



SURFACE VEHICLE STANDARD	J180™	OCT2024
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Superseding J180 MAY2019		
Electrical Charging Systems for Off-Road Work Machines		

RATIONALE

Administrative changes to modernize language (i.e., replace references to master and slave). Grammar, capitalization, hyphenation corrections needed to be made.

1. SCOPE

This SAE Standard describes alternator physical, performance, and application requirements for heavy-duty electrical charging systems for off-road work machines, including those defined in SAE J1116.

1.1 Purpose

The purpose of this SAE Standard is to provide information on which to base machine and component design and to establish minimum requirements that will result in the most satisfactory operation of electrical charging systems for off-road work machines and other heavy-duty applications.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J56	Road Vehicles - Alternators with Regulators - Test Methods and General Requirements
SAE J537	Storage Batteries
SAE J930	Storage Batteries for Off-Road Self-Propelled Work Machines
SAE J1113-11	Immunity to Conducted Transients on Power Leads
SAE J1116	Categories of Off-Road Self-Propelled Work Machines

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SAE J1416	Generator Terminal Labeling
SAE J1455	Recommended Environmental Practices for Electronic Equipment Design in Heavy-Duty Vehicle Applications
SAE J2669	Voltage Regulators for Automotive-Type Generators

3. DEFINITIONS

3.1 BATTERYLESS OPERATION

Batteryless operation occurs in a machine application whenever the battery becomes disconnected from the alternator. The electrical load of the alternator is significantly different in this situation. The disconnection may be intentional or unintentional. In some applications, machines are shipped for export without batteries. In this situation, an external battery may be used for jump-starting the machine. After the machine is started, the battery is disconnected, and the machine is moved. During movement, the alternator is operating without the battery and expected to power such items as the engine control unit, transmission control unit, and engine fuel solenoids.

Batteryless operation can also occur during operational usage whenever there is:

- a. A battery open cell failure
- b. The battery becomes extremely sulfated
- c. The connections to the battery become loose
- d. The connections to the battery become corroded
- e. A master disconnect switch becomes open or its connections become open

The effect of the alternator operating in a batteryless situation is typically a wider range of voltages in output than when loaded with a battery. Some alternators do not produce output without a battery, or voltage regulation may become unstable.

3.2 LOAD DUMP

A sudden interruption of most electrical loads from the alternator during alternator operation causes a self-induced voltage surge named load dump. Load dump could be caused by such items as connections to the alternator B+ terminal becoming loose, connections to the alternator B+ terminal being corroded, defective alternator output cables, etc. The effect of a load dump is the presence of voltage spikes significantly exceeding system voltage and may exceed the voltage breakdown limits of some electrical components to cause damage.

3.3 NORMAL CHARGING SYSTEM OPERATION

Normal charging system operation includes an alternator that generates electrical energy from a mechanical source, a voltage regulator to control the alternator output voltage, and a battery that provides a standby source of electrical energy. Further information on voltage regulators is found in SAE J2669 and on battery specifications is found in SAE J537 and SAE J930.

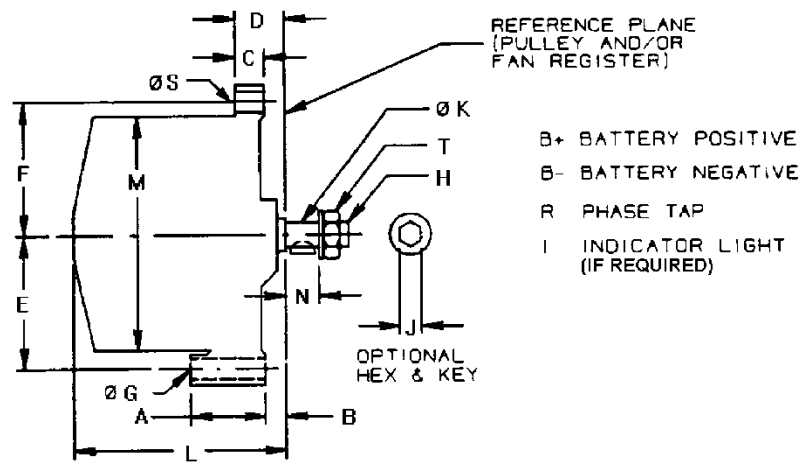
3.4 REVERSE POLARITY

Reverse polarity occurs when the battery positive and negative cables are hooked up in reverse. This condition normally results in damage to the alternator and to any other semiconductor loads that experience the reverse polarity hookup.

4. PHYSICAL REQUIREMENTS

4.1 Dimensional

Figure 1 portrays a spool-mount alternator. Figure 2 portrays a hinge-mount alternator. Figure 3 portrays a pad-mount alternator. Included in all are alternator shaft hub dimensions.



															Terminals			
A	B	C	D	E	F	G	H	J	K	L	M	N	S	T	B+	B-	R	I
◇	◇			Max	Max				◇	Max	Max			Torque Max				
51	21	16	32	105	105	10	5/8 or M16	8	17 or 22.2	170	180	20	10 or M8	65 Nm	5/16 or M10	1/4 or M6	#10 or M4	#10 or M4

Note: Unless indicated all dimensions are nominal.
◇ is a critical dimension

Figure 1 - Alternator dimensions for spool mounting

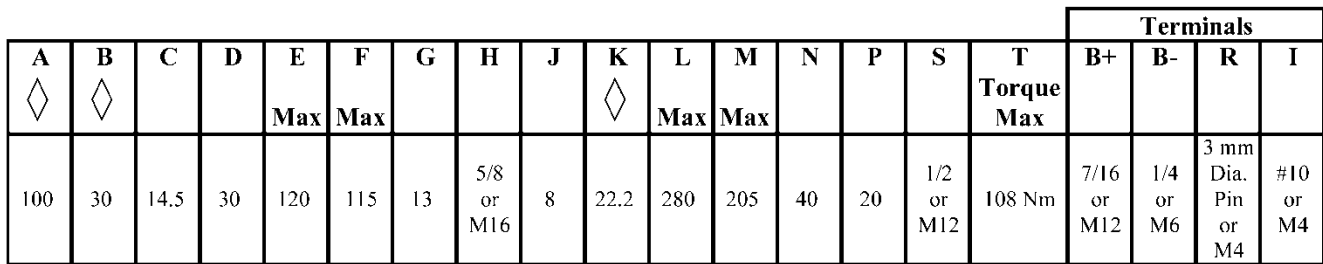


Figure 2 - Alternator dimensions with hinge mounting