

**Cable Electrolysis Test**  
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At present the severed stump of the String-1 umbilical remains plugged into the Junction Box, with power wires exposed to seawater, forming a short circuit. It has been suggested that by applying power to the JB we might be able to corrode away the umbilical power wires sufficiently to raise the seawater path resistance to the point that the JBEM can again receive power. In order to investigate the effects of such electrolytically enhanced corrosion, we simulated the operation using a sample of umbilical cable supplied by Bob Mitiguy.

A clean 30-gallon plastic garbage can was filled with clean seawater supplied by the Seattle Aquarium. The umbilical cable was prepared by cutting an end neatly using a saw, to simulate the effects of the acoustic release guillotine, and immersing this end in the seawater sample. The other end of the cable was connected through a ballast (three 100W light bulbs in series) to a 350VDC/1A power supply. The experiment, shown in Fig. 1, was set up in our machine shop welding area, with a moveable ventilating duct positioned over the tank to draw off evolved gas (presumably hydrogen).

Upon applying power, we immediately observed copious production of gas and a bright glow at the positive electrode. However, current was limited to about 0.1A independently of the ballast by seawater resistance, and this value did not change significantly throughout the test period. The seawater became cloudy with debris from burned off insulation. This material settled out completely after power was turned off. After 11 hours of current flow, the cable was removed and dissected. We found that the copper core of the positive wire, along with its insulation, had been eroded back 7 cm from the end. There was no significant change to the negative wire. The yellow Hytrel jacket was not severely damaged. It appears that while the positive wire's copper was eroded, there was no significant effect on the seawater path resistance due to the large cavity created by attendant erosion of the insulation.

The present arrangement differs substantially from real conditions at the JB in several respects. We are not readily able to simulate the water pressure, low temperature, and low oxygen levels at the site in a crude test of this type. However, in order to simulate the electrolytic environment more accurately, we attached an aluminum plate to the positive lead of the power supply and immersed this in the seawater tank to emulate the seawater return pad. The experiment was run a few hours with this setup (Fig. 2). As would be expected, the aluminum electrode became the sacrificial anode, evolving copious amounts of gas, and there was no evident activity at the wire ends. Essential no corrosion was observed in the wires. Since the actual return electrode is several feet away from the umbilical end, and is made of different material, we assume that the actual situation is intermediate between the two cases observed (rapid erosion of wire without anode, negligible erosion with electrode present).

It is difficult to draw definitive conclusions from this test, but it seems clear that application of power to the JB will result either in erosion of the wire without substantial change in the path resistance, or damage to the return electrode, or both. Although this test did not show failure of water blocking (or at least indicated that the insulation supported 350V down the length of the umbilical sample), we do not know if that would be the case at 7500 psi, and do not have the facilities to perform this test under realistic pressure without substantial cost. We recommend leaving JB power off until the connector can be removed by a submersible.

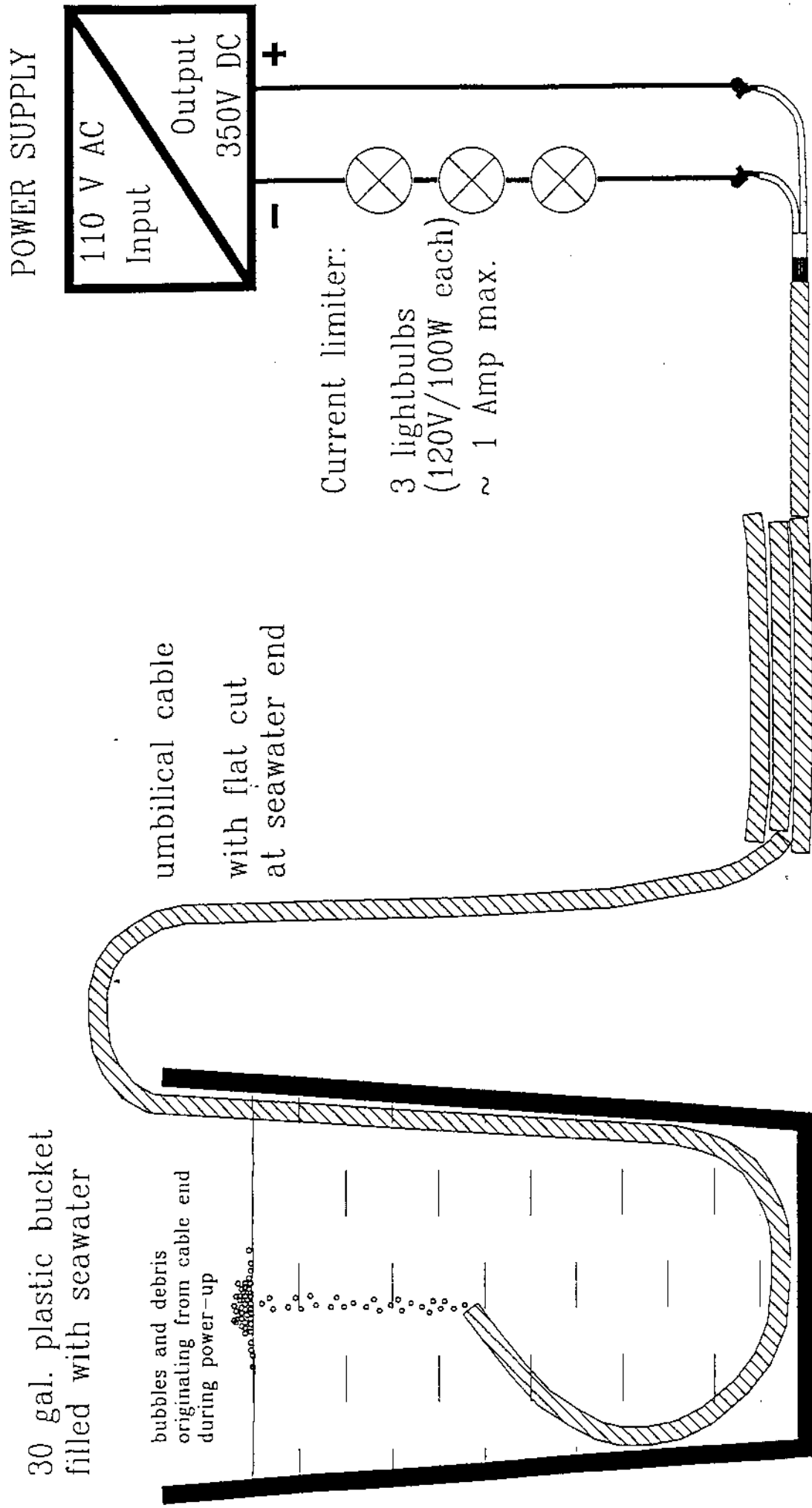


FIG.1: umbilical cable corrosion test with 350 V DC in seawater.

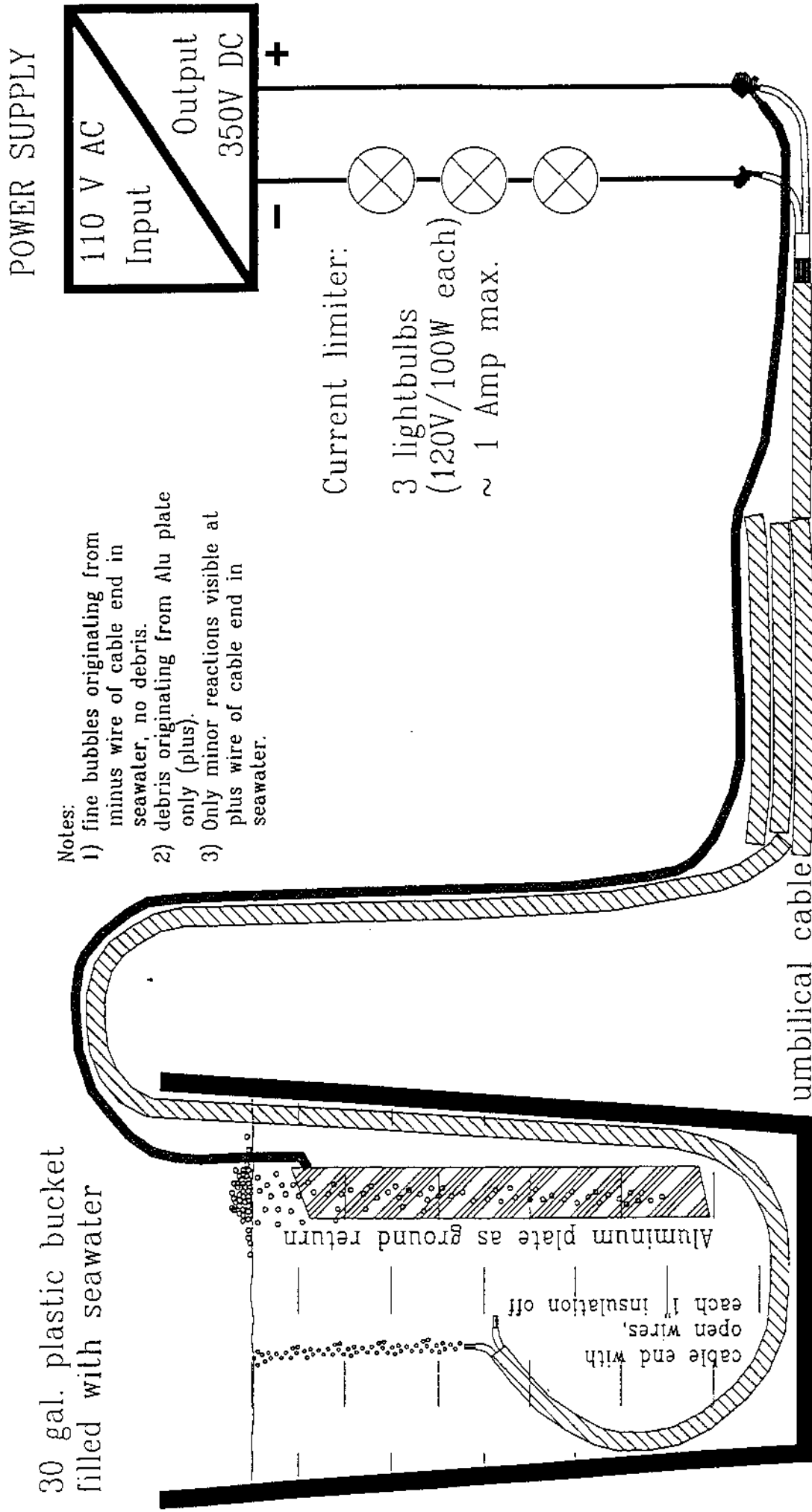


FIG.2: umbilical cable corrosion test with 350 V DC in seawater, with Alu plate as ground return (plus).