

Rechargeable Li-ion Battery Model BT F331, BT F332

Tested under

UL/ULC 2271: Standard for Batteries for Use In Light Electric Vehicle (LEV) Applications, Second Edition, Dated September 7, 2018

File: E115619

MET Report: 127169

Approved: July 3, 2023

Applicant:

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For:

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| <input type="checkbox"/> MET Classification | <input type="checkbox"/> MET-C Classification |

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Change Record

Change Number	Description	Approval Date	Project Number	Amendment Engineer	Engineer Initials
-	-	-	-	-	-

Description

Product(s) Covered:

Rechargeable Li-ion Battery

Product Description:

Used in light electric vehicle applications

Model Differences:

BT F331 and BT F332 are all same except the capacity and IEC designation.

The Capacity of BT F331 is 19,6 Ah and the IEC designation is 14S4P,

The Capacity of BT F332 is 14,7 Ah and the IEC designation is 14S3P.

Electrical Rating:

BT F331:

Rated: 50,8Vdc, 19,6Ah, Typical: 52 Vdc,20 Ah

BT F332:

Rated: 50,8Vdc, 14,7Ah, Typical: 52 Vdc,15 Ah

Engineering Considerations (Not For Field Representative's Use):

- The Rechargeable Li-ion Battery, BT F331 and BT F332 have been investigated in accordance with UL/ULC 2271: Standard for Batteries for Use In Light Electric Vehicle (LEV) Applications, Second Edition, Dated September 7, 2018.
- The cell type INR21700-50E++ has been investigated in accordance with ANSI/UL2580, Second Edition, Dated June 17, 2016; CAN/ULC-S2580, Edition 1, Dated June 17, 2016, in File MH62891, Vol 1.
- The cell type INR21700M-50E++ has been investigated in accordance with UL 1642, 5th Edition, dated March 13, 2012 (Revised June 23, 2015), in File MH21015, Volume 1.
- The enclosure has been investigated in accordance with UL50/CSA C22.2 No. 94.1, Twelfth Edition: Enclosures for Electrical Equipment, Non-Environmental Considerations; Rev Sept. 4, 2007 for Type 3R testing.
- This equipment is for use only in an end-product where the acceptability of the combination is determined by a Nationally Recognized Testing Laboratory.

Description (Continued)

Note to Field Representative:

See Conditions of Acceptability in this Section.

General Requirements

Scope of Requirements: The requirements contained within this section apply to all products contained within this Follow-Up Service Report File where applicable.

Definitions: (as defined or used in the context of the standard)

Term	Definitions
SELV:	Safety Extra Low Voltage
PCB:	Printed Circuit Board
TNV:	Telecommunications Network Voltage
Listed/Recognized Component:	A component evaluated to the applicable U.S. standards by a Nationally Recognized Testing Laboratory (NRTL).
Certified Component:	A component evaluated to the applicable Canadian standards by a Certification Organization (CO).
Listee:	Applicant

Measurements: All dimensions indicated in the body of this report are approximations unless otherwise indicated.

Corrosion Protection: All corrosive metals shall be provided with a means to protect from corrosion. Acceptable methods include painting, plating and galvanizing. Dissimilar metals shall not be employed where reliable continuity is required.

Soldered Connections: All soldered connections shall be made mechanically secure before soldering. Tack soldering is not acceptable. Acceptable forms of mechanical securement include:

- A) Lead is inserted through an eyelet or opening of a terminal block prior to soldering.
- B) Lead is inserted into a U or V shaped slot in the terminal prior to soldering.
- C) Lead is wrapped around a terminal post prior to soldering.
- D) Lead is tied to adjacent lead with wire tie-wrap near termination point.

Electrical Connections: All electrical connections other than soldering shall be provided with positive detent, crimp type insulated Recognized Component connectors suitable for the voltage and temperatures involved. They shall be sized for the wire and mounting terminations. Where hazardous voltage or energy is involved, all wire connections to connectors shall employ a recognized method of double securement. Where fork-type lugs are used, they shall be snap-on or up-turned lug type.

Mechanical Assembly: All parts shall be secured by welding, bolts/nuts with lock or star washers, or thread forming screws.

Creepage and Clearances: Shall be in accordance with the evaluated product standards.

General Requirements (Continued)

Where present, the following items are required.

PCB: Shall be a Recognized Component, rated minimum 94V-0 and 130°C.

Tubing and Sleeving: Shall be a Listed/Recognized/Certified Component, rated minimum 600V, 80°C, unless otherwise noted.

Wire Connectors: (Various crimp-type) Shall be Listed/Recognized/Certified Components sized for the wire and mounting terminations. Both the wire insulation and the conductor shall be crimped.

Fuseholder: Operator accessible fuseholders, when provided, are connected to the ungrounded conductor(s) of the primary circuit.

Internal Wiring: All internal wiring and connections are properly jacketed or enclosed within the equipment. Wiring is routed and secured to reduce the possibility of stress being transmitted to electrical connections, as necessary. All internal conductors in the secondary circuits are routed away from primary circuit conductors and from uninsulated live parts. There is no internal wiring subject to contact by the user when the product is employed as intended. The internal wiring is acceptable for conditions of service to which it will be subjected. Internal conductors consist of Recognized Component AWM insulated individual conductors; sized in accordance with the National Electric code and Canadian Electrical code, as may be applicable for the current expected in the conductor, 600V, 80°C and 600V,200°C

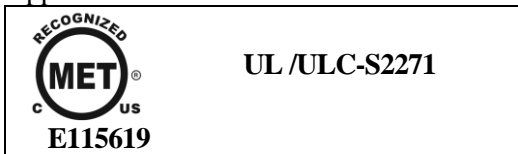
Interconnecting Cords and Cables: Flexible telecommunication cord and cable assemblies employed for interconnection between components are to be rated for and comply with temperatures, exposure to oil or grease and other conditions of service within the environment the product is to be utilized.

Markings

Etching, molding, die-stamping, silk-screening, stamped-, or etched-metal labels secured by rivets or screws are considered permanent. Recognized/Certified Component, Marking and Labeling Systems, and/or labels tested and deemed suitable for the surface to which it is applied is also considered permanent. Per the Canadian Electrical Code described in CSA C22.2 No. 0 General Requirements, Canadian product certification requires warning/cautionary markings in both English and French languages. It is the Applicant's responsibility to provide the listed Bilingual Markings shown below in accordance with the Canadian regulatory requirements. Each product is to be permanently marked with the following information:

- a. The MET Mark (refer to MET Applicant Contract), with the applicant/listee name or alternate listee name as identified within this report, trade name or trade mark, product model number, and a date of manufacture or serial number. If the date of manufacture is in a code, it shall not repeat in less than 10 years and it shall not require reference to the manufacturer's records to determine when the product was manufactured.

- b. Method of applying the MET Mark:
 - Direct Imprinting
 - Purchasing Labels from Eurofins E&E NAApproved MET Mark:



- c. Near each terminal and control, there shall be a marking to identify the function.
- d. Terminals shall be marked " positive" or " +" and " negative" or " -" or both to indicate polarity unless the terminal is keyed in a manner that prevents incorrect connections in the end use vehicle.
- e. All external terminals and connections shall be provided with identification and if applicable, polarity markings.
- f. ISO CAUTIONARY SYMBOL (ISO Publication ISO 3864, No. B.3.1) consisting of an exclamation mark within an equilateral triangle. Color and contrast shall be in accordance with the applicable standard. Shall be provided in operator line-of sight during normal use.

Markings(Continued)

BAFANG



UL 2271
CAN/ULC-S2271
E115619

Rechargeable Li-Ion Battery:
14INR22/71-4
Model: BT F331
Voltage: 52Vdc
Capacity: 20Ah
Energy: 1040Wh
Manufacturer: Bafang New Energy
(Suzhou) Co.,Ltd

⚠ CAUTION:

- Risk of fire or explosion if battery is used with an incompatible system.
- Do not open, disassemble or pierce battery due to risk of short circuit, fire or explosion.
- In case of drop, shock or similar event, do not continue to use battery and return immediately for examination.
- Only use the original charger as supplied with battery due to risk of fire or explosion.
- Disposal of used batteries should follow locally enforced regulations.

WARNING - To reduce the risk of injury, user must read instruction manual.

AVERTISSEMENT - Pour prévenir les blessures, l'utilisateur doit lire le manuel d'utilisation .





BAFANG



UL 2271
CAN/ULC-S2271
E115619

Rechargeable Li-Ion Battery:
14INR22/71-3
Model: BT F332
Voltage: 52Vdc
Capacity: 15Ah
Energy: 780Wh
Manufacturer: Bafang New Energy
(Suzhou) Co.,Ltd

⚠ CAUTION:

- Risk of fire or explosion if battery is used with an incompatible system.
- Do not open, disassemble or pierce battery due to risk of short circuit, fire or explosion.
- In case of drop, shock or similar event, do not continue to use battery and return immediately for examination.
- Only use the original charger as supplied with battery due to risk of fire or explosion.
- Disposal of used batteries should follow locally enforced regulations.

WARNING - To reduce the risk of injury, user must read instruction manual.

AVERTISSEMENT - Pour prévenir les blessures, l'utilisateur doit lire le manuel d'utilisation .





Note: Tag should be permanently affixed to battery

Manual/Service Instructions

- Operations and Service instructions are provided with the equipment.

Alternate Listee Information

Alternate listees and product names or model numbers: None

	Company Name	Product Name	Listing Number
Applicant			
Alt. Listee 1			

Note: An alternate listee is not allowed to open the product and make modifications. An alternate listee is only allowed to change the Company name, Product name and model number.

Alternate recording of an OEM to be used **only if the OEM is not to be identified.**

*Note: The File Number “E112790¹” may be utilized in lieu of listing an alternate listee as long as the product marking contains the Digi International’s 50001730-xx² series of product model numbers. The “xx” can be any number 0-9. Each number inserted for the “xx” represents a different alternate listee.



Applicant's Responsibilities

Product Modifications:

Minor product modifications by the manufacturer may be allowed using the following guidelines:

1. Components identified in this report as "Listed, Recognized, or Certified" and **NOT** identified with a manufacturer name or part number may be exchanged with an alternate "Listed, Recognized, or Certified" component of equivalent value.

Example: Appliance Inlet Connector - Listed/Certified Component, IEC 320 style male connector, rated 250 volts and 20 amperes. Mechanically secured to the front panel with screws and locking washers.

- This inlet connector may be replaced with any Listed/Certified inlet connector with the same ratings as stated and where mechanical securement is maintained.

2. Components identified by a manufacturer name, part number, or with specific comments, (such as AC only, indoor use only, approved for use in this product only), may **NOT** be replaced or modified without prior approval from MET Laboratories.

Example: Circuit Breaker - Recognized/Certified Component, ABCD Co. P/N XYZ123, rated 250 volts maximum, 50/60 Hz, 25 full-load amperes, 31.3 trip amperes. Toggle handle marked with IEC on/off symbols. Mechanically secured to the front panel with screws and locking washers.

- This circuit breaker can **NOT** be modified or changed without prior approval by Eurofins E&E NA, Inc.

Applicant's Responsibilities (Continued)

Project Amendments:

For any changes related to product construction, manufacturing locations, if the product is intended to be marketed/sold under an alternate name or model number than that originally listed, or any issues which would require notification or change in the status of this file, please complete the form and return to Eurofins E&E NA following the instructions provided on the form.

For your convenience a Project Amendment Request (PAR) form is available for download at <http://corp.metlabs.com/safetyreq/> Alternatively, please provide it to your local Eurofins office or Eurofins Partner Representative.

If you are terminating or temporarily suspending production of this product for an extended period, please send a letter on company letterhead to:

Eurofins E&E NA, Inc.
Attn: Follow Up Services Department
914 West Patapsco Avenue
Baltimore, Maryland 21230
USA
Fax: (410) 354-3313

Applicant's Responsibilities (Continued)

Manufacturing and Production-Line Tests and Documentation performed by Manufacturer.

This product is exempt from Production Line Test.

Conditions of Acceptability

When installed in the end product, consideration shall be given to the following:

1. The battery pack had not been subjected to Dielectric Voltage Withstand Test per section 28 of UL/ULC 2271 as this test is only applicable to battery with hazard voltage.
2. The battery pack had not been subjected to Isolation Resistance Test per section 29 of UL/ULC 2271 as this test is only applicable to battery with hazard voltage.
3. The battery pack had not been subjected to a Crush Test per section 32 of UL/ULC 2271 as this test is only applicable to on road LEVs such as scooters and motorcycles. Additional tests may be needed in the end application and the acceptance shall be determined in the end use application.
4. The battery pack had not been subjected to Handle Loading Test per section 35 of UL/ULC 2271 as this test is only considered the strength of the handle(s) in the end use application.
5. The battery pack had not been subjected to Strain Relief Test per section 37 of UL/ULC 2271 as this test is considered if the battery pack wiring connector are exposure to outside of the end product in the end use application.
6. Repeat of temperature test shall be considered in the end use application.
7. Any other marking as required in the end use application shall be considered.

Critical Components

Figure /item No.	Object/ Parts No.	Manufacturer/ Trademark	Type/ Model	Technical Data	Standard (Edition / year)	Mark(s) of Conformity	Secured Method
Battery BT F331							
3/2	Cell	SAMSUNG	INR21700-50E	3,63Vdc, 4,9Ah, Li-ion	UL/CUL 2580	UL/CSA MH62891, Vol 1	Interconnect on by welding
					UL 1642	UL MH21015 Vol 1	
2/2	IC (U8, U9, U11)	ABLIC Inc.	S-8215AAV-K8T2U	40~85°C OVP:4,3±0,025V	UL/CUL 2271	UL/CSA Test with application	Soldered with PCB
2/2	IC (U2)	SINO WEALTH Electronics Co., Ltd.	SH367309	-40~85°C OVP:4.25±0.05V UVP:2.80±0.05V	UL/CUL 2271	UL/CSA Test with application	Soldered with PCB
2/2	MOSFET (QC1, QC5, QD1, QD2, QD3, QD4, QD5, QD6)	Yangzhou Yangjie Electronic Technology Co., Ltd.	YJG100G08 A	VDS: 80V, VGS: ±20V Id: 100A; Tstg: -55°C ~+150°C Tj(max)=150°C	UL/CUL 2271	UL/CSA Test with application	Soldered with PCB
2/2	Fuse (F1)	CYG Wayon Circuit Protection Co.,Ltd.	WPF45A14 K-2	45A, 62VDC	UL/CUL 248-14	UL/CSA E311435	Soldered with PCB
2/2	Fuse (F2)	Dongguan Better Electronics Technology Co., Ltd.	2412100100	10A 125VDC	UL/CUL 248-14	UL/CSA .E300003	Soldered with PCB
2/2	NTC (RCL1)	Nanjing Shiheng Electron Technology CO.,LTD.	MF52 D 103F3435	- 20~105°C R25°C : 10KΩPmax: 50mW	UL/CUL1434	UL/CSA E240991	Soldered with PCB
2/2	PCB	Suzhou Wutong Electronic CO.,LTD.	GS-4	V-0,130	UL/CUL 796	UL/CSA E236256	Secured with screws
1/1	Enclosure	FORMOSA CHEMICALS & FIBRE CORP PLASTICS DIV	AC310(+)	V-0	UL/CUL 94	UL/CSA E162823	Secured with screws
2/2	Internal Wiring	DONGGUAN KAOGLE ELECTRONIC CO.LTD.	3135	200°C, 600V, 12-18AWG	UL/CUL 758	UL/CSA E347603	Soldered with PCB
2/2	Internal Wiring	DONGGUAN KAOGLE ELECTRONIC CO.LTD.	1007	80°C, 300V, 24AWG	UL/CUL 758	UL/CSA E336285	Soldered with PCB

Critical Components (Continued)

Figure/i tem No.	Object/ Parts No.	Manufacturer/ Trademark	Type/ Model	Technical Data	Standard (Edition / year)	Mark(s) of Conformity	Secured Method
Battery BT F 332							
6/2	Cell	SAMSUNG	INR21700-50E	3,63Vdc, 4,9Ah, Li-ion	UL/CUL 2580 UL 1642	UL/CSA MH62891, Vol 1 UL MH21015 Vol 1	Interconnect on by welding
5/2	IC (U8, U9, U11)	ABLIC Inc.	S-8215AAV-K8T2U	40~85°C OVP:4,3±0,025V	UL/CUL 2271	UL/CSA Test with application	Soldered with PCB
5/2	IC (U2)	SINO WEALTH Electronics Co., Ltd.	SH367309	-40~85°C OVP:4.25±0.05V UVP:2.80±0.05V	UL/CUL 2271	UL/CSA Test with application	Soldered with PCB
5/2	MOSFET (QC1, QC5, QD1, QD2, QD3, QD4, QD5, QD6)	Yangzhou Yangjie Electronic Technology Co., Ltd.	YJG100G08 A	VDS: 80V, VGS: ±20V Id: 100A; Tstg: -55°C ~+150°C Tj(max)=150°C	UL/CUL 2271	UL/CSA Test with application	Soldered with PCB
5/2	Fuse (F1)	CYG Wayon Circuit Protection Co.,Ltd.	WPF45A14 K-2	45A, 62VDC	UL/CUL 248-14	UL/CSA E311435	Soldered with PCB
5/2	Fuse (F2)	Dongguan Better Electronics Technology Co., Ltd.	2412100100	10A 125VDC	UL/CUL 248-14	UL/CSA .E300003	Soldered with PCB
5/2	NTC (RCL1)	Nanjing Shiheng Electron Technology CO.,LTD.	MF52 D 103F3435	- 20~105°C R25°C : 10KΩ Pmax: 50mW	UL/CUL14 34	UL/CSA E240991	Soldered with PCB
5/2	PCB	Suzhou Wutong Electronic CO.,LTD.	GS-4	V-0,130	UL/CUL 796	UL/CSA E236256	Secured with screws
4/1	Enclosure	FORMOSA CHEMICALS & FIBRE CORP PLASTICS DIV	AC310(+)	V-0	UL/CUL 94	UL/CSA E162823	Secured with screws
5/2	Internal Wiring	DONGGUAN KAOGLE ELECTRONIC CO.LTD.	3135	200°C, 600V, 12-18AWG	UL/CUL 758	UL/CSA E347603	Soldered with PCB
5/2	Internal Wiring	DONGGUAN KAOGLE ELECTRONIC CO.LTD.	1007	80°C, 300V, 24AWG	UL/CUL 758	UL/CSA E336285	Soldered with PCB

Critical Drawings

Title:	Drawing No.:	Rev. Level:	Date:
None			

Figures

Figure 1.



Overview of battery BT F331



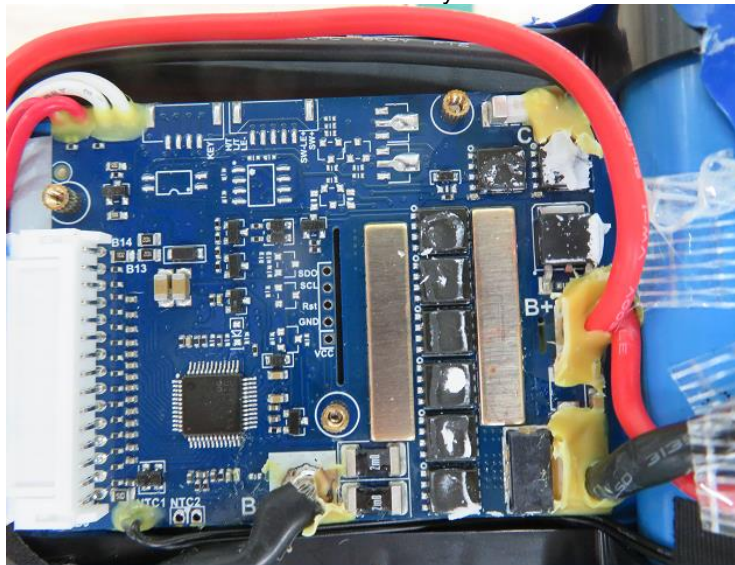
Overview of battery BT F331

Figures (Continued)

Figure 2.



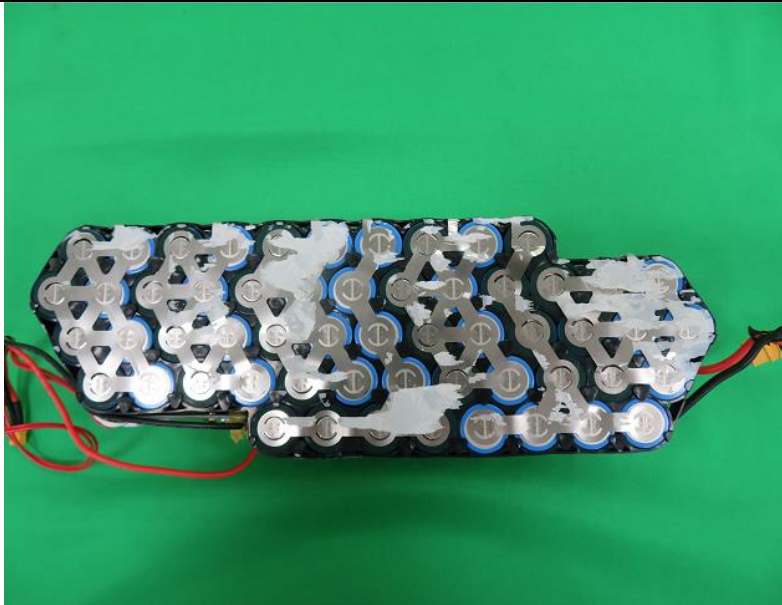
Internal view of battery BT F331



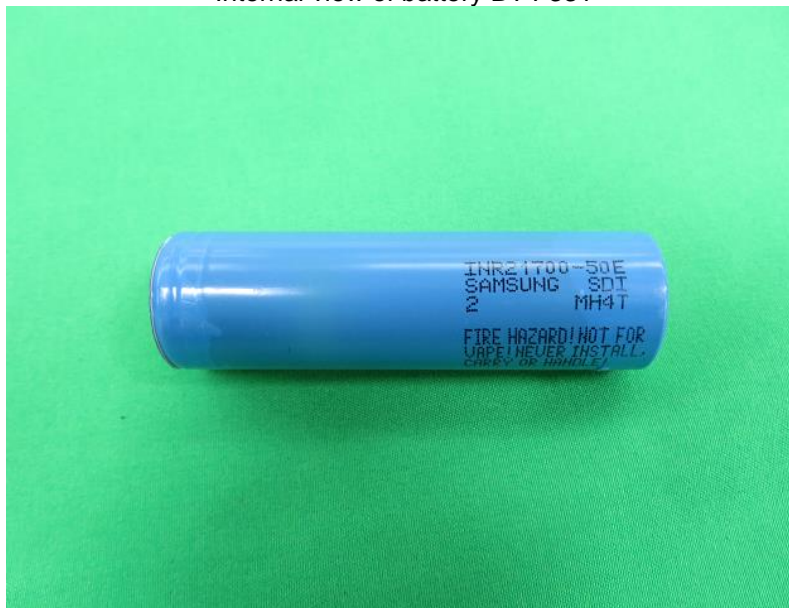
Internal view of battery BT F331

Figures (Continued)

Figure 3.



Internal view of battery BT F331



Cell view of BF F331

Figures (Continued)

Figure 4.



Overview of battery BT F332



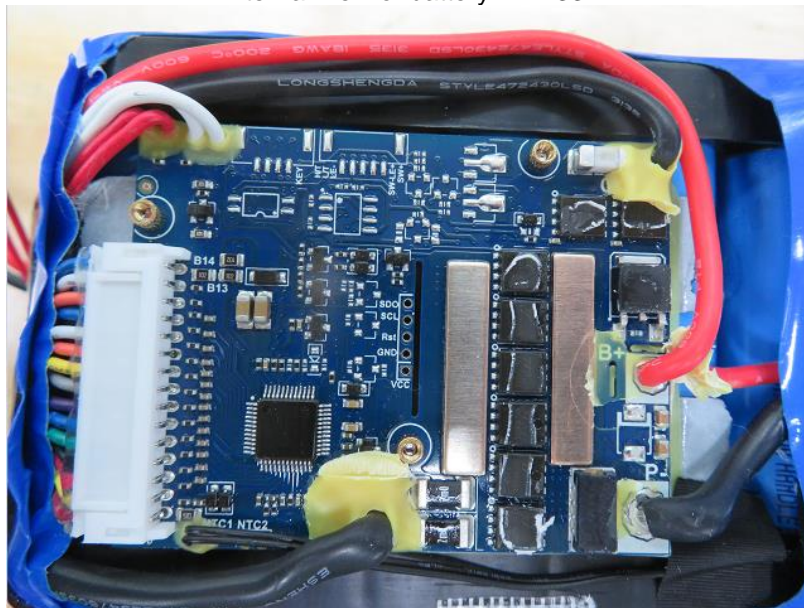
Overview of battery BT F332

Figures (Continued)

Figure 5.



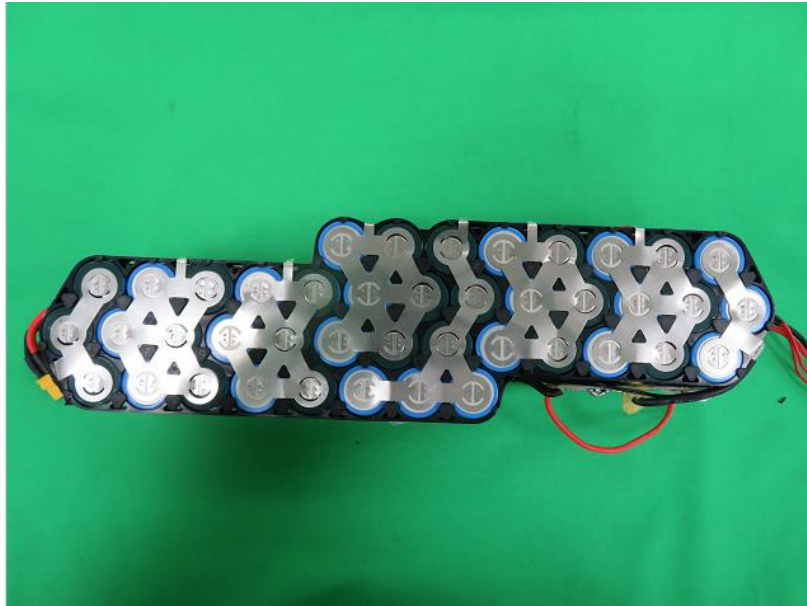
Internal view of battery BT F332



PCB view of battery BT F332

Figures (Continued)

Figure 6.



Internal view of battery BT F332



Cell view of BF F332

Illustrations

Illustration 1.

Battery:

Model of battery pack:	BT F331
Nominal Voltage	50,8Vdc
Rated Capacity	19,6 Ah
Typical Voltage	52 Vdc
Typical Capacity	20,0 Ah
Max. Charge Current	4,0 A
Max. Charge Voltage	58,8 V
Max. Discharge Current	30,0 A
Discharge Cut-off Voltage	37,8 V
Charge Operating Temperature	0 ~ 45 °C
Discharge Operating Temperature	-20 ~ 60 °C
Construction	14S4P

Model of battery pack:	BT F332
Nominal Voltage	50,8 Vdc
Rated Capacity	14,7 Ah
Typical Voltage	52,0 Vdc
Typical Capacity	15,0 Ah
Max. Charge Current	4,0 A
Max. Charge Voltage	58,8 V
Max. Discharge Current	30,0 A
Discharge Cut-off Voltage	37,8 V
Charge Operating Temperature	0 ~ 45 °C
Discharge Operating Temperature	-20 ~ 60 °C
Construction	14S3P

Cell:

Model of cell	INR21700-50E++
Nominal Voltage	3,63 Vdc
Rated Capacity	4,9 Ah
Max. Charge Current	4,9 A
Max. Charge Voltage	4,25 V
Max. Discharge Current	10.0 A
Discharge Cut-off Voltage	2,50V
Charge Operating Temperature	0 ~ 45 °C
Discharge Operating Temperature	-20 ~ 60 °C

Testing Considerations

A sample of the Rechargeable Li-ion Battery BT F331 and BT F332 as subjected to the following test program with satisfactory results. All tests were conducted in accordance UL/ULC 2271: Standard for Batteries for Use In Light Electric Vehicle (LEV) Applications , Second Edition, Dated September 7, 2018.

Only these tests were considered necessary due to engineering considerations. Detailed test results are on file at MET Laboratories under project number 127169

TESTS CONDUCTED:

BT F 331

1. Overcharge Test
2. Short-Circuit Test
3. Over-discharging Test
4. Temperature Test
5. Imbalanced Charging Test
6. Vibration Endurance Test
7. Shock Test
8. Drop Test
9. Roll Over Test
10. Immersion Test
11. Water Exposure Test
12. Thermal Cycling Test
13. Label Permanence Test
14. Label Permanence Test

TESTS CONDUCTED:

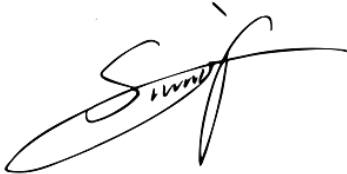
BT F 332

15. Overcharge Test
16. Short-Circuit Test
17. Over-discharging Test
18. Temperature Test
19. Imbalanced Charging Test
20. Immersion Test
21. Water Exposure Test

Conclusion

The product(s) covered by this report have been tested, examined, and found to comply with the applicable requirements of UL/ULC 2271: Standard for Batteries for Use In Light Electric Vehicle (LEV) Applications , Second Edition, Dated September 7, 2018. This certification has been granted under a System 3 program as defined in ISO/IEC 17067.

Prepared By:



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