NICKEL-HYDROGEN BATTERY STATE OF CHARGE DURING LOW RATE TRICKLE CHARGING

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THE 1995 NASA AEROSPACE BATTERY WORKSHOP
THE HUNTSVILLE HILTON
HUNTSVILLE, ALABAMA
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BACKGROUND

- THE AXAF-I PROGRAM HAS BEEN INVESTIGATING TECHNIQUES FOR MANAGING NICKEL-HYDROGEN BATTERY STATE OF CHARGE, DURING PRELAUNCH AND LAUNCH OPERATIONS, IN THE ABSENCE OF ACTIVE COOLING

- THE OVERALL CONCLUSION OF THESE INVESTIGATIONS IS THAT HIGH STATE OF CHARGE CAN BE ACHIEVED AND MAINTAINED, IN THE ABSENCE OF ACTIVE COOLING, UTILIZING

  - ADIABATIC CHARGING, AND

  - LOW RATE TRICKLE CHARGING

- THE ADIABATIC CHARGING TECHNIQUE WAS PRESENTED AT THE 1994 NASA BATTERY WORKSHOP AND LOW RATE TRICKLE CHARGING WAS DISCUSSED AT THE 1995 IECEC

- TODAY'S PRESENTATION ADDRESSES STEADY STATE BATTERY CAPACITY AND TEMPERATURE, DURING LOW RATE TRICKLE CHARGING, IN A SIMULATED PRELAUNCH AMBIENT ENVIRONMENT

CONT'D

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  NICKEL-HYDROGEN BATTERY STATE
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  THE 1995 IECEC

- TODAY'S PRESENTATION ADDRESSES
  TEMPERATURE, DURING LOW RATE T
  PRELAUNCH AMBIENT ENVIRONMENT

BACKGROUND CONT'D

- THE ABILITY TO PREDICT BATTERY TEMPERATURE IS IMPORT
  STATE OF CHARGE IS A STRONG FUNCTION OF TEMPERATUR
- PREDICTION OF BATTERY TEMPERATURE REQUIRES KNOWL
  BATTERY HEAT CAPACITY, DISSIPATION, AND COOLING.
- THE AXAF-I BATTERY MOUNTING CONFIGURATION PROVIDES
  THERMAL ISOLATION IN TERMS OF CONDUCTIVE AND RADIAT
  TRANSFER. BATTERY COOLING, IN THE PRELAUNCH ENVIRO
  TO HEAT TRANSFERRED TO THE AIR IN CONTACT WITH THE E
- HEAT TRANSFER FROM THE BATTERY, AS INTEGRATED INTO
  TO THE AMBIENT AIR IS DIFFICULT TO MODEL.
- ACCORDINGLY A SIX-CELL MODULE, SIMULATING BATTERY
  CHARACTERISTICS, WAS DESIGNED AND FABRICATED. THIS
  MOUNTED IN A STRUCTURE SIMULATING THE THERMAL ENVI
  BATTERY WOULD EXPERIENCE, IN THE SPACECRAFT, DURIN
  OPERATIONS.

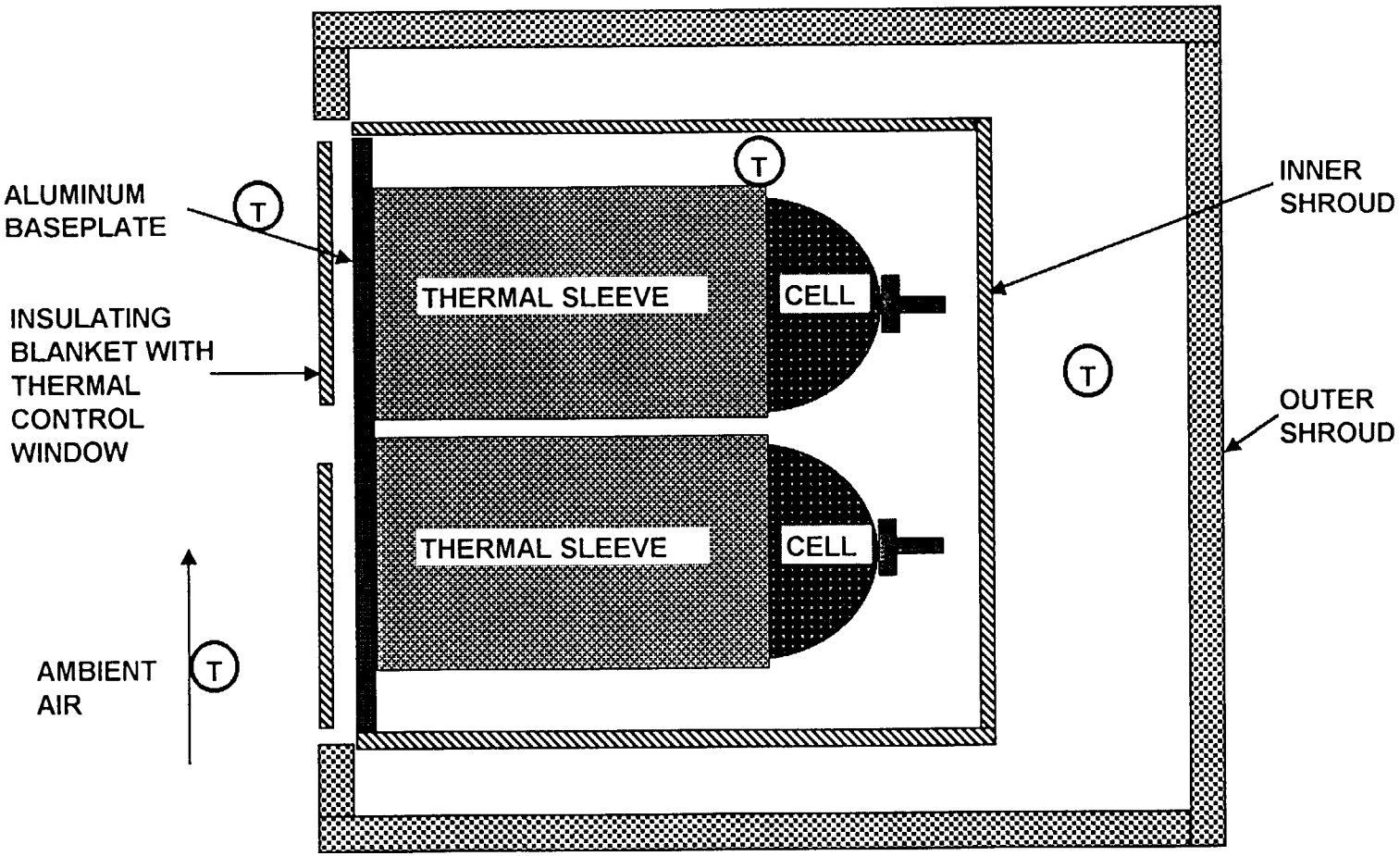
TEST ARTICLES

- TESTING WAS PERFORMED ON A SIX-CELL MODULE DESIGNED TO SIMULATE FLIGHT BATTERY STEADY STATE THERMAL CHARACTERISTICS

- TEST CELL DEFINITION

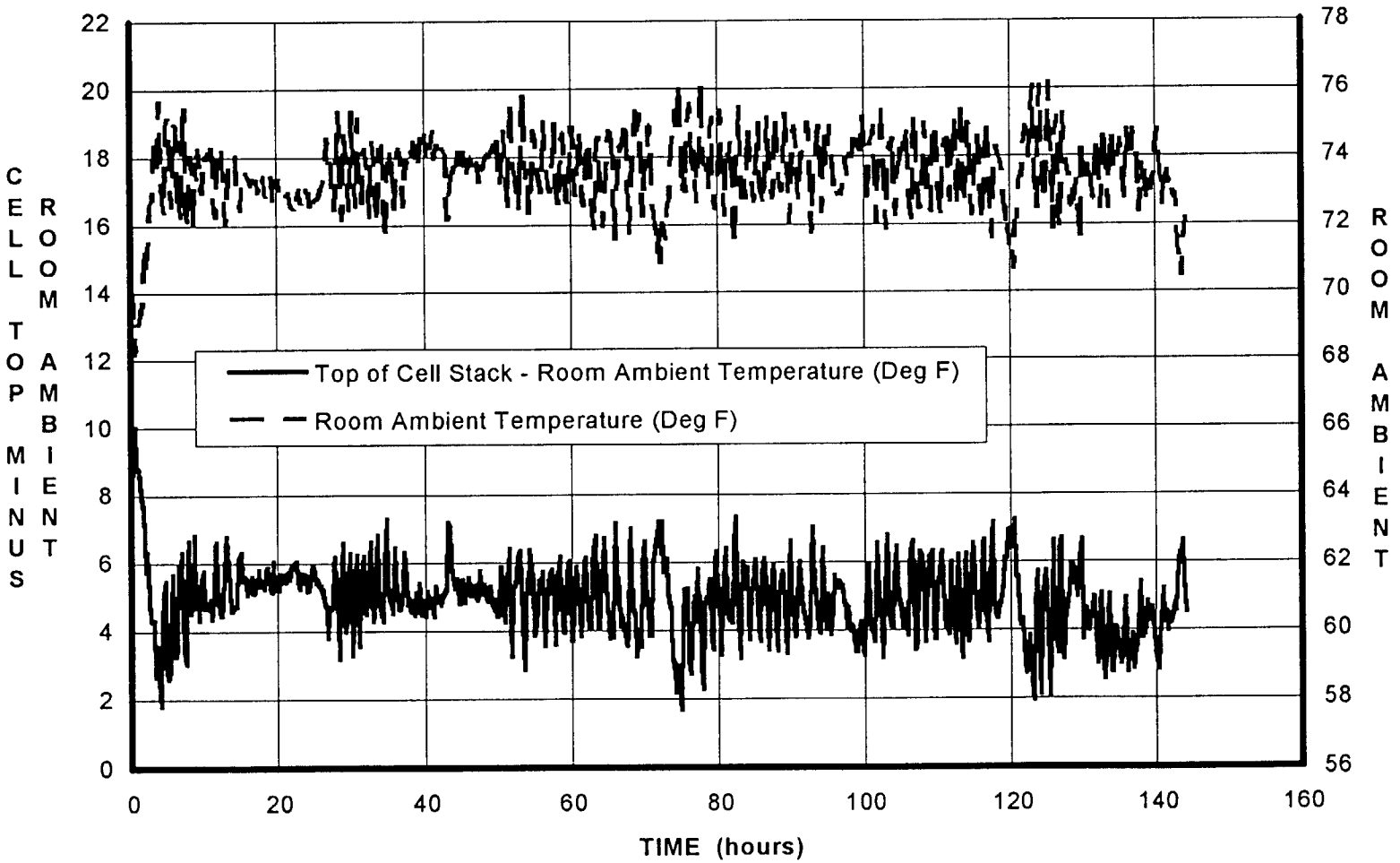
CELL PART NUMBER	RNH 30-9
RATED CAPACITY (Ah)	30
STACK CONFIGURATION	BACK-TO-BACK
POSITIVE ELECTRODE	0.030", SLURRY
SEPARATOR	ZIRCAR, 2 LAYERS
ELECTROLYTE (%, FINAL)	31
OPERATING PRESSURE (psi)	475
STRAIN GAUGE	YES
TERMINAL CONFIGURATION	AXIAL
WEIGHT (gms)	1010
PRECHARGE	POSITIVE

SIX-CELL MODULE
TRICKLE CHARGE TEST SET UP

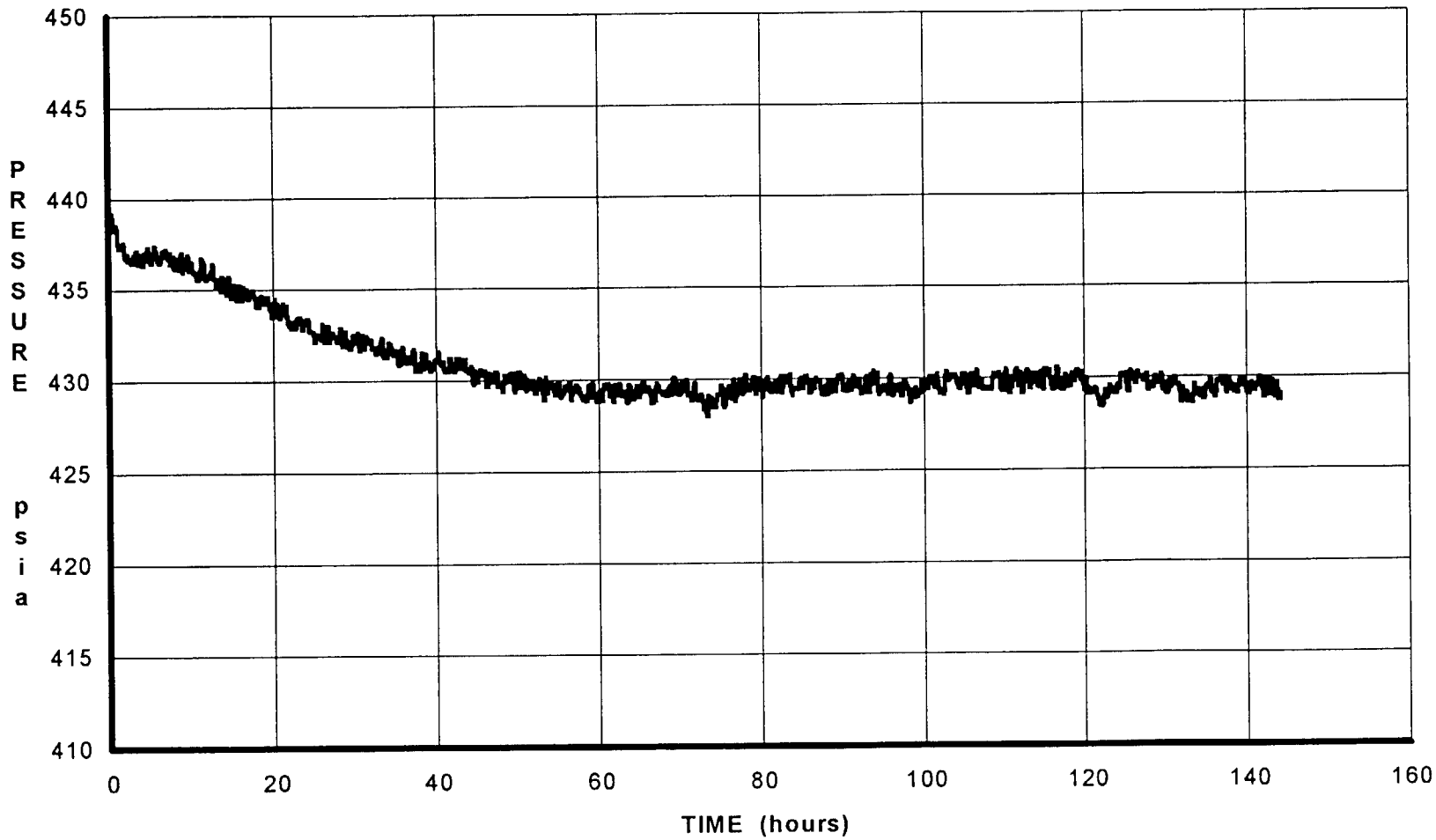


C/500
TEMPEF

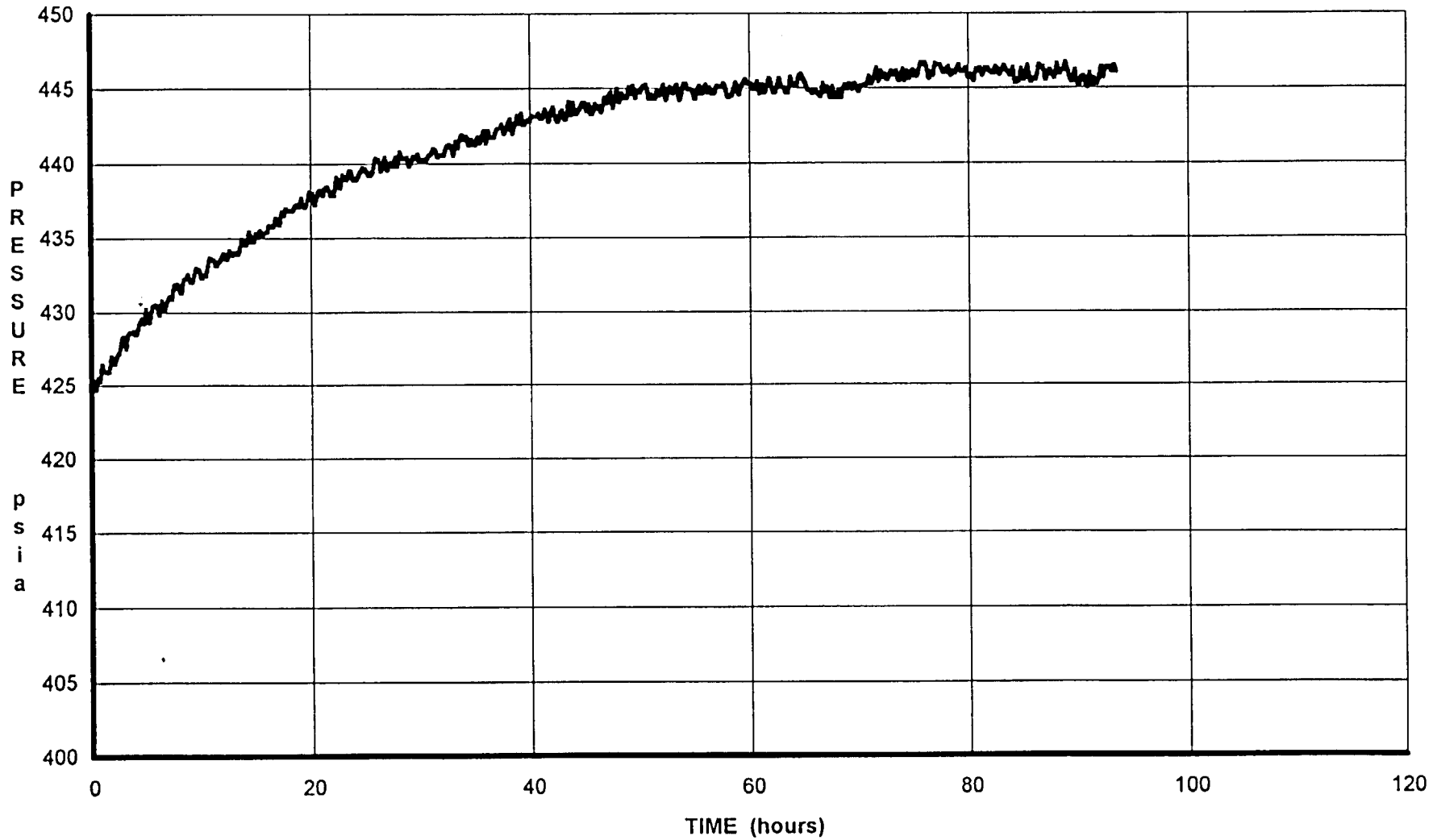
C/500 RATE TRICKLE CHARGE
TEMPERATURE INCREASE



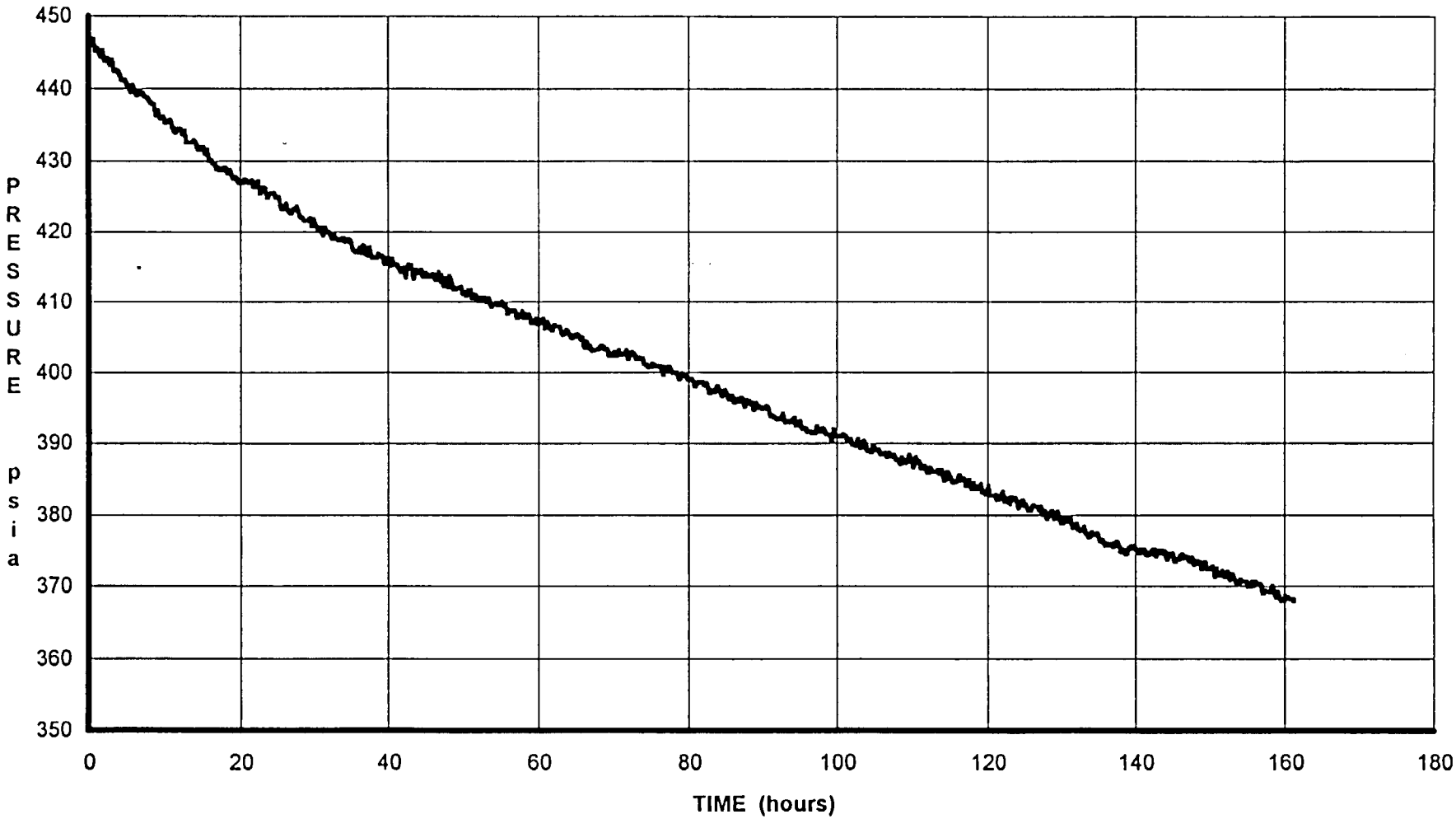
C/500 RATE TRICKLE CHARGE
STEADY STATE CAPACITY



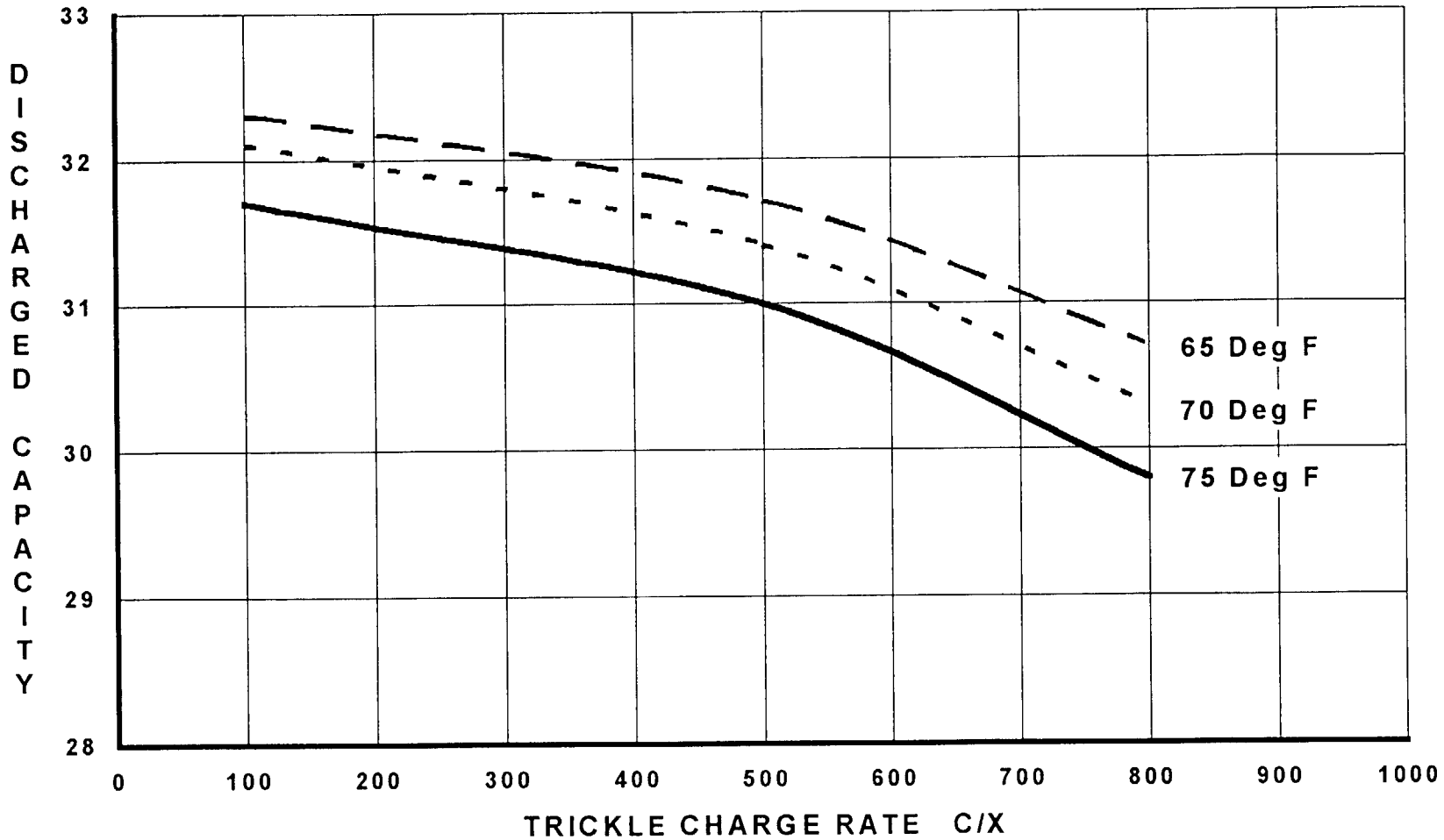
C/250 RATE TRICKLE CHARGE
STEADY STATE CAPACITY



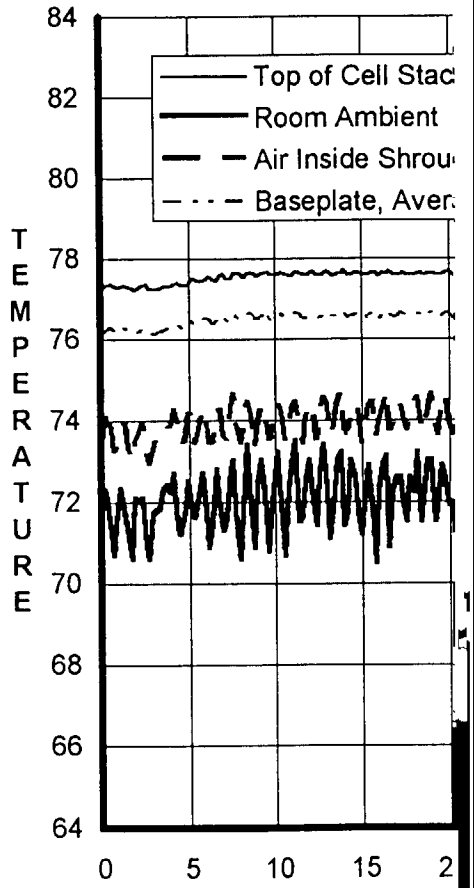
OPEN CIRCUIT STAND
SELF DISCHARGE



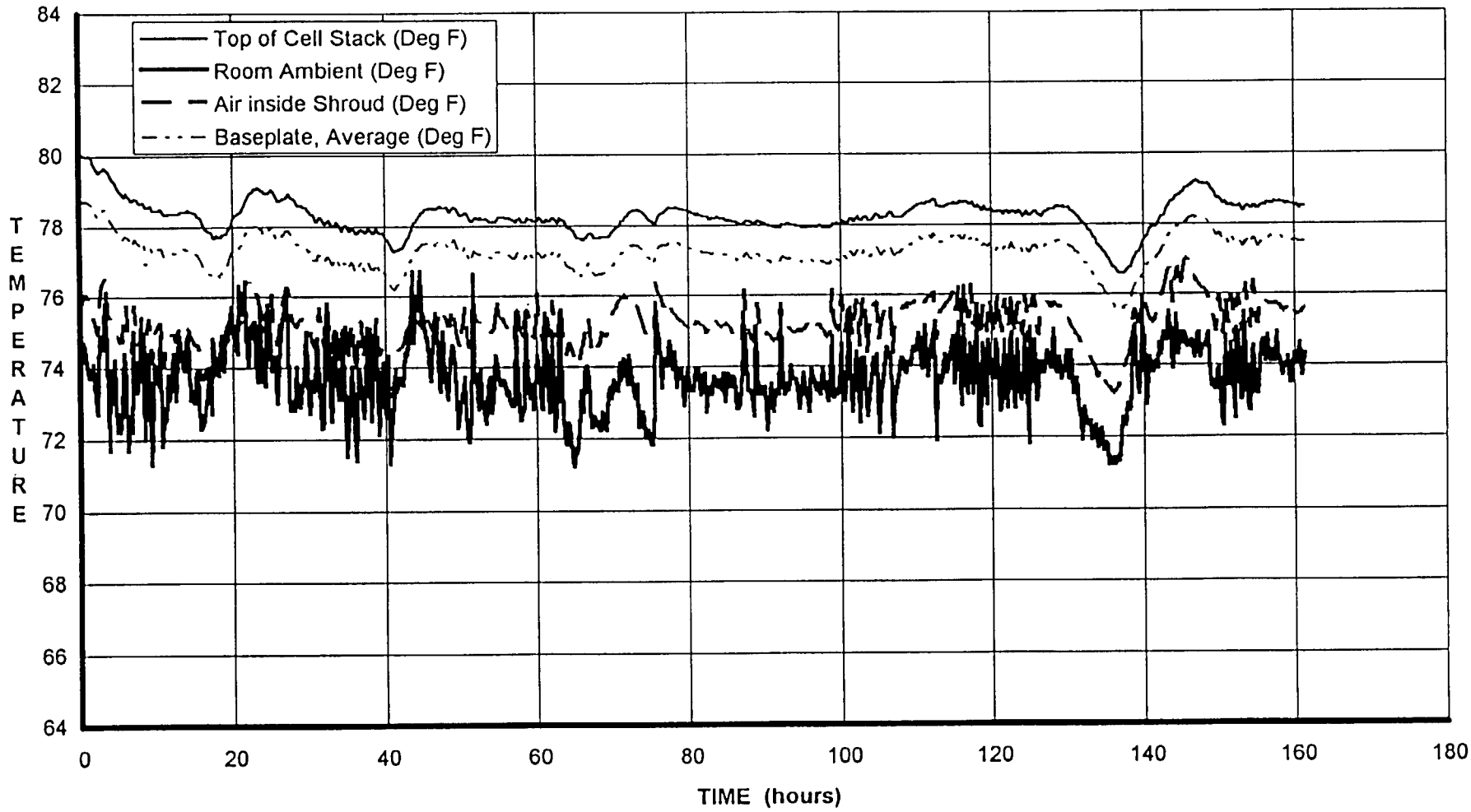
STEADY STATE CAPACITY
FUNCTION OF TRICKLE CHARGE RATE AND TEMPERATURE



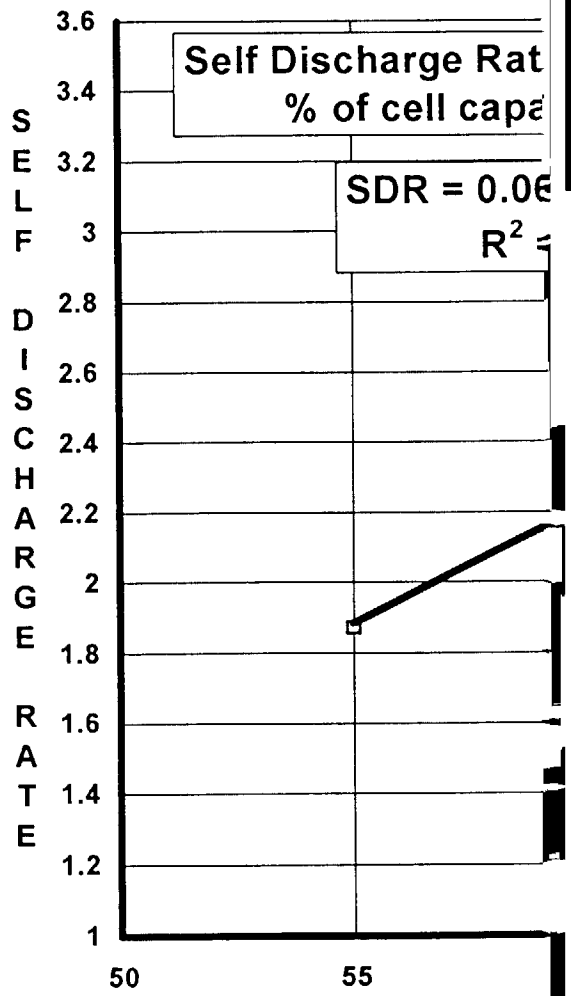
C/1000 RATE TRI
TEMPERATURE DATA



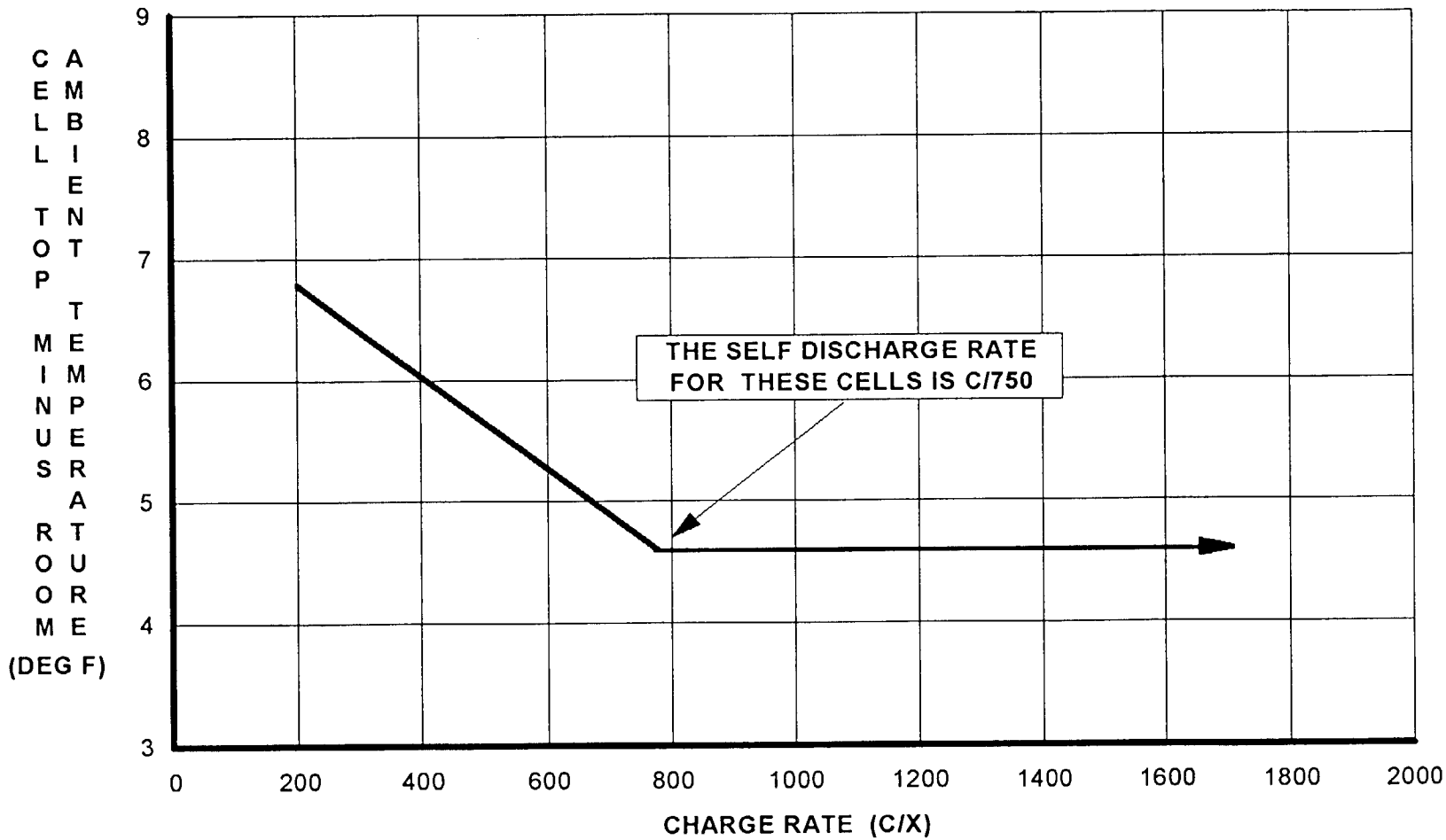
OPEN CIRCUIT STAND
TEMPERATURE DATA



SELF DISCHARGE R
AS A FUNCTION OF TEMP



TEMPERATURE INCREASE
AS A FUNCTION OF TRICKLE CHARGE RATE



SUMMARY

- BATTERY TEMPERATURE INCREASE, DUE TO LOW RATE TRICKLE CHA
  HAS BEEN DETERMINED EXPERIMENTALLY, USING A SIX-CELL BATTE
  MODULE IN A TEST SETUP SIMULATING THE ANTICIPATED AXAF-I PRE
  ENVIRONMENT.

- TEST RESULTS INDICATE

  - TRICKLE CHARGE RATES LESS THAN OR EQUAL TO THE SELF DIS
    RATE DO NOT INCREASE DISSIPATION BEYOND THAT DUE TO THE
    DISCHARGE.

  - SIGNIFICANT TRICKLE CHARGE RATES (~C/500) RESULT IN BATTE
    TEMPERATURES ONLY A FEW DEGREES (F) HIGHER THAN OBSER
    DURING PERIODS OF OPEN CIRCUIT STAND.