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EIA STANDARD

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Firewall Flame Test Procedure for Electrical Connectors

EIA-364-45A

(Revision of EIA-364-45)

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Electronic Components, Assemblies & Materials Association

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(From Project Number 4524-A, formulated under the cognizance of the CE-2.0 National Connector Standards Committee.)

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TEST PROCEDURE No. 45A

FIREWALL FLAME TEST PROCEDURE FOR ELECTRICAL CONNECTORS

(From EIA Standards Proposal No. 4524-A, formulated under the cognizance EIA CE-2.0 Committee on National Connector Standards, and previously published in EIA-364-45.)

1 Introduction

1.1 Scope

This standard establishes a test method to determine the ability of a mated electrical firewall connector to resist specified flame and vibration during a 20 minute exposure by preventing the flame from breaching the firewall through the connector, and providing specified electrical performance for the first 6 minutes of the 20 minute exposure.

NOTE — Do not use this test procedure to describe or appraise the fire hazard or fire risk of the materials, products or assemblies under actual fire conditions. Each application should be assessed for compatibility with electrical and circuit requirements.

CAUTION —

1 This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all safety problems associated with its use or all regulatory requirements. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to determine the applicability or regulatory limitations before its use.

2 This test should be conducted in a well ventilated area to avoid inhalation of smoke and toxic products of combustion. Protect personnel and equipment from risk of fire.

2 Test resources

2.1 Equipment

2.1.1 An inspirator torch capable of producing and maintaining a flame at a constant temperature of 1100 °C ± 25 °C (2012 °F ± 45 °F) from propane or natural gas with a flow rate equivalent to an input of 3.48×10^7 J/h to 3.90×10^7 J/h (33,000 Btu/h to 37,000 Btu/h). Primary cone diameter shall be 12.7 mm - 19 mm (0.50 inch - 0.75 inch) at nozzle. Secondary cone shall engulf or provide representative impingement coverage, dependent on size of the test sample.

2.1.2 A gas flowmeter with an accuracy of ± 1% full scale.

2.1.3 A themocouple with an exposure junction as shown in figure 1 and temperature meter capable of continuously measuring 1100 °C ± 25 °C (2012 °F ± 45 °F) with an accuracy of 1% of the reading.

2.1.4 A firewall test fixture as shown in figures 2, 3 and 4.

2.1.5 Vibration equipment capable of vibrating the connector and test fixture continuously at 33 Hz with a total excursion of 6.3 millimeters (0.25 inch).

2.1.6 DC power supply with a maximum open circuit voltage of 28 volts capable of producing test currents between 5 amperes and 150 amperes.

2.1.7 A center-tapped transformer ac power supply capable of producing 110/220 to 130/260 volts at 50 Hz to 60 Hz capable of delivering a minimum current of 2 amperes.

2.1.8 A multirange undamped dc ammeter with an accuracy of 1% full scale and capable of measuring dc currents between 5 amperes and 150 amperes.

2.1.9 Two ac ammeters, with an accuracy of ± 1% capable of measuring 2 amperes.

2.2 Material

2.2.1 Fiberglass wrap (untreated glass tape) or equivalent; see figure 4

3 Test specimen

3.1 Description

The test sample shall be wired mated and torqued connectors, complete with accessories having straight saddle bar cable clamps.

3.2 Preparation

3.2.1 Connect alternate contacts into two series groups, see figure 5, with wire suitable for high temperature application.

3.2.2 Thoroughly clean the test sample of oil, grease, dirt and other foreign matter using a noncombustible solvent.

3.2.3 Wrap wire bundles with plain fiberglass wrap (untreated glass tape); see figure 4, or other suitable means to protect the wire from the flame and to stabilize the wire bundle-connector interface during flame and vibration application. Protective wrap should be as close as possible to the rear of the connector dielectric and under the cable clamp. Protective wrap shall extend 178 mm (7 inches) minimum from the rear of the saddle clamp on the plug.

4 Test procedure

4.1 Attach the test sample to the connector mounting plate shown in figures 2, 3 and 4.

4.2 Attach the mounting plate and thermal insulator sheet to the firewall test fixture as shown in figure 3.

4.3 Mount the firewall test fixture on the vibration machine table as shown in figure 4.

4.4 Support the wire bundles on both sides of the connector to stationary structure 200 mm to 250 mm (8 inches to 10 inches) from the connector backshell.

4.5 Connect the wired connector to the circuit shown in figure 5 to test the connector's electrical integrity in accordance with 4.11.

4.6 The connector shall be solidly grounded during the entire test.

4.7 Position the thermocouple with respect to the coupling nut of the connector as shown in figure 4.

4.8 With the torch and thermocouple moved away from the connector (flame not contacting connector) ignite the gas. Adjust the flow of gas for 3.48×10^7 J/h to 3.90×10^7 J/h (33,000 Btu/h to 37,000 Btu/h) and a flame temperature of 1100 °C ± 25 °C (2012 °F ± 45 °F). Position the torch so that the thermocouple measures the hot spot of the flame.

4.9 Load all contacts with the dc current shown in table 1. Do not alter the current during the test.

4.10 Start the vibration machine and vibrate continuously at 33 Hz with a total excursion of 6.3 millimeters (0.25 inch).

4.11 Flame and vibration test (20 minutes total)

4.11.1 Move the torch and thermocouple to the position shown in figure 4. When the thermocouple reaches 1100 °C ± 25 °C (2012 °F ± 45 °F). start the 20 minute test. Continuously monitor the gas flow and temperature.

4.11.2 Observe and record the presence of flame, for any reason or from any source, on the protected side of the firewall test fixture during the entire 20 minutes of flame exposure.

4.12 Electrical performance test, figure 5 (six minutes)

4.12.1 During the first five minutes of combined flame and vibration with switch 1 closed, apply specified dc test current, table 1, through all contacts. Monitor the ammeter for fluctuations indicating current discontinuities which shall not drop below 10% of initial value.

Table 1 – Connector test currents

Contact size	DC test currents, amperes
22	5.0
20	7.5
16	13
12	23
8	46
4	80
0	150

4.12.2 At the end of five minutes, disconnect the dc power and its load by opening switch 1.

4.12.3 Apply ac voltage for one minute between each group of contacts and the shell by closing switch 2. Observe the ammeters for leakage currents, which should not exceed two amperes.

4.13 Flame and vibration, continued (14 minutes)

At the end of six minutes remove the ac potential and continue flame and vibration for another 14 minutes for a total elapsed time of 20 minutes.

5 Details to be specified

The following details shall be specified in the referencing document:

5.1 Connector assembly including backshells, cable clamps and accessories

5.2 Special mounting and torque requirements, if applicable

5.3 Vibration frequency if other than 33 Hz

5.4 Voltage and test currents, if other than specified herein.

6 Documentation

Documentation shall contain the details specified in clause 5, with any exceptions, and the following:

6.1 Title of test

6.2 Sample description

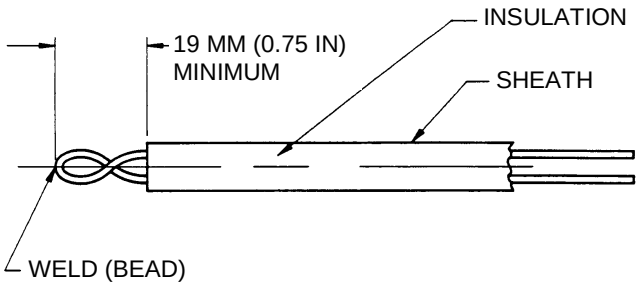
6.3 Show calculation equating the fuel type to the required Btu/h thermal flux

6.4 Test equipment used, and date of last and next calibration

6.5 Fuel type

6.6 Values and observations, including observed discontinuities and leakage currents

6.7 Name of operator and date of test



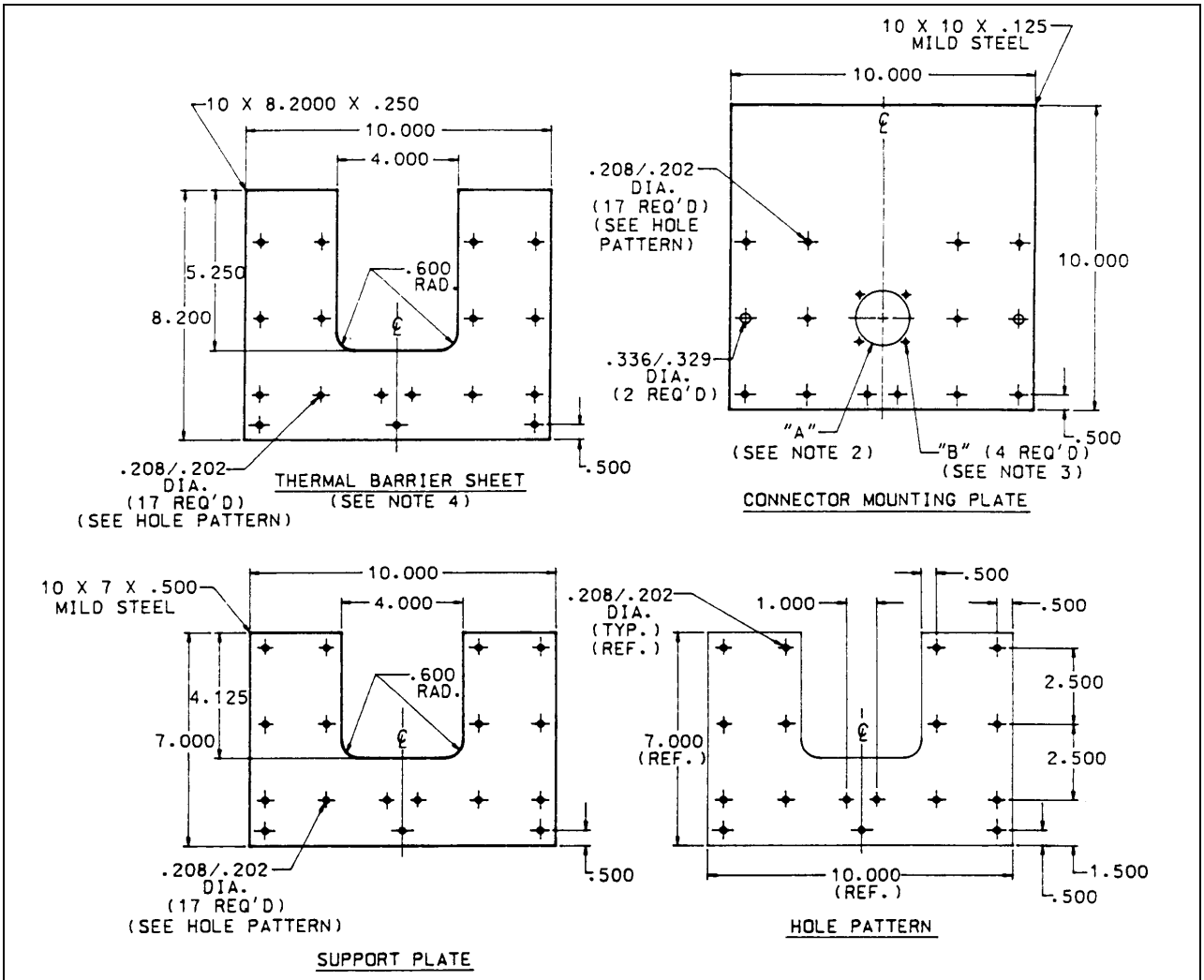
NOTES

1 The thermocouple wire shall be platinum-rhodium, type R, 22 AWG.

2 If a metal sheath is used, the maximum diameter shall not exceed 3 mm (0.12 inch).

3 The thermocouple shall be unshielded.

Figure 1 – Thermocouple details



NOTES

1 Dimensions are in inches. Unless otherwise specified, dimensions symmetrical about centerline.

2 "A" hole shall provide suitable clearance for the applicable connector.

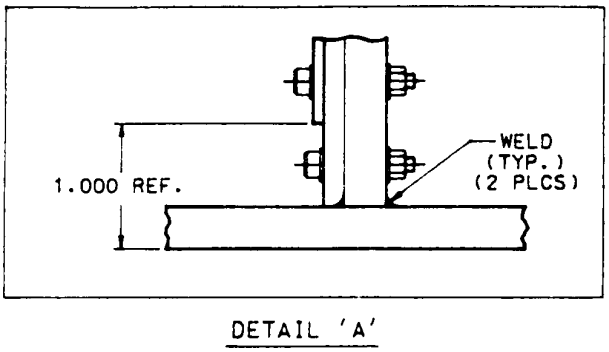
3 "B" connector mounting holes shall be as specified for the connector.

4 Thermal barrier sheet required to prevent destructive heat transfer to vibration equipment.

mm	inch
3.18	0.125
5.13	0.202
5.28	0.208
8.36	0.329
8.53	0.336
12.70	0.500
15.24	0.600
38.10	1.500
63.50	2.500
101.60	4.000
104.78	4.125
133.35	5.250
177.80	7.000
208.30	8.200
254.00	10.000

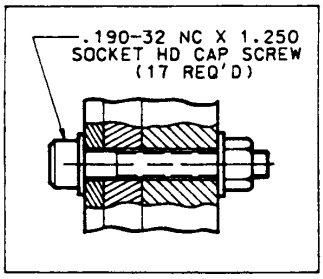
Figure 2 – Firewall connector fixture details

	mm	inch

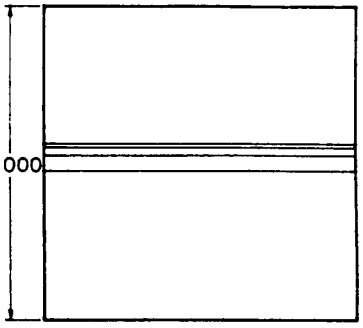


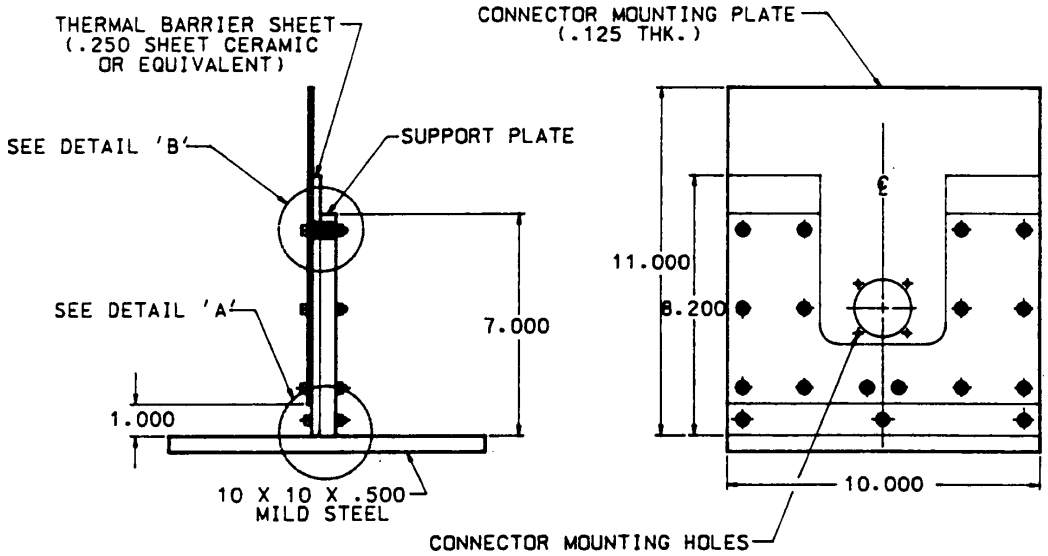
DETAIL 'A'

3.18	0.125
4.83	0.190
6.35	0.250
12.70	0.500
25.40	1.000
31.75	1.250
177.80	7.000
208.28	8.200
254.00	10.000
279.40	11.000



DETAIL 'B'





NOTE — Dimensions are in inches. Unless otherwise specified, dimensions symmetrical about centerline.

Figure 3 – Firewall connector fixture assembly

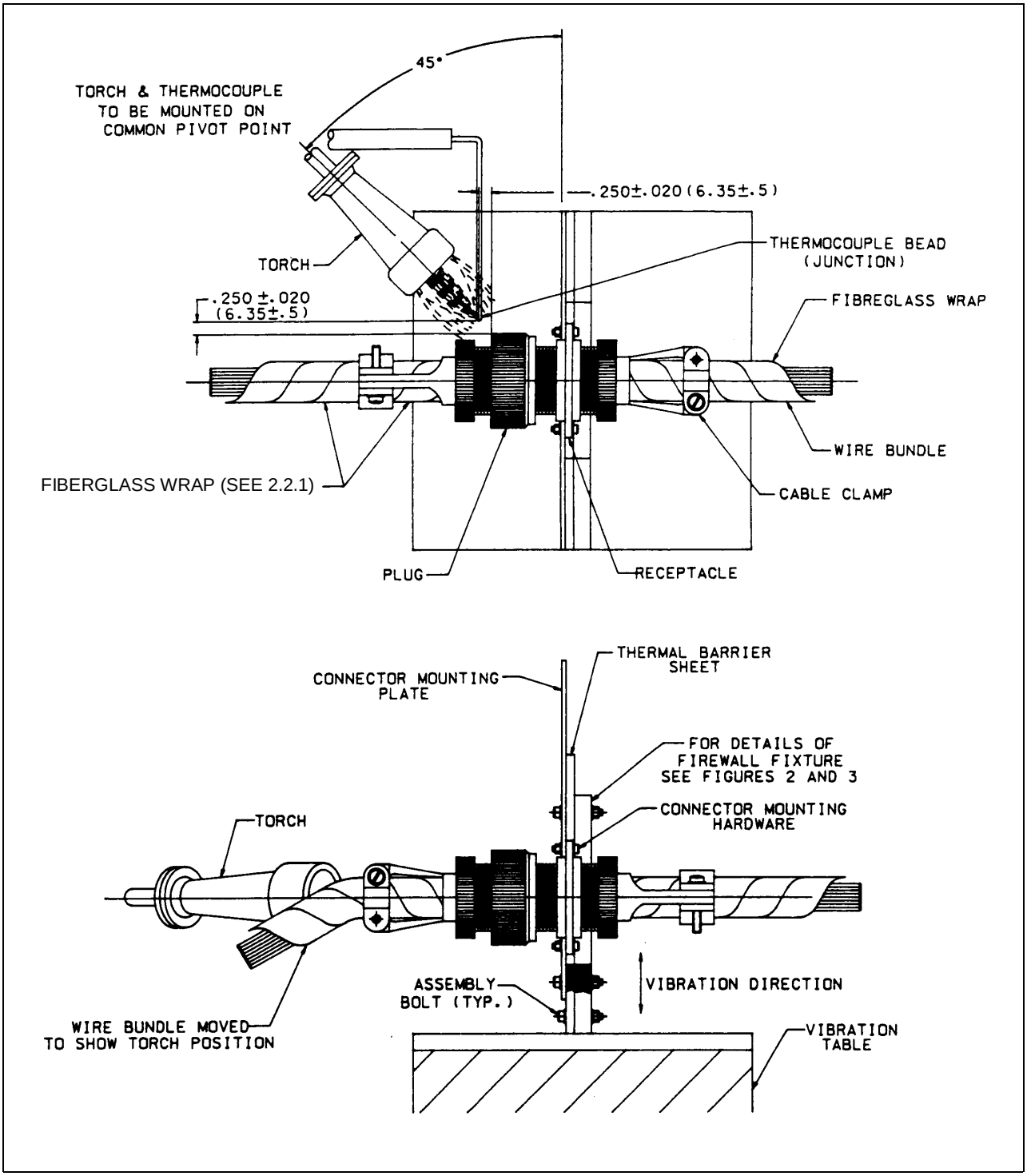


Figure 4 – Firewall connector test setup

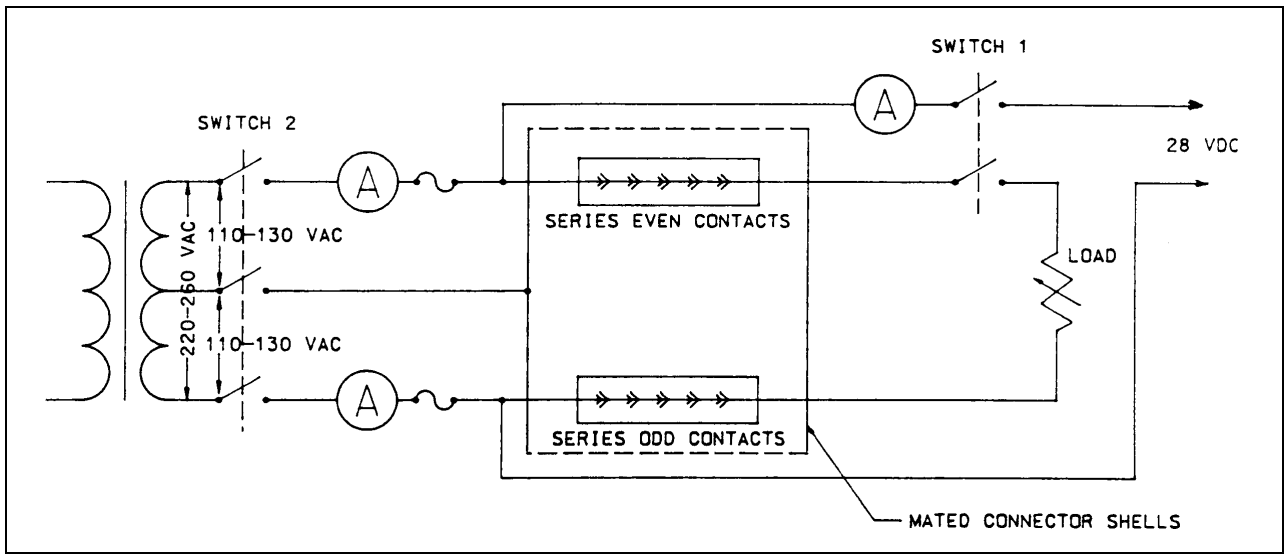


Figure 5 – Schematic circuit for testing firewall connectors

EIA Document Improvement Proposal

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