206

PROGRAM REPORT

VOLUME 9

APPENDIX 15

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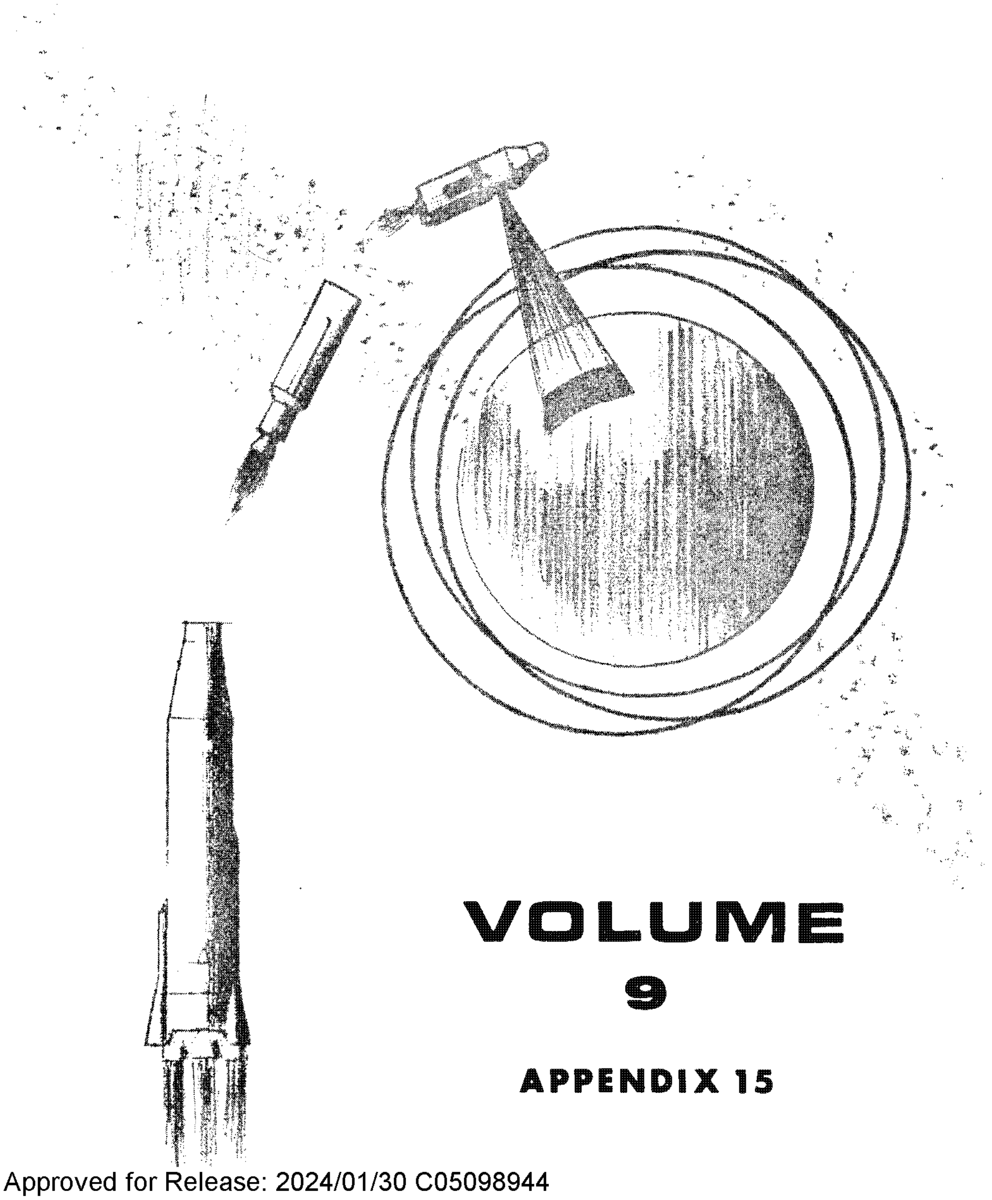
206
PROGRAM REPORT



VOLUME 9

APPENDIX 15

CONTENTS

APPENDIX 15

PRELIMINARY FLIGHT EVALUATION REPORT

(U) PRELIMINARY FLIGHT EVALUATION REPORT

FOR PROGRAM 206

This document is for **Flight** No. 38

Prepared by

Program 206 Associated Contractor Representatives
at Sunnyvale, California

Assembled under
Contract AF 04(695)-1001

19 June 1967

Prepared for

SECRETARY AIR FORCE SPECIAL PROJECTS
Los Angeles Air Force Station
Los Angeles, California

AEROSPACE CORPORATION

Post Office Box 95085, Los Angeles, California 90045, Telephone 648-5000

19 June 1967

To: All Associate Contractors

The attached Preliminary Flight Evaluation Report for Program 206 Flight No. 38 is forwarded for your information.

The conclusions and recommendations contained in this document are those of the Program 206 Sunnyvale Field Office of Aerospace Corporation and the Associate Contractor representatives at Sunnyvale, California. Authorization is granted to investigate whatever action is required to implement these recommendations provided such investigations are within the scope of your present contract. Action to implement these recommendations, however, is to be initiated only upon receipt of specific authorization from the Program Office.

AEROSPACE CORPORATION

J. W. Luecht
Systems Engineering Director
Program 206

JWL/MCO:mc

3

PRELIMINARY FLIGHT EVALUATION REPORT
FOR PROGRAM 206

This document is for Flight No. 38. It contains coordinated inputs from the Program 206 Sunnyvale Field Office and Program 206 Associated Contractor Representatives at Sunnyvale. These inputs reflect the current analysis at the Sunnyvale area as of 19 June 1967.

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FOREWORD

This document presents a preliminary evaluation of vehicle and ground system performances during the thirty-eighth Program 206 flight. The evaluation is based upon data gathered during operations at the Satellite Test Center (STC), Sunnyvale, California. The purpose is to: a) isolate and identify malfunctions and anomalies observed; b) provide results of preliminary data evaluations performed by field groups for further investigation; and c) document evaluation results relative to field group performance. Configuration descriptions and other general information are available in other documents as referenced.

Aerospace Corporation and the Associate Contractors maintained close coordination as data were gathered and analyzed. Agencies contributing to this report submitted formal inputs to Aerospace Corporation within seven days after the completion of operations. Aerospace Corporation compiled the inputs and published the final document two days thereafter. Throughout the preparation of this report, editorial considerations were minimized in order to effect a timely publication of technically useful information.

CONTENTS

SECTION 1

FLIGHT SUMMARY

1.1 DESCRIPTION OF FLIGHT

1.1.1 Launch and Ascent

Program 206 Flight No. 38 was launched from SLC-4E (Standard Launch Complex-4 East) on 4 June 1967 at 1107:01.12 PDT and continued for eight days. A history of flight vehicle preparation and powered flight is given in Reference 2.

1.1.2 Orbit Injection

The vehicle was injected into an orbit which differed from the nominal by $-.5^{\circ}$ in α angle (horizon sensor pitch reference angle). As a result, nodal period was 18 seconds high, the apogee altitude was 12.45 miles high, the perigee altitude was .61 miles high, and the latitude of perigee was shifted 11.9° south. A tabular listing and comparison of injection conditions is given in Table 1-1. A complete comparison of first revolution orbit parameters may be found in Table 1-2.

1.1.3 On-Orbit Operations

Two orbit adjusts were accomplished on this flight. A negative OA on Rev 12 and a positive OA on Rev 28 were executed during the flight. See Section 3 for details of these adjusts. The vehicle tape recorder failed on Rev 117 or Rev 118 as indicated by lack of modulation on $\Delta 3$ at Rev 118 Boss when the recorder was supposed to be reading out data.

1.1.4 RV Re-Entry and Recovery

RV re-entry was accomplished on Rev 130 using the primary attitude control system. Air recovery was successful at 24.7°N latitude and 163.25°W longitude, approximately 45 n mi SSW of predicted impact point.

Terminal events leading up to recovery were as follows:

1. Yaw reverse - Rev 127/128 dark side.
2. Pitch down - Rev 128 Pogo.
3. Secure word load - Rev 128 Pogo.
4. Disconnects - Rev 129 Pogo.
5. Tell tales - Rev 130 Pogo.
6. Separation and retro - Rev 130 Kodi.

Recovery force deployment, impact and ground track are shown in Figure 1-1. See Section 3 for details of RV deboost and re-entry events.

Table 1-1. Equivalent Injection Conditions

Op 4360

Parameter	Desired Nominal	Actual Conditions at Nominal Latitude	Actual Conditions at Injection	Variation at Nominal Latitude
Radius (ft)	21,409,970	21,407,396	21,407,396	-2574
Velocity (ft/sec)	25,817.12	25,848.80	25,848.80	31.68
Flight Path Angle (deg)	.3155	.1712	.1712	-.1443
Longitude (deg)	128.31 W	128.34 W	128.34 W	.03 W
Geocentric Latitude (deg)	15.03	15.03	15.03	0
Azimuth (deg)	195.47	195.41	195.41	-.06
Altitude (n mi)	80.48	80.05	80.05	-.43
Time from Liftoff (sec)	575	575	576	0

9

Table 1-2. First Revolution Orbit Comparison

Op 4360

Orbit Parameter	Planned	Actual	Variation
Nodal Period (min) Nodal Period (sec)	89.21 5353	89.52 5371	.31 18
Period Decay (sec/rev)	.375	.314	-.061
Lifetime (revs)	195	235	40
Inclination (deg)	104.95	104.89	-.06
Minimum Altitude (n mi) at Latitude (deg)	78.83 -27.8 N *	79.90 -17.4 N	1.07 10.4 S
Maximum Altitude (n mi) at Latitude (deg)	182.74 44.6 S	194.82 31.9 S	12.08 12.7 N
Perigee Altitude (n mi) Perigee Radius (ft) Latitude of Perigee (deg)	79.84 21,384,285 -37.9 N	80.45 21,400,977 -26.0 N	.61 16,692 11.9 S
Apogee Altitude (n mi) Apogee Radius (ft) Latitude of Apogee (deg)	181.69 22,007,183 34.4 S	194.14 22,093,976 23.7 S	12.45 86,793 10.7 N
Eccentricity	.01396	.01588	.00192
Longitude Shift (deg/rev)	22.222	22.293	.071
Longitude Shift Decay (deg/rev)	.001347	.002459	.001112

* Positive values are south-to-north

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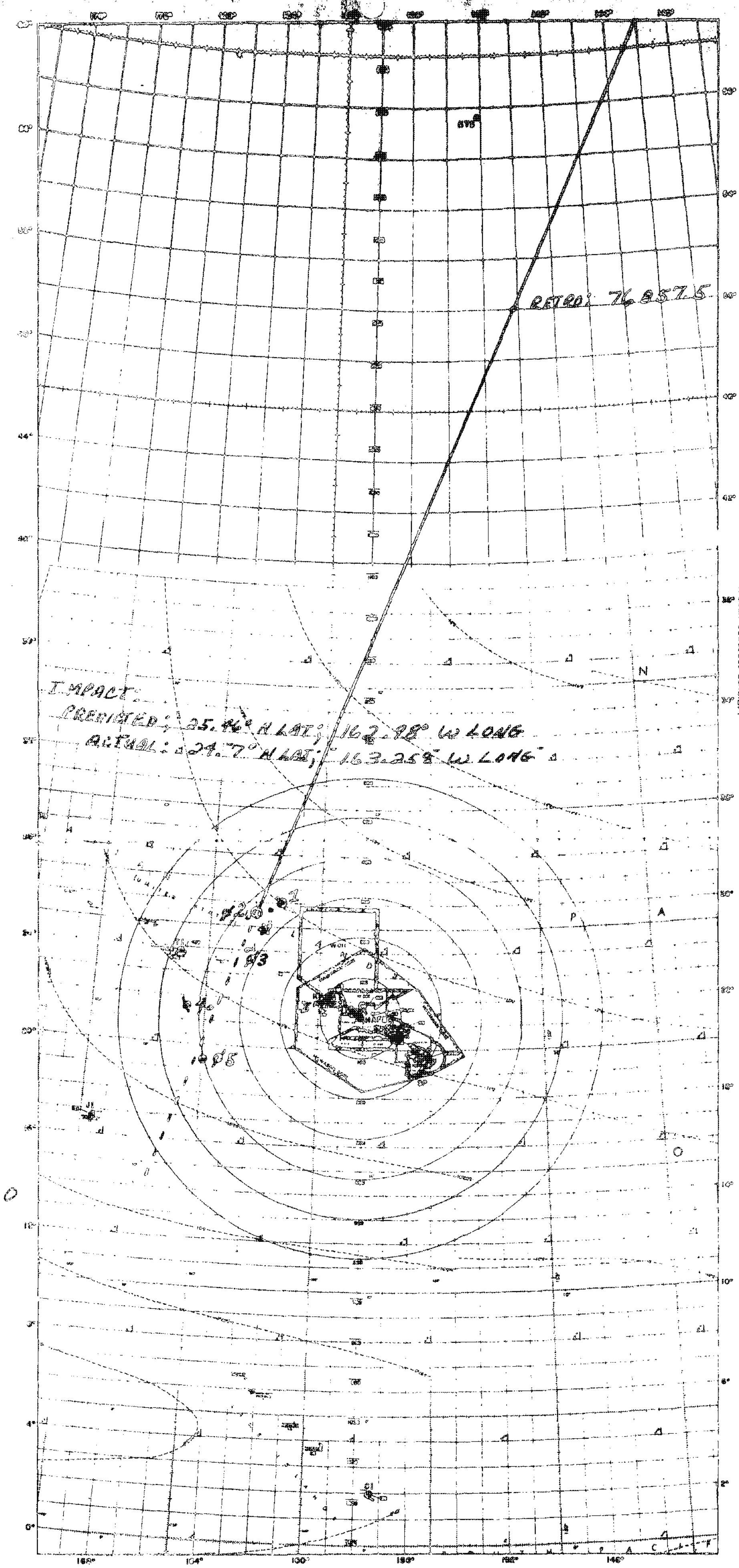

Figure 1-1

11

1.1.5 OCV Deboost

After RV re-entry, the OCV was pitched zero and left in a yaw reverse attitude until Rev 131 when the OCV was deboosted. Engine burn was completed in the Pogo cone with OCV impact predicted at approximately 40°N latitude and 180° longitude. Tracking data obtained from Pogo and Kodi indicated the OCV deboost was nominal with impact occurring within 0.5° latitude of the predicted. A BUSS test was performed successfully over Kodi by commanding Z26/23 and KZ31.

1.2 PROBLEMS

1.2.1 General

1. PROBLEM: None

1.2.2 General Electric Company Special Military Space Project

1. PROBLEM: Inoperative tape recorder. Beginning at Rev 118, there was no tape recorder playback, and only noise was observed on the Link 3 carrier whenever the tape recorder was commanded to playback.

PROBABLE CAUSE: A broken tape or high speed drive belt No. 3.

POSSIBLE SOLUTION: None required.

1.3 FLIGHT OBJECTIVE ACCOMPLISHMENT

1.3.1 Primary Flight Objective

The Primary Flight Objective for Program 206 Flight Number 38 was to:

> "Continue development of an orbital flight vehicle with extended capabilities having reliable and precise orbit and re-entry systems."

1.3.2 Secondary Flight Objectives

The Secondary Flight Objectives and a summary of preliminary results are presented in Table 1-3. The flight objective numbers used in Reference 1 are retained for consistency. The results expressed in Table 1-3 are related to the experiment accomplished in support of the objective. Estimates of the degree of success in accomplishing the over-all objective must be based on detailed analysis of data, and are not included in this preliminary report.

Category 1 objectives involve the acquisition of engineering data required for the earliest development of the system.

Category 2 objectives were related to improving system effectiveness and malfunction analysis.

Category 3 objectives were concerned with gathering data for evaluation of non-vital changes.

Table 1-3. Secondary Flight Objective Summary

No.		Objective	Category	Results
1		Evaluate the OCV stabilization sub-system's capability to:	1	Accomplished
	a.	Provide initial earth acquisition and rate stabilization during normal orbit operations after separation from the Agena.		Accomplished
	b.	Provide proper OCV yaw-around and pitch-down orientation.		Accomplished
	c.	Provide adequate roll maneuvers.		Accomplished
	d.	Provide adequate freon impulse for OCV stabilization.		Accomplished
	e.	Provide proper rate and position stabilization during orbit adjust engine firing.		Accomplished
2		Determine the capability of the command subsystem to receive, store and execute real time, stored and secure commands properly.	1	Accomplished.
7		Determine the capability of the environmental control subsystem to provide adequate thermal control.	1	Accomplished.

Table 1-3. Secondary Flight Objective Summary (Cont'd)

No.		Objective	Category	Results
9		Determine the capability of the OCV power supplies.	2	Accomplished
22		Evaluate the capability of the OCV orbit adjust subsystem to provide:		
	a.	Command orbit change.	1	Accomplished
	b.	The total velocity impulse capability.	2	Not planned
	c.	A velocity increment to deboost the OCV on command.	None	Accomplished
23		Evaluate BUSS capabilities.	2	Accomplished

14

SECTION 2

SEQUENCE OF MAJOR EVENTS

Rev No.	Event	Remarks
0	Lift-off, ascent and injection	Lift-off occurred on 4 June 1967 at ST 65221.12 (1107:01.12 PDT). Ascent and injection were near nominal (velocity of 31 fps higher than planned, a pitch down of .5°). The resulting nodal period was 18 seconds long, apogee altitude was 12.45 miles high, perigee altitude was .61 miles high and the latitude of perigee was shifted 11.9° south of nominal. Second and third stage Amp Hour Meter reported inoperative on Pad. OK after lift-off.
0,1,2,3,17, 33,48,50, 66,82,99, 115	Thermal Record	Thermal diagnostic data recorded on revs indicated.
1/2 Rev	Tracking	Both Turkey and Fylingsdale supported the operation by providing early tracking data to assist in the determination of the need for a Rev 1 orbit adjust (not required).
3	Roll Matrix	The roll matrix performed at Pogo was nominal.
5	GROBIN enabled	GROBIN program was enabled for the balance of the flight except for a short period during Rev 12, discussed below.
5-126	Control Gas Tank Pressure Balance	The pressure balancing procedure (RS-5/S-10) associated with the redundant stabilization pneumatics system functioned properly on all attempts (Revs 5, 7, 9, 10, 12, 14, 23, 25, 28, 31, 42, 45, 58, 60, 74, 79, 90, 95, 106, 112, 122 and 126).

SEQUENCE OF MAJOR EVENTS (Cont'd)

Rev No.	Event	Remarks
12	Orbit Adjust	Preceded by a successful yaw reverse, a negative OA was accomplished at Rev 12 perigee changing the altitude at apogee from 192.17 miles to 158.10 miles, the period from 89.47 to 88.83 minutes, with an apparent thrust of 96.84 lbs (59.7 feet/sec ΔV). GROBIN was "NO OPED" briefly to permit recording of yaw and OA data.
14	Loss of Command Capability at Boss 14: Use 125	A series of word rejects and verification alarms on Boss 14 led to the use of the 125 for loading A/S (Green) 109.
16	BUSS Dropping Bypass Module Selected	On Rev 16 Cook, an S-6 was sent, selecting the BUSS bypass module.
19	SCLOCK Slope Input	An SCLOCK slope of 11.84 msec/day was input on Rev 19 load to correct for a fast clock.
22	Commands via 125 failed to enter	On Rev 22 Boss, echo alarms were indicated in prepass check so the 125 was enabled and used for loading Message 116. Subsequent rejects made loading impossible prior to fade. Analysis showed DL 1 was not being erased. Loaded satisfactorily on 23 Cook as A/S 117.
28	Orbit Adjust	Approximately 269 seconds of two-engine burn provided an orbit adjust at perigee on Rev 28, making the orbit nearly synchronous. The change was 178.7 ft/sec ΔV raising apogee to 253 miles.

SEQUENCE OF MAJOR EVENTS (Cont'd)

Rev No.	Event	Remarks
51-66	Data Line failures (Pogo)	The Pogo data lines became troublesome on Rev 51 and continued, intermittently, to give trouble until about Rev 66. The ability to transmit command messages was lost at times, but no commanding was lost.
82	SCLOCK Slope change	The clock drift was corrected with a new SCLOCK slope of 17.0898 msec/day.
117	Boss pass	Battery #3 depleted.
118	Boss pass	Boss reported no modulation on Δ3 during tape recorder playback. Recorder playback inoperative for remainder of flight.
119	Cook pass	Microwave data confirmed no modulation on Δ3 when tape recorder was playing back. Tape recorder playback inoperative. Decision made to terminate flight after 8 days.
120	Cook pass	1000 PSI switch had tripped at Cook acquisition.
121	Kodi pass	Reversed transmitters (S-8) to further confirm that recorder playback was inoperative. After determining no modulation was present on Δ2, transmitters were switched back to normal (S-7).
125	Guam pass	Battery #2 essentially depleted.

SEQUENCE OF MAJOR EVENTS (Cont'd)

Rev No.	Event	Remarks
128	Pogo/Cook pass	Yaw reverse and pitch down verified at Pogo, and A/S Message 173 (SW) loaded at Pogo for RV deboost.
129	Pogo pass	Disconnects 1 and 2 verified. Battery #6 essentially depleted.
130	RV Re-entry	Tell tales executed properly at Pogo, and separation and retro were accomplished at Kodi. RV re-entry was near nominal with air recovery at 24.7°N latitude and 163.25°W longitude, approximately 45 n mi SSW of predicted. After separation, the OCV was pitched zero over Kodi in preparation for OCV deboost.
131	OCV Deboost	The OCV deboost message (SW) was loaded at Hula. OCV deboost occurred on Rev 131, with engines off (375 second burn) in the Pogo cone. OCV deboost was nominal, with impact at about 40°N latitude and 180° longitude. A BUSS experiment was successfully conducted over Kodi (Z26/23 and KZ-31).

19

SECTION 3

SATELLITE VEHICLE PERFORMANCE
(Prepared by General Electric Co., Special Military Space Project)

3.1 TELEMETRY SUBSYSTEM

3.1.1 General

3.1.1.1 The Telemetry Subsystem performed satisfactorily throughout the operation except for a slight data loss from the Delta 2 transmitter following split 2 during the lift-off Cook pass and the loss of the tape recorder output after Rev 118. The output of Delta 2 was nominal for the remainder of the operation. Cook reported, post-pass, that the loss was apparently caused by a 2 megacycle carrier shift of the Delta 2 transmitter. The problem did not recur. The recorder malfunction is discussed below.

3.1.2 Tape Recorder

3.1.2.1 Tape recorder operation was nominal through Rev 117. There was no output when playback was commanded (R2+) for station passes on Revs 118, 119 and 120. Voice reports stated that only noise was observed on the Link 3 carrier. The Cook 119 microwave data reduced on orbit showed that 3 Bravo (BUSS data) was nominal both before and after the R2+ period, confirming that the malfunction was confined to the tape recorder. A further test was made by reversing transmitters on Rev 121. The tape recorder malfunction was again confirmed. After confirmation of the recorder failure, recorder playback commanding was deleted from all subsequent messages by "no-oping" GROBIN. GROBIN normally assembles all R2+ commands.

3.1.2.2 This tape recorder had been reworked by replacing the tape head with a new design to correct for poor frequency response at 0°F. Also, the tape loop was replaced with a newer type tape. This tape had 38.9 hours of operation prior to lift-off. The tape has a 100 hour life specification before tape wear tends to cause loss of frequency response. Less than 50 hours are expected in orbit.

3.1.2.3 The cause of the recorder failure is not known. Inasmuch as the recorder playback currents were nominal after the failure, it is unlikely that the failure was the result of a jammed tape or drive belt, or shorted motor. A more likely failure mechanism would be a servo electronics circuitry malfunction, a broken tape or high speed drive belt #3.

3.1.2.4 A command generation error caused the recorder to run in the playback mode for 16 minutes at Rev 31 Boss. This is the equivalent of 4 revs at once. The service instruction, Borg-Warner Controls P/N302-6204, indicates a test where the reproduce mode speed is used for 12 minutes continuously. No maximum time is specified.

3.1.3 Data System Performance

3.1.3.1 Overall data system performance utilizing Model 9 Augie was good throughout the flight. Augie Mode formats had been altered to present the added Redundant Pneumatic sensors and the revised Command/Decoder Busy Signal. Occasional discrepancies were noted but data losses were minimized.

3.1.3.2 Spurious Command Decoder busy signals were printed on Mode 301 during Rev 130 Pogo, yet the Command System appeared to be functioning normally. Post flight analysis revealed a few spurious busy signals during Rev 129 Pogo and continuous busy signal alarms during Rev 131 Pogo. Normal busy signals from other stations at that time verified proper operation of the Command System.

3.1.3.3 Incorrect ground station patching resulted in three playbacks of Mode 310 at Rev 101 Boss before the correct channel (Channel 13) was processed through Decom 1.

3.1.4 Six Minute Timer

The time out duration of the six minute timer was checked on 15 different occasions after vehicle temperatures had stabilized on orbit. The maximum duration was 337 seconds and the minimum duration was 329 seconds with an average duration of 333 seconds. This was 4 seconds shorter than the predicted value but well within the specified limits. The predicted value of 337 seconds was based on pre-launch test data and a time out duration versus temperature curve obtained on Vehicle 982. The six minute timer time out relay (K17) was a suspect Golden G Relay but normal operation was observed.

3.2 COMMAND SUBSYSTEM PERFORMANCE

3.2.1 General

3.2.1.1 Command Subsystem performance was nominal throughout the flight. An occassional difficulty was encountered while loading from the Boss tracking station. Verification alarms were indicated while attempting to erase and load a previously full delay line.

Verification alarms were also indicated at other tracking stations during the flight that were not associated with a full delay line.

Guam on Rev 12 and Boss on Rev 22 also experienced ground system problems which resulted in subsequent commanding difficulties.

The above difficulties are described in greater detail in the following section.

3.2.2 Verification Alarms

3.2.2.1 Verification alarms were indicated on numerous occasions throughout the flight. A verification alarm is an indication of the Augie Command System not receiving an accept or a reject pulse within a specified time duration after the last bit of a command has been transmitted.

During this flight, alarms resulted from three different commanding conditions:

(1) Transmission of the erase command to erase a full delay line.

(2) Transmission of real time or stored program commands with poor beacon lock.

(3) Transmission of a real time command to reverse transmitters.

3.2.2.1.1 Verification alarms were indicated on Boss Revs 14, 69 and 117 while in the process of erasing and reloading of full delay lines. This is directly traceable to a characteristic of the Command Subsystem logic.

When a full delay line is erased, the Command Subsystem logic will functionally erase the delay line but will generate a reject pulse to telemetry. The generation of the reject pulse is delayed approximately 25 msec, therefore the reject pulse received by the ground station is delayed for this one set of conditions. The Augie Command System will wait a fixed number of S-pulse transmission periods after the last bit of a command has been transmitted and if an accept or a reject is not received within this duration of time, a verification alarm will be indicated.

The Command Subsystem erase logic has always produced this delay when a full delay line was erased. It is possible that the one shot tolerances on this vehicle are such that the delay may have increased just enough to cause the verification alarms. Since Boss was the only station to experience this problem while numerous other stations erased full lines, possibly a marginal timing problem with Boss Augie Command System exists.

3.2.2.1.2 Verification alarms were also indicated for real time command transmissions and also for stored command transmissions during a delay line load. The real time verification alarms were at Pogo Rev 79 and 95 and Guam Rev 12 and 45. The verification alarms while loading stored commands occurred at Pogo Rev 111.

These verification alarms all occurred as a direct result of poor beacon lock. With poor beacon lock, command bits and S-pulses can be transmitted and not received by the vehicle. When S-pulses are not received, the Command Subsystem cannot respond with an accept or a reject of the command. Therefore, the time allowed by the Augie Command System for a vehicle response may be exceeded and a verification alarm will result.

3.2.2.1.3 The third condition resulting in a verification alarm occurred at Kodi, Rev 121, with the transmission of a Sierra 8 command to reverse transmitters. Telemetry data indicates that the command was accepted and executed properly. Due to the reversing of the transmitters, the accept pulse is approximately 5 msec in duration. (Normal accept pulse width is 22 msec.) It may be possible that this accept pulse was not of sufficient duration to be recognized by the Augie System as an accept.

22

A Sierra 7 command to again reverse the transmitters during this pass was executed with no verification alarm. Telemetry data again indicates a shortened accept pulse of approximately 5 msec in duration. This indicates that the Augie Command System can recognize a short accept pulse.

It appears then, that a possible cause of the verification alarm was a premature switching of the station patching before the accept pulse reached the Augie Command System.

3.2.3 Guam, Rev 12, experienced commanding difficulties with resultant verification alarms and constant rejects. This was due to an intermittent accept/reject link caused by the ground antenna's auto lock system not functioning correctly and therefore not interrogating the vehicle continuously.

3.2.4 Echo alarms and constant rejects were indicated while attempting to load a message at Boss, Rev 22. After the first word (Address Delay Line) of the message was accepted, all future attempts at commanding the vehicle resulted in echo alarms and constant rejects. Attempts to load the message, erase delay line, return to real time and turn off the PPD, all produced echo alarms and rejects.

The echo recording from Boss Rev 22 indicated that only zero bits were being transmitted to the vehicle. This accounts for the acceptance of the Delay Line 1 address command which is all zero bits and the subsequent rejection of all other commanding attempts. Boss later reported that a logic card failure had occurred in the pulse modulator.

3.2.5 Vehicle Clock Performance

The vehicle clock drift started at 11 msec per day (fast) and increased to 19 msec per day (fast) at the end of the mission. The predicted drift from ground test data was 17 msec per day fast. This is well within the specification limit of 432 msec per day.

3.2.6 Secure Word Check

The secure word check sequence was not executed this flight. The check was deleted since the secure circuitry was checked by the execution of engine burns on prior revs.

3.2.7 Beacon Performance

Beacon performance was near-nominal throughout the flight. Early rev outgassing was evident at Revs 3 and 4 Pogo and Rev 4 Guam (distortion of the return pulse). Pogo experienced difficulty achieving Alpha Lock on Revs 2, 3 and 4 but it is felt that the non-nominal injection and subsequent tracking pre-pass error created part of the difficulty. The beacon was turned on by a Zeke command at Rev 19 Kodi with a solid Alpha Lock achieved 45 seconds later. This demonstrated beacon warm-up performance comparable or even superior to that experienced on previous flights.

3.3 SPECIAL COMMAND SEQUENCES

3.3.1 Three sequences were modified prior to use on this flight. These three sequences and their modifications are described in detail below.

3.3.1.1 Orbit Adjust-2 (Sequence 141)

Rel. Time	Cmd. No.	Descriptor
-35.0	333	R1+YHC PHF RHC IDE-ABE-TC-TQ-RT-CH+0
-30.0	388	PTP IR+I-TM CH+AC+E-
0.0	300	E1+E2+
ΔT +0.0	371	IR+I-TM CH+AC+E-
ΔT +3.0	371	IR+I-TM CH+AC+E-
ΔT+60.0	323	R1+YLC PLC RLC IDE-ABE-TC-TQ-RT-CH-0

3.3.1.1.1 This sequence modification consisted of the substitution of Command Number 300 (E1+E2+) for Command Number 303 (E2+) at Relative Time 0.0. This modification was performed because the planned engine burns were to be of sufficient duration that a double engine burn was desireable. This modified sequence was executed on Revs 12 and 28.

3.3.1.2 Tell Tale Primary and Backup (Sequences 155 and 156)

The tell tale sequences were modified by deletion of the R2+ (Recorder Playback) Command in the primary and backup delay lines. This modification was a direct result of the recorder failure which occurred on Rev 118. The recorder failure prevented the recorder playback mode of operation.

3.3.1.3 OCV Deboost-AC (Sequence 150)

Rel. Time	Cmd. No.	Descriptor
-515.0	397	PZ IR+I-TM CH-AC+
-260.0	285	CPB R1-PO CP+YC PC RC
-40.0	321	R1+YLC PLC RLC IDE-ABE-TC-TQ-RT-CH-0
-35.0	388	PTP IR+I-TM CH+AC+E-
-34.0	388	PTP IR+I-TM CH+AC+E-
-10.0	337	R1+YLC PLF RLC IDE-ABE-TC-TQ-RT-CH-0
-2.0	317	R1+YLC PLF RLC IDE-ABE-TQ-RT-CH+0
0.0	300	E1+E2+
1.0	300	E1+E2+
200.0	333	R1+YHC PHF RHC IDE-ABE-TC-TQ-RT-CH+0
ΔT+0.0	371	IR+I-TM CH+AC+E-
ΔT+1.0	371	IR+I-TM CH+AC+E-

3.3.1.3.1 The above OCV deboost sequence was newly defined for this flight to perform the OCV deboost using the available impulse remaining in both tanks. This was accomplished by switching from low thrust to high thrust after 200 seconds of burn.

3.3.4.2 The impulse available at the time of OCV deboost was of sufficient quantity that it was considered wiser to perform the entire burn in the high thrust mode rather than switching control pneumatics in the middle of the burn.

3.3.4.3 Therefore, the above sequence was redefined as follows:

Rel. Time	Cmd. No.	Descriptor
-515.0	397	PZ IR+I-TM CH-AC+
-260.0	285	CPB R1-PO CP+YC PC RC
-2.0	333	R1+YHC PHF RHC IDE-ABE-TC-TQ-RT-CH+0
0.0	300	E1+E2+
1.0	300	E1+E2+
ΔT+0.0	371	IR+I-TM CH+AC+E-
ΔT+1.0	371	IR+I-TM CH+AC+E-
ΔT+2.0	286	CPB R1-PO CP-YC PC RC

3.3.4.4 This sequence modification eliminated the low thrust mode and in addition deleted the pressurize command (PTP) since two engine burns had been executed previously.

3.4 ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEM PERFORMANCE

3.4.1 Battery Thermal Control

The battery well doors on both sides of V988 had A/E = 1.05 thermal control coatings.

3.4.2 Pre-launch Battery Failures

Two of the batteries originally activated for V988, serial nos. 775 and 776, developed cell to case voltage during pre-launch tests. The batteries were replaced with serial nos. 779 and 784. Subsequent tear-down analysis of the failed batteries revealed each contained one cracked cell case. The nature of the cracks indicated they were damaged during assembly into the battery rather than in transit.

3.4.3 Pre-launch Ampere Hour Meter Failure

Pre-launch tests indicated that the 2nd stage of the ampere-hour meter counter was not resetting from the 100% condition, when the vehicle was on external power. When switched to internal power, the counter reset to zero on all three stages. It was expected that the counter would operate normally in flight until the 2nd stage counter reached 100%. It would then remain at 100% and the first stage would continue to cycle normally. This anomaly did not occur in flight. It may have been caused by the AGE, since it was noted while the vehicle was on external power; or it may have been intermittant.

3.4.4 Battery Details

V988 Battery Details are presented in Table 3.4.1. The cell test data indicated a slightly higher average capacity than other recent batter sets, but the spread between cells was greater. Under present manufacturing procedures, the test cell data is related to a particular battery. The batteries which had the highest test cell capacity were installed in the left hand battery wells (positions 2, 3, 6 and 8).

25

3.4.5 Discharge Profile

The Beta angle was initially +27.7°, decreasing about 1° per day. Thus, Batteries 2, 3, 6 and 8, which were installed in the left hand battery wells, operated in a warmer environment than Batteries 1, 4, 5 and 7. The hot side batteries produced the largest load share throughout most of the flight, peaking at about Rev 80. The load share on all hot side batteries had declined to a negligible amount by Rev 129. However, due to the use of isolating diodes between each battery and the vehicle bus, it is expected that these batteries could have yielded a small additional capacity as the bus voltage dropped. Significant events during the discharge cycle are presented in Table 3.4.2.

3.4.6 Power System Loads

Previous recent vehicles exhibited a predictable power use rate which varied as a function of the Beta angle. The curve developed from this experience indicated V988 should require an average of 18.5 ampere hours per rev, whereas the actual mid-mission rate was 21.1 ampere hours per rev. Thus, V988 required 2.6 ampere hours per rev, or an average of 1.7 amperes continuous, in excess of the expected electrical power. This amount can be entirely attributed to the stabilization subsystem bus, which showed a corresponding increase after about Rev 10 over the requirements of previous vehicles. Stabilization Subsystem current for V986 and V988 are compared in Figure 3.6.2. Additional evidence of higher Stabilization Subsystem power use existed in the TARS Electronics Temperature which averaged 25°F high. Environmental power was commanded off at Rev 127.4.

3.4.7 Power System Capacity

3.4.7.1 The mission planning included provisions for a 9 day flight. It was evident after the first day that due to the unusually high power use rate, the normal electric power margin would not be available for a flight of this duration. Later power system predications indicated insufficient power for 9 days using the standard capacity computations (Table 3.4.1) and the projected use rate. The power capacity was re-computed to allow for conditions which had been observed in previous flights in large Beta angles. These are as follows:

3.4.7.2 Tail-Off

This is the term applied to capacity achieved by a hot side battery beyond 1/8 of the set capacity. It is capacity produced at less than rated load, and can only be realized from depleted batteries when other batteries are able to sustain the main load due to being at an earlier state of discharge.

3.4.7.3 End Temperature

The capacity of the cold side batteries is derated according to the predicted end temperature. If the main load shifts to the cold side two to three days before the end of the mission, the temperature rise may be sufficient to permit re-evaluation of the temperature derating.

TABLE 3.4.1

V988 BATTERY DETAILS

BATTERY NO.	SERIAL NO.	CELL TEST DATE	TEST CELLS, AH (15 DAY WET STAND)
1	772	December 30, 1966	393.2, 411.2
2	771	December 30, 1966	405.8, 406.5
3	773	December 30, 1966	414.1, 419.6
4	774	January 23, 1967	401.8, 389.1
5	784	January 4, 1967	393.0, 397.0
6	777	March 20, 1967	418.1, 414.2
7	779	February 1, 1967	394.2, 399.5
8	778	March 22, 1967	432.1, 428.6

Activation Date: 24 May 1967 (1, 2, 3, 4, 6, 8); 30 May 1967 (5, 7)

Battery Wet Stand Time to Launch: 11 days (1, 2, 3, 4, 6, 8); 5 days (5, 7)

Capacity Factors	Ampere Hours
Average Test Cell Capacity $\bar{x}$	407.4
Standard Deviation, 1 Sigma	13.0
Average Capacity for Set, $8\bar{x}$	3259.2
Derating for Dry Stand	-68.0
Derating for Wet Stand	+44
Sigma x 1.7 $\sqrt{8}$	-62.5
-1.7 SIGMA CAPACITY, SET, WET AND DRY STAND DERATED	3172.7
Derating for Low Temperature (4 @ 50°F)	100
Pre-launch Test Use	97.8
Available for Flight	2974.9

Battery Well Doors A/E = 1.05 both sides

TABLE 3.4.2

REV	BATTERY NO. (% LOAD SHARE & TEMP.)								TOTALS		SIGNIFICANT EVENTS
	1	2	3	4	5	6	7	8	A	AH	
L/O	12.2% 70°F	11.2% 70°F	20.7% 70°F	6.9% 70°F	15.4% 67°F	7.5% 70°F	15.4% 67°F	10.6% 73°F	18.8	97.8	Lift-off conditions
P16	15.0% 66°F	17.8% 80°F	11.7% 80°F	8.9% 61°F	13.9% 61°F	11.1% 75°F	8.3% 64°F	13.3% 80°F	18.0	407.8	Batteries 2, 3, 6 & 8 warmer due to environment
P32	10.4% 58°F	16.4% 84°F	15.3% 82°F	8.2% 56°F	11.5% 54°F	14.2% 80°F	9.3% 56°F	14.8% 84°F	18.3	737.8	Batteries 2, 3, 6 and 8 lead in load share
P48	8.3% 51°F	16.1% 84°F	17.2% 84°F	7.2% 46°F	9.4% 46°F	16.7% 84°F	7.8% 49°F	17.2% 86°F	18.0	1077.8	
P64	7.3% 43°F	16.8% 82°F	17.9% 84°F	5.6% 40°F	8.4% 40°F	17.9% 84°F	7.3% 40°F	19.0% 88°F	17.9	1417.8	
P80	7.2% 40°F	17.2% 82°F	17.2% 82°F	5.6% 37°F	8.3% 34°F	17.8% 86°F	7.8% 37°F	18.9% 88°F	18.0	1757.8	Batteries 2, 3, 6 and 8 at peak load share
P96	7.6% 37°F	16.8% 82°F	16.3% 82°F	6.0% 37°F	8.7% 34°F	18.0% 84°F	8.7% 37°F	18.0% 88°F	18.4	2097.8	Load Shift begin
P112	10.4% 40°F	13.2% 82°F	9.2% 80°F	9.8% 37°F	12.0% 37°F	17.2% 84°F	13.2% 40°F	15.0% 86°F	17.4	2437.8	
B118	13.5% 42°F	10.4% 80°F	1.8% 75°F	12.3% 40°F	15.3% 42°F	16.6% 86°F	16.6% 46°F	13.5% 84°F	16.3	2567.8	Battery 3 load share negligible
G124	17.3% 46°F	1.7% 75°F	1.7% 70°F	16.2% 40°F	19.0% 40°F	12.8% 84°F	21.8% 46°F	9.5% 80°F	17.9	2697.8	Battery 2 load share negligible
P127	20.0% 49°F	1.0% 73°F	1.5% 70°F	19.4% 46°F	22.4% 46°F	8.7% 82°F	25.5% 53°F	1.5% 77°F	19.6	2767.8	Battery 8 load share negligible. Heaters off.

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TABLE 3.4.2 (continued)

REV	BATTERY NO. (% LOAD SHARE & TEMP.)								TOTALS		SIGNIFICANT EVENTS
	1	2	3	4	5	6	7	8	A	AHAH	
129	21.0% 49°F	1.3% 73°F	2.1% 70°F	21.0% 46°F	23.7% 46°F	2.1% 82°F	27.0% 53°F	2.1% 77°F	14.8	2797.8	Battery 6 load share negligible
K131	21.4% 54°F	1.8% 64°F	1.8% 66°F	22.3% 51°F	23.2% 54°F	1.8% 73°F	25.9% 54°F	1.8% 70°F	22.4	2837.8	Final Data
	296.1	416.7	404.5	237.5	323.4	420.3	307.8	431.5			Final Individual AH.

TABLE 3.4.3

BATTERY CONSIDERATIONS

1. Assuming end of life conditions as 27.5 volts at .5 amps instead of 4 amps gives an additional 20 AH/Battery or total of 80 AH for the four hot side batteries.

2. Present data indicates that cold side batteries will be closer to 60°F than 50°F. Assuming a final temperature of 60°F and an average load of 3.5 Amp/Battery, the capacity derating for temperature reduces from 25 AH/Battery at 50°F to 12 AH/Battery at 60°F for an improvement of 52 AH.

3. Assuming an end of life voltage of 27.0 volts instead of 27.5 volts yields 12 AH/Battery from the 4 cold side batteries or 48 AH total.

4. The above yields total 180 AH or 8+ revs at 21.1 AH/Rev.

5. These yields are recovered at reduced bus voltage - but reasonable assurance is given that stab and command systems will perform down to 24 VDC.

TABLE 3.4.4

BATTERY NO.	1/8 SET CAPACITY	ACTUAL YIELD	TAIL-OFF	TEST CELL AVERAGE
2	396.6 AH	416.7 AH	20.1 AH	406.1 AH
3	396.6 AH	404.5 AH	7.9 AH	416.8 AH
6	396.6 AH	420.3 AH	23.7 AH	416.1 AH
8	396.6 AH	431.5 AH	34.9 AH	430.3 AH
TOTALS	1586.4 AH	1673.0 AH	86.6 AH	1669.3 AH

3.4.7.4 In addition to these factors, consideration was given to the power gain which could be achieved by accepting a lower than normal operating voltage. The normal battery voltage for end of life calculations is 27.5 volts. Specified minimum allowable bus voltage is 26.0 volts. The expected gains from all sources are listed in Table 3.4.3. The actual gain from "tail-off" is presented in Table 3.4.4. Final cold side temperatures at Rev 131 as shown in Table 3.4.2 averaged 53°F, indicating revising the derating factor to 60° end temperature for predictions to Rev 146 was a reasonable estimate. At Rev 131, 1165 ampere hours had been used from the 4 cold side batteries. The 1.7 sigma capacity available in this group considered as a set of 4, derated for wet stand, dry stand and an end temperature of 60°F, was 1547 ampere hours. The remaining capacity was 382 ampere hours, or 18 additional revs at 21.1 AH/Rev. (This figure does not include a power gain from operation at less than 27.5 volts terminal voltage.) This was considered to be insufficient contingency margin for a 9 day flight.

3.5 ENVIRONMENTAL CONTROL SUBSYSTEM PERFORMANCE

3.5.1 Orbit Parameters

Date of Launch	4 June 1967
Lift-Off Time	65221 seconds
Beta (Sun) Angle	+27.7 deg. decreasing 1° per day

S/V programmed for -6.4 roll attitude after Rev 3.4

	Before First OA L/O to Rev 12	Before Second OA Rev 12-28	After Second OA Rev 28 - End of Flight
Perigee	80.6 n.m.	80.4 n.m.	80.7 n.m.
Apogee	192.6 n.m.	158.5 n.m.	255 n.m.
Inclination	104.9°	104.9°	104.9°

3.5.2 Orbital record sequences plotted for the following measurements are shown in Figures 3.5.1 through 3.5.9.

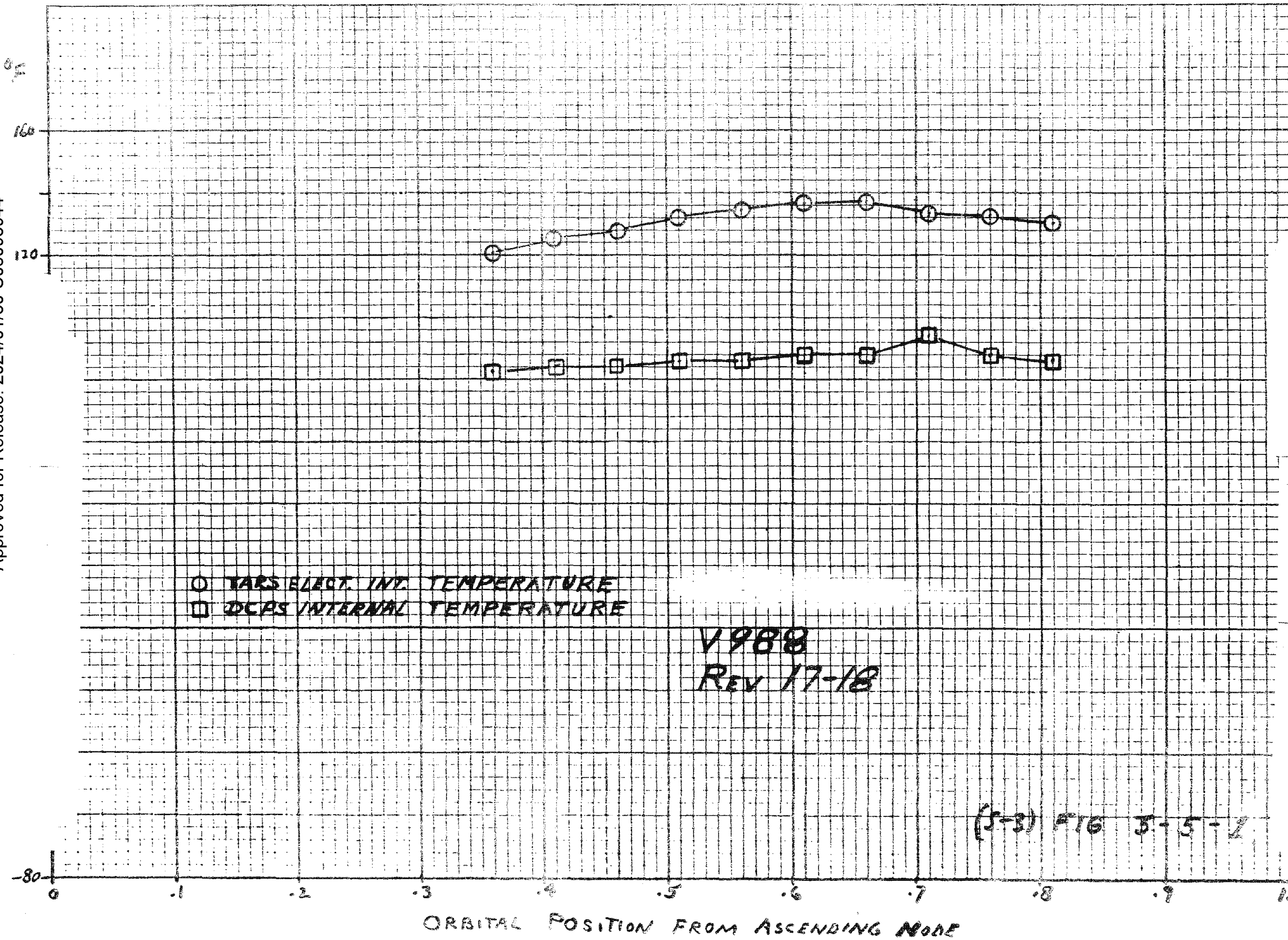
TARS Electronics Internal Temp. Revs 17-18, 33-34, 34-35, 50-51, 65-66, 82-83, 115-116.

6V Power Supply Base Plate and Command Decoder Programmer Plate Temps. Revs 17-18, 115-117.

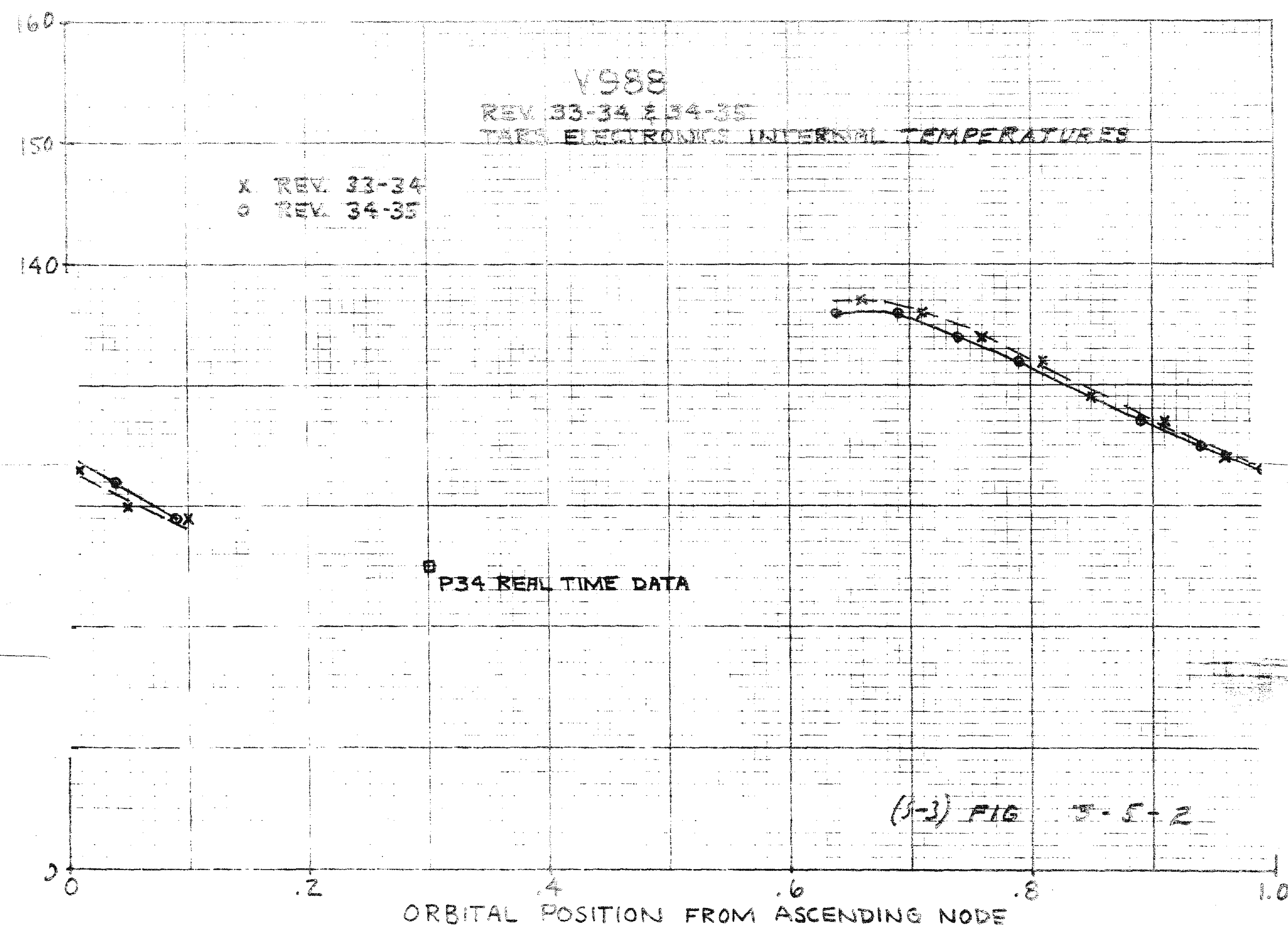
DCPS Internal Temp. Revs 17-18.

OCV Skin Temperatures Revs 17-18, 115-116.

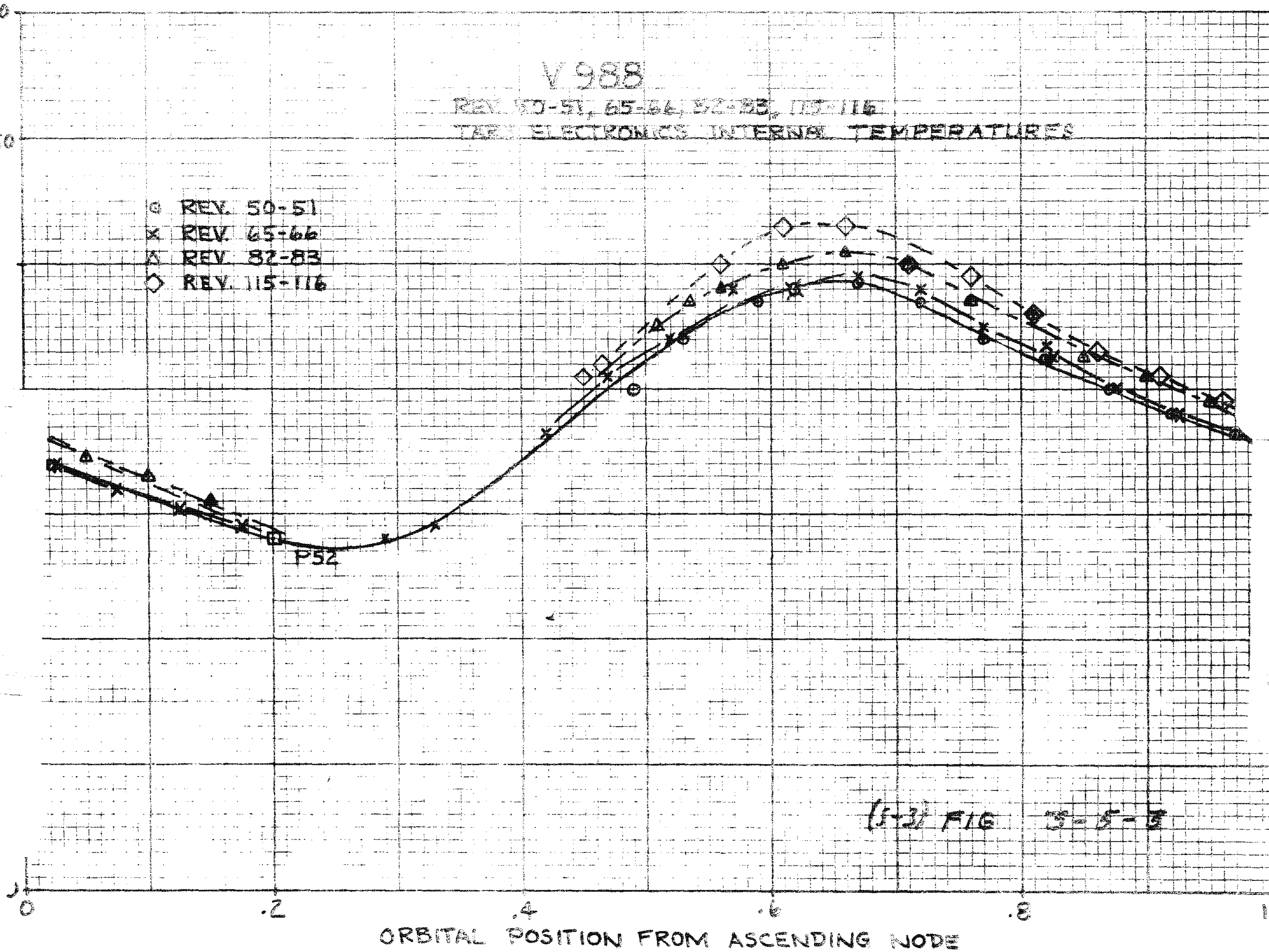
Adapter Skin Temps. Revs 17-18, 115-117.



Approved for Release: 2024/01/30 C05098944


V988
REV. 33-34 & 34-35
TARS ELECTRONICS INTERNAL TEMPERATURES
x REV. 33-34
o REV. 34-35
P34 REAL TIME DATA
160
150
140
0
.2
.4
.6
.8
1.0
ORBITAL POSITION FROM ASCENDING NODE

(5-3) FIG 5-5-2



Approved for Release: 2024/01/30 C05098944

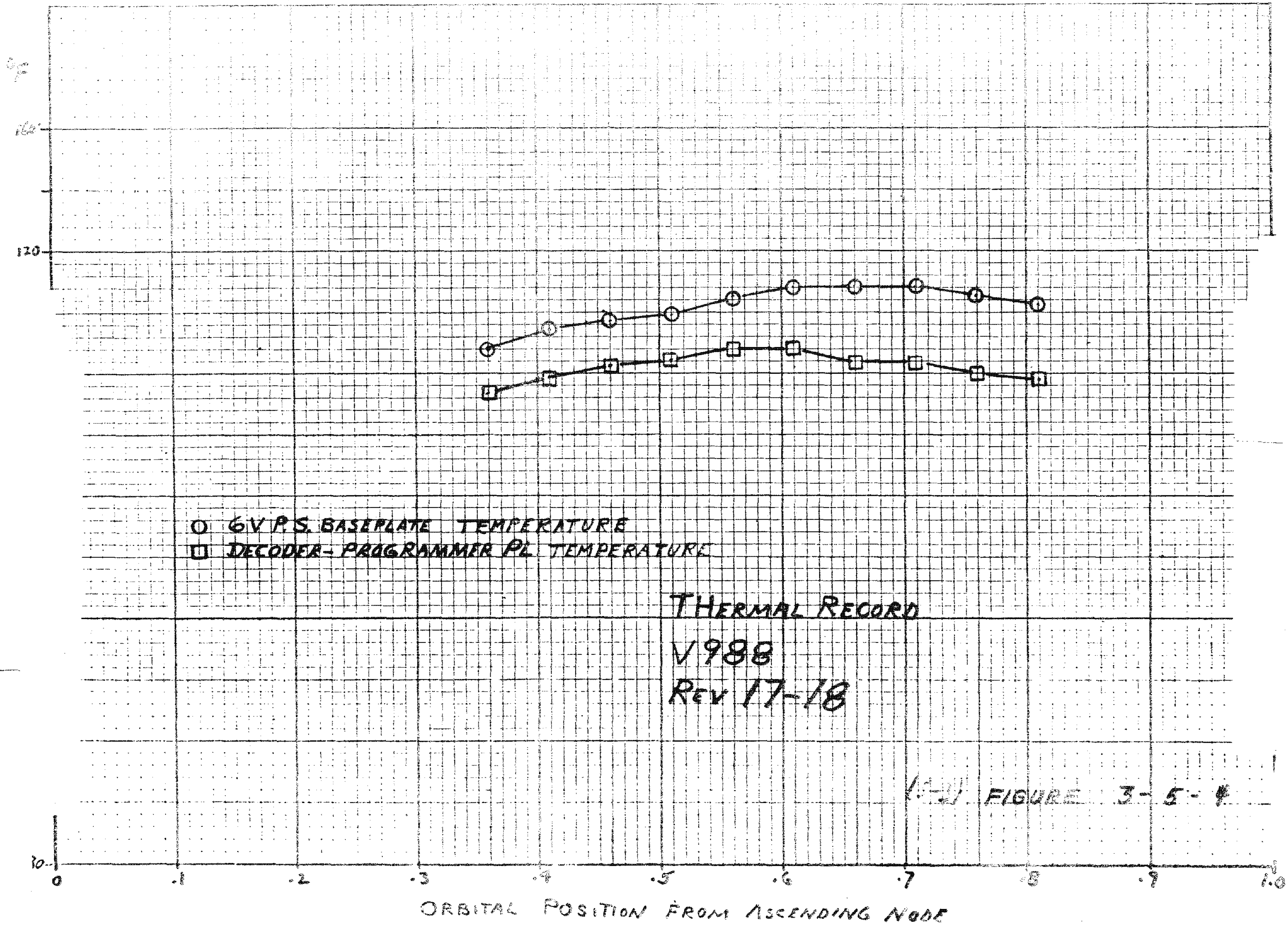
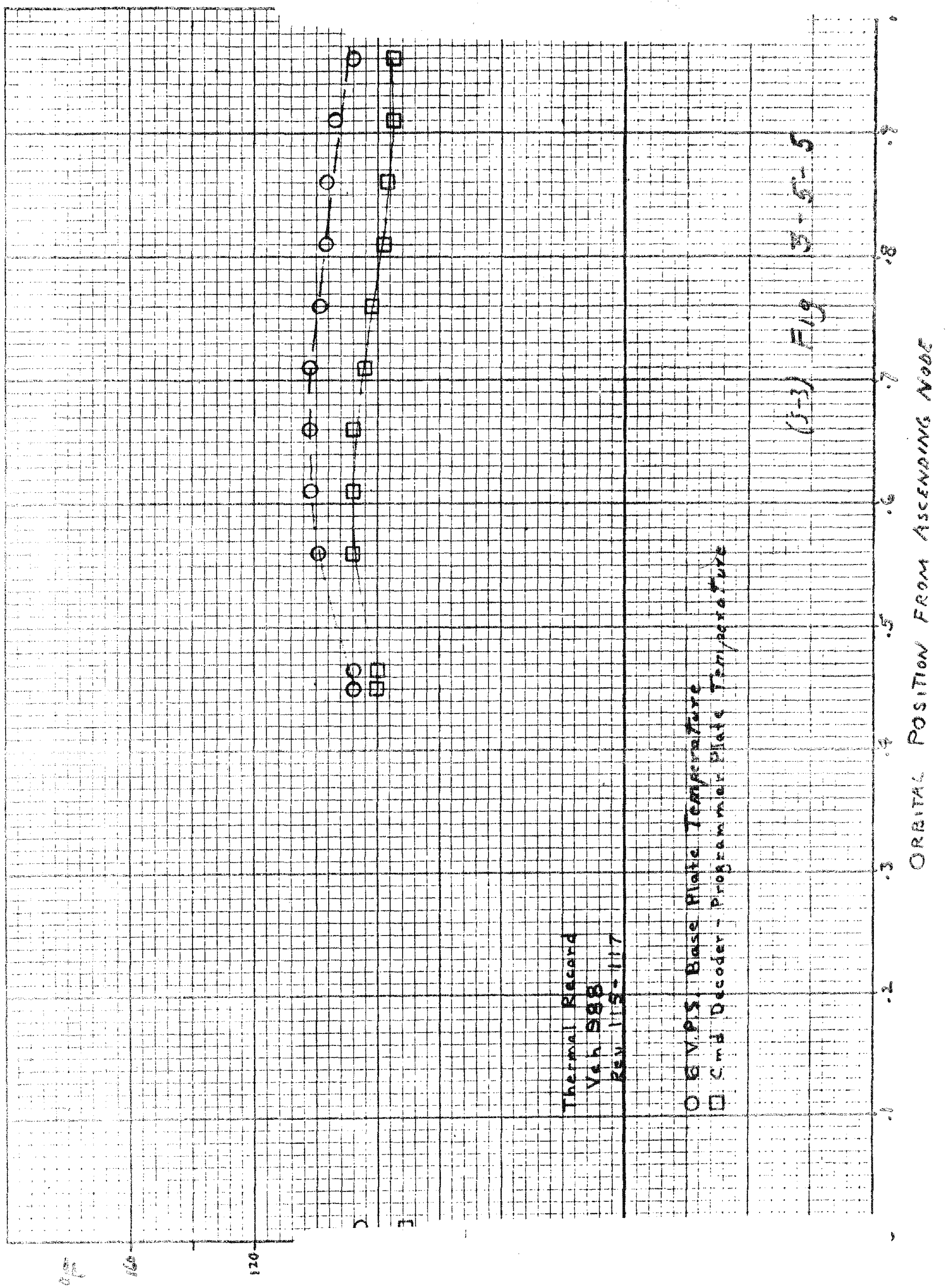
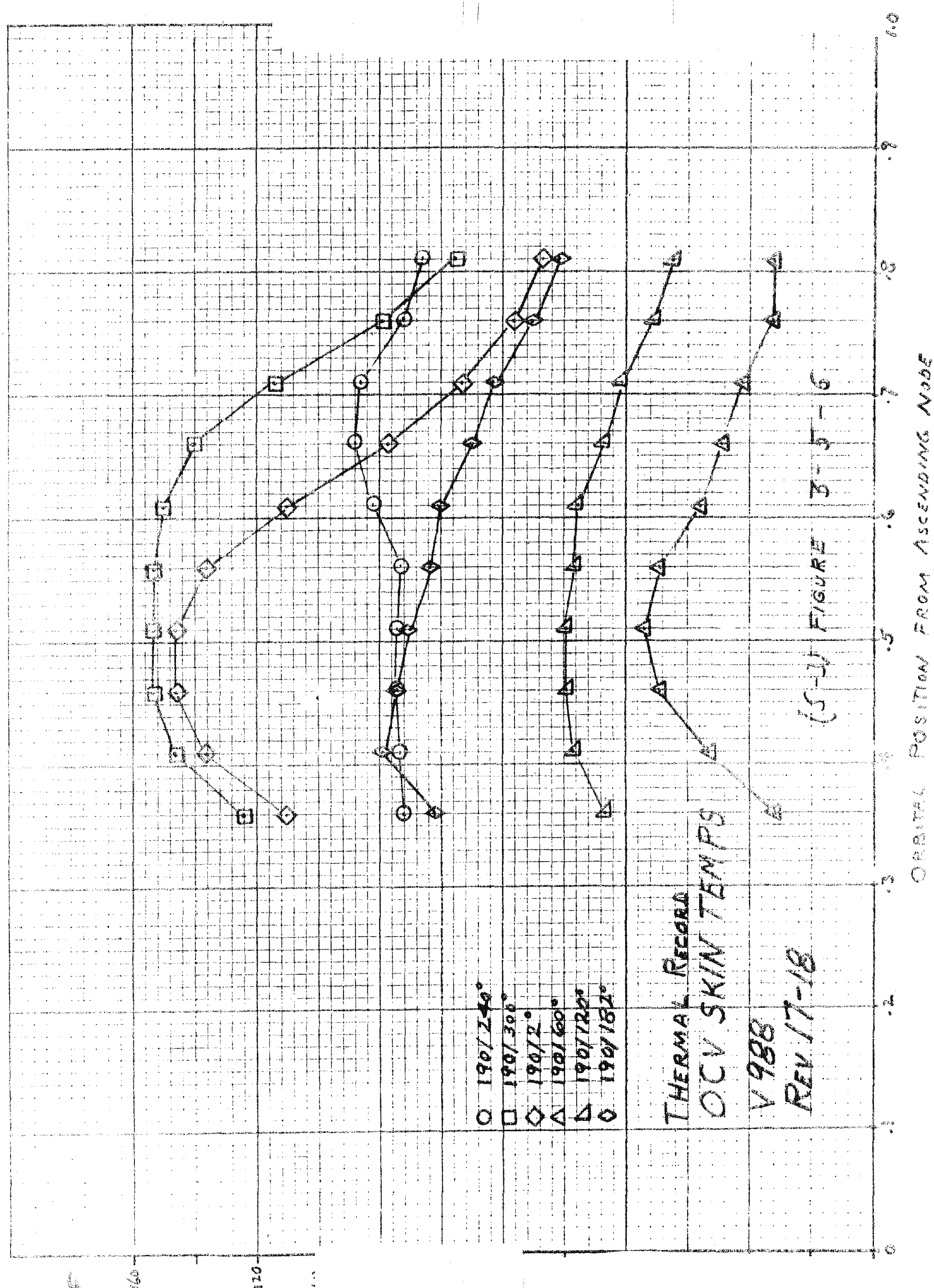
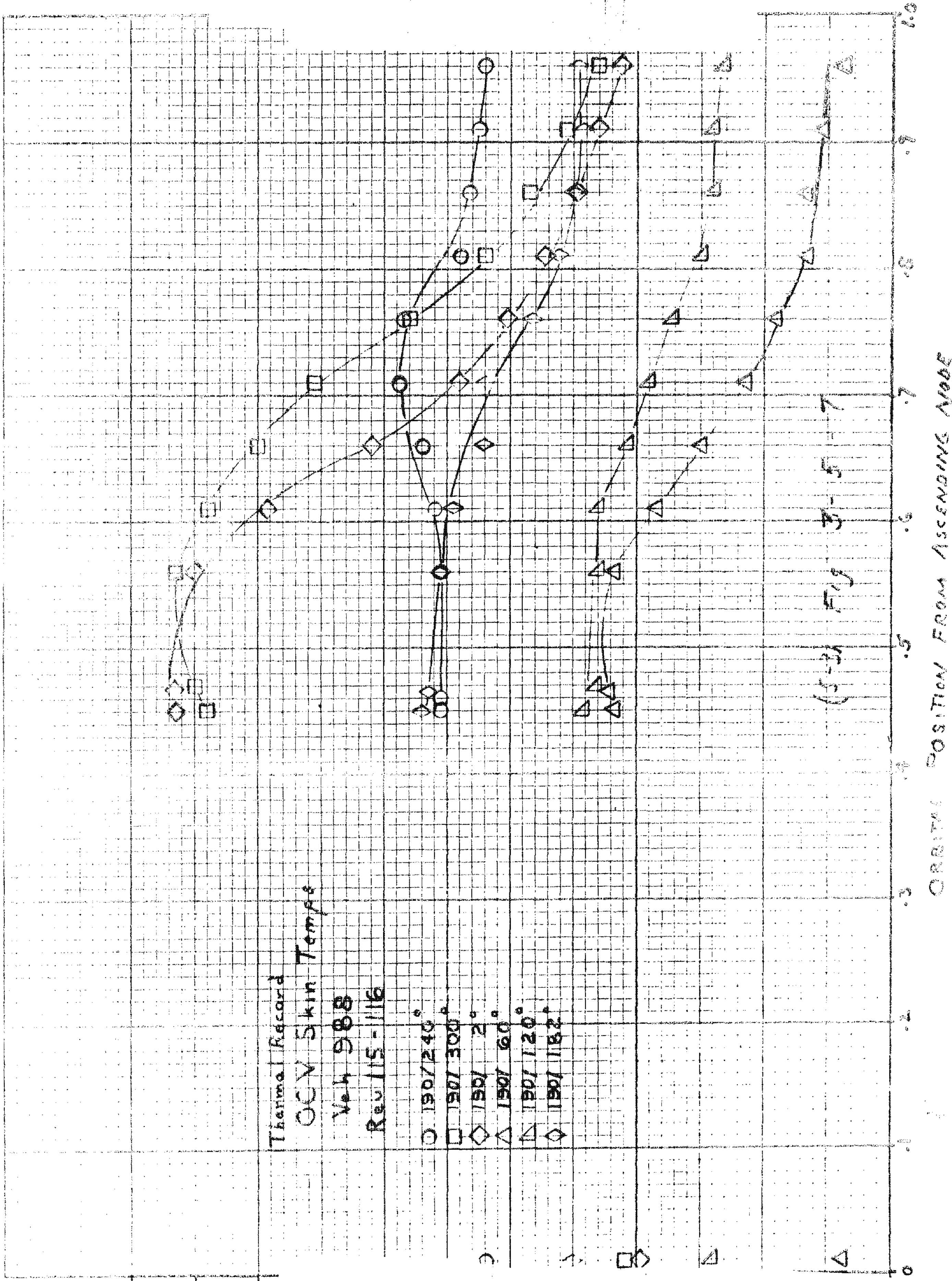


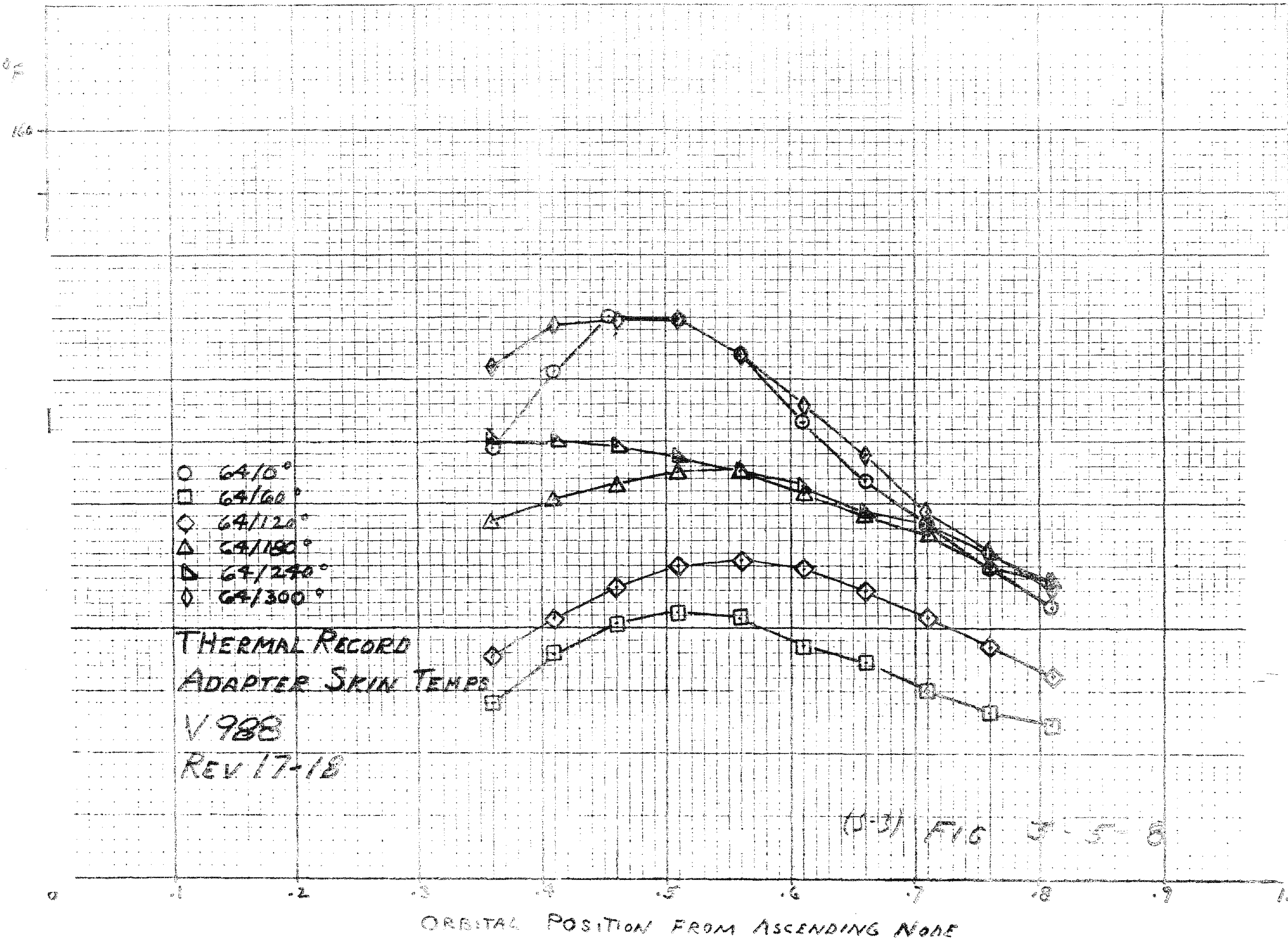
FIGURE 3-5-4

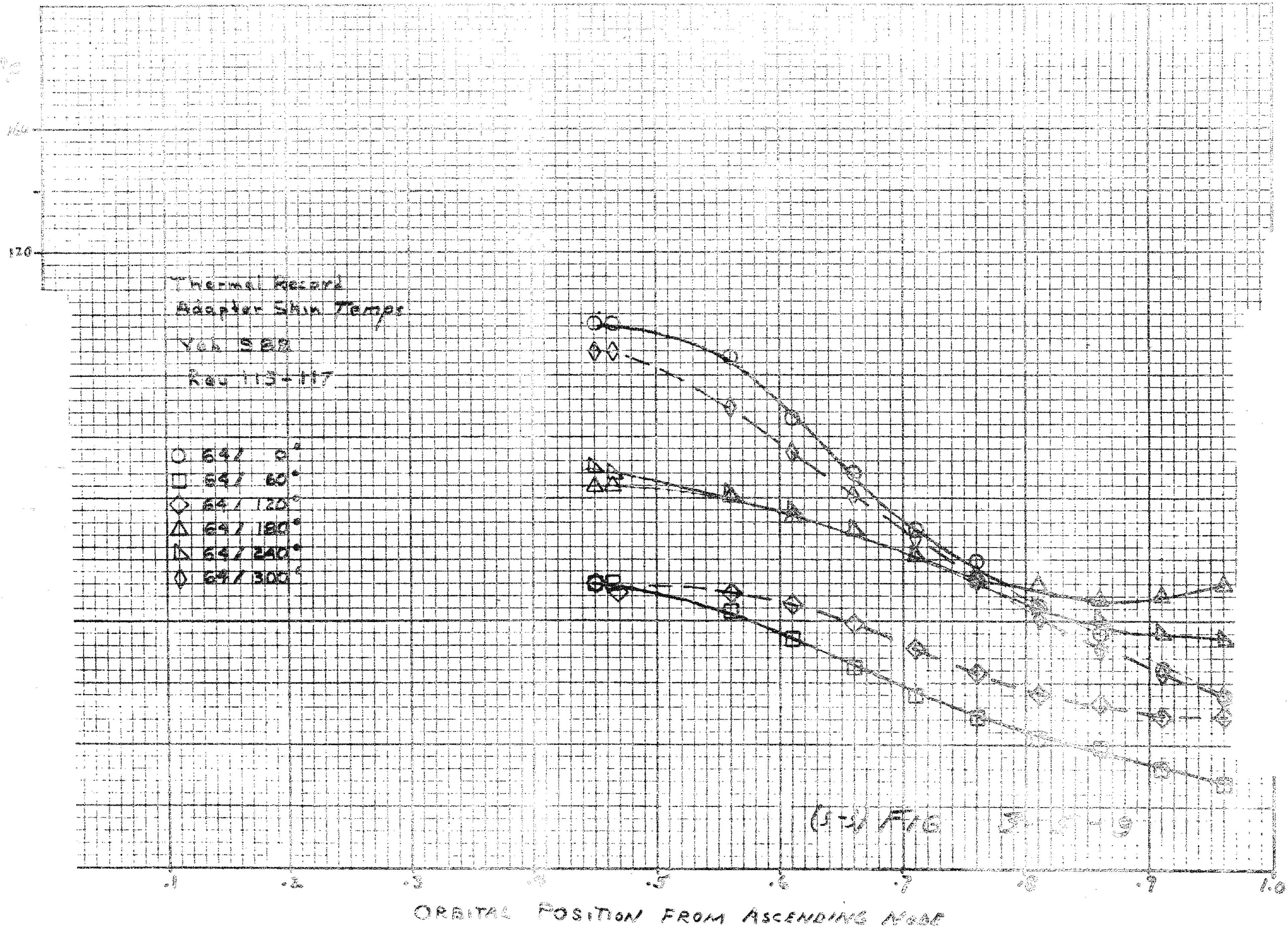
Approved for Release: 2024/01/30 C05098944


Thermal Record
Veh 988
Rev 115-117
○ E.V.P.S. Base Plate Temperature
□ Cmd Decoder - Programmer Plate Temperature
ORBITAL POSITION FROM ASCENDING NODE
.1
.2
.3
.4
.5
.6
.7
.8
.9
100
120
(S-J) Fig 3-5-5


THERMAL RECORD
OCV SKIN TEMPS
V 988
REV 17-18
190/300°
190/2°
190/60°
190/120°
FIGURE
ORBITAL POSITION FROM ASCENDING NODE
160
120


Thermal Record
OCV Skin Temps
Veh 988
Rev 115-116
○ 190/240°
□ 190/300°
◇ 190/2°
△ 190/60°
190/120°
190/182°
Orbital Position From Ascending Node


°F
100
64/0°
64/60°
64/120°
64/180°
64/240°
64/300°
THERMAL RECORD
ADAPTER SKIN TEMPS
V 988
REV 17-18
(U-3) FIG 3-5-6
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
ORBITAL POSITION FROM ASCENDING NODE


Thermal Record
Adapter Skin Temps
Veh 588
Rev 113-117
○ 64 / 0°
□ 64 / 60°
◇ 64 / 120°
△ 64 / 180°
◺ 64 / 240°
◇ 64 / 300°
120
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
ORBITAL POSITION FROM ASCENDING NODE

3.5.3 Significant features of these plots and figures A-26 and A-26.a are:

(a) TARS EP Internal Temp: This measurement was usually 25° higher than normal. The qualification value of this item is 108°F since stabilization current was about 1.5 amp higher than normal, it is suspected that some correlation exists between the increased current drain and increased temperature.

(b) The effects of a decreasing B angle during the flight are shown in Figure 3.5.3, the result being increased temperature.

(C) Section 5 Heater Temps: From figures A-26 and A-26.a, it appears that the sensor located at station 104/180° registered about 10° high for the duration of the flight. Comparison with previous vehicles and the absence of supporting anomalous symptoms indicate that this high reading was probably caused by incorrect sensor bias.

3.6 ATTITUDE CONTROL AND STABILIZATION SUBSYSTEM PERFORMANCE

3.6.1 General

The Pneumatic System Storage tanks contained 252 lbs of control gas at launch, yielding a usable impulse of 10,050 lb-sec. Performance of the Attitude Control System satisfied specification requirements throughout the flight.

3.6.2 Roll Matrix

The Roll Matrix was executed over Pogo on Rev 3. Vehicle accelerations, decelerations and coast rates as determined by Attitude Control logic were within specification limits. The roll maneuvers executed on the roll matrix satisfied the following software maneuver formulas:

Low Rate Maneuvers $T = \frac{\Delta\theta}{.26} + 5$ seconds

Medium Rate Maneuvers $T = \frac{\Delta\theta}{1.61} + 1.6$ seconds

High Rate Maneuvers $T = \frac{\Delta\theta}{3.12} + 2.6$ seconds

3.6.3 Design Changes Effective Vehicle 988

3.6.3.1 Redundant Pneumatics System

The Pneumatic System was redesigned into a Redundant System, consisting of a high thrust branch from one storage tank and a low thrust branch from the other. The storage tanks were isolated by two balancing valves. Under normal conditions, the vehicle pneumatic system was designed to operate the same as previous vehicles with periodic balancing to provide equal control capability in each branch. In the event a leak developed in either branch, further balancing could be terminated and control capability of the normal branch could be used. Each branch was designed with a degraded operating mode capability which could be commanded by real time commands. The balancing was also controlled by real time commands.

3.6.3.2 Outboard Roll Nozzles

The high thrust roll nozzles were mounted on the exterior vehicle skin at bulkhead 216. This change increased the lever arm of the roll high thrust nozzles and eliminated the impingement effects. Since it was desired to keep the radial acceleration the same as for previous vehicles, the increased lever arm resulted in an impulse saving per high or medium rate maneuver.

3.6.3.3 Engines On/ACA's to High Thrust Taboo Logic Removed

It was determined from prior experience that the vehicle could be controlled during engine burn with low thrust nozzles as well as high thrust nozzles so the taboo logic was removed. This gave the capability of controlling the vehicle during engine burn with either branch of the Redundant pneumatic System.

TABLE 1 (Balance Log)

1.	Boss 5	12.	Guam 45
2.	Cook 7	13.	Hula 58
3.	Cook 9	14.	Boss 60
4.	Cook 10	15.	Hula 74
5.	Guam 12	16.	Pogo 79
6.	Boss 14	17.	Hula 90
7.	Cook 23	18.	Pogo 95
8.	Kodi 25	19.	Hula 106
9.	Guam 28	20.	Pogo 112
10.	Pogo 31	21.	Hula 122
11.	Hula 42	22.	Boss 126

2.6.4 Redundant Pneumatics

3.6.4.1 Balancing

Table 1 above shows a log of balancing events throughout the mission. The increased frequency of balancing in the early portion of the mission was to prevent the back pressure on the balance valves from exceeding 400 psia. In the latter part of the mission, balancing was done to provide equal controlling capability in each tank. So, if a leak did occur in either branch, a maximum of impulse would be available in the other branch. No operational problems were encountered with the freqeuncy of balancing shown in Table 1.

3.6.5.2 Degraded Mode Operation

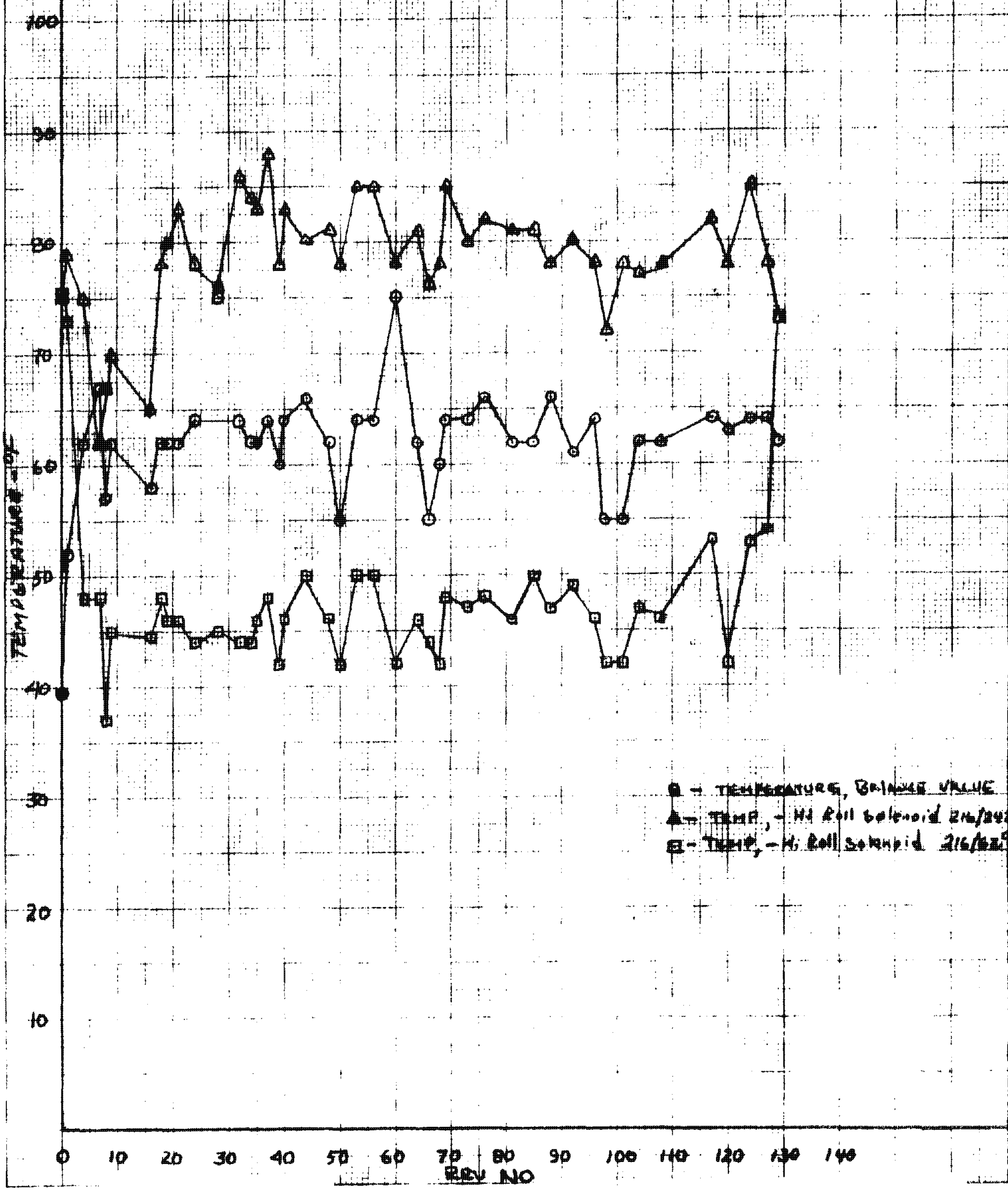
Since no branch failures occurred the redundant capability was not used for controlling the vehicle. No test sequences were commanded to verify system operation.

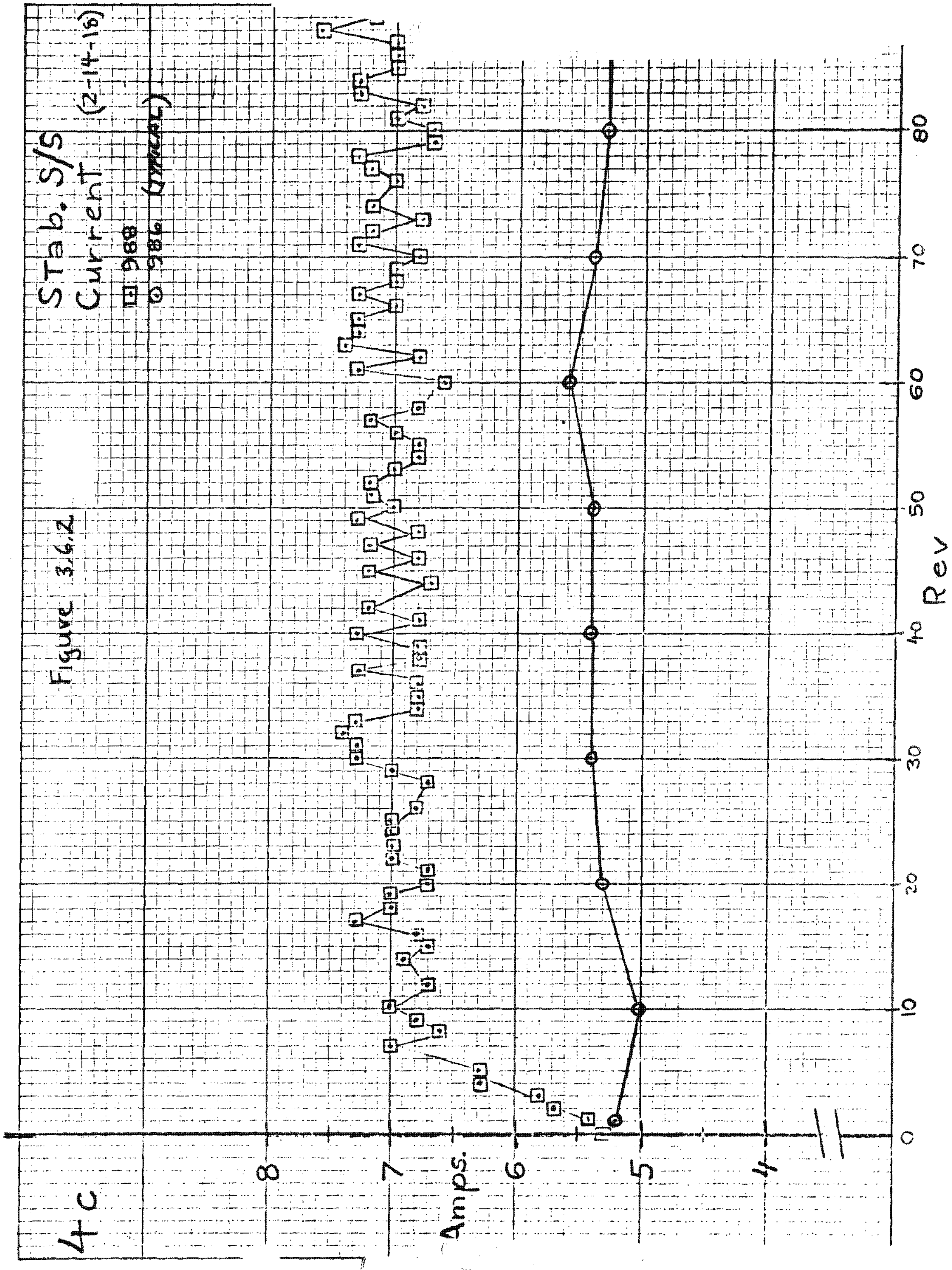
3.6.4.3 Solenoid and Balance Valve Temperatures

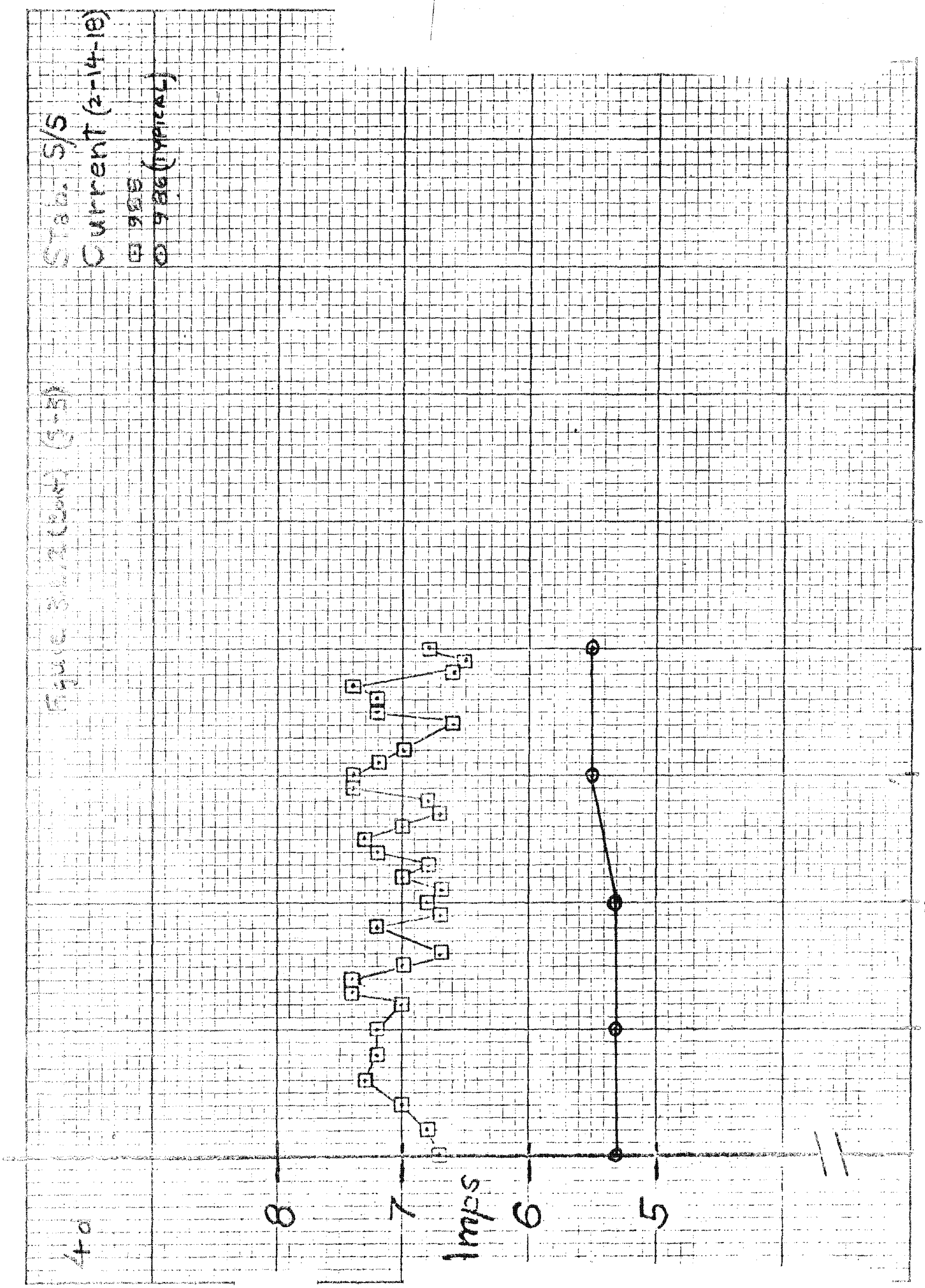
Figure 3.6.1 shows the temperature profile of the outboard high thrust roll solenoids and the balance valves throughout the flight. No abnormal temperature excursions were observed.

Figure 3.6.1

DIAGNOSTIC TEMPERATURE MONITORS FOR REDUNDANT PNEUMATICS SYSTEM




STab. S/S
Current (2-14-15)
988
986
Figure 3.6.2
Amps.
8
7
6
5
4
Rev
0
10
20
30
40
50
60
70
80
4C


Stab. S/S
Current (2-14-18)
985
986 (TYPICAL)
Amps
8
7
6
5
Rev
100
110
120
130
140

3.6.5 ΔV Inputs from B Factor Determination

As a result of moving the high thrust roll nozzles outboard, the impingement effect which had produced a positive velocity change (ΔV) was reduced. However, the low thrust nozzles still caused an impingement effect and a resultant positive velocity change. Attempts were made to correlate the drag factor (B factor) variations to low thrust maneuvers but there appeared to be no significant correlation.

3.6.6 Three Axis Reference System Problems

3.6.6.1 Torque Motor Voltage

It was observed throughout the flight that the torque motor voltage telemetry monitor indicated a ±10% bandwidth offset after a transient vehicle movement. After a period of time, the offset would decrease to zero. No detrimental effect on vehicle stabilization system performance was noted.

3.6.6.2 Stabilization System Current

Figure 3.6.2 shows a comparison of stabilization system current for this vehicle compared to Vehicle 986. The average value of current flow was approximately 1.7 amperes more. The figure indicates that some event occurred after lift-off which caused more current drain.

3.6.6.3 Electronics Package (EP) Temperature

Figure A-25 and A-25.a in the Appendix show the EP temperature throughout the flight. The EP temperature was approximately 25°F higher than vehicles since 978. It has been speculated that the higher EP temperature was a result of the increased stabilization current. However, since the total stabilization and control system operated normally, a malfunction which would cause a continuous current drain of 1.7 amps is difficult to imagine.

3.6.6.4 TARS Gyro Temperatures

Figure A-24 and A-24.a in the Appendix show the TARS gyro temperatures throughout the flight. Between Revs 12 and 18, all gyros went out of band, on telemetry. This was attributed to the negative orbit adjust performed on Rev 12. The yaw reverse and yaw forward were accomplished in a manner so that the gyros were exposed to sun radiation for a much longer time than normal. The temperatures returned to normal by Rev 18 and appeared normal for the remainder of the flight.

3.7 SEPARATION AND RECOVERY SUBSYSTEM PERFORMANCE

3.7.1 Ascent Separation Events

Due to the absence of a down range telemetry ship, ascent events could not be verified. The vehicle tape recorder readout at Pogo 1 did not contain the time interval associated with ascent events. Because of subsequent operational capabilities, it can be assumed that all ascent separation events occurred without descernible malfunction.

47

3.7.2 SRV Re-Entry and Recovery

3.7.2.1 Separation, retro and recovery of the SRV using the primary command subsystem were accomplished on Rev 130 with air recovery occurring at 24°42'N, 163°15'W; approximately 45 n.m. South and 15 n.m. West of predicted impact.

3.7.2.2 RV Separation Events Summary

Rev	Events	System Time Commanded	Verified
127	TQ+ (Yaw Around)	63716.5	Verified
128	TQ-F- (Fly Reverse)	64166.5	Verified
128	PD (Pitch Down)	65403.5	Verified
129	Disconnect 1	70849.8	70851
129	Disconnect 2	70851.3	Verified
130	Arm	76798.0	76797.9
130	Transfer	76853.0	76852.3
130	OCV/SRV IFD	76853.9	76853.2
130	Separation	76854.5	76854.6
130	Spin	76857.3	76856.4
130	Retro Fire	76858.55	76857.5
130	Despin	76869.3	76868.3
130	Thrust Cone Disc	76870.8	76870.0
130	Thrust Cone Eject	76871.0	76870.2
130	PZ (Pitch Zero)	76882.9	76884
130	3G Switch Closed	-	Unable to Verify
130	3G Switch Open	-	Unable to Verify
130	Para Cover Off	-	Unable to Verify

3.7.2.3 GTERMIN

Start of Retro

System Time	76858.6
Altitude	496,019 ft.
Geocentric Latitude	49.9032° N
Longitude	150.2335° W
Inertial Velocity	25915:5 ft/sec.
Inertial Azimuth	203.4822 deg.
Inertial FPA	-.02867 deg.
Right Ascension	70.5207 deg.

End of Retro

System Time	76866.93
Altitude	492,073 ft.
Geocentric Latitude	49.3766° N
Longitude	150.6193° W
Inertial Velocity	25452.5 ft/sec.
Inertial Azimuth	203.2144 deg.
Inertial FPA	-1.79687 deg.
Right Ascension	70.1698 deg.

Top of Atmosphere

System Time	76958.46
Altitude	410,001 ft.
Geocentric Latitude	43.7556° N
Longitude	161.4679° W
Inertial Velocity	23,335.8 ft/sec.
Inertial Azimuth	199.8904 deg.
Inertial FPA	-2.51572 deg.
Right Ascension	-.0002

Predicted Impact

System Time	77323.4
Latitude	25.4596° N
Longitude	162.9761° W

3.8 ORBIT ADJUST SUBSYSTEM PERFORMANCE

3.8.1 The Orbit Adjust Subsystem was successfully employed on three occassions during the flight of Vehicle 988.

3.8.2 The first employment was at Rev 12.4 when a 91.5 second negative orbit adjust was performed. At Rev 28, a 269.8 second positive orbit adjust took place. Lastly, on Rev 131, the orbit adjust engines were burned for 375.0 seconds in order to effect OCV deboost.

3.8.3 On Rev 12, just before the 1st orbit adjust maneuver, the oxidizer and fuel tanks were pressurized. This pressurization occurred, as commanded, over the Guam tracking station. Nitrogen gas pressure (2-15-16) was observed to drop 235 lbs/in^2 as fuel and oxidizer tank pressures rose to 288 and 290 lb/in^2 respectively - these all being nominal values.

3.8.4 At System Time 41362.7, Rev 12.0, yaw around to fly reverse was commanded. At System Time 43599.4, a double engine burn was commanded. 91.5 seconds later, engines off was commanded. Total engine thrust was estimated at 96.85 lbs., the velocity change at -59.72 ft/sec. The effect of this ΔV on the orbit parameters is indicated by Table 3.8.

3.8.5 A positive orbit adjust on Rev 28 was deemed necessary in order to increase orbit life. A double engine burn was initiated at System Time 42279 and terminated 269.8 seconds later. The engine thrust was estimated at 96.748 lbs. and ΔV at +178.711 ft/sec. The orbit parameters of Rev 24 vs. Rev 29 parameters are shown in Table 3.8 to indicate the effects of this 2nd orbit adjust. The vehicle orbital life was now over 200 revs. Neither of these first two orbit adjusts were initiated or terminated over a tracking station.

44

TABLE 3.8

ORBITAL PARAMETERS

	Rev 10	Rev 14
Perigee	80.616 n.m.	80.429 n.m.
Arg. of Perigee	150.814°	149.385°
Inclination	104.893°	104.888°
Right Ascension	215.543°	216.100°
Period (integrated)	89 min. 27.92 sec.	88 min. 48.72 sec.
(Keplerian)	89 min. 33.16 sec.	88 min. 53.97 sec.
Eccentricity	.015647	.010838
Minimum Altitude	80.04 n.m.	79.51 n.m.
Maximum Altitude	192.58 n.m.	158.49 n.m.

	Rev 24	Rev 29
Perigee	80.481 n.m.	80.651 n.m.
Arg. of Perigee	147.023°	147.596°
Inclination	104.891°	104.893°
Right Ascension	217.506°	218.207°
Period (integrated)	88 min. 44.36 sec.	90 min. 37.69 sec.
(Keplerian)	88 min. 49.73 sec.	90 min. 42.74 sec.
Eccentricity	.0103122	.024079
Minimum Altitude	79.45 n.m.	80.16 n.m.
Maximum Altitude	155.29 n.m.	255.18 n.m.

3.8.6 OCV Re-Entry

3.8.6.1 After RV separation on Rev 130, the OCV was pitched back to 0°, remaining yawed reverse. On Rev 131 at System Time 81225.0 both O.A. engines were commanded ON. The engines OFF command was executed, and observed, over station Pogo at System Time 81600.0 giving a total burn time of 375.0 seconds and a ΔV of about -250 ft/sec.

3.8.6.2 The total orbit adjust subsystem usage for the flight of Vehicle 988 was 736.3 seconds of double engine burn time imparting some 488 ft/sec of velocity increments to the satellite vehicle.

3.8.7 GN_2 Pressure

3.8.7.1 During the Rev 12 orbit adjust, the nitrogen gas pressure dropped from 4350 to 4000 lbs/in^2. For a 91.5 second burn period this gives a nitrogen use rate of 229 psi/minute. The Rev 28 GN_2 usage was 1000 psi or a rate of 223 psi/min. On the OCV deboost the GN_2 parameters were 1350 psi and 216 psi/min. The standard GN_2 depletion rate as determined from previous vehicle experience is 230 ±30 psi/min.

3.8.7.2 Between Revs 29 and 130 the nitrogen gas pressure - as indicated by both telemetry points 2-15-16 and 2-10-29 dropped about 100 psi at a steady rate. This probably was caused by a decrease in temperature of the OA system.

3.8.8 OCV Deboost

3.8.8.1 The GTERMIN predicted parameters relating to the Rev 131 OCV deboost sequence are:

	Start Retro	End Retro
System	81225 sec.	81600 sec.
Altitude	818697 ft.	647210 ft.
Geocentric Latitude	53.5012°	72.9839°
Longitude	27.8028°	68.5612°
Inertial Velocity	25536.4 ft/sec.	25485.7 ft/sec.
Inertial Azimuth	334.4363°	298.6659°
Inertial FPA	-1.16938°	-1.15834°
Right Ascension	211.1946°	172.0029°
Acceleration	-.0217 ft/sec.^{2}	-.0223 ft/sec.^{2}

	Top of Atmosphere	Impact
System Time	82036 sec.	82570.9 sec.
Altitude	410000 ft.	
Geocentric Latitude	64.1341°	37.8627°
Longitude	157.1456°	-179.9729°
Velocity	26168.7 ft/sec.	
Azimuth	217.036°	
FPA	-1.245°	

3.8.8.2 These GTERMIN values lack some of their usual accuracy due to the insertion in the calculations of an OCV model weighing 262 lbs. more than the actual vehicle. This weight descrepancy resulted from a human error in neglecting to subtract the weight of stabilization gas, and O.A. expendables consumed during the flight. The Kodi tracking data on the OCV re-entry was fragmentary, but coupled with the Pogo data, the impact was nominal.

3.9 BUSS SUBSYSTEM

3.9.1 A BUSS experiment was performed at Rev 131 Kodi following the OCV deboost engine burn completed at 131 Pogo. The BUSS test was executed in the BRT mode with the secure command initiated at System Time 81966. Subsequent BUSS performance was nominal.

3.9.1.1 Alignment and stabilization of the OCV to the magnetic vector occurred within 20 seconds after "BUSS Gas On".

3.9.1.2 Throughout the flight, TM magnetometer readings were compared to GBUSS magnetometer predictions and the folowing average descrepancies were observed.

P Axis	-1%
Q Axis	-4%
R Axis	-5%

3.9.1.3 After BUSS execution, with the OCV aligned and stabilized to the magnetic vector, the P and Q Axis magnetometer signals indicated a normal null field condition. This implies that the TM and magnetometer control signals were accurate and that the previous error indications were primarily due to inaccuracies in the GBUSS predictions, possibly due to a higher than normal orbit altitude.

3.9.1.4 BUSS gas status following BUSS execution was observed as follows:

Execution System Time 81970	Alignment System Time 81994	Fade System Time 82179
3480 psia	1960 psia	800 psia
71°F	62°F	30°F

3.9.1.5 BUSS Execution Events at 131 Kodi:

Event	Expected Time	Actual Time
Zeke 26/23 (BRT)	81933 (V)	81935.7 (R)
KIK-Zeke 31 initiated	81966 (V)	81966.5 (R)
KIK-Zeke 31 executed (T0)		81970.0 (R)
BUSS T1	81972.0	81972.4 (R)
BUSS T2	81974.0	81974.1 (R)
BUSS T3	81976.0	81976.3 (R)
Vehicle attitude aligned to mag. vector and stabilized		81994 (R)
BUSS T4	82075.5	82075.9 (R)
BUSS T5	82078.0	82078.2 (R)

(V) Voice Report

52

SECTION 4

SATELLITE CONTROL FACILITY PERFORMANCE

4.1 GENERAL

The primary Satellite Control Facilities supporting this operation were:

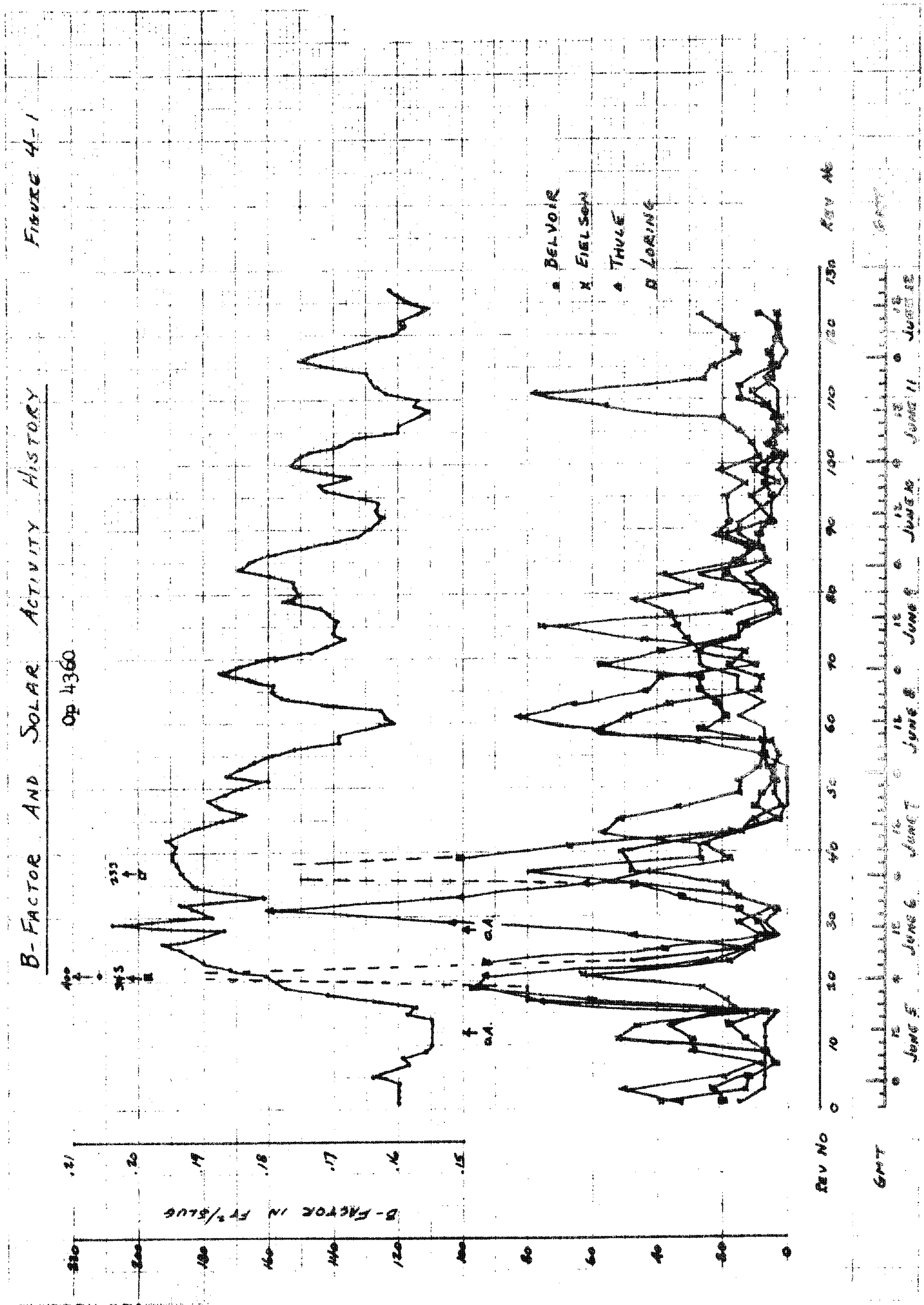
- Satellite Test Center, Sunnyvale, California
- Kodiak Tracking Station, Kodiak, Alaska
- New Boston Tracking Station, New Boston, N. H.
- Thule Tracking Station, Thule, Greenland
- Vandenberg Tracking Station, Vandenberg AFB, Calif.
- Hawaii Tracking Station, Kaena Point, Hawaii
- Guam Tracking Station
- Western Test Range Instrumentation Aircraft located downrange on-track
- Western Test Range Recovery Group (ships and aircraft)
- Air Force Recovery Support Groups (aircraft and Recovery Control Center, Hickam AFB, Hawaii)

See Reference 3 for the detailed evaluation of the SCF.

4.2 ORBIT DETERMINATION

Except for the first few fit spans, the orbit determination policy was 8 rev fit spans and 7 parameter solutions. The performance of the orbit determinations are exhibited by two types of figures. The first is the B-factor and Solar Activity History shown in Figure 4-1. The B-factors plotted were the orbit determination solutions for this parameter; the variation was from .1549 to .2040 ft^2/slug. The A_k's are values reported from four stations. Heavy solar activity was noted from Rev 18 to Rev 40. The second figure, shown in Figure 4-2 and titled "Prediction Accuracy", reflects directly the orbit determination performance. In this figure, the predicted node crossing time error associated with orbit determination solutions used in command messages were plotted. The errors are the differences of times predicted and reference node crossing times, obtained from the average of times within fit spans. From these comparisons, we note the errors to be generally less than 0.5 seconds, or 2 nautical miles in-track. A tabular listing of prediction errors for orbit determination solutions used in generating command messages is given in Table 4-1, titled "Prediction Accuracy Summary".

Two orbit adjusts were executed during this flight. Table 4-2, entitled "Orbit Adjust History", compares the planned adjusts with the actual adjusts.


B-FACTOR AND SOLAR ACTIVITY HISTORY
Op 4360
FIGURE 4-1
BELVOIR
EIELSON
THULE
LORING
B-FACTOR IN FT²/SLUG
REV NO
GMT
REV NO
O.A.
O.A.
400
345
233
JUNE 5
JUNE 6
JUNE 7
JUNE 8
JUNE 9
JUNE 10
JUNE 11

PREDICTION ACCURACY

FIGURE 4-2

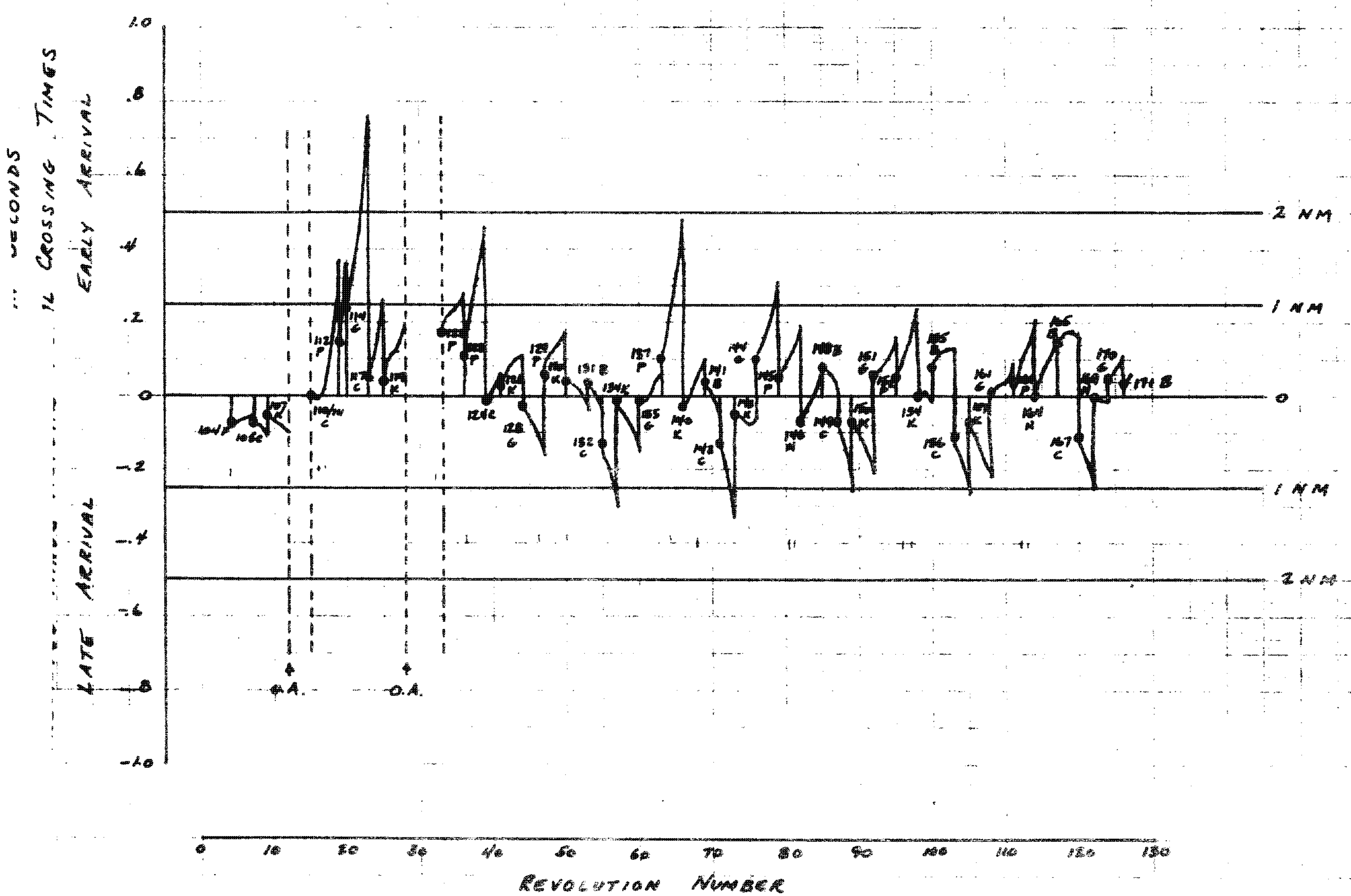


Table 4-1. Prediction Accuracy Summary

In-track errors (predicted minus actual ascending node times) versus number of ascending nodes from the end of orbit fit span.

MSG/ LOAD-REV	RUN	FIT SPAN	IN-TRACK ERROR IN SECONDS EPOCH +1	+2	+3	+4	+5	+6	+7	+8
104/4P	002	1-2	-.06	-.07	-.07	-.06	-.05	-.05	-.05	-.07
105/7C	005	1-4	-.04	-.06	-.07	-.08	-.11	-.15	-.18	.-22
107/9K	008	1-7	-.04	-.05	-.07	-.08	-.10	+.03	.42	.73
109/14B	013	3-10	.00	.00	.28	.61	.99	OA on Rev 12		
110/15P) 111/16C)	017	7-14	.00	-.01	+.02	.16	.37	.64	.96	1.36
112/19P	022	9-16	.12	-.02	+.15	.36	.63	.97	1.43	2.01
114/20G	026	14-18	.14	.24	.35	.51	.76	1.08	1.56	1.99
117/23C	033	15-22	.05	.14	.26	.43	.56	.76		
119/25K	037	17-24	.04	.11	.12	.19	-.45	-1.26	OA on Rev 28	
120/30B	041	21-28	-.71	-1.55	-2.37	-3.26	+5.85	OA on Rev 28		
122/33P	044	22-30	.12	.15	.17	.22	.24	.28	.35	.39
123/36P	049	29-33	.00	.04	.11	.23	.32	.46	.62	.83
124/39C	052	30-37	-.02	-.01	.02	.06	.12	.18	.21	.25
126/41K	056	33-39	.01	.03	.07	.10	.11	.11	.11	.12
128/44G	061	35-42	.01	-.03	-.06	-.11	-.16	-.21	-.31	-.40
129/47P	066	39-46	.06	.12	.14	.17	.21	.23	.22	.21
130/50K	067	40-47	.05	.03	.04	.03	.01	-.04	-.11	-.20
131/53B	071	42-50	.16	.06	.04	.01	-.05	-.09	-.17	-.27
132/55C	075	46-53	-.07	-.13	-.20	-.30	-.43	-.58	-.75	-.93
134/57K	079	49-56	-.01	-.05	-.09	-.15	-.20	-.23	-.28	-.27
135/60G	082	51-58	-.01	-.01	-.01	+.03	.06	.15	.24	.36
137/63P	086	54-61	.05	.10	.20	.32	.48	.69	.93	.20
140/66K	092	57-64	-.04	-.03	.00	+.05	.10	.11	.09	.09
141/69B	096	60-67	.03	.04	.00	-.08	-.15	-.25	-.35	-.47
142/71C	099	62-69	-.04	-.13	-.22	-.33	-.46	-.60	-.74	-.90
143/73K	102	64-71	-.03	-.05	-.06	-.07	-.06	-.05	-.06	-.03
144/76G	105	66-73	.03	.06	.10	.16	.22	.31	.40	.51
145/79P	108	69-76	+.01	.02	.05	.08	.12	.19	.29	.42
146/82H	113	73-80	-.07	-.07	-.04	+.01	.05	.06	.05	.03
148/85B	118	76-83	.06	.08	.06	.02	-.04	-.14	-.22	-.35
149/87C	121	78-85	-.01	-.07	-.15	-.26	-.38	-.53	-.70	-.89
150/89K	124	80-87	-.03	-.07	-.09	-.15	-.21	-.28	-.35	-.40
151/92G	127	82-89	.05	.05	.06	.07	.10	.16	.22	.30
152/95P	130	85-92	-.02	.00	.05	.09	.15	.24	.32	.39
154/98K	134	89-96	-.02	.00	+.01	-.01	.00	-.04	-.09	-.17

Table 4-1. (Continued)

In-track errors (predicted minus actual ascending node times) versus number of ascending nodes from the end of orbit fit span.

MSG/ LOAD-REV	RUN	FIT SPAN	IN-TRACK ERROR IN SECONDS EPOCH +1	+2	+3	+4	+5	+6	+7	+8
155/100B	138	92-98	.05	.08	.11	.13	.13	.12	.13	.10
156/103C	141	94-101	-.05	-.11	-.18	-.27	-.39	-.53	-.69	-.86
157/105K	144	96-103	-.05	-.07	-.11	-.17	-.22	-.29	-.37	-.42
161/108G	149	99-106	.01	.01	.03	.04	.09	.15	.19	.27
162/111P	152	101-108	-.01	-.01	.04	.10	.13	.21	.34	.45
164/114H	158	105-112	-.02	.00	+.06	.10	.15	.18	.19	.19
165/117B	161	107-114	.07	.11	.15	.17	.18	.16	.14	.13
167/120C	164	111-118	-.05	-.11	-.18	-.25	-.35	-.44	-.56	-.66
169/122H	167	113-120	.00	.00	-.01	-.01	-.01	.01	.01	
170/124G	171	115-122	.02	.05	.07	.11	.13			
171/126B	175	117-124	.00	.04	.06					

57

Table 4-2. Orbit Adjust History

No.	Rev	Time	Duration (sec)	Thrust (lbs)		Velocity (fps)	
				Planned	Actual	Planned	Actual
1	12	6/5/67 12h 6m 39.40s	91.505	96.000	96.846[1]	-59.199	-59.721
2	28	6/6/67 11h 44m 38.96s	269.812	96.000	96.748[2]	177.329	178.711

1 Solved from fit 7-14, along with the six orbit parameters; fixed B of .1549.

2 Solved from fit 22-30 without Guam Rev 29 data. Six orbit parameters and B (.1888) also solved from fit.

SECTION 5

REFERENCES

1. System Test Objectives for Program 206, Aerospace Corporation Report No. TOR-269(4123)-19 dated 27 February 1964 (basic); TWX Program 206 Operational Data for Flight No. 38, cite [redacted]-0/00136, dated 2 May 1967, and Addenda 1 and 2.

2. Final Launch Report for Program 206, Aerospace Corporation Report No. TOR-1001(2101-01)-20, dated 4 June 1967.

3. SCF Operations Evaluation Report to be prepared by Det. #1, Hq AFSCF and published 10 days after termination of operations.

5 4

APPENDIX A

(Prepared by General Electric Company, Special Military Space Project)

CONTENTS

APPENDIX A

VEHICLE STATUS AT LIFT-OFF

6-Minute Timer	337 ±15 sec.
12-Minute Timer	690 ±31 sec.
Clock Drift	17.3 msec/day Fast
Pressure Switch Settings	1025/750 psia
Recorder Loop	236.2 sec. 3.97 (ratio)
Recorder Count	0
Secure Word Count	10
Stab. Cold Gas Pressure: Hi Thrust Tank	4600 psia
Low Thrust Tank	4600 psia
Stab. Cold Gas Temperature: Hi Thrust Tank	102°F
Lo Thrust Tank	102°F
Stab. Cold Gas Weight	253 lbs.
Impulse Available	9945 lb/sec.
GN_2 Pressure	4700 psia
Oxidizer Weight	186.5 lbs.
Fuel Weight	130.4 lbs.
BUSS Gas Pressure	3480 psia
BUSS Gas Temperature	70°F
Amp. Hrs. used Prior L.O.	97.8 A.H.
Amp. Hrs. Available for Flight	2974.9 A.H.
OCV Bus Voltage	30.9 volts
Terminal Battery Voltage	31.1 volts
Battery Temperatures	67-73°F
Sun Incidence Angle	+27.7 deg. (decreasing 1°/day)
Fly Reverse Limitation	3 Revs
SV Weight	4814.8 lbs.

APPENDIX A

COMMAND ACTIVITY SUMMARY

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
0			103	99E	99E	99E	99E	X		
1	Pogo	Sierra 14						X		
		Sierra 9						X		
	Hula	Sierra 9						X		
2	Pogo		102				69E	X		1 Block Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
	Kodi	Sierra 9						X		
3	Pogo	Zeke 26/21						X		
		Sierra 9						X		
	Kodi	Sierra 9						X		
4	Pogo		104	96E	72E	94E	11E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
	Guam	Zeke 26/21						X		
5	Boss	Sierra 14						X		
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
6										No Contacts
7	Cook		105	96E	87E	85E	86E	X		4 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
	Kodi									No Commanding
8	Cook	Zeke 26/21						X		
	Kodi	Sierra 14						X		
		Sierra 9						X		
9	Hula									No Commanding
	Kodi		107	99E	99E	97E	95E	X		4 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
10	Hula	Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
11										No Contacts
12	Guam		108						X	Constant rejects experienced during Auto Sierra commanding due to ground station problem, 125 enabled and message loaded normally.
			108			97E		X		1 Block Green
		Restricted/								
		Sierra 5							X	
		Zeke 26/21						X		
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
13										No Contacts
14	Boss		109	94E	90E	84E	50E	X		Verification alarms on Blocks 2 (DL1) and 3 (DL2). Blocks 3 (DL2) and 4 (DL3) loaded with the 125. 2 Blocks Auto Sierra, 2 Blocks Green. Ref. Command Subsystem Section 3.2.2.
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
15	Pogo		110	94E	94E	55E	48E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
16	Pogo									No Commanding
	Cook		111	77E	81E	15E	41E	X		4 Blocks Auto Sierra
		Zeke 26/21						X		
		Restricted/								
		Sierra 6						X		
		Sierra 9						X		
17	Pogo	Sierra 14						X		
		Sierra 9						X		
18	Pogo									No Commanding
	Kodi	Zeke 26/21						X		
	Hula									No Commanding
19	Pogo		112	96E	87E	94E	76E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
	Kodi	Zeke 26/21						X		
20	Guam		114	98E	84E	54E	79E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9							X	Near Fade
		Sierra 9							X	Near Fade
		Sierra 9							X	After Fade
21	Boss	Zeke 26/21						X		
22	Boss		116						X	Continuous rejects
			Green/							while attempting to
			116						X	command the vehicle
			944/							were due to a ground
			(Blk 1)						X	station equipment
		Sierra 9							X	malfunction. Ref.
		Sierra 17							X	Command Subsystem
		Sierra 17							X	Section 3.2.4.
23	Cook		117	87E	95E	79E	96E	X		4 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
24	Cook	Zeke 26/21						X		
25	Kodi		118	96E	94E	96E	80E	X		4 Blocks Green
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		

REV	STA.	RTC & ZEKE	MSG NO.	DL1	DL2	DL3	DL4	VERIFIED YES	NO	REMARKS
26	Hula	Zeke 26/21						X		
27										No Contacts
28	Guam		119	98E	89E		80E	X		3 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
29	Guam	Zeke 26/21						X		
30	Boss		120	99E	54E	42E	52E	X		4 Blocks Green
		Green 14						X		
		Green 9						X		
31	Pogo		121	93E	58E	48E	45E	X		4 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
	Boss									No Commanding
32	Pogo									No Commanding
	Cook									No Commanding
33	Pogo	Sierra 14						X		
			122	93E	83E	75E	51E	X		4 Blocks Auto Sierra
		Sierra 9						X		
34	Pogo									No Commanding
	Kodi	Sierra 14						X		
		Sierra 9						X		
	Hula									No Commanding
35	Pogo	Zeke 26/21						X		
	Kodi	Zeke 26/21						X		
36	Pogo		123	94E	97E	65E	64E	X		4 Blocks Auto Sierra
		Sierra 9						X		
	Guam									No Commanding
37	Boss	Sierra 14						X		
		Sierra 9						X		
	Pogo	Zeke 26/21						X		
38	Boss	Zeke 26/21						X		

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
39	Cook		124	99E	95E	80E	74E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
	Kodi	Zeke 26/21						X		
40	Cook	Zeke 26/21						X		
	Kodi	Green 14						X		
		Zeke 26/21						X		
		Sierra 9						X		
41	Kodi		126	96E	90E	99E	48E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
42	Hula	Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
43										No Contacts
44	Guam		128	83E	93E	74E	43E	X		4 Blocks Auto Sierra
		Zeke 26/21						X		
		Sierra 9						X		
45	Guam	Sierra 14							X	Verification Alarm (poor lock)
		Sierra 14						X		Ref. Command Sub-system Section 3.2.2.1.2
		Restricted/ Sierra 5							X	Reject (poor lock)
		Restricted/ Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
46	Boss	Zeke 26/21						X		
47	Pogo		129	96E	71E	88E	88E	X		4 Blocks Auto Sierra
		Sierra 14							X	Bravo fade at time of
		Sierra 14							X	of first transmis-
		Sierra 14							X	sion.
48	Pogo	Sierra 9						X		
	Cook									No Commanding
49	Pogo	Zeke 26/21						X		
50	Kodi		130	98E	92E	71E	65E	X		4 Blocks Auto Sierra
		Sierra 9						X		

REV	STA.	RTC & ZEKE	MSG NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
51	Pogo	Sierra 14						X		
		Sierra 9						X		
52	Pogo									No Commanding
53	Boss		131	99E	95E	63E	86E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Zeke 26/21						X		
		Sierra 9						X		
54	Boss	Sierra 14						X		
		Sierra 9						X		
55	Cook		132	97E	96E	89E	92E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
56	Cook	Sierra 14						X		
		Zeke 26/21						X		
		Sierra 9						X		
57	Kdoi		134	92E	84E	90E	72E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
58	Hula	Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
59										No Contacts
60	Guam		135	96E	98E	50E	19E	X		4 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
61	Guam	Sierra 9						X		
62	Boss	Zeke 26/21						X		
63	Pogo		137	93E	80E	46E	41E	X		4 Blocks Green
		Sierra 14						X		
		Sierra 9						X		

REV	STA.	RTC & ZEKE	MSG NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
64	Pogo	Green 9						X		
	Cook	Zeke 26/21						X		
65	Pogo	Zeke 26/21						X		
66			140	96E	99E	54E	15E	X		
		Sierra 14						X		
		Sierra 9						X		
67	Pogo	Sierra 9						X		
68	Pogo	Zeke 26/21						X		
	Guam									No Commanding
69	Boss		141	98E	89E	59E	88E	X		Verification alarm Block 2 (DL2). Ref. Command Sub-system Section 3.2.2
		Sierra 14						X		4 Blocks Auto Sierra
		Zeke 26/21						X		
		Sierra 9						X		
70	Boss	Sierra 14						X		
		Sierra 9						X		
71	Cook		142	95E	92E	87E	91E	X		Block 3 Reject Word Count 61, Reset and Trans, Block completed normally. 4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
72	Kodi	Sierra 14						X		
		Sierra 9						X		
73	Kodi		143	99E	97E	92E	81E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Zeke 26/21						X		
		Sierra 9						X		
74	Hula	Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
75										No Contacts

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	NO	REMARKS
76	Guam		144	97E	99E	90E	48E	X		
		Sierra 9						X		
		Zeke 26/21						X		
77	Guam	Zeke 26/21						X		
78	Boss	Zeke 26/21						X		
79	Pogo		145	97E	99E	61E	53E	X		
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9							X	Verification alarm (Bravo Fading). Ref. Command Sub-system Section 3.2.2.1.2
		Sierra 9						X		
80	Pogo	Sierra 9						X		
	Cook	Zeke 26/21						X		
81	Pogo									No Commanding
82	Hula		146	85E	90E	81E	93E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
83	Pogo	Sierra 14						X		
		Sierra 9						X		
84	Pogo	Zeke 26/21						X		
85	Boss		148	94E	86E	54E	78E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
86	Boss	Sierra 14						X		
		Sierra 9						X		
87	Cook		149	99E	99E	97E	91E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
88	Kodi	Sierra 14						X		
		Zeke 26/21						X		
		Sierra 9						X		
89	Kodi		150	98E	99E	97E	95E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
90	Hula	Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
91										No Contacts
92	Guam		151	88E	96E	89E	76E	X		4 Blocks Auto Sierra
		Sierra 9						X		
		Zeke 26/21						X		
93	Guam	Zeke 26/21						X		
94	Boss	Zeke 26/21						X		
95	Pogo		152	96E	96E	63E	55E	X		4 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9							X	Sierra 9 sent continuous at Fade with verification alarms. Ref. Command Subsystem Section 3.2.2.1.2
96	Pogo	Sierra 9						X		
	Cook	Zeke 26/21						X		
97	Pogo	Zeke 26/21						X		
98	Kodi		154	81E	91E	75E	72E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
99	Pogo	Sierra 14						X		
		Sierra 9						X		
100	Pogo	Zeke 26/21						X		
101	Boss		155	91E	88E	53E	64E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
102	Boss	Zeke 26/21						X		
		Sierra 9						X		

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
103	Cook		156	98E	97E	96E	91E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
104	Kodi	Sierra 14						X		
		Zeke 26/21						X		
		Sierra 9						X		
105	Kodi		157	88E	99E	99E	97E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
106	Hula	Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 14						X		
		Sierra 9						X		
107										No Contacts
108	Guam		161	99E	99E	96E	81E	X		4 Blocks Auto Sierra
		Zeke 26/21						X		
		Sierra 9						X		
109	Guam	Zeke 26/21						X		
110	Boss	Zeke 26/21						X		
111	Pogo		162	99E	98E	23E	60E	X		Heavy countdown and RFI resulted in verification alarms during transmission at Block 1 (DL4). 4 Blocks Auto Sierra - Ref. Command Subsystem Section 3.2.2.1.2
		Sierra 9						X		
		Zeke 26/21						X		
112	Pogo	Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
	Cook	Zeke 26/21						X		
113	Pogo									No Commanding

REV	STA.	RTC & ZEKE	MSG. NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
114	Hula		164	69E	99E	65E	70E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
115	Pogo	Sierra 14						X		
		Sierra 9						X		
116	Pogo	Zeke 26/21						X		
117	Boss		165	82E	69E	97E	66E	X		Verification alarm Block 2. 4 Blocks Auto Sierra - Ref. Command Subsystem Section 3.2.2.1.1
		Sierra 14						X		
		Zeke 26/21						X		
		Sierra 9						X		
118	Boss	Sierra 13						X		
		Sierra 9						X		
119	Cook	Zeke 26/21						X		
120	Cook		167	89E	98E	93E	97E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Sierra 9						X		
121	Kodi	Sierra 8							X	Verification Alarm Ref. Command Sub-System Section 3.2.2.1.3
		Sierra 8						X		
		Zeke 26/21						X		
		Sierra 7						X		
		Sierra 9						X		
122	Hula		169	99E	98E	86E	63E	X		4 Blocks Auto Sierra
		Sierra 14						X		
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
123										No Contacts
124	Guam		170	99E	74E	96E	94E	X		4 Blocks Auto Sierra
		Zeke 26/21						X		
		Sierra 9						X		
125	Guam									No Commanding

72

REV	STA.	RTC & ZEKE	MSG NO.	DL1	DL2	DL3	DL4	VERIFIED YES	VERIFIED NO	REMARKS
126	Boss		171	98E	97E			X		2 Blocks Auto Sierra
		Restricted/								
		Sierra 5						X		
		Sierra 10						X		
		Sierra 9						X		
127	Pogo	Sierra 9						X		
	Boss									No Commanding
128	Pogo		173	80E	82E			X		2 Blocks Auto Sierra
	Cook									No Commanding
129	Pogo									No Commanding
130	Pogo	Zeke 26/23						X		
	Kodi									No Commanding
	Hula		175	21E	11E			X		2 Blocks Auto Sierra
131	Pogo	KIK-Zeke 32						X		
		Green 13						X		
		Green 14						X		
		Green 9						X		
	Kodi	Zeke 26/23						X		
		KIK-Zeke 31						X		
		Zeke 26/23							X	
		KIK-Zeke 32						X		
			966						X	Not completely verified due to low elevation during OCV deboost
		Sierra 17							X	Spoof

APPENDIX I

PROGRAM 2(

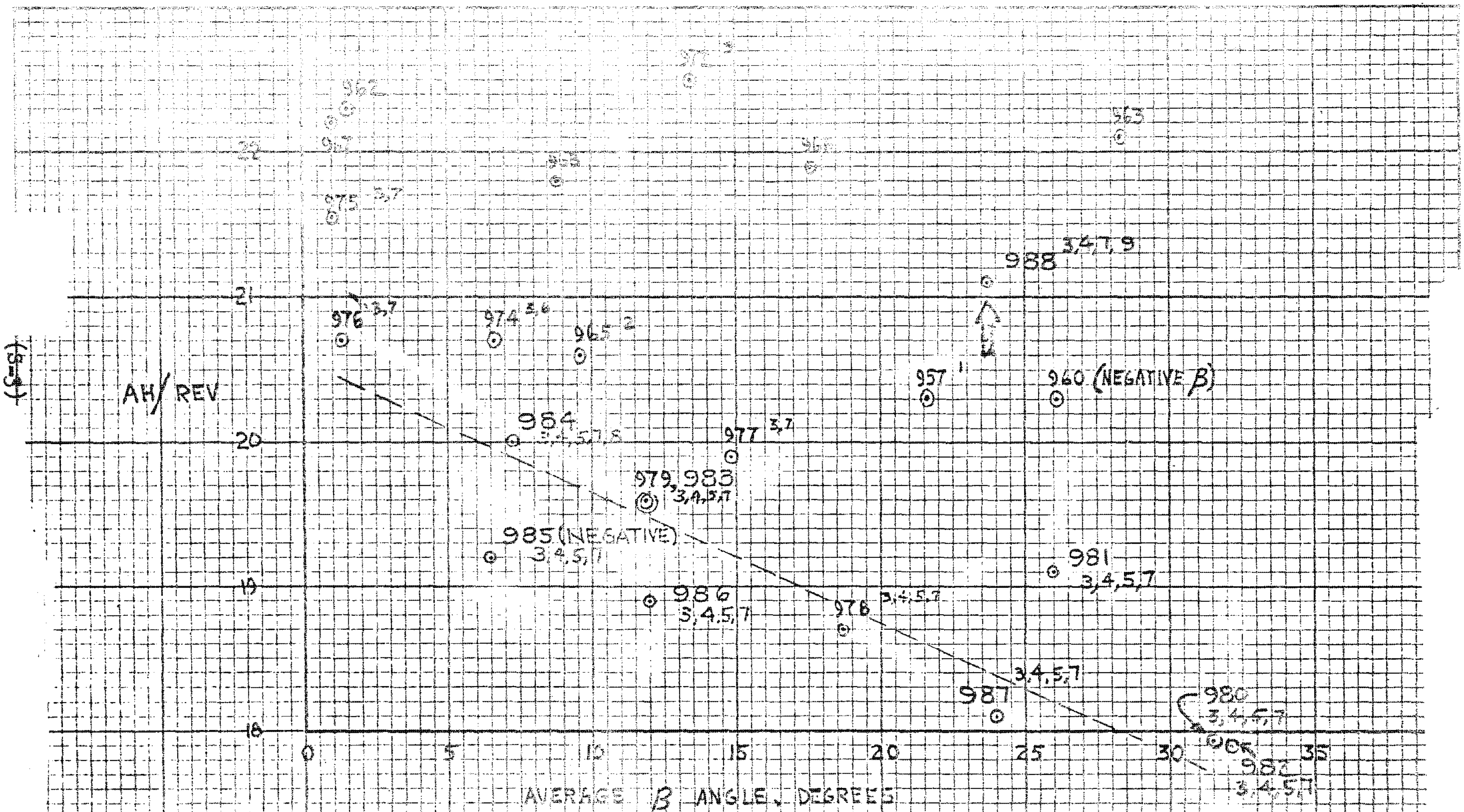
ORBITAL OPERATION SUMMARY

OCV NO.	OPS NO.	LAUNCH DATE	INCLINATION ANGLE	BETA ANGLE	RECOVERY REV.	OCV DEBOOST REV.	COMMENTS
951		7/12/63	95.4°	-9°	18	---	BUSS
952		9/06/63	94.4°	+11°	34	---	Agena
953		10/25/63	99.1°	+23°	34	65	Agena, EP-(53)
954		12/18/63	97.9°	-15°	34	---	BUSS
955		2/25/64	95.6°	+20°	34	83	EP-(37)
956		3/11/64	95.7°	+2°	51	83	
957		4/23/64	103.5°	+24°	66	81	
958		5/19/64	101.1°	+13°	34	---	Bad Injection
959	3684	7/06/64	93.1°	+17°	34	34	BUSS
960	3802	8/14/64	95.5°	-26°	66	---	BUSS, EP-(46)
961	4035	10/07/64	---	---	---	---	Not Injected
962	4262	9/23/64	92.9°	0°	67	---	EP-(68)
963	4384	10/23/64	95.5°	+28°	---	82	No RV Deorbit
964	4439	12/04/64	97.0°	+19°	18	18	BUSS
965	4703	1/23/65	102.5°	+12°	64		
966	4920	3/12/65	107.5°	+22°	67	81	EP-(64-68,79)
967	4983	4/28/65	95.5°	+0.5°	83	84	
968	5236	5/27/65	95.5°	+8°	83	84	EP-(81)
969	5501	6/25/65	105°	+11°	18	---	BUSS
970	5810	7/12/65	---	---	---	---	Not Injected
971	5698	8/03/65	107.5°	+18°	67	67	BUSS, EP-(52-63)
972	6004	9/30/65	95.5°	+13°	67	77	EP-(74)
973	6232	11/08/65	94.0°	+14°	18	18	BUSS
974	7253	1/19/66	93.9°	+6°	83	99	
975	1184	2/15/66	96.5°	+2.5°	83	99	
976	0879	3/18/66	101.0°	+4°	99	100	Non-nominal inj.
977	0910	4/19/66	117°	+25°	98	111	EP-(98)
978	1950	5/14/66	110.6°	+25°	99	114	
979	1577	6/03/66	87°	+7°	99	100	
980	1850	7/12/66	95.5°	+30.5°	131	131	LLCB & BRTNG
981	1832	8/16/66	93.25°	+24.5°	130	131	EP-(124)
982	1686	9/16/66	94°	+31.5°	115	116	EP-(111)
983	2055	10/12/66	90.97°	+9°	131	132	EP-(126.6)
984	2070	11/02/66	90.97°	-8.5°	115	116	EP-(44,92,109)
985	1890	12/05/66	104.64°	-3°	131	132	EP-(125)
986	4399	2/02/67	102.9°	+15.5°	131	---	BUSS
987	4321	5/22/67	91.5°	+21°	131	132	EP-(127.2)
988	4360	6/04/67	105°	+27.7°	130	131	EP-(127.4)

BATTER

S/V No	AMPERE HOURS				USE RATES, AH/REV			
	AVE.CAP NX	PAD USE	AVAILABLE FLIGHT	TOTAL USED	0-10	10-SEP	SOLO	OVERALL
951		228.8		1410.0				19.8
2		157.3		1280.0				
3		160.0		1390.0				18.9
4		233.0		610.0				
5		100.0		1520.0		19.7	15.4	17.1
6		93.6		1740.0	18.0	20.7	19.0	20.1
7		84.0		1704.0	20.3	20.3	18.7	20.0
8		94.7		964.7	21.0			21.2
9		78.0		816.0	20.0	22.0		21.7
960	2025.5	99.0	1870.0	1419.0	20.0	20.3		20.3
1								
2	2028.0	131.0	1784.5	1721.0	18.0	22.3	14.3	21.2
3	2025.5	85.2	1925.3	1825.0	20.0	22.1	19.4	21.2
4		97.0	1914.0	487.0				
5	2041.5	70.0	1879.0	1740.0	18.0	20.6	18.7	20.1
6		101.5	1863.7	1811.5	20.0	21.9	20.0	21.1
7	2191.0	83.4	2027.1	1913.4	19.0	22.2		21.8
8	2090.5	67.9	1900.8	1857.9	20.0	21.8		21.6
9	2086.0	132.4	1883.4	262.4				
970	2069.0	66.3	1962.1					
1	2086.5	80.2	1953.7	759.6				
2	2131.0	280.6	1796.8	1960.3	21.0	22.5	19.0	21.8
3	2017.5	86.3	1831.9	506.3	20.0			23.3
4	2491.8	81.6	2283.7	2071.6	19.0	20.7	18.1	20.1
5	2488.8	115.0	2146.0	2185.0	18.0	21.65	19.4	20.9
6	2466.0	72.0	2214.8	2122.0	19.0	20.7		20.5
7	2479.0	73.0	2177.0	2203.0	18.9	19.9	14.6	19.2
8	2400.0	68.8	2168.3	2128.8	16.7	18.7	16.0	18.1
9	2510.0	67.4	2213.7	1987.4	18.0	19.6		19.4
980	3217.6	65.7	2785	2406	18.0	17.93	0	17.94
1	3188.9	65.2	2814.7	2535.2	17.0	19.1		18.9
2	3192.0	162.1	2783.7	2232.1	17.0	17.9		17.8
			2438 (after loss Batt. #3 at Rev 12)					
3	3265.6	59.7	3081.3	2605	17.5	19.5		19.3
4	3254.4	63.7	2918	2233.7	18.0	18.9		18.7
5	3187.5	113.7	2814.3	2603.7	17.0	19.1	0	18.9
986	3165.6	66.6	2917.8	3106.6	18.0	18.9	20.0	19.0
7	3224.8	103	2859	2483	17.0	18.1	--	18.0
8	3259.2	97.8	2974.9	2837.8	18.0	21.1	--	20.9

A



AH/REV vs AVERAGE β ANGLE (REV 10 TO RV SEPARATION)

(1) FLY-LOW EXPERIMENT
(2) HEATER ANOMALY
(3) -64° ROLL ATTITUDE
(4) MINIMUM STATION CONTACTS
(5) TARS EF ACPS OPTIMIZED
(6) A3 CONIC T/M XMITTER
(7) 21, 22 CONIC T/M XMITTERS
(8) REV 10-44
(9) HIGH STABILIZATION AV

(5-3)

APPENDIX A

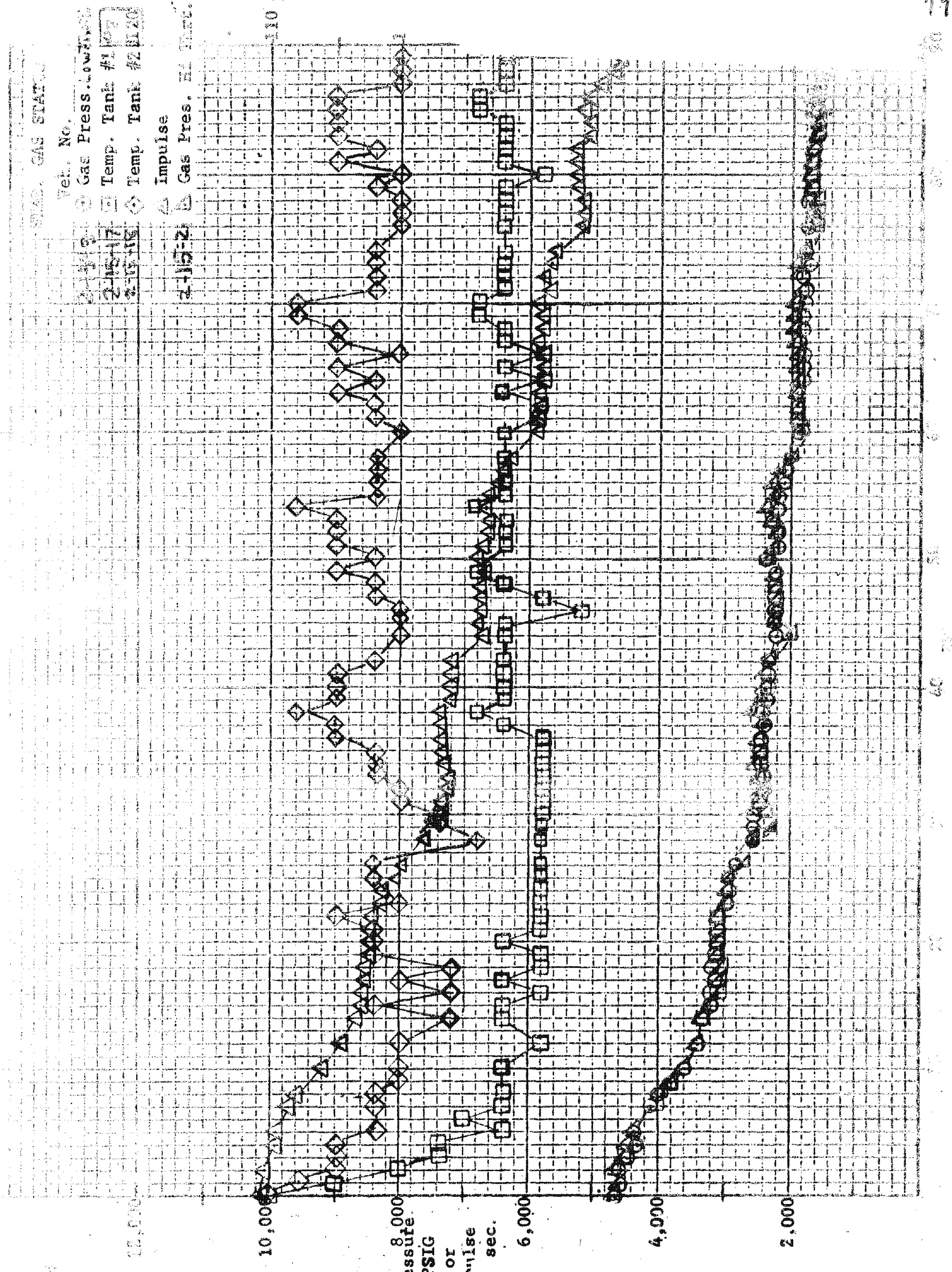
ORBITAL REAL TIME DATA PLOTS

NOTE: Data used to plot the ambient data curves has been obtained from real time data over a number of tracking stations at different locations in the orbital cycle. Therefore, variations will indicate an uncorrelated scatter in the data points.

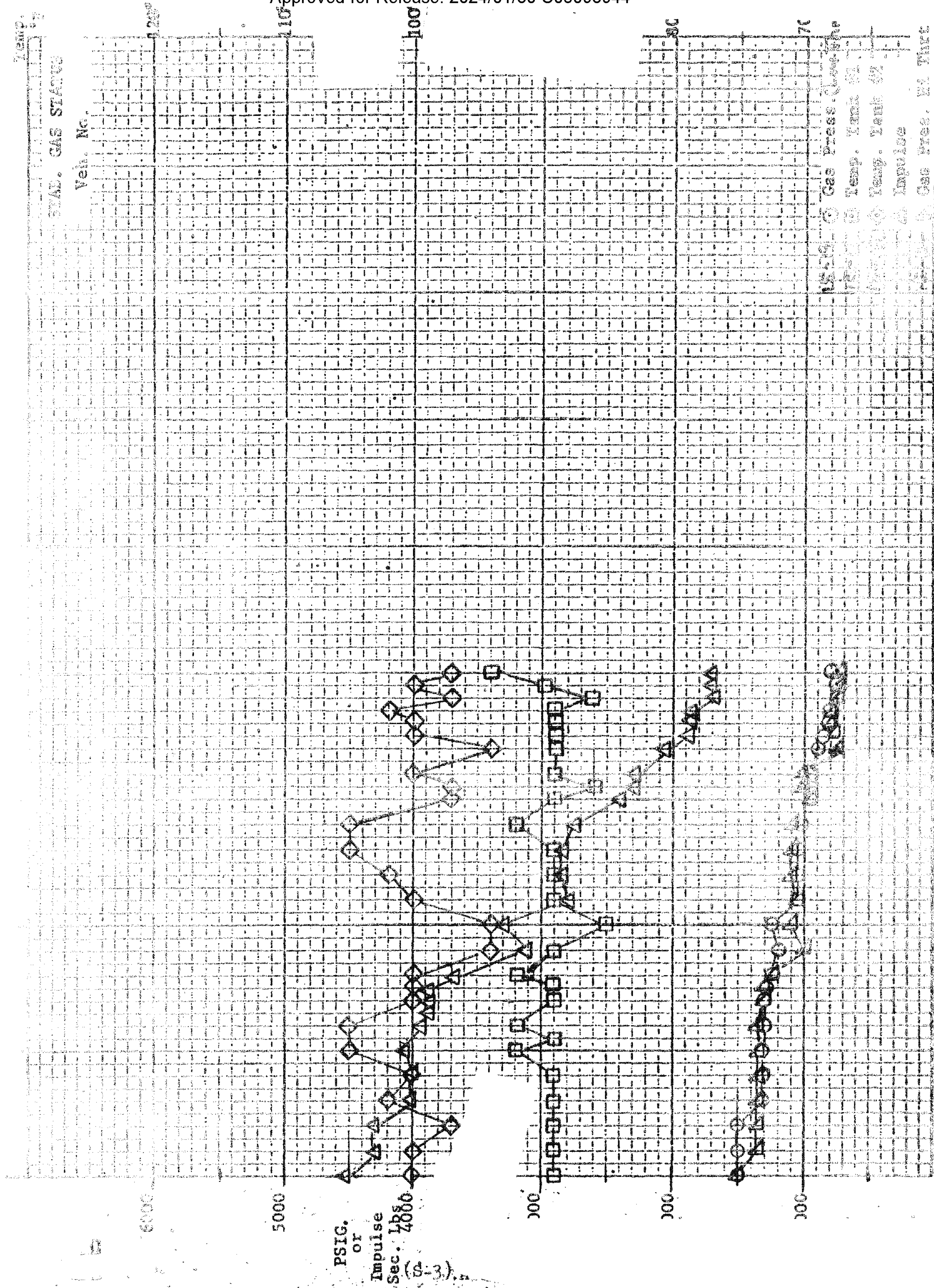
ORBITAL REAL-TIME GRAPHS

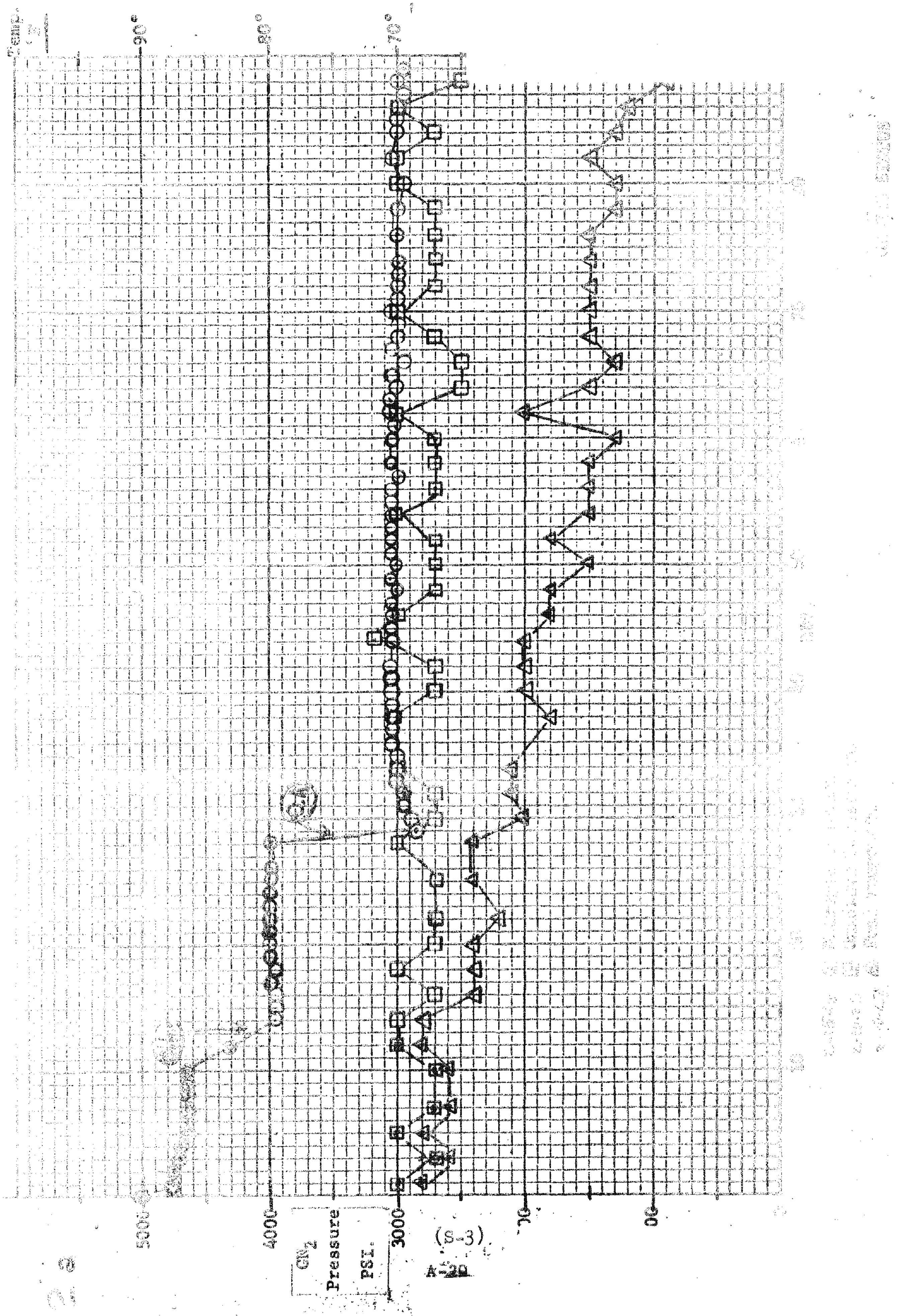
Graph Number	Title	Parameter	Telemetry Reference No. L-C-P
1	Stabilization Gas Status	Pressure Cold Gas Low Thrust Tank	2-15-19
		Temp. Cold Gas Tank #1	2-15-17
		Temp. Cold Gas Tank #2	2-15-18
		Impulse	
		Pressure Cold Gas High Thrust Tank	2-15-21
2	Orbit Adjust Gas Status	Pressure Nitrogen	2-15-16
		Temp. Oxidizer	2-10-26
		Temp. Fuel	2-10-27
3	BUSS Gas Status	Pressure BUSS Gas	3-13-10
		Temp. BUSS Gas	3-13-11
4	Subsystem Current	Amps, Command S/S	2-12-14
		Amps, Stabilization S/S	2-14-18
		Amps, BUSS S/S	2-16-14
5	BUSS Magnetometer Error	Pitch (Actual-Predicted)	2-16-19
		Yaw (Actual-Predicted)	2-16-20
		Roll (Actual-Predicted)	2-16-21
6	TARS Equipment Temperature	Temp. Roll Platform	2-10-32
		Temp. Pitch Platform	2-10-33
		Temp. Yaw Platform	2-10-34
7	TARS & RAGS Equipment Temperature	Temp., RAGS Gyro Block	2-10-38
		Temp., TARS Elect. Interior	2-10-35
8	Section 5 Heater Temperature	Temp., 84/180°	2-10-61
		Temp., 104/15°	2-10-62
		Temp., 104/90°	2-10-63
		Temp., 104/270°	2-10-65
9	Structure Temperature	Temp., Vehicle Structure Sta. 127/180°	2-10-58
		Temp., Outside Insulation	2-10-60
		Temp., Adapter Structure	2-10-73
10	Capsule Temperature	Temp., Recovery Battery	2-10-79
		Temp., Piggyback #6	2-10-74
		Temp., Thrust Cone	2-10-77
		Temp., Capsule	2-10-78
11	Command Decoder	Temp., PG/CD Plate	2-10-59
		Temp., 6 VDC Power	2-10-48

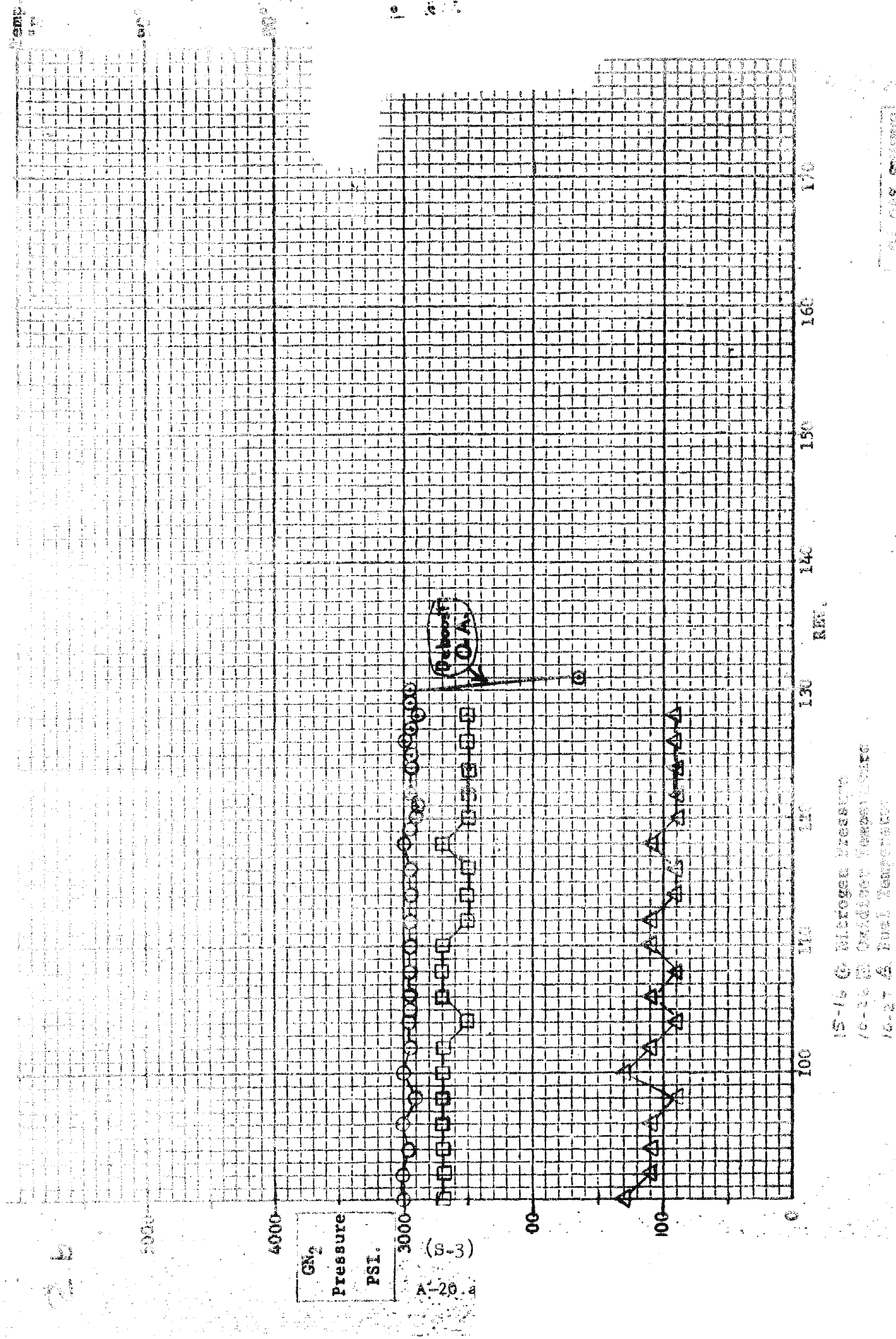
Graph Number	Title	Parameter	Telemetry Reference No. 1-C-P
12	Miscellaneous Component Temperature	Temp., Delta III Transmitter	2-10-75
		Temp., S-Band Beacon	2-16-25
		Temp., Recorder	2-10-76
13	OCV Battery Temperature	Temp., Battery 1	2-10-81
		Temp., Battery 4	2-10-84
		Temp., Battery 5	2-10-85
		Temp., Battery 7	2-10-87
14	OCV Battery Temperature	Temp., Battery 6	2-10-86
		Temp., Battery 2	2-10-82
		Temp., Battery 3	2-10-83
		Temp., Battery 8	2-10-88
15	Battery Voltage	Volts, OCV Battery	2-16-01
		Volts, Back-up Battery	2-16-02
16	Battery Percentage Load	Amps, Battery 1	2-16-06
		Amps, Battery 4	2-16-09
		Amps, Battery 5	2-16-10
		Amps, Battery 7	2-16-12
17	Battery Percentage Load	Amps, Battery 6	2-16-11
		Amps, Battery 2	2-16-07
		Amps, Battery 3	2-16-08
		Amps, Battery 8	2-16-13
18	OCV Battery Amp. Hrs.	Amp. Hrs., Battery 1	
		Amp. Hrs., Battery 4	
		Amp. Hrs., Battery 5	
		Amp. Hrs., Battery 7	
19	OCV Battery Amp. Hrs.	Amp. Hrs., Battery 6	
		Amp. Hrs., Battery 2	
		Amp. Hrs., Battery 3	
		Amp. Hrs., Battery 8	
20	Total Amp. Hrs.	Amp. Hrs., All OCV Batteries	
21	Roll Solenoid Temp.	Temp. -High Roll Solenoid QI	3-13-12
		Temp. -High Roll Solenoid QI7	3-13-13
		Temp. -High Roll Solenoid QI7	3-13-14

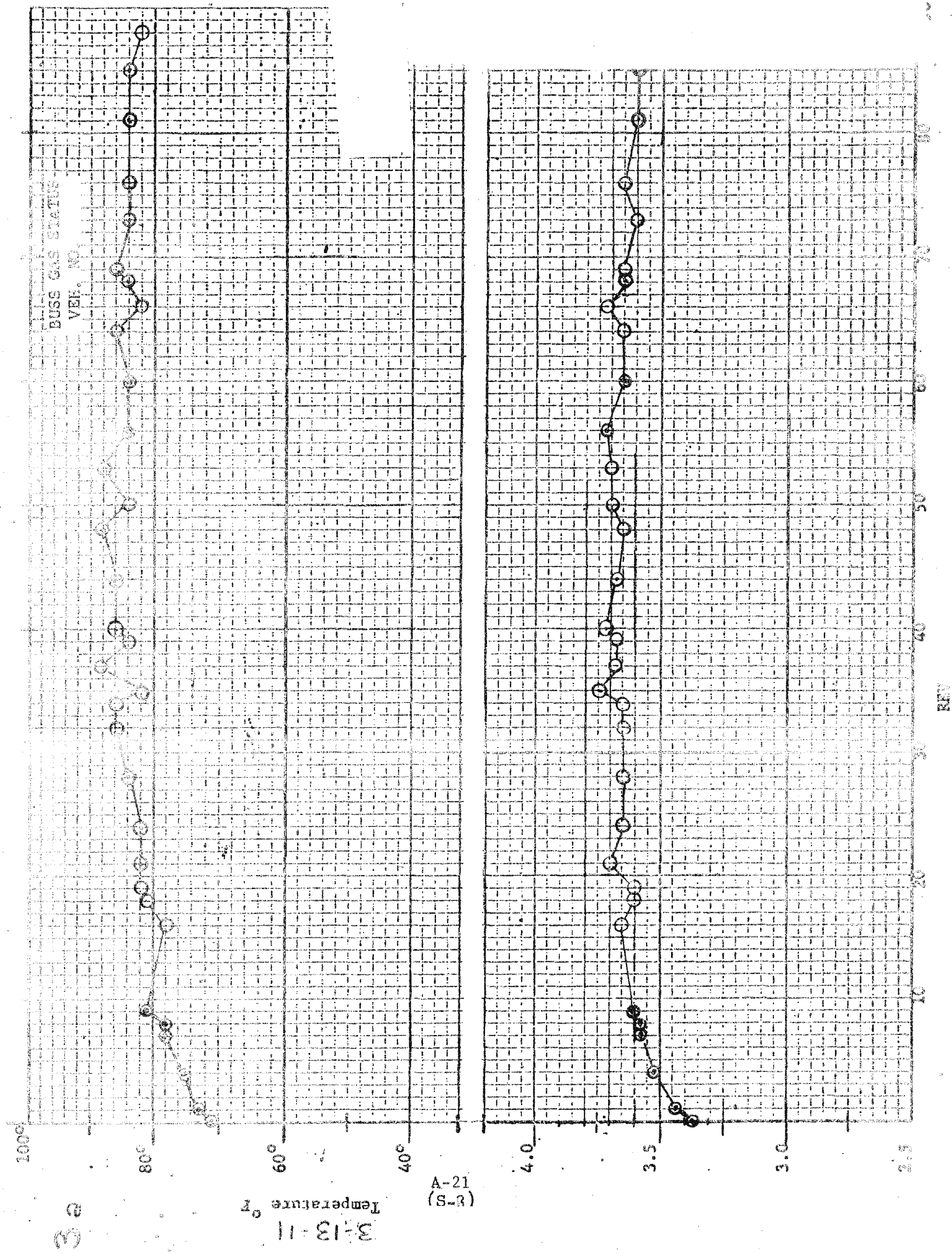

Veh. No.
Impulse
10,000
8,000
6,000
4,000
2,000
Pressure
PSIG
or
Impulse
sec.

(S-3)


Temp.
Veh. No.
100°
110°
5000
4000
PSIG. or Impulse Sec. Lbs.
(S-3)

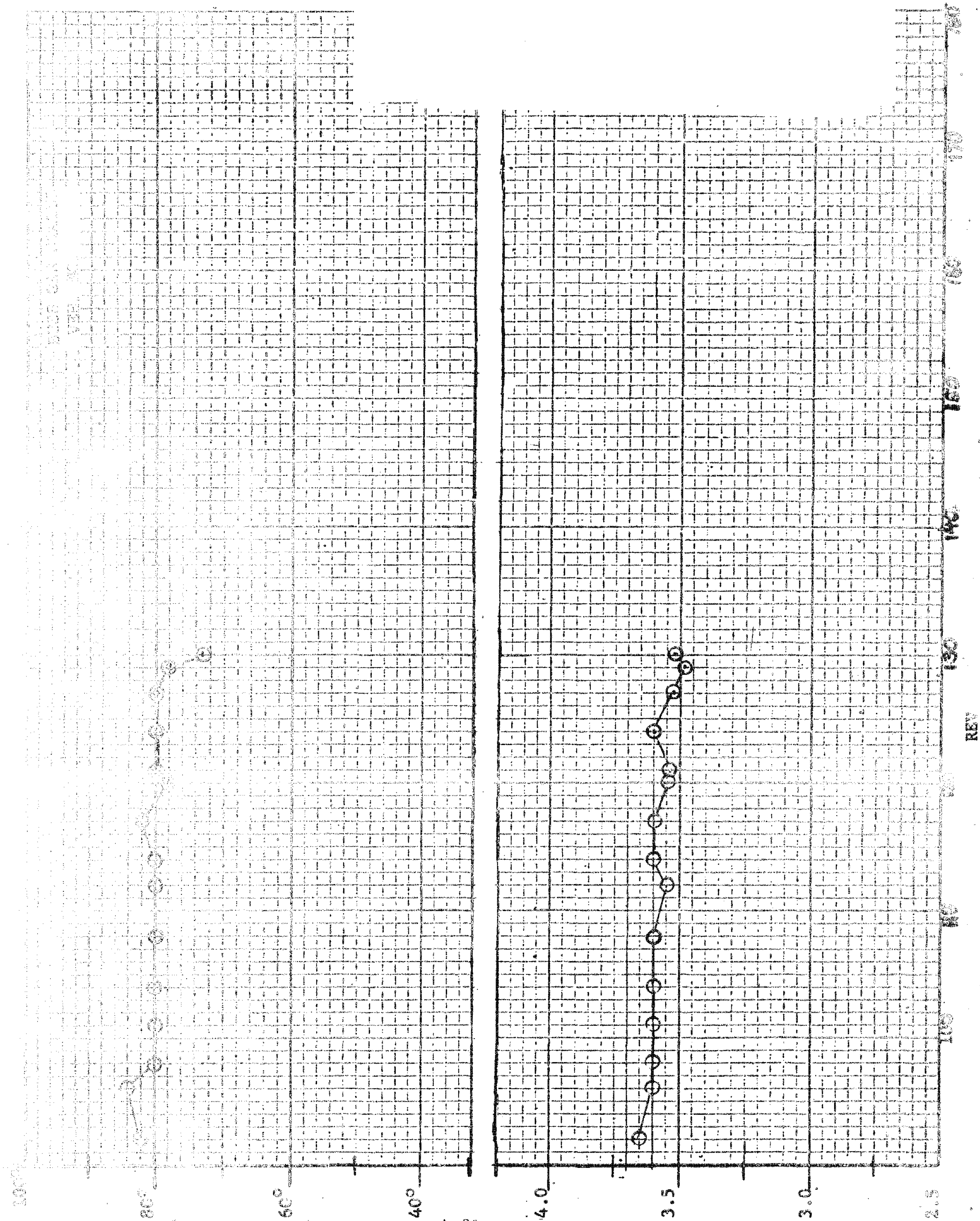

Temp.
90°
80°
70°
5000
4000
3000
GN_2 Pressure PSI.
(S-3)
A-29


GN2 Pressure PSI.
4000
3000
00
100
0
100
110
120
130
140
150
160
170
REV.
Dubois
(S-3)
A-20.a
Nitrogen Pressure
Oxidizer Temperature
Fuel Temperature



A-21
(S-3)

84

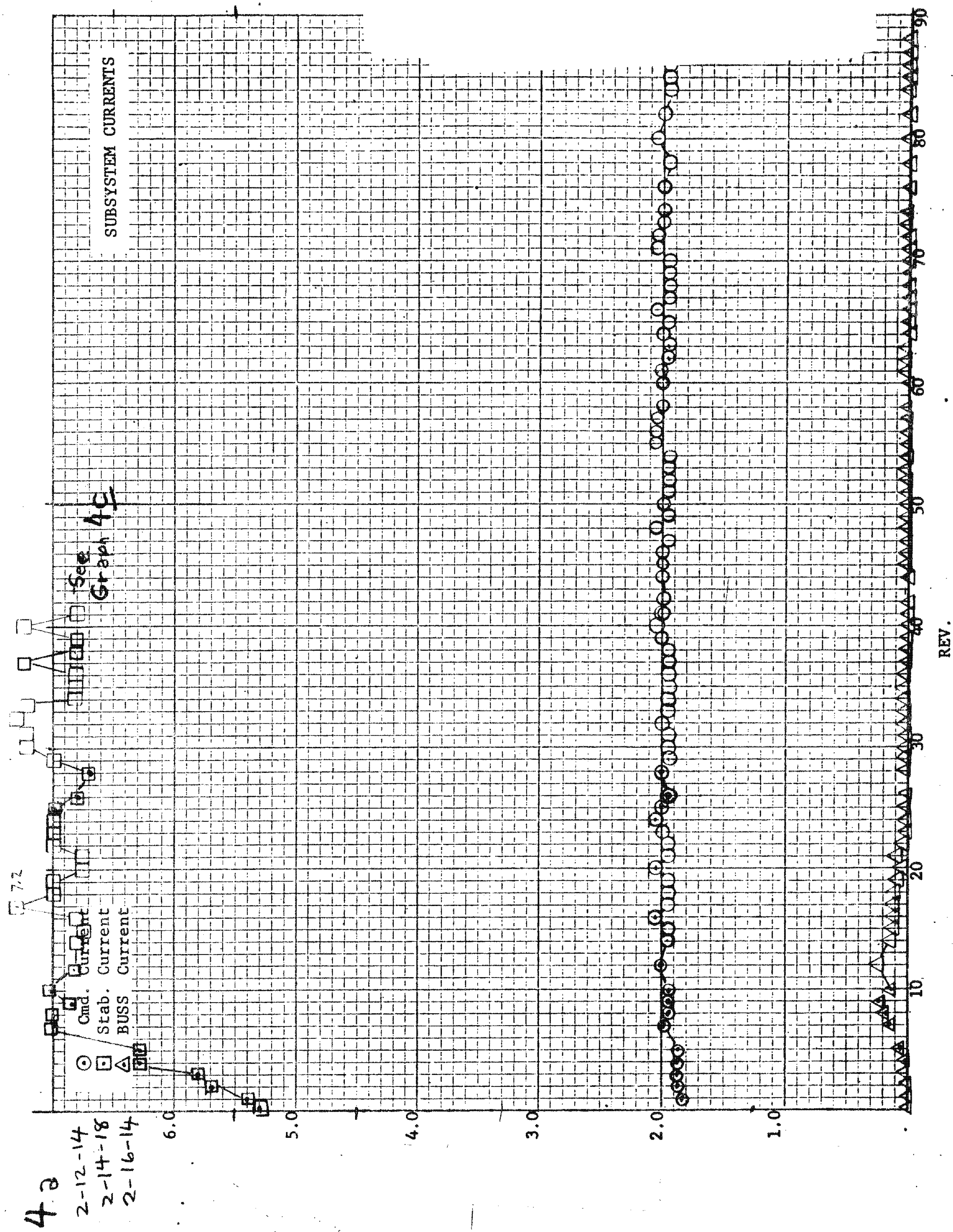


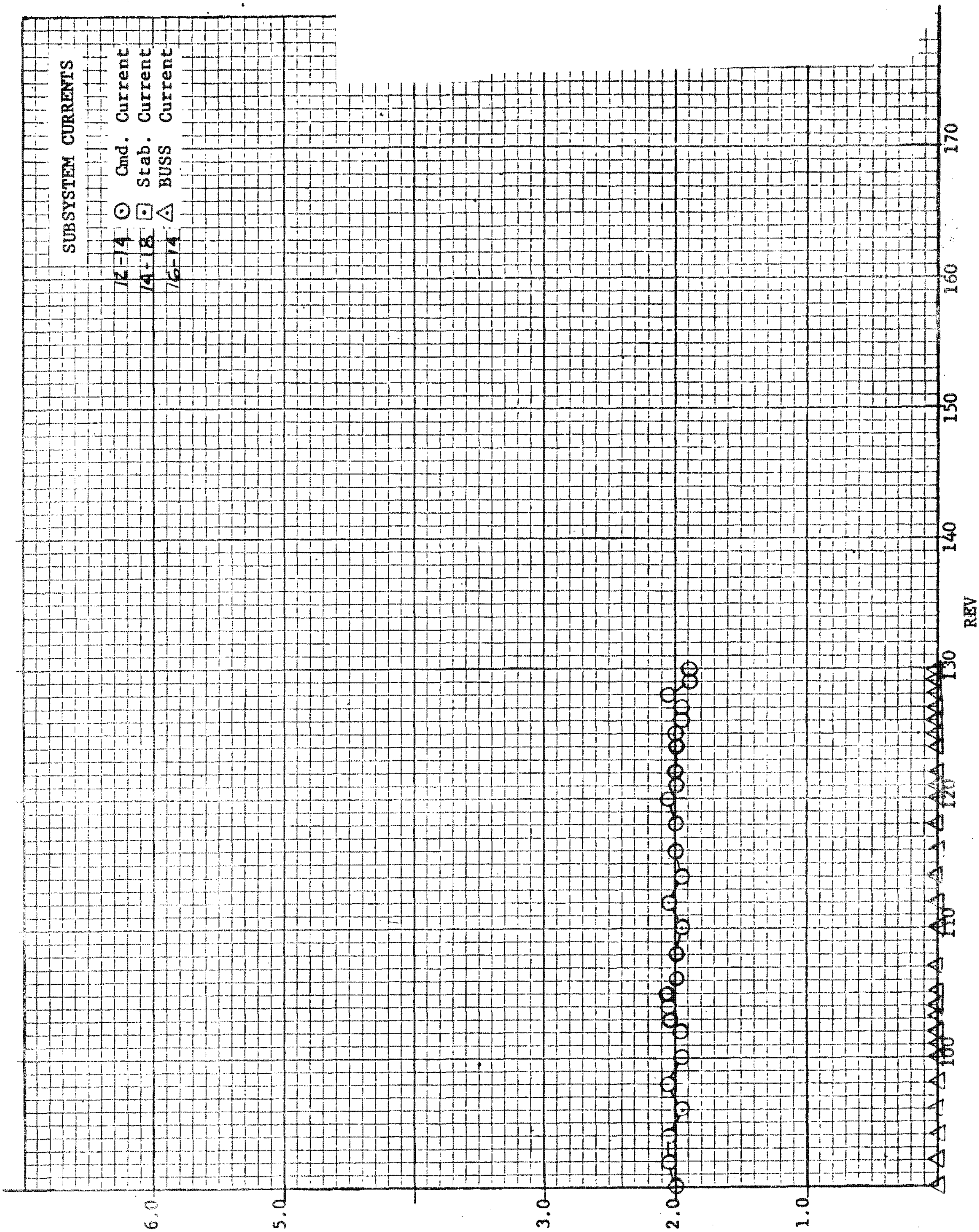
A-21.a

(S-3)

Temperature °F

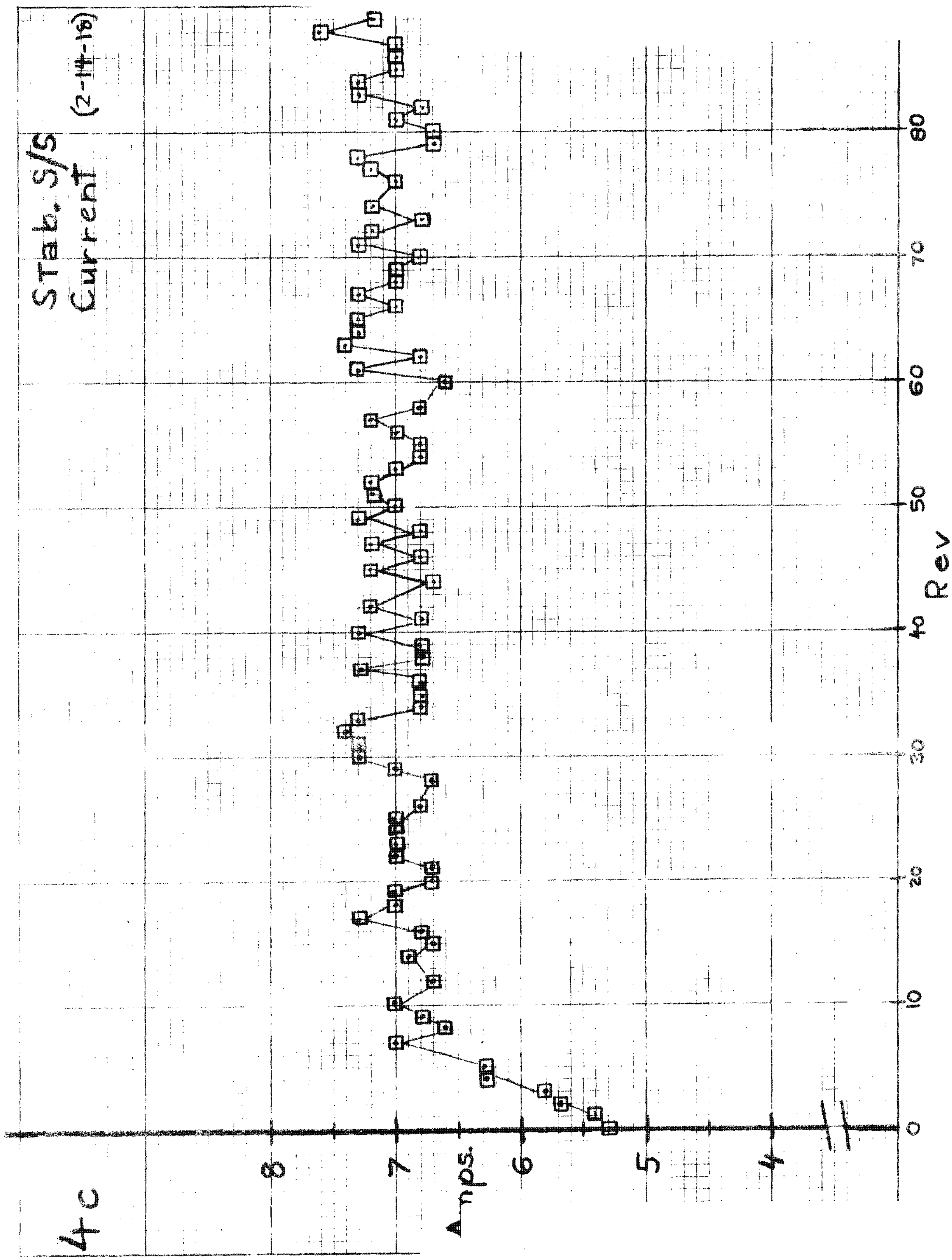
13-11


SUBSYSTEM CURRENTS
Cmd. Current
Stab. Current
BUSS Current
REV.
6.0
5.0
4.0
3.0
2.0
1.0
10
20
30
40
50
60
70
80
90
7.2
See Graph 4C
4a
2-12-14
2-14-18
2-16-14

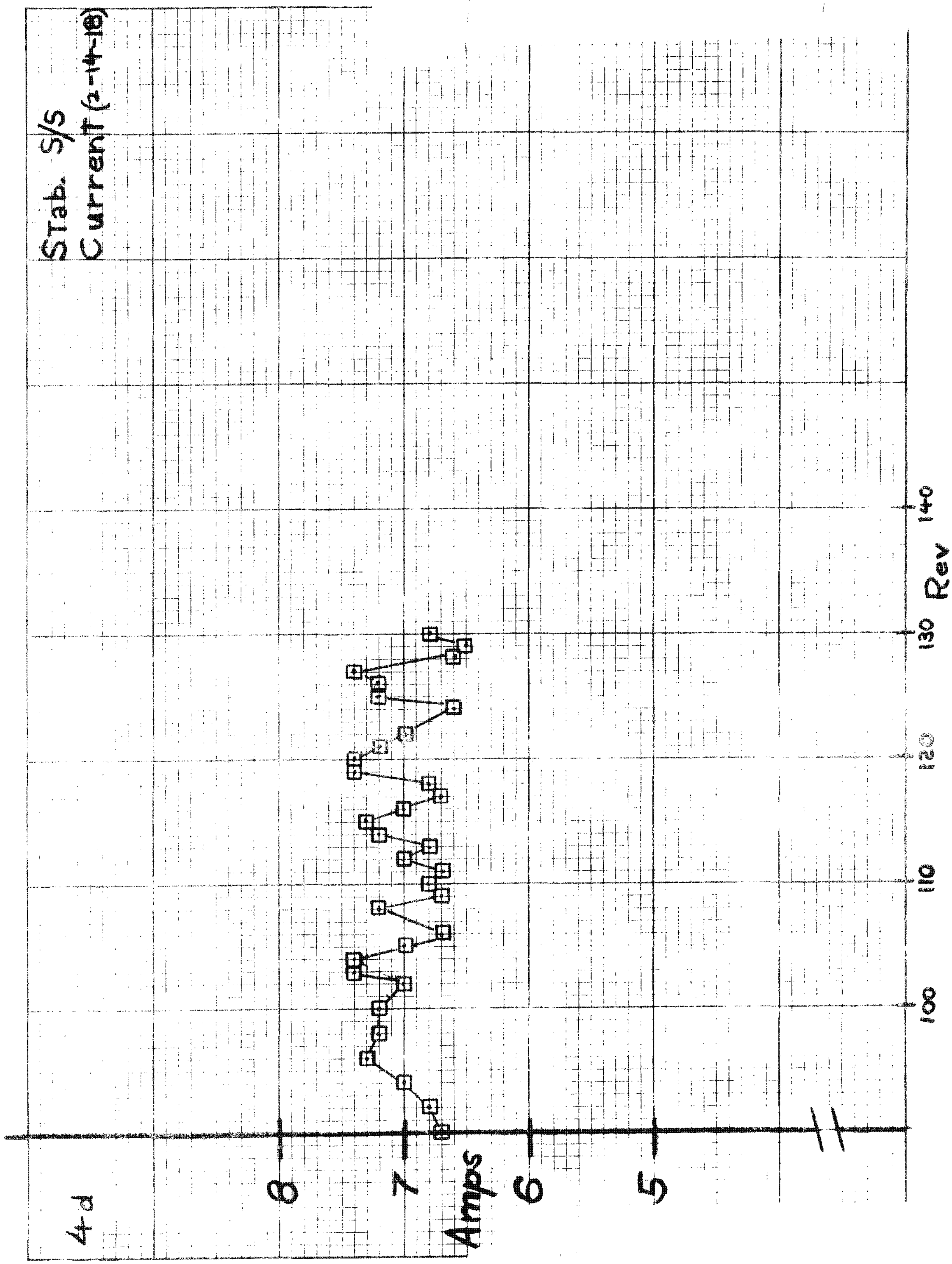


SUBSYSTEM CURRENTS
12-14 ⊙ Cmd. Current
14-18 ⊡ Stab. Current
16-14 △ BUSS Current
6.0
5.0
3.0
2.0
1.0
AMPS
100
110
120
130
140
150
160
170
REV

(S-3)A-22

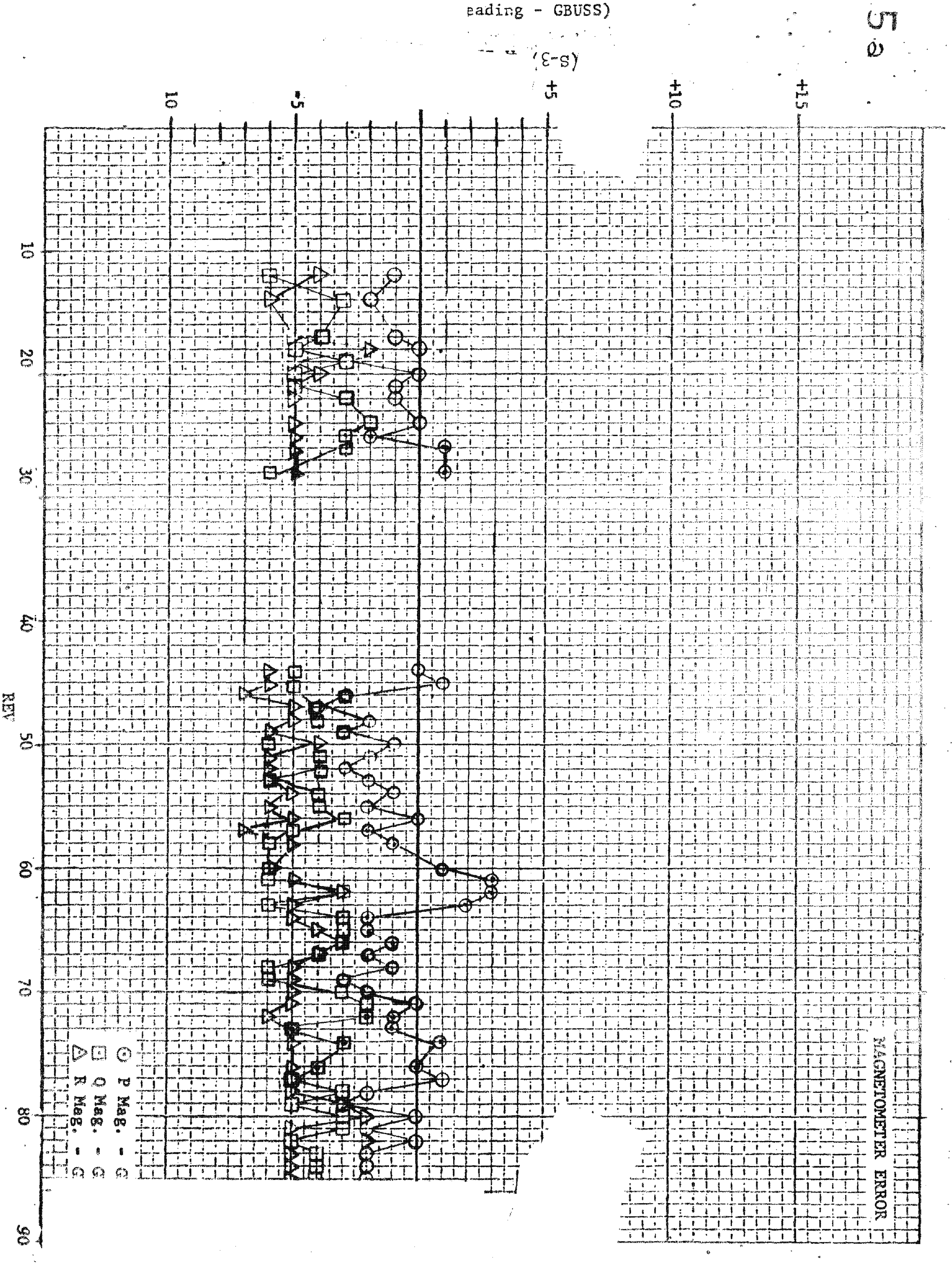


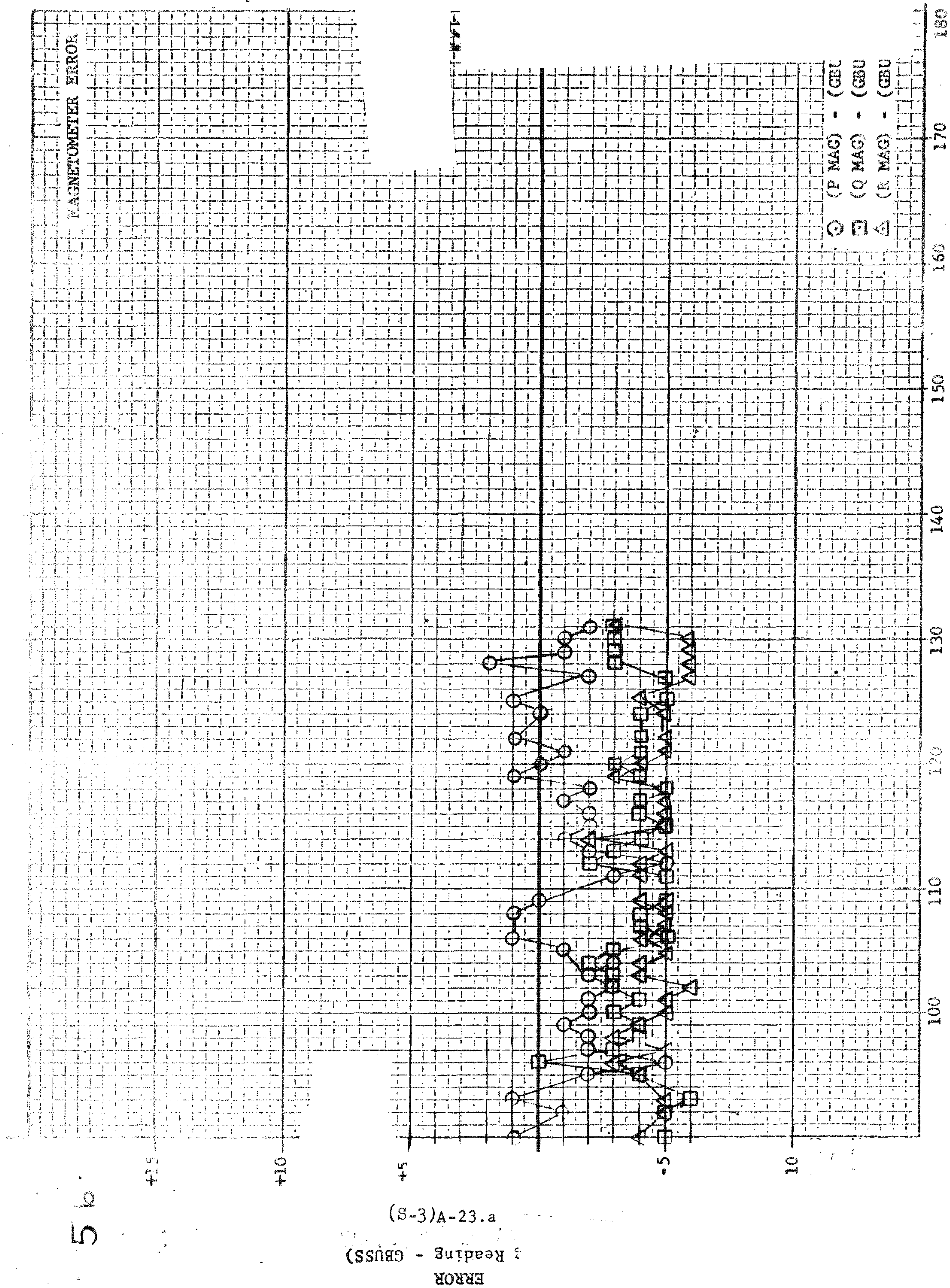
(S-3) A-22.b



(S-3) A-22.c

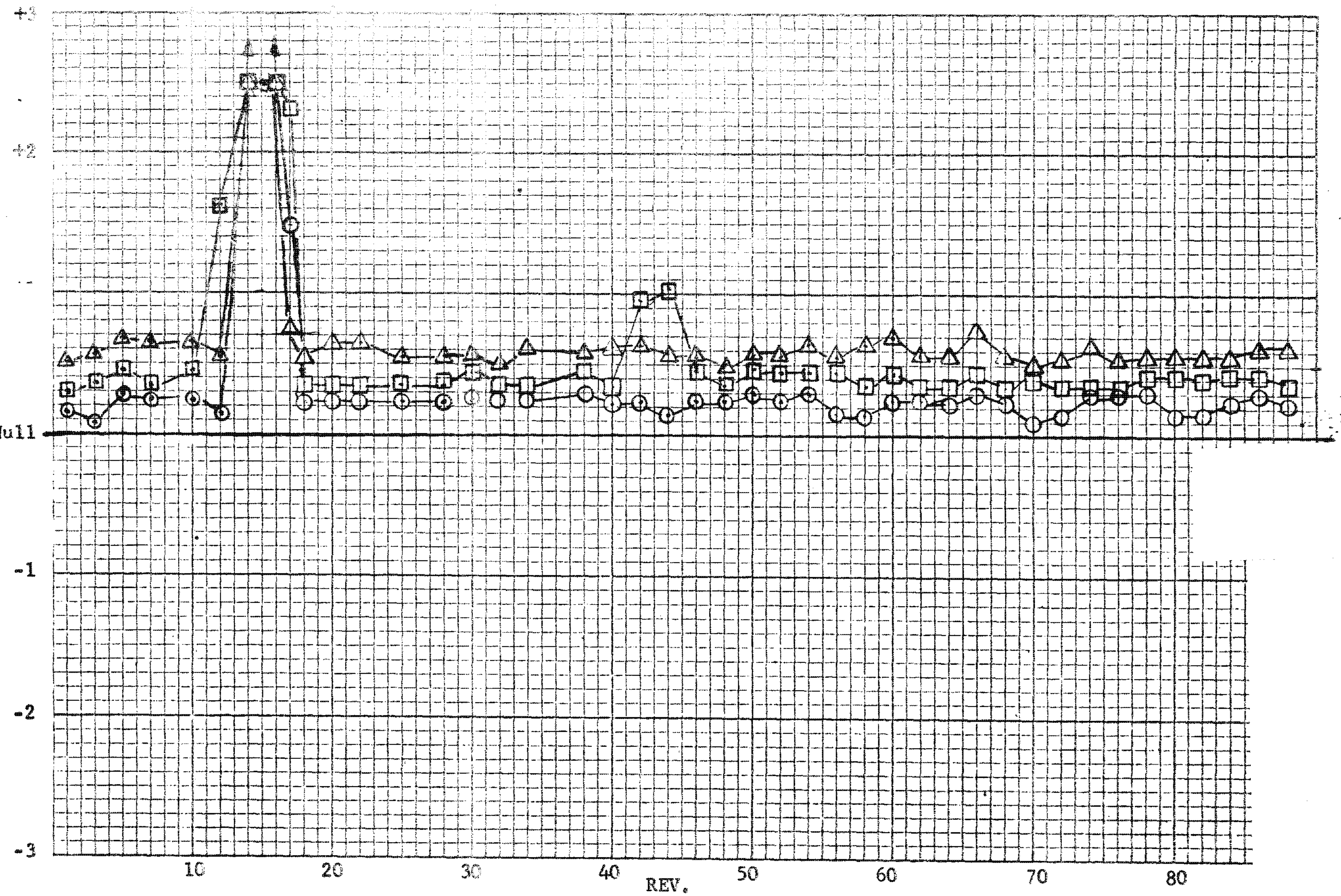
5a


eading - GBUSS)
(S-3)
MAGNETOMETER ERROR
REV
10
-5
+5
+10
+15
10
20
30
40
50
60
70
80
90
P Mag. - G
Q Mag. - G
R Mag. - G


MAGNETOMETER ERROR
(P MAG) - (GBU
(Q MAG) - (GBU
(R MAG) - (GBU
100
110
120
130
140
150
160
170
180
+15
+10
+5
-5
10

(S-3)A-23.a

5b

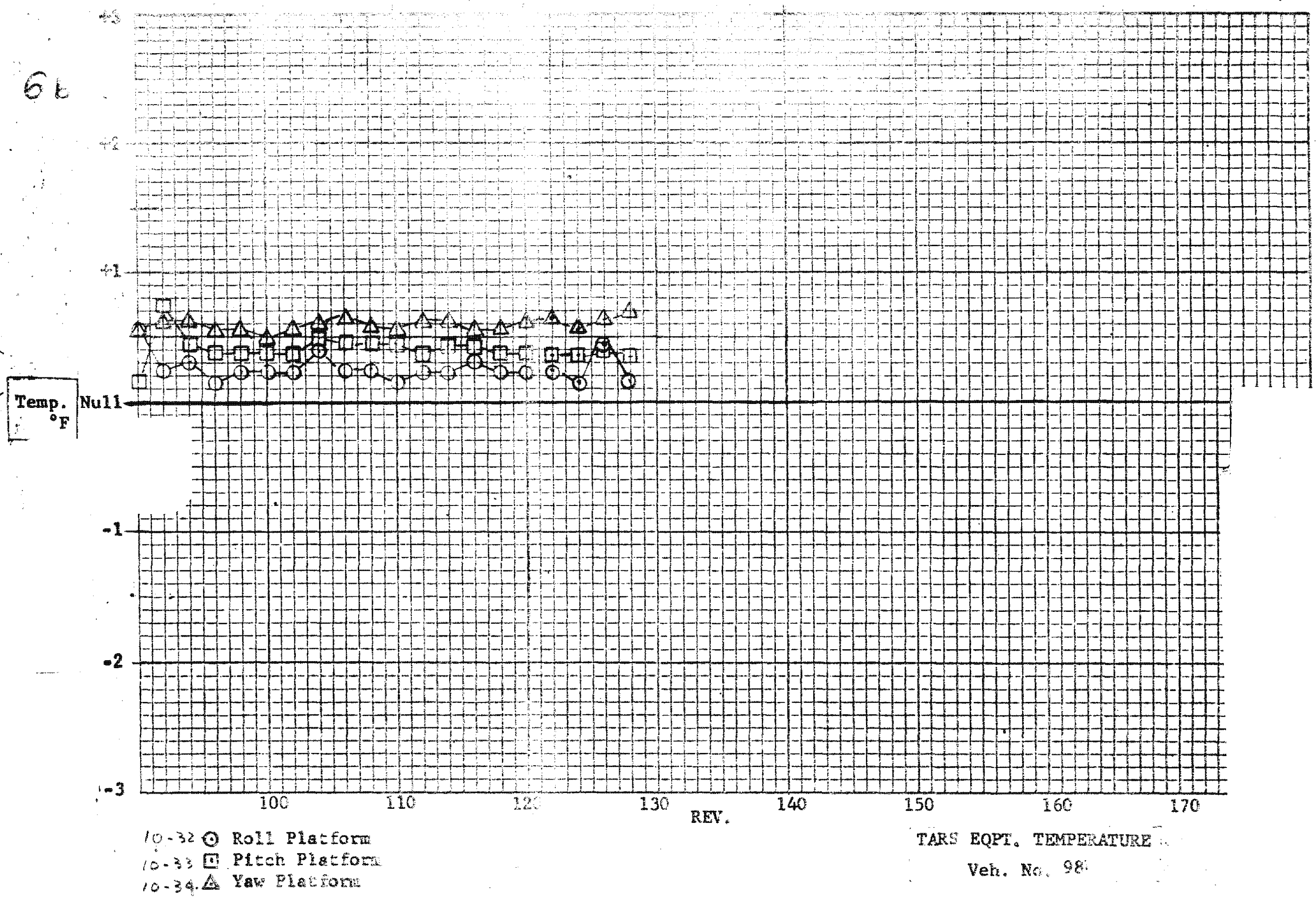


⊙ Roll Platform 2-10-32
⊡ Pitch Platform 2-10-33
⚠ Yaw Platform 2-10-34

TARS Equipment Temperature
Veh. No. 98

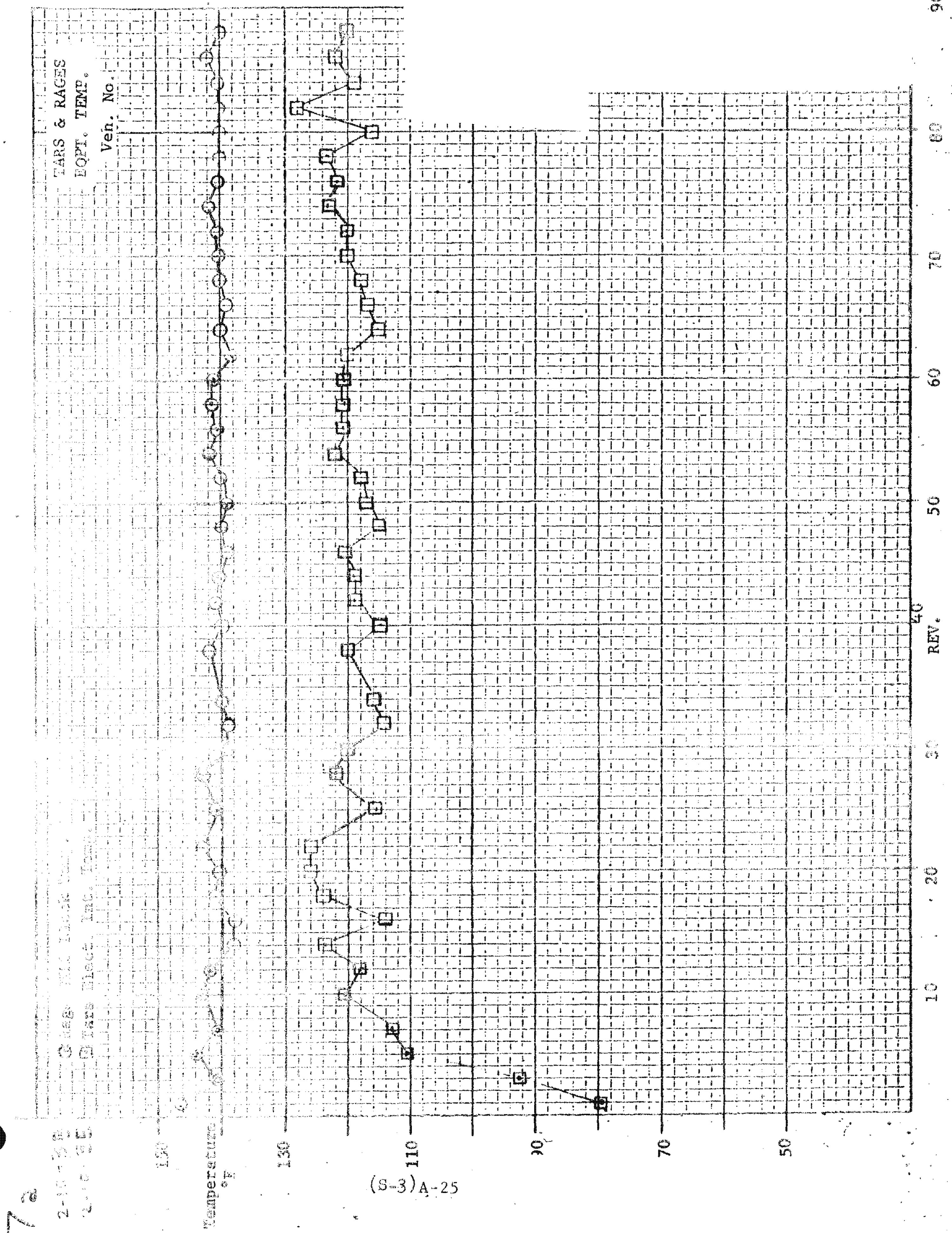
(S-3) A-24

6b



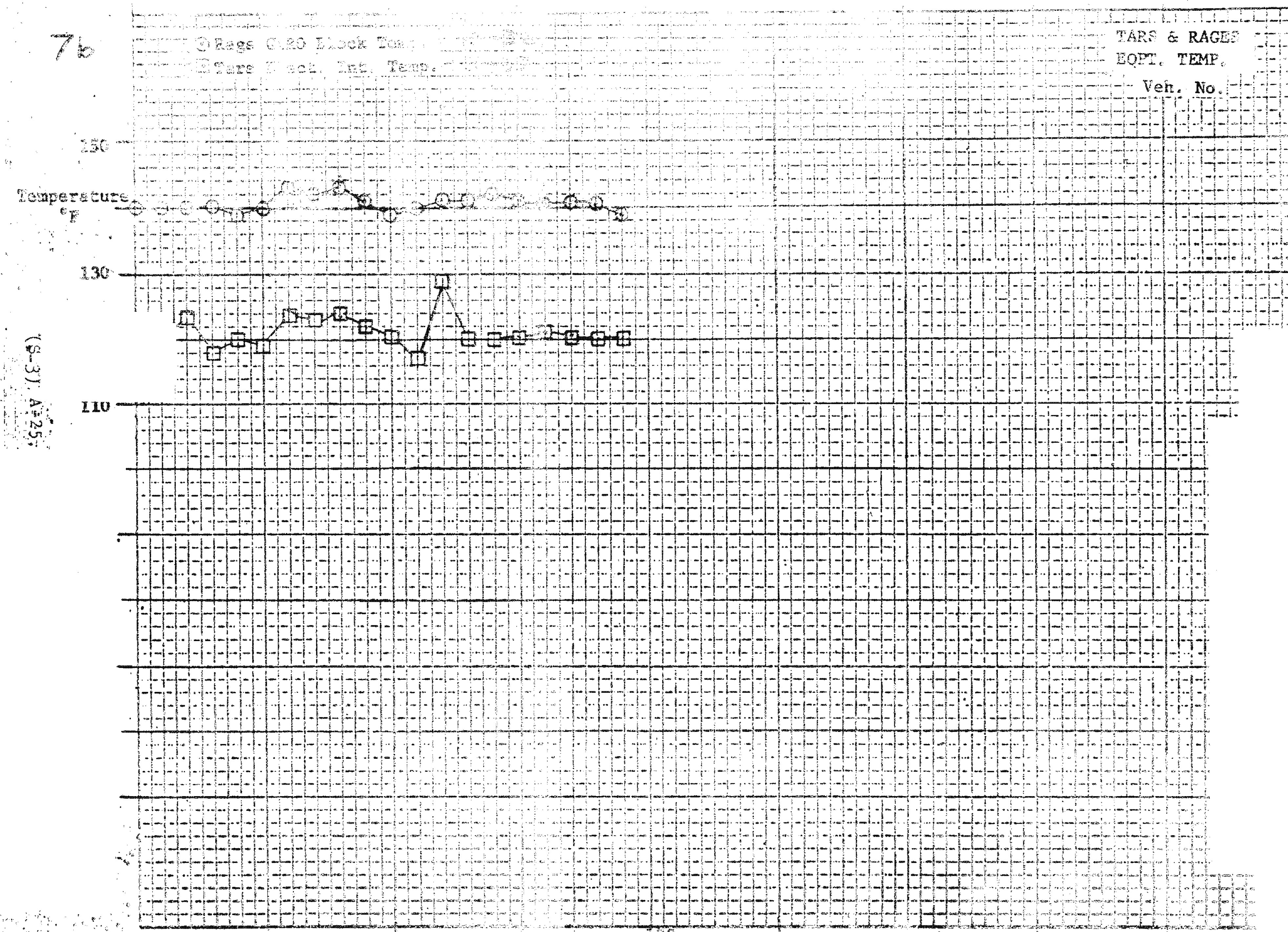
(S-3) A-24.a

Approved for Release: 2024/01/30 C05098944


TARS & RAGES
EQPT. TEMP.
Veh. No.
REV.
Temperature °F
150
130
110
90
70
50
10
20
30
40
50
60
70
80
90

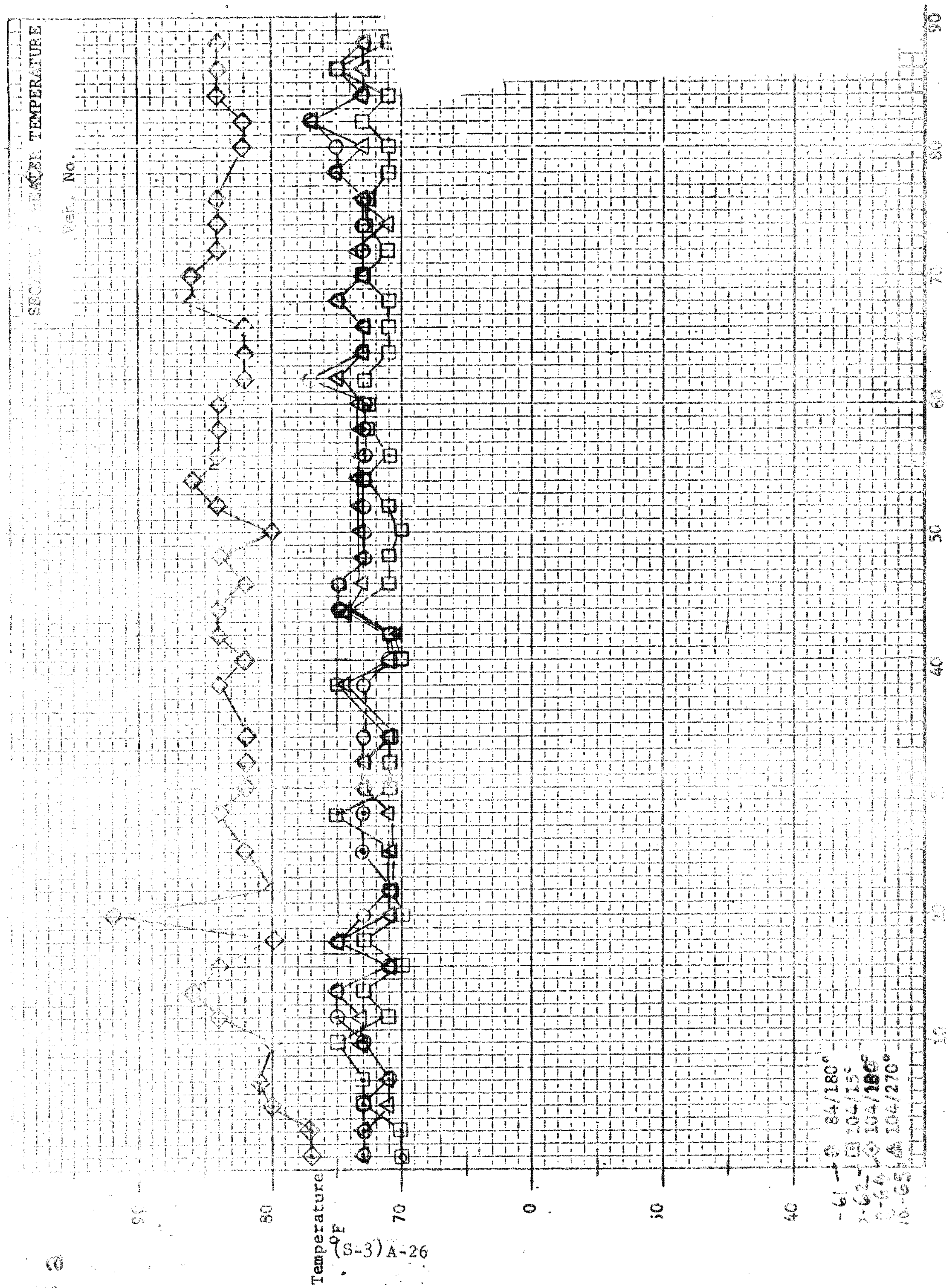
(S-3) A-25

7b

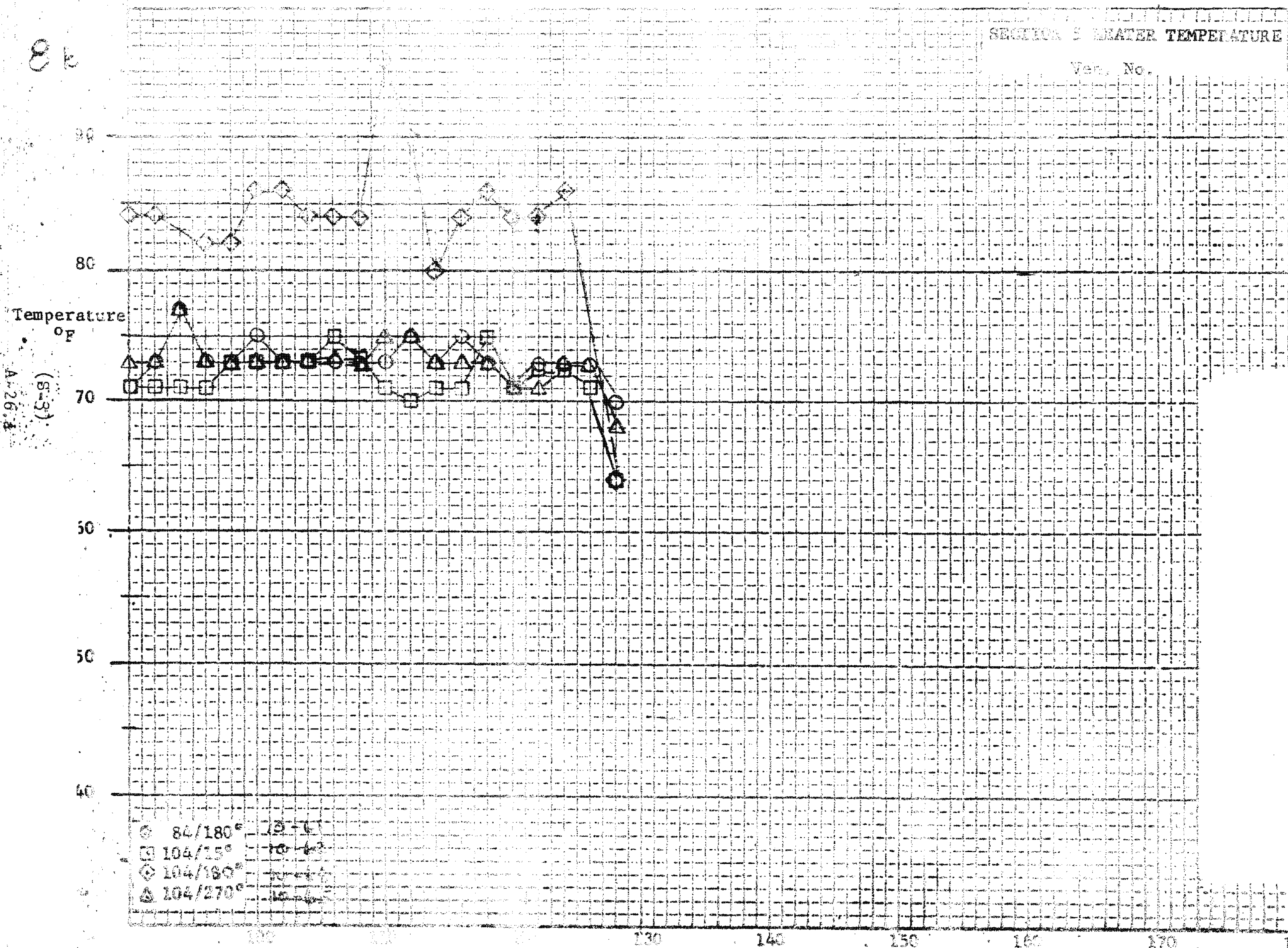


(S-3) A-25

Approved for Release: 2024/01/30 C05098944


TEMPERATURE
Veh. No.
84/180°
104/180°
106/270°
Temperature °F
90
80
70
60
50
40
10
20
30
40
50
60
70
80
90

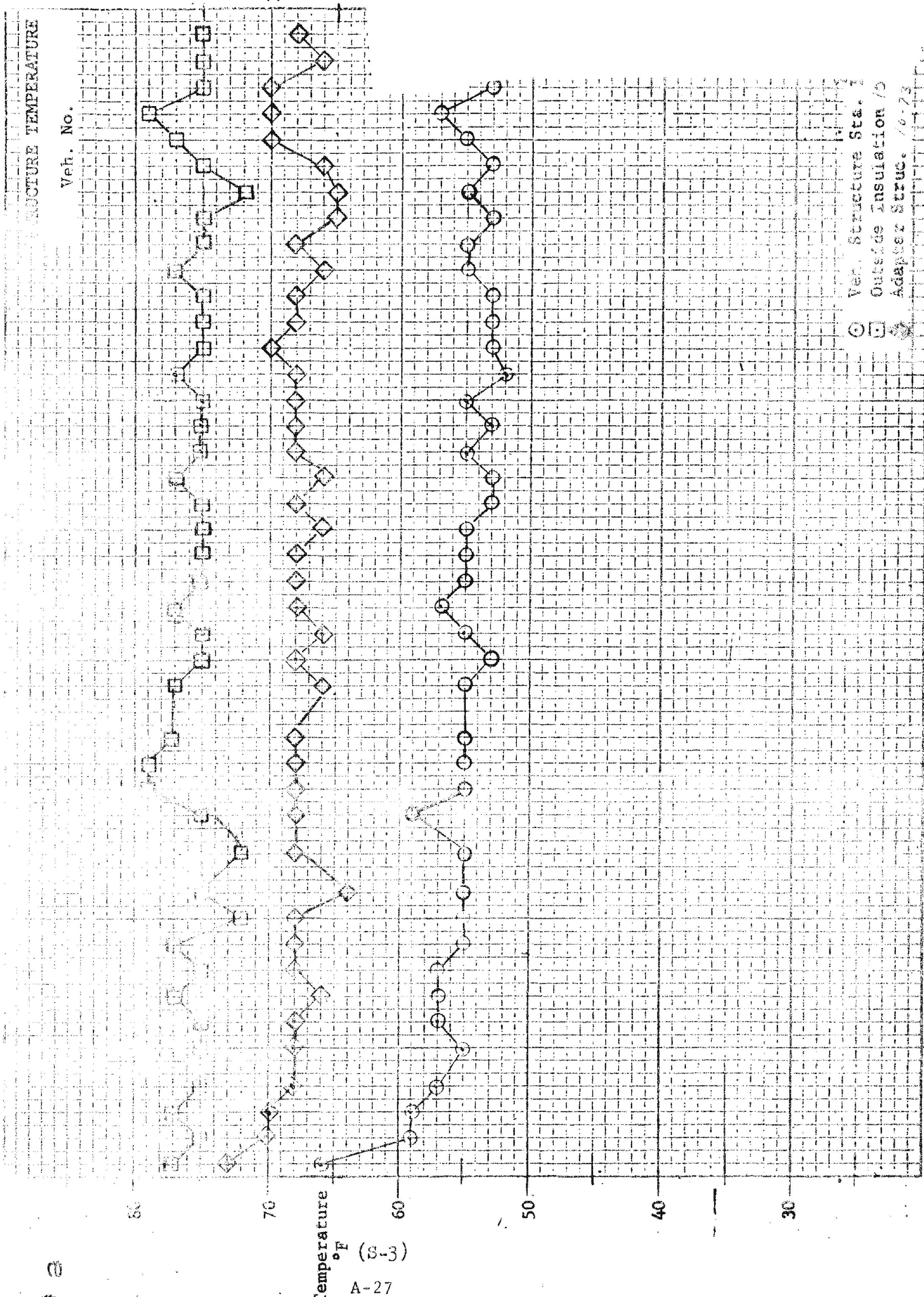
(S-3) A-26

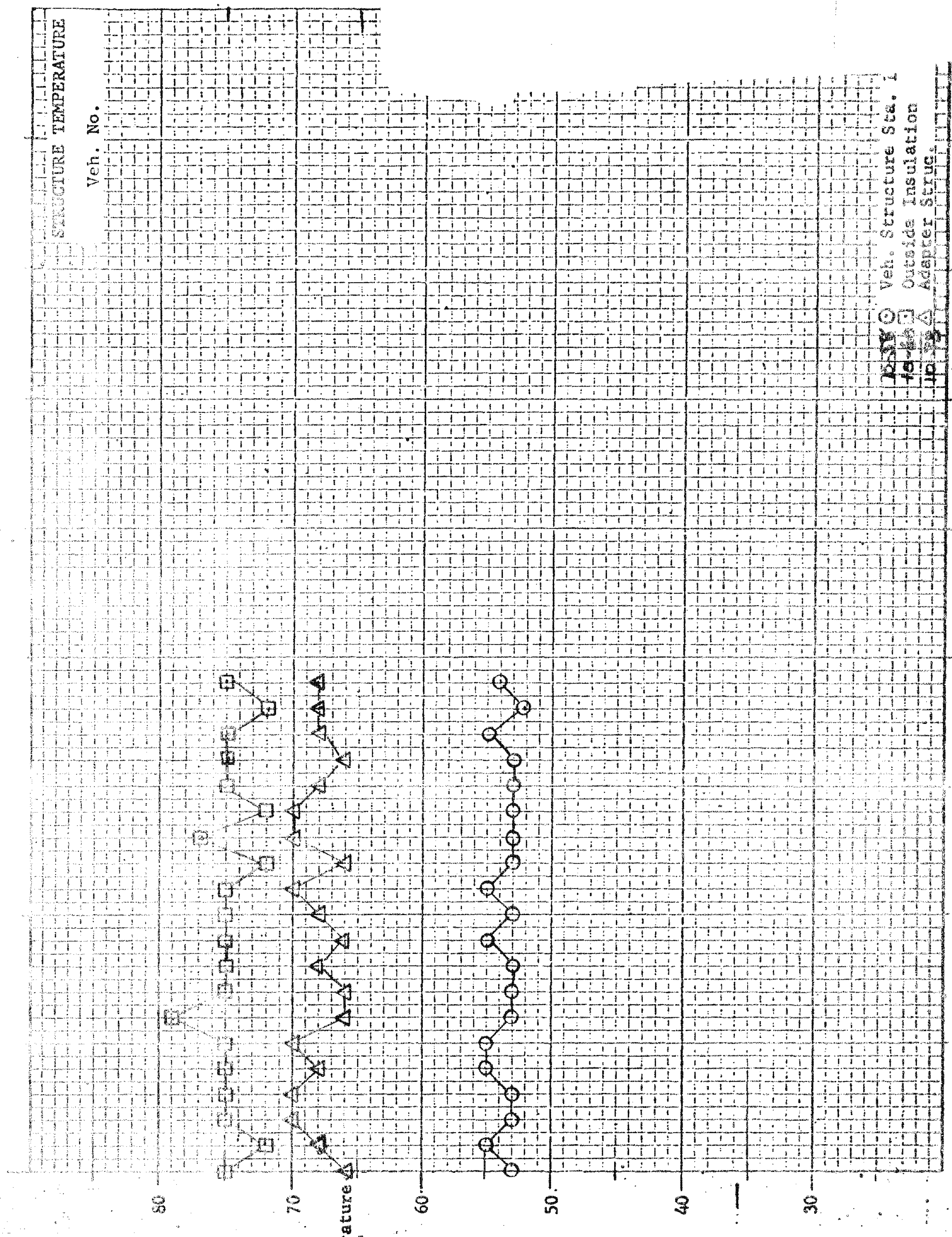


(S-3)

A-26.4

Approved for Release: 2024/01/30 C05098944

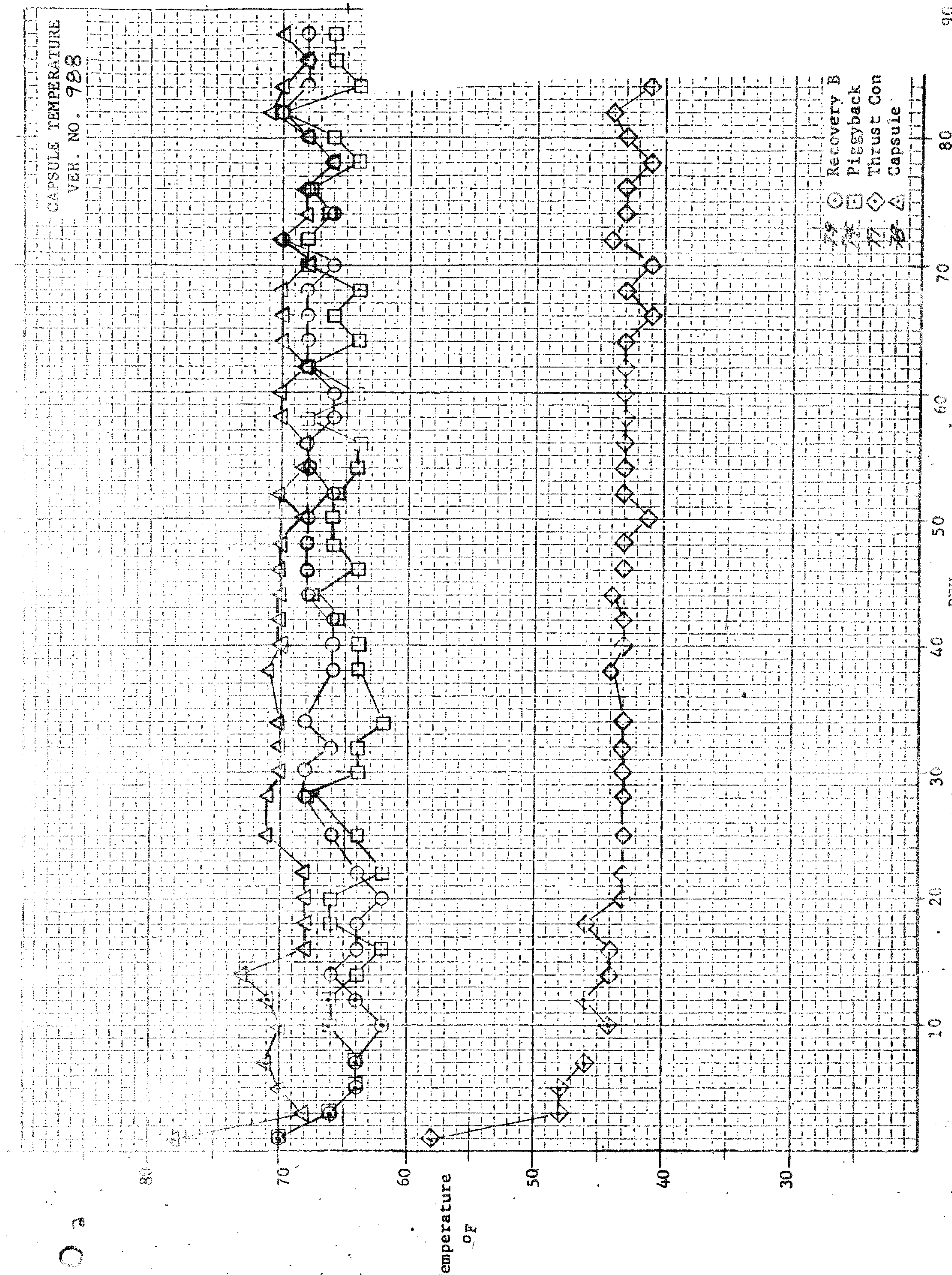

STRUCTURE TEMPERATURE
Veh. No.
Veh. Structure Sta.
Outside Insulation
Adapter Struc.
REV.
10
20
30
40
50
60
70
80
90
Temperature °F (S-3)
80
70
60
50
40
30


STRUCTURE TEMPERATURE
Veh. No.
Temperature °F
80
70
60
50
40
30
100
110
120
130
140
150
160
170
REV
Veh. Structure Sta. 1
Outside Insulation
Adapter Struc.

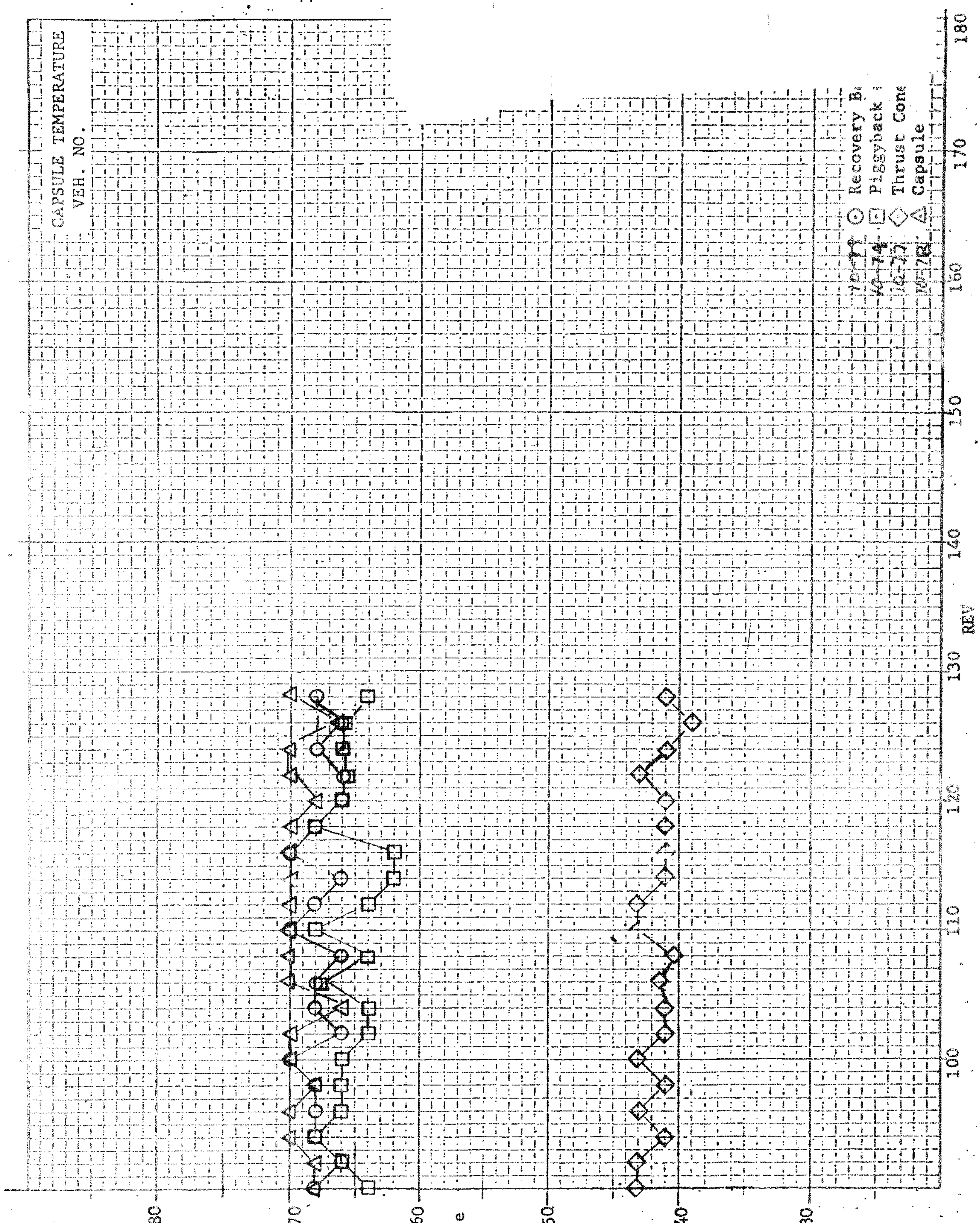
9b

(S-3)

A-27.a

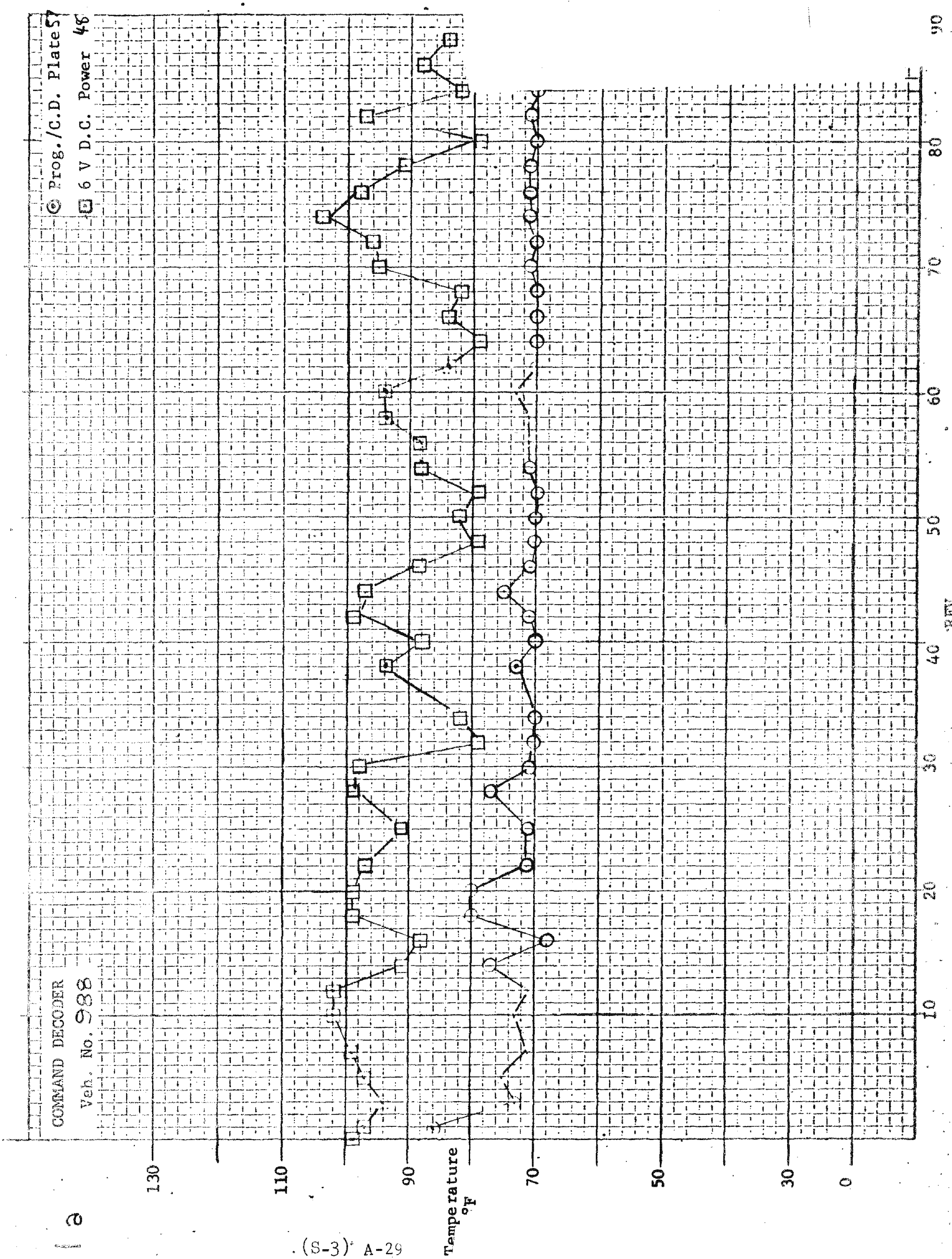

CAPSULE TEMPERATURE
VEH. NO. 988
Recovery B
Piggyback
Thrust Con
Capsule
REV
10
20
30
40
50
60
70
80
90
80
70
60
50
40
30
Temperature
°F

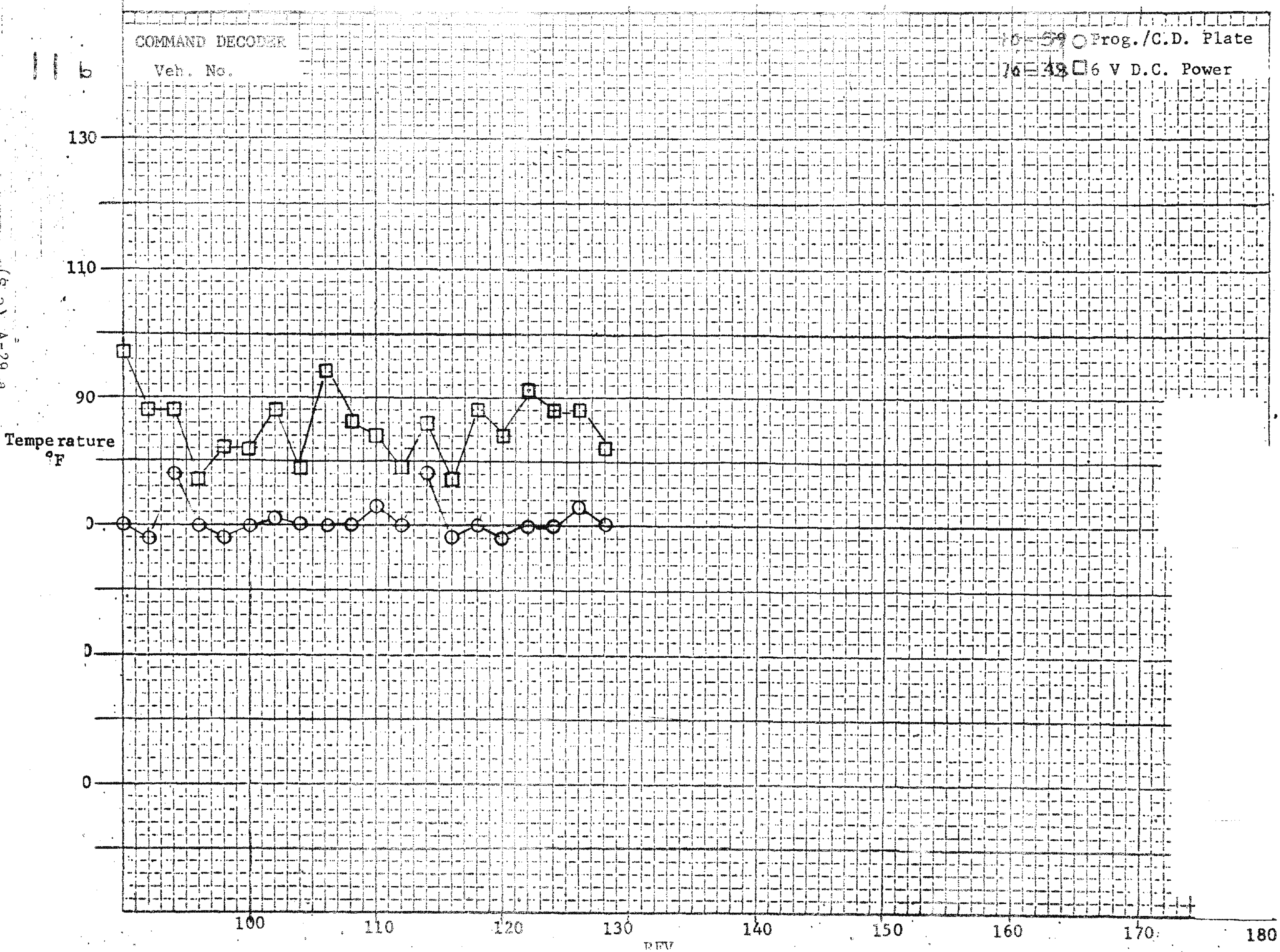
(S-3) A-28


CAPSULE TEMPERATURE
VEH. NO.
Recovery B
Piggyback
Thrust Cone
Capsule
REV
80
70
60
50
40
30
100
110
120
130
140
150
160
170
180
erature
°F

10b

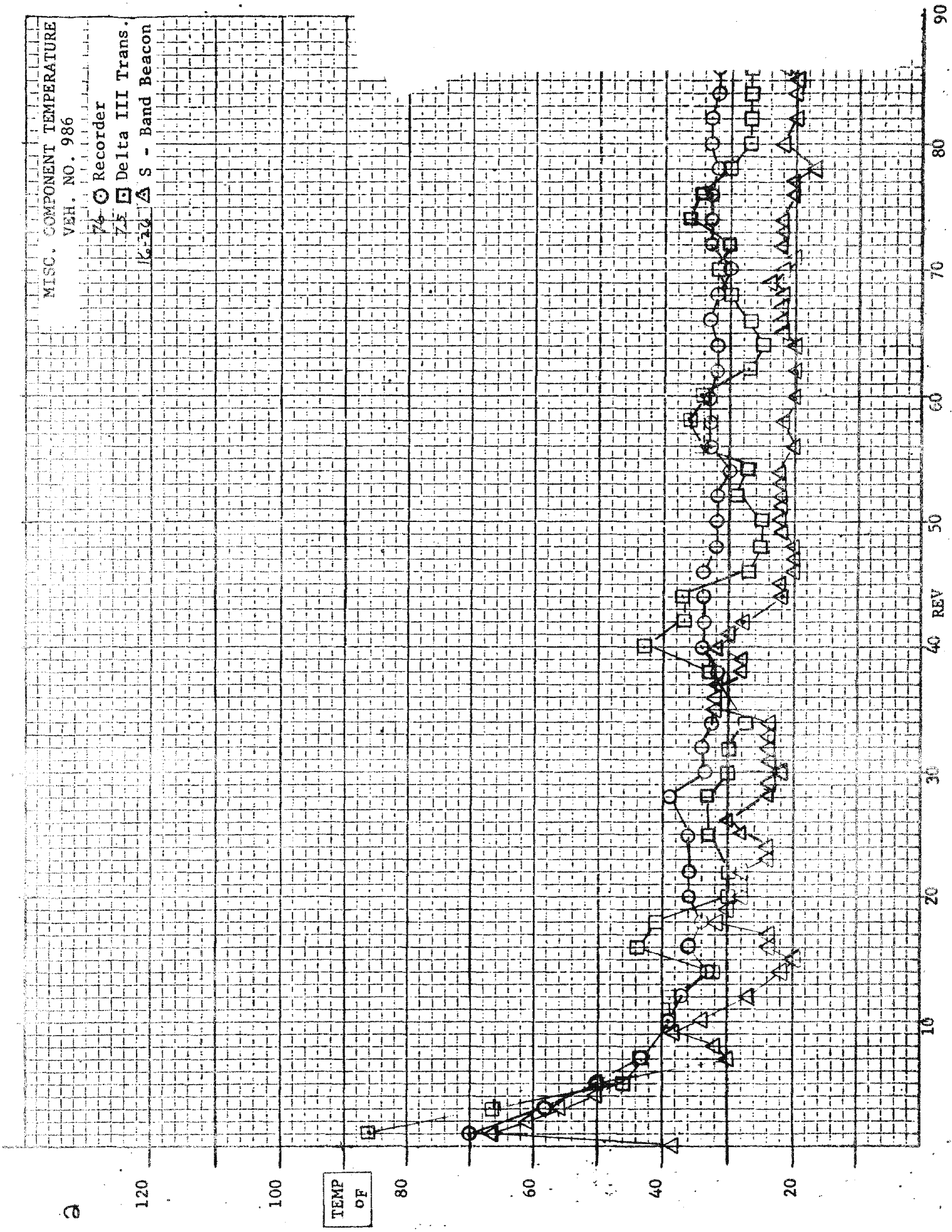
(S-3) A-28.a


⊙ Prog./C.D. Plate 57
⊡ 6 V D.C. Power 48
COMMAND DECODER
Veh. No. 988
Temperature °F
REV.
130
110
90
70
50
30
0
10
20
30
40
50
60
70
80
90


COMMAND DECODER
Veh. No.
Prog./C.D. Plate
6 V D.C. Power
130
110
90
0
0
0
Temperature °F
100
110
120
130
140
150
160
170
180
REV

(S-3) A-29.a

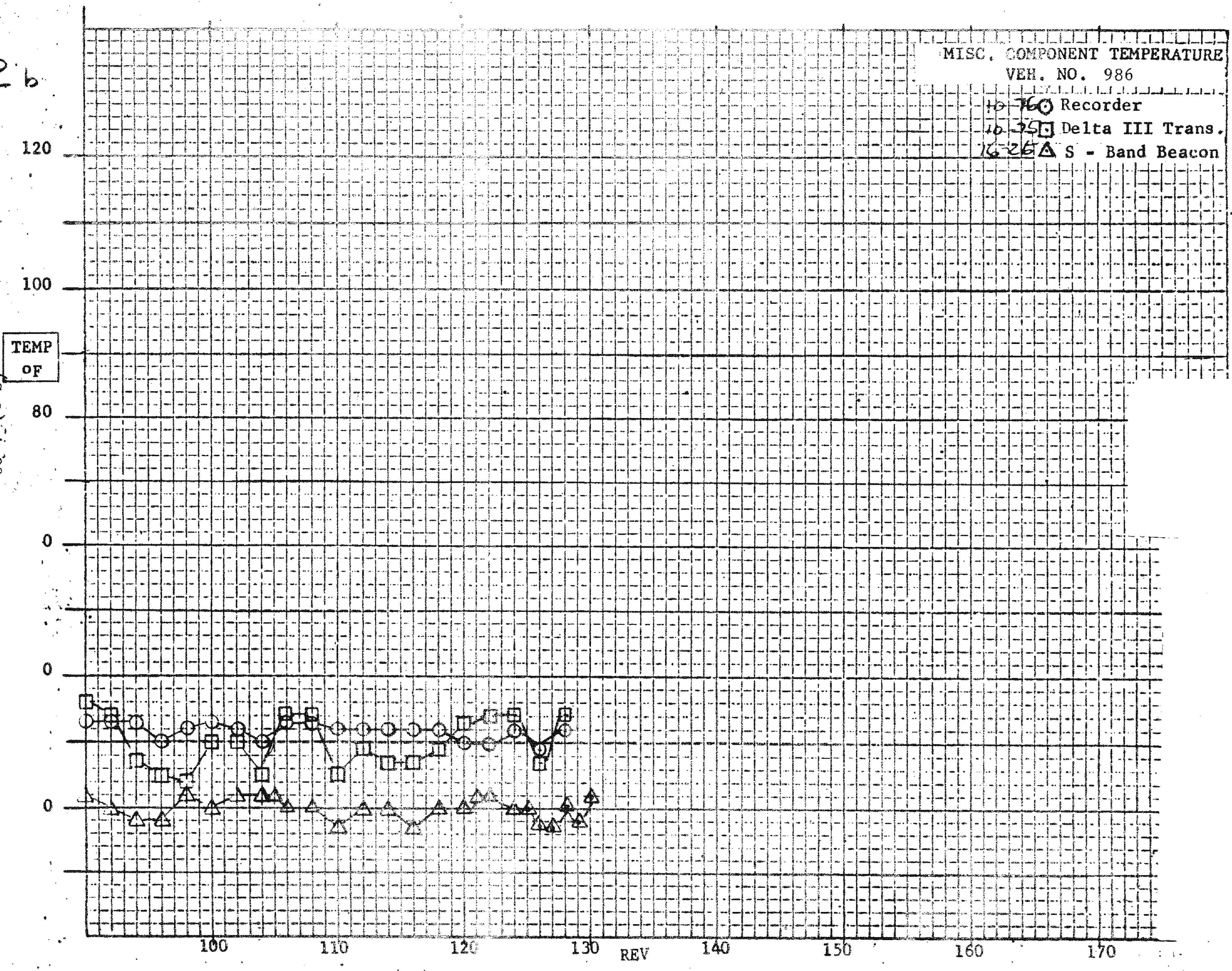
C05098944



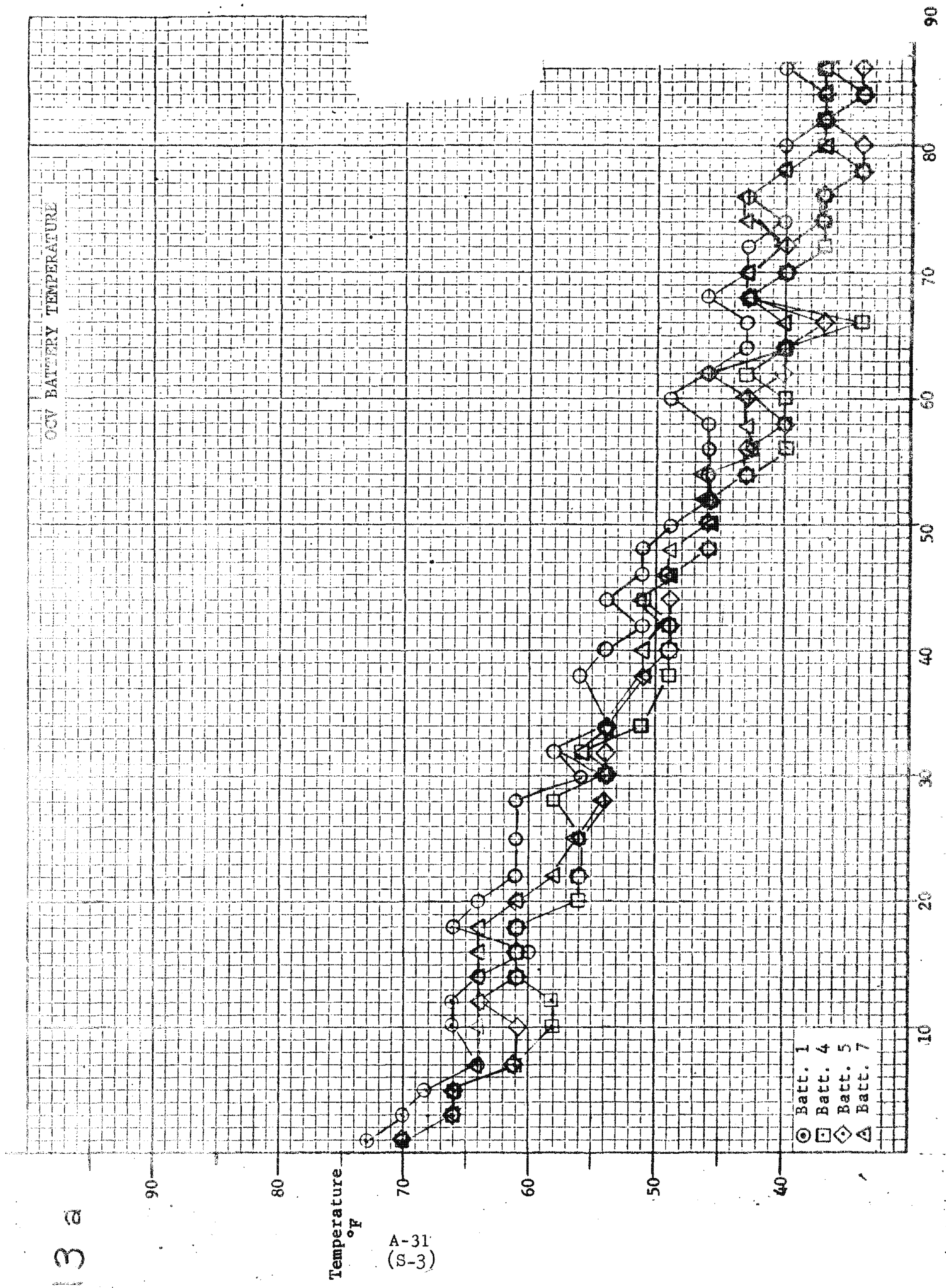
2a

(S-3) A-3

12b

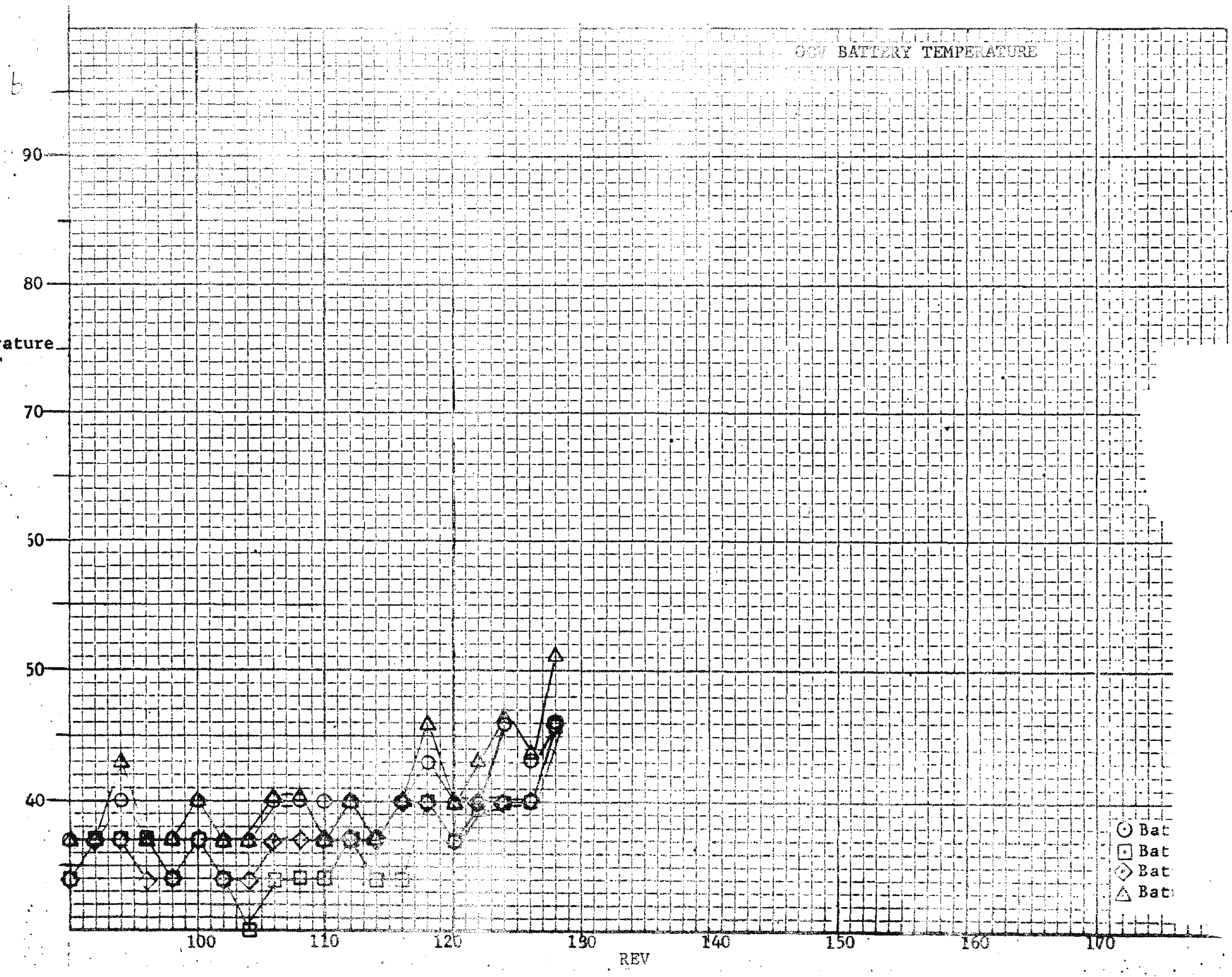

MISC. COMPONENT TEMPERATURE
VEH. NO. 986
10-76 ⊙ Recorder
10-35 ⊡ Delta III Trans.
16-26 △ S - Band Beacon
TEMP °F
120
100
80
0
0
0
REV
100
110
120
130
140
150
160
170

(S-3) A-30.a


OCV BATTERY TEMPERATURE
REV.
Temperature °F
90
80
70
60
50
40
10
20
30
40
50
60
70
80
90
⊙ Batt. 1
⊡ Batt. 4
◇ Batt. 5
△ Batt. 7

13a

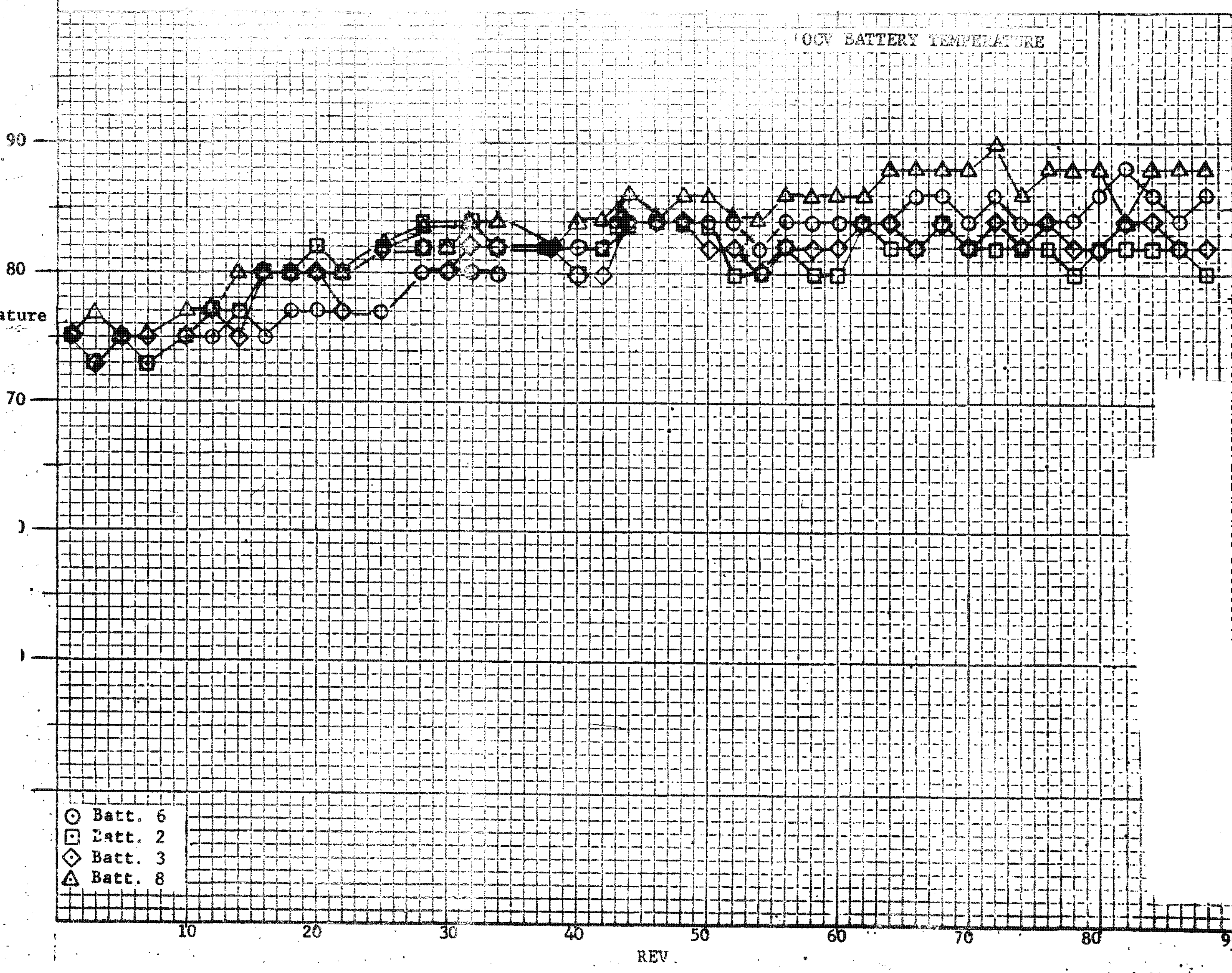
A-31
(S-3)


OCV BATTERY TEMPERATURE
Temperature °F
90
80
70
50
40
100
110
120
130
140
150
160
170
REV
Bat
Bat
Bat
Bat

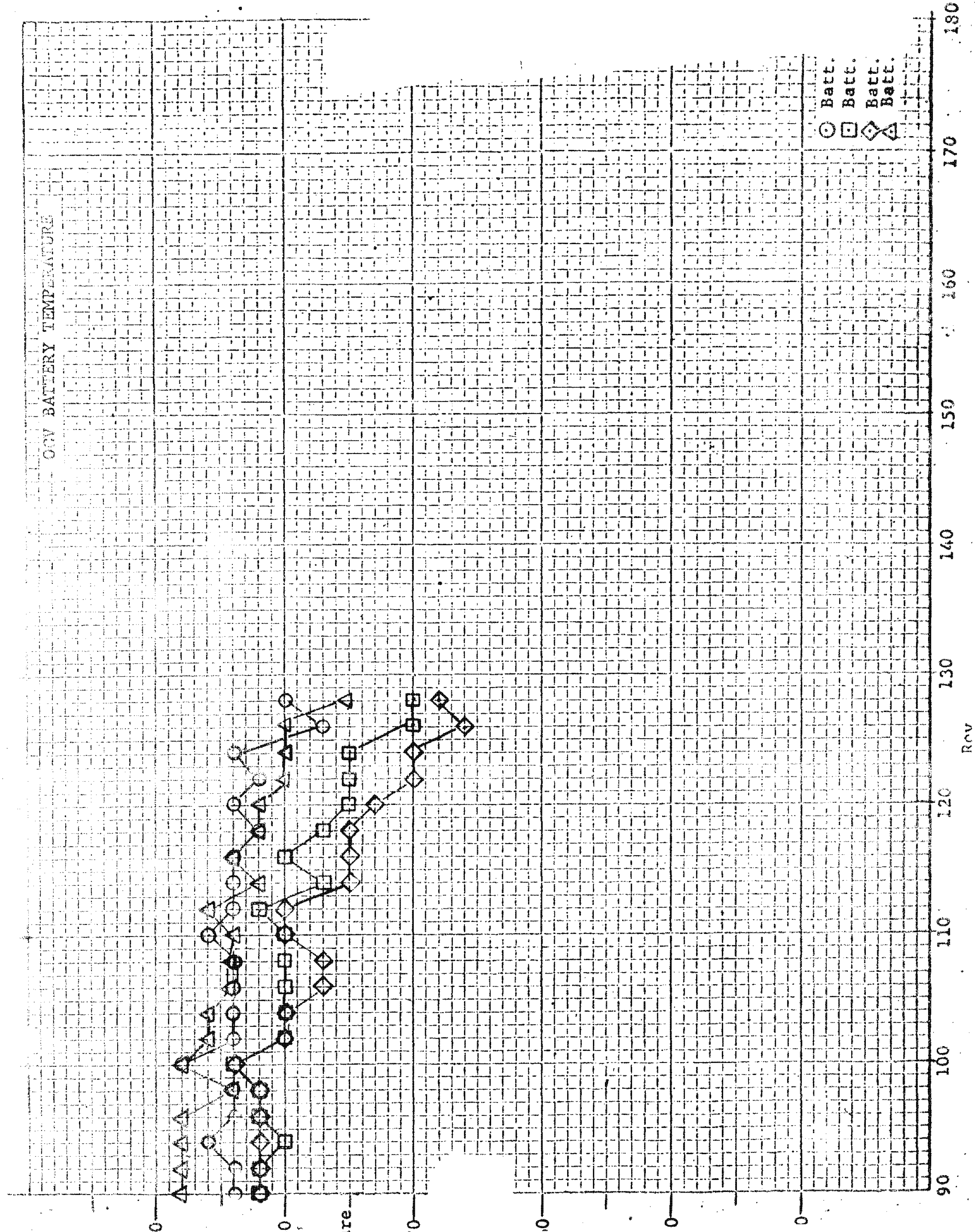
(S-3)

A-31.a

14 a


OCV BATTERY TEMPERATURE
90
80
70
Temperature °F
10
20
30
40
50
60
70
80
90
REV
Batt. 6
Batt. 2
Batt. 3
Batt. 8

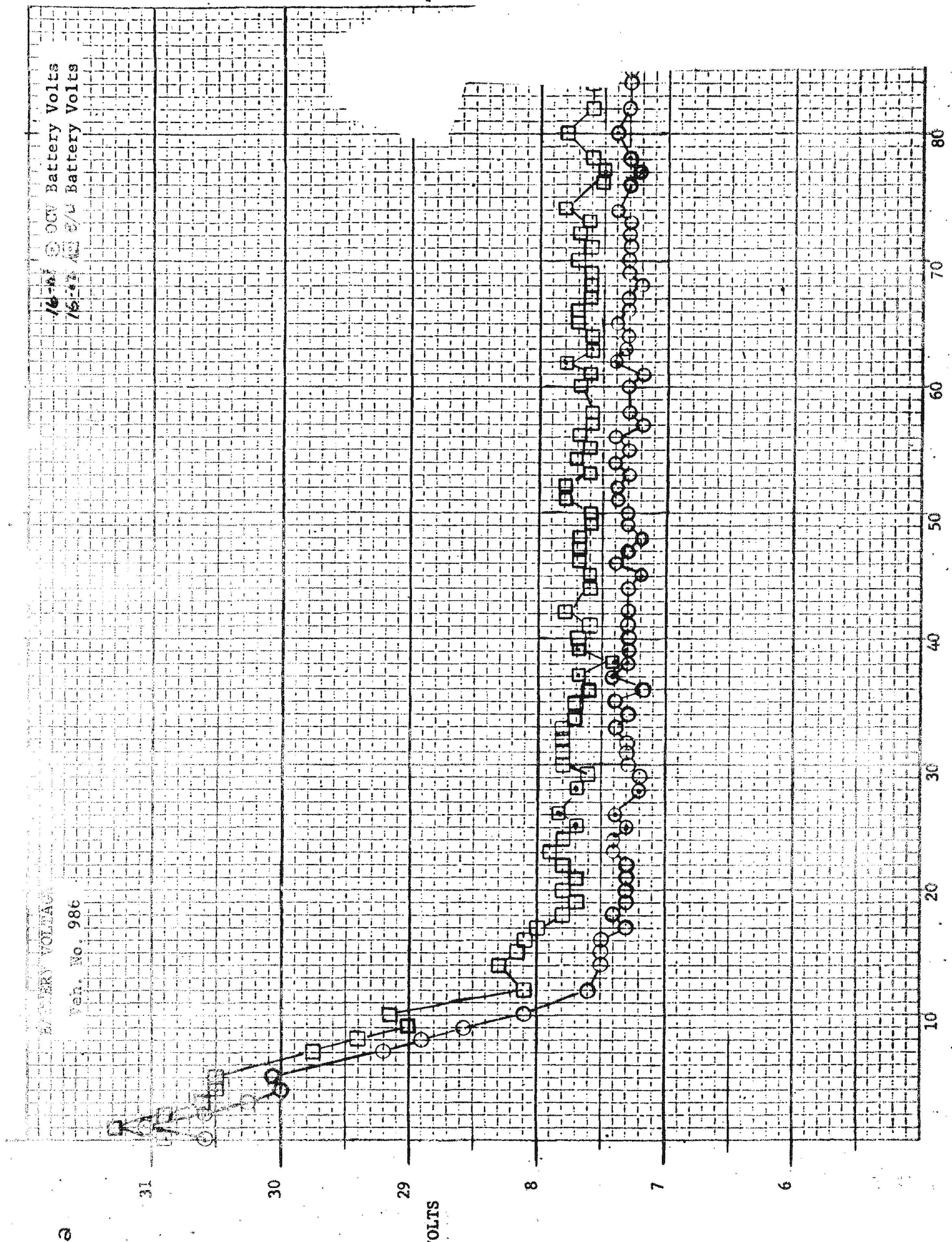
(S-3



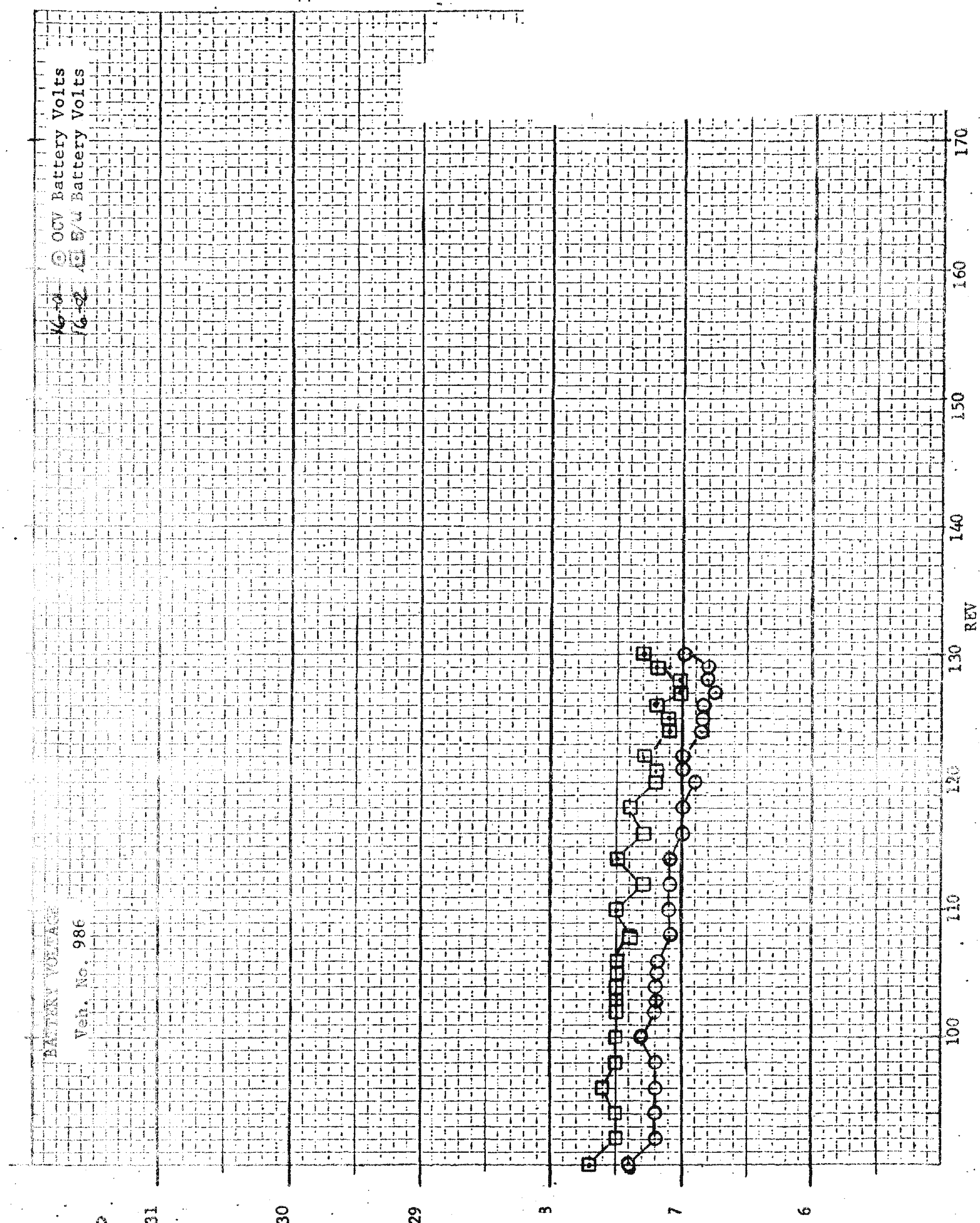
4 b

(S-3

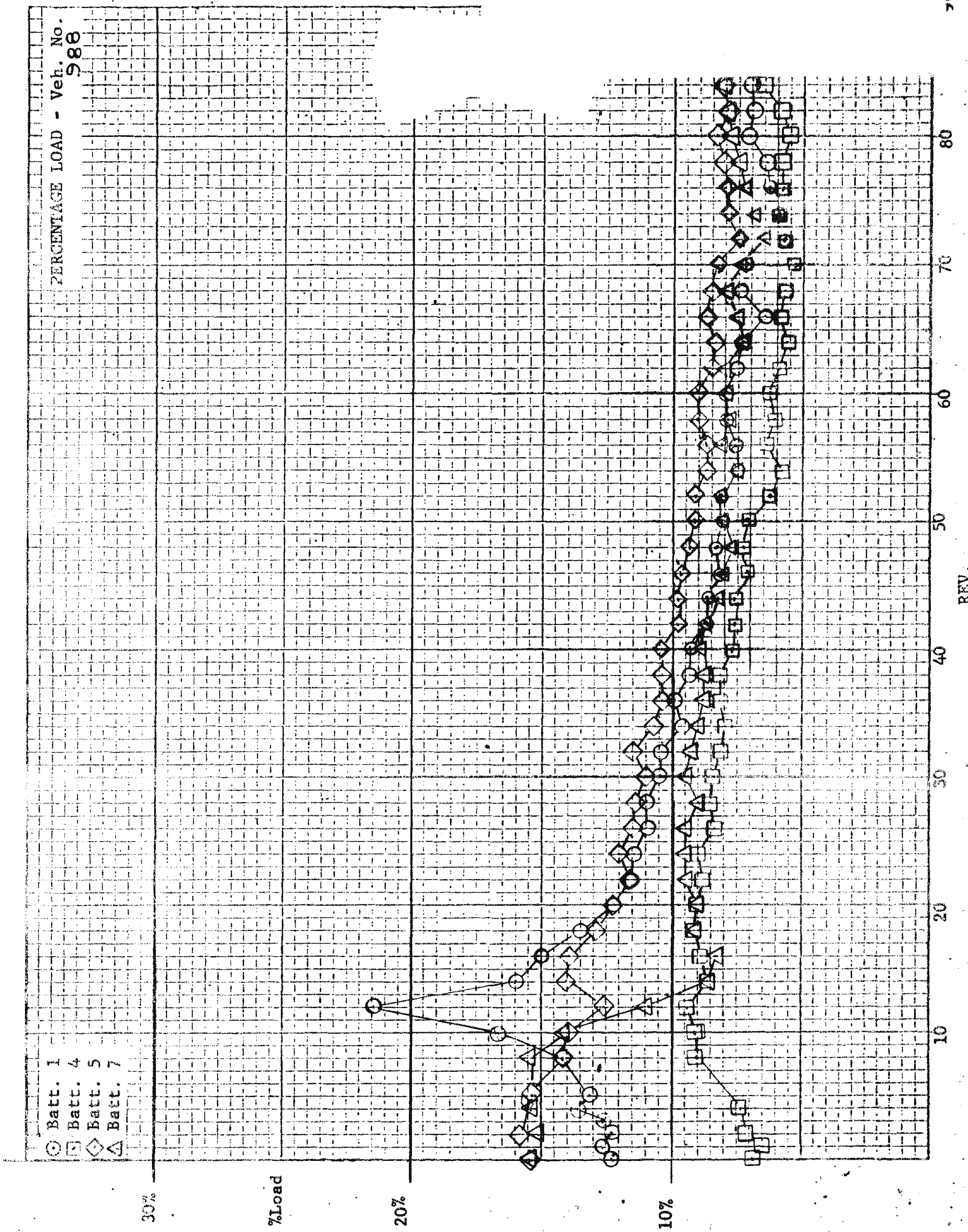
Approved for Release: 2024/01/30 C05098944


Veh. No. 986
OCV Battery Volts
C/U Battery Volts
31
30
29
8
7
6
VOLTS
10
20
30
40
50
60
70
80

A-33
(S-3)

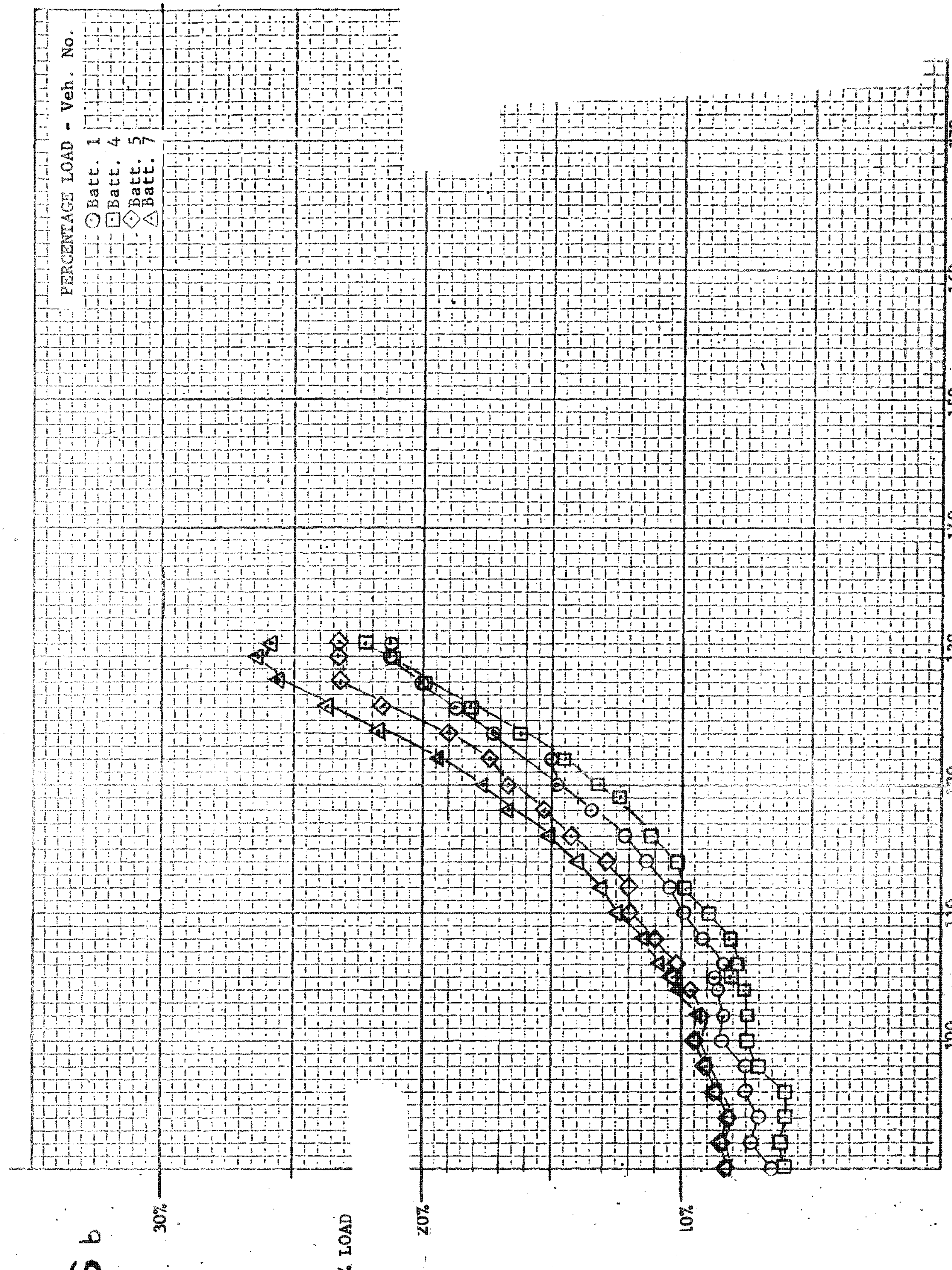

BATTERY VOLTAGE
Veh. No. 986
16-a ⊙ OCV Battery Volts
16-2 ⊡ B/U Battery Volts
REV
100
110
120
130
140
150
160
170
VOLTS
31
30
29
8
7
6

15b


PERCENTAGE LOAD - Veh. No. 988
Batt. 1
Batt. 4
Batt. 5
Batt. 7
30%
%Load
20%
10%
10
20
30
40
50
60
70
80
REV.

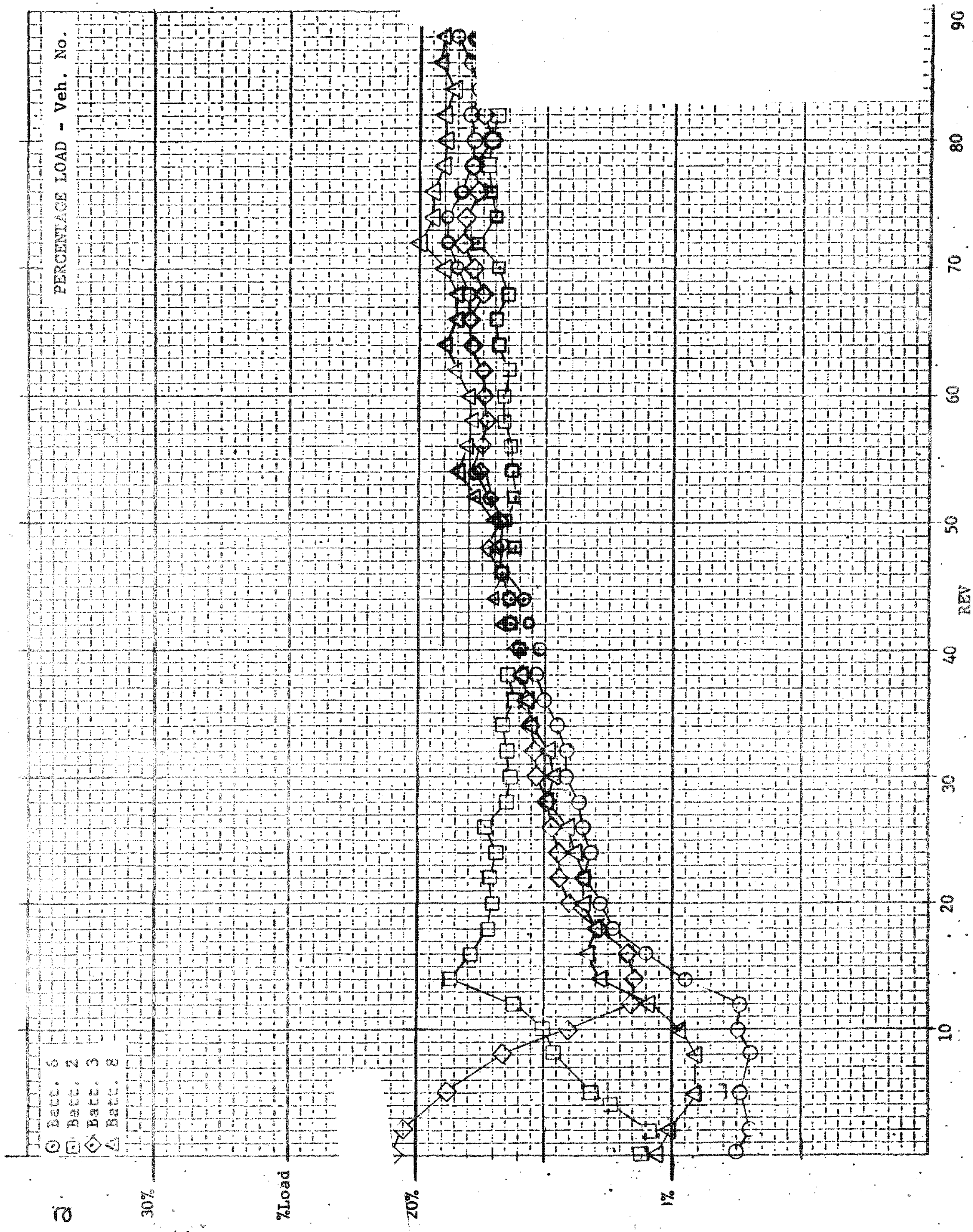
(S-3) A-34

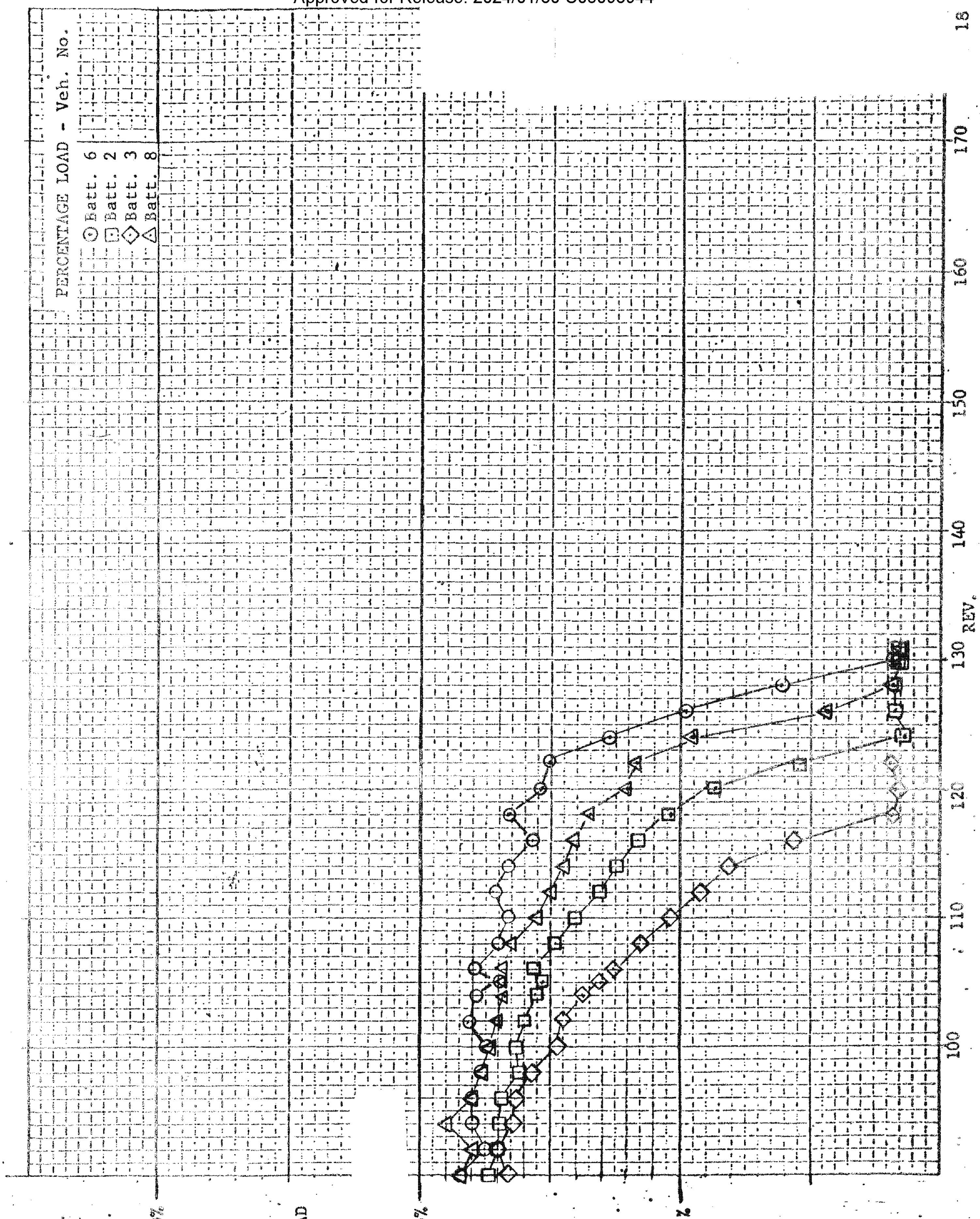
6a

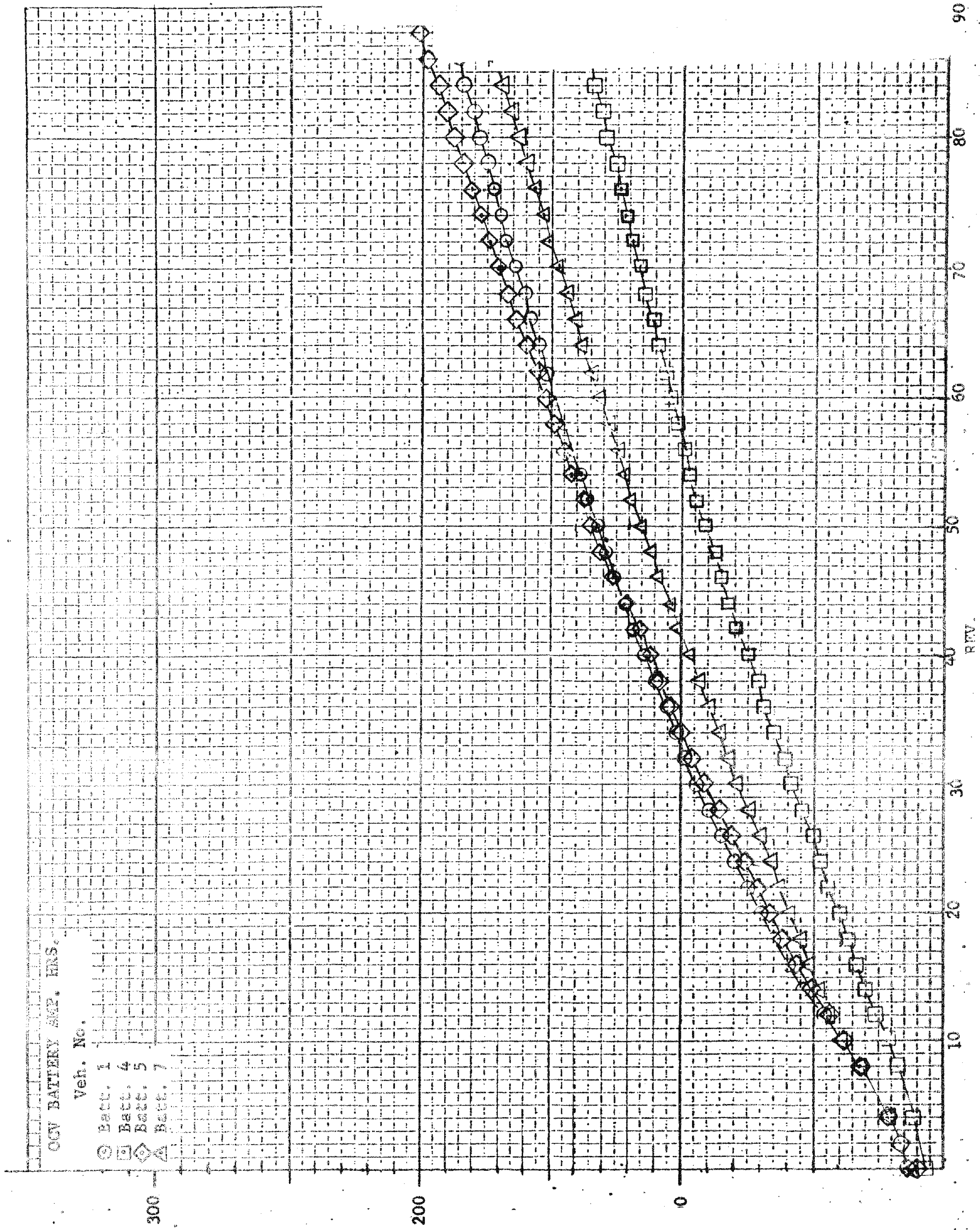

PERCENTAGE LOAD - Veh. No.
Batt. 1
Batt. 4
Batt. 5
Batt. 7
170
160
150
140
130 REV.
120
110
100
30%
% LOAD
20%
10%

16b

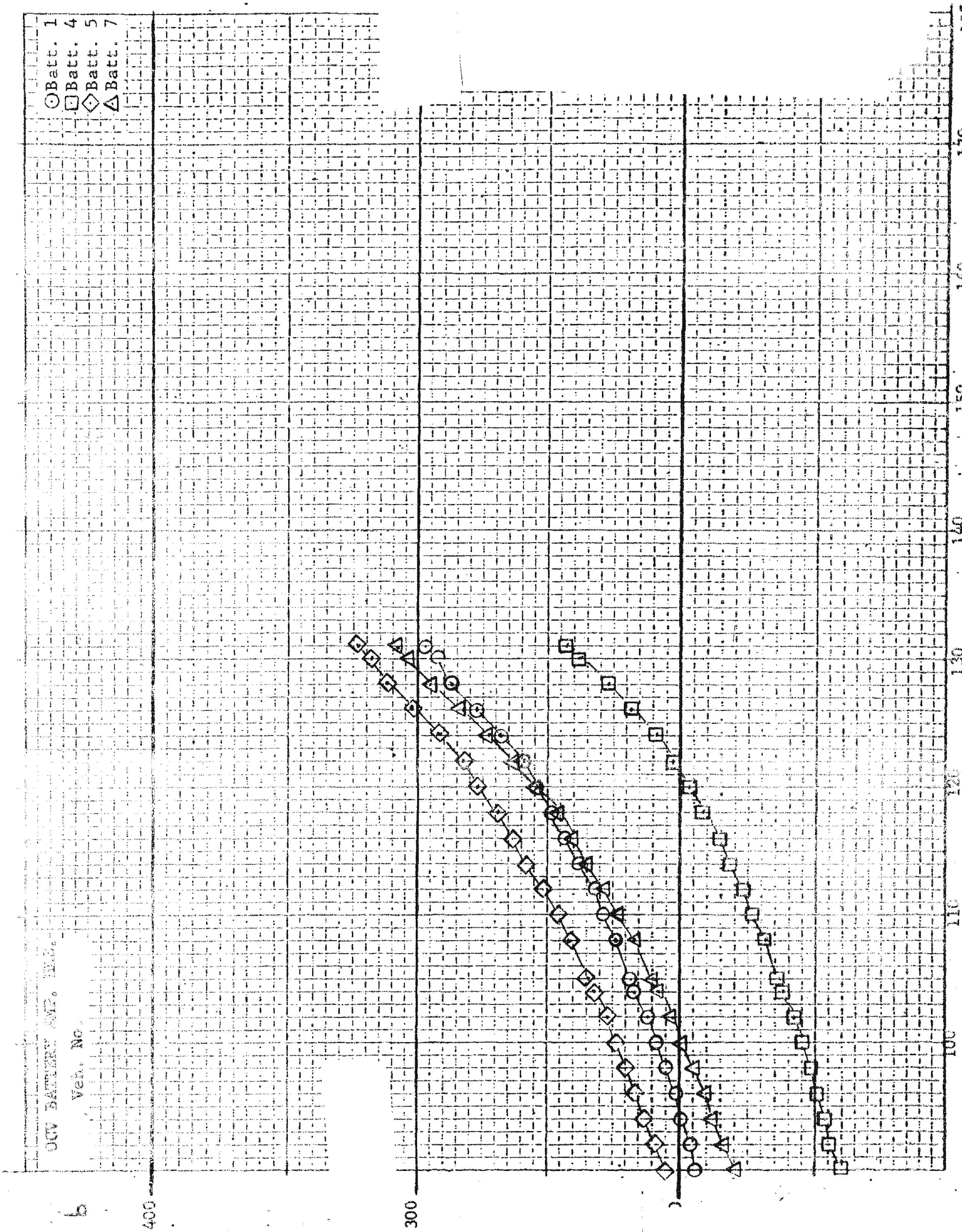
A-34.a
(S-3)


PERCENTAGE LOAD - Veh. No.
Batt. 6
Batt. 2
Batt. 3
Batt. 8
30%
%Load
20%
1%
REV
10
20
30
40
50
60
70
80
90

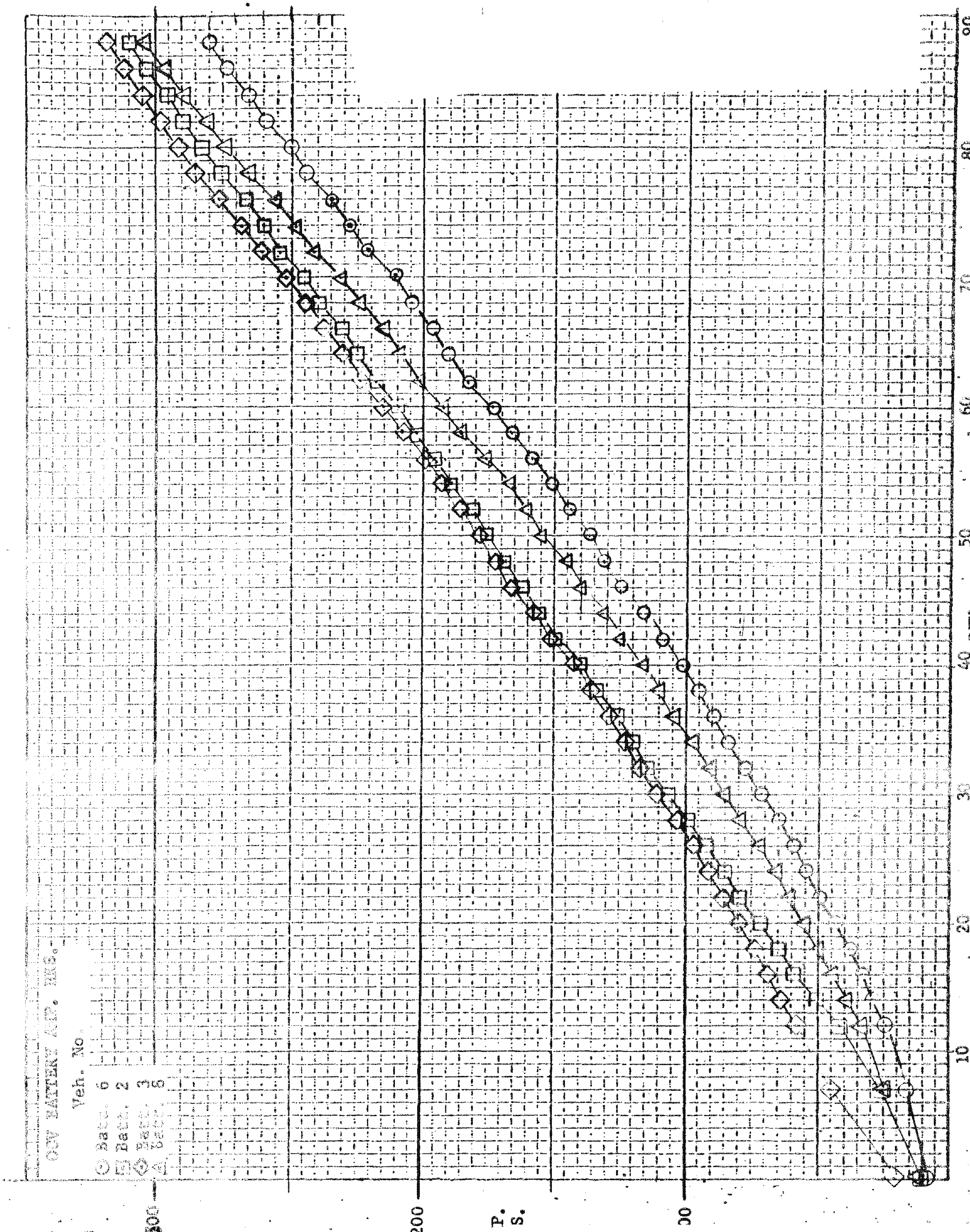

PERCENTAGE LOAD - Veh. No.
Batt. 6
Batt. 2
Batt. 3
Batt. 8
30%
% LOAD
20%
100
110
120
130
REV.
140
150
160
170
18


OCV BATTERY AMP. HRS.
Veh. No.
Batt. 1
Batt. 4
Batt. 5
Batt. 7
REV.
300
200
0
10
20
30
40
50
60
70
80
90

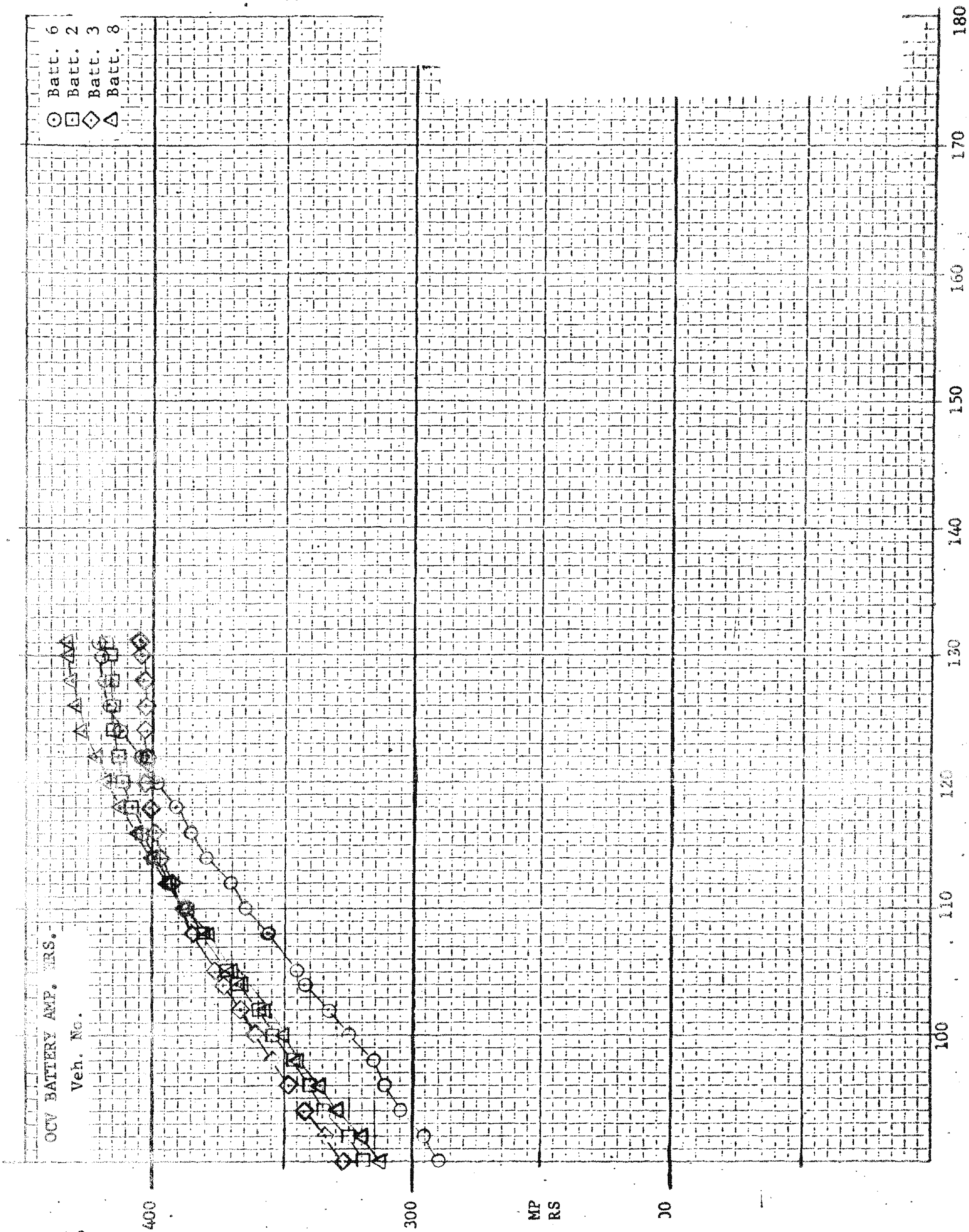
(S-3) A-36


Batt. 1
Batt. 4
Batt. 5
Batt. 7
Veh. No.
400
300
100
110
120
130
140
150
160
170
180

(S-3)A-36.a

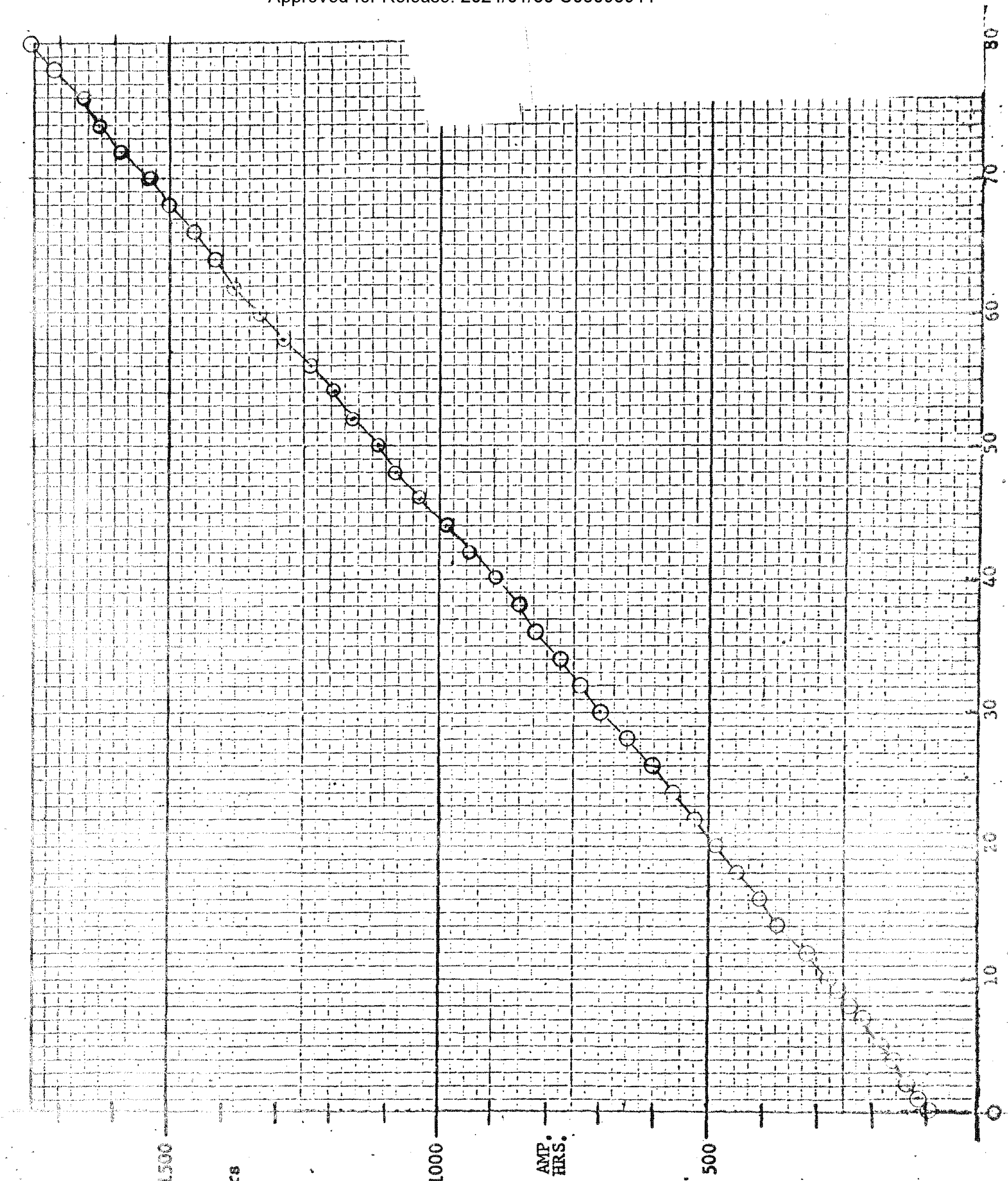

OCV BATTERY AMP. HRS.
Veh. No.
Batt. 6
Batt. 2
Batt. 3
300
200
00
P. S.
REV.
10
20
30
40
50
60
70
80
90

(S-3) A-37


OCV BATTERY AMP. HRS.
Veh. No.
Batt. 6
Batt. 2
Batt. 3
Batt. 8
100
110
120
130
140
150
160
170
180
400
300
MP
RS
30

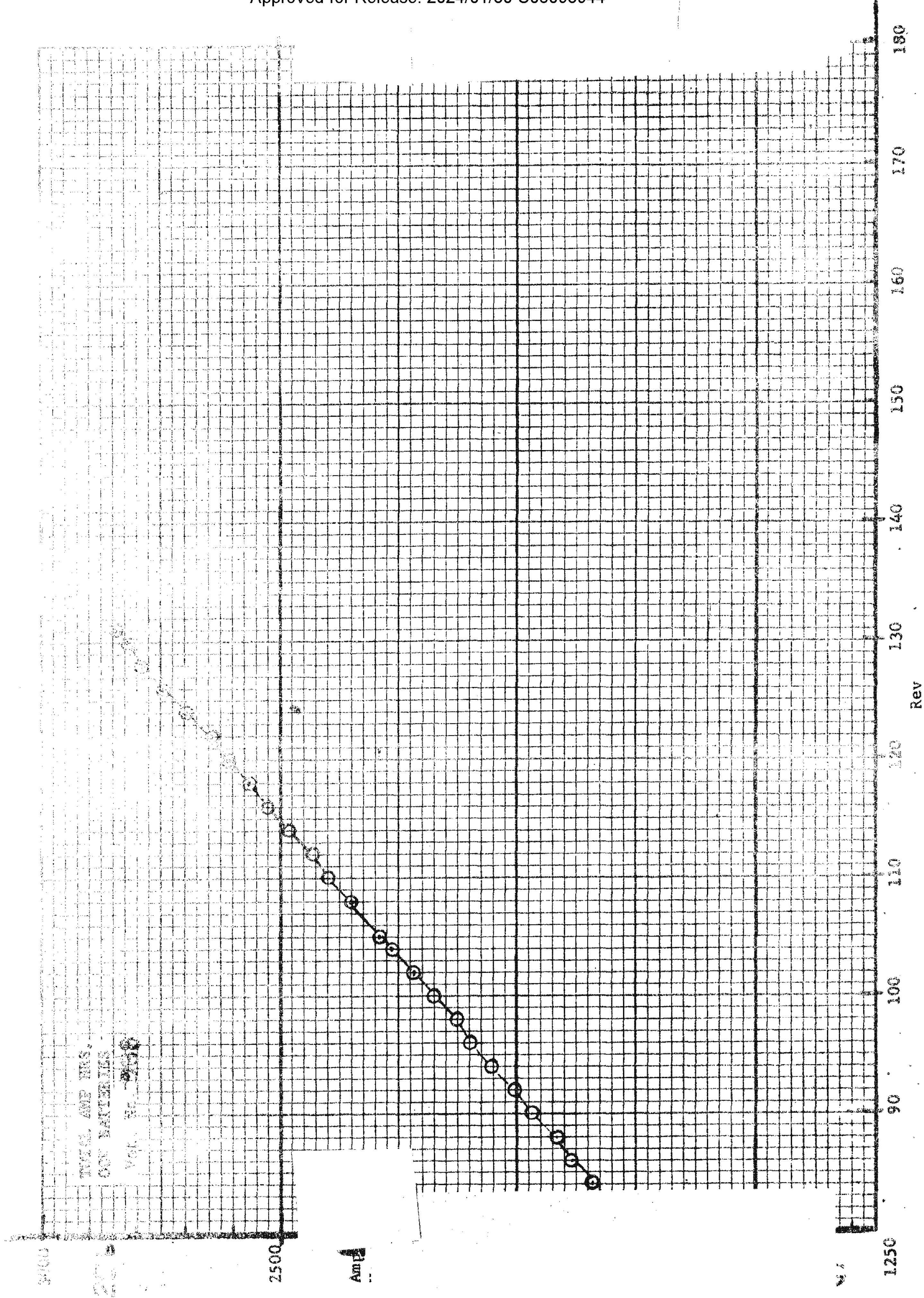
9b

(8-3) A-37a



Total Amp. Hours
OCV Batteries
Veh. No.

(S-3)A-3



180
170
160
150
140
130
Rev
120
110
100
90
1250
2500
Amp