Ampacity Ready Reckoner

Current carrying capacity for automotive low voltage DC stranded flex cable

Sub 60V DC • Stranded copper conductor • Free air (single conductor) | voltforge.co.uk

Scope and limitations

This is a practical rough and ready reference guide for current carrying capacity (ampacity) of stranded copper flex cable in sub-60V DC automotive and marine applications. Figures are derived from averages across SAE J1127 and J1128 data and are suitable for general guidance. They are not a substitute for a full cable sizing calculation on a specific installation.

All figures are for a single conductor in free air at the stated ambient temperature. Real installations are rarely this simple — see the bundling and routing section below.

Temperature, insulation, and why it matters

A cable's current rating is fundamentally a thermal limit. Current flowing through resistance generates heat. As long as the cable can shed that heat fast enough to keep the conductor and insulation below their rated maximum temperature, it is operating safely. Exceed that temperature and insulation degrades, softens, or fails.

Two temperatures matter: the ambient temperature around the cable, and the maximum rated temperature of the insulation. The higher the ambient, the less headroom the cable has before it reaches its thermal limit — which is why the same cable has a lower current rating in a hot engine bay than in open air at 25°C.

Insulation types — characteristics and trade-offs

- **PVC 80°C (standard)** The most common and lowest-cost automotive insulation. Fine for body electrical, interior lighting, and general accessories. Not suitable for under-bonnet runs near heat sources. Adequate flexibility in normal temperatures but stiffens in cold. Poor UV resistance over time. Maximum conductor temperature 80°C. Most budget and mid-range cable falls here. SAE J1128 Type GPT.

- **PVC 105°C (quality automotive)** Better grade PVC compound with higher temperature rating. Noticeably more flexible than standard PVC and significantly better under-bonnet performance. Still cost-effective. The sweet spot for most quality automotive installations. Common in OEM harnesses from reputable manufacturers. SAE J1128 Type HDT / SXL / GXL.

- **XLPE / XLPO / LSZH (crosslinked insulations — 90°C and 125°C)** XLPE (crosslinked polyethylene) and XLPO (crosslinked polyolefin) are related but distinct materials frequently used interchangeably in the trade, which causes confusion. Both use a crosslinking process that creates molecular bonds across the polymer chains, giving better temperature resistance and chemical resistance than standard PVC. XLPO uses a polyolefin base compound rather than pure polyethylene — in practice this gives better low-temperature flexibility, slightly better UV resistance, and is the preferred base compound for most LSZH (low smoke zero halogen) formulations. When you see LSZH cable, the insulation compound underneath is typically XLPO. HFFR (halogen-free flame retardant) and LSZH describe fire performance characteristics rather than the base compound — they are often the same product. Crosslinked types are available in two main temperature grades: 90°C (standard XLPE/XLPO/FLRY-B) and 125°C (SAE J1128 SXL, GXL, TXL — all crosslinked polyethylene). A common source of confusion: SXL, GXL and

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Company Number: **16082140**
VAT Number: **GB486043577**

TXL are frequently described as 105°C types in trade literature but the correct SAE J1128 rating is 125°C. Both grades are shown side by side in the ampacity table for this family. European designations: ISO 6722 FLRY-B (90°C, thin-walled), ISO 6722 Class E (125°C), DIN 72551.

- **PTFE / Silicone (high specification)** The premium end. PTFE (polytetrafluoroethylene) offers outstanding chemical resistance, minimal friction, and conductor ratings to 150°C+. Silicone insulation is exceptionally flexible even at very low temperatures and handles up to 180°C. Both are significantly more expensive and PTFE in particular is less abrasion-resistant than it looks — the insulation is tough chemically but can be cut or abraded more easily than PVC. Used in motorsport, aerospace-adjacent applications, and runs very close to heat sources. SAE J1127 Type SGT (silicone), specialist PTFE not covered by a single SAE type.

Bundling, routing, and when to go up a size

The ampacity figures in this document are for a single conductor in free air. The moment you bundle cables together, run them through conduit, or route them behind insulation panels, you reduce their ability to shed heat. Cables in a bundle share heat with each other. The more cables in the bundle, and the more tightly they are packed, the greater the derating required.

A full derating calculation is beyond the scope of this guide. The pragmatic rule is this:

> **If in doubt, go up a size. Bigger is always better. A cable that runs slightly cool costs almost nothing extra and lasts significantly longer. A cable that runs hot is a fire waiting for a bad day.**

Specific situations where you should go up at least one size as a minimum: cables in conduit or trunking, runs behind thermal or acoustic insulation panels, bundles of more than 3–4 cables, any run in an engine bay where ambient regularly exceeds 40°C, and any circuit where the cable run exceeds 3–4 metres (volt drop becomes a factor too).

How to read the tables

- **mV/A/m** Millivolts per amp per metre — numerically identical to milli-ohms per metre (mΩ/m). Multiply by your current (A) and run length (m) to get volt drop in millivolts. Divide by 1000 for volts. Useful for checking whether your run stays within acceptable volt drop limits (typically ≤5% of supply voltage on a 12V system = 600mV max).
- **Ampacity at 25°C** Baseline figure. Use this for indoor, sheltered, or ambient-temperature installations.
- **Ampacity at 40°C** Realistic for many under-bonnet or exposed roof runs in summer conditions.
- **Ampacity at 60°C** Engine Bay proximity, runs near exhaust heat shields, or enclosed hot environments. Figures highlighted in amber are significantly derated — consider going up a size.

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Reference standards — and why the picture is messier than it should be

The primary references for this document are SAE J1127 (battery cables and welding cable) and SAE J1128 (low voltage primary cable), published by SAE International. It is worth explaining why we lead with American standards in a document produced by a British engineering business — because the answer says something useful about the state of the wider standards landscape.

SAE J1127 and J1128 are simply the most comprehensive and practically useful standards available for automotive cable construction and insulation classification. They are prescriptive about conductor construction, insulation compounds, temperature ratings, and dimensional tolerances in a way that the European equivalents are not. When you need to know what a cable actually is and what it will reliably do, SAE did the heavy lifting — and the global automotive industry, including European manufacturers, knows it. You will find SAE type references in German, French, and Italian OEM documentation without apology.

The European picture is more complicated, and it is worth being honest about why.

ISO 6722 and DIN 72551 are solid references and widely used in European OEM harnesses. The FLRY-B designation in particular is the dominant European type designation you will encounter on cable datasheets, and we reference it throughout. But the broader European standards landscape for low-voltage automotive electrical systems is fragmented in a way that does not serve the people actually doing the work. Part of the reason for this is straightforwardly commercial: the major European OEMs have had significant influence over the development of standards that, in some cases, reflect their own proprietary preferences as much as any universal engineering principle. The result is a collection of standards that can appear comprehensive on paper but leave significant gaps in practice — particularly around insulation classification, temperature rating methodology, and the kind of prescriptive conductor construction detail that makes a standard genuinely useful for procurement and specification.

BS EN standards in the leisure vehicle sector have their own version of this problem. BS EN 1648, the governing standard for leisure vehicle electrics in the UK, was substantially authored by the major British leisure vehicle OEMs. That is not unusual — standards are routinely developed with industry input — but it does mean the standard reflects the architecture and commercial interests of factory-built leisure vehicles rather than the much wider range of conversions, self-builds, and off-highway applications that make up a significant part of the real-world market. The current edition of both parts dates from 2018 and has not been updated since. More fundamentally, BS EN 1648 is published in two parts which, on close reading, contain provisions that directly contradict each other — a situation that leaves practitioners in the invidious position of having to decide which part of the same standard to follow. That is not a theoretical observation. It is a practical problem that anyone attempting to use BS EN 1648 as a serious design reference will eventually encounter. The result is a standard that creates the appearance of harmonisation without consistently delivering the substance of it. If you have ever tried to navigate European cable standards and come away more confused than when you started, that confusion is not a reflection of your ability. The standards are genuinely inconsistent, and the people who work with them professionally know it.

None of this means the European standards are wrong or should be ignored. It means they should be understood in context. We reference both SAE and the relevant European designations throughout, cross-referenced where they overlap, so that this document is useful regardless of which standard your cable supplier or datasheet leads with.

Neither SAE J1127 nor J1128 is freely published. Both are available through SAE International and, as with the other Know How documents in this series, are not especially difficult to locate with a search engine and a few minutes of patience. ISO 6722 is available through BSI and ISO; DIN 72551 through DIN/Beuth.

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If you are in the UK and would prefer not to pay for access, it is worth knowing that British Standards — including the BS EN standards referenced in this document — are available free of charge through the British Library's Business & IP Centre network, based in public libraries across the UK. Individual users can read standards on site at no cost. If you are accessing as a registered business, in our experience the BIPC will email standards to you directly. A search for "Business and IP Centre" plus your nearest city will find your local access point.

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 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)1670336766

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Ampacity Ready Reckoner — PVC 80°C — Standard Automotive

SAE J1128 Type GPT • ISO 6722 Class B / DIN 72551 FLY • Max conductor temp 80°C • General body electrical, interior, accessories • Not recommended for under-bonnet heat exposure

Cable Size	AWG Equiv.	Resistance mV/A/m	Ampacity — Free Air (Single Conductor)			Typical Use
mm²	(nearest)	(= mΩ/m)	25°C ambient	40°C ambient	60°C ambient	(free air)
0.5 mm²	20 AWG	36.0	**8 A**	7 A	5 A	*Sensor/signal wiring*
0.75 mm²	18 AWG	24.5	**10 A**	9 A	7 A	*Lighting, low current accessories*
1.0 mm²	17 AWG	18.1	**13 A**	11 A	9 A	*Lighting, instruments*
1.5 mm²	15 AWG	12.1	**17 A**	15 A	12 A	*Lighting circuits, horns*
2.5 mm²	13 AWG	7.4	**24 A**	21 A	17 A	*Main lighting, small motors*
4.0 mm²	11 AWG	4.6	**32 A**	28 A	22 A	*Starter circuits (small), fans*
6.0 mm²	10 AWG	3.1	**41 A**	36 A	28 A	*Alternator feeds, heavy accessories*
10.0 mm²	8 AWG	1.8	**57 A**	50 A	39 A	*Main feed cables, winches*
16.0 mm²	6 AWG	1.1	**76 A**	66 A	52 A	*Main feed, high-current accessories*
25.0 mm²	4 AWG	0.7270	**101 A**	88 A	69 A	*Battery-to-distribution feed*
35.0 mm²	2 AWG	0.5240	**125 A**	109 A	85 A	*Battery cables, main feeds*
50.0 mm²	1/0 AWG	0.3870	**151 A**	131 A	103 A	*Battery/starter cables*
70.0 mm²	2/0 AWG	0.2680	**192 A**	167 A	131 A	*Heavy battery/starter cables*
95.0 mm²	3/0 AWG	0.1930	**232 A**	202 A	158 A	*Very heavy duty, starter motors*
120.0 mm²	4/0 AWG	0.1530	**274 A**	238 A	187 A	*High current inverter/starter feeds*
150.0 mm²	300kcmil	0.1240	**305 A**	265 A	208 A	*Maximum automotive runs*
185.0 mm²	350kcmil	0.0990	**340 A**	296 A	232 A	*Specialist high-current only*
240.0 mm²	500kcmil	0.0762	**400 A**	348 A	273 A	*Specialist high-current only*

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Ampacity Ready Reckoner — PVC 105°C — Quality Automotive

SAE J1128 Type HDT/GPT (105°C grade) • ISO 6722 Class C–D / DIN 72551 FLRY • Max conductor temp 105°C • Under-bonnet, OEM-grade harnesses, general high-quality installations.
Note: SXL, GXL and TXL are crosslinked types rated to 125°C — see the XLPE/XLPO table.

Cable Size	AWG Equiv.	Resistance mV/A/m	Ampacity — Free Air (Single Conductor)			Typical Use
mm²	(nearest)	(= mΩ/m)	25°C ambient	40°C ambient	60°C ambient	(free air)
0.5 mm²	20 AWG	36.0	**9 A**	8 A	7 A	*Sensor/signal, better under-bonnet*
0.75 mm²	18 AWG	24.5	**12 A**	11 A	9 A	*Lighting, accessories*
1.0 mm²	17 AWG	18.1	**15 A**	14 A	11 A	*Lighting, instruments*
1.5 mm²	15 AWG	12.1	**19 A**	17 A	14 A	*Lighting circuits, horns*
2.5 mm²	13 AWG	7.4	**27 A**	25 A	20 A	*Main lighting, small motors*
4.0 mm²	11 AWG	4.6	**36 A**	33 A	26 A	*Starter circuits, fans*
6.0 mm²	10 AWG	3.1	**47 A**	43 A	34 A	*Alternator feeds, under-bonnet runs*
10.0 mm²	8 AWG	1.8	**65 A**	59 A	47 A	*Main feeds, winches*
16.0 mm²	6 AWG	1.1	**87 A**	79 A	63 A	*Main feed, high-current accessories*
25.0 mm²	4 AWG	0.7270	**115 A**	105 A	84 A	*Battery-to-distribution feed*
35.0 mm²	2 AWG	0.5240	**143 A**	130 A	104 A	*Battery cables, main feeds*
50.0 mm²	1/0 AWG	0.3870	**173 A**	157 A	126 A	*Battery/starter cables*
70.0 mm²	2/0 AWG	0.2680	**220 A**	200 A	160 A	*Heavy battery/starter cables*
95.0 mm²	3/0 AWG	0.1930	**266 A**	242 A	194 A	*Very heavy duty*
120.0 mm²	4/0 AWG	0.1530	**314 A**	286 A	229 A	*High current inverter/starter feeds*
150.0 mm²	300kcmil	0.1240	**350 A**	319 A	255 A	*Maximum automotive runs*
185.0 mm²	350kcmil	0.0990	**390 A**	355 A	284 A	*Specialist high-current only*
240.0 mm²	500kcmil	0.0762	**460 A**	419 A	335 A	*Specialist high-current only*

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Ampacity Ready Reckoner — XLPE / XLPO / LSZH — Crosslinked Insulations

SAE J1128 SXL/GXL/TXL (125°C) • ISO 6722 FLRY-B / Class E • DIN 72551 • LSZH/HFFR compounds typically XLPO-based • 90°C and 125°C grades compared side by side

Note: SXL, GXL and TXL (SAE J1128) are crosslinked polyethylene rated to 125°C and are correctly shown in the 125°C column. FLRY-B and standard XLPO/LSZH compounds are typically rated to 90°C. HFFR (halogen-free flame retardant) and LSZH compounds are usually XLPO-based — the two terms describe the compound type and fire performance respectively and are often the same product. ★ column = typical use key below.

Cable Size	AWG Equiv.	Res. mV/A/m	XLPE/XLPO 90°C — ISO 6722 FLRY-B / DIN 72551 / SAE HDT			XLPE/XLPO 125°C — SAE J1128 SXL/GXL/TXL / ISO 6722 Class E			★
mm²	(nearest)	(= mΩ/m)	25°C	40°C	60°C	25°C	40°C	60°C	use
0.5 mm²	20 AWG	36.0	**9 A**	8 A	6 A	**10 A**	9 A	9 A	1
0.75 mm²	18 AWG	24.5	**11 A**	10 A	8 A	**13 A**	12 A	11 A	2
1.0 mm²	17 AWG	18.1	**14 A**	12 A	10 A	**16 A**	15 A	14 A	3
1.5 mm²	15 AWG	12.1	**18 A**	16 A	13 A	**21 A**	20 A	18 A	4
2.5 mm²	13 AWG	7.4	**26 A**	23 A	18 A	**30 A**	28 A	26 A	5
4.0 mm²	11 AWG	4.6	**35 A**	30 A	25 A	**40 A**	37 A	34 A	6
6.0 mm²	10 AWG	3.1	**45 A**	39 A	32 A	**52 A**	48 A	45 A	7
10.0 mm²	8 AWG	1.8	**62 A**	54 A	43 A	**72 A**	67 A	62 A	8
16.0 mm²	6 AWG	1.1	**83 A**	72 A	57 A	**96 A**	89 A	83 A	9
25.0 mm²	4 AWG	0.7270	**110 A**	96 A	76 A	**127 A**	118 A	109 A	10
35.0 mm²	2 AWG	0.5240	**137 A**	119 A	94 A	**158 A**	147 A	136 A	11
50.0 mm²	1/0 AWG	0.3870	**165 A**	144 A	113 A	**191 A**	178 A	164 A	12
70.0 mm²	2/0 AWG	0.2680	**210 A**	183 A	144 A	**243 A**	226 A	209 A	13
95.0 mm²	3/0 AWG	0.1930	**253 A**	220 A	173 A	**294 A**	274 A	253 A	14
120.0 mm²	4/0 AWG	0.1530	**299 A**	260 A	205 A	**347 A**	323 A	298 A	15
150.0 mm²	300kcmil	0.1240	**334 A**	291 A	229 A	**387 A**	360 A	333 A	16
185.0 mm²	350kcmil	0.0990	**372 A**	324 A	255 A	**431 A**	401 A	370 A	17
240.0 mm²	500kcmil	0.0762	**437 A**	380 A	299 A	**507 A**	472 A	436 A	18

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Ampacity Ready Reckoner — PTFE / Silicone — High Specification

SAE J1127 Type SGT (silicone) / specialist PTFE • No direct European standard equivalent • Max conductor temp 150°C+ (PTFE) / 180°C (silicone) • Motorsport, aerospace-adjacent, extreme heat proximity

Cable Size	AWG Equiv.	Resistance mV/A/m	Ampacity — Free Air (Single Conductor)			Typical Use
mm²	(nearest)	(= mΩ/m)	25°C ambient	40°C ambient	60°C ambient	(free air)
0.5 mm²	20 AWG	36.0	**10 A**	10 A	9 A	*Motorsport, aerospace-grade signal*
0.75 mm²	18 AWG	24.5	**13 A**	12 A	12 A	*High-temp environments*
1.0 mm²	17 AWG	18.1	**16 A**	15 A	15 A	*Instruments, high-temp runs*
1.5 mm²	15 AWG	12.1	**21 A**	20 A	19 A	*High-temp lighting/accessories*
2.5 mm²	13 AWG	7.4	**30 A**	29 A	27 A	*High performance accessories*
4.0 mm²	11 AWG	4.6	**40 A**	38 A	36 A	*Motorsport feeds*
6.0 mm²	10 AWG	3.1	**52 A**	50 A	47 A	*Engine bay, high-temp runs*
10.0 mm²	8 AWG	1.8	**72 A**	69 A	65 A	*Main feeds, high-temp*
16.0 mm²	6 AWG	1.1	**96 A**	92 A	87 A	*High-current, high-temp*
25.0 mm²	4 AWG	0.7270	**127 A**	122 A	115 A	*Battery feeds, engine proximity*
35.0 mm²	2 AWG	0.5240	**158 A**	152 A	144 A	*Battery cables, extreme environments*
50.0 mm²	1/0 AWG	0.3870	**191 A**	183 A	174 A	*Heavy battery/starter*
70.0 mm²	2/0 AWG	0.2680	**243 A**	233 A	221 A	*Heavy duty, high-temp*
95.0 mm²	3/0 AWG	0.1930	**294 A**	282 A	267 A	*Very heavy, extreme environments*
120.0 mm²	4/0 AWG	0.1530	**347 A**	333 A	316 A	*Maximum, motorsport/specialist*
150.0 mm²	300kcmil	0.1240	**387 A**	372 A	352 A	*Specialist only*
185.0 mm²	350kcmil	0.0990	**431 A**	414 A	392 A	*Specialist only*
240.0 mm²	500kcmil	0.0762	**507 A**	487 A	461 A	*Specialist only*

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⚠ All figures are for a single conductor in free air at the stated ambient temperature. Real installations are rarely this simple. Derate for bundled, conduit, or concealed runs — when in doubt, go up a size. A cable that runs cool costs almost nothing extra and lasts significantly longer. Ampacity is a thermal limit; always check volt drop separately (mV/A/m × A × m ÷ 1000 = volt drop in volts). Amber cells at 60°C indicate significant derating — consider the next size up. Figures are derived from averages across SAE J1127 and J1128 data and are suitable for general guidance only — consult the cable manufacturer datasheet for precise figures for a specific product. These figures are not a substitute for a full cable sizing calculation on a specific installation.

★XLPE/XLPO typical use key: 1 Signal/sensor, fire-safe | 2 Lighting, accessories | 3 Lighting, instruments | 4 Lighting circuits | 5 Main lighting, motors | 6 Fans, motor feeds | 7 Alternator, under-bonnet | 8 Main feeds, winches | 9 High-current accessories | 10 Battery feeds | 11 Battery cables | 12 Battery/starter | 13 Heavy battery/starter | 14 Very heavy duty | 15 Inverter/starter feeds | 16 Maximum runs | 17 Specialist high-current | 18 Specialist high-current

Disclaimer

This document is provided for general reference and educational purposes only. The figures and guidance contained in it are derived from published industry standards and are intended to support informed decision-making — they are not a substitute for a full engineering assessment of a specific installation.

Electrical system design involves variables that no general reference document can account for: installation method, routing, ambient conditions, load characteristics, circuit protection, and the specific products used all affect safe and correct cable sizing. It is the responsibility of the installer to carry out an appropriate assessment for their specific application and to ensure that any installation complies with applicable standards, regulations, and any vehicle or equipment manufacturer requirements.

Voltforge and Zeromachine Ltd accept no liability for loss, damage, injury or consequential loss arising from the use of or reliance on the information in this document. If you are in any doubt about the suitability of a cable size or installation method for your application, stop and get proper advice before proceeding.

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