

UL 634

Connectors and Switches for Use with Burglar-Alarm Systems



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Northbrook, IL 60062-2096

UL Standard for Safety for Connectors and Switches for Use with Burglar-Alarm Systems, UL 634

Ninth Edition, Dated October 12, 2007

Summary of Topics

The Ninth Edition of the Standard for Connectors and Switches for Use with Burglar-Alarm Systems, UL 634, is being issued as an American National Standard. The following revisions have been made to the standard: (a) requirements in Sections 49 – 57 were revised to apply to both High Security Switches (Level 1) and High Security Balanced Magnetic Switches, BMS (Level 2), (b) Sections 58 – 65 were added for High Security Balanced Magnetic Switches, BMS (Level 2), (c) standard references were updated, (d) the scope paragraph addressing investigation of new and different features of products was deleted, and (e) editorial corrections were made.

The following table lists the future effective date with the corresponding item.

Future Effective Date	References
January 19, 2009	Section 57

The new requirements are substantially in accordance with UL's Proposal(s) on this subject dated October 27, 2006 and April 13, 2007.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net/ulforeword.html>.

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if

the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Recognition, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-58	October 12, 2007
A1-A2	October 12, 2007
SR1-SR2	October 12, 2007

No Text on This Page



OCTOBER 12, 2007

1



ANSI/UL 634-2007

UL 634

**Standard for Connectors and Switches for Use with Burglar-Alarm
Systems**

First Edition – December, 1962
Second Edition – September, 1972
Third Edition – June, 1973
Fourth Edition – October, 1978
Fifth Edition – November, 1985
Sixth Edition – November, 1990
Seventh Edition – April, 1995
Eighth Edition – February, 2000

Ninth Edition

October 12, 2007

The most recent designation of ANSI/UL 634 as an American National Standard (ANSI) occurred on October 12, 2007. The ANSI approval for this standard does not include the cover page, transmittal pages or the title page.

This ANSI/UL Standard for Safety, which consists of the ninth edition, is under continuous maintenance, whereby each revision is ANSI approved upon publication.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc. and is not part of the ANSI Standard.

The Department of Defense (DoD) has adopted UL 634 on July 16, 1991. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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APPENDIX A

Standards for Components..... A1

INTRODUCTION

1 Scope

1.1 These requirements cover connectors and switches for use with burglar-alarm systems in mercantile premises, mercantile safes and vaults, bank safes and vaults, government and corporate locations, and residences. They are intended to be used in circuits of limited energy, for these applications, in accordance with Article 725 of the National Electrical Code, NFPA 70.

1.2 The connectors and switches covered by these requirements include insulated contact springs and mating brackets; magnetically actuated and mercury switches; heat, smoke, and vibration detectors; floor mats; floor traps, special contacts for safes and vaults; flexible connectors; foil connectors; and shunting devices.

1.3 Switches covered by these requirements are intended for use in protective circuits to supervise doors, windows, hatches, vents, trap doors, and the like, to initiate an alarm signal when actuated.

1.4 Connectors covered by these requirements are intended to join various parts of protective circuit components and wiring.

1.5 The products covered by these requirements may require an external source of electrical energy not integral with the product.

1.6 The products covered by these requirements are intended to be installed in accordance with the Standard for Installation and Classification of Burglar and Holdup Alarm Systems, UL 681, or with the Standard for Installation and Classification of Residential Burglar Alarm Systems, UL 1641.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

2.2 Units of measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are root-mean-square (rms).

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

2.4 Terminology

2.4.1 The term "product" as used in this standard refers to all types of connectors and switches.

3 Glossary

3.1 For the purpose of this standard the following definitions apply.

3.2 **BALANCED MAGNETIC SWITCH (BMS)** – A switch that is constructed in such a manner or that includes additional components that increase resistance to magnetic, electrical and mechanical tampering or defeat.

3.3 CIRCUITS, ELECTRICAL –

a) **High-Voltage (Class 1)** – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage power-limited circuit.

b) **Low-Voltage** – A circuit involving a potential of not more than 30 volts AC rms, 42.4 volts DC or AC peak.

c) **Power-Limited** – A circuit whose output is limited as specified in Power-Limited Circuits, Section 40.

d) **Class 2** – A circuit in which the voltage and power limitations are in accordance with the requirements of Table 40.1 for AC circuits and Table 40.2 for DC circuits.

e) **Class 3** – A circuit in which the voltage and power limitations are in accordance with the requirements of Table 40.1 for AC circuits and Table 40.2 for DC circuits.

3.4 **LEVEL 1 HIGH SECURITY SWITCH** – In addition to complying with the applicable requirements specified in Sections 1 – 48, a High Security Level 1 Switch shall comply with the requirements specified in Sections 50 – 57.

3.5 **LEVEL 2 HIGH SECURITY SWITCH (BMS)** – A Level 2 High Security Switch is a Balance Magnet Switch including requirements specified for a Level 1 High Security Switch and additional requirements specified in Sections 58 – 64.

3.6 **SUPPLEMENTARY DEVICE** – An assembly of parts intended to provide a supplementary service or function as opposed to primary, required service.

CONSTRUCTION

ASSEMBLY

4 General

4.1 Unless specifically indicated otherwise, the construction requirements specified for a product shall apply also for any accessories or supplementary devices with which it is to be used.

5 Frame and Enclosure

5.1 General

5.1.1 The frame and enclosure of a product shall have strength and rigidity to resist total or partial collapse that may result in reduction of mechanical protection or electrical spacings (see Spacings, General, Section 15), loosening or displacement of parts, or other serious defects.

5.1.2 Electrical parts of a product shall be located or enclosed so that protection is provided against unintentional contact with uninsulated high-voltage live parts.

5.1.3 Operating parts, such as gear mechanisms, light-duty relays, and similar devices, shall be enclosed to protect against malfunction from dust or other material that may impair their intended operation.

5.1.4 An enclosure shall have means for mounting that shall be accessible without disassembling any operating part of the product. Removal of a completely assembled panel to mount the enclosure is not considered to be disassembly of an operating part.

5.2 Cast metal

5.2.1 The minimum thickness of cast metal for an enclosure shall be as indicated in Table 5.1.

Exception: Cast metal of lesser thickness may be used if, upon investigation, the shape, size, and function of the enclosure provides equivalent mechanical strength. See the Impact Test, Section 32.

5.3 Sheet metal

5.3.1 The thickness of sheet metal used for the enclosure of a product shall not be less than that indicated in Table 5.2 or 5.3, whichever applies.

Exception: Sheet metal of lesser thickness may be used if, upon investigation, the shape, size, and function of the enclosure provides equivalent mechanical strength. See the Impact Test, Section 32.

5.3.2 A sheet metal member to which a wiring system is to be connected in the field shall not be less than 0.032 inch (0.81 mm) thick if of uncoated steel, 0.034 inch (0.86 mm) if of galvanized steel, and 0.045 inch (1.14 mm) if of nonferrous metal.

5.4 Nonmetallic

5.4.1 Nonmetallic material used for an enclosure shall have a wall thickness of not less than 1/16 inch (1.6 mm).

Table 5.1
Cast-metal enclosures

Use, or dimensions of area involved ^a	Minimum thickness			
	Die-cast metal,		Cast metal of other than the die-cast type,	
	inch	(mm)	inch	(mm)
Area of 24 square inches (155 cm ²) or less and having no dimension greater than 6 inches (152 mm)	1/16	1.6	1/8	3.2
Area greater than 24 square inches (155 cm ²) or having any dimension greater than 6 inches (152 mm)	3/32	2.4	1/8	3.2
At a threaded conduit hole	1/4	6.4	1/4	6.4
At an unthreaded conduit hole	1/8	3.2	1/8	3.2

^a The area limitation for metal 1/16 inch (1.6 mm) thick may be obtained by the provision of reinforcing ribs subdividing a larger area.

Table 5.2
Minimum thickness of sheet metal for enclosures – carbon steel or stainless steel

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness uncoated,		Minimum thickness metal coated,	
Maximum width, ^b	Maximum length, ^c	Maximum width, ^b	Maximum length, ^c	inch	(mm)	inch	(mm)
inches	(cm)	inches	(cm)	[MSG]		[GSG]	
4.0 (10.2)	Not limited	6.25 (15.9)	Not limited	0.020	(0.51)	0.023	(0.58)
4.75 (12.1)	5.75 (14.6)	6.75 (17.1)	8.25 (21.0)	[24]		[24]	
6.0 (15.2)	Not limited	9.5 (24.1)	Not limited	0.026	(0.66)	0.029	(0.74)
7.0 (17.8)	8.75 (22.2)	10.0 (25.4)	12.5 (31.8)	[22]		[22]	
8.0 (20.3)	Not limited	12.0 (30.5)	Not limited	0.032	(0.81)	0.034	(0.86)
9.0 (22.9)	11.5 (29.2)	13.0 (33.0)	16.0 (40.6)	[20]		[20]	
12.5 (31.8)	Not limited	19.5 (49.5)	Not limited	0.042	(1.07)	0.045	(1.14)
14.0 (35.6)	18.0 (45.7)	21.0 (53.3)	25.0 (63.5)	[18]		[18]	
18.0 (45.7)	Not limited	27.0 (68.6)	Not limited	0.053	(1.35)	0.056	(1.42)
20.0 (50.8)	25.0 (63.5)	29.0 (73.7)	36.0 (91.4)	[16]		[16]	
22.0 (55.9)	Not limited	33.0 (83.8)	Not limited	0.060	(1.52)	0.063	(1.60)
25.0 (63.5)	31.0 (78.7)	35.0 (88.9)	43.0 (109.2)	[15]		[15]	
25.0 (63.5)	Not limited	39.0 (99.1)	Not limited	0.067	(1.70)	0.070	(1.78)
29.0 (73.7)	36.0 (91.4)	41.0 (104.1)	51.0 (129.5)	[14]		[14]	
33.0 (83.8)	Not limited	51.0 (129.5)	Not limited	0.080	(2.03)	0.084	(2.13)
38.0 (96.5)	47.0 (119.4)	54.0 (137.2)	66.0 (167.6)	[13]		[13]	
42.0 (106.7)	Not limited	64.0 (162.6)	Not limited	0.093	(2.36)	0.097	(2.46)
47.0 (119.4)	59.0 (149.9)	68.0 (172.7)	84.0 (213.4)	[12]		[12]	
52.0 (132.1)	Not limited	80.0 (203.2)	Not limited	0.108	(2.74)	0.111	(2.82)

Table 5.2 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness uncoated,		Minimum thickness metal coated,	
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	inch (mm) [MSG]		inch (mm) [GSG]	
60.0 (152.4)	74.0 (188.0)	84.0 (213.4)	103.0 (261.6)	[11]		[11]	
63.0 (160.0)	Not limited	97.0 (246.4)	Not limited	0.123 (3.12)		0.126 (3.20)	
73.0 (185.4)	90.0 (228.6)	103.0 (261.6)	127.0 (322.6)	[10]		[10]	

^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal which is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and which has sufficient torsional rigidity to resist the bending moments which may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure which is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes:

- 1) A single sheet with single formed flanges (formed edges);
- 2) A single sheet which is corrugated or ribbed; and
- 3) An enclosure surface loosely attached to a frame, for example, with spring clips.

^b The width is the smaller dimension of a rectangular sheet metal piece which is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels which are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

Table 5.3
Minimum thickness of sheet metal for electrical enclosures – aluminum, copper, or brass

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness, inch (mm)	
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)		
3.0 7.6	Not limited	7.0 17.8	Not limited	0.023	0.58
3.5 8.9	4.0 10.2	8.5 21.6	9.5 24.1		
4.0 10.2	Not limited	10.0 25.4	Not limited	0.029	0.74
5.0 12.7	6.0 15.2	10.5 26.7	13.5 34.3		
6.0 15.2	Not limited	14.0 35.6	Not limited	0.036	0.91
6.5 16.5	8.0 20.3	15.0 38.1	18.0 45.7		
8.0 20.3	Not limited	19.0 48.3	Not limited	0.045	1.14
9.5 24.1	11.5 29.2	21.0 53.3	25.0 63.5		
12.0 30.5	Not limited	28.0 71.1	Not limited	0.058	1.47
14.0 35.6	16.0 40.6	30.0 76.2	37.0 94.0		
18.0 45.7	Not limited	42.0 106.7	Not limited	0.075	1.91
20.0 50.8	25.0 63.5	45.0 114.3	55.0 139.7		
25.0 63.5	Not limited	60.0 152.4	Not limited	0.095	2.41
29.0 73.7	36.0 91.4	64.0 162.6	78.0 198.1		

Table 5.3 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness, inch (mm)
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, inches (cm)	
37.0 94.0	Not limited	87.0 221.0	Not limited	0.122 3.10
42.0 106.7	53.0 134.6	93.0 236.2	114.0 289.6	
52.0 132.1	Not limited	123.0 312.4	Not limited	0.153 3.89
60.0 152.4	74.0 188.0	130.0 330.2	160.0 406.4	

^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal which is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and which has sufficient torsional rigidity to resist the bending moments which may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure which is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes:

- 1) A single sheet with single formed flanges (formed edges);
- 2) A single sheet which is corrugated or ribbed, and
- 3) An enclosure surface loosely attached to a frame, such as by spring clips.

^b The width is the smaller dimension of a rectangular sheet metal piece which is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels which are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

5.4.2 Among the factors taken into consideration when determining the acceptability of a nonmetallic enclosure are:

- a) The mechanical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Flammability and resistance to ignition from electrical sources;
- e) Dielectric strength, insulation resistance, and resistance to arc tracking;
- f) Resistance to distortion and creeping at temperatures to which the material may be subjected under any conditions of use; and
- g) The effect of exposure to weathering if for outdoor use.

All these factors are to be considered with respect to aging in accordance with the Tests on Polymeric Materials, Section 38, and the Impact Test, Section 32.

5.4.3 Assembly screws that hold essential working parts and that must be loosened or removed in order to wire or install a connector or switch shall not thread into material other than metal.

6 Corrosion Protection

6.1 Iron and steel parts, other than bearings, and the like, where such protection is impracticable, shall be protected against corrosion by enameling, galvanizing, sherardizing, plating, or other equivalent means, as determined by the requirements of the Corrosion Tests – Indoor Use, Section 26.

6.2 The requirement in 6.1 applies to all enclosures of sheet steel or cast iron, and to all springs and other parts upon which intended mechanical operation may depend.

Exception No. 1: This requirement does not apply to parts, such as washers, screws, bolts, and the like, if corrosion of such unprotected parts would not result in risk of electric shock or fire, or impair the operation of the product.

Exception No. 2: Parts made of stainless steel, polished or treated, if necessary, do not require additional protection against corrosion.

6.3 Bearing surfaces shall be of such materials and design as to resist binding due to corrosion.

6.4 Metals used in combination shall be galvanically compatible.

6.5 Enclosures of corrosion-resistant material may be used without special corrosion protection.

FIELD WIRING CONNECTIONS

7 General

7.1 Common requirements

7.1.1 Wiring terminals or leads shall be provided for connection of conductors of at least the size required by the National Electrical Code, NFPA 70.

7.1.2 A field wiring terminal shall comply with the requirements in:

- a) 7.1.4 – 7.1.8;
- b) The field wiring requirements for the Standard for Electrical Quick-Connect Terminals, UL 310;
- c) The Standard for Wire Connectors, UL 486A-486B;
- d) The Standard for Equipment Wiring Terminals for Use With Aluminum and/or Copper Conductors, UL 486E; or
- e) The field wiring requirements (Code 2) for the Standard for Terminal Blocks, UL 1059.

The current-carrying parts shall be silver, copper, a copper alloy, or a similar nonferrous conductive material. Securing screws and the like may be plated steel. Equipment provided with quick-connect terminals intended for field termination of electrical conductors to the equipment and complying with the requirements in the Standard for Electrical Quick-Connect Terminals, UL 310, shall be provided with strain relief, and the installation instructions shall include instructions for effecting the strain relief and include reference to the specific connectors to be used.

7.1.3 A field wiring terminal shall be prevented from turning or shifting in position. This may be accomplished by means such as two screws or rivets; by square shoulders or mortises; by a dowel pin, lug, or offset; or by a connecting strap or clip fitted into an adjacent part. Friction between surfaces shall not be used as a means for preventing movement of the terminals.

7.1.4 Field wiring terminals intended for connection of 10 AWG (5.3 mm²) and smaller wires may consist of terminal plates with wire binding screws.

7.1.5 A terminal plate tapped for a wire binding screw shall not have less than two full threads in the metal (the terminal plate metal may be extruded to provide the two full threads) and shall have upturned lugs, clamps, or the equivalent, to hold the wires in position. Other constructions may be used if they provide equivalent thread security of the wire binding screw.

Exception No. 1: Two full threads are not required if fewer threads will result in a secure connection in which the threads will not strip with tightening torque in accordance with the values indicated in the Standard for Wire Connectors, UL 486A-486B.

Exception No. 2: Other constructions may be used if they provide equivalent ruggedness of the terminal plate and thread security of the wire binding screw.

7.1.6 A wire binding screw shall not be smaller than No. 8 (4.2 mm diameter).

Exception: A No. 6 (3.5 mm diameter) screw may be used for the connection of one 14 AWG (2.1 mm²) or smaller conductor and a No. 4 (2.8 mm diameter) screw may be used for the connection of one 19 AWG (0.65 mm²) or smaller conductor.

7.1.7 A terminal plate tapped for a wire binding screw shall be of nonferrous metal not less than 0.050 inch (1.3 mm) thick if used with a No. 8 (4.2 mm diameter) or larger screw, and not less than 0.030 inch (0.76 mm) thick if used with No. 6 (3.5 mm diameter) or smaller screw.

7.1.8 If two or more conductors are intended to be connected by wrapping under the same screw, a nonferrous intervening metal washer shall be used for each additional conductor. If the wires protrude above terminal barriers, the nonferrous separator shall include means, such as upturned tabs or sides, to retain the wire.

Exception: A separator washer is not required if two conductors are separated and intended to be secured under a common clamping plate.

7.2 Terminals – qualified application

7.2.1 Any of the following terminal configurations may be used for connection of field wiring if the construction complies with all of the requirements in 7.2.2.

- a) Push-In Terminals – Nonferrous (screwless) push-in terminals of the type used on some switches and receptacles wherein solid conductors may be pushed into slots containing spring-type retaining contacts. The leads can be removed by means of a tool inserted to relieve the spring tension on the conductor. Push-in terminals shall not be used with aluminum conductors. The marking adjacent to the terminal shall indicate that only copper conductors are to be used.
- b) Quick-Connect Terminals – Nonferrous quick-connect (push-type) terminals consisting of male posts permanently secured to the device and provided with compatible female connectors for connection to field wiring. Requires special tool for crimping of field wires. Mating terminals shall be shipped with the product, with instructions for their installation.
- c) Solder Terminals – Conventional nonferrous solder terminals.
- d) Solderless Wrapped Terminals – Nonferrous terminals requiring a special tool and terminal post design.
- e) Telephone Type Terminals – Nonferrous terminal plates using a narrow V-shaped slot for securing of a conductor in a special post design, and requiring a special tool for wire connection.
- f) Other Terminals – Other terminal connections may be used if determined to be equivalent to those described in (a) – (e).

7.2.2 Any of the terminal configurations listed in 7.2.1 may be used for connection of field wiring if the construction complies with all of the following:

- a) If a special tool is required for connection, its use shall be indicated on the installation wiring diagram and the name of the manufacturer and the model number, or equivalent shall also be indicated, along with information as to where the tool may be obtained.
- b) The range of wire sizes shall be indicated in the installation wiring diagram. The minimum permissible wire size to be used shall not be smaller than 22 AWG (0.32 mm²).
- c) The wire size to be used shall have the current-carrying capacity of the circuit application.
- d) The terminal configuration shall comply with the requirements in the Special Terminal Assemblies Tests, Section 39.

Exception: Terminals complying with the requirements in any of the standards specified in 7.1.2 are not required to be subjected to the Special Terminal Assemblies Tests, Section 39.