o cylinder o boost temperature <ul style="list-style-type: none"> o fuel o engine oil o exhaust o DPF o coolant o ambient air position <ul style="list-style-type: none"> o throttle o crankshaft o camshaft o EGR (exhaust gas recirculation) o VGT (variable geometry turbocharger) <ul style="list-style-type: none"> - electronic unit injectors pulse width <ul style="list-style-type: none"> poppet control valve circuit protection <ul style="list-style-type: none"> - hydraulic electronic unit injector (HEUI) high pressure pump pressure regulator pressure sensor unit injector oil reservoir <ul style="list-style-type: none"> - high pressure common rail high pressure pump pressure regulator pressure sensor

time-pressure (PT) injector

- injector drivers
- status switches
- cruise control
- clutch and brake
- exhaust brake
- power take-off
- air brake
- electronic control module
- protection shut down
- limp home mode
- backup microprocessor

5.2.3 Describe the principles of operation of full-authority electronic control diesel fuel injection systems and components.

- sensors
- speed
 - o crankshaft
 - o camshaft
 - o turbocharger
 - o driveline
- pressure
 - o engine oil
 - o exhaust
 - o intake manifold
 - o atmospheric
 - o fuel
 - o injection actuation
 - o cylinder
 - o boost
- temperature
 - o fuel
 - o engine oil
 - o exhaust
 - o DPF
 - o coolant
 - o ambient air
- position
 - o throttle
 - o crankshaft
 - o camshaft
 - o EGR (exhaust gas recirculation)
 - o VGT (variable geometry turbocharger)
- electronic unit injectors
 - pulse width
 - pulse profile
 - poppet control valve
 - effective stroke control
 - time control
 - injector drivers
 - switching characteristics
 - spiked actuation
 - injector response time
 - hydraulic electronic unit injector (HEUI)



high pressure pump
 pressure regulator
 pressure sensor
 unit injector
 oil reservoir
 - high pressure common rail
 high pressure pump
 pressure regulator
 pressure sensor
 time-pressure (TP) injector
 - electronic control module
 protection shut down
 limp home mode
 backup microprocessor
 injector driver
 cooling
 power de-rate mode
 data management
 programming
 power bulge

5.2.4 Perform inspection and diagnostic procedures following manufacturers' recommendations for full-authority electronically controlled diesel fuel injection systems.

- identify components and locations
- diagnostic techniques
- interpret electronic flow charts
- demonstrate the application of the electronic service tool (EST) and personal computer
- demonstrate reprogramming and uploading processes using a electronic service tool (EST)
- confirm electronic diagnosis with multi-meter testing

5.2.5 Recommend reconditioning or repair procedures following manufacturers' recommendations for full-authority engine management systems.

- describe connector seal assembly procedures
- outline checking procedures for electrical ground connection integrity
- outline boost starting procedures
- battery
- charger
- unit to unit

Course Outcome 3

Learning Objectives for Course Outcome 3

Upon successful completion the apprentice is able to interpret the exhaust emissions produced by diesel engines following manufacturers' recommendations.

5.3.1 Explain the fundamentals of diesel engine emission systems.

- properties
- carbon monoxide
- hydrocarbons
- oxides of nitrogen
- particulates
- carbon dioxide



sulphur dioxide
 aldehydes
 - catalysts
 oxidation
 emission standards
 federal regulations
 provincial regulations
 - aneroids
 - altitude compensators
 - sensors on emission controls

5.3.2 Demonstrate testing procedures following manufacturers' recommendations for diesel engine emission systems.
 - inspecting emission control devices
 - exhaust smoke analysis
 light extinction methods
 opacity meter
 filtration/colour code method
 - exhaust gas analysis
 four gas analysis

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Shop Assignments	40%
Theory Test	60%

Date:

February 10, 2020

Addendum:

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

