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Spring 1-2015

# DST 120.01: Electrical Systems

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**ELECTRICAL SYSTEMS**  
**DET 120**  
**8 CREDITS**  
**SPRING 2015**

**COURSE DESCRIPTION:**

The theory of AC/DC electricity including Ohm's Law, Magnetism, Wiring Diagrams, and Circuit analysis. Starting, Charging, and related systems will be covered in depth using test equipment found in the heavy equipment field. Electronic systems are studied including the usage of computers and scan tools for troubleshooting related type systems using manufacture spec software and testing of related typed sensors and their operation.

**COURSE OBJECTIVES:**

- 1) Perform electrical and electronic troubleshooting and repair procedures in a safe manner.
- 2) Explain the principles of electricity as found in heavy equipment electrical systems.
- 3) Diagnosis and repair a charging system or starting system and related components using the correct test equipment as found in heavy equipment repair facilities.
- 4) Hook-up and interpret test data using common electrical meters and related test equipment.
- 5) Explain the common operation of electronic components as applied to the heavy equipment field.
- 6) Diagnosis and repair of computerized systems using scan type tools and computers including the correct manufactures software when applicable.

## **REQUIRED TEXTS:**

Heavy Duty Truck Systems  
5<sup>th</sup> edition  
Sean Bennett

## **COURSE OUTLINE:**

### **SAFETY**

- A) Electrical Safety
- B) General Shop Safety

### **BASIC THEORIES**

- A) Basic Electron Flow
- B) Voltage
- C) Amperage
- D) Resistance
- E) Meter Usage
- F) Circuits

### **BASIC ELECTRICAL TROUBLESHOOTING**

- A) Troubleshooting Techniques
- B) Test Instruments
- C) Component Testing
- D) Testing for Opens, Shorts, Grounds
- E) Voltage Drop Testing

### **WIRING AND WIRE SCHEMATICS**

- A) Wire Size
- B) Wire Repairs
- C) Connector Construction and Repair
- D) Use of Wiring Diagrams

### **BATTERIES**

- A) Battery Construction and Operation
- B) Battery Maintenance
- C) Battery Ratings
- D) Load Testing Batteries
- E) Charging Procedures

### **STARTING SYSTEMS**

- A) Basic Starter Motor Construction and Operation
- B) Starter Motor Diagnosis and Repair
- C) Starter System Check-out
- D) Series Parallel Systems

## CHARGING SYSTEMS

- A) Basic Charging System Construction and Operation
- B) Generator/Alternator Diagnosis and Repair
- C) Charging System Check-out
- D) Generator/Alternator Bench Testing
- E) Regulation of Current and Voltage

## LIGHTING SYSTEMS

- A) Head Light Circuits
- B) Tail Light Circuits
- C) Turn Signal/Hazard Circuits
- D) Accessory Light Circuits

## INSTRUMENTATION AND WARNING SYSTEMS

- A) Gauge/Sending Unit Operation
- B) Engine Shutdown Systems

## ELECTRICAL ACCESSORIES

- A) Wiper Motors
- B) Blower Motors
- C) Jacobs Engine Brakes
- D) Thematic Engine Fans

## IGNITION SYSTEMS

- A) Basic Ignition Systems
- B) Ignition Timing
- C) Computer Controlled Timing

## DIESEL COMPUTER SYSTEMS

- A) Analog and Digital Principles
- B) Central Processing Unit
- C) Computer Inputs and Outputs
- D) ECM Programming

## **GRADING:**

**LECTURE:** Counts for 50% of your final grade-this will include tests, quizzes, work ethics, attitude, attendance. If you have an overall score of 92% or better in lecture at finals time you do not have to take the final-your lecture grade will be an A for lecture.

**LAB:** Counts for 50% of your final grade-this will include lab sheets signed off by the instructor at the time of completion-Please do not ask for sign off's after the completion of the current project and the start of another, I will not sign the sheet unless prior arrangements have been made!! Attitude, Work Ethics and attendance will also influence your lab grade. Your lab grade can only raise your final grade one letter grade overall.

**NOTEBOOK:** Each student will be required to keep a three ring type notebook to contain the following: Handouts as given by date, class notes, and lab job sheets signed by the instructor in order of completion.

**ATTENDANCE:** Each student will have **3 free days** during the semester; After the 3 days are used up each unexcused absence after will drop the final grade one letter until a grade of F is reached. Being Late Counts the same of being Absence.

**TOOLS:** Each student must have a multi meter meeting the EM710 MAC Tools meter specifications. The student is responsible for fuses, meter leads and clips.

**CELL PHONE/MUSIC:** Cell phones are to be turned off unless you are expecting an emergency type call. Listening to music during class time will not be tolerated!!!

## LAB CHECK-OFF SHEET

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

LAB PARTNERS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**THIS SHEET WILL BE TURNED IN AT THE END OF THE SEMESTER ALONG WITH ALL JOB SHEETS OR THE LAB GRADE WILL BE F**

### CIRCUITS

2 series circuits	1 _____	2 _____
2 parallel circuits	1 _____	2 _____
2 series-parallel circuits	1 _____	2 _____
2 wiring schematic drawings	1 _____	2 _____

### TEST EQUIPMENT

2 analog volt meter usages	1 _____	2 _____
2 digital volt meter usages	1 _____	2 _____
2 analog amp meter usages	1 _____	2 _____
2 digital amp meter usages	1 _____	2 _____
2 analog ohm meter usages	1 _____	2 _____
2 digital ohm meter usages	1 _____	2 _____
2 carbon pile usages	1 _____	2 _____

### BATTERIES

2 battery clean and test	1 _____	2 _____
2 battery cable end repairs	1 _____	2 _____

### CHARGING SYSTEMS

2 alternator rebuild/test 1 \_\_\_\_\_ 2 \_\_\_\_\_  
2 charging system checkouts 1 \_\_\_\_\_ 2 \_\_\_\_\_

**STARTING SYSTEMS**

1 automotive style rebuild 1 \_\_\_\_\_  
2 heavy duty rebuilds 1 \_\_\_\_\_ 2 \_\_\_\_\_  
2 heavy duty on vehicle tests 1 \_\_\_\_\_ 2 \_\_\_\_\_

**ACCESSORY CIRCUITS**

2 lighting systems test/repairs 1 \_\_\_\_\_ 2 \_\_\_\_\_  
2 turn signal test/repairs 1 \_\_\_\_\_ 2 \_\_\_\_\_  
2 trailer test/repairs 1 \_\_\_\_\_ 2 \_\_\_\_\_

**ELECTRONIC ENGINE CIRCUITS**

1 Detroit Diesel 60 series checkout 1 \_\_\_\_\_  
1 Cummins N-14 checkout 1 \_\_\_\_\_  
1 Cat 3176/3126 checkout 1 \_\_\_\_\_  
1 Cat C-15 checkout 1 \_\_\_\_\_  
1 Navistar 466/444 E checkout 1 \_\_\_\_\_

**LAB GRADING SCALE**

42-46=A  
37-41=B  
32-36=C  
27-31=D  
0-31=F