



400 Commonwealth Drive, Warrendale, PA 15096-0001

# SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1939-13

ISSUED JUL 1999

Issued 1999-07

Submitted for recognition as an American National Standard

## Off-Board Diagnostic Connector

**Foreword**—This series of SAE Recommended Practices have been developed by the Truck and Bus Control and Communications Network Subcommittee of the Truck and Bus Electrical Committee. The objectives of the subcommittee are to develop information reports, recommended practices, and standards concerned with the requirements design and usage of devices which transmit electronic signals and control information among vehicle components. The usage of these documents is not limited to truck and bus applications. Other applications may be accommodated with immediate support being provided for construction and agricultural equipment and stationary power systems.

These SAE Recommended Practices are intended as a guide toward standard practice and are subject to change to keep pace with experience and technical advances.

### TABLE OF CONTENTS

1.	Scope .....	1
2.	References .....	2
2.1	Applicable Publications .....	2
3.	Off-Board Diagnostic Connector.....	2
3.1	General Requirements .....	2
3.1.1	Mounting .....	2
3.1.2	Serviceability .....	2
3.2	Connector Performance Requirements .....	3
3.2.1	Connect/ Disconnect .....	3
3.2.2	Environmental Requirements .....	3
3.3	Physical Requirements.....	3
3.3.1	Pin Designation .....	3
3.3.2	Connector Mechanical Requirements .....	3

1. **Scope**—These SAE Recommended Practices are intended for light- and heavy-duty vehicles on- or off-road as well as appropriate stationary applications which use vehicle derived components (e.g., generator sets). Vehicle of interest include but are not limited to; on- and off-highway trucks and their trailers; construction equipment; and agricultural equipment and implements.

The purpose of these documents is to provide an open interconnect system for electronic systems. It is the intention of these documents to allow electronic devices to communicate with each other by providing a standard architecture.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-8512 FAX: (724) 776-0243  
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790  
SAE WEB ADDRESS <http://www.sae.org>

2. **References**—General information regarding this series of documents is found in SAE J1939.
- 2.1 **Applicable Publications**—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest revision of SAE publications shall apply.
- 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.
- SAE J1708—Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications  
SAE J1939/11—Physical Layer—250K bits/s, Shielded Twisted Pair  
SAE J2030—Heavy-Duty Electrical Connector Performance Standard
- 2.1.2 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.
- ISO 11783-2  
ISO 11898—Road vehicles—Interchange of digital information—Controller Area Network (CAN) for high speed communication
3. **Off-Board Diagnostic Connector**—This section describes the Off-Board Diagnostic connector used on the vehicle to get access to the vehicle communication links.
- The diagnostic connector defined supports both the twisted shielded pair media (SAE J1939/11) as well as the twisted unshielded quad media (ISO 11783-2). The designations of the individual signal wires are CAN\_H and CAN\_L. For SAE J1939/11, a third connection for the termination of the shield is denoted by CAN\_SHLD. For ISO 11783-2, this same third connection is not connected.
- In addition to the designations of the CAN media wires, the designations of the SAE J1708 physical media wires, power and ground are: SAE J1708 (+), SAE J1708 (−), Battery (+) and Battery (−). There are two pins designated for proprietary vehicle OEM use.
- 3.1 **General Requirements**
- 3.1.1 MOUNTING—The connector shall be mounted inside the cab in a location that is easily accessible according to the guidelines as follows.
- a. For on road heavy trucks, the connector should be mounted on the driver side and if possible, accessible from the ground next to the cab.
- b. For busses, the connector should be located within reach of the operator's seat. For rear engine busses, an additional connector may be mounted in the engine compartment that will allow access from the ground next to the bus.
- c. For construction and agricultural equipment, it is recommended that the connector for the tractor bus be located behind the operator's seat or under the dash at the operator's knees. This connector must be labeled as the diagnostic connector. A diagnostic connector may be located elsewhere, in addition to a connector at the recommended location.
- d. The cable tail length for the diagnostic connector is 0.66 m maximum for the vehicle and 0.33 m maximum for the off-board diagnostic tool.
- 3.1.2 SERVICEABILITY—The connector shall be serviceable allowing field replacements of contacts and seals.

### 3.2 Connector Performance Requirements

#### 3.2.1 CONNECT/ DISCONNECT

- a. The connector shall comply with SAE J2030 except the number of connect/disconnect cycles shall be 1000.
- b. The receptacle shall support/provide positive and friction-locking mechanism versions. It shall provide alignment before contact engagement to ensure proper engagement of the connector. The connector shall be capable of engagement with one hand.
- c. The connector shall have easily identified keying arrangement by sight and touch.

3.2.2 ENVIRONMENTAL REQUIREMENTS—The connector shall be available in both sealed and unsealed versions. A dust cap shall be available.

### 3.3 Physical Requirements

#### 3.3.1 PIN DESIGNATION

- a. The pins/sockets shall be sized commensurate with 2, 1, 0.8, and 0.5 mm<sup>2</sup> conductors (corresponding to 14, 16, 18, and 20 AWG). The size of the mating end of the contact is 16 AWG, regardless of wire size.
- b. CAUTION: Appropriate conductor seals are necessary to ensure the sealing integrity of the connector.
- c. The connector shall have nine pins designated as follows:

Pin A	Battery (-)
Pin B	Battery (+)              Unswitched - with Unconditioned 10 A fuse
Pin C	CAN_H              Tractor Bus
Pin D	CAN_L              Tractor Bus
Pin E	CAN_SHLD (for SAE J1939/11) or No Connection (for ISO 11783-2)
Pin F	SAE J1708 (+)
Pin G	SAE J1708 (-)
Pin H	Proprietary OEM Use or Implement Bus CAN_H
Pin J	Proprietary OEM Use or Implement Bus CAN_L

- d. For information regarding cable termination, including the shield, reference SAE J1939/11, Appendix B.

3.3.2 CONNECTOR MECHANICAL REQUIREMENTS —The dimensional characteristics of the diagnostic connectors are shown in Figures 1 through 5. Pin designations on the connector are preferred but not required. Any pin designation applied to the connector must conform to Figures 1 through 5.

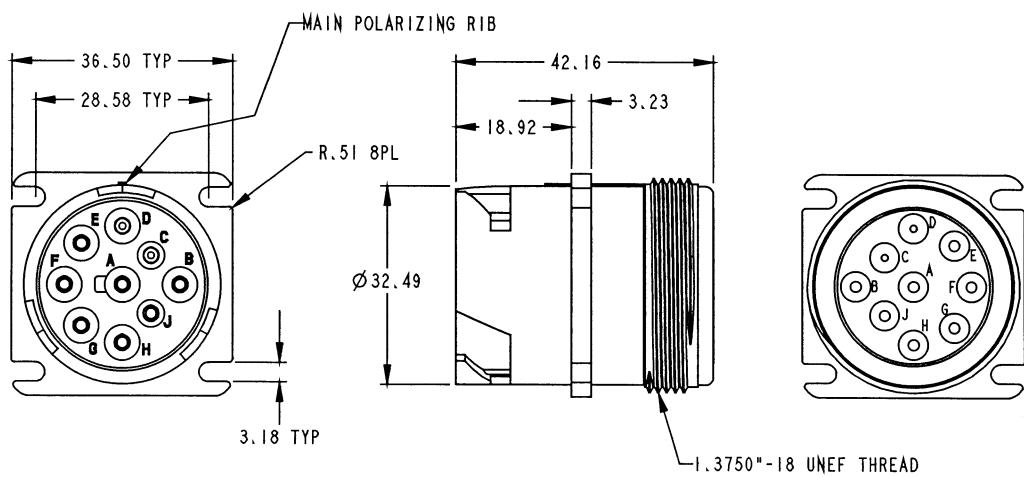


FIGURE 1—FLANGE MOUNT DIAGNOSTIC RECEPTACLE CONNECTOR

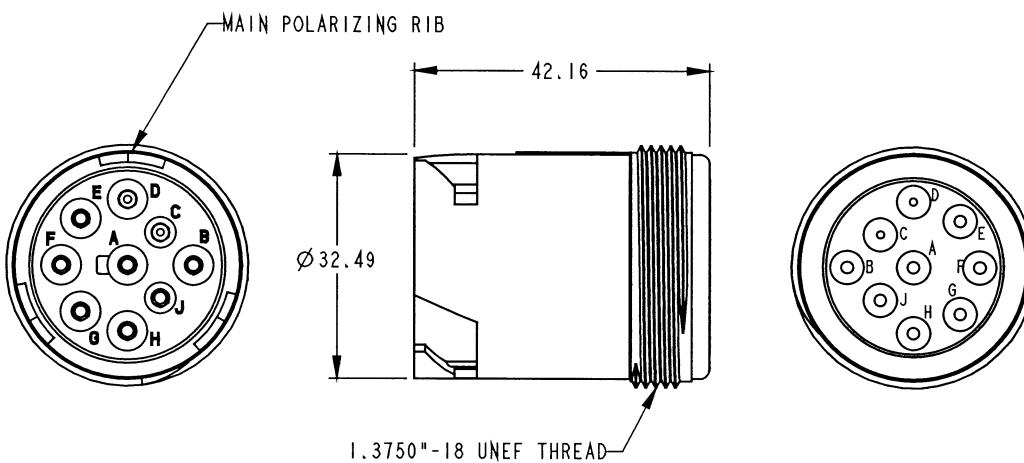


FIGURE 2—IN-LINE DIAGNOSTIC RECEPTACLE CONNECTOR

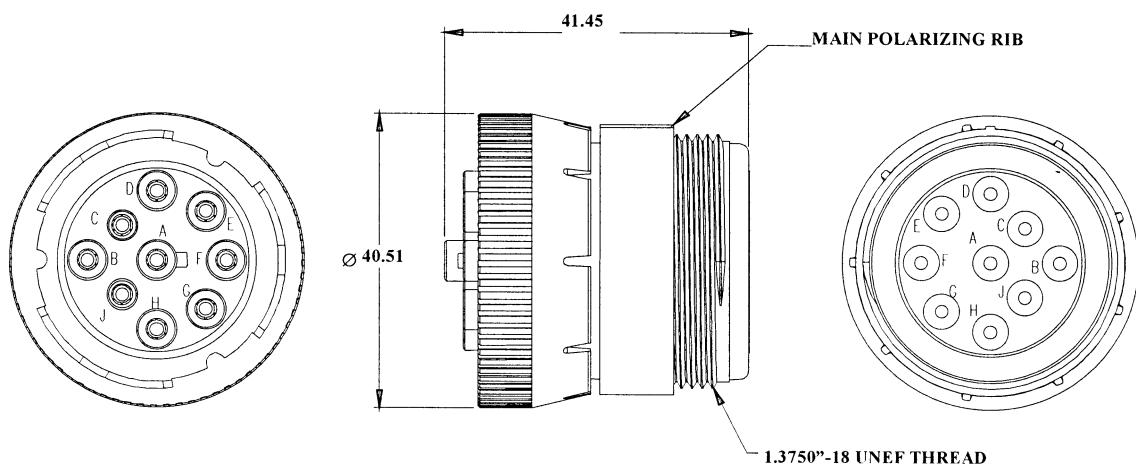


FIGURE 3—DIAGNOSTIC PLUG CONNECTOR

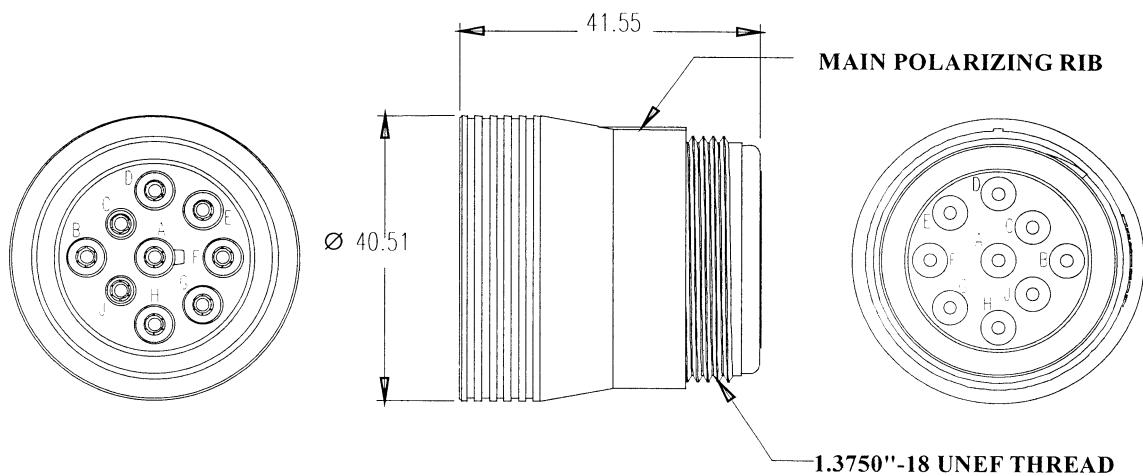
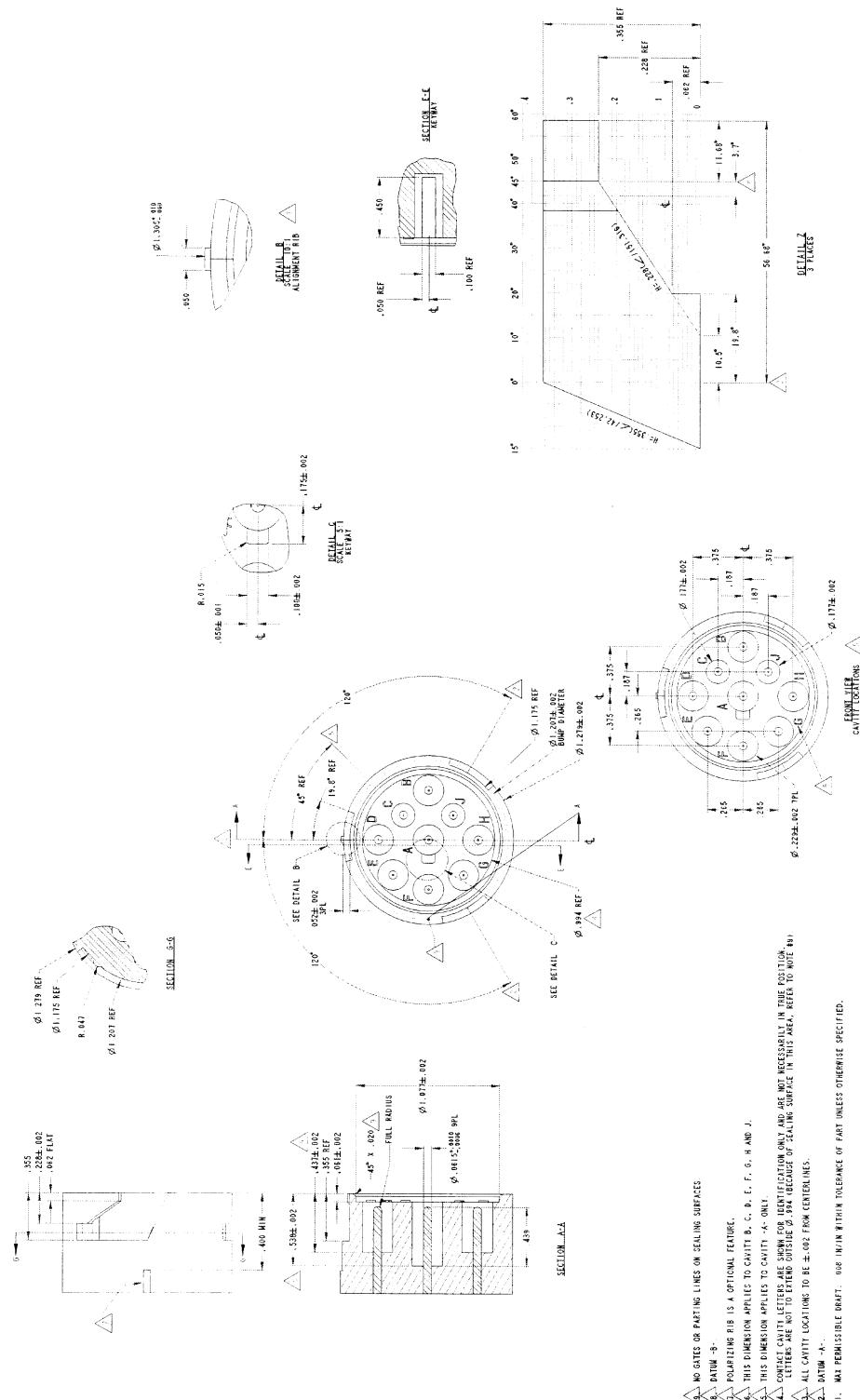


FIGURE 4—FRICTION-LOCKING PLUG CONNECTOR



#### FIGURE 5—INTERFACE DETAILS

PREPARED BY THE SAE TRUCK AND BUS CONTROL AND COMMUNICATIONS NETWORK  
SUBCOMMITTEE OF THE SAE TRUCK AND BUS ELECTRICAL COMMITTEE

**Rationale**—Not applicable.

**Relationship of SAE Standard to ISO Standard**—Not applicable.

**Application**—These SAE Recommended Practices are intended for light- and heavy-duty vehicles on- or off-road as well as appropriate stationary applications which use vehicle derived components (e.g., generator sets). Vehicles of interest include but are not limited to; on- and off-highway trucks and their trailers; construction equipment; and agricultural equipment and implements.

The purpose of these documents is to provide an open interconnect system for electronic systems. It is the intention of these documents to allow electronic devices to communicate with each other by providing a standard architecture.

#### **Reference Section**

SAE J1708—Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications

SAE J1939/11—Physical Layer—250K bits/s, Shielded Twisted Pair

SAE J2030—Heavy-Duty Electrical Connector Performance Standard

ISO 11783-2

ISO 11898—Road vehicles—Interchange of digital information—Controller Area Network (CAN) for high speed communication

**Developed by the Truck and Bus Control and Communications Network Subcommittee**

**Sponsored by the SAE Truck and Bus Electrical Committee**