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TEMPERATURE CONTROL SYSTEM FOR USE ON THE SURFACE OF MARS TO MAINTAIN
STABLE TEMPERATURES FOR LONG-TERM PROVISION STORAGE

Abstract

Future crewed expeditions to Mars will most likely be of considerable length due to the time it takes to get to and from the surface of the planet. This means that long-term provisions such as food or water have to be taken along from Earth all the way to the surface of Mars and, then, they must be storable to be consumed by the astronauts. The equator of Mars has huge temperature differences from day to night, meaning that the storage system must be able to manage heat in both ways, cooling the provisions during the day and heating them at night. In this work, a temperature control system is proposed where heat is removed during the day, and provisions are heated during the night. The temperature control system acts as a normal heat exchanger adapted to Mars's surface during the day, and during the cold night, only the heater is at work. Achieving a stable storage temperature throughout the duration of the mission is crucial to optimize energy usage and minimize cost. The focus of this work has been the design of a new temperature control cycle and research has been carried out to choose an appropriate refrigeration system, which can withstand the broad range of Mars's surface temperatures and at the same time have enough heat conduction capacity.