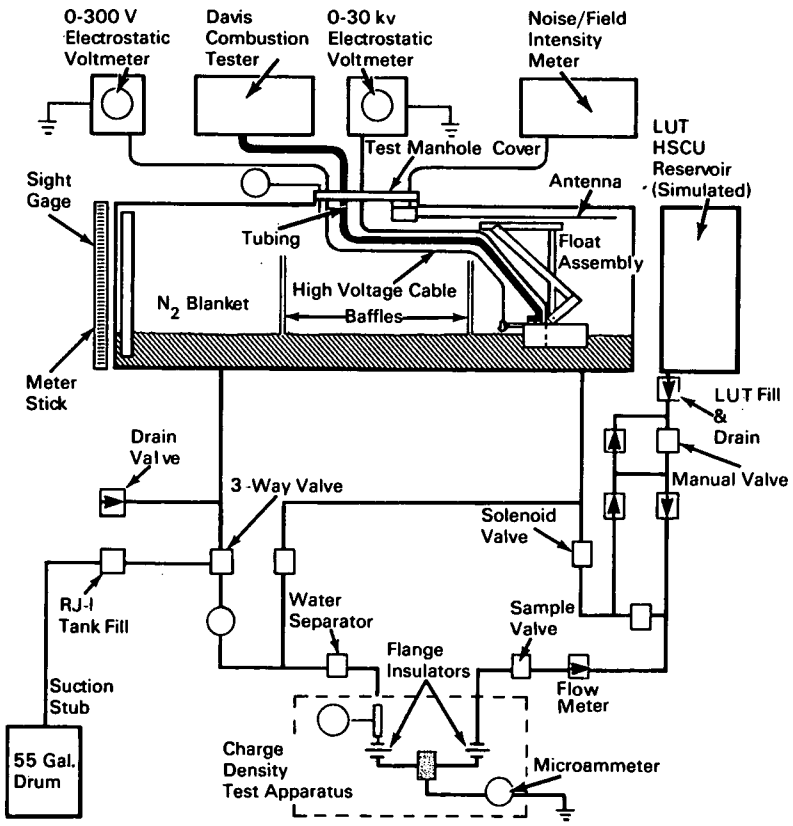
NASA TECH BRIEF

Test Instrumentation Evaluates Electrostatic Hazards in Fluid System



The problem:

To determine the degree of hazard originating from a static electricity buildup in RJ-1 hydraulic fluid during normal operation of the RJ-1 and Sodium Nitrite Services Truck. It is also desired to determine testing details that will be required during any subsequent RJ-1 static charge tests.

Static electricity generation during handling of hazardous hydrocarbon fuels has resulted in numerous explosions, attributed to electrostatic charge generation in equipment such as aircraft fuel tanks, tanker compartments, blending tanks, and storage tanks. These explosions have occurred in various climatic conditions and geographical areas. A large proportion

(continued overleaf)

of accidents have resulted with fuels such as JP-4 which form flammable vapor–air mixtures at ambient temperatures. Many of the accidents have been attributed to electrical discharges which occurred in the tank ullage, causing ignition of the vapor–air mixture present. RJ-1 fuel is to be used as a hydraulic fluid for test and checkout of the S-IC booster stage.

The solution:

Measure the RJ-1 surface potential with a probe mounted on a float in contact with the fluid surface. The probe is connected to an electrostatic voltmeter with a high voltage cable that passes through the RJ-1 tank manhole cover.

How it's done:

Electrical discharges from the fluid are sensed in the tank ullage with a dipole antenna and measured with a noise/field intensity meter. Simultaneous monitoring of the fluid level, fluid potential, and electrical discharges provide data relating arcing to field strengths in the ullage space. The measurements taken during tank fill from 55 gallon drums are correlated with the liquid level in the RJ-1 tank to provide an indication of the most hazardous phase of the filling operation.

Measurements of filter current and tank potential recorded during circulation provide data on the potential buildup in the tank. The relative contributions to the total potential by the charging effect of the individual components, i.e., electrically insulated filter, water separator, and other plumbing, are determined.

The potential relaxation monitored after a given potential is obtained in the RJ-1 tank provides a measure of the rest period necessary to dissipate the RJ-1 tank charge through ohmic discharge to the tank walls.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
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Reference: B67-10145

Patent status:

No patent action is contemplated by NASA.

Source: L. H. Collins, D. Krebs, and R. Henry
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