UL 1283

STANDARD FOR SAFETY

Electromagnetic Interference Filters

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UL Standard for Safety for Electromagnetic Interference Filters, UL 1283

Seventh Edition, Dated May 17, 2017

SUMMARY OF TOPICS

This revision of ANSI/UL 1283 dated June 26, 2020 includes the replacement of reference to UL 508C with UL 61800-5-1; 7.1.4

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new requirements are substantially in accordance with Proposal(s) on this subject dated May 1, 2020.

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The most recent designation of ANSI/UL 1283 as an American National Standard (ANSI) occurred on June 3, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 1283 on August 2, 1989. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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 https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover electromagnetic interference (EMI) filters installed on, or connected to, 1,000 V or lower potential circuits, 50 – 60 Hz, or up to 1,500 Vdc, and installed in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements cover filters used to attenuate unwanted radio-frequency signals (such as noise or interference) generated from electromagnetic sources. These filters consist of capacitors and inductors used alone or in combination with each other and may be provided with resistors.

1.3 These requirements cover facility filters, cord-connected filters, and direct plug-in filters.

1.4 These requirements do not cover transient-voltage surge suppressors (that is, devices for repeated limiting of voltage surges on power circuits such as silicone avalanche diodes, metal oxide varistors, gas tubes, spark-gaps, etc). Transient Voltage Surge Suppressors are investigated under the Standard for Surge Protective Devices, UL 1449. These requirements also do not cover EMI filters for outdoor use. Appliance filters are covered under the Standard for Passive Filter Units for Electromagnetic Interference Suppression – Part 3: Passive Filter Units for Which Safety Tests are Appropriate, UL 60939-3.

1.5 These requirements do not cover direct plug-in products and cord-connected products provided with more than two receptacles. A direct plug-in product employing more than two receptacles and having an EMI filter is investigated under the requirements for current taps in the Standard for Attachment Plugs and Receptacles, UL 498. A cord-connected product employing more than two receptacles and having an EMI filter is investigated under the Standard for Relocatable Power Taps, UL 1363. The EMI filter part of these products would be investigated to determine compliance with the requirements in this standard in so far as they apply.

2 Components

2.1 Except as indicated in 2.2, 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.

2.2 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.

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

2.4 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.

3 Units of Measurement

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

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4 Undated References

4.1 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.

5 Glossary

5.1 CORD-CONNECTED FILTER – A filter provided with a supply cord having an attachment plug for connecting the filter to a branch-circuit receptacle. It is also provided with one or two receptacles for distribution of the filtered voltage to an external (other equipment) load.

5.2 DIRECT PLUG-IN FILTER – A filter provided with blades at the filter body that plug directly into a 15 A, 120 V branch-circuit receptacle. It is also provided with one or two receptacles for the distribution of the filtered voltage to an external (other equipment) load.

5.3 FACILITY FILTER – A filter intended for installation on the load side of the service equipment overcurrent device; including filters located at the branch panel.

5.4 FIELD-WIRING TERMINAL – Any terminal to which a supply conductor or other wire can be connected by an installer in the field. However, if a wire is provided as part of the filter and a pressure terminal, connector, soldering lug, crimped eyelet, or other means for making the field connection is factory assembled to the wire, the combination of the wire and the connecting means is not considered to be a field-wiring terminal.

5.5 OPPOSITE POLARITY – A difference in potential between two points, such that shorting of these two points would result in a condition involving an overload, rupturing of printed wiring-board tracks, components, or fuses, and similar results.

CONSTRUCTION

6 General

6.1 Only materials that are acceptable for the particular use shall be used in an EMI filter. Every filter shall be made and finished with the degree of uniformity and grade of workmanship that are practicable in a well-equipped factory.

7 Frame and Enclosure

7.1 General

7.1.1 The following conditions indicate the maximum acceptable size for any opening in the enclosure of a filter including a hole, louver, or an opening protected by means of wire screening, expanded metal, or a perforated cover:

a) A floor-mounted filter over 48-in (1.22-m) high and a table- or desk-mounted filter shall have no top openings having a maximum linear dimension (in any direction) greater than 3/16 in (4.8 mm). Any other type of filter shall have no top openings.

b) Bottom openings of perforated metal not larger than described in Table 7.1 are acceptable. Other patterns and hole sizes are acceptable if they comply with the ignition test described in Ignition Through Bottom Openings, Section 37.

c) Any opening in other than the bottom or top shall not permit the entrance of a rod greater than 25/32 in (20 mm) in diameter. See also Accessibility of Live Parts, Section 18.

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Table 7.1
Acceptable perforated-metal bottom plates

Nominal thickness in (mm)	Minimum thickness in (mm)	Maximum diameter of holes in (mm)	Minimum spacing of holes center to center in (mm)
0.030 (0.76)	0.026 (0.66)	0.045 (1.14)	0.067 (1.70) (233 holes per in^2 or 36 holes per cm^2)
0.030 (0.76)	0.026 (0.66)	3/64 or 0.047 (1.19)	3/32 or 0.094 (2.36)
0.035 (0.89)	0.032 (0.81)	0.075 (1.91)	1/8 or 0.125 (3.18) (72 holes per in^2 or 11 holes per cm^2)
0.040 (1.02)	0.036 (0.91)	1/16 or 0.063 (1.60)	7/64 or 0.109 (2.77)
0.040 (1.02)	0.036 (0.91)	5/64 or 0.078 (1.98)	1/8 or 0.125 (3.18)

7.1.2 If screening is used as part of the enclosure, the wires shall not be smaller than 16 AWG (1.29 mm nominal diameter) for screen openings 1/2 in^2 (323 mm^2) or less in area, and shall not be smaller than 12 AWG (2.05 mm nominal diameter) for larger screen openings. Sheet metal used for expanded-metal mesh and perforated sheet metal shall have a thickness of not less than 0.042 in (1.07 mm) for mesh openings or perforations 1/2 in^2 (323 mm^2) or less in area, and shall have a thickness of not less than 0.093 in (2.36 mm) for larger openings.

7.1.3 An opening into a wiring compartment shall be so located or so shielded that direct emission of molten metal, burning insulation, and the like from components other than wiring does not occur under fault conditions.

7.1.4 Insulated live parts or portions of insulated live parts which extend through a primary Type 12 enclosure, as defined in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E, shall be protected from dripping non-corrosive liquids and circulating dust by either of the following methods:

a) When protection from dripping non-corrosive liquids is provided by electrical insulation integral to the insulated live part, the insulation material shall meet the requirements for Flame Rating, RTI, HWI, HAI and CTI as described in the requirements for Insulating Material in the Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy, UL 61800-5-1, and additionally the requirements for Volume Resistivity and Dielectric Strength, both of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, following exposure to water in accordance with the requirements for Water Exposure and Immersion of UL 746C.

b) When protection from dripping liquids is provided by mechanical means such as a cavity, channel, hood, or guard, the construction shall inhibit contact with dripping liquids when the assembly including primary enclosure is subjected to the Drip Test in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E, with the enclosure mounted in all orientations allowed.

c) Protection from circulating dust shall be verified by either the Dust Test or the Atomized Water Test of UL 50E. At the conclusion of either the Dust Test or Atomized Water Test, no contaminants (cement particles or water droplets) are allowed to be in contact with uninsulated live parts. Water droplets or cement particles are allowed to contact insulating material. Verification of contaminant ingress is to be accomplished by disassembly and visual inspection immediately following the conclusion of the test.

Exception: At the conclusion of either the Dust or Atomized Water Test in (c), contaminants are allowed in contact with uninsulated live parts in Class 2 or limited voltage/current circuits, as

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described in UL 61800-5-1, that might be exposed in places such as the windings of a cooling fan supplied by a limited voltage/current source.

7.2 Metal enclosures

7.2.1 A metal enclosure of a filter shall have a minimum thickness in accordance with Table 7.2 except as provided for perforated bottom plates in Table 7.1.

7.2.2 A cover that must be removed for the connection of circuit conductors shall not be provided with any means, such as a knockout for conduit, for the connection of a wiring system.

Table 7.2
Minimum acceptable thicknesses of enclosure metal

Metal	At small, flat unreinforced surfaces and at surfaces of a shape or size to provide adequate mechanical strength		At surfaces to which a wiring system is to be connected in the field		At relatively larger unreinforced flat surfaces	
	in	(mm)	in	(mm)[a]	in	(mm)
Die-cast metal	3/64	(1.2)	–	–	5/64	(2.0)
Cast malleable iron	1/16	(1.6)	–	–	3/32	(2.4)
Other cast metal	3/32	(2.4)	–	–	1/8	(3.2)
Uncoated sheet steel	0.026	(0.66)	0.032	(0.81)	0.026	(0.66)
Galvanized sheet steel	0.029	(0.74)	0.034	(0.86)	0.029	(0.74)
Nonferrous sheet metal	0.036	(0.91)	0.045	(1.14)	0.036	(0.91)

[a] A sheet-steel wall of a thickness less than that specified is acceptable if the area surrounding the knockout has a thickness not less than 0.053 in (1.35 mm).

7.3 Nonmetallic enclosures

7.3.1 A nonmetallic enclosure is to be investigated under the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

7.3.2 The following are among the factors to be taken into consideration when using the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, to judge the acceptability of an enclosure or frame construction made of materials other than metal:

a) Mechanical strength, including crushing resistance for filters considered likely to be stepped on;

b) Resistance to impact;

c) Moisture-absorptive properties;

d) Combustibility;

e) Resistance to arcing;

f) Resistance to temperatures to which the material might be subjected under conditions of normal or abnormal use; and

g) Aging characteristics.

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Exception: Direct plug-in filters are to be tested for crushing and impact, (a) and (b), as indicated in Direct Plug-In Units – Mechanical Strength Tests, Section 34.

7.3.3 Direct plug-in filters are to be tested for blade secureness as indicated in Direct Plug-In Units – Mechanical Strength Tests, Section 34.

8 Corrosion Protection

8.1 Iron and steel parts shall be protected against corrosion by painting, enameling, galvanizing, plating, or other equivalent means if the malfunction of such unprotected parts is likely to result in a fire or electric shock.

Exception: If the oxidation of iron or steel from exposure of the metal to air and moisture is not likely to be appreciable – thickness of metal and temperature also being factors – surfaces of sheet-steel and cast-iron parts within an enclosure may not be required to be protected against corrosion. Bearings, laminations, or minor parts of iron or steel (such as washers, screws, and the like) need not comply with this requirement. Terminals passing through glass heads in a filter enclosure need not comply with this requirement.

9 Supply Connections

9.1 Facility filters

9.1.1 A facility filter shall have provision for the permanent connection of one of the wiring methods in the National Electrical Code, NFPA 70. See Grounding, Section 22, for grounding requirements.

9.1.2 A sheet-metal member to which a wiring system is to be connected in the field shall have a thickness as indicated in Table 7.2 for points of wiring system connections.

9.1.3 A terminal box or compartment in which field-wiring connections are intended to be made shall be so located that, after the filter is installed as intended, the field-wiring connections can be readily made and inspected without disturbing the wiring or the filter.

9.1.4 A terminal compartment intended for connection of a supply raceway shall be so attached to the filter that the compartment cannot turn.

9.1.5 A filter shall be provided with field-wiring terminals or leads for the connection of circuit conductors having an ampacity of not less than 125% of the current rating of the filter.

9.1.6 The free length of a lead inside a wiring compartment shall be 6 in (152 mm) or more if the lead is intended for field connection to an external circuit.

Exception: A lead may be less than 6 in (152 mm) in length if it is evident that the use of a longer lead might result in adverse effects.

9.1.7 A field-wiring terminal shall be prevented from turning by means other than friction alone. Lockwashers, properly applied, may be acceptable.

9.1.8 A field-wiring terminal shall be provided with a soldering lug or pressure terminal connector firmly bolted or held by a screw.

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Exception: A wire-binding screw may be employed at a wiring terminal intended to accommodate a 10 AWG (5.3 mm^2) or smaller conductor if upturned lugs, cupped washers, or the equivalent are provided to hold the wire in position.

9.1.9 Upturned lugs, cupped washers, and the equivalent shall be capable of retaining a supply conductor of the size indicated in 9.1.5 under the head of the screw or washer.

9.1.10 A wire-binding screw shall not be smaller in size than No. 10 (4.8 mm diameter).

9.1.11 A terminal plate for a field-wiring wire-binding screw shall be of metal not less than 0.050-in (1.27-mm) thick, except that a plate not less than 0.030-in (0.76-mm) thick is acceptable if tightening of the wire-binding screw does not strip the threads from the terminal plate or the screw. There shall be two or more full threads in the metal, which may be extruded if necessary to provide the threads.

9.1.12 A filter intended for connection to a supply circuit that includes a grounded circuit conductor shall have one terminal or lead that is identified for the connection of the grounded conductor of the supply circuit.

9.1.13 A field-wiring terminal intended for the connection of a grounded supply conductor shall be identified by means of a metal coating that is substantially white in color and shall be easily distinguishable from the other terminals, or proper identification of the terminal for the connection of the grounded conductor shall be clearly shown in some other manner, such as on an attached wiring diagram. If wire leads are provided instead of terminals, the identified lead shall have a white or gray color and shall be distinguishable from the other leads.

9.1.14 If a knockout or hole is provided for the field connection of a wiring system, the knockout or hole shall be surrounded by a flat surface. The surface shall have an area large enough to permit the assembly to the filter of a length of standard rigid steel conduit, of the largest size that the knockout or hole will accommodate, by means of a hexagon-shaped locknut.

9.1.15 The minimum diameter of the flat surface surrounding knockouts of the 1/2-, 3/4-, and 1-in trade sizes shall be 1-5/32, 1-29/64, and 1-13/16 in (29.4, 36.9, and 46.0 mm), respectively.

9.1.16 Knockouts shall be so secured in place that they can be removed readily without distortion of the enclosure and will remain in place during normal handling.

9.2 Cord-connected filters

9.2.1 A supply cord either shall be permanently attached to the filter, or shall be a detachable power-supply cord having a cord connector for connection to a mating male attachment plug inlet attached to the filter.

9.2.2 The flexible cord shall be Type SJO, SJT, SJTO, SO, ST, or STO.

9.2.3 A supply cord shall have a voltage rating not less than the rated voltage of the filter, and shall have an ampacity not less than the current rating of the filter.

9.2.4 The length of a supply cord measured from the outside surface of the enclosure of a filter to the plane of the face of the attachment plug shall not exceed 15 ft (4.6 m).

9.2.5 If the attachment plug is other than the nonpolarity type, one of the circuit conductors in the flexible cord shall be identified for connection of the grounded supply conductor if the filter is rated at 125 V or less or at 125/250 V or less (3 wires).

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9.2.6 An attachment plug shall have a current rating not less than the rated current of the filter, and a voltage rating consistent with the voltage rating of the filter.

9.3 Direct-plug-in type

9.3.1 The blade assembly shall comply with the applicable requirements for attachment plugs, and the blade configuration and any grounding pin shall be for use with 15 A, 125 V general-purpose nonlocking receptacles.

9.3.2 A product having integral blades for direct insertion into a receptacle shall comply with the specifications in Table 9.1.

Table 9.1
Specifications for plug-in products

Specification		
M	≤	28 oz (0.79 kg)
WY/Z	≤	48 oz (1.36 kg)
WY/S	≤	48 oz (1.36 kg)
WX	≤	80 oz-in (0.57 N·m)
Z_3	≤	3-1/4 in (82.6 mm)
S_1, S_2, Z_1, and Z_2	≤	5 in (127 mm), each
In which:		
M is the mass in oz (kg)		
W is the weight in oz (kg)		
Y and Z_3 are the distances, in inches (mm), illustrated in Figure 9.1		
Z is the shorter distance, in inches (mm), of Z_1 or Z_2		
S is the shorter distance, in inches (mm), of S_1 or S_2 illustrated in Figure 9.1		
X is the longer distance, in inches (mm), of X_1 or X_2 illustrated in Figure 9.1		

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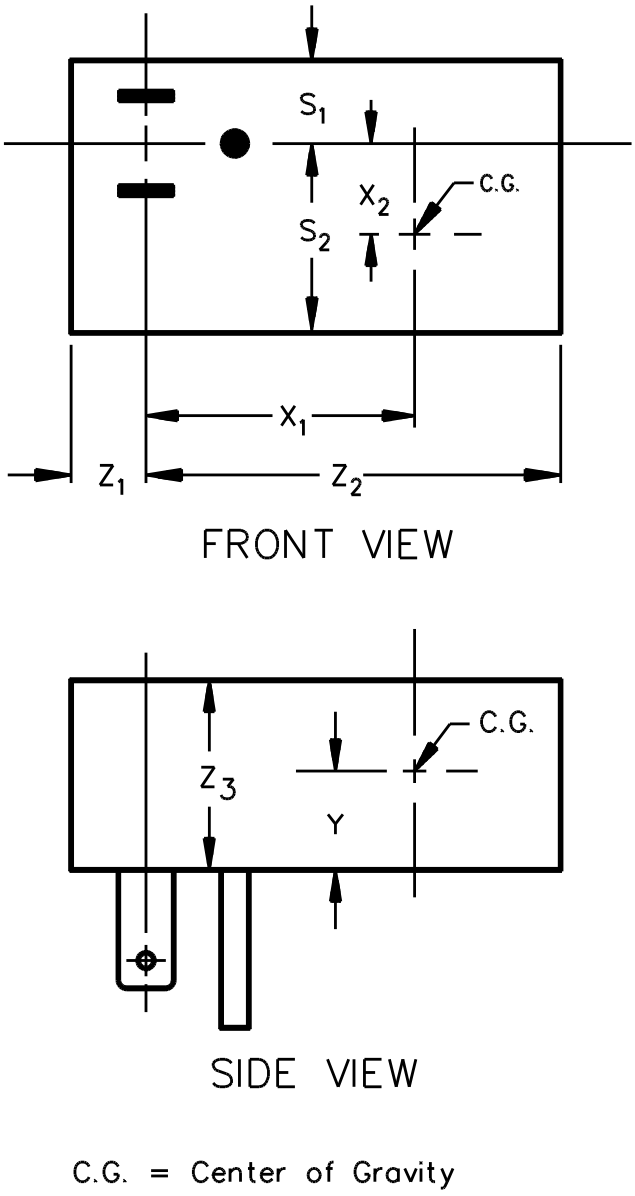
Figure 9.1

Dimensions of a plug-in product



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9.3.3 When inserted in a parallel-blade duplex receptacle, no part of a product shall interfere with full insertion of an attachment plug in the adjacent receptacle.

Exception: A product need not comply with this requirement if it renders the adjacent receptacle completely unusable.

9.3.4 The unit shall not be provided with a mounting tab.

9.3.5 The enclosure of a unit shall be capable of being gripped for removal from the receptacle to which it is connected, and the perimeter of the face section from which the blades project shall not be less than 5/16 in (7.9 mm) from any point on either blade.

10 Power Supply Cord Bushings

10.1 At each point where a supply cord passes through an opening in a metal or other wall, barrier, or enclosing case, a smooth, well-rounded surface against which the cord can bear shall be provided to protect the cord against damage. An insulating bushing shall be provided if a Type SPT-2 or SPT-3 cord is employed and the opening is in metal.

10.2 Ceramic materials and some molded compositions are generally acceptable for insulating bushings, but bushings of wood or hot-molded shellac and tar compositions are not acceptable.

10.3 Vulcanized fiber may be employed if the bushing is not less than 3/64-in (1.2-mm) thick and is so formed and secured in place that it cannot be affected adversely by conditions of ordinary moisture.

11 Strain Relief

11.1 Strain relief shall be provided so that a mechanical stress on a supply cord is not transmitted to terminals, splices, or interior wiring.

11.2 The strain relief means shall comply with the strain-relief requirements in Strain Relief, Section 33.

11.3 Means shall be provided so that the supply cord cannot be pushed into the filter through the cord-entry hole if such displacement is likely to subject the cord to mechanical damage or expose it to a temperature higher than that for which the cord is rated or if such displacement is likely to reduce spacings (such as to a metal strain-relief clamp) below the minimum acceptable values.

11.4 A knot shall not be employed to provide strain relief.

11.5 A metal strain-relief clamp or band without auxiliary protection is acceptable with a Type SVO, SJO, SJT, SJTO, SO, ST, STO or equivalent cord. A metal strain-relief clamp or band is acceptable with a Type SVT, SVTO, SPT-2, SPT-3 or equivalent cord only if acceptable auxiliary mechanical protection that is not electrically conductive is provided over the cord.

12 Receptacles

12.1 A receptacle provided as part of a filter shall have a marked current rating, see 43.8, not more than the current rating of the filter and a voltage rating consistent with the voltage rating of the filter.

12.2 A receptacle shall be of the grounding type if, and only if, the filter is provided with a grounding-type attachment plug inlet or other means for grounding. See Grounding, Section 22.

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