Fact Sheet

ELECTRIC VEHICLE OPTIMIZATION FOR NORTHERN CLIMATES

During the winters of 1995 and 1996, the Cold Regions Research and Engineering Laboratory (CRREL) studied the performance of electric vehicles in cold climates. This work was sponsored by the State of Vermont and the Northeast Alternative Vehicle Consortium. Electric vehicles were tested to determine their traction and handling in snow, cabin comfort and battery thermal management efficiency, effects of lubricant stiffness on vehicle range, and the applicability of low rolling resistance tires to winter conditions. These problems were analyzed using computer modeling, laboratory tests in coldrooms, and on-road vehicle testing.

Low temperatures affect the power level and storage capacity of batteries, and cabin heating during winter months can draw a significant amount of the vehicle's power. A thermal (heating) model was used to evaluate the load of the vehicle cabin heating system at low temperatures as well as the efficiency of battery heaters and insulation. Thermal properties of the vehicle components were evaluated in a coldroom where temperatures ranged from –25° to 40°F. This information was used to design the optimum cabin heating and battery thermal management system.

Increased frictional resistance to vehicle motion accounts for a major reduction in vehicle operating range during winter months. Some of the increase in friction can be reduced by use of lubricants suitable for winter temperatures. Also, low rolling resistance tires can decrease the vehicle motion resistance (increasing range) in all weather conditions; however, these tires may not have adequate traction for winter environments. The performance of electric vehicle tires was compared to that of snow tires in terms of winter traction, as well as rolling resistance and vehicle range.

POINTS OF CONTACT

Sally A. Shoop
603-646-4321
Fax: 603-646-4640
E-mail: sshoop@crrel.usace.army.mil

Dr. Paul W. Richmond
603-646-4461
Fax: 603-646-4640
E-mail: richmond@crrel.usace.army.mil

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Cold Regions Research & Engineering Laboratory

CRREL, 72 Lyme Road, Hanover, NH 03755-1290
http://www.crrel.usace.army.mil