TR-596

January 8, 1968

JOHN F. KENNEDY SPACE CENTER

FINAL TEST REPORT

SYSTEM VALIDATION TEST

LEM CREW COMPARTMENT COOLING UNIT

LAUNCH COMPLEX 37, LAUNCH AREA B

PROJECT NO. 30164

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TEST PLANNING AND REVIEW
SUPPORT OPERATIONS DIVISION
CATALYTIC-DOW

for

KSC FACILITIES ENGINEERING DIVISION
JOHN F. KENNEDY SPACE CENTER - NASA

SQT-51248

KSC FORM 16-12 (4/66)

TR-596

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LEM CREW COMPARTMENT COOLING UNIT
LAUNCH COMPLEX 37, LAUNCH AREA B

JOHN F. KENNEDY SPACE CENTER, NASA

PROJECT NO. 30164

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JOHN F. KENNEDY SPACE CENTER

TR- 596

FINAL TEST REPORT

CATALYTIC-DOW

LEM CREW COMPARTMENT COOLING SYSTEM

LAUNCH COMPLEX 37, LAUNCH AREA B

ABSTRACT

This report presents a summary of the Unit and Systems Validation Testing performed on the LEM CREW COMPARTMENT COOLING UNIT (KECO Industries, Incorporated, Model F-106) and the complete LEM CREW COMPARTMENT COOLING SYSTEM as installed on the Launch Complex 37 Service Structure.

Based on the test data obtained and the method of test performed, the system was considered acceptable to the procuring agency.

SECTION I

INTRODUCTION

1-1 PURPOSE

This report presents a summary of the validation test history and results obtained during the Systems Validation Test Program performed during the period 8 October 1967, through 11 November 1967, on the KECO Industries Model F-106 LEM Crew Compartment Cooling Unit per se, and the LEM Crew Compartment Cooling System.

1-2 SCOPE

Test information presented encompasses Unit Confidence testing performed on the ground, Unit Validation testing and System Validation testing performed in situ on the LC-37 Service Structure.

1-3 APPLICABLE DOCUMENTS

GP-384	System Validation Test Procedure, LEM Crew Compartment Cooling Unit
GP-384, Rev. B	System Validation Test Procedure, LEM Crew Compartment Cooling Unit
Technical Manual KECO Model F-106 Crew Compartment Cooling Unit	KECO Industries Cincinnati, Ohio

SECTION II

VERIFICATION OF PRE-REQUISITES

2-1 OBJECTIVES

To verify pre-requisites, performance of pre-requisite testing and the mechanical and electrical configuration of the sub-systems and system.

2-2 METHOD

Pre-requisites required are defined in Section IV of the System Validation Test Procedures GP-384 and GP-384 Revision B. Those pre-test conditions impacting test and not met prior to start of test were recorded at the pre-test review and satisfied by means of deviation documents.

2-3 PRE-REQUISITE TEST DATA

Test data is presented in the order of the pre-requisite test sequence as performed.

2-4 SEQUENCE OF TESTS

Testing was performed in the following sequence delineated in Sections III thru VI. They are:

(a) Unit Confidence Test
(b) Unit Validation Test
(c) System Validation Test
(d) System Validation Retest

SECTION III

UNIT CONFIDENCE TEST

3-1 OBJECTIVES

This test was performed to check out, calibrate and gain confidence in the operational stability of LEM Crew Compartment Unit, Model F-106, S/N 66086 over a steady-state operating period of 72 hours. This test was performed remotely from the unit installation site.

3-2 METHOD

Unit S/N 66086 and auxilliary control duct were assembled at the remote location and instrumented for the following parameters:

a. LEM Interface Air Velocity
b. LEM Interface Dry Bulb Air Temperature
c. LEM Interface Wet Bulb Air Temperature
d. Unit Static Pressure
e. Ambient Air Dry Bulb Temperature
f. Ambient Air Wet Bulb Temperature
g. Blower (air handler) speed
h. Fan (condenser) speed
i. Differential Pressure, Primary Filter
j. Differential Pressure, Intermediate Filter
k. Differential Pressure, Final Filter
l. Compressor Suction Pressure
m. Compressor Discharge Pressure
n. Coil Leaving Air Dew Point

These data are presented plotted against time over the entire duration of the test, in the test data section.

Prior to the start of the test, the unit compressor gauges were calibrated against a laboratory standard gauge. Calibration data for these items are presented in subsection 3-5 Test Data.

Filter differential pressures were calibrated against a flexible tube water manometer. No correction for temperature was made as the specific gravity of the unit manometer fluid was given as 0.835 at 70°F. This was within 3°F of the temperature at which calibration was made.

3-2 METHOD (Continued)

A test interconnect cable was fabricated for controlled operation and calibration at the remote testing location.

The output of the unit reheat proportional amplifier was calibrated by substitution of the LEM Interface Air Temperature sensor with a calibrated standard resistance of 956 ohms. The output was then adjusted in accordance with the instructions given in the KECO O and M Manual, and read on a calibrated V.T.V.M. The temperature set control was then positioned to agree with the LEM Interface Temperature as read on a calibrated pyrometer.

The LEM Interface Air Velocity was set to approximately 1300 FPM as read on a calibrated Velometer by adjustment of the damper motor proportional bridge. Damper hurting was minimized by adjustment of the damper motor speed control and the output of the associated proportional bridge amplifier.

The 72 hour confidence test was started 1630 hours EDT and the unit was allowed to stabilize for one (1) hour prior to the tabulation of official data started at 1730 hours EDT.

3-3 TEST RESULTS SUMMARY

The unit confidence test duration was 69 hours, three (3) hours short of the intended 72 hour duration. The test was prematurely terminated to investigate and repair an anomaly in blower operation. Auxilliary duct was removed and cleaned to level four (4) by others.

3-4 DISCREPANCIES

Filter deferential pressure manometers were inoperative because of insufficient fluid in each. These were refilled and calibrated as stated in section 3-2. HEPA filter discharge pressure sensing line was pinched closed at sensing point. The line was replaced with 1/8" "TYGON" plastic hose and the manometer recalibrated.

Unit discharge temperature readout was found to be in error by 12% of actual temperature. Since repair of this unit is not practical, substitution is recommended.

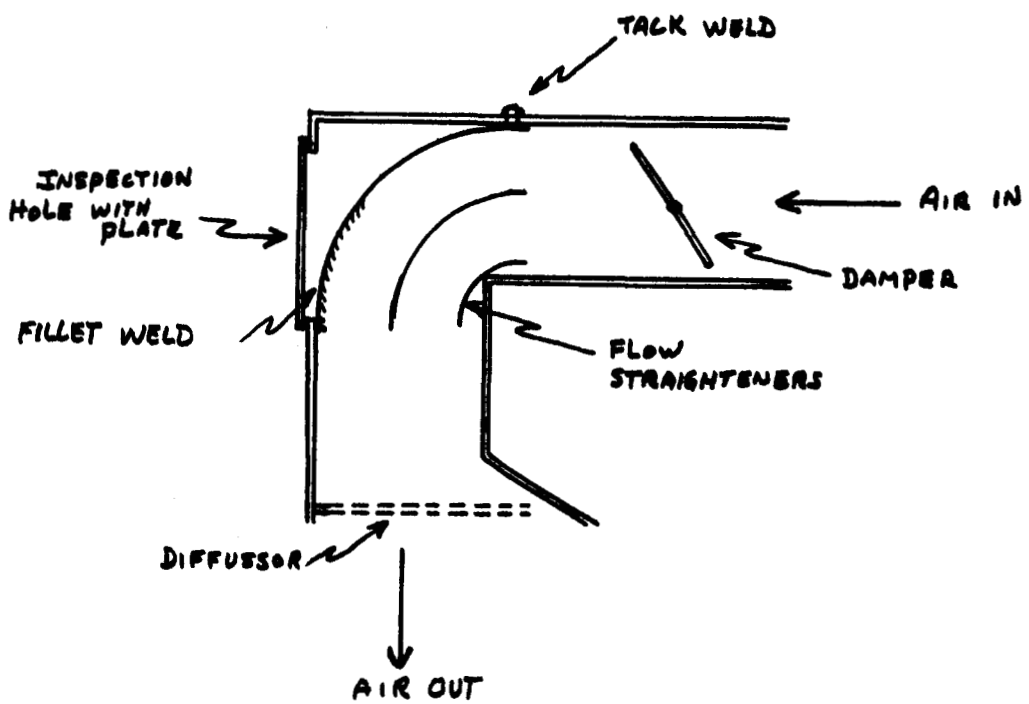
3-4 DISCREPANCIES (Contined)

The static pressure sensor at the readout device was found to read over 100 megohms. Inspection of static pressure transducer in auxilliary duct showed that electrical connector was not plugged into transducer. Connection was made and readout secured.

At 1430 hours EDT on 10-9-67, after 69 hours of continuous operation, a loud noise (approximately 10 dB over general unit noise level), started in the general area of the blower discharge motorized damper. Noticeable vibration of the ducting in this area, which was capable of modulation by the motorized damper prompted immediate termination of the test. The blower housing was removed, the impeller and the damper blades inspected for indication of damage. An inspection hole was cut into the duct in the area of the flow straighteners. The outside straightener was found to be loose at the upstream edge. The flow straightener was welded in place and a cover installed over the inspection hole. The blower was restarted with no reoccurrence of the vibration problem. Figure 3-1 shows the method of repair.

3-5 TEST DATA

Figures 3-2 thru 3-5 present information concerning a record of, the data obtained during this test.



Mfr: KECO Industries, Inc.	Mfr. Model: F-106, S/N 66086

Figure 3-1 Diagram, Unit Flow Straightener Repair

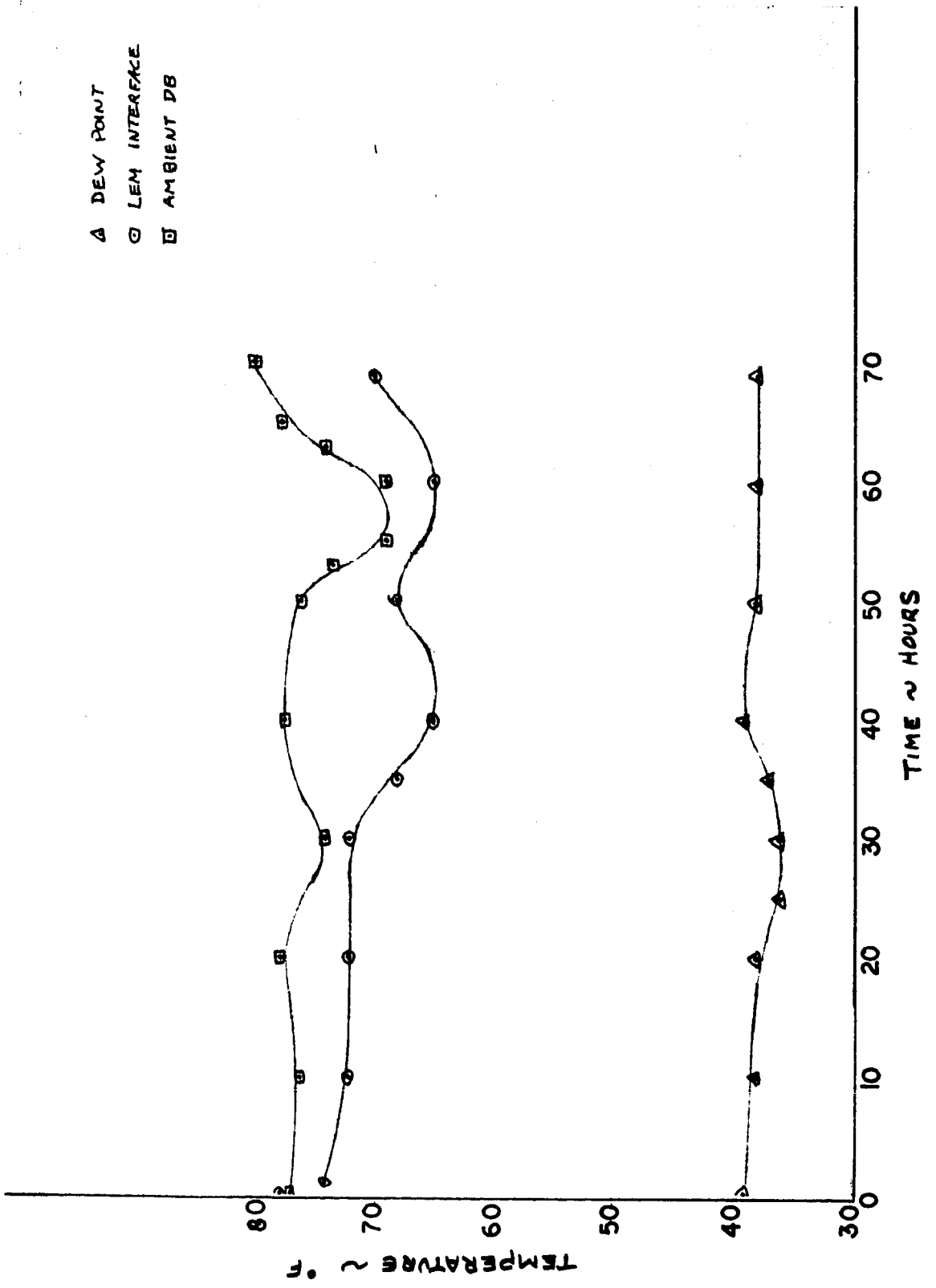


Figure 3-2 Unit Confidence Test - Temperature vs Time

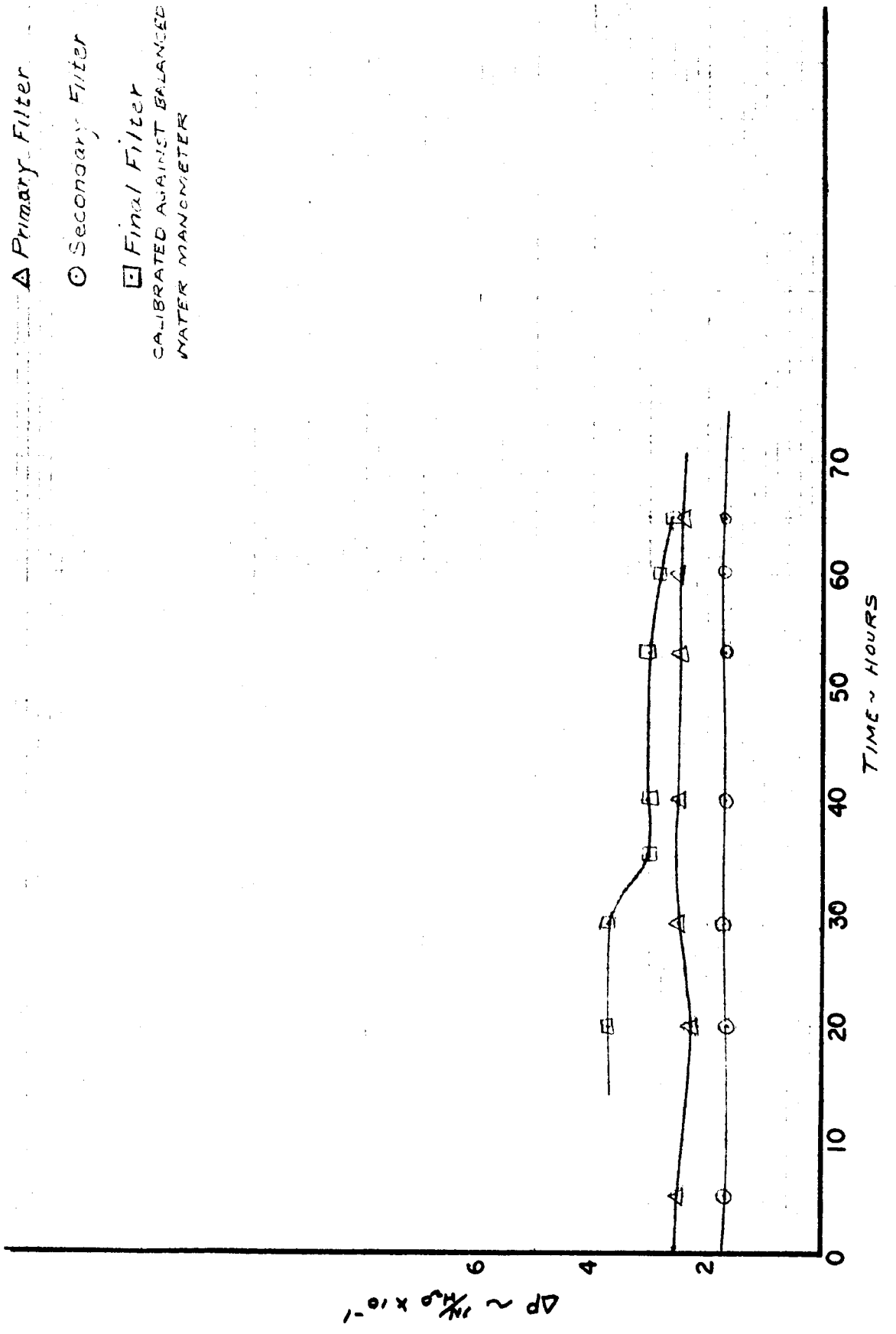


Figure 3-3 Unit Confidence Test - Filter Pressure Drop vs Time

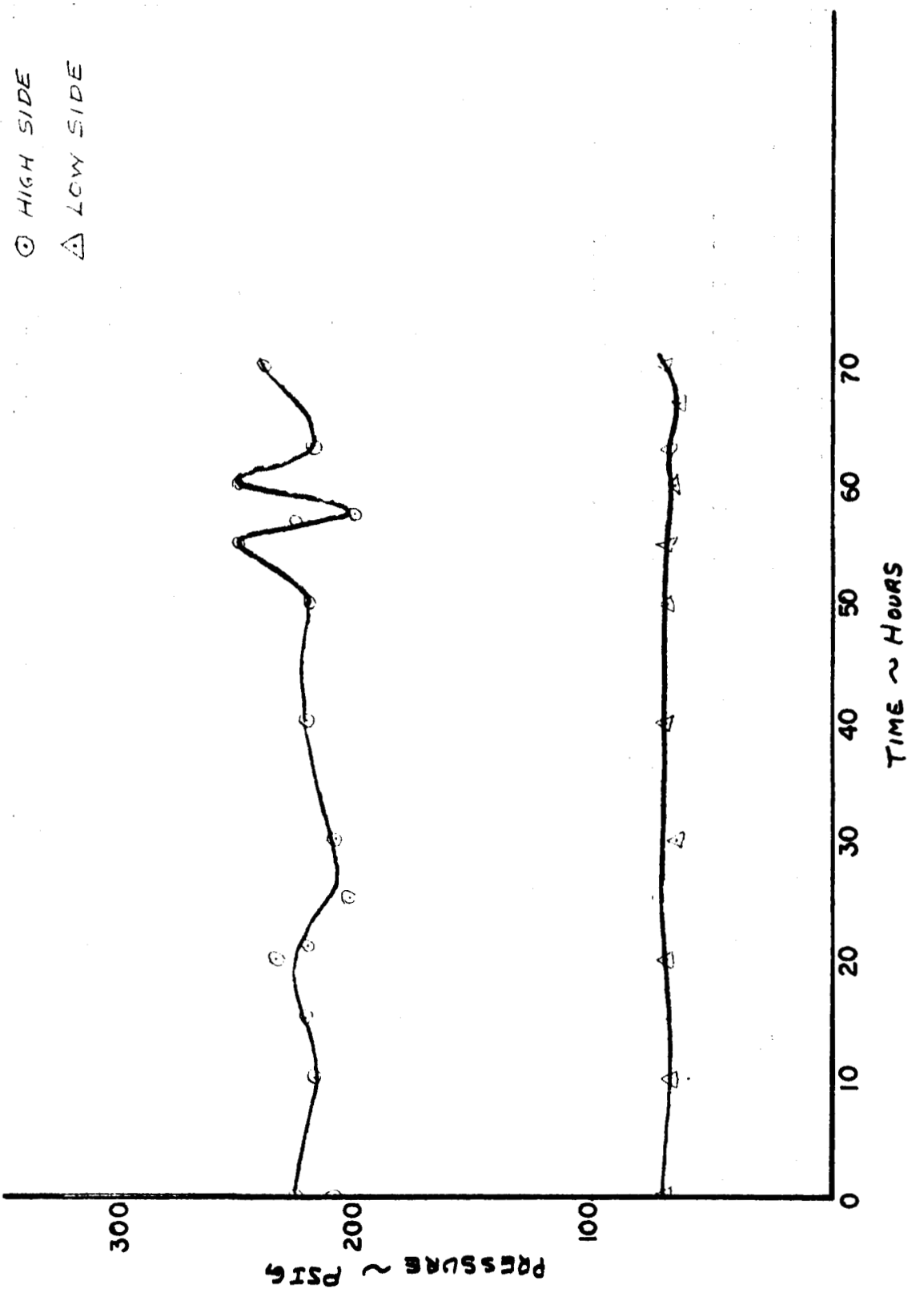


Figure 3-4 Unit Confidence Test - Pressure vs Time, Compressor

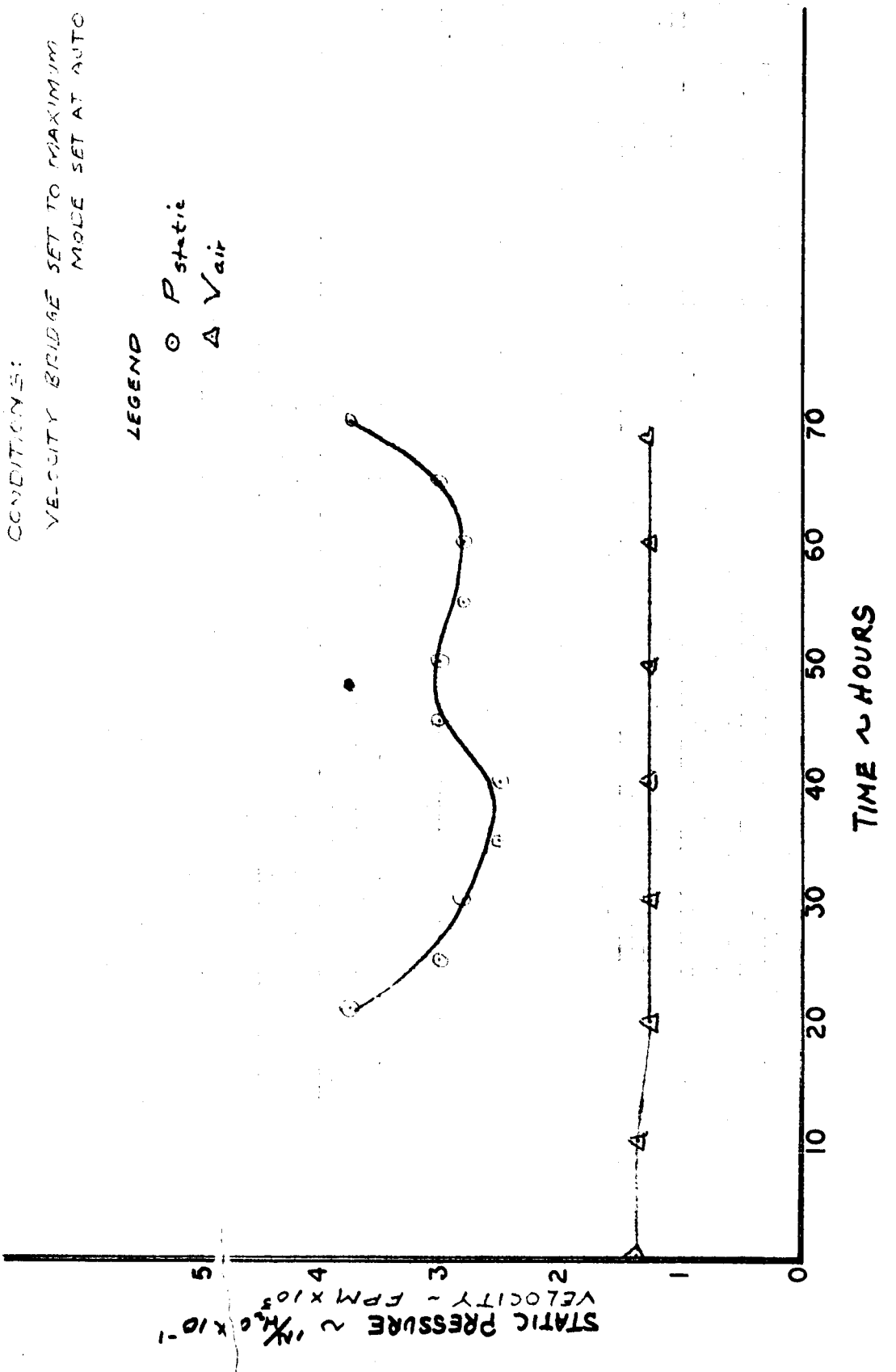


Figure 3-5 Unit Confidence Test - Static Discharge vs Time

SECTION IV

UNIT VALIDATION TEST

4-1 OBJECTIVES

This test was performed during the period from October 14 thru October 16, 1967. Primary objectives were to obtain operational data from the unit over a 72 hour period while delivering the rated 41 lbs./min. air, while in place on the service structure. Additional system confidence would be gained ancillary to the primary objectives as a result of the planned 72 hour test duration.

4-2 METHOD

The unit was secured in place on the fixed platform at level seven (7) of the LC-37 Service Structure with the structure in launch position at Pad B. The auxillary duct was positioned approximately 60 feet downstream of the unit in the place provided in the rigid ducting. The sensing cable was connected and the unit operated to deliver air through LEM interface duct 51.2. Figure 4-1 shows the test set-up used. A test fixture was inserted at the LEM interface to obtain the required laminar flow for accurate velocity measurements. The weight flow of air at 70°F was calculated from the velocity data as follows:

$$\dot{W} = AV\rho \qquad [1.]$$

$$= \frac{\left(\frac{\pi D^2}{4}\right)}{144} V\rho \qquad [2.]$$

$$= \frac{\left(\frac{(3.14)8^2}{4}\right)}{144} \left(1600\right)\left(0.0748\right)$$

$$= 41.6 \ ^{lbs}/_{min}$$

$\dot{W}$ = AVERAGE WEIGHT FLOW OF AIR ~ lbs/min

A = AREA DISCHARGE ~ FT^2

ρ = DENSITY OF AIR AT 70°F $^{lbs}/_{ft^3}$ (0.0748)

D = DIAMETER OF DUCT ~ in.

$\dot{V}$ AVERAGE VELOCITY OF DISCHARGE ~ FPM

4-2 METHOD (Continued)

41.0 lbs./min. is the total air weight flow ICD requirement at the LEM interface. By substitution of this value in equation [1] and solving for V a value of approximately 1600 fpm was obtained. The damper control was set to obtain this value at the LEM interface and the discharge temperature set to obtain 68°F. Discharge air temperatures were varied throughout the test from the lower to the upper limit of the reheat control. Figures 4-5 thru 4-8 are the test parameters plotted against time over the test duration.

Prior to the start of data acquisition, the entire duct system was pressure checked at 3 psi. Hard line ducting was found to be essentially leak free. Static discharge pressure was taken at the discharge of the unit and reflects the pressure drop thru the entire line plus the test fixture at the rated velocity of 1600 fpm.

Actual start of acceptance test was 1530 hours EDT on October 14, 1967. The first official data was entered at 2000 hours the same day. Data was recorded in one (1) hour increments over the duration of the test. Adjustments of the proportional bridge amplifiers were made during initial phases of the test to assure proper tracking of the unit over a wide temperature range. The psychrometric properties of the air at the LEM interface were obtained thru the use of calibrated instrumentation carrying "in date" calibration certifications.

4-3 TEST RESULTS SUMMARY

The test data was within limits until 2400 hours on October 15, 1967 when, after 29 hours of continuous operation, the unit dew point was recorded as 44°F. The absolute humidity at this dew point is out of limits. A violent rain storm was in progress during this time and differential pressure across the primary filter at a constant flow rate was increasing rapidly. It was concluded that possibly, rain was being entrained into the suction diffuser and flooding the coil.

The total Q thru the unit was decreased by placing the damper control on manual decrease and stopping at a velocity of 1200 CFM in an attempt to dry the unit by decreasing the water entrainment. The dew point stopped increasing and finally stabilized at approximately 42°F. This velocity was then returned to the rated value of 1600 FPM and the unit placed in the auto control mode once more. The dew point failed to return to below 40°F and the test was prematurely terminated at 0900 hours EDT October 16, 1967.

4-3 TEST RESULTS SUMMARY (Continued)

Based on the high primary filter differential pressure, the high dew point and the direction and speed of the prevailing winds during the rain storm, it was recommended that a protective hood be provided over the suction diffuser to preclude the possibilitiy of water entrainment.

It was also recommended that the unit expansion valve be adjusted to increase the refrigeration effect and lower the dew point if this parameter did not return to within limits after the unit dried out. Further testing proved this requirement to be unnecessary.

4-4 DISCREPANCIES

Premature termination of the test after 38 hours of run time was attributed to water entrainment thru the unit suction diffuser. The design specification requires that the unit supply 41 lbs/min air at an absolute humidity of 37 grains vapor per pound of dry air, while the relative humidity of the incoming air is 100%. The test data shows that the unit was unable to meet these requirements in it's present configuration. It was therefore recommended that environmental protection be incorporated in the area of the suction side of the unit prior to retest. Figure 4-2 shows the general configuration of the modification to the unit to effect this.

4-5 TEST DATA

Figures 4-3 thru 4-8 present test data information obtained during performance of the test.

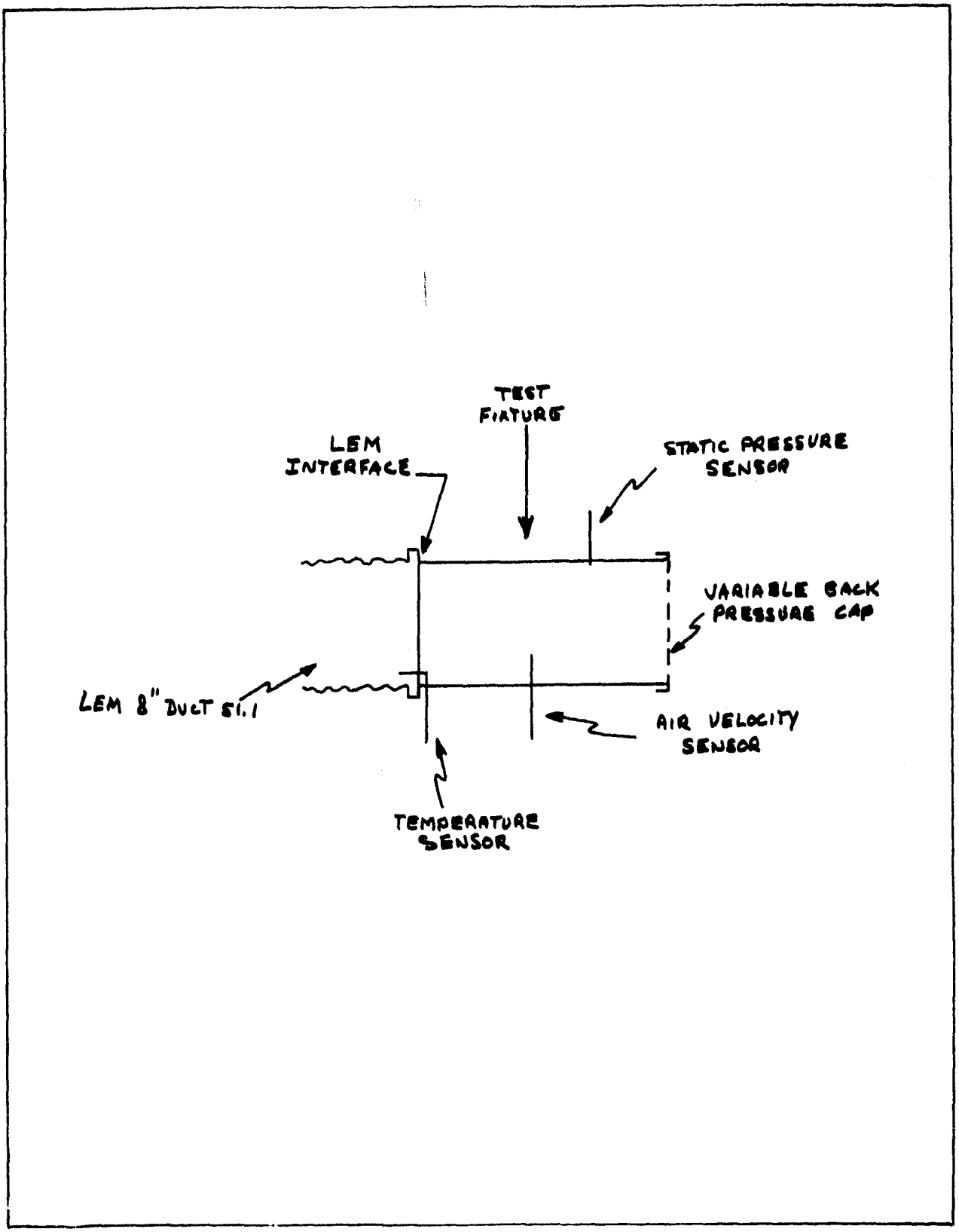


Figure 4-1 Diagram, Test Fixture at LEM Interface - Duct 51.1

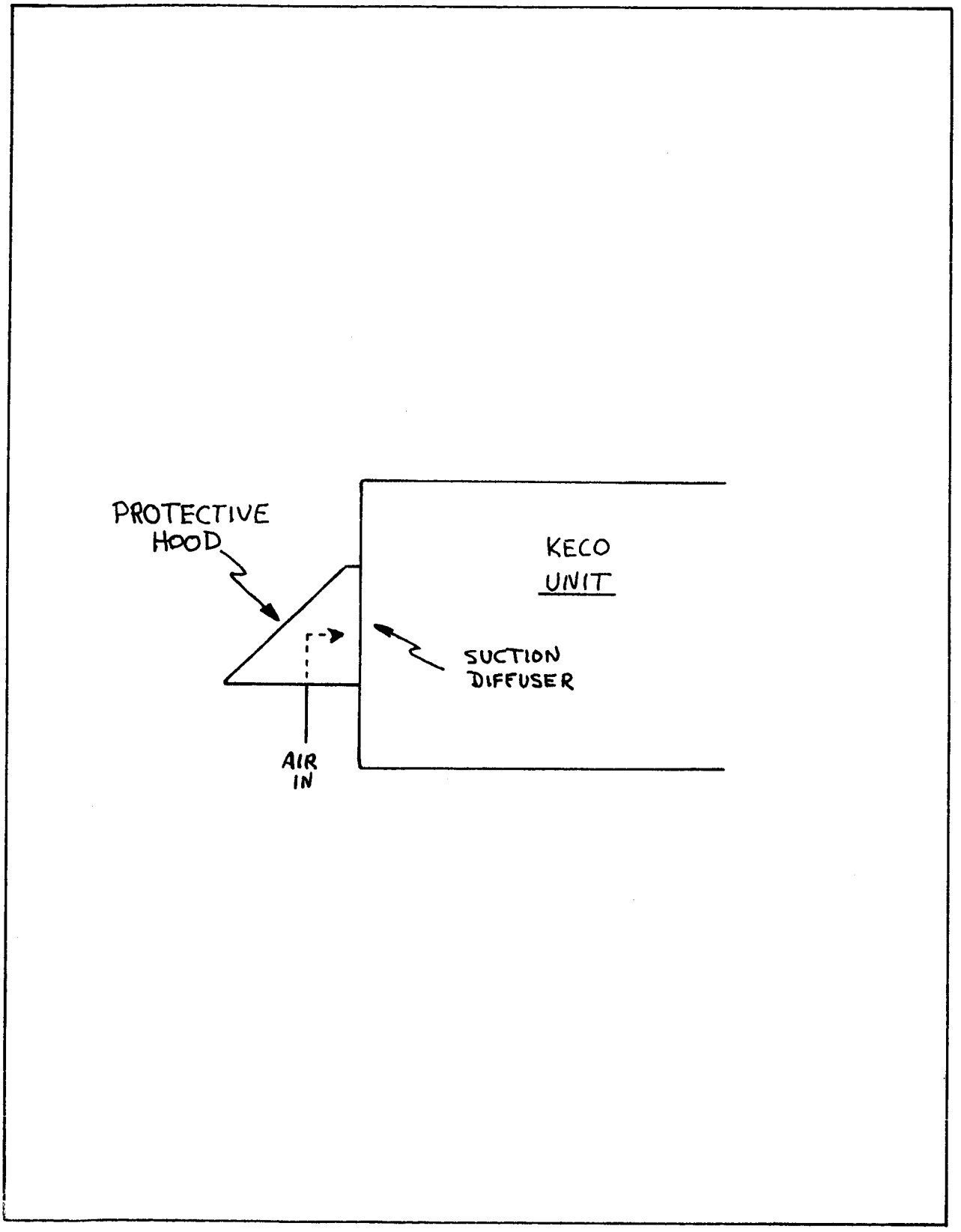


Figure 4-2 General Arrangement, Environmental Protective Hood

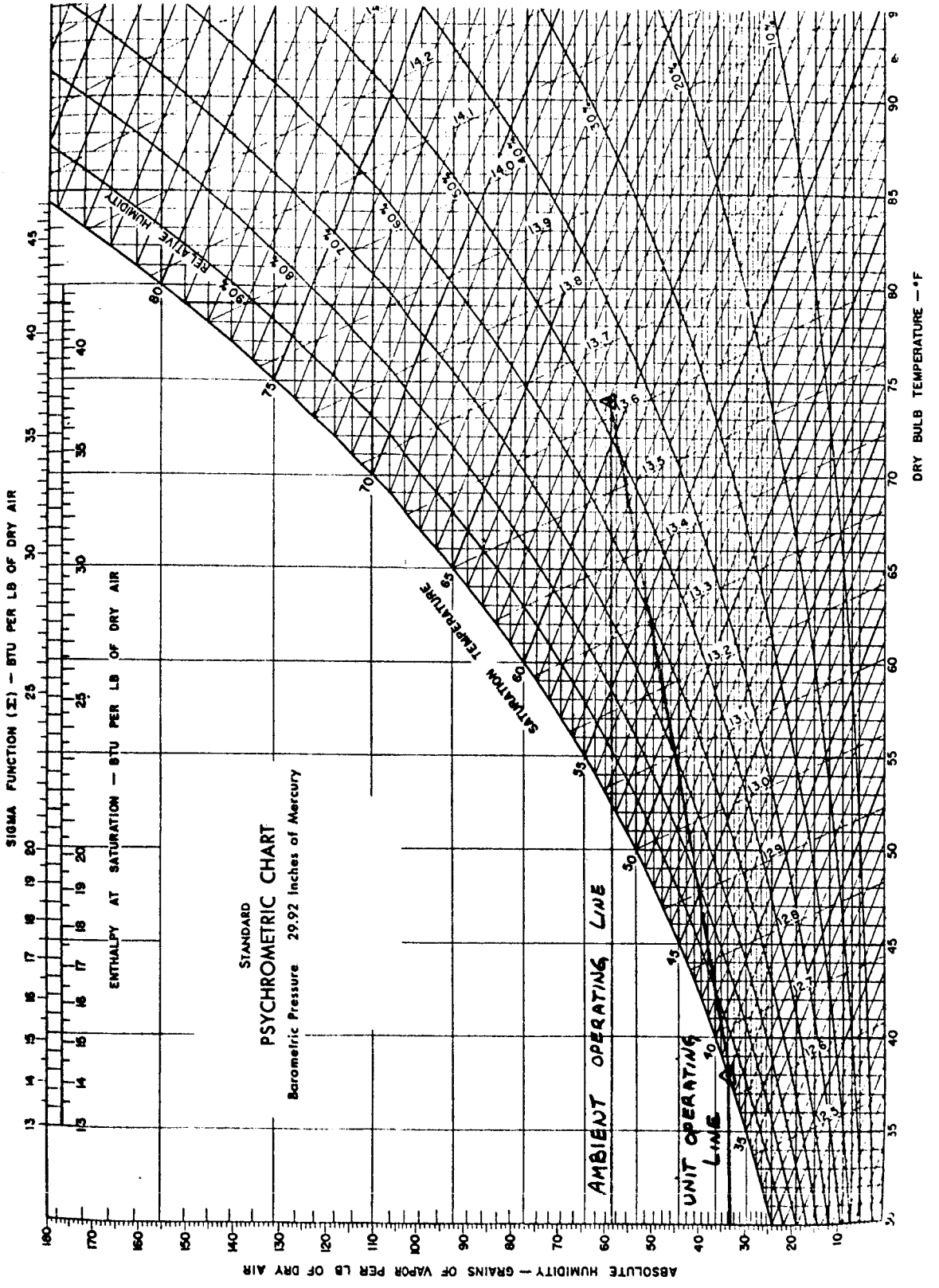


Figure 4-3 Unit Validation Test - Psychrometrics at Start of Test

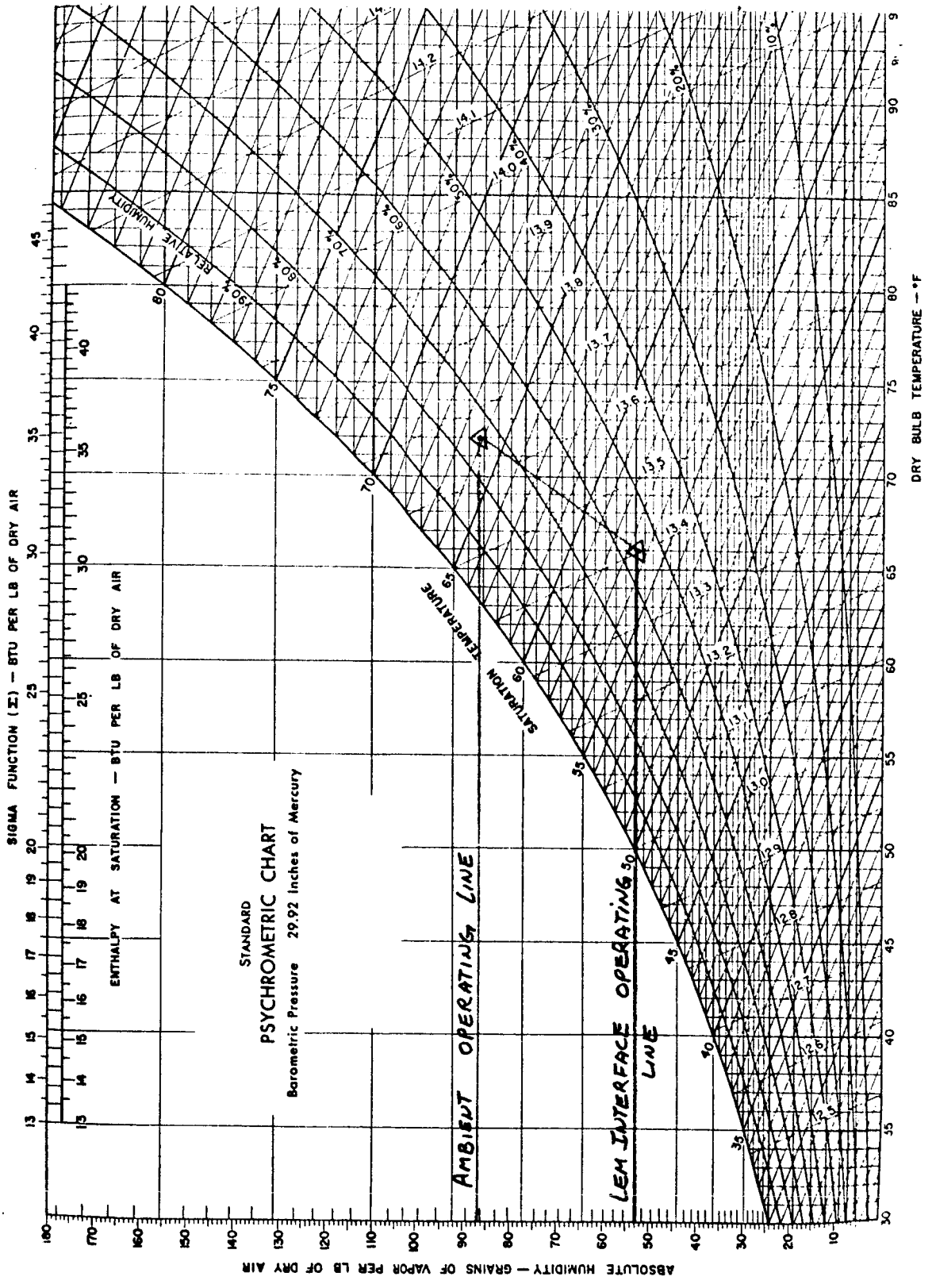


Figure 4-4 Unit Validation Test - Effect of Water Entrainment

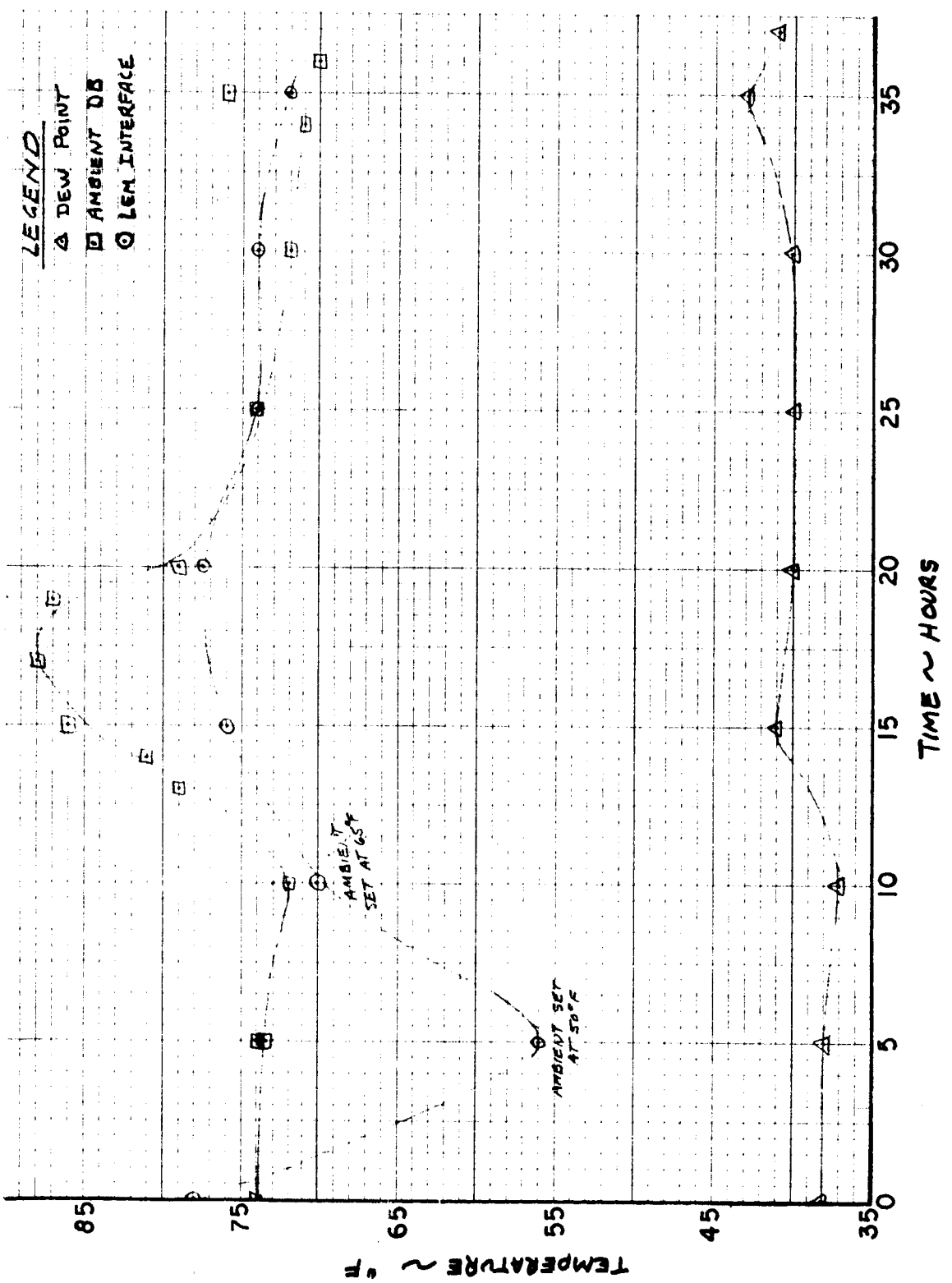


Figure 4-5 Unit Validation Test - Temperature vs Time

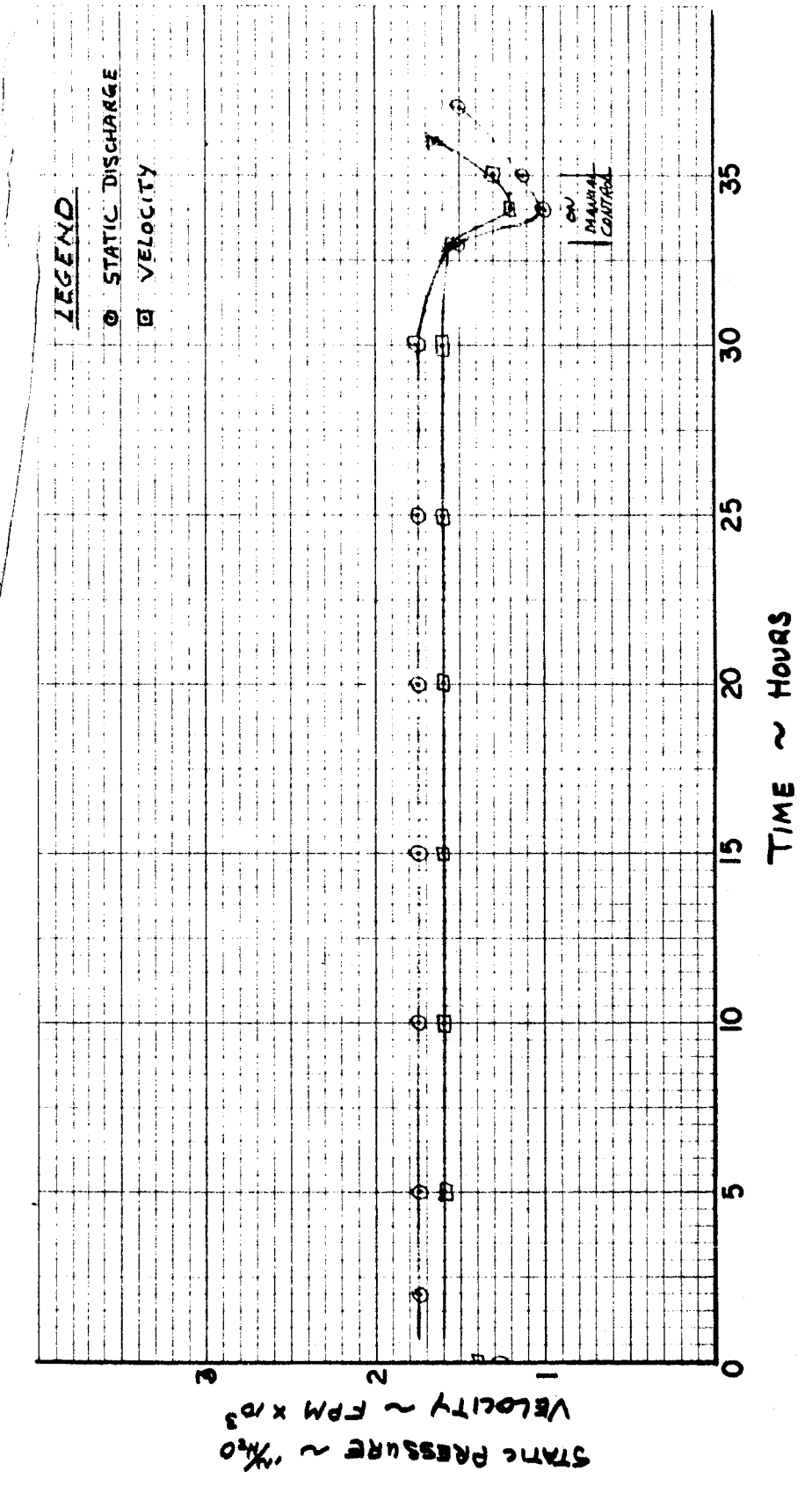


Figure 4-6 ...t Validation Test - Static Discharge and Velocity vs Time

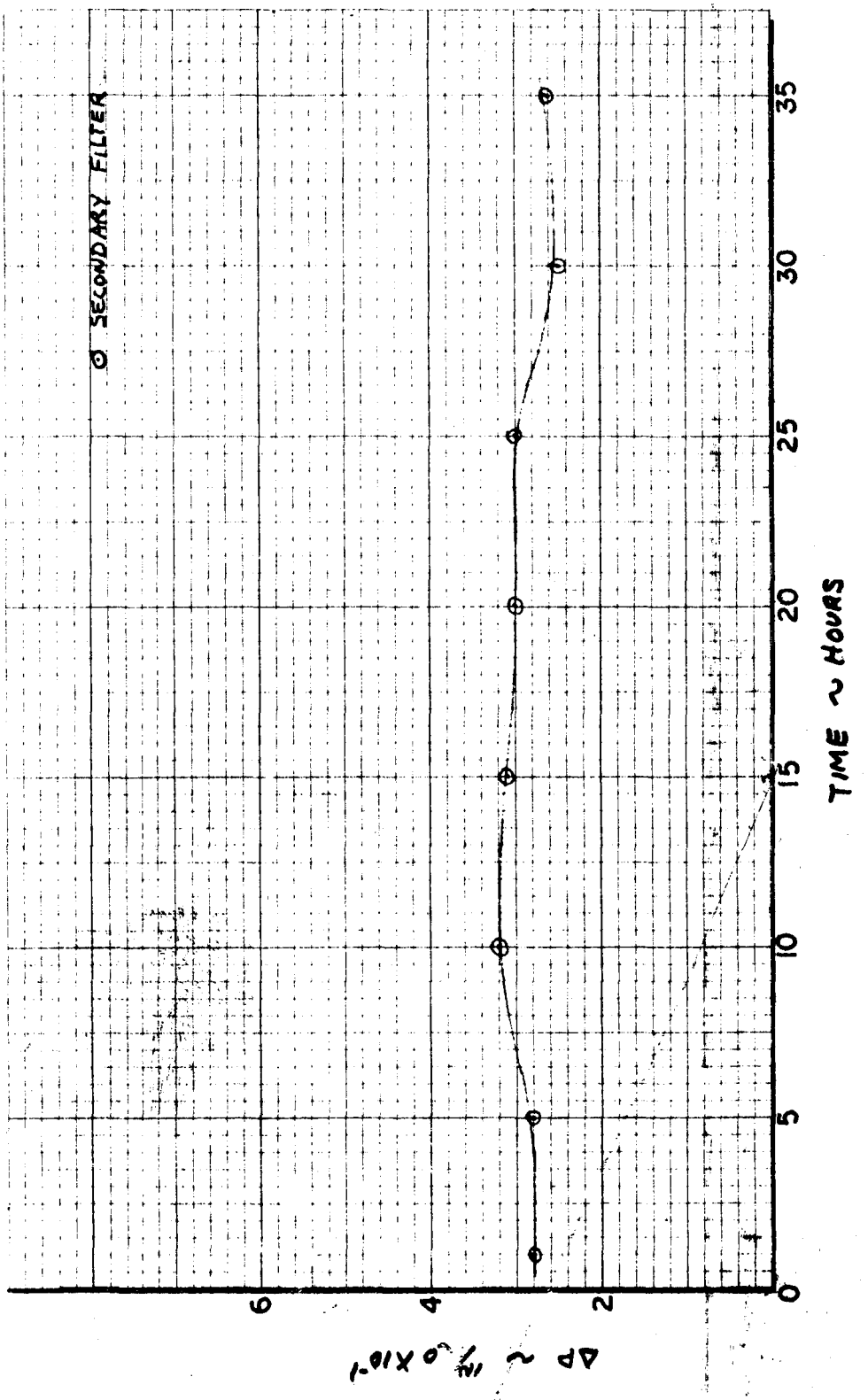


Figure 4-7 Unit Validation Test - ΔP Filter vs Time

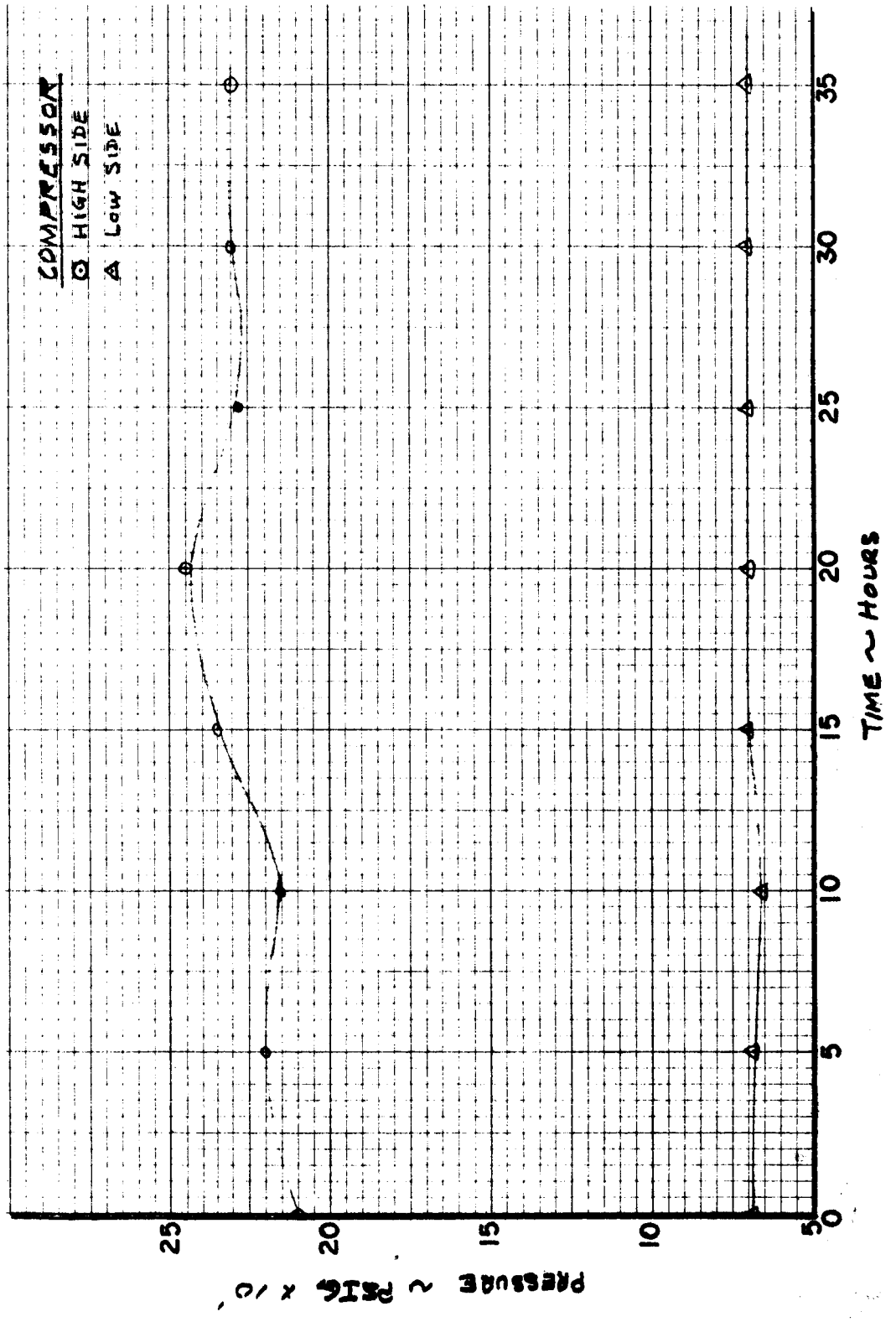


Figure 4-8 Unit Validation Test - Pressure vs Time

SECTION V

SYSTEM VALIDATION TEST

5-1 OBJECTIVES

Primary objectives for this test were to show that the unit and associated ducting could meet the requirements of the Interface Control Documentation over a period of 72 hours. These success criteria were defined in the Data Acquisition Requirements Document as presented in the Validation Test Procedure GP-384 Revision B.

Secondary objectives were to balance the unit air delivery weight flow between the LEM delivery ducts, and gain additional confidence in unit operation.

5-2 METHOD

The required static pressure and air weight flow between the ducts was adjusted by means of varying the pressure drop at the discharge of the test fixtures installed at the end of each. These fixtures were required to provide the laminar flow profiles necessary to obtain a representative velocity average, and also to provide a place for static pressure measurement. Figure 5-1 shows the test set-up at the LEM Interface.

A functional test of damper operation was performed prior to the start of testing. The dampers were actuated from the valve panel located on adjustable platform No. 6, of the service structure. All dampers were observed to actuate as required. The configuration of the ducting for initial balancing was as follows:

(a) LEM Interface Duct B - damper closed
(b) LEM Interface Duct 51.1 - damper open
(c) ACE Interface Duct 51.2 - damper open

ICD requirements were that 21 lbs/min air be delivered from LEM Duct B or LEM Duct 51.1 simultaneously with 20 lbs/min from ACE Duct 51.2.

Duct B and Duct 51.1 were both 8 inch diameter ducts at the interface connection. The average velocity equivalent to 21 lbs/min air at 70°F was therefore:

5-2 METHOD (Continued)

$$\dot{V} = \frac{\dot{W}}{A\rho}$$

$$= \frac{21}{\left[\frac{\frac{\pi 8^2}{4}}{144}\right] 0.075} = 805 \text{ ft/min}$$

For the 6 inch diameter ACE duct, the average velocity equivalent to 20 lbs/min air at 70°F is:

$$\frac{20}{\left[\frac{\frac{\pi 6^2}{4}}{144}\right] 0.075} = 1360 \text{ ft./min}$$

The test fixture back pressure was adjusted to these values while monitoring the static pressure. Static pressure was increased by adjustment of the total flow from the unit while simultaneously increasing the pressure drop at the test fixture discharge to keep the average velocities near the values derived.

The entire ducting system was cleaned to level IV by a commercial cleaning agency. Particle analysis report was submitted prior to test. The unit was started at 1600 hours EDT on November 3, 1967, and allowed to run at 70°F to dry lines of residual Freon cleaning agent, the Freon/air mixture being pumped into the LEM platform enclosure (adjust level 5).

Official data acquisition was stated at 0200 hours EDT on November 5, 1967 for the 72 hour validation test. Figure 5-2 presents the parameters measured with respect to test time.

5-3 TEST RESULTS SUMMARY

Data acquisition for this test was started at 0230 hours EDT on November 5, 1967. The test results show the change in the pyschrometric properties of the air at the LEM interface prior to and during the time of the loss of reheat. (See 5-4 Discrepancies).

The results of this test did not meet the requirements of the success criteria and a retest was performed.

5-4 DISCREPANCIES

Systems validation test progressed without incident for 23 hours with the exception of unit dew point, and concomitantly, the Relative Humidity at the LEM interface both of which were out of acceptable limits. The system test was continued while the search for the cause of the high absolute humidity continued.

At 0230 hours on November 6, 1967, while attempting to obtain a temperature of 85°F DB at the LEM interface, reheat capability was lost and the unit temperature dropped to 48°F. Figure 5-2 shows the effect of the heater failure.

The cooling coil was found to be iceing, and a compressor unloader was adjusted to decrease the refrigeration effect. The iceing condition was resolved, but the high absolute humidity problem remained.

Trouble shooting continued, and it was discovered that the current to each of the three (3) heaters measured one (1) ampere or less. The output from the proportional bridge amplifier was monitored while still connected to the silicon controlled rectifiers supplying the heaters. The input signal was varied, and it was found that there was no change in output (22vdc). The test was terminated at 1800 hours EDT, the unit shut down, and the heater fuses checked. Those protecting heaters No. 1 and 2 measured open. Continuity checks showed that both heaters were short circuited to ground potential. Further analysis of the heater failure showed that they had been subjected to immersion in water resulting from failure of the condensate drain valve to fully drain the unit of cooling coil condensate.

The damper in duct 51.1 was found to leak air excessively in the fully closed position. Removal and analysis of the unit showed that the damper blade was not closing properly. The unit was cleaned and the seat refitted to effect a better seal.

Subsequent repair of unit S/N 66086 was made by substitution prior to retest under System Validation Test Procedure GP-384, Rev. B as deviated. These deviations are presented in the appendix section of this report.

5-5 TEST DATA

Figure 5-2 shows the effect of the loss of reheat on air temperature and relative humidity as recorded at the LEM Interface.

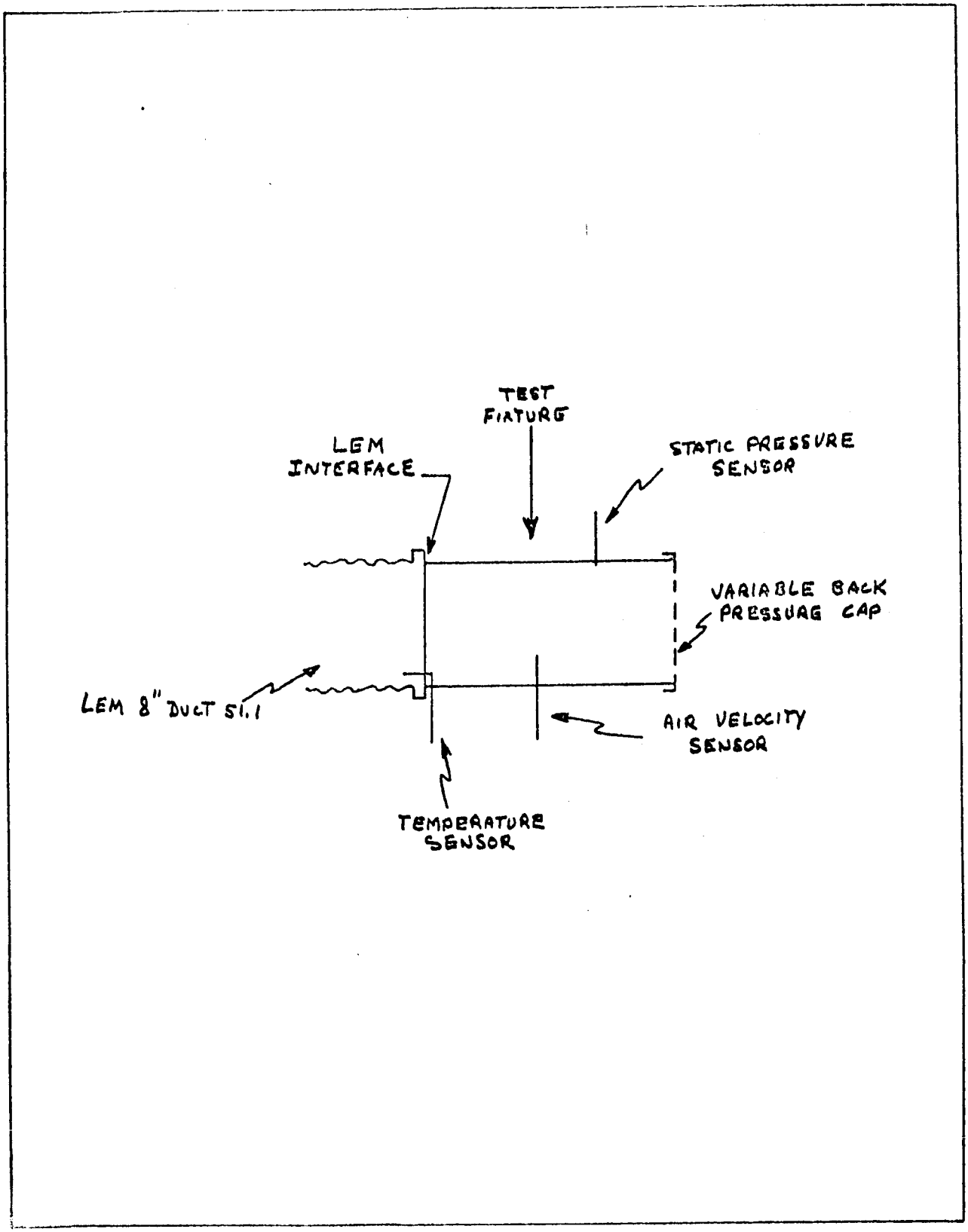


Figure 5-1 Diagram, Test Fixture at LEM Interface - Duct 51.1

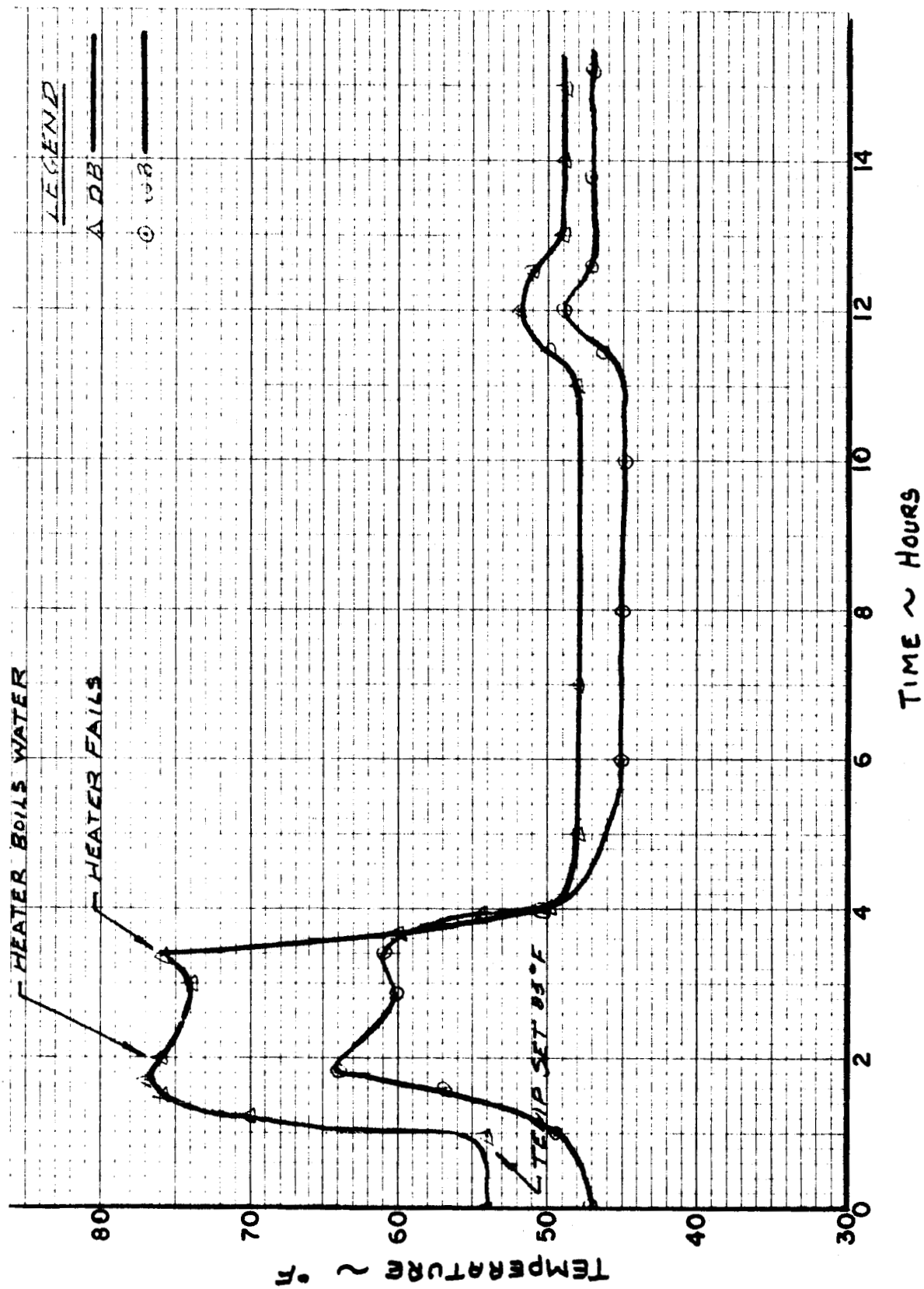


Figure 5-2 System Validation Test - LEM Interface Duct 51.1
Temperature vs Time

SECTION VI

SYSTEM VALIDATION RETEST

6-1 OBJECTIVES

The primary objective of the system retest was to obtain acceptance test data in accordance with the requirements of System Validation Test Procedure GP-384 Revision B, as deviated. Secondary objectives were to verify the merit of operational repair to the cooling unit and to obtain system confidence over an extended test duration.

6-2 METHOD

The test set-up was similar to that used in the basic System Validation test (Section V). The major difference being the shorter duration of the retest requirement, and the more limited scope of the LEM Interface parameters.

6-3 TEST RESULTS SUMMARY

The test was started at 1600 hours EST on November 11, 1967, and was completed at 2400 hours EDT the same day. All data obtained was within the limits specified by the Data Acquisition Requirements Document and/or the success criteria.

6-4 DEVIATIONS

All deviations to the Test Procedure made during the test are recorded on pages 6-2 thru 6-4. Authorization for the deviations was obtained prior to performance of the operation impacted and each is secured by Systems and Project Engineering as well as the Test Planning and Review Department approval.

The requirement for near 100% Relative Humidity Conditions could not be obtained by ordinary means, and prevailing ambient conditions were used throughout the test. (see page 6-2)

6-4 DEVIATIONS (Continued)

The ten (10) inch damper in one (1) of the LEM Compartment Supply lines was found not to be functioning properly, allowing the acquisition of psychrometric measurements at only one (1) duct interface. Authorization for the deletion of the test requirements dictated by the DARD are presented on page 6-3.

6-5 TEST DATA

Test data obtained during the performance of the test are presented in the following tables and figures.

30164

11-11-67

TEST DEVIATION RECORD GP-384 Rev. B

STEP NO.	IS NOW	CHANGED TO READ	TEST ENGR.
6.1 A-5	Close damper (FW-7)	requirement deleted	
6.1 A-6	monitor and record air temperature...	" "	
6.1 A-12	close damper (FW-7)	requirement deleted	
6.1 A-14	monitor and record air temperature...	" "	
6.1 A-16	Utilizing a water hose.....	requirement deleted	
none	Add step A-22.	monitor and record dry bulb and wet bulb temperature of air at 3" duct interface after completion of all other validation test requirements. Exhibit TC	

6-3

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PAGE 1 OF 1

TEST DEVIATION RECORD

STEP NO.	IS NOW	CHANGED TO READ	TEST ENGR.
4.2.1		6" Duct addition welded by non-certified	
		welder - Q.A. to validate after completion	
		of the System Validation Test.	
4.2.2		See above	
4.2.3		Not applicable	
4.4.1		See 6.1 following:	
6.1 & 6.1A	Original Steps were A-1 thru A-21.	Proceed in following sequence A-1, A-2, A-3,	
		A-4, A-11, A-12, A-5, A-6, A-13, A-14, A-15.	
		A-16, A-17, A-18, A-19, A-20 and A-21.	
		DELETE STEPS A-7, A-8, A-9 and A-10	
		See NOTE 2.	
Table 4-1 DARD	Original DARD required sequence of	Proceed in following sequence: Meas. 1 thru	
	measurements No. 1 thru No. 60	10, Meas. 35 thru 42, Meas. 11 thru 18.	
	consecutively.	Meas. 43 thru 60.	
		DELETE MEASUREMENT 19 thru 34	
7.1.5.1		Deviation as stated in NOTE 1.	
7.1.11.2		Deviation as stated in NOTE 1.	

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Approved: Management
11/7/67

TEST DEVIATION RECORD

STEP NO.	IS NOW	CHANGED TO READ	TEST ENGR.
Meas. 6	440 to 540 fpm	720 to 890 fpm	
Meas. 22	440 to 540 fpm	720 to 890 fpm	
Meas. 38	440 to 540 fpm	720 to 890 fpm	
Meas. 56	440 to 540 fpm	720 to 890 fpm	

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Q 48

Approved: Inspector
11/7/67

TEST DEVIATION RECORD GP 384 Rev. B

STEP NO.	IS NOW	CHANGED TO READ	TEST ENGR.
	NOTE 1: -	AFTER STABILIZATION OF EACH GRADIENT	
		POINT, THE TEST SHALL BE CONDUCTED	
		AND DATA RECORDED FOR FORTY-FIVE	
		(45) MINUTES AT FIFTEEN (15) MINUTE	
		INTERVALS.	
	NOTE 2: -	TO MAINTAIN SYSTEM CLEANLINESS INTEGRITY	
		BLIND FLANGE ANY NON-OPERATING DUCT.	
		AT THE CONCLUSION OF THIS SYSTEM VALIDA-	
		TION TEST BLIND FLANGE ALL INTERFACE	
		FLANGES.	
		Approved: [signature] 11/7/67	

C-D 64

Q 48

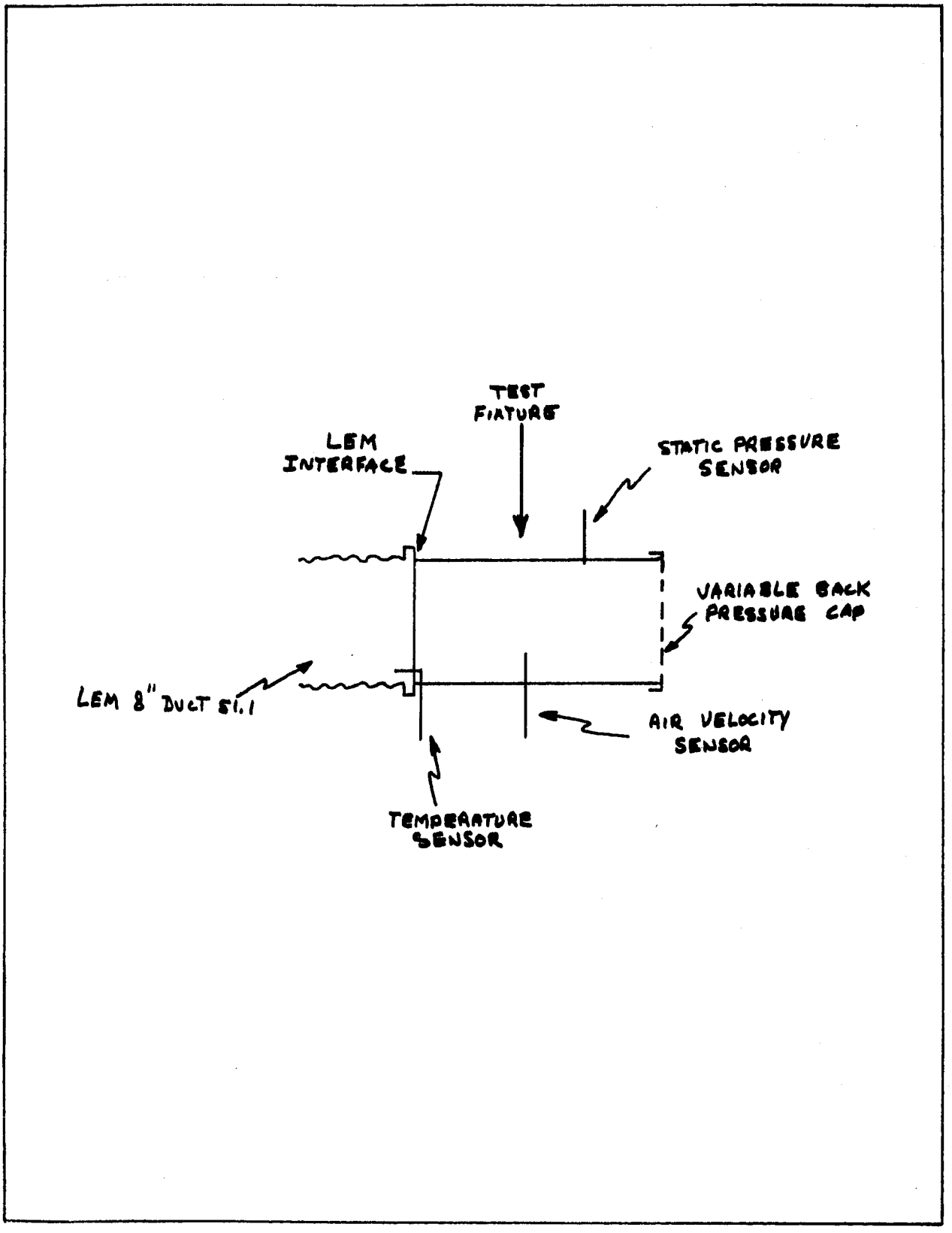

Figure 6-1 Diagram, Test Fixture at LEM Interface - Duct 51.1

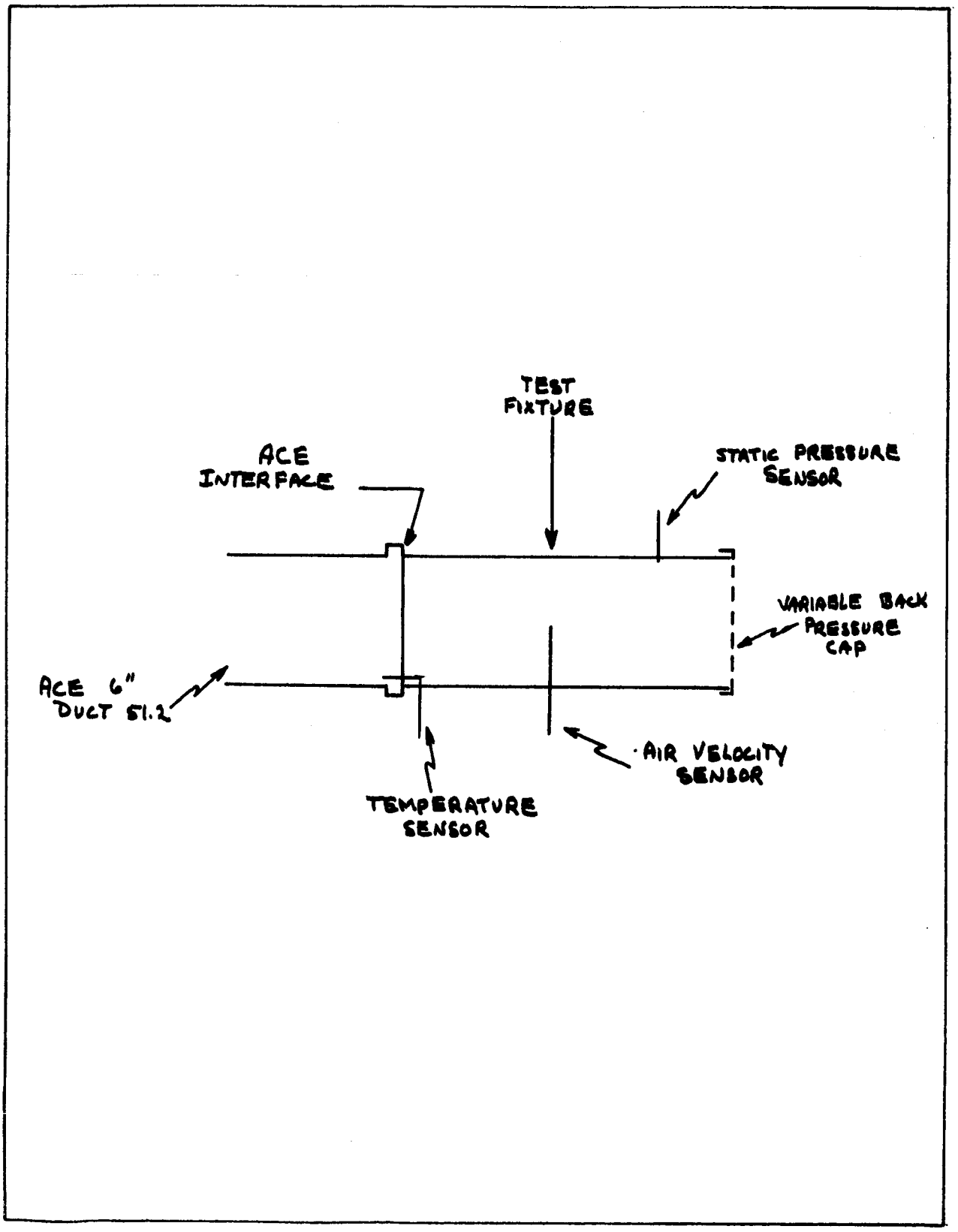

Figure 6-2 Diagram, Test Fixture at ACE Interface - Duct 51.2

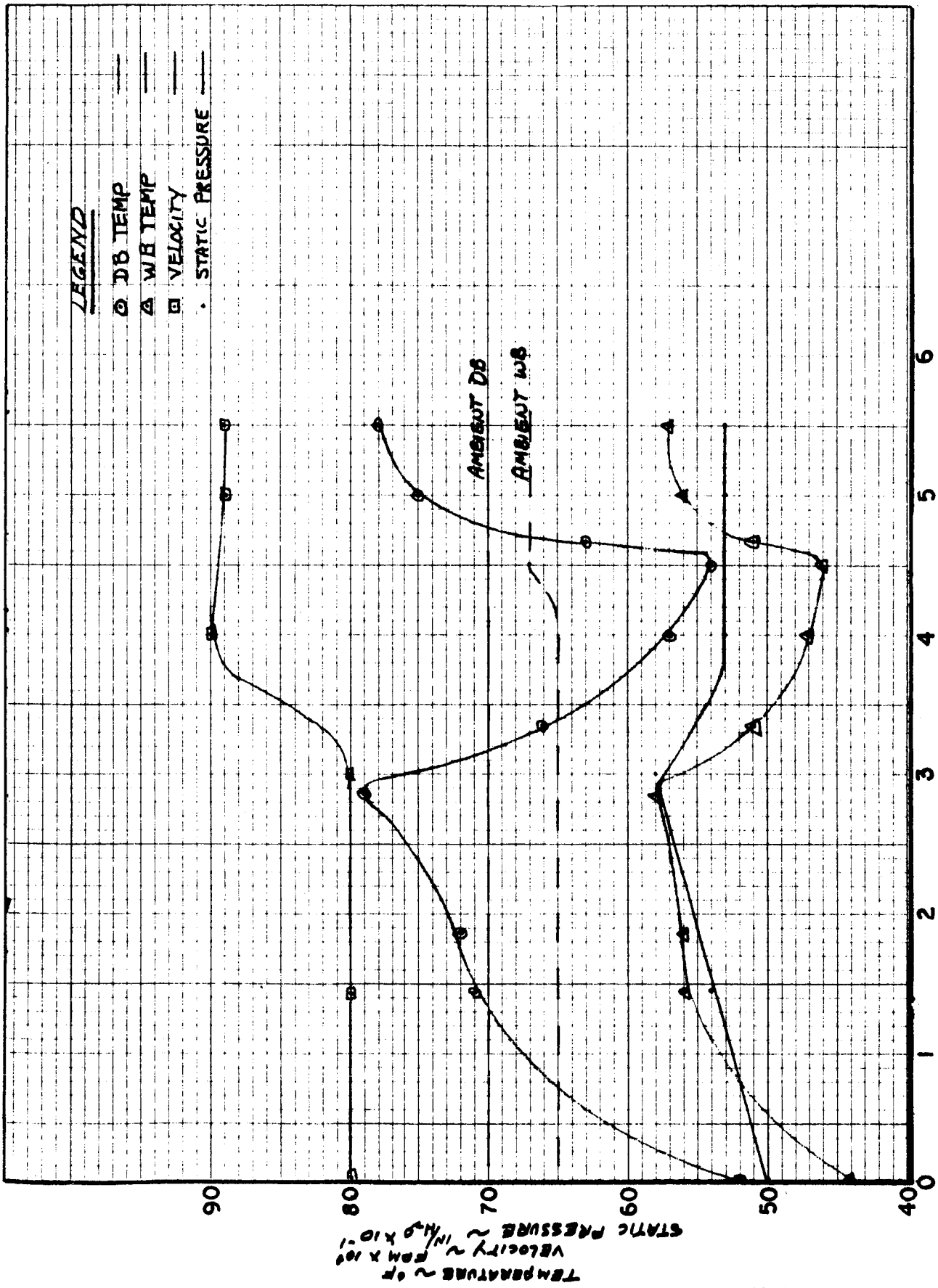

Figure 6-3 Systems Validation Test - LEM Interface Duct 51.1 Temperature, Velocity and Static Pressure vs Time

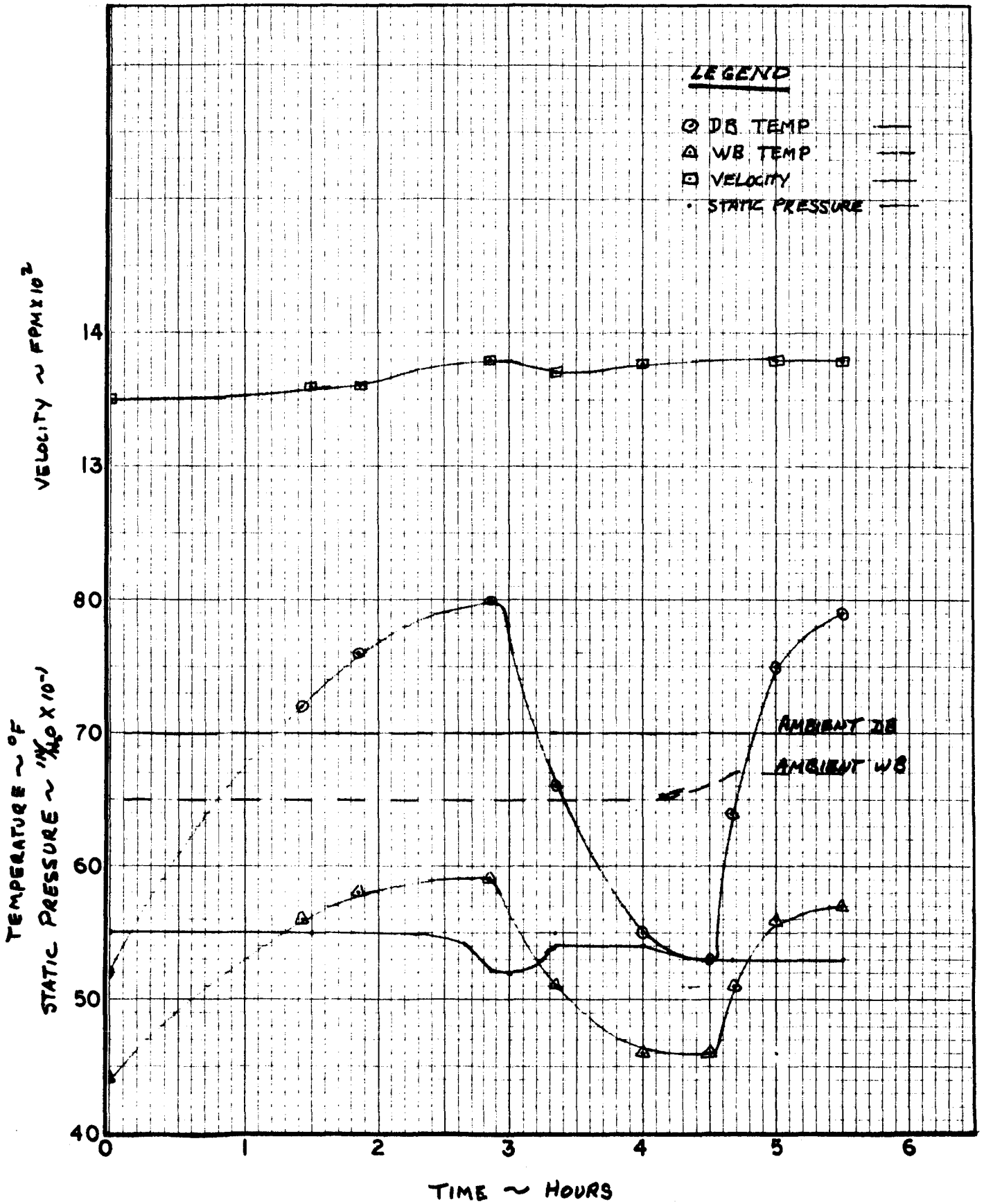

Figure 6-4 Systems Validation Test - ACE Interface Duct 51.2 Temperature, Velocity and Static Pressure vs Time

TABLE 6-1

DATA ACQUISITION REQUIREMENTS DOCUMENT

MEAS. NO.	COMPONENT OR ITEM	DESCRIPTION OF MEASUREMENT						REMARKS
		SCHEM. FIND #	PARAMETER	UNITS	LIMITS	READOUT FORM	MEAS. VALUE	
1	Entering Air Grill CCCU	1	Dry Bulb Temp.	°F	35 to 90	Strip Chart	71	
2	Entering Air Grill CCCU	1	Wet Bulb Temp.	°F	35 to 82	Strip Chart	65	
3	Duct 51.1 Interface	2	Dry Bulb Temp.	°F	50 ± 2	Strip Chart	52	
4	Duct 51.1 Interface	2	Wet Bulb Temp.	°F	44 to 46	Strip Chart	45	
5	Duct 51.1 Interface	2	Air Static Pressure	Inches W.C.	4 to 8	Tab	5.4	
6	Duct 51.1 Interface	2	Air Velocity	ft./min	440 to 540 720 to 890	Tab	800	See deviation
7	Duct 51.2 Interface	3	Dry Bulb Temp.	°F	50 ± 2	Strip Chart	52	
8	Duct 51.2 Interface	3	Wet Bulb Temp.	°F	44 to 46	Strip Chart	45	
9	Duct 51.2 Interface	3	Air Static Pressure	Inches W.C.	4 to 8	Tab	5.5	
10	Duct 51.2 Interface	3	Air Velocity	ft./min	1275 to 1560	Tab	1450	

NOTES:

TABLE 6-1

DATA ACQUISITION REQUIREMENTS DOCUMENT

MEAS. NO.	COMPONENT OR ITEM	DESCRIPTION OF MEASUREMENT						REMARKS
		SCHEM. FIND #	PARAMETER	UNITS	LIMITS	READOUT FORM	MEAS. VALUE	
11	Duct 51.2 Interface	3	Dry Bulb Temp.	°F	50 ± 2	Strip Chart	52	
12	Duct 51.2 Interface	3	Wet Bulb Temp.	°F	44 to 46	Strip Chart	45	
13	Duct 51.2 Interface	3	Air Static Pressure	Inches W C.	4 to 8	Tab	5.4	
14	Duct 51.2 Interface	3	Air Velocity	ft./min	1275 to 1560	Tab	1500	
15	LEM 8" Duct Interface	4	Dry Bulb Temp	°F	50 ± 2	Strip Chart		See deviation
16	LEM 8" Duct Interface	4	Wet Bulb Temp.	°F	44 to 46	Strip Chart		See deviation
17	LEM 8" Duct Interface	4	Air Static Pressure	Inches W.C.	4 to 8	Tab		See deviation
18	LEM 8" Duct Interface	4	Air Velocity	ft./min	720 to 890	Tab		See deviation
19	Duct 51.1 Interface	2	Dry Bulb Temp.	°F	70 ± 2	Strip Chart	72	
20	Duct 51.1 Interface	2	Wet Bulb Temp.	°F	53 to 55	Strip Chart	55	

NOTES:

TABLE 6-1

DATA ACQUISITION REQUIREMENTS DOCUMENT

MEAS. NO.	COMPONENT OR ITEM	DESCRIPTION OF MEASUREMENT						REMARKS
		SCHEM. FIND #	PARAMETER	UNITS	LIMITS	READOUT FORM	MEAS. VALUE	
21	Duct 51.1 Interface	2	Air Static Pressure	Inches W.C.	4 to 8	Tab	5.3	
22	Duct 51.1 Interface	2	Air Velocity	ft./min	440 to 540 720 to 890	Tab	890	See deviation
23	Duct 51.2 Interface	3	Dry Bulb Temp.	^{o}F	70 $\pm$ 2	Strip Chart	72	
24	Duct 51.2 Interface	3	Wet Bulb Temp.	^{o}F	53 to 55	Strip Chart	55	
25	Duct 51.2 Interface	3	Air Static Pressure	Inches W.C.	4 to 8	Tab	5.3	
26	Duct 51.2 Interface	3	Air Velocity	ft./min	1275 to 1560	Tab	1380	
27	Duct 51.2 Interface	3	Dry Bulb Temp.	^{o}F	70 $\pm$ 2	Strip Chart	72	
28	Duct 51.2 Interface	3	Wet Bulb Temp.	^{o}F	53 to 55	Strip Chart	55	
29	Duct 51.2 Interface	3	Air Static Pressure	Inches W.C.	4 to 8	Tab	5.3	
30	Duct 51.2 Interface	3	Air Velocity	ft./min	1275 to 1560	Tab	1380	

NOTES:

TABLE 6-1

DATA ACQUISITION REQUIREMENTS DOCUMENT

MEAS. NO.	COMPONENT OR ITEM	DESCRIPTION OF MEASUREMENT						REMARKS
		SCHEM. FIND #	PARAMETER	UNITS	LIMITS	READOUT FORM	MEAS. VALUE	
31	LEM 8" Duct Interface	4	Dry Bulb Temp.	^{o}F	70 $\pm$ 2	Strip Chart		See deviation
32	LEM 8" Duct Interface	4	Wet Bulb Temp.	^{o}F	53 to 55	Strip Chart		See deviation
33	LEM 8" Duct Interface	4	Air Static Pressure	Inches W. C.	4 to 8	Tab		See deviation
34	LEM 8" Duct Interface	4	Air Velocity	ft. /min	720 to 890	Tab		See deviation
35	Duct 51. 1 Interface	2	Dry Bulb Temp.	^{o}F	80 $\pm$ 2	Strip Chart	78	
36	Duct 51. 1 Interface	2	Wet Bulb Temp.	^{o}F	57 to 59	Strip Chart	57	
37	Duct 51. 1 Interface	2	Air Static Pressure	Inches W. C.	4 to 8	Tab	5. 3	
38	Duct 51. 1 Interface	2	Air Velocity	ft. /min	440 to 540 720 to 890	Tab	890	See deviation
39	Duct 51. 2 Interface	3	Dry Bulb Temp.	^{o}F	80 $\pm$ 2	Strip Chart	79	
40	Duct 51. 2 Interface	3	Wet Bulb Temp.	^{o}F	57 to 59	Strip Chart	57	

NOTES:

TABLE 6-1

DATA ACQUISITION REQUIREMENTS DOCUMENT

MEAS. NO.	COMPONENT OR ITEM	DESCRIPTION OF MEASUREMENT						REMARKS
		SCHEM. FIND #	PARAMETER	UNITS	LIMITS	READOUT FORM	MEAS. VALUE	
41	Duct 51.2 Interface	3	Air Static Pressure	Inches W.C.	4 to 8	Tab	5.3	
42	Duct 51.2 Interface	3	Air Velocity	ft./min	1275 to 1560	Tab	1380	
43	Duct 51.2 Interface	3	Dry Bulb Temp.	^{o}F	80 $\pm$ 2	Strip Chart	79	
44	Duct 51.2 Interface	3	Wet Bulb Temp.	^{o}F	57 to 59	Strip Chart	57	
45	Duct 51.2 Interface	3	Air Static Pressure	Inches W.C.	4 to 8	Tab	5.3	
46	Duct 51.2 Interface	3	Air Velocity	ft./min	1275 to 1560	Tab	1380	
47	LEM 8" Duct Interface	4	Dry Bulb Temp.	^{o}F	80 $\pm$ 2	Strip Chart	76	Data taken by others. Not stabilized.
48	LEM 8" Duct Interface	4	Wet Bulb Temp.	^{o}F	57 to 59	Strip Chart	65	Data taken by others. Not stabilized.
49	LEM 8" Duct Interface	4	Air Static Pressure	Inches W.C.	4 to 8	Tab		See deviation
50	LEM 8" Duct Interface	4	Air Velocity	ft./min	720 to 890	Tab		See deviation

NOTES:

TABLE 6-1

DATA ACQUISITION REQUIREMENTS DOCUMENT

MEAS. NO.	COMPONENT OR ITEM	DESCRIPTION OF MEASUREMENT						REMARKS
		SCHEM. FIND #	PARAMETER	UNITS	LIMITS	READOUT FORM	MEAS. VALUE	
51	Entering Air Grill CCCU	1	Dry Bulb Temp.	^{o}F	35 to 90	Strip Chart		See deviation
52	Entering Air Grill CCCU	1	Wet Bulb Temp.	^{o}F	Within 5^{o} of Dry Bulb Temp	Strip Chart		See deviation
53	Duct 51.1 Interface	2	Dry Bulb Temp.	^{o}F	70 ± 2	Strip Chart		See deviation
54	Duct 51.1 Interface	2	Wet Bulb Temp.	^{o}F	57 to 59	Strip Chart		See deviation
55	Duct 51.1 Interface	2	Air Static Pressure	Inches W. C.	4 to 8	Tab		See deviation
56	Duct 51.1 Interface	2	Air Velocity	ft. /min	440 to 540 720 to 890	Tab		See deviation
57	Duct 51.2 Interface	3	Dry Bulb Temp	^{o}F	70 ± 2	Strip Chart		See deviation
58	Duct 51.2 Interface	3	Wet Bulb Temp.	^{o}F	57 to 59	Strip Chart		See deviation
59	Duct 51.2 Interface	3	Air Static Pressure	Inches W. C.	4 to 8	Tab		See deviation
60	Duct 51.2 Interface	3	Air Velocity	ft. /min	1275 to 1560	Tab		See deviation

NOTES: