

Cable Sizing Guide — 24V Systems

Plant, agricultural machinery, LGV, PCV and 24V DC installations

voltforge.co.uk

Before you start

Picking the right cable comes down to two things: how much current it needs to carry, and where it's going to run. Get those right and the rest follows. This guide covers 24V DC systems as used in plant and agricultural machinery, light goods vehicles, coaches and buses, and other commercial and off-highway applications. For 12V leisure vehicle and campervan installations see our dedicated 12V guide at voltforge.co.uk.

Current carrying capacity — ampacity — is a thermal limit. Too much current through too small a cable generates heat. Enough heat and the insulation fails, and that's how fires start. Cables are cheap. Vans are not.


When in doubt, go up a size. A cable running slightly under its rating runs cooler, lasts longer, and costs almost nothing extra.

The figures in this guide are for a single cable run in open air at normal temperature. If your cable runs through conduit, behind panels, or is bundled with other cables, it cannot shed heat as easily — go up a size as a minimum in those situations. In plant and agricultural applications, ambient temperatures are often higher than in a leisure vehicle — engine bays, machinery cabs and enclosed compartments can easily exceed 40°C. Use the appropriate derating figures from our Ampacity Reference Document.

A word on stranding

Cable cross-sectional area determines current capacity — but how the conductor is constructed determines how pleasant it is to work with and how long it lasts. Automotive cable uses fine-stranded flex: many thin strands rather than a few thick ones. It routes more easily, terminates more cleanly, and holds up better to the vibration and flexing that every vehicle installation lives with every day.

It costs a little more than generic cable. It is worth it.


 For a full explanation of cable construction, conductor classes and why it matters in practice, see our Know How guide to cable specifications at voltforge.co.uk

All cable has an insulation rating — the maximum temperature it can handle. This affects how much current it can safely carry, and where it can be installed.

For most leisure vehicle and campervan work, there are really only two types you need to think about:

- **Standard PVC (80°C rated)** — Fine for interior runs, lighting, and body electrical. Avoid using it near heat sources or in engine bays. This is the cheaper cable you'll find at most motor factors.
- **Quality automotive PVC (105°C rated)** — Better in every way. More flexible, handles heat better, lasts longer. Worth spending the extra for anything permanent. This is what OEM harnesses use. If you're not sure which to buy, buy this.

There are higher-spec insulation types — crosslinked compounds, PTFE, silicone — for demanding applications. The current figures in this guide are based on quality 105°C cable as the practical recommendation for leisure vehicle work.

 For a full breakdown of insulation types, temperature ratings, OEM cable standards, and detailed ampacity data across all insulation grades and ambient temperatures, see our Ampacity Reference Document at voltforge.co.uk

Common applications — what size do I need?

Use this table as a starting point. Always check the current draw of your specific device on its datasheet or label — these figures cover typical equipment but yours may differ.

Application	Typical Current (12V basis)	24V Cable	Notes
SLI battery to auxiliary battery (VSR or B2B/DC-DC charger)	VSR: up to 80–100 A sustained B2B: per charger rating	VSR: 10–16 mm² B2B: per charger spec	VSR connections carry sustained alternator output current — size for continuous duty, not peak. B2B/DC-DC chargers have a defined output current — size cable to the charger's rated output, not the battery capacity. Check volt drop on longer runs, which can be significant on large machinery. A VSR on a smart or variable-voltage alternator is not suitable — use a B2B charger.
Auxiliary battery to fuse box / distribution	Size to total load	10–25 mm²	Size to total expected load plus 20% headroom. Err on the larger side — this is your main feed.
Cab refrigerator / cool box	4–10 A	2.5 mm²	Running current is low but startup surge can be 3×. Keep runs short or go up a size on longer runs.
Cab / auxiliary LED lighting circuit	1–5 A per circuit	1.0–1.5 mm²	LED draws are low. 1.0 mm ² is fine for most circuits. Run individual circuits — don't daisy-chain.
Cab power outlets and USB chargers	10–15 A	2.5 mm²	Allow for multiple devices running simultaneously. A 2-socket outlet can pull 20A+ if both sockets are loaded.
Inverter feed	See note →	See note	Divide inverter wattage by system voltage to get current. A 1000W / 24V inverter draws ~42A — that needs 10–16 mm ² . Always size to inverter's rated input current, not output.
Solar panel to MPPT charge controller (where fitted)	Varies by panel	4–6 mm²	Size to panel short-circuit current (I _{sc}) × 1.25 safety factor. Check your MPPT datasheet for max input current.
MPPT to battery	Varies by controller	6–10 mm²	Size to the MPPT's maximum output current rating. This is often higher than the panel input current.
Water pump / low-current auxiliary pump	5–15 A	2.5 mm²	Check pump datasheet for stall current. Pumps are motor loads — startup current can be significantly higher than running current.
Diesel cab heater (e.g. Webasto, Espar, Eberspacher)	10–25 A (startup)	4 mm²	Glow plug startup draws high current briefly. Running current is much lower. Size for the startup peak — 4 mm ² as a minimum on 12V.
Cab resistive loads (kettle, blanket, heating element)	Up to 20 A (12V)	4–6 mm²	High resistive loads. Check the device's rated wattage and divide by system voltage. Keep runs short — volt drop matters here.
Winch	100–400 A (operating)	35–70 mm²	Always check the winch or machinery manufacturer's cable sizing recommendation. Winch and actuator cables carry enormous current for short periods. Do not undersize.

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Registered office: Blyth, Northumberland
NE24 2QW

Company Number: **16082140**

VAT Number: **GB486043577**

All cable sizes are minimum recommendations for free air runs at normal ambient temperature using quality 105°C cable. Go up a size for runs in conduit, behind panels, bundles, or in high ambient temperature environments typical of plant and agricultural machinery.

Quick current rating reference

The current carrying capacity of a cable is the same regardless of system voltage — it's a property of the conductor and insulation, not the voltage. The figures below are for a 24V system. Current carrying capacity is the same regardless of voltage — it is determined by the conductor and insulation, not the voltage. For 12V or 48V systems see our dedicated guides at voltforge.co.uk.

Cable Size	AWG Equiv.	Max Current (free air)	Typical applications
Quality 105°C cable, free air		Max Current (free air)	
1.0 mm ²	17 AWG	13 A	Sensors, instruments, low-power LED
1.5 mm ²	15 AWG	17 A	Lighting circuits, small accessories
2.5 mm ²	13 AWG	24 A	Sockets, fridge, water pump, lighting feeds
4.0 mm ²	11 AWG	32 A	Diesel heater, heavy accessories, small motor feeds
6.0 mm ²	10 AWG	41 A	Alternator sense, heavy accessories, solar feeds
10.0 mm ²	8 AWG	57 A	Main distribution feeds, medium inverters
16.0 mm ²	6 AWG	76 A	Large inverters, main battery feeds (smaller systems)
25.0 mm ²	4 AWG	101 A	Battery to distribution main feed. On large plant and agricultural machinery the run from battery to main distribution can be considerable — always check volt drop, not just current rating.
35.0 mm ²	2 AWG	125 A	Battery cables, high-current main feeds
50.0 mm ²	1/0 AWG	151 A	Heavy battery/starter cables, large inverters
70.0 mm ²	2/0 AWG	192 A	Very heavy duty battery cables
95.0 mm ²	3/0 AWG	232 A	Starter motors, large system main feeds

Figures for quality 105°C PVC insulated stranded copper flex, single conductor, free air, 25°C ambient. Real-world capacity will be lower in hot environments or bundled runs. For under-bonnet or high-ambient plant applications consider 125°C rated XLPE/XLPO cable — see our Ampacity Reference Document.

Volt drop — why cable length matters

Every cable has resistance. Current flowing through resistance causes a voltage drop along the run. On a 24V system volt drop has less impact than on 12V for the same power delivery, but it still matters — particularly on long runs to remote loads on large machinery.

A rough rule of thumb: keep volt drop to 5% or less of your supply voltage on any circuit. On a 24V system that's 1.2V maximum. Note that 24V systems have a significant advantage over 12V here — the same volt drop is half the percentage of supply voltage, which means smaller cable can be used for equivalent power delivery over the same run length.

Longer runs need bigger cable — not just to carry the current safely, but to keep the voltage drop within acceptable limits. If your run is more than 3–4 metres, check the volt drop, don't just check the current rating.

Volt drop = (cable resistance in mΩ/m) × current (A) × run length (m) ÷ 1000. Your cable datasheet will give you the resistance figure.

 For full resistance data (mV/A/m) for all cable sizes, see our Ampacity Reference Document at voltforge.co.uk

About Voltforge

Voltforge is the retail brand of Zeromachine Ltd, an engineering business based in Blyth, Northumberland. Zeromachine's longer-term programme is the development of a hydrogen fuel cell hybrid electric powertrain for off-highway machinery — serious engineering work that needs a serious commercial foundation underneath it. Voltforge is that foundation, and also the live sandbox for it: a place where low-voltage DC system design principles, documentation standards and product development thinking get tested in the real world before they scale. The pigtailed fund the programme. That means they have to be good.

The engineering background behind Voltforge spans over 30 years of low-voltage DC and high-voltage DC electrical experience across automotive, OEM leisure vehicle, EV, and off-highway and construction machinery applications — including time spent working in OEM leisure vehicle electrical design in the North East. We build connector assemblies, pigtail kits and cable harnesses with the same thinking we apply to much larger and more complex work: correct materials, correct process, and a clear understanding of how a product will actually be used once it leaves the bench. Every assembly we make comes with a full bill of materials citing OEM part numbers, because you should always know exactly what you've got. All Voltforge-built assemblies carry a 2-year warranty.

For larger and more complex work, Zeromachine Works Studio offers bespoke harness design and production, low-voltage DC system design, B2B engineering services, and consultancy for trade and commercial customers. We also offer specialist repair, diagnosis and electrical design services for leisure vehicles, campervans, overlanders and 4x4s across the North East of England. If your system has a fault you can't trace, an install that's grown past what you originally planned, or a build that needs properly thinking through from the start, that's exactly the kind of job we're set up for.

If you know what you need, you can go straight to the shop. If the job is bigger or less straightforward, talk to us. **Tell us what you're building and where you're stuck.**

w voltforge.co.uk

w zeromachine.co.uk

e info@voltforge.co.uk

t [+44\(0\)1670 336766](tel:+44(0)1670336766)

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