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AEROSPACE INFORMATION REPORT

AIR 1402

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COMMON TERMINATION METHOD, ELECTRICAL WIRING SYSTEM, APPLICATION OF

1. PURPOSE

This Aerospace Information Report (AIR) defines guidelines for a COMMON TERMINATION METHOD as applied to an electrical wiring system for installation in an aerospace vehicle.

2. SCOPE

This report defines the guidelines for a COMMON TERMINATION METHOD for aerospace vehicle electrical wiring systems and shows how designers can select a minimum number of different parts, among preferred connecting devices that will satisfy all system requirements while achieving the objective of minimum cost in procurement, assembly and maintenance without compromising quality or reliability.

3. COMMON TERMINATION METHOD (CTM)

Common Termination Method is achieved when all the terminations of an electrical wiring system have been accomplished with:

- Common Connecting Devices: These may vary in shape, but are common when the connecting devices selected for a system use interchangeable contacts, interchangeable rear accessories and use identical contact assembly tools and methods.
- Common Contacts: Contacts are restricted to one type only for each required size, 22 through 0, to fit all of the connecting devices selected for the system.
- Common Rear Accessories: Rear accessories may vary in shape but are common only when these are interchangeable among the connecting devices selected, cylindrical interchangeable with cylindrical connectors and rectangular interchangeable with rectangular connectors, and the back-end (wire entry) of the rear accessories selected all have identical assembly and cable termination methods.
- Common Assembly Tools: Tools to crimp, insert and extract contacts are restricted to one set of tools for each given contact size required for the system.

4. GENERAL

4.1 Connecting devices required to attach and detach electrical wires from electrical/avionic equipment installed in an aerospace vehicle can be generally categorized in three (3) categories:

- Cable to Panel Application: Cylindrical connectors with threaded, bayonet or push-pull coupling.
- Rack to Panel Application: Rectangular or Cylindrical connectors with blind-mate coupling.
- Component Termination and Bussing Application: For terminating wires at junctions or electrical equipment such as switches, relays, etc.

4.1 (Continued)

All three categories involve military-type connecting devices with crimp removable, rear release and front release contacts. Some of these connecting devices of the various specifications specify use of contacts, rear accessories and contact assembly tools which are common to each other. These are the ones that should be sought out and selected to achieve commonality.

- CAUTION: Use of both front and rear release contacts in the same vehicle should be avoided to prevent potential connector damage that can occur by use of wrong installing/removal tools, and to prevent the insertion of the wrong type of contacts.

4.2 In-as-much as the connecting devices with rear release contacts can provide commonality in an aerospace vehicle's wiring system, this AIR will identify only those connecting devices with rear release contacts. These are:

MIL-C-5015: MS3450 Series, Threaded Coupling
MIL-C-26482: Series 2, Bayonet Coupling
MIL-C-83723: Series 3, Threaded and Bayonet Coupling
MIL-C-81703: Series 3, Push-Pull and Blind Mate Coupling
MIL-C-38999: Series I and II, Bayonet Coupling
MIL-C-83733: Blind Mate Coupling
MIL-C-81659: Series 2, Blind Mate Coupling
MIL-T-81714: Terminal Junction System
MIL-STD-1549: Common Termination System

Basically, all of these connecting devices are similar in construction and performance. They all include rear release contacts, some common to each other; all cylindrical connectors have threaded back shells for rear accessory attachment but some have threads common to each other that allows for interchangeability of the back hardware, and most of them use common tools for crimping, inserting and extracting the contacts. Also, these devices are similarly constructed to be environment resistant by inclusion of resilient interfacial seals and wire sealing grommets compatible with most of the new medium weight wires available today.

4.3 Selection from the above list can, therefore, be based on commonality of parts as required for any given wiring system. To achieve optimum reduction of different parts, the designer should consider:

4.3.1 Contact Requirements: Size and Type

4.3.2 Coupling Methods: Threaded, Bayonet, Push-Pull, Blind-Mate

4.3.3 Application Environment: Temperature, Vibration, Fluids, Finish

4.3.4 Rear Accessories: Plain, Cable Support, RFI, Waterproof

4.3.5 Contact Assembly Tools: Crimp, Installing Removal

4.3.6 Then select from the list of connecting devices those connectors best suited for his wiring system, but restrict the number of different parts required to a minimum.

5. GUIDELINES

The guidelines provided herein are not intended to lead the designer into the selection of any one specific connector, but rather to guide him in selecting connecting devices that will provide the minimum number of different parts for an aerospace vehicle's electrical wiring system.

5.1 To facilitate the designer in the selection of common connecting devices and associated contacts, assembly tooling and accessories, the following tables are provided:

- TABLE 1: Identifies all of the contacts and their associated insertion/extraction tools used with the connecting devices listed in this AIR.

- TABLE 2: Identifies the rear accessories associated with the connecting devices listed.

5.2 To illustrate the use of these tables, assume that it has been determined that an electrical wiring system for an aerospace vehicle requires connecting devices with contacts from size 22 through 0 and coupling methods to include threaded, bayonet, push-pull and blind-mate couplings; a terminal junction system is also required. The designer can then select the connecting devices, accessories and tooling that are common from Tables 1 and 2. In each case, the selection of the listed connecting devices is such that all of the wiring system requirements are met with the minimum number of different parts and tools. (See Tables 3 and 4 for examples)

Complete commonality as defined in para. 3. was not achieved in this case, because of the duplication of size 22D contacts for the 38999 and 83733 high density series and because of different type contacts required for the Termination Junction. The purpose of reducing the number of different parts, however, was achieved; a step in the right direction.

5.3 A greater reduction in different parts may be achieved in a wiring system which does not require all of the connecting devices assumed above; the designer should establish his application requirements and select the minimum types of connecting devices to fit these requirements. The COMMON TERMINATION METHOD (CTM) defined herein is one approach to achieve this goal.

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TABLE I. APPLICATION OF REAR RELEASE CONTACTS

(DATA FOR REF ONLY. FOR DESIGN ALWAYS REFER TO APPLICABLE SPEC SHEETS)

CONNECTORS

MIL-C-39029A CONTACTS /1	MIL-C-38999 SERIES I BAYONET	MIL-C-38999 SERIES II BAYONET	MIL-C-26482 SERIES 2 BAYONET	MIL-C-83723 SERIES 3 /2 BAY & THREAD	MIL-C-81703 SERIES 3 PUSH-PULL BLIND MATE	MIL-C-83733 BLIND MATE	MIL-C-81659 SERIES 2 BLIND MATE	MIL-C-5015 MS3450 SERIES THREADED /2	MIL-T-81714 TERMINAL JUNCTION	MIL-STD-1549 COMMON TERMINATION SYSTEM
	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE	CONTACT SIZE
	22D 20 16 12	22D 20 16 12	20 16 12	20 16 12	20 16 12	22D 20 16 12	22 20 16 12	16S 16 12 8 4 0	22 20 16 12	20 22 16 12
POWER										
M39029/56	X X X X									X
M39029/57		X X X X				X				
M39029/58	X X X X	X X X X				X				
M39029/4 & /5			X X X	X X X	X X X	– X X X	X X X X			
M39029/11 & /12								X X X X X X		
M39029/29 & /30									X X X X	X X X X
M39029/1										X X X
M39029/22										
SHIELDED										
M39029/7 & /8				X	X	X	X			
M39029/27 & /28		X					X			
M39029/50 & /51										
M39029/59 & /60	#8 CAVITY									
THERMOCOUPLE										
M39029/9 & /10			X	X	X	– X				
INSTALL/REMOVE TOOLS	M81969/14 (MS27534)						M81969/1 (MS3156)	13 14	M81969/14 (MS27534)	

NOTES:
1. FOR SUPERSEDED CONTACT PART NUMBERS SEE APPROPRIATE SLASH SHEETS OF MIL-C-39029A
2. AVAILABLE FOR FIREWALL APPLICATION AND SELF-LOCKING COUPLING NUT
3. M81969/14 (MS27534) TOOL FOR CONTACT SIZES 16S, 16, 12
4. M81969/17 & /19 (MS3483) TOOL FOR CONTACT SIZES 8, 4, 0

TABLE 2. APPLICATION OF REAR ACCESSORIES

(DATA FOR REF ONLY . FOR DESIGN ALWAYS REFER TO SPEC SHEETS)

BACK HARDWARE	CONNECTORS										
			MIL-C-38999		MIL-C-26482	MIL-C-83723		MIL-C-81703	MIL-C-5015	MIL-C-83733	MIL-C-81659
			SERIES I	SERIES II	SERIES 2	SERIES 3 TYPE T	SERIES 3 TYPE B	SERIES 3	MS3450 SERIES		SERIES 2
MS3416					X	X	X	X	X		
MS3417					X	X	X	X	X		
MS3418					X	X	X	X	X		
MS3419					X	X	X	X	X		
MS3158					X	X	X	X	X		
MS3152					X	X	X	X	X		
MS3153					X	X	X	X	X		
MS3154					X	X	X	X	X		
MS3437					X	X	X	X	X		
MS3188					X	X	X	X	X		
MS3189					X	X	X	X	X		
MS27342 -1			X								
MS27485			–	X							
MS27486			–	X							
MS27487			X	X							
MS27489			X	X							
MS27506			X	X							
MS27507			X	X							
MS27663			X	X							
MS27666			X	X							
MS27668			X	X							
MS27669			X	X							
MS27670			X	X							
M38999/1-/8			X	X							
M83733/15										X	
M83733/16										X	

STANDARDS NOT AVAILABLE