Standard Specification

ATevo Series Float Battery Charger

An industrial battery charger shall be furnished in accordance with the following specification.

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1 - General

1.1. The battery charger shall be sized, using industry accepted IEEE sizing methods, to continuously carry any constant load and recharge the battery.

1.2. The battery charger shall provide a continuous regulated dc output derived from an ac source. The battery charger shall provide for a 2-rate output to accommodate both float and equalizing charge, as applicable for the technology.

1.3. The battery charger shall be of a design that employs microprocessor technology to control and define all critical operational, calibration, regulation, and alarm functions.

2 - Applicable Codes

The charger shall meet requirements of latest versions of the following industry and agency standards:

2.1. IEEE 2405.2022 / NEMA PE5 for stationary battery chargers

2.2. IEEE 946 DC System Design

2.3. UL 1564 standard for industrial battery chargers

2.4. UL 1012 standard for stationary power supplies

2.5. CSA 22.2 standard for battery chargers

2.6. IEEE/ANSI C37.90 surge withstand capability (SWC)

2.7. FCC Part 15 Subpart J Class A

2.8. current seismic compliance: IEEE 693-2005 High

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3 - Standard Features

3.1. Standard Input Voltages include: 120, 208, 240, 480, and 600Vac @ 60Hz, and 220, 380, 416Vac @ 50-60Hz. Input frequency tolerance 47Hz to 63Hz, and ac input voltage tolerance is +10%/-12%. Other custom ac input voltages are available.

3.2. Standard Output Voltages include: 24, 48, 130, and 260Vdc with output current ratings from 6Adc to 1000Adc. See catalog model details for available combinations.

3.3. Output regulation of +/- 0.25% of dc voltage setting with input line variations of +10%/12% voltage, and/or +/-5% frequency with load variations from no load to full load over the operating dc voltage range.

3.4. AC input and dc output circuit breakers are standard.

3.5. Output control is constant-voltage, current-limited.

3.6. The charger can deliver 110% continuous rated output current at the maximum equalize voltage and at the rated ac input voltage, from -10 °C to + 50 °C. Current limit shall be factory set at 110% of output and be adjustable from 50% to 110% of the nominal output.

3.7. Operating environments shall be:

- 3.7.1. -18 ºC to +50 ºC (-1 ºF to 122 ºF) without de-rating
- 3.7.2. -30 ºC to +70 ºC (-22 ºF to 158 ºF) storage
- 3.7.3. RH 0% - 95% non-condensing
- 3.7.4. elevation to 1,000 meters (3,300 feet)

3.8. Minimum dc output filtering, consisting of two inductors and one or more electrolytic capacitors, limiting the output ripple as specified in IEEE 2405 / NEMA PE5.

3.9. Random parallel load share operation of two (2) or more chargers with the same dc voltage rating shall be a standard feature of the filtered charger.

3.10. DC voltage transients due to sudden changes in load current over the range of 10% to 90% or 90% to 10% of full load occurring within 2 milliseconds shall not result in an output variation of greater than +/-6% of the nominal voltage setting. Recovery to within +/-0.25% of the nominal will occur within 300 milliseconds.

3.11. Startup: Charger start-up will incorporate a safe start feature that stabilizes charger output within 15 seconds when a load of at least 5% of rating is applied to the charger which is connected to a fully charged battery.

3.12. Charger will operate into zero battery voltage without activating any protective devices other than electronic current limiting.

3.13. Charger will start and operate with a crowbar short circuit on the output without tripping the standard dc circuit breaker.

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3.14. Cooling: Battery charger internal heat dissipation (generated by transformer, inductors, rectifier, etc.) is dependent upon requirement & model / enclosure.

3.14.1. NEMA Type-1 top-vented enclosures (smaller ratings)
- natural convection (all 1PH/3PH 6Adc - 300 Adc models)
- also applies with optional NEMA Type-2 drip shield

3.14.2. NEMA Type-1 top-vented enclosures (larger ratings)
- forced air cooling (all 3PH 400Adc - 1000 Adc models)
- fans powered by battery charger's isolation transformer
- also applies with optional NEMA Type-2 drip shield

3.14.3. NEMA Type-4 weather-proof cabinets (smaller ratings)
- forced air cooling (Style-5054, Style-5070 & Style-5030 models)
- fans not powered by battery charger
- terminal block provided for external 120 Vac 1PH power connection to cabinet cooling fans

3.14.4. NEMA Type-4 weather-proof cabinets (larger ratings)
- forced air cooling (Style-163 & Style-198 models)
- fans powered by battery charger's isolation transformer

3.15. Chargers shall have the ***HindlePower*** patented clear safety cover over all internal components. The safety cover is marked with a component layout and connection diagram. *(excludes certain larger battery charger enclosures)*

3.16. Remote sense terminals are standard for all chargers. This sensing feature detects and compensates for a voltage difference, as measured between the charger and the battery, caused by any resistance in a dc cable over a given distance.

3.17. All non-magnetic wiring shall use Hypalon or XLPE (cross-linked polyethylene) insulation system, 600V, 105 °C. Printed circuit board interconnections may use ribbon cables, or other standard pcb components.

3.18. Solderless CU-AL compression input & output terminals, including user ground to chassis.

3.19. Test points are provided for easy field testing of dc output voltage.

3.20. Metering shall be back lit, LCD, displaying simultaneously: Vdc, Adc, ground fault metering, and resistance.

3.20.1. The display shall provide all alarm and status indications in plain English.

3.21. Firmware shall be downloadable.

3.21.1. All firmware shall be encrypted.

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4 - Operation

4.1. Battery charger shall be programmable via the HMI soft touch pad and at a minimum display the following:

- 4.1.1. dc output voltage (Vdc)
- 4.1.2. dc output current (Adc)
- 4.1.3. float / equalize mode
- 4.1.4. manual / auto equalize timer mode
- 4.1.5. equalize hours remaining
- 4.1.6. error and message codes
- 4.1.7. AC ON
- 4.1.8. alarm indications
- 4.1.9. **ATevo** menu functions (*see Section 8.1.1*)
- 4.1.10. Hindle Health® System (HHS) to indicate overall health of the charger

4.2. The charger dc output voltage (Vdc) and dc output current (Adc) are displayed simultaneously, using a back-lit LCD device, with 0.5% accuracy.

4.3. Float and equalize charge modes are displayed in the upper line of the display.

4.4. Equalize methods (*see Section 5.1*) are displayed in upper line of LCD. In equalize mode the display will alternate between the display mode setting and the hours of equalize charge remaining.

4.5. Alarms are indicated by the associated labeled LEDs and on the bottom line of the display.

4.6. The battery charger shall automatically annunciate alarms and respond to any programmed options, without operator intervention. Errors and messages, indicated by self-diagnostics and operating conditions, shall be indicated on the front panel digital HMI display, using plain English words (no codes).

4.7. High DC Voltage shutdown may be operator enabled or disabled and operates by negating the gate pulses to the SCRs.

- 4.7.1. When enabled, High DC Voltage shutdown requires user intervention to reset.

4.8. Charger operational security may be enabled and activated by user defined password.

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5 - Equalize Modes and Functions

5.1. Equalize modes:

- 5.1.1. Equalize mode disabled
- 5.1.2. Manual Timed Equalize
  - 5.1.2.1. Activate by pressing “Charge Mode” button
  - 5.1.2.2. Charger returns to float mode after equalize timer expires.
- 5.1.3. Auto Timed Equalize
  - 5.1.3.1. Charger will activate equalize mode when ac power is restored after an outage of greater than 12 seconds.
  - 5.1.3.2. Charger returns to float mode after equalize timer expires.

5.2. Equalize Timer

- 5.2.1. Equalize Timer is adjustable from 0 to 255 hours in 1-hour increments.

5.3. Equalize time remaining appears on display when equalize charge mode is active.

6 - Alarms & Communication

6.1. Standard Alarms:

- 6.1.1. AC failure, low voltage
- 6.1.2. High DCV battery bus (HVDC)
- 6.1.3. High level detect alarm (analog HVDC)
- 6.1.4. Low DCV battery bus (LVDC)
- 6.1.5. Low level detect alarm (analog LVDC)
- 6.1.6. DC output failure
- 6.1.7. Battery open alarm
- 6.1.8. Alarm relay failure
- 6.1.9. Open external feedback
- 6.1.10. Open internal feedback
- 6.1.11. DC power supply failure
- 6.1.12. Main microprocessor failure
- 6.1.13. Charger output ripple
- 6.1.14. Charger output at current limit
- 6.1.15. Charger over temperature alarm
- 6.1.16. Rectifier temperature sensor failure
- 6.1.17. End of discharge alarm
- 6.1.18. DC Circuit Breaker (DCCB) open
- 6.1.19. Cooling fan not operating (applies only to 400A+, forced air-cooled models)
- 6.1.20. Ground fault:
  - 6.1.20.1. Positive (+) fault
  - 6.1.20.2. Negative (–) fault

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6.2. Form-C Contacts (relays)

6.2.1. Standard, one (1) common Form-C contact for all alarm functions.

6.2.1.1. Common alarm relay can be configured to activate when any alarm(s) occur.

6.2.1.2. Contact rating: 130Vac/Vdc @ 0.50A, 24Vdc @ 1.0A

6.2.2. Optional, additional Form-C contacts for alarms.

6.2.2.1. Programmable Form-C contact for any one alarm (groups of 6 relays)

6.2.2.2. Contact rating 130Vac/Vdc @ 0.50A/24VDC @ 1.0A

6.3. Alarm and Form-C Contact Configuration

6.3.1. Common alarm assignment

6.3.1.1. The three (3) versions of the common alarm Form-C contact can be programmed to activate when any one (1) of a group of alarms is present. Group Alarm assignments as follows:

6.3.1.1.1 Common Alarm

6.3.1.1.2 Major Alarm

6.3.1.1.3 Minor Alarm

6.3.2. Optional Form-C contact alarm assignment

6.3.2.1. Each Form-C contact can be programmed to indicate the status of any one (1) alarm.

6.3.3. Each Form-C contact has a time delay configuration.

6.3.3.1. The Form-C contact relay time delay is adjustable from 0 to 999 seconds after alarm occurs.

6.3.4. Each Form C contact may be configured to “latch” when active.

6.3.4.1. “Self-clearing” relays automatically return to the non-alarm state when alarm clears.

6.3.4.2. “Latched” relays will remain in the alarmed state until the user manually clears the alarm.

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6.4. Optional Communications

6.4.1. Serial Communications Adapter

6.4.1.1. **ATevo** battery chargers can support up to three (3) Serial Communication Adapters

6.4.1.2. Serial Modbus and DNP3.0 ports can be supported simultaneously.

6.4.1.3. Each Serial Communication Adapter will support:

6.4.1.3.1 Isolated Port Connection (*isolated from charger and all other ports*)

6.4.1.3.2 RS-232 or RS-485 (2-wire or 4-wire) networks

6.4.1.3.3 Modbus, DNP3.0, or IEC-61850 protocols, supporting all HMI functions and alarms

6.4.1.3.4 Forced Load Sharing option

6.4.1.3.5 (*future expandability*)

6.4.2. Ethernet Communications Adapter

6.4.2.1. Supports 10/100 Mbps copper media via standard RJ-45 connector

6.4.2.2. Supports both Modbus, DNP3.0 & IEC-61850 simultaneously

6.4.3. Fiber Communications

6.4.3.1. Serial fiber options are available

6.4.3.2. Ethernet over fiber options are available

7 - Protective Devices

7.1. The battery charger shall employ protection circuit breakers as standard, for ac input and dc output connections.

7.2. AC input transient over voltage protection shall be accomplished via MOVs (metal oxide varistor) on ac input terminals.

7.3. DC external transient over voltage protection shall be via a MOV (metal oxide varistor) on the dc bus. This shall be located on the battery charger Power Board.

7.4. The charger shall be protected against damage if the battery is connected in reverse.

7.5. Output electronic current limit shall be adjustable from 50% to 110% of rated dc output current.

7.6. The battery charger shall electronically protect itself from a short circuit in the output to limit the current output. When the short is corrected, the battery charger will automatically return to normal charger operation. An alarm shall be provided to indicate a short circuit of the output. The error code shall be automatically removed when the output voltage rises above 2.0Vdc.

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8 - Soft Touch Human Machine Interface (HMI)

8.1. The HMI will be interactive, and provide the following information via a single LCD screen display:

- 8.1.1. Standard menu for programming the charger:
  - 8.1.1.1. Charger operation and alarm settings
  - 8.1.1.2. System settings: date, time, backlight, contrast
  - 8.1.1.3. Alarm view: view active alarms
  - 8.1.1.4. Event log: view event log
  - 8.1.1.5. Event log utilities: clear or download event log
  - 8.1.1.6. Relay configuration: latching/non-latching, delay, relay assignment to alarms
  - 8.1.1.7. Relay utilities: reset latched alarms
  - 8.1.1.8. System information: software version
- 8.1.2. Network and communication settings
- 8.1.3. Lamp/display test will test display operation and lamps
- 8.1.4. Hindle Health® System (*see Section 10*)
- 8.1.5. Alarm conditions, status and adjustments (*see Section 6*)
- 8.1.6. Event logging of alarm conditions (*see Section 9*)
- 8.1.7. Security password

9 - Data Recording and Event Log

9.1. System to record all data events for the life of the charger and provide status as follows:

- 9.1.1. Each alarm function, date, start time and end time
- 9.1.2. Each self-diagnostic event, date and time
- 9.1.3. Hours of operation since last reset

9.2. All events are viewable on the digital display and may be downloaded using comma-separated value (.CSV) format.

9.3. Over 1,000 events may be stored on the battery charger's removable memory SD card.

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10 - Hindle Health® System

10.1. The Hindle Health® System (HHS) provides a 2-stage self-diagnostic and system verification tool designed to assist the operator in verifying proper operation and settings of system parameters. This feature offers a systematic verification procedure to confirm the health of the battery charger. It queries the operator to verify all charger parameters and alarm settings. HHS steps the operator through an electronic functional check of all parameters including relay operations.

10.1.1. HHS Status Lights: Front panel green and red status lights confirm whether battery charger is functioning properly or requires attention.

10.1.2. HHS Parameters Verification:

10.1.2.1. LED Lamp Test
10.1.2.2. Verify dc output using hand-held dc voltmeter
10.1.2.3. Float voltage
10.1.2.4. Equalize voltage
10.1.2.5. Equalize timer
10.1.2.6. Auto equalize on/off
10.1.2.7. Current limit
10.1.2.8. High dc alarm
10.1.2.9. High dc voltage level detect
10.1.2.10. High dc voltage shutdown
10.1.2.11. Low dc alarm
10.1.2.12. End of discharge alarm
10.1.2.13. Low dc voltage level detect
10.1.2.14. AC ripple
10.1.2.15. Positive (+) ground detect
10.1.2.16. Negative (-) ground detect

10.1.3. The self-diagnostic system automatically monitors any battery charger malfunction or alarm condition.

10.1.4. Alarm Simulations.

10.1.4.1. High dc voltage alarm
10.1.4.2. Low dc voltage alarm
10.1.4.3. AC ripple alarm
10.1.4.4. Negative (-) ground detect
10.1.4.5. Positive (+) ground detect
10.1.4.6. Common alarm relay

10.1.5. HindleHealth+ (*see Section 12.29*)

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11 - Construction

11.1. I/O power terminals appropriately sized for field wiring.

11.1.1. CU-AL compression box lugs (Style-5070 & Style-5030)
11.1.2. Circuit Breaker compression lugs (Style-5054, -163 & -198)

11.2. Alarm function contacts use standardized solderless compression screw terminal blocks for #22-14 GA wire.

11.2.1. optional barrier type terminal blocks for connections using spade or ring type connectors, with wire sizes to #10 GA

11.3. Enclosure steel thicknesses as follows, by enclosure: ***(tba)***

11.4. Enclosure finish: ANSI-61 gray, baked powder epoxy inside and out

11.5. Serviceability: The battery charger shall be serviceable by a technician using standard hand tools. No special tools are required for any routine installation, maintenance, or repair. All service is made through front of unit, no rear access required. The addition of any and all options (including but not limited to: filtering, alarm capabilities, battery eliminator, remote temperature compensation, forced load sharing, medium or high AIC circuit breakers, and/or fuses) will be capable of being added in the field by the technician without any special training, using standard hand tools.

12 - Options

12.1. Multi-input tap ac input transformers.

12.2. Battery eliminator filter per IEEE 2405 / NEMA PE5. (*See Section **13.2***)

12.3. Special filtering to 30mV rms on 130Vdc systems, with a battery connected (measured at 130V battery terminals)

12.4. Programmable Form-C contacts in groups of six (6) for available alarms. Maximum of two (2) groups of six (6) available. Contact rating: 120Vac/Vdc @ 0.50A

12.5. AC Input Metering Module for Vac and Aac

12.6. Battery Current Charge / Discharge Meter (+/- Adc) & Battery Discharge Alarm

12.7. Communications (for SCADA applications):

12.7.1. MODBUS/DNP3.0 communications for all HMI functions and alarms
12.7.2. Ethernet Communications of all HMI functions and alarms
12.7.3. Fiber Link
12.7.4. IEC-61850 (*separate accessory*)
12.7.5. Expandable ports for future communications protocols

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12.8. Generic Binary Inputs

12.8.1. Independent optical isolated inputs are available in groups of four
12.8.2. Input can be user configured for 12, 24, 48, or 130Vdc thresholds
12.8.3. Use examples include, remote shutdown, electrolyte level, vent fan failure

12.9. Generic Analog Inputs

12.9.1. 0-10Vdc inputs referenced to charger DC(-) are available in groups of four (4)
12.9.2. Input can be scaled to report and alarm in primary values
12.9.3. Examples include, ac voltage, ac current, and temperature transducer inputs

12.10. Forced Load Sharing: Two chargers (2) with the same dc ratings, connected to the same dc bus, will equally share the system load. The chargers negotiate the load via a serial communications board, using a cable connected between to the two (2) chargers.

12.11. Custom Rated AC & DC AIC Circuit Breakers. For additional details, see online document (https://www.hindlepowerinc.com/media/4v2dcekw/**JF5072-00**.pdf).

12.12. Auxiliary Alarm Contacts for DC Output Circuit Breaker

12.12.1. optional Auxiliary Alarm Contacts for AC Input Circuit Breaker

12.13. Temperature Compensation (TempCo):

12.13.1. external temperature probe, mounted on or near battery
12.13.2. for Lead-Acid or Nickel-Cadmium battery chemistries (same probe)
12.13.3. cables (to remote battery) available in 25, 50, 100, and 200 foot lengths

12.14. Battery temperature alarm (requires temperature compensation probe)

12.15. Remote Equalize (with the addition of an auxiliary I/O board)

12.16. Circuit breaker lockable, and lock-out features

12.17. Special Enclosure Features:

12.17.1. NEMA Type-2 drip shield
12.17.2. NEMA Type-4 cabinet (weather-proof)

12.18. Copper Ground Bus Bar w/CU-AL Compression Box Lug

12.19. ANSI/IEEE-472 AC Input Lightning Arrestor Protection

12.20. Barrier Type Alarm Terminal Blocks

12.21. Custom Paint (internal/external)

12.22. Custom Engraved Equipment Tag Plates

12.23. Thermostat-Controlled Space-Heaters

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12.24. Fungus Proofing

12.25. Anti-Static Protection

12.26. Conformal Coating of Printed Circuit Boards

12.27. Customized (As-Built) Record Drawing Packages

12.28. Certified Test Data

12.29. **HindleHealth+** (*separate accessory*)

- continuous open battery monitoring (for alarm)
- calculated battery Ah capacity remaining
- remote battery charge/discharge metering (+/-Adc)
- remote battery discharge alarm
- remote battery temperature dc voltage compensation (TempCo)
- remote battery temp monitoring (ºC) & battery over-temp alarm

13 - Filtering

13.1. Standard dc output filter, consistent with industry specifications IEEE 2405.2022 & NEMA PE5. Circuit consists of two (2) inductors and one (1) or more electrolytic capacitors, capable of limiting the output ripple with a battery connected. The dc output filter reduces output ripple voltage to less than:

13.1.1. 30mVrms (or less) on batteries through 48V
13.1.2. 100mVrms (or less) on 130V batteries
13.1.3. 200mVrms (or less) on 260V batteries

Ripple measurements made at the ***battery*** terminals.

13.2. Battery eliminator filter, consistent with industry specifications IEEE 2405.2022 & NEMA PE5. Circuit consists of two (2) inductors and two (2) stages of capacitor sets, capable of limiting the output ripple ***without*** (or with) a battery connected. The eliminator filter reduces output ripple voltage to less than:

13.2.1. 30mVrms (or less) on 24V and 48V systems
13.2.2. 100mVrms (or less) on 130V systems
13.2.3. 200mVrms (or less) on 260V systems

Ripple measurements made at the ***charger*** dc output terminals.

13.3. Special filtering to 30mVrms on 130Vdc models (with battery connected), measured ***at*** 130V battery terminals.

13.4. As defined by NEMA PE5, a test battery must be fully charged and have an Ampere-hour capacity equal to four (4) times the rated output of the charger, where the Ah rating is at least four (4) times the charger dc output current rating.

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14 - Documentation

14.1. A manual describing the installation, operation, and maintenance of the battery charger, including all accessories and options shall be included. The charger shall have provision for storing the manual in a convenient permanent pocket attached directly to the chassis.

14.1.1. The charger's manual shall be available on the manufacturer's public website, and be downloadable at no cost and without registration. This electronic copy shall have active hyperlinks to key additional descriptive details, and have a digital-accessible table of contents, as standard.

14.2. Standard drawings consisting of enclosure outlines, internal component layouts, electrical schematics, and connection diagrams are provided in the manual. Hyperlinks to freely downloadable versions of these documents also provided.

14.3. A customized parts data package report, including manufacturer's replacement part number and recommended spares, shall be included with the battery charger.

14.4. Production Test Data per IEEE 2405-2022 / NEMA PE 5 shall be included with the battery charger.

14.5. Optional customized as-built record drawings are available for user-defined battery charger requirements.

14.6. Optional customized approval drawings are available for user-defined battery charger requirements.

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Job-Specific Details

Job Name _____

(Please refer to the specification for "Fill-In" details)

Feature	Spec Section	Detail	Specifier Fill-In Details
AC Input	3.1	Voltage	
		No. of Phases	
		Frequency	
DC Output	3.2	DC Voltage (*nominal*)	
		DC Current	
DC Output Filtering	13.0	per IEEE 2405 / NEMA PE5	
AC Circuit Breaker	7.0	AIC Rating	
DC Circuit Breaker	7.0	AIC Rating	
Standard Alarms (relays are programmable)	6.0	Number of Alarm Relays *(six per Aux I/O Board)*	
		Barrier Terms for Alarm Relays	
Desired Optional Alarms	6.0	see Section 12 for details	
Communications	6.4	Serial (*DNP or Modbus*)	
		Ethernet (*DNP or Modbus*)	
		Serial & Ethernet	
		IEC-61850 over Ethernet	
Enclosure	12.17	NEMA Type-1 (*top vented*)	
		NEMA Type-2 (*drip shield*)	
		NEMA Type-4 (*cabinet*)	
Protection	12.x	Copper Ground Bus	
		Lightning Protection IEEE-472	
		Fungus Protection	
		Static Proofing	
HindleHealth+	12.29	Continuous Battery Monitoring	
Additional Features	n/a		

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