SURFACE VEHICLE STANDARD

J3082™ NOV2015

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Auxiliary Two Conductor Electrical Power Connector for Truck-Trailer High Power Jumper Cable

RATIONALE

Provide a standard for high current connections between a tractor and a (semi-) trailer to provide power to application specific equipment installed on the trailer.

1. SCOPE

This SAE Standard provides the minimum requirements for high power two conductor jumper cable plug and receptacle for truck-trailer jumper cable systems. It includes the test procedures, design, and performance requirements. This document covers receptacles rated at more than 30A (Ampere) up to and including 150A and is intended for a single circuit with one power conductor and one common return conductor. Single conductor high current connectors are not recommended for future designs because of inadequate ground return through 5th wheel / king pin. Cable size selection is to be made by the vehicle OEM for specific applications and the specific voltage drop requirements of those applications. This SAE Standard covers two variants of high power two conductor connections: a heavy duty version with horizontally aligned pins, typically for lift-gate battery charging and a medium duty version with vertically aligned pins: typically for loads such as power tarpaulins.

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 J560 Primary and Auxiliary Seven Conductor Electrical Connector for Truck-Trailer Jumper Cable

SAE J2202 Heavy-Duty Wiring Systems for On-Highway Trucks

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 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 J1127 Low Voltage Battery Cable

SAE J1908 Electrical Grounding Practice

2.2.2 American Society for Testing and Materials (ASTM) Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM G 153 Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

ASTM G 154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

2.2.3 International Organization for Standardization (ISO) Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ISO 4091 Road Vehicles - Connectors for the Electrical Connection of Towing and Towed Vehicles - Definitions, Tests and Requirements.

ISO 9227 Corrosion Tests in Artificial Atmospheres - Salt Spray Tests.

ISO 30013 Rubber and Plastics Hoses - Methods of Exposure to Laboratory Light Sources - Determination of Changes in Colour, Appearance and Other Physical Properties

ISO 22241-1 NOx Reductin Agent AUS 32 - Part 1: Quality Requirements

2.2.4 Federal Motor Vehicle Safety Standards (FMVSS)

Available from U.S. Department of Transportation, National Highway Traffic Safety Administration, safety assurance, office of vehicle safety compliance, 400 7th Street, SW, Room 6111, mail code NSA-30, Washington, DC 20590, www.nhtsa.gov.

FMVSS 108 Lamps, Reflective Devices, and Associated Equipment

FMVSS 121 Air Brake Systems

3. DEFINITIONS

3.1 AUXILIARY CONNECTOR

As used in this document refers to the receptacle and cable plug that provides power to the low power auxiliary devices on the trailer, but does not provide power to safety lighting and the Antilock Braking System (ABS) as required by FMVSS 108 and/or FMVSS 121.

3.2 AUXILIARY POWER CONNECTOR

As used in this document refers to the receptacle and cable plug that provides high power to auxiliary devices on the trailer, but does not provide power to safety lighting, the Antilock Braking System (ABS), or low power auxiliary devices.

3.3 CABLE PLUG

The cable plug is part of the jumper cable assembly.

3.4 COUPLING CYCLE

One coupling cycle is coupling and uncoupling the plug and receptacle.

3.5 PRIMARY CONNECTOR

As used in this document refers to the receptacle and cable plug that provides power to safety lighting and the ABS as required by FMVSS 108 and FMVSS 121.

3.6 RECEPTACLE

The receptacle consists of the connector socket, its housing, and a cover which latches the cable plug in place.

3.7 SERVICEABLE

A serviceable part is one that can be removed with reasonable force and reinstalled without visible damage.

4. IDENTIFICATION CODE DESIGNATION

4.1 Manufacturer Identification

Devices conforming to this document shall be identified with the manufacturer's identification. The device may include the model or part number.

4.2 SAE Designation

Devices conforming to this document shall be visually differentiated by connector type

4.2.1 SAE J3082 AUX PWR – Heavy Duty (Horizontal Pin)

This is a heavier duty dual pole connection with horizontally aligned pins typically used for lift-gate battery charging. The connector shall be identified by either the color red and/or permanently marked with ‘LIFTGATE’ or ‘AUX PWR’. See Table 3 and Figure 1 for wiring function.

4.2.2 SAE J3082 AUX PWR – Medium Duty (Vertical Pin)

This is a dual pole connection with vertically aligned pins typically used for loads such as power tarpaulins which do not require as high of a current rating as the lift-gate connection. This connector shall be marked by either the color red and/or permanently marked with “AUX PWR”. It is an acceptable option but not recommended to leave this connection unmarked. The vertical pin alignment prevents mis-mating with heavy duty, higher rating connection. See Table 3 and Figure 4 for wiring function.

4.3 Revision (month and year) of the document to which the device conforms

4.3.1 Example –

XYZ Corp.
SAE J3082
Mo/Yr.

5. TEST EQUIPMENT AND INSTRUMENTATION

5.1 The Power Supply

The power supply shall be capable of supplying the continuous current required to perform all tests.

5.2 Voltmeter

A direct current (dc) digital Voltmeter (DVM) with an input resistance greater than 1,000Ω/V (Ohms / Volt) and with a resolution of 0.1Vdc shall be used. To achieve this resolution, the full-scale deflection shall be appropriate to the voltage rating of the system being tested.

A DVM having at least a 3-1/2-digit display with an accuracy of ±1% plus one digit is recommended for millivolt readings.

5.3 Ammeter

A DC ammeter shall be used for current measurements. The meter range resolution shall be 0.1A.

5.4 Milli-ammeter

A DC milli-ammeter shall be used for current measurements. The meter range resolution shall be 1.0mA.

5.5 Hipot (High Potential insulation tester)

Capable of detecting leakage currents of 0.5mA at 500Vac

6. TEST PROCEDURES

6.1 Test Sequences

The tests in 6.2, 6.3, and 6.4 are to be tested in the order listed in Table 1. Each test sequence is to be performed on six different production level connector assemblies. No supplemental lubrication or other cleaning of the terminal pins prior or during the test sequence is permitted.

Table 1 - Test sequences

Test Order	Durability Test		Mechanical Test		Environmental Test	
1	Voltage Drop	6.2.1	Voltage Drop	6.2.1	Voltage Drop	6.2.1
2	Isolation Resistance	6.2.2	Isolation Resistance	6.2.2	Isolation Resistance	6.2.2
3	Thermal Shock	6.4.3	Thermal Shock	6.4.3	Thermal Shock	6.4.3
4	Coupling Force	6.3.1	Vibration	6.2.3	Salt Spray	6.4.2
5	Uncoupling Force	6.3.2	Straight Pull	6.3.4	Fluid Resistance	6.4.1
6	Angular Pull Force	6.3.3	Terminal Retention Force	6.3.6	Voltage Drop	6.2.1
7	Cycle Cover Spring	6.3.7	Voltage Drop	6.2.1	Isolation Resistance	6.2.2
8	Coupling Cycle Test	6.3.8	Isolation Resistance	6.2.2		
9	Voltage Drop	6.2.1	Terminal Wire Retention	6.3.5		
10	Isolation Resistance	6.2.2				

6.1.1 Test Samples

All test samples are to be configured with the mating designed cable unless otherwise noted

6.2 Electrical

6.2.1 Voltage Drop

The test is to be conducted in a draft-free room maintained at an ambient temperature of 25°C ± 5°C. Test sample to comprise of a mated SAE J3082 assembly consisting of a receptacle and plug each with their terminals terminated to a 500 to 1,000mm length of cable

6.2.1.1 Connect a 500 to 1,000mm long cable to the receptacle terminals and another 500 to 1,000mm long (SAE J1127 cable) to the cable plug terminals. Minimum #4 American Wire Gauge (AWG) cable should be used for heavy duty horizontal Pin connection and minimum #6 AWG cable for medium duty vertical pin connection.

6.2.1.2 Mate the cable plug and receptacle.

6.2.1.3 Connect a power supply and load to the two cable ends in such a way that it applies 100Adc to each circuit.

6.2.1.4 Turn on power supply and wait 15-30 minutes for the circuits to stabilize.

6.2.1.5 Measure the voltage drop across each circuit of the assembly at a convenient point on the wire at least 25mm from the terminal.

6.2.2 Isolation Resistance

See SAE J560 for this test procedure

6.2.3 Vibration

See SAE J560 for this test procedure

6.3 Mechanical

6.3.1 Coupling Force

See SAE J560 for this test procedure

6.3.2 Uncoupling Force

See SAE J560 for this test procedure

6.3.3 Angular Pull Force

See SAE J560 for this test procedure

6.3.4 Straight Pull (Cable Plug)

See SAE J560 for this test procedure

6.3.5 Terminal Wire Retention

This test pertains to the mechanical connection between the connector terminals and the cable wires. (Usually a crimped, welded, or set screw design). The strength of the connection shall be tested by using a suitable apparatus at a constant speed within the range of 50 to 100mm / minute. If the terminal has a cable insulation crimp, it shall be rendered mechanically ineffective. All samples are to be pulled to destruction.

6.3.6 Terminal Retention Force within the Plug and Receptacle

Both the receptacle and or cable plug terminals shall be subjected to a direct pull and push force of 175 Newton (N) for one minute. The force is to be exerted on each terminal without sudden or jerking forces during the test.

NOTE: Secondary lock devices should be utilized if part of the design.

6.3.7 Cycle Cover Spring

See SAE J560 for this test procedure.

6.3.8 Coupling Cycle Test

See SAE J560 for this test procedure.

6.4 Environmental

6.4.1 Fluid Resistance

See SAE J2202 for this test procedure.

6.4.2 Salt Spray

See SAE J560 for this test procedure.

6.4.3 Thermal Shock

See SAE J560 for this test procedure.

6.5 Additional Testing

6.5.1 Ultraviolet Effects

See SAE J560 for this test procedure.

7. PERFORMANCE REQUIREMENTS

7.1 Test Sequences

The samples shall comply with all the tests in the sequence. Failure of one test during the sequence constitutes a failure of the sample.

7.2 Electrical

7.2.1 Voltage Drop

The voltage drop for each circuit shall not exceed 0.001Vdc / Ampere (0.10Vdc at 100A) for the heavy duty connector variant and shall not exceed 0.0015Vdc/Ampere (0.075Vdc at 50A) for the medium duty variant.

7.2.2 Isolation Resistance

See SAE J560 for this test's performance requirements.

7.2.3 Vibration

See SAE J560 for this test's performance requirements.

7.3 Mechanical

7.3.1 Coupling Force

See SAE J560 for this test's performance requirements.

7.3.2 Uncoupling Force

See SAE J560 for this test's performance requirements.

7.3.3 Angular Pull Force

See SAE J560 for this test's performance requirements.

7.3.4 Straight Pull

See SAE J560 for this test's performance requirements.

7.3.5 Terminal Wire Retention

This is a destructive test. The tensile test of paragraph 6.3.5 performed on the terminal/wire interface shall meet the requirements of Table 2.

Table 2 - Minimum tensile strength for terminal/wire interface connections

Cable Size (AWG)	Minimum Tensile Strength (N)
0	600N
2	600N
4	400N
6	355N

This pull test serves to evaluate terminal / wire integrity and is not to be construed as specifying conductor cabling used in specific applications. Cabling specifications are made by the vehicle manufacturer.

7.3.6 Terminal Retention Force

The terminal shall maintain its original position in the connector after testing in accordance with 6.3.6.

7.3.7 Cycle Cover Spring

See SAE J560 for this test's performance requirements.

7.3.8 Coupling Cycle Test

See SAE J560 for this test's performance requirements.

7.4 Environmental

7.4.1 Fluid Resistance

See SAE J2202 for this test's performance requirements.

7.4.2 Salt Spray

See SAE J560 for this test's performance requirements.

7.4.3 Thermal Shock

See SAE J560 for this test's performance requirements.

7.5 Additional Tests

7.5.1 Ultraviolet Effects

See SAE J560 for this test's performance requirements.

8. DESIGN REQUIREMENTS

8.1 Interchangeability

The cable plug and receptacle shall be designed to conform to the performance requirements of this document.

8.2 Latch-ability

The cable plug shall be designed to mate and latch to any receptacle designed to conform to this document. Cable plugs designed to meet J560 shall not be compatible with receptacles designed to conform to this document likewise plugs designed to conform to this document shall not be compatible with any J560 receptacles. The latch mechanism shall be constructed to latch and release without interference.

8.3 Indexing

The cable plug and receptacle shall be designed with an indexing feature. Indexing is required to ensure proper electrical mating.

8.4 Wiring Circuits

The function and color code of each circuit is shown in Table 3. The location of each circuit is shown in Figures 1 and 4. The wire color code refers to the color of the insulation on the conductors. The receptacle and cable plug shall be constructed so that the terminals can accommodate the following wire sizes:

- Heavy Duty (Horizontal Terminal Configuration per Figure 1): Typical: 2 or 4 AWG
    - 4 AWG is minimum
    - 0 AWG is acceptable if needed for voltage drop purposes
- Medium Duty (Vertical Terminal Configuration per Figure 4): Typical 6 AWG
    - 6 AWG is minimum
    - 2 AWG or 4 AWG are acceptable if needed for voltage drop purposes.

Table 3 - Wiring circuits (Reference TTMA TB #65 & #119)

Conductor Identification Terminal Number	Conductor Identification Wire Color	Circuit Function
Aux Pwr		
1	BlkBlack	Ground return to towing vehicle
2	Red	Constant or ignition power

NOTE ON COLOR: For tractor and trailer wiring to receptacles the recommended colors are power red and return black. For wiring internal to the cable between the tractor and trailer the recommended colors of the individual conductors are red for power and black for return, however other colors such as black and black are acceptable as the cavity markings on the plugs is the primary method for determining the signal used on the jacketed cable.

8.5 Receptacle

Figures 1 and 2 indicate receptacle dimensions and design requirements and alternate construction features for heavy duty horizontal pin receptacles. Figures 3 and 4 indicate the design requirements for the medium duty vertical pin receptacles. An integral cover with a weather-tight seal shall be provided to protect the male contacts when uncoupled. The male contacts shall not be split. Formed contacts are acceptable provided the seams are closed.

8.6 Cable Plug

Figure 3 indicates plug dimensions and design requirements for the heavy duty horizontal pin plug. Figure 6 indicates plug dimensions and design requirements for the medium duty vertical pin plug. The terminals in the plug shall be free floating for ease of alignment with the receptacle during coupling. Cable plug assemblies shall incorporate a strain relief to relieve the tension on the electrical connection between the plug contacts and the jumper cable conductors.

8.7 Circuit Identification

Circuit identification by color or numeric is mandatory on the wire connection side of the cable plug and receptacle. It is recommended that circuit identification be on both the front and back sides of each.

8.8 Cavity Identification

Cavities shall be marked (“Pos” or “+”) for power and (“Neg” or “-“) for common return. “Pos” / ”+” is on the left when looking at the connector mating surface of the receptacle – pin is visible. If the pins are arranged vertically, the “Pos” / ”+” is on the top.

8.9 Latching Means

Receptacle cover shall be provided with a latching means that engages with the cable plug.

9. GUIDELINES

9.1 Electrical current-carrying parts should be copper or copper alloy. Protective coating or metallic plating is recommended to provide improved corrosion resistance.

9.2 A device should be provided to protect the plug in the uncoupled state. The device should be designed to resist contaminated or corrosive liquid from entering the terminals.

9.3 For ease of alignment, receptacle contacts shall be free floating within the dimensional boundaries of Figure 1. Cable plug contacts shall have a minimum float of 0.25mm from their true basic position.

9.4 The common return pin terminal should be longer than the power pin to allow the common to “make” before the power when performing a “hot make” of the receptacle. This is done to reduce possible back channel ground current through either of the J560 connectors or through the king pin / 5th wheel path in the event of a misconnection between signal common and the trailer chassis.

9.5 The common return for the power auxiliary receptacle should be isolated from the trailer frame rail. This extra effort is to prevent the J560 primary or J560 auxiliary connectors’ ground circuits from forming a “back path” to battery negative. The J560 circuits do not have “extra” capacity and would be over whelmed by the magnitude of current that flows through the power auxiliary connector in either a complete failure of the ground return or a partial failure where there was some load sharing taking place. The ground path from frame rail through king pin and fifth wheel is no longer a recommended practice.

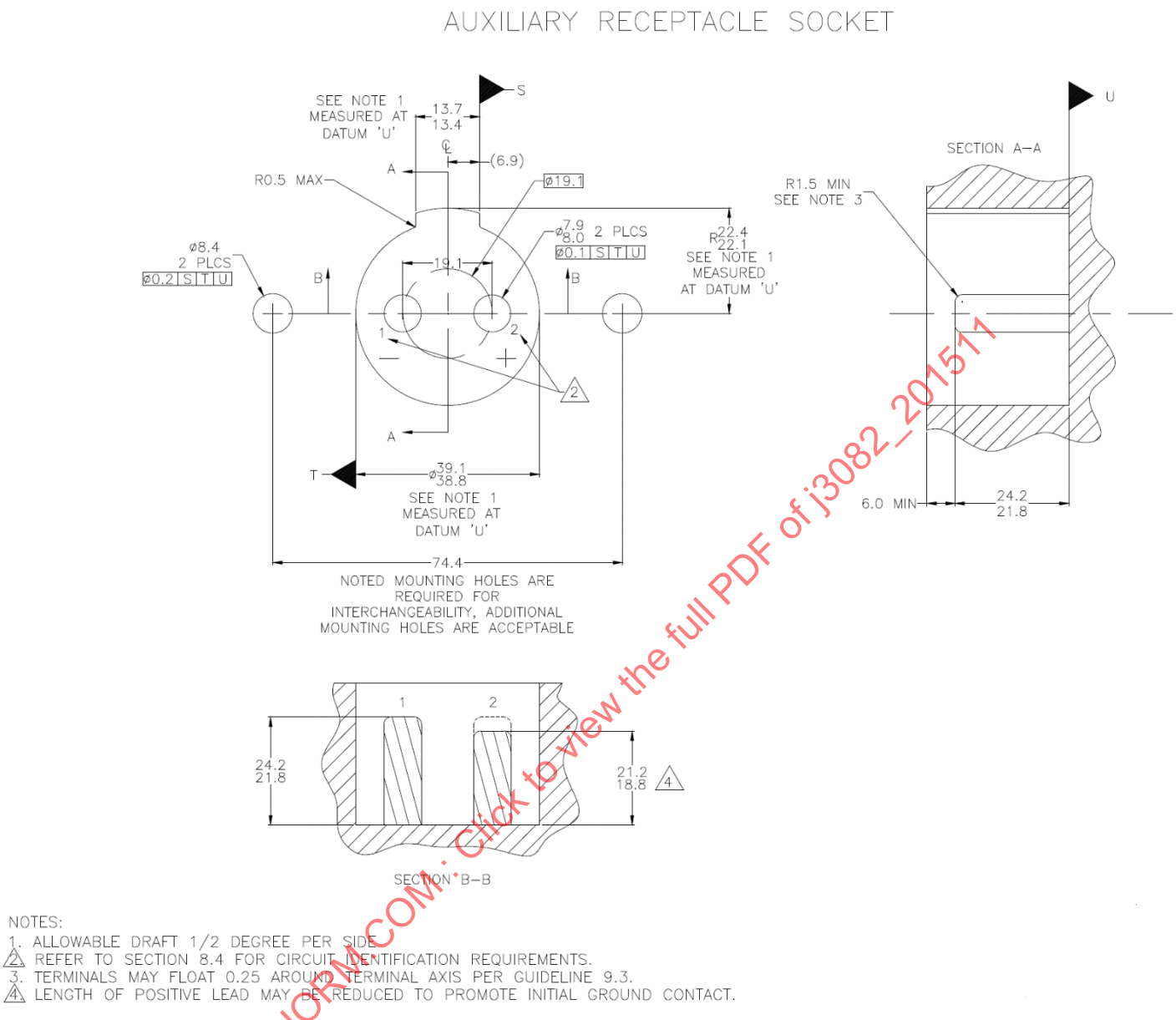
9.6 We recommend that the latest SAE J560 and SAE J2202 publications be referenced when conducting tests against this document. We also recommend that SAE J560 and SAE J2202 publication dates are recorded on any formal tests using this document.

10. NOTES

10.1 Revision Indicator

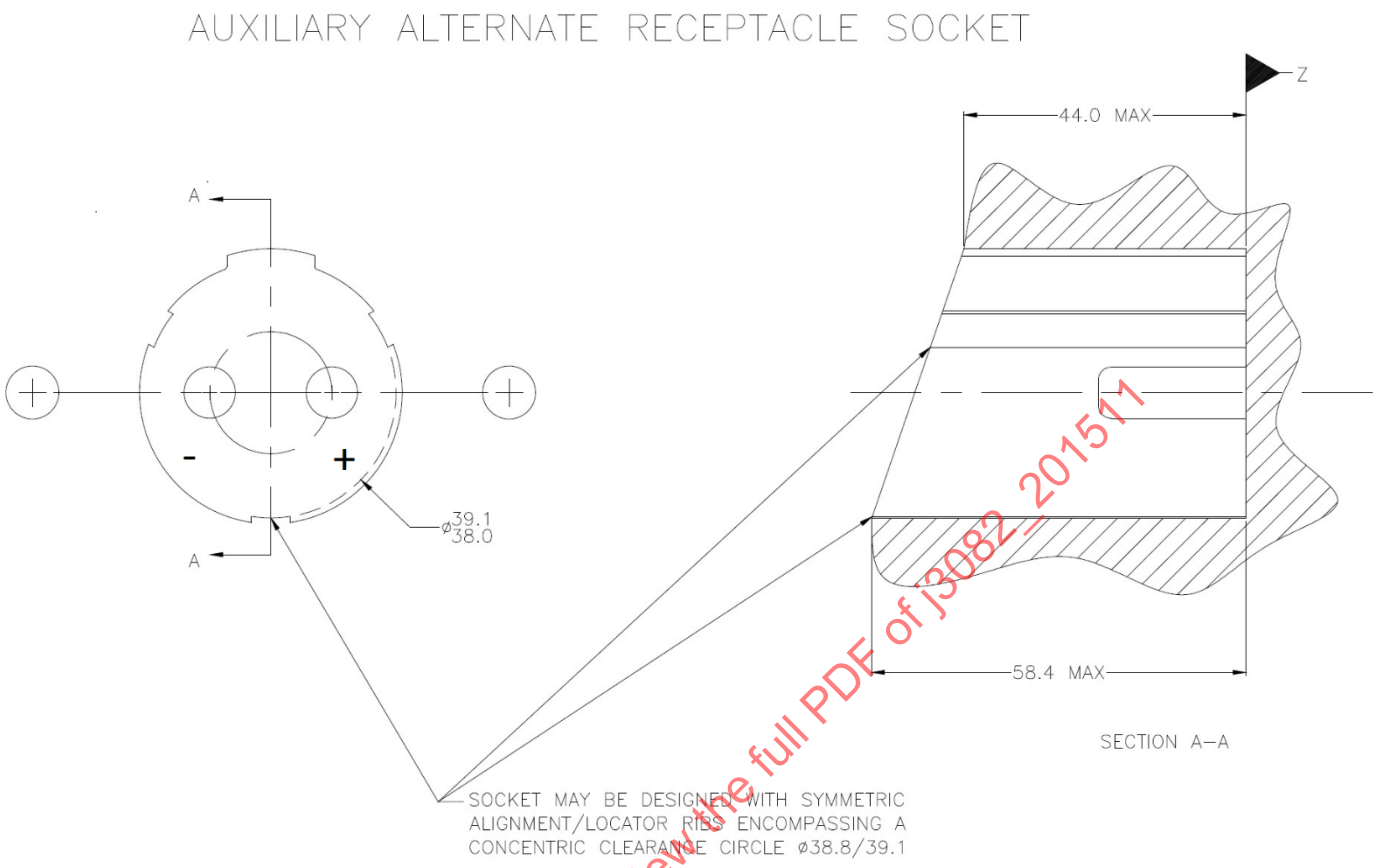
A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, or in documents that contain editorial changes only.

PREPARED BY THE SAE TRUCK AND BUS ELECTRICAL SYSTEMS COMMITTEE
OF THE SAE TRUCK AND BUS ELECTRICAL AND ELECTRONIC STEERING COMMITTEE



NOTES:
1. ALLOWABLE DRAFT 1/2 DEGREE PER SIDE.
2. REFER TO SECTION 8.4 FOR CIRCUIT IDENTIFICATION REQUIREMENTS.
3. TERMINALS MAY FLOAT 0.25 AROUND TERMINAL AXIS PER GUIDELINE 9.3.
4. LENGTH OF POSITIVE LEAD MAY BE REDUCED TO PROMOTE INITIAL GROUND CONTACT.

Figure 1 - Auxiliary power receptacle



NOTES:
1. ALL DATUMS, DIMENSIONS, AND NOTES ON FIGURE 1 ARE APPLICABLE TO THIS FIGURE.

Figure 2 - Alternate auxiliary power receptacle