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October 25, 2019

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To: EDGES Group

From: Alan E.E. Rogers

Subject: Proposed air circulation system for EDGES-3

The EDGES-3 prototype was deployed at the Skull Creek, Oregon for a brief test in September 2019. During this test (see memo 310) sky and internal calibration data was taken with the front-end controlled to a temperature of 30 °C. During these observations the internal temperature range was 17 to 37 °C and the outside air ranged from about 10 to 25 °C. With this modest temperature range it was not necessary to remove the heat from the antenna box because enough heat was removed by the natural air circulation. Convection without wind is estimated to be about 15 w/K so that enough heat was removed naturally for the thermal control to maintain 30 °C. If EDGES-3 were to be deployed at the MRO the outside temperature range is about 5 to 40 °C making it difficult to be able to maintain temperature control of the front end without being able to remove heat by circulation to a cooler area like below the ground. Without air circulation and an outside temperature of 40 °C, assuming the Goldstone paint prevents an absorption from the Sun, about 150 watts would need to be transferred. In this case the antenna box would need to be at 50 °C for enough heat to be withdrawn by convection and the temperature inside the inner box would exceed the 50 °C maximum operating temperature of the Signatec card.

Figure 1 shows a proposed air circulation scheme which would allow the removal of about 13 w/K so that the receiver box could be maintained at 35 °C by removing about 130 w via a 17 CFM air circulation through a 40 ft coil of PVC pipe buried about 5 ft below the ground.

To prevent heat transfer via convection and maintain heat transfer mainly via the air circulation a thin layer of insulation could be added to the inside of antenna box cover. The heat transfer to the ground assumes a thermal conductivity of the soil of 0.9 w/m-K. If the soil has lower conductivity it may be necessary to use a larger diameter pipe.

San Ace 40 40x40x56mm
 32.9 CFM 1.7kPa static pressure
 12v 2.5a counter rotating fan
 1" inner diam
 PVC path between
 BOXES

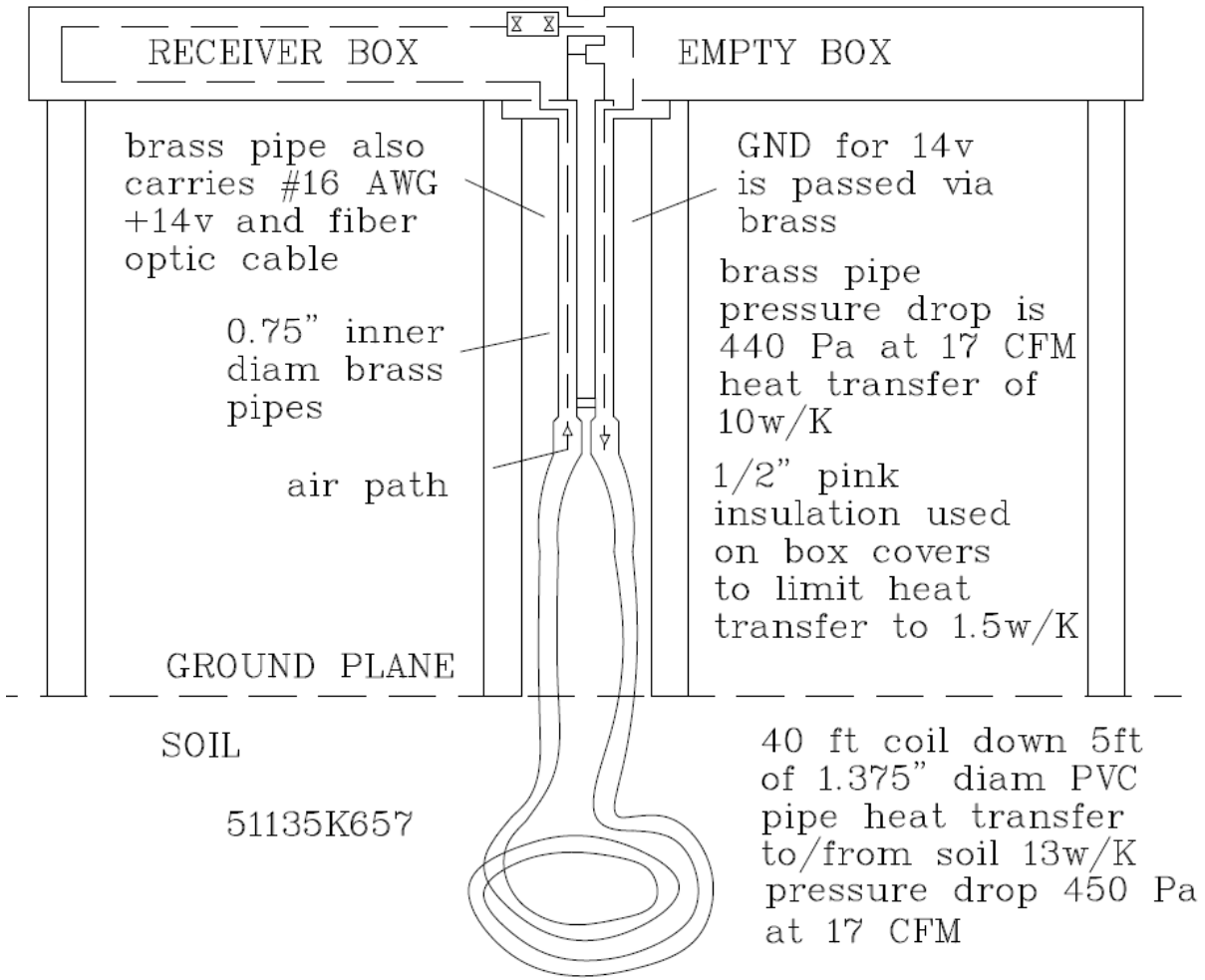


Figure 1.