Upper Amp rating range for bus staples used as end to end current shunts based on bare copper in free air

AmpacityStapleBusBars.xlsx

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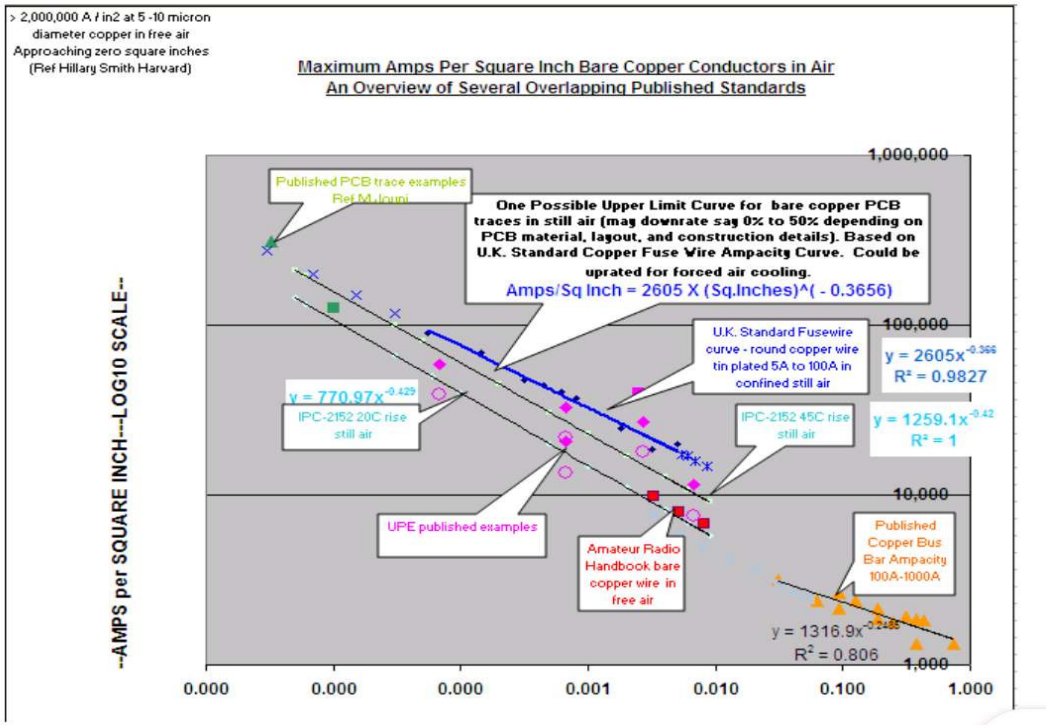
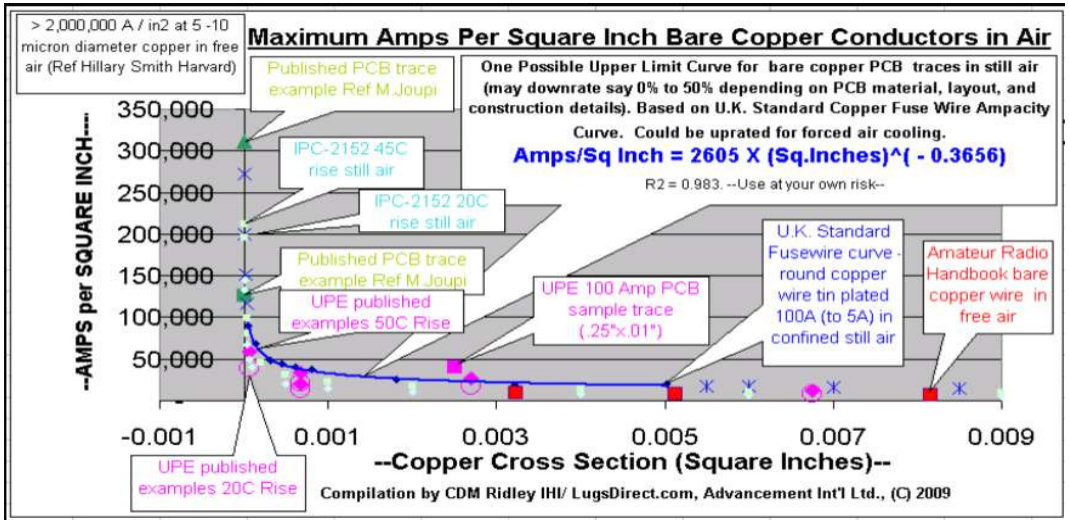
Part No.	Cross section Thickness	Width	CSA Inch^2	Continuous current Round Fuse wire (UK) Tin plated copper High temperature rise Not recommended =2206*D6^(-0.3656)*D6	Continuous Current GENERAL AMP R A N G E see 1-7 ModestHeatRise Low Max Amp 25% Derating factor	HighHeatRise High Max Amp 48% Derating factor	A/in2 Low Moderate Temp Rise	A/In2 High High Temp Rise	Reference Amps Per 20C rise Comparison IPC 2152 Cu traces** 20C rise only if PCB foil =770.97*D7^(-0.429)*D7
14257	0.05	0.24	0.012	157	**39**	**76**	3281	6299	**62**
14307	0.06	0.14	0.0084	126	**31**	**60**	3738	7177	**50**
14259	0.062	0.38	0.02356	242	**60**	**116**	2564	4922	**91**
15812	0.05	0.20	0.01	140	**35**	**67**	3507	6734	**56**
15810	0.063	0.30	0.0189	210	**53**	**101**	2779	5335	**80**
15723	0.078	0.34	0.026832	262	**66**	**126**	2445	4694	**98**

1. Actual heat rise depends on the width and weight of copper foil in the PCB, and the power in and power out power cable sizes.
2. ** "Flat" wires, cool better than round wires due to the increased surface area per cross section area, for cooling.
3. Since staples are flat but not foil-like thin, cooling is better than round wire but worse than wide trace width foils.
4. Resistivity of copper staple buses is about 0.00000176 ohm-cm at 20C partially cold worked. 98% IACS.
5. It is imperative to test actual heat rise at the desired current flow and cooling conditions and ambient temperatures.
6. Life of PCB solder joints have been shown to be halved (50%) for each 10 degree C rise in operating/ cycling temperature.
7. cycle testing for projecting the life of soldered high current components is a requirement to capture all the variables.




> 2,000,000 A / in2 at 5 -10 micron diameter copper in free air (Ref Hillary Smith Harvard)
Maximum Amps Per Square Inch Bare Copper Conductors in Air
Published PCB trace example Ref M.Joupi
One Possible Upper Limit Curve for bare copper PCB traces in still air (may downrate say 0% to 50% depending on PCB material, layout, and construction details). Based on U.K. Standard Copper Fuse Wire Ampacity Curve. Could be uprated for forced air cooling.
Amps/Sq Inch = 2605 X (Sq.Inches)^(- 0.3656)
R2 = 0.983. --Use at your own risk--
IPC-2152 45C rise still air
IPC-2152 20C rise still air
Published PCB trace example Ref M.Joupi
UPE published examples 50C Rise
UPE 100 Amp PCB sample trace (.25"x.01")
U.K. Standard Fusewire curve - round copper wire tin plated 100A (to 5A) in confined still air
Amateur Radio Handbook bare copper wire in free air
--AMPS per SQUARE INCH---
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-0.001
0.001
0.003
0.005
0.007
0.009
--Copper Cross Section (Square Inches)--
UPE published examples 20C Rise
Compilation by CDM Ridley IHI/ LugsDirect.com, Advancement Int'l Ltd., (C) 2009