

Sailboat Refit 12V ABYC - Permit Report

Project ID: —

Designed by	CircuitProof — MarinePowerLab Team
Jurisdiction	ABYC E-11 — Marine (US / Canada)
System	12 V DC · 3.6 kWh storage · 2000 W inverter
Generated	2026-07-21
Code revision basis	2023 NEC / 2024 ABYC (confirm locally-adopted revision)
Revision	A — issued for review · 2026-07-21

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Scope: electrical documentation package. Site plans, roof framing plans, and structural sheets are outside this document's scope — see the cover note on what this document is and is not.

What this document is

A multi-page design report covering the modeled system: one-line schematic, bill of materials with manufacturer SKUs, wire-sizing calculations, voltage-drop verification per circuit, overcurrent-protection justification, and a code compliance checklist. Each calculation cites its source clause.

What it is not

This is not a Professional Engineer (P.Eng / PE) stamped drawing. It does not replace AHJ approval where one is required. Verify all calculations and code references with a licensed professional before installation.

Disclaimer

CircuitProof produces design documentation from user-supplied inputs against the published code revision indicated above. This document is not a Professional Engineer (P.Eng) / Chartered Engineer stamp and does not substitute for one where one is required. Jurisdictions and insurance carriers may require P.Eng review or AHJ approval before installation or operation. Code references reflect the revision year stated above; confirm the locally-adopted revision with your AHJ. CircuitProof does not warrant fitness for any specific installation. The user is solely responsible for installation safety, compliance with local codes, and adherence to manufacturer specifications.

Executive summary

This design models 5 components across 4 wire runs. Battery storage totals 3,600 Wh at a 12 V nominal DC bus. Peak combined DC + AC load is 240 W (continuous 240 W). All values below are derived deterministically from the canvas state and cited against the controlling code sections.

System capacity

Nominal DC bus voltage	12 V
Battery storage	3,600 Wh (300 Ah at bus)
PV array	0 W
Inverter continuous rating	2000 W
AC load total	0 W
Peak load (DC + AC)	240 W
Continuous load	240 W
Components modeled	5
Wire runs modeled	4
Estimated equipment cost †	\$2,412 USD

Compliance rollup

Overall	FAIL
Errors (must address)	1
Warnings	0
Notes / informational	1
Passing rules	9

Detailed per-rule findings appear in the Compliance Checklist page later in this document.

Approval blocks

Filing under: Generic / unsubmitted · Code references as cited per page

Designer: _____ Date: _____

Reviewed by (P.Eng / PE): _____ Lic. #: _____ Date: _____

AHJ / inspector: _____ Date: _____

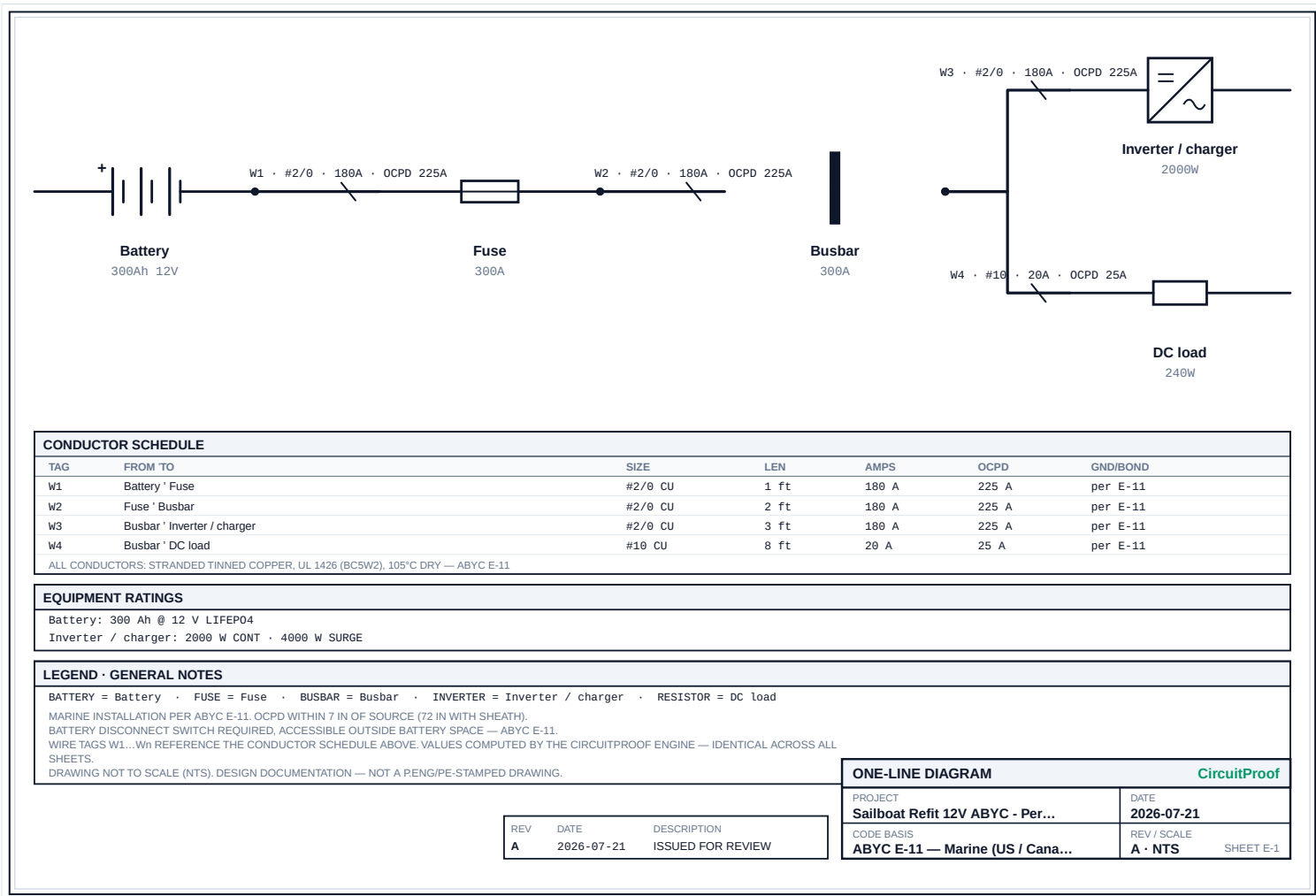
Insurance reviewer: _____ Date: _____

Submit with your jurisdiction's permit form. CircuitProof produces design documentation, not a P.Eng stamp.

Signature blocks are blanks for the appropriate parties to complete. CircuitProof does not pre-fill any of them and never represents itself as a stamping engineer.

One-line diagram

Wire tags (W1...Wn) key to the conductor schedule on-sheet and to the wire-sizing and overcurrent tables on the following sheets — all values computed by the same engine. Drawing not to scale (NTS).



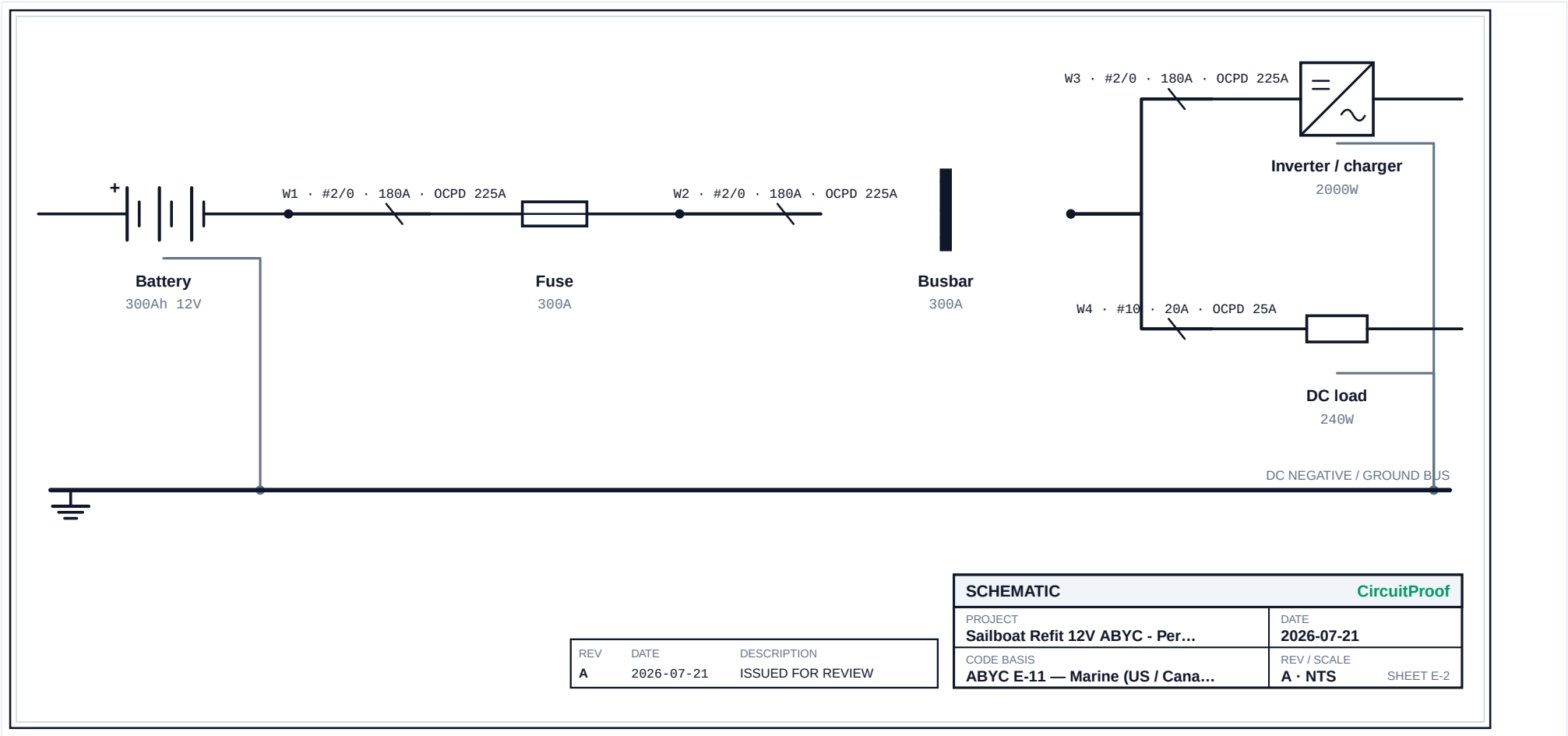
Sheet title: Sailboat Refit 12V ABYC - Permit Report — one-line diagram
Drawn by: CircuitProof

Date: 2026-07-21 · Scale: NTS · Rev A
Jurisdiction: ABYC E-11 — Marine (US / Canada)

SAMPLE — NOT FOR
CONSTRUCTION

DC schematic — two-line + EGC return

Positive conductors are routed per run; the negative return and equipment-grounding path are drawn to the DC negative/ground bus below the components. Wire tags key to the E-1 conductor schedule. Drawing not to scale (NTS).



SAMPLE — NOT FOR
CONSTRUCTION

Bill of materials

Quantities aggregated by item identity (label, manufacturer, SKU, spec). Prices below are estimated MSRP only — verify with current supplier quotes before ordering.

#	Item	Manufacturer	SKU / Model	Spec	Qty	Unit †	Total †
1. Storage							
1.1	Battery	Battle Born	BB10012	300 Ah @ 12 V	1	\$950	\$950
Storage subtotal †							\$950
2. Conversion & charging							
2.1	Inverter / charger	Victron	MultiPlus 12/2000	2000 W continuous	1	\$1,450	\$1,450
Conversion & charging subtotal †							\$1,450
3. Protection & disconnects							
3.1	Fuse	Blue Sea	ANL-5191	300 A	1	\$12	\$12
Protection & disconnects subtotal †							\$12
4. Distribution							
4.1	Busbar	Blue Sea	2105	300 A	1	—	—
Distribution subtotal †							\$0
5. Loads							
5.1	DC load	—	—	240 W	1	—	—
Loads subtotal †							\$0
Grand total †							\$2,412 USD

† Estimated MSRP only — verify the current price with your supplier before ordering. CircuitProof does not warrant price accuracy.

Wire sizing calculations

For each modeled wire run, the table lists the design current, run length, allowable voltage drop, the smallest conductor that satisfies both the ampacity and voltage-drop constraints, and the cited source. Code basis: ABYC E-11.

From 'To	Amps	Len (ft)	VD limit	AWG	Ampaci-ty	VD %	Citation
Battery 'Fuse	180	1	3%	2/0	231	0.24%	ABYC E-11 Table VI + E-11.4.d voltage drop — VERIFY
Fuse 'Busbar	180	2	3%	2/0	231	0.48%	ABYC E-11 Table VI + E-11.4.d voltage drop — VERIFY
Busbar 'Inverter / charger	180	3	3%	2/0	231	0.73%	ABYC E-11 Table VI + E-11.4.d voltage drop — VERIFY
Busbar 'DC load	20	8	3%	10	42	2.76%	ABYC E-11 Table VI + E-11.4.d voltage drop — VERIFY

Method

Selected AWG is the smallest conductor whose ampacity (after temperature + bundling derating) meets or exceeds the design current AND whose voltage drop across the round-trip length stays at or below the 3% design limit (NEC 210.19(A) Informational Note / ABYC E-11.4.d for critical circuits). Where the engine could not find a conductor in range, the row is flagged "oversize" — the design needs a parallel run, a higher system voltage, or a shorter physical route.

Voltage-drop verification

Each circuit's voltage drop is recomputed here from first principles using NEC Chapter 9, Table 8 DC resistance values. The formula is shown alongside the values used.

Formula (DC)
$$Vd_v = (2 \times L_{ft} \times I_a \times R_{kft}) / 1000$$
$$Vd_{pct} = (Vd_v / V_{system}) \times 100$$

L = one-way run length (ft); the factor of 2 accounts for the round trip of a 2-wire DC circuit. R = DC resistance per 1000 ft from NEC Ch.9, Table 8. AC analysis adds the reactance term per Table 9; for the conductor sizes here the reactance term is small enough to ignore (resistance-dominated).

Per-circuit results

From To	AWG	L (ft)	I (A)	R kft	Vd (V)	Vd (%)	Limit	Result
Battery 'Fuse	2/0	1	180	0.0967	0.035	0.29%	3%	PASS
Fuse 'Busbar	2/0	2	180	0.0967	0.07	0.58%	3%	PASS
Busbar 'Inverter / charger	2/0	3	180	0.0967	0.104	0.87%	3%	PASS
Busbar 'DC load	10	8	20	1.21	0.387	3.23%	3%	FAIL

Sample worked example
$$Vd = 2 \times 1 \text{ ft} \times 180 \text{ A} \times 0.0967 \text{ kft} \div 1000 = 0.035 \text{ V (0.29\%)}$$

Overcurrent protection

For each modeled wire run, the selected overcurrent device rating must protect the conductor — i.e. its ampere rating must not exceed the conductor's allowable ampacity. Where the design current is between two standard sizes (NEC 240.6(A)), the engine applies NEC 240.4(B) and selects the next standard size up.

From To	Design A	AWG	Ampaci-ty	OCPD A	240.4(B)	Citation	Result
Battery 'Fuse	180	2/0	231	225	yes	ABYC E-11.10 / NEC 240.4	PASS
Fuse 'Busbar	180	2/0	231	225	yes	ABYC E-11.10 / NEC 240.4	PASS
Busbar 'Inverter / charger	180	2/0	231	225	yes	ABYC E-11.10 / NEC 240.4	PASS
Busbar 'DC load	20	10	42	25	yes	ABYC E-11.10 / NEC 240.4	PASS

Interrupting rating (AIC) check

Estimated available short-circuit current at the battery terminals: 6,035A (Ohm's-law loop model, datasheet-typical internal resistance). Every overcurrent device on the battery side must carry an interrupting rating (AIC) above this value — NEC 110.9 / ABYC E-11. Common device families: ANL (automotive) 2,500 A (NOT OK) · ANL (marine-rated) 6,000 A (NOT OK) · MRBF terminal fuse 10,000 A (OK) · Class T 20,000 A (OK). Verify with manufacturer fault-current curves before purchase.

Notes on selection

Standard OCPD sizes used: NEC 240.6(A) for AC, an extended low-end rung set for DC practice (5 / 7.5 / 10 / 15 / 20 / 25 / 30 / 35 / 40 / 45 / 50 / 60 / 70 / 80 / 90 / 100 / 110 / 125 / 150 / 175 / 200 / 225 / 250 / 300 / 350 / 400 A). Code basis: ABYC E-11. Where ABYC is in effect, battery-to-inverter feeds must carry overcurrent protection within 7 in (178 mm) of the positive post per E-11.10.

Labels & placards schedule

Fabricate and apply the placards below at the stated locations. Numeric values (voltages, currents, fault current) are computed from the modeled system by the same engine that produced the diagrams and calculation sheets — the values cannot disagree between sheets. Use durable, weather-resistant labels suitable for the environment; wording keys to the code cycle on the cover.

Placard text	Code basis	Location	Status
BATTERY SWITCH — MAIN DC DISCONNECT · 12 V DC	ABYC E-11 (battery disconnect switch requirement)	Battery switch, accessible from outside the battery space	REQ
WARNING — AC AND DC VOLTAGE SOURCES PRESENT. DISCONNECT ALL SOURCES BEFORE SERVICING.	ABYC E-11 (multiple-source warning at panelboards)	AC panelboard + inverter	REQ
INVERTER — OUTPUT REMAINS LIVE WITH SHORE POWER OFF	ABYC E-11 (inverter source labeling)	At the inverter and AC panel	REQ
NO DEDICATED BATTERY DISCONNECT MODELED — E-11 REQUIRES ONE	ABYC E-11	—	REQ

Available fault current basis

Estimated available short-circuit current at the battery terminals: 6,035A (Ohm's-law loop model with datasheet-typical internal resistance for the modeled chemistry and bank size). This is an order-of-magnitude engineering estimate for label and AIC-selection purposes — verify against the battery manufacturer's published fault-current data before fabrication.

Compliance checklist

Per-rule findings from the deterministic compliance engine. Items not flagged are marked PASS because the engine had no matching error/warning/info to surface against them. Final acceptance rests with the AHJ and any licensed reviewer of record.

Result	Rule	Code	Detail
PASS	PV must be regulated Photovoltaic input must pass through a charge controller before reaching the battery.	NEC 690	Charge controller present on PV array.
PASS	Charge controller $\geq 125\%$ I_{sc} Controller input current rating must be at least 125% of the array's short-circuit current.	NEC 690.8(A)(1)	Charge controller rated $\geq 125\%$ of I_{sc} .
PASS	OCPD present at source Every ungrounded conductor leaving a source must be protected.	ABYC E-11.10	At least one fuse or breaker is present in the circuit.
PASS	Battery-inverter local OCPD Battery feeding an inverter requires OCPD within 7 in (178 mm) of the positive post.	ABYC E-11.10	Battery-to-inverter feed is locally protected.
FAIL	OCPD $\geq$ conductor ampacity Fuse / breaker rating must not exceed the protected conductor's ampacity.	NEC 240.4	Fuse 300A exceeds the 199.5A ampacity of its 1/0 AWG conductor — protect the wire, not just the load.
PASS	Critical-circuit voltage drop $\leq 3\%$ Battery-inverter and other critical feeds drop $\leq 3\%$ at full load.	ABYC E-11.4	Battery-inverter run within 3% voltage drop.
PASS	Standard OCPD ampere size Fuse and breaker ratings must be a standard ampere value listed in 240.6(A).	NEC 240.6(A)	All OCPD ratings are standard sizes.
PASS	Inverter rated for AC load Inverter continuous output equals or exceeds total connected AC load.	Design	Inverter continuous rating $\geq$ summed AC load.
PASS	Battery bank voltage uniformity All batteries in a paralleled bank should share a nominal voltage.	Design	All batteries share the same nominal voltage.
PASS	Battery chemistry uniformity Do not parallel different battery chemistries (LiFePO4 / AGM / lead-acid) in one bank.	Best practice	Battery bank uses a single chemistry.
NOTE	Battery monitor present A shunt-based battery monitor is recommended for accurate state-of-charge.	Best practice	No battery monitor/shunt — recommended for accurate state-of-charge.

Rules above are the subset the CircuitProof engine checks today. Code coverage will expand over time; absence from this list does not imply a requirement is waived.

Appendix — references

Cited code sections

NEC 240 Overcurrent Protection (NFPA 70 Article 240) — NFPA	www.nfpa.org/codes-and-standards/all-codes-and-s...
NEC 310.16 Allowable Ampacities of Insulated Conductors — NFPA	www.nfpa.org/codes-and-standards/all-codes-and-s...
NEC 690 Solar Photovoltaic (PV) Systems — NFPA	www.nfpa.org/codes-and-standards/all-codes-and-s...
NEC 706 Energy Storage Systems — NFPA	www.nfpa.org/codes-and-standards/all-codes-and-s...
NEC 710 Stand-Alone Systems — NFPA	www.nfpa.org/codes-and-standards/all-codes-and-s...
ABYC E-11 AC and DC Electrical Systems on Boats — American Boat & Yacht Council	abycinc.org/page/Standards
ISO 13297 Small craft — Electrical systems — Alternating and direct current installations — International Organization for Standard-ization	www.iso.org/standard/72539.html
AS/NZS 3001 Electrical installations — Connectable installations and supplies up to and including 32 A — Standards Australia / Standards New Zealand	www.standards.org.au/standards-catalogue/standard-details
AS/NZS 3008.1.1 Electrical installations — Selection of cables — Standards Australia / Standards New Zealand	www.standards.org.au/standards-catalogue/standard-details

Component datasheets

Battery Battle Born · BB10012	battlebornbatteries.com/product/12v-100ah-lithium-battery-b...
Busbar Blue Sea · 2105	www.blueseas.com/products/2105

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