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AEROSPACE INFORMATION REPORT

AIR 1329

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Revised

ELECTRICAL CONNECTORS AND WIRING, COMPATIBILITY OF

1. PURPOSE

This Aerospace Information Report (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. SCOPE

This 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.

3. GENERAL

Connectors covered by the Military Specifications listed in Table I 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 Fig. 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 I 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.

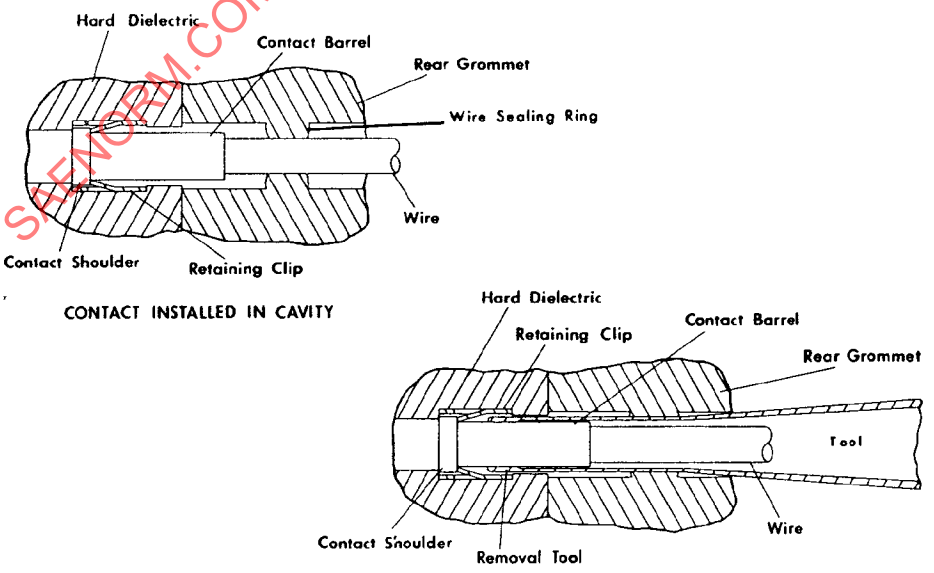

FIGURE 1 TYPICAL CROSS SECTION OF CONNECTOR CONTACT CAVITY

3.1 Variations in Connector Types: The following defines the areas where variations may exist between one connector style and another.

a) Contact Cavity Diameter - Hard Dielectric - This diameter is slightly larger for a given contact than the shoulder of that contact.

b) Wire Seal Cavity - Sealing Area - The sealing cavity accommodates a given contact size, and range of finished wire diameters.

c) 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.

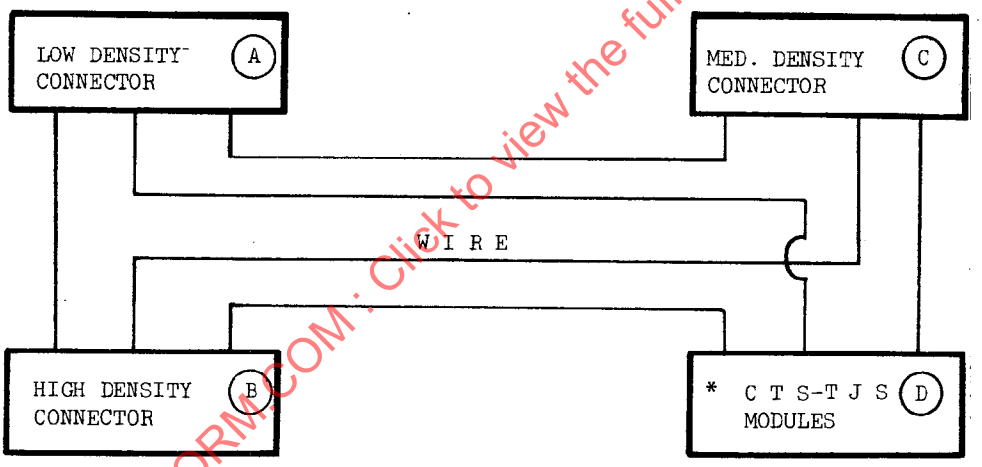

FIGURE 2 TYPICAL WIRING HARNESS CONCEPT

For example: A wire selected to seal with connector B of Fig. 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.

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.

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

* Common Termination and/or Terminal Junction Systems

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 he must look at the wire sealing ranges of each connector type and where applicable look at the bundle size limits. Table I compares this information for a number of rear-release connector types.

TABLE I

WIRE SIZE	CONTACT SIZE	WIRE SEALING RANGE, O.D.: INCHES (INFORMATION FOR REFERENCE ONLY. SEE CURRENT SPECIFICATION REVISIONS).										WIRE O.D. RANGE COMPATIBLE WITH ALL CONNECTORS LISTED /1 & /2	
		MIL-C-00 5015F CRIMP REAR-RELEASE	MIL-C-83723B SERIES 1 & 3	MIL-C-00264 82F SERIES 2 AND MIL-C-81703 SERIES 3	MIL-C-83733A	MIL-C-00389 99D	MIL-C-00815 11D SERIES 3 & 4	MIL-C-81659A SERIES 2	MIL-C-24308 CRIMP	MIL-STD-1549 *	MIL-T-81714B **	MIN. – MAX.	
		MS3447 OR MS27534 (NO. 8, NO. 0) AND MS3165	MS3447 M83723/31 MS27534	MS3447 OR MS27534	MS27534	MS27534	MS3160 OR MS27534-22D (NO. 23 CONTACTS ONLY)	MS3156	MS27534	MS27534	MS27534 OR M83723/31		
32 30 28	23 22 DR 22D	—	.040 .083	—	.030 .060	.030 .060	.030 .054	.030 .054	.030 .054	.030 .060	.034 .066	.034 – .054	
26 24 22													
24 22 20	20	—	.040 .083	.040 .083	.040 .083	.040 .083	.040 .074	.040 .071	.040 .071	.040 .083	.038 .083	.040 – .071	
20 18 16	16	.053 .103	.053 .103	.053 .103	.063 .103	.065 .109	.060 .103	.068 .103	—	.065 .109	.060 .101	.068 – .101	
14 12	12	.085 .158	.097 .158	.099 .158	.081 .158	.097 .142	.097 .135	.097 .135	—	.097 .142	.087 .147	.099 – .135	
10 8	8	.132 .255	—	—	—	—	—	—	—	—	—	.132 – .255	
6 4	4	.237 .370	—	—	—	—	—	—	—	—	—	.237 – .370	
2 1 0	0	.360 .550	—	—	—	—	—	—	—	—	—	.360 – .550	
APPLICABLE INSERTION/ EXTRACTION TOOLS													

NOTES:

/1 WIRE O.D.'s ASSUME THAT BOTH END OF THE WIRE TERMINATE IN CONTACTS OF THE SAME SIZE. IF DIFFERENT CONTACT SIZES ARE USED (e.g. NO. 22 WIRE HAVING ONE END TERMINATED IN A SIZE 22D CONTACT AND THE OTHER END IN A SIZE 20 CONTACT) USABLE WIRE O.D.'s WILL BE FURTHER RESTRICTED.

/2 MAX. WIRE O.D. CAN BE FURTHER RESTRICTED WITH SOME CONNECTORS TO MAINTAIN THE REQUIRED BUNDLE LIMIT. (e.g. REFER TO TABLE II OR MIL-C-83723B). FAILURE TO OBSERVE THIS LIMIT MAY RESULT IN UNDERSIRABLE WIRE SEAL GROMMET EXPANSION AND CAUSE INTERFERENCE WITH ASSEMBLY HARDWARE OR PREVENT INSERTION/EXTRACTION OF CONTACT.

* COMMON TERMINATION SYSTEM

** TERMINAL JUNCTION SYSTEM

The wire O.D. range compatible with all connectors shown in Table I was established by applying the following equations:

1. MINIMUM O.D. OF FINISHED WIRE $\geq$ LARGEST MINIMUM SEAL OF ANY CONNECTOR IN SYSTEM

   · To insure environmental seal throughout system.

2. MAXIMUM O.D. OF FINISHED WIRE $\leq$ SMALLEST MAXIMUM WIRE SEAL OF ANY CONNECTOR IN SYSTEM

   · To insure removal of contact and avoid over expansion of wire sealing grommet.