

Air sampling pump performance versus altitude

Andria Eiting, Jeffrey Page, John Sohl
Department of Physics, Weber State University, Ogden, UT.

We tested the performance of several lightweight atmospheric instrumentation pumps at varying simulated altitudes. The pumps were operated inside and outside of a low vacuum chamber. The pumps were controlled using Pulse Width Modulation (PWM) and/or a varying DC supply voltage. The goal was to compare the performance of the pumps at altitude in comparison with cost, weight, and power demands. Typical pump datasheets do not list performance at pressures significantly different from sea level which can make pump selection for sondes difficult.

We used a Honeywell flow sensor AWM5101VN that has been previously calibrated against a variable area flowmeter (a tapered tube with a float). This flow meter has also been tested in situ at high altitudes (34 km ASL). Using the controlled vacuum chamber, the pressure can be varied to directly simulate high altitude conditions. We used a target flow rate of 0.5 standard liters per minute. The chamber is brought to an initial target pressure (typically either 1.0 or 200 millibar) and slowly brought to a pressure of 850 millibar. (Our lab is approximately 1430 m ASL with a typical ambient pressure of 850 mb.) Thus, the simulations start at high altitude then drops to ground level ambient pressure.