SAE International™

SURFACE VEHICLE STANDARD

SAE J2120 AUG2008

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Superseding J2120 JUL1997

Personal Watercraft—Electrical Systems

RATIONALE

SAE Personal Watercraft Recommended Practice J2120 was finalized in July 1997. It has been widely accepted by the Personal Watercraft industry and used as a guide towards standard engineering practice since its inception. It is part of the certification criteria of the National Marine Manufacturers Association Personal Watercraft Certification Program and has become a technical reference within ISO 13590 – Personal Watercraft Construction and System Installation Requirements. As a result of this activity, the Recommended Practice classification of this SAE Technical Report can be upgraded to the Standard level.

1. SCOPE

This SAE Standard applies to personal watercraft as defined in Section 3. With the exception of Sections 5 and 6, this document does not apply to electronic circuits having a current flow of less than 1 A; conductors which are totally inside an equipment housing; resistance conductors that control circuit amperage; high-voltage secondary conductors and terminations that are in ignition systems; pigtails of less than 180 mm of exposed length; and cranking motor conductors.

1.1 Purpose

This document specifies construction and performance guidelines for electrical systems of personal watercraft. It is intended as a guide toward standard practice and is subject to change to keep pace with experience and technical advances.

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

SAE J378 Marine Propulsion System Wiring

SAE J1127 Low Voltage Battery Cable

SAE J1128 Low Voltage Primary Cable

SAE J2031 High Tension Ignition Cable

3. DEFINITIONS

3.1 AWG

American Wire Gauge.

3.2 Conduit

Any type of rigid plastic or metal piping or tubing which supports the conductors contained within.

3.3 Electrical Component

Electrical equipment such as, but not limited to, conductors, solenoids, motors, alternators, distributors, resistors, and electrical control devices.

3.4 High Voltage Circuit

A nominal voltage of 50 V or more.

3.5 Ignition Protection

The design and construction of a device such that under design operation conditions it will not ignite a flammable hydrocarbon mixture surrounding the device when an ignition source causes an internal explosion, or it is incapable of releasing sufficient electrical or thermal energy to ignite a hydrocarbon mixture, or the source of ignition is hermetically sealed.

3.6 Low Voltage Circuit

A nominal voltage of less than 50 V.

3.7 Personal Watercraft

A vessel less than 4 m (13 ft) in length which uses an internal combustion engine powering a water jet pump as its primary source of propulsion, and is designed to be operated by a person or persons sitting, standing, or kneeling on rather than within the confines of a hull.

3.8 Pigtail

External power conductors or wires that are part of electrical components such as bilge pumps, blowers, switches, solenoids, and fuses.

3.9 Sheath

A material used as a continuous protective covering, such as electrical tape, molded rubber, molded plastic, or flexible tubing, around one or more insulated conductors.

4. CONDUCTOR TYPE, SIZE, AND IDENTIFICATION

4.1 Each conductor must be insulated, stranded copper.

4.2 Low-voltage conductors shall comply with SAE J378b, SAE J1127, SAE J1128, or equivalent standards.

4.3 No conductor shall be used to carry an amperage greater than that specified in Table 1 for its gauge. The ampacity of conductors in an engine compartment must be corrected by the appropriate factor indicated in Table 1.

4.4 A means of identification shall be used to distinguish individual conductors.

5. CONDUCTOR SUPPORT AND PROTECTION

5.1 Each conductor shall be installed so that it is protected from physical damage. Except for the first 500 mm of battery cables, conductors shall be supported by clamps or straps not more than 400 mm apart unless the conductor(s) is contained in a conduit.

5.2 Clamps, straps, or conduits shall be designed to prevent damage to the conductor insulation.

5.3 Conductors connecting components that can move with relation to each other shall be protected from stress.

5.4 Conductors passing through bulkheads, junction boxes, or other rigid surfaces shall be bushed with conduit or grommets, or the conductor shall be protected by a sheath.

6. EXTERNAL IGNITION PROTECTION

A representative electrical system as installed in the watercraft, or in an enclosure simulating the watercraft, must not ignite a propane gas and air mixture that is 4.25 to 5.25% propane gas by volume surrounding the electrical system when it is operated in the mode in which it draws its maximum current. The test voltage supply shall be adjusted to 120% of the nominal system voltage except magneto ignition systems.

TABLE 1 - MAXIMUM CURRENT OF CONDUCTORS (AMPERAGE)
TEMPERATURE RATING OF CONDUCTOR INSULATION

(AWG) Wire Size	60 °C (140 °F)	75 °C (167 °F)	80 °C (178 °F)	90 °C (194 °F)	105 °C (221 °F)	125 °C (257 °F)	200 °C (392 °F)
18	10	10	15	20	20	25	25
16	15	15	20	25	25	30	35
14	20	20	25	30	35	40	45
12	25	25	35	40	45	50	55
10	40	40	50	55	60	70	70
8	55	65	70	70	80	90	100
6	80	95	100	100	120	125	135
4	105	125	130	135	160	170	180
3	120	145	150	155	180	195	210
2	140	170	175	180	210	225	240
1	165	195	210	210	245	265	280
0	195	230	245	245	285	305	325
10	225	265	285	285	330	355	370
100	260	310	330	330	385	410	430
1000	300	360	385	385	445	475	510
ENGINE COMPARTMENT CORRECTION FACTORS							
	0.56	0.75	0.78	0.82	0.85	0.89	1.00

7. OVERCURRENT PROTECTION

7.1 Except for conductors from self-limiting generators or alternators, each ungrounded current-carrying conductor shall be protected by a manually reset, trip-free circuit breaker or fuse. The fuse or breaker shall be within 180 mm of the origin of the conductor to be protected so long as the fuse or breaker is sized for the smallest conductor in the circuit.

7.1.1 Exception 1

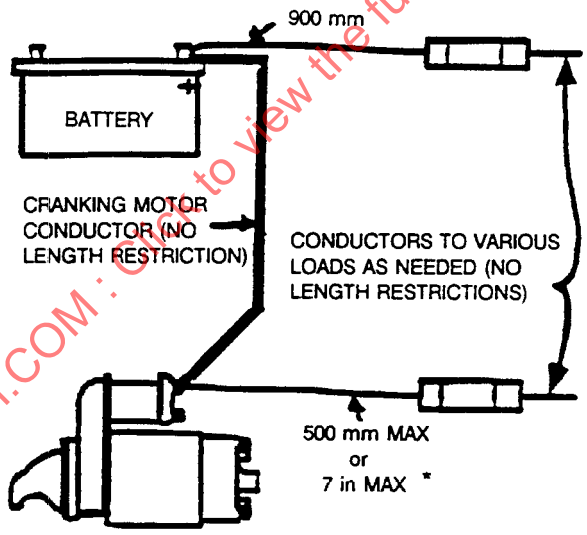
If a conductor is continuously protected from physical damage by a sheath or enclosure between its terminal ends, the maximum distance to its protecting fuse or breaker may be increased to 500 mm from the power source measured along the conductor.

7.1.2 Exception 2

An ungrounded supply conductor starting at a storage battery must have its breaker or fuse within 900 mm of the battery measured along the conductor Figure 1.

7.2 The voltage rating of each circuit breaker or fuse shall not be less than the nominal voltage of the circuit it is protecting.

7.3 The current ratings of the circuit breaker or fuse shall not be more than 150% of the value in Table 1 for the conductor it is protecting including the correction factor if any part of the conductor is in an engine compartment.



*** NOTE: Up to 500 mm max is allowed if the conductor, throughout this distance, is contained in a sheath of enclosure such as a junction box, control box, or enclosed panel.**

FIGURE 1 - BREAKER/FUSE LOCATION FOR AN UNGROUNDED SUPPLY CONDUCTOR STARTING AT A STORAGE BATTERY

7.4 Circuit breakers or fuses for non-self-limiting generators and alternators shall have a current rating not exceeding 120% of the maximum rated output at 60 °C.

8. CONDUCTOR TERMINATIONS

8.1 All connections outside of junction boxes or enclosures shall be made with closed ring, eyelet, captive spade, or mechanical or spring lock type connectors. Wire nuts shall not be used on any connection.