



## COURSE OUTLINE: TCT813 - ELECTRICAL SYSTEMS

Prepared: Josh Boucher

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	TCT813: ELECTRICAL SYSTEMS
<b>Program Number: Name</b>	6082: T/C TECHN-LEVEL III
<b>Department:</b>	MOTIVE POWER APPRENTICESHIP
<b>Semesters/Terms:</b>	20W
<b>Course Description:</b>	Upon successful completion the apprentice is able to understand the principle of operation, diagnose and repair heavy duty charging circuits, and heavy duty ignition systems and components and is able to disassemble, repair, reassemble and diagnose heavy duty electrical components.
<b>Total Credits:</b>	4
<b>Hours/Week:</b>	0
<b>Total Hours:</b>	32
<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>	<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>
<b>Course Evaluation:</b>	<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>
<b>Other Course Evaluation &amp;</b>	Students will be tested on the material covered per apprenticeship curriculum by multiple

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 2020-2021 academic year.



SAULT COLLEGE | 443 NORTHERN AVENUE | SAULT STE. MARIE, ON P6B 4J3, CANADA | 705-759-2554

**Assessment Requirements:**

choice questions, assignments, and practical tests. The weigh factor for each area of testing will be as follows:

- Theory Tests 50%
- Practical Tests 30%
- Assignments 20%

This evaluation can change depending on the emphasis placed on each of the above testing procedures.

**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.

The following semester grades will be assigned to students:

**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.

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 2020-2021 academic year.



SAULT COLLEGE | 443 NORTHERN AVENUE | SAULT STE. MARIE, ON P6B 4J3, CANADA | 705-759-2554

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:**

Heavy Duty Truck Systems by Bennett  
 Publisher: Cengage Learning Edition: 6th

**Course Outcomes and Learning Objectives:**

Course Outcome 1	Learning Objectives for Course Outcome 1
<p>Explain the purpose and fundamentals off heavy duty charging circuits.</p>	<p>Explain the purpose and fundamentals off heavy duty charging circuits.</p> <ul style="list-style-type: none"> <li>- electronic basics</li> <li>- diodes and transistors</li> <li>- electromagnetism</li> <li>- voltage induction principles</li> <li>- inductive reactance of stator</li> <li>- battery conditions as affecting internal resistance</li> <li>- principles of tracing wiring schematics</li> <li>- electrical / electronic symbols</li> <li>- Ohm`s Law</li> <li>- temperature effects</li> <li>- factors affecting voltage and amperage output</li> <li>- field strength</li> <li>- rotor speed</li> <li>- inductive reactance</li> </ul> <p>Identify the functions, construction, types, and application of heavy duty charging circuits.</p> <ul style="list-style-type: none"> <li>- brush type alternators</li> <li>- rectifier</li> <li>- stator</li> <li>- delta, wye</li> <li>- rotor</li> <li>- field winding, poles, slip rings</li> <li>- diode trio</li> <li>- brush assembly</li> <li>- case</li> <li>- brushless alternators</li> <li>- stationary field</li> <li>- magnetic poles</li> </ul> <p>Ontario College of Trades            TRUCK &amp; COACH TECHNICIAN - LEVEL3 40</p> <ul style="list-style-type: none"> <li>- transformer multiple voltage system</li> <li>- remote sensing regulators</li> <li>- equalizer</li> <li>- bearings</li> <li>- pulleys</li> <li>- drive gears</li> </ul>

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 2020-2021 academic year.

- drive gear adapters
- voltage regulators
- external electronic
- internal electronic
- electronic digital
- charge equalizer
- cooling
- fans
- oil
- charge relays (bus and coach)

Describe the principle(s) of operation of heavy duty charging circuits.

- three-phase
- rectification
- full wave
- half wave
- induction principles
- alternating current
- differences between brush and brush less alternators
- dual voltage alternator
- transformer principle
- remote Sensing Regulators
- voltage regulator
- internal and external
- electronic principles
- load response
- charger indicators
- equalizers
- low voltage disconnect (LVD) switches

Perform inspection, testing and diagnostic procedures on heavy duty charging circuits.

- perform charging system visual inspection of
- belt tension and alignment
- connections and wiring
- battery and alternator specifications and application
- outline recommended charging system-testing sequence
- perform battery condition tests
- perform charging circuit resistance voltage drop tests
- perform charging system current and voltage output tests
- identify specific charging system faults from test results
- demonstrate voltage regulator bench tests
- test electronic noise suppression devices
- LED fault display

Ontario College of Trades

TRUCK & COACH TECHNICIAN - LEVEL3 41

Recommend reconditioning or repairs following manufacturers' procedures on heavy duty charging circuits.

- verify output capacity to satisfy the specific vehicle electrical load

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 2020-2021 academic year.



SAULT COLLEGE | 443 NORTHERN AVENUE | SAULT STE. MARIE, ON P6B 4J3, CANADA | 705-759-2554

	<p>specifications</p> <ul style="list-style-type: none"> <li>- adjust alternator drive belt tension and alignment</li> <li>- disassemble, test, reconditioning and reassemble alternators</li> <li>- repair oil cooled alternator</li> <li>- outline voltage regulator rebuilding procedures</li> <li>- performance test repairs on vehicle</li> </ul>
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
Understand the principles of operation, diagnose and repair heavy duty ignitions systems and components	<p>LEARNING OUTCOMES AND CONTENT</p> <p>Explain the purpose and fundamentals of heavy-duty electronic ignition systems.</p> <ul style="list-style-type: none"> <li>- electronic ignition systems</li> <li>- electronic engine management</li> <li>- distributorless ignition</li> <li>- electromagnetism, electron theory</li> <li>- semi-conductors, capacitance</li> <li>- Ohm`s law</li> <li>- four-stroke cycle and spark timing</li> <li>- centrifugal force</li> <li>- ignition timing factors</li> <li>- engine speed</li> <li>- load</li> <li>- temperature</li> <li>- detonation</li> </ul> <p>Identify the functions, construction, types, styles and application of heavy-duty electronic ignition systems.</p> <ul style="list-style-type: none"> <li>- coils</li> <li>- primary and secondary windings</li> <li>- distributors</li> <li>- reluctor and pick-up coil</li> <li>- hall effect</li> <li>- optical</li> <li>- spark timing advance mechanisms</li> <li>- mechanical</li> <li>- vacuum</li> <li>- computer controlled</li> <li>- secondary voltage output circuit</li> <li>- high-tension spark plug wires</li> <li>- spark plugs</li> </ul> <p>Ontario College of Trades TRUCK &amp; COACH TECHNICIAN - LEVEL3 44</p> <ul style="list-style-type: none"> <li>- coil and plug</li> <li>- ignition modules</li> <li>- sensors</li> <li>- crankshaft position</li> <li>- camshaft position</li> <li>- coolant temperature</li> <li>- knock sensor</li> <li>- manifold absolute pressure</li> </ul> <p>Describe the principle(s) of operation of heavy-duty electronic</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 2020-2021 academic year.



ignition systems.

- coils
- pulse transformer theory
- capacitive discharge
- coil and plug
- distributors
- reluctor and pick-up coil
- hall effect
- optical
- spark timing advance mechanisms
- mechanical
- vacuum
- computer controlled
- speed
- load
- temperature
- detonation
- secondary voltage output circuit
- high-tension spark plug wires
- spark plugs
- ignition modules
- sensors
- crankshaft position
- camshaft position
- coolant temperature
- knock sensor
- manifold absolute pressure

Ontario College of Trades TRUCK & COACH TECHNICIAN -  
LEVEL3 45

Perform inspection, testing and diagnostic procedures using an  
ignition analyzer  
(scope).

- identify and locate electronic ignition system components on  
vehicles
- distributor components
- coils, ignition modules
- sensors
- switches
- wiring
- ignition timing and spark advance operation
- ignition coils and high-tension wires
- diagnose electronic ignition system component condition  
using  
recommended testing sequence

Recommend reconditioning or repairs following manufacturers`  
procedures on heavyduty electronic ignition systems.

- replacing spark plugs

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 2020-2021 academic year.



SAULT COLLEGE | 443 NORTHERN AVENUE | SAULT STE. MARIE, ON P6B 4J3, CANADA | 705-759-2554

	<ul style="list-style-type: none"> <li>- diagnostic testing sequence</li> <li>- coils and coil packs</li> <li>- ignition modules</li> <li>- sensors</li> <li>- wiring and connections</li> <li>- distributor components</li> </ul>
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
To disassemble, repair, reassemble and diagnose heavy duty electrical components.	<p>Explain inspection, testing and diagnostic procedures on heavy-duty electrical components and circuits.</p> <ul style="list-style-type: none"> <li>- diagnose electrical auxiliary component malfunctions</li> <li>- diagnose battery state of charge and condition</li> <li>- diagnose cranking circuit malfunctions</li> <li>- diagnose charging circuit malfunctions</li> <li>- hard flow charts</li> <li>- soft flow charts</li> <li>- electronic circuit schematics</li> <li>- software guided troubleshooting</li> <li>- on-line troubleshooting</li> <li>- sequential troubleshooting strategies</li> <li>- software sequenced troubleshooting</li> <li>- proprietary PC software</li> <li>- truth table routing</li> <li>- default modes</li> <li>- audit trails</li> <li>- tattletales</li> </ul> <p>Identify reconditioning or repairs following manufacturers' procedures on heavy-duty electrical components.</p> <ul style="list-style-type: none"> <li>- recondition truck electrical auxiliary components</li> <li>- reconditioning truck electrical cranking motors</li> <li>- recondition truck and coach AC generators</li> </ul>

<b>Evaluation Process and Grading System:</b>	<b>Evaluation Type</b>	<b>Evaluation Weight</b>
	Assingments	20%
	shop	30%
	theory tests	50%

**Date:** September 2, 2020

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

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 2020-2021 academic year.