3M

Scotchlok™ 4460-D Shield Connector

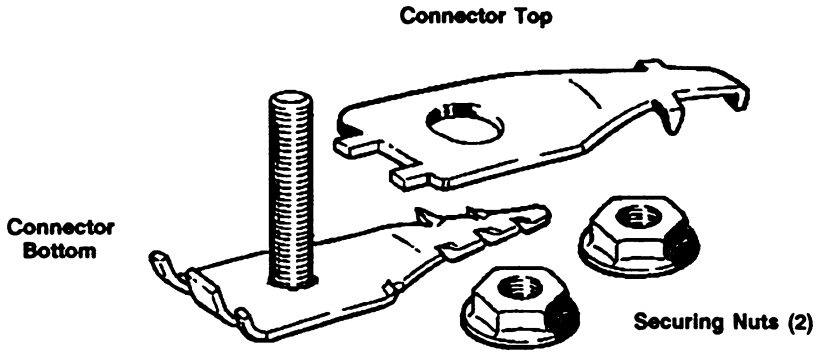
Technical Report

October 1989
80-6104-1693-7

1.0 PRODUCT DESCRIPTION

The Scotchlok™ 4460-D Shield Connector is designed to make a stable and low resistance electrical connection to communication cables of 0.8 in. (20.3 mm) or less diameter. This is equivalent to cable sizes of 100 pair - 24 AWG (0.5 mm) and smaller.

The 4460-D will accommodate a solid bonding strap, stranded or solid wire, or flat bonding braid.



Material Composition:

Connector top and bottom	Tin plated copper alloy
Inserted stud	#300 series stainless steel
Securing nuts	Zinc plated hardened steel with a yellow Dichromate dip

2.0 TEST PROGRAM OVERVIEW

To predict the long term performance of the 4460-D Shield Connector, the connectors have been subjected to a number of tests which expose them to conditions more severe than anticipated in actual field use. The tests performed were selected based on the particular needs of this connector and the relatively small size cable connected. The connectors were evaluated in the following areas:

1. The stability of the 4460-D Shield Connector when subjected to a simulated life environment.
2. The ability to carry varying levels of fault current both with and without previous connector aging.
3. The tensile strength of the connector to cable joint.
4. The physical strength of the stud and connector.

The following sections describe each of the test series and report the results obtained.

3.0 ENVIRONMENTAL TEST SERIES

The 4460-D was subjected to a series of stresses which was designed to simulate real life hazards. The test samples consisted of sections of cable 6 in. (15.2 cm) long with a connector installed at each end. A single flanged nut was installed onto each connector. The nut was tightened to 30 in-lb (3.4 N-m). The test samples are described in the following matrix.

Sample Number	Cable Pair Count	Wire Size AWG (mm)	Assembly Temperature
1	100	24 (0.5)	70°F (21°C)
2	100	24 (0.5)	70°F (21°C)
3	100	24 (0.5)	70°F (21°C)
4	50	24 (0.5)	70°F (21°C)
5	50	24 (0.5)	70°F (21°C)
6	50	24 (0.5)	70°F (21°C)
7	25	24 (0.5)	70°F (21°C)
8	25	24 (0.5)	70°F (21°C)
9	25	24 (0.5)	70°F (21°C)
10	6	22 (0.65)	70°F (21°C)
11	6	22 (0.65)	70°F (21°C)
12	6	22 (0.65)	70°F (21°C)
13	100	24 (0.5)	0°F (-18°C)
14	100	24 (0.5)	0°F (-18°C)
15	100	24 (0.5)	0°F (-18°C)
16	50	24 (0.5)	0°F (-18°C)
17	50	24 (0.5)	0°F (-18°C)
18	50	24 (0.5)	0°F (-18°C)
19	25	24 (0.5)	0°F (-18°C)
20	25	24 (0.5)	0°F (-18°C)
21	25	24 (0.5)	0°F (-18°C)

Vibration

All samples were measured for initial connection resistance. The samples were rigidly mounted on a vibration table and vibrated for two hours in each of three mutually perpendicular planes.

The vibration sequence consisted of sweeping from 10 to 55 to 10 Hertz in one minute, with a maximum test specimen excursion of 0.06 in. (1.5 mm). During the test, each sample was monitored for discontinuities of 10 microseconds or more. Connection resistance was measured in each sample following the vibration test.

Temperature Cycle

The samples were exposed to 25 temperature cycles ranging from -40°F to 140°F (-40°C to 60°C). Each cycle had a total duration of eight hours. Connection resistance was measured following the temperature cycle.

Six inches (15.2 cm) of Scotch™ #25T Grounding Braid with Eyelets was installed on each shield connector. It was secured with the second flanged nut. The nut was tightened to 30 in-lb (3.4 N•m).

Aged Fault Current Test

Each sample was energized with a 60 Hz current of 800 amperes. Time to failure of each sample was recorded.

In all cases, the cable sheath melted and the cable sheath fused open. The #25 braid and the 4460-D shield connectors remained intact throughout the duration of the test. The results from the Environmental Test Series are presented below.

ENVIRONMENTAL TEST SERIES RESULTS

Sample Number	Initial Resistance (Milliohms)	Resistance After Vibration (Milliohms)	Vibration Circuit Discontinuities	Resistance After Temp. Cycling (Milliohms)	Time to Current Failure (Seconds)
1	1.37	1.76	None	2.27	13
2	1.54	1.82	None	2.83	18
3	1.50	1.52	None	1.84	27
4	1.27	1.55	None	1.90	19
5	1.49	1.72	None	2.75	16
6	1.40	1.53	None	1.85	16
7	1.65	1.78	None	2.15	8
8	1.51	1.62	None	1.81	8
9	1.82	2.13	None	2.45	9
10	1.57	1.68	None	2.11	7
11	1.71	1.94	None	2.02	6
12	1.67	1.67	None	2.02	6
13	1.57	2.15	None	2.52	15
14	1.45	1.70	None	1.86	23
15	1.45	1.78	None	2.15	26
16	1.66	1.85	None	2.22	14
17	1.62	1.84	None	1.86	16
18	1.45	1.59	None	1.79	17
19	1.50	1.74	None	1.93	7
20	1.45	1.65	None	1.89	10
21	1.63	1.85	None	2.53	6

4.0 FAULT CURRENT TEST

Fourteen unaged samples were prepared for this test. Seven samples were assembled on 100 pair 24 AWG (0.5 mm) air core PIC cable. Seven were assembled on 6 pair 22 AWG (0.65 mm) filled buried service wire. The cable sections were all 6 in. (15.2 cm) long. The connectors were secured with one flanged nut tightened to 30 in-lb (3.4 N-m).

Six inches (15.2 cm) of Scotch™ #25T Grounding Braid with Eyelets was installed onto each shield connector. It was secured with the second flanged nut. The nut was tightened to 30 in-lb (3.4 N-m).

The test samples were subjected to an A.C. surge current of 500, 750, or 1000 amperes. The time to failure was recorded.

Sample Number	Cable Pair Count	Wire Gauge AWG (mm)	Test Amperage	Failure (Seconds)
1	100	24 (0.5)	500	* 60
2	100	24 (0.5)	750	34
3	100	24 (0.5)	750	39
4	100	24 (0.5)	750	31
5	100	24 (0.5)	1000	10
6	100	24 (0.5)	1000	13
7	100	24 (0.5)	1000	11
8	6	22 (0.65)	500	* 50
9	6	22 (0.65)	750	9
10	6	22 (0.65)	750	9
11	6	22 (0.65)	750	8
12	6	22 (0.65)	1000	3
13	6	22 (0.65)	1000	3
14	6	22 (0.65)	1000	3

5.0 PULLOUT STRENGTH TEST

Ten unaged samples were prepared for this test. Five samples were assembled on 100 pair 24 AWG (0.5 mm) air core PIC cable. Five were assembled on 6 pair 22 AWG (0.65 mm) filled buried service wire. The cable sections were all 6 in. (15.2 cm) long. The connectors were secured to each end with one flanged nut tightened to 30 in-lb (3.4 N-m).

The test samples were attached to the jaws of an Instron tensile tester by means of metal straps. The studs of the 4460-S connectors were inserted into holes in the metal straps and fastened with a flanged nut. The jaw separation speed was 2 in/min. (50.8 mm/min.)

PULLOUT STRENGTH TEST RESULTS

Sample Number	**Cable Pair Count**	**Wire Size** AWG (mm)	**Pullout Force** Pounds (Newtons)
1	100	24 (0.5)	135.4 (602)
2	100	24 (0.5)	144.0 (641)
3	100	24 (0.5)	131.3 (584)
4	100	24 (0.5)	137.0 (609)
5	100	24 (0.5)	151.4 (673)
6	6	22 (0.65)	124.6 (554)
7	6	22 (0.65)	131.0 (583)
8	6	22 (0.65)	122.9 (547)
9	6	22 (0.65)	127.3 (566)
10	6	22 (0.65)	122.5 (545)

6.0 STUD TORQUE TEST

Five 4460-D Shield Connectors were tested to verify the strength of the press-in stainless steel stud. Each connector was secured in a metal bracket with the stud protruding through a hole. A flanged nut was installed on the stud. The nut was tightened against the test bracket until the stud broke or was pulled from the connector base. A torque wrench was used to measure the maximum torque. The results are presented below.

	Maximum Torque	
	Inch-Pounds	(Newton-Meters)
	112.5	(12.7)
	127.5	(14.4)
	145.0	(16.4)
	140.0	(15.8)
	125.0	(14.1)
Average	130.0	(14.7)

7.0 CONCLUSIONS

Throughout this test the Scotchlok™ 4460-D Shield Connector exhibited excellent performance. The results from the Environmental Test Series, the Fault Current Test and the Pullout Strength Test indicate that the 4460-D connector will perform satisfactorily in most real world applications. The results from the Stud Torque test confirms that the connectors were designed with enough strength to meet and exceed the application requirements.

For information concerning specific agency approvals please contact your 3M TelComm Products Division representative.

Important Notice
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