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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J821

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Submitted for recognition as an American National Standard

ELECTRICAL WIRING SYSTEMS FOR CONSTRUCTION, AGRICULTURAL, AND OFF-ROAD MACHINES

***Foreword*—**This Reaffirmed Document has been changed only to reflect the new SAE Technical Standards Board Format.

***1. Scope*—**This SAE Recommended Practice applies to off-road, self-propelled work machines defined in SAE J1116 JUN81.

1.1 Purpose—This document is intended as a guide in establishing recommended material specifications and identification of the on-board electrical wiring systems for construction, agricultural, and off-road machines.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J537—Storage Batteries
SAE J538—Grounding of Storage Batteries
SAE J538—Electrical Terminals—Eyelet and Spade Type
SAE J858—Electrical Terminals—Blade Type
SAE J928—Electrical Terminals—Pin and Receptacle Type
SAE J1116—Categories of Off-Road Self-Propelled Work Machines
SAE J1127—Battery Cable
SAE J1128—Low Tension Primary Cable

2.1.2 MIL PUBLICATIONS—Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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3. Definitions

3.1 Electrical Circuits—An electrical circuit includes all of the components and connecting cables, starting from the electrical energy source, going to the functional component(s), and the return route to the energy source.

3.2 Electrical Component—An electrical component is normally a combination of parts, sub-assemblies, or assemblies and is a self-contained element intended to store, generate, distribute, alter, or consume electrical energy or effect an electrical junction.

3.2.1 ELECTRICAL CABLE—Insulated stranded electrical conductor used to establish a single current path.

3.2.2 HARNESS—A group of two or more cables, bundled together.

3.2.3 CABLE OR HARNESS PROTECTION—Any material which provides increased protection from abrasion, pinching, and abuse, such as woven braid, nonmetallic, or metallic conduit.

3.2.4 TERMINAL—A device attached to a cable to facilitate connection with another cable or termination.

3.2.5 CONNECTOR—A coupling device which provides an electrical and/or mechanical junction between two cables, or between a cable(s) and an electrical component.

4. Specifications

4.1 Cable, Primary—Per SAE J1128, Type SXL is recommended.

4.2 Cable, Battery—Per SAE J1127.

4.3 Terminals, Eyelet and Spade—Per SAE J561. Wherever possible, it is recommended to apply these terminals by combination of crimping and soldering. Terminals may be brass, phosphorus, bronze, or copper, with tin plating.

4.4 Terminals, Battery—Per SAE J537. Sealed terminals are preferred to avoid oxidation and corrosion of the connection. The lead die cast type with steel reinforcement is the recommended type on the tapered post terminals. For stud type terminals, the terminal to the battery cable core shall be any of several methods designed to cause intimate electrical contact of the terminal with the cable core. The connection should be sealed or molded with a suitable covering to resist corrosion or oxidation. The connection shall meet the performance requirements of MIL-T-7928, paragraph 3, 5, and 7 and Table II except for tensile (break) strength which shall exceed 50% of the rated strength of the cable to which it is attached. For greater strength, protection from corrosion, and better conductivity, soldering of terminals is recommended in addition to the mechanical method of retention.

4.5 Terminals, Connector Type—Refer to SAE J858 and SAE J928. This type is intended for rapid disconnection. There are various connectors which provide different levels of environmental protection, load-carrying capacity, etc. It is the designer's responsibility to evaluate the requirements and select a reliable connector.

4.5.1 Corrosion protective compounds may be used on connectors where required.

4.6 Terminal Insulation Material—Individual terminations may be protected by insulation material to provide a tight nonslip assembly. Shrinkable or molded insulating sleeves are recommended; this is intended to prevent vibration produced fatigue at the transition point of the terminal to the cable.

5. Circuits

5.1 Circuit Identification—Circuits shall be identified by either color, numbers, letters, symbols, or a combination.

5.1.1 CIRCUIT IDENTIFICATION (NUMBERS, LETTERS, OR SYMBOLS)—Identification of circuits may be by use of tags, imprint, or hot stamp, with embossed numbers, letters, or symbols at the circuit connections.

5.1.2 CIRCUIT IDENTIFICATION COLOR CODE—Identification of circuits may be by use of colored cable. The color of cables shall correspond to SAE J1128.

5.1.3 COLOR, IDENTIFYING NUMBER, LETTER, OR SYMBOL COMBINATION—The identification of complex circuits may employ the basic color assigned to the group plus the circuit identification number. Circuit identification shall change when passing through an electrical component, but not change when passing through terminal block or plug type connectors.

5.2 Circuit Group Identifications by Function

5.2.1 BATTERY FEED GROUP—This group of circuits includes all live leads from the battery(s) and charging system to the live terminals of the various circuits when all switches are in the "off" position, with the exception of the main switch and the battery master disconnect switch.

5.2.2 ENGINE GROUP—This group of circuits is concerned with the functioning of the engine, including starter actuation, electrical ignition, engine run, engine stop functions, electric clutch, or fan.

5.2.3 MONITORING GROUP—This group of circuits is concerned with monitoring the operation of the machine by providing operator feedback indication and warnings, such as temperature, pressure, quantity, quality, and position.

5.2.4 LIGHTING GROUP—This group of circuits encompasses all circuits providing work and travel illumination for machine operation, visual identification, cab, panel, and gauge illumination.

5.2.5 CONTROL GROUP—This group of circuits is concerned with the control characteristics of the machine.

5.2.6 ACCESSORIES GROUP—This group of circuits includes accessories and components such as horns, window wipers, heaters and air conditioners, communication entertainment, etc.

5.2.7 ELECTRICAL PROPULSION—This group of circuits encompasses all circuits controlling power for electric propulsion of the machine.

5.2.8 AUXILIARY POWER GROUP—This group of circuits encompasses all circuits providing and using auxiliary power of any voltage or frequency different from the basic battery feed group.

6. General Considerations

6.1 Harnesss and Cables—When exposed to the weather, machine fluids, abrasion, abuse, etc., harnesses and cables shall be protected with material defined in 3.2.3. Other harnesses and cables may be bundled with lacing cord or nonmetallic tie straps.

6.2 Circuit Diagrams—A circuit diagram should be furnished for the electrical system of each machine, including voltage and ground polarity data.

6.3 Grounding—The negative side of the battery system shall be grounded securely in conformance with SAE J538. When used, the master disconnect switch should be installed on the ground side of the battery system.

6.4 General Recommendations

a. The use of an electrical master disconnect switch on the ground side of the battery circuit
b. The use of a neutral start switch
c. The use of electrical circuit protection
d. The use of voltage monitoring

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