Guides / How to crimp 12 V wire in a van: lugs, terminals, ferrules and heat shrink

HOW TO CRIMP 12 V WIRE IN A VAN: LUGS, TERMINALS, FERRULES AND HEAT SHRINK

THE SHORT ANSWER

Crimp it with the right tool, never pliers: match the terminal to the cable and stud, strip to the terminal maker's length, crimp small terminals in the matching colour cavity of a ratcheting crimper and battery lugs with a die, hydraulic or hammer lug crimper, then inspect, tug-test, seal with heat shrink and torque the lug flat on its stud. Ferrules go on stranded wire in screw terminals.

Last updated 25 November 2026

KEY TAKEAWAYS

Crimp with the tool the terminal was made for: a ratcheting crimper for 22 to 10 AWG terminals, a ferrule crimper for screw terminals and a lug crimper for battery cable. Victron rules out pliers.

Match the colour: Klein's cavities are red 22 to 16 AWG, blue 16 to 14 and yellow 12 to 10; Ancor's heat shrink terminals use the same yellow for 12 to 10 AWG.

Inspect, tug and seal every joint. Molex prints UL 486A lab minimums from 8 lb at 22 AWG to 90 lb at 8 AWG; Victron's field check is a small tug.

> Victron does not recommend butt splices or bullet terminals in a DC system, and wants every lug flat on its stud with nothing between, plus slack in the cable against vibration.

Every 12 V joint in a van electrical system ends in a crimp. This guide is the termination step that wire size, fuse size and busbars lead up to, and the tools are in van build tools.

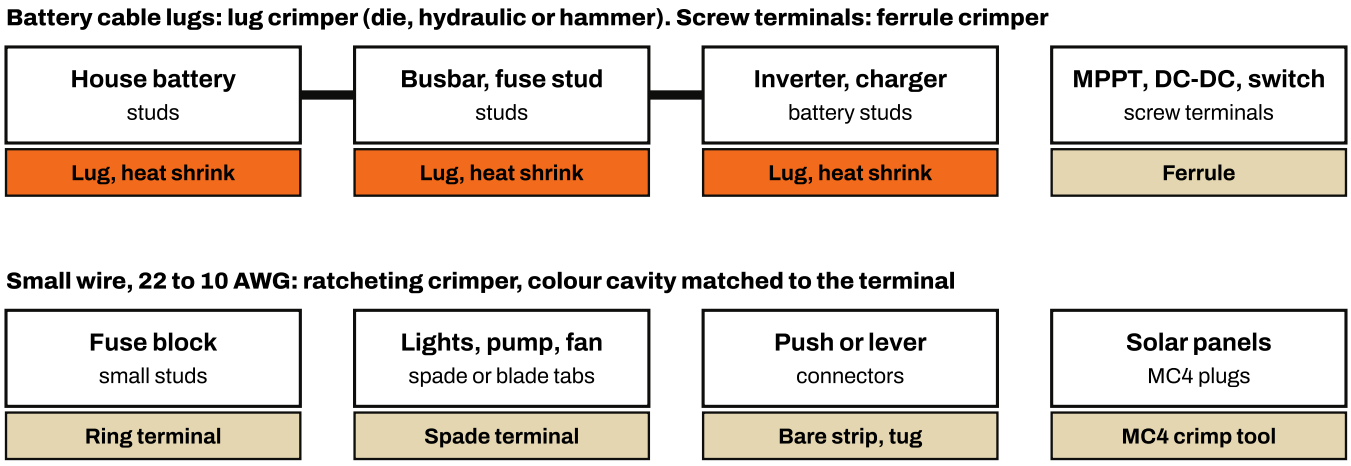
WHAT DOES A GOOD CRIMP NEED?

The right terminal for the cable and stud, the tool made for that terminal, the maker's strip length, a full crimp cycle, and a check afterwards. Victron says each lug, ferrule and spade terminal needs a special or dedicated crimping tool. [1] [10]

Molex explains that the crimp must apply enough pressure to break down the oxides on the stripped conductor and the tin plating inside the terminal for metal-to-metal contact, that without it resistance can increase, and that over-crimping squeezes the conductor's area down and raises resistance too. [16] That is why the tool matters. Ancor quotes ABYC as recommending a crimp tool made by the same brand as the connectors, because barrel and insulation thickness vary from maker to maker. [6] Ratcheting tools enforce a full cycle: Klein's handles will not release until the crimp is complete, and Ancor's ratcheting crimpers must be fully closed before they open, with a lever to release a mis-placed terminal mid-cycle. [10] [6]

WHICH TERMINAL GOES ON WHICH CONNECTION?

Lugs on battery cable at battery, busbar, fuse and inverter studs; ring terminals on small wire at studs; ferrules on stranded wire in screw terminals; spade terminals on tabs; bare stripped wire in push connectors. Victron advises against butt splices and bullet terminals. [1]



Avoid in-line butt splices and bullet terminals where you can (Victron).

Orange: battery cable lugs. Tan: small wire, ferrules and connectors.

Our diagram, based on Victron's Wiring Unlimited chapter 4. Not a wiring diagram.

Our diagram of the connection types in Victron's Wiring Unlimited, chapter 4. Not a wiring diagram. [1]

Termination by connection (copy it)

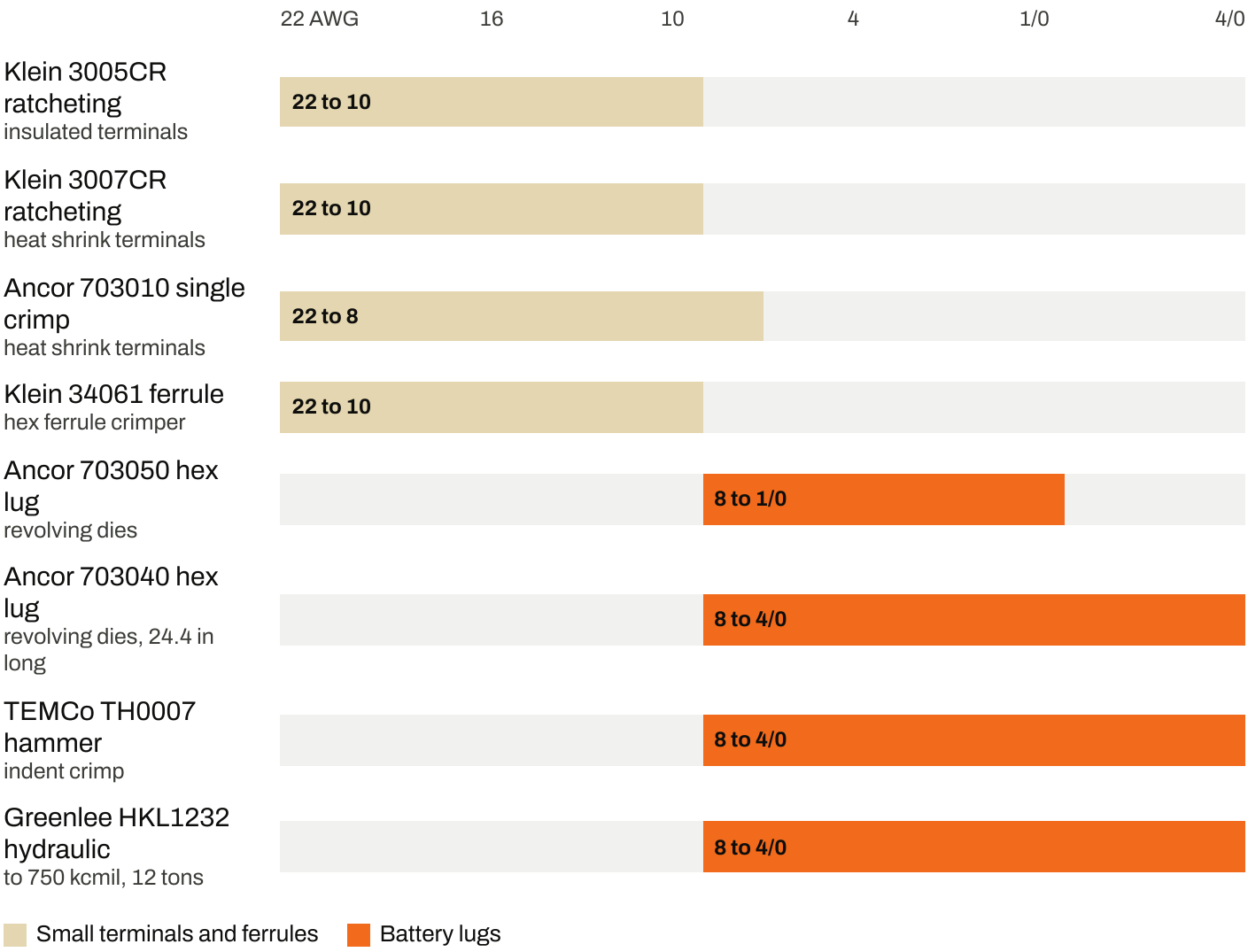
CONNECTION	TERMINATION	TOOL
Battery, busbar, fuse and inverter studs	Copper lug matched to cable and stud, sealed with heat shrink; insulate an uninsulated lug [1] [4]	Lug crimper: die, hydraulic or hammer [13] [14] [15]
Small wire at a stud (fuse block, switch panel)	Insulated or heat shrink ring terminal, colour matched to the wire [1] [2]	Ratcheting crimper, matching colour cavity [8] [9]
Standard screw terminal (charger, controller)	Ferrule; required on a standard screw terminal [1]	Ferrule crimper [1] [11]
Spade or blade tab on a device	Spade crimp terminal [1]	Special crimping tool [1]
Push or lever connector	Stripped wire, no insulation inside, no bare wire outside; small tug [1]	Stripper only
In-line join	Avoid; Victron suggests a WAGO 221-482 (to 4 mm^2) over a butt splice; Ancor heat shrink butts are UL 486C [1] [3]	Crimper matched to the connector brand [6]
Solar panel leads	MC4 connectors, or pre-made cables [1]	MC4 crimping tool [1]

WHICH CRIMPING TOOL COVERS WHICH WIRE SIZE?

Ratcheting terminal and ferrule crimpers stop at 10 AWG (Ancor's heat shrink tool at 8); lug crimpers start at 8 AWG and run to 1/0 or 4/0. So a van with battery cable needs two kinds of tool. [8] [11] [6] [15]

TOOL RANGES

Wire sizes each crimper is made for, as the makers state them



Ranges from Klein's 3005CR, 3007CR and 34061 pages, Ancor's 2024 catalog page 50, TEMCo's TH0007 page and Greenlee's HKL1232 manual, read 25 November 2026; chart ours. [8] [9] [11] [6] [15] [14]

For battery cable there are three kinds of lug crimper, and each maker's instructions differ. Grote's die crimpers rotate a die to the setting for the cable gauge and connector style, close fully, and crimp at least 1/8 in in from the barrel end.[13] Ancor's hex lug crimpers use revolving dies to make a hex crimp, 8 to 1/0 AWG on the portable 703050 and 8 to 4/0 on the 24.4 in 703040.[6] A hydraulic tool such as Greenlee's HKL1232 uses dies matched to the connector, pumps until a relief valve pops at about 12 tons, and has you make the number of crimps its connector chart lists.[14] TEMCo's hammer crimper takes a hammer, vise or press; TEMCo says the gauges some crimpers carry are a recipe for bad crimps because wire and terminal

walls vary, so it goes by the feel of the strike.[15] We found no independent test comparing the three, so we do not rank them. For a handful of battery cables in a van, our tools guide suggests renting or borrowing the lug crimper.

WHAT DO THE RED, BLUE AND YELLOW TERMINALS MEAN?

They are wire size bands. In AWG, Klein's crimpers and Ancor's heat shrink terminals both use yellow for 12 to 10 AWG and blue for 16 to 14; red is 22 to 16 on Klein's tool and 22 to 18 on Ancor's terminals.[8][2]

Terminal colour bands by maker (copy it)

SOURCE	RED	BLUE	YELLOW
VICTRON, INSULATED CRIMP TERMINALS[1]	0.5 to 1.5 mm²	1.5 to 2.5 mm²	2.5 to 6 mm²
KLEIN 3005CR AND 3007CR CAVITIES[8][9]	22 to 16 AWG	16 to 14 AWG	12 to 10 AWG
ANCOR HEAT SHRINK TERMINALS[2]	22 to 18 AWG (0.3 to 0.8 mm²)	16 to 14 AWG (1 to 2 mm²)	12 to 10 AWG (3 to 5 mm²)

The bands overlap at the edges, so read the range printed on the packet and the tool. Victron also gives a maximum current per colour, which it shows as an image we could not read as text, so we do not repeat it here; size the wire first in wire size and the fuse in fuse size, then pick the terminal.[1] For battery cable, Ancor's own wire table shows why the barrel must match the cable you hold: SAE cable has less copper than AWG cable of the same number.[7]

SAME NUMBER, LESS COPPER

SAE cable copper as a share of AWG copper, same gauge number



Circular mil areas from Ancor's 2024 catalog page 64, read 25 November 2026; percentages ours. [7]

HOW TO CRIMP AND TERMINATE 12 V WIRE IN A VAN, STEP BY STEP

Match, strip, slide on the tubing, crimp with the right tool, inspect, tug, shrink, seat and check under load. The steps follow Victron, Klein, Grote, Greenlee, TEMCo, Ancor and Molex; your terminal and tool maker's instructions come first. [1] [10] [13]

SKILL	STEPS	TOOLS
Intermediate	**11**	Wire cutter and stripper Ratcheting crimper with cavities matched to your terminals

Ferrule crimper

Lug crimper for battery cable: die, hydraulic or hammer type

Heat gun

Insulated tools and a torque wrench

Eye protection

MATERIALS

Ring, spade and butt terminals matched to the wire

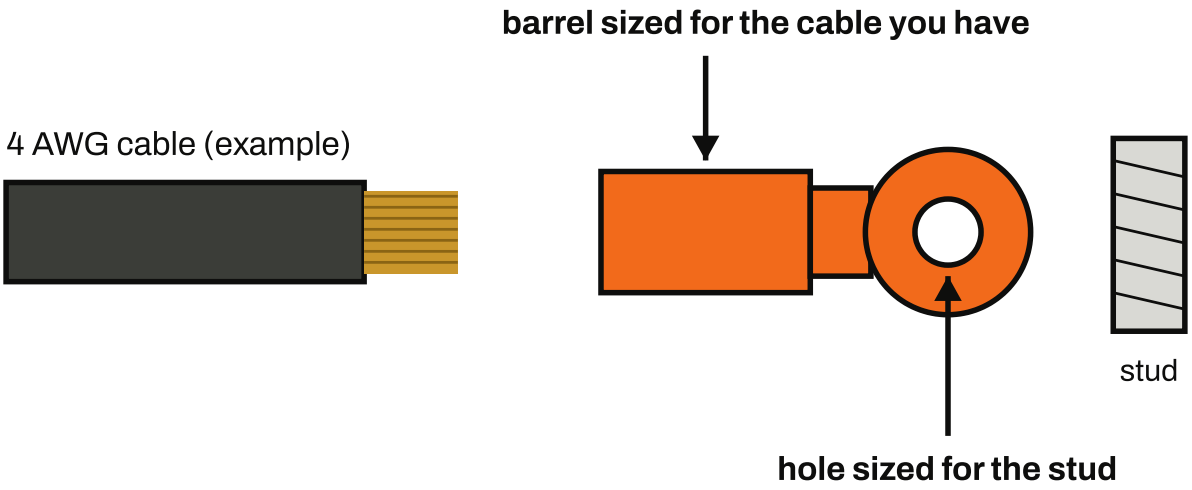
Ferrules

Copper lugs matched to cable and stud

Adhesive-lined heat shrink tubing

01 Match the terminal to the cable and the stud

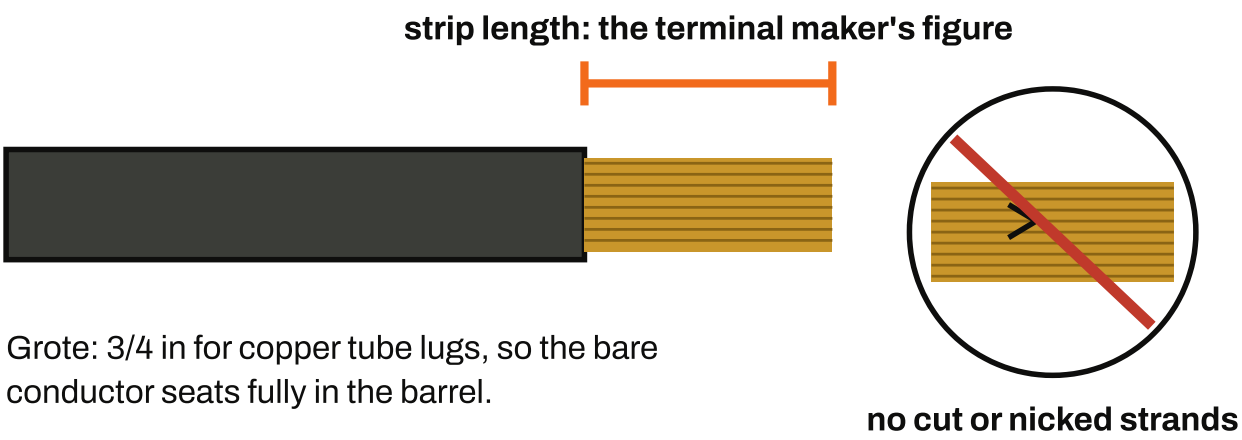
Choose a terminal for the conductor you actually have and a ring hole for the stud it goes on. Victron says a cable eye lug must match the cable's thickness; Ancor's lugs are listed by AWG and stud size, from #10 to 1/2 in.[1][4] Ancor's table shows SAE cable carries less copper than AWG cable of the same number, so check the barrel against the cable itself.[7] Sizes come from wire size.



SAE cable has less copper than AWG cable of the same number (Ancor), so check the barrel against the cable itself, not the printed gauge.

02 Cut square and strip to the terminal maker's length

Strip stranded copper wire to the length the terminal maker gives, Klein's instructions say, and Grote strips 3/4 in for copper tube lugs so the bare conductor seats fully in the connector.[10][13] Do not cut or nick strands: Molex lists cut or nicked strands among the causes of weak crimps.[16] No insulation should go into a connector and no bare wire should show outside it.[1]



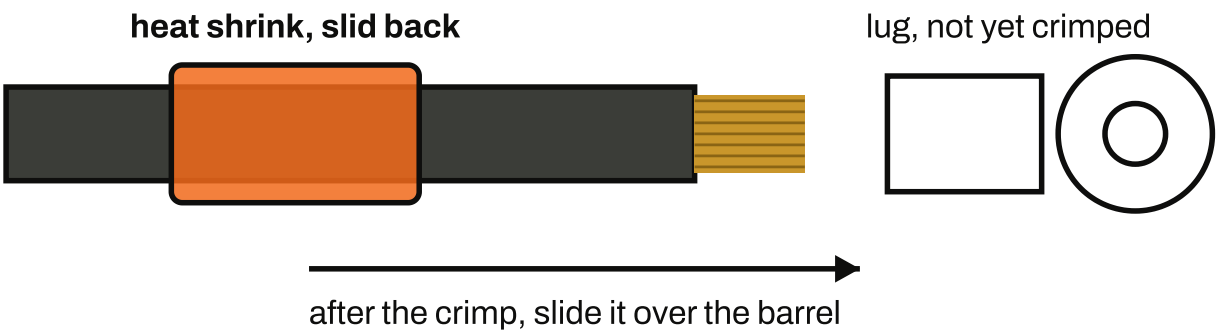
Grote: 3/4 in for copper tube lugs, so the bare conductor seats fully in the barrel.

no cut or nicked strands

No insulation inside the connector and no bare wire showing outside it (Victron).

03 Slide the heat shrink on before the terminal

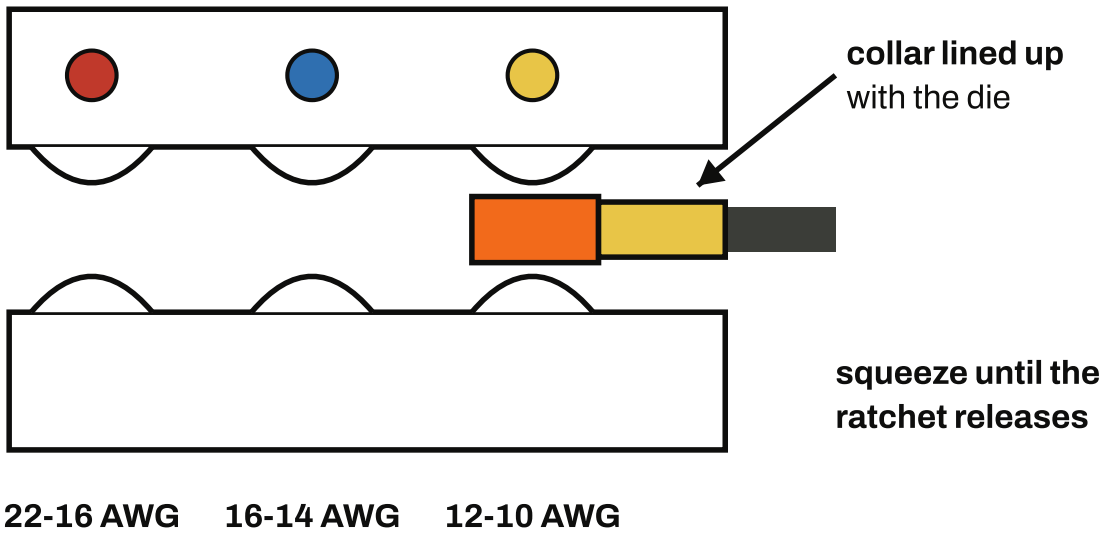
If the joint will be sealed with heat shrink tubing, Grote's instructions say to slide it over the cable before applying the connector. Victron asks for insulation on any uninsulated lug.[13][1] Ancor sizes its adhesive-lined tubing by wire range, for example 3/4 in tube for 8 to 2/0 AWG and 1 in for 2 to 4/0.[5]



Tubing first: it will not pass over the ring once the lug is on (Grote).

04 Crimp small terminals in the matching colour cavity

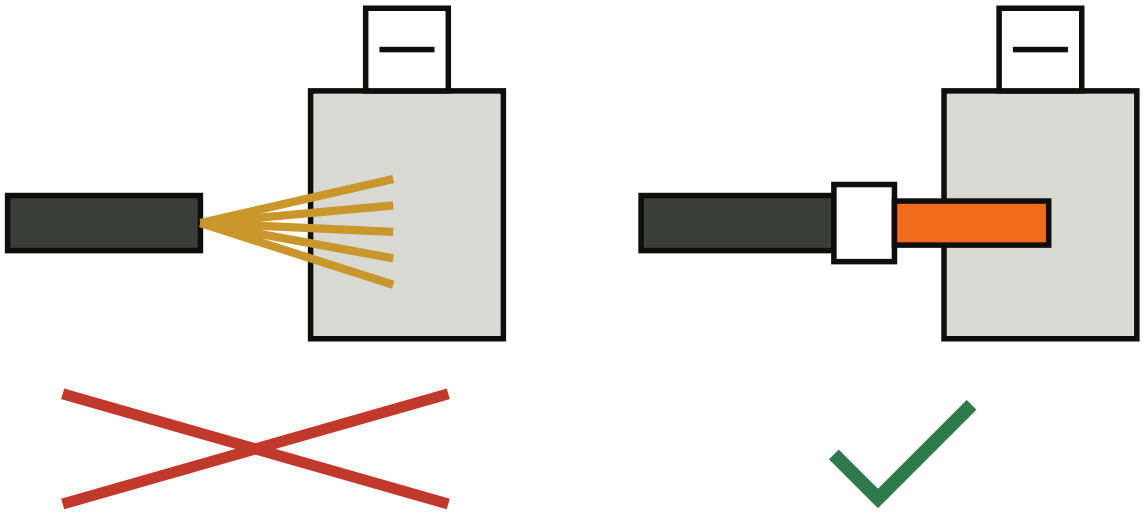
Insert the wire into the right size terminal, place it in the cavity marked for it, line the collar up with the die and squeeze until the handles release; the ratchet will not open until the cycle is complete.[10] Klein's 3005CR and 3007CR cavities are red 22 to 16 AWG, blue 16 to 14 and yellow 12 to 10.[8][9] Use the tool type the terminal needs: Ancor sells a single crimp tool for heat shrink terminals and a double crimp tool for nylon and vinyl ones.[6]



One cycle crimps the core and the insulation sleeve at different pressures (Victron).

05 Fit ferrules on stranded wire for screw terminals

Victron says a standard screw terminal requires a ferrule, a rising cage clamp does not but most makers allow one, and a ferrule must be crimped with a dedicated crimping tool, never just tightened in the terminal.[1] Klein's ferrule crimpers cover 10 to 22 AWG stranded wire and, like its terminal crimpers, release only after a full cycle.[11][12]



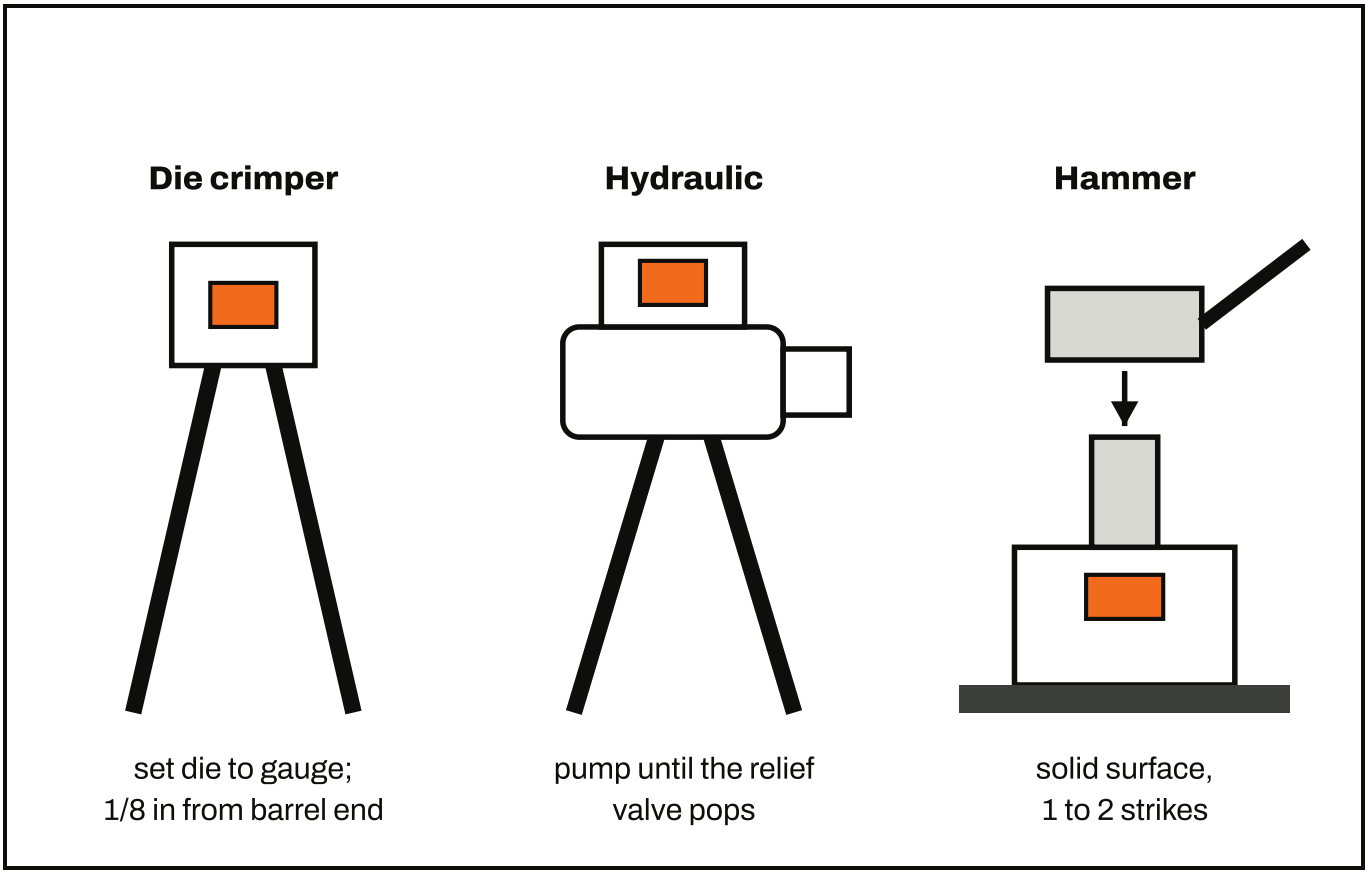
bare strands splay and pinch **crimped ferrule, fully seated**

Victron: a standard screw terminal needs a ferrule, crimped with a dedicated tool.

06 Crimp battery lugs with a lug crimper

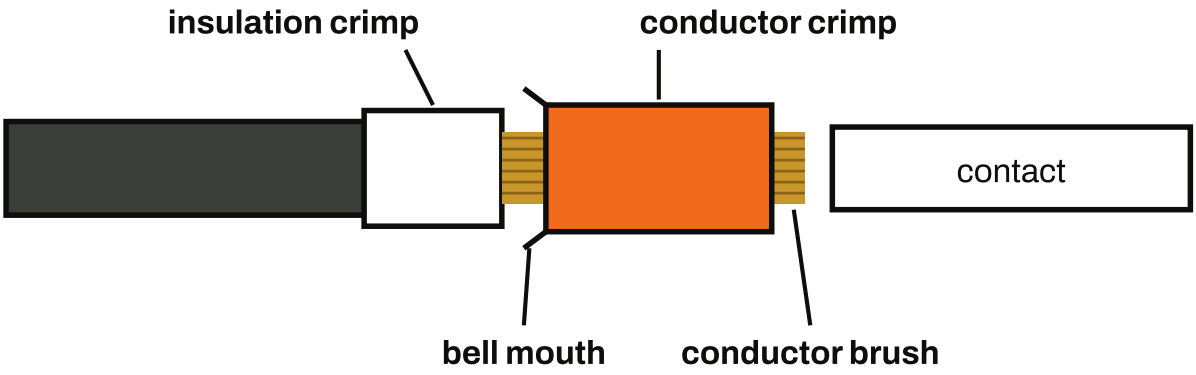
Die crimper: set the die for the cable gauge and connector, close the dies fully and crimp at least 1/8 in in from the barrel end. [13] Hydraulic: insert the cable fully, centre the connector in the dies and pump until the relief valve pops; Greenlee warns that if the handle load does not drop suddenly, the crimp is not complete. [14] Hammer: TEMCo's steps are terminal in the jaw, wire in the terminal, one to two strikes on a solid surface until the impact feels solid. [15]

Caution. Greenlee warns that an incomplete crimp can cause a fire, and that the wrong die, connector and cable combination can give one. Wear eye protection; Klein and Greenlee both ask for it. [14] [10]



07 Inspect the crimp

Look at it before you seal it. Molex's handbook names what to check: a bell mouth at the cable end of the conductor crimp, a little conductor brush of strand ends past the crimp, no cut strands, and an insulation crimp that grips the insulation without it entering the conductor crimp.[16] Victron makes the same point about insulation pushed too deep into the terminal.[1]



Look for: a bell mouth, a little strand showing past the crimp, no insulation under the conductor crimp and no cut strands (Molex).

08 Give every crimp a tug

After crimping, Victron calls it good practice to give the wire a small tug to make sure the terminal is securely crimped; Klein says to verify the terminal is securely crimped onto the wire.[1][10] The lab test is stricter: Molex prints UL 486A minimum pull-out forces of 50 lb for 14 AWG and 80 lb for 10 AWG on a pull tester at 1 in per minute.[16]

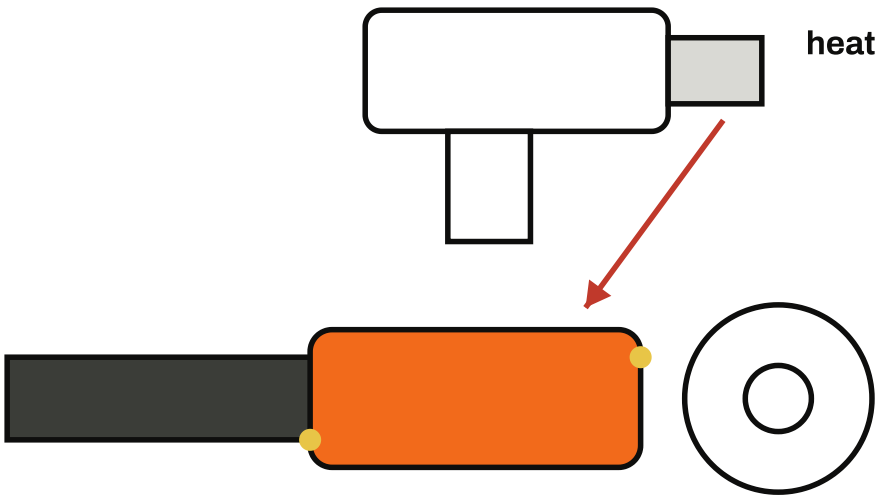


Victron: give every crimp a small tug; it should not move.

UL 486A pull-out minimums (printed by Molex) are for a pull tester at 1 in per minute, not for a hand test.

09 Shrink the tubing with gentle heat

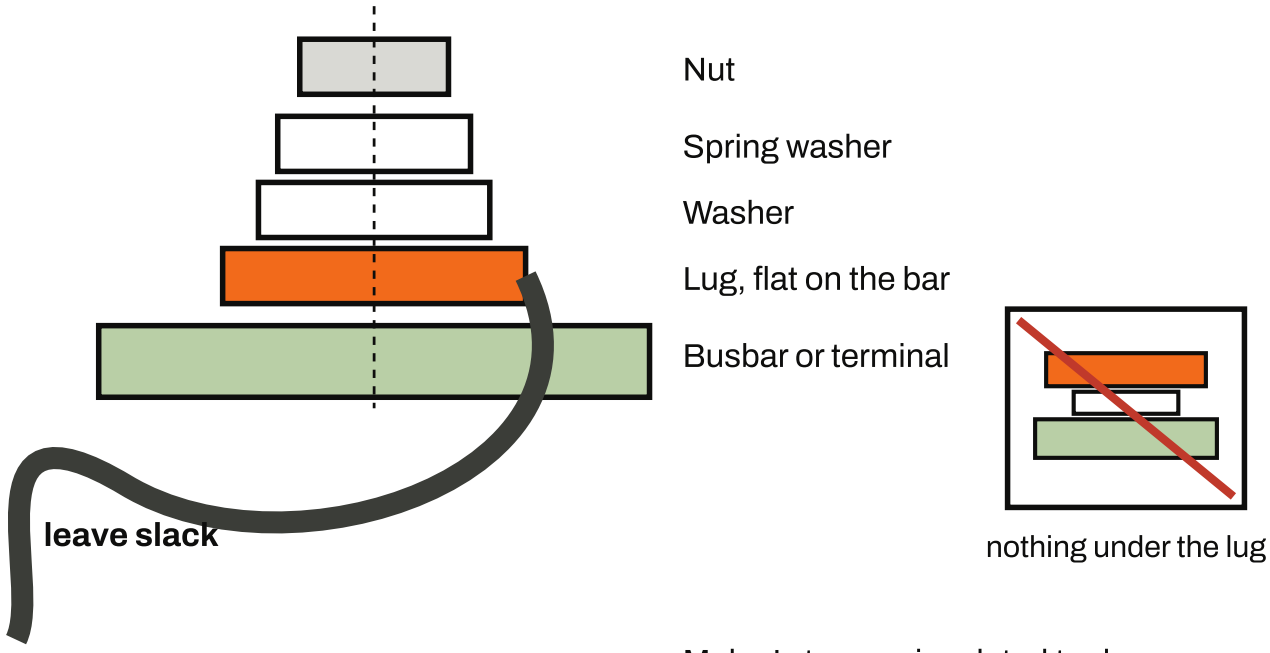
Slide the tubing over the barrel and heat it until it closes and the adhesive shows at the ends. Ancor's heat shrink terminals shrink at 275 °F (135 °C) and its adhesive-lined tubing at 257 °F (125 °C), to one third of its size; Grote finishes each lug with heat shrink tubing. [2] [5] [13]



Ancor heat shrink terminals shrink at 275 °F (135 °C);
its adhesive-lined tubing at 257 °F (125 °C), to one third of its size.

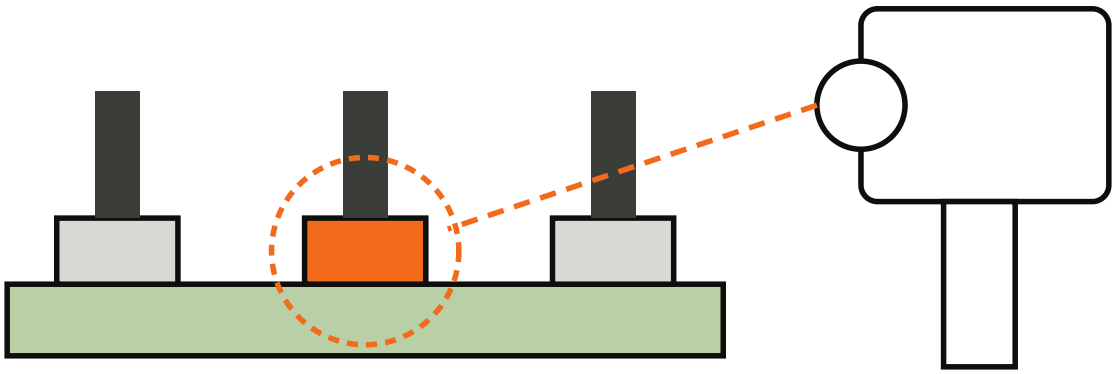
10 Seat the lug flat and torque it

The lug sits flush on the terminal or busbar with nothing between, then a washer, a spring washer and the nut, tightened to the maker's torque with insulated tools. Leave slack: Victron warns that tight cables and vehicle vibration loosen crimps and terminals over time. [1] Stud torques are in busbars and the electrical guide.



11 Check the joints at full load

Once the system runs, Victron suggests running it at full load and checking the cables with a thermal camera, which also finds loose connections and badly crimped terminals. Redo any joint that runs warmer than its neighbours. [1]



loose or badly crimped

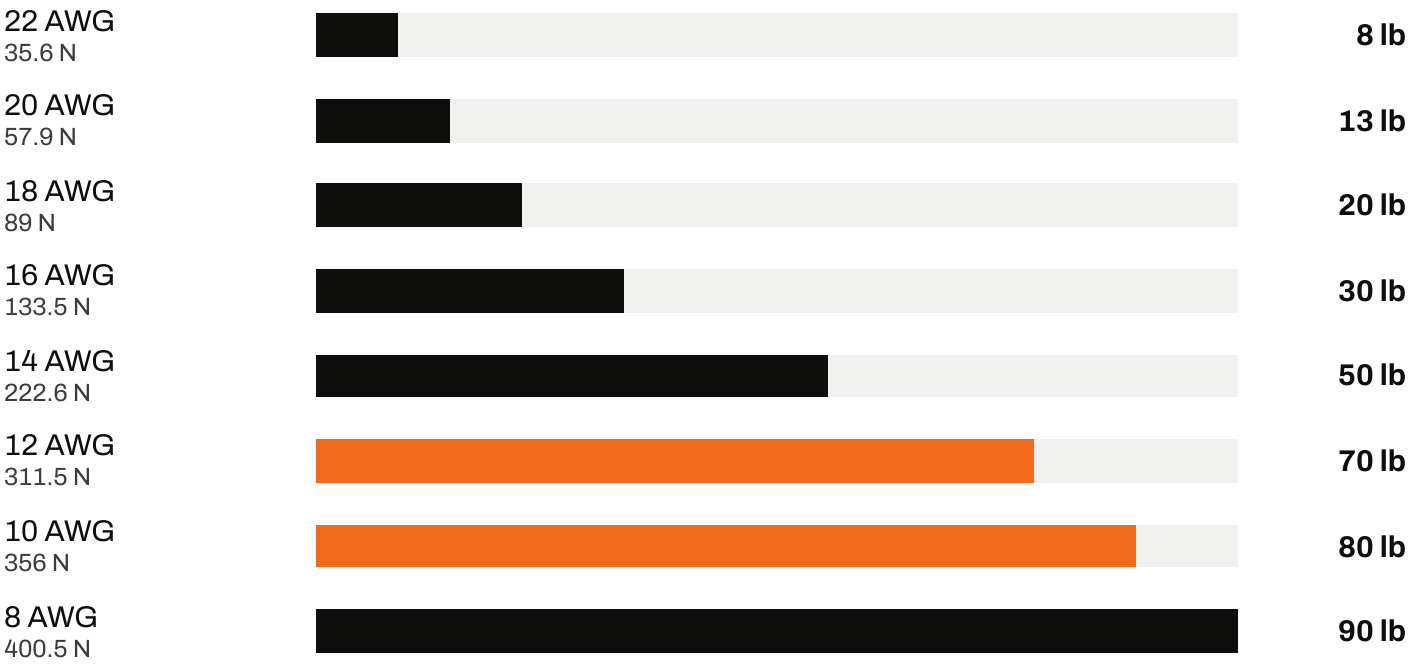
Run the system at full load and look for a hot joint (Victron).

HOW DO YOU KNOW A CRIMP IS GOOD?

Look, pull and measure. Check the bell mouth, strand ends and insulation position, give it a small tug, and check the joints at full load with a thermal camera or by voltage drop. A crimp that moves or runs warm gets cut off and redone. [16] [1]

LAB PULL TEST

UL 486A minimum pull-out force by wire size, as printed by Molex



Molex, Quality Crimping Handbook, section 7, table "Test Values for Pull Force Test, UL486A", read 25 November 2026; Molex notes "consult individual specifications". A lab figure for a pull tester, not a hand test. Chart ours. [16]

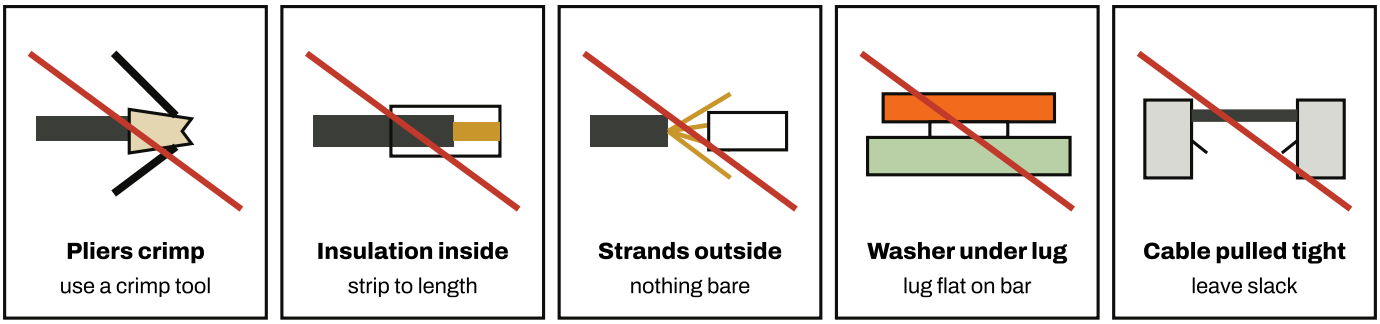
These are lab numbers for a pull tester at 1 in per minute, with the terminal clamped at its contact end and at least five samples per setup, so read them as a sense of scale rather than a home test. [16] What you can do at the bench is the visual check and the tug; Molex also suggests bending the wire 60 to 90 degrees in any direction to judge the insulation crimp, which should hold the wire without shearing. [16] Once the system runs, measure voltage at both ends of each heavy cable at full load, as in the electrical guide, and use a thermal camera if you have one. [1]

Crimp inspection checklist (copy it)

CHECK	PASS
Terminal	Barrel matches the cable you have; hole matches the stud; colour matches the wire [1] [2]
Tool	Made for that terminal type and size; ratchet completed its cycle [6] [10]
Strip	Maker's length; no cut or nicked strands; no insulation in the conductor crimp; no bare wire outside [10] [16] [1]
Shape	Bell mouth at the cable end; a little strand showing past the crimp [16]
Lug	Crimped at least 1/8 in from the barrel end (Grote); hydraulic: relief valve popped (Greenlee) [13] [14]
Tug	A small tug moves nothing [1]
Seal	Heat shrink over the barrel and onto the insulation; uninsulated lugs insulated [1] [13]
Mount	Lug flat with nothing under it; washer, spring washer, nut at the maker's torque; slack in the cable [1]
Load	No joint warmer than its neighbours at full load [1]

WHAT SHOULD YOU NEVER DO WHEN TERMINATING 12 V WIRE?

Do not squeeze terminals with pliers, leave insulation in the barrel or strands outside it, put a washer under a lug, pull cables tight between fixed points, or rely on butt splices and bullet terminals. Each comes from a maker's warning. [1] [16]



Our drawings of the faults Victron and Molex warn about. [1] [16]

Victron's list is specific: lugs, spades and ferrules need a special crimping tool; insulation in a connector raises resistance and can melt it; bare wire outside a connector risks shock or a short; anything under a lug cuts the current the joint can carry; and tight cables with vehicle vibration put crimps and battery posts under stress until they come loose. [1] It does not recommend bullet or butt splice terminals, which it says often make bad contact, and it warns against strands soldered together in a screw terminal unless the terminal is designed for it. [1] On solder in general, the makers we read all specify crimps; Molex describes crimping as developed to replace soldered terminations. [16] We could not open a maker page that rules on solder-only joints in vehicles, so we make no claim about them. Battery clamps are for temporary connections only, Victron adds, and car plugs cannot carry more than 10 A. [1]

WHO SELLS VAN WIRING PARTS AND KITS?

These 3 verified businesses in our directory make van electrical gear or sell wiring kits and components; each links to its listing.

Victron Energy B.V., Almere, Netherlands: Maker of off-grid energy equipment such as inverters, chargers, batteries, battery monitors and solar charge controllers, used in vans, boats and buildings.

Explorist.life, Redmond, Oregon: Husband-and-wife business selling camper electrical systems, components and wiring kits for DIYers, with professional installation in Redmond, Oregon.

Vanlife Outfitters, Sarasota, Florida: Sarasota, Florida store for camper van electrical systems, batteries, solar, suspension, water tanks, swivels and other road-tested van parts.

More in parts makers and kit makers; every build topic is on the DIY hub. The electrical series: the whole system, wiring diagram, wire size, fuse size, busbars, lights and switches, inverters and 120 V outlets. The tools are in van build tools.

The live version of this guide, with every source linked: vanlife.co/guides/crimp-12v-wire. Builders, kits and parts makers we checked: vanlife.co/builders.

QUESTIONS PEOPLE ASK

Can I crimp terminals with pliers?

No. Victron says lugs, ferrules and spade terminals each need a special or dedicated crimping tool, and a professional ratcheting crimper for insulated terminals. Ancor quotes ABYC recommending a crimp tool from the same brand as the connectors, because barrel and insulation thickness vary by maker.

Should I solder 12 V connections instead of crimping them?

Every maker we read specifies a crimp. Molex describes crimping as developed to replace soldered terminations, and Victron warns against strands soldered together in a screw terminal unless the terminal is designed for it. We found no maker page that rules on solder-only joints in vehicles, so we make no claim either way.

Are butt splices OK in a van?

Avoid them where you can. Victron does not recommend butt splice terminals, saying they often make bad contact, and suggests a WAGO 221-482 lever connector for wire up to 4 mm² instead. Ancor makes heat shrink butt connectors listed to UL 486C with a crimp indicator on the barrel; crimp them with the matching tool.

Is a hammer crimper good enough for battery cable?

TEMCo sells one for 8 AWG to 4/0 and says strike it one to two times on a solid surface until the impact feels solid. We found no test comparing hammer, die and hydraulic crimps, so we cannot rank them. Whatever you use, inspect the crimp, tug it and check it under load.

What colour terminal goes on 12 AWG wire?

Yellow. Klein's ratcheting crimpers use red for 22 to 16 AWG, blue for 16 to 14 and yellow for 12 to 10, and Ancor's heat shrink terminals use the same yellow band for 12 to 10 AWG. Victron gives the bands in square millimetres: red 0.5 to 1.5, blue 1.5 to 2.5, yellow 2.5 to 6.

Do I need ferrules on every wire?

On stranded wire going into a standard screw terminal, yes: Victron says ferrules are required there. A rising cage clamp does not need one, though most makers allow it, and a push or lever connector takes bare stripped wire. Crimp ferrules with a ferrule crimper, never just the terminal screw.

How strong should a crimp be?

Strong enough that a small tug does nothing, which is Victron's field check. In the lab, Molex prints UL 486A minimum pull-out forces measured on a pull tester at 1 inch per minute: 20 lb for 18 AWG, 50 lb for 14 AWG, 70 lb for 12 AWG and 90 lb for 8 AWG.

SOURCES

Procedure from the makers' written instructions: Victron's Wiring Unlimited (cable connections, ferrules, crimp terminals), Klein's ratcheting and ferrule crimper instructions and product pages, Ancor's 2024 catalog (terminals, lugs, tubing, tools, and its ABYC tool tip), Grote's battery lug crimper instructions, Greenlee's HKL1232 hydraulic manual, TEMCo's hammer crimper page and Molex's Quality Crimping Handbook (as hosted by DigiKey; the UL 486A pull-out table is Molex's printing, not the standard itself). The SAE vs AWG chart is our arithmetic on Ancor's page 64, the same data as our wire size guide. TE Connectivity and Blue Sea Systems pages refused our connection, so neither is quoted; we could not open ABYC E-11 or UL 486A themselves. No maker states a time per crimp, so none is given. All read 25 November 2026.

Victron Energy, Wiring Unlimited, chapter 4: DC wiring (cable connections, eye lugs, ferrules, crimp terminals, cable runs) (https://www.victronenergy.com/media/pg/The_Wiring_Unlimited_book/en/dc-wiring.html). Read 25 November 2026

Ancor (marine wire maker), Catalog 2024, page 24: adhesive-lined heat shrink terminals, colour bands, shrink temperature, UL 486A (https://docs.navico.com/view/362211770/24/). Read 25 November 2026

Ancor, Catalog 2024, page 25: heat shrink butt and step-down connectors, UL 486C, crimp indicator (https://docs.navico.com/view/362211770/25/). Read 25 November 2026

Ancor, Catalog 2024, page 30: tinned copper lugs, seamless barrel, closed end, UL 486A (https://docs.navico.com/view/362211770/30/). Read 25 November 2026

Ancor, Catalog 2024, page 36: adhesive-lined heat shrink tubing, 3:1 shrink ratio, shrink temperature, sizes by wire range (https://docs.navico.com/view/362211770/36/). Read 25 November 2026

Ancor, Catalog 2024, page 50: hex lug crimpers, single and double crimp ratcheting crimpers, and its tip on crimp tool selection quoting ABYC (https://docs.navico.com/view/362211770/50/). Read 25 November 2026

Ancor, Catalog 2024, page 64: AWG and SAE circular mil areas, 18 to 4/0

(https://docs.navico.com/view/362211770/64/). Read 25 November 2026

Klein Tools, 3005CR Ratcheting Crimper, 10-22 AWG, Insulated Terminals (product page and specifications) (https://www.kleintools.com/catalog/ratcheting-crimpers/ratcheting-crimper-10-22-awg). Read 25 November 2026

Klein Tools, 3007CR Ratcheting Heat Shrink Terminal Crimper, 10 to 22 AWG Wire (product page) (https://www.kleintools.com/catalog/combination-cutting-tools/ratcheting-heat-shrink-terminal-crimper-10-22-awg-wire). Read 25 November 2026

Klein Tools, instructions for the 3005CR, 3006CR, 3007CR and 3000CRKIT ratcheting crimpers (1391016, Rev. 07/25 A) (https://data.kleintools.com/sites/all/product_assets/documents/instructions/klein/1391016ART%20-%203005CR%20-%203006CR%20%20-%203007CR%20-%20%203000CRKIT%20-%20Ratcheting%20Crimper%20Web%20Manual.pdf). Read 25 November 2026

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