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By the Authority Vested By Part 5 of the United States Code § 552(a) and Part 1 of the Code of Regulations § 51 the attached document has been duly INCORPORATED BY REFERENCE and shall be considered legally binding upon all citizens and residents of the United States of America. *HEED THIS NOTICE*: Criminal penalties may apply for noncompliance.

Document Name: SAE J1962: Diagnostic Connector Equivalent to ISO/DIS

CFR Section(s): 40 CFR 86.094-17(h)(4)

Standards Body: Society of Automotive Engineers

APPROVED

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DIAGNOSTIC CONNECTOR—SAE J1962 JAN95 SAE Recommended Practice

Report of the SAE Vehicle E/E Systems Diagnostics Standards Committee approved June 1992, completely revised June 1993, revised June 1994 and January 1995. Rationale statement available.

Foreword—The purpose of this SAE Recommended Practice is to define a minimum set of diagnostic connector requirements that will promote the use of a common diagnostic connector throughout the motor vehicle industry.

It is intended that the connector specified herein be used on complex luxury vehicles as well as simple utility vehicles.

This SAE document is under the control and maintenance of the Vehicle E/E System Diagnostics Committee. This committee will periodically review and update this document as needs dictate.

Rationale relative to intent is provided, where applicable, to minimize ambiguity.

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1. Scope—The SAE J1962 diagnostic connector consists of two mating connectors, the vehicle connector (see Figure 1) and the test equipment connector (see Figure 2).

This document:

a. Defines the functional requirements for the vehicle connector. These functional requirements are separated into three principal areas: connector location/access, connector design, and connector terminal assignments.
b. Defines the functional requirements for the test equipment connector. These functional requirements are separated into two principal areas: connector design and connector terminal assignments.

The scope of this document does not include the needs of long-term retention, such as in-flight recorder type applications. To ensure long-term retention, additional steps outside of the scope of this document must be taken.

2. References

2.1 Applicable Documents—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 J1850—Class B Data Communication Network Interface

SAE J1930—Electrical/Electronic Systems Diagnostic Acronyms, Terms, and Definitions

SAE J1978—OBD II Scan Tool

SAE J2201—OBD II Scan Tool Universal Interface

(R) SAE J2223-3—Connections for On-Board Road Vehicle Electrical Wiring Harnesses—Part 3: Multipole Connectors—Flat Blade Terminals—Dimensional Characteristics and Specific Requirements

2.1.2 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 9141-2:1994(E)—Road vehicles—Diagnostic systems—CARB requirements for interchange of digital information ISO 8092-3—Road vehicles—Flat, quick connection terminations

(R) 2.1.3 OTHER PUBLICATIONS

California Code of Regulations, Title 13, 1968.1: Malfunction and Diagnostic Systems Requirements, - 1994 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles with feedback fuel control systems

Environmental Protection Agency 40 CFR Part 86 Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Regulations Requiring On-Board Diagnostic Systems on 1994 and Later Model Year Light-Duty Vehicles and Light-Duty Trucks

2.2 Diagnostic Terms, Definitions, and Acronyms—SAE J1930 is hereby referenced as the basis for all such terms in this document, with the following additions:

N Newtons

SAE J1850 10.4 VPW - SAE J1850 One wire, 10.4 Kbps, VPW

SAE J1850 41.6 PWM - SAE J1850 Two wire, 41.6 Kbps, PWM

3. Vehicle Connector Location/Access

3.1 Consistency of Location—The vehicle connector shall be located in the passenger compartment in the area bounded by the driver's end of the instrument panel to 300 mm beyond the vehicle centerline, attached to the instrument panel, and accessible from the driver's seat. The preferred location is between the steering column and the vehicle centerline. The vehicle connector shall be mounted to facilitate mating and unmating.

3.2 Ease of Access—Access to the vehicle connector shall not require a tool for the removal of an instrument panel cover, connector cover, or any barriers. The vehicle connector should be fastened and located so as to permit a one-handed/blind insertion of the mating test equipment connector. Refer to Figure 1 for mated connector space requirements.

3.3 Visibility—The vehicle connector should be out of the occupant's (front and rear seat) normal line of sight but easily visible to a "crouched" technician.

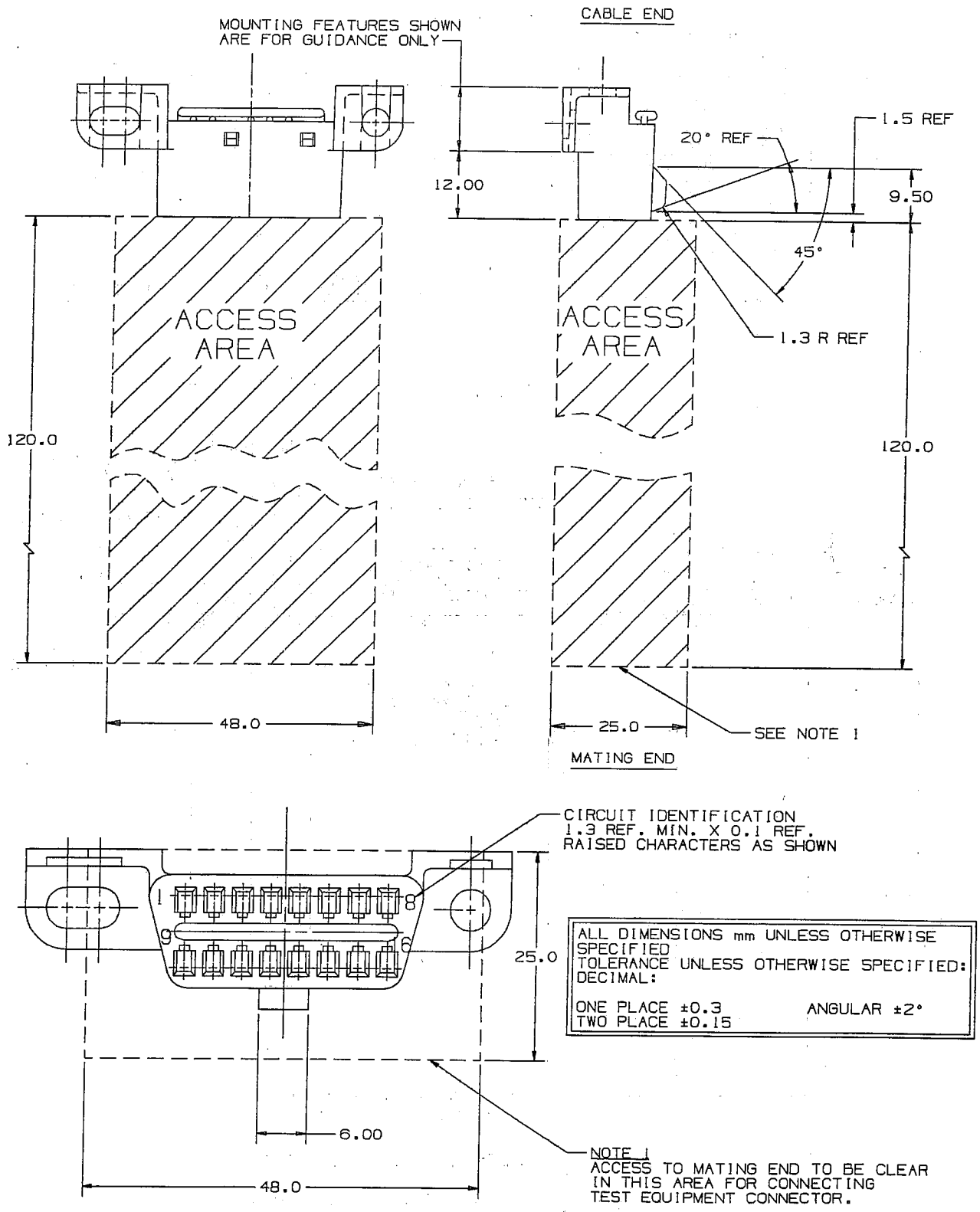


FIGURE 1—VEHICLE CONNECTOR

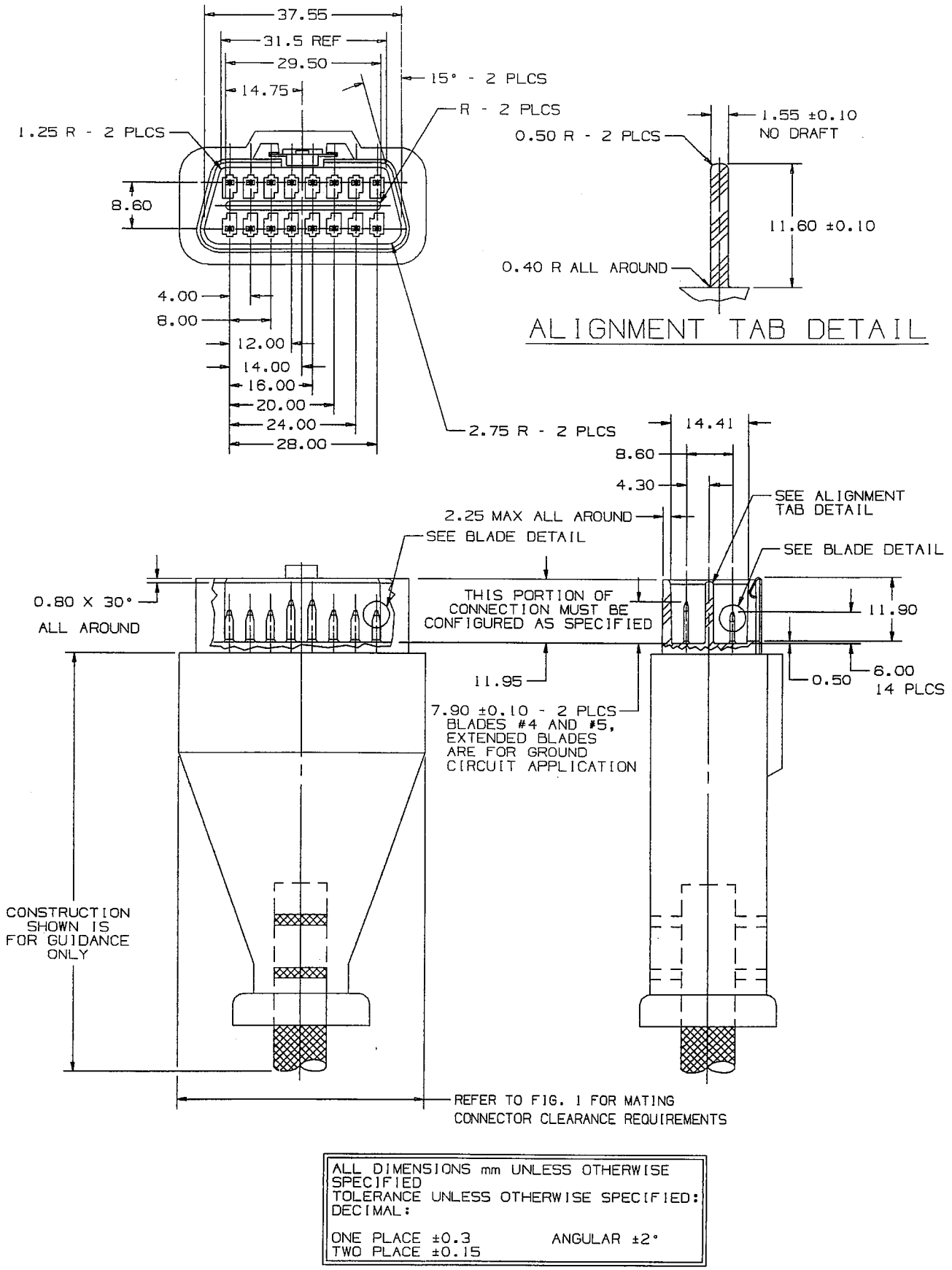


FIGURE 2—TEST EQUIPMENT CONNECTOR

3.4 Vehicle Operation—Attachment of any equipment to the vehicle connector should not preclude normal physical and electrical operation of the vehicle.

4. Vehicle and Test Equipment Connector Design

4.1 Previous Designs Acceptable—This version of this document includes changes to some of the dimensions of the Vehicle Connector and the Test Equipment Connector. Vehicle Connectors and Test Equipment Connectors manufactured to the specifications of the previous versions of this document that are compatible with connectors designed to the specifications of this document are acceptable. The specification changes made to the Test Equipment Connector were made to prevent potential bent terminal problems with the two extended ground terminals in the Test Equipment Connector.

4.2 Number of Terminals—The vehicle and test equipment connectors shall each be capable of accommodating 16 terminals.

4.3 Terminal Requirements—The terminals shall be rated for currents not to exceed 10 A DC continuous.

4.3.1 TERMINAL TYPES—The vehicle connector shall consist of female terminals that will mate with the test equipment connector male blade terminals.

4.3.2 TERMINAL SPACING—Terminal spacing is shown in Figure 2.

4.4 Connector Mating—The test equipment connector contact mating shall be designed so that the signal ground and the chassis ground terminals of the test equipment connector will make electrical contact prior to any other test equipment connector terminals making electrical contact. On the disconnect cycle, these same two terminals will not lose electrical contact until all of the other terminals have been disconnected.

4.5 Connector Shape/Features—The mating portions of both connectors shall be "D" shaped. The connectors shall have easily discernible keying features to allow for easy connection in a one-handed/blind operation.

The vehicle connector and the test equipment connector shall have latching features that assure the test equipment connector will remain mated when properly connected. The latching feature will be designed to provide a positive feel when the test equipment connector is fully seated. The latching feature should not require the activation of any levers on either connector to mate or unmate. Pulling on the test equipment connector to separate the two mated halves shall not result in any damage to either connector.

4.6 Spring Clip—An optional Spring Clip (see Figure 3) may be used on the Test Equipment Connector.

4.7 Material Selection

4.7.1 CONNECTOR MATERIAL—Selection and specification of connector material shall be made by the appropriate vehicle and test equipment manufacturers. However, the minimum recommended temperature range for the selected material is –40 to 85 °C.

4.7.2 TERMINAL MATERIAL—Selection and specification of terminal base material shall be made by the appropriate vehicle and test equipment manufacturers.

Selection of terminal material, especially plating if any, may be a significant factor to the durability of the terminals in the vehicle connector and/or the test equipment connector. Different applications of these connectors generally will require selection of different terminal material/plating, especially for the test equipment connector.

4.8 Vehicle Connector Cycle Life—The vehicle connector shall meet the requirements of this document after 200 mating cycles.

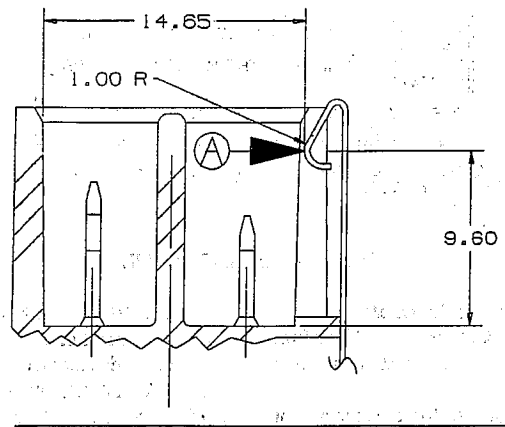
4.9 Test Equipment Connector Cycle Life—The test equipment manufacturer shall specify the minimum number of mating cycles the test equipment connector is capable of while meeting the requirements of this document.

4.10 Strain Relief—The test equipment connector shall have strain relief features for the wires/cable connected to it.

4.11 Terminal and Connector Parameters and Performance Requirements

4.11.1 FUNCTIONAL PARAMETERS FOR TERMINALS

a. Blade Size for Test Equipment Connector: Shall conform to the dimensions shown in Figure 4
b. Maximum Current DC: 10 A DC continuous
c. Temperature Range: –40 to +85 °C
d. Voltage Range DC: –0.05 to 30.0 V DC
e. Suggested Maximum Cable Size: 0.8 mm^2 (18 AWG)



ALL DIMENSIONS mm UNLESS OTHERWISE SPECIFIED
TOLERANCE UNLESS OTHERWISE SPECIFIED:
DECIMAL:

ONE PLACE ±0.3 ANGULAR ±2°
TWO PLACE ±0.15

NOTE: SPRING CLIP PERFORMANCE

A FORCE APPLIED AS SHOWN BY ARROW "A" MUST DEFLECT CLIP OUTWARD FOR A DISTANCE OF 2.50 ±0.15 MM. CLIP MUST RECOVER TO ORIGINAL POSITION. CONNECTOR MUST MEET SPECIFICATION SHOWN IN 5.8.2.e.2 CONNECTOR MATING FORCE WITH 16 TERMINALS WITH SPRING CLIP, WITH SPRING CLIP IN PLACE.

FIGURE 3—SPRING CLIP DETAIL (Optional)

4.11.2 PERFORMANCE REQUIREMENTS FOR TERMINALS—The terminal system (i.e., mated terminal pairs) must meet the performance standards in (a) through (c) following each of the environmental exposures listed in 4.11.4. Performance measurements are to be taken at room temperature.

a. Resistance Interface (measured at 1 A): 3 mΩ maximum
b. Recommended Resistance Cable to Cable per Terminal Pair (measured at 1 A): 10 mΩ maximum
c. Recommended Low Energy Resistance: 100 mΩ maximum at 100 μA at 20 mV (open circuit voltage) at initial mating

4.11.3 CONNECTOR SYSTEM PERFORMANCE REQUIREMENTS—The connector system must meet the performance standards outlined in (a) through (f) following each of the environmental exposures listed in 4.11.4. Performance measurements must be taken at room temperature.

a. Isolation Resistance—Between adjacent terminals must exceed 20 MΩ at 16 V DC.
b. Retention Force—Terminal to connector retention force to exceed 80 N.
c. Connector Disengagement Force with 16 terminal pairs—Not to exceed 88 N.
d. Connector Mating Force with 16 terminal pairs:
   (1) without spring clip 110 N maximum
   (2) with spring clip 142 N maximum (see Figure 3)
e. Indexing Feature—Must prevent mismating of connectors when a force of 300 N is applied.
f. Mounting Feature—The vehicle connector mounting feature shall withstand a 300 N force applied to the connector mating area in the direction of the mating and unmating process.

4.11.4 ACCELERATED ENVIRONMENTAL EXPOSURES FOR THE VEHICLE CONNECTOR—Accelerated environmental testing shall be conducted for the vehicle connector while not being mated to the test equipment connector. Following each environmental exposure, the vehicle connector shall be mated to an unused test equipment connector for the performance measurements specified in sections 4.11.2 and 4.11.3.

a. Thermal Cycling—1000 cycles of 30 min at –40 °C and 30 min at 110 °C.
b. Temperature/Humidity Cycling—15 cycles of the following:
   16 h at 95% RH and 40 °C
   2 h at –40 °C
   2 h at +85 °C
   4 h at room temperature
c. Mechanical Shock—3 shocks of 50 G in each of 3 mutually perpendicular axes.
d. Vibration—Sinusoidal 1.5 mm ± 0.15 mm amplitude by 15 G for 2 h in each of 3 mutually perpendicular axes.

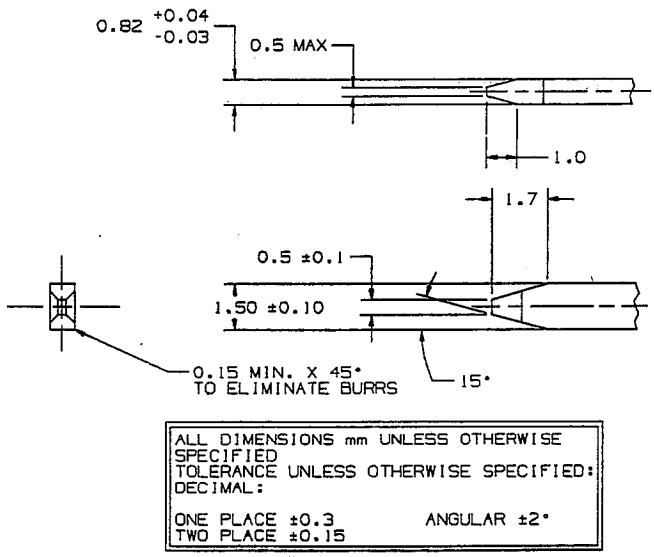


FIGURE 4—BLADE DETAIL

5. Vehicle and Test Equipment Connector Terminal Assignments

5.1 Vehicle and Test Equipment Connector Terminal Identification—See Figure 5 for vehicle connector and test equipment connector terminal identifications.

5.2 General Terminal Assignments—See Figure 6 for a summary of terminal assignments.

5.3 Vehicle Connector Terminal Assignments

5.3.1 VEHICLE CONNECTOR TERMINALS - GENERAL LIMITS—All uses of all terminals of vehicle connector are limited to the range of –0.05 to 30.0 V DC.

5.3.2 VEHICLE CONNECTOR TERMINALS 1, 3, 6, 8, 9, 11, 12, 13, AND 14—Assignment of vehicle connector terminals 1, 3, 6, 8, 9, 11, 12, 13, and 14 is left to the discretion of the vehicle manufacturer.

5.3.3 VEHICLE CONNECTOR TERMINAL 2—If SAE J1850 10.4 VPW is used in a vehicle to supply OBD II required communication services, then terminal 2 of the vehicle connector must be the SAE J1850 10.4 VPW connection.

If SAE J1850 41.6 PWM is used in a vehicle to supply OBD II required communication services, then terminal 2 of the vehicle connector must be the Bus + Signal of the SAE J1850 41.6 PWM connection.

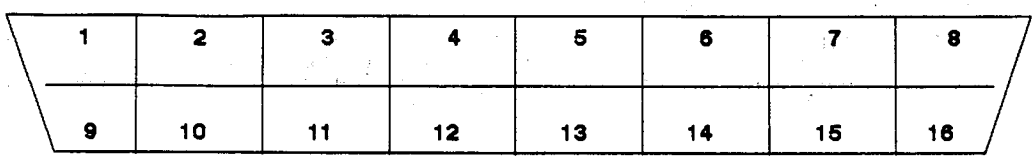


FIGURE 5—VEHICLE CONNECTOR MATING END VIEW

If neither SAE J1850 10.4 VPW nor SAE J1850 41.6 PWM is used in a vehicle to supply OBD II required communication services, then assignment of this terminal is left to the discretion of the vehicle manufacturer, provided this assignment does not interfere with the operation of, nor cause damage to, tools conforming to SAE J1978.

5.3.4 VEHICLE CONNECTOR TERMINAL 4—Vehicle connector terminal 4 is designated Chassis Ground and must be connected to the vehicle in such a way as to provide a power ground for test equipment taking current as defined in SAE J1978. Paragraph 5.5.4 defines the use of this terminal by test equipment.

5.3.5 VEHICLE CONNECTOR TERMINAL 5—Vehicle connector terminal 5 is designated Signal Ground and must be implemented in the vehicle connector in such a way as to provide a ground reference for the communication transceivers in test equipment and as a possible power ground for test equipment taking current as defined in SAE J1978. Its implementation in the vehicle must take into consideration noise contributions and node to node voltage offset limitations of the OBD II communication interface used in the vehicle. The use of a battery minus (–), common vehicle clean signal ground, "clean," "logic," or other connection points within a vehicle that minimize node to node voltage offsets and noise is recommended. Paragraph 5.5.5 defines the use of this terminal by test equipment.

Terminal	General Assignment
1	Discretionary*
2	Bus + Line of SAE J1850 **
3	Discretionary*
4	Chassis Ground
5	Signal Ground
6	Discretionary*
7	K Line of ISO 9141-2 **
8	Discretionary*
9	Discretionary*
10	Bus - Line of SAE J1850 **
11	Discretionary*
12	Discretionary*
13	Discretionary*
14	Discretionary*
15	L Line of ISO 9141-2 **
16	Unswitched Vehicle Battery Positive

* Note, assignment of terminals 1, 3, 6, 8, 9, 11, 12, 13, and 14 in the vehicle connector is left to the discretion of the vehicle manufacturer.

** Note, for terminals 2, 7, 10, and 15 the related OBD II communication assignments are shown. These terminals may also be used for alternate assignments in the vehicle connector. See the section titled Vehicle Connector Terminal Assignments and the section titled Test Equipment Connector Terminal Assignments for further information.

FIGURE 6—GENERAL TERMINAL ASSIGNMENTS

5.3.6 VEHICLE CONNECTOR TERMINAL 7—If a two wire or a one wire ISO 9141-2 interface is used in a vehicle to supply OBD II required communication services, then terminal 7 of the vehicle connector must be the K Line of the ISO 9141-2 interface.

If neither a two wire nor a one wire ISO 9141-2 interface is used in a vehicle to supply OBD II required communication services, then assignment of this terminal is left to the discretion of the vehicle manufacturer, provided this assignment does not interfere with the operation of, nor cause damage to, tools conforming to SAE J1978.

5.3.7 VEHICLE CONNECTOR TERMINAL 10—If an SAE J1850 41.6 PWM interface is used in a vehicle to supply OBD II required communication services, then terminal 10 of the vehicle connector must be the Bus – signal of the SAE J1850 41.6 PWM interface.

If an SAE J1850 41.6 PWM interface is not used in a vehicle to supply OBD II required communication services, then assignment of this terminal is left to the discretion of the vehicle manufacturer, provided this assignment does not interfere with the operation of, nor cause damage to, tools conforming to SAE J1978.

5.3.8 VEHICLE CONNECTOR TERMINAL 15—If a two wire ISO 9141-2 interface is used in a vehicle to supply OBD II required communication services, then terminal 15 of the vehicle connector must be the L Line of the ISO 9141-2 interface.

If a two wire ISO 9141-2 interface is not used in a vehicle to supply OBD II required communication services, then assignment of this terminal is left to the discretion of the vehicle manufacturer, provided this assignment does not interfere with the operation of, nor cause damage to, tools conforming to SAE J1978.

(R) 5.3.9 VEHICLE CONNECTOR TERMINAL 16—Vehicle connector terminal 16 is designated Unswitched Vehicle Battery Positive and must be implemented in the vehicle connector. This terminal must be connected directly (i.e., unswitched) to the DC Positive of the vehicle's battery. This connection does not preclude the use of a fuse or other circuit protection elements. This circuit may be grouped with other similar circuits. This terminal must be able to supply a minimum of 4.0 A.

5.4 Vehicle Connector Terminal Protection—It is recommended that the vehicle manufacturer provide circuit protection in the event that the terminals of the vehicle connector are shorted together. This protection is limited to the ranges of voltages present at the vehicle connector before the test equipment connector is mated to it.

5.5 Test Equipment Connector Terminal Assignments

5.5.1 TEST EQUIPMENT CONNECTOR TERMINALS—GENERAL LIMITS—All uses of all terminals of test equipment connector are limited to the range of – 0.05 to 30.0 V DC.

5.5.2 TEST EQUIPMENT CONNECTOR TERMINALS 1, 3, 6, 8, 9, 11, 12, 13, AND 14—The use of test equipment connector terminals 1, 3, 6, 8, 9, 11, 12, 13, and 14 is left to the discretion of the test equipment manufacturer.

These test equipment connector terminals shall normally be in a high impedance state, that is at greater than500 kΩ impedance relative to Signal Ground and at greater than 500 kΩ impedance relative to Chassis Ground.

Before the condition of these test equipment connector terminals is changed from this high impedance state, the test equipment user and/or the test equipment must verify the proper usage of these vehicle connector terminals.

5.5.3 TEST EQUIPMENT CONNECTOR TERMINALS 2, 7, 10, AND 15—Assignment and use of test equipment connector terminals 2, 7, 10, and 15 must be compatible with the assignment and use of their mating terminal in the vehicle connector (see 5.3) and SAE J2201.

5.5.4 TEST EQUIPMENT CONNECTOR TERMINAL 4—Test equipment connector terminal 4 is designated Chassis Ground and is defined by SAE J2201. This terminal may be used by test equipment as a power ground. Implementation of this terminal in the test equipment connector is optional.

(R) 5.5.5 TEST EQUIPMENT CONNECTOR TERMINAL 5—Test equipment connector terminal 5 is designated Signal Ground and is defined by SAE J2201. This terminal must be used by the SAE J1978 OBD II Scan Tool as the signal reference for communication transceivers. This terminal must be implemented in the test equipment connector for support of SAE J2201. Test equipment must not draw more than 1.5 A through this terminal. (Note that the 1.5 A limit refers to uses of test equipment covered by this document [i.e., support of the requirements of SAE J1978]. Support of other uses of the SAE J1962 connectors [e.g., connecting a vehicle manufacturer discretionary terminal to ground] is not covered by this limitation.)

5.5.6 TEST EQUIPMENT CONNECTOR TERMINAL 16—Test equipment connector terminal 16 is designated as Unswitched Vehicle Battery Positive and is available to supply operating power and a reference voltage to test equipment.

5.6 Test Equipment Connector Terminal Protection—It is recommended that all circuits connected to the terminals of the test equipment connector be protected to the extent that no damage will come to these circuits if ANY terminal of the test equipment connector:

(R) a. Is connected to vehicle connector terminal 16 - Unswitched Vehicle Battery Positive for up to 10 A,

b. Is connected to vehicle connector terminal 4 - Vehicle Chassis Ground, or

c. Is connected to vehicle connector terminal 5 - Vehicle Signal Ground.

(R) *6. Minimum Current Available*—In order to ensure that adequate current is available to operate diagnostic scan tools, the minimum current available through terminal 16 of the vehicle connector shall be no less than 4.0 A.

The vehicle manufacturer shall not be responsible for supplying more than 4.0 A.

(R) *7. Liability for Devices That Draw More Than 4.0 A*—Manufacturers of devices that include a connection to the vehicle connector, and which draw in excess of 4.0 A from terminal 16 of the vehicle connector, may be responsible for any damage to the vehicle.