

# WIRING PROGRAMMING SYSTEM PATCHBOARDS, SPECIFICATION FOR

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*Reference EDR Log #: 8852 NASA KSC Export Control Office, (321) 867-9209*

**March 19, 2021**

**Engineering Directorate**

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National Aeronautics and  
Space Administration

**John F. Kennedy Space Center**



**WIRING PROGRAMMING SYSTEM PATCHBOARDS,  
SPECIFICATION FOR**

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**March 19, 2021**

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**RECORD OF REVISIONS/CHANGES**

<b>REV LTR</b>	<b>CHG NO.</b>	<b>DESCRIPTION</b>	<b>DATE</b>
A		General revision.	March 18, 1974
B		General revision.	July 25, 1994
	1	General revision and editorial update.	March 19, 2021

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## 1. SCOPE

This specification establishes the procedures and lists the equipment required for wiring the programming system patchboards.

## 2. APPLICABLE DOCUMENTS

The following documents form a part of this document to the extent specified herein. When this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels, amendments, and approval dates of said documents shall be specified in an attachment to the Solicitation/Statement of Work/Contract. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

### 2.1 Governmental

#### 2.1.1 Specifications

##### John F. Kennedy Space Center (KSC), NASA

KSC-E-165	Electrical Ground Support Equipment, Fabrication, Specification for
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##### Military

MIL-C-22520/1	Crimping Tools, Terminal, Hand, Wire Termination for Wire Barrel Sizes 12 Through 20
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MIL-C-22520/5	Crimping Tools, Terminal, Hand, Wire Termination, Large for Coaxial, Shielded Contacts and Ferrules, Terminal Lugs, Splices, and End Caps
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MIL-1-23053	Insulation Sleeving, Electrical, Heat Shrinkable, General Specification for
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MIL-W-16878	Wire, Electrical, Silicone, Rubber Insulated, 200 Deg. C, 600 Volts
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MS3191-1	Tool, Hand, Crimp, Class 1 for Contacts of Electric Connectors
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MS25274	Cap, Electrical (Wire End, Crimp Style, Type II, Class 1) for 105 Deg. C Total Conductor Temperature
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## **2.1.2 Drawings**

John F. Kennedy Space Center (KSC), NASA

79K22638

Solderless Electrical Connections (Supersedes  
75M05668)

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer.)

## **3. REQUIREMENTS**

### **3.1 Material**

#### **3.1.1 Patchboards**

Patchboards programming systems manufactured by Anderson Electric Company, AMP Inc., or an approved equal determined by the Contracting Officer's technical representative shall be used.

#### **3.1.2 Patchcord Pins**

Patchcord pins manufactured by Anderson Electric Company, AMP Inc., or an approved equal determined by the Contracting Officer's technical representative shall be used. (See [Table 1](#) and [Figure 1](#))

#### **3.1.3 Wire**

No. 20 American wire gage (AWG) wire shall be used for the patchcords. Wire shall conform to MIL-W-16878, types B or J, 19 strand, color white.

#### **3.1.4 End Caps**

For multipatch wiring, end caps conforming to MS25274 and manufactured by Thomas & Betts, AMP Inc., or an approved equal determined by the Contracting Officer's technical representative shall be used to make the pigtail splice. (See [Figure 2](#))

#### **3.1.5 Heat-Reactive Tubing**

Tubing conforming to MIL-I-23053 shall be used throughout the program.

### 3.2 Tools

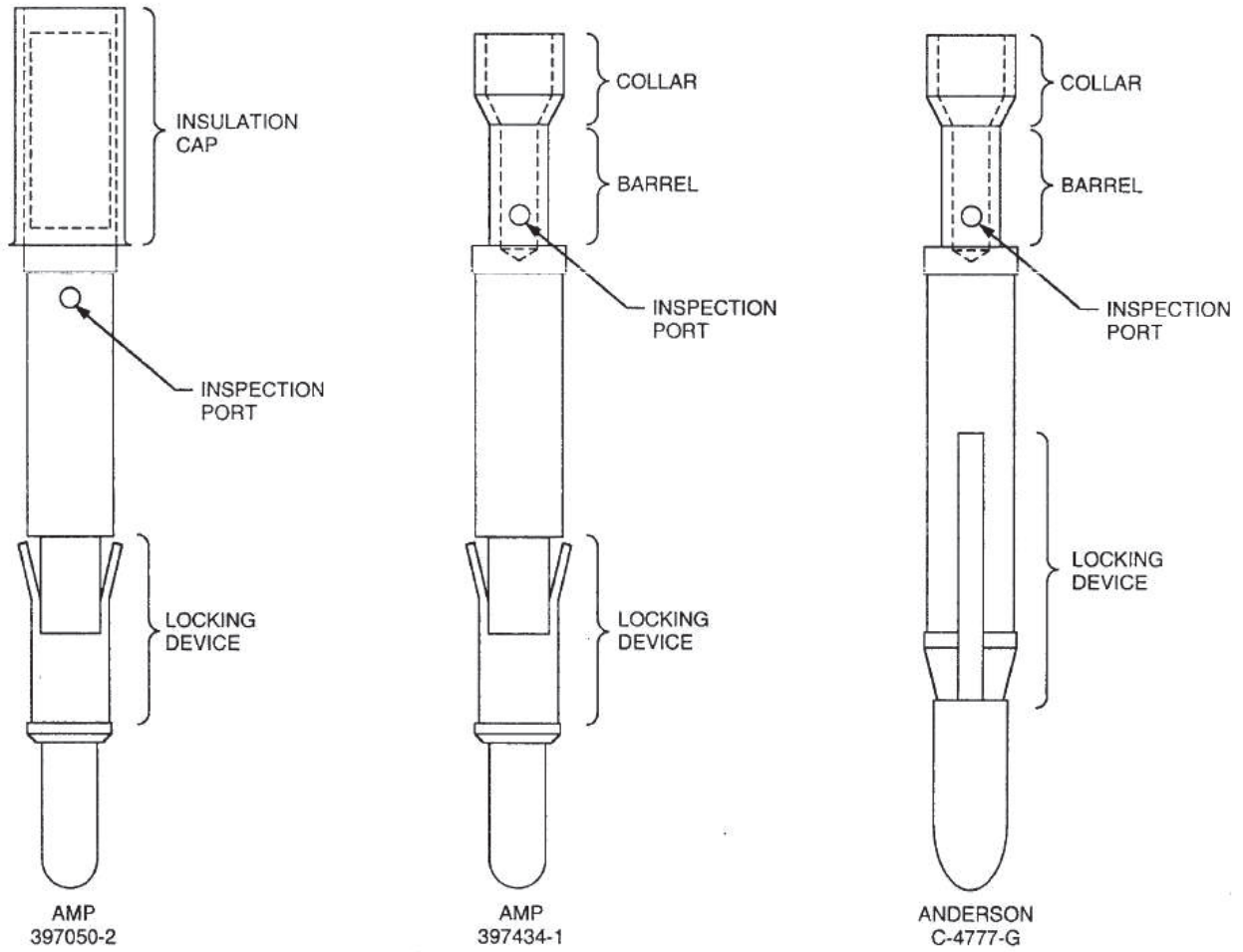
#### 3.2.1 Crimping Tools

For crimping of patchcord pins and end caps, only the crimping tool specified by the manufacturer or the Contracting Officer's technical representative shall be used. (See [Table 1](#)) Crimping tools shall be inspected prior to the beginning of initial work and at periodic intervals not to exceed 40 hours of work service or 30 days of time, whichever occurs first. The tools shall be inspected for wear and clearances between dies and limits. The clearances and dimensions shall conform to the respective standards or to the dimensions approved by the Contracting Officer's technical representative.

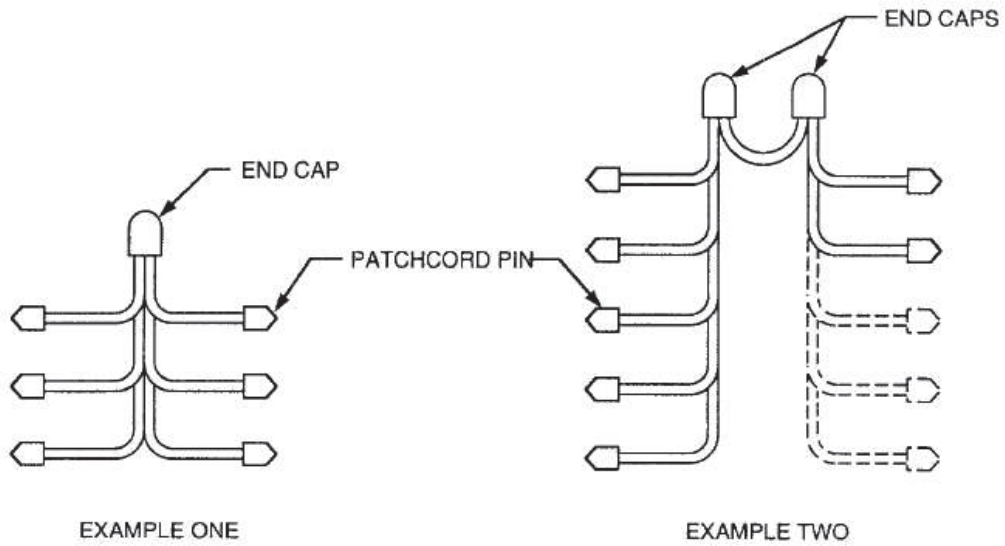
**Table 1. Patchcord Pins and End Caps**

Item	Part Number	Crimping Tool	Extraction Tool	Approved Source	
				Item	Tool
Anderson Patchcord Pin	Anderson C-4777-G	Military Tool MIL-C-22520/1-01; MS3191-1	Anderson C-4853	Anderson	Anderson; Buchanan
AMP Patchcord Pin (With Insulation)	AMP 397050-2	AMP Basic Tool 47386; AMP Pin Stop SA 20-004	AMP 305183	AMP Inc.	AMP Inc.
AMP Patchcord Pin (Without Insulation)	AMP 397434-1	Military Tool MIL-C-22520/1-01; Buchanan Positioner 4461-1	AMP 305183	AMP Inc.	AMP Inc.; Buchanan
Thomas & Betts End Caps	Thomas & Betts RB-15 RC-15	Military Tool MIL-C-22520/5	None Required	Thomas & Betts	Thomas & Betts
AMP End Caps	AMP 328308 328309	Military Tool MIL-C-22520/5	None Required	AMP Inc.	AMP Inc.

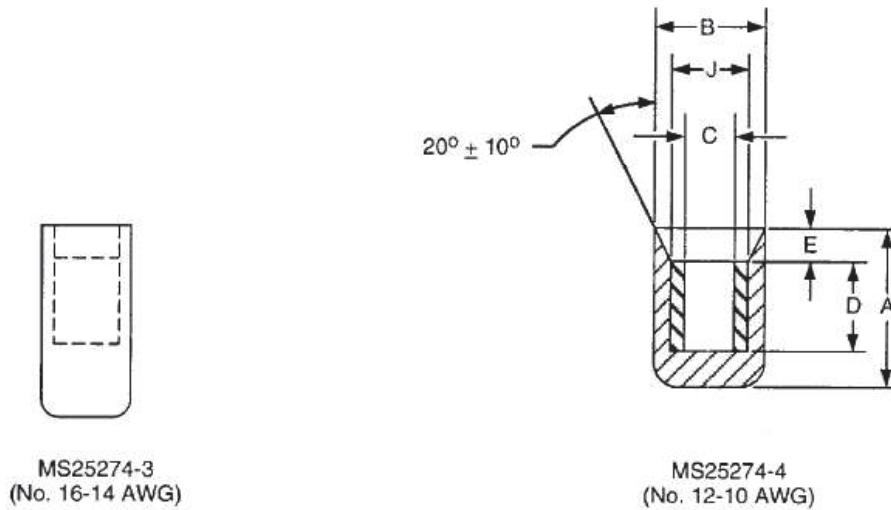




**Figure 1. Patchcord Pins**



JUMPERS



END CAPS

WIRE CAPACITY (No. 20 AWG)	WIRE SIZE (AWG)	A	B	C		D	E	J	COLOR CODE
		MAX	MAX	MAX	MIN	MAX	MIN	MAX	
2-3	16-14	0.480	0.245	0.090	0.080	0.305	0.082	0.170	BLUE
4-6	12-10		0.315	0.140	0.129	0.345		0.229	YELLOW

Figure 2. Multipatch Wiring Arrangements: Jumpers and End Caps

### **3.2.2 Extraction Tools**

Only approved extraction tools shall be used for the extraction of patchcord pins. (See [Table 1](#))

### **3.2.3 Stripping Tools**

Thermal strippers shall be used in stripping insulation from individual conductors. Under conditions where the type of insulation or the wire size will not permit use of a thermal stripper, a mechanical type shall be used. Ideal Stripmaster stripper 16-26 or an approved equal determined by the Contracting Officer's technical representative is acceptable.

### **3.2.4 Heat-Application Method**

A thermal gun is recommended as the source for applying heat to the heat-reactive tubing to ensure a proper fit. However, an oven or radiation heat will be acceptable. A thermal gun with a temperature range of 400 to 540 degrees Celsius (°C) [750 to 1000 degrees Fahrenheit (°F)] (i.e., Master Appliances Corporation NSN 4940-00-986-5899 or approved equal determined by the Contracting Officer's technical representative) is acceptable.

## **3.3 Wiring Procedure**

### **3.3.1 Patchcord-Pin Installation**

To install the patchcord pins on the wire, (1) remove the insulation from the end of the wire with a thermal stripper to the length required, according to the depth of the pin barrel; (2) slip a 1/2-inch piece of heat-reactive tubing (except when using AMP 397050-2) over each end of the wire; (3) insert the stripped wire into the barrel of the patchcord pin until the wire can be seen through the inspection port, ensuring the wire insulation extends down inside the collar of the patchcord pin and then crimp with the specified crimping tool (see [Table 1](#)); and (4) slip the heat-reactive tubing over the patchcord pin cap and barrel and then heat the tubing.

### **3.3.2 Multipatch Jumper Installation**

When multipatch jumpers and end caps are ready for installation, (1) lay white precut jumpers neatly atop the installed patchcord jumpers, (2) cut to the desired length, (3) strip the insulation from the wire ends, (4) install the end cap, and (5) crimp, using the specified crimping tool. (See [Table 1](#))

### **3.3.3 End-Cap Capacity**

Not more than six wires shall be installed in any one end cap. Should it be desirable to join more than six wires, two or more caps shall be used in an arrangement as that shown in [Figure 2](#), Example Two.

## **4. QUALITY ASSURANCE PROVISIONS**

### **4.1 Inspection and Test**

The supplier shall be responsible for the performance of all inspection and test requirements specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection and test facilities and services acceptable to NASA. Inspection and test records shall be kept complete and, upon request, shall be made available to the Contracting Officer. The Contracting Officer reserves the right to perform any or all of the inspections and tests set forth in the specification to ensure the end item conforms to the prescribed requirements.

### **4.2 Discrepancies**

The following discrepancies shall be sufficient reason for rejection of the patchboard.

#### **4.2.1 Material**

Only materials specified herein or as approved by the Contracting Officer shall be acceptable.

##### **4.2.1.1 Wire**

Improper gage, insufficient or excessive length, twisted or kinked wire, or broken insulation shall be reason for rejection.

##### **4.2.1.2 End Caps**

Nonapproved end caps or end caps with broken insulation, cracked ferrules, or of the wrong color shall be cause for rejection.

#### **4.2.2 Workmanship**

##### **4.2.2.1 End-Cap Crimp**

Improper crimp of end caps from improper crimping tools or crimping die sets, improper location of crimp, or a crimp that cannot withstand the tensile strength test specified in MS25274 shall be sufficient reasons for rejecting the patchboard and returning it for rework.

##### **4.2.2.2 Patchcord-Pin Crimp**

Improper crimp as called out in 79K22638 of patchcord pins from improper crimping tools or locator or improper locations of crimp shall cause the patchcord jumper to be rejected.

##### **4.2.2.3 Patchcord-Pin Inspection**

The stripped end of the jumper wire shall be visible through the patchcord-pin inspection port or the patchcord shall be rejected. Likewise, nicks, rings, gouges, or scrapes on jumper wire caused

by stripping shall cause the patchcord to be rejected. Inspection shall be performed after crimping but prior to placing and shrinking the heat-reactive tubing.

#### **4.2.2.4 Patchcord-Pin Retention**

Inability of the installed patchcord pins to withstand the specified force [approximately 22 newtons (5 pounds)] applied to the tip of the pin shall be reason for rejection, and the patchboard shall be returned for rework.

### **5. PREPARATION FOR DELIVERY**

There are no applicable requirements.

### **6. NOTES**

**NOTICE:** The Government drawings, specifications, or data are prepared for the official use by, or on behalf of, the United States Government. The Government neither warrants these Government drawings, specifications, or other data, nor assumes any responsibility or obligation, for their use for purposes other than the Government project for which they were prepared or provided by the Government, or any activity directly related thereto. The fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded, by implication or otherwise, as licensing in any manner the holder or any other person or corporation nor conveying the right or permission, to manufacture, use, or sell any patented invention that may relate thereto.

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