Cable & Terminal Selection Guide

Cable and Terminal Selection Guidelines

courtesy of Rebling.com — March 20, 2023

Product Category	Industry Standard or Test Results	Product	Tool Required for Mating & Un-mating	Cross Sectional Area of Conductor mm^2	30° C Rise 55° total	60° Touch	45° C Rise 70° total	77° Brewed	60° C Rise 85° total	85° Touch	100° Boiling	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	1,020		1,270		1,470			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, 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	1,010		1,250		1,430			
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