



TEST REPORT

SERFAS INC

Technical Report: (3223)158-0296

Jun.07,2023

Date Received: Jun.07,2023

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SERFAS INC
2333W. UTOPIA RD., PHOENIX, AZ 85027,USA

SAMPLE INFORMATION:

Sample Description:	ELECTRIC BICYCLES	Sample Quantity:	N/A
Vendor:	N/A	Style No(s):	E-DART-500W
Manufacturer:	HANGZHOU BTN EBIKE CO.,LTD	SKN/SKU No.:	N/A
Buyer:	SERFAS INC	PO No.:	N/A
Labeled Age Grade:	N/A	Ref #:	N/A
Appropriate Age Grade:	N/A	Country of Origin:	CHINA
Client Specified Age Grade:	N/A	Assortment No.:	N/A
Tested Age Grade:	N/A	Country of Destination:	USA
UPC Code:	N/A	Color :	N/A

EXECUTIVE SUMMARY:

TEST REQUESTED	CONCLUSION
ANSI/CAN/UL2849:2020, 1st Edition, dated January 2, 2020	PASS

Note: With the client's prior consent, all tests were subcontracted test item.

BVCPS (ZHEJIANG) GENERAL CONTACT INFORMATION FOR THIS REPORT

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Critical components information:
Only following safety critical components were evaluated and/or tested, and were confirmed to comply with the standard requirements mentioned in this test report. Use of components not listed here may lead to non-compliance test results, and it's the sole responsibilities of the manufacturer to make sure all products should be produced in consistent way and only approved components can be used.

Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity
1.Charger	SHENZHEN ATNEN TECHNOLOGY CO LTD	LBC030546020	Output:54.6V,2.0A	UL1012	UL E505003
2.Battery pack	Bafang New Energy (Suzhou) Co., LTD	BT F290.D633	48V 13.2Ah	UL2271	Report No. BATT- 2023050602-001
3.Motor	SUTTO	M110 02C.D	48V 650W	--	--
4.Mainboard	Yuecheng electromechanical technology wuxi co. LTD	YCKS394-004- 48T	--	--	--
4-1. PCB	Interchangeable	Interchangeable	Min V-1,130°C	UL796	UL
4-2. Motor Power wires	Interchangeable	Interchangeable	Min 80 °C,60V,18awg	UL758	UL
4-3. Motor Power connector	Interchangeable	Interchangeable	Min 60V, 80 °C	UL1977 or Plastic Enclosure of connector comply with UL94,UL746C	UL
4-4.IC(U2)	Infineon	XC836	--	--	--
4-5.IC(MB1)	XLSEMI	XL7045	--	--	--
4-6.MOSFET (V0A,V1A,V2A,V 0B,V1B,V2B,V0C ,V1C,V2C)	Si-Tech	S80N10R	68V 80A	--	--

Possible test case verdicts:	
- 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)
Testing	
Date of receipt of test item.....:	2023-05-06
Date (s) of performance of tests.....:	2023-05-06 to 2023-05-22
General remarks:	



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"(See Enclosure #)" refers to additional information appended to the report.
 "(See appended table)" refers to a table appended to the report.

Throughout this report a comma / point is used as the decimal separator.

General product information and other remarks:

- E-BIKE Model E-DART-500W
- Rated voltage 48V, rated capacity 13.2Ah.
- Max. speed 45 km/h, Max load limit 150kg.
- Specified operating ambient range: -20°C~ 60°C, specified charging ambient range: 0°C~ 45°C.
- With battery pack model BT F290.D633, rated 48V 13.2Ah.
- With motor model M110 02C.D, rated 48V,650W.
- With charger model LBC030546020 output rated 54.6V,2.0A.

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Clause	Requirement + Test	Result - Remark	Verdict
1	Scope - Covers the electrical system of eBikes powered by a lithium-based, rechargeable battery. EBikes include both Electrically Power Assisted Cycle (EPAC – pedal assist) and non-pedal assist eBikes.		P
2	Components		P
3	Units of Measurement		P
	CONSTRUCTION		
7	General		P
7.1	The information provided in Sections 7 through 10 is essential for the proper evaluation of the products covered by this Standard. The concepts in these Sections will outline and define the evaluation path based on what is provided in the electrical system.		—
7.2	The concepts in Sections 7 through 10 are general in nature and could result in different methods of evaluation for each different product type dependent upon its overall design.		—
7.3	For EPACs, motors shall disengage their assist function when the rider stops pedaling, when a maximum predetermined speed as specified by the manufacturer is reached, or when the user applies the brakes (if the brakes are provided with cutoff functions).		N/A
	For non-EPAC versions of the eBike, motors are not required to disengage when the user stops pedaling.		P
	A non-EPAC type eBike may be provided with an EPAC mode.		N/A



7.4	The electrical system located on the eBike, those subassemblies or components shall comply with all the requirements in this Standard at a maximum altitude of 2000 m (6562 feet) and over an ambient temperature range of 0°C to 40°C (32°F to 104°F) and be subjected to ingress protection tests.		P
	Equipment may be used at ambient temperature extremes for operation and battery charging that exceed the default limits above (e. g., -10 ° C or +50 ° C) when specified by the manufacturer and the equipment shall be provided with instructions in accordance with 46.3 (j) and (k), and 48.3.	The specified operating ambient range (-20°C ~ 60°C) was provided in the Instruction.	P
8	Power Levels		P
8.1	General		—
8.1.1	For all products covered by this Standard, a specific power level will be associated with the eBike. This will require rated voltage and current levels to be assigned, but can also include voltages or currents that are available within the eBike being evaluated.		—
	Different approaches can be used based on the potential hazards associated with a given power level.		—

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Clause	Requirement + Test	Result - Remark	Verdict
8.1.2	For the purposes of this Standard, different designations will be used. This includes hazardous voltage and/or hazardous current resulting in hazardous energy, and in all cases these designations indicate a voltage, current or energy level that is potentially dangerous to the user and means of protection are required.		—
	Additional designations cover Low Voltage, Limited Energy (LVLE) which indicates voltage and current levels that are not inherently hazardous to the user and the need for specific protection means may be reduced.		—
8.2	Hazardous Voltage and Hazardous Energy		P
8.2.1	Any accessible circuit or accessible part, as determined by the articulate probe in Figure 18.1, that is operating at a voltage above 42.4 volts peak or 60 V dc is considered to be operating at a hazardous voltage. In these cases, the user must be protected against contact with the part or circuit by the use of an enclosure or proper insulation.	The product only involve maximum working voltage of 54.6 Vdc, which is considered as non-hazardous voltage circuit.	N/A
	The requirements for both enclosures and insulation are included in this Standard and shall be applied as appropriate in all cases where hazardous voltages exist.		—



8.2.2	Hazardous energy exists in any circuit or part that is operating with a stored energy level of 20 J or more, or has an available continuous power level of 240 VA or more, at a potential of 2 volts or more. In these cases, the user shall be protected against contact with the part or circuit by the use of an enclosure or proper insulation.	Check ok: The circuit and part with Hazardous Energy are protected by the enclosure.	P
	The requirements for both enclosures and insulation are included in this Standard and shall be applied as appropriate in all cases where hazardous energy exist.		—
8.3	Low Voltage Limited Energy Circuits		P
8.3.1	A Low-Voltage Limited Energy Circuit (LVLE) shall comply with the limits in Table 8.1.	Check ok	P
8.3.2	The power limitations in Table 8.1 may be obtained by the use of any of the following configurations:		—
	a) An inherently-limited transformer;		—
	b) A non-inherently-limited transformer coupled with an overcurrent protective device in the output circuit;		—
	c) A combination transformer and fixed impedance; or		—
	d) An arrangement determined to be equivalent to (a), (b), or (c).		—
8.3.3	A part or device, other than the battery pack, located in or supplied by an LVLE circuit need not be investigated.	No parts or device located in or supplied by an LVLE circuit.	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
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	The secondary winding of the transformer, the fuse or circuit protective device, or the regulating network, and all wiring up to the point at which the current and voltage are limited shall be judged under the applicable requirements in this Standard.	Controller output connected with throttle, Controller output connected with Cutoff brake levers and Controller output connected with Start Switch & Operator Interface were investigated.	P
8.3.4	The maximum load current is to be drawn under any condition of loading, including short circuit, using a resistor.		P
	The current is to be measured 60 seconds after the application of the load. The resistor is to be continuously readjusted during this 1 minute period to maintain maximum load current.	The current measured after 60 seconds: Controller output connected with throttle: 0A Controller output connected with Cutoff brake levers: 0A Controller output connected with Start Switch & Operator Interface:0A	P
	The measured load current shall not exceed the value listed in Table 8.1.	Check ok	P



8.3.5	With reference to the voltage limit specified in Table 8.1, measurement is to be made with the product connected to the intended source of supply and with all loading circuits disconnected.	Connected with charger and open the motor power.	P
8.3.6	The over-current protective device provided in the LVLE circuit used to limit the current shall be rated or set at not more than the values specified in Table 8.1.	Check ok	P
	The device shall not be of the automatically reset type.	Check ok	P
8.3.7	If a regulating network is used to limit the output under any conditions, the LVLE current limitation in Table 8.1 shall not be affected by malfunction of a single component, excluding resistors.		N/A
	The network shall comply with the value in Table 8.1 when the current is measured after 5 seconds.		N/A
9	Combination of Battery, Battery Management System, and Charger		P
9.1	For battery packs that are provided with an integral BMS, that BMS shall be evaluated as part of the battery pack in accordance with Battery Packs, Section 11.	The BMS was integrated into the battery.	P
	If the BMS, or a portion of the BMS, resides in components or circuits external to the battery pack, then the combination of the external components and the battery pack is critical to safety and shall be evaluated together in accordance with 9.2.		N/A
9.2	All testing of the system shall be performed with the actual battery/BMS and charger that is recommended by the manufacturer.		N/A
	Any protection circuits, or other external components or systems, can remain in place provided those circuits or systems are proven to be reliable in accordance with Sections 12 and 19.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
10	User Protection While Charging		P
10.1	General		P
10.1.1	Charging of the battery may occur while the battery is installed on the eBike, with the battery removed from the eBike, or both options may apply based on user preference.		P
	If the battery is only intended to be charged when it is removed from the eBike, then an inherent means shall be provided to insure that this option is the only option for charging the battery.		N/A



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	If no inherent means are provided, and it is possible to charge the battery while on the eBike, the battery shall be considered to be charged both on board and off board the eBike.		P
10.1.2	If the battery is intended to be charged while on the eBike, whether by inherent construction or user preference, then the requirements in 10.2 apply.		P
	If the battery is only intended to be charged when removed from the eBike, then the requirements in 10.2 do not apply.		N/A
10.1.3	The requirements in 10.1.1 and 10.1.2 are to be used in conjunction with the requirements in Section 8.		P
	If energy levels are such that no hazard exists, then protection means may be reduced.		P
10.2	Charging batteries that are on the eBike		P
10.2.1	Charging of the battery on an eBike where voltage or energy levels exceed the lower limits for shock hazards or electric energy hazards will require that the exposed conductive surfaces of the eBike are protected and monitored during charging to prevent a shock hazard due to the charging energy supplied to the eBike.	The output of the charger was 54.6V/2.0A, didn't exceed the lower limits for shock hazards or electric energy hazards.	N/A
	The personnel protection system supplied shall be as indicated in 10.2.2.	Not applicable	N/A
10.2.2	For equipment where the specifics of the installation of the on board electrical system is part of the evaluation, the eBike shall be provided with a system of protection that is considered suitable to protect the user.		N/A
	This may include suitable means such as double insulation systems onboard the eBike. The suitability of the protection system shall be judged based on the requirements in this Standard.		N/A
10.2.3	With reference to 10.2.2, products utilizing a system of protection based on protective grounding shall comply with the requirements in 10.2.4 and products utilizing a system of protection based on double insulation shall comply with the requirements in 10.2.5.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
10.2.4	Protection systems relying on protective grounding for user protection shall comply with the applicable requirements for grounding and bonding in Section 22.		N/A



	The requirements shall be applied to all points where protective grounding is used as a means to protect the user.		N/A
10.2.5	A system of double insulation provided to protect the user shall be in accordance with the requirements in UL 2097.		N/A
10.2.6	The eBike shall have charger connect-interlock so that the motor cannot be activated when the charger is plugged in.	Check ok: the motor cannot be activated when the charger is plugged in.	P
	If there is no interlock, there shall be a secondary means of preventing inadvertent motor activation.		N/A
11	Battery Packs		P
11.1	Battery packs that provide power to the motor shall be provided with an appropriate Battery Management System (BMS) either integral to the pack or as part of a system that includes components and circuits external to the pack.	The Battery Management System (BMS) was integral to the pack.	P
	The BMS shall be designed to safely withstand normal and foreseeable misuse conditions for the eBike involved.	Check ok by test.	P
	For a BMS that includes components or circuits external to the battery pack, the BMS shall comply with Safety Circuits and Safety Analysis, Section 12, as applicable.		N/A
	A battery pack used in eBikes covered by this Standard shall comply with one of the following:		P
	a) UL 2580/ULC-S2580;		N/A
	b) UL/ULC 2271;		P
	c) CSA C22.2 No. 62133/UL 62133. See also 11.2; or		N/A
	d) UL 2054. See also 11.2.		N/A
11.2	A battery pack in accordance with 11.1 (c) and (d) is additionally required to comply with the requirements in Overcharging Test, Section 32.2; Short Circuit Test, Section 32.7; Imbalanced Charging Test, Section 32.8; Shock Test, Section 32.9; Vibration Test (battery method), Section 38.2; and Thermal Cycling Test, Section 32.10.		P
11.3	For rechargeable batteries providing power to other than the motor and part of the eBike electrical system, the battery shall comply with UL 62133 or UL 2054.	There was no batteries providing power to other than the motor and part of the eBike electrical system.	N/A
12	Safety Circuits and Safety Analysis	According to the manufacturer's request, the section was not evaluated.	N/A
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Clause	Requirement + Test	Result - Remark	Verdict



13	Enclosing and Insulating Hazardous Parts		P
13.1	General		P
13.1.1	An eBike shall be provided with one or more enclosures that house all live parts that are considered hazardous. The parts of the enclosure that are required to be in place to comply with the requirements for risk of fire, electric shock, injury to persons, and electrical energy – high current levels shall comply with the applicable enclosure requirements specified in this Standard.	Check ok	P
	Exception: For a part of the system that is in accordance with enclosure requirements of the applicable components or end products standard for the part in question, these requirements do not apply.	The Battery pack and Charger meet the requirements of their corresponding standards for enclosure	P
13.1.2	An enclosure shall have the strength and rigidity required to resist the possible physical abuses that it will be exposed to during its intended use, in order to reduce the risk of fire or injury to persons.		P
13.2	Materials		P
13.2.1	Nonmetallic materials		P
13.2.1.1	The materials employed for enclosures shall comply with the applicable enclosure requirements outlined in UL 746C and CSA C22.2 No. 0.17, except as modified by this Standard.		P
13.2.1.2	Polymeric materials employed for enclosures shall have a minimum flame rating of V-1 in accordance with Flammability, Section 17, or the enclosure may alternatively be evaluated to the 20 mm end product flame test in accordance with UL 746C and CSA C22.2 No. 0.17.		P
13.2.1.3	The following factors in (a) – (e) shall be taken into consideration when an enclosure employing nonmetallic materials is being evaluated. For a nonmetallic enclosure all of these factors shall be considered with respect to thermal aging. Dimensional stability of a polymeric enclosure is addressed by compliance to the mold stress relief test. Suitability to factors (a) – (e) below may be determined by the tests of this Standard.	Check ok by test of this Standard.	P
	a) Resistance to Impact; b) Crush Resistance; c) Abnormal Operations; d) Severe Conditions; and e) Mold Stress Relief Distortion.		—
13.2.1.4	The polymeric materials employed for enclosures and insulation shall be suitable for anticipated temperatures encountered in the intended application.		P
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Clause	Requirement + Test	Result - Remark	Verdict
	Enclosures shall have a Relative Thermal Index (RTI) with impact suitable for temperatures encountered in the application but no less than 80°C (176°F), as determined in accordance with UL 746B and CSA C22.2 No. 0.17.		P
13.2.1.5	Materials employed as electrical insulation in the assembly shall be resistant to deterioration that would result in a risk of electrical shock, fire or other safety hazard. Compliance is determined by the tests of this Standard. Materials employed for direct support of live parts at hazardous voltage, shall additionally meet the direct support insulation criteria outlined in UL 746C and CSA C22.2 No. 0.17, unless employed as part of a component that has been evaluated to a suitable component standard. Insulated wiring is subjected to the requirements outlined in Section 18, Internal Wiring and Terminals.	The product only involve maximum working voltage of 54.6 Vdc, which is considered as non-hazardous voltage circuit.	N/A
13.2.1.6	Gaskets and seals relied upon for safety, shall be determined suitable for the environmental conditions and chemical substances they are anticipated to be exposed to in their end use.	No Gaskets or seals relied upon for safety in the product.	N/A
13.2.1.7	Enclosure materials intended to be directly exposed to sunlight in the end use application shall comply with the UV Resistance test in accordance with UL 746C and CSA C22.2 No. 0.17.	The product will store indoors when not in use, and was required in user manual.	N/A
13.2.2	Metallic materials		P
13.2.2.1	Metal enclosures shall be corrosion resistant. A suitable plating or coating process can achieve corrosion resistance. Additional guidance on methods to achieve corrosion protection can be found in UL 50E/CSA C22.2 No. 94.2.		P
13.2.2.2	Metal enclosures may be provided with an insulating liner to prevent shorting of live parts to the enclosure. If using an insulating liner for this purpose, the insulating liner shall consist of non-moisture absorbent materials that have a temperature rating suitable for temperatures during operation including charging.		P
13.2.2.3	Conductive parts in contact at terminals and connections shall not be subject to corrosion due to electrochemical action.		P
13.3	Strength of Enclosures		P
13.3.1	The enclosure shall be subjected to the Impact Test, Section 33.	Check ok by test.	P
13.4	Sharp Edges		P
13.4.1	An enclosure, a frame, a guard, a handle, or similar device shall not have sharp edges that constitute a risk of injury to persons in normal maintenance and use.	Check ok.	P



13.5	Ingress Protection		P
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Clause	Requirement + Test	Result - Remark	Verdict
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13.5.1	Openings in the enclosure shall be designed to inhibit inadvertent access to hazardous parts. Compliance is determined by the Tests for Protection Against Access to Hazardous Parts Indicated by the First Characteristic Numeral, of IEC 60529, for a minimum IP rating of IP3X. Evaluation per IEC 60529, consists of the use of the Test Rod 2.5 mm, 100 mm long, shown in UL/ULC 2271, applied with a force of 10 N ±10 percent.	Check ok by test.	P
13.5.2	Openings in an enclosure shall be designed to prevent ingress of water as installed in the intended application in accordance with intended use and IP rating in accordance with IEC 60529, with a minimum rating of IPX4. Compliance is determined by the Ingress Protection Tests in Section 36.	Check ok by test.	P
14	Mounting		P
14.1	Components mounted on the eBike shall be subjected to the Vibration Test, Section 38.	Check ok by test.	P
15	Printed Wiring Boards		P
15.1	A printed-circuit board shall comply with the requirements in UL 796, and shall have a flammability rating as indicated in Section 17.		P
15.2	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 does not become displaced and cause a risk of electric shock or fire by a force that is capable of being exerted on it during assembly, intended operation, or servicing of the power supply.		P
16	Spacings and Separation of Circuits	The product only involve maximum working voltage of 54.6 Vdc, which is considered as non-hazardous voltage circuit, thus no spacings is required for the product.	N/A
16.1	Electrical circuits within the electrical system shall be provided with reliable physical spacing to prevent inadvertent short circuits (i. e., electrical spacings on printed wiring boards, physical securing of uninsulated leads and parts). Insulation suitable for the anticipated temperatures and voltages shall be used where spacings cannot be controlled by reliable physical separation.		N/A
16.2	Electrical spacings in circuits shall have the following minimum over surface and through air spacing as outlined in one of the following:		N/A



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	a) Table 16.1;		N/A
	b) The spacings requirements outlined in UL 60950- 1/CSA C22.2 No. 60950-1, in Clearances, Creepage Distances and Distances Through Insulation; or		N/A
	c) The spacing requirements outlined in UL 62368-1/CAN/CSA C22.2 No. 62368-1.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
16.3	As an alternative to the spacing requirements in 16.2, the spacing requirements in UL 840 and CSA C22.2 No. 0.2, may be used. For determination of clearances, the overvoltage category is considered Overvoltage Category II; and the pollution degree would be Pollution Degree 3 unless reduced by design in accordance with UL 840 and CSA C22.2 No. 0.2.		N/A
16.4	As an alternative to the clearance values outlined in UL 60950-1/CSA C22.2 No. 60950-1 in Clearances, Creepage Distances and Distances Through Insulation, the alternative method for determining minimum clearances in the Annex for Alternative Method for Determining Minimum Clearances, Annex G, of the UL 60950-1/CSA C22.2 No. 60950-1 may be applied.		N/A
16.5	There are no minimum spacings applicable to parts where insulating compound completely fills the casing of a component or subassembly, if the distance through the insulation at voltages above 60 Vdc or above 30 Vrms is a minimum of 0.4 mm (0.02 inch) thick for supplementary or reinforced insulation, and the eBike passes the Dielectric Strength Test, Section 30, and the Isolation Resistance Test, Section 29.		N/A
	There is no minimum insulation thickness requirement for insulation of circuits at or below 60 Vdc or for basic or functional insulation.		N/A
16.6	Conductors of circuits operating at different voltages shall be reliably separated from each other through the use of mechanical securements such as barriers or wire ties to maintain spacing requirements unless they are each provided with insulation acceptable for the highest voltage involved.		N/A
	An insulated conductor shall be reliably retained so that it cannot contact an uninsulated live part of a circuit operating at a different voltage.		N/A
17	Flammability		P



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17.1	Nonmetallic materials used for enclosures shall have a minimum flammability rating of V-1 in accordance with the requirements in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17.		P
	As an alternative, finished enclosures may be tested in accordance with the 20 mm end-product flame test in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17.		N/A
	Metallic materials used for enclosures are considered to comply without further evaluation.		P
17.2	Nonmetallic materials used for internal parts within the overall enclosure shall be rated V-2 minimum.		P

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Clause	Requirement + Test	Result - Remark	Verdict
17.3	Internal parts of components shall comply with the flammability requirements of the component standard in accordance with Components, Section 2.		P
17.4	Small parts, and gaskets, that are not located near live parts, and are located in a manner such that they cannot propagate flame from one area to another within the equipment, are not required to have a specific flame rating.		P
17.5	Nonmetallic materials located outside the enclosure, and not used to complete the enclosure, are considered decorative parts. These parts do not have a specified flame rating.		P
17.6	Printed wiring board materials used for circuits or components at hazardous voltage or hazardous energy levels shall be rated V-1 minimum.		P
17.7	For the requirements outlined in 17.2 – 17.6, the flammability rating of the material shall be provided as part of the material rating or the flammability rating may be determined in accordance with UL 94 and CAN/CSA C22.2 No. 0.17.		P
18	Internal Wiring and Terminals		P
18.1	Wiring shall be insulated and acceptable for the purpose, when considered with respect to temperature, voltage, and the conditions of service to which the wiring is likely to be subjected within the equipment.	Check ok by Temperature test.	P



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18.2	Wiring internal to an enclosure shall be routed, supported, clamped or secured in a manner that reduces the likelihood of excessive strain on wire and on terminal connections; loosening of terminal connections; and damage of conductor insulation.	Check ok.	P
	In safety critical circuits, for soldered terminations, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering alone to maintain the conductor in position.	Check ok: The conductor was also fixed by glue.	P
18.3	An external terminal shall be designed to prevent inadvertent shorting. An external terminal shall be designed to prevent inadvertent misalignment or disconnection when the eBike is in use.	Check ok.	P
18.4	An external terminal for charging shall be designed to prevent an inadvertent shorting and misalignment and a reverse polarity connection when connected to the charger.	Check ok.	P
18.5	Any other external terminals with hazardous voltage shall be designed to prevent access by the user.		N/A
	Any external terminals with hazardous energy level as determined in accordance with 8.2.2 shall not be bridged by a metallic object.		N/A
	Compliance is determined by use of the articulate probe shown in Figure 18.1.		N/A
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Clause	Requirement + Test	Result - Remark	Verdict
18.6	A hole by which insulated wires pass through a metal wall shall be provided with a smoothly rounded bushing or shall have smooth surfaces, free of burrs, fins, sharp edges, and the like, upon which the wires may bear, to prevent abrasion of the insulation.	Check ok.	P
18.7	Wiring for hazardous voltage on board the eBike shall be enclosed in junction boxes with hazardous voltage warning labels such as ISO 7010, No. W012 (i. e. lightning bolt within triangle), or shall be protected by suitable enclosures that are not accessible to the user.		N/A
18.8	Wires that are subjected to flexing during normal operation or due to user accessibility shall be subjected to the Flexing Test, Section 35.	Check ok by Flexing test.	P
19	Overcurrent Protection		P
19.1	Power, control and auxiliary circuits shall have overcurrent protection that is sized to prevent overheating of the smallest size conductor.		P



19.2	The need for overcurrent protection in the power circuit to motors, whether one protective device for each motor or one device for multiple motors, is to be determined on the basis of the locked rotor and running overload tests described in Section 32.	Overcurrent protection in the power circuit to motors was provided in control board and was check ok in locked rotor and running overload tests.	P
19.3	Overcurrent devices in the control and power circuit shall be physically located the shortest distance possible from the power supply or battery.		P
19.4	The need for overcurrent protection in the LVLE circuits is to be determined on the basis of the requirements described in Low-Voltage Limited Energy Circuit, 8.3.	No overcurrent protection in the LVLE circuits.	N/A
19.5	The overcurrent protective device specified in 19.4 shall be a circuit breaker, fuse or positive temperature coefficient device.		N/A
19.6	A fuse or circuit breaker shall be either:	No fuse or circuit breaker (except for BMS in battery pack).	N/A
	a) Acceptable for branch circuit use; or		N/A
	b) A supplementary type.		N/A
19.7	A positive temperature coefficient device shall comply with Manufacturing Deviation and Drift; Endurance; and Requirements for Controls Using Thermistors, in UL 60730-1/CSA C22.2 E60730-1.	No positive temperature coefficient device.	N/A
	The positive temperature coefficient device shall be tested and determined to comply in the actual battery configuration and environment.		N/A
19.8	Fuses shall be acceptable for the current and voltage of the circuit they are protecting and shall comply with 19.9 and 19.10.		N/A
	Fuses shall be tested and determined to comply in the actual battery configuration and environment.		N/A
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Clause	Requirement + Test	Result - Remark	Verdict

19.9	Fuses provided for protection of circuits or outputs shall comply with CSA C22.2 No.248.1/UL 248-1 and the applicable parts of the series.		N/A
	Fuseholders used with these fuses shall comply with CSA C22.2 No. 4248.1/UL 4248-1 and the applicable parts of the series.	No Fuse holder.	N/A
19.10	For user replaceable fuses, a fuse replacement marking in accordance with 44.3 shall be located adjacent to each fuse or fuse holder, or on the fuse holder, or in another location provided that it is obvious to which fuse the marking applies.	No replaceable fuses.	N/A
	Where user replaceable fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated.		N/A



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	Information on proper fuse replacement of user replaceable fuses shall also be included in the instructions. See Section 47.		N/A
20	Motors and Motor Controllers		P
20.1	A traction motor used in a eBike shall not be hazardous under locked rotor and overload conditions. Compliance is determined by the tests of this standard unless previously evaluated as part of a motor and motor protector combination evaluation.	Check ok by locked rotor and running overload test.	P
20.2	Motors shall be capable of carrying the maximum normal anticipated load without exceeding temperatures on insulation and windings as determined during the temperature test.	Check ok by Temperature test.	P
20.3	Motors located in hazardous voltage circuits shall comply with the requirements of UL 1004-1 and CSA-C22.2 No. 100.		N/A
	Motors located in low voltage circuits shall comply with either UL 1004-1 or CSAC22.2 No. 100 or the requirements of this Standard.	Comply with the requirements of this Standard.	P
20.4	Sensors and controls associated with the motor control, either as a stand-alone component or system, provided to perform a safety function shall comply with the applicable requirements in the appropriate controls standard in accordance with 2.1.		P
	For eBikes and EPACs provided with a startup assistance function, the control for providing startup assistance shall require a voluntary and continuous action by the user to allow startup assistance, such as the use of a dead man switch.	No startup assistance function	N/A
20.5	In addition to the testing associated with the control of the motors in this Standard, hazards associated with the motor control shall be included in the analysis required in Safety Circuits and Safety Analysis, Section 12.	According to the manufacturer's request, the Section 12 was not evaluated.	N/A
21	Operator Interface		P
21.1	The operator interface shall be constructed such that the user will not have access to hazardous parts.	Check ok.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	If hazardous parts exist in the operator interface, then the operator interface shall comply with the requirements for enclosing hazardous parts in Section 13. Also, the interface shall comply with 21.2.	No hazardous parts exist in the operator interface.	N/A



21.2	An operator interface with internal battery circuits and/or a touchscreen with high voltage backlights shall be evaluated as Limited Current Circuits in accordance with UL 60950-1/CSA C22.2 60950-1 or UL 62368-1/CSA C22.2 No. 62368-1.		N/A
22	Grounding and Bonding	The product only involve maximum working voltage of 54.6 Vdc, which is considered as non-hazardous voltage circuit, thus no grounded system requirement was need for the product.	N/A
22.1	General		N/A
22.1.1	For eBikes that are using a grounded system of protection to mitigate hazards associated with electric shock or electrical energy while charging, a means of extending the ground to the eBike through a bonding conductor shall be provided.		N/A
22.1.2	The requirement in 22.1.1 applies for both on board chargers and off board chargers.		N/A
22.2	Bonding connections		N/A
22.2.1	For grounded systems, there shall be provision for bonding all dead metal parts of an eBike to the main ground connection. This requirement applies to all dead metal parts that are exposed or that possess a risk of being contacted by a person during intended operation or adjustment and that are capable of becoming energized as a result of electrical malfunction.		N/A
22.2.2	The bonding shall be by a positive means, such as by clamps, rivets, bolted or screwed connections, or by welding, soldering, or brazing with materials having a softening or melting point greater than 455° C (850° F).		N/A
	Bonding around a resilient mount shall not depend on the clamping action of rubber or similar material.		N/A
22.2.3	An equipment-bonding terminal, or lead-bonding point, shall be connected to the frame or enclosure by a positive means, such as by a bolted or screwed connection.		N/A
	To reduce the risk of inadvertent loosening, the head of the screw or bolt shall not be accessible from outside of the enclosure.		N/A
22.2.4	An equipment-bonding connection shall penetrate a nonconductive coating, such as paint or vitreous enamel.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
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22.2.5	An equipment-bonding point shall be located so that the risk of inadvertently removing the bonding means during		N/A
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	servicing is reduced.		
22.2.6	An equipment-bonding lead shall be the same size as the grounding lead associated with the AC power source.		N/A
	The surface of the insulation shall be green.		N/A
22.2.7	For eBikes that are connected to NEMA 5-20R receptacles directly, the equipment-grounding conductor of a power-supply cord shall be connected to dead metal parts within the frame or enclosure by means of a screw, or stud and nut combination, or other equivalent means, not to be removed during ordinary servicing not involving the power-supply cord.		N/A
	The surface of any insulation on the grounding conductor shall be green with or without one or more yellow stripes and no other conductor shall be so identified.		N/A
	This connection can be part of a non-detachable cord that is part of the eBike, or in the case of detachable cords, from the ground blade on the eBike side connector.		N/A
22.2.8	An equipment-grounding conductor or equipment-bonding conductor shall not be spliced, nor shall it involve a trace on a printed wiring board.		N/A
22.2.9	A soldering lug, a connection means that depends on solder only, a screwless (push-in) connector, a quick-connect, or other friction-fit connector shall not be used for equipment-grounding or equipment-bonding.		N/A
22.2.10	The equipment-grounding terminal or equipment-bonding terminal shall be capable of securing a conductor of a size intended for the application.		N/A
22.2.11	A terminal intended for the connection of an equipment-bonding conductor shall be identified by:		N/A
	a) Being marked "G", "GR", "GND", "Ground", "Grounding", or the like; or		N/A
	b) The grounding symbol illustrated in Figure 22.1 on or adjacent to the terminal or on a wiring diagram provided on the product.		N/A
	<p style="text-align: center;"><small>Figure 22.1 Symbol for equipment bonding connection</small></p>		
23	Chargers		P
23.1	The charger used to recharge the battery shall comply with one of the following:		P
	a) UL 1012, and CSA C22.2 No. 107.1;		N/A
	b) UL 1310 and CSA C22.2 No. 223;	Charger UL File No. E505003	P



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	c) UL 60950-1/CSA C22.2 No. 60950-1, along with the relevant Part 2 Standard as applicable; or		N/A
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Clause	Requirement + Test	Result - Remark	Verdict
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	d) UL 62368-1/CSA C22.2 No. 62368-1.		N/A
23.2	For chargers that comply with 23.1 (b), no hazard exists at the output of the charger and requirements to mitigate a shock hazard or an energy hazard maybe reduced as described in 8.3. Personnel protection in accordance with Section 10 is not required.		N/A
23.3	Chargers that comply with 23.1 (a), (c), or (d) are not necessarily limited at the output and the requirements for hazard mitigation for electrical systems connected to the output of the charger apply. Personnel protection in accordance with Section 10 shall be provided.		P
23.4	Chargers for lithium-ion battery systems shall have voltage, current, and temperature monitoring of the cells in the battery pack.		P
	This monitoring may be part of the battery management system integral to the battery pack. In this case, compliance with Section 11 is sufficient.		P
	If the monitoring is part of circuits or components located outside the battery pack, then those circuits or components shall be evaluated as part of the overall battery management system and shall be subjected to the risk assessment of Section 12.		N/A
24	Electrical Cables and Connectors Between the eBike and the Equipment		P
24.1	Cables that are used to connect the off board equipment to the eBike shall be permanently connected to the charger or connected to the charger with a connector that complies with 24.2.	The charge connector was complies with 24.2.	P
	The cable shall comply with UL 62/CSA C22.2 No. 49, and shall be suitably rated for the voltage and temperature it will be subjected to in the end use application and shall be sufficiently sized to conduct the anticipated current.		P
24.2	Connectors used to connect the off board equipment to the eBike or EPAC shall comply with UL 2251/CSA C22.2 No. 282, or UL 1977 and CSA C22.2 No. 182.3.		P
	The connectors shall be suitably rated for the application.		P



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25	Supply Connections		N/A
25.1	For all equipment located off board the eBike and transferring power to the eBike, the connection to the supply source will be in accordance with the applicable standard for that equipment. See Chargers, Section 23.		N/A
	PERFORMANCE		
26	General		P
27	Input Test		P
28	Temperature Test		P
29	Isolation Resistance Test		N/A
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Clause	Requirement + Test	Result - Remark	Verdict

30	Dielectric Strength Test		N/A
31	Humidity Conditioning		N/A
32	Abnormal Operations Tests		P
32.1	General		P
32.2	Overcharging test		N/A
32.3	Component fault tests		P
32.4	Forced ventilation/blocked ventilation		N/A
32.5	Locked rotor motor test		P
32.6	Running overload test		P
32.7	Short circuit test		P
32.8	Imbalanced charging test		N/A
32.9	Shock test		P
32.10	Thermal cycling		P
33	Impact Test		P
34	Mold Stress		P
35	Flexing Test		P
36	Ingress Protection Tests		P
37	Permanence of Marking		P
38	Vibration Test		P
38.1	Complete device		P
38.2	Batteries/battery packs		P
39	Strain Relief		P
39.1	General		P



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39.2	Strain relief – pull test		P
39.3	Strain relief – push back test		P
40	Startup Assistance Mode Test		N/A
41	Motor Assistance Control		P
41.1	General		P
41.2	Reverse Pedaling Test		N/A
41.3	Pedal Cessation Test for EPACs		N/A
41.4	Cutoff When Braking Test		P
41.5	Cutoff at Maximum Speed Test		P
	MARKING		P
42	General		P
43	Nameplate and Identification		P
43.1	Products shall be marked with the manufacturer's name, trade name, trademark or other descriptive marking which may identify the organization responsible for the product,		P
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Clause	Requirement + Test	Result - Remark	Verdict

	part number or model number, and		P
	electrical ratings.		P
43.2	date of manufacture.		P
43.3	Products that are provided with a battery pack that has its battery management system residing in components or circuits outside the battery pack shall be marked with the charger that is specified for use.		N/A
43.4	All external terminals and connections intended to be made in the field, including the battery terminals if the battery pack is not keyed, shall be provided with identification and if applicable, polarity markings.		P
43.5	Factory code (manufacturer produces or assembles vehicle systems at more than one factory location)		N/A
44	Cautionary Markings		P
44.1	Letter height.		P
44.2	Location of caution markings.		P
44.3	Fuse replacement marking.		N/A
	INSTRUCTIONS		P
45	General		P
46	Instructions Pertaining to a Risk of Fire or Electric Shock		P
47	Installation Instructions		P



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48	Operating Instructions		P
49	User Maintenance Instructions		P
50	Moving and Storage Instructions		P
27	Table: Input Test		P
	Condition	Rated Current (A)	Measured Current (A)
	With LED operated	2.0	1.99

28	TABLE: Temperature Test					P
Temperature Locations	Chamber or Ambient Temp, °C	Mfg's Max Recommended Ambient, °C	Maximum Recorded Temp, °C	Calculated Temp* °C	Maximum Temp Limits, °C	
Left Handle	25	60	25.5	60.5	75	
Knob			25.3	60.3	75	
Operating button on Dashboard			25.3	60.4	85	
Cover of Dashboard			26.4	61.7	95	
Right handbrake			24.7	59.4	60	
Saddle			25.2	60.0	75	
Cover of headlamp			37.6	72.2	95	
PWB near Motor MOEFET of control board			58.9	93.6	130	
PWB near main IC of control board			32.4	67.5	130	
Input wiring of control board			35.5	70.2	80	
Motor power wiring			34.6	69.9	80	
Motor connector			33.2	68.3	80	
Motor winding 1			65.6	100.3	105	
Motor winding 2			67.1	102.0	105	
Insulating sheet in Motor			64.3	99.1	105	
Motor PWB	65.0	99.8	105			

32.2	TABLE: Overcharge Test				N/A
Fault Condition	Max Measured Temp on battery, °C	Max overall Measured Voltage, Vdc	Max cell voltage measured, Vdc	Protection Tripped, Y or N?	Results

Results:

- A – no fire, no explosion, no leakage, no rupture, and insulation remained intact if applicable
- B- Operational after test
- C – evidence of fire and/or explosion
- D – evidence of rupture
- E – evidence of external leakage
- F – evidence of insulation breakdown (electric shock hazard)
- G – Other (explain)



32.3 TABLE: Component Fault Test				P
Component No.	Fault type	Result	Code	
Motor Current Sensing Resistor on control board	Short circuit	A	A,D	
MOSFET for Motor Current Control on control board	Short circuit	A	A,D	

Result:
 A- No Burning, glowing, or charring of the tissue paper or cheesecloth
 B- Burning, glowing, or charring of the tissue paper or cheesecloth

Code:
 A- A component opens and renders the product inoperative.
 B- The branch circuit overcurrent protection opens.
 C- Internal fuse(s) open.
 D- Monitored temperatures achieve thermal stabilization.
 E- Other: _____

32.5 TABLE: Locked Rotor Motor Test					P
Test in E-bike or on Bench	Location of Thermocouples	Maximum Temperature on Windings, °C	Protective Circuit Bypassed?	Ignition of combustibles? Y or N	
on Bench	Windings	55.3	Normal	N	
on Bench	Windings	272.6	Bypassed	N	

32.6 TABLE: Running Overload Test					P
Test in E-bike or on Bench	Location of Thermocouples	Maximum Temperature on Windings, °C	Protective Circuit Bypassed?	Ignition of combustibles? Y or N	
on Bench	Windings	103.7	Normal	N	
on Bench	Windings	254.1	Bypassed	N	

32.7 TABLE: Short Circuit Test							N/A
Short Circuit	Short Location	Fault Condition	Max Measured Temp on battery, °C	Measured Ext. Resistance, mΩ	Protection Tripped, Y or N?	Results	
First (20 mΩ)							
				Meas. Current, A			
90% trip current							

Results:
 A – no fire, no explosion, no leakage, no rupture, and insulation remained intact if applicable
 B – Operational after test
 C – evidence of fire and/or explosion



D – evidence of rupture
 E – evidence of external leakage
 F – evidence of insulation breakdown (electric shock hazard)
 G – Other (explain)

Short Location:
 A– Battery pack output terminals
 B– Personal e-mobility device inputs
 C– Personal e-mobility device outputs if applicable

32.8	TABLE: Imbalanced Charging			N/A
Fault Condition	Imbalanced cell Voltage at Start, Vdc	Max Measured imbalanced cell Voltage, Vdc	Max Measured Temp on battery, °C	Results

Results:
 A – no fire, no explosion, no leakage, no rupture, and insulation remained intact if applicable
 B – Operational after test
 C – evidence of fire and/or explosion
 D – evidence of rupture
 E – evidence of external leakage
 F – evidence of insulation breakdown (electric shock hazard)
 G – Other (explain)

40	Table: Start Up Assistance Mode Test		N/A
Condition	The speed measured (km/h)	Results	

Results
 A– the maximum speed did not exceed 6km/h (~3.6 mph)
 B–the maximum speed did exceed 6km/h (~3.6 mph)

41.2	Table: Reverse Pedaling Test		P
No Load Current Point (A)	Maximum current pedaling in reverse (A)	Results	
0.02	0.02	A	

Results
 A–The motor current when pedaling in reverse did not exceed the no-load current point.
 B–The motor current when pedaling in reverse did exceed the no-load current point.

41.3	Table: Pedal Cessation Test For EPAC'S		N/A
No Load Current Point (A)	Maximum distance traveled (m)	Results	

Results
 A–The motor current was not greater than the no-load current point within 2 meters of travel distance once pedaling stopped.
 B–The motor current was greater than the no-load current point within 2 meters of travel distance once pedaling stopped.

41.4	Table: Cutoff When Breaking Test		P
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No Load Current Point (A))	Current when The E-bike was pedaled to achieve the test speed (A)	Current when the brake was activated (A))	Results
0.02	8.8	0.01	B

Results
 A–The motor current did not decrease when the brake was activated.
 B–The motor current did decrease when the brake was activated.

41.5 **Table: Cutoff At Maximum Speed Test** P

No Load Current Point (A))	Current before the maximum marked speed was reached (A)	Current when the maximum marked speed was reached (A)	Results
0.02	14.6	0.01	B

Results
 A–The motor current did not decrease when the maximum marked speed was reached
 B–The motor current did decrease when the maximum marked speed was reached

Enclosure

Supplement ID	Description
01 to 03	Overall view of E-bike
04	Overall view of Battery pack
05	Overall view of Charger
06	Overall view of Control board
07	Internal view of Control board
08	Overall view of Motor
09	Internal view of Motor
10	Overall dimension of E-bike
11	Overall dimension of Battery pack
12	Overall dimension of Motor
13	Schematic of Control board
14	PCB Layout of Control board
15	Specification of E-bike
16	Specification of Battery pack

ID 15

Specification of E-bike			
Charger:		Personal e-mobility device:	
Model No.	LBC030546020	Model No.	E-DART-500W
Manufacturer	SHENZHEN ATNEN TECHNOLOGY CO LTD	Electrical Ratings (volts, current and/or power)	48V 500W



Input Voltage Rating	100~240Vac 50~60Hz	Weight of device, kg (lbs)	23.55Kg
Output Voltage Rating:	54.6V dc	Max Weight Limit, kg (lbs)	150Kg
Input Current Rating	2.2A(MAX)	Max Speed, km/h (mph)	45km/h
Output Current Rating	2.0A	IP rating	IPX4
MOTORS:		Specified operating ambient range, C	-20~60°C
Motor model	M110 02C.D	Specified charging ambient range, C	0~45°C
Insulation Class	Class A		
Specified Voltage	48V		
Specified Current/Wattage	13A, 650W		

ID 16

Specification of Battery pack			
COMPONENT CELL:		Battery pack:	
Manufacturer	EVE Energy CO., Ltd	Manufacturer	Bafang New Energy (Suzhou) Co., LTD
Model	EVE- INR18650/33V	Model	BT F290.D633
Type	NA	Configuration:XP/YS	13S4P
Capacity	3.2Ah	Capacity	13.2Ah
Standard Charging Current	1.55A	Standard Charging Current	2A
Standard Full Charging Voltage	4.2V	Standard Full Charging Voltage	54.6v
End of Charging Current	50mA	End of Charging Current	200mA
Maximum Charging Current	3.1A	Maximum Charging Current	3A
Upper Charging Voltage Limit	4.25V	Maximum Charging Voltage	54.6v
Standard Discharging Current	0.62A	Standard Discharging Current	8A
Discharge End Point Voltage	2.5A	Discharge End Point Voltage	35V



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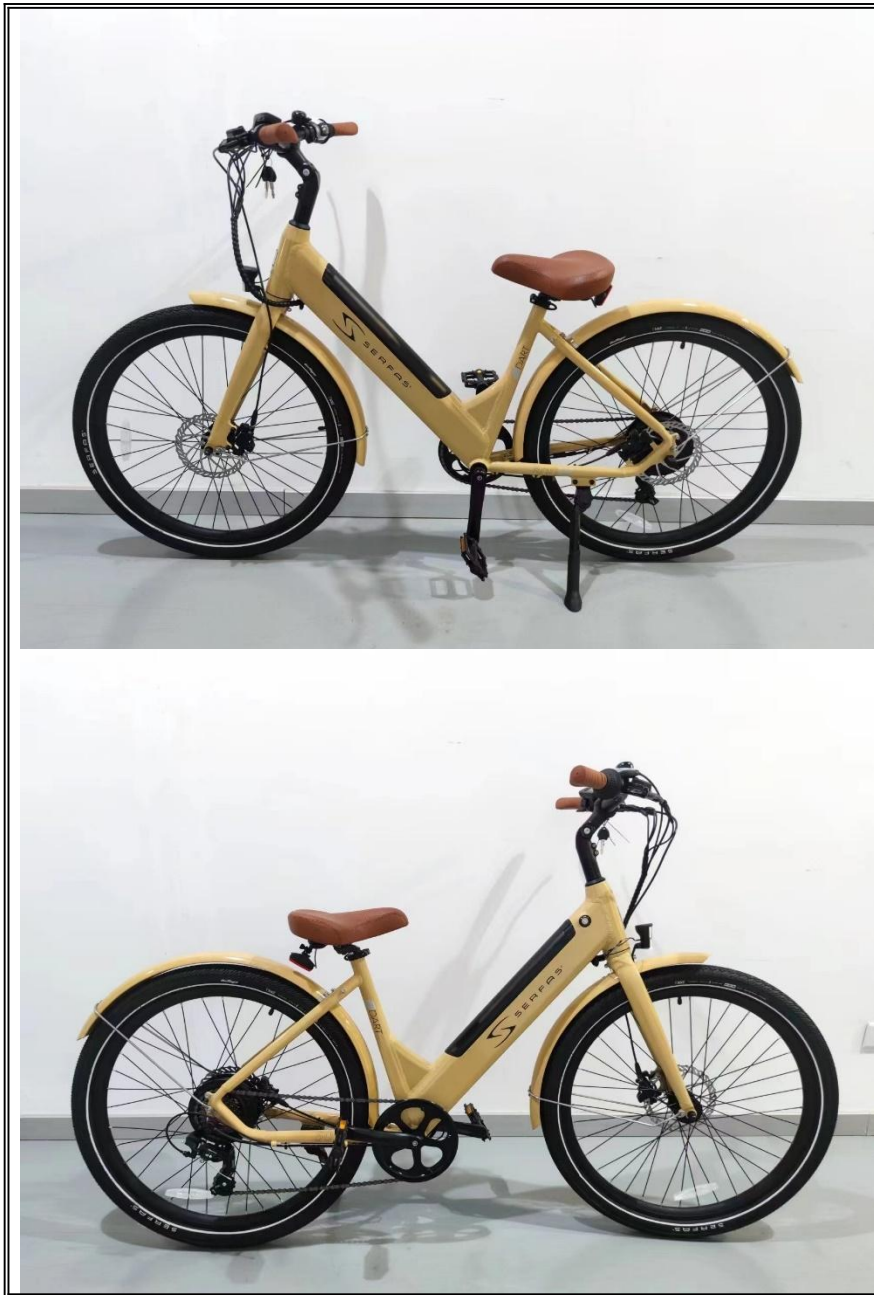
Maximum Discharge Current	10A	Maximum Discharge Current	30A
Charging Temperature Range	0~45°C	Charging Temperature Range	0~45°C
Discharging Temperature Range	-20~60°C	Discharging Temperature Range	-20~60°C
Cell surface temperature limit	80		



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SAMPLE REFERENCE PHOTO:





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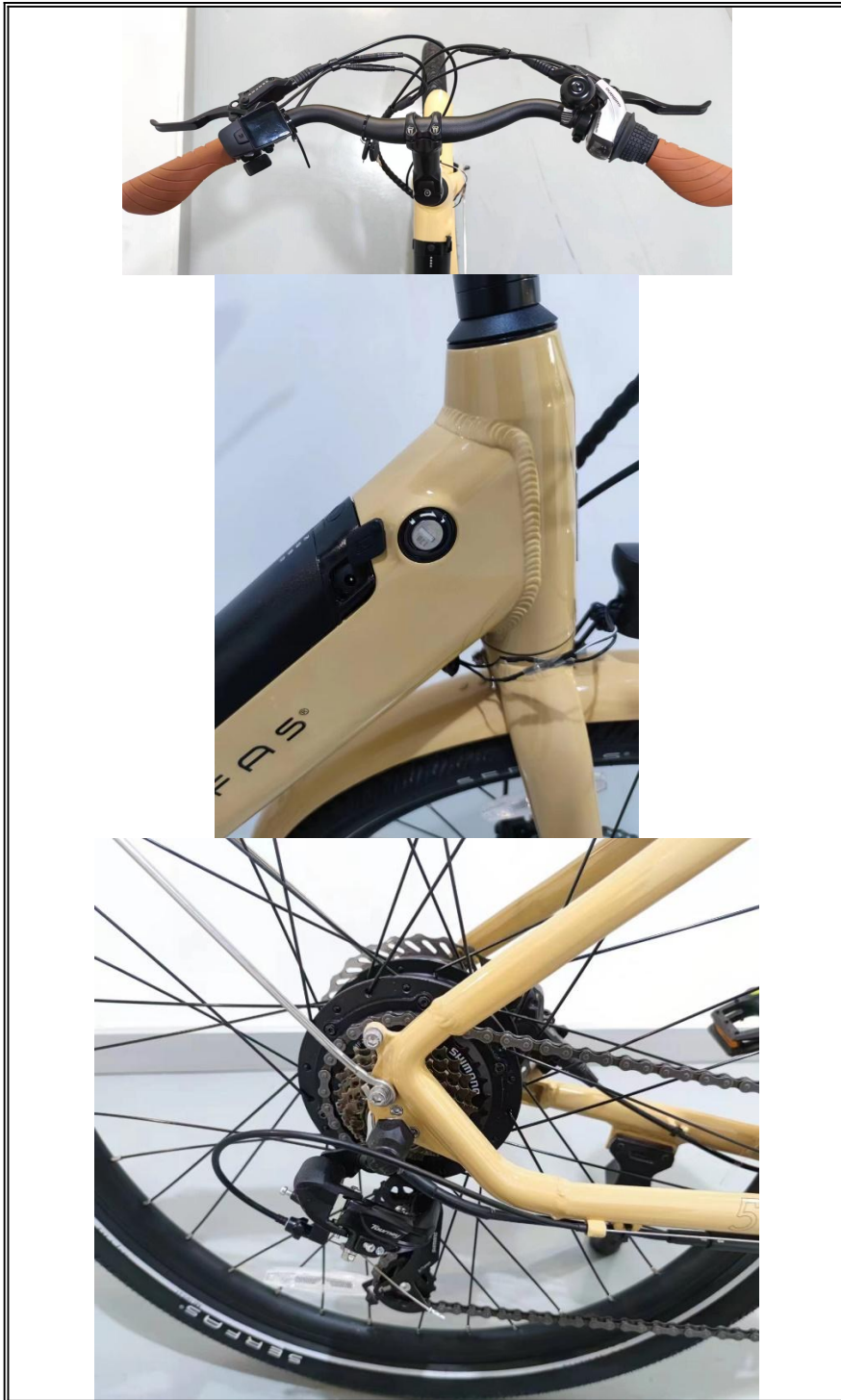
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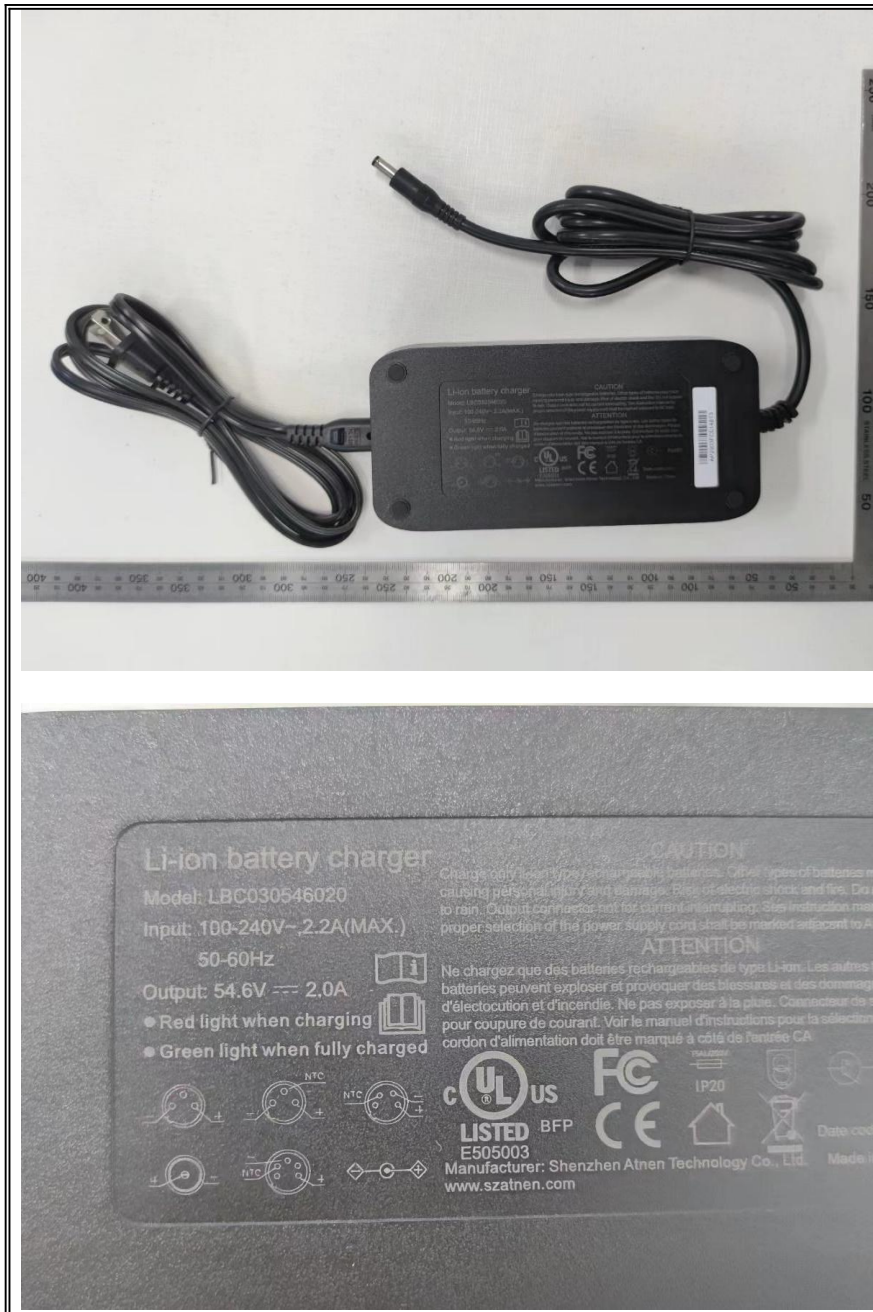
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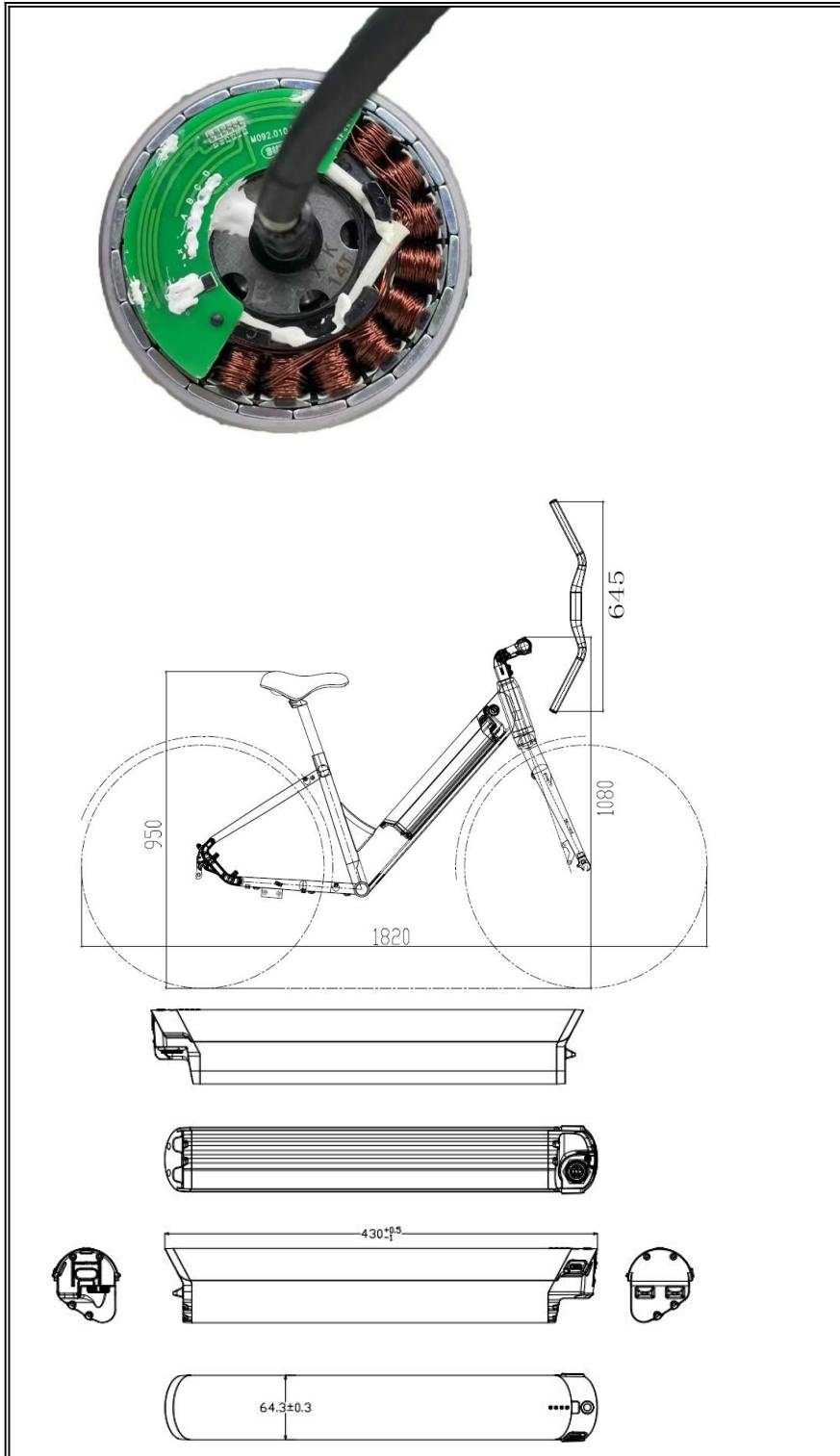
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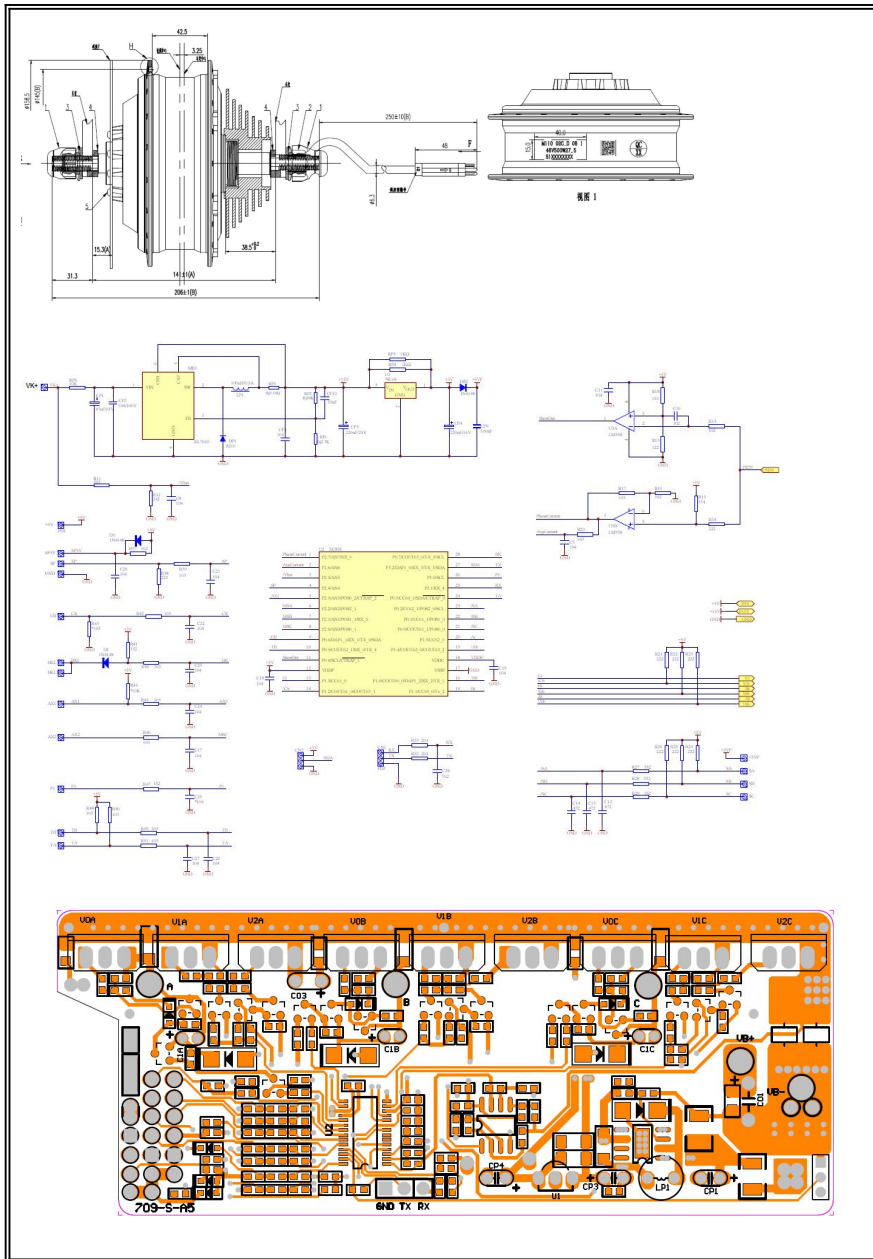
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