



COURSE OUTLINE: HET715 - FUEL SYSTEMS

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	HET715: FUEL SYSTEMS
Program Number: Name	
Department:	MOTIVE POWER APPRENTICESHIP
Semesters/Terms:	21F, 22W, 22S
Course Description:	Upon successful completion the apprentice is able to identify the type of fuel system used on various types of Heavy Equipment or Agricultural equipment engines describe the operating principles for mechanical governor systems, Electronic governors, diesel in-line fuel injection pump systems, Rotary fuel pump injection systems, Electronic Unit Injection systems and hydro mechanical injectors . The Students will be able to perform testing procedures, service procedures and timing procedures for in-line injection pump systems, distributor pump systems, and diesel unit injection systems as well as perform necessary adjustments and repair procedures to the fuel systems mentioned and is able to identify and perform injector replacement procedures - all following manufacturers` recommendations and government policies.
Total Credits:	4
Hours/Week:	0
Total Hours:	32
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>

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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Course Evaluation:	<p>Passing Grade: 50%, D</p> <p>A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.</p>
Other Course Evaluation & Assessment Requirements:	<p>EVALUATION PROCESS/GRADING SYSTEM:</p> <p>Students will be tested on the material covered per apprenticeship curriculum by multiple choice questions, assignments, and practical tests. The weigh factor for each area of testing will be as follows:</p> <ul style="list-style-type: none"> - Theory Tests 50% - Practical Tests 30% - Assignments 20% <p>This evaluation can change depending on the emphasis placed on each of the above testing procedures.</p>
Books and Required Resources:	<p>Medium/Heavy Duty Fuel Systems and computerized management systems by Bennett Publisher: cengage Edition: 5th</p>

Course Outcomes and Learning Objectives:	Course Outcome 1	Learning Objectives for Course Outcome 1
	<p>GENERAL LEARNING OUTCOME</p> <p>Upon successful completion the apprentice is able to describe the testing procedures for mechanical governor systems following manufacturers recommendations</p>	<p>LEARNING OUTCOMES AND CONTENT</p> <p>Upon successful completion, the apprentice is able to:</p> <p>5.1.1 Explain the purpose and fundamentals of diesel engine fuel injection system governors. [.5/0] - define terms</p> <ul style="list-style-type: none"> - high idle - rated speed - governor cut-off - droop curve - torque curve - hysteresis - hunting - torque rise - aneroid <p>5.1.2 Identify the construction features of mechanical governors. [.5/0]</p> <ul style="list-style-type: none"> - mechanical governors - variable speed - limiting speed - isochronous - linkages and control levers - aneroid - diaphragm, piston, or bellows - spring - boost pressure inlet - linkage rods - atmospheric vent - altitude compensators

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		<p>65</p> <p>5.1.3 Describe the principles of operation of mechanical governors. [1/0]</p> <ul style="list-style-type: none"> - mechanical governors - variable speed - limiting speed - isochronous - springs and flyweights - linkages and control levers - thrust collars - aneroid - diaphragm, piston, or bellows - spring - boost pressure inlet - linkage rods - atmospheric vent - altitude compensators <p>5.1.4 Perform testing procedures following manufacturers recommendations for mechanical governor assemblies. [0/2]</p> <ul style="list-style-type: none"> - demonstrate testing engine-governed speed - high idle speed - low idle speed
	<p>Course Outcome 2</p>	<p>Learning Objectives for Course Outcome 2</p>
	<p>GENERAL LEARNING OUTCOME Upon successful completion the apprentice is able to describe diesel in-line fuel injection pump system service procedures following manufacturers' recommendations and government policies</p>	<p>stem service procedures following manufacturers recommendations and government policies.</p> <p>LEARNING OUTCOMES AND CONTENT Upon successful completion, the apprentice is able to:</p> <p>5.2.1 Explain the purpose and fundamentals of diesel in-line injection pumps systems. [.5/0] - in-line pumps, metering, and controls</p> <ul style="list-style-type: none"> - pump housing - camshaft - charging gallery - pumping elements - port/helix - sleeve metering - delivery valves - lubrication - high pressure lines <p>5.2.2 Identify the component construction features of diesel in-line injection pumps. [.5/0]</p> <ul style="list-style-type: none"> - pump housing - camshaft - charging gallery - pumping element - plunger and barrel spill ports

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		<ul style="list-style-type: none"> - delivery valves <p>5.2.3 Describe the principles of operation of diesel in-line injection pumps. [2/0]</p> <ul style="list-style-type: none"> - metering in-line injection pumps - gallery charging - pumping element operation - port closure and effective stroke - racks - cam profile and injection rate - delivery valves - residual line pressure - lubrication - cam box - viscous sealing - heat dissipation <p>5.2.4 Recommend reconditioning or repairs following manufacturers' recommendations for inline injection pump systems. [0/3]</p> <ul style="list-style-type: none"> - demonstrate in-line injection pump static and dynamic timing - timing pins - electronic alignment - dial indicator - high and low speed adjustment - spill port timing
	Course Outcome 3	Learning Objectives for Course Outcome 3
	<p>GENERAL LEARNING OUTCOME Upon successful completion the apprentice is able to describe the timing procedures for distributor pump systems following manufacturers recommendations</p>	<p>LEARNING OUTCOMES AND CONTENT Upon successful completion, the apprentice is able to:</p> <p>5.3.1 Explain the purpose and fundamentals of inlet metering, opposed plunger and sleeve metering distributor injection pump systems. [.5/0]</p> <ul style="list-style-type: none"> - housing - opposed plungers - rotor - cam ring - hydraulic head - regulator assembly - timing advance - metering valve - transfer pump - fluid flow and capacity measurement - fuel supply system <p>5.3.2 Identify the construction features of inlet metering, opposed plunger and sleeve metering distributor high-pressure pumps and controls. [1.5/0]</p> <ul style="list-style-type: none"> - distributor pump and controls

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	<ul style="list-style-type: none"> - opposed plunger - single plunger - rotor - plungers - cam ring - hydraulic head - pressure regulator assembly - advance mechanism - metering valve - transfer pump <p>5.3.3 Describe the principles of operation of inlet metering, opposed plunger and sleeve metering distributor high-pressure pumps and controls. [2/0]</p> <ul style="list-style-type: none"> - distributor pump and controls - opposed plunger - single plunger - rotor - plungers - cam ring - hydraulic head - pressure regulator assembly - advance mechanism - metering valve - transfer pump <p>5.3.4 Recommend reconditioning or repairs following manufacturers recommendations for inlet metering, opposed plunger and sleeve metering distributor pumps. [1/3]</p> <ul style="list-style-type: none"> - Demonstrate distributor pump timing and indexing procedures - high and low speed adjustment
	<p>Course Outcome 4</p> <p>Learning Objectives for Course Outcome 4</p>
<p>GENERAL LEARNING OUTCOME Upon successful completion the apprentice is able to describe the diesel unit injection system repair procedures following manufacturers recommendations</p>	<p>LEARNING OUTCOMES AND CONTENT Upon successful completion, the apprentice is able to:</p> <p>5.4.1 Explain the purpose and fundamentals of diesel fuel unitized injection systems. [1/0]</p> <ul style="list-style-type: none"> - fuel flow - fuel delivery - injector types - controls - actuation <p>5.4.2 Identify the construction features of diesel fuel unitized injection system components. [2/0]</p> <ul style="list-style-type: none"> - fuel delivery - fuel manifolds - jumper pipes

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- transfer pump
- unit injectors
- body
- pumping element
- plunger and bushing
- upper and lower bushing ports
- helix designs
- needle valves
- control rack assembly
- tube
- rack levers

5.4.3 Describe the principles of operation of diesel fuel unitized injection systems.

[1/0]

- transfer pump
- positive displacement gear
- mechanically actuated unit injectors
- effective stroke
- timing of injection
- nozzle-opening valves
- pumping principle
- upper and lower bushing ports
- helix designs
- control rack and cam shaft
- injection rate
- fuel flow

5.4.4 Demonstrate inspecting, testing, and diagnostic procedures following manufacturers recommendations for unit injectors and control devices.

[1/1]

- diagnostic procedures of common failures
- troubleshooting techniques
- isolate faulty injector
- engine misfire

5.4.5 Recommend reconditioning, repairs, or adjustment procedures following manufacturers recommendations for diesel fuel unitized injection systems.

[0/2]

- demonstrate diagnostic procedures for:
- unit injectors
- return flow assessment
- temperature
- aeration
- volume
- suction
- pressure
- high and low speed adjustment

Course Outcome 5

Learning Objectives for Course Outcome 5

GENERAL LEARNING

LEARNING OUTCOMES AND CONTENT

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	<p>OUTCOME Upon successful completion the apprentice is able to identify injector replacement procedures following manufacturers' recommendations.</p>	<p>Upon successful completion, the apprentice is able to:</p> <p>5.5.1 Explain the purpose and fundamentals of electronic fuel injection systems. [.5/0]</p> <ul style="list-style-type: none"> - emission control - power/torque - economy - service intervals <p>5.5.2 Identify the construction features of electronic fuel injector components. [1.5/0]</p> <ul style="list-style-type: none"> - electronic unit injectors - poppet valve - nozzle - plunger - high pressure circuit - low pressure circuit - pressure regulation - high pressure - low pressure - hydraulic electronic unit injectors - poppet valve - nozzle - plunger - hydraulic control circuit - pressure regulation - fuel circuits - high pressure - low pressure <p>5.5.3 Describe the principles of operation of electronic fuel injector system devices. [1.5/0]</p> <ul style="list-style-type: none"> - electronic unit injectors - fuel circuit - low pressure - cooling - lubrication - high pressure - atomization - fuel control - metering - delivery - timing - hydraulic electronic unit injectors - hydraulic control circuit - pressure regulation - fuel circuits - high pressure - low pressure <p>5.5.4 Perform replacement procedures following manufacturers</p>
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recommendations operations
for electronic fuel injectors.
[.5/2]
- demonstrate injector replacement procedures
- outline servicing precautions for injector replacement
- electrical
- hydraulic
- fuel
- mechanical

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
assignments	20%
Shop Practical	30%
theory	50%

Date:

July 30, 2021

Addendum:

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

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