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**PPD / EED / Infrastructure Group**

Technical Note: IG\_ 20120002

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**Power Distribution for Resistive Evaporation System (EvapEXT #8 – 8” MCP Electroding) at Lab 7.**

**Overview:**

Current from a low-voltage / high-current power supply is passed through a heating element (vessel shaped, commonly termed “boat source”) located inside an evacuated vacuum chamber. Metallic material held within the vessel evaporates due to the heat and is deposited on surfaces of items also located in the container. This document describes the system used to safely pass current through the heating element.

**Power Supply:**

The power supply is a Hewlett Packard model HP6464C rated at 8V / 1000A. The target current is <400A. The HP6464C draws its power from a 600V-3 Phase / 60A receptacle via 6AWG / 4C power cable. A separate low-voltage / low-current power supply is used to precisely control the output of the HP646C. This and other ancillary equipment in the rack draw power from a power strip connected to a 120V / 20A receptacle by 12AWG / 3C power cable.

**Power Distribution:**

To facilitate current flow to / from the heating element, tin plated copper buss pieces have been fabricated and commercial high vacuum, high current feed throughs have been purchased. The drawing numbers of the buss pieces are included in the system drawing (# 173837) and all have been included in this document.

Current from the + terminal of the power supply is delivered to two 4/0 cables through buss piece 173661. Each 4/0 cable is protected with a Buss 200A fuse. Each fuse is connected to its cable via buss piece 173650. The cables terminate at buss piece 173647 which is bolted to buss piece 173649 which in turn is bolted to the 600A feed through. Current returning from the heating element (held between two feed throughs in the vacuum container) passes from a similar feed through to buss piece 173649 to buss piece 173647 and to two 4/0 cables. The two cables terminate at buss piece 173646 which is bolted to one side of a 1000A / 100mV shunt, which is bolted to buss piece 173661. Buss piece 173661 is bolted to the – terminal of the power supply, completing the circuit.

A Digital Panel Meter displays the voltage drop across the shunt, which is interpreted as current through the heating element / power distribution system.

All fasteners are silicon bronze and torqued to the following values:

1/4-20 – 70 in-lbf.

5/16-18 – 125 in-lbf.

3/8-16 – 240 in-lbf.

For a current of 400A, the maximum current densities for all buss pieces are listed below:

* 173645: (1000A / 0.75 in. / (1.75 in – 0.25 in.)) = 889 A/in2. \*
* 173646: (400A / 0.375 in. / (2.000 in – 0.391 in.)) = 663 A/in2.
* 173647: (400A / 0.375 in. / (1.500 in. – 0.391 in.)) = 961 A/in2.
* 173649: (400A / 1.0 in. / 1.0 in.)) = 400 A/in2.
* 173650: (200A / 0.375 in. / 0.75 in.)) = 711 A/in2. \*\*
* 173661: (400A / 0.375 in. / 1.313 in.) = 812 A/in2.

\*This buss piece is upstream of the fuses thus can be subjected to the full current of the supply.

\*\*This 4/0 cable flag is downstream of a 200A fuse and will not be subjected to 400A.

Appendix:

The appendix consists of the system wiring diagram (# 173837), the mechanical drawings of the buss pieces (173645, 173646, 173647, 173649, 173650 and 183661). Data sheets for the HP6464C power supply and the Nor-Cal Products feed through have been included as well.