



QA Technology Company, Inc.

A p p l i c a t i o n s N o t e

Current Carrying Capacity Double Ended Probes in Vacuum

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Background:

This study was performed to show the current carrying capacity in vacuum of QA's .100", .075" and .050" double-ended probes. A fixture manufacturer built a customized vacuum fixture for this study; sketches describing the fixture appear in Appendix A.

Conclusions:

Thermocouples were located at three points along the length of the sockets as shown in the sketch. Tests showed that the bottom thermocouple was hottest during the tests. This may have been since the highest resistance along the assembly is in the bottom area, and therefore the most heat was generated there. However, there is another likely reason.

It is probable that the thermocouple temperatures are affected by fixture leaks, which allow airflow across the probes when vacuum is applied. This airflow produces a cooling effect through forced convection. This cooling theory is supported by comparing the first two graphs, which show vacuum versus non-vacuum for .100" centers single probes. Maximum current with vacuum applied was 8 Amps; without vacuum was only 4.5 Amps. Since the absence of air would normally cause *higher* temperatures (no heat loss through conduction or convection – loss through radiation only), the lower temperatures must be attributed to forced convection cooling due to leaks.

Realistically, the same effect probably occurs in vacuum fixtures on the whole, since some leakage usually exists.

Procedure:

Vacuum was applied to the fixture while a current of 0.5A was passed through the single, instrumented probe from the .100" centers group. Probe temperature was allowed to stabilize for five minutes, then temperature was recorded at each of the three thermocouples. Current was increased by 0.5A, and the procedure repeated until the hottest thermocouple exceeded 250 degrees Fahrenheit.

The probe was allowed to cool, then all three .100" centers probes were wired in series and the process was repeated. The same steps were followed for .075" and .050" centers, but only the bottom (hottest) thermocouple was used. Note that the .075" and .050" centers probes were actually mounted on .100" centers.

To establish a baseline for comparison, the same fixture was used to collect data for the .100" centers single probe without vacuum.



Data:

Complete numeric data (degrees Fahrenheit) appear below. The graphs on the following pages summarize the data for each series.

Current Carrying Capacity for Double-Ended Probes

.100” Centers Probes

Amps	Single Probe			Row of 3 Probes			In Air (No Vac)
	Top	Mid	Bot	Top	Mid	Bot	Bot
0	72	72	72	72	72	72	74
0.5	72	72	74	74	74	77	77
1	72	73	76	75	75	78	85
1.5	73	74	79	76	78	82	96
2	74	78	84	78	83	87	111
2.5	75	83	89	80	89	95	130
3	77	90	96	82	96	103	149
3.5	79	96	104	86	106	113	172
4	81	105	114	91	117	125	199
4.5	84	115	125	96	131	139	229
5	90	130	139	101	143	152	
5.5	94	142	152	106	160	172	
6	97	156	169	114	179	190	
6.5	101	172	185	121	200	212	
7	105	187	202	130	222	236	
7.5	111	206	223				
8	116	224	244				

.075” Centers Probes

Amps	Single Probe	Row of 3 Probes
	Bot	Bot
0	72	72
1	76	80
2	86	92
3	101	113
4	124	144
5	145	174
6	183	225
6.5	206	
7	230	

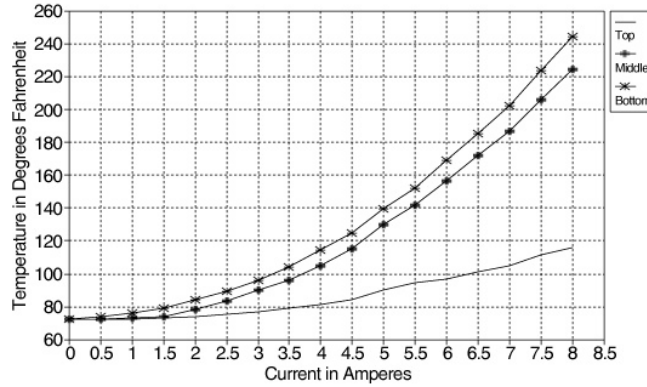
.050” Centers Probes

Amps	Single Probe	Row of 3 Probes
	Bot	Bot
0	72	72
1	75	81
2	93	97
3	115	123
4	144	160
5	181	200
6	227	



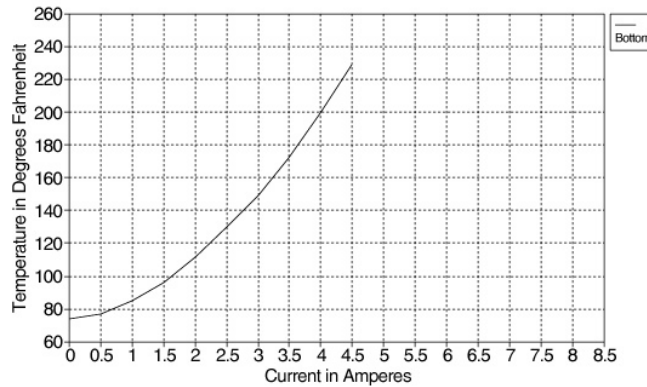
Current Versus Temperature for .100" Centers Double-Ended Probes

Current Carrying Capacity in Vacuum
.100 Double-Ended Probe (Single)



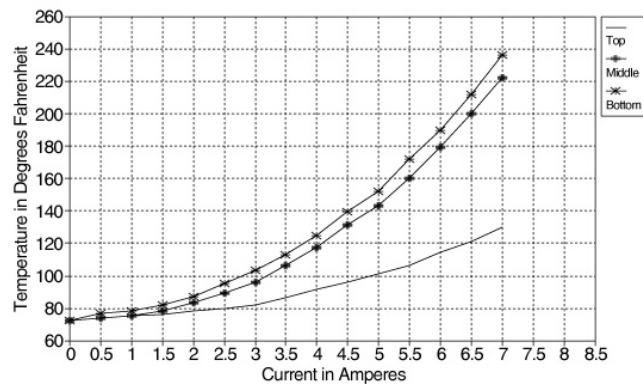
Single probe in vacuum, maximum current 8 Amps. Forced convection cooling due to leaks.

Current Carrying Capacity in Air
.100 Double-Ended Probe (Single)



Single probe in air, maximum current 4.5 Amps. See text.

Current Carrying Capacity in Vacuum
.100 Double-Ended Probes (3 X .100" Ctrs)

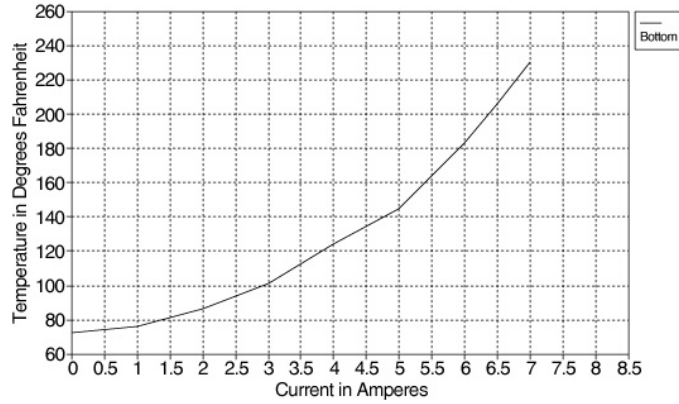


Group of three probes in vacuum, maximum current 7 Amps.



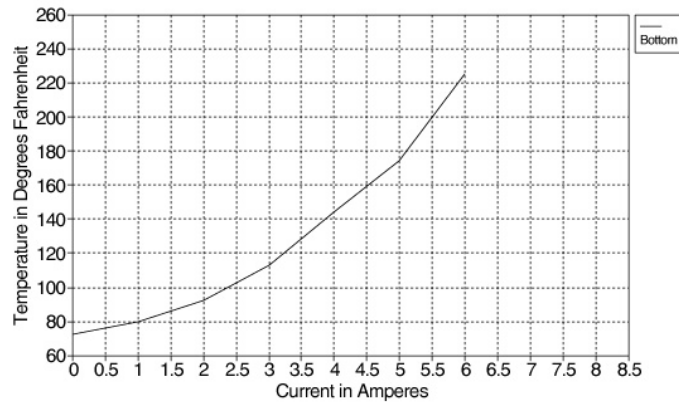
Current Versus Temperature for .075” Centers Double-Ended Probes

Current Carrying Capacity in Vacuum
.075 Double-Ended Probe (Single)



Single probe in vacuum, maximum current 7 Amps.

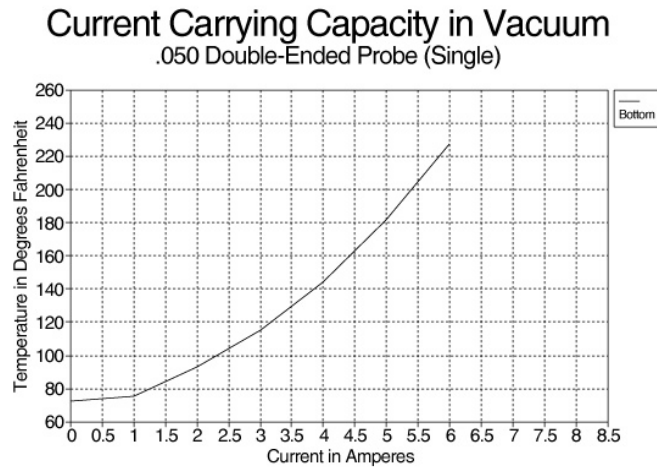
Current Carrying Capacity in Vacuum
.075 Double-Ended Probes (3 X .100" Ctrs)



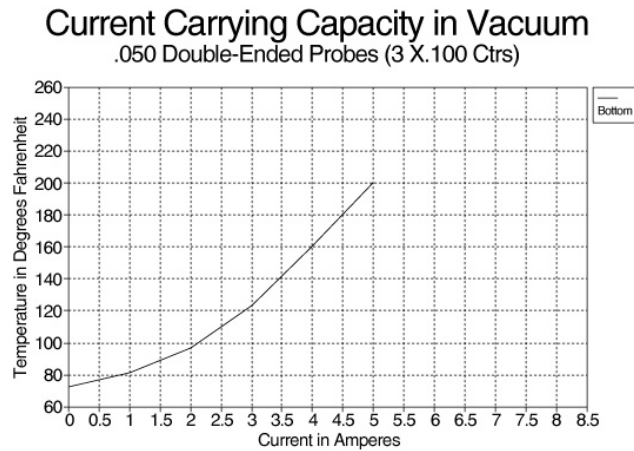
Group of three probes in vacuum, maximum current 6 Amps.



Current Versus Temperature for .050” Centers Double-Ended Probes

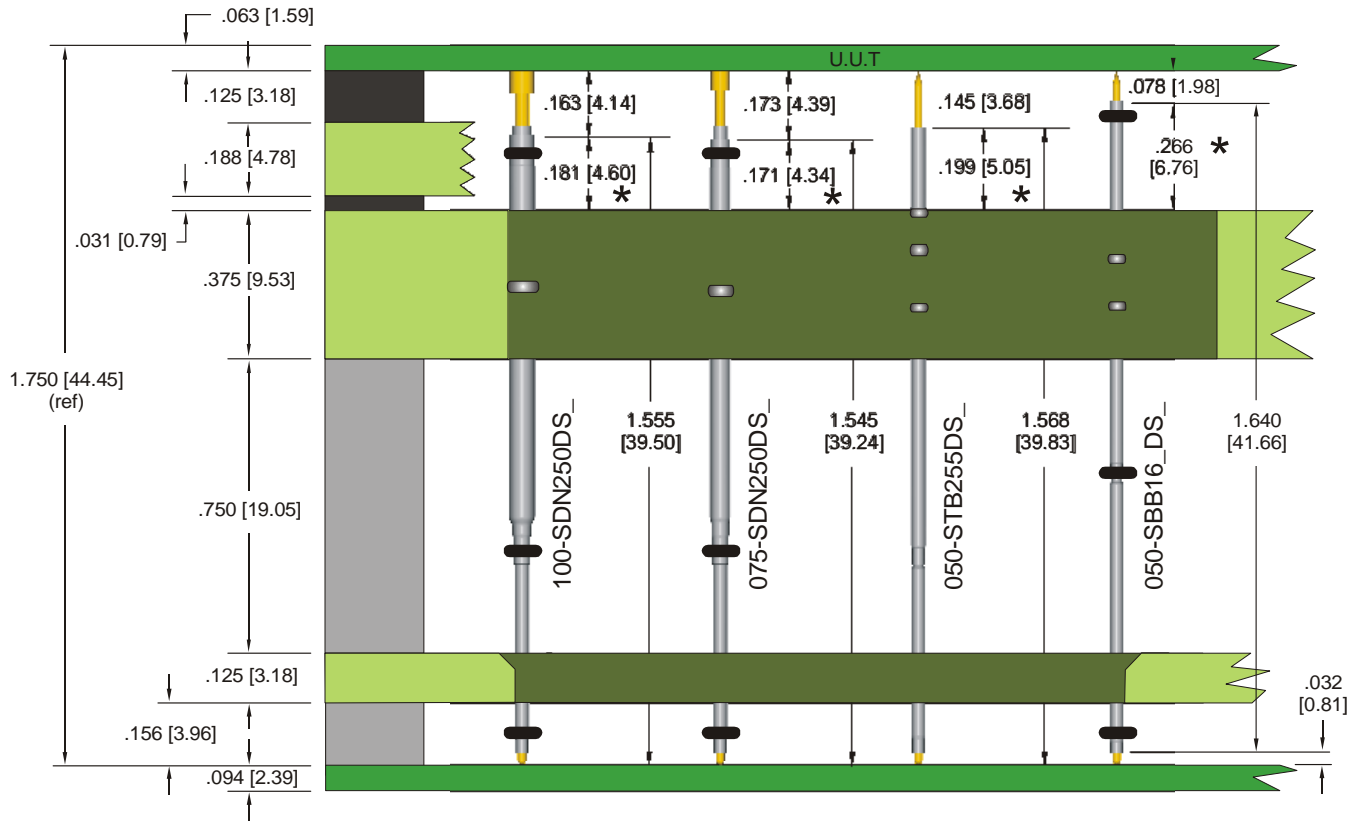


Single probe in vacuum, maximum current 6 Amps.



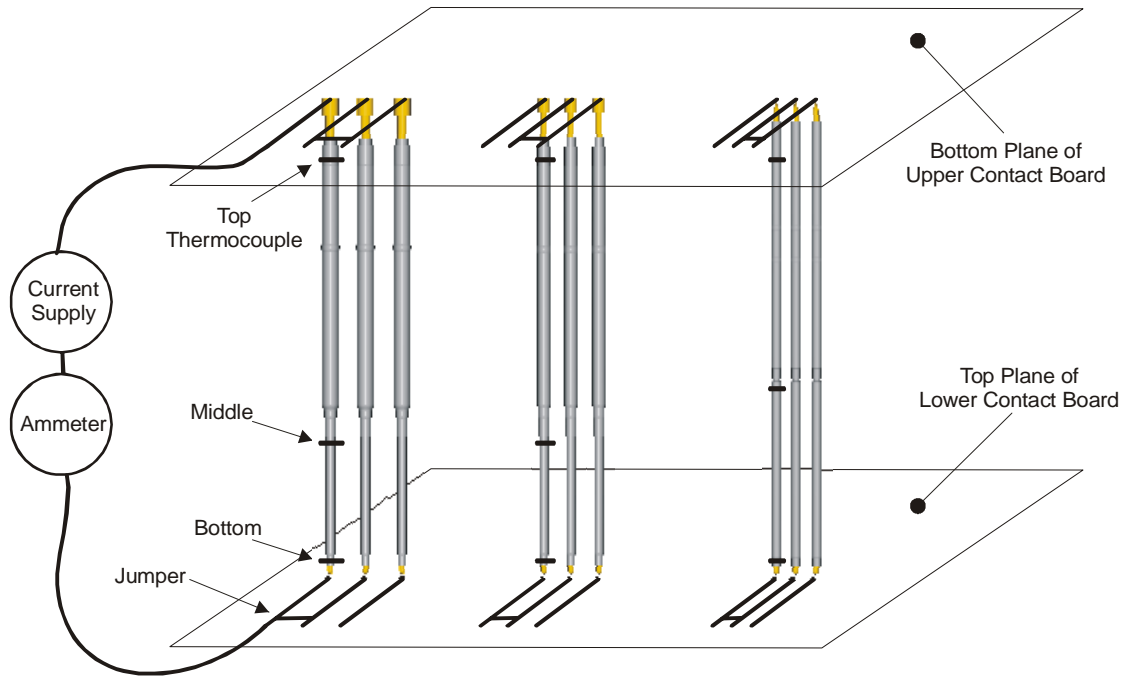
Group of three probes in vacuum, maximum current 5 Amps.

Appendix A
Vacuum Test Fixture for Measuring
Current Carrying Capacity of Double-Ended Probes



Dark lines indicate thermocouple mounting locations
 Note Differences in Socket Set Heights (marked with *)

Wiring Setup for Measuring Current Carrying Capacity of Single Probe



Wiring Setup for Measuring Current Carrying Capacity of Three Probes

