**Produkte**
*Products*

| | | | |
|---|---|---|---|
| **Prüfbericht - Nr.:**<br>*Test Report No.:* | **CN2482CL 001** | | **Seite 1 von 45**<br>*Page 1 of 45* |
| **Auftraggeber:**<br>*Client:* | **SWFT Emobility LLC**<br>2 Skyline Drive Hawthorne, NY 10532 USA | | |
| **Gegenstand der Prüfung:**<br>*Test item:* | **Electric Bike** | | |
| **Bezeichnung:**<br>*Identification:* | **See model list** | **Serien-Nr.:**<br>*Serial No.:* | Engineering samples |
| **Wareneingangs-Nr.:**<br>*Receipt No.:* | 170371696 | **Eingangsdatum:**<br>*Date of receipt:* | 2024-02-28 |
| **Zustand des Prüfgegenstandes bei Anlieferung:**<br>**Condition of test item at delivery:** | | Good for testing and checking | |
| **Prüfort:**<br>*Testing location:* | **TÜV Rheinland (GuangDong) Co., Ltd.**<br>No.199 Kezhu Road, GZ Science City, Guangzhou 510663, P.R. China | | |
| **Prüfgrundlage:**<br>*Test specification:* | **ANSI/CAN/UL 2849:2022** | | |
| **Prüfergebnis:**<br>*Test Result:* | **Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).**<br>*The test item passed the test specification(s).* | | |
| **Prüflaboratorium:**<br>*Testing Laboratory:* | **TÜV Rheinland (Shenzhen) Co., Ltd.**<br>1F East & 2-4F, Cybio Technology Building, No. 1, No. 16 Keijibei 2nd Road.<br>High Tech Industrial Park North, Nanshan District, 518057, Shenzhen, China | | |

| **Geprüft/** *Tested by:* | | | **Kontrolliert/** *Reviewed by:* | | |
|---|---|---|---|---|---|
| Jam chen | | | Sailing Li | | |
| 2024-04-1 | Jam Chen / PE | | 2024-04-01 | Sailing Li / TC | |
| **Datum**<br>*Date* | **Name**<br>*Name* | **Unterschrift**<br>*Signature* | **Datum**<br>*Date* | **Name**<br>*Name* | **Unterschrift**<br>*Signature* |

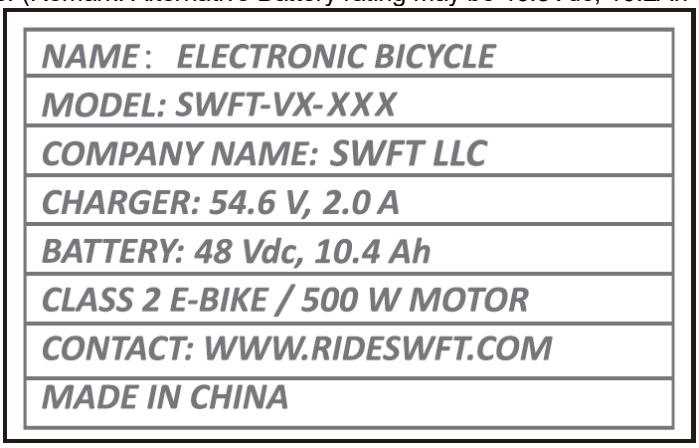
**Sonstiges/** Other Aspects:
This file is issued for test report, including 2 attachments: Attachment 1: Photo document (12 pages); Attachment 2: CDF (3 pages).

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Abkürzungen:*** | ***P(ass)*** | ***=*** | ***entspricht Prüfgrundlage*** | ***Abbreviations:*** | ***P(ass)*** | ***=*** | ***passed*** |
| | ***F(ail)*** | ***=*** | ***entspricht nicht Prüfgrundlage*** | | ***F(ail)*** | ***=*** | ***failed*** |
| | ***N/A*** | ***=*** | ***nicht anwendbar*** | | ***N/A*** | ***=*** | ***not applicable*** |
| | ***N/T*** | ***=*** | ***nicht getestet*** | | ***N/T*** | ***=*** | ***not tested*** |

| TEST REPORT<br>UL 2849:2022<br>Electrical Systems for eBikes | |
|---|---|
| **Report Reference No** ... ..... : | See cover page |
| Tested by<br>(printed name and signature) ..... : | See cover page |
| Approved by<br>(printed name and signature) ..... : | See cover page |
| Date of issue ..... : | See cover page |
| **Testing Laboratory Name** ..... : | See cover page |
| Address ..... : | See cover page |
| Testing location ..... : | See cover page |
| Address ..... : | See cover page |
| **Applicant's Name** ..... : | See cover page |
| Address ..... : | See cover page |
| **Test specification** | |
| Standard..... : | See cover page |
| Test procedure ..... : | Test report |
| Non-standard test method ..... : | N/A |
| **Test Report Form No**. ..... : | N/A |
| TRF originator ..... : | TUV Rheinland (Shenzhen) Co., Ltd. |
| Master TRF ..... : | Dated May 2018 |
| **Test item description** ..... : | **Electric Bike** |
| Trademark ..... : | SWFT |
| Manufacturer ..... : | **SWFT Emobility LLC**<br>2 Skyline Drive Hawthorne, NY 10532 USA |
| Factory ..... : | **GUANGZHOU LEONIS MACHINERY CO.,LTD**<br>WEST DONGFENG AVENUE,GANGKOU INDUSTRY PARK,XINHUA TOWN HUADU DISTRICT,GUANGZHOU CITY,CHINA |

**Copy of marking plate:**

Nameplate: (Remark: Alternative Battery rating may be 46.8Vdc, 10.2Ah or 10.4Ah)




Brand: SWFT printed at eBike body

Manufacture date code: YYMM means year and month, included in serial number.


Remark:
1. For models: SWFT-VX-XXX (XXX can be letters A to Z indicate appearance color).
2. Optional rating and model name, refer to the Electrical Rating.

**Copy of Safety Instructions:**

# SAFETY INSTRUCTIONS

Motorized e-bikes are new to most riders so in the interest of safe cycling make sure you read, understand, and follow the instructions in this manual.

This manual contains important safety, signal words such as **DANGER**, **WARNING, CAUTION, IMPORTANT**, and **NOTE** or **NOTICE**. These are important signal words telling you to pay special attention to that text as rider safety is involved.

**This symbol will appear in areas of critical rider safety.**
Pay special attention to the words **DANGER** and **WARNING** as failure to do so can result in serious injury or death to the rider or others.

**CAUTION** notes will indicate instructions that need to be followed to prevent injury, mechanical failure, or damage to the e-bike. They also indicate a hazardous situation, which, if not avoided, can cause minor or moderate injury.

**NOTE** or **NOTICE** or **IMPORTANT** specify special interest notes. Pay close attention to these as your safety and that of your e-bike is involved.

**IMPORTANT:** Read the **BEFORE RIDING** section and check that all parts are working as stated in the manual. If you understand how the e-bike operates, you will ensure the vehicle's best performance. When you read this manual, compare the illustrations to your e-bike. Learn the location of all controls and parts and their functions. **KEEP THIS MANUAL FOR FUTURE REFERENCE.**

**CAUTION:** Before you ride the e-bike, check the brakes and other parts of the bike. Make sure all parts are assembled correctly, securely tightened, and working properly. Take your first ride in a large, open, level area away from traffic.

**DO NOT RIDE YOUR E-BIKE WITHOUT FIRST SECURING AND FASTENING ALL HARDWARE CORRECTLY.**

Make sure you read this complete manual before riding your e-bike. Failure to do so, or failure to follow its guidelines could lead to serious injury or death.

Brake pads and rotors get very hot during use and could burn skin. The edges can also be very sharp and cut skin. Do not touch the brake pads or rotors directly after riding your e-bike.

Proper use of your brake is vital to ensure safe, efficient stopping. To avoid misuse and potential injury, do not apply sudden or excessive force to your brakes. Apply your brakes gradually and give yourself enough room to come to a complete stop safely.

Different localities and countries have different laws governing riding on public roads, and you should check with local officials to ensure you are

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complying with these laws

Brakes do not work as well under wet conditions as they do when dry, It is recommended that you do not ride your e-bike in wet weather, as there are electronic components of your e-bike that may be damaged if exposed to water.

Wet conditions will require a longer distance to stop. Brake earlier and avoid sudden stops when riding in wet conditions.

When you ride in low-visibility conditions such as fog, dusk, or at night, vision could be impaired, which could lead to a collision. Wear bright reflective clothing when riding in poor lighting conditions and use lights.

**WARNING**
There may be additional risk to injury if you use your e-bike incorrectly. This includes, but is not limited to:

- Riding e-bike over debris or obstacles
- Performing stunts
- Riding on off-road terrain
- Riding fast
- Racing other riders
- Riding in an unusual manner

The aforementioned examples add stress to each part of your e-bike and can lead to long term damage of the e-bike. Damage to your e-bike can lead to an accident or increase your risk of injury. To decrease your risk of injury, operate your e-bike correctly.

**IMPORTANT**
Do not ride the e-bike without the battery pack. The battery pack must be on the e-bike while riding or else the motor and safety lights will not function when needed.

Check to see that your wheels are securely fastened and that your helmet is securely fastened.

Protect the battery docking connector. When the battery pack is removed, apply a protective cover to prevent corrosion and damage to the connector.

Remove the battery pack from the e-bike and store it elsewhere in the vehicle during your transport.

Always respect local transportation laws when riding your e-bike.

Lithium battery packs of this size and power are considered "Dangerous Goods, Class 9." When transporting, regulations may restrict the transport of separate lithium batteries in some places.

**WARNING!**
Tampering or modifying the electric circuit system may case a shock, fire or explosion and permanently damage the system. Exposed wiring and circuitry in the charger may cause electric shock. Always keep the charger housing closed.

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## Copy of Safety Instructions:

**WARNING!**
**SEEK *IMMEDIATE* MEDICAL ATTENTION IF YOU ARE EXPOSED TO ANY SUBSTANCE THAT IS EMITTED FROM THE BATTERY PACK.**

This equipment is not intended to be used at ambient temperatures less than -20°C (-4°F) or above ambient temperatures of 50°C (122°F)."

The battery is intended to be charged when the ambient temperature is between 0°C (32°F) and 25°C (77°F)

**SAFETY PRECAUTIONS**
• To reduce the rish of injury, close supprvision is necessary when the product is used near children.
• If the e-bike is not to be used for an extended period of time, you may need to recharge the battery every 1 month to maintain the battery life.
• Ensure that the screws on the front and back tires are locked firmly before each ride.
• Check to ensure the tires are not worn..
• Check to ensure all connections are maintained on your e-bike.
• Ensure the brake cables are well lubricated. It is suggested you lubricate brakes every 6 months
• Ensure all gears move smoothly.
• Make sure there are no frayed cables, loose connections, missing fasteners or axle/lug nuts.
• For your safety, always wear a helmet that meets CPSC or CE safety standards. In the event of an accident, a helmet can protect you from serious injury and in some cases, even death.
• Obey all local traffic laws. Obey red and green lights, one-way streets, stop signs, pedestrian crosswalks, etc..
• Ride with the traffic, not against it.
• A crash can put extraordinary stress on your e-bike's components, possibly causing them to fail prematurely. Components suffering from stress fatigue can fail suddenly, causing loss of control, or serious injury.

**CARE & MAINTENANCE**
• Do not expose the e-bike to liquid, moisture, or humidity to avoid damage to the electrical system.
• Do not use abrasive cleaning solvents to clean the e-bike.
• Do not expose the e-bike to extremely high or low temperatures as this will shorten the life of the electrical system, destroy the battery, and/or distort certain plastic parts.
• Do not dispose of the e-bike in a fire as it may explode or combust.
• Do not expose the e-bike to contact with sharp objects as this will cause scratches and damage.
• Do not let the e-bike fall from high places, as doing so may damage the internal circuitry.
• Do not attempt to disassemble the e-bike.
• Use only the specified charger provided.
• Ensure the e-bike chain is well lubricated for optimal performance.
• To minimize tire wear and for maximum riding safety, comfort and handling, maintain recommended tire air pressure which can be found on the side wall of all tires. Use a reliable tire air pressure gauge to check for proper inflation before every ride. At the same time, inspect tires for excessive wear and cracks. Replace tires if necessary.

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# PREFACE

**Congratulations on the purchase of your new e-bike! With proper assembly and maintenance it will offer you years of enjoyable riding!**

**IMPORTANT:** Carefully read and follow this manual (and any other materials included with this bike) before riding. Please retain this manual for future use. If this bike was purchased for a child, it is the responsibility of the purchaser to verify the bike has been properly assembled, and that the user has been properly trained and instructed in use of the bike. This manual is provided to assist you and is not intended to be a comprehensive manual covering all aspects of maintaining and repairing your bicycle. The bicycle you have purchased is a complex piece of equipment that must be properly assembled and maintained in order to be ridden safely.

**If you have any doubts about the assembly or your ability to properly assemble and maintain the bicycle. You must have it assembled and maintained by a professional bicycle mechanic.**

**WARNING: E-bikes are fun to ride but can be dangerous to use. The user or consumer assumes all risk of personal injuries, damage, or failure of the bicycle or system and all other losses or damages to themselves and others and to any property arising as a result of using the bicycle.**

**WARNING**

**DO NOT DISASSEMBLE, MODIFY OR REPLACE ELECTRICAL PARTS.**
**If you need to change any parts, please consult a professional bicycle mechanical or contact customer service for additional help.**

**NOTE: YOUR INSURANCE POLICIES MAY NOT PROVIDE COVERAGE FOR ACCIDENTS INVOLVING THE USE OF THIS BICYCLE. TO DETERMINE IF COVERAGE IS PROVIDED YOU SHOULD CONTACT YOUR INSURANCE COMPANY OR AGENT.**

**DANGER:** Failure to properly assemble and maintain your bicycle could result in serious injury or death to the rider.

**This manual contains important safety, performance and service information.** The purpose of this manual is to help you use your e-bike safely in the manner intended and allow you to enjoy the benefits it offers for years to come. **Please read it carefully before you take your first ride on your e-bike and keep it in a safe place for reference.**

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**Copy of Safety Instructions:**

## OWNER RESPONSIBILITY

**IMPORTANT:** Reading and following the information and instructions in this manual are essential to the ability of the owner or any other persons allowed to use this bicycle in order to ride safely.

1. It is the responsibility of the owner or in the case of a younger rider the parents of the rider to be certain all assembly instructions have been followed, even if the bike has been assembled by the seller, manufacturer, or a professional assembly company.

2. Brakes are essential to safety. Be sure they are checked and working properly before each use. Remember that any mechanical system changes condition during use and must be maintained and checked before each use.

3. Rules for bicycle use (bicycle laws) vary from location to location so be certain the rider knows and understands the rules that apply to bicycle usage in all areas where the bicycle will be used. Wearing a helmet, light or reflective clothing, using lights and reflectors are examples of rules which may exist and which make sense as rider safety precautions at all times.

4. Know how to operate the bicycle and all equipment on it before first use and be certain anyone allowed to use the bike knows how to properly and safely use the bike as well.

5. There are many different types of bicycles and often these types are designed for different uses. Make sure you know what type unit you have and do not exceed its service limitations. Be sure you check and understand the bicycle classifications set in this manual, including size of the unit that is proper for the rider to insure good control during use. Riders who are too small or large may have control problems. Do not overload a unit with a rider that is too heavy or too large, and do not attempt to carry extra passengers, packages or loads on the bicycle. Do not use street bikes for off road riding.

6. Your electric bike is water-resistant, but must be properly maintained to preserve this condition. Please do not submerge the bicycle or any electric components in water. Water entering electric components can cause a short circuit and damage the electric components with possible injury to the rider and others.

7. The battery's performance can be effected by its environment. Generally speaking, battery's discharge performance is better in a higher temperature. Electric power will drop by more than 1/3 when the temperature is below 32°F (0°C). Thus, this e-bike's riding distance per charge will become shorter in winter or cold areas. It returns to normal / optimal when the temperature is higher than 68°F (20°C).

8. Do not put any metal objects in charge hole or battery circuit, it may cause a short circuit, start a fire, or cause an explosion with personal injury or property damage.

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**CAUTION:** For your safety you must carefully read this manual and follow its instructions. Your bicycle may come with additional instruction sheets that cover features unique to your bike. Please ensure that you read and become familiar with their contents and retain them with this manual for future reference. Remember bicycles, in most areas, are subject to the same laws, rules, and regulations as motor vehicles.

Always wear a CPSC approved helmet when riding your bike.

Learn and follow local and state traffic use laws.

Any major service or adjustments on your bike not covered in this manual should be carried out by a professional bicycle mechanic. If you wish to make adjustments yourself, this manual contains important tips on how to do it.

**CAUTION:** Any adjustments you make are entirely at your own risk. Do **NOT** use your bike for freestyle and stunt riding, jumping or competitive events. Even if you are riding a mountain bike, you should know that off-road use or any similar activities can be dangerous, and you assume the risk for personal injury, damages or losses incurred from such use. Do not ride your bike when any part is damaged or not working properly.

**You must, for your safety and the safety of other users, consult a professional bicycle mechanic for any questions on repairs or maintenance.**

### WARNING

**As with all mechanical components, the bicycle is subjected to wear and high stresses. Different materials and components react to wear or stress fatigue in different ways. As your bicycle ages, you should inspect it more frequently to look for deformed, cracked, bent, or loose components. Such conditions may lead to sudden failure. This may possibly cause injuries to the rider. If something is cracked or broken, do not ride until repairs have been made.**

### ALWAYS WEAR A HELMET! IT COULD SAVE YOUR LIFE

A properly fitting, CPSC-approved bicycle helmet should be worn at all times when riding your e-bike.

The correct helmet should:
- be lightweight and comfortable
- have good ventilation
- cover the forehead and fit correctly
- be securely fastened on the rider

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**Copy of Safety Instructions:**

# RIDING PRECAUTIONS

**1. WARNING - ON AND OFF ROAD CONDITIONS:** The condition of the riding surface is very important to your safety. If the surface is wet, or has sand, leaves, small rocks or other loose debris on the surface where you plan to ride, carefully decrease the speed of the bicycle and ride with extra caution. It will take a longer time and more distance to stop. Apply the brakes sooner and with less force. Always apply the rear brake first allowing time and distance for it to take effect. Then follow by cautiously applying the front brake, in order to maintain control of the bicycle. Rapid front brake application first may cause a front pitch over or fall. Learn to use your brakes properly under controlled conditions until you learn proper braking under all road conditions.

**2. NOTICE:** State and federal regulations require a full set of reflectors. Some state and local laws may require that your bike be equipped with a warning device, such as a horn or bell and most states require a light. The manufacturer and many legal authorities **DO NOT** approve or encourage riding at night. Vision is quite limited at dawn, dusk and at night for bike riders, motorists and by-standers. If you must ride at night, take extra precautions, use front and rear lights, wear flashers on your arms, wear light-colored clothing, and plan your route to ride in well lighted areas avoiding heavy traffic areas.

**3. NOTE:** Always wear shoes when riding a bicycle and avoid loose fitting clothes. Wear a cuff band or trouser clip to keep pants or other loose clothing from getting caught in the chain wheel. Long sleeves, long pants, gloves, eye protection, a CPSC-approved helmet, elbow and knee pads are recommended.

**Helmet use is required by law in many states and is always a good idea for your safety.**

**4. CAUTION: WET WEATHER WARNING:** Check your brakes frequently. The ability to stop is critical to your safety. Roads are slippery in wet weather so avoid sharp turns and allow more distance for stopping. Brakes become less efficient when wet. Leaves, loose gravel and other debris on the road can also lengthen stopping distance. If at all possible, do not ride in wet weather. Vision and control are impaired, creating a greater risk of accidents and injury.

**5. CAUTION:** A bicycle rider's best defense against accidents is to be alert to road conditions and traffic in the area. Do not wear anything that restricts your vision or your hearing.

6. When riding, **ALWAYS WEAR A CPSC-APPROVED BIKE HELMET.** It may save your life.

7. Obey all traffic regulations. Most traffic regulations apply to bike riders as well as automobile operators. Observe all state and local traffic regulations, signs and signals. Check with your local police station on bicycle licensing and inspection, and where it is legal to ride your bike.

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8. Keep to the **RIGHT SIDE** of the road. Follow the traffic flow in a straight line close to the curb. Watch out for opening car doors and cars moving in and out of traffic. Use caution at intersections.

9. Never carry passengers. This is dangerous and it makes the bicycle harder to control. Never carry anything that can inhibit your ability to control the bicycle or see the road.

10. When riding in pairs or in larger groups, form a single line along the right side of the road. Set up a sensible distance between riders. Don't follow too closely.

11. Always be alert. Animals or people may dart in front of you. Give pedestrians the right-of-way. Don't ride too close to pedestrians, and don't park your bicycle where it can get in the way of foot/vehicle traffic.

12. Be careful at all intersections. Slow down and look both ways before crossing.

13. Use hand signals. Always let other drivers and pedestrians know what you are going to do. Signal 100 ft. before turning unless your hand is needed to control the bike.

**14. WARNING: NIGHT TIME OPERATION:** We do **NOT** recommend riding your bike at night. If you have an emergency that requires you to ride at night you must have proper lights and reflectors. **NEVER** ride at night without a helmet, taillight, a white front reflector, a red rear reflector, pedal reflectors and white wheel reflectors. You must be able to clearly see the surface where you are riding and be seen by others.

15. Never hitch rides. Never hold onto moving vehicles while riding. Never stunt ride or jump on your bike.

**16. ON AND OFF ROAD OPERATION:** Avoid the following road hazards: drain grates, pot holes, ruts, soft road edges, gravel, leaves (especially when they are wet), uneven pavement, railroad crossings, manhole covers, curbs, speed bumps, puddles, and debris as all have an effect on your riding and may result in loss of control. Adjust your speed and the way you use your brakes if you must ride in such areas.

17. If any components becomes loose while riding, **(STOP!!)** immediately and tighten, or bring to a mechanic for repair.

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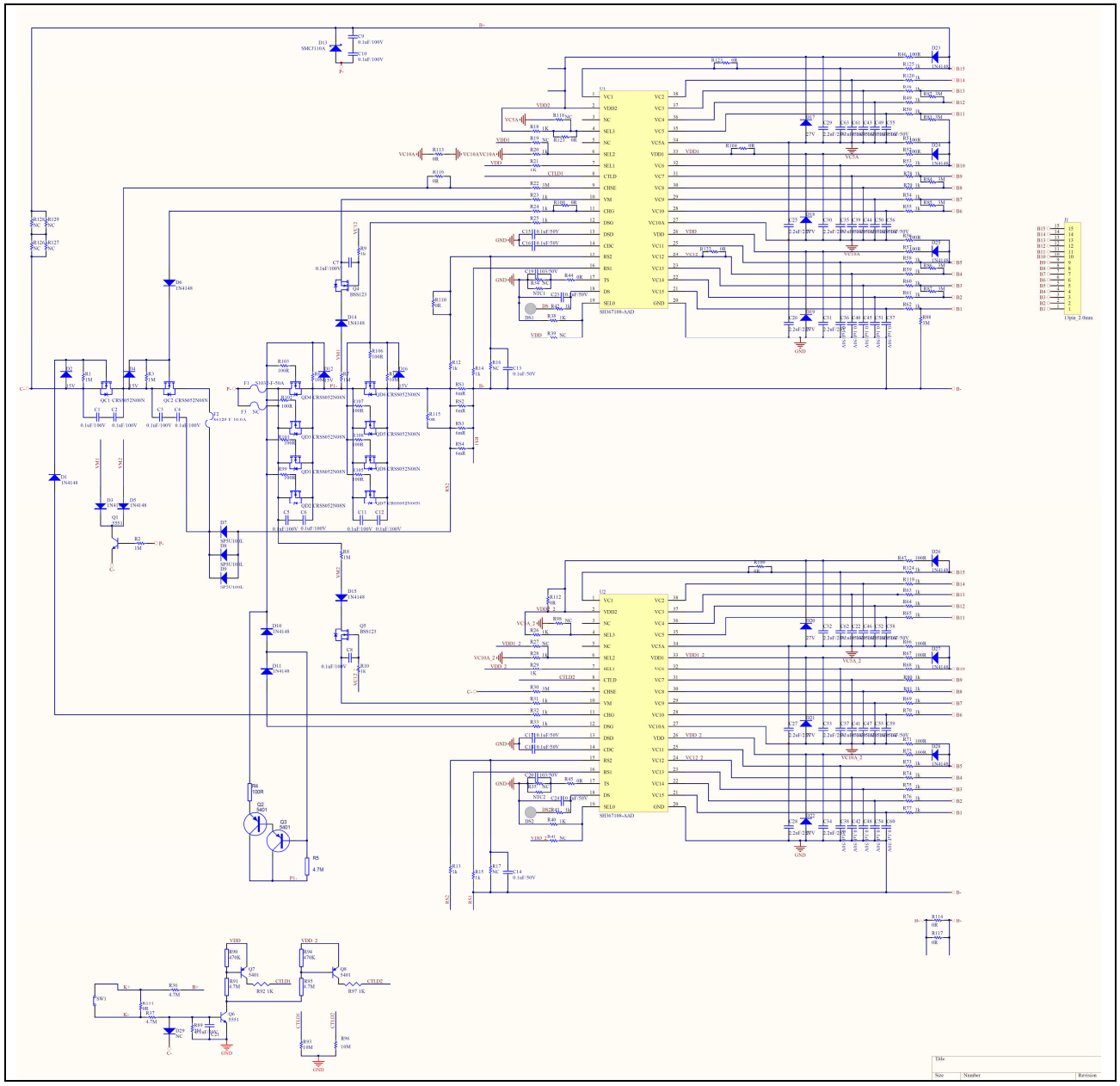
| **General remarks**<br>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.<br>"(see Enclosure #)" refers to additional information appended to the report.<br>"(see appended table)" refers to a table appended to the report.<br>Throughout this report a point is used as the decimal separator. |
| **Summary of testing:**<br>Test record refer to report No. CN23QSOW 001.<br>All models were tested and fulfilled the test specifications.<br>The tested model was complied with the test standards ANSI/CAN/UL 2849:2022. |
| **Particulars: test item vs. test requirements**<br>Equipment mobility ..... : Portable<br>Operating condition..... : Continuous<br>Mass of equipment (kg)..... : N/A |
| **Test case verdicts**<br>Test case does not apply to the test object : N/A<br>Test item does meet the requirement ..... : P(ass)<br>Test item does not meet the requirement .. : F(ail) |
| **Testing**<br>Date of receipt of test item ..... : 2024-02-28<br>Date(s) of performance of test ..... : 2024-02-28 ~ 2024-03-08 |

| |
|---|
| **General product information:**<br>This report is intended to evaluate Electrical Systems for eBikes only.<br>The product covered by this report is a electric bike, supplied by one approved battery pack charged by one specific UL listed battery charger. |

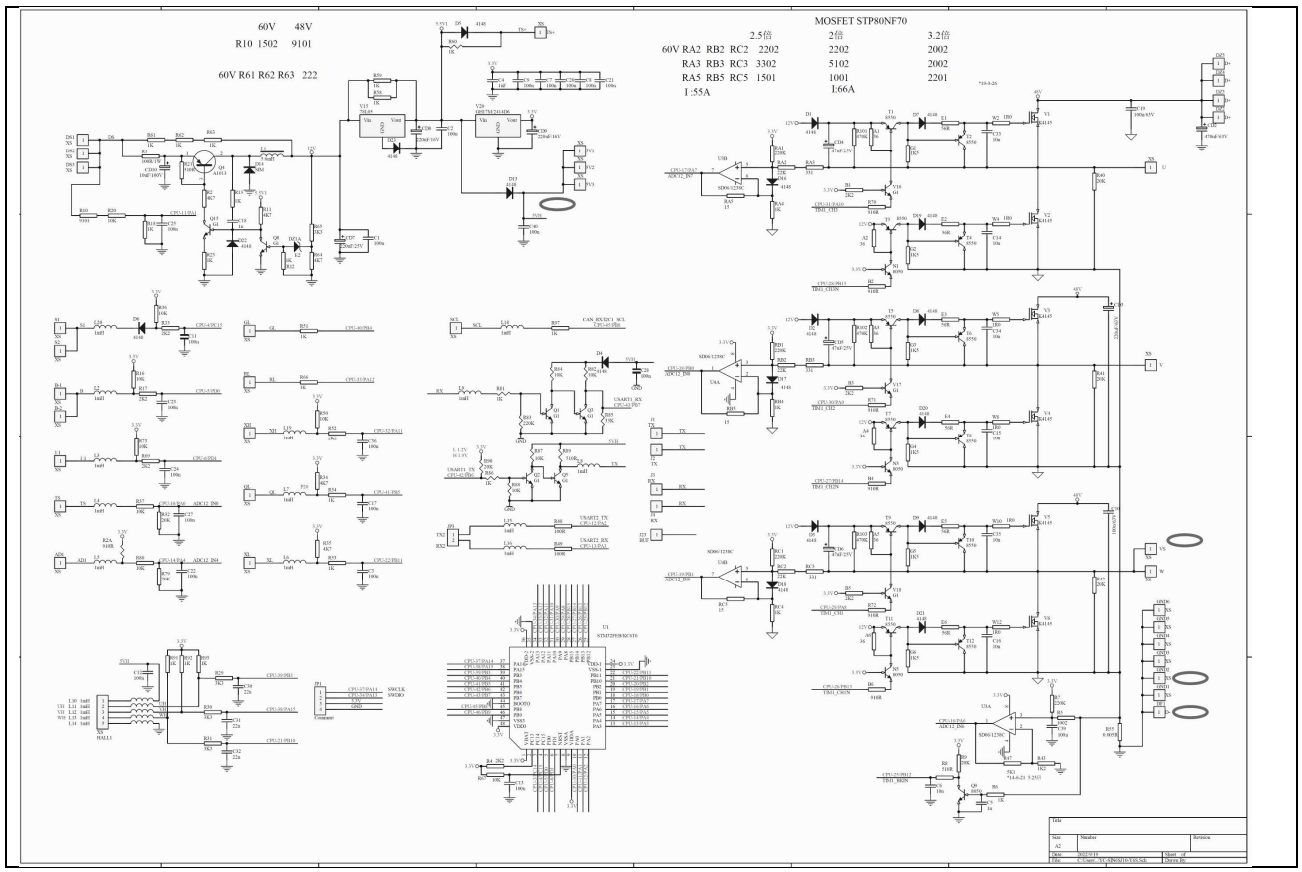
| **Electrical Rating** | |
|---|---|
| Models No. | Rating |
| SWFT-VX-XXX<br><br>(Remark: XXX can be letters A to Z indicate appearance color) | Charging voltage and current: DC54.6V 2.0A max.<br>Battery pack: 46.8Vdc 10.4Ah, 46.8Vdc 10.2Ah or 48Vdc 10.4Ah<br>Max assistant speed: 20 MPH.<br>Maximum Weigh load: 265 lbs. |
| Model similarity:<br>NA | |

**Product Construction**:

1. Circuit Diagram of Battery Pack



2. Circuit Diagram of Motor Controller



| UL/CAN 2849 | | | |
|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| | **CONSTRUCTION** | | **P** |
| 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. | | P |
| 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. | | P |
| 7.3 | EBikes consist of both EPAC and non-EPAC types, but in all cases functional pedals shall be provided. 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). For non-EPAC versions of the eBike, motors are not required to disengage when the user stops pedaling. A non-EPAC type eBike may be provided with an EPAC mode. | | P |
| 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. 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. | IPX4 considered and complied | P |
| 8<br>8.1 | Power Levels<br>General | | P<br>P |
| 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. | Battery operated ebike, charged by one UL approved battery charger. | P |
| 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. | | P |
| 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 requirements for both enclosures and insulation are included in this Standard and shall be applied as appropriate in all cases where hazardous voltages exist. | Operating voltage not exceed 60Vdc, no hazardous voltage | P |

| UL/CAN 2849 | | | |
|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 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. 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. | All components enclosured well | P |
| 8.3 | Low Voltage Limited Energy Circuits | Battery operated appliance, no LVLE circuit | N/A |
| 8.3.1 | A Low-Voltage Limited Energy Circuit (LVLE) shall comply with the limits in Table 8.1. | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 8.3.2 | The power limitations in Table 8.1 may be obtained by the use of any of the following configurations: | | N/A |
| | a) An inherently-limited transformer; | | N/A |
| | b) A non-inherently-limited transformer coupled with an overcurrent protective device in the output circuit; | | N/A |
| | c) A combination transformer and fixed impedance; or | | N/A |
| | d) An arrangement determined to be equivalent to (a), (b), or (c). | | N/A |
| 8.3.3 | A part or device, other than the battery pack, located in or supplied by an LVLE circuit need not be investigated. 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. | Appliance supplied by Battery pack evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 8.3.4 | The maximum load current is to be drawn under any condition of loading, including short circuit, using a resistor. 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 measured load current shall not exceed the value listed in Table 8.1. | | N/A |
| 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. | Battery operated appliance, no LVLE circuit | N/A |
| 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. The device shall not be of the automatically reset type. | | N/A |
| 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. 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 |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 9.1 | The battery management system (BMS) is used to control battery charging and discharging. 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. 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. | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. BMS integrated with battery pack. No external BMS for end product. | P |
| 9.2 | All testing of the system shall be performed with the actual battery/BMS and charger that is recommended by the manufacturer. 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. | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. BMS integrated with battery pack. No external BMS for end product. | P |
| 10 | User Protection While Charging | | P |
| 10.1 | General | | |
| 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. 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. 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. | Considered to be charged both on board and off board the eBike.<br>Charging by one UL approved battery charger, which certified by UL UL/CSA 62368-1. | 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. If the battery is only intended to be charged when removed from the eBike, then the requirements in 10.2 do not apply. | Clause 10.2 applicable | P |
| 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. 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 personnel protection system supplied shall be as indicated in 10.2.2. | Charging by one UL approved battery charger, which certified by UL UL/CSA 62368-1.<br><br>No shock hazards or electric energy hazards. | P |
| 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. 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. | Charging by one UL approved battery charger, which certified by UL UL/CSA 62368-1.<br><br>No shock hazards or electric energy hazards. | P |
| 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. | UL approved battery charger | 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. The requirements shall be applied to all points where protective grounding is used as a means to protect the user. | UL approved battery charger | 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. | Charging by one UL approved battery charger, which certified by UL UL/CSA 62368-1.<br><br>No need to consider UL 2097 requirement | P |
| 10.2.6 | The eBike shall have charger connect-interlock so that the motor cannot be activated when the charger is plugged in. If there is no interlock, there shall be a secondary means of preventing inadvertent motor activation. | | P |
| 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 BMS shall be designed to safely withstand normal and foreseeable misuse conditions for the eBike involved. 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. 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) iCSA C22.2 No. 62133-1/iUL 62133-1 or CSA C22.2 No. 62133-2/UL 62133-2. 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. | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 11.3 | For rechargeable batteries providing power to other than the motor and part of the eBike electrical system, the battery shall comply with iCSA C22.2 No. 62133-1/UL 62133-1 or CSA C22.2 No. 62133-2/UL 62133-2 or UL 2054. | Not such construction | N/A |
| 11.4 | The charging and discharging external terminals of a battery pack intended for removal from eBike for charging, shall be evaluated to either the No-Load Endurance Test or the Endurance with Load Test, as applicable, in accordance with UL 2251 / CSA C22.2 No. 282, without being subjected to the exposure to contaminants. | Not terminal construction, UL approved adapter connector and battery pack input connector UL approved. | N/A |
| | Exception: Battery packs with external terminals that have been evaluated to UL 2251 as defined in UL/ULC 2271 are not repeatedly subjected to this test. | | N/A |
| 12 | Safety Circuits and Safety Analysis | | P |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 12.1 | The ielectrical system of the eBike shall undergo a safety analysis as specified in 12.4 to verify that potential hazards associated with the design are addressed in this evaluation, and to identify protective circuits that prevent or detect the potential hazards. | | P |
| 12.2 | For battery management systems, the protective circuit shall maintain the cells within their normal operating region for voltage, temperature, and current, during charging and discharging; and, if normal limits are exceeded, the protective circuit shall limit or shut down the charging or discharging to prevent further excursions beyond normal operating limits. Compliance is determined through a review of the battery system data including the safety analysis of 12.4 – 12.6, evaluation of functional safety in 12.7, and through the tests in this Standard. | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. Internal BMS evaluated by UL 2271. No external BMS.<br>Motor driver funtional safety were evaluated in report# SHFS230100002871 according to EN ISO 13849-1:2015 and EN ISO 13849-2:2012. | P |
| 12.3 | iProtective circuits used to iprevent hazardous conditions related to assistance functions, such as iunintentional self-start, electric motor assistance without pedaling, electric motor assistance without activation of the startup assistance mode, and the like, shall also be evaluated based on the requirements in this Section as applicable. Compliance is determined through a review of the design and overall system, including the safety analysis of 12.4 – 12.6, evaluation of functional safety in 12.7, and through the tests in this Standard. | | P |
| 12.4 | An analysis of potential hazards shall be conducted on the electrical system of the eBike, including the charger and other icircuits as applicable, to determine that events that could lead to a hazardous condition have been identified and addressed through iprotective circuits, passive protective devices, or other means. Documents that can be used as guidance for the safety analysis include:<br>a) IEC 60812; | | P<br>P |
| | b) IEC 61025; | | P |
| | c) SAE J1739; | | P |
| | d) MIL-STD-1629Ai; and | | P |
| | e) ISO 12100. | | P |
| | Other risk assessment standards that provide equivalent analysis methods, assessment means, and coordination may be used. | | P |
| 12.5 | The analysis in 12.4 is utilized to identify anticipated faults or conditions in the system which could lead to a hazardous condition and the types and levels of protection provided to mitigate the potential hazards. The manufacturer shall provide the analysis of 12.4 for review as part of the evaluation of the system. The manufacturer shall indicate potential risks associated with the system and document the level of risk associated with each potential risk. During the review of the analysis during this evaluation, the results associated with the analysis may change or may be modified as deemed appropriate. The analysis shall consider single fault conditions in the protection circuit/scheme as part of the anticipated faults; and faults that occur as a result of those single faults are to be included. | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. Internal BMS evaluated by UL 2271.<br><br>Other analysis documents of motor driver of ebike were provided by manufacturer.<br><br>Motor driver funtional safety were evaluated in report# SHFS230100002871 according to EN ISO 13849-1:2015 and EN ISO 13849-2:2012. | P |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 12.6 | When conducting the analysis of 12.4, isingle-fault conditions of protective circuits shall not cause, or not cause a failure to detect, a hazardous condition. Protective circuits shall not be relied upon for critical safety unless: | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. Internal BMS evaluated by UL 2271.<br><br>Other analysis documents of motor driver of ebike were provided by manufacturer.<br><br>Motor driver funtional safety were evaluated in report# SHFS230100002871 according to EN ISO 13849-1:2015 and EN ISO 13849-2:2012. | P |
| | a) They are provided with a redundant passive protection device; | | N/A |
| | b) They are provided with a redundant iprotective circuit that remains functional and energized upon loss of power/failure of the first iprotective circuit; | | N/A |
| | c) They are determined to fail safe upon loss of power to/failure of the iprotective circuit; or | | N/A |
| | d) They are part of a protective circuit that has been shown to comply with iIEC 61508 Safety<br>Integrity Level (SIL) 2 or ISO 13849 Performance Level (PL) c. | | P |
| 12.7 | iProtective circuits shall be tested for functionality and reliability in the relevant configuration and environment, in accordance with appropriate functional safety requirementsi. Functional safety criteria can be found in one of the following sets of standards as appropriate to the design of the iprotective circuits, with required safety level(s) defined by the safety analysis in 12.4: | Battery pack evaluated in TUV Rheinland report#, refer to below CDF. Internal BMS evaluated by UL 2271.<br><br>Other analysis documents of motor driver of ebike were provided by manufacturer. | P |
| | a) UL 991, UL 1998, and CSA C22.2 No. 0.8; | | N/A |
| | b) UL 60730-1 and CSA C22.2 E60730-1; | | N/A |
| | c) IEC 61508-1 and all parts; or<br>d) ISO 13849-1 and ISO 13849-2. | | N/A<br>N/A |
| 12.8 | Any product containing hazardous voltage shall have a manual disconnect to prevent inadvertent access to hazardous voltage parts during servicing. The manual disconnect shall: | No hazardous voltage | N/A |
| | a) Disconnect both poles of the hazardous voltage circuit; | | N/A |
| | b) Be accessible and able to be operated without the use of a tool in the event of a collision or during servicing; | | N/A |
| | c) Require manual action to break the electrical connection; | | N/A |
| | d) Ensure disconnection is physically verifiable and can include actual removal of the battery system from the eBike or unplugging the battery system connector/plug; and | | N/A |
| | e) When engaged (i.e. under disconnection), it does not create exposed conductors capable of becoming energized and is insulated to inhibit a shock hazard during actuation. | | N/A |
| 12.9 | If a hazardous voltage automatic disconnect device is provided to isolate accessible conductive parts from the hazardous voltage circuit of the battery system, it shall: | No hazardous voltage | N/A |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| | a) Not be able to be reset automatically although it may be able to be reset deliberately upon clearing of the fault; | | N/A |
| | b) Disconnect both poles of the hazardous voltage circuit;<br>c) Be capable of handling full load disconnects of the hazardous voltage circuit that it is isolating; and | | N/A<br>N/A |
| | d) Not result in a hazardous condition upon automatic actuation. | | N/A |
| 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. | Enclosed | P |
| | Exception: For a part of the system that is in accordance with enclosure requirements of the applicable component or end product standard for the part in question, these requirements do not apply. | | 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 | No Nonmetallic materials served as hazardous live parts enclosue, appliance without hazardous voltage parts.<br>Battery pack is recognized component. | N/A |
| 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. | | N/A |
| 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.<br>Exception: Nonmetallic enclosures of rechargeable batteries that use a cell that complies with PS1 (Power source class 1) requirements outlined in UL 62368-1/CAN/CSA C22.2 No. 62368-1 are exempt from the above requirement. | | N/A<br><br><br><br>N/A |
| 13.2.1.3 | The following factors in (a) – (ic) 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) – (c) below ishall be determined by the tests of this Standard. | | N/A |
| | a) Resistance to Impact; | | N/A |
| | b) Abnormal Operations; | | N/A |
| | c) Mold Stress Relief Distortion. | | N/A |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 13.2.1.4 | The polymeric materials employed for enclosures and insulation shall be suitable for anticipated temperatures encountered in the intended application. 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. | No Nonmetallic materials served as hazardous live parts enclosue, appliance without hazardous voltage parts.<br>Battery pack is recognized component. | N/A |
| 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. | | 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. | | 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. | | 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. | Aluminium alloy with spray paint | 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. | No such construction | N/A |
| 13.2.2.3 | Conductive parts in contact at terminals and connections shall not be subject to corrosion due to electrochemical action. | No such construction | N/A |
| 13.3 | Strength of Enclosures | | P |
| 13.3.1 | The enclosure shall be subjected to the Impact Test, Section 33. | Tested and complied | 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. | | P |
| 13.5 | Ingress Protection | | P |
| 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. | Battery pack UL 2271 tested and complied | P |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 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. | Complied with requirement of IPX4 | P |
| 14 | Mounting | | P |
| 14.1 | Components mounted on the eBike shall be subjected to the Vibration Test, Section 38. | Tested and complied | P |
| 15 | Printed Wiring Boards | | P |
| 15.1<br><br><br>15.2 | A printed-circuit board shall comply with the requirements in UL 796, and shall have a flammability rating as indicated in Section 17.<br>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<br><br><br>P |
| 16 | Spacings and Separation of Circuits | | P |
| 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. | Battery operated appliance, charged by one UL listed battery charger, battery voltage 37Vdc, battery pack was evaluated in TUV Rheinland report#, refer to below CDF.<br>Battery pack short circuit test was considered according to UL 2271. | P |
| 16.2 | Electrical spacings in circuits shall have the following minimum over surface and through air spacings as outlined in one of the following: | | N/A |
| | 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 |
| 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 |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 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. There is no minimum insulation thickness requirement for insulation of circuits at or below 60 Vdc or for basic or functional insulation. Some examples include potting, encapsulation, and vacuum impregnation. | Battery operated appliance, charged by one UL listed battery charger, battery voltage 36Vdc, battery pack was evaluated in TUV Rheinland report#, refer to below CDF.<br>Battery pack short circuit test was considered according to UL 2271. | P |
| 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. 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 |
| 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. 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. Metallic materials used for enclosures are considered to comply without further evaluation. | No Nonmetallic materials served as hazardous live parts enclosue, appliance without hazardous voltage parts.<br>Battery pack is recognized component. | N/A |
| | Exception: Nonmetallic enclosures of rechargeable batteries that use a cell that complies with PS1 (Power source class 1) requirements outlined in UL 62368-1/CAN/CSA C22.2 No. 62368-1 are exempt from the above requirement. | | N/A |
| 17.2 | Nonmetallic materials used for internal parts within the overall enclosure shall be rated V-2 minimum. | | N/A |
| | Exception: Nonmetallic materials used for internal parts within the overall enclosure of PS2 circuits (Power source class 2 requirements outlined in UL 62368-1/CAN/CSA C22.2 No. 62368-1) shall comply with one of the following: | | N/A |
| | a) Be mounted on minimum V-1 class material or VTM-1 class material; | | N/A |
| | b) Be constructed of minimum V-2 class material, VTM-2 class material, or HF-2 class foamed material; | | N/A |
| | c) Have a size of less than 1750 mm3 (0.11 in3);<br>d) Have a mass of combustible material of less than 4 g (0.14 oz); | | N/A<br>N/A |
| | e) Be separated by at least 13 mm (0.51 in) of air from electrical parts (other than insulated wires and cables) which under fault conditions are likely to produce a temperature that could cause ignition; | | N/A |
| | f) Be in a sealed enclosure of 0.06 m3 (2.12 ft3 ) or less, consisting totally of non-combustible material and having no ventilation openings; or | | N/A |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| | g) Not ignite during Abnormal Operations Tests, Section 32. | | N/A |
| 17.3 | Internal parts of components shall comply with the flammability requirements of the component standard in accordance with Components, Section 2. | Battery pack recognzied | 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. | | N/A |
| 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. | | N/A |
| 17.6 | Printed wiring board materials used for circuits or components at hazardous voltage or hazardous energy levels shall be rated V-1 minimum. | PCB UL94 and UL 796 recognized | 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. | | N/A |
| 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. | UL 758 recognized internal wires | P |
| 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. 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. | | 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. | | 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. | | P |
| 18.5 | Any other external terminals with hazardous voltage shall be designed to prevent access by the user. Any external terminals with hazardous energy level as determined in accordance with 8.2.2 shall not be bridged by a metallic object. Compliance is determined by use of the articulate probe shown in Figure 18.1. | No hazardous voltage | N/A |
| 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. | | 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. | No hazardous voltage | 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. | No such construction | N/A |

| UL/CAN 2849 | | | |
|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 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. | Current fuse located in battery pack. Battery pack BMS served as protection. | 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. | Battery pack recognzied, current fuse located in battery pack | P |
| 19.5 | The overcurrent protective device specified in 19.4 shall be a circuit breaker, fuse or positive temperature coefficient device. | | P |
| 19.6 | A fuse or circuit breaker shall be either: | Battery pack recognzied, current fuse located in battery pack | P |
| | a) Acceptable for branch circuit use; or | | N/A |
| | b) A supplementary type. | | P |
| 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 or UL 1434/CSA LTR No. I-003. The positive temperature coefficient device shall be tested and determined to comply in the actual battery configuration and environment. | No such construction | 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. Fuses shall be tested and determined to comply in the actual battery configuration and environment. | Battery pack recognzied, current fuse located in battery pack | P |
| 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. Fuseholders used with these fuses shall comply with CSA C22.2 No. 4248.1/UL 4248-1 and the applicable parts of the series. | Battery pack recognzied, current fuse located in battery pack | P |
| 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. Where user replaceable fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated. Information on proper fuse replacement of user replaceable fuses shall also be included in the instructions. See Section 47. | Not user replaceable fuses | 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. | | 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. | Max load: 265lbs | P |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 20.3 | Motors located in hazardous voltage circuits shall comply with the requirements of UL 1004-1 and CSA-C22.2 No. 100. Motors located in low voltage circuits shall comply with either UL 1004-1 or CSA-C22.2 No. 100 or the requirements of this Standard. | No hazardous voltage | N/A |
| 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. 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. | | P |
| 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. | | P |
| 21 | Operator Interface and Communication Devices | | P |
| 21.1 | The operator interface and communication devices shall be constructed such that the user will not have access to hazardous parts. 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 | P |
| 21.2 | An operator interface and communication devices 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 No. 60950-1 or UL 62368-1/CSA C22.2 No. 62368-1.<br>The operator interface and communication devices that comply with UL 60950-1/CSA C22.2 No. 60950-1 or UL 62368-1/CSA C22.2 No. 62368-1 are considered to comply with the requirement of this Standard. | No such construction<br>Evaluated according to this standard | N/A<br>N/A |
| 22 | Grounding and Bonding | No Grounding and Bonding | 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. | No Grounding and Bonding | 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). The bonding connection shall penetrate nonconductive coatings, such as paint or vitreous enamel. Bonding around a resilient mount shall not depend on the clamping action of rubber or similar material. | | N/A |

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| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 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. To reduce the risk of inadvertent loosening, the head of the screw or bolt shall not be accessible from outside of the enclosure. | No Grounding and Bonding | N/A |
| 22.2.4 | An equipment-bonding connection shall penetrate a nonconductive coating, such as paint or vitreous enamel. | | N/A |
| 22.2.5 | An equipment-bonding point shall be located so that the risk of inadvertently removing the bonding means during servicing is reduced. | | N/A |
| 22.2.6 | An equipment-bonding lead shall be the same size as the grounding lead associated with the AC power source. 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. 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. 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. | No Grounding and 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 |
| | IEC Publication 60417, Symbol 5019 | | N/A |
| 23 | Chargers | UL listed battery 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. 107.2; | | N/A |
| | b) UL 1310 and CSA C22.2 No. 223; | | N/A |
| | c) UL 60950-1/CSA C22.2 No. 60950-1, along with the relevant Part 2 Standard as applicable; or | | N/A |
| 23.2 | d) UL 62368-1/CSA C22.2 No. 62368-1.<br>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 may be reduced as described in 8.3. Personnel protection in accordance with Section 10 is not required. | UL 62368-1/CSA C22.2 No. 62368-1 listed battery chargers | P<br>N/A |

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|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 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. | Considered and complied | P |
| 23.4 | Chargers for lithium-ion battery systems shall have voltage, current, and temperature monitoring of the cells in the battery pack. This monitoring may be part of the battery management system integral to the battery pack. In this case, compliance with Section 11 is sufficient. 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. | Battery pack recognized | P |
| 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 cable shall comply with UL 62/CSA C22.2 No. 49 or UL 758/CSA C22.2 No. 210, 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, iUL 486A-486B/CSA C22.2 No. 65, UL 1977/CSA C22.2 No. 182.3, ior UL 2238/CSA C22.2 No. 182.3. The connectors shall be suitably rated for the application. | UL 1977 recognized | P |
| 25 | Supply Connections | Not such type | 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. | Not such type | N/A |

| | | | |
|---|---|---|---|
| | **PERFORMANCE** | | P |
| 26 | General | | P |
| 27 | Input Test | | P |
| 28 | Temperature Test | | P |
| 29 | Isolation Resistance Test | | N/A |
| 30 | Dielectric Strength Test | | N/A |
| 31 | Humidity Conditioning | | N/A |
| 32 | Abnormal Operations Tests | | P |
| 32.1 | General | | P |
| 32.2 | Overcharging test | battery pack was evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 32.3 | Component fault tests | | P |
| 32.4 | Forced ventilation/blocked ventilation | No such construction | N/A |
| 32.5 | Locked rotor motor test | | P |
| 32.6 | Running overload test | | P |
| 32.7 | Short circuit test | battery pack was evaluated in TUV Rheinland report#, refer to below CDF. | N/A |

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|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 32.8 | Imbalanced charging test | battery pack was evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 32.9 | Shock test | battery pack was evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 32.10 | Thermal cycling | battery pack was evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 33 | Impact Test | | P |
| 34 | Mold Stress | | P |
| 35 | Flexing Test | | N/A |
| 36<br>37 | Ingress Protection Tests<br>Permanence of Marking | IPX4 | P<br>P |
| 38 | Vibration Test | | P |
| 38.1 | Complete device | | P |
| 38.2 | Batteries/battery packs | battery pack was evaluated in TUV Rheinland report#, refer to below CDF. | N/A |
| 39 | Strain Relief | | N/A |
| 39.1 | General | | N/A |
| 39.2 | Strain relief – pull test | | N/A |
| 39.3 | Strain relief – push back test | | N/A |
| 40 | Startup Assistance Mode Test | Checked and complied | P |
| 41 | Motor Assistance Control | | P |
| 41.1 | General | | P |
| 41.2 | Reverse Pedaling Test | | P |
| 41.3 | Pedal Cessation Test for EPACs | Motor assistance stopped immediately | P |
| 41.4 | Cutoff When Braking Test | Motor current decreased to 0 immediately while brake device was actuated. | P |
| 41.5 | Cutoff at Maximum Speed Test | | P |

| | | | |
|---|---|---|---|
| | **MARKING** | | **P** |
| | iAdvisory Note: Markings required by this Standard may have to be provided in other languages to conform with the language requirements of the country or region where the product is to be used. In Canada, there are two official languages, English and French. Annex A provides translations in French of the English safety markings specified in this Standard. | | P |
| 42 | General | | P |
| 42.1 | The markings required for compliance to this Standard shall be legible and permanent such as etched, adhesive labels, etc. An adhesive-backed label shall comply with UL 969 and CSA C22.2 No. 0.15, for the intended exposure conditions and surface adhered to. Alternatively, the label shall be subjected to the Permanence of Marking Test, Section 37. | | P |
| 43<br>43.1 | Nameplate and Identification<br>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, part number or model number,and electrical ratings in volts dc and Ah or Wh. | | P<br>P |

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|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 43.2 | Products shall be marked with the date of manufacture, which may be in the form of a code that does not repeat within 10 years. | | 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. An example of such markings would be the following or equivalent "Use Only Charger (_____)." The blank would be filled in with identifying information for the charger. | | P |
| 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. | Not such type | N/A |
| 43.5 | If a manufacturer produces or assembles eBike systems at more than one factory location, the equipment shall have a distinctive marking – which may be in code – to identify it as the product of a particular factory. | One factory | P |
| 44 | Cautionary Markings | | P |
| 44.1 | The words, "CAUTION", "WARNING", OR "DANGER" in a cautionary marking shall be in letters not less than 3.2 mm (1/8 inch) high. The remaining letters in a cautionary marking shall not be less than 1.6 mm (1/16 inch) high. The words, "WARNING" or "DANGER" are alternatives for the word, "CAUTION". | | P |
| 44.2 | A cautionary marking shall be located on a part that is not removable; or if removable, on a part that impairs the operation of the unit when removed. The marking shall also be visible and legible to the operator during normal operation of the unit. | | P |
| 44.3 | There shall be a replacement marking adjacent to a fuse or fuseholder if the fuse is used to reduce the risk of fire and electric shock and the fuse is user replaceable. The marking shall be located where it will be readily visible during replacement of the fuse, and shall consist of the word, "WARNING" and the following or equivalent: "Risk of Fire and Electric Shock – Replace Only With Same Type and Ratings of Fuse." | Not such construction | N/A |

| | **INSTRUCTIONS** | | **P** |
|---|---|---|---|
| 45 | General | | P |
| 45.1 | A product shall be provided with legible installation instructions, operation instructions, and instructions pertaining to a risk of fire, electric shock, or injury to persons associated with the use of the product. Also, user maintenance instructions and moving and storage instructions associated with the use of the product by the end user shall be included. | | P |
| 45.2 | The instructions mentioned in 45.1 shall be in separate manuals or shall be combined in one or more manuals when the instructions pertaining to a risk of fire, electrical shock, or injury to persons are separated in format and emphasized to distinguish them from the rest of the text. | | P |
| 45.3 | An illustration is allowed with a required instruction to clarify the intent but shall not replace the written instruction. | | P |
| 45.4 | The following items shall be entirely in upper case letters or shall be emphasized to distinguish them from the rest of the text: | | P |

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|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| | a) The headings for the installation, operation, user maintenance, and moving and storage instructions; | | P |
| | b) The heading for the instructions pertaining to a risk of fire, electric shock, or injury to persons; and | | P |
| | c) The opening and closing statements of the instructions specified in 48.3 – “IMPORTANT SAFETY INSTRUCTIONS” and “SAVE THESE INSTRUCTIONS”, or the equivalent. | See copy of instruction pages | P |
| 45.5 | Unless otherwise indicated, the text of all instructions shall be in the words specified or words that are equivalent, clear, and understandable. Substitution of the signal word "DANGER" for "WARNING " is allowed, when the risk associated with the eBike is such that a situation exists which, if not avoided, will result in death or serious injury. For other than the signal words " DANGER" and "WARNING," if a specific conflict exists in the application of such wording to an eBike, modified wording is allowed. | | P |
| 46 | Instructions Pertaining to a Risk of Fire or Electric Shock | | P |
| 46.1 | Instructions pertaining to a risk of fire or electric shock shall warn the user of reasonably foreseeable risks and state the precautions to be taken to reduce such risks. Such instructions shall be preceded by the heading, “INSTRUCTIONS PERTAINING TO RISK OF FIRE or ELECTRIC SHOCK” or the equivalent. | | P |
| 46.2 | Numbering of the items in the list in 46.3 and including other instructions pertaining to a risk of fire, electric shock, or injury to persons that the manufacturer determines to be necessary and that do not conflict with the intent of the instructions are acceptable. | | P |
| 46.3 | The instructions pertaining to a risk of fire, electric shock, or injury to persons shall include those items in the following list that are applicable to the product. The statement “IMPORTANT SAFETY INSTRUCTIONS” or the equivalent shall precede the list, and the statement “SAVE THESE INSTRUCTIONS” or the equivalent shall either precede or follow the list. The word “WARNING” shall be entirely in upper case letters or shall be emphasized to distinguish it from the rest of the text. | | P |
| | IMPORTANT SAFETY INSTRUCTIONS | | P |
| | WARNING – When using this product, basic precautions should always be followed, including the following: | | P |
| | a) Read all the instructions before using the product. | | P |
| | b) To reduce the risk of injury, close supervision is necessary when the product is used near children. | | P |
| | c) Do not put fingers or hands into the product. | | P |
| | d) Do not use this product if the flexible power cord or output cable is frayed, has broken insulation, or any other signs of damage. | | P |
| | e) For an off board charger provided with a field wiring terminal or leads, the installation instructions shall state that the installation is intended to use copper wires only. | Not such construction | N/A |
| | f) For an off board charger, when a pressure terminal connector, or the fastening hardware, are not provided on the unit as shipped. The instruction manual shall indicate which pressure terminal or component terminal assemblies are for use with the unit. | Not such construction | N/A |

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|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| | g) With reference to (f), the terminal assembly packages and the instruction manual shall include information identifying the wire size and the manufacturer's name, trade name, or other descriptive marking by which the organization responsible for the product is identified. | Not such construction | N/A |
| | h) When a pressure terminal connector provided on an off board charger, for a field installed conductor requires the use of other than an ordinary tool for securing the conductor, identification of the tool and any required instructions for using the tool shall be included in the installation instructions. | Not such construction | N/A |
| | i) The instruction manual for a unit where the abnormal test is terminated by operation of the intended branch circuit over current protective device, shall include the word "CAUTION" and the following or equivalent: "To reduce the risk of fire, connect only to a circuit provided with _____ amperes maximum branch circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70." The blank space is to be filled in with the applicable ampere rating of branch circuit overcurrent protection. | Not such type | N/A |
| | j) For all equipment, the instructions shall indicate “This equipment is not intended to be used at ambient temperatures less than _____°C (_____°F) or above ambient temperatures of _____°C (_____°F).” The blanks are to be filled in with the manufacturer’s specified ambient temperature ratings. | | P |
| | k) For all equipment, the instructions shall indicate “The battery is intended to be charged when the ambient temperature is between _____°C (_____°F) and _____°C (_____°F). Never charge the battery when ambient temperatures are outside this range.” The blanks are to be filled in with the manufacturer’s specified ambient temperature range for charging. | | P |
| | SAVE THESE INSTRUCTIONS | | P |
| 46.4 | The instructions pertaining to a risk of fire, electric shock, or injury to persons, or the installation instructions shall include the following items if applicable. If the following instructions are included in the installation instructions, a reference to these instructions shall be included in the list mentioned in 46.3 as a separate item. The headings and the word “WARNING” shall be entirely in upper case letters or shall be emphasized to distinguish it from the rest of the text. | | P |
| | GROUNDING INSTRUCTIONS | No grounding construction | N/A |
| | This product must be grounded. If it should malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This product is equipped with a cord having an equipment grounding conductor and a grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes ordinances. | | N/A |
| | WARNING – Improper connection of the equipment grounding conductor is able to result in a risk of electric shock. Check with a qualified electrician if you are in doubt as to whether the product is properly grounded. Do not modify the plug provided with the product – if it will not fit the outlet, have a proper outlet installed by a qualified electrician. | | N/A |
| 47 | Installation Instructions | | P |

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|---|---|---|---|
| **Clause** | **Requirement – Test** | **Result – Remark** | **Verdict** |
| 47.1 | Installation instructions shall contain all the information needed to install the product for use as intended, and shall be preceded by the heading, “INSTALLATION INSTRUCTIONS” or the equivalent. | | P |
| 48 | Operating Instructions | | P |
| 48.1 | Operating instructions shall contain all the information needed to operate the product as intended, and shall be preceded by the heading “OPERATING INSTRUCTIONS” or the equivalent. | | P |
| 48.2 | Instructions in relation to operating that appear in the instructions pertaining to a risk of fire, electric shock, or injury to persons, are not required to be repeated here; but a reference to those instructions shall be included here. | | P |
| 48.3 | The instruction manual shall contain the following information: | | P |
| | a) Instructions regarding battery charging, temperature limits for equipment use and storage, battery use and storage, and the recommended temperature range for charging. | | P |
| | b) A warning shall be provided against modifying or attempting to repair the eBike system except as indicated in the instructions for use and care. | | P |
| 48.4 | Instructions shall indicate that charging of the eBike shall only be performed with the manufacturer's recommended charger. | | P |
| 49 | User Maintenance Instructions | | P |
| 49.1 | Instructions for user maintenance shall include explicit instructions for all cleaning and servicing that are intended to be performed by the user, and shall be preceded by the heading, “USER MAINTENANCE INSTRUCTIONS” or the equivalent. | | P |
| 49.2 | For units with user replaceable fuses, the user maintenance instructions shall contain statements concerning fuse replacement instructions and reference to the correct fuse ratings that are to be used. | | P |
| 50<br>50.1 | Moving and Storage Instructions<br>If moving or storage of the product is able to result in damage to the product that could result in a risk of fire, electric shock, or injury to persons during subsequent use, the instructions shall describe the proper moving and storage procedure, and shall be preceded by the heading, “MOVING AND STORAGE INSTRUCTIONS” or the equivalent. | | P<br>P |

| | | | |
|---|---|---|---|
| | **Annex A – French Translations** | | **INFO** |
| | (Informative) | | Info |

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

Figure 1.: Overall view

Figure 2.: Overall view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

Figure 3.: Overall view

Figure 4.: Overall view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX


Figure 5.: Motor view

Figure 6.: Controller view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX


Figure 7.: Controller view


Figure 8.: Controller view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

Figure 9.: Controller view

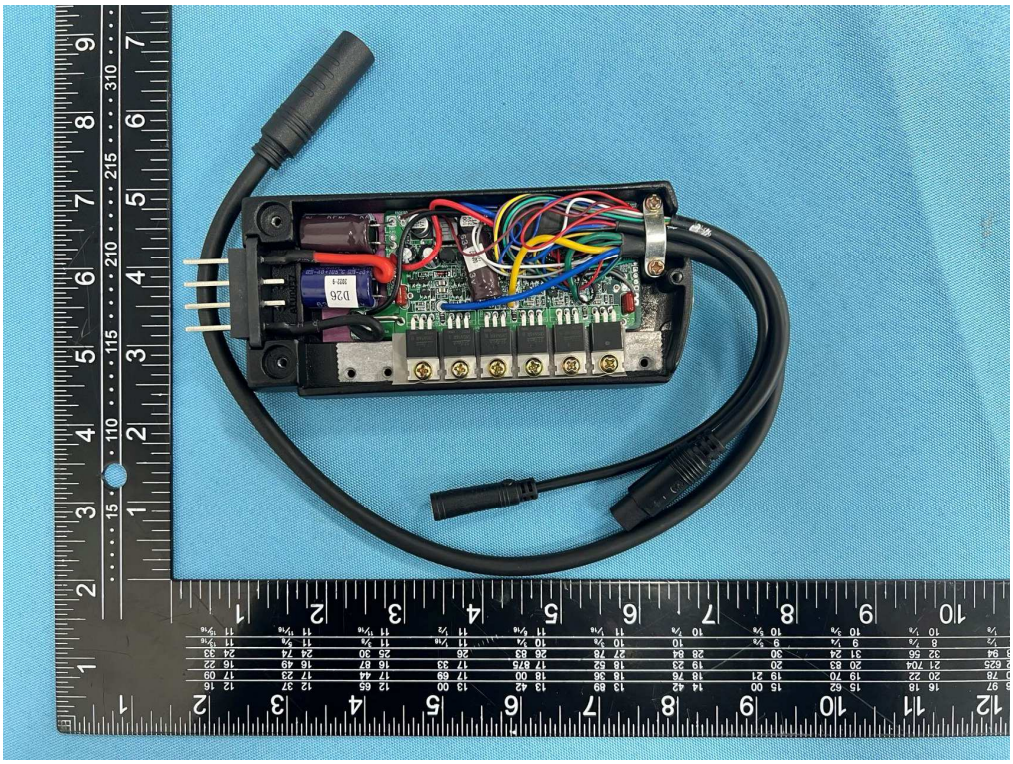

Figure 10.: Controller view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

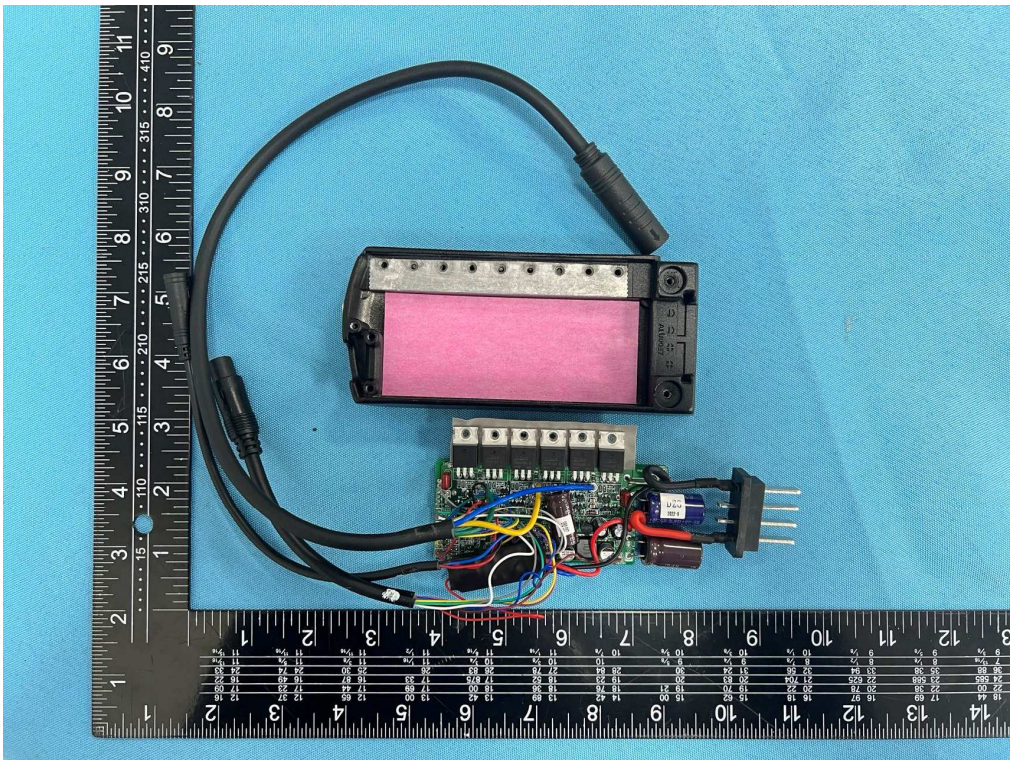

Figure 11.: Controller view

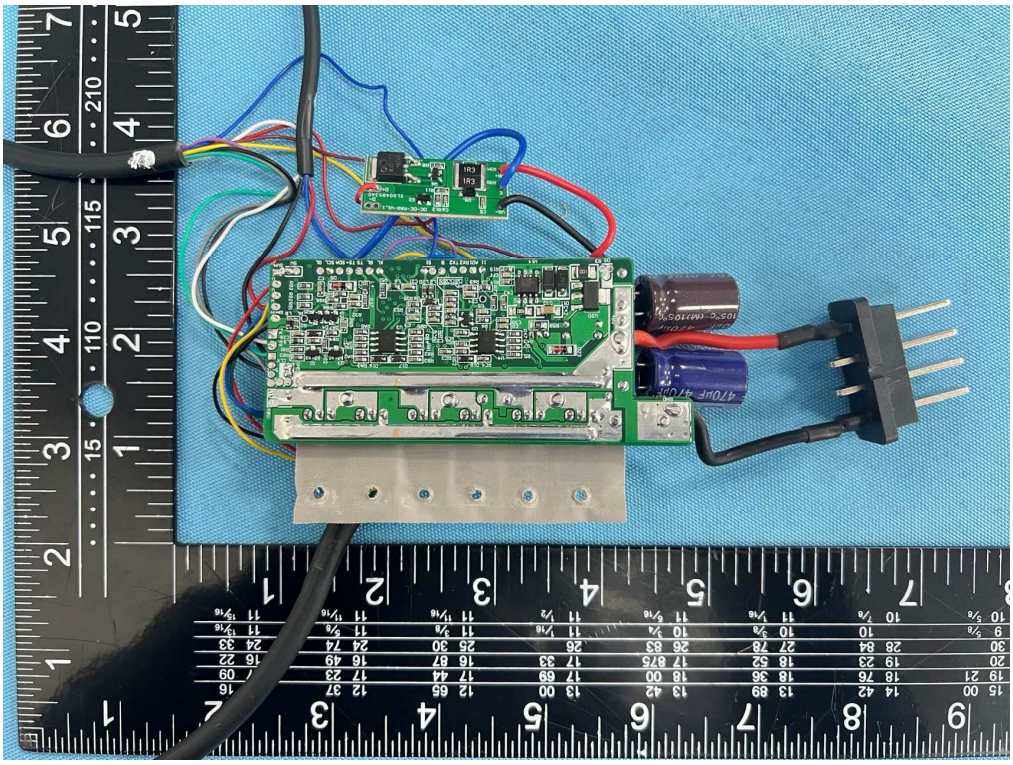

Figure 12.: Controller view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

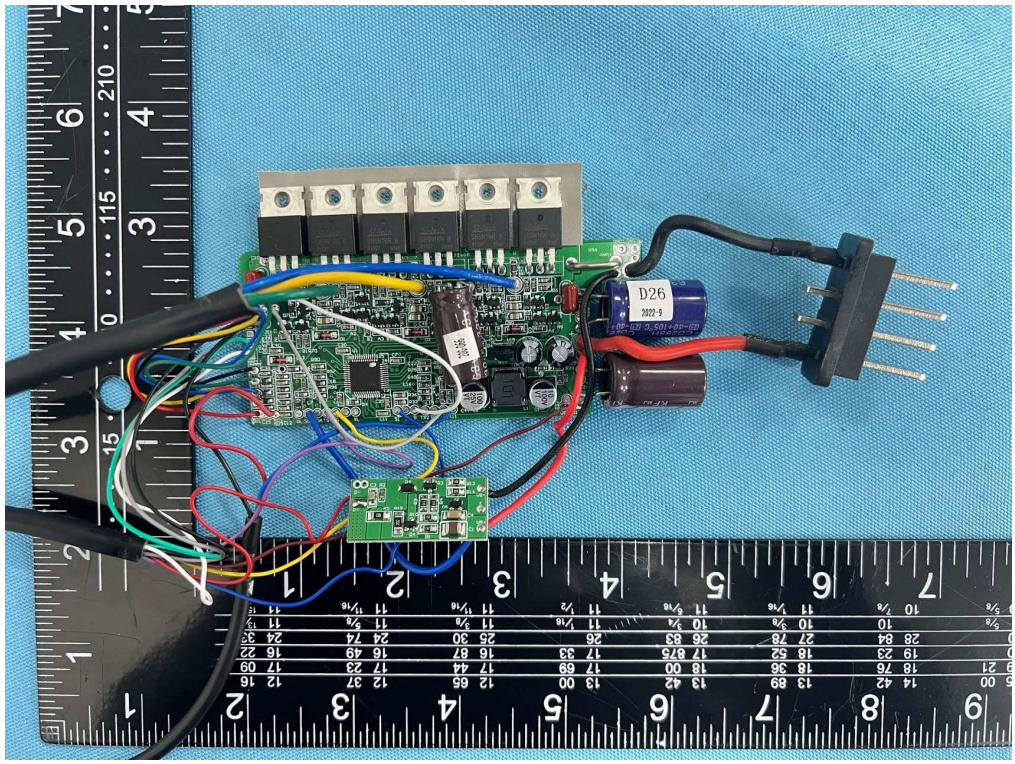


Figure 13.: Controller view

Figure 14.: Dashboard Overall view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

Figure 15.: Dashboard internal view

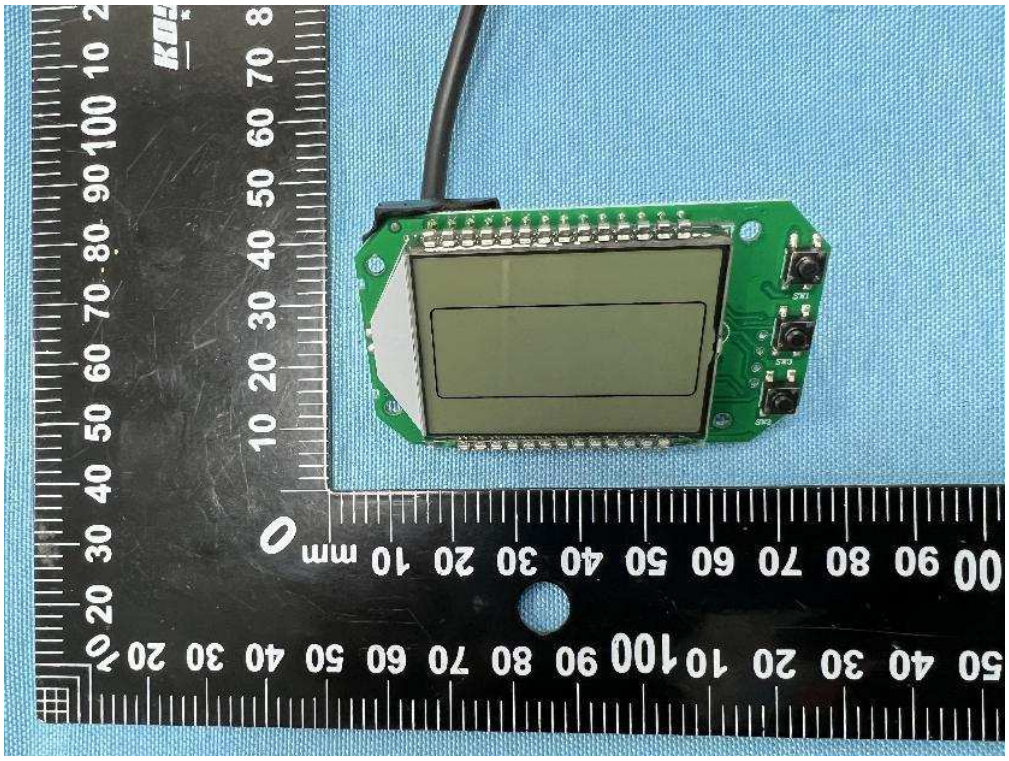

Figure 16.: Dashboard internal view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

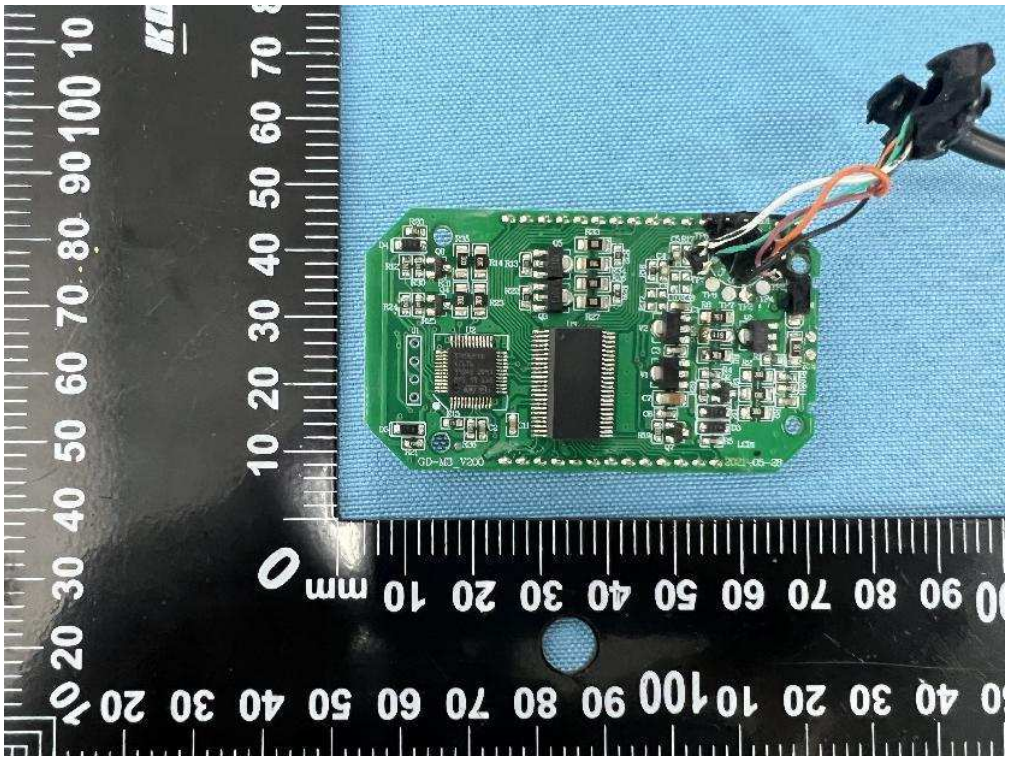

Figure 17.: Dashboard internal view


Figure 18.: Battery view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX


Figure 19.: Battery view


Figure 20.: Battery

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX


Figure 21.: Alternative Battery


Figure 22.: External adaptor view

**Attachment 1: Photo document**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

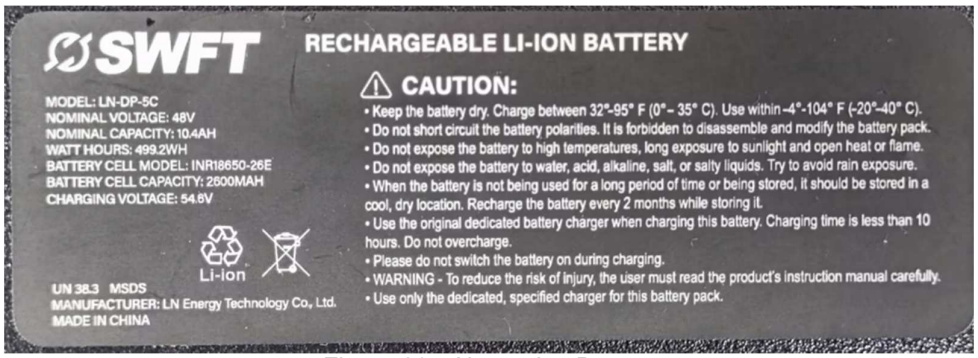


Figure 23.: Alternative Battery


Figure 24.: Alternative Wheel reflector

**Attachment 2: CDF**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

| Item No. | Object/part no. | Manufacturer/ Trademark | Type/Mode | Technical Data | Standard | Mark(s) of Conformity |
|---|---|---|---|---|---|---|
| 1. | Frame | GUANGZHOU LEONIS MACHINERY CO.,LTD | AY461882 | Steel. Minimum thickness: 1.8 mm, spray paint. | -- | -- |
| 2. | Battery Charger | SHENZHEN FUYUANDIAN POWER CO LTD | FY1505462000 | Input: 100-240Vac, 50/60Hz, 2.5A. Output: 54.6VDC, 2.0A | UL 62368-1, CAN/CSA C22.2 No. 62368-1 | UL E350715 |
| 3. | Battery pack | Sichuan Junchang Intelligent Technologhy Co., Ltd | JCE007 13INR19/65-4 | 46.8V, 10.4Ah, 486.72Wh. | UL/ULC 2271 | TUV Rh Report# CN22PHPA 001 |
| 4. | Alternative | Sichuan Junchang Intelligent Technologhy Co., Ltd | JCE007-A | 46.8V, 10.2Ah, 477.36Wh. | UL/ULC 2271 | TUV Rh Report# CN23EDTL 001 |
| 5. | Alternative | Sichuan Junchang Intelligent Technologhy Co., Ltd | JCE007-B | 46.8V, 10.4Ah, 486.72Wh. | UL/ULC 2271 | TUV Rh Report# CN23EDTL 001 |
| 6. | Alternative | LN Energy Technology Co., Ltd | LN-DP-5C | 48V, 10.4Ah, 499.2Wh. | UL/ULC 2271 | TUV Rh Report# CN23MU55 002 |
| Components in Motor assembly below | | | | | | |
| 7. | Motor | Changzhou Jiabo Machinery Manufacturing Co. Ltd | LEO-110C-175-X （X representing internal batch code) | 48V20"500W. | UL 2849 | Test with appliance |
| 8. | Motor Housing | Various | Various | ADC12. Aluminium alloy. | -- | -- |
| 9. | Winding | ZHEJIANG SANXING ELECTRICAL TECHNOLOGY CO., LTD | QZ-X/155 | 155℃. | UL 1446 | UL E327855 |
| | | TONGLING NONFERROUS COPPER CROWN ELECTRICAL CO LTD | PEW | 155℃. | UL 1446 | UL E217937 |

**Attachment 2: CDF**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

| Item No. | Object/part no. | Manufacturer/ Trademark | Type/Mode | Technical Data | Standard | Mark(s) of Conformity |
|---|---|---|---|---|---|---|
| 10. | Slot Liner | SICHUAN DONGFANG INSULATING MATERIAL CO LTD | 6644 (F-DM) | Suitable for use in class F insulation system:type DF-155. | UL 1446 | UL E324567 |
| 11. | Slot wedge and end spider | CHANGZHOU JINLONG INSULATION MATERIAL CO LTD | DMD (F6641) | Suitable for use in class F insulation system:type JL-F. | UL 1446 | UL E522956 |
| 12. | Insulation tube/sleeving | SHENZHEN WOLIDA TRADING CO LTD | RSFR-H | Flexible heat shrinkable Polyolefin tubing. 600V, 125℃, VW-1. | UL 224 | UL E329530 |
| 13. | Internal wires (motor) | Kunshan Julet Electronic Co Ltd | JL-F-Z910AM | Male and Female Molded-on Cable Fitting. 3x16AWG for power+6x24AWG for signal. 12A for power, 1A for signal. | UL 2238 | UL E506985 |
| | | ZHEJIANG XINXIN ELECTRONIC WIRE ROD CO LTD | 20464 | 32-10AWG, 90 or 150Vac, 60-105℃ | UL 778 | E225383 |
| 14. | Printed Wiring Board | WEIYUANDA INDUSTRIAL CO LTD | WYD-9 | Single layer printed wiring boards. 130℃, V-0. | UL 94, UL 796 | UL E327080 |
| | Alternative | Various | Various | Single layer printed wiring boards. 130℃, V-0. | UL 94, UL 796 | UL |
| 15. | NTC Transistor | Quest For Advanced Materials Electronics Co Ltd | QN0603×103@3950#B | Resistance at 25° C: 10k ohm, Tmoa: 125℃, Class C3 | UL 1434, UL 60730-1 | UL E521677 |
| Components in Display below | | | | | | |
| 16. | PCB | Various | Various | 94V-0, 130℃. | UL 796 | UL |
| Components in Motor Driver as below | | | | | | |
| 17. | Motor Dirver | Yuecheng electromechanical technology wuxi Co., LTD | YCSL200-099-48TAP | Rated 48Vdc, current limiting: 18A. | UL 2849 | Test with appliance |

**Attachment 2: CDF**

**Product:** Electric bike **Type designation:** SWFT-VX-XXX

| Item No. | Object/part no. | Manufacturer/ Trademark | Type/Mode | Technical Data | Standard | Mark(s) of Conformity |
|---|---|---|---|---|---|---|
| 18. | Internal wiring 1 of Motor Driver | YANG ZHOU DE YOU WIRE & CABLE CO LTD | 20167 | For the connections of motor and motor driver.<br>AWM 20167, 17AWG*3C +24AWG*6C. 300V, 105℃ minimum. | UL 758 | UL E318368 |
| | | Various | 20167 | For the connections of motor and motor driver.<br>AWM 20167, 17AWG*3C +24AWG*6C. 300V, 105℃ minimum. | UL 758 | UL |
| 19. | Internal wiring 2 of Motor Driver | DONGGUAN ZHONGZHEN ENERGY TECHNOLOGY CO.,LTD | 3135 | 16AWG. 600V, 200℃, VW-1. | UL 758 | UL E318368 |
| | | Various | 3135 | 16AWG. 600V, 200℃, VW-1. | UL 758 | UL |
| 20. | Internal wiring 3 of Motor Driver | Zhejiang Top Wire Technology Co Ltd | 2095 | Multiple-conductor, thermoplastic insulation. 300V, 80℃. | UL 758 | UL |
| | | Various | 2095 | Multiple-conductor, thermoplastic insulation. 300V, 80℃ | UL 758 | UL |
| 20. | Power Input Connector | DONGGUAN CIQIN INDUSTRIAL ELECTRICAL APPLIANCES CO LTD | CQ-QPES, followed by -2 thru -10, followed by M or F | Connectors for Use in Data, Signal, Control and Power Applications.<br>Rated 500 V, 20 A | UL 1977, CSA C22.2 NO. 182.3 | UL E507357 |