

FA4 Advanced Electrical Systems

June 2024

Reference Materials: Note: Exam may contain "accepted practice" type questions not found in the reference material listed below.

NFPA 1900: Standard for Aircraft Rescue and Firefighting Vehicles, Automotive Fire Apparatus, Wildland Fire Apparatus, and Automotive Ambulances (**NFPA 1901 Chapters 10, 11, 21, 22 & Annex A**) 2024 edition

NFPA 1960, Standard for Fire Hose Connections, Spray Nozzles, Manufacturer's Design of Fire Department Ground Ladders, Fire Hose, and Powered Rescue Tools (**NFPA 1936 Chapters 22**) 2024 edition

NFPA 1910: Standard for the Inspection, Maintenance, Refurbishment, Testing and Retirement of In-Service Emergency Vehicles and Marine Firefighting Vessels (**NFPA 1911 Chapters 6, 26 & Annex A**) 2024 edition

to order NFPA documents call 800-344-3555 or order online at www.nfpa.org

Fundamental Electrical Troubleshooting, by Dan Sullivan 800-227-1603 <http://www.esitest.com/182.html> or online retailers

Essentials of Electrical Power Generation, by Dan Sullivan 800-227-1603 <http://www.esitest.com/183.html> or online retailers

Guide to Hydraulic Power Generation, Russell Scott Dixon. Call the EVT office at 847-426-4075 to request a copy to be emailed to you for no charge for a limited time, compliments of Scott Dixon.

V-MUX Six-Step Troubleshooting Guide v1- v3, **V-MUX Input/Output Relationships Report & V-MUX Troubleshooting**

Checklist download for no charge from <http://www.akronbrass.com> then to Vehicle Electronics, Firmware & Software, Manuals

Any manufacturers operational and troubleshooting manual or Engine manufacturers electronic diagnostic manuals

LEARNING OBJECTIVES

The technician shall understand the concepts, terms, and phrases related to:

1. A/C Line Voltage

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|------------------------------|------------------------------------|--|
| a. Components and terms | b. Application and Troubleshooting | (8) Effects of voltage drops on components |
| (1) Single phase | (1) Wiring connections | (9) Portable Equipment |
| (2) Three phase | (2) Wiring methods | A. Maximum voltage supplied to |
| (3) Neutral wire | (3) Repair techniques | c. Installations |
| (4) Ground wire | A. Tools | (1) Receptacles |
| (5) Bonding | B. Electrical | A. Mounting height in wet locations |
| (6) Inrush / startup current | C. Harness connectors | B. Switching |
| (7) Soft start | (4) Receptacle types | (2) Light masts |
| (8) Frequency | (5) Wire routing | (3) Wiring |
| (9) Sine wave | (6) Diagnostic tools | A. Connection to frame rails |
| (10) Photo resistor | (7) NFPA standards | |
| (11) Resistor | A. Conductors | |
| (12) True Power | B. Polarity verification | |
| (13) Prime Movers | C. Circuits | |
| (14) Voltage Drop | D. Remote power Distribution | |
| (15) Testing | E. Transfer switch | |
| (16) Hertz | F. Grounding | |
| | G. Testing | |
| | (a) Full load test | |
| | H. Out of Service | |

2. System Knowledge

- | | | |
|----------------------------|---------------------------------------|--------------------------|
| a. Circuit drawings | (8) Capacitor | c. Transfer switches |
| (1) Resistor | (9) Pressure Governor | d. Power transmission |
| (2) Diode | (10) Potentiometer | (1) Branch circuits |
| (3) Rectifier | (11) AND gate | (2) Distribution remote |
| (4) Transistors | (12) OR gate | e. Amperage loads |
| A. Base | b. Circuit protection | f. Component information |
| B. Emitter | (1) Over current protection | (1) capacitor |
| C. Collector | (2) Circuit rating | (2) relays |
| (5) Thermistors | (3) Ground fault circuit interrupters | g. Wire connections |
| (6) Wire Splice | (4) Wet/dry listings | (1) Wire Symbols |
| (7) Pulse Width Modulation | (5) Circuit breaker switches | h. Crimping tools |

3. Sources

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|---------------------------|----------------------------|--------------------------|
| a. Shoreline power | (2) Generator installation | (6) Drive Diagnostics |
| b. Invertors & converters | A. Requirements | (7) Generator poles |
| (1) Dynamic power | B. Voltage regulation | (8) Hydraulic generators |
| (2) Static power | (3) Drives | A. Capacitor effects |
| c. Generators | (4) Generator Governors | B. PTO inspection |
| (1) Interlocks | (5) Generator Diagnostics | C. Filters |

D. Hose reversal

4. **Accessories**

- a. Cable reels
- b. Scene lighting
 - (1) Requirements
 - (2) Interlocks
 - (3) Light masts
 - (4) Remote towers
 - (5) Operational testing

5. **Low Voltage Systems**

- a. Load managers/sequencers
 - (1) 1900/1910
 - A. Inspection and Maintenance
- b. Troubleshooting
 - (1) Testing
 - A. Voltage drop test
 - B. Functional test
- c. Low Voltage System Knowledge
 - (1) Parallel & Series wiring
 - (2) PWM
 - (3) Manufacture Recommendations
 - (4) Inspection & Maintenance
 - (5) Kirchoff's Law

6. **Multiplex Systems**

- a. Components
 - (1) V-MUX modules
 - A. Hercules node
 - B. Vista node
 - C. Mini node
 - D. Deutsch connectors
 - (2) Sensors
 - A. Active
 - B. Passive
 - (3) Class 1 ES-Key Modules
- b. Interface
 - (1) Fast idle function
 - (2) PEER to PEER

7. **Operations**

- a. Load minder
- b. Water tank level indicating system
- c. Rotation limiting
- d. Pressure governor
- e. Transducers

- c. Rescue tools
 - (1) Quik-connect requirements
 - (2) Battery powered
- d. Hydraulic power unit
- e. Winches

- d. Data Recorders
 - (1) Data recorded
- e. Seat Belt Warning System
 - (1) Warning Devices
 - A. Audible
 - B. Visual
- f. 1910/1901
 - (1) Power Supply
 - (2) Low Voltage Batteries

- c. Programming
 - (1) Interlocks
 - (2) Control Module
 - (3) Reports
 - (4) Communication
- d. Terminology
 - (1) CAN
- e. Troubleshooting
 - (1) VMUX
 - (2) Welding
 - (3) CAN
- f. System Knowledge
 - (1) Wiring
 - (2) Amount of components
 - (3) Effect of AC voltage

- f. Proximity switches
- g. Engine Controls
 - (1) Throttle position sensor
 - (2) Electronic unit injector
 - (3) Sensors
 - (4) ECU
 - (5) D.P.F. Systems
- h. Vehicle data recorder
- i. Ground connections