**Thermal Design Challenges Posed by the Four Bed CO2 Scrubber COTS Air-Save Pump**

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The Four Bed Carbon Dioxide (4BCO2) scrubber Air-Save Pump (ASP) operates as part of the adsorbent bed regeneration cycle. The ASP removes residual air from the bed for return to the cabin prior to heat and vacuum exposure which drives out the CO2 regenerating the bed. 4BCO2 employs a Commercial Off-the-Shelf (COTS) scroll type air pump, repackaged in an acoustically insulated enclosure to reduce noise and mounted to a cold plate. The International Space Station (ISS) Low Temperature Loop (LTL) flow (operating between 38°F and 50°F) first cools the process air, and then flows through the cold plate, cooling the pump. This results in competing ASP thermal design goals: (1) to keep the pump and motor sufficiently cool and (2) to avoid forming condensation due to over-cooling. Surfaces below 60°F typically warrant careful consideration of condensation. A test-calibrated thermal model demonstrates such a balanced design is feasible with temperatures above 60°F. A separate, coupled fluid model predicts the potential for condensation formation, allowing risk assessment of flying with the unmodified design.

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