AEROSPACE INFORMATION REPORT

AIR1329	REV. C

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Superseding AIR1329B

(R) Electrical Connectors and Wiring, Compatibility of

RATIONALE

Revision is required to improve drawing quality, to update connector specification references, to remove crimp tool part numbers, to add AS95234 and AS29600 sealing information, to add additional wire detail sheets referenced in AS50881, and to update document format with current SAE guidelines.

1. SCOPE

This SAE Aerospace Information Report (AIR) defines the areas where incompatibility may exist between the selected wire and the electrical connector in which it is terminated and how to design for compatibility. Refer to ARP914 for a glossary of connection terms.

1.1 Purpose

This AIR documents the need for a system compatibility analysis between the wire, its termination within the electrical connector, and the associated contact insertion/extraction tool.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 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.

ARP914 Glossary of Electrical Connection Terms

AS50881 Wiring Aerospace Vehicle

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3. GENERAL

Connectors covered by the Military Specifications listed in Table 1 incorporate crimp rear release contacts and an integral wire sealing grommet.

The inserts of these connectors are usually made up of two basic materials (see Figure 1):

a. a hard dielectric section which incorporates the contact retaining mechanism in each contact cavity and

b. a rear grommet with wire sealing rings in each contact cavity.

Contact insertion and removal methods are common for the connectors listed in Table 1 and employ a tool to release the contact retaining device as shown in Figure 1. Most tools are made of a plastic material, inexpensive but fragile especially for the small size contacts. Caution must be exercised when using these tools to avoid broken tool chips which could remain in the connector. Correct tool alignment and the avoidance of excessive force will extend tool life as well as protecting the connector from damage to the rear grommet or retaining clip.

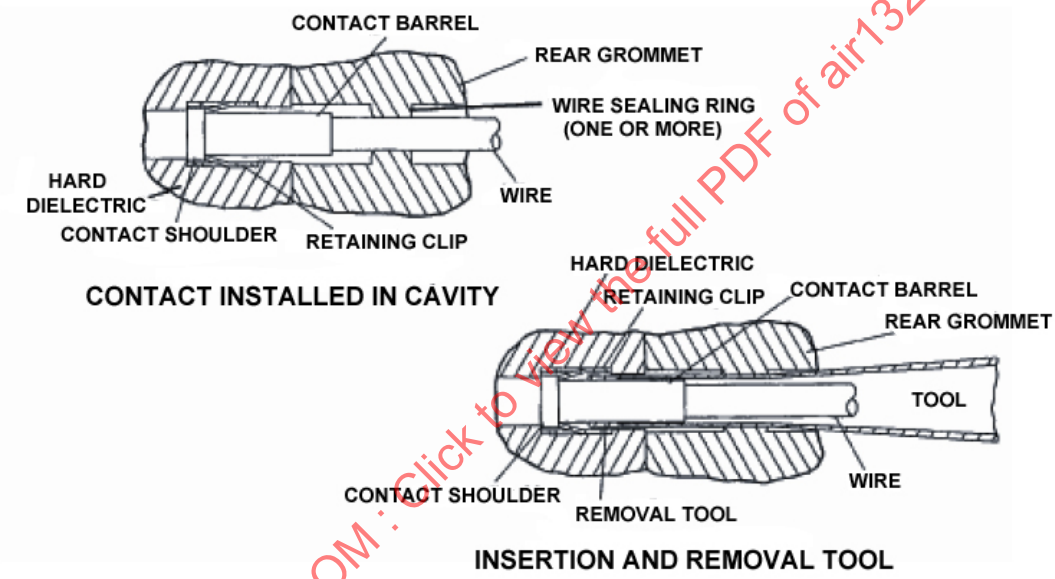

FIGURE 1 - TYPICAL CROSS SECTION OF CONNECTOR CONTACT CAVITY

3.1 Variations in Connector Types

The following defines the areas where variations may exist between one connector specification and another:

a. Contact cavity diameter* hard dielectric: This diameter is slightly larger for a given contact than the shoulder of that contact.

*rear of cavity

b. Wire seal cavity - sealing area: The sealing cavity accommodates a given contact size, and range of finished wire diameters.

b. Contact geometry - barrel - shoulder diameters: The barrel plus the thickness of the tool must be compatible with the shoulder diameter of that contact.

d. Insertion/extraction tool - thickness: The O.D. of the wire plus tool thickness must be compatible with the rear I.D. of the contact cavity.

3.2 Incompatibilities

Variations in the above areas, which do exist from one specification to another, can result in difficulties with the removal of a wired contact or lack of wire seal. This incompatibility will most often occur when the same wire is terminated at one end with one connector and at the other end with a different type or different contact size.

For example: A wire selected to seal with connector B of Figure 2 may be too small to seal with connector A. On the other hand, a wire selected to seal with connector A may be too large for the contact extraction tool used with connector B. Also, if the wire selected is larger than the I.D. of a given tool, it will increase the O.D. of the tool tip which must enter the contact cavity. The reverse is also true. If the diameter of the wire is significantly smaller than the I.D. of the tool, the I.D. of the tool can be compressed by the wire sealing rings, making it difficult to lead the tool over the rear of the contact crimp barrel.

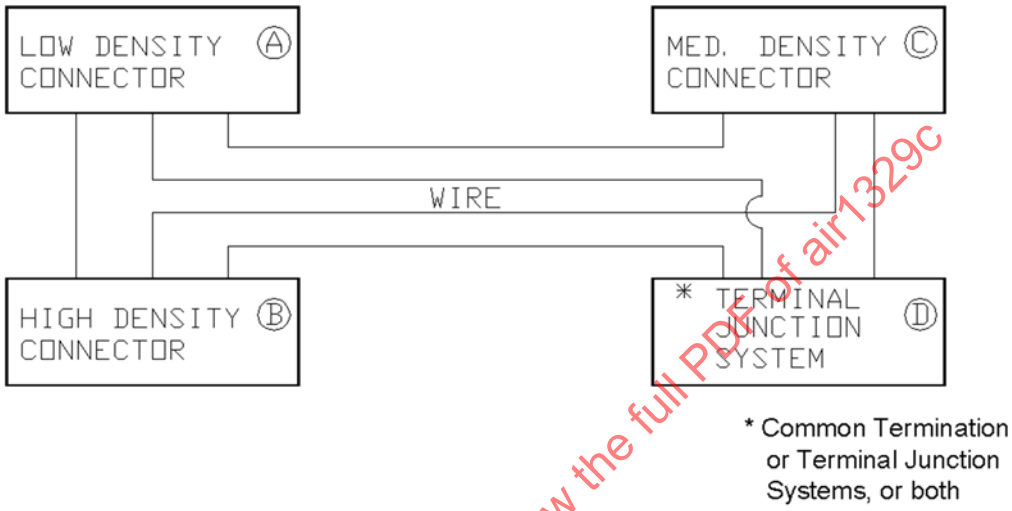

FIGURE 2 - TYPICAL WIRING HARNESS CONCEPT

In the first case, the small wire can be locally increased in diameter to obtain a seal but if the wire is too large, it will be virtually impossible to remove the wired contact unless special techniques are employed.

Also, oversize wire can cause, with some connectors, undesirable expansion of the sealing grommet. This can result in interference with assembly hardware, prevent insertion/extraction of the contact, or damage the grommet, degrading the connector's environmental characteristics.

The use of supplementary insulation to build up wires to the recommended sealing range can cause maintenance problems and is not recommended. Refer to the applicable revision of AS50881 for connector/wire compatibility requirements.

3.3 Solutions

To avoid these pitfalls, the designer should establish the allowable minimum-maximum diameter of a finished wire. This can be done through a complete analysis of all the connectors required for the wiring harness system. To accomplish this the designer must examine the wire sealing ranges of each connector type and where applicable, look at the bundle size limits. Table 1 compares this information for a number of rear release connector types. Table 2 provides finished diameters for a number of common wire types.

4. It is very unlikely that any one program or project will require all of the connectors listed in Table 1. Therefore, the designer should establish their own table based on this project's connector requirements and from this establish the wire range that is compatible with the connectors in the system. This could include connectors other than those listed in Table 1.

CAUTION: Elastomer grommets are generally qualified to seal on wires having diameters within the specification grommet sealing range and only one wire per grommet hole. For proper selection and installation of wires, refer to Appendix A of AS50881.

5. NOTES

1. All wire O.D.s assume that both ends of the wire terminate in contacts of the same size. If different sizes are used (e.g., no. 22 wire having one end terminated in a size 22D contact and the other end terminated in a size 20 contact) usable wire O.D.s will be further restricted.

2. The cumulative effect of full utilization of connectors having large numbers of contacts with wires approaching the maximum allowable diameter can be a resultant of expansion of the rear grommet which interferes with the assembly of accessory hardware or contacts.

3. To assure integrity of the wire seal it is particularly important to dress wires so as to avoid grommet distortion when using wires approaching the minimum diameter. When minimum wire O.D. per Table 2 is less than the minimum sealing range shown, the effective diameter should be increased by using a larger wire gage. For connector aircraft applications AS50881 recommends strain relief backshells such as AS85049 be used to ensure sealability of the grommet-wire interface and minimize strain on the connector-contact interface.

4. The wire O.D. range compatible with all connectors shown in Table 1 was established by applying the following equation (to insure environmental seal throughout system and to insure contact removal and avoid overexpansion of wire sealing grommet).

   a. Minimum O.D. of finished wire greater than or equal to the largest minimum wire seal of any connector in system.

   b. Maximum O.D. of finished wire less than or equal to smallest maximum wire seal of any connector in system.

5. The properties and characteristics of connector insertion and removal tools are defined in AS81969. The installing and removal tools, which are designed to insert and remove contacts from a particular connector are designed to work with the wire diameters which were intended for that connector contact cavity. If wire or sleeving is oversize, it may not be compatible with the inside diameter of the installing or removal tool. Caution should be used when oversize wire is detected.

6. Wire sizes for 10 gage and larger are not included in Table 2. See applicable wire specification for min/max finished wire diameters.

5.1 A change bar (l) 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, nor in documents that contain editorial changes only.

PREPARED BY SAE SUBCOMMITTEE AE-8C1, CONNECTORS OF
SAE COMMITTEE AE-8, AEROSPACE ELECTRICAL/ELECTRONIC DISTRIBUTION SYSTEMS