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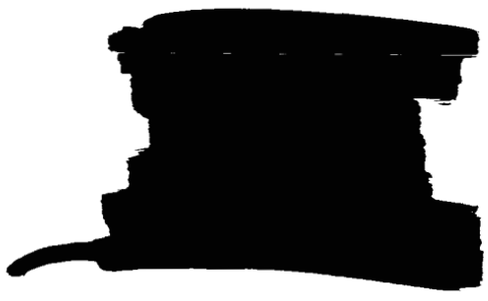

DUGHT INC

TEST PLAN

UNMANNED EXTRAVEHICULAR ENVIRONMENTS OPERATION QUALIFICATION TEST OF THE GEMINI ELSS (Extravehicular Life Support System)

Report No. 00.690

10 September 1965

Contract: NAS 9-3414

Prepared by:

F. H. Goodnight

T. E. Mouritsen

Checked by:

F. T. Esenwein

Approved by:

G. B. Whisenhunt
Manager, Propulsion and Environment

Approved by:

K. P. Sperber
NASA- SC Flight Safety Office
Quality Assurance Branch

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1.0 INTRODUCTION

This test plan describes the unmanned portion of the extravehicular environments operation qualification test program for the Gemini Extravehicular Life Support System (ELSS). This test will be performed for the NASA Manned Spacecraft Center by LTV Astronautics under Contract NAS 9-3414 as amended. This series of tests is designed to qualify the ELSS for proper operation in the extravehicular environment. The unit will be subjected to conditions of orbit environmental extremes and operational stresses including simulated emergency conditions. Final manned system tests at NASA-MSC subsequent to this test will provide the final qualification for space flight.

This test plan is submitted for the approval of the NASA Manned Spacecraft Center in accordance with test requirements outlined by the NASA-MSC. This test plan may be modified at any time prior to or during the test through mutual concurrence of cognizant NASA-MSC personnel and LTV.

2.0 SUMMARY

The Gemini Extravehicular Life Support System (ELSS) series of tests described in this report is the unmanned portion of the extravehicular environments operation qualification test program which leads to the qualification of the unit for space flight. The operating ELSS unit will be subjected in various operating modes to the environmental extremes of extravehicular operation in orbit as well as emergency conditions simulated by component failures. Simulation of environments will include:

1. Vacuum (5×10^{-4} mm Hg or less).
2. Solar radiation at 1 solar constant.
3. Heat sink of deep space (liquid nitrogen cooled chamber walls).
4. Simulation of crewman metabolic sensible and latent heat loads.

The unit will be subjected to normal operational modes up to the unit's design limits and to the following simulated failures:

1. Umbilical failure.
2. Simulated suit penetration.
3. Heat exchanger failure.

Operation within specified parameters during the periods of test will constitute acceptable performance and will lead to qualification of the unit. Test data recorded during the testing will provide documentation of acceptable operation.

The experimental apparatus will be installed in the SES and the chamber pressure will be reduced by three 32 inch diffusion pumps to the 10^{-4} to 10^{-5} pressure range. The ELSS will then be operated in the modes and environments outlined in this test plan.

3.0 TEST OBJECTIVES

The overall objective of this series of tests is to qualify the ELSS for operation in the extravehicular environments of earth orbit. The ELSS is designed to provide adequate environmental control for the astronaut while performing extravehicular operations and, secondly, to provide an emergency supply of oxygen.

The ELSS operation within the parametric limits listed below constitutes acceptable performance. The parameters listed will be measured and recorded for evaluation. The parameters listed under "Primary Requirements" are those being measured for the first time during qualification. The listing under "Secondary Requirements" includes those parameters documented for this unit but which are required for verification of system operation. These requirements were presented by NASA-MSC in reference 1.

Primary Requirements

1. Chestpack surface temperatures - $0^{\circ}F$ minimum to $100^{\circ}F$ maximum.
2. Umbilical gas Delta T $40^{\circ}F$ (inlet - outlet).
3. Chestpack and umbilical disconnect temperature: $-60^{\circ}F$.
4. Chestpack outlet (suit inlet) temperature: $57 \pm 13^{\circ}F$; chestpack inlet temperature: $+60^{\circ}F$ to $+90^{\circ}F$.
5. Outflow valve protector must not build ice next to poppet.
6. Chestpack inlet pressure 3.7 ± 0.2 psid (measured with respect to chamber pressure).
7. Heat exchanger overboard dump valve - must operate, even if iced.
8. Suit inlet dew point: $45^{\circ}F$ maximum; suit outlet dew point: $90^{\circ}F$ maximum.
9. Chestpack internal temperatures - O_2 bottle: $0^{\circ}F$ minimum, $160^{\circ}F$ maximum.

   Battery: $+30^{\circ}F$ minimum to $120^{\circ}F$ maximum.
   Electronic Modules: $-60^{\circ}F$ to $+160^{\circ}F$.

10. Umbilical skin temperature: $-200^{\circ}F$ to $160^{\circ}F$.

Secondary Requirements

1. Minimum suit flow rate (medium ejector setting) 20.5 ± 1 lb/hr.
2. Maximum flow rate (high ejector setting) 26.2 ± 1 lb/hr.
3. Minimum time for suit penetration emergency operation - 15 min.
4. Minimum suit outlet pressure during suit penetration - 3.2 psid (measured with respect to chamber pressure).

4.0 FACILITY AND TEST EQUIPMENT

4.1 TEST FACILITY

The Gemini ELSS unmanned extravehicular environments operation qualification test will be conducted in the Ling-Temco-Vought, Inc. Space Environment Simulator (SES). The SES is a horizontal cylindrical test chamber which simulates the thermal and pressure environments of space. The test chamber dimensions are 10 feet in diameter by 10 feet length. The ELSS will be suspended in the chamber to simulate attachment to an Astronaut. Special test equipment (described in paragraph 4.2) has been designed for installation in the chamber to complete test conditions not provided by the basic chamber equipment.

The vacuum of space is simulated in the SES through evacuation by three 32-inch diffusion pumps with an ejector and mechanical forepumping system. The ultimate capability of the SES is approximately 10^{-7} mm Hg Abs. (with minimum outgassing of installed components). The tests outlined in this report call for pressures of 5×10^{-4} mm Hg Abs. maximum which can be adequately maintained during the course of the tests.

The thermal heat sink of space is provided by absorbing walls ($\alpha = 0.98$) that are cooled to liquid nitrogen temperature (-320°F). The absorbing walls or "cryowall" completely enclose the test area except for the openings to admit simulated solar energy. The total area of the openings is approximately 4.4% of the wall area. The maximum average cold wall temperature during tests shall not exceed -290°F.

Simulated solar energy is provided by a bank of collimated and horizontally directed Mercury-Xenon arc lamps. The spectral and flux distribution of the lamps is described in references 2 and 3. The simulated solar flux is variable over the range of approximately .60 to 1.0 solar constant in the test area. A water-cooled, mechanical shutter located in front of the lamps provides rapid "on-off" action of the solar flux.

4.2 SPECIAL TEST EQUIPMENT

The equipment discussed in the following paragraphs is required for mechanically supporting the test and supplying the functions listed.

Crewman Simulators (CMS)

Crewman simulators are provided to supply the ELSS with the moisture and heat output typical of an astronaut to permit an evaluation of the ELSS performance. Each of the crewman simulators can supply up to 1500 BTU/hr of snesible heat and also water for humidification of the circulating atmosphere. Two crewman simulators are utilized due to a maximum metabolic heat load requirement of 2000 BTU/hr during this test. Operating controls and a power supply are provided for regulating and measuring the output of the crewman simulators and providing moisture to the atmosphere. The simulators are insulated in the installed location to prevent excessive heat loss to the chamber during reduced temperature conditions. The crewman simulators are supplied by NASA Manned Spacecraft Center.

ELSS Servicing Equipment

The ELSS requires servicing of the high pressure oxygen bottle, the battery, and the heat exchanger prior to each period of testing. The 7500 psi oxygen bottle and the battery will be serviced with equipment that is utilized for MMU servicing. The water fill system for the ELSS heat exchanger has been constructed by LTV from both NASA and company furnished equipment. The heat exchanger servicing unit provides deionized water filtered to 1/2 micron.

Infrared Lamps

A bank of infrared lamps surrounding the entire test setup within the SES is provided to control the test equipment temperatures during pumpdown of the chamber. The vacuum pumpdown over a period of approximately 1 hour with liquid nitrogen flowing in the chamber walls would cause an appreciable reduction in the test equipment temperatures. The infrared lamps are arranged to permit the maintenance of normal ambient temperatures within the equipment prior to the initiation of the test.

ELSS Control Actuators

The ELSS controls will be remotely operated during the test to permit various operating modes required in the qualification. The evaporator control and flow selector are actuated by Barber-Coleman JYLG-5299 1.75 inch travel electric motor screw jacks. The bypass valve control is actuated by an on-off solenoid. These controls permit the mode of operation to be remotely selected while the ELSS is under test in the SES chamber.

Experimental Rotation

The ELSS may be rotated $\pm 90^{\circ}$ from the installed position by a jack screw and gear motor arrangement. The whole apparatus is suspended from a rail installed at the top of the SES chamber. This permits the ELSS to be rotated to permit simulated solar radiation of three sides of ELSS.

Atmosphere Supply

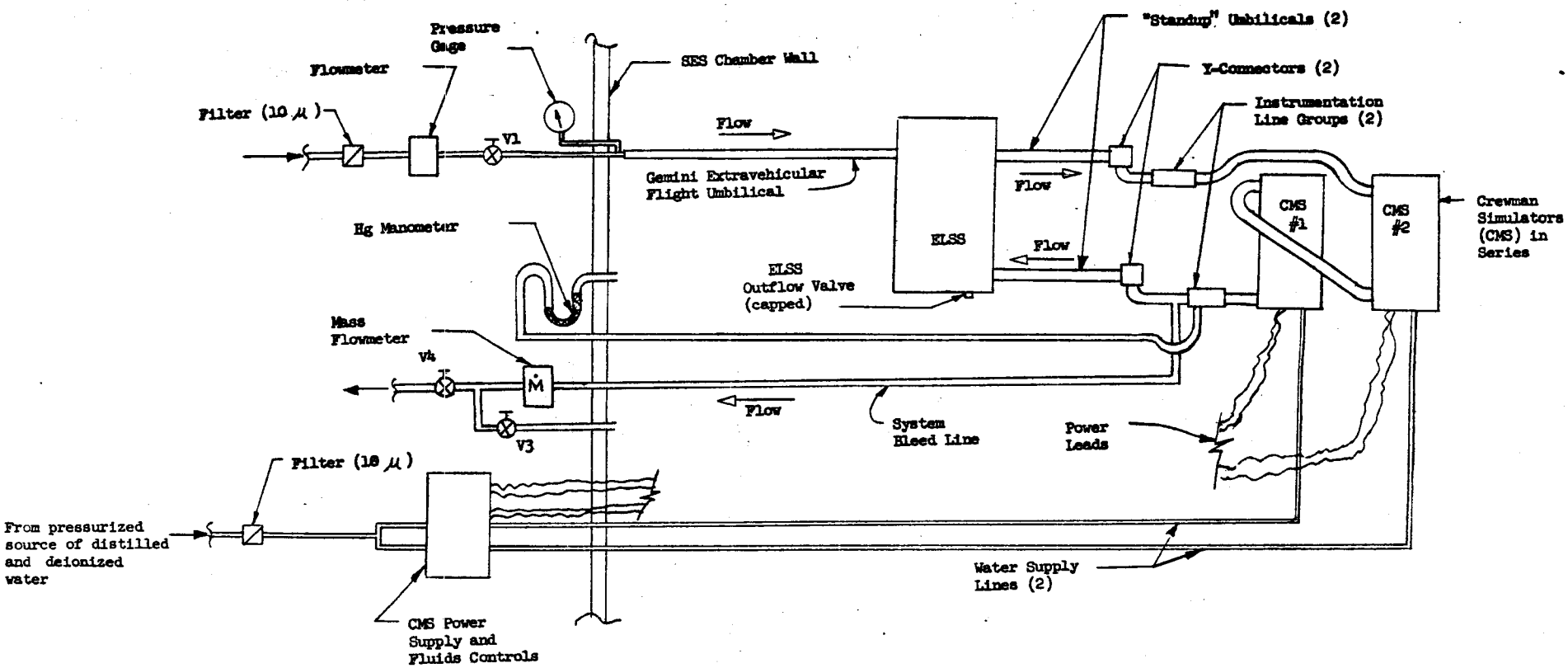
The atmosphere for the ELSS test will be aviators grade oxygen supplied to the test setup at 92 psia ± 10 psi (MIL-O-27210).

Test System Arrangement

The ELSS unit is installed in a test system that simulates the extravehicular operation while providing environmental control and breathing atmosphere. The arrangement for this series of tests is shown in Figure 1 . A schematic of the ELSS is shown in Figure 2 . The equipment requirements for this test setup are indicated on Table I . This test system arrangement permits the evaluation of the ELSS under the various normal and emergency operating modes with various ambient environments.

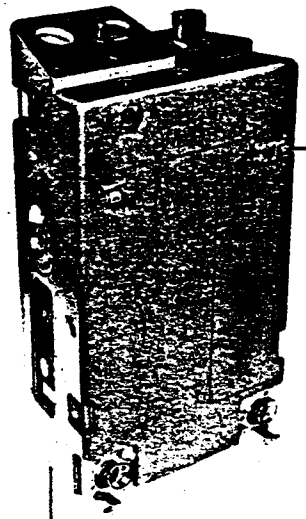
FIGURE 1

ELSS TEST INSTALLATION



NOTES:
(1) Loop standup umbilicals over back of ELSS and apply 10 layer superinsulation (not shown) over back of ELSS.
(2) Actuators for remote control of ELSS Flow Selector, Bypass and Evaporator required (not shown).
(3) ELSS/CMS test mounting fixture not shown.
(4) Suspend ELSS/CMS test group from overhead beam (no part number) fabricated for suit tests under NAS 9-3414.
(5) Install cylindrical IR lamp array (not shown) to encircle ELSS/CMS.

PROJECT GEMINI



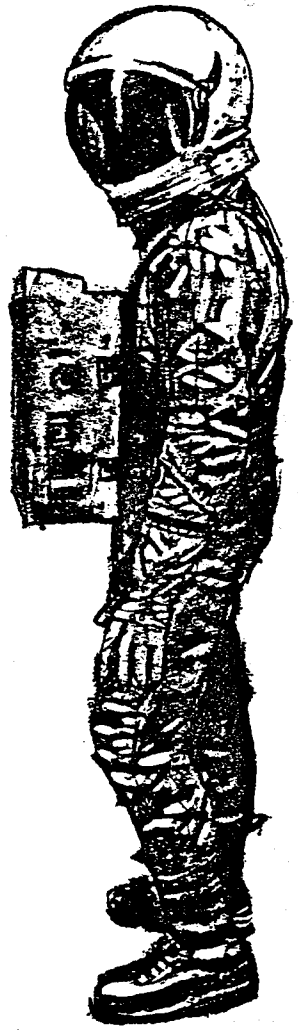


FIGURE 2 **EXTRAVEHICULAR LIFE SUPPORT SYSTEM**

TABLE I

ELSS EQUIPMENT REQUIREMENTS

QTY.	NOMENCLATURE & IDENT.	PARAMETER	RANGE	CALIBRATION AND CHECKOFF
1	Oxygen K-bottle per MIL-O-27210 (with gauge regulators and S/O valve)	N/A	2200 psig 0 to 150 psig outlet pressure regulation 0 to 30 lb/hr	
1	Nitrogen K-bottle (with gauge, regulator and S/O valve)	N/A	2200 psig 0 to 100 psig outlet pressure regulation	
1	Pressure Gauge	Flight Umbilical Regulator Supply Pressure	0 to 150 ± 5 psig	
3	Manual S/O Valves	N/A	N/A	N/A
1	2 Micron Filter for N_2 Pressure Supply	N/A	N/A	
1	10 Micron Filter for CMS Water Fill	N/A	N/A	
1	Water Storage Pressure Vessel	N/A	30 psig min. 3 gal. capacity	N/A
2	Y-Connectors	N/A	N/A	N/A
2	Instrumentation Line Groups	Inlet Pressure Delta Pressure Temperature Flow Rate & Dew Point		

TABLE I (Cont'd)

ELSS EQUIPMENT REQUIREMENTS

QTY.	NOMENCLATURE & IDENT.	PARAMETER	RANGE	CALIBRATION AND CHECKOFF
2	Standup Umbilicals	N/A	N/A	N/A
1	Gemini Flight Umbilical	N/A	N/A	N/A
1	CMS Power Supply	N/A		
1	CMS Fluid Control Board			
2	Crewman Simulators (In Series)		0 to 2000 BTU/hr total	
1	Cylindrical Bank of IR Lamps	N/A		
1	ELSS/CMS Test Mounting Fixture	N/A	N/A	N/A
1	ELSS/CMS Rotation Mechanism	N/A	±30 degrees rotation in SES	N/A
1	Ignitron Power Supply	N/A	N/A	N/A
1	Test Timer (Clock)	Test Time		
1	Mirror (For viewing outflow valve)	N/A	N/A	N/A
1	ELSS Emergency O_2 Bottle Servicing System	N/A		
1	ELSS Battery Charge System	N/A		
1	ELSS Evaporator Charge System	N/A		

TABLE I (Cont'd)

ELSS EQUIPMENT REQUIREMENTS

QTY.	NOMENCLATURE & IDENT.	PARAMETER	RANGE	CALIBRATION AND CHECKOFF
2	Gas Analysis Sampling Bombs			
1	ELSS Flow Selector Remote Actuator			
1	ELSS Bypass Valve Remote Actuator			
1	ELSS Evaporator Control Remote Actuator			
1	Water Reservoir	CMS Supply		

4.3 INSTRUMENTATION

The instrumentation and data recording system for this test is based on the measurement and recording of the Primary and Secondary Requirements for Qualification as previously outlined in Section 3.0, Test Objectives. The data collected will provide the basis for the unmanned qualification of the ELSS in the extravehicular thermal environment.

4.3.1 Parameters

The measurements of data include those of temperature, pressure, flowrate, atmosphere dewpoint, power, and ELSS emergency warning signal. Temperatures will be measured with Copper-Constantan thermocouples attached to the various ELSS surfaces and components or installed in the testing system. Thermocouples have been installed on the first ELSS test unit by the Manned Spacecraft Center prior to delivery to LTV. LTV and MSC personnel will instrument the second test article in an identical manner prior to any test usage. The temperatures to be recorded include:

1. ELSS Surface (4)
2. Flight umbilical inlet gas
3. Flight umbilical outlet gas (or ELSS inlet)
4. ELSS Battery case (2)
5. Skin of flight umbilical (4)
6. ELSS Electronic Modules (1)
7. Surface of ELSS Oxygen bottle (2)
8. Atmosphere to and from Chestpack (2)
9. SES cryowell temperatures (6)
10. ELSS outflow temperature (4) (on Test Days 1 and 2)
11. ELSS inlet and outlet dry bulb temperature

Pressures to be measured in this series of tests include:

1. Flight umbilical inlet pressure
2. Chestpack inlet pressure
3. Chestpack delta pressure
4. Outflow valve external pressure (0.08 psia at 7.8 lb/hr flow - Test Days 3 and 4)
5. SES chamber pressure

Additionally, parameters of flowrate, dewpoint, and crewman simulator conditions will be measured. These include:

1. Flowrate of ELSS
2. System bleedline flowrate
3. Dewpoint inlet and outlet of chestpack (2)
4. Crewman Simulator power input
5. Crewman Simulator water flowrate

6. Visual observation of
   (a) Icing of outflow valve
   (b) Icing of evaporator control
7. Real Time Monitoring of ELSS Emergency Tone and manual time recording

The equipment required for the test system instrumentation is detailed in Table II. Additional equipment supplied by the NASA Manned Spacecraft Center for this test series will be documented as received.

4.3.2 Data Acquisition and Recording System

The data generated by the instrumentation system will be recorded in the following manner:

1. Digital Voltmeter Automatic Print-out
2. Strip Recorders
3. Manual recording of visually read instruments and conditions
4. Manual time recording of the ELSS Emergency audio tone

Figures 3 and 4 detail the arrangement of the DVM automatic print-out and strip chart recording data systems.

TABLE II

Instrumentation Equipment Requirements

Item No.	Qty.	Nomenclature and Identification	Parameter	Range	Calibration	Checked TC	Checked Q
1	4	Westronics Input Divider Model D-1		1-10000			
2	4	Westronics Adjustable Span-Zero, Model ASZ-2	Dewpoint, Pressure Recorders				
3	1	Westronics 4 Channel Strip Chart Recorder, Model DD11A/U/DV5H5M					
4	1	Cubic Pre-Amplifier, Model A-85	Delta Pressure,				
5	1	Cubic Digital Voltmeter, Model VR-71P	Thermo-couple output	0-1000 volts			
6	1	Cunningham Crossbar Scanner, Model SQ6L5C3D-1		300 Channel			
7	1	Hewlett-Packard Digital Printer, Model 561B					
8	2	Brown Pen Recorder	Gas Flowrate	0 - 50 mv.			
9	1	Sony Tape Recorder, Model TC-200	Emergency Tone Level				
10	1	Hastings-Raydist Mass Flowmeter, Model HF-5	Gas Flow in System Bleed Line	0 - 5 SCFM			
11	1	Mercury Manometer	System Bleed Line Pressure	40 inches			

TABLE II (continued)
Instrumentation Equipment Requirements

Item No.	Qty.	Nomenclature and Identification	Parameter	Range	Calibration	Checked	
						TC	Q

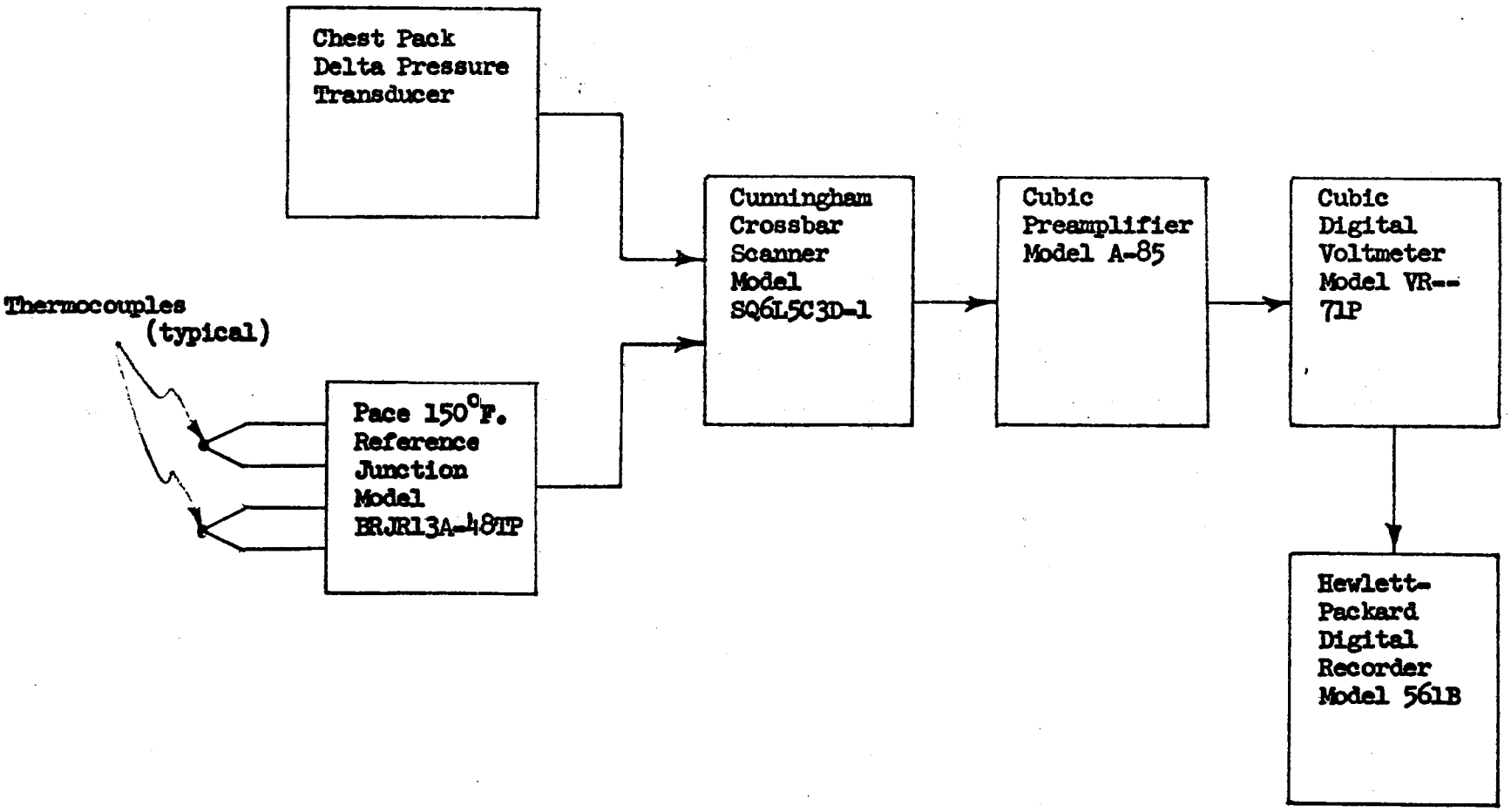


Figure 3 DIGITAL VOLTMETER RECORDING SYSTEM

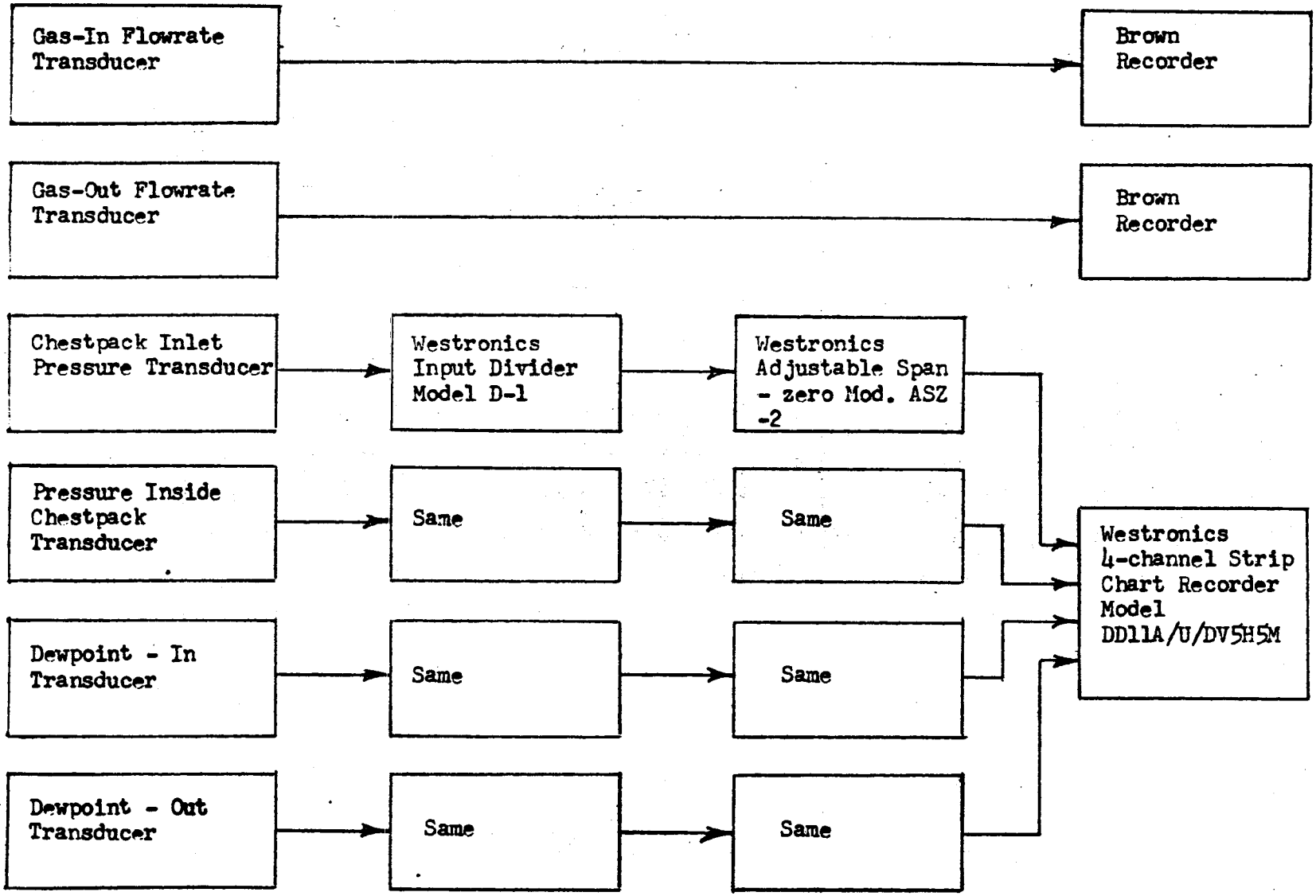


Figure 4 ELSS TEST PARAMETER RECORDING SYSTEM

5.0 DATA PROCESSING

5.1 TEMPERATURE DATA

The temperature data generated by thermocouple outputs will be recorded in millivolt values on the automatic print out of the Cubic Digital Voltmeter system and then be converted to temperature values by the LTV Aeronautics Flight Test Section through IBM computer techniques. All values will be identifiable with respect to test time, test conditions, and any significant events. For inclusion in the test report, graphs of temperature versus time, along with adequate notation of significant test conditions, will be provided.

5.2 PRESSURE DATA

The system pressure data (with one exception) will be continuously recorded on strip-chart recorders throughout the test. This record will be marked to indicate test time, test points or conditions, and any significant events occurring at the time of record. The strip-chart recorders will be calibrated to read suit pressures directly from the scale in units of psia and psid. The ELSS chestpack delta pressure will be recorded on the digital voltmeter and automatic print out.

After conclusion of the tests, the entire pressure record will be examined and notations made of maximum, nominal and minimum pressures existing during any significant test time, such as test points or particular events.

5.3 INSTRUMENTATION LOG BOOK

As a means to facilitate data reduction, increase reliability of test data, and to provide a record of significant test conditions, an instrumentation log book will be maintained throughout the test. This log book will serve to provide associated details, explanatory notes, and any other pertinent comments in support of actual test data.

6.0 SYSTEMS CHECK PROCEDURES

The following pages present check procedures for the several test systems included in the overall test setup. The persons responsible for the checks will initial and record all significant notes and deviations in the test conductor's control test plan. During second and subsequent checks, completion of checks only is required. Each system check list has provisions for both test conductor and NASA-MSC Flight Safety Office-Quality Assurance (FSO-QA) write-off of procedures.

The check lists included in this section are as follows:

Table No.	Title
III	SES Chamber Check List
IV	SES Pumpdown Check List
V	LN_2 System Check List
VI	Solar Simulator Check List
VII	Instrumentation Subsystem Check List
VIII	Data Acquisition and Recording System (DARS) Check List
IX	LN_2 Warm-up System Check List

TABLE III

SES CHAMBER CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
1	Chamber walls cleaned.				
2	LN_2 Shroud installed and cleaned.				
3	LN_2 Shroud leak checked.				
4	Chamber feedthrough visually inspected.				
5	Mechanical Pump oil level checked.				
6	Ejector Pump oil level checked.				
7	Diffusion Pump oil levels checked.				
8	Water chiller system operating.				
9	Pneumatic Valve nitrogen supply checked.				
	Approved: T.C. _____				
	Approved: MSC-FSO-QA _____				

TABLE IV

SES PUMP DOWN CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
1	Magnivac & GIC-100 gauge tubes				
	visually inspected.				
2	Inside of chamber cleaned.				
3	Grating and rails removed.				
4	Door O-rings and all chamber				
	penetrations visually inspected.				
5	Mass spectrometer leak detector				
	connected.				
6	Vacuum valve control nitrogen pressure				
	set to 40 psig				
7	LN_2 shroud thermocouples connected				
	and operating.				
8	Chamber area cleared and door closed.				
9	Door vacuum line connected and valve				
	open.				
10	Door water lines connected and valves				
	opened.				
11	KD310 pump oil level checked.				
12	KD310 pump cleared for operation.				
13	Magnivac gauge turned on.				
14	Magnivac gauge calibrated for				
	atmospheric pressure.				
15	Mechanical pump started.				

TABLE IV (Cont'd)

SES PUMP DOWN CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
16	Door LN_2 lines connected.				
17	Door safety cable installed.				
18	Door retainer bolts disconnected.				
19	Ejector and diffusion pumps turned on.				
20	GIC-100 pressure gauge turned on.				
21	GIC-100 pressure gauge calibrated.				
	Approved: T.C. _____				
	Approved: MSC-FSO-QA _____				

TABLE V

LN_2 SYSTEM CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
1	LN_2 system visually inspected.				
2	LN_2 storage tank level noted in log				
	book.				
3	Emergency dump valve closed.				
4	Tank exhaust valve opened.				
5	Shroud inlet valve opened.				
6	Shroud outlet valve opened.				
7	Inlet line pressure gauge operating.				
8	Outlet line pressure gauge operating.				
9	LN_2 storage tank supply valve opened.				
10	Shroud temperature recorder turned on.				
11	LN_2 pump outlet valve opened.				
12	Lines and shroud cooled gradually by				
	gravity flowing LN_2.				
13	LN_2 pump turned on.				
14	Shroud pressure adjusted with pump				
	outlet valve.				
15	Shroud temperatures monitored.				
	Approved: T.C. _____				
	Approved: MSC-FSO-QA _____				

TABLE VI

SOLAR SIMULATOR CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
1	Lamp house cleared of equipment and				
	personnel.				
2	Chamber quartz windows cleaned.				
3	Air filters visually inspected.				
4	Lamp cooling system visually inspected.				
5	All lamp stepping switches set to				
	zero position.				
6	Solar control switch turned on.				
7	Lamp power supply switches turned on.				
8	Lamp start switches turned on.				
9	Using lamp stepping switches maintain				
	lamp current less than 60 amps until				
	stable output is obtained.				
10	Temperature of hemispherical				
	reflectors not exceeding 400°F.				
11	Operate SES lamps at 1 solar constant				
	Approved: T.C. _____				
	Approved: MSC-FSO-QA _____				

TABLE VII

INSTRUMENTATION SUBSYSTEM CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
1	Chestpack inlet pressure transducer				
	checked and operating.				
2	Chestpack Delta pressure transducer				
	checked and operating.				
3	Chestpack inlet gas temperature thermo-				
	couple checked and operating.				
4	Chestpack outlet gas temperature thermo-				
	couple checked and operating.				
5	Chestpack inlet gas flowrate transducer				
	checked and operating.				
6	Chestpack outlet gas flowrate transducer				
	checked and operating.				
7	Chestpack inlet gas dewpoint transducer				
	checked and operating.				
8	Chestpack outlet gas dewpoint transducer				
	checked and operating.				
9	Chestpack interior pressure transducer				
	checked and operating.				
10	ELSS thermocouples checked and operating.				
11	Umbilical hose thermocouples checked				
	and operating				
12	CMS thermocouples checked and				
	operating.				

TABLE VII (Cont'd)

INSTRUMENTATION SUBSYSTEM CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
13	Mass flowmeter in system bleed line				
	checked and operating.				
	Approved: T.C. _____				
	Approved: MSC-FSO-QA _____				

TABLE VIII

DARS CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
1	Check chart paper supply in Westronics and				
	Brown recorders to be adequate for each				
	test run.				
2	Check paper tape supply in Hewlett-Packard				
	digital printer to be adequate for each				
	test run.				
3	Set cubic pre-amplifier multiplier switch				
	to 1000.				
4	Set cubic digital voltmeter range switch				
	to 10 volts full scale.				
5	Set Cunningham crossbar scanner controls				
	to selected first and last channels to				
	be monitored.				
6	Print complete cycle of all DVM channels				
	to assure proper operation.				
7	Verify proper operation of each ELSS				
	parameter for each test run (Westronics				
	and Brown Recorder channels).				
8	Verify that SES chamber pressure recorder				
	is on and ready for operation.				
	Approved: T.C _____				
	Approved: MSC-FSO-QA _____				

TABLE IX

LN_2 SYSTEM WARM-UP CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
1	LN_2 pump switch turned off.				
2	LN_2 storage tank valve closed.				
3	Shroud inlet valve closed.				
4	After shroud pressurizes to 5 psig,				
	shroud inlet valve opened.				
5	Shroud inlet valve closed.				
6	Warm-up blower suction valve opened.				
7	Warm-up blower outlet valve opened.				
8	Shroud makeup gas valve opened.				
9	After shroud pressurizes to 20 psig				
	shroud makeup gas valve opened.				
10	Warm-up heater temperature set to 120°F				
	(position 7).				
11	Warm-up heater temperature limit set				
	to 400°F.				
12	Warm-up system switch turned on.				
13	Maintain shroud pressure less than				
	25 psig with emergency dump valve				
	during warm-up period.				
14	After shroud temperature of 70°F is				
	obtained, warm-up system switch turned				
	off.				
15	Warm-up blower suction valve closed.				

TABLE IX (Cont'd)

LN_2 SYSTEM WARM-UP CHECK LIST

ITEM	DESCRIPTION	CHECKED BY			
16	Warm-up blower outlet valve closed.				
	Approved: T.C. _____				
	Approved: MSC-FSO-QA _____				

7.0 TEST PROCEDURES

This test series will subject the Gemini ELSS to a series of simulated conditions selected to accomplish the unmanned environmental qualification of the unit. The test objectives for acceptable operation of the ELSS are presented in Section 3.0. The test conditions that will be performed are defined by reference 1 and are summarized by Table X

Tables XI through XV present the detailed test procedures and identification of tasks to accomplish the tests. The test conductor will direct and coordinate the accomplishment of the tasks in Tables XI through XV and the person responsible will initial the test conductor's copy as evidence of accomplishment. The tables will be maintained such as to provide a complete record of the test events, significant data events and times. It should be noted that space for sign off of each test item by the test conductor and the NASA Flight Safety Office-Quality Assurance is provided on each of the tables.

TABLE X

SUMMARY OF ELSS QUALIFICATION TESTS

Test Day 1:

Conditions: Minimum SES pressure (5×10^{-4} torr maximum), LN_2 walls, solar on, ELSS outflow valve closed.

Agenda: 1. Medium Length Mission - 55 minutes at 1400 BTU/hr CMS output; flow valve set high. Time flow from 0 to 55 minutes.

2. Short Time High Metabolic Output - 10 minutes at 2000 BTU/hr CMS output; flow valve set high. Time flow from 55 to 65 minutes.

3. Simulated Umbilical Failure - 15 minutes at 2000 BTU/hr CMS output; flow valve set high. Time flow from 65 to 80 minutes.

Test Day 2:

Conditions: Minimum SES pressure (5×10^{-4} torr maximum), LN_2 walls, solar on-off as called for, ELSS outflow valve closed.

Agenda: 1. Long Length Mission - 55 minutes daylight at 1000 BTU/hr CMS metabolic output, flow valve set medium. Elapsed time 0 to 55 minutes.

2. Long Length Mission Continued - 40 minutes nighttime at 1000 BTU/hr CMS metabolic output; flow valve set medium. Elapsed 55 to 95 minutes.

3. Long Length Mission Continued - 10 minutes nighttime at 2000 BTU/hr CMS metabolic output; flow valve set high. Elapsed time 95 to 105 minutes.

4. Simulated Suit Penetration - Last 15 minutes of test dump 12 $\pm$ 1 lb/hr through system pressure umbilical. Metabolic output and flow valve settings as outlined in 1 and 2 above. Elapsed time, 90 to 105 minutes.

Test Day 3:

Conditions: Minimum SES pressure (5×10^{-4} torr maximum), LN_2 walls, solar on, off, ELSS outflow valve closed.

Agenda: 1. Operational Life Limit Qualification - 1000 BTU/hr flow valve set medium, cycle solar on 50 minutes / off 40 minutes, 3 ninety minute simulated orbits (elapsed time 270 minutes) unless directed by cognizant test monitors to cease testing.

TABLE X (Cont'd)

SUMMARY OF ELSS QUALIFICATION TESTS

Test Day 4:

Conditions: Minimum SES pressure, (5×10^{-4} torr maximum) LN_2 walls, solar on, ELSS outflow valve closed.

Agenda:

1. Medium Length Mission - 55 minutes at 1400 BTU/hr metabolic output, flow valve set high. Elapsed time, 0 to 55 minutes.

2. Short Time High Metabolic Output - 10 minutes at 2000 BTU/hr; flow valve set high. Elapsed time, 55 to 65 minutes.

3. Heat Exchanger Failure - 5 minutes at 1400 BTU/hr; flow valve set high. Elapsed time, 50 to 55 minutes.

4. Heat Exchanger Failure Continued - 10 minutes at 2000 BTU/hr; flow valve set high, bypass valve on. Flow 55 to 65 minutes.

ELSS Displays Illumination Evaluation:

Conditions: SES Chamber door closed sufficiently for darkness, solar on and off as indicated, protected subject with extravehicular Gemini helmet standing chest to ELSS.

Agenda:

1. Darkness, sunshade up.

2. Solar on, facing solar, sunshade down.

3. Solar on, sunshade down at other than "facing solar" position.

TABLE XI

TESTING PROCEDURE - TEST DAY NO. 1

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	1	Chamber check list complete					
	2	Service ELSS.					
	2a	Oxygen bottle serviced to stabilized 7500 psia.					
	2b	Battery charged and installed, switch off.					
	2c	Evaporator charged with water, control off.					
	2d	All valves closed					
	3	ELSS installed in test position in SES.					
	3a	Remote actuators connected and functionally checked.					
	3b	Bypass normal.					
	3c	Standup umbilicals attached.					
	3d	Insulation installed on back of pack.					
	3e	Outflow valve capped and cover removed.					
	3f	Thermocouples attached to DARS.					
	3g	Flight umbilical attached and valve V1 (Figure 1) open and pressurize system to ~~3.3 ± 0.1 psid. Umbilical supply pressure~~ shall be 92 psid (with respect to SES chamber pressure) and maintained at 92 psid during pumpdown.					
	3h	Flow selector OFF.					

TABLE [illegible] (Con'd)
TESTING PROCEDURE - TEST DAY NO. 1

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	3i	Emergency oxygen handle open.					
	4	Instrumentation check list and calibration complete.					
	5	DARS check list complete.					
	6	Perform functional checks of all systems.					
	7	Perform flow systems functional conformance checks.					
	8	Begin data acquisition and recording (for monitoring purposes).					
	9	Begin SES pumpdown check list.					
	9a	Turn ELSS battery switch to "ON".					
	9b	Switch test switch to test position to verify emergency tone and return					
		normal position; then, turn off ELSS battery.					
	9c	Close SES door.					
	9d	Open valve V3 (figure 1) when SES vacuum pump is started and throttle					
		flow through V3 to monitor pressure of 3.7 to 4.2 psid above SES pressure in					
		ELSS/CMS loop.					
	9e	Close valve V3 (figure 1) when manometer on system bleed line in-					
		dicates 7 in. Hg. absolute.					
	9f	Complete SES pumpdown check list.					

TABLE XI (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 1

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	10	Begin LN_2 system check list.					
	11	Begin to monitor temperature of chest pack surfaces.					
	11a	Begin to control infrared lamp array power so as to control ELSS surface temperatures to 70±10°F.					
	11b	Begin to monitor CMS internal temperature and regulate CMS electrical power to maintain 60 to 90°F CMS internal temperature.					
	12	Complete LN_2 system check list.					
	13	Complete solar check list, shutter closed.					
	14	Position ELSS to "facing solar."					
	15	Begin "TEST DAY NO. 1" (All seq. No. 15 actions must be accomplished as nearly simultaneously as possible). Elapsed test time begins w/completion of 15 g.					
	15a	Actuate ELSS battery switch to "on."					
	15b	Begin ELSS flow by setting selector valve to high position.					
	15c	Verify regulated pressure to flight umbilical to 92 ± 10 psia (77.3 ± 10 psig).					
	15d	Adjust valve V4 to maintain ELSS inlet pressure at 3.7 ± 0.2 psia.					
	15e	After completion of 15d, reduce ELSS pressure to 3.3 psid to verify emergency tone and then return to 3.7 ± .2 psid control by V4.					

TESTING PROCEDURE - TEST DAY NO. 1

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	15f	Set CMS power and waterflow to 1400 BTU/hr per Figure 5.					
	15g	Open ELSS evaporator control.					
	15h	Infrared lamp array off.					
	15i	Solar shutter open.					
	15j	Begin manual recordings versus time.					
		o CMS power and water flow. o Umbilical regulated pressure.					
		o System bleedline flowrate.					
	15k	Orient ELSS as directed. Record actual test orientation versus time.					
	16	At 55 minutes elapsed test time, increase CMS power and water flow to 2000 BTU/hr					
		rate per Figure 5.					
	17	At 65 minutes elapsed test time close off flight umbilical supply by closing					
		V1. Maintain same setting of V4 as established at end of Seq. 15d.					
	17a	Verify initiation of emergency tone as V1 is closed.					
	18	COMPLETE "TEST DAY NO. 1" at end of					
		80 minutes elapsed test time.					
	18a	Open valve V1 and readjust V4 as necessary to maintain ELSS inlet pres-					
		sure at 3.7 ±.2 psig (with respect to SES chamber).					

TABLE XI (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 1

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	18b	Turn solar shutter off; turn off solar.					
	18c	Begin to control ELSS surface temperature to 80 ± 20°F with infrared lamp array.					
	18d	Reduce CMS metabolic rate to zero and control internal temperature to 80 ± 20°F.					
	18e	Close ELSS evaporator control and turn battery off.					
	18f	Turn off DARS.					
	19	Begin LN_2 system warm-up check list.					
	20	LN_2 system warm-up check list complete.					
	21	Regulate Valves V4 and V3 to maintain 3.7 to 4.2 psid above chamber ambient.					
	21a	Return SES pressure to ambient.					
	22	Open chamber.					
	23	Enter chamber and close ELSS emergency O_2 valve.					
	24	Close Valve V1 and allow umbilical inlet pressure to build to zero psig.					
	25	Install ELSS outflow valve cover.					
	26	Remove ELSS from chamber and close flow section valve.					
	27	Close all valves.					

TABLE XI (Cont'd)

COMMENTS

TESTING PROCEDURE - TEST DAY NO. 1

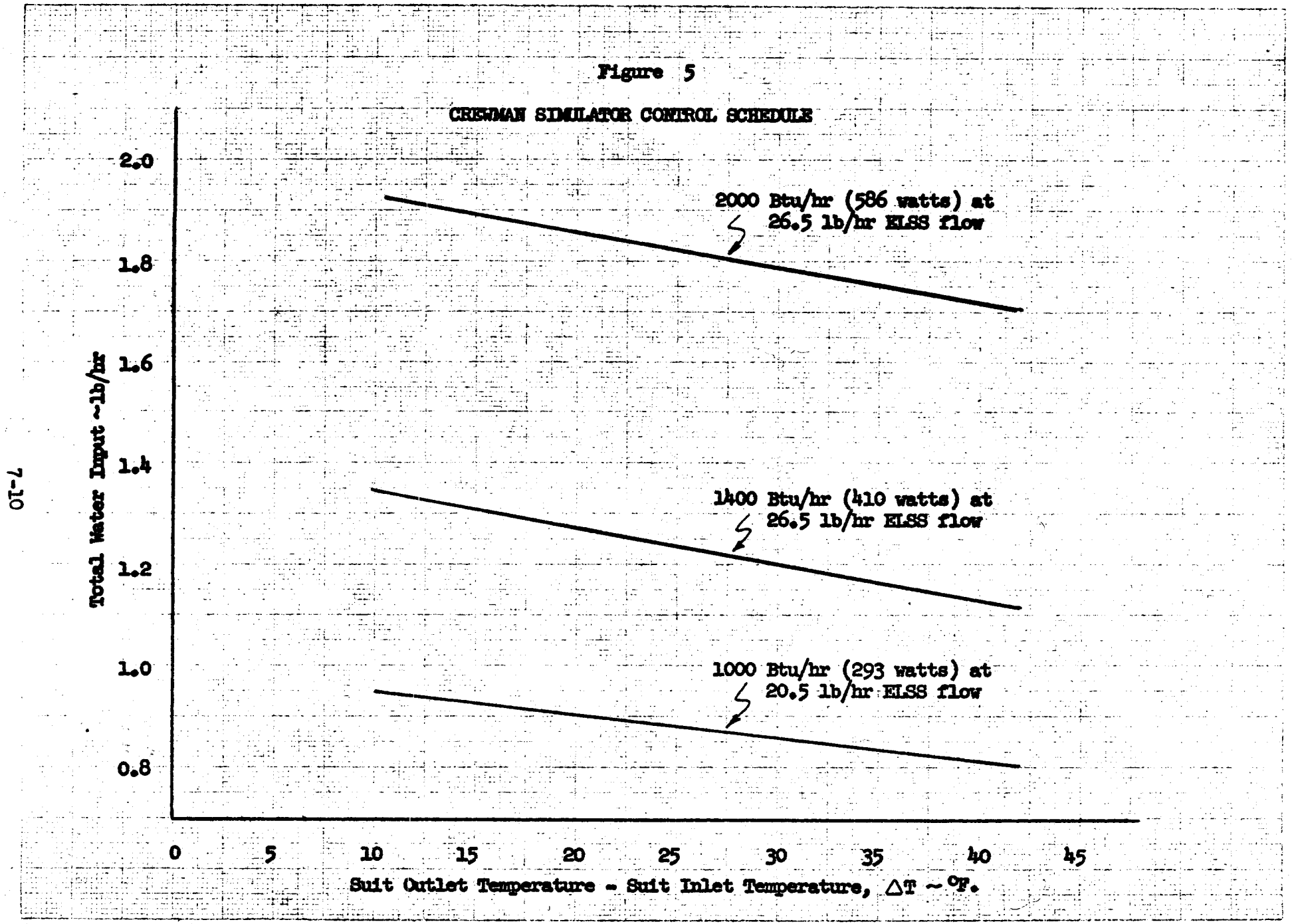


Figure 5
CREWMAN SIMULATOR CONTROL SCHEDULE
2000 Btu/hr (586 watts) at
26.5 lb/hr ELSS flow
1400 Btu/hr (410 watts) at
26.5 lb/hr ELSS flow
1000 Btu/hr (293 watts) at
20.5 lb/hr ELSS flow
Total Water Input ~lb/hr
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0
5
10
15
20
25
30
35
40
45
Suit Outlet Temperature - Suit Inlet Temperature, ΔT ~°F.

TABLE XII
TESTING PROCEDURE - TEST DAY NO. 2

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	1	Chamber check list complete.					
	2	Service ELSS.					
	2a	Oxygen bottle serviced to stabilized 7500 psia.					
	2b	Batteries charged and installed, switch off.					
	2c	Evaporator charged with water, control off.					
	2d	All valves closed.					
	3	ELSS installed in test position in SES.					
	3a	Remote actuators connected and functionally checked.					
	3b	Bypass valve at normal and evaporator control off.					
	3c	Standup umbilicals attached.					
	3d	Insulation installed on back of pack.					
	3e	Outflow valve capped and cover removed.					
	3f	Thermocouples attached to DARS.					
	3g	Flight umbilical attached and valve V1 (Figure 1) open and pressurize system to					
		3.3 ±0.1 psid (with respect to SES chamber pressure) and maintained at 92 ~~psid during pumpdown.~~					
	3h	Flow selector set "off".					

TABLE XII
TESTING PROCEDURE - TEST DAY NO. 2

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	3i	Emergency oxygen handle set to operate.					
	4	Instrumentation check list and calibration complete.					
	5	DARS check list complete.					
	6	Perform functional checks of all systems.					
	7	Perform flow system functional conformance checks.					
	8	Begin data acquisition and recording (for monitoring purposes).					
	9	Begin SES pumpdown check list.					
	9a	Turn ELSS battery switch to "on"					
	9b	Switch test switch to test position to verify emergency tone and return to					
		normal position, then, turn off battery switch.					
	9c	Close SES door.					
	9d	Open Valve V3 (Figure 1) when SES vacuum pump is started and throttle					
		flow through Valve V3 to maintain pressure of 3.7 to 4.2 psid (above SES pressure in ELSS/CMS loop.					
	9e	Close Valve V3 (Figure 1) when manometer on system bleed line indicates 7 in. Hg.					
		absolute.					
	9f	Complete SES pumpdown check list.					

TABLE XII (Cont'd)

TESTING PROCEDURE - TEST DAY NO. 2

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	10	Begin LN_2 system check list.					
	11	Begin to monitor temperature of chest pack surfaces.					
	11a	Begin to control infrared lamp array power so as to control ELSS surface temperatures to 70 ± 10°F.					
	11b	Begin to monitor CMS internal temperatur and regulate CMS electrical power to maintain 60 to 90°F CMS internal temperature.					
	12	Complete LN_2 system check list.					
	13	Complete solar check list, shutter closed.					
	14	Position ELSS to "facing solar."					
	15	Begin "TEST DAY NO. 2" (All Seq. No. 15 actions must be accomplished as nearly simultaneously as possible). Begin recording elapsed test time from completion of Seq. No. 15g.					
	15a	Actuate battery switch to "on."					
	15b	Begin ELSS flow by setting ELSS flow selector valve to medium position.					
	15c	Verify regulated pressure to flight umbilical to 92 ± 10 psia (77.3 ± 10 psig.)					
	15d	Adjust valve V4 to maintain ELSS inlet pressure at 3.7 ± .2 psid.					

TABLE XII (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 2

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	15e	After completion of 15d, reduce ELSS pressure to 3.3 psid to verify emer-					
		gency tone and then return to 3.7 ± .2 psid control by V4.					
	15f	Set CMS power and waterflow to 1000 BTU/hr per Figure 5.					
	15g	Open ELSS evaporator control.					
	15h	Infrared lamp array off.					
	15i	Solar shutter open.					
	15j	Begin manual recordings versus time.					
		o CMS power and water flow. o Umbilical regulated pressure. o System bleed line flowrate.					
	15k	Orient ELSS as directed and record actual test orientation versus time.					
	16	At 55 minutes elapsed test time close solar shutter.					
	17	At 90 minutes elapsed test time, open valve V4 and maintain 12 ± 1 lb/hr flow					
		out system bleed line. (Control V4 by monitoring mass flowmeter in bleed line).					
	17a	Monitor ELSS outlet pressure - notify test conductor if it falls below 3.2 psid					
		during 90 to 105 minutes elapsed test times.					
	18	At 95 minutes elapsed test time, set CMS to 2000 BTU/hr.					
	19	Adjust ELSS flow control to high position at 95 minutes.					

TABLE XII (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 2

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	20	COMPLETE "TEST DAY NO. 2" at end of 105 minutes elapsed test time.					
	20a	Regulate valve V1 and readjust V4 as necessary to maintain ELSS inlet					
		pressure at 3.7 ± .2 psid (with respect to SES chamber).					
	20b	Turn solar shutter off; turn off solar.					
	20c	Begin to control ELSS surface temperatures to 80 ± 20°F with infrared lamp					
		array.					
	20d	Reduce CMS metabolic rate to zero and control internal temperature to 80 ± 20°F					
		with CMS power supply.					
	20e	Close ELSS evaporator control and turn battery switch to off.					
	20f	Turn off DARS.					
	21	Begin LN_2 system warm-up check list.					
	22	LN_2 system warm-up check list complete.					
	23	Regulate valves V4 and V3 to maintain 3.7 to 4.2 psid above SES pressure.					
	23a	Return SES pressure to ambient.					
	24	Open chamber.					
	25	Enter chamber and close emergency O_2 valve.					
	26	Close valve V1 and allow umbilical inlet pressure to bleed to zero psig.					

TABLE XII (Cont'd)

TESTING PROCEDURE - TEST DAY NO. 2

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	27	Install ELSS outflow valve cover.					
	28	Remove ELSS from chamber and close flow selector valve.					
	29	Close all valves.					

TABLE XII (Cont'd)

COMMENTS

TESTING PROCEDURE - TEST DAY NO. 2

TABLE XIII

TESTING PROCEDURE - TEST DAY NO. 3

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	1	Chamber check list complete.					
	2	Service ELSS.					
	2a	Oxygen bottle serviced to stabilized 7500 psia.					
	2b	Batteries charged and installed, switch off.					
	2c	Evaporator charged with water, control "off".					
	2d	All valves closed.					
	3	ELSS installed in test position in SES.					
	3a	Flow selector, evaporator control and bypass switch remote actuators connected and functionally checked.					
	3b	Bypass set normal and evaporator control OFF.					
	3c	Standup umbilicals attached.					
	3d	Insulation installed on back of ELSS.					
	3e	ELSS outflow valve capped and cover removed.					
	3f	ELSS instrumentation sensors attached to DARS.					
	3g	Flight umbilical attached and valve V1 (Figure 1) open and pressurize system to 3.3±0.1 psid. Umbilical supply pressure shall be 92 psid (with respect to SES chamber pressure) and maintained at 92 psid during pumpdown.					

TABLE XIII (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 3

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	3h	Set ELSS flow selector "off" and evaporator control "off".					
	3i	Emergency oxygen handle set to operate.					
	4	Instrumentation check list and calibration complete.					
	5	DARS check list complete.					
	6	Perform functional checks of all systems.					
	7	Perform flow system functional conformance checks.					
	8	Begin data acquisition and recording (for monitoring purposes)					
	9	SES pumpdown check list initiated.					
	9a	Turn ELSS battery switch to "on"					
	9b	Switch test switch to test position to verify emergency tone and return to normal position; then turn off battery.					
	9c	Close SES door.					
	9d	Open valve V3 (Figure 1) when SES vacuum pump is started and throttle flow through valve V3 to maintain pressure of 3.7 to 4.2 psid (above SES ~~pressure in ELSS/CMS loop~~).					
	9e	Close valve V3 when system bleed line manometer indicates 7 in Hg absolute.					

TABLE XIII (cont'd)
TESTING PROCEDURE - TEST DAY NO. 3

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	9f	Complete SES pumpdown check list.					
	10	Begin LN_2 system check list.					
	11	Begin to monitor temperatures of ELSS exterior surfaces.					
	11a	Control power to IR lamp array as required to maintain ELSS surface temperatures at 70 ± 10°F.					
	11b	Begin to monitor CMS internal temperatures and regulate CMS power as required to maintain 60 to 90°F CMS internal temperature.					
	12	Complete LN_2 system check list.					
	13	Complete solar system check list, shutter closed.					
	14	Position ELSS to"facing solar."					
	15	Begin "TEST DAY NO. 3" (All Seq. No. 15 items must be accomplished as nearly simultaneously as possible). Elapsed test time begins when Seq. 15g is completed.					
	15a	Actuate ELSS battery switch.					
	15b	Set ELSS flow selector to "Medium" to begin flow.					
	15c	Regulate V4 to maintain ELSS inlet pressure at 3.7 ± .2 psid.					
	15d	Regulate flight umbilical supply pressure to 92 ± 10 psia (77.3 ± 10 psig).					
	15e	After completion of 15d, reduce ELSS pressure to 3.3 psid to verify emergency tone and then return to 3.7 ± .2 psid control by V4.					

TABLE XIII (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 3

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	15f	Set CMS power and water flow to 1000 BTU/hr per Figure 5.					
	15g	Open ELSS evaporator control.					
	15h	IR lamp array off.					
	15i	Solar shutter open.					
	15j	Begin all manual recordings versus time (frequency as directed by test conductor)					
		o CMS power and water flow.					
		o Umbilical regulated pressure. o System bleedline flowrate.					
	15k	Orient ELSS as directed - record actual test orientations versus time.					
	16	At 50 minutes elapsed time close solar shutters.					
	17	At 90 minutes elapsed time open solar shutters.					
	18	At 140 minutes elapsed time close solar shutters.					
	19	At 180 minutes elapsed time open solar shutters.					
	20	At 230 minutes elapsed time close solar shutters and turn off solar.					
	21	At 270 minutes elapsed time complete Test Day 3.					
	22	Begin to control ELSS surface temperatures at 80 ± 20°F withinfrared lamp array.					

TABLE XIII (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 3

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	23	Reduce CMS metabolic output to zero (control internal temperatures to 80 ± 20°F					
		afterward with CMS power supply).					
	24	Close ELSS evaporator control.					
	25	Turn off DARS.					
	25a	Turn off ELSS battery.					
	26	Begin LN_2 system warm-up check list.					
	27	LN_2 system warmpup check list complete.					
	28	Regulate valves V4 and V3 to maintain 3.7 to 4.2 psid above SES pressure.					
	29	Return SES pressure to ambient.					
	30	Open chamber.					
	31	Enter chamber and close ELSS emergency O_2 valve.					
	32	Close valve V1 and allow umbilical inlet pressure to bleed to 0 psig.					
	33	Install ELSS outflow valve cover.					
	34	Remove ELSS from chamber and close flow selector valve.					
	35	Close all valves.					

TABLE XIII (Cont'd)

TESTING PROCEDURE - TEST DAY NO. 3

TABLE XIV
TESTING PROCEDURE - TEST DAY NO. 4

Date: **Test Conductor:** **Observers:**

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	1	Chamber check list complete.					
	2	Service ELSS.					
	2a	Oxygen bottle serviced to stabilized 7500 psia.					
	2b	Battery charged and installed, switch off.					
	2c	Evaporator charged with water, control off.					
	2d	All valves closed.					
	3	ELSS installed in test position in SES.					
	3a	Remote actuators connected and functionally checked.					
	3b	Bypass normal.					
	3c	Standup umbilicals attached.					
	3d	Insulation installed on back of pack.					
	3e	ELSS outflow valve capped, and cover removed.					
	3f	Thermocouples attached to DARS.					
	3g	Flight umbilical attached and valve V1 (Figure 1) open and pressurize system to 3.3 ±0.1 psid. Umbilical supply pressure shall be 92 psid (with respect to SES chamber pressure) and maintained at 92 psid during pumpdown.					
	3h	Set ELSS flow selector "off" and evaporator control "off."					
	3i	Emergency oxygen handle open.					

TABLE XIV (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 4

Date: **Test Conductor:** **Observers:**

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	4	Instrumentation check list and calibration complete.					
	5	DARS check list complete.					
	6	Perform functional checks of all systems.					
	7	Perform flow systems functional conformance checks.					
	8	Begin data acquisition and recording (for monitoring purposes).					
	9	Begin SES pumpdown check list.					
	9a	Turn ELSS battery switch to "ON."					
	9b	Switch test switch to test position to verify emergency tone and return normal					
	9c	position, **then turn off battery.** Close SES door.					
	9d	Open valve **V3** (Figure 1) when SES **vacuum** pump is started and throttle					
		flow through **V3** to monitor pressure of 3.7 to 4.2 psid(above SES pressure in					
		ELSS/CMS loop.)					
	9e	Close valve **V3** (Figure 1) when manometer on system bleed line indicates					
		7 in. Hg. **absolute.**					

TABLE XIV (cont'd)
TESTING PROCEDURE - TEST DAY NO. 4

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	9f	Complete SES pumpdown check list.					
	10	Begin LN_2 system check list.					
	11	Begin to monitor temperature of chest pack surfaces.					
	11a	Begin to control infrared lamp array power so as to control ELSS surface temperatures to 70 ± 10°F.					
	11b	Begin to monitor CMS internal temperature and regulate CMS electrical power to maintain 60 to 90°F CMS internal temperature.					
	12	Complete LN_2 system check list.					
	13	Complete solar check list, shutter closed.					
	14	Position ELSS to "facing solar."					
	15	Begin "TEST DAY NO. 4" (All seq. No. 15 actions must be accomplished as nearly simultaneously as possible). Elapsed test time begins with completion of 15g.					
	15a	Actuate ELSS battery switch to "on."					
	15b	Begin ELSS flow by setting selector valve to high position.					
	15c	Verify regulated pressure to flight umbilical is 92 ± 10 psia (77.3 psig) and fully open valve V1.					
	15d	Adjust valve V4 to maintain ELSS inlet pressure at 3.7 ± .2 psid.					

TABLE XIV (Cont'd)
TESTING PROCEDURE - TEST DAY NO. 4

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	15e	After completion of 15d, decrease ELSS pressure to 3.3 psid to verify emergency tone and return to control to 3.7 ± .2 psid.					
	15f	Set CMS power and waterflow to 1400 BTU/hr per Figure 5.					
	15g	Open ELSS evaporator control.					
	15h	Infrared lamp array off.					
	15i	Solar shutter open.					
	15j	Begin all manual recordings versus time. o CMS power and water flow. o Umbilical regulated pressure.					
	15k	Orient ELSS as directed. Record actual orientations versus time.					
	16	At 50 minutes elapsed test time, start heat exchanger failure by closing the ELSS evaporator control.					
	17	At 55 minutes elapsed time, turn bypass valve "on" and increase CMS power and water flow to 2000 BTU/hr metabolic output per Figure 5.					
	17a	Adjust valve V4 as necessary to maintain ELSS inlet pressure at 3.7 ± 0.2 psid (with respect to SES chamber).					
	18	Complete TEST DAY NO. 4" at end of 65 minutes elapsed test time.					
	18a	Close bypass valve.					

TABLE XIV (Cont'd)

TESTING PROCEDURE - TEST DAY NO. 4

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	18b	Close solar shutter; turn off solar.					
	18c	Begin to control ELSS surface temperature to 80 ± 20°F with infrared lamp					
		array.					
	18d	Reduce CMS metabolic rate to zero and control internal temperature to 80 ± 20°F.					
	18e	Close ELSS evapprator control, and actuate ELSS battery to "off."					
	18f	Turn off DARS.					
	19	Begin LN_2 system warm-up check list.					
	20	LN_2 system check list complete.					
	21	Regulate valves V4 and V3 to maintain 3.7 to 4.2 psid above chamber ambient.					
	21a	Return SES pressure to ambient.					
	22	Open chamber.					
	23	Enter chamber and close ELSS emergency O_2 valve.					
	24	Close valve V1 and allow umbilical inlet pressure to bleed to zero psig.					
	25	Install ELSS outflow valve cover.					
	26	Remove ELSS from chamber and close flow section valve.					
	27	Close all valves.					

TABLE XIV (cont'd)

COMMENTS

TESTING PROCEDURE - TEST DAY NO. 4

TABLE XV
PROCEDURE - ELSS DISPLAY ILLUMINATION EVALUATION

Date: **Test Conductor:** **Observers:**

Time	Sel. No.	Operation	Responsible Individual	Reading	Checked		Remarks
					RJ	C	
	1	Position Elss on table in SES facing					
		solar ports, displays at chest level,					
		all outlets capped, Evaporator control					
		closed.					
	2	Protect subject with aluminized mylar					
		solar shield totally.					
	3	Complete solar check list, shutters					
		closed & SES door open					
	4	Install Gemini extravehicular helmet on					
		head of unsuited subject					
	4a	Install scarf around neck of subject and					
		drape over chest					
	5	Position subject immediately behind ELSS					
	6	Lower helmet sunshade					
	7	Open shutters for 10 seconds to confirm proper solar protection for subject,					
		then close solar shutter					

TABLE XV (Cont'd)

PROCEDURE - ELSS DISPLAY ILLUMINATION EVALUATION

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	8	Turn ELSS Battery switch to "ON"					
	9	Close chamber door - do not connect retainer bolts, LN_2 lines or safety cable					
	10	Evaluate ELSS display illumination in darkness on ELSS normal illumination					
		setting.and bright setting.					
	10a	Pressure visor only down.					
	10b	Pressure visor plus protective visor down					
	10c	Pressure visor plus protection plus sun visor down.					
	11	Open solar shutter					
	12	Evaluate display illumination facing solar.					
		pressure protective and sun visors down.					
	12a	Attempt evaluation with pressure and protective visors down.					
	13	Evaluate display illumination at 45° to solar repeating sequence 12 and 12a.					
	14	Repeat 12 and 12a except with the illumination at 90°.					
	15	Repeat 12 and 12a except with the illumination at 120°.					
	16	Repeat 12 and 12a except with the illumination at 180°.					
	17	Close solar shutter.					
	18	Open chamber door.					

TABLE XV (Cont'd)

TESTING PROCEDURE - ELSS DISPLAY ILLUMINATION EVALUATION

Date: Test Conductor: Observers:

Time	Seq. No.	Operation	Responsible Individual	Reading	Checked TC	Checked Q	Remarks
	19	Change subjects and repeat steps 2-7 and 9-18.					
	20	Same as 19.					
	21	Place ELSS display panel facing solar simulation.					
	22	Repeat steps 2-7 and 9-12, 12a, 17 and 18.					
	23	Change subjects and repeat step 22.					
	24	Repeat step 23					
	25	Turn off solar.					
	26	Open chamber door.					
	27	Subject's evaluation and comments of ELSS display illumination tape recorder during test.					

TABLE XV (cont.)

COMMENTS

ELSS Display Illumination Evaluation

REFERENCES

1. Johnston, Richard A., NASA-MSC Letter to LTV on Gemini ELSS Extravehicular Environment Operation Qualification Series, dated 2 September 1965.

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3. Drummond, A. J., "Examination of Spectral Energy Distribution of Mercury-Xenon Lamps," The Eppley Laboratory, Inc., dated 27 June 1962.


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