

# TEST REPORT

On Behalf of

Product Name: INTELLIGENT PULSE REPAIR

Trademark: N/A

Model Number: XJB1210-2

Prepared For: Tianchang Jinjie Electronics Co., Ltd

Address: Union village Qinlan Town Tianchang City Anhui Province

Prepared By: Shenzhen Huaxiang Testing Co., Ltd

Address: 1st Floor, Building A1, No. 2082 Jincheng Road, Shajing Street, Bao'an District,  
Shenzhen City, Guangdong Province, China

Report No.: HUAX250428085KR

<b>TEST REPORT</b> <b>UL 1310</b> <b>STANDARD FOR SAFETY</b> <b>Class 2 Power Units</b>	
<b>Report Number.....:</b>	HUAX250428085KR
<b>Date of issue.....:</b>	Apr. 28, 2025
<b>Applicant's name.....:</b>	Tianchang Jinjie Electronics Co., Ltd
<b>Address.....:</b>	Union village Qinlan Town Tianchang City Anhui Province
<b>Test specification:</b>	
Standard.....:	UL 1310:2018+REV.2:2022
Test procedure.....:	UL test report
Non-standard test method.....:	N/A
<b>Test Report Form No.....:</b>	UL1310_1A
Test Report Form(s) Originator.....:	HUAK
Master TRF.....:	Dated 2020-06-26
<b>General disclaimer:</b>	
The test results presented in this report relate only to the object tested.	
Test Item description .....	INTELLIGENT PULSE REPAIR
Trade Mark .....	N/A
Manufacturer.....:	Tianchang Jinjie Electronics Co., Ltd
Manufacturer Address.....:	Union village Qinlan Town Tianchang City Anhui Province
Model/Type reference.....:	XJB1210-2
Ratings.....:	Input Voltage:AC110-240V, 50-60Hz Output Voltage:12V-15.5V Output Current:DC 10A(4-180Ah)

### Testing procedure and testing location

Laboratory name..... : Shenzhen Huaxiang Testing Co., Ltd

Testing location/address: : 1st Floor, Building A1, No. 2082 Jincheng Road, Shajing Street, Bao'an District, Shenzhen City, Guangdong Province, China

Testing procedure : TL ☒ RMT ☐ SMT ☐ WMT ☐ TMP ☐

Prepared by  
(Engineer)

Kevin Su

*Kevin Su*

Reviewed By  
(Supervisor)

: Amy Jiang

*Amy Jiang*

**List of Attachments (including a total number of pages in each attachment):**

-Appendix 1: Photo attachments. (6 pages)

**Summary of testing:**
**Tests performed (name of test and test clause):**

All clauses.

**Testing location:**

1st Floor, Building A1, No. 2082 Jincheng Road, Shajing Street, Bao'an District, Shenzhen City, Guangdong Province, China

**Summary of compliance with National Differences:**

N/A

☒ The product fulfils the requirements of UL 1310:2018+REV.2:2022.



**Copy of marking plate:**

The artwork below may be only a draft.

**INTELLIGENT PULSE REPAIR**

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Rating: Input Voltage:AC110-240V, 50-60Hz

Output Voltage:12V-15.5V

Output Current:DC 10A(4-180Ah)



Tianchang Jinjie Electronics Co., Ltd

Union village Qinlan Town Tianchang City Anhui Province

Made in China YYMM

<b>POSSIBLE TEST CASE VERDICTS:</b>	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement..... :	F (Fail)
- Date of receipt of test item..... :	Apr. 24, 2025
-Date (s) of performance of tests..... :	Apr. 24, 2025 to Apr. 28, 2025
<b>GENERAL REMARKS:</b>	
<p>"(See Enclosure #)" refers to additional information appended to the report.  "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p> <p>Determination of the test result includes consideration of measurement uncertainty from the test equipment and methods.</p>	
<b>Manufacturer's Declaration per sub-clause 4.2.5 of IEC60068-2-1:</b>	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided..... :	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
<b>When differences exist; they shall be identified in the General product information section.</b>	
<b>Name and address of factory (ies)..... :</b>	Same as Manufacturer
<b>GENERAL PRODUCT INFORMATION:</b>	
Product Description – The products are INTELLIGENT PULSE REPAIR, electronic components mounted on PCB, external enclosure is plastic material.	

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
3	Components		P
3.1	Except as indicated in 3.2, 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 used in the products covered by this standard.		P
3.2	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.		P
3.3	A component shall be used in accordance with its rating established for the intended conditions of use.		P
3.4	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.		P
4	Units of Measurement		P
4.1	Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.		N/A
5	Undated References		P
5.1	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.		P
6	Terminology		P
6.1	The term "power unit" as used in these requirements refers to all power supplies, battery chargers, and transformers covered by these requirements.		P
7	Mechanical Assembly		P
7.1	A unit shall be formed and assembled so that it has the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without producing or increasing a risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacing, loosening or displacement of parts, or other serious defects. See also 46.1.1.		P
7.2	A unit shall have all parts reliably secured in place		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
7.3	An enclosure, an opening, a frame, a guard, a knob, a handle, or the like shall not be sufficiently sharp to cause a risk of injury in normal maintenance or use.		P
7.4	A unit shall be constructed so that it is not necessary to open or remove the enclosure when the unit is used as intended.		P
7.5	Each lampholder, switch, and similar component shall be mounted securely and shall be prevented from turning by more than friction between surfaces. For example, the use of a lock washer is acceptable to prevent the turning of a device having a single hole mounting means.		N/A
7.6	A replaceable lamp in a unit shall be wired in the secondary circuit, and shall be replaceable without opening the enclosure. There shall be no primary live part accessible to contact during lamp replacement.		N/A
7.7	A non-replaceable pilot lamp, such as an indicating-type overload- or short-circuit protector, a neon light, or an indicator light, is one in which the lamp is sealed-in, such as by a non-removable jewel.		N/A
7.8	A switch in the primary circuit or an over current protective device shall be located within the unit enclosure in such a manner as not to be accessible or exposed to tampering nor subject to damage during normal use. This requirement does not apply to the actuating means of a switch, except as noted in 7.10.		P
7.9	If the exterior part of the switch or control forms part of a unit enclosure, the part shall be subjected to the Abuse Tests, Section 46.		N/A
7.10	The requirements in 7.8 also apply to the actuating means – toggle, handle, or the like – if the dislodging of such part exposes live parts or film-coated magnet wire that can be contacted as specified in Accessibility of Live Parts, Section 16.		P
7.11	The maximum acceptable moment, center of gravity, dimensions, and weight of a direct plug-in unit shall comply with the following requirements (See 7.12)		P
7.12	The moment and weight specified in 7.11 are to be determined as follows:		P
7.13	When inserted in a duplex receptacle, no part of a direct plug-in unit, including an integral tab or output wiring, shall interfere with full insertion of an attachment plug into the adjacent receptacle. See Figure 7.2 and Figure 7.3.		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
7.14	A portable cord-connected unit intended for wall mounting shall employ key hole slots or the equivalent as a mounting means.		N/A
7.15	A mounting tab shall not be provided with a direct plug-in unit unless all of the following conditions are met:		P
7.16	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 0.20 inch (5.1 mm) from any point on either blade. In order to determine compliance with this requirement for units with rounded edges, the perimeter of the face section is considered to be the point at which the articulate probe is able to access as shown in Figure 7.5.		P
7.17	With reference to 7.16, for an extension from the face for mechanical support of the blades provided as shown in Figure 7.4, the point of measurement shall be determined by application of the articulate probe, Figure 16.2, as shown in Figure 7.5.		P
8	<b>Enclosure</b>		P
8.1	A unit shall be provided with an enclosure that shall house all current-carrying parts that pose a risk of electric shock. The enclosure shall have the strength and properties necessary to reduce the risk of mechanical damage to the various parts.	V-0 used	P
8.2	A unit shall have no openings larger than those complying with 16.2.1.		P
8.3	If an acceptable grade of vulcanized fiber is used as part of the enclosure for the support of secondary parts (terminals and the like) that do not present a risk of fire or electric shock, the amount of fiber shall not be more than is necessary to support the secondary parts in question. The fiber shall not be less than 1/32 inch (0.8 mm) thick and shall not introduce a risk of fire, electric shock, or injury to persons as a result of abuse. See 46.1.1.		N/A
8.4	An enclosure constructed of sheet metal shall be formed from stock having a thickness not less than that specified in Table 8.1. The thickness of enclosure sheet metal other than steel or aluminum shall not be less than that specified in Table 8.1 for uncoated steel and shall have the necessary strength and rigidity.		N/A
8.5	In addition to the performance tests specified in this Standard, the factors to be considered when evaluating a polymeric enclosure are:		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
8.6	A conductive coating applied to a nonmetallic surface such as the inside surface of a cover, enclosure, and the like shall comply with the appropriate requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, unless it can be determined that flaking or peeling of the coating does not result in a reduction of spacings or the bridging of live parts that may result in a risk of fire, electric shock, or injury to persons.		P
8.7	An adhesive used in the assembly of the enclosure shall be investigated as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C		P
9	Protection Against Corrosion		N/A
9.1	Except as noted in 9.2, iron and steel parts shall be protected against corrosion by galvanizing, plating, enameling, or other equivalent means if the corrosion of such unprotected parts results in a risk of fire, electric shock, or injury to persons.		N/A
9.2	The requirement in 9.1 applies to all enclosing cases or to other parts upon which intended mechanical operation may depend. It does not apply to laminations and small minor parts of iron or steel, such as washers, screws, and bolts, that are not current carrying, if the corrosion of such unprotected parts would not result in a risk of fire, electric shock, or injury to persons, or result in the device not operating as intended.		N/A
10	Switches	No such part	N/A
10.1	The requirements in this Section apply to switches not in a Class 2 circuit, and to switches in a Class 2 circuit the breakdown of which electrically or mechanically is likely to introduce a risk of fire or electric shock.		N/A
10.2	A switch subjected to a temperature higher than 50°C (122°F) shall be evaluated with respect to the temperature limits of the materials used.		N/A
10.3	A switch shall be located and positioned so that it is not subject to mechanical damage during normal use or as a result of abuse. See 46.1.1.		N/A
10.4	Other than as indicated in 10.7 and 10.8, a switch or other control device shall be acceptable for the application and shall have current and voltage ratings not less than those of the load that it controls.		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
10.5	5 A primary circuit switch shall be connected to an ungrounded circuit conductor.		N/A
10.6	A primary circuit switch shall have a current rating not less than twice the normal current draw under normal load conditions, or the switch shall be investigated for the application in accordance with the Overload and Endurance Tests on Switches and Controls, Section 36.		N/A
10.7	A switch or other control device connected in the output circuit may be used if the device complies with the Normal Temperature Test and the Overload Test on Secondary Switches. See 33.1 and 37.1.		N/A
10.8	A switch or other controller not having an acceptable rating and located on a direct plug-in unit where it cannot be operated unless the unit is withdrawn from a receptacle may be used if it complies with the Operation Test, Section 38.		N/A
11	Protective Devices		P
11.1	A protective device built into a unit shall comply with the requirements for that component.		P
11.2	The protective device may be located in either the primary or secondary circuit		P
11.3	Crossed or nicked (reduced) cross-section conductors shall not be employed as a protective device.		N/A
11.4	Protective devices mentioned in 11.1 include, but are not limited to, eutectic material, fuses, Over temperature and over current protectors, thermal protectors, and similar devices intended to interrupt or limit the follow of current as a result of overload.		N/A
11.5	A thermostat, thermal cutoff, Positive Temperature Coefficient (PTC) resistor, or Negative Temperature Coefficient (NTC) resistor incorporated in a unit shall not cause a risk of fire or electric shock due to improper application.		N/A
11.6	A manually reset thermostat shall be constructed so that automatic tripping of the thermostat is not prevented by any setting or position of the reset mechanism.		N/A
11.7	An automatically or manually reset protective device or a replaceable over current-protective device shall not open when the unit is delivering its rated output. See the Normal Temperature Test, Section 33.		N/A



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Clause	Requirement + Test	Result - Remark	Verdict
11.8	A primary circuit over current protective device of the single-pole type, other than an automatic control without a marked "off" position, shall be connected to an ungrounded circuit conductor. See Exception No. 5 to 14.2.1.		P
11.9	When a single fuse is located in the primary circuit, it shall be connected to an ungrounded circuit conductor.		P
11.10	When both circuit conductors of a product intended for connection to a nominal 120 volt branch circuit are fused, the fuse in the grounded circuit conductor shall be rated not less than the fuse in the ungrounded circuit conductor. See 52.8.		N/A
11.11	A unit investigated for compliance with the energy limitations of 30.3.1 shall be provided with protection, such as a fuse or PTC, complying with the Calibration of Over current Protection Devices Test, Section 31.		P
11.12	A protective device that is provided to comply with 11.11 shall not be of the automatic reclosing type, and shall not have automatic tripping prevented by any setting or position of the reset mechanism. When an accessible control of a manual reset protective device is held in the o or reset position, and the protective device is automatically tripped, the contact shall not automatically return to the closed position.		P
11.13	An over current protective device shall be located inside the unit enclosure. The device shall be inaccessible to tampering.		P
11.14	A fuse provided in the secondary circuit of a not inherently limiting Class 2 power unit shall be rated in accordance with Table 30.2.		N/A
12	Components		P
12.1	A component – a fixed resistor, Positive Temperature coefficient (PTC) or Negative Temperature Coefficient (NTC) resistor, diode, or the like – employed to limit (see 2.8) the output of a unit to within the required current or power levels, or otherwise used to obtain acceptable performance, shall have permanence and stability which does not decrease its limiting capacities. Among the factors considered when evaluating a limiting component are		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
12.2	There shall be no components connected between primary and output circuits which result in a conductive connection (see 2.4). If capacitive coupling is provided between primary and output circuits, it shall consist of either:		P
13.0	Coil Insulation		P
13.1	General		P
13.1.1	A coil shall be provided with insulation between the coil and any dead metal part, and between each adjacent pair of windings.		P
13.2	Insulation for transformers		P
13.2.1	The insulation between un-insulated, primary wires of opposite polarity shall be one of the following:		P
13.2.2	Insulation between the primary and secondary windings shall be one of the following (for additional requirements, see 13.2.3 and 13.2.4):		P
13.2.3	Tape used as insulation in lieu of spacings for a flanged bobbin wound transformer shall provide a continuous 1/32 inch (0.8 mm) minimum wide bent up edge against the bobbin flanges.		P
13.2.4	A flanged, bobbin-wound transformer shall be subjected to the output loading test described in 39.2. The test shall be continued for 15 days if the transformer has:		P
13.2.5	Insulation between the primary winding and the core shall be one of the following:		N/A
13.2.6	Insulation between the primary winding lead connections and a metallic enclosure shall be one of the following		N/A
13.2.7	Insulation in accordance with 13.2.8 shall be provided between a crossover lead and		P
13.2.8	To comply with 13.2.7, insulation shall be one of the following		P
13.2.9	With reference to Exception No. 1 to 13.2.8, the magnet coil of a molded bobbin transformer having a slot for the crossover or start lead un-spliced at the windings – is acceptable as crossover lead insulation if		N/A
13.2.10	Insulation between the primary-lead connections and the adjacent winding, and between secondary-lead connections and the primary winding shall be one of the following		N/A
14	Input Connections		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
14.1	Direct plug-in units		P
14.1.1	The integral blade assembly of direct plug-in units shall comply with the construction requirements in the Standard for Wiring Device Configurations, UL 1681. See 7.16 and 7.17.		P
14.1.2	If a direct plug-in unit employs a manually operated line connected single-pole switch or a fuse with an accessible contact, it shall employ a polarized- or grounding-type blade assembly.		P
14.1.3	If a direct plug-in unit employs folding or retractable blades for the input connectors, it shall comply with the requirements specified in Section 44, Direct Plug-in Security of Input Contacts Test.		P
14.1.4	If a multiple voltage rated power unit is intended for use by travelers, the power unit shall comply with (a) – (e)		N/A
14.2	Cord-connected units		N/A
14.2.1	A portable or stationary unit shall be provided with a flexible cord in accordance with Table 14.1 and an attachment plug for connection to the branch circuit. The blade assembly for connection to the branch circuit shall be of the polarized- or grounding-type. The length of cord external to the unit and including the attachment plug shall not be less than 6 feet (1.8 m) as measured from the face of the attachment plug to the point of attachment or entry.		N/A
14.2.2	If a unit with a permanently attached power supply cord can be adapted for use on two or more different voltages by field alteration of internal connections, the attachment plug provided with the unit shall be of a type required for the voltage and current for which the unit is connected when shipped from the factory.		N/A
14.2.3	If a multiple voltage rated power unit is intended for use with a detachable power supply cord, the cord shall be provided with the unit if either of the following apply		N/A
14.2.4	If a multiple voltage rated power unit is provided with a permanently attached power supply cord, and it is intended for use by travelers, the power unit shall comply with (a) – (e)		N/A
14.3	DC input units		N/A
14.3.1	Units with a dc input shall be provided with a vehicle battery adapter in compliance with the Standard for Vehicle Battery Adapters, UL 2089		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
14.3.2	A fuse provided with a dc input jack shall not be relied upon to provide the over current protection specified in the Output Current and Power Test, Section 30.		N/A
15	Output Connections		P
15.1	General		P
15.1.1	A unit shall be provided with an output cord, terminals, insulated leads, or output connectors. A battery charger with backfield protection shall be provided with an output cord terminating in a connector, or a connector attached to or integral with the enclosure. See 15.4.3		P
15.2	Output wiring		P
15.2.1	The output wiring shall be stranded conductors having insulation not less than 0.013 inch (0.33 mm) thick, and permanently attached to the output circuit. The wiring shall extend at least 6 feet (1.8 m) outside the unit, and shall comply with the requirements in 18.1 and 18.2.		P
15.2.2	For a cord-connected power unit with a minimum 6-foot (1.8-m) power-supply cord, the output flexible cord required by 15.1.1, whether permanently attached to the power unit or provided in the form of a separate cord set, shall be of any desirable length. The maximum combined length of the input and output cords shall not exceed 20 feet (6.1 m).		P
15.2.3	With respect to 15.2.1, for units with jacketed multi conductor output wiring, the individual conductor insulation may be less than 0.013 inch (0.33 mm) provided that the following conditions are met:		N/A
15.2.4	A fitting having female contacts shall be constructed so that it does not receive the blades of a standard attachment plug. A fitting having male contacts shall be constructed so that the contacts do not touch a live part of a standard attachment-plug receptacle.		N/A
15.3	Output terminals		N/A
15.3.1	A terminal plate tapped for a wire-binding screw or stud shall be of brass or other nonferrous metal, or plated steel, not less than 0.030 inch (0.76 mm) thick, and shall provide not less than two full threads in the metal for the binding screw.		N/A



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
15.3.2	A wire-binding screw or terminal stud shall not be smaller than No. 6 (3.5 mm diameter) and shall not have more than 32 threads per inch (25.4 mm). The screw or stud shall be of brass or other nonferrous metal, or plated iron or steel.		N/A
15.3.3	Terminal studs shall be prevented from turning by means other than friction between mounting surfaces. The acceptability of a lock washer or similar means to prevent turning shall be determined by the test described in 45.1 and 45.2.		N/A
15.3.4	A multi-output unit employing output terminals the output of which exceeds the current limit specified in 30.2 with outputs interconnected shall be marked in accordance with 52.12.		N/A
15.4	Output connectors		N/A
15.4.1	A unit with multiple outputs where interconnection exceeds Class 2 levels as defined in this standard shall be provided with a polarized connector.		N/A
15.4.2	Output connectors mounted on the enclosure and intended for direct connection of accessories, such as separable battery holders and the like, shall provide a secure connection between mating parts. The connections shall be polarized if the output is direct-current or if multiple outputs are provided.		N/A
15.4.3	A battery charger shall be provided with a means to inhibit backfeed of current during a fault in the output circuit, including faults in the output wiring, which results in a risk of fire or electric shock. The means of prevention shall protect each output and shall consist of any of the following		N/A
15.4.4	Deleted effective May 3, 2007		N/A
15.4.5	Connectors normally used with coaxial cable shall not be used for output connections.		N/A
15.5	Bushings		P
15.5.1	At a point where a flexible cord passes or is intended to pass through an opening in a metal wall, barrier, or enclosing case, there shall be a bushing or the equivalent that shall:		P
15.5.2	If the cord hole is in a non-conducting material, a smooth, rounded surface is considered to be the equivalent of a bushing		P
16	Accessibility of Live Parts		P
16.1	General		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
16.1.1	A live part that poses a risk of electric shock shall be located or enclosed so that the risk of contact is reduced.		P
16.1.2	The input impedance of the voltmeter used to measure voltage in accordance with the requirements of 16.2.1 and 16.3.1 is to be a minimum of one megohm. The input impedance of a meter with more than one megohm input impedance can be lowered by using shunt impedance.		P
16.1.3	A guard, baffle, or cover that can be removed without using a tool is to be removed when determining if a live part is accessible to the user. A live part that can be contacted by the test pin, articulate probe, or accessibility probe illustrated in Figure 16.1, Figure 16.2, or Figure 16.4 is considered to be accessible.		P
16.2	Live parts other than exposed wiring terminals		P
16.2.1	The test pin and articulate probe illustrated in Figures 16.1 and 16.2, respectively, when applied as indicated in 16.2.2, shall not contact:		P
16.2.3	The test pin and articulate probe referenced in 16.2.1 are to be applied with a force not exceeding 1 pound (4.4 N) to determine whether the live parts are accessible. The test pin shall not be applied to fuseholders and the like.		P
16.3	Exposed wiring terminals		P
16.3.1	The accessibility probe illustrated in Figure 16.4, when applied as indicated in 16.3.3, shall not contact an exposed wiring terminal with a voltage greater than that specified in 16.3.2 with respect to ground or to any other terminal simultaneously accessible to the probe.		P
16.3.2	The maximum voltages which may be accessible in accordance with 16.3.1 are:		P
16.3.3	The accessibility probe referenced in 16.3.1 is to be applied with a force not exceeding 5.62 pounds (25 N) to determine whether the exposed wiring terminals are accessible. Prior to applying the probe, wire binding screws are to secure the largest wire in accordance with Table 45.1.		P
17	Live Parts		P
17.1	A current-carrying part shall be silver, copper, a copper alloy, plated iron or steel, stainless steel, or other corrosion-resistant alloys acceptable for the application.		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
17.2	An un-insulated live part shall be secured to the base or mounting surface so that it does not turn or shift in position if such motion results in a reduction of spacings below the minimum acceptable values.		N/A
17.3	Friction between surfaces is not acceptable as a means to prevent shifting or turning of a live part but a lock washer is acceptable.		P
18	Strain Relief		P
18.1	Strain relief shall be provided for the supply cord and output wiring, and shall be tested in accordance with the Strain Relief Test, Section 41.		P
18.2	Means shall be provided to prevent the cord or wiring from being pushed into the enclosure through the cord-entry hole when such displacement results in:		P
19	Internal Wiring		P
19.1	The internal wiring of a unit shall consist of insulated conductors having mechanical strength, dielectric properties, and impurity for the application. See 19.6.		P
19.2	Each splice and connection shall be mechanically secure, shall provide reliable electrical contact, and shall be provided with insulation at least equivalent to that of the wire involved unless acceptable permanent spacing between the splice and all other metal parts will be maintained. When determining the required minimum thickness of splice insulation, the circuit voltage and interaction with other circuits shall be taken into consideration.		P
19.3	A wire connector for making a splice in a unit shall be a type that is applied by a tool in which the application force of the tool making the splice is independent of the force applied by the operator of the tool.		P
19.4	The connection between a lead, including a flexible cord, and the transformer winding or other part of the unit shall be soldered, welded, or otherwise securely connected within the enclosure. A soldered joint shall be mechanically secure before soldering.		P
19.5	If a lead is rigidly held in place without the use of solder, or if it is retained in place so as not to be subjected to any motion, no additional mechanical security is required. Mechanical sacrament of a lead is not required if separation of the connection does not result in a risk of fire or electric shock.		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
19.6	The motor or generator shall comply with the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1 except as noted in Table 5.1		N/A
19.7	An insulated conductor shall be located or protected to reduce the risk of contact with any sharp edge, burr, fin, moving part, or the like, that can damage the conductor insulation.		P
20.0	Separation of Circuits		P
20.1	Unless provided with insulation rated for the highest voltage involved, insulated conductors of different circuits – internal wiring – shall be separated by barriers or shall be segregated and shall, in any case, be separated or segregated from un-insulated live parts connected to different circuits		P
20.2	Segregation of insulated conductors may be accomplished by clamping, routing, or equivalent means that provides permanent separation from an insulated or un-insulated live part of a different circuit.		P
20.3	A barrier used to separate or segregate internal wiring shall have mechanical strength and be held in place to provide permanent separation, and it shall be acceptable for the temperatures involved.		P
20.4	A barrier intended to separate or segregate low-voltage field wiring from line-voltage parts shall be of material of sufficient thickness to serve its intended purpose. It shall be supported so that its deformation cannot be readily accomplished to defeat its purpose.		P
21	Insulating Materials		P
21.1	Integral parts such as insulating washers and bushings, and bases or supports for mounting of live parts, shall be of moisture-resistant materials that are not damaged by the temperatures and stresses to which they are subjected under conditions of actual use.		P
21.2	An insulating material is to be evaluated for the application in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. Consideration is to be given to such factors as its mechanical strength, resistance to ignition sources, dielectric strength, insulation resistance, and heat-resistant properties in both the aged and unaged conditions, the degree to which it is enclosed, and any other features affecting the risk of fire and electric shock.		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
22	Printed Wiring Boards		P
22.1	A printed wiring board in a unit shall comply with the Standard for Printed Wiring Boards, UL 796, and shall be classed V-1 or less flammable, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94		P
22.2	A resistor, capacitor, inductor, or other part that is mounted on a printed circuit board to form a printed circuit assembly shall be secured so that it cannot be displaced to cause a risk of fire or electric shock by a force likely to be exerted on it during assembly or normal operation as determined during the Abuse Tests, Section 46		P
22.3	A printed wiring board as indicated in Exception No. 1 to 24.1		N/A
23	Grounding	No Grounding	N/A
23.1	General		N/A
23.1.1	Provision shall be made for grounding of all dead metal parts that are exposed or that are likely to be touched by a person during intended operation or adjustment of the unit, and that are likely to become energized through electric fault.		N/A
23.1.2	For a direct plug-in unit intended for semi permanent installation, a metal mounting tab may serve as the grounding member.		N/A
23.1.3	A grounding means, if employed, shall be conductively connected to accessible metal parts. For units not having accessible dead metal parts, the grounding means shall be connected		N/A
23.1.4	With reference to 23.1.3(c), for units having the grounding means connected to a bonding wire in the output cord, the bonding wire shall comply with 23.2.6		N/A
23.1.5	To determine whether a part is likely to become energized, such factors as construction, the proximity of wiring, a dielectric voltage withstand test after the overload and endurance tests, a burnout test, and similar considerations are to be evaluated		N/A
23.2	Bonding conductor		N/A
23.2.1	Bonding shall be accomplished by a metal-to-metal contact of parts or by a separate bonding conductor as specified in 23.2.6		N/A
23.2.2	A bonding conductor shall be copper, copper alloy, or another acceptable material.		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
23.2.3	Ferrous metal in the grounding path shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means.		N/A
23.2.4	A separate bonding conductor: a) Shall be protected from mechanical damage or located within the outer enclosure; and b) Shall not be secured by a removable fastener used for a purpose in addition to bonding, unless the bonding conductor is not likely to be omitted if the fastener is removed and replaced as intended.		N/A
24	Spacing		P
24.1	Spacing between live parts of opposite polarity, between live and dead metal parts, and between live parts and a metal enclosure, shall be as specified in Table 24.1 or Table 24.2, as appropriate. If a live part is not rigidly secured in position by a means other than friction between surfaces, or if a movable dead metal part is in proximity to an un-insulated live part, the construction shall be such that at least the minimum spacing will be maintained.		P
24.2	For the purpose of determining working voltage in units employing nonlinear circuitry:		P
24.3	All un-insulated live parts connected to different circuits, including all secondary circuits, shall be spaced from one another as though they were parts of opposite polarity and shall be evaluated on the basis of the highest voltage involved.		P
24.4	At other than field-wiring terminals, spacing in a Class 2 secondary circuit from the transformer secondary winding on or beyond the energy-limiting component, as may be appropriate, are not specified between live parts of opposite polarity and between a live part and a dead metal part.		N/A
24.5	As an alternative to the spacing requirements of Table 24.1 or Table 24.2, as appropriate, the spacing requirements in the Standard for Insulation Coordination Including Clearances and Creepage Distances For Electrical Equipment, UL 840, may be used. The spacing requirements of UL 840 shall not be used for output wiring terminals and spacings to a dead metal enclosure.		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
24.6	It is anticipated that the level of pollution expected will be pollution degree 2. Hermetically sealed or encapsulated enclosures, or coated printed wiring boards in compliance with the Printed Wiring Board Coating Performance Test specified in the Standard for Insulation Coordination Including Clearances and Creepage Distances For Electrical Equipment, UL 840, are considered pollution degree 1.		N/A
24.7	It is anticipated the equipment will be rated overvoltage category II and overvoltage category I as defined in the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840.		N/A
24.8	In order to apply Clearance B (controlled overvoltage) clearances, control of overvoltage shall be achieved by providing an overvoltage device or system as an integral part of the product.		N/A
24.9	All printed wiring boards are considered to have a minimum comparative tracking index (CTI) of 100 without further investigation.		N/A
24.10	An insulating barrier or liner used to provide spacing shall be of material acceptable for the application and shall not be less than 0.028 inch (0.71 mm) thick.		N/A
25	PERFORMANCE		P
25.1	The number of representative samples indicated in Table 25.1 shall be subjected to the tests described in Sections 26 – 47. Unless otherwise specified, all tests are to be conducted at the applicable voltage specified in Table 25.2. A power unit marked with an operating voltage range shall comply with the requirements while connected to a source of voltage adjusted to that value within the specified range which results in the most severe operating condition.		P
26	Leakage Current Test		P
26.1	The leakage current of a unit, tested in accordance with 26.3 – 26.7, shall not be more than:		P
26.2	Leakage current refers to all currents, including capacitive coupled currents, that may be conveyed between exposed surfaces and ground or other exposed surfaces of a unit.		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
26.3	All exposed surfaces, including output terminals, are to be tested for leakage currents. The leakage currents from these surfaces are to be measured to the grounded supply conductor individually as well as collectively where simultaneously accessible, and from one surface to another where simultaneously accessible, except not from one output terminal to another. Parts are considered to be exposed surfaces unless guarded by an enclosure that complies with the requirements for Enclosures, Section 8		P
26.4	If a surface other than metal is used for the enclosure or part of the enclosure, the leakage current is to be measured using a metal foil with an area of 10 by 20 centimeters (3.94 by 7.88 inches) in contact with the surface. Where the surface is less than 10 by 20 centimeters, the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to affect the temperature of the unit.		P
26.5	The measurement circuit for leakage current is to be as illustrated in Figure 26.1. The meter actually used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument. The meter used need not have all the attributes of the defined instrument. The measurement instrument is to be		P
26.6	Unless the meter is being used to measure leakage from one part of the unit to another, the meter is to be connected between the accessible parts and the grounded supply conductor.		P
27	Leakage Current Test and Dielectric Voltage Withstand Test After Humidity Exposure		P
27.1	A unit shall comply with the Leakage Current Test, Section 26, and Dielectric Voltage Withstand Test, Section 34, following exposure for 48 hours to air having a relative humidity of 88 ± 2 percent at a temperature of 32 ± 2°C (89.6 ± 3.6°F)		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
27.2	To determine whether a unit complies with the requirement in 27.1, a sample of the unit at a temperature just above 34°C (93.2°F) is to be conditioned for 48 hours in a humidity chamber maintained as specified in 27.1. Following the conditioning, the sample is to be tested un-energized as described in 26.7(a), and then energized and tested as described in 26.7(b) and 26.7(c). The test is to be discontinued when the leakage current stabilizes or decreases. The sample is then to be subjected to the Dielectric Voltage Withstand Test, Section 34.		P
28	Maximum Output Voltage Test		P
28.1	The maximum output voltage under any load condition (including no load) between any two output terminations of a unit shall not be more than the peak voltages specified in 16.2.2 when the primary is connected to the supply circuit. The Exception to 16.2.2 does not apply to this requirement. See 28.3.		P
28.2	If a unit has more than one pair of output terminations, the output voltage mentioned in 28.1 is to be measured with any combination of interconnections of the output terminations		P
28.3	The maximum voltage between output terminations of a multiple output unit may exceed the values specified in 28.1 when the output terminations are interconnected		P
29	Maximum Input Test		P
29.1	The primary input of a unit shall not be more than 660 watts when the unit is connected to the supply circuit with any condition of secondary load, including the short-circuiting of any combination of outputs.		P
29.2	To determine compliance with 29.1, one sample of the unit is to be connected to the load specified in Table 25.3, and the loads are to be adjusted to cause maximum input to the sample. The supply circuit is then to be de-energized and the sample is to be allowed to cool to room temperature. The supply circuit is then to be energized a second time and the input power measured within 15 seconds after application of voltage to the primary windings.		P
30	Output Current and Power Test		P
30.1	General		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
30.1.1	The maximum output current and output volt-amperes specified in 30.2 and 30.3 are to be determined using a current meter and a watt meter. A resistive load is to be adjusted to result in maximum reading of the meters. With no further adjustment of the load, the sample is to be de-energized and cooled to room temperature. The sample is then to be energized and maximum current and wattage measurements are to be taken at the time specified in 30.2		P
30.2	Inherently limited		P
30.2.1	Under any condition of resistive loading – including short-circuit and interconnection of outputs when not prohibited by marking – the maximum output current shall not exceed the value specified in Table 30.1 and the maximum output volt-amperes shall not be more than 100 volt-amperes, except as indicated in 30.2.3 and 30.3.1, for the following conditions,		P
30.2.2	If the value of current and power cannot be obtained due to operation of a protective device, damage to the transformer, or the like		P
30.2.3	The current between output terminations of a multi-output unit is not required to comply with 30.2.1 when output terminations are interconnected if the following conditions are met:		P
30.3	Not inherently limited		P
30.3.1	When the unit includes means to automatically de-energize the output circuit (see 11.11), the values of the output current and volt-amperes specified in 30.2.1 shall not exceed those specified in Table 30.2.		P
30.3.2	To determine if a unit complies with the requirement in 30.3.1, the unit is to be allowed to deliver the test current to a resistance load, with the primary connected to a source of supply. The unit is to be draped with a double layer of cheesecloth conforming to the device outline. Charring, glowing, or flaming of the cheesecloth is unacceptable		P
31	Calibration of Over current Protection Devices Test		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
31.1	A protective device provided as a part of a not inherently limited unit shall operate in not more than the time indicated in Table 31.1 when the unit is delivering the specified secondary current. There shall be no emission of flame or molten metal from the enclosure, and no evidence of a risk of fire or electric shock as described in 39.1.2. The unit shall withstand the dielectric voltage withstand test as specified in 34.1.1(a), applied between the primary winding and secondary windings, and between the primary and exposed dead metal parts.		P
31.2	During the test, the grounding means is to be connected to ground through a 3-ampere Non time-delay fuse and the unit is to be draped with a double layer of cheesecloth conforming to the outline of the unit.		P
32	Full-Load Output Current Test		P
32.1	A unit shall deliver its rated full-load secondary current continuously		P
32.2	To determine compliance with the requirement in 32.1, one sample is to be tested as follows. With a variable load as specified in Table 25.3 and an ammeter connected to the output, the primary is to be connected to the supply circuit. The load is to be adjusted to draw rated output current. After 15 minutes of operation, the resistance is to be readjusted, if necessary, to return the current to that value. The test is then to be continued for 1 hour without further adjustment. At the end of 1 hour, the output current shall not be less than 90 percent of the rated load current. An over temperature- or over current-protective device shall not function during this test		P
32.3	If a unit has its output rated in volt-amperes or watts, the rated output current is to be determined by dividing the rated output voltage into the rated output volt-amperes or watts.		P
33	Normal Temperature Test		P
33.1	The temperature rises on various materials and parts shall not exceed the limits specified in Table 33.1 when the unit is operated as specified in 33.2 – 33.5. Upon completion of this test, the unit shall comply with the Dielectric Voltage Withstand Test, Section 34		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
33.2	For a direct plug-in unit, this test is to be conducted in both the horizontal and vertical positions. For a cord-connected unit, this test is to be conducted in all likely mounting positions. A sample is to be operated with the primary energized from a circuit as specified in 25.3 and 25.4. Each output is to be loaded as specified in 25.8. A battery charger which is likely to be used for consecutive charging of batteries is to be tested as specified in 33.5 and 33.6		P
33.3	If the load mentioned in 33.2 and specified in 25.8 includes a variable resistance, the load is to be adjusted after 15 minutes of operation, if necessary, to return the output to the original value. If the load consists of a battery, the battery shall be discharged as specified in 25.10, 25.11, or 25.12, as applicable.		P
33.4	If a battery charger which is not likely to be used for consecutive charging of batteries is tested with a battery load, the test is to be continued until temperatures peak. The load is to be replaced by a second discharged battery. The test is terminated when temperatures peak during the second load condition		P
33.5	A battery charger which is likely to be used for consecutive charging of batteries is to be tested with the intended battery load. The test is to be conducted in accordance with 33.6.		P
33.6	With respect to 33.5, a charger is to be tested in accordance		P
33.7	With reference to footnote c to Table 33.1, the thermal conductivity of a material can be obtained by comparison with materials that have known thermal conductivities. Samples of materials with known values of the constant and a sample of the material for which the value is unknown are to be fixed to a heated metal plate. All samples are to be of the size used in the unit. The temperatures of the faces of the reference samples opposite the heated metal plate are to be plotted as a function of the constant. The constant of the material for which the value is unknown is derived from the curve by reading off the value corresponding to the temperature attained by the sample under investigation		P
33.8	All values in Table 33.1 are based on an assumed ambient temperature of 25°C (77°F), but a test may be conducted at any ambient temperature within the range specified in 25.7		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
33.9	A temperature is considered to be constant when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 15 minutes, indicate no further increase		P
33.10	Except when it is specifically stated that the temperature determinations are to be made by the resistance method, temperatures are to be measured by means of thermocouples. The junction of the thermocouple is to be secured in intimate contact with the point of the surface at which the temperature is to be measured.		P
33.11	Thermocouples are to consist of wires not larger than 24 AWG (0.21 mm <sup>2</sup> ) and not smaller than 30 AWG (0.05 mm <sup>2</sup> ). When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of 30 AWG iron and constantan wire and a potentiometer-type instrument; and such equipment is to be used whenever referee temperature measurements by thermocouples are necessary. The thermocouples and related instruments are to be accurate and calibrated in accordance with accepted laboratory practice. The thermocouple wire is to comply with the requirements listed in the Initial Calibration Tolerances for Thermocouples table in Temperature Measurement Thermocouples, ANSI/ISA MC96.1.		P
33.12	Coil and winding temperatures are to be measured by thermocouples located on exposed surfaces, except the resistance method is to be used for a coil that is inaccessible for mounting of these devices such as a coil:		P
33.13	The temperature rise of a copper winding is determined by the resistance method by comparing the resistance of the winding at a temperature to be determined with the resistance at a known temperature according to the formula		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
33.14	Because it is generally necessary to de-energize the winding before measuring R, the value of R at shutdown may be determined by taking several resistance measurements at short intervals, beginning as quickly as possible after the instant of shutdown. A curve of the resistance values against time may be plotted and extrapolated to give the value of R at shutdown. Instrumentation by which R can be measured while the coil is energized may be used.		P
33.15	For manufacturers who choose to declare an operating ambient above 25°C, the following formulas can be used to determine compliance when testing in a normal room temperature environment:		P
34	Dielectric Voltage Withstand Test		P
34.1	General		P
34.1.1	One minute after the applicable test, the unit shall withstand for 1 minute without breakdown the application of a potential. The test potential shall be:		P
34.1.2	To determine if a unit complies with the requirements in 34.1.1, it is to be tested by means of a transformer of 500-volt-ampere capacity or larger, having an output voltage that is essentially sinusoidal or continuous direct current, as applicable, and can be varied. The applied potential is to be increased from zero until the required test level is reached, and is to be held at that level for 1 minute. The increase in applied potential is to be at a substantially uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter		P
34.2	Induced potential		N/A
34.2.1	One sample of a transformer as described in Exception No. 1 to 13.2.8 and 13.2.9 is to be subjected to this test. While in a heated condition from operation as described in Normal Temperature, Section 33, the primary winding shall withstand without breakdown an alternating potential of twice the rated voltage of the winding.		N/A
34.2.2	The test voltage is to be started at one-quarter or less of the full value and increased to full value in not more than 15 seconds. After being held for the time specified, the voltage is to be reduced within 5 seconds to one-quarter or less of the maximum value and the circuit is to be opened.		N/A



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
34.2.3	With reference to 34.2.1, a transformer may be conditioned in an oven to obtain the temperature reached in the Normal Temperature Test, Section 33, before conducting the induced potential test.		N/A
35	Endurance Test on Over current- and Over temperature-Protective Devices		P
35.1	One sample of a unit employing a manually reset over current- or over temperature-protective device shall be operated under the condition of maximum obtainable output current, including short circuit, and the protector shall be cycled for 50 operations as quickly as the protector can be reset. During this test the grounding means, if provided, is to be connected to ground through a 3-ampere non time delay fuse. A risk of fire or electric shock as described in 39.1.2 shall not result and the temperature rise at any point on the enclosure shall not exceed 65°C (117°F). The protector device shall be operational upon completion of the test.		P
35.2	One sample of a unit employing an automatically reset protective device or a protector that stays open as long as the overload is connected is to be connected and operated under the conditions described in 35.1 for 15 days but not less than 2000 cycles. A risk of fire or electric shock – see 39.1.2 – shall not result and the temperature rise at any point on the enclosure shall not exceed 65°C (117°F). Temperatures are to be measured at the end of the test. The protective device shall be operational upon completion of the test.		P
35.3	The test described in 35.2 shall be conducted for 24 hours for units incorporating thermostats, the acceptability of which has been determined by the requirements in the Standard for Temperature-Indicating and -Regulating Equipment, UL 873		P
35.4	Following the endurance test, the unit is to be subjected to a repeat dielectric voltage withstand test as described in Section 34		P
36	Overload and Endurance Tests on Switches and Controls		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
36.1	A switch or other control that has not been shown to be acceptable for the purpose in accordance with 10.6 shall perform acceptably when subjected to an overload test consisting of 50 cycles of operation making and breaking the applicable load, and to an endurance test consisting of 6000 cycles of operation at rated load. There shall be no electrical or mechanical breakdown of the device, undue burning or pitting of the contacts as a result of the overload or endurance test, or opening of the fuse in the grounding connection		N/A
36.2	For the test specified in 36.1, the output of the unit is to be connected to its intended load based on its input and output ratings and to a supply having a frequency specified in 25.4. For the overload test, the supply voltage is to be increased to 110 percent of the maximum test voltage specified in 25.1. For the endurance test, the test voltage specified in 25.1 is to be used. During these tests, exposed dead metal parts of the unit are to be connected to ground through a 3-ampere nontime-delay fuse. The device is to be operated at a rate of not more than 10 cycles per minute, except that a faster rate of operation may be employed if agreeable to those concerned		N/A
37	Overload Test on Secondary Switches		N/A
37.1	If tests are required in accordance with 10.7, a switch or other control device shall be tested as described in 37.2. The performance is unacceptable		N/A
37.2	To determine if a secondary circuit switch or other control device is capable of performing acceptably in the overload test mentioned in 10.7, the unit is to be connected to a circuit supplying the maximum test voltage as specified in 25.1 and the rated frequency in accordance with 25.4. The switch is to be caused to make and break 150 percent of the rated secondary load current or maximum obtainable, whichever is less. During the test, exposed dead-metal parts of the unit are to be connected to the polarity opposite to the switching device through a 3-ampere fuse. The device is to be operated for 50 cycles at a rate of not more than 10 cycles per minute, except that a faster rate of operation may be employed if agreeable to those concerned.		N/A
38	Operation Test		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
38.1	A switch or other controller required to be tested in accordance with 10.8 is to be subjected to 1000 operations through all positions. The operations are to be with no electrical load. There shall be no mechanical breakdown of the switching mechanism or loosening of parts.		P
38.2	After the 1000 operations, the switch shall be capable of making and breaking the circuit for 50 cycles of operation as indicated in the Overload and Endurance Tests on Switches and Controls, Section 36. For a voltage selector switch, the test voltage is to be based on the highest rated voltage.		P
39	Abnormal Tests		P
39.1	General		P
39.1.1	A unit shall not emit flame or molten metal or become a risk of fire or electric shock when subjected to the following tests: output loading, reverse polarity, switch position, component breakdown, and when required, the printed wiring board abnormal operation test. Each abnormal test shall be followed by a dielectric voltage withstand test as required by 34.1.1(a).		P
39.1.2	A risk of fire or electric shock is considered to exist if any of the following occur		P
39.1.3	Each test is to be conducted on a separate sample unless the manufacturer requests that more than one test be conducted on the same sample		P
39.1.4	During each test, the grounding means, if provided, is to be connected to ground through a 3-ampere non time-delay fuse.		P
39.1.5	A polarity-protection circuit provided to reduce the likelihood of output-current flow until a battery is connected as intended to the output is to be made inoperative so that the required output current will flow.		P
39.1.6	During all abnormal tests, the unit is to be draped with a double layer of cheesecloth conforming to the outline of the unit.		P
39.1.7	The temperature rises specified are based on an assumed ambient temperature of 25°C (77°F), but a test may be conducted at any ambient temperature of 21 – 30°C (70 – 86°F). However, if the operation of an automatic thermal control during the test limits the temperatures under observation, no temperature higher than 25°C (77°F) plus the specified maximum rise is acceptable.		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
39.2	Output loading		P
39.2.1	One sample of a unit shall be tested under the short circuit output condition. If this does not result in the most severe output loading, the unit shall be tested under the most severe condition, which may be maximum obtainable output current, or either of the conditions described in 39.2.3 and 39.2.4. A fuse or circuit breaker provided as part of the unit is to remain in the circuit, and a user replaceable fuse is to be replaced by the largest fuse the fuseholder will accept. The test is to be continued until the internal protection opens, constant temperatures are attained, or the transformer winding opens. For a transformer as described in 13.2.4, if an automatically reset protector is provided, or if constant temperatures are attained, the test is to be continued for 15 days. For all other units, if an automatically reset protector is provided, or constant temperatures are attained, the test is to be continued for 7 hours. A manually reset protector is to be operated for 10 cycles. The protector contacts are to be operative upon completion of the test.		P
39.2.2	During the short-circuit condition on a direct plug-in unit, the temperature rise on the enclosure shall not exceed 65°C		P
39.2.3	In regard to 39.2.1, for some designs it may be necessary to conduct the test at conditions of maximum power transfer and no secondary load to determine the most severe operating condition.		P
39.2.4	For units with more than one output, one output is to be loaded as specified in 39.2.1 while the other outputs are open circuited or loaded to rated conditions in accordance with Table 25.2, whichever results in a more severe operating condition.		P
39.2.5	If short circuiting causes operation of an automatically or manually reset protective device, compliance is also to be determined using the maximum load value that allows continuous operation		P
39.2.6	If short circuiting causes opening of a fuse, the unit is to be tested with a load current that causes the maximum current to flow in the fused circuit for 7 hours without opening the fuse.		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
39.2.7	When conducting this test, at least two load conditions are to be used; one load condition where IFC (n=c) results in 7 hours of operation, and one load condition where IFC (n=c+1) results in opening of the fuse prior to 7 hours of operation. Prior to each test, the sample is to be at room temperature. See 39.2.6.		P
39.2.8	If short circuiting causes opening of a thermal cutoff or a single-operation bimetallic device, the device is to be shunted and a thermocouple attached to its body. The load current is to be raised slowly until a temperature equal to the rated trip temperature of the device plus 5°C (9°F) is reached. Without further readjustment of the load, the unit is to be operated for the remainder of the 7 hour period.		P
39.2.9	If short circuiting causes opening of a winding, tests are to be conducted with the secondary winding loaded to a current (IL) equal to the rated current (IR) plus X percent of the difference between the short-circuit current (ISC) and the rated current (IR). In the tests, the values of X are to be 75, 50, 25, 20, 15, 10, and 5, in that order. If a load current results in 7 hours of continuous operation, further tests need not be conducted. For the tests, a variable resistance load is to be adjusted to the required value as quickly as possible and readjusted, if necessary, 1 minute after application of the source of supply		P
39.2.10	For a unit employing regulating circuitry where short circuiting the output results in 7 hours of continuous operation, tests are to be conducted with the output loaded to deliver maximum output power for 7 hours without shut-down of the unit.		P
39.3	Transformer burnout		P
39.3.1	A unit having components in the output circuit shall not emit flame or molten metal or result in a risk of fire or electric shock as described in 39.1.2 while first operating as described in the temperature test, followed by operation under the loading conditions described in 39.3.3 for linear designs, 39.3.4 for switch mode designs. Each test is to be followed by a dielectric voltage withstand test described in 34.1.1(a) with the potential applied between primary and secondary windings. During this test the grounding means, if provided, is to be connected directly to ground. The unit is to be operated continuously:		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
	If a transformer has more than one secondary winding or a tapped secondary winding, separate tests are to be conducted for each winding, or each section of a tapped winding, with the other windings loaded or unloaded as may occur in service unless it can be determined that one condition will produce the most unfavorable results.		P
39.3.2	For linear designs, a resistive load that will draw three times the normal input alternating current or maximum obtainable output current, whichever is less, is to be connected directly to the transformer secondary winding with the unit connected to the maximum test voltage.		P
39.3.3	For switch mode designs, a resistive load is to be connected at a point in the secondary circuit where energy limiting circuitry (see 2.8) is not affected. The load is to be adjusted to result in three times the normal input current to the transformer or maximum obtainable output current, whichever is less.		P
39.4	Reverse polarity		P
39.4.1	For a device intended for charging batteries and provided with non polarized output connections, the external output leads are to be connected in reverse polarity to a fully charged battery intended for the application. The unit is then to be connected to its maximum test voltage, and operated until the ultimate condition is observed, or 4 hours if cycling of an automatically reset protector occurs		P
39.5	Switch position		P
39.6	Component breakdown		P
39.7	Printed wiring board abnormal operation test		P
39.7.1	To comply with Exception No. 1 to 24.1, a printed wiring board is to be tested as described in 39.7.2 – 39.7.5		P
39.7.2	During this test, if a printed wiring board trace opens, the gap is to be electrically shorted and the test continued until ultimate results occur. This applies to each occurrence. If the circuit is interrupted by the opening of a component other than described in 39.7.3, the test is to be repeated two more times using new components as necessary		P
39.7.3	Operation of an over current protective device other than the branch circuit over current protective device is acceptable.		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
39.7.4	A sample of the unit employing the printed wiring board is to be connected to its nominal rated supply circuit as specified in Section 25, General. A foil trace is to be short-circuited to each of its adjacent traces that do not have the spacing specified in Table 24.1 or 24.2 one at a time		P
39.7.5	The test is to be continued for 1 hour or until one of the conditions described in 39.1.2 occurs. However, if at the end of 1 hour no condition described in 39.1.2 occurs, but indications are that such a condition may eventually occur, the test is to be continued until ultimate results are obtained (usually 7 hours)		P
39.8	Backfeed protection		P
39.8.1	The output connector of a battery charger provided with backfeed protection in accordance with 15.4.3 (b) or (c) shall be subjected to the test described in 39.8.2. As a result of the test, the backfeed current shall not exceed 8.0 amperes at five seconds, and there shall be no emission of flame or molten material from the enclosure or output cord		P
39.8.2	In accordance with 39.8.1, the output connector is to be connected to a source as specified in (a) or (b). A resistive load up to and including short circuit is to be connected as close as practicable across the output connector such that the maximum obtainable backfeed current is passed through the output connector. The current is to be measured at five seconds. The test is to be continued until ultimate results are obtained.		P
39.8.3	A battery charger provided with backfeed protection in accordance with 15.4.3(d) shall be subjected to simulated component faults, one at a time, of open or short circuit which may result in backfeed of current into the secondary circuit (refer to 39.8.4). During the test the output connector shall be connected to a source as specified in 39.8.2 (a) or (b), and the test is to be continued until ultimate results are obtained. One minute after the test the unit shall be subjected to the dielectric voltage withstand test of 34.1.1 (a), (b) and (c). As a result of the test, there shall be no emission of flame or molten material from the enclosure or output cord, and no indication of dielectric breakdown.		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
39.8.4	In accordance with 39.8.3, faults shall be simulated for components such as diodes, transistors, capacitors, and the like unless the components have permanence and reliability (see 12.1). If an overcurrent protector, such as a fuse or PTC, operates to limit the backfeed current, the protector shall comply with requirements applicable to the component.		P
40	Tests on Insulating Materials		P
40.1	If required by 13.2.1(b), 13.2.2(c), 13.2.5(c), 13.2.6(c), 13.2.10(b), insulating material shall be subjected to the test described in 40.2.		P
40.2	The insulating material is to be placed between two opposing electrodes. The electrodes are to be cylindrical brass or stainless steel rods 1/4 inch (6.4 mm) in diameter, with edges rounded to a 1/32-inch (0.8 mm) radius. The upper moveable electrode is to weigh 50.2 grams to exert sufficient pressure on the specimen to provide good electrical contact. The test potential is to be increased to the test value and the maximum test potential is to be maintained for 1 second. The result is acceptable if there is no dielectric breakdown		P
40.3	With reference to the Exception to 40.1, insulation may be of a generic material type specified in Table 40.1 where the layer(s) of each generic material is of a minimum thickness such that all layers collectively are greater than or equal to the minimum thickness required		P
41	Strain Relief Test		P
41.1	With internal connections disconnected, the strain relief means provided for a supply cord, or a multi-conductor output cord where the interconnection of outputs exceeds Class 2 shall withstand the force described in 41.3 applied to the cord for 1 minute without displacement or breakage of the cord or deformation of its anchoring surface		P
41.2	The output wiring of a unit other than one having a multi-conductor cord as specified in 41.1 shall withstand the force described in 41.4 applied for 1 minute. The results are considered acceptable if, with the output wiring connected internally, movement of the cord does not result		P
41.3	A 35 lbf (156 N) force is to be suspended from the cord and supported by the unit so that the strain relief means is stressed from the most severe angle that the construction of the unit permits.		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
41.4	For units employing a flexible output cord, or a multi-conductor cord where the interconnection of outputs does not exceed Class 2, a 20 pounds-force (89 N) is to be applied to the cord and supported by the unit so that the strain relief means is stressed from the most severe angle that the construction of the unit permits. For units employing output wiring consisting of separate leads, a 10 pounds-force (44 N) is to be applied to each lead.		P
42	Push-Back Relief Test		N/A
42.1	To determine compliance with 18.2, a product shall be tested in accordance with 42.2 without occurrence of any of the conditions specified in or 18.2 (a) – (d)		N/A
42.2	The supply cord or lead is to be held 1 inch (25.4 mm) from the point where the cord or lead emerges from the product and is then to be pushed back into the product. When a removable bushing which extends further than 1 inch is present, it is to be removed prior to the test. When the bushing is an integral part of the cord, the test is to be carried out by holding the bushing. The cord or lead is to be pushed back into the product in 1-inch (25.4-mm) increments until the cord buckles or the force to push the cord into the product exceed 6 pounds-force (26.7 N). The supply cord or lead within the product is to be manipulated to determine compliance with 18.2.		N/A
43	Direct Plug-In Blade Secureness Test		P
43.1	Each blade and the grounding pin, if provided, shall withstand a direct pull of 20 pounds-force (89 N) for 2 minutes without loosening. The two blades tested together shall also withstand a direct pull of 20 pounds for 2 minutes without loosening		P
43.2	To determine whether a unit complies with the requirement in 43.1, it is to be supported on a horizontal steel plate with the blades projecting downward through a hole having a diameter sufficient only to permit the blades to pass through it. A 20-pound (9.1-kg) weight is to be supported by each blade and the grounding pin, if provided, in succession and then by the two blades tested together. In a unit of nonrigid construction – for example, a unit of soft molded material – the displacement of either blade shall not exceed 3/32 inch (2.4 mm) measured 2 minutes after removal of the weight.		P
44	Direct Plug-In Security of Input Contacts Test		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
44.1	General		P
44.1.1	The plug-in blades and the grounding pin shall not loosen to a degree that introduces a risk of fire or electric shock as a result of the tests described in 44.1.2 and 44.1.3.		P
44.2	Folding and retractable blade units		P
44.2.1	In addition to the requirements of 44.1, units employing folding or retractable blades for the input contacts shall be subjected to the testing indicated in 44.2.2 – 44.2.4		P
44.2.2	The folding or retractable blades of the unit shall withstand 6000 cycles of rotating the blades from the plug-in position to the fully recessed position. For the purpose of this test, the blade is considered to be in the plug-in position when the actuator is extended, and the blades are in the "out" position and locked in place, as in normal use. The fully retracted position is considered to be when the actuator is retracted and the blades are returned to the "in" position		P
45	Security of Output Connectors Test		P
45.1	For a unit provided with wire-binding terminals as output connectors, a terminal or terminal stud shall not turn or cause stress on internal connections when subjected to the test of 45.2.		P
46	Abuse Tests		P
46.1	General		P
46.1.1	The enclosure of a unit shall withstand the applicable mechanical abuse tests described in 46.2 – 46.5 without: a) Making live parts which pose a risk of electric shock accessible to the probe illustrated in Figure 16.2; or b) Producing any other condition that results in a risk of electric shock.		P
46.1.2	The probe illustrated in Figure 16.2 applied as specified in 16.2.3 is to be used to determine whether a live part is accessible.		P
46.2	Impact on direct plug-in units		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
46.2.1	Three samples are to be subjected to this test. Each unit is to be dropped (free fall) three times in succession from a height of 3 feet (914 mm) onto a hardwood surface as described in 46.2.2. Each of the drops is to result in the impact occurring at a point on the unit different from the impact points on the other drops. The blades shall not be subjected to a direct impact		P
46.3	Impact on cord connected units		P
46.3.1	Each of three samples is to be subjected to a single impact of 5 foot-pounds (6.78 N·m) on any surface that is exposed to a blow during intended use. This impact is to be produced by dropping a steel sphere, 2 inches (51 mm) in diameter and weighing approximately 1.18 pounds (535 g), from a height of 51 inches (1.30 m). The steel sphere is to strike the surface in a location different from those in the other two impacts. For surfaces other than the top of an enclosure, the steel sphere is to be suspended by a cord and allowed to swing as a pendulum dropping through a vertical distance of 51 inches (1.30 m).		P
46.4	Rod pressure on direct plug-in units		P
46.1	Any point on the product that is accessible to the rod described in 46.4.2 shall be subjected to a force of 20 pounds-force (89 N) for 1 minute.		P
46.2	The force specified in 46.4.1 is to be increased from 0 to 20 pounds-force (0 to 89 N) over a period of 5 seconds applied through the axis of a 1/2 inch (12.7 mm) diameter metal rod, having a flat contact end with the edge rounded to a radius of 1/32 inch (0.8 mm) to eliminate sharp edges. The force is then to be maintained at 20 pounds for 1 minute. The axis of the rod is to be perpendicular to the surface under test. During the test, the unit is to rest on a flat surface in any convenient position, and is to be energized. Shock current between the enclosure and earth, and between any parts of the enclosure between which such currents may exist, are to be monitored. The instrumentation used is to be that described in 26.5.		P
46.5	Resistance to crushing on direct plug-in units		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
46.5.1	One sample of the unit shall withstand for 1 minute a steady crushing force of 75 pounds-force (334 N) applied at right angles to the mounting surfaces. The enclosure is to be tested between two parallel, flat, hardwood blocks, each not less than 1/2 inch (12.7 mm) thick. One block is to contain slots into which the blades of the device are to be fully inserted. The crushing force is to be applied gradually in a direction normal to the mounting surface.		P
47	Bonding Conductor Test		P
47.1	With respect to 23.2.6, a bonding conductor that is smaller than any internal conductor supplying the part to be bonded is acceptable if, using a separate sample for each test, neither the bonding conductor nor the connection opens when		P
47.2	The test circuit described in 47.1(b) is to have a power factor of 0.9 – 1.0 and a closed-circuit-test voltage as specified in 25.1. The open-circuit voltage is to be 100 – 105 percent of the closed-circuit voltage.		P
48	Dielectric Voltage Withstand Test		P
48.1	Each unit shall withstand without electrical breakdown, as a routine production line test, the application of a potential at a frequency within the range of 40 to 70 hertz:		P
48.2	The applied potential for the test shall be either: a) 1000 volts for 60 seconds; or b) 1200 volts for 1 second.		P
48.3	The unit may be in a heated or unheated condition for the test.		P
48.4	The test is to be conducted when the unit is complete and fully assembled. It is not intended that the unit be unwired, modified, or disassembled for the test.		P
48.5	If a unit employs a solid-state component that may be damaged by the dielectric potential, the test may be conducted before the component is electrically connected provided that a random sampling of each day's production is tested at the potential specified in 48.2. The circuitry may be rearranged for the purpose of the test to reduce the likelihood of solid state component damage while retaining representative dielectric stress of the circuit.		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
48.6	The test equipment shall include a transformer having an essentially sinusoidal output, a means of indicating the test potential, an audible or visual indicator of electrical breakdown, and either a manually reset device to restore the equipment after electrical breakdown or an automatic reject feature of any Un acceptable unit.		P
48.7	If the output of the test-equipment transformer is less than 500 volt-amperes, the equipment shall include a voltmeter in the output circuit to directly indicate the test potential.		P
49	Grounding Continuity Test		N/A
49.1	Each unit that has a grounding pin connected to a dead metal part as described in 23.1.1 shall be tested, as a routine production-line test, to determine that electrical continuity exists between the grounding pin and accessible dead metal parts of the units that are likely to become energized		N/A
49.2	Only a single test need be conducted if the accessible metal selected is conductively connected by design to all other accessible metal		N/A
50	RATING		P
50.1	The electrical ratings of a unit shall include: primary or input voltage or input voltage range; primary or input frequency expressed in hertz, Hz, cycles-per-second, cps, cycles/second, or c/s; output in amperes, volt-amperes, or watts for each output; and output voltage for each output in alternating or direct current.		P
50.2	If a unit is marked with an input amperes, volt-amperes, or watts rating, the rating shall be at least 90 percent of the value which occurs under rated load conditions.		P
50.3	The output rating of each output shall not exceed 30 volts rms or 60 volts dc		P
50.4	The sum of the volt-ampere ratings of all outputs shall not be more than 100 volt-amperes.		P
51	MARKING		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
51.1	A unit shall be legibly and permanently marked, where readily visible, with: a) The manufacturer's name, trade name, or trademark; b) The date or other dating period of manufacture not exceeding any three consecutive months; c) A distinctive catalog or model number, or the equivalent; and d) The electrical rating.		P
51.2	If a manufacturer produces or assembles a unit at more than one factory, each unit shall have a distinctive marking to identify it as the product of a particular factory		P
51.3	The repetition time cycle of a date code shall not be less than 20 years. The date code shall not require reference to the manufacturer's records to determine when the unit was manufactured.		P
51.4	A unit shall be marked with one of the following terms, as applicable: a) "Class 2 battery charger"; b) "Class 2 Transformer"; c) "Class 2 Power Supply"; or d) "Class 2 Power Unit."		P
52	Cautionary Markings		P
52.1	A cautionary marking shall be prefixed by the word "CAUTION," "WARNING," or "DANGER" in letters not less than 1/8 inch (3.2 mm) high. The remaining letters shall not be less than 1/16 inch (1.6 mm) high.		P
52.2	A cautionary marking shall be located on: a) A part that cannot be removed without impairing the operation of the unit; or b) A tag complying with the requirements in 52.3, 53.2, and 53.3.		P
52.3	A cautionary marking may be provided on a permanent tag that is secured to the input or output cord of a unit. The tag shall be attached in such a way that it cannot be easily removed. The tag shall also be marked "Do not remove this tag," or the equivalent, in letters not less than 3/32 inch (2.4 mm) high.		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
52.4	A direct plug-in unit having a mounting tab for semipermanent mounting shall be marked – on the unit, a marking tag, or an instruction sheet packed with the unit – with the word "CAUTION" and the following mounting instructions or the equivalent: a) "Risk of Electric Shock – Disconnect power to the receptacle before installing or removing the unit. When removing receptacle cover screw, cover may fall across plug pins or receptacle may become displaced;" b) "Use only with duplex receptacle having center screw;" and c) "Secure unit in place by receptacle cover screw."		P
52.5	A direct plug-in unit intended to be semipermanently mounted that exceeds the surface temperature limits specified in Table 33.1 for either metallic or nonmetallic shall be legibly marked where readily visible after installation with the word "CAUTION" and the following or the equivalent: "HOT SURFACES – Risk of Burns– Do not touch.		P
52.6	A unit shall be marked with the word "CAUTION" and "Risk of Electric Shock" and the following or the equivalent: "Dry location use only" or "Do not expose to liquid, vapor, or rain		P
52.7	A direct plug-in unit that resembles an attachment plug of a power supply cord shall be plainly marked with the word "CAUTION" and the following or the equivalent: "Risk of Fire or Electric Shock. Do not replace this plug assembly.		P
52.8	A unit which employs fusing in both supply conductors shall be marked, where readily visible during servicing, "CAUTION" and the following or equivalent: "Risk of Electric Shock. Both sides of line are fused. Test before touching."		P
53	Application of Labeling		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
53.1	Unless specifically excepted, markings required by this Standard shall be permanent. A permanent marking shall be molded, die-stamped, paint-stenciled; stamped or etched metal that is permanently secured; or indelibly stamped on a pressure-sensitive label secured by adhesive that complies with the Standard for Marking and Labeling Systems, UL 969. Ordinary usage, handling, storage, and the like of the unit are to be considered in determining whether a marking is permanent.		P
54	Instruction Manual		P
54.1	Multiple-voltage cord-connected equipment shall be provided with instructions to: a) Indicate the type of detachable supply cord and attachment plug that is to be used for connection to the alternate voltage; and b) Inform the operator to set the voltage selector switch to the voltage to which the product will be connected. See 14.2.3.		P
54.2	Multiple voltage equipment intended for use with a detachable power supply cord shall be provided with instructions to indicate the type of detachable power supply cord that is to be used for connection to the alternate voltage in accordance with 14.2.3.		P
54.3	In accordance with the Exceptions to 14.2.1 and 14.2.3, the instructions for a power unit intended for use with a detachable power supply cord which is not provided with the unit shall contain complete details concerning proper selection of the power supply cord. The instructions shall specify selection of a cord complying with the requirements in 14.2.1.		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
54.4	<p>With reference to 14.1.4 and 14.2.4, the instructions for a multiple voltage rated unit shall include (a) – (c) or the equivalent, as appropriate. The items shall be preceded by "IMPORTANT SAFETY INSTRUCTIONS – SAVE THESE INSTRUCTIONS" and "DANGER – TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, CAREFULLY FOLLOW THESE INSTRUCTIONS" in letters of 1/8 inch (3.18 mm) high or in a readily visible contrasting text.</p> <p>a) "Be sure voltage selector is in correct voltage position before plugging in." The instructions shall also specify the procedures to follow for changing the voltage selector.</p> <p>b) "For use in the U.S.A., the voltage selector switch must be placed in the 120 volt position. For use in countries other than the U.S.A., the voltage selector may need to be placed in other than the 120 volt position. Confirm the voltage available at each country location before using the product."</p> <p>c) "For connection to a supply not in the U.S.A., use an attachment plug adapter of the proper configuration for the power outlet."</p>		P
54.5	<p>The operating orientation of a direct plug-in power unit shall be indicated in the instructions as follows: "This power unit is intended to be correctly orientated in a vertical or floor mount position," or equivalent wording.</p>		P
55	OUTDOOR USE		N/A
56	Enclosures		N/A
56.1	<p>A product intended for outdoor use shall comply with the Rain Test in 64.3.</p> <p>Exception: A type 3R, 3S, or 4X enclosure evaluated in accordance with the Standard for Enclosures for Electrical Equipment, UL 50, is not required to be subjected to the Rain Test.</p>		N/A
56.2	<p>A product that is for use in an outdoor location shall comply with 64.1 and 64.2, in addition to the Ultraviolet (UV) Light Test and Water Immersion Tests specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C</p>		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
56.3	A power unit, or similar component, that is for use in an outdoor location and is to be mounted within 1 foot of the ground, whether as a separate product or provided as a part of a product, shall comply with the Standing Water Immersion Test in 64.4. A power unit installed at a height greater than 1 foot from the ground shall be marked in accordance with 65.6.		N/A
56.4	A gasket or similar sealing device used to comply with the Rain Test in 64.3 shall comply with Section 58, Gaskets.		N/A
56.5	A panel, or cover, in the outer enclosure of an appliance shall require the use of a tool for removal.		N/A
56.6	An enclosure of a unit intended for outdoor use shall be constructed to reduce the risk of electric shock due to weather exposure and shall prevent live parts, electrical components, or wiring (not identified for use while in contact with water) from becoming wet. A part identified for use while in contact with water includes flexible cords (whose marking ends with a "W"), liquid tight flexible metal conduit, outlet boxes marked for use in wet locations, and rigid conduit.		N/A
56.7	To determine compliance with 56.6, a complete assembly shall be subjected to the Rain Test in 64.3.		N/A
57	Protection Against Corrosion		N/A
57.1	Metal shall be used in combinations that are galvanically compatible.		N/A
57.2	A hinge and other attachments shall be resistant to corrosion.		N/A
57.3	A decorative grille, or similar part, that is not required to form a part of the enclosure is not required to comply with 57.4 – 57.14.		N/A
57.4	A non-metallic enclosure shall be judged on the basis of the effect of exposure to ultraviolet light and water, in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.		N/A
57.5	A metallic enclosure shall be protected against corrosion as specified in 57.6 – 57.14. These requirements do not contemplate corrosion that is caused by exposure to earth or other corrosive agents.		N/A



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
57.6	Copper, bronze, and brass containing no less than 80 percent copper, or stainless steel may be used without additional protection against corrosion. Sheet, extruded, cast aluminum, die-cast zinc, and other metals shall be of a grade or alloy known to be resistant to atmospheric corrosion, shall be subjected to appropriate tests, or shall be protected against corrosion.		N/A
57.7	An enclosure of cast iron or malleable iron at least 3.2 mm (1/8 inch) thick shall be protected against corrosion by: a) A coating of zinc, cadmium, or the equivalent, which is 0.0038 mm (0.00015 inch) thick on the outside surface, and a visible coating of such metal on the inside surface; or b) One coat of an organic finish of the epoxy or alkyd-resin type, or other outdoor paint on each surface.		N/A
57.8	Corrosion tests are required unless suitability of a paint can be determined by consideration of its composition.		N/A
57.9	An enclosure of sheet steel less than 3.20 mm (0.126 inch) thick if zinc-coated, or 3.12 mm (0.123 inch) thick if uncoated, shall be protected against corrosion by other metallic or non-metallic coatings that have been found to give equivalent protection as described in 57.12, or by one of the following means:		N/A
58	Gaskets		N/A
58.1	This section applies to gaskets that are required for an electrical enclosure to maintain a tight fit		N/A
58.2	A gasket shall be secured with adhesive or by mechanical means, including force-fit or the combination of the gasket's shape and elastomeric properties. The gasket and its securing means shall not be damaged when the cover is opened.		N/A
58.3	The gasket material and adhesive combination, if applicable, shall comply with the Standard for Gaskets and Seals, UL 157. The Tensile Strength Test and Ultimate Elongation Test, when tested in accordance with the Standard for Gaskets and Seals, UL 157, shall have a tensile strength of no less than 60 percent and an elongation of no less than 75 percent of the values determined before conditioning.		N/A
59	Supply Connections		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
59.1	A conduit opening in the enclosure of a fixed power unit shall be evaluated in accordance with Sections 67 – 71.		N/A
59.2	The power supply cord provided with a power unit intended for use in an outdoor location shall be at least as serviceable as junior hard service cord type SJW, SJOW, SJTW, SJTOW, SW, SOW, STW, or STOW		N/A
59.3	An outdoor power unit shall be provided with means for connection of the supply with one of the following: a) Terminals or leads for permanent connection to the supply for fixed equipment. A lead shall be no less than 152.4 mm (6 inches) in length and shall not exceed 609.6 mm (24 inches) in length. The requirements of Sections 67 – 71 shall also apply; b) A non-detachable power supply cord for connection to the supply by means of a plug; or c) A direct plug-in unit.		N/A
59.4	A cord-connected power unit intended for use in an outdoor location shall employ a 3-conductor grounding type supply cord.		N/A
59.5	For an appliance in which vibration is likely to occur – such as a vibrator – the requirement in 16.2.1 will necessitate the use of lock washers or other equivalent means to prevent wire-binding screws and nuts from becoming loosened		N/A
60	Output Connections and Wiring		N/A
60.1	Output wiring shall be suitable for outdoor use, "W" rated, and sunlight-resistant as applicable to outdoor cords.		N/A
60.2	An output connection shall be suitable for outdoor use, protected against corrosion, and sunlight-resistant as applicable to outdoor connections.		N/A
61	Spacings		N/A
61.1	A unit intended for outdoor use shall comply with Section 24, Spacings, except that 24.1 and 24.5 – 24.8 shall be replaced with 61.2.		N/A
61.2	The spacing between live parts of opposite polarity, live and dead metal parts, and live parts and a metal enclosure, shall be as specified in Table 24.1. This table applies to units with or without openings.		N/A
62	Accessibility of Live Parts		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
62.1	A unit intended for outdoor use shall comply with Section 16, Accessibility of Live Parts, except that 16.2.2 and 16.3.2 shall be replaced with 62.2 and 62.3, respectively		N/A
62.2	The maximum voltages which may be accessible in accordance with 16.2.1 are: a) 15 V for sinusoidal AC and 21.2 V peak for nonsinusoidal AC; b) 30 V for continuous DC; and c) 12.4 V peak for DC interrupted at a rate of 10 – 200 Hz or less with 50 percent duty cycle.		N/A
62.3	The maximum voltages which may be accessible in accordance with 16.3.1 are: a) 15 V for sinusoidal AC and 21.2 V peak for nonsinusoidal AC; b) 30 V for continuous DC; and c) 12.4 V peak for DC interrupted at a rate of 10 – 200 Hz or less with 50 percent duty cycle.		N/A
63	Ground-Fault Circuit-Interrupters		N/A
63.1	Each power unit shall be protected by an integral ground-fault circuit-interrupter that complies with the requirements for a Class A ground-fault circuit-interrupter in the Standard for Ground-Fault Circuit-Interrupters, UL 943		N/A
63.2	If provided, a ground-fault circuit-interrupter (including any external open-neutral circuitry) shall be connected between the supply lead or terminal connections and all other electrical conductors and equipment. This determination is to be made with the unit connected in all intended voltage configurations.		N/A
63.3	In a power unit, the conductors on the load side of the ground-fault circuit-interrupter shall not occupy boxes or enclosures containing other conductors unless the additional conductors are also protected by a ground-fault circuit-interrupter.		N/A
64	Performance		N/A
64.1	General		N/A
64.2	Abuse tests		N/A
64.3	Rain test		N/A
64.4	Standing water immersion test		N/A
65	Markings		N/A

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
65.1	A required marking shall be capable of withstanding the stresses of ordinary usage, including exposure to weather and other ambient conditions, handling, storage, and similar conditions. An adhesive-backed label shall comply with the requirements in the Standard for Marking and Labeling Systems, UL 969, for the exposure conditions and surface temperatures of minimum range from 80°C (176°F) to minus 35°C (minus 31°F). If a tag is utilized, it shall be permanent and tear resistant.		N/A
65.2	An outdoor use power unit complying with the Exception to 63.1 shall be provided with a marking that consists of the following or equivalent wording: a) For a permanently connected power unit: "WARNING: Risk of Electric Shock. Install only on a circuit protected by a Class A GFCI." b) For a cord connected or direct plug-in power unit: "WARNING: Risk of Electric Shock. Install only to a covered Class A GFCI receptacle that has an enclosure that is weatherproof with the attachment plug cap inserted or removed."		N/A
65.3	An outdoor unit shall be marked "raintight" or "rainproof" in accordance with 64.3.1.		N/A
65.4	In accordance with 56.9, a direct plug-in power unit shall be marked "WARNING: Not for use with receptacles that are weatherproof only when the receptacle is covered (attachment plug cap not inserted and receptacle cover closed)."		N/A
	A permanently connected unit shall be marked in accordance with Section 70, Marking		N/A
65.5	In accordance with 56.3, a unit intended to be mounted greater than 0.30 m (1 foot) from the ground surface shall be marked as follows: "WARNING: Risk of Electric Shock. Mount the unit at a height greater than 1 foot from the ground surface."		N/A
66	Instructions		N/A
66.1	The text of the safety instructions required by 66.3 shall be verbatim, or in equally definitive terminology, unless otherwise indicated.		N/A
67	PERMANENTLY-CONNECTED UNITS		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
67.1	The requirements in Sections 67 – 71 supplement and, in some cases, modify the general requirements in Sections 1 – 66. This section is intended to cover the requirements for power units that are to be permanently connected to the supply.		P
68	Construction		P
68.1	A permanently-connected power unit shall have a provision for the connection of a wiring system in accordance with Sections 67 – 71.		P
69	Wiring Terminals and Leads		N/A
69.1	The field-wiring terminals in 68.3 – 68.12 are terminals to which supply connections are made in the field when the power unit is installed.		N/A
70	Markings		P



UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict
70.1	<p>In addition to the markings specified in this Standard, a permanently connected power unit shall be provided with the following markings:</p> <p>a) The type of conductors to be utilized, for example, "use copper conductors only";</p> <p>b) A terminal intended for connection of grounded power supply conductor shall be made of or plated with metal substantially white or gray in color and shall be readily distinguishable from other terminals; Exception: This requirement does not apply when proper identification of a terminal that is intended for connection of grounded power supply conductor is clearly shown in some other manner, such as on an attached wiring diagram or adjacent marking letter "N" or "Common".</p> <p>c) The surface of a lead for the connection of a grounded power supply conductor shall be white or gray and shall be readily distinguishable from the other leads;</p> <p>d) The line conductor or the connection of the line conductor shall be easily distinguishable from the other connections, for example, adjacent marking letter "L";</p> <p>e) The terminal for the connection of the equipment grounding terminal, shall be identified by:</p> <p>1) A green colored terminal hexagonal screw, hexagonal nut, or a green colored pressure wire connector;</p> <p>2) The marking "G", "GND", or "GROUND" at or near the grounding terminal; or</p> <p>3) The grounding symbol illustrated in Figure 70.1, on or adjacent to the terminal.</p> <p>f) If the wiring compartment attains a temperature above 60°C (140°F) during normal operation, the unit shall be marked near the point at which the supply connections are made with the minimum temperature rating of the conductors that must be used; and</p> <p>g) The tightening torque, if applicable for wiring terminals.</p>		P

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict

Test unit	<input checked="" type="checkbox"/> portable <input type="checkbox"/> stationary	Measured Leakage Current, mA							
Condition	Switch S1	Switch S2 Position 1				Switch S2 Position 2			
		(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
As Received	Open	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
	Closed	--							
	0-5 s	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
	5 s – 1 h (thermal stability)	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006

Between parts	Test Voltage (Vac)	Breakdown
Line / Neutral and exposed surface	<input checked="" type="checkbox"/> 1480 / <input type="checkbox"/> 1240	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Line / Neutral and output terminals	<input checked="" type="checkbox"/> 1480 / <input type="checkbox"/> 1240	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Sec. circuits and dead metal parts	<input type="checkbox"/> 500	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Both terminals of Y-Cap	<input type="checkbox"/> 2093 / <input type="checkbox"/> 1753 Vdc	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A

Model	Supply Voltage	Measured Input			Marked Rated Output <input type="checkbox"/> VA, <input type="checkbox"/> A, <input checked="" type="checkbox"/> W	Rating / measured value (%)
		<input checked="" type="checkbox"/> VA	<input checked="" type="checkbox"/> A	<input checked="" type="checkbox"/> W		
01480	5V, 2A	4.9	1.8	9.9	1.4	--
	5V, 2A	5.2	2.1	10.2		--
	5V, 2A	5	1.9	10		--

Test voltage (V) :	5V/ horizontal	Shift to 35°C	5V/ vertical	Shift to 35°C	—
Test load description:	--				
T1 ( °C ) :	23.1	--	23.0	--	—
T2 ( °C ) :	23.2	--	23.2	--	—
Part	Measured (°C)				Required (°C)
PCB	57.4	69.3	58.1	70.1	130
EC1 body	53.2	65.1	53.6	65.6	105
EC5 body	48.7	60.6	48.9	60.9	105
Inside enclosure near T1	50.5	62.4	50.8	62.8	90
Outside enclosure near T1	42.6	54.5	42.9	54.9	95
Primary winding of T1	64.1	76.0	64.5	76.5	110
Bobbin of T1	63.0	74.9	63.2	75.2	110
Winding of T1	63.3	75.2	63.6	75.6	110
Test voltage (V) :	5 V/ horizontal	Shift to 35°C	5V/ vertical	Shift to 35°C	—

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict

Test load description:		--			
T1 ( °C)	:	22.3	--	22.2	--
T2 ( °C)	:	22.5	--	22.3	--
Part	Measured (°C)				Required (°C)
PCB		58.1	70.8	58.8	71.6
EC1 body		54.9	67.6	55.4	68.2
EC5 body		50.2	62.9	50.6	63.4
Inside enclosure near T1		51.6	64.3	52.1	64.9
Outside enclosure near T1		43.4	56.1	43.9	56.7
Primary winding of T1		67.7	80.4	68.6	81.4
Bobbin of T1		66.1	78.8	66.7	79.5
Winding of T1		66.8	79.5	67.2	80.0
Winding	R1 (Ω)	R2 (Ω)	Measured (K)	Required (K)	Insulation Class
Primary	--	--	--	--	--
Secondary	--	--	--	--	--

UL 1310			
Clause	Requirement + Test	Result - Remark	Verdict

Ambient temperature						22.1 °C
No.	Component	Fault	Test voltage (V)	Test time	Input current (A)	Result
1	EC1	S-C	240	1s	0	Observation: Fuse opened, no hazard, no broken.
2	EC2	S-C	240	1s	0	Observation: Fuse opened, no hazard, no broken.
3	BD1	S-C	240	1s	0	Observation: Fuse opened, no hazard, no broken.
4	D3	S-C	240	1s	0	Observation: Fuse opened, no hazard, no broken.
5	U1	S-C	240	1s	0	Observation: Fuse opened, no hazard, no broken.
6	U2	S-C	240	10 mins	0.006	Observation: Unit shut down, recoverable
7	Output	S-C	240	10 mins	0.008	Observation: Unit shut down, recoverable
8	EC5	S-C	240	10 mins	0.008	Observation: Unit shut down, recoverable
<p>Note:</p> <p>S: Short-circuited; O: Open-circuited; O/L: Overloaded; B: Blocked; L: Locked.</p> <p>Observation: The observations during and after fault condition tests.</p> <p>Damaged: Which component (components) damaged during the fault condition test.</p> <p>Max. Voltage: The maximum accessible voltage of DC output terminal during the fault condition test.</p>						



-Appendix 1: Photo document.

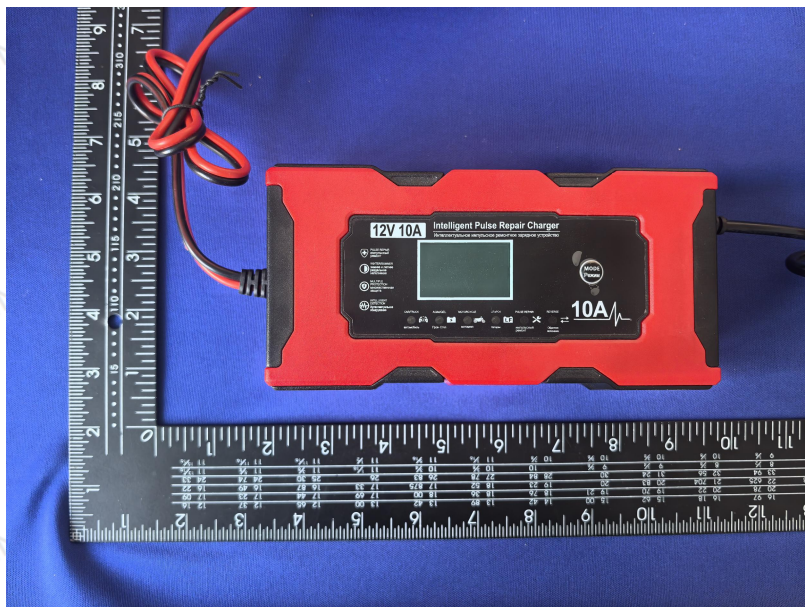


Figure-1



Figure-2



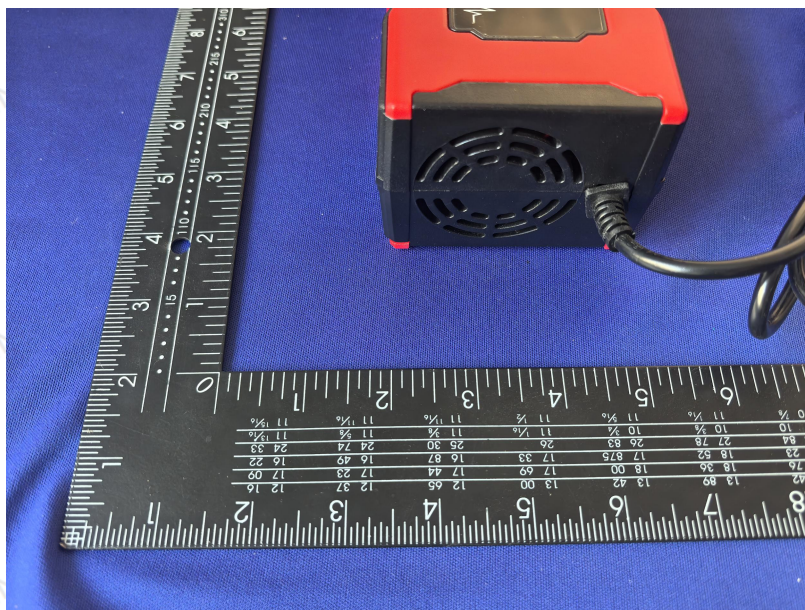


Figure-3

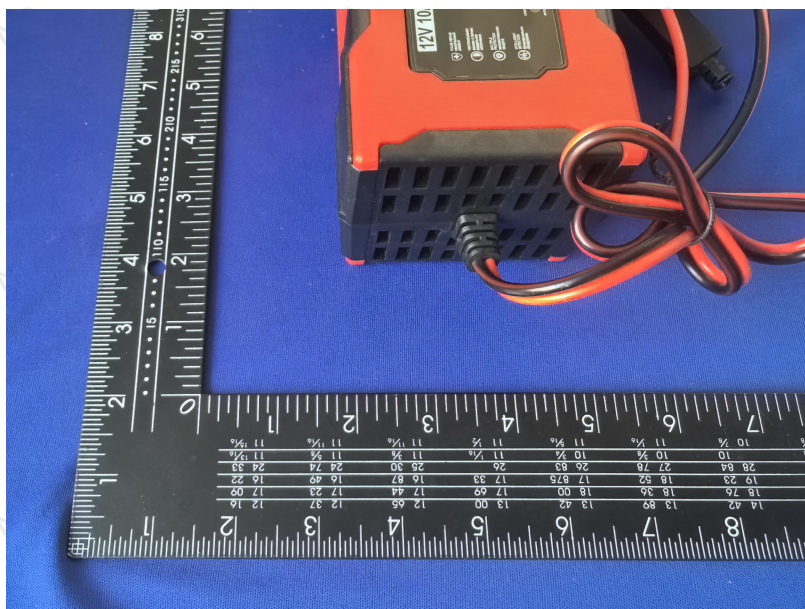


Figure-4

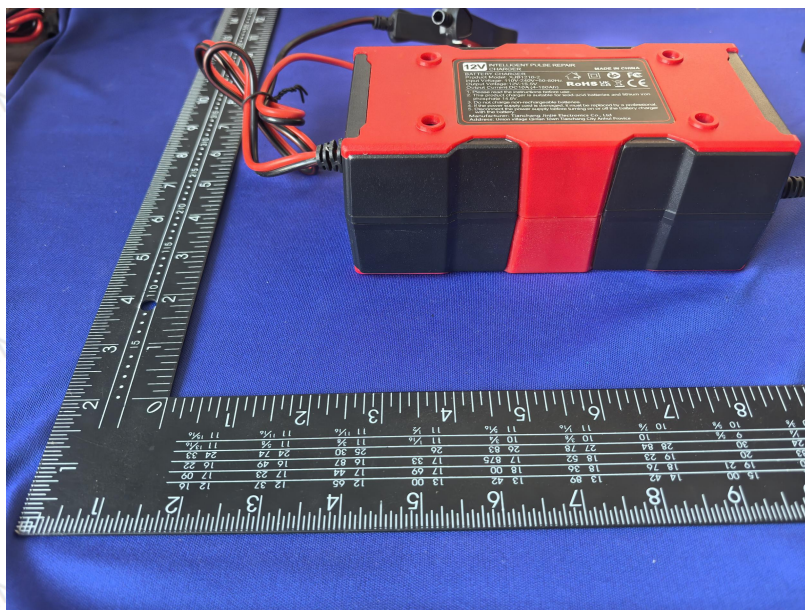


Figure-5

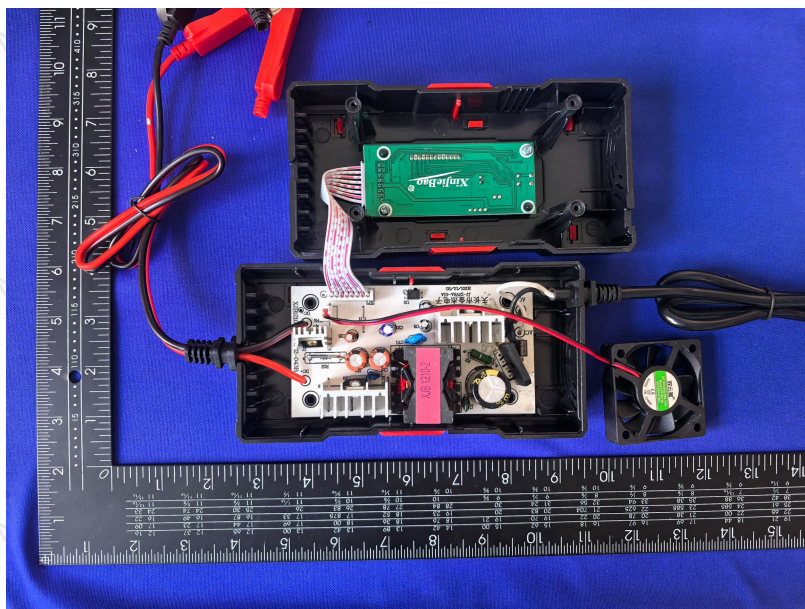


Figure-6



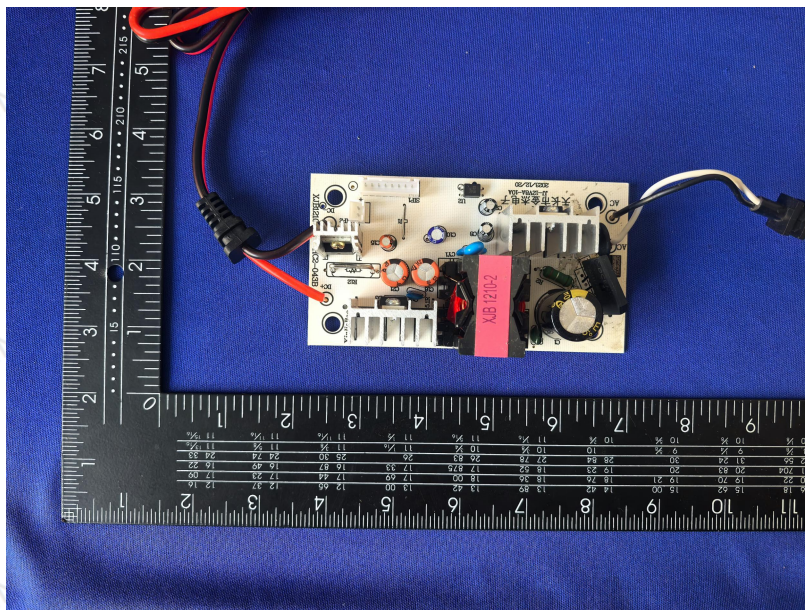


Figure-7

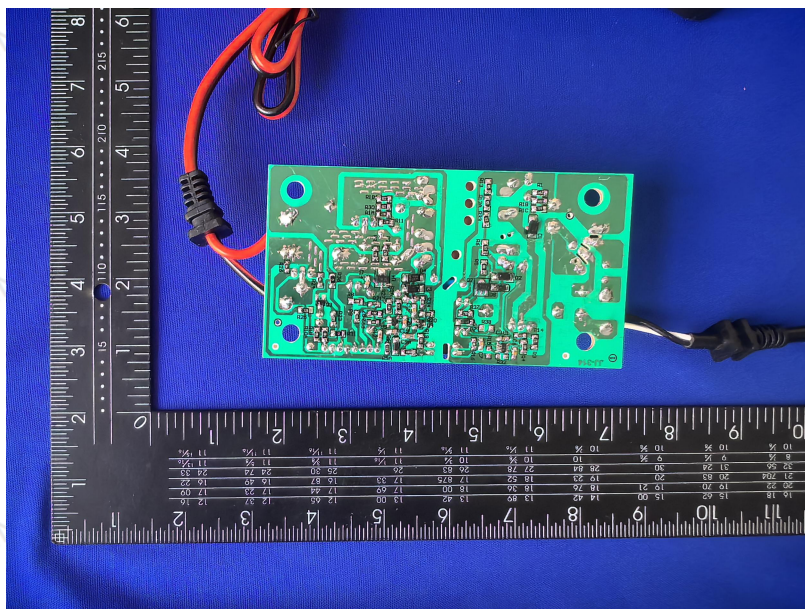


Figure-8



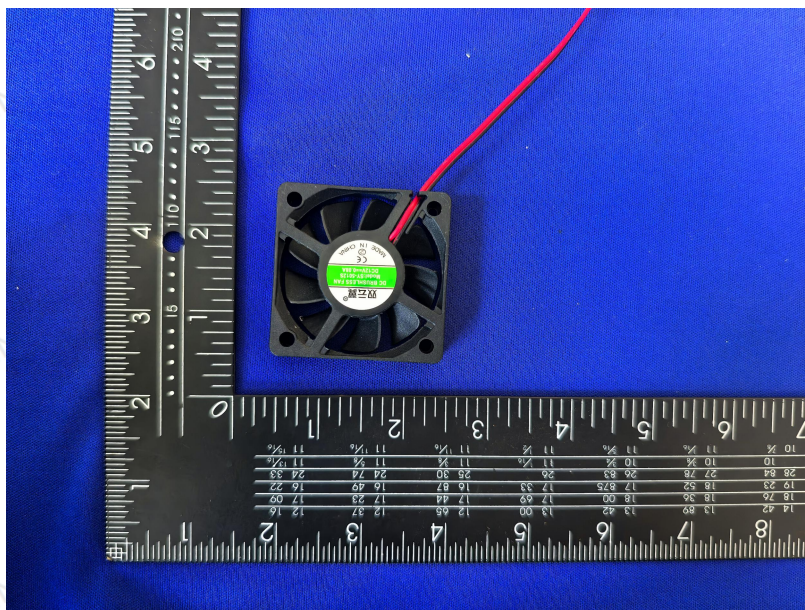


Figure-9

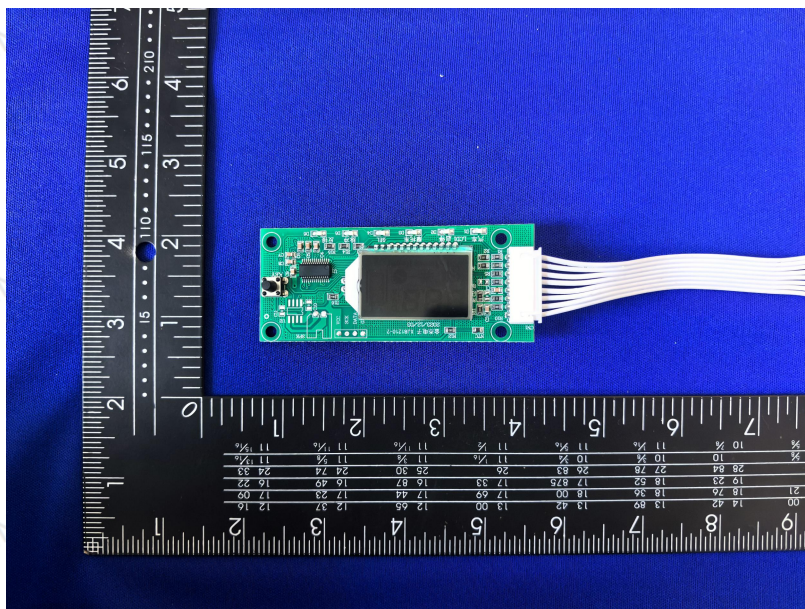


Figure-10

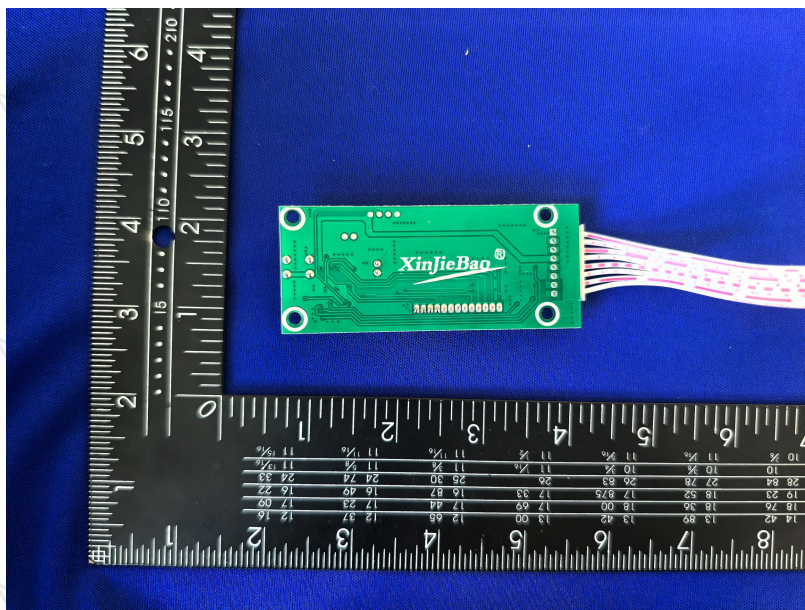


Figure-11

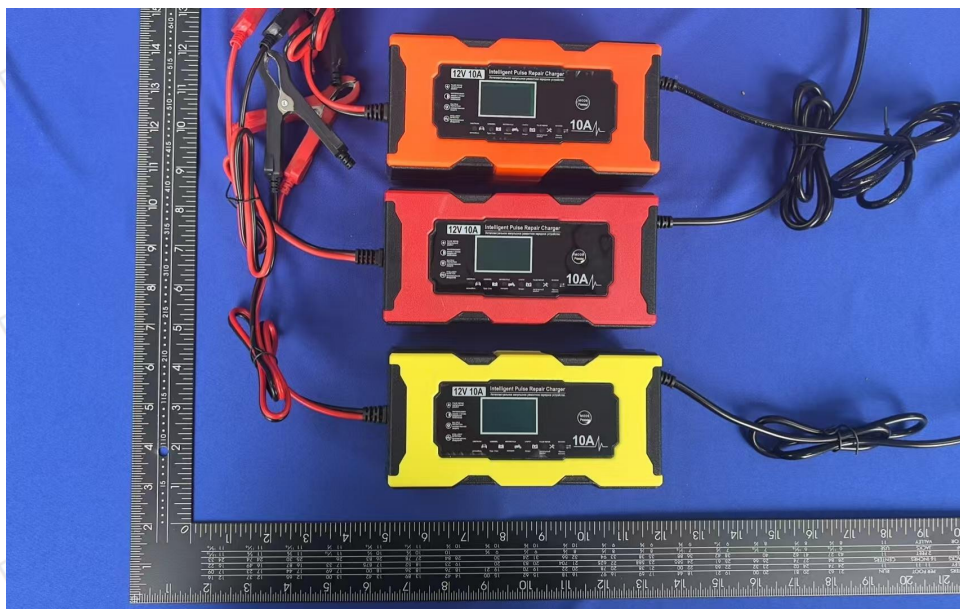


Figure-12

-----End of report-----