



# COURSE OUTLINE

## TCT814

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<b>Course Code: Title</b>	TCT814: FUEL SYTEMS
<b>Program Number: Name</b>	6082: T/C TECHN-LEVEL III
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semester/Term:</b>	18W
<b>Course Description:</b>	Upon successful completion the apprentice is able to understand the principles of operation, diagnose and repair hydraulically actuated, electronic unit injector systems, electronic unit pump diesel fuel systems, time-pressure (TP), electronic common rail systems, and electronically controlled, common rail accumulator, high pressure injection pumps.
<b>Total Credits:</b>	3
<b>Hours/Week:</b>	0
<b>Total Hours:</b>	24
<b>Essential Employability Skills (EES):</b>	<p>#2. Respond to written, spoken, or visual messages in a manner that ensures effective communication.</p> <p>#3. Execute mathematical operations accurately.</p> <p>#4. Apply a systematic approach to solve problems.</p> <p>#5. Use a variety of thinking skills to anticipate and solve problems.</p> <p>#6. Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>#7. Analyze, evaluate, and apply relevant information from a variety of sources.</p> <p>#10. Manage the use of time and other resources to complete projects.</p>
<b>General Education Themes:</b>	Science and Technology
<b>Course Evaluation:</b>	
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<p>Theory testing 70%</p> <p>Practical application testing 30%</p> <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>

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W Student has withdrawn from the course without academic penalty.

**Evaluation Process and Grading System:**

Evaluation Type	Evaluation Weight
practical application testing	30%
theory testing	70%

**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.**

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair of Hydraulically Actuated, Electronic Unit Injector (HEUI) Systems.

**Learning Objectives 1.**

:  
Explain the purpose and fundamentals of HEUI fuel systems.

- electronics
- computers
- input circuits
- electronics schematics
- hydraulics
- oil pumps
- fuel sub-systems

Identify the functions, construction, types, and application of HEUI fuel systems.

- system layout
- input circuits
- fuel circuit
- high-pressure oil circuits
- stepper pump
- injection pressure control module
- injection pressure control regulator
- HEUI assembly
- solenoid control
- amplifier / intensifier piston
- plunger and chamber
- pilot/PRIME plungers
- hydraulics nozzles
- engine controller module (ECM)

Describe the principle(s) of operation of HEUI fuel systems.

- rail fuel flow
- high-pressure oil management
- HEUI actuation principles
- cold start / warm-up strategies
- emission control strategies
- injection rate control
- pilot/PRIME feature
- oil specifications

Perform inspection, testing and diagnostic procedures on HEUI fuel systems.

- service requirements
- troubleshooting strategies
- using diagnostic flow chart
- cylinder balance testing
- analyzing actuation voltage
- interpreting fault codes
- selecting and using the system appropriate EST

Recommend reconditioning or repairs following manufacturers'™ procedures on HEUI fuel systems.

- HEUI replacement precautions
- HEUI replacement procedure
- failure analysis
- customer data programming
- interpreting proprietary terminology and system differences

## **Course Outcome 2.**

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair Electronic Unit Pump Diesel Fuel Systems.

## **Learning Objectives 2.**

Explain the purpose and fundamentals of electronic unit pump systems.

- electricity
- electronics
- computers
- digital electronics
- input and output circuits
- characteristics of cam geometry

Describe the principle(s) of operation of electronic unit pump systems.

- pump driver units
  - actuation voltage characteristics
  - electronic unit pumps
- control solenoid cartridges

Identify the functions, construction, and application of electronic unit pump systems

- ECMs: chassis and engine/fuel controllers
- switching apparatus
- interface modules
- pump driver units
- EUP components

- solenoid cartridge valves
- tappet, plunger and barrel assemblies
- charge fuel routing
- hydraulic nozzle assemblies
- electrohydraulic injectors (EHIs)
- high-pressure pipes
- distinguishing factors between different EUP systems

Describe the principle(s) of operation of electronic unit pump systems.

- pump driver units
- actuation voltage characteristics
- electronic unit pumps
- control solenoid cartridges
- injection pumping components
- hydraulic nozzles
- electrohydraulic injector (EHIs) control
- high-pressure pipes
- effective stroke control
- pilot injection
- default modes
- tattletale / audit trail logging
- effective stroke duty cycle/pulse width

Perform inspection, testing and diagnostic procedures electronic unit pump systems

- analyze customer data programming
- analyze proprietary data programming
- perform sequential troubleshooting using OEM text
- analyze circuit malfunctions
- perform an electronic EUP cutout test
- perform a snapshot test

Recommend reconditioning or repairs following manufacturers'™ procedures on electronic unit pump systems.

- outline procedure for diagnosing electronic malfunctions
- outline procedure for diagnosing hydromechanical malfunctions
- demonstrate proprietary data download procedures
- outline procedure for removing and replacing EUPs
- program customer engine and chassis data to an ECM

### **Course Outcome 3.**

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair time-pressure (TP), electronic common rail systems.

### **Learning Objectives 3.**

Explain the purpose and fundamentals of Time Pressure (TP), electronic common rail fuel systems.

- fuel sub-systems
- time pressure hydraulic equation
- dual cam geometry
- quiescent combustion

Identify the functions, construction, and application of Time Pressure (TP), electronic common rail fuel systems.

- fuel sub-system
- HPI-TP Injectors
- plunger and cup
- timing chamber
- timing solenoid
- metering solenoid
- cylinder head configuration
- ECM fuel flow routing

Describe the principle(s) of operation of Time Pressure (TP), electronic common rail fuel systems.

- common rail, time-pressure theory
- rail pressure management
- metering solenoid functions
- timing solenoid function
- flow controls
- dual camshaft functions
- engine brake management
- injector timing
- effective stroke characteristics
- trapped volume spill (TVS) management

Perform inspection, testing and diagnostic procedures on Time Pressure (TP), electronic common rail fuel systems.

- demonstrate adjustment procedure HPI-TP Injectors
- demonstrate priming procedure
- demonstrate electronic cylinder cutout procedure
- troubleshooting strategies

Recommend reconditioning or repairs following manufacturers' procedures on Time Pressure (TP), electronic common rail fuel systems.

- demonstrate engine timing fear procedure
- demonstrate electronically guided trouble shooting procedures

## **Course Outcome 4.**

Upon successful completion, the apprentice is able to understand the principles of operation, diagnose and repair of electronically controlled, common rail accumulator, high pressure injection pumps.

## **Learning Objectives 4.**

Explain the purpose and fundamentals of Common Rail, Accumulator Fuel Systems.

- fuel sub-systems
- fuel circuit schematic
- fueling hydraulic equations
- fuel sub-system
- linear proportioning solenoids
- injector actuation and controls

Identify the functions, construction, and application of Common Rail, Accumulator Fuel

Systems.

- fuel sub-system
- electrohydraulic Injectors (EHI)
- solenoid actuated
- piezo-actuated
- fuel rail design
- Fuel Amplified Common Rail Systems (FACR)
- intensifier piston
- amplification ratios
- high pressure pipes
- quill/transfer tubes
- low pressure fuel flow routing
- high pressure fuel flow routing

Describe the principle(s) of operation of Common Rail, Accumulator Fuel Systems.

- common rail fuel equations
- rail pressure management
- desired pressure/actual pressure
- rail pressure regulator
- rail pressure sensors
- flow controls
- pump characteristics
- injection controls
- solenoid actuators
- piezo actuators
- Fuel Amplified Common Rail Systems (FACR)
- fuel rate shaping
- multi-pulse injection

Perform inspection, testing & diagnostic procedures following manufacturers'™ recommendations on common rail systems

- cylinder balance test
- static actuator test
- test data analysis
- outline procedure for removing/replacing high pressure pipes

**Date:**

Thursday, March 1, 2018

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