

Cable and Terminal Selection Guidelines (Temperature Rise vs Current)

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Product Category	Industry Standard or Test Results	Product	Tool Required for Mating & Un-mating	Cross Sectional Area of Conductor mm ²	# amps for 30° C Rise 55° total	# amps for 45° C Rise 70° total	# amps for 60° C Rise 85° total	# amps for 90° C Rise 115° total
Connector	Test Results	Rebling BFT or XFT 1,000 amp rating with one 380 mm ² cable per terminal	Wrench	390	1,010	1,250	1,430	1,690
Connector	Test Results	Rebling BFT or XFT 750 amp rating with one 380 mm ² cable per terminal	Wrench	390	900	1,100	1,250	1,440
Connector	Test Results	Rebling MFT or Top Seal 500 amp rating with one 230 mm ² cable per terminal	Wrench	240	520	630	730	840
Connector	Test Results	Rebling LFT, SIP, SFT, Top Seal 250 amp rating with one 105 mm ² cable per terminal	Wrench	130	280	340	390	450
Connector	Test Results	Anderson SB350 with one 105 mm ² cable per terminal	None	130	280	340	390	450
Connector	Test Results	Rebling 7010+7020 with one 105 mm ² cable per terminal	None	75	270	330	380	430
Connector	Test Results	Rebling TFT 100 amp rating with one 32 mm ² cable per terminal	Wrench	40	115	150	170	190
Cable	Test Results	750 MCM Cable 7,600 strands of 30 gauge wire		380	1,020	1,270	1,470	
Cable	Test Results	450 MCM Cable 4,500 strands of 30 gauge wire		230	550	660	770	
Cable	Test Results	250 MCM Cable 2,500 strands of 30 gauge wire		130	360	450	520	
Cable	Test Results	4/0 Cable 2,060 strands of 30 gauge wire		105	290	350	400	
Cable	Test Results	3/0 Cable 1,590 strands of 30 gauge wire		80	260	310	350	
Cable	Test Results	2/0 Cable 1,280 strands of 30 gauge wire		65	240	290	335	
Cable	Test Results	1/0 Cable 1,000 strands of 30 gauge wire		50	230	270	315	
Cable	Test Results	2 AWG Cable 625 strands of 30 gauge wire		32	120	160	180	
Cable	Test Results	4 AWG Cable 375 strands of 30 gauge wire		19	90	105	120	
Cable	Test Results	6 AWG Cable 260 strands of 30 gauge wire		13	80	100	110	
Cable	Test Results	8 AWG Cable 160 strands of 30 gauge wire		8.1	75	90	105	
Cable	Test Results	10 AWG Cable 105 strands of 30 gauge wire		5.3	50	60	70	
Cable	Test Results	12 AWG Cable 65 strands of 30 gauge wire		3.3	35	40	50	
Cable	Test Results	14 AWG Cable 40 strands of 30 gauge wire		2.0	20	25	30	
Cable	NEC/UL Std	4/0 Cable 2,060 strands of 30 gauge wire		105	195	230	260	
Cable	NEC/UL Std	2/0 Cable 1,280 strands of 30 gauge wire		65	145	175	195	
Cable	NEC/UL Std	1/0 Cable 1,000 strands of 30 gauge wire		50	125	150	170	
Cable	NEC/UL Std	2 AWG Cable 625 strands of 30 gauge wire		32	95	115	130	
Cable	NEC/UL Std	6 AWG Cable 260 strands of 30 gauge wire		13	55	65	75	

Cable and Connector Selection Guidelines: The cross sectional areas of the terminal and the cable attached to the terminal should be the same. Attaching a small cable to a large terminal is like attaching a 1 inch pipe to a 4 inch fitting, the size of the cable will limit the system's electrical and thermal performance, not the terminal. To select the optimal connector, follow the steps below:

- Step 1: determine the temperature rise your equipment design can tolerate. The higher the temperature rise your equipment can tolerate, the lower the cost of cable and connectors.
- Step 2: determine if your equipment needs to comply with UL, NEC, IEC or other standards
- Step 3: determine the steady state current which your equipment must handle. If there are frequent or extended peaks of higher currents, use these peaks to estimate an average steady state current.
- Step 4: select the smallest cable which can carry your steady state current which does not exceed the temperature rise you can tolerate and which conforms to the standard with which you wish to comply.
- Step 5: determine if your equipment needs a separable electrical connection. Separable connections are more expensive and less reliable than permanent (soldered or welded) connections.
- Step 6: determine if it is acceptable to use a tool to un-mate your electrical connection. Tool-less connectors are more expensive and less reliable than connectors which require tools but might be justifiable if: frequent un-matings occur, the installer is unskilled, a 20 second reduction in maintenance time is critical or lowered assembly labor costs offset the increased cost of the tool-less connector.
- Step 7: select the lowest cost connector which: does not exceed the temperature rise your equipment can tolerate at your steady state current and meets your un-mating tool requirements.

Temperature Rise Values: the NEC (National Electrical Code) values are NEC's recommendations for typical thermoplastic insulated cables enclosed in a conduit which are close to other cables. UL has adopted NEC's 45° C rise values as their recommendations for current levels per cable size in UL 98. The values labeled "Test Results" were obtained from current vs temperature rise testing of individual cables and connectors suspended in air inside an 18" x 18" x 18" test chamber. Lithium battery system designers usually select components which keep the temperature rise to a maximum of 30° C due the sensitivity of lithium cells. It is wise to compare connectors based upon temperature rise test results since the rated currents and total allowable temperatures defined by standards like UL1977 and IEC 61984 can vary by a factor of 2.5. The current vs temperature rise characteristics of your application may be significantly different than the assumptions used in NEC, UL or IEC standards.

Touch Safe Temperatures: IEC/UL 60950-1 defines the maximum allowable temperature for 3 seconds of contact between a metal component and the human body as 60° C; for plastic it's 85° C.

Cross Sectional Area of Conductor: the cross sectional areas of the stranded cables shown above were calculated using the diameter of one 30 gauge wire = 0.01000 inches