

DEFINITION OF A RESISTOJET CONTROL SYSTEM FOR THE MANNED ORBITAL RESEARCH LABORATORY FINAL REPORT

VOLUME IV GROUND AND FLIGHT TEST PLAN

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by Douglas Aircraft Company
Missile and Space Systems Division
Huntington Beach, California
for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



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THE MANNED ORBITAL RESEARCH LABORATORY
FINAL REPORT**

**VOLUME IV
GROUND AND FLIGHT TEST PLAN**

MAY 1968

BY R.V. GRECO

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PREFACE

This report is submitted to the National Aeronautics and Space Administration's Langley Research Center (NASA-LRC), Langley AFB, Virginia. It has been prepared under Contract No. NAS1-6702 and describes the results of a detailed assessment of the use of a resistojet control system for the MORL.

The study results are documented in five volumes:

DAC-58130	I	Summary
DAC-58131	II	Resistojet Control System Analysis
DAC-58132	III	Biowaste Utilization
DAC-58133	IV	Ground and Flight Test Plan
DAC-58134	V	Resistojet Design and Development

Volume I is a summary report in which the significant results are presented. Volume II contains a detailed definition of the selected resistojet control system, the recommended orbit injection system, the supporting system analyses and integration, and comparative evaluation data. Volume III presents the biowaste utilization analysis. Volume IV details the ground and flight test program for a resistojet control system. Volume V presents the results of the resistojet design and development program. Life test data will be provided in a separately bound addendum to Volume V at the conclusion of the life test.

Requests for further information concerning this report will be welcomed by the following Douglas representative:

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FOREWORD

Units, abbreviations, and prefixes used in this report correspond to the International System of Units (SI) as prescribed by the Eleventh General Conference on Weights and Measures and presented in NASA Report SP-7012. The basic units for length, mass, and time are meter, kilogram, and second, respectively. Throughout the report, the English equivalent (foot, pound, and second) are presented for convenience.

The SI units, abbreviations, and prefixes most frequently used in this report are summarized below:

Basic Units

Length	meter	m
Mass	kilogram	kg
Time	sec	s
Electric current	ampere	A
Temperature	degree Kelvin	°K

Supplementary Units

Plane angle	radian	rad
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Derived Units

Area	square meter	m^2	
Volume	cubic meter	m^3	
Frequency	hertz	Hz	(s^{-1})
Density	kilogram per cubic meter	kg/m^3	
Velocity	meter per second	m/s	
Angular velocity	radian per second	rad/s	
Acceleration	meter per second squared	m/s^2	
Angular acceleration	radian per second squared	rad/s^2	
Force	newton	N	$(kg-m/s^2)$
Pressure	newton per sq meter	N/m^2	
Kinematic viscosity	sq meter per second	m^2/s	
Dynamic viscosity	newton-second per sq meter	$N-s/m^2$	

Work, energy, quantity of heat	joule	J	(N-m)
Power	watt	W	(J/s)
Electric charge	coulomb	C	(A-s)
Voltage, potential difference, electromotive force	volt	V	(W/A)
Electric field strength	volt per meter	V/m	
Electric resistance	ohm	Ω	(V/A)
Electric capacitance	farad	F	(A-s/V)
Magnetic flux	weber	Wb	(V-s)
Inductance	henry	H	(V-s/A)
Magnetic flux density		T	(Wb/m ²)
Magnetic field strength	ampere per meter	A/m	
Magnetomotive force	ampere	A	

Prefixes

Factor by which unit is multiplied	Prefix	Symbol
10^6	mega	M
10^3	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ

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DEFINITION OF A RESISTOJET CONTROL SYSTEM
FOR THE MANNED ORBITAL RESEARCH LABORATORY

FINAL REPORT

VOLUME IV

GROUND AND FLIGHT TEST PLAN

By R. V. Greco

INTRODUCTION AND SUMMARY

The selection of an NH_3 resistojet reaction-control system for the MORL necessitated the definition of a test program to achieve an operational system. This section summarizes the recommended approach for demonstrating operational capability of the resistojet control system. This approach consists of a flight test of an experimental resistojet system, preceded by limited ground qualification test.

The established test programs were based on an evaluation of the resistojet system current status, the potential launch and operational requirements, and the system operational life requirements. Careful evaluation of the Apollo Applications Test Requirements* for systems with long-duration operation and/or open-ended missions showed that schedule and cost constraints would prohibit full-duration ground qualification testing. Therefore, the test program philosophy limits the ground qualification test to only a demonstration of the system's flight worthiness. This is followed by flight test of an experiment system to demonstrate operational capability.

Successful completion of the program will permit the use of a resistojet control system to provide CMG desaturation and orbit keeping of advanced Earth-orbital spacecraft. The use of such a low-thrust system will permit the attainment of the increasingly stringent requirements for spacecraft orientation that are imposed by sophisticated astronomical experiments. Such a system would also minimize, if not totally eliminate, the environmental contamination of the spacecraft that is caused by particulate exhaust products from conventional rocket engines. The resistojet system would provide the necessary impulse at low-thrust and low-noise levels, eliminating these disturbing effects on the spacecraft, the operating experiments, and the astronaut activities. In addition, since the resistojet system uses a single propellant and provides a higher specific impulse than the conventional bipropellant engines, the amount of propellant and the resupply complexity are significantly reduced. The combined effects of these system advantages justify the qualification and flight-worthiness efforts required to permit usage of a resistojet system on the long-duration manned spacecraft anticipated for the next decade.

*Apollo Applications Test Requirements. NASA Office of Manned Space Flight, Report No. NHB 8080.3, October 13, 1967.

The flight test was formulated to accomplish the following objectives:

- (1) Demonstrate the resistojet's capability to control the spacecraft.
- (2) Demonstrate the astronaut's ability to perform system maintenance.
- (3) Demonstrate propellant resupply.
- (4) Operate the experiment for a sufficient duration to permit the post-test prediction of the system's operational life.
- (5) Provide for recovery of one or both thruster modules for post-flight examination.

The equipment to be used in both the ground and flight testing is described in this document. Briefly, it consists of the following assemblies: tankage fill and drain, propellant feed, power control, command controller, thruster module (two required), and propellant resupply (see fig. 1). The recommended propellant for the experiment system is ammonia (NH_3), but the potential use of liquid hydrogen (LH_2) led to definition of an alternate LH_2 propellant tankage and feed assembly.

The two thruster modules will be mounted in diametrically opposed locations on the vehicle surface. The remaining subsystems can be mounted in an unpressurized area of the spacecraft, with the exception of the command controller, which is to be installed in the spacecraft control console.

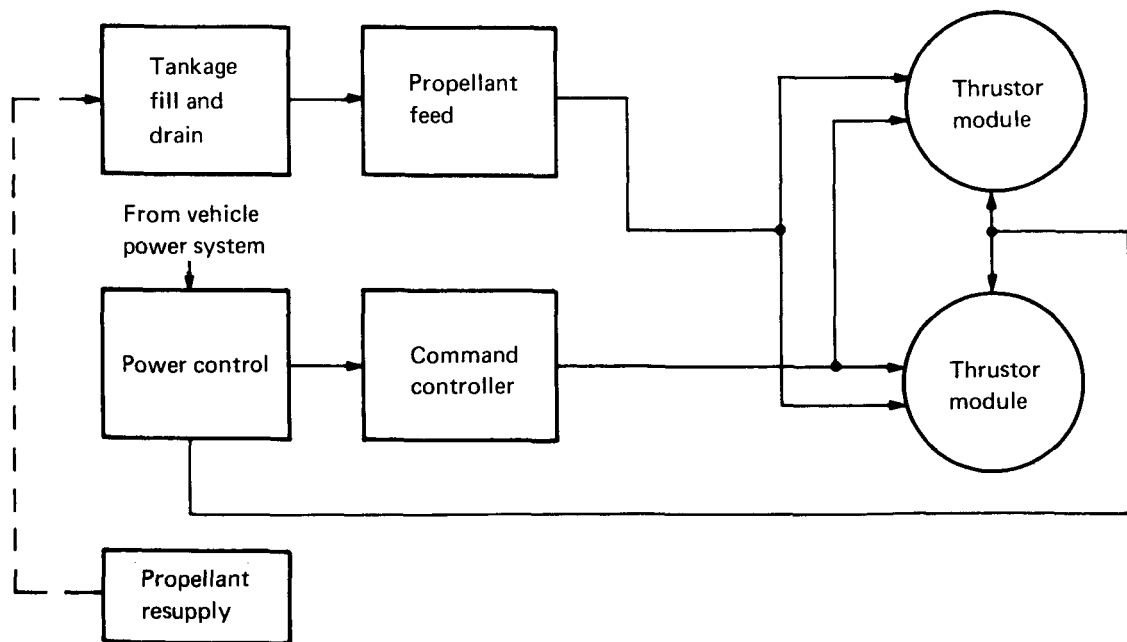


Figure 1. Experiment Package – Block Diagram

The launch weight, volume, and power requirements for both the NH_3 and H_2 experiment systems, are summarized in table 1.

The total ground- and flight-test program (shown in fig. 2) can be completed, through experiment evaluation, in 4.5 years. The ground-test program through integrated system test will require 2.5 years, with the flight system launched 1 year later or 3.5 years from program Authority to Proceed (ATP).

An approximate cost of \$7.7 million has been established for the ground-test program with the thruster-module development and qualification program requiring \$3.5 million, the development and qualification of the system's critical components requiring \$1.7 million, and the integrated-system test requiring \$2.5 million. The cost of the flight-test program will be dependent on spacecraft selection and cannot be estimated at this time.

Flight Test Program

The flight-test program consists of system procurement and test, vehicle installation, orbital operations, and experiment evaluation to be conducted over a 2-year period. The 6-month orbital operations, or experiment phase will consist of system operation to accomplish maneuvering demonstrations, extravehicular activity (EVA) demonstrations, and firing demonstrations. It is anticipated that a spacecraft of this mission duration will be available in the time period of the flight test program.

TABLE 1
EXPERIMENT SYSTEM WEIGHT VOLUME AND POWER

Identification	Weight		Volume		Power	
	(lbm)	(kg)	ft ³	m ³	Max (watts)	Average (watts)
NH_3 Experiment	495	225	11.7	0.33	665	345
H_2 Experiment	390	177	55.2	156	1 035	530
NH_3 Propellant Resupply	435	197.5	11.25	0.319	---	20
H_2 Propellant Resupply	← (not identified) →					

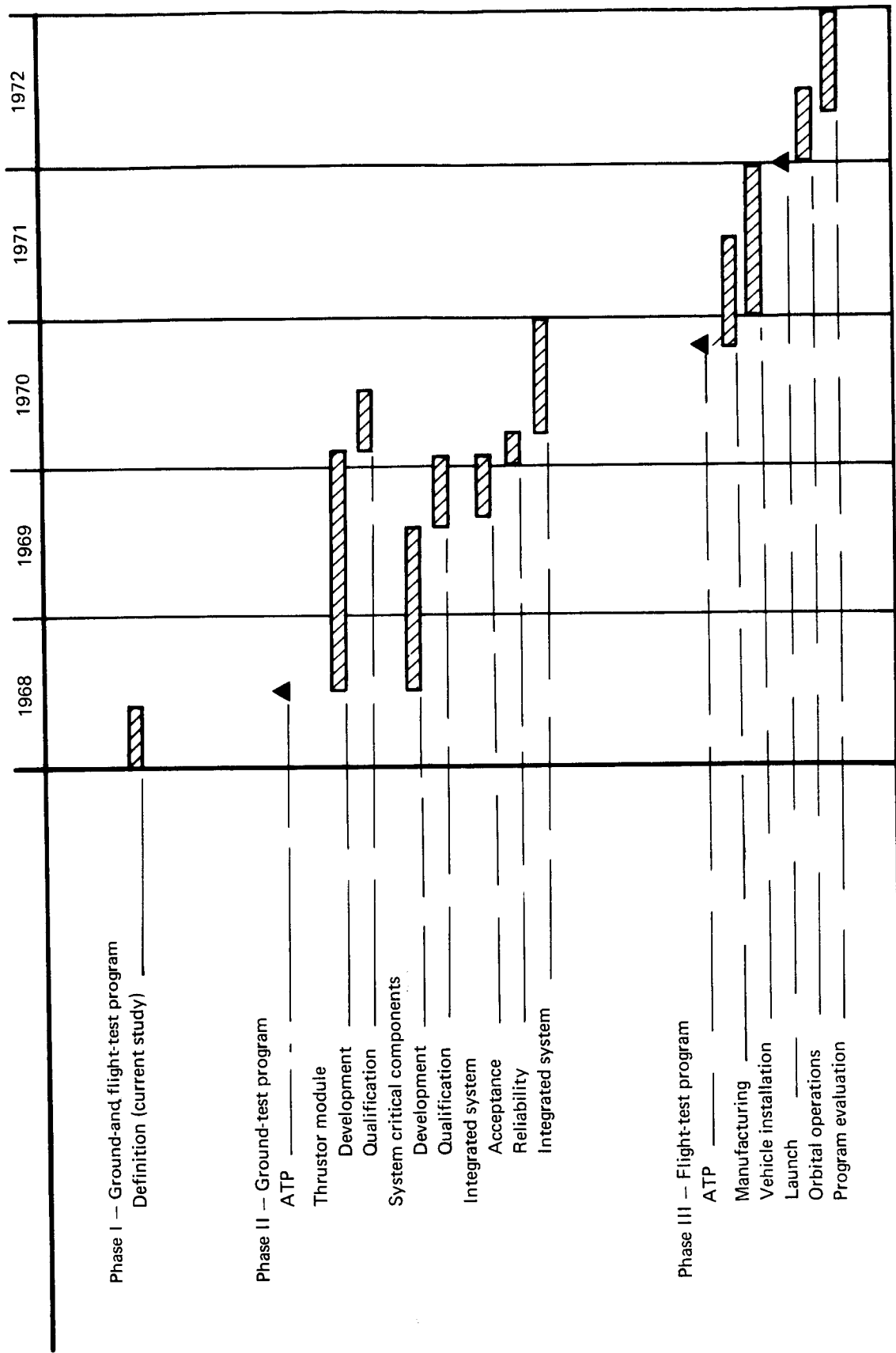


Figure 2. Ground-and Flight-Test Program Schedule

Maneuvering demonstrations will be performed twice during the experiment for a period of 8 to 16 orbits each (at the start and end of the experiment). The maneuvers will provide data on resistojet performance and operational life.

In the EVA exercises, the astronauts will demonstrate their ability to perform system maintenance and to accomplish propellant resupply. Three EVA exercises will be performed: (1) thruster-module removal and replacement, (2) propellant resupply, and (3) thruster-module removal and placement of module in the re-entry spacecraft. The recovered thruster module will be returned to Earth for post-experiment test, evaluation, and inspection.

The firing demonstration will be performed for approximately 170 days of the experiment period. Two opposed thrusters will be fired simultaneously on varied duty cycles. Appropriate selection of thrusters and their operating duty cycles will provide different accumulated operating time for each pair of thrusters. The effects of the various operating times will be assessed on the recovered module and will assist in the determination of resistojet operating life.

Ground Test Program

The ground-test program was formulated in accordance with Saturn launch requirements and the operational requirements for a MORL-type spacecraft. The preliminary qualification requirements for all system components were established. A detailed qualification test plan was formulated for the resistojet thruster module. Critical components of the experiment system were evaluated, and qualification test plans were established for the inverter, the transformer, the propellant-flow regulator, and the LH₂ propellant tankage and feed system. An integrated-system test program was also formulated.

The ground-test program for the thruster module is a 2-year effort consisting of 19 months of development testing and 5 months of qualification testing. The development effort includes the design, fabrication, and experimentation of the thruster-module components and the determination of the associated acceptance-test procedures and criteria. Assembled modules will then be subjected to both acceptance testing and overall functional tests to guarantee the operational performance of the module prior to qualification testing.

The qualification testing of the thruster module has the primary purpose of demonstrating that the module has no weakness to environmental stress and other conditions expected to arise during operational service.

The ground-test program, through qualification, for the critical components of the experiment system is in identical phases to those specified for the thruster module.

The test program for the integrated experiment-system is a 16-month effort consisting of three major phases: (1) acceptance testing, (2) reliability testing, and (3) integrated-systems testing. The program was formulated to verify that the system performance requirements will be met and that the components and subassemblies are physically, functionally, and operationally compatible with mating hardware and ground-support equipment (GSE).

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FLIGHT TEST PROGRAM

The flight-test program was prepared for a spacecraft in a circular low-Earth orbit. The spacecraft was assumed to have CMG's for primary attitude control and a conventional, chemical RCS for CMG desaturation. The resistojet experiment package, shown in fig. 3, was defined as the minimum system required to demonstrate the system performance, operational capability, and maintenance and to provide sufficient data to predict system operational life.

The experiment is composed of 12 distinct functions which will provide sufficient data to meet the objectives stated previously in the Introduction. These functions are delineated below in the order in which they will be performed:

(1) Translation maneuvers, then return to the original orbit (with two or four thrusters firing).

(2) Rotation maneuvers, then return to the original orientation (with two thrusters firing).

(3) Orientation maneuvers, inertial and local horizontal, then return to original orientation (with a maximum of four thrusters firing).

Functions 1, 2, and 3 will be scheduled at a time in the mission where interference with other spacecraft operations is minimized. The functions can be accomplished during a period of 8 to 16 orbits.

(4) Opposed-thruster operation on various duty cycles (with two opposed thrusters firing).

(5) Removal and replacement of a thruster module. Astronaut EVA is required to accomplish this function. It is anticipated that this event can be completed in less than one orbit.

(6) Repeat of Function 4 (with two opposed thrusters firing). This will continue until the propellant has been depleted.

Functions 4, 5, and 6 will be performed during a ≈ 90 -day period. The only astronaut participation is that previously described for Function 5 and the monitoring of the command controller for Functions 4 and 6.

(7) Accomplish propellant resupply. Astronaut EVA is required to accomplish this function. It is anticipated that this event can be completed in less than one orbit.

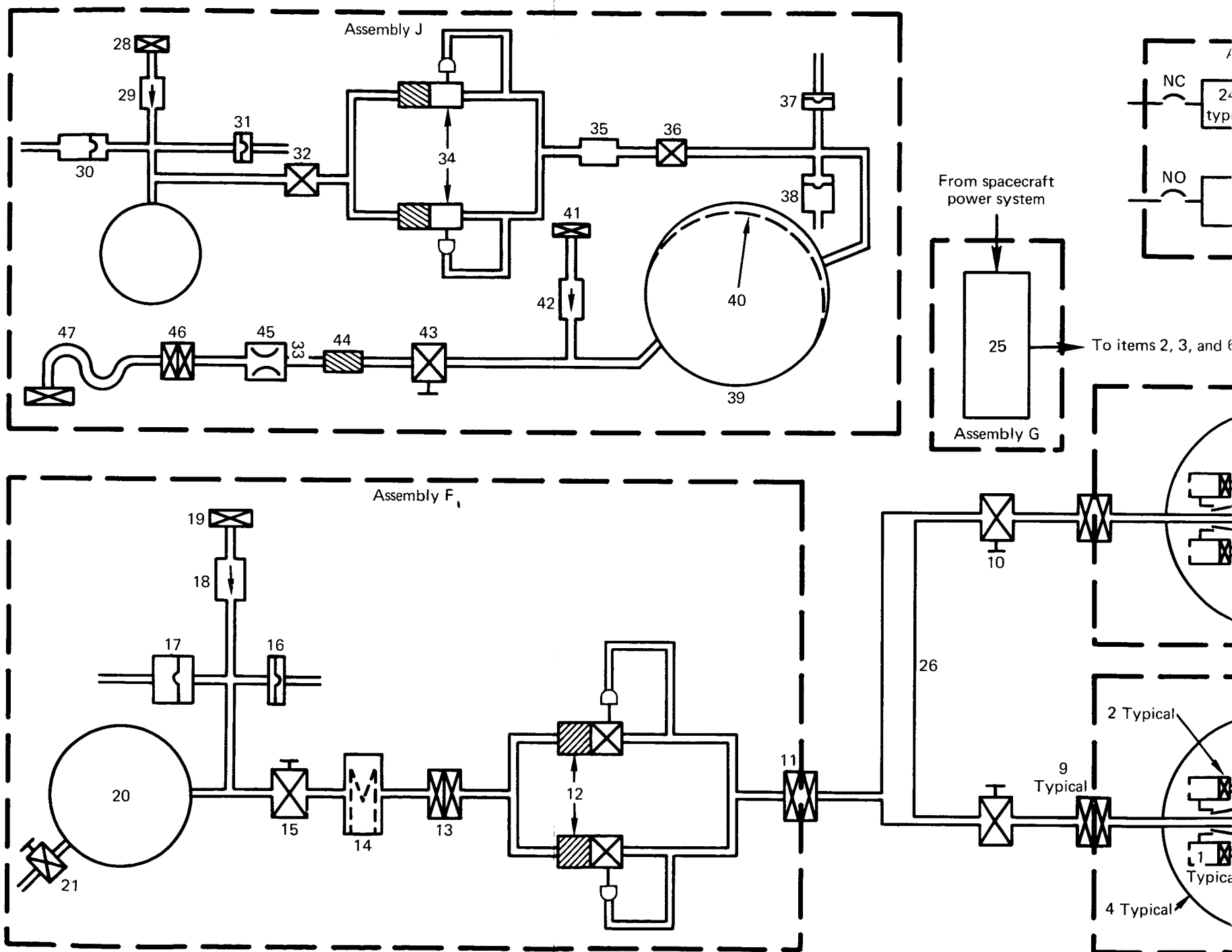
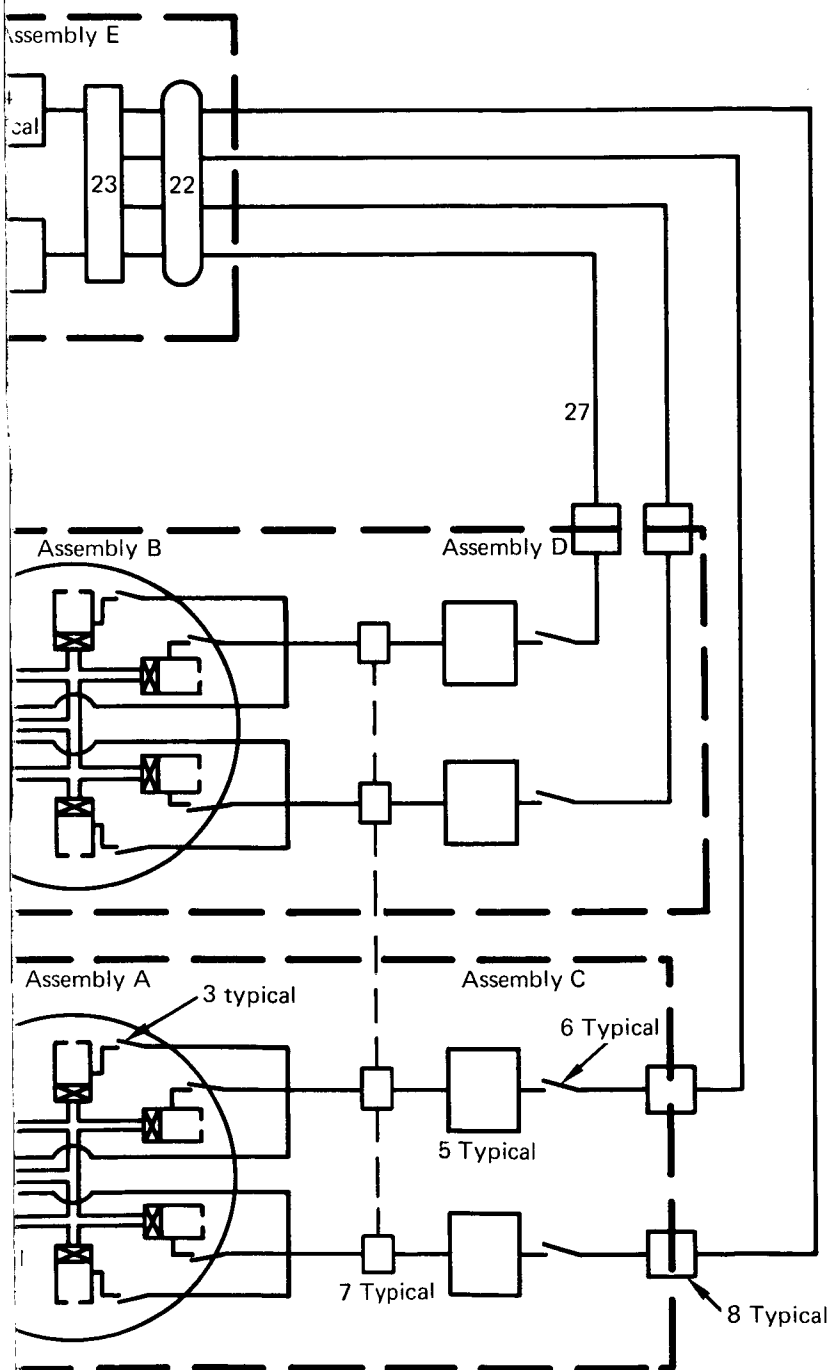


Figure 3. Experiment Package - NH₃ Resistojet-Control System



- 1 Resistojet
- 2 Resistojet valve
- 3 Resistojet controller
- 4 Mount structure
- 5 Transformer
- 6 Power switches
- 7 Electrical connector
- 8 Electrical connector
- 9 Propellant-line connector
- 10 Hand valve
- 11 Propellant-line connector
- 12 Pressure regulator filter
- 13 Propellant-line connector
- 14 Electric heater
- 15 Hand valve
- 16 Burst disk
- 17 Burst disk relief valve
- 18 Check valve
- 19 Propellant-fill connector
- 20 Propellant tank
- 21 Hand valve
- 22 Primary patch panel breaker assembly
- 23 Resistojet power bus
- 24 Inverter
- 25 Command controller
- 26 Accumulator (tank or line)
- 27 Electrical cabling
- 28 Pressurant (N_2) fill connector
- 29 Check valve
- 30 Burst disk/relief valve
- 31 Burst disk
- 32 Solenoid valve
- 33 Pressurant tank (N_2)
- 34 Pressure regulator/filter
- 35 Check valve
- 36 Solenoid valve
- 37 Burst disk
- 38 Burst disk/relief valve
- 39 Propellant tank
- 40 Propellant bladder
- 41 Propellant-fill connector
- 42 Check valve
- 43 Hand valve
- 44 Filter
- 45 Venture
- 46 Propellant-drain connector
- 47 Flexible propellant-transfer line

- (8) Repeat of Function 4 (with two opposed thrusters firing).
- (9) Repeat Function 1 (with two or four thrusters firing).
- (10) Repeat Function 2 (with two thrusters firing).
- (11) Repeat Function 3 (with a maximum of four thrusters firing).

Functions 9, 10, and 11 have the same operational constraints as Functions 1, 2 and 3. They will be performed to determine the degradation of thruster performance that results from operating duration.

(12) Removal of a thruster module, placement of it into a container, and securing it in the return spacecraft. (Astronaut participation required; this event can be completed in less than two orbits.)

Functions 7 through 12 will comprise ≈ 90 days of experiment operation. Function 8 will require ≈ 85 days of this period, during which time astronaut participation is limited to monitoring of the command controller.

These functions can be grouped into three main categories: maneuvering demonstrations (Functions 1, 2, 3, 9, 10, and 11); EVA demonstrations (Functions 5, 7, and 12); and firing demonstrations (Functions 4, 6, and 8). The following paragraphs discuss the requirements for each of these three categories, the astronaut participation and training, and the experiment equipment.

Maneuvering Demonstrations

The performance of the resistojets will be tested by means of maneuvering the spacecraft (8 to 16 orbits, twice during the mission). In addition to rotational and inertial-pointing maneuvers, minor orbital changes will be made. These functions are not constrained by such things as lighting or time of month. There is, however, a tracking-data constraint; that is, sufficient tracking data should be obtained so that accurate orbital parameters for the spacecraft can be obtained. Since neither the spacecraft, the orbit altitude, the orbit inclination, and so forth, have been established as yet, it is impossible to specify the orbital location of the spacecraft during measurements, the number of measurements to be taken, or the time per measurement. It is necessary, however, that the spacecraft position be accurately determined: in track, ± 305 m (± 1 000 ft); cross-track, ± 61 m (± 200 ft); radial, ± 61 m (± 200 ft). The spacecraft CMG gimbal angles should be known to $\pm 0.01^\circ$.

The translation, rotation, and inertial positioning maneuvers will provide data on thruster performance and performance degradation. The spacecraft orientation and tracking data and/or the CMG gimbal-angle data will be obtained with and without resistojet operation for several orbits. The orbits flown without resistojet operation will be used to determine the effect of all spacecraft disturbance torques (with the exception of crew motion). The data obtained with resistojet operation will reduce or null the disturbance torques. The torques caused by resistojet operation will be obtained from

these data. Since the thruster operating time is a known input to the command subsystem, and since the thruster-moment arm is obtained from vehicle geometry, the thruster force can be determined. Thruster specific impulse will be determined from propellant-flow rate and thruster force. Flow rate will be determined from propellant feed-line pressure and temperature (assuming there is no degradation or change in the thruster's nozzle throat). If spacecraft orientation and tracking data alone are available (no CMG's), the spacecraft torque determination can still be obtained, but to a lesser degree of accuracy.

Thruster efficiency will be obtained from thrust, specific impulse, and input power. The electrical efficiency of the system will be obtained from the ratio of thruster input power to spacecraft supply power.

During maneuvers, the astronaut will operate the command controller. Appropriate training, in which contractor personnel will demonstrate the procedures for maneuvering, accompanied by a demonstration of the system's normal operation and failure-mode characteristics will be provided. Since the command controller will be of a design similar to other spacecraft control instruments, only 1-g shirtsleeve exercises will be performed.

It is recommended that all spacecraft astronauts assigned to the specific mission on which this program is conducted receive this command-control training.

EVA Demonstrations

A space-suited astronaut will perform three separate EVA exercises: (1) removal and replacement of the resistojet module, (2) demonstration of propellant resupply, and (3) removal of the thruster module and return of it to the re-entry spacecraft. The experiment and the spacecraft primary reaction-control system will not be operating during these events, and the spacecraft will be stabilized in a gravity-gradient orientation. It is anticipated that there will be lighting requirements to assure the astronaut's visibility and safety.

The following is a description of the astronaut activities during the EVA activities.

Removal and replacement of a thruster module. -- The pressure-suited astronaut must exit the spacecraft and transport himself and the necessary tools to the thruster module. He will be required to separate the electrical leads (component 7) to the module. The astronaut will then be required to close the manual propellant hand valve (component 10) and disconnect the propellant line connector (component 9). Having isolated the thruster module, he will proceed to undo the module positioning and holding clamps and remove the module.

The procedure for replacement of the module consists of repositioning the module, connecting the propellant line connector, opening the manual propellant hand valve, and connecting the electrical leads. Having secured the

module, the astronaut will communicate with the spacecraft control astronaut who will conduct a module checkout. Module checkout will verify operational capability. The astronaut will then transport himself and the tools to the spacecraft.

Demonstration of NH_3 propellant resupply. -- The sequence presented here is applicable for both simulated propellant resupply (resupply assembly on spacecraft) or actual resupply (resupply assembly on logistics vehicle).

The pressure-suited astronaut will exit the spacecraft and proceed to the propellant tankage and feed assembly (Assembly F₁). He will then close the propellant hand valve (component 15), which isolates the propellant tankage from the feed system. The astronaut must then proceed to connect the flexible propellant line (component 47) to the propellant fill connector (component 19) and open the resupply assembly hand valve (component 43). Having accomplished these tasks, the astronaut will return to the spacecraft.

The actual accomplishment of propellant transfer will be initiated, controlled, and terminated from the spacecraft control room. After termination of propellant resupply, the resupply assembly will be vented. A pressure-suited astronaut will then exit the spacecraft, transport himself to the propellant resupply assembly, close the resupply hand valve, disconnect the flexible propellant transfer line from the propellant fill connector, and store the flexible propellant transfer line. He then must open the propellant tankage assembly hand valve and transport himself back into the spacecraft.

Removal of a thruster module and return of it to the re-entry spacecraft. -- This EVA exercise requires an astronaut to perform the thruster-module removal sequence previously described and then transport himself, the module, and the tools back to the spacecraft.

The astronaut performing the EVA demonstrations must be able to communicate with the other astronauts in the spacecraft. It is assumed that this communication will be achieved in a standard manner.

It is recommended that a second astronaut be equipped to assist, if necessary, in the EVA demonstrations.

Immediately after performing each EVA, the astronaut will provide a preliminary assessment of the activity. After the flight, he will document the EVA exercises, the maneuvering results, and any other pertinent experiment-package observations. The EVA's will demonstrate the astronaut's ability to perform system maintenance, propellant resupply, and thruster-module recovery. The recovered thruster module may provide the most significant test data.

The post-test inspection, ground-performance testing, metallographic examination, sectioning, etc., of the module components will provide the basis for operational-life prediction.

An estimated 4 weeks will be devoted by the contractor to primary training of the astronauts for the EVA demonstrations. During the training, the astronauts will be thoroughly briefed on the resistojet system, the hardware mockups, and the hydrostatic test facility. Contractor personnel will demonstrate the EVA in the 1-g shirtsleeve, pressure-suit, and neutral-buoyancy pressure-suit modes. Both the test conductor and the astronaut are to be satisfied with the finalized EVA procedures. Evaluation of experiment procedures will be based upon the astronaut's comments and a review of the photographic coverage. The training will conclude when the astronaut completes a determined number of practice runs. (It is assumed that the astronaut trainees will have some basic scuba-diving experience.)

To train the astronauts, the contractor will provide a suitable laboratory and the necessary facilities. These will include a segment of convex cylindrical shell, the attachment receptacles, and a model resistojet module. A mockup of the propellant tankage and the propellant resupply assemblies will also be provided. These will be used for 1-g simulation exercises in both shirtsleeve and pressure-suit modes.

The 1-g simulation hardware will be suitable for use in a contractor-provided hydrostatic test facility. This facility will be used for the neutral-buoyancy exercises in which pressure-suited astronauts will demonstrate the removal and replacement of the module and the propellant resupply.

Firing Demonstrations

The firing demonstrations take up the greatest portion of the experiment duration (approximately 170 days). During these demonstrations, two opposing resistojets are fired simultaneously on various duty cycles. Since the selected opposing thrustors and the duty cycles will be varied (in Functions 4, 6, and 8), different operating times can be accumulated for each pair of thrustors. This, in turn, will provide the most information for the assessment of performance degradation and operating life.

The operation of two opposing thrustors results in zero force on the spacecraft. It can therefore be assumed that this experiment will not interfere with other spacecraft activities. Furthermore, the firing demonstrations can be performed without regard to spacecraft orientation.

This phase of the experiment can be done with minimal participation of the astronauts. The command controller will provide the engine selection and the required duty-cycle logic. The astronaut is only required to start and stop the sequence from the command controller.

Equipment Description

Although the propellant recommended for the resistojet-control-system experiment is NH_3 , the following description of experiment equipment applies to H_2 as well.

The experiment package is comprised of two thruster modules, a power-control subsystem, a command controller, a propellant-feed subsystem, a tankage fill and drain subsystem, and a propellant-resupply subsystem.

The complete experiment package for the NH_3 system is shown in fig. 3, in which the system's assemblies and the components are specified by item number. Table 2 delineates the items, the number required for the NH_3 experiment package, and the development status of the components. The component development status is identified by the following generalized categories:

(1) Conceptual--Preliminary design analysis has been performed; component development status is within the limits of current technology; finalized design, development, and fabrication have not been performed.

(2) Prototype (specified for resistojet only because of its unique status): Design analysis has been performed; development units have been fabricated; operational characteristics and limits have not been identified.

(3) Design: Design analysis has been performed; development units fabricated; operational characteristics and limits identified; qualification to experiment requirements has not been performed.

(4) Flight hardware: Design analysis complete; operational characteristics and limits known; flight-qualified hardware is available; but may require additional qualification testing to specific experiment requirements.

The experiment-package assemblies, with the exception of the command controller (Assembly G), are to be mounted in an unpressurized area of the spacecraft. The thruster modules (Assemblies A and B), which are identical, are mounted to the vehicle shell, protruding externally. The thruster modules, shown in fig. 4, are diametrically opposed to each other (180° apart). The transformers/switches (Assemblies C and D), shown in fig. 5, are mounted to the inner face of the vehicle shell near the thruster modules. The power panel/inverters (Assembly E), shown in fig. 6, and the propellant tankage and feed assembly (Assembly F_1), in fig. 7, can be mounted in any position on the inner vehicle shell. The command controller (Assembly G), shown in fig. 8, is installed in the spacecraft control room.

Assembly H is the necessary electrical leads and propellant lines required to connect the various assemblies. Proper routing of these leads and lines will minimize electrical losses and propellant pressure drop.

The NH_3 propellant resupply (Assembly J), shown in fig. 9, can be mounted to the spacecraft on the inner vehicle shell, or it can have a mounting arrangement similar to that on a logistics resupply vehicle.

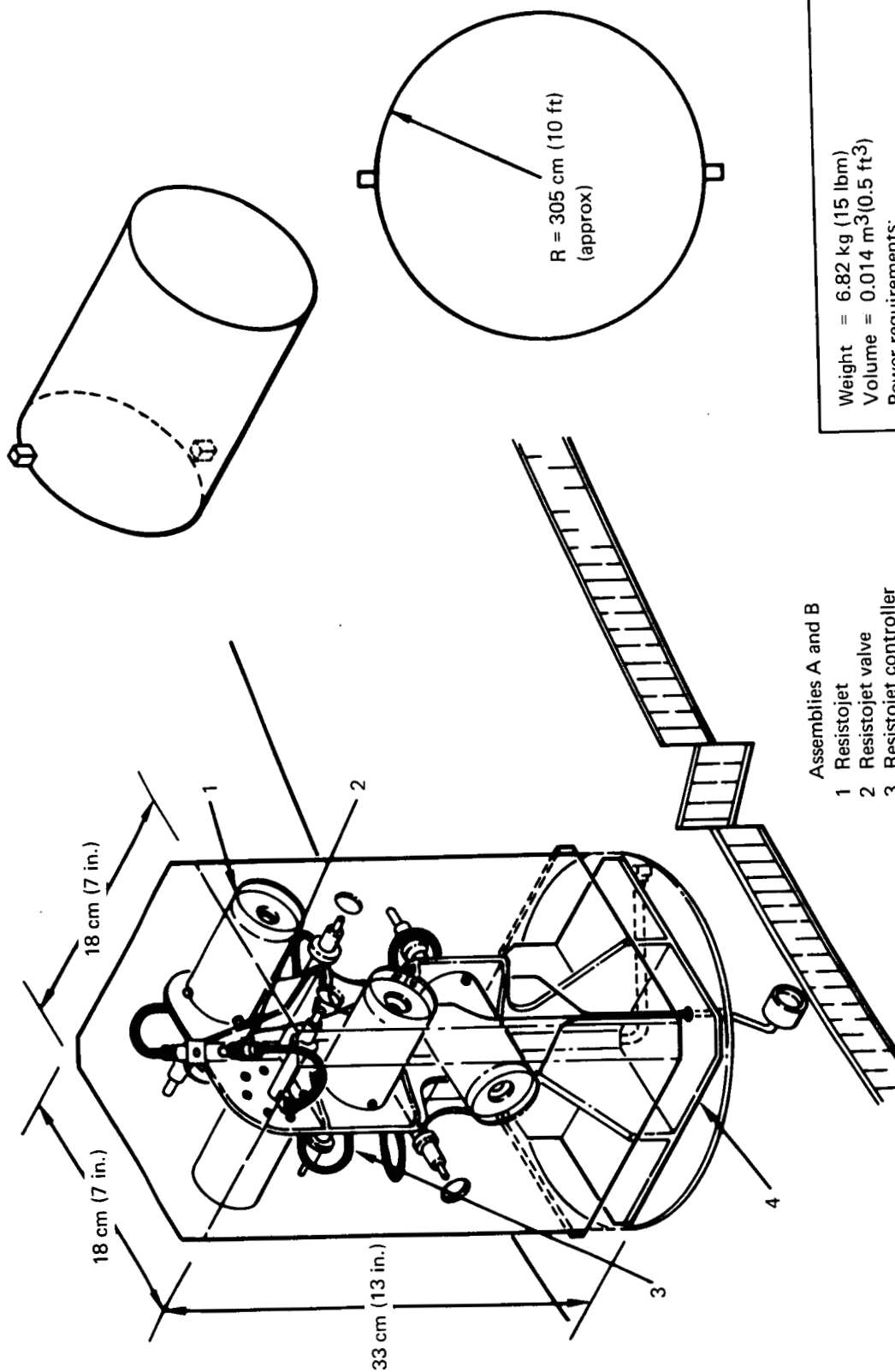
If it is decided to use an H_2 resistojet system, the propellant tankage and feed assembly of fig. 10 must be used. The components for this assembly (Assembly F_2) are specified by component number and identified in table 3.

TABLE 2
NH₃ EXPERIMENT PACKAGE

Assembly	Item No.	Component	Quantity	Status
A and B (Thruster modules)	1	Resistojet	12	Prototype
	2	Resistojet valve	12	Conceptual
	3	Resistojet	12	Conceptual
	4	controller Mount structure	2	Conceptual
C and D (Transformers/ switches)	5	Transformer	4	Conceptual
	6	Power switches	4	Design
	7	Electrical connector	4	Conceptual
E (Power panel/ inverter)	22	Primary patch panel/breaker assembly	1	Conceptual
	23	Resistojet power bus	1	Conceptual
	24	Inverter	2	Conceptual
F ₁ (Propellant tankage and feed)	11	Propellant-line connector	1	Flight hardware
	12	Pressure regulator/filter	2	Design
	13	Propellant-line connector	1	Design
	14	Electric heater	1	Design
	15	Hand valve	1	Flight hardware
	16	Burst disk	1	Flight hardware
	17	Burst disk/ relief valve	1	Flight hardware
	18	Check valve	1	Flight hardware
	19	Propellant-fill connector	1	Flight hardware
	20	Propellant tank	1	Conceptual
	21	Hand valve	1	Flight hardware
G (Command controller)	25	Command controller	1	Conceptual

TABLE 2
NH₃ EXPERIMENT PACKAGE – Continued

Assembly	Item No.	Component	Quantity	Status
H (Propellant lines/ cabling)	8	Electrical connector	4	Conceptual
	9	Propellant-line connector	1	Flight hardware
	10	Hand valve	1	Flight hardware
	26	Accumulator (tank or line)	1	Conceptual
	27	Electrical cabling	---	Flight hardware
J (Propellant resupply)	28	Pressurant (N ₂)-Fill connector	1	Flight hardware
	29	Check valve	1	Flight hardware
	30	Burst disk/ relief valve	1	Flight hardware
	31	Burst disk	1	Flight hardware
	32	Solenoid valve	1	Flight hardware
	33	Pressurant tank (N ₂)	1	Conceptual
	34	Pressure regulator/filter	1	Flight hardware
	35	Check valve	1	Flight hardware
	36	Solenoid valve	1	Flight hardware
	37	Burst disk	1	Flight hardware
	38	Burst disk/ relief valve	1	Flight hardware
	39	Propellant tank	1	Conceptual
	40	Propellant bladder	1	Conceptual
	41	Propellant-fill connector	1	Flight hardware
	42	Check valve	1	Flight hardware
	43	Hand valve	1	Flight hardware
	44	Filter	1	Flight hardware
	45	Venturi	1	Conceptual
	46	Propellant-drain connector	1	Flight hardware
	47	Flexible propellant-transfer line	1	Conceptual



- Assemblies A and B
- 1 Resistojet
 - 2 Resistojet valve
 - 3 Resistojet controller
 - 4 Mount structure

Weight = 6.82 kg (15 lbm)
 Volume = 0.014 m³(0.5 ft³)
 Power requirements:
 Standby = 10 W
 Average = 160 W (NH₃) – 250 W (H₂)
 Maximum = 320 W (NH₃) – 500 W (H₂)

Figure 4. Resistojet Thrustor-Module Assembly

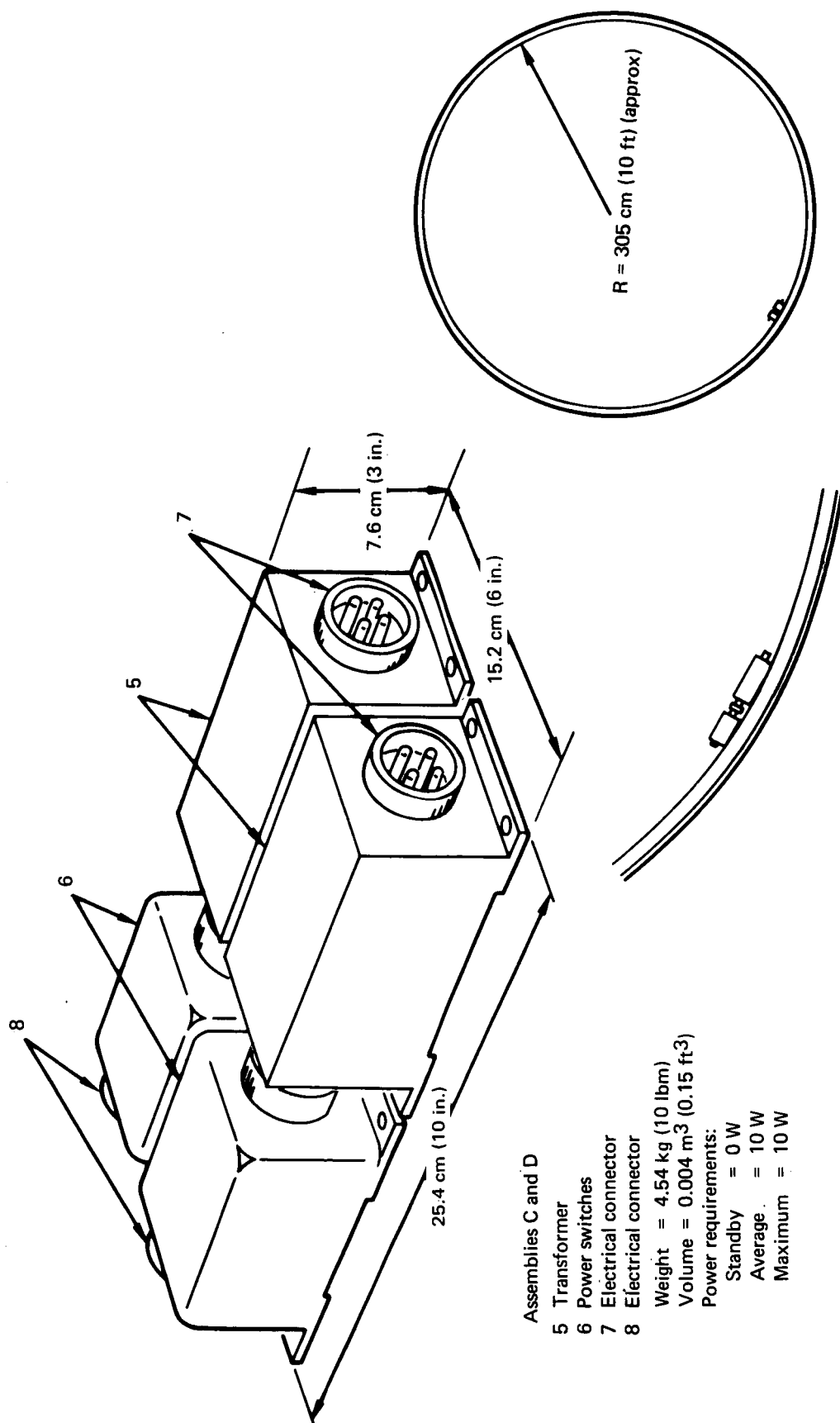


Figure 5. Transformers/Switches Assembly

Assembly E

- 22 Primary patch panel
breaker assembly
- 23 Resistojet power bus
- 24 Inverter

Weight = 11.35 kg (25 lbm)
Volume = 0.011 m³ (0.4 ft³)

Power requirements:

Standby = 0 W
Average = 5 W
Maximum = 5 W

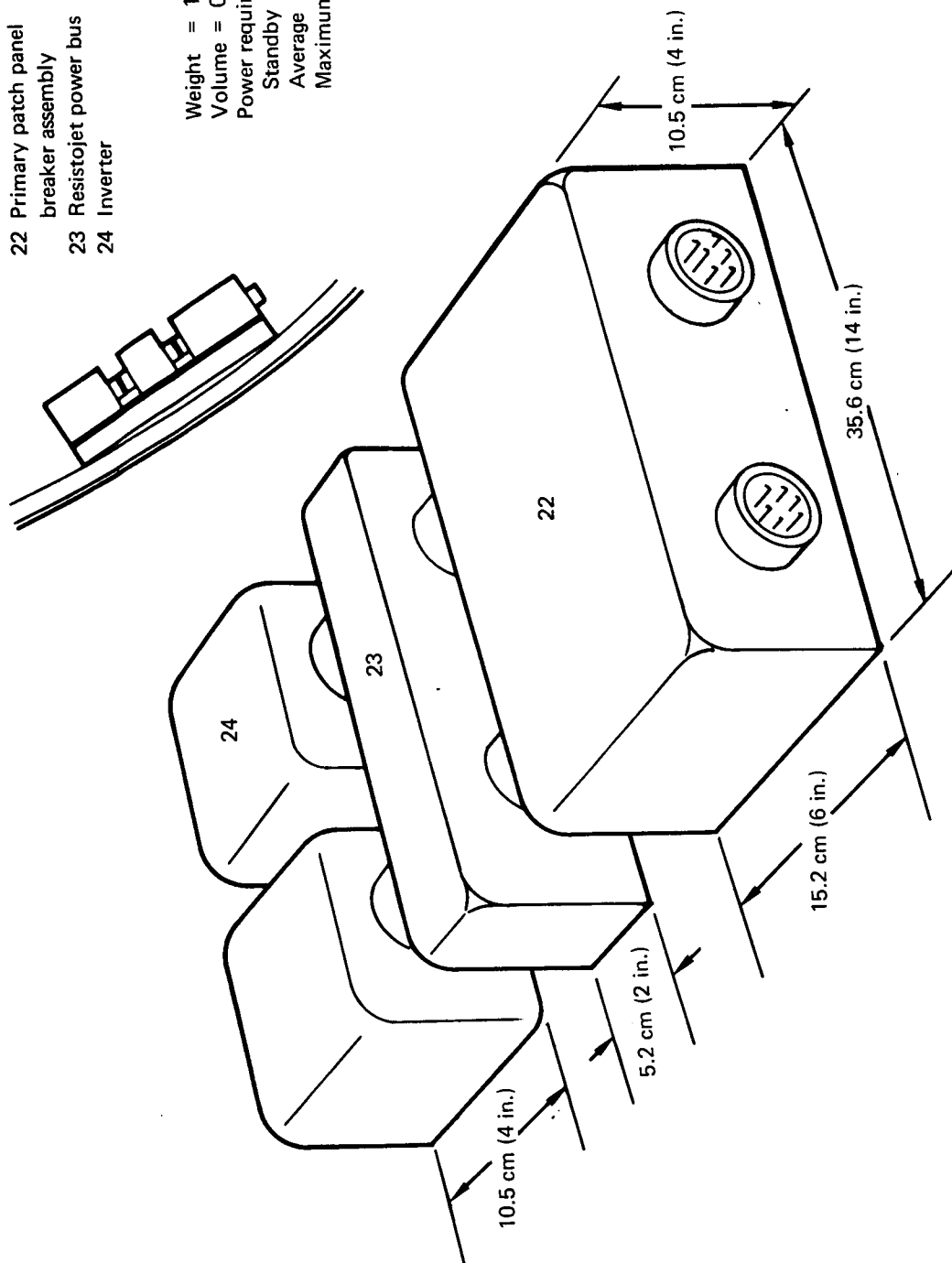


Figure 6. Power Panel/Inverter Assembly

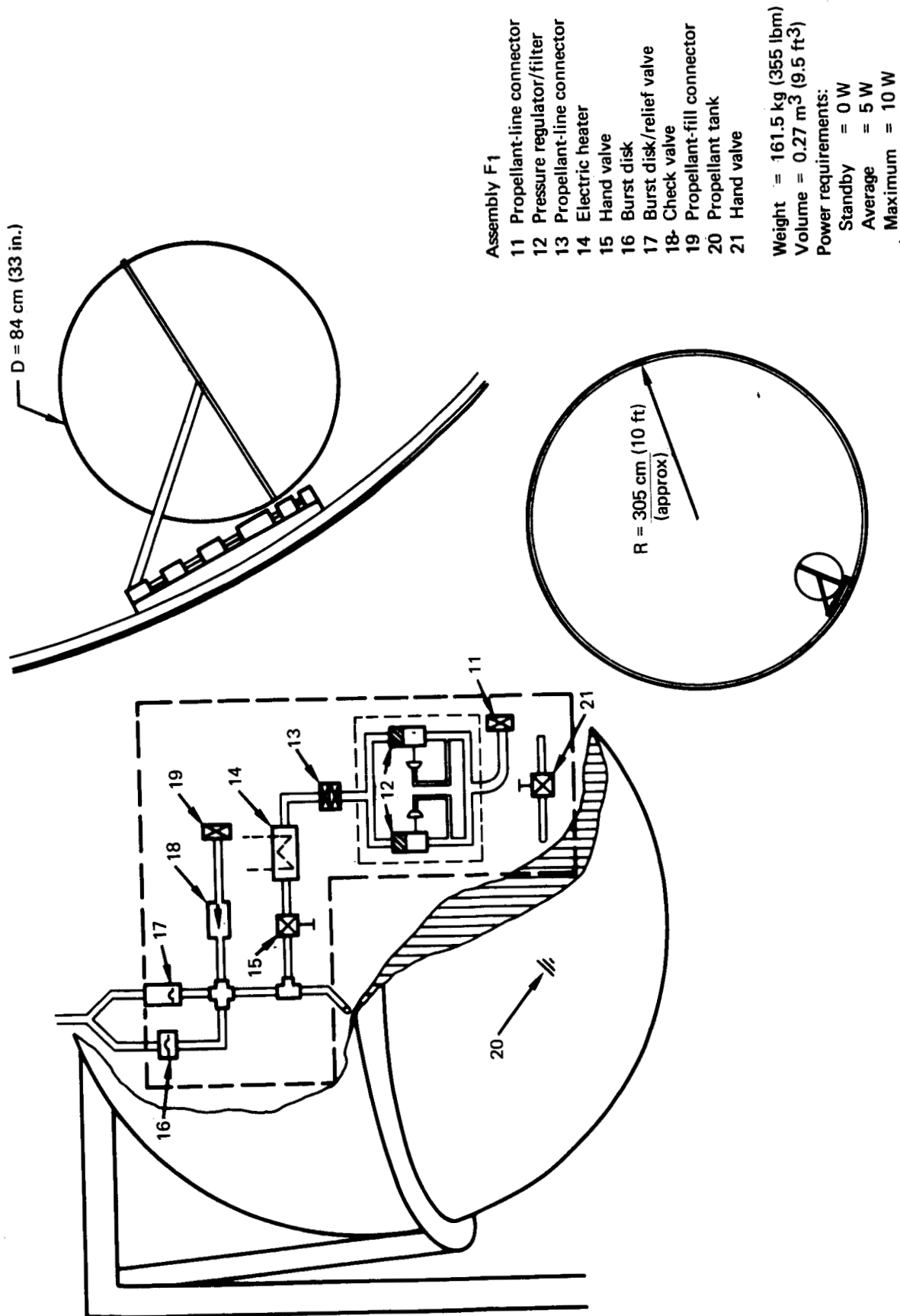


Figure 7. NH₃ Propellant Tankage and Feed Assembly

Assembly G
 Weight = 11.35 kg (25 lbm)
 Volume = 0.014 m³ (0.5 ft³)
 Power requirements:
 Standby = 0 W
 Average = 5 W
 Maximum = 5 W

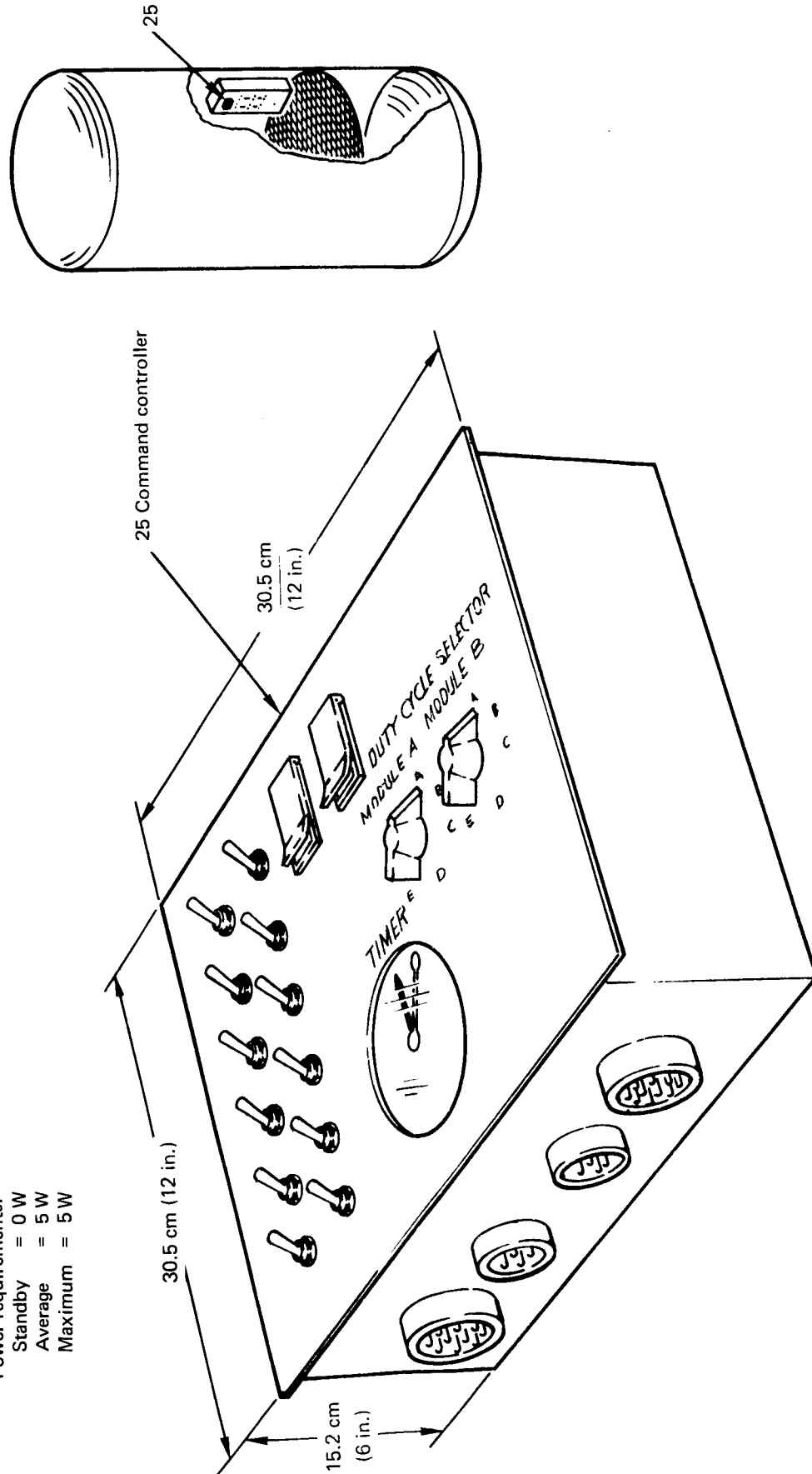


Figure 8. Command Controller Assembly

Assembly J

- 28 Pressurant (N₂) fill connector
- 29 Check valve
- 30 Burst disk/relief valve
- 31 Burst disk
- 32 Solenoid valve
- 33 Pressurant tank (N₂)
- 34 Pressure regulator/filter
- 35 Check valve
- 36 Solenoid valve
- 37 Burst disk
- 38 Burst disk/relief valve
- 39 Propellant tank
- 40 Propellant bladder
- 41 Propellant-fill connector
- 42 Check valve
- 43 Hand valve
- 44 Filter
- 45 Venture
- 46 Propellant-drain connector
- 47 Flexible propellant transfer line

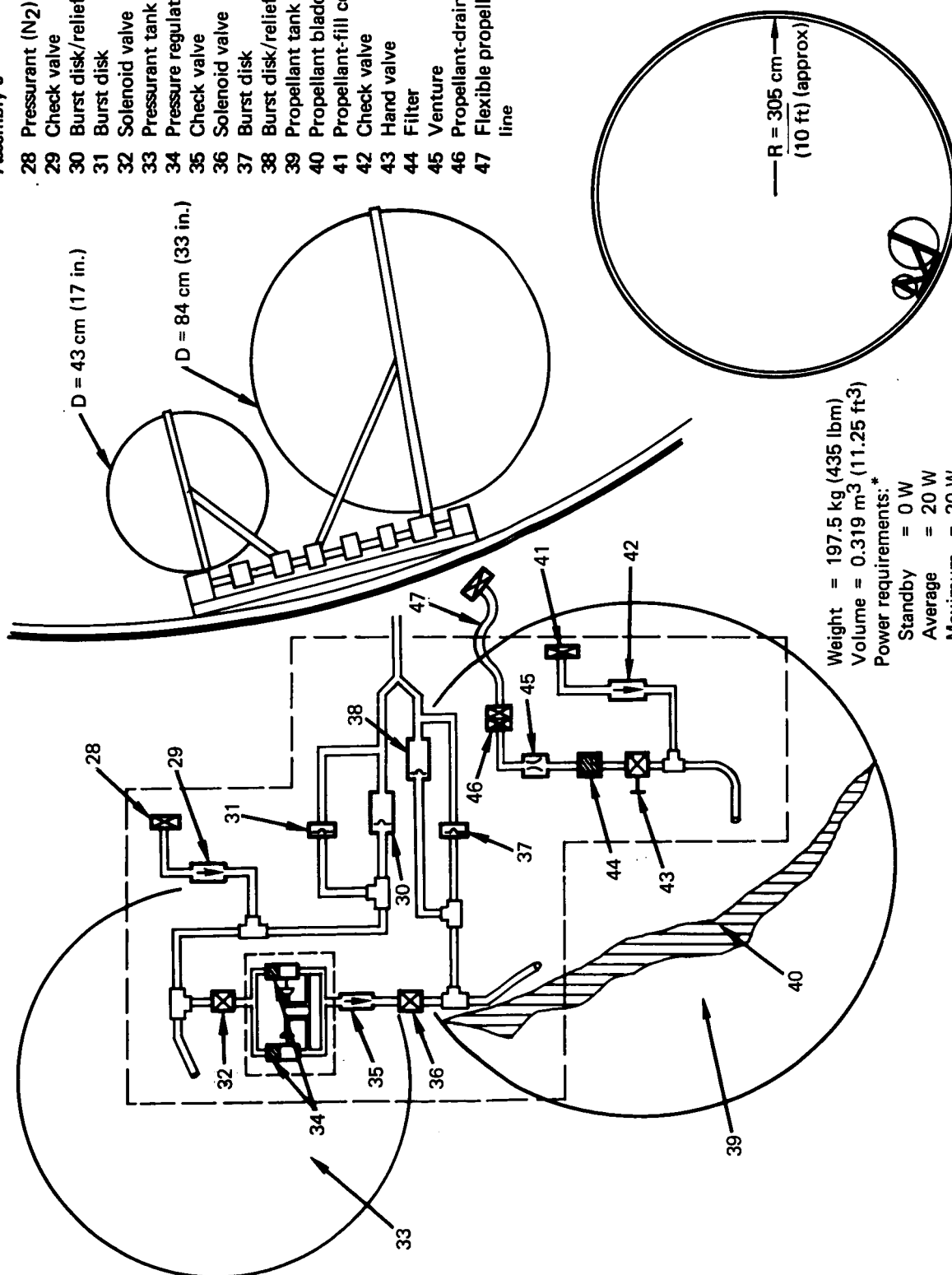


Figure 9. NH₃ Propellant Resupply Assembly

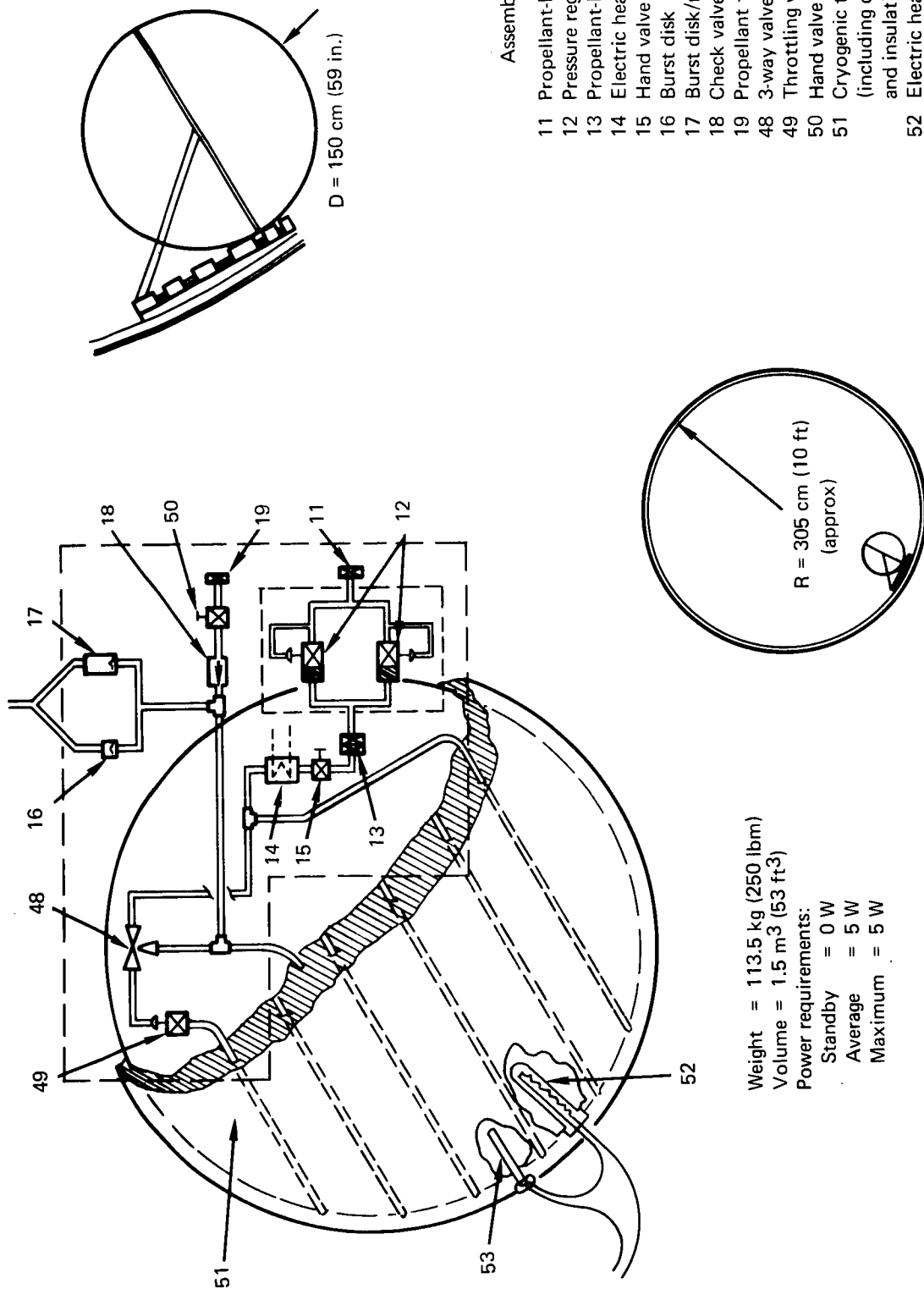


Figure 10. H₂ Propellant Tankage and Feed Assembly

TABLE 3
CRYOGENIC H₂ TANKAGE AND FEED ASSEMBLY COMPONENTS

Assembly	Item No.	Component	Quantity	Status
F ₂ (Propellant tankage and feed)	11	Propellant-line connector	1	Flight hardware
	12	Pressure regulator/filter	1	Design
	13	Propellant-line connector	1	Design
	14	Electric heater	1	Design
	15	Hand valve	1	Flight hardware
	16	Burst disk	1	Flight hardware
	17	Burst disk/relief valve	1	Flight hardware
	18	Check valve	1	Flight hardware
	19	Propellant-fill connector	1	Flight hardware
	48	3-way valve	1	Design
	49	Throttling valve	1	Design
	50	Hand valve	1	Design
	51	Cryogenic tankage (including cooling coil and insulation)	1	Conceptual
	52	Electric heater	1	Conceptual
	53	Pressure switch	1	Design

(Where components are similar to those of the NH₃ package, identical component numbers have been used.) Component status nomenclature is identical to that used in table 2.

The weight and size of the assemblies are shown in table 4. These assemblies have the same volume and shape in both the stored and operational modes. It is necessary, however, that there be astronaut access to the thruster modules for the demonstration of the module removal and replacement. The propellant-resupply demonstration will also require astronaut access. The volume and shape of these areas cannot be specified at this time and will be dependent upon spacecraft selection and experiment installation.

TABLE 4
EXPERIMENT PACKAGE WEIGHT AND SIZE

Assembly	Weight		Volume		Dimensions		Shape ^a
	kg	(lbm)	m ³	(ft ³)	cm	(in.)	
A--thruster module	6.82	(15)	0.014	(0.5)	33 x 17.8 x 17.8	(13 x 7 x 7)	parallelepiped on circular base
B--thruster module	6.82	(15)	0.014	(0.5)	33 x 17.8 x 17.8	(13 x 7 x 7)	parallelepiped on circular base
C--transformers/switches	4.54	(10)	0.004	(0.15)	25.4 x 15.2 x 10.2	(10 x 6 x 4)	parallelepiped
D--transformers/switches	4.54	(10)	0.004	(0.15)	25.4 x 15.2 x 10.2	(10 x 6 x 4)	parallelepiped
E--power panel/inverters	11.35	(25)	0.011	(0.4)	35.5 x 30.5 x 10.2	(14 x 12 x 4)	parallelepiped
F1--propellant tankage and feed (NH ₃) (including propellant)	161.5	(355)	0.27	(9.5)	83.8 diam	(33 diam)	sphere and flow components
F2--propellant tankage and feed (H ₂) (including propellant)	113.5	(250)	1.50	(53.0)	150 diam	(59 diam)	sphere and flow components
G--command controller	11.35	(25)	0.014	(0.5)	30.5 x 30.5 x 15.2	(12 x 12 x 6)	parallelepiped
H--propellant lines/cabling	18.15	(40)	---	---	---	---	small diameter lines
J--propellant resupply (NH ₃)	197.5	(435)	0.319	(11.25)	43.2 diam and 83.8 diam	(17 diam and 33 diam)	two spheres and flow components
Totals ^b	225	(495)	0.33	(11.7)	---	---	---
	177	(390)	1.56	(55.2)	---	---	---
^a Stored and operational configurations are identical. ^b Propellant resupply assembly not included; re-entry container not included.							

FOLDOUT FRAME 1

FOLDOUT FRAME

FOLDOUT FRAME 2

The total weight of the NH_3 and H_2 assemblies is 225 kg (495 lbm) and 177 kg (390 lbm), respectively. The total volume of the NH_3 and H_2 systems is 0.33 m^3 (11.7 ft^3) and 1.56 m^3 (55.2 ft^3), respectively. Weight of the propellant lines/cabling (Assembly H) is 18.5 kg (40 lbm).

The recovery of a thruster module requires that there be a return container in the re-entry vehicle. This container will be slightly larger than the thruster module and secured in a manner to prevent module damage during re-entry. The estimated weight of the container is 4.54 kg (10 lbm). It will be cylindrical in shape, 30.5-cm diam x 38.2-cm long (12-in. diam x 15-in. long), and occupy a volume of 0.028 m^3 (1 ft^3).

The power requirements for the assemblies are given in table 5. The primary power demand is made by the resistojet thrusters. For the maneuvering operations, two thrusters in each module will be operated (which is

TABLE 5
EXPERIMENT - SYSTEM POWER REQUIREMENTS

	Standby (watts)	Average (watts)	Maximum (watts)
NH_3 system total power	20	350	670
H_2 system total power	20	530	1035
Assemblies A and B (NH_3)	10	160	320
Assemblies A and B (H_2)	10	250	500
Assemblies C and D	0	10	10
Assembly E	0	0	5
Assembly F_1 (NH_3)	0	5	5
Assembly F_2 (H_2)	0	5	10
Assembly G	0	5	5
Assembly H	0	5	5
Assembly J^* (NH_3)	0	20	20
*For propellant transfer only (4 hours).			

the maximum power demand). For the major part of the experiment, opposing engines in a module will be fired on various duty cycles. This operation will be scheduled so there are always two engines firing, which will result in the average power demand. The standby power requirement will only be necessary for a short time immediately before the resistojet experiment begins. The differences in power between the NH_3 and the H_2 systems are primarily because of the resistojet requirements, although the cryogenic H_2 tankage and feed system (Assembly F₂) requires electrical power.

The instrumentation power requirements are not included in table 5. This power demand will have a very minor effect on the total power requirement of the system.

The data-measurement requirements for each assembly are given in table 6. The measurements for Assembly J (propellant resupply) will be required for the period of propellant transfer only (approximately 4 hours). In addition to the parameters listed in the table, spacecraft orientation measurements, such as CMG gimbal angles, and ground-tracking data measurements will be required at the beginning and end of maneuvering functions. It was assumed that these measurements would not impose a data requirement in excess of that specified for normal spacecraft operation. Telemetry of data from the spacecraft can be accomplished in accordance with spacecraft requirements.

The flight-system shipping and handling procedures and the installation and checkout procedures have not been evaluated in the depth required to permit a final determination. However, preliminary evaluation has resulted in the following concept: The propellant tankage and feed (Assembly F), the propellant lines and cabling (Assembly H), the command controller (Assembly G), and the power panel/inverter (Assembly E) are installed by the vehicle manufacturer before shipment to the launch site. Should the experiment include the propellant resupply (Assembly J) on the spacecraft, installation by the vehicle manufacturer is recommended. The inclusion of these assemblies in the vehicle permits propellant- and power-system checkout at the manufacturing site as well as at the launch site.

The thruster modules (Assemblies A and B) and the transformers/switches (Assemblies C and D) are handled and shipped as recommended by the respective suppliers. These assemblies are checked-out at a launch-site laboratory and then installed. (The operating constraints of the resistojet system precludes operational checkout of the entire system after vehicle installation.)

The required launch-site facilities include office, laboratory, and assembly areas. The laboratory and assembly areas must conform to clean-room standards. The laboratory equipment will include resistojet-power-system and propellant-supply simulators and a vacuum facility. Equipment to determine the performance of the thruster modules and transformers/switches will be required. Propellant-fill GSE will also be required. For the liquid hydrogen (LH_2) experiment package, the propellant fill must be included in the launch-vehicle countdown schedule.

TABLE 6

DATA-MEASUREMENT REQUIREMENTS

Parameter to be measured	Assembly A and B				Assembly F ₁ and F ₂		Assembly J			
	Thruster		Propellant-feed line		Pressure	Temperature	Resupply propellant tank		Resupply pressurant tank	
	Voltage	Current	Temperature	Pressure			Pressure	Temperature	Pressure	Temperature
Expected values										
Average	4.8 V*	21.3 A*	760°R	585°R	35 psia	585°R*	310 psia	585°R	3000-800 psia	530-600°R
	6.0 V†	40 A†				46°R†				
Range	4-5-5.5V*	30-40 A*	560-860°R	530-600°R	215-250°	530-600 psia,*	250-400 psia,	530-600°R	4000-500 psia	530-600°R
	5.5-6.5 V†	45-55 A†				40-60 psia†				
Measurement characteristics										
How often total no. in mission	Each operation 10 000	Each operation 10 000	Each operation 10 000	Each operation 10 000	Each operation 10 000	Each hour 2500	Each 5 min 50	Each 5 min 50	Each 5 min 50	Each 5 min 50
Output signal of instrument ^b										
Amplitude	High	High	Low	Low	High	Low	High	Low	High	Low
Resolution	±1%	±1%	±1%	±1%	±1%	±1%	±1%	±1%	±1%	±1%
Readout requirement ^c										
Number of channels	2 avg, 4 max.	2 avg, 4 max.	2 avg, 4 max.	1 avg, 2 max.	1	1	1	1	1	1
Sampling rate	10/hour	10/hour	10/hour	10/hour	10/hour	Each hour	Each 5 min	Each 5 min	Each 5 min	Each 5 min
^a All measurements are instantaneous. ^b All output signals are low-frequency digital. ^c All readout requirements to be on-board recorded, with spacecraft clock-time identification.										

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

Schedule

The flight-test program is comprised of four major phases, (system manufacturing, vehicle installation/integration, experiment operations, and program evaluation), and will require a 2-year period (fig. 11). The system manufacturing phase (8 months) is to provide a prototype system and two flight systems. One flight system will be installed in the spacecraft and the other used as a spare. The vehicle installation/integration phase will consist of system installation, prelaunch checkout, and GSE installation and checkout. The prelaunch checkout tests will verify that the experiment system is ready for launch and that the GSE is ready to support the launch. The prelaunch checkout tests shall include, as a minimum, (1) complete visual inspection to ensure that the physical condition of the hardware is satisfactory when received, (2) a functional preuse checkout and verification test on all experiment subassemblies, (3) a simulated-system inflight operation, and (4) verification, to the maximum extent practical, of the functional operation of all subassemblies and their components prior to launch.

Upon spacecraft launch and attainment of the desired orbit, the experiment operational sequence will be initiated and will operate for a period of 6 months. If the primary objectives of the spacecraft mission require a logistics vehicle, it can be accomplished approximately 3 months after first launch, and the vehicle can be used in the propellant-resupply demonstration. (If not, propellant resupply will be simulated by a resupply assembly installed on first-launch spacecraft.)

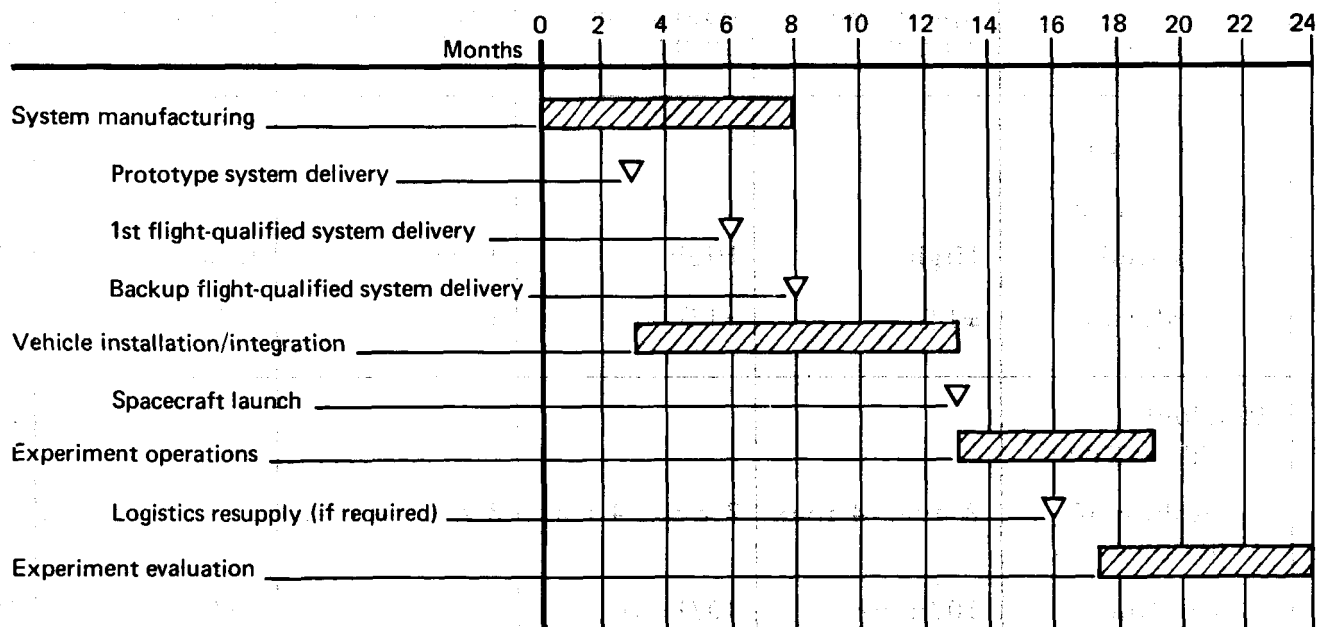


Figure 11. Flight-Test Schedule

The program evaluation phase will consist of data evaluation, astronaut assessment reports, and thruster-module examination. During this 7-month phase, the resistojet performance and performance degradation will be determined, system maintenance will be evaluated, and resistojet operational-life will be established. The evaluation will conclude with an assessment of the completed flight-test objectives and a determination of the system's operational capability.

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GROUND TEST PROGRAM

The flight-test phase, described in the previous section, and the operational requirements specified by the MORL study results were used to define the preliminary requirements for qualification testing. These requirements were evaluated with regard to component status to define the required ground-test program and are presented in the appendix.

Qualification tests for the ground-test program were defined for the following:

- (1) The thruster module.
- (2) The critical components of the experiment system (that is, the inverter, transformer, and propellant-flow regulator).
- (3) The liquid hydrogen (LH₂) propellant tankage and feed system (should LH₂ be selected for the experiment).
- (4) The integrated experiment system.

Qualification testing of the thruster module (Assemblies A and B) was defined in depth; that is, the number of components to be tested, the test limits, the assembly tests and associated cost, the schedule and facility requirements are all specified. Qualification testing for the inverter, transformer, propellant-flow regulator, LH₂ tankage and feed assembly, and the integrated system were established, and preliminary costs and schedules were determined.

These programs are in accordance with the guidelines of Apollo Applications Test Requirements. The component and subassembly programs are specified for development and qualification efforts. The integrated-system program includes acceptance and reliability testing of components and subassemblies and flight-worthiness demonstration of the integrated system.

Thruster Module

The thruster module is comprised of six resistojet thrusters, six controllers, and six valves mounted in a structural housing or module.

The resistojets are of the concentric-tubular design (fig. 12). This thruster design will operate with either NH₃ or H₂ propellant, has undergone development, and is presently in life test. The resistojet has demonstrated

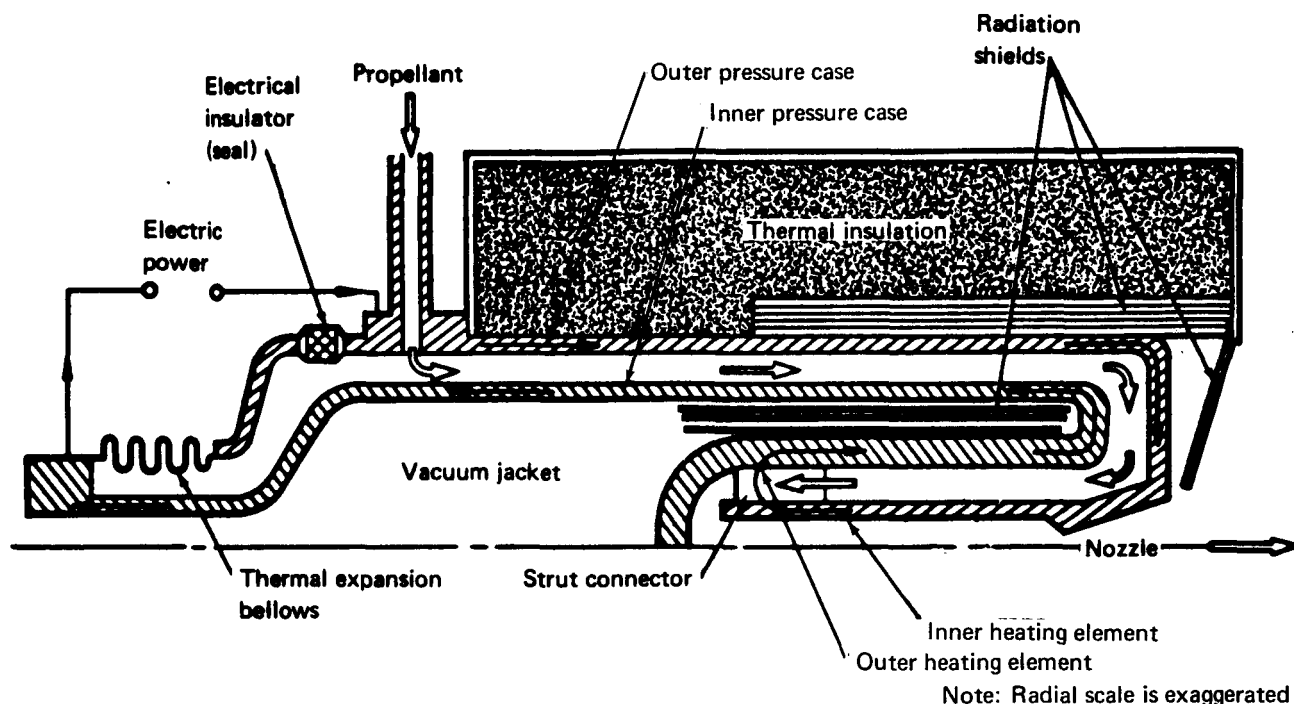


Figure 12. Concentric-Tubular Resistojet

specific impulse of 725 sec with H_2 and 340 sec with NH_3 . Corresponding electrical efficiencies are 60% with H_2 and 45% with NH_3 .

The primary inputs to the resistojet are propellant and power. The propellant enters the thruster, flows down the outer annulus, through the transition area, then back up the inner annulus, past the strut connector, and finally down the center passage where it approaches wall temperature prior to expulsion out the nozzle. The electrical path is along the outer-pressure case, the case end, the nozzle, and the inner heating element, then across the strut connector, along the outer heating element, and the inner-pressure case, completing the circuit at the power source. The power is dissipated primarily in the inner heating element ($\approx 80\%$) and the outer heating element ($\approx 15\%$). The electrical efficiency is maximized and the thermal losses are minimized by use of the vacuum jacket, the radiation shields, and the thermal insulation.

The heating elements, and pressure cases of the thruster module are made of vapor-deposited rhenium. These parts are electron-beam welded to form a leak-tight thruster. The radiation shields are fabricated from pure rhenium foil. The main housing, the bellows (thermal-expansion compensator), and the insulation housing are made of stainless steel. Boron-nitride electrical insulators are used. The thermal insulation is Dyna-Quartz and Min K-2 000.

The controller is a solid-state electronic unit. As such, detailed evaluation will be required to determine both thermal management and in-space environmental factors. It is anticipated that the development status of micro-electronic solid-state equipment will be such that the controller will not require testing to verify the effects of long-term space exposure.

The resistojet valve is a high-response, solenoid-activated unit with an integral filter. The design has a primary requirement of extremely low internal and external leakage. The integral filter was incorporated as a backup to the feed-system filter and, as such, will not require extensive testing.

The structural module is a cross-shaped structure (fig. 4) on which the resistojets, valves, and controllers are mounted. The structural module contains the propellant-feed manifold, the module cover, and the mounting base. The primary requirements for the structural module include launch loads (structural, dynamic, and thermal), low-propellant leakage, and resistojet thruster alignment.

The development of the resistojet thruster module through its qualification is discussed in the following paragraphs. The schedule for these ground-test activities, shown in fig. 13, is in two major phases; development test and qualification test.

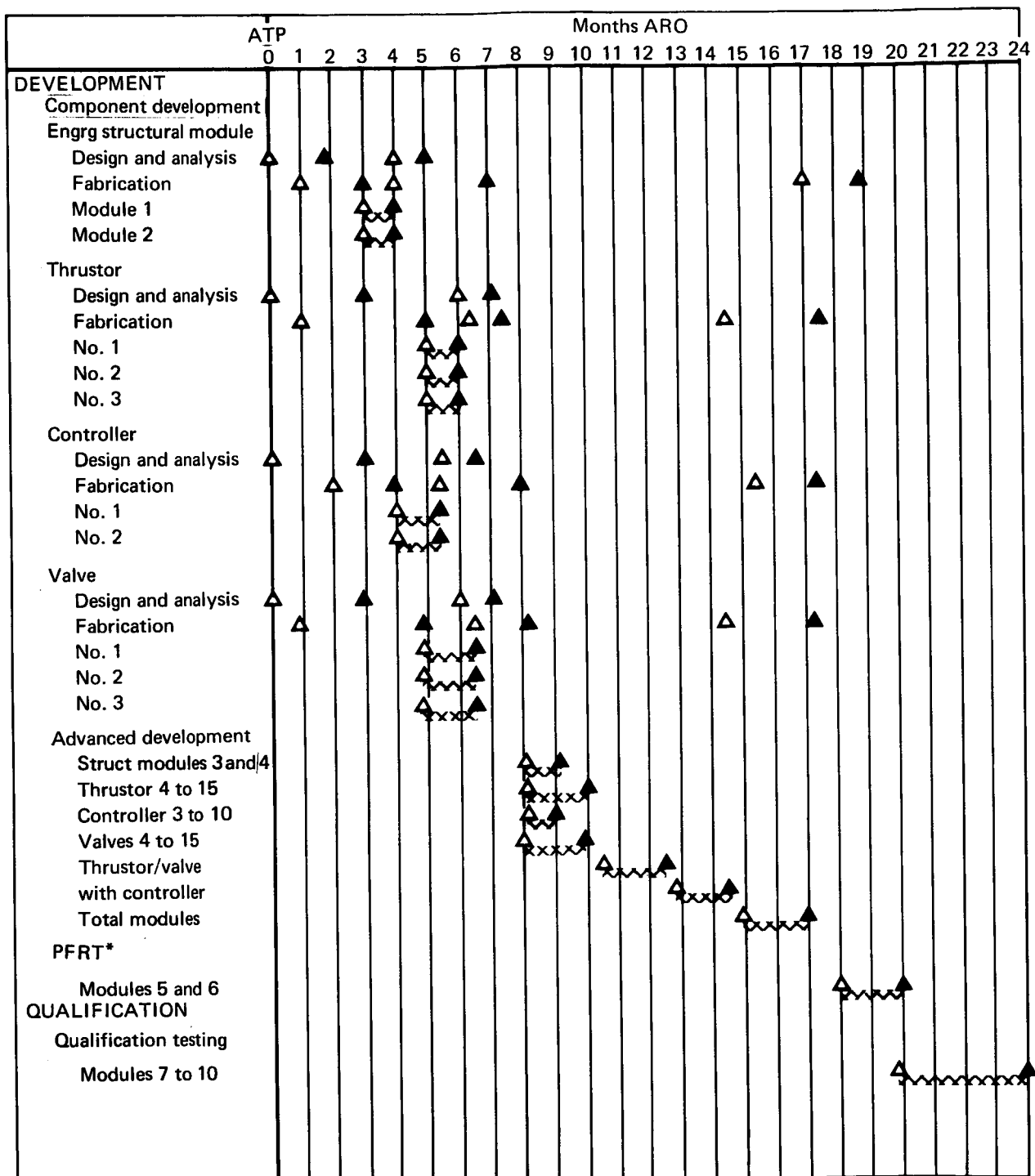
Development test. — The development tests are conducted to verify the feasibility of the design approach and to provide the confidence in the ability of the design hardware to pass qualification tests. Tests are conducted primarily to acquire data to support the design and development processes. The tests are specified to determine the following:

- (1) Adequacy and optimization of design margins.
- (2) Significant failure modes and effects.
- (3) The effects of varied stress levels.
- (4) The effects of combinations of tolerances and drift of design parameter.
- (5) The effects of combinations and sequences of environment and stress levels.
- (6) Safety parameters and functions.

The tests will also include overstress or off-limit conditions where additional confidence or design margin data are required. Material compatibility will be verified against available certified data or, if no certification data exists, by tests as follows:

- (1) Materials shall meet the requirements of NASA-approved specifications, procedures, and requirements.*
- (2) Materials shall meet the compatibility requirements in the specification range of both materials under expected use conditions.

*Procedures and Requirements for the Evaluation of Spacecraft Non-metallic Materials--MSC-AD-66-3A. Apollo Spacecraft Program Office Non-metallic Material Selection Guidelines--ASPO RQTD-D67-5A.



*Preliminary flight-rating tests to guarantee operational performance prior to qualification tests.

Figure 13. Thruster-Module Qualification-Test Schedule

Development testing also includes the accomplishment of structural tests, dynamic tests, thermal-vacuum tests, and compatibility tests for module-level hardware.

The development-test objectives and requirements specified above can be accomplished by means of performing the work described in the following paragraphs.

Component-level tests will be performed on the structural module, the resistojet thruster, the controller, and the valve. Testing will be performed as indicated in table 7 and according to the preliminary requirements for component qualification (in appendix). Wherever possible, exact test requirements were specified. The test conditions which are predicated upon selection of the launch vehicle, the position and mounting of the experiment, etc., cannot be established at this time (includes shock, acceleration, and static loading). As shown in fig. 13, two structural modules, three resistojet thrusters, two controllers, and three valves will be subjected to component development.

Advanced development testing will be conducted on both components and complete modules. The objective of these tests is to establish the acceptance-test procedures and criteria for a complete module. However, the tests conducted will be of a functional nature and will include the necessary pretest inspection, dynamic tests, operational tests, and post-test inspection. Fig. 14 illustrates the sequence of tests to be performed on the prototype hardware used in this phase. Fig. 13 shows the quantities of the components and modules to be tested.

TABLE 7
EXPERIMENTAL TESTS

Hardware Tests	Structural modules	Thrusters	Controller	Valves	Total module assembly
Vibration	X	X	X	X	X
Shock	X	X	X	X	X
Static load	X				
Pressure drop w/temperature	X	X		X	X
Pressure limit	X			X	X
Temperature distribution	X	X			X
Discharge voltage		X	X		
Resistance w/temperature		X			X
Response		X	X	X	X
Functional tests		X	X	X	X
Leakage	X	X		X	X
Amperage limits		X	X	X	X

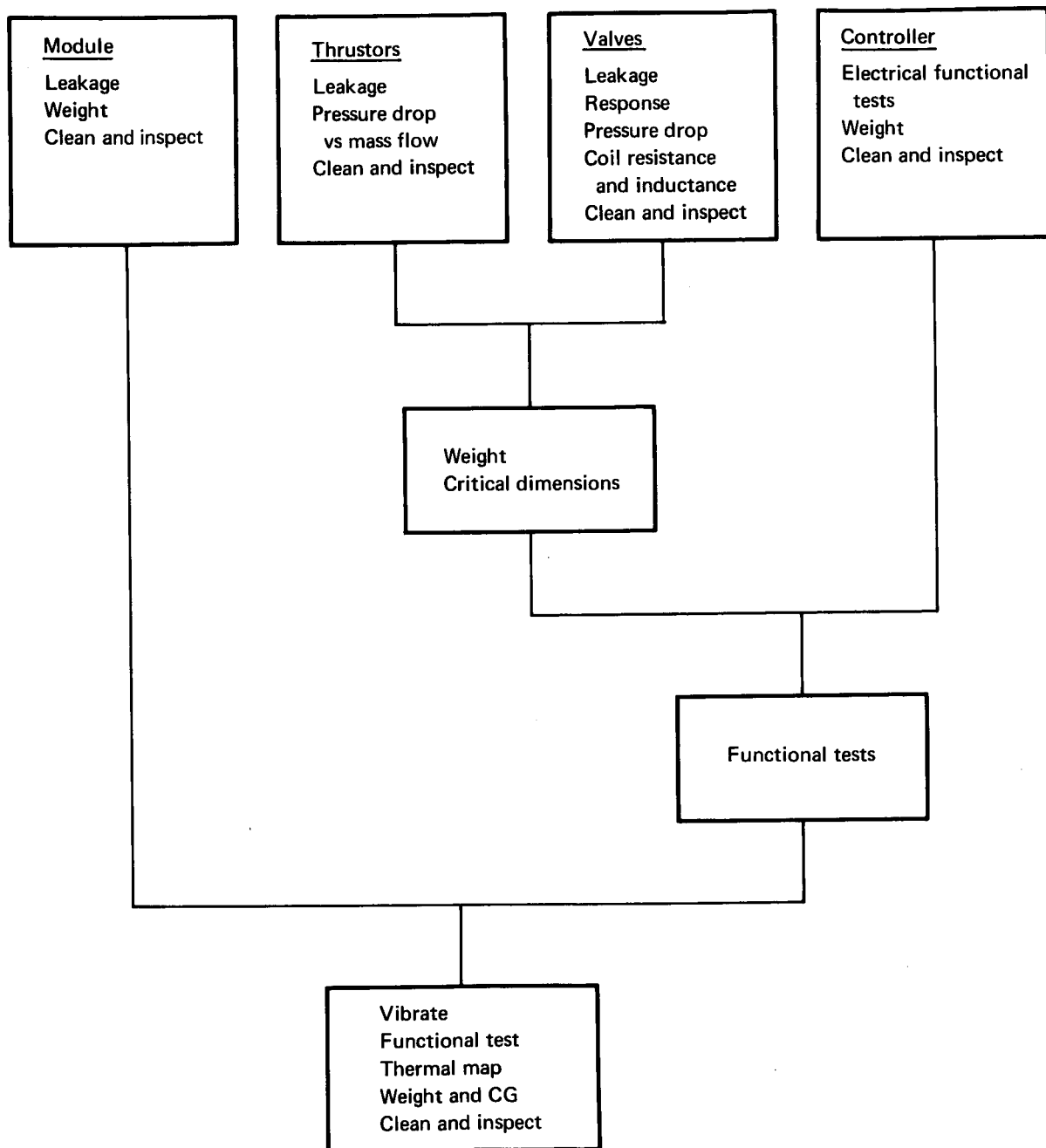


Figure 14. Advanced Development Test Sequence

The final phase of development is the accomplishment of preliminary flight-rating tests (PFRT). The objective of this phase is to guarantee the operational performance of the resistojet module prior to qualification testing. Two complete modules will be subjected to this phase. They will also be subjected to the acceptance-test procedures and criteria established during advanced development, prior to overall functional testing. Fig. 15 shows the sequence for this PFRT phase.

Qualification test. - These tests will verify that flight-type hardware will meet the performance and design requirements under anticipated operational environments. The tests will be conducted on components and assemblies as a formal demonstration of performance and design adequacy. Prior to the actual qualification testing, all hardware will be subjected to testing that is identical to the acceptance tests to be performed on operational flight hardware. The qualification tests are designed to verify, as a minimum, the following:

- (1) The effects of combinations of tolerances and drift of design parameters.
- (2) The effects of combinations and sequences of environment and stress levels and will reflect the severest anticipated mission environment.
- (3) Electromagnetic compatibility.

All qualification tests will be performed under strict control of environment and procedures. Revisions to procedures, adjustments, or tuning is not permissible during the course of the test unless it is normal to in-service

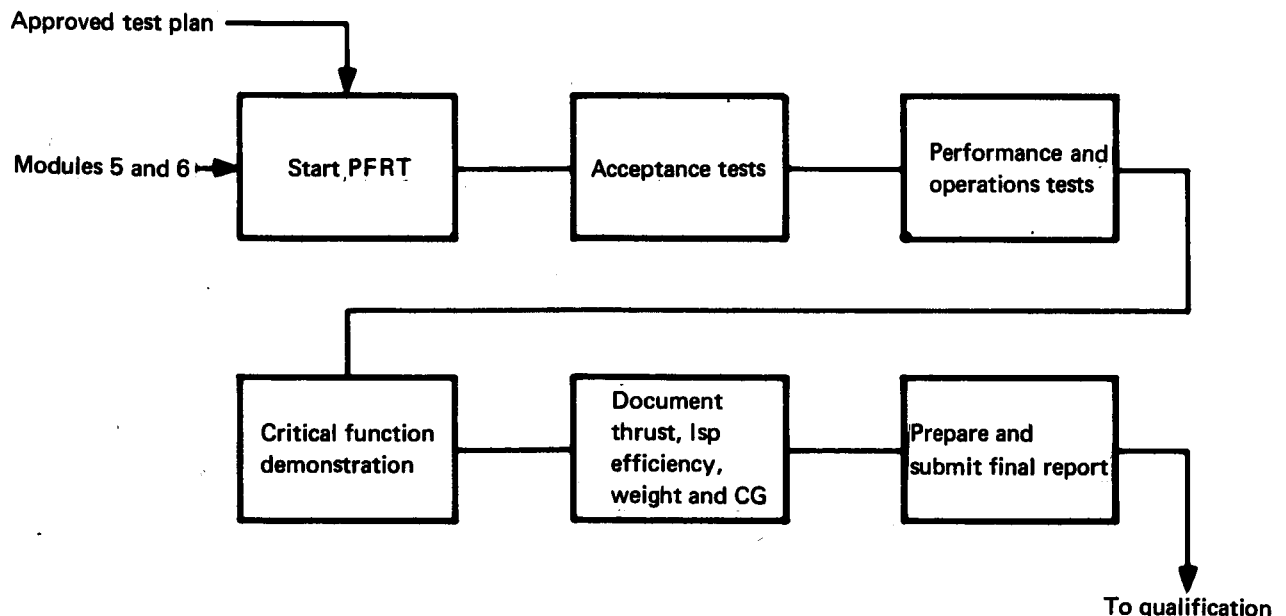


Figure 15. PFRT Test Sequence

operation. A record of total accumulated operational and nonoperational test time is to be maintained on qualification hardware.

Four assembled resistojet modules will be used in qualification testing. The sequence of testing is shown in fig. 16. Launch-sequence testing includes any prelaunch checkout (electrical continuity, etc., launch shock, and vibration aerodynamic loading, thermal cycling, etc.). Module-activation sequences test, hold-mode operation tests, and operating-mode tests (for various resistojet duty cycles) will be performed.

Facilities. — The components and assembled thruster module are of such a size and shape to allow their development and qualification testing to be done in existing thermal-vacuum facilities at the module manufacturer's plant. The total propellant-flow rate and thermal environment limits conform to pumping requirements which can be provided.

Cost. — The preliminary cost estimate for thruster-module ground testing through qualification is \$3.5 million. This estimate is based on the quantity of components and the schedule specified in fig. 13. The cost breakdown by major program phases is shown in table 8.

Experiment-System Critical Components

The NH_3 experiment system has three critical components (excluding the thruster module). These components are the inverter, the transformer,

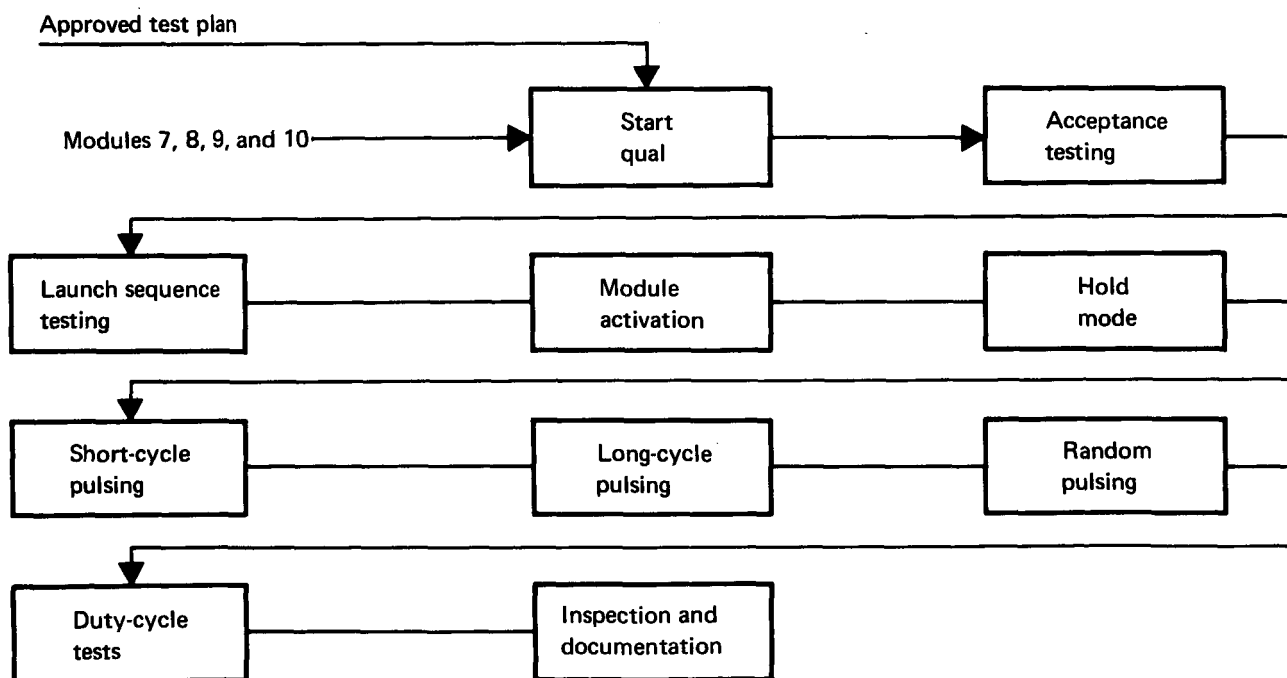


Figure 16. Qualification Test Sequence

TABLE 8
COST BREAKDOWN
THRUSTOR-MODULE GROUND-TEST PROGRAM

Program phase	Duration (months)	Cost
Development	8	\$ 700 000
Advanced development	9	1 000 000
PFRT	2	600 000
Qualification	<u>4</u>	<u>1 200 000</u>
Total program	24	\$3 500 000

and the propellant-flow regulator. Should the LH₂ experiment system be selected, qualification of the LH₂ tankage and feed assembly would also be required.

Qualification-test programs for these critical components are presented in the following paragraphs. The programs for the inverter, transformer, and propellant-flow regulator are applicable for both the NH₃ and LH₂ experiment systems. The programs consist of development and qualification phases with objectives and test requirements identical to those specified for the thruster module.

Inverter. — The inverter schematic is shown in fig. 17. Input power from 28-Vdc and 260-Vdc sources supply the inverter, which has a pulse-width modulated ac square-wave output (fig. 18). This waveform is modulated to 200-volt rms with $\pm 1/4\%$ voltage regulation when the 260-Vdc input is held to the $\pm 1\%$ regulation specified for the dc-link bus. The spacecraft power sources were assumed to be identical to those for the MORL. (See fig. 19.)

The output stage is protected from external shorts by a silicone-control rectifiers (SCR) crowbar circuit that opens the 260-volt-input circuit breaker should the output voltage fall below a specified level. The output stage is driven by a magnetic-coupled multivibrator which is supplied directly from the 28-Vdc load bus. The driver output is pulse-width modulated using a magnetic amplifier whose gate windings are connected, in series, with the base of one of the two conducting-series output transistors. Two of the bridge-connected transistors are therefore allowed to conduct for a controlled period in each half cycle. Current for the control windings will be supplied from a feedback-control circuit that senses the output voltage. By means of varying this control current, the width of the zero dwell of the output waveform will be adjusted to hold the rms voltage value to within the $1/4\%$ tolerance required.

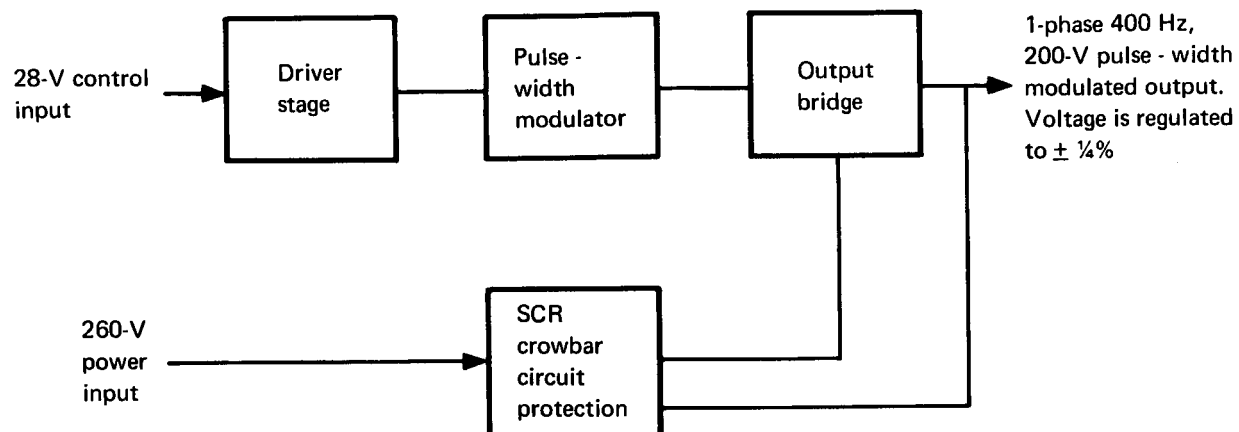


Figure 17. Inverter Design

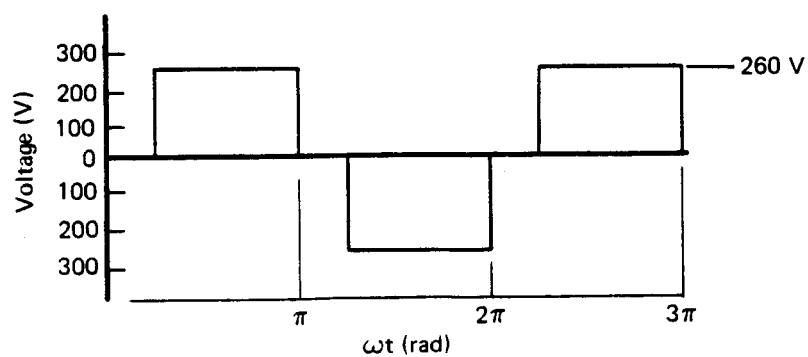


Figure 18. Square-Wave Output

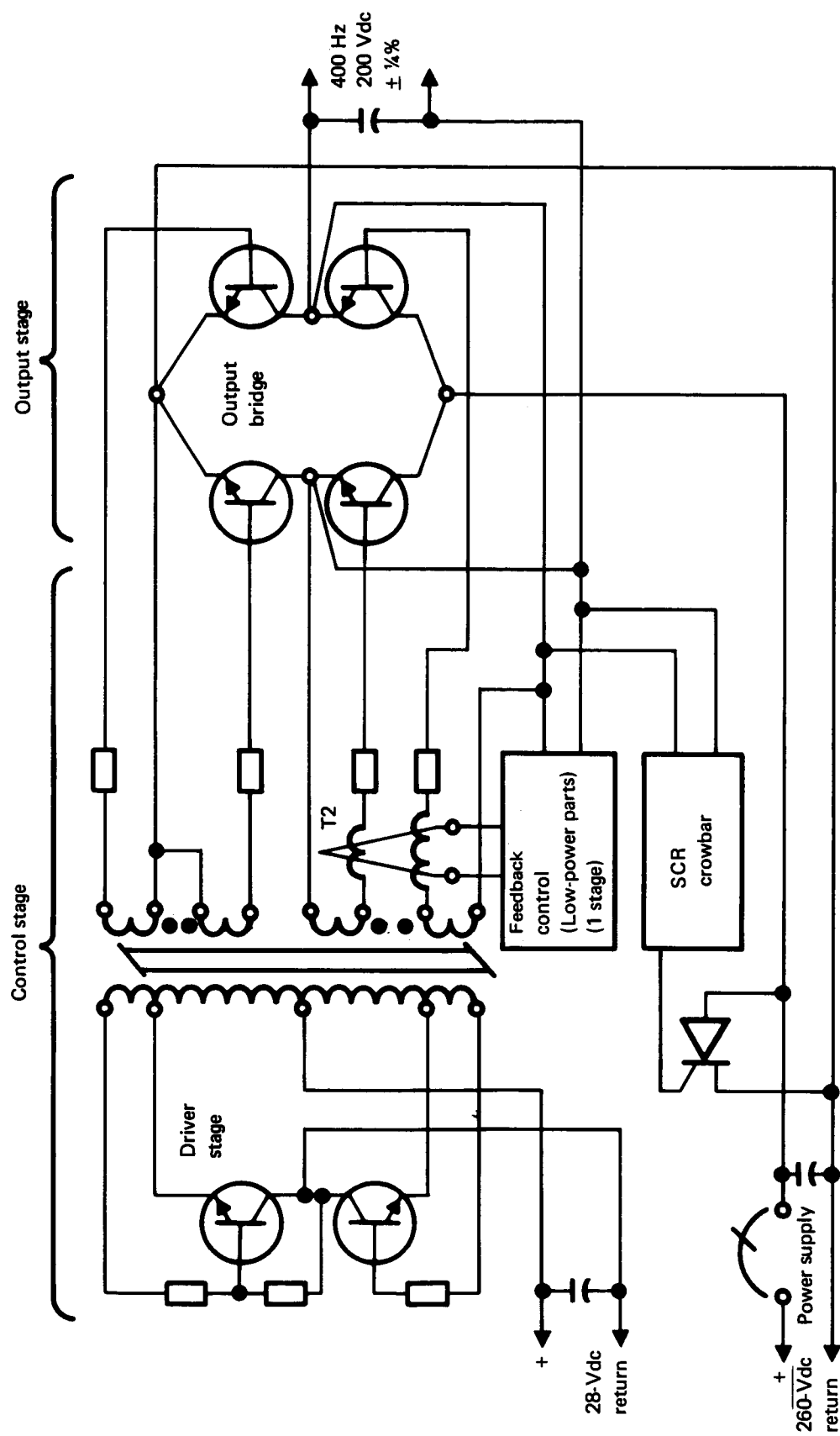


Figure 19. Resistojet Power Inverter

Several tradeoffs were considered in the inverter design. The alternatives considered in designing the output stage were a push-pull output or a bridge output. Also of consideration was the use of transistors or SCR's as the power switches. The bridge output stage was selected since the voltage on the semiconductor would be equal only to the input voltage of 260 volts, instead of twice that value in the push-pull output stage. The lower voltage in the bridge circuit would offset the small additional loss in the semiconductor by having two saturated devices on at the same time rather than one in the push-pull design.

Transistors should be used in the output stage rather than SCR's. Transistors are now available in 500-volt ratings that will work well in this application. The small increase in efficiency gained in the SCR circuit because of the elimination of base-drive requirements does not warrant the increase in circuit complexity resulting from the commutation components needed to turn off the SCR's. While the output transistors do not have the surge capability of the SCR, the transistors will be protected from overloads on the output by an SCR crowbar.

The drive-stage frequency will vary directly as a function of input voltage. Frequency of the output will therefore vary from 375 cps to 425 cps with a 25.5-volt to 28.5-volt input. The output transformers were designed around a 12-kilogauss flux density at 400 cps. At the low frequency, this would raise the flux density to 12.8-kilogauss and the core loss would increase 1.1×10^{-3} watts/gm (0.5 watts/lbm). This increase would raise the transformer dissipation 0.25 watts/transformer. The saving of 2 watts in the entire system does not warrant the increased circuit complexity of regulating the input voltage to the driver stage.

Output regulation is accomplished by pulse-width modulating the drive wave-form to the output transistors. This modulation is accomplished by a magnetic amplifier control (as described above) in response to feedback from the output voltage. Pulse-width modulation was chosen for regulation because of its low losses. The inverter design is estimated to be 99% efficient. The inverter development, which is considered to be with the limits of current technology, will include the establishment of a hermetically sealed configuration that will permit prolonged operation in space.

The preliminary schedule for qualification testing of the inverter is shown in fig. 20. A total of 18 months is required. Of this, the development and breadboard testing will take about 10 months, a portion of which must be devoted to testing the inverter in a thermo-vacuum facility. Prototype testing and qualification testing will be conducted over a 10-month period. All operational qualification testing will be performed in a thermo-vacuum facility. The supporting analyses for design and qualification are included.

A preliminary cost estimate for design, development, and qualification of the inverter is about \$500 000. The cost breakdown by major program phases is shown in table 9.

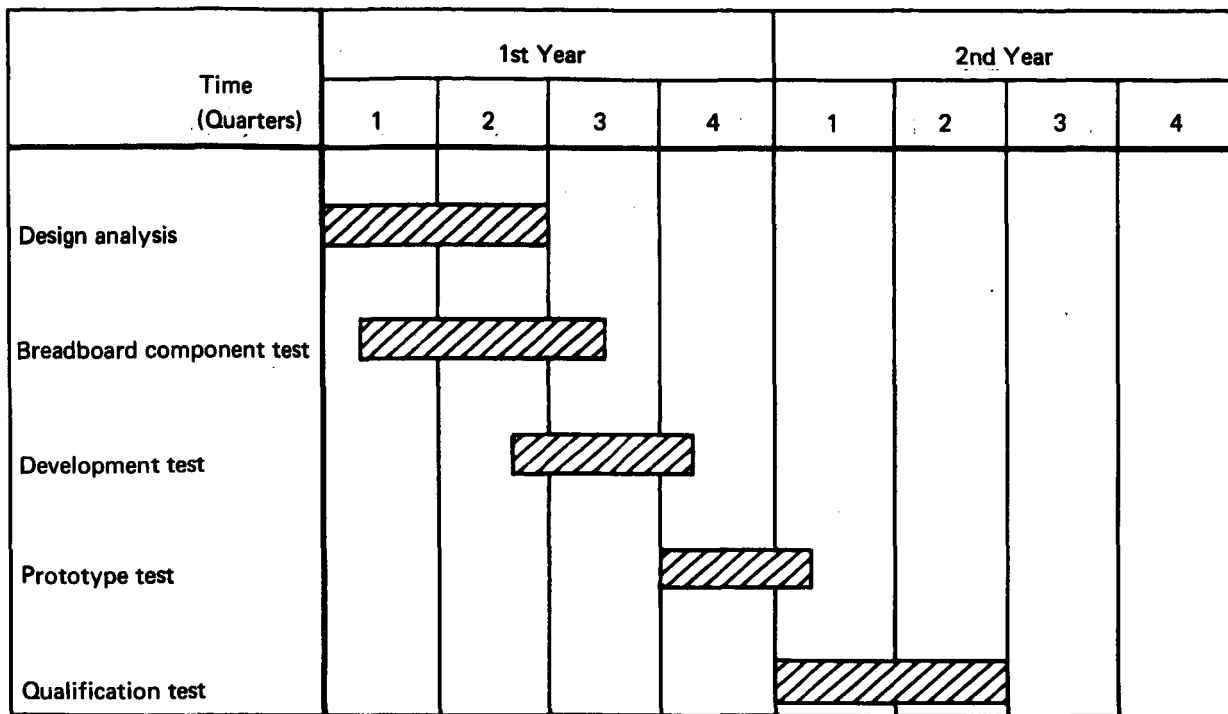


Figure 20. Qualification Testing Schedule — Inverter

TABLE 9
COST BREAKDOWN
INVERTER GROUND-TEST PROGRAM

Program phase	Duration (months)	Cost
Design analysis	6	\$ 40 000
Breadboard component test	6	60 000
Development test	5	95 000
Prototype test	4	75 000
Qualification test	<u>6</u>	<u>230 000</u>
Total program	18	\$500 000

Transformer. — The step-down transformer design was evaluated, and the recommended design was selected to achieve high reliability and minimum weight. (See fig. 5.)

The transformer cores are 4-mil grain-oriented silicon-steel C and E. These cores were selected instead of a toroidal core because of the large "strap" wire needed to carry the high secondary currents. A flux density of 12 000 gauss was selected for the magnetic material. A study of designs established the proper current density in the copper for maximum efficiency. A 750 circular mil/ampere design was selected.

At present, the failure-rate design goal for transformers of this type is 0.001%/1000 hours before failure. While the goal has not been proved through test, it has been adopted for such projects as MOL and Spartan. The transformer design is considered to be within the limits of the current technology. However, development effort will be required to hermetically seal the unit to enhance the long-duration operating requirement.

The breadboard and development testing of the transformer will require approximately 7 months, with a portion of the development testing to be conducted in a thermo-vacuum facility. Prototype testing and qualification testing can be performed in 6 months. The complete testing, shown in fig. 21, will require approximately 12 months.

The cost of the program is estimated to be \$300 000. The program cost by major phases is shown in table 10.

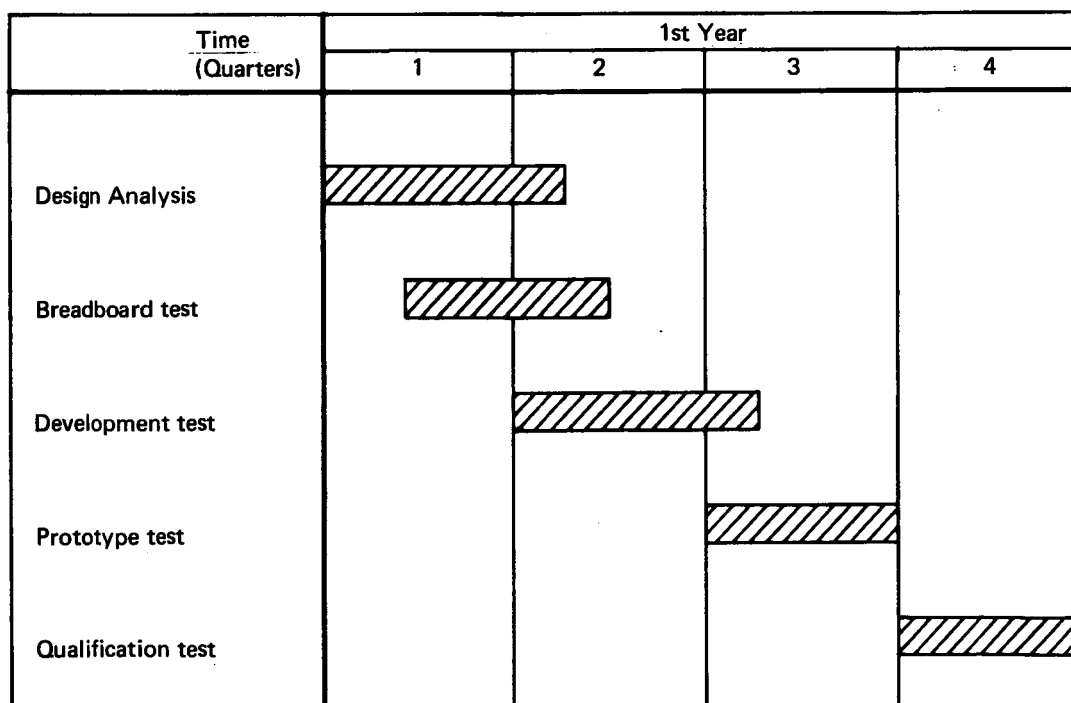


Figure 21. Qualification Testing Schedule — Step-Down Transformer

TABLE 10
COST BREAKDOWN
STEP-DOWN TRANSFORMER GROUND-TEST PROGRAM

Program phase	Duration (months)	Cost
Design analysis	4	\$ 25 000
Breadboard test	3	45 000
Development test	4	70 000
Prototype test	3	50 000
Qualification test	3	110 000
Total program	12	\$300 000

Propellant-flow regulator. — The propellant-flow regulator design for the resistojet propellant-feed system is similar in flow-rate and pressure-control requirements of the units used on experimental, animal life-support systems. The Adel Division of DeLaval Turbine (Burbank, California) has proposed using a modified Absolute Pressure Regulator, Part No. 71730, for the resistojet application. Modification will include redesign into a modular package with two regulators in parallel with a filtered inlet.

A preliminary cost estimate and schedule for obtaining the required regulator has been prepared. The schedule allows 3 months for application and design-evaluation testing, culminating in design approval. Manufacturing of qualification units is estimated to take approximately 4 months, and qualification testing will take another 4 months. (See fig. 22.)

The estimated cost is \$75 000 over the 12-month period. The cost breakdown is shown in table 11.

LH₂ Propellant Tankage and Feed System. — The recommended configuration for a resistojet system using LH₂ propellant has been shown in fig. 10. This system incorporates (1) a thermodynamic liquid-vapor separator with regenerative cooling coils, (2) an optional propellant-bypass system to bypass the separator and cooling coils, (3) an auxiliary electric heater, and (4) a storage tank with high-performance insulation (HPI).

This design uses conventional components which could be developed for this application with moderate effort. In all uses, the required development

Time (Quarters)	1st year			
	1	2	3	4
Application engineering and design evaluation test				
Qualification unit manufacturing				
Qualification test				

Figure 22. Qualification Testing Schedule — Absolute Pressure Regulator

TABLE 11
COST BREAKDOWN
ABSOLUTE PRESSURE REGULATOR GROUND-TEST PROGRAM

Program phase	Duration (months)	Cost
Application engineering and design evaluation test	3	\$20 000
Qualification unit manufacturing	4	20 000
Qualification test	<u>5</u>	<u>35 000</u>
Total program	12	\$75 000

will be directed at controlling the propellant-flow rate to this thrusting-control system and to prevent deterioration of the performance of the LH₂ tank insulation. The components of this system and their respective design restraints are discussed below.

LH₂ storage tank: The storage tank consists of a 150-cm- (59-in.)-diam sphere of 0.13-cm- (0.05-in.)-thick aluminum 2014-T6A1, covered with 116 layers of NRC-2 insulation. The two halves of the tank are spun and then welded together to form the final tank. Studies have shown that small propellant leakage can cause serious deterioration in the insulating characteristics of the HPI. This will require additional development in the welding procedure so that a satisfactory weld at the jointing point of the tank halves can be produced. Satisfactory welds have been made in aluminum where the wall sections were 0.64-cm (0.25-in.)-thick or thicker and have been made in thin-wall stainless-steel tankage. The thin-wall aluminum tank will require more development and will likely require the fabrication of special tooling for the welding. Welding sample testing for structural integrity and leakage control will be required. Proofing and leak testing after cryo-shocking of completed structures within a vacuum environment will also be required.

The superinsulation for the LH₂ tank in its final design configuration must be tested under a space environmental condition to establish its nominal thermal environment. This will be accomplished by a large, but not necessarily full-scale, calorimeter test.

Cooling coil: The regenerative cooling coil is formed on the outside of the tank by 0.64-cm- (0.25-in.)-diam aluminum tubing with a 0.076-cm (0.03-in.) wall thickness. The coil is approximately 13.1-m (43-ft) long and will be attached along the length of the coil at about 16 points. The attaching standoffs are 0.64-cm- (0.25-in.)-diam aluminum pins which are 1.27-cm (0.5-in.) long. The fabrication of this system will not require further development; however, component-evaluation testing will be required to determine the actual heat-transfer characteristics of this system. Any difference in actual heat transfer, compared to the design value, can be adjusted by means of changing the number and size of standoffs. The evaluation of heat-transfer rates through a typical insulated tank section could be evaluated through the use of a test model with a single standoff arrangement. This should be a low-g simulation experiment, such as a KC135 aircraft test, in order to take into account this environmental effect.

Tank-fill system: The tank fill system incorporates a conventional hand-actuated shutoff valve and a manual disconnect. A shutoff valve with low through-leakages, such as with the control-component valve, would be specified for this configuration. No development program would be required.

Electric heater for H₂ tank: The electric heater in the tank will be in the 7-to 10-watt size, and elements of this size are available. The packaging of this element into a heater configuration will be required. After fabrication of the heater, an evaluation test will be needed; however, since similar units in longer sizes are presently available, the packaging and testing effort should not be extensive.

The pressure-switch assembly would be a conventional LH₂ pressure switch with little or no modification required.

H₂ feed system: The H₂ propellant-feed system incorporates a conventional three-way selector valve and a pressure-regulator throttle valve. The three-way valve controls the flow path so that the propellant can flow through the cooling coil or can by-pass the coil and flow directly into the heat exchanger. This valve can be manually or electrically actuated and will be selected primarily for low through-leakage control. The pressure-sensing throttle valve is a conventional pressure-regulating valve which will sense accumulator pressure and modulate to the $3.1 \times 10^5 \text{ N/m}^2$ (45 psia) setting. Both of these valves are of conventional design but will require minor modification to provide adequate leakage control in the full-closed position. This minor rework will require some development testing to provide acceptable components.

Tank safety system: The tank safety system consists of a burst disk and a relief valve which are connected in parallel and are vented through a nondirectional vent outlet. The burst disk will be selected for a pressure relief at $7.57 \times 10^5 \pm 0.35 \times 10^5 \text{ N/m}^2$ (110 $\pm$ 5 psia) and will be a conventional design. The relief valve will be selected for low through-leakage and will be set for $5.5 \times 10^5 \text{ N/m}^2$ (80 psia). Since leakage through this valve will cause premature propellant depletion, it will be necessary to protect the pressure-relief valve with a burst disk (relief pressure of $5.85 \times 10^5 \pm 0.35 \times 10^5 \text{ N/m}^2$ (85 $\pm$ 5 psia). An alternate solution is to provide an $5.5 \times 10^5 \text{ N/m}^2$ (80 psia) pressure switch and an electrically actuated shutoff valve to perform this relief function. In this case, the pressure switch would be of conventional design, but the solenoid switch would require a development effort.

The component development requirements for this system would require approximately 6 months for conceptual development and an additional 6 months for evaluation of the final configuration. The time needed to satisfy the storage-tank development and the tooling requirements is more difficult to estimate because of the difficulty in obtaining high-quality welds in the thin-wall aluminum material. However, the final tank configuration should be available after a 12-month development effort.

The developed hardware should be completely assembled and checked out in a space-simulation facility using H₂ under vacuum conditions and a simulated-temperature environment. This would include storage leakage and functional tests of the total LH₂ feed system. Qualification testing to meet Saturn requirements will require about 6 months and must be conducted in a space-simulation facility.

This effort, along with the required supporting analyses, is shown in fig. 23. The 24-month effort is estimated to cost approximately \$650 000. The cost breakdown for the major program phases is shown in table 12.

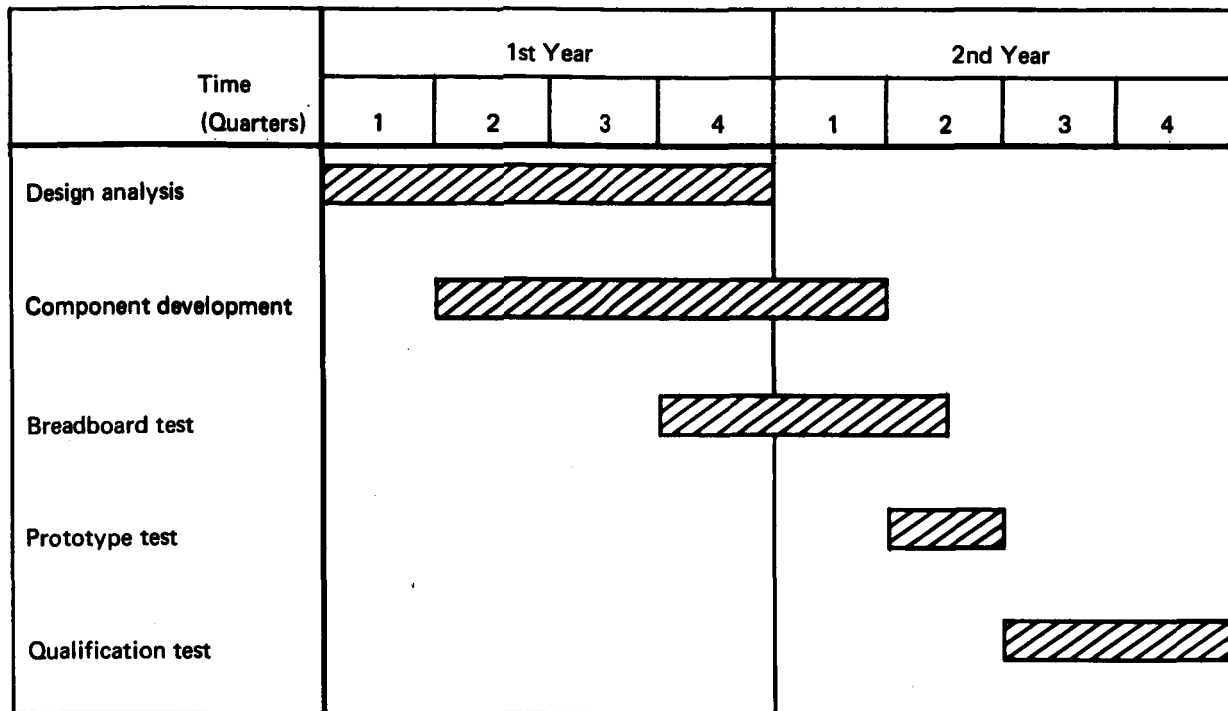


Figure 23. Qualification Testing Schedule — LH₂ Propellant Tankage and Feed Assembly

TABLE 12
COST BREAKDOWN
LH₂ PROPELLANT TANKAGE AND FEED ASSEMBLY
GROUND-TEST PROGRAM

Program phase	Duration (months)	Cost
Design analysis	12	\$ 95 000
Component development	12	110 000
Breadboard test	8	105 000
Prototype test	3	90 000
Qualification test	<u>6</u>	<u>250 000</u>
Total program	24	\$650 000

Integrated Experiment-System Test Program

Prior to integrated system test, qualification of individual components and assemblies will have been completed. As a part of this qualification, the specifications and acceptance test procedures will be defined, and contract end items (CEI's) will be specified.

The integrated-system test program consists of three major phases: (1) acceptance test, (2) reliability test, and (3) integrated system test. The GSE necessary to support the flight system will be utilized in the program phases. Two complete systems will be used in the test program. One system will be subjected to acceptance test and reliability test. The second system will be subjected to acceptance test and integrated system test.

Acceptance tests. — Testing to verify that the end-item hardware conforms to the applicable specifications and performance as a basis for acceptance. The testing will confirm that the end-item performance and configuration is equivalent to the previously qualified end item. The acceptance-test requirements shall include, as a minimum, the following:

(1) Receiving tests and inspection (nondestructive) to verify conformance with end-item specification including weight, dimensional configurations, and inspection.

(2) Environmental tests to be conducted on flight hardware and GSE under environmental conditions. The tests are to be of sufficient severity to uncover latent quality defects, but not severe enough to cause damage or fatigue of the hardware. The tests will include combinations and sequences of environments.

(3) Manufacturing checkout tests to include environmental testing to verify functional operation. The tests will verify that the end item meets the performance/design requirements of the CEI specifications, including physical and functional-mating compatibility with flight and GSE equipment, as applicable.

Reliability tests. — Testing will be performed to establish a significant level of engineering confidence in the flight-type hardware and GSE performance of their intended functions. The tests will be supported by failure modes and effects analysis, criticality analysis, and single-failure-point analysis. The tests will be conducted on hardware which has undergone acceptance testing and will include, as a minimum, testing to verify the useful life of the system. These tests, normally performed as a continuation of qualification testing, include overstress and off-limits tests to determine failure modes and safety margins.

Integrated system test. — Testing will be performed to verify that all assemblies will meet system performance requirements when integrated and that these assemblies are physically, functionally, and operationally compatible with interfacing systems, including GSE.

Test assessment will be conducted to verify that the assembled hardware satisfies integrated-system performance and design requirements of the specifications, including (1) interface/performance/design requirements which cannot be verified at the level of component end-item, (2) integrated performance within specification limits after being subjected to transportation and handling environment, (3) requirements for selective environmental stresses at integrated system level, singly or in combination (for example, dynamic/vibration, thermal, and vacuum pressure stresses), and (4) the interchangeability and maintainability requirements of the system in the configuration that will be flown.

The integrated-system test program is shown in fig. 24. The program requires approximately 16 months to complete. The successful completion of this program will result in a resistojet experiment system that is ready for flight test.

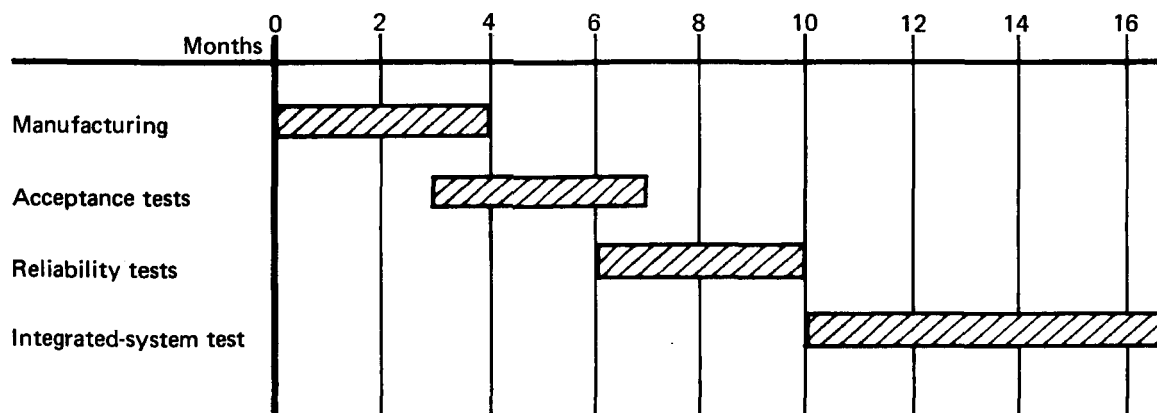


Figure 24. Integrated Experiment-System Test Schedule

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APPENDIX

PRELIMINARY TEST REQUIREMENTS

The following pages contain preliminary qualification test requirement by component. Items 1 through 47 on these sheets correspond to the NH_3 components that were shown in fig. 3 and identified in table 2. Items 1 through 19, 22 through 27, and 48 through 53 comprise the H_2 experiment package (less the propellant-resupply assembly). As previously mentioned, many items are common to both the NH_3 and H_2 systems. Where the qualification requirements for these items differ, separate sheets have been provided.

A summary of the qualification requirements, by assembly, is presented in table 13. These preliminary requirements were established to provide realistic guidelines for the experiment cost and schedule exercise.

The equipment of the experiment package will be qualified in accordance with Saturn launch requirements. The vibration tolerance limits will be comparable to those listed in table 14. The values presented will vary, depending on location of equipment and method of mounting. The tolerance limits of the experiment package to noise, radiation, radio-frequency interference (RFI), and electromagnetic interference (EMI) have not as yet been evaluated or established. Although the resistojet system will not produce any noise, vibration, radiation, RFI signals, or EMI signals, it will exhaust hot gases and produce an exhaust plume.

TABLE 13

SUMMARY OF QUALIFICATION REQUIREMENTS

Requirement	Measurement	
	NH ₃ system	H ₂ system
Assemblies A and B		
Force--N (mlbf)	0.044	0.044
Chamber pressure--N/m ² (psia)	2.41 x 10 ⁵	2.41 x 10 ⁵
Chamber temperature--°K (°R)	2410	2410
Proof pressure--N/m ² (psia)	3.31 x 10 ⁵	3.31 x 10 ⁵
Burst pressure--N/m ² (psia)	4.68 x 10 ⁵	4.68 x 10 ⁵
Nominal power--watts	150	240
Maximum power--watts	151.5	242
Thruster current--amps	31.3	40.0
Specific Impulse	340	725
Assemblies C and D		
Nominal transformer voltage--volts	4.8	6.0
Maximum transformer voltage--volts	4.81	6.02
Assembly E		
Nominal inverter voltage--volts	4.8	6.0
Assemblies F ₁ and F ₂		
Cycles	20	20
Nominal storage pressure--N/m ² (psia)	22.1 x 10 ⁵	3.78 x 10 ⁵
	(310)	(55)

TABLE 13

SUMMARY OF QUALIFICATION REQUIREMENTS - Continued

Requirement	Measurement	
	NH ₃ system	H ₂ system
Nominal storage temperature-- oK (oR)	325 (585)	25 (46)
Maximum storage pressure-- N/m ² (psia)	27.5 x 10 ⁵ (400)	5.5 x 10 ⁵ (80)
Maximum storage temperature-- oK (oR)	333 (600)	28 (50)
Proof pressure--N/m ² (psia)	45.9 x 10 ⁵ (667)	10.3 x 10 ⁵ (147)
Burst pressure--N/m ² (psia)	64.4 x 10 ⁵ (934)	14.2 x 10 ⁵ (206)
Pressure regulator		
Minimum outlet pressure--N/m ² (psia)	2.34 x 10 ⁵ (34)	2.34 x 10 ⁵ (34)
Maximum outlet pressure--N/m ² (psia)	2.48 x 10 ⁵ (36)	2.48 x 10 ⁵ (36)
Operating temperature-- ^o K (^o R)	333 (600)	333 (600)
Maximum flow--N/sec (lb/sec)	5.18 x 10 ⁻⁴ (11.7 x 10 ⁻⁵)	2.45 x 10 ⁻⁴ (5.52 x 10 ⁻⁵)
Minimum flow--N/sec (lb/sec)	2.59 x 10 ⁻⁴ (5.88 x 10 ⁻⁵)	2.45 x 10 ⁻⁴ (5.52 x 10 ⁻⁵)
Cycles	40 000	40 000
Proof pressure--N/m ² (psia)	3.31 x 10 ⁵ (48)	3.31 x 10 ⁵ (48)
Burst pressure--N/m ² (psia)	4.68 x 10 ⁵ (68)	4.68 x 10 ⁵ (68)

TABLE 13

SUMMARY OF QUALIFICATION REQUIREMENTS - Continued

Requirement	Measurement	
	NH ₃ system	H ₂ system
Assembly G		
Propellant lines		
Nominal line pressure-- N/m ² (psia)	2.41 x 10 ⁵ (35)	2.41 x 10 ⁵ (35)
Maximum line pressure-- N/m ² (psia)	2.48 x 10 ⁵ (36)	2.48 x 10 ⁵ (36)
Proof pressure--N/m ² (psia)	3.31 x 10 ⁵ (48)	3.31 x 10 ⁵ (48)
Burst pressure--N/m ² (psia)	4.68 x 10 ⁵ (68)	4.68 x 10 ⁵ (68)
Electrical cabling		
Current--amps	31.3	40
Insulation	TBD	TBD
Assembly J		
Pressurant (N ₂) tankage and feed		
Nominal storage pressure-- N/m ² (psia)	2.07 x 10 ⁷ (3000)	
Nominal storage temperature-- °K (°R)	295 (530)	
Maximum storage pressure-- N/m ² (psia)	2.58 x 10 ⁷ (3750)	
Maximum storage temperature-- °K (°R)	333 (600)	

TABLE 13

SUMMARY OF QUALIFICATION REQUIREMENTS -- Concluded

Requirement	Measurement	
	NH ₃ System	H ₂ System
Proof pressure--N/m ² (psia)	3.44 x 10 ⁷ (5000)	N/A
Burst pressure--N/m ² (psia)	4.83 x 10 ⁷ (7000)	
Pressurant regulator		
Minimum outlet pressure-- N/m ² (psia)	22.4 x 10 ⁵ (325)	N/A
Maximum outlet pressure-- N/m ² (psia)	25.8 x 10 ⁵ (375)	
Operating temperature--°K (°R)	333 (600)	
Cycles	5000	
Proof pressure--N/m ² (psia)	3.44 x 10 ⁷ (5000)	
Burst pressure--N/m ² (psia)	4.83 x 10 ⁷ (7000)	
Propellant-resupply tankage and feed		
Nominal storage pressure--N/m ² (psia)	22.1 x 10 ⁵ (310)	N/A
Nominal storage temperature-- °K (°R)	325 (585)	
Maximum storage pressure-- N/m ² (psia)	27.5 x 10 ⁵ (400)	
Maximum storage temperature-- °K (°R)	333 (600)	
Proof pressure--N/m ² (psia)	45.9 x 10 ⁵ (667)	
Burst pressure--N/m ² (psia)	64.4 x 10 ⁵ (934)	

TABLE 14
VIBRATION ENVIRONMENT

Sine			
Radial axis		Thrust and tangential	
5-40 cps at 0.04 D. A. disp*		5-40 cps at 0.04 D. A. disp*	
40-255 cps at 3.2-g peak		40-2000 cps at 3.2-g peak	
225-290 cps at 0.0013 D. A. disp*			
290-2000 cps at 5.4-g peak			
Random			
Radial axis		Thrust and tangential	
20-200	0.02 g ² /cps	20-200	0.02 g ² /cps
200-280	22 db/octave	200-280	10 db/octave
280-700	0.25 g ² /cps	280-700	0.06 g ² /cps
700-1300	-12 db/octave	700-1300	-5.5 db/octave
1300-2000	0.02 g ² /cps	1300-2000	0.02 g ² /cps

*D. A. disp = double amplitude displacement.

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 1					
5. TITLE RESISTOJET						6. TYPE TEST QUAL		7. DATE		8. REVISION					
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.					
13. TEST DESCRIPTION - REVISION USAGE: RESISTOJET MODULE						14. EFFECTIVITY				15. MILESTONE					
						16. COORD W/CUSTOMER				17. DATE					
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA					
						21. SCN NO.									
22. ENVIR		DASH NO.				REMARKS		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE	
(1) FUNCTIONAL															
(2) LOW TEMP		X				220°K (400°R) & 30 000 cycles						X		X	
(3) ROOM TEMP															
(4) HIGH TEMP		X				390°K (700°R) & 30 000 cycles						X		X	
(5) PROOF		X				3.24 x 10 ⁵ N/m ² (48 psia)					X	X			
(6) BURST		X				4.15 x 10 ⁵ N/m ² (60 psia)					X	X			
(7) MECH PROPERTIES															
(8) PRESS. CYCLE		X				500 cycles			X		X				
(9) COLLAPSE															
(10) AXIAL LOAD															
(11) BEND LOAD															
(12) SHEAR LOAD															
(13) SPRING RATE															
(14) LEAKAGE		X				at 2.41 x 10 ⁵ N/m ² (35 psia)			X			X			
(15) VIBRATION		X				at 2.41 x 10 ⁵ N/m ² (35 psia)			X			X			
(16) SHOCK (MECH)		X				at 2.41 x 10 ⁵ N/m ² (35 psia)			X			X			
(17) SHOCK (THERM)		X				at vacuum			X			X			
(18) ACCELERATION		X							X				X		
(19) ACOUSTICS															
(20) EMI															
(21) VACUUM		X				30 days			X		X	X			
(22) FLOW ΔP															
(23) RESPONSE TIME															
(24) PROP EXP/MIG															
(25) HUMIDITY															
(26) SALT SPRAY															
(27) SAND/DUST															
(28) TEMP CYCLE															
(29) CONT OP															
(30) Inspection						X-ray/resistance check									
(31)															
(32)															
(33)															
23. SPEC NO.								SEQUENCE INDICATED BY LETTERS							
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Prototype unit under development at Marquardt.												25. TEST COMPLETION DATE			
												26. ORIGINATOR			
												27. CHF ENGR-TECH			
												28. CHF RELIAB ENGR			
												29. CHF DES ENGR			
												30. CHF ENGR QUALTEST			
31.															

COMPONENT TEST CONTROL AUTHORITY

1. BASIC PART NO.

2. ECP/PCP LOG.

3. LOG NO.

4. LINE ITEM
2

5. TITLE

RESISTOJET VALVE

6. TYPE TEST
QUAL

7. DATE

8. REVISION

9. TEST CONTROL DWG

10. TEST PROCED DWG

11. SUPPLIER & P/N

12. E.C.C.L.

13. TEST DESCRIPTION - REVISION

USAGE:

RESISTOJET MODULE

14. EFFECTIVITY

15. MILESTONE

16. COORD W/CUSTOMER

17. DATE

18. CO/NASA LTR

19. ECP/PCP

20. TAN/WOA

21. SCN NO.

LOW
TEMPROOM
TEMPHIGH
TEMP

STRUCT

OP

NON-OP

REPEAT
CYCLE

22. ENVIR DASH NO.

REMARKS

(1) FUNCTIONAL

(2) LOW TEMP

(3) ROOM TEMP

X

30 000 cycles

X

X

(4) HIGH TEMP

X

30 000 cycles

X

X

(5) PROOF

X

3.24 x 10⁵ N/m² (48 psia)

X

X

(6) BURST

X

4.15 x 10⁵ N/m² (60 psia)

X

X

(7) MECH PROPERTIES

(8) PRESS. CYCLE

(9) COLLAPSE

(10) AXIAL LOAD

(11) BEND LOAD

(12) SHEAR LOAD

(13) SPRING RATE

(14) LEAKAGE

X

2.41 x 10⁵ N/m² (35 psia)

X

X

(15) VIBRATION

X

2.41 x 10⁵ N/m² (35 psia)

X

X

(16) SHOCK (MECH)

X

2.41 x 10⁵ N/m² (35 psia)

X

X

(17) SHOCK (THERM)

(18) ACCELERATION

(19) ACOUSTICS

(20) EMI

(21) VACUUM

(22) FLOW ΔP

(23) RESPONSE TIME

(24) PROP EXP/MIG

(25) HUMIDITY

(26) SALT SPRAY

(27) SAND/DUST

(28) TEMP CYCLE

(29) CONT OP

(30)

(31)

(32)

(33)

23. SPEC NO.

SEQUENCE INDICATED BY LETTERS

24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST

2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT

3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION.

This unit is nonstandard. Marquardt is proposed supplier.

25. TEST COMPLETION DATE

26. ORIGINATOR

27. CHF ENGR-TECH

28. CHF RELIAB ENGR

29. CHF DES ENGR

30. CHF ENGR QUALTEST

31.

COMPONENT TEST CONTROL AUTHORITY

1. BASIC PART NO.

2. ECP/PCP LOG

3. LOG NO.

4. LINE ITEM

3

5. TITLE

RESISTOJET SWITCH

6. TYPE TEST
QUAL

7. DATE

8. REVISION

9. TEST CONTROL DWG

10. TEST PROCED DWG

11. SUPPLIER & P/N

12. E.C.C.L.

13. TEST DESCRIPTION - REVISION

USAGE:

RESISTOJET MODULE

14. EFFECTIVITY

15. MILESTONE

16. COORD W/CUSTOMER

17. DATE

18. CO/NASA LTR

19. ECP/PCP

20. TAN/WOA

21. SCN NO.

22. ENVIR DASH NO.

REMARKS

LOW
TEMPROOM
TEMPHIGH
TEMP

STRUCT

OP

NON-OP

RESEAT
CYCLE

(1) FUNCTIONAL

(2) LOW TEMP

X

30 000 cycles at vacuum

X

X

(3) ROOM TEMP

X

30 000 cycles at vacuum

X

X

(4) HIGH TEMP

X

30 000 cycles at vacuum

X

X

(5) PROOF

(6) BURST

(7) MECH PROPERTIES

(8) PRESS. CYCLE

(9) COLLAPSE

(10) AXIAL LOAD

(11) BEND LOAD

(12) SHEAR LOAD

(13) SPRING RATE

(14) LEAKAGE

(15) VIBRATION

X

X

X

(16) SHOCK (MECH)

X

X

X

(17) SHOCK (THERM)

(18) ACCELERATION

(19) ACOUSTICS

(20) EMI

(21) VACUUM

(22) FLOW ΔP

(23) RESPONSE TIME

(24) PROP EXP/MIG

(25) HUMIDITY

(26) SALT SPRAY

(27) SAND/DUST

(28) TEMP CYCLE

(29) CONT OP

(30)

(31)

(32)

(33)

23. SPEC NO.

SEQUENCE INDICATED BY LETTERS

24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST

2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT

3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT
AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE
EVALUATION.

This unit is nonstandard. Marquardt is proposed supplier.

25. TEST COMPLETION DATE

26. ORIGINATOR

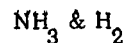
27. CHF ENGR-TECH

28. CHF RELIAB ENGR

29. CHF DES ENGR

30. CHF ENGR QUALTEST

31.

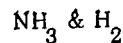


COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 4	
5. TITLE RESISTOJET MOUNT MODULE						6. TYPE TEST QUAL		7. DATE		8. REVISION	
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.			
13. TEST DESCRIPTION - REVISION USAGE: MODULE						14. EFFECTIVITY		15. MILESTONE			
						16. COORD W/CUSTOMER				17. DATE	
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA	
						21. SCN NO.					
22. ENVIR		DASH NO.		1		REMARKS		LOW TEMP		ROOM TEMP	
(1) FUNCTIONAL											
(2) LOW TEMP				220°K (400°R) and 30 000 cycles						X	
(3) ROOM TEMP											
(4) HIGH TEMP		X		333°K (600°R) and 30 000 cycles				X		X	
(5) PROOF		X		3.24 x 10 ⁵ N/m ² (48 psia)				X		X	
(6) BURST		X		4.15 x 10 ⁵ N/m ² (60 psia)				X		X	
(7) MECH PROPERTIES											
(8) PRESS. CYCLE											
(9) COLLAPSE											
(10) AXIAL LOAD											
(11) BEND LOAD											
(12) SHEAR LOAD											
(13) SPRING RATE											
(14) LEAKAGE		X		2.41 x 10 ⁵ N/m ² (35 psia)						X	
(15) VIBRATION		X		2.41 x 10 ⁵ N/m ² (35 psia)				X			
(16) SHOCK (MECH)		X		2.41 x 10 ⁵ N/m ² (35 psia)				X			
(17) SHOCK (THERM)											
(18) ACCELERATION											
(19) ACOUSTICS											
(20) EMI											
(21) VACUUM											
(22) FLOW ΔP											
(23) RESPONSE TIME											
(24) PROP EXP/MIG											
(25) HUMIDITY											
(26) SALT SPRAY											
(27) SAND/DUST											
(28) TEMP CYCLE											
(29) CONT OP											
(30)											
(31)											
(32)											
(33)											
23. SPEC NO.						SEQUENCE INDICATED BY LETTERS					
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. This unit is nonstandard and consists of mount structure, module housing cover, inlet propellant feed, mount to vehicle structure, etc., to be qualified as a unit.								25. TEST COMPLETION DATE			
								26. ORIGINATOR			
								27. CHF ENGR-TECH			
								28. CHF RELIAB ENGR			
								29. CHF DES ENGR			
								30. CHF ENGR QUAL TEST			
31.											

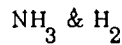
COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 5				
5. TITLE STEP-DOWN TRANSFORMER						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: POWER CONTROL						14. EFFECTIVITY				15. MILESTONE				
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL	X			1 000 hours at 112% load				X		X		X		
(2) LOW TEMP	X			225°K (460°R)									X	
(3) ROOM TEMP														
(4) HIGH TEMP	X			390°R (700°R)									X	
(5) PROOF														
(6) BURST														
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE														
(15) VIBRATION	X								X				X	
(16) SHOCK (MECH)	X								X				X	
(17) SHOCK (THERM)	X			255°K to 390°K (460°R to 700°R)									X	
(18) ACCELERATION														
(19) ACOUSTICS	X								X				X	
(20) EMI														
(21) VACUUM	X			10 ⁻⁶ to 10 ⁻⁹				X		X				X
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Nonstandard unit. Special fabrication may be required. Qualify as component.								25. TEST COMPLETION DATE						
								26. ORIGINATOR						
								27. CHF ENGR-TECH						
								28. CHF RELIAB ENGR						
								29. CHF DES ENGR						
								30. CHF ENGR QUALTEST						
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 6								
				5. TITLE POWER SWITCHES		6. TYPE TEST QUAL		7. DATE		8. REVISION								
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.										
13. TEST DESCRIPTION - REVISION USAGE: TRANSFORMER/SWITCHES ASSEMBLY						14. EFFECTIVITY		15. MILESTONE										
						16. COORD W/CUSTOMER				17. DATE								
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA								
						21. SCN NO.												
22. ENVIR						REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL																		
(2) LOW TEMP						X 30 000 cycles--at vacuum						X				X		
(3) ROOM TEMP						X 30 000 cycles--at vacuum							X			X		
(4) HIGH TEMP						X 30 000 cycles--at vacuum								X		X		
(5) PROOF																		
(6) BURST																		
(7) MECH PROPERTIES																		
(8) PRESS. CYCLE																		
(9) COLLAPSE																		
(10) AXIAL LOAD																		
(11) BEND LOAD																		
(12) SHEAR LOAD																		
(13) SPRING RATE																		
(14) LEAKAGE																		
(15) VIBRATION																		
(16) SHOCK (MECH)																		
(17) SHOCK (THERM)																		
(18) ACCELERATION																		
(19) ACOUSTICS																		
(20) EMI																		
(21) VACUUM																		
(22) FLOW ΔP																		
(23) RESPONSE TIME																		
(24) PROP EXP/MIG																		
(25) HUMIDITY																		
(26) SALT SPRAY																		
(27) SAND/DUST																		
(28) TEMP CYCLE																		
(29) CONT OP																		
(30)																		
(31)																		
(32)																		
(33)																		
23. SPEC NO.						SEQUENCE INDICATED BY LETTERS												
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. STANDARD UNIT, REQUIRES QUALIFICATION.												25. TEST COMPLETION DATE						
												26. ORIGINATOR						
												27. CHF ENGR-TECH						
												28. CHF RELIAB ENGR						
												29. CHF DES ENGR						
												30. CHF ENGR QUAL TEST						
31.																		

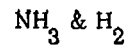
COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 7				
5. TITLE ELECTRICAL CONNECTOR						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: CABLING CONNECTOR						14. EFFECTIVITY		15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL														
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP														
(5) PROOF														
(6) BURST														
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE														
(15) VIBRATION	X							X				X		
(16) SHOCK (MECH)	X							X				X		
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM	X								X		X			
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION.								25. TEST COMPLETION DATE						
								26. ORIGINATOR						
								27. CHF ENGR-TECH						
								28. CHF RELIAB ENGR						
								29. CHF DES ENGR						
								30. CHF ENGR QUALTEST						
31.														



COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 8						
				5. TITLE ELECTRICAL CONNECTOR		6. TYPE TEST QUAL		7. DATE		8. REVISION						
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.								
13. TEST DESCRIPTION - REVISION USAGE: CABLING CONNECTOR						14. EFFECTIVITY		15. MILESTONE								
						16. COORD W/CUSTOMER				17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA						
						21. SCN NO.										
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL																
(2) LOW TEMP																
(3) ROOM TEMP																
(4) HIGH TEMP																
(5) PROOF																
(6) BURST																
(7) MECH PROPERTIES																
(8) PRESS. CYCLE																
(9) COLLAPSE																
(10) AXIAL LOAD																
(11) BEND LOAD																
(12) SHEAR LOAD																
(13) SPRING RATE																
(14) LEAKAGE																
(15) VIBRATION	X															
(16) SHOCK (MECH)	X										X				X	
(17) SHOCK (THERM)											X				X	
(18) ACCELERATION																
(19) ACOUSTICS																
(20) EMI																
(21) VACUUM	X															
(22) FLOW ΔP											X				X	
(23) RESPONSE TIME																
(24) PROP EXP/MIG																
(25) HUMIDITY																
(26) SALT SPRAY																
(27) SAND/DUST																
(28) TEMP CYCLE																
(29) CONT OP																
(30)																
(31)																
(32)																
(33)																
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS												
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION.												25. TEST COMPLETION DATE				
												26. ORIGINATOR				
												27. CHF ENGR-TECH				
												28. CHF RELIAB ENGR				
												29. CHF DES ENGR				
												30. CHF ENGR QUALTEST				
												31.				



COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 9, 11						
5. TITLE PROPELLANT-LINE CONNECTOR						6. TYPE TEST QUAL		7. DATE		8. REVISION						
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT-LINE ASSEMBLY						14. EFFECTIVITY				15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA						
						21. SCN NO.										
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X														
(2) LOW TEMP																
(3) ROOM TEMP		X		200 cycles--connect and disconnect										X		X
(4) HIGH TEMP																
(5) PROOF		X		3.8 x 10 ⁵ N/m ² (55 psia)									X			
(6) BURST		X		5.3 x 10 ⁵ N/m ² (77 psia)									X			
(7) MECH PROPERTIES																
(8) PRESS. CYCLE																
(9) COLLAPSE																
(10) AXIAL LOAD																
(11) BEND LOAD																
(12) SHEAR LOAD																
(13) SPRING RATE																
(14) LEAKAGE																
(15) VIBRATION		X		3.8 x 10 ⁵ N/m ² (55 psia)							X			X		
(16) SHOCK (MECH)		X		3.8 x 10 ⁵ N/m ² (55 psia)							X			X		
(17) SHOCK (THERM)																
(18) ACCELERATION																
(19) ACOUSTICS																
(20) EMI																
(21) VACUUM																
(22) FLOW ΔP																
(23) RESPONSE TIME																
(24) PROP EXP/MIG																
(25) HUMIDITY																
(26) SALT SPRAY																
(27) SAND/DUST																
(28) TEMP CYCLE																
(29) CONT OP																
(30)																
(31)																
(32)																
(33)																
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS						25. TEST COMPLETION DATE						
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. This unit is assumed to be standard with connecting/disconnecting handle for in-flight removal and replacement.												26. ORIGINATOR				
												27. CHF ENGR-TECH				
												28. CHF RELIAB ENGR				
												29. CHF DES ENGR				
												30. CHF ENGR QUAL TEST				
												31.				



COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 10	
				5. TITLE HAND VALVE		6. TYPE TEST QUAL		7. DATE		8. REVISION 4	
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.			
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT-LINE ASSEMBLY						14. EFFECTIVITY		15. MILESTONE			
						16. COORD W/CUSTOMER				17. DATE	
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA	
						21. SCN NO.					
22. ENVIR						DASH NO.					
						REMARKS		LOW TEMP		ROOM TEMP	
(1) FUNCTIONAL											
(2) LOW TEMP											
(3) ROOM TEMP						X		200 cycles			
(4) HIGH TEMP						X		200 cycles			
(5) PROOF						X		3.24 x 10 ⁵ N/m ² (48 psia)		X	
(6) BURST						X		4.15 x 10 ⁵ N/m ² (60 psia)		X	
(7) MECH PROPERTIES											
(8) PRESS. CYCLE											
(9) COLLAPSE											
(10) AXIAL LOAD											
(11) BEND LOAD											
(12) SHEAR LOAD											
(13) SPRING RATE											
(14) LEAKAGE						X		2.41 x 10 ⁵ N/m ² (35 psia)		X	
(15) VIBRATION						X		2.41 x 10 ⁵ N/m ² (35 psia)		X	
(16) SHOCK (MECH)						X		2.41 x 10 ⁵ N/m ² (35 psia)		X	
(17) SHOCK (THERM)											
(18) ACCELERATION											
(19) ACOUSTICS											
(20) EMI											
(21) VACUUM											
(22) FLOW ΔP											
(23) RESPONSE TIME											
(24) PROP EXP/MIG											
(25) HUMIDITY											
(26) SALT SPRAY											
(27) SAND/DUST											
(28) TEMP CYCLE											
(29) CONT OP											
(30)											
(31)											
(32)											
(33)											
23. SPEC NO.						SEQUENCE INDICATED BY LETTERS					
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Basic design has been qualified. Airborne design with proven seat and larger actuating handle exists.						25. TEST COMPLETION DATE					
						26. ORIGINATOR					
						27. CHF ENGR-TECH					
						28. CHF RELIAB ENGR					
						29. CHF DES ENGR					
						30. CHF ENGR QUALTEST					
31.											

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 12				
5. TITLE PRESSURE REGULATOR/FILTER						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT FEED						14. EFFECTIVITY		15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.				REMARKS		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X				27.5 x 10 ⁵ N/m ² (400 psia)			X			X		
(2) LOW TEMP														
(3) ROOM TEMP		X				40 000 cycles								X
(4) HIGH TEMP														
(5) PROOF		X				45.9 x 10 ⁵ N/m ² (667 psia)			X		X			
(6) BURST		X				64.4 x 10 ⁵ N/m ² (934 psia)			X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X				27.5 x 10 ⁵ N/m ² (400 psia)			X			X		
(15) VIBRATION		X				27.5 x 10 ⁵ N/m ² (400 psia)			X			X		
(16) SHOCK (MECH)		X				27.5 x 10 ⁵ N/m ² (400 psia)			X			X		
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Nonstandard unit, but basic design exists and can be modified. (Adel is proposed supplier.)										25. TEST COMPLETION DATE				
										26. ORIGINATOR				
										27. CHF ENGR-TECH				
										28. CHF RELIAB ENGR				
										29. CHF DES ENGR				
										30. CHF ENGR QUALTEST				
										31.				

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 12				
5. TITLE PRESSURE REGULATOR/FILTER						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT FEED						14. EFFECTIVITY		15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.				REMARKS		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X				5.5 x 10 ⁵ N/m ² (80 psia)		X				X		
(2) LOW TEMP														
(3) ROOM TEMP		X				40 000 cycles								X
(4) HIGH TEMP														
(5) PROOF		X				10.3 x 10 ⁵ N/m ² (147 psia)		X			X			
(6) BURST		X				14.2 x 10 ⁵ N/m ² (205 psia)		X			X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X				5.5 x 10 ⁵ N/m ² (80 psia)		X				X		
(15) VIBRATION		X				5.5 x 10 ⁵ N/m ² (80 psia)		X				X		
(16) SHOCK (MECH)		X				5.5 x 10 ⁵ N/m ² (80 psia)		X				X		
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.								SEQUENCE INDICATED BY LETTERS						
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Nonstandard unit, but basic design exists and can be modified. (Adel is proposed supplier,)								25. TEST COMPLETION DATE						
								26. ORIGINATOR						
								27. CHF ENGR-TECH						
								28. CHF RELIAB ENGR						
								29. CHF DES ENGR						
								30. CHF ENGR QUAL TEST						
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 13				
8. TITLE PROPELLANT-LINE CONNECTOR						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCEDURE DWG		11. SUPPLIER & P N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: TANKAGE/FEED CONNECTION						14. EFFECTIVITY				15. MILESTONE				
						16. COORD # CUSTOMER				17. DATE				
						18. CO NASA LTR		19. ECP/PCP		20. TAN WGA				
						21. SCN NO.								
22. ENVIR		DASH NO				REMARKS		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X				260 cyclesf				X		X		
(2) LOW TEMP												X		X
(3) ROOM TEMP		X				200 cycles						X		X
(4) HIGH TEMP														
(5) PROOF		X				45.9 x 10 ⁵ N/m ² (667 psia)			X		X			
(6) BURST		X				64.4 x 10 ⁵ N/m ² (934 psia)			X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE														
(15) VIBRATION		X				22.4 x 10 ⁵ N/m ² (325 psia)			X			X		
(16) SHOCK (MECH)		X				22.4 x 10 ⁵ N/m ² (325 psia)			X			X		
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW/ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.										SEQUENCE INDICATED BY LETTERS				
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. This unit is assumed to be standard with connecting/disconnecting handle for in-flight removal and replacement.								25. TEST COMPLETION DATE						
								26. ORIGINATOR						
								27. CHF ENGR-TECH						
								28. CHF RELIAB ENGR						
								29. CHF DES ENGR						
								30. CHF ENGR QUALTEST						
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM 13					
5. TITLE PROPELLANT-LINE CONNECTOR				6. TYPE TEST QUAL.	7. DATE	8. REVISION						
9. TEST CONTROL DWG	10. TEST PROCED DWG	11. SUPPLIER & P/N				12. E. C. L.						
13. TEST DESCRIPTION - REVISION USAGE: TANKAGE/FEED CONNECTION				14. EFFECTIVITY		15. MILESTONE						
				16. COORD W CUSTOMER		17. DATE						
				18. CO-NASA LTR	19. ECP/PCP	20. TAN WOA						
				21. SCN NO.								
22. ENVIR	DASH NO				REMARKS	LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL	X				260 cycles	X				X		
(2) LOW TEMP	X				260 cycles					X		X
(3) ROOM TEMP										X		X
(4) HIGH TEMP												
(5) PROOF	X				10.3 x 10 ⁵ N/m ² (147 psia)		X		X			
(6) BURST	X				14.2 x 10 ⁵ N/m ² (206 psia)		X		X			
(7) MECH PROPERTIES												
(8) PRESS. CYCLE												
(9) COLLAPSE												
(10) AXIAL LOAD												
(11) BEND LOAD												
(12) SHEAR LOAD												
(13) SPRING RATE												
(14) LEAKAGE												
(15) VIBRATION	X				5.5 x 10 ⁵ N/m ² (80 psia)	X				X		
(16) SHOCK (MECH)	X				5.5 x 10 ⁵ N/m ² (80 psia)		X			X		
(17) SHOCK (THERM)												
(18) ACCELERATION												
(19) ACOUSTICS												
(20) EMI												
(21) VACUUM												
(22) FLOW ΔP												
(23) RESPONSE TIME												
(24) PROP EXP/MIG												
(25) HUMIDITY												
(26) SALT SPRAY												
(27) SAND/DUST												
(28) TEMP CYCLE												
(29) CONT OP												
(30)												
(31)												
(32)												
(33)												
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS								
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. This unit is assumed to be standard with connecting/disconnecting handle for in-flight removal and replacement.						25. TEST COMPLETION DATE						
						26. ORIGINATOR						
						27. CHF ENGR-TECH						
						28. CHF RELIAB ENGR						
						29. CHF DES ENGR						
						30. CHF ENGR QUAL TEST						
31.												

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COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 14				
8. TITLE HEATER-ELECTRIC						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.				
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT FEED						14. EFFECTIVITY				15. MILESTONE				
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.				REMARKS		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X				5.5 x 10 ⁵ N/m ² (80 psia)		X				X		
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP														
(5) PROOF		X				10.3 x 10 ⁵ N/m ² (147 psia)				X	X			
(6) BURST		X				14.2 x 10 ⁵ N/m ² (206 psia)			X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE		X				200 cycles								
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X				5.5 x 10 ⁵ N/m ² (80 psia)			X			X		
(15) VIBRATION		X				5.5 x 10 ⁵ N/m ² (80 psia)			X				X	
(16) SHOCK (MECH)		X				5.5 x 10 ⁵ N/m ² (80 psia)			X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW/ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30) Efficiency		X				5.5 x 10 ⁵ N/m ² (80 psia)								
(31)														
(32)														
(33)														
23. SPEC NO.								SEQUENCE INDICATED BY LETTERS						
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Nonstandard unit requiring special fabrication. State-of-the-art component.								25. TEST COMPLETION DATE						
								26. ORIGINATOR						
								27. CHF ENGR-TECH						
								28. CHF RELIAB ENGR						
								29. CHF DES ENGR						
								30. CHF ENGR QUALTEST						
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM	
5. TITLE HAND VALVE				6. TYPE TEST QUAL	7. DATE	8. REVISION 15, 21, 43		
9. TEST CONTROL DWG	10. TEST PROCED DWG	11. SUPPLIER & P/N				12. E.C.C.L.		
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT AND PROPELLANT RESUPPLY				14. EFFECTIVITY		15. MILESTONE		
				16. COORD W/CUSTOMER		17. DATE		
				18. CO/NASA LTR	19. ECP/PCP	20. TAN/WOA		
				21. SCN NO.		LOW TEMP	ROOM TEMP	HIGH TEMP
22. ENVIR	DASH NO.	REMARKS						
(1) FUNCTIONAL								
(2) LOW TEMP								
(3) ROOM TEMP	X	200 cycles						X
(4) HIGH TEMP	X	200 cycles						X
(5) PROOF	X	45.9 x 10 ⁵ N/m ² (667 psia)				X	X	
(6) BURST	X	64.4 x 10 ⁵ N/m ² (934 psia)				X	X	
(7) MECH PROPERTIES								
(8) PRESS. CYCLE								
(9) COLLAPSE								
(10) AXIAL LOAD								
(11) BEND LOAD								
(12) SHEAR LOAD								
(13) SPRING RATE								
(14) LEAKAGE	X	27.5 x 10 ⁵ N/m ² (400 psia)					X	X
(15) VIBRATION	X	27.5 x 10 ⁵ N/m ² (400 psia)				X		X
(16) SHOCK (MECH)	X	27.5 x 10 ⁵ N/m ² (400 psia)				X		X
(17) SHOCK (THERM)								
(18) ACCELERATION								
(19) ACOUSTICS								
(20) EMI								
(21) VACUUM								
(22) FLOW ΔP								
(23) RESPONSE TIME								
(24) PROP EXP/MIG								
(25) HUMIDITY								
(26) SALT SPRAY								
(27) SAND/DUST								
(28) TEMP CYCLE								
(29) CONT OP								
(30)								
(31)								
(32)								
(33)								
23. SPEC NO.		SEQUENCE INDICATED BY LETTERS						
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Basic design has been qualified. Airborne design with proven seat and large actuating handle exists.						25. TEST COMPLETION DATE		
						26. ORIGINATOR		
						27. CHF ENGR-TECH		
						28. CHF RELIAB ENGR		
						29. CHF DES ENGR		
						30. CHF ENGR QUAL TEST		
31.								

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 15, 21, 43				
5. TITLE HAND VALVE						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT AND PROPELLANT RESUPPLY						14. EFFECTIVITY				15. MILESTONE				
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL														
(2) LOW TEMP														
(3) ROOM TEMP		X		200 cycles										X
(4) HIGH TEMP		X		200 cycles										X
(5) PROOF		X		10.3 x 10 ⁵ N/m ² (147 psia)					X		X			
(6) BURST		X		14.2 x 10 ⁵ N/m ² (206 psia)					X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X		5.5 x 10 ⁵ N/m ² (80 psia)						X		X		
(15) VIBRATION		X		5.5 x 10 ⁵ N/m ² (80 psia)					X				X	
(16) SHOCK (MECH)		X		5.5 x 10 ⁵ N/m ² (80 psia)					X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Basic design has been qualified. Airborne design with proven seat and large actuating handle exists.										25. TEST COMPLETION DATE				
										26. ORIGINATOR				
										27. CHF ENGR-TECH				
										28. CHF RELIAB ENGR				
										29. CHF DES ENGR				
										30. CHF ENGR QUALTEST				
31.														

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COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM 17, 38	
5. TITLE BURST DISK/RELIEF VALVE				6. TYPE TEST QUAL	7. DATE	8. REVISION		
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N		12. E.C.C.L.		
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT TANKAGE				14. EFFECTIVITY		15. MILESTONE		
				16. COORD W/CUSTOMER		17. DATE		
				18. CO/NASA LTR		19. ECP/PCP		
				20. TAN/WOA				
21. SCN NO.				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT OP	
22. ENVIR				REMARKS				
(1) FUNCTIONAL	X			(29.3 x 10 ⁵ N/m ² (425 psia) relief				X
(2) LOW TEMP								
(3) ROOM TEMP								
(4) HIGH TEMP	X			50 cycles				X
(5) PROOF								
(6) BURST								
(7) MECH PROPERTIES								
(8) PRESS. CYCLE								
(9) COLLAPSE								
(10) AXIAL LOAD								
(11) BEND LOAD								
(12) SHEAR LOAD								
(13) SPRING RATE								
(14) LEAKAGE	X			up to 27.5 x 10 ⁵ N/m ² (400 psia)				X
(15) VIBRATION	X			27.5 x 10 ⁵ N/m ² (400 psia)				X
(16) SHOCK (MECH)	X			27.5 x 10 ⁵ N/m ² (400 psia)				X
(17) SHOCK (THERM)								
(18) ACCELERATION								
(19) ACOUSTICS								
(20) EMI								
(21) VACUUM								
(22) FLOW ΔP								
(23) RESPONSE TIME								
(24) PROP EXP/MIG								
(25) HUMIDITY								
(26) SALT SPRAY								
(27) SAND/DUST								
(28) TEMP CYCLE								
(29) CONT OP								
(30)								
(31)								
(32)								
(33)								
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS				
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Standard part available from Calmec Manufacturing Company.				25. TEST COMPLETION DATE				
				26. ORIGINATOR				
				27. CHF ENGR-TECH				
				28. CHF RELIAB ENGR				
				29. CHF DES ENGR				
				30. CHF ENGR QUAL TEST				
31.								

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 17, 38						
5. TITLE BURST DISK/RELIEF VALVE						6. TYPE TEST QUAL		7. DATE		8. REVISION						
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT TANKAGE						14. EFFECTIVITY				15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA						
						21. SCN NO.										
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X		5.8 x 10 ⁵ N/m ² (85 psia) relief						X				X		
(2) LOW TEMP																
(3) ROOM TEMP																
(4) HIGH TEMP		X		50 cycles												X
(5) PROOF																
(6) BURST																
(7) MECH PROPERTIES																
(8) PRESS. CYCLE																
(9) COLLAPSE																
(10) AXIAL LOAD																
(11) BEND LOAD																
(12) SHEAR LOAD																
(13) SPRING RATE																
(14) LEAKAGE		X		Up to 5.5 x 10 ⁵ N/m ² (80 psia)								X		X		
(15) VIBRATION		X		5.5 x 10 ⁵ N/m ² (80 psia)							X				X	
(16) SHOCK (MECH)		X		5.5 x 10 ⁵ N/m ² (80 psia)							X				X	
(17) SHOCK (THERM)																
(18) ACCELERATION																
(19) ACOUSTICS																
(20) EMI																
(21) VACUUM																
(22) FLOW ΔP																
(23) RESPONSE TIME																
(24) PROP EXP/MIG																
(25) HUMIDITY																
(26) SALT SPRAY																
(27) SAND/DUST																
(28) TEMP CYCLE																
(29) CONT OP																
(30)																
(31)																
(32)																
(33)																
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS												
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Standard part available from Calmec Manufacturing Company.												25. TEST COMPLETION DATE				
												26. ORIGINATOR				
												27. CHF ENGR-TECH				
												28. CHF RELIAB ENGR				
												29. CHF DES ENGR				
												30. CHF ENGR QUALTEST				
31.																

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 18, 35 and 42				
5. TITLE CHECK VALVE						6. TYPE TEST QUAL		7. DATE		8. REVISION ↑				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT AND PROPELLANT RESUPPLY FILL; FLOW CONTROL						14. EFFECTIVITY				15. MILESTONE				
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	RESEAT CYCLE
(1) FUNCTIONAL		X		Up to 0.55 N/m ² (8 psia)						X		X		
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP		X		200 cycles									X	
(5) PROOF		X		45.9 x 10 ⁵ N/m ² (667 psia)					X		X			
(6) BURST		X		64.4 x 10 ⁵ N/m ² (934 psia)					X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X		27.5 x 10 ⁵ N/m ² (400 psia)						X		X		
(15) VIBRATION		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(16) SHOCK (MECH)		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Similar Saturn unit to be qualified.							25. TEST COMPLETION DATE							
							26. ORIGINATOR							
							27. CHF ENGR-TECH							
							28. CHF RELIAB ENGR							
							29. CHF DES ENGR							
							30. CHF ENGR QUALTEST							
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 18, 35 & 42			
8. TITLE CHECK VALVE						6. TYPE TEST QUAL		7. DATE		8. REVISION			
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.					
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT AND PROPELLANT RESUPPLY						14. EFFECTIVITY		15. MILESTONE					
						16. COORD W/CUSTOMER				17. DATE			
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA			
						21. SCN NO.		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP
22. ENVIR		DASH NO.		REMARKS									
(1) FUNCTIONAL	X				Up to 0.55 N/m ² (8 psia)				X			X	
(2) LOW TEMP	X				200 cycles								X
(3) ROOM TEMP													
(4) HIGH TEMP													
(5) PROOF	X				10.3 x 10 ⁵ N/m ² (147 psia)				X		X		
(6) BURST	X				14.2 x 10 ⁵ N/m ² (206 psia)				X		X		
(7) MECH PROPERTIES													
(8) PRESS. CYCLE													
(9) COLLAPSE													
(10) AXIAL LOAD													
(11) BEND LOAD													
(12) SHEAR LOAD													
(13) SPRING RATE													
(14) LEAKAGE	X				Up to 5.5 x 10 ⁵ N/m ² (80 psia)						X	X	
(15) VIBRATION	X				5.5 x 10 ⁵ N/m ² (80 psia)					X			X
(16) SHOCK (MECH)	X				5.5 x 10 ⁵ N/m ² (80 psia)					X			X
(17) SHOCK (THERM)													
(18) ACCELERATION													
(19) ACOUSTICS													
(20) EMI													
(21) VACUUM													
(22) FLOW ΔP													
(23) RESPONSE TIME													
(24) PROP EXP/MIG													
(25) HUMIDITY													
(26) SALT SPRAY													
(27) SAND/DUST													
(28) TEMP CYCLE													
(29) CONT OP													
(30)													
(31)													
(32)													
(33)													
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS									
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Similar Saturn unit to be qualified.									25. TEST COMPLETION DATE				
									26. ORIGINATOR				
									27. CHF ENGR-TECH				
									28. CHF RELIAB ENGR				
									29. CHF DES ENGR				
									30. CHF ENGR QUALTEST				
31.													

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 19, 41, and 46				
5. TITLE PROPELLANT-FILL CONNECTOR						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: STORAGE FILL						14. EFFECTIVITY				15. MILESTONE				
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL														
(2) LOW TEMP														
(3) ROOM TEMP		X		50 cycles at 2, 41 N/m ² (35 psia)										X
(4) HIGH TEMP		X		200 cycles at 41.3 x 10 ⁵ N/m ² (600 psia)										X
(5) PROOF		X		45.9 x 10 ⁵ N/m ² (667 psia)					X		X			
(6) BURST		X		64.4 x 10 ⁵ N/m ² (934 psia)					X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X		Up to 27.5 x 10 ⁵ (400 psia)						X		X		
(15) VIBRATION		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(16) SHOCK (MECH)		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Item 1B58697 is qualified for Saturn usage and may be used without additional qualification.										25. TEST COMPLETION DATE				
										26. ORIGINATOR				
										27. CHF ENGR-TECH				
										28. CHF RELIAB ENGR				
										29. CHF DES ENGR				
										30. CHF ENGR QUALTEST				
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 19, 41 and 46	
5. TITLE PROPELLANT-FILL CONNECTOR						6. TYPE TEST QUAL		7. DATE		8. REVISION	
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.	
13. TEST DESCRIPTION - REVISION USAGE: STORAGE FILL						14. EFFECTIVITY				15. MILESTONE	
						16. COORD W/CUSTOMER				17. DATE	
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA	
						21. SCN NO.				LOW TEMP	ROOM TEMP
22. ENVIR		DASH NO.		REMARKS							
(1) FUNCTIONAL											
(2) LOW TEMP		X		200 cycles						X	
(3) ROOM TEMP		X		50 cycles at 2.41 N/m ² (35 psia)						X	
(4) HIGH TEMP											
(5) PROOF		X		10.3 x 10 ⁵ N/m ² (147 psia)						X	
(6) BURST		X		14.2 x 10 ⁵ N/m ² (206 psia)						X	
(7) MECH PROPERTIES											
(8) PRESS. CYCLE											
(9) COLLAPSE											
(10) AXIAL LOAD											
(11) BEND LOAD											
(12) SHEAR LOAD											
(13) SPRING RATE											
(14) LEAKAGE		X		Up to 5.5 x 10 ⁵ N/m ² (80 psia)						X	
(15) VIBRATION		X		5.5 x 10 ⁵ N/m ² (80 psia)						X	
(16) SHOCK (MECH)		X		5.5 x 10 ⁵ N/m ² (80 psia)						X	
(17) SHOCK (THERM)											
(18) ACCELERATION											
(19) ACOUSTICS											
(20) EMI											
(21) VACUUM											
(22) FLOW ΔP											
(23) RESPONSE TIME											
(24) PROP EXP/MIG											
(25) HUMIDITY											
(26) SALT SPRAY											
(27) SAND/DUST											
(28) TEMP CYCLE											
(29) CONT OP											
(30)											
(31)											
(32)											
(33)											
29. SPEC NO.				SEQUENCE INDICATED BY LETTERS							
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Item 1B58697 is qualified for Saturn usage and may be used without additional qualification.										25. TEST COMPLETION DATE	
										26. ORIGINATOR	
										27. CHF ENGR-TECH	
										28. CHF RELIAB ENGR	
										29. CHF DES ENGR	
										30. CHF ENGR QUALTEST	
31.											

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 20				
5. TITLE PROPELLANT TANK						6. TYPE TEST QUAL		7. DATE		8. REVISION 4				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT STORAGE						14. EFFECTIVITY				15. MILESTONE				
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL														
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP														
(5) PROOF		X		45.9 x 10 ⁵ N/m ² (667 psia)						X	X			
(6) BURST		X		64.4 x 10 ⁵ N/m ² (934 psia)					X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE		X		200 cycles					X		X			
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X		27.5 x 10 ⁵ N/m ² (400 psia)					X			X		
(15) VIBRATION		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(16) SHOCK (MECH)		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.							25. TEST COMPLETION DATE							
							26. ORIGINATOR							
							27. CHF ENGR-TECH							
							28. CHF RELIAB ENGR							
							29. CHF DES ENGR							
							30. CHF ENGR QUALTEST							
31.														

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COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 22						
5. TITLE PRIMARY PATCH PANEL/BREAKER SUBASSEMBLY/POWER CONTROL CONNECTOR						6. TYPE TEST QUAL		7. DATE		8. REVISION						
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.								
13. TEST DESCRIPTION - REVISION USAGE: 19 POWER CONTROL						14. EFFECTIVITY		15. MILESTONE								
						16. COORD W/CUSTOMER				17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA						
						21. SCN NO.										
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL																
(2) LOW TEMP																
(3) ROOM TEMP																
(4) HIGH TEMP																
(5) PROOF																
(6) BURST																
(7) MECH PROPERTIES																
(8) PRESS. CYCLE																
(9) COLLAPSE																
(10) AXIAL LOAD																
(11) BEND LOAD																
(12) SHEAR LOAD																
(13) SPRING RATE																
(14) LEAKAGE																
(15) VIBRATION	X														X	
(16) SHOCK (MECH)	X														X	
(17) SHOCK (THERM)																
(18) ACCELERATION																
(19) ACOUSTICS																
(20) EMI																
(21) VACUUM	X														X	
(22) FLOW ΔP																
(23) RESPONSE TIME																
(24) PROP EXP/MIG																
(25) HUMIDITY																
(26) SALT SPRAY																
(27) SAND/DUST																
(28) TEMP CYCLE																
(29) CONT OP																
(30)																
(31)																
(32)																
(33)																
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS												
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Nonstandard unit, to be qualified in subsystem.												25. TEST COMPLETION DATE				
												26. ORIGINATOR				
												27. CHF ENGR-TECH				
												28. CHF RELIAB ENGR				
												29. CHF DES ENGR				
												30. CHF ENGR QUAL TEST				
				31.												

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 23						
5. TITLE RESISTOJET POWER BUS						6. TYPE TEST QUAL		7. DATE		8. REVISION						
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.								
13. TEST DESCRIPTION - REVISION USAGE: POWER CONTROL						14. EFFECTIVITY				15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA						
						21. SCN NO.										
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL																
(2) LOW TEMP																
(3) ROOM TEMP																
(4) HIGH TEMP																
(5) PROOF																
(6) BURST																
(7) MECH PROPERTIES																
(8) PRESS. CYCLE																
(9) COLLAPSE																
(10) AXIAL LOAD																
(11) BEND LOAD																
(12) SHEAR LOAD																
(13) SPRING RATE																
(14) LEAKAGE																
(15) VIBRATION		X									X				X	
(16) SHOCK (MECH)		X									X				X	
(17) SHOCK (THERM)																
(18) ACCELERATION																
(19) ACOUSTICS																
(20) EMI																
(21) VACUUM																
(22) FLOW ΔP																
(23) RESPONSE TIME																
(24) PROP EXP/MIG																
(25) HUMIDITY																
(26) SALT SPRAY																
(27) SAND/DUST																
(28) TEMP CYCLE																
(29) CONT OP																
(30)																
(31)																
(32)																
(33)																
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS												
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special item, to be qualified with subsystem.										25. TEST COMPLETION DATE						
										26. ORIGINATOR						
										27. CHF ENGR-TECH						
										28. CHF RELIAB ENGR						
										29. CHF DES ENGR						
										30. CHF ENGR QUALTEST						
				31.												

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 24						
5. TITLE INVERTER						6. TYPE TEST QUAL		7. DATE		8. REVISION						
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: POWER CONTROL--2 REQUIRED						14. EFFECTIVITY				15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA						
						21. SCN NO.										
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL	X			1 000 hours at 112% load								X		X		
(2) LOW TEMP	X			225°K (460°R)											X	
(3) ROOM TEMP																
(4) HIGH TEMP	X			390°K (700°R)											X	
(5) PROOF																
(6) BURST																
(7) MECH PROPERTIES																
(8) PRESS. CYCLE																
(9) COLLAPSE																
(10) AXIAL LOAD																
(11) BEND LOAD																
(12) SHEAR LOAD																
(13) SPRING RATE																
(14) LEAKAGE																
(15) VIBRATION	X										X				X	
(16) SHOCK (MECH)	X										X				X	
(17) SHOCK (THERM)	X			225°K to 390°K (460°R to 700°R)							X				X	
(18) ACCELERATION																
(19) ACOUSTICS	X										X				X	
(20) EMI	X										X			X		
(21) VACUUM	X			10 ⁻⁶ to 10 ⁻⁹						X		X				X
(22) FLOW ΔP																
(23) RESPONSE TIME																
(24) PROP EXP/MIG																
(25) HUMIDITY																
(26) SALT SPRAY																
(27) SAND/DUST																
(28) TEMP CYCLE																
(29) CONT OP																
(30)																
(31)																
(32)																
(33)																
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS												
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Nonstandard unit. Special fabrication may be required. Qualify as component.												25. TEST COMPLETION DATE				
												26. ORIGINATOR				
												27. CHF ENGR-TECH				
												28. CHF RELIAB ENGR				
												29. CHF DES ENGR				
												30. CHF ENGR QUAL TEST				
												31.				

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 25				
8. TITLE COMMAND CONTROLLER						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: COMMAND CONTROLLER ASSEMBLY						14. EFFECTIVITY		15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X		1 000 hours						X		X		
(2) LOW TEMP		X											X	
(3) ROOM TEMP														
(4) HIGH TEMP		X											X	
(5) PROOF														
(6) BURST														
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE														
(15) VIBRATION		X							X				X	
(16) SHOCK (MECH)		X							X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI		X							X			X		
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.								SEQUENCE INDICATED BY LETTERS						
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special component. Will require qualification.										25. TEST COMPLETION DATE				
										26. ORIGINATOR				
										27. CHF ENGR-TECH				
										28. CHF RELIAB ENGR				
										29. CHF DES ENGR				
										30. CHF ENGR QUALTEST				
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM 26	
5. TITLE ACCUMULATOR (TANK OR LINE)				6. TYPE TEST QUAL	7. DATE	8. REVISION		
9. TEST CONTROL DWG	10. TEST PROCED DWG	11. SUPPLIER & P/N				12. E.C.C.L.		
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT FEED				14. EFFECTIVITY		15. MILESTONE		
				16. COORD W/CUSTOMER		17. DATE		
				18. CO/NASA LTR	19. ECP/PCP	20. TAN/WOA		
				21. SCN NO.		LOW TEMP	ROOM TEMP	HIGH TEMP
22. ENVIR	DASH NO.						REMARKS	
(1) FUNCTIONAL								
(2) LOW TEMP								
(3) ROOM TEMP								
(4) HIGH TEMP								
(5) PROOF	X				3.24 x 10 ⁵ N/m ² (48 psia)		X	
(6) BURST	X				4.15 x 10 ⁵ N/m ² (60 psia)		X	
(7) MECH PROPERTIES								
(8) PRESS. CYCLE	X				500 cycles		X	
(9) COLLAPSE								
(10) AXIAL LOAD								
(11) BEND LOAD								
(12) SHEAR LOAD								
(13) SPRING RATE								
(14) LEAKAGE	X				2.41 x 10 ⁵ N/m ² (35 psia)		X	
(15) VIBRATION	X				2.41 x 10 ⁵ N/m ² (35 psia)		X	
(16) SHOCK (MECH)	X				2.41 x 10 ⁵ N/m ² (35 psia)		X	
(17) SHOCK (THERM)								
(18) ACCELERATION								
(19) ACOUSTICS								
(20) EMI								
(21) VACUUM								
(22) FLOW ΔP								
(23) RESPONSE TIME								
(24) PROP EXP/MIG								
(25) HUMIDITY								
(26) SALT SPRAY								
(27) SAND/DUST								
(28) TEMP CYCLE								
(29) CONT OP								
(30)								
(31)								
(32)								
(33)								
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS				
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.						25. TEST COMPLETION DATE		
						26. ORIGINATOR		
						27. CHF ENGR-TECH		
						28. CHF RELIAB ENGR		
						29. CHF DES ENGR		
						30. CHF ENGR QUAL TEST		
31.								

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 27	
8. TITLE ELECTRICAL CABLING						6. TYPE TEST QUAL		7. DATE		8. REVISION	
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.	
13. TEST DESCRIPTION - REVISION USAGE: CABLING ASSEMBLY						14. EFFECTIVITY				15. MILESTONE	
						16. COORD W/CUSTOMER				17. DATE	
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA	
						21. SCN NO.				LOW TEMP	ROOM TEMP
22. ENVIR		DASH NO.		REMARKS							
(1) FUNCTIONAL											
(2) LOW TEMP											
(3) ROOM TEMP											
(4) HIGH TEMP											
(5) PROOF											
(6) BURST											
(7) MECH PROPERTIES											
(8) PRESS. CYCLE											
(9) COLLAPSE											
(10) AXIAL LOAD											
(11) BEND LOAD											
(12) SHEAR LOAD											
(13) SPRING RATE											
(14) LEAKAGE											
(15) VIBRATION		X								X	
(16) SHOCK (MECH)		X								X	
(17) SHOCK (THERM)											
(18) ACCELERATION											
(19) ACOUSTICS											
(20) EMI											
(21) VACUUM											
(22) FLOW ΔP											
(23) RESPONSE TIME											
(24) PROP EXP/MIG											
(25) HUMIDITY											
(26) SALT SPRAY											
(27) SAND/DUST											
(28) TEMP CYCLE											
(29) CONT OP											
(30)											
(31)											
(32)											
(33)											
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS							
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special wiring installation.										25. TEST COMPLETION DATE	
										26. ORIGINATOR	
										27. CHF ENGR-TECH	
										28. CHF RELIAB ENGR	
										29. CHF DES ENGR	
										30. CHF ENGR QUAL TEST	
										31.	

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 28	
5. TITLE PRESSURANT-FILL CONNECTOR						6. TYPE TEST QUAL		7. DATE		8. REVISION	
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.			
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY						14. EFFECTIVITY		15. MILESTONE			
						16. COORD W/CUSTOMER				17. DATE	
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA	
						21. SCN NO.		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT
22. ENVIR		DASH NO.		REMARKS							
(1) FUNCTIONAL											
(2) LOW TEMP											
(3) ROOM TEMP		X		10 cycles							
(4) HIGH TEMP		X		10 cycles							
(5) PROOF		X		$3.34 \times 10^7 \text{ N/m}^2$ (5 000 psia)				X		X	
(6) BURST		X		$4.82 \times 10^7 \text{ N/m}^2$ (7 000 psia)				X		X	
(7) MECH PROPERTIES											
(8) PRESS. CYCLE											
(9) COLLAPSE											
(10) AXIAL LOAD											
(11) BEND LOAD											
(12) SHEAR LOAD											
(13) SPRING RATE											
(14) LEAKAGE		X		$2.07 \times 10^7 \text{ N/m}^2$ (3 000 psia)				X		X	
(15) VIBRATION		X		$2.07 \times 10^7 \text{ N/m}^2$ (3 000 psia)				X		X	
(16) SHOCK (MECH)		X		$2.07 \times 10^7 \text{ N/m}^2$ (3 000 psia)				X		X	
(17) SHOCK (THERM)											
(18) ACCELERATION											
(19) ACOUSTICS											
(20) EMI											
(21) VACUUM											
(22) FLOW ΔP											
(23) RESPONSE TIME											
(24) PROP EXP/MIG											
(25) HUMIDITY											
(26) SALT SPRAY											
(27) SAND/DUST											
(28) TEMP CYCLE											
(29) CONT OP											
(30)											
(31)											
(32)											
(33)											
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS							
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Saturn qualified item exists.								25. TEST COMPLETION DATE			
								26. ORIGINATOR			
								27. CHF ENGR-TECH			
								28. CHF RELIAB ENGR			
								29. CHF DES ENGR			
								30. CHF ENGR QUAL TEST			
31.											

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 29						
5. TITLE CHECK VALVE						6. TYPE TEST QUAL		7. DATE		8. REVISION						
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY						14. EFFECTIVITY				15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA						
						21. SCN NO.										
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL	X			Up to 2.75×10^5 N/m ² (40 psia)								X		X		
(2) LOW TEMP																
(3) ROOM TEMP																
(4) HIGH TEMP	X			200 cycles												X
(5) PROOF	X			3.34×10^7 N/m ² (5 000 psia)							X		X			
(6) BURST	X			4.82×10^7 N/m ² (7 000 psia)							X		X			
(7) MECH PROPERTIES																
(8) PRESS. CYCLE																
(9) COLLAPSE																
(10) AXIAL LOAD																
(11) BEND LOAD																
(12) SHEAR LOAD																
(13) SPRING RATE																
(14) LEAKAGE	X			2.07×10^7 N/m ² (3 000 psia)								X		X		
(15) VIBRATION	X			2.07×10^7 N/m ² (3 000 psia)							X				X	
(16) SHOCK (MECH)	X			2.07×10^7 N/m ² (3 000 psia)							X				X	
(17) SHOCK (THERM)																
(18) ACCELERATION																
(19) ACOUSTICS																
(20) EMI																
(21) VACUUM																
(22) FLOW ΔP																
(23) RESPONSE TIME																
(24) PROP EXP/MIG																
(25) HUMIDITY																
(26) SALT SPRAY																
(27) SAND/DUST																
(28) TEMP CYCLE																
(29) CONT OP																
(30)																
(31)																
(32)																
(33)																
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS												
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Saturn qualified unit exists.												25. TEST COMPLETION DATE				
												26. ORIGINATOR				
												27. CHF ENGR-TECH				
												28. CHF RELIAB ENGR				
												29. CHF DES ENGR				
												30. CHF ENGR QUALTEST				
31.																

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 30				
5. TITLE BURST DISK/RELIEF VALVE						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY						14. EFFECTIVITY		15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL		X		relief at $2.48 \times 10^7 \text{ N/m}^2$ (3 600 psia)						X		X		
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP		X		50 cycles										X
(5) PROOF														
(6) BURST														
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X		up to $2.07 \times 10^7 \text{ N/m}^2$ (3 000 psia)						X		X		
(15) VIBRATION		X		$2.07 \times 10^7 \text{ N/m}^2$ (3 000 psia)					X				X	
(16) SHOCK (MECH)		X		$2.07 \times 10^7 \text{ N/m}^2$ (3 000 psia)					X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Standard part available from Calmec Manufacturing Company.										25. TEST COMPLETION DATE				
26. ORIGINATOR														
27. CHF ENGR-TECH														
28. CHF RELIAB ENGR														
29. CHF DES ENGR														
30. CHF ENGR QUALTEST														
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM	
5. TITLE BURST DISK				6. TYPE TEST QUAL	7. DATE	8. REVISION 31		
9. TEST CONTROL DWG	10. TEST PROCED DWG	11. SUPPLIER & P/N		12. E.C.C.L.				
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY				14. EFFECTIVITY		15. MILESTONE		
				16. COORD W/CUSTOMER		17. DATE		
				18. CO/NASA LTR	19. ECP/PCP	20. TAN/WOA		
				21. SCN NO.		LOW TEMP	ROOM TEMP	HIGH TEMP
22. ENVIR	DASH NO.				REMARKS			
(1) FUNCTIONAL	X				relief at 4.13×10^7 N/m ² (6 000 psia)			
(2) LOW TEMP								
(3) ROOM TEMP								
(4) HIGH TEMP	X				10 cycles			X
(5) PROOF								
(6) BURST								
(7) MECH PROPERTIES								
(8) PRESS. CYCLE								
(9) COLLAPSE								
(10) AXIAL LOAD								
(11) BEND LOAD								
(12) SHEAR LOAD								
(13) SPRING RATE								
(14) LEAKAGE	X				up to 4.13×10^7 N/m ² (6 000 psia)			X
(15) VIBRATION	X				2.07×10^7 x N/m ² (3 000 psia)			X
(16) SHOCK (MECH)	X				2.07×10^7 x N/m ² (3 000 psia)			X
(17) SHOCK (THERM)								
(18) ACCELERATION								
(19) ACOUSTICS								
(20) EMI								
(21) VACUUM								
(22) FLOW ΔP								
(23) RESPONSE TIME								
(24) PROP EXP/MIG								
(25) HUMIDITY								
(26) SALT SPRAY								
(27) SAND/DUST								
(28) TEMP CYCLE								
(29) CONT OP								
(30)								
(31)								
(32)								
(33)								
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS				
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Standard part available from Calmec Manufacturing Company.						25. TEST COMPLETION DATE		
						26. ORIGINATOR		
						27. CHF ENGR-TECH		
						28. CHF RELIAB ENGR		
						29. CHF DES ENGR		
						30. CHF ENGR QUALTEST		
31.								

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM 32, 36
5. TITLE SOLENOID VALVE				6. TYPE TEST QUAL	7. DATE	8. REVISION	
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N			12. E.C.C.L.
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY				14. EFFECTIVITY		15. MILESTONE	
				16. COORD W/CUSTOMER		17. DATE	
				18. CO/NASA LTR		19. ECP/PCP	
				20. TAN/WOA			
21. SCN NO.				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT
22. ENVIR				REMARKS			
(1) FUNCTIONAL	X			up to 4.13×10^7 N/m ² (6 000 psia)			
(2) LOW TEMP					X		X
(3) ROOM TEMP	X			200 cycles at 2.07×10^7 N/m ² (3 000 psia)			
(4) HIGH TEMP							X
(5) PROOF	X			3.34×10^7 N/m ² (5 000 psia)			
(6) BURST	X			4.82×10^7 N/m ² (7 000 psia)			
(7) MECH PROPERTIES					X		X
(8) PRESS. CYCLE					X		X
(9) COLLAPSE							
(10) AXIAL LOAD							
(11) BEND LOAD							
(12) SHEAR LOAD							
(13) SPRING RATE							
(14) LEAKAGE	X			up to 2.07×10^7 N/m ² (3 000 psia)			
(15) VIBRATION	X			2.07×10^7 N/m ² (3 000 psia)			
(16) SHOCK (MECH)	X			2.07×10^7 N/m ² (3 000 psia)			
(17) SHOCK (THERM)					X		X
(18) ACCELERATION							
(19) ACOUSTICS							
(20) EMI							
(21) VACUUM							
(22) FLOW ΔP							
(23) RESPONSE TIME							
(24) PROP EXP/MIG							
(25) HUMIDITY							
(26) SALT SPRAY							
(27) SAND/DUST							
(28) TEMP CYCLE							
(29) CONT OP							
(30)							
(31)							
(32)							
(33)							
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS			
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Saturn qualified valve exists.				25. TEST COMPLETION DATE			
				26. ORIGINATOR			
				27. CHF ENGR-TECH			
				28. CHF RELIAB ENGR			
				29. CHF DES ENGR			
				30. CHF ENGR QUALTEST			
				31.			

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 33				
5. TITLE PRESSURANT TANK						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PRESSURANT TANK						14. EFFECTIVITY		15. MILESTONE						
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL														
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP														
(5) PROOF	X				3.34 x 10 ⁷ N/m ² (5 000 psia)				X	X				
(6) BURST	X				4.82 x 10 ⁷ N/m ² (7 000 psia)			X			X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE	X				10 cycles			X			X			
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE	X				2.07 x 10 ⁷ N/m ² (3 000 psia)			X			X			
(15) VIBRATION	X				2.07 x 10 ⁷ N/m ² (3 000 psia)			X				X		
(16) SHOCK (MECH)	X				2.07 x 10 ⁷ N/m ² (3 000 psia)			X				X		
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.												25. TEST COMPLETION DATE		
26. ORIGINATOR														
27. CHF ENGR-TECH														
28. CHF RELIAB ENGR														
29. CHF DES ENGR														
30. CHF ENGR QUAL TEST														
31.														

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COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 39				
5. TITLE PROPELLANT TANK (RESUPPLY)						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY						14. EFFECTIVITY				15. MILESTONE				
						16. COORD W/CUSTOMER				17. DATE				
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.		REMARKS				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE
(1) FUNCTIONAL														
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP														
(5) PROOF		X		45.9 x 10 ⁵ N/m ² (667 psia)						X	X			
(6) BURST		X		64.4 x 10 ⁵ N/m ² (934 psia)					X		X			
(7) MECH PROPERTIES														
(8) PRESS. CYCLE		X		200 cycles					X		X			
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X		27.5 x 10 ⁵ N/m ² (400 psia)					X			X		
(15) VIBRATION		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(16) SHOCK (MECH)		X		27.5 x 10 ⁵ N/m ² (400 psia)					X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS										
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.												25. TEST COMPLETION DATE		
												26. ORIGINATOR		
												27. CHF ENGR-TECH		
												28. CHF RELIAB ENGR		
												29. CHF DES ENGR		
												30. CHF ENGR QUALTEST		
												31.		

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM 40
5. TITLE PROPELLANT BLADDER				6. TYPE TEST QUAL		7. DATE	8. REVISION
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N			12. E.C.C.L.
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY				14. EFFECTIVITY		15. MILESTONE	
				16. COORD W/CUSTOMER		17. DATE	
				18. CO/NASA LTR		19. ECP/PCP	
				20. TAN/WOA			
21. SCN NO.				LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT OP
22. ENVIR				REMARKS			
DASH NO. →							
(1) FUNCTIONAL				up to 3.45 x 10 ⁵ N/m ² (50 psia)			
(2) LOW TEMP							
(3) ROOM TEMP							
(4) HIGH TEMP							
(5) PROOF							
(6) BURST							
(7) MECH PROPERTIES							
(8) PRESS. CYCLE				10 cycles			
(9) COLLAPSE							
(10) AXIAL LOAD							
(11) BEND LOAD							
(12) SHEAR LOAD							
(13) SPRING RATE							
(14) LEAKAGE							
(15) VIBRATION							
(16) SHOCK (MECH)							
(17) SHOCK (THERM)							
(18) ACCELERATION							
(19) ACOUSTICS							
(20) EMI							
(21) VACUUM							
(22) FLOW/ΔP							
(23) RESPONSE TIME							
(24) PROP EXP/MIG							
(25) HUMIDITY							
(26) SALT SPRAY							
(27) SAND/DUST							
(28) TEMP CYCLE							
(29) CONT OP							
(30)							
(31)							
(32)							
(33)							
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS			
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.				25. TEST COMPLETION DATE			
				26. ORIGINATOR			
				27. CHF ENGR-TECH			
				28. CHF RELIAB ENGR			
				29. CHF DES ENGR			
				30. CHF ENGR QUAL TEST			
31.							

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM
5. TITLE FILTER				6. TYPE TEST QUAL		7. DATE	8. REVISION
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N			12. E.C.C.L.
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY				14. EFFECTIVITY		15. MILESTONE	
				16. COORD W/CUSTOMER		17. DATE	
				18. CO/NASA LTR		19. ECP/PCP	
				20. TAN/WOA		21. SCN NO.	
22. ENVIR	DASH NO.						REMARKS
(1) FUNCTIONAL	X						27.5 x 10 ⁵ N/m ² (400 psia)
(2) LOW TEMP							
(3) ROOM TEMP							
(4) HIGH TEMP							
(5) PROOF	X						45.9 x 10 ⁵ N/m ² (667 psia)
(6) BURST	X						64.4 x 10 ⁵ N/m ² (934 psia)
(7) MECH PROPERTIES							
(8) PRESS. CYCLE							
(9) COLLAPSE							
(10) AXIAL LOAD							
(11) BEND LOAD							
(12) SHEAR LOAD							
(13) SPRING RATE							
(14) LEAKAGE	X						27.5 x 10 ⁵ N/m ² (400 psia)
(15) VIBRATION	X						27.5 x 10 ⁵ N/m ² (400 psia)
(16) SHOCK (MECH)	X						27.5 x 10 ⁵ N/m ² (400 psia)
(17) SHOCK (THERM)							
(18) ACCELERATION							
(19) ACOUSTICS							
(20) EMI							
(21) VACUUM							
(22) FLOW ΔP							
(23) RESPONSE TIME							
(24) PROP EXP/MIG							
(25) HUMIDITY							
(26) SALT SPRAY							
(27) SAND/DUST							
(28) TEMP CYCLE							
(29) CONT OP							
(30)							
(31)							
(32)							
(33)							
23. SPEC NO.		SEQUENCE INDICATED BY LETTERS					
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Similar unit already qualified for Saturn (Westem Filter - P/N 1B55934). Higher pressure requirement would necessitate requalification.							25. TEST COMPLETION DATE
26. ORIGINATOR							
27. CHF ENGR-TECH							
28. CHF RELIAB ENGR							
29. CHF DES ENGR							
30. CHF ENGR QUALTEST							
31.							

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 45				
5. TITLE VENTURI						6. TYPE TEST QUAL		7. DATE		8. REVISION				
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.						
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT RESUPPLY						14. EFFECTIVITY		15. MILESTONE						
						16. COORD W/CUSTOMER		17. DATE						
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA				
						21. SCN NO.								
22. ENVIR		DASH NO.				REMARKS		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	RESEAT CYCLE
(1) FUNCTIONAL		X				27.5 x 10 ⁵ N/m ² (400 psia)			X			X		
(2) LOW TEMP														
(3) ROOM TEMP														
(4) HIGH TEMP														
(5) PROOF		X				45.9 x 10 ⁵ N/m ² (667 psia)			X			X		
(6) BURST		X				64.4 x 10 ⁵ N/m ² (934 psia)			X			X		
(7) MECH PROPERTIES														
(8) PRESS. CYCLE														
(9) COLLAPSE														
(10) AXIAL LOAD														
(11) BEND LOAD														
(12) SHEAR LOAD														
(13) SPRING RATE														
(14) LEAKAGE		X				27.5 x 10 ⁵ N/m ² (400 psia)			X			X		
(15) VIBRATION		X				27.5 x 10 ⁵ N/m ² (400 psia)			X				X	
(16) SHOCK (MECH)		X				27.5 x 10 ⁵ N/m ² (400 psia)			X				X	
(17) SHOCK (THERM)														
(18) ACCELERATION														
(19) ACOUSTICS														
(20) EMI														
(21) VACUUM														
(22) FLOW ΔP														
(23) RESPONSE TIME														
(24) PROP EXP/MIG														
(25) HUMIDITY														
(26) SALT SPRAY														
(27) SAND/DUST														
(28) TEMP CYCLE														
(29) CONT OP														
(30)														
(31)														
(32)														
(33)														
23. SPEC NO.						SEQUENCE INDICATED BY LETTERS								
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.								25. TEST COMPLETION DATE						
								26. ORIGINATOR						
								27. CHF ENGR-TECH						
								28. CHF RELIAB ENGR						
								29. CHF DES ENGR						
								30. CHF ENGR QUALTEST						
31.														

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 47								
5. TITLE FLEXIBLE PROPELLANT TRANSFER LINE						6. TYPE TEST QUAL		7. DATE		8. REVISION								
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N						12. E.C.C.L.								
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT TRANSFER						14. EFFECTIVITY		15. MILESTONE										
						16. COORD W/CUSTOMER				17. DATE								
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA								
						21. SCN NO.												
22. ENVIR		DASH NO.		REMARKS						LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE		
(1) FUNCTIONAL																		
(2) LOW TEMP																		
(3) ROOM TEMP																		
(4) HIGH TEMP																		
(5) PROOF	X				45.9 x 10 ⁵ N/m ² (667 psia)						X		X					
(6) BURST	X				64.4 x 10 ⁵ N/m ² (934 psia)					X			X					
(7) MECH PROPERTIES																		
(8) PRESS. CYCLE	X				200 cycles					X			X					
(9) COLLAPSE																		
(10) AXIAL LOAD																		
(11) BEND LOAD																		
(12) SHEAR LOAD																		
(13) SPRING RATE																		
(14) LEAKAGE	X				27.5 x 10 ⁵ N/m ² (400 psia)						X		X					
(15) VIBRATION	X				27.5 x 10 ⁵ N/m ² (400 psia)					X					X			
(16) SHOCK (MECH)	X				27.5 x 10 ⁵ N/m ² (400 psia)					X					X			
(17) SHOCK (THERM)																		
(18) ACCELERATION																		
(19) ACOUSTICS																		
(20) EMI																		
(21) VACUUM																		
(22) FLOW ΔP																		
(23) RESPONSE TIME																		
(24) PROP EXP/MIG																		
(25) HUMIDITY																		
(26) SALT SPRAY																		
(27) SAND/DUST																		
(28) TEMP CYCLE																		
(29) CONT OP																		
(30)																		
(31)																		
(32)																		
(33)																		
23. SPEC NO.		SEQUENCE INDICATED BY LETTERS																
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.																	25. TEST COMPLETION DATE	
26. ORIGINATOR																		
27. CHF ENGR-TECH																		
28. CHF RELIAB ENGR																		
29. CHF DES ENGR																		
30. CHF ENGR QUAL TEST																		
31.																		

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM 50
8. TITLE HAND VALVE				6. TYPE TEST QUAL		7. DATE	
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N			12. E.C.C.L.
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT TANKAGE AND FEED				14. EFFECTIVITY		15. MILESTONE	
				16. COORD W/CUSTOMER		17. DATE	
				18. CO/NASA LTR		19. ECP/PCP	
				20. TAN/WOA		21. SCN NO.	
22. ENVIR				REMARKS			
DASH NO.							
(1) FUNCTIONAL							
(2) LOW TEMP				X 200 cycles			
(3) ROOM TEMP				X 200 cycles			
(4) HIGH TEMP							
(5) PROOF				X 10.3 x 10 ⁵ N/m ² (147 psia)			
(6) BURST				X 14.2 x 10 ⁵ N/m ² (205 psia)			
(7) MECH PROPERTIES							
(8) PRESS. CYCLE							
(9) COLLAPSE							
(10) AXIAL LOAD							
(11) BEND LOAD							
(12) SHEAR LOAD							
(13) SPRING RATE							
(14) LEAKAGE				X up to 5.5 x 10 ⁵ N/m ² (80 psia)			
(15) VIBRATION				X 5.5 x 10 ⁵ N/m ² (80 psia)			
(16) SHOCK (MECH)				X 5.5 x 10 ⁵ N/m ² (80 psia)			
(17) SHOCK (THERM)							
(18) ACCELERATION							
(19) ACOUSTICS							
(20) EMI							
(21) VACUUM							
(22) FLOW ΔP							
(23) RESPONSE TIME							
(24) PROP EXP/MIG							
(25) HUMIDITY							
(26) SALT SPRAY							
(27) SAND/DUST							
(28) TEMP CYCLE							
(29) CONT OP							
(30)							
(31)							
(32)							
(33)							
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS			
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Basic design exists. Qualification testing required.				25. TEST COMPLETION DATE			
				26. ORIGINATOR			
				27. CHF ENGR-TECH			
				28. CHF RELIAB ENGR			
				29. CHF DES ENGR			
				30. CHF ENGR QUALTEST			
				31.			

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 51					
5. TITLE CRYOGENIC H ₂ TANKAGE (INCLUDING INSULATION AND COOLING COIL)						6. TYPE TEST QUAL		7. DATE		8. REVISION					
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.							
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT TANKAGE AND FEED						14. EFFECTIVITY		15. MILESTONE							
						16. COORD W/CUSTOMER				17. DATE					
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA					
						21. SCN NO.		LOW TEMP		ROOM TEMP		HIGH TEMP		STRUCT	
22. ENVIR		DASH NO.		REMARKS											
(1) FUNCTIONAL															
(2) LOW TEMP															
(3) ROOM TEMP															
(4) HIGH TEMP															
(5) PROOF X 10.3 x 10 ⁵ N/m ² (147 psia) X X															
(6) BURST X 14.2 x 10 ⁵ N/m ² (206 psia) X X															
(7) MECH PROPERTIES															
(8) PRESS. CYCLE X 200 cycles X X															
(9) COLLAPSE															
(10) AXIAL LOAD															
(11) BEND LOAD															
(12) SHEAR LOAD															
(13) SPRING RATE															
(14) LEAKAGE															
(15) VIBRATION X 5.5 x 10 ⁵ N/m ² (80 psia) X X															
(16) SHOCK (MECH) X 5.5 x 10 ⁵ N/m ² (80 psia) X X															
(17) SHOCK (THERM) X 5.5 x 10 ⁵ N/m ² (80 psia) X X															
(18) ACCELERATION															
(19) ACOUSTICS															
(20) EMI															
(21) VACUUM															
(22) FLOW ΔP															
(23) RESPONSE TIME															
(24) PROP EXP/MIG															
(25) HUMIDITY															
(26) SALT SPRAY															
(27) SAND/DUST															
(28) TEMP CYCLE															
(29) CONT OP															
(30)															
(31)															
(32)															
(33)															
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS											
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication will be required.										25. TEST COMPLETION DATE					
26. ORIGINATOR															
27. CHF ENGR-TECH															
28. CHF RELIAB ENGR															
29. CHF DES ENGR															
30. CHF ENGR QUAL TEST															
31.															

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.	2. ECP/PCP LOG	3. LOG NO.	4. LINE ITEM	
5. TITLE ELECTRIC HEATER				6. TYPE TEST QUAL	7. DATE	8. REVISION 52		
9. TEST CONTROL DWG	10. TEST PROCED DWG	11. SUPPLIER & P/N				12. E.C.C.L.		
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT TANKAGE				14. EFFECTIVITY		15. MILESTONE		
				16. COORD W/CUSTOMER		17. DATE		
				18. CO/NASA LTR	19. ECP/PCP	20. TAN/WOA		
				21. SCN NO.		LOW TEMP	ROOM TEMP	HIGH TEMP
22. ENVIR	DASH NO.						REMARKS	
(1) FUNCTIONAL								
(2) LOW TEMP								
(3) ROOM TEMP								
(4) HIGH TEMP								
(5) PROOF								
(6) BURST								
(7) MECH PROPERTIES								
(8) PRESS. CYCLE	X			50 cycles			X	
(9) COLLAPSE								
(10) AXIAL LOAD								
(11) BEND LOAD								
(12) SHEAR LOAD								
(13) SPRING RATE								
(14) LEAKAGE								
(15) VIBRATION	X			$5.5 \times 10^5 \text{ N/m}^2$ (80 psia)	X		X	
(16) SHOCK (MECH)	X			$5.5 \times 10^5 \text{ N/m}^2$ (80 psia)	X		X	
(17) SHOCK (THERM)	X			$5.5 \times 10^5 \text{ N/m}^2$ (80 psia)			X	
(18) ACCELERATION								
(19) ACOUSTICS								
(20) EMI								
(21) VACUUM								
(22) FLOW/ΔP								
(23) RESPONSE TIME								
(24) PROP EXP/MIG								
(25) HUMIDITY								
(26) SALT SPRAY								
(27) SAND/DUST								
(28) TEMP CYCLE								
(29) CONT OP								
(30)								
(31)								
(32)								
(33)								
23. SPEC NO.				SEQUENCE INDICATED BY LETTERS				
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Special fabrication required.						25. TEST COMPLETION DATE		
						26. ORIGINATOR		
						27. CHF ENGR-TECH		
						28. CHF RELIAB ENGR		
						29. CHF DES ENGR		
						30. CHF ENGR QUAL TEST		
31.								

COMPONENT TEST CONTROL AUTHORITY				1. BASIC PART NO.		2. ECP/PCP LOG		3. LOG NO.		4. LINE ITEM 53							
5. TITLE PRESSURE SWITCH						6. TYPE TEST QUAL		7. DATE		8. REVISION							
9. TEST CONTROL DWG		10. TEST PROCED DWG		11. SUPPLIER & P/N				12. E.C.C.L.									
13. TEST DESCRIPTION - REVISION USAGE: PROPELLANT TANKAGE						14. EFFECTIVITY		15. MILESTONE									
						16. COORD W/CUSTOMER				17. DATE							
						18. CO/NASA LTR		19. ECP/PCP		20. TAN/WOA							
						21. SCN NO.											
22. ENVIR						DASH NO.		REMARKS		LOW TEMP	ROOM TEMP	HIGH TEMP	STRUCT	OP	NON-OP	REPEAT CYCLE	
(1) FUNCTIONAL		X				up to 5.5×10^5 N/m ² (80 psia)				X				X			
(2) LOW TEMP		X				200 cycles											
(3) ROOM TEMP																	
(4) HIGH TEMP																	
(5) PROOF		X				10.3×10^5 N/m ² (147 psia)				X				X			
(6) BURST		X				14.2×10^5 N/m ² (206 psia)				X				X			
(7) MECH PROPERTIES																	
(8) PRESS. CYCLE																	
(9) COLLAPSE																	
(10) AXIAL LOAD																	
(11) BEND LOAD																	
(12) SHEAR LOAD																	
(13) SPRING RATE																	
(14) LEAKAGE		X				up to 5.5×10^5 N/m ² (80 psia)				X				X			
(15) VIBRATION		X				5.5×10^5 N/m ² (80 psia)					X				X		
(16) SHOCK (MECH)		X				5.5×10^5 N/m ² (80 psia)					X				X		
(17) SHOCK (THERM)																	
(18) ACCELERATION																	
(19) ACOUSTICS																	
(20) EMI																	
(21) VACUUM																	
(22) FLOW ΔP																	
(23) RESPONSE TIME																	
(24) PROP EXP/MIG																	
(25) HUMIDITY																	
(26) SALT SPRAY																	
(27) SAND/DUST																	
(28) TEMP CYCLE																	
(29) CONT OP																	
(30)																	
(31)																	
(32)																	
(33)																	
23. SPEC NO.						SEQUENCE INDICATED BY LETTERS											
24. NOTES: 1. ALL COMPONENTS RECEIVE PRE & POST TEST 2. TEMP PERTAINS TO CONDITIONED TEMP OF COMPONENT 3. FUNCTIONAL INCLUDES (WHERE APPLICABLE), ELECTRICAL, CRACK & RESEAT AND OTHERWISE ANY NORMAL FUNCTION OF COMPONENT PLUS PERFORMANCE EVALUATION. Basically a standard component.												25. TEST COMPLETION DATE					
												26. ORIGINATOR					
												27. CHF ENGR-TECH					
												28. CHF RELIAB ENGR					
												29. CHF DES ENGR					
												30. CHF ENGR QUAL TEST					
												31.					