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GENERAL SPECIFICATION

FOR

PAYLOAD QUALIFICATION

AND ACCEPTANCE

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1.0 SCOPE

This specification defines the environments which the [redacted] Payload will encounter during ascent, orbital, and recovery operations; further, it establishes qualification and acceptance test requirements based on these criteria. Boost phase environments are based on the use of the Thorad. This document may be used as an intrinsic part of detail equipment specifications.

1.1 Purpose

a. To consolidate all pertinent environmental and test criteria.

b. To establish qualification and acceptance test levels.

c. To provide design reference to be used in optimizing reliability.

d. To standardize requirements and tolerances such that repeatability may be achieved.

1.2 Use

This document may be used in conjunction with detail specification to specify requirements against which the payload shall be designed, qualified, and accepted.

1.3 Application

Detail specifications may be combined with this document to specify design or test requirements. In these instances the following additional specific requirements shall be specified:

a. Sequence of testing or a statement that such a sequence is unnecessary.

b. Acceptable performance limits before and after the test.

c. Standards of acceptance for qualification.

d. Arrangement and mode of operation.

e. A statement as to whom should receive records and data.

f. Specific locations of test instrumentation.

g. Special tests and unusual test conditions.

h. Location and orientation of components which are not to be qualified for the general payload usage.

i. Design operating and shelf life

j. Location of points of comparison to determine resonances.

k. Deviations to the general specification.

l. Which of the tests herein shall be performed.

1.4 Deviations

a. Requirements may be modified if it is shown that installations protect equipments from existing environments.

b. Requirements may be modified if it can be shown that equipment performance is not sensitive to certain phases of operation.

c. Requirements may be modified if an increase in severity of requirement will not result in increased weight and power.

1.5 Severity of Qualification Tests

The qualification tests specified herein are for qualifying equipment designed for use in the payload (Agena interface forward) only. They are not intended as acceptance tests suitable for verifying manufacturing integrity. The test levels are therefore set sufficiently high to compensate for absence of combined environments during testing, normal variations in manufacture, and to verify design safety factors.

1.6 Definitions

1.6.1 Component or Minor Subassembly

The lowest level of assembly of parts, arranged within one package that will permit performance of some prescribed function and which is easily removable as a self-contained functional unit. In general, items here defined as components are not disassemblable to a lower level by payload personnel.

1.6.2 System

An assembly which integrates the outputs of various components into a final prescribed function or group of functions. For the purposes of this specification, systems are divided into three groups by weight:

a. 75 lbs. or less

b. 76 lbs. to 250 lbs.

c. Above 250 lbs.

1.6.3 Structure

An assembly whose major function is the support of components and systems.

1.6.4 "Non-recoverable" is defined as any component, system, or structure which does not re-enter.

1.6.5 "Payload System Complete" is defined as the spaceframe structures and all internal parts, with the exception of simulated batteries, parachutes, retro rockets, and those live pyros not being tested.

2.0 APPLICABLE DOCUMENTS

2.1 The intent of the following documents shall form the basis of this specification.

2.1.1 LMSC 6117D, General Environmental Specification

LMSC 675653, Satellite Encountered Radiation Doses from Trapped Particles

2.2 Precedence of Specifications

In the event of conflict between this specification and the detail specifications, the detail specifications shall take precedence.

2.3 Conflict

This document is not intended to conflict in any way with mandatory Federal Specifications.

3.0 ENVIRONMENTAL CRITERIA

Payload components, systems, and structures shall be designed to fulfill operation objectives in all of the following phases, under maximum stresses predicted for these phases:

a. Thorad Booster Phase

b. Agena Burn Phase

c. Orbital Flight

d. Re-entry

The following stresses to be here defined are actual loads either measured or predicted.

a. Shock

b. Vibration

c. Acceleration

d. Temperature

e. Pressure

f. Radiation

g. Humidity

Handling equipment shall be designed such that stresses encountered in storage and test shall in no case exceed those defined in operational phases.

3.1 Thorad Booster Phase

3.1.1 Sinusoidal Vibration

a. Complete Payload

Longitudinal

Freq. (cps)	Level (g's)
15 - 20	3.0

Lateral

Freq. (cps)	Level (g's)
15 - 20	0.25

Disturbance occurs at Thorad Burnout (T-200 seconds)

b. Systems

Systems receive inputs as shown in para. 3.1.1 a.

Resonances in the 15-20 cps range shall be avoided.

c. Components - See 3.1.1 b. - Components may have any orientation.

3.1.2 Random Vibration

a. Complete payload - 6 g's rms overall - all axes at Thorad Ignition and in transonic region.

b. System resonances at all frequencies are excited sinusoidally.

c. Components (see. 3.1.2 b.)

3.1.3 Steady-State Acceleration

a. Complete Payload

6 g's axial

1 g lateral

At Thorad Burnout

Components may have any orientation. See 3.1.1 a.

3.1.4 Shock at the Agena/Payload Interface

a. Complete Payload

1. Thorad Ignition Phase 16g's longitudinal

2 g's lateral

2. Separation pyro event

(Under investigation) _____ g's - all axes

3.1.5 Temperature

a. Complete Payload

The following correlation curves based upon predicted skin temperatures for ten design trajectories shall be used as a basis for ascent thermal design. These data are based on the assumption that the payload skin outer surface has the emissivity of gold. Higher ascent temperatures are found in the +Z side of the payload during ascent.

b. Internal Systems

$70^{\circ}F \pm 30^{\circ}F$

c. Components

See 3.1.5 b.

3.1.6 Pressure Static

a. Complete Payload

1. 0.4 - 0.8 psi differential at the payload Agena interface at launch.

2. The absolute pressure during ascent is reduced from sea level to 25 mm Hg. in 90 seconds. A maximum pressure reduction rate of 15 mm Hg.

per second occurs in the transonic region for a maximum duration of 30 seconds.

b. Internal Systems

See 3.1.6 a.

c. Components

See 3.1.6 a.

3.1.7 Dynamic Pressure

a. Complete Payload

Maximum dynamic pressure is 800 p.s.f.

b. Internal Systems

Not applicable

c. Components

Not applicable

3.1.8 Radiation (Negligible)

3.1.9 Humidity

a. Payload Complete

External surface

exposure to relative humidity up to 100%.

b. Internal Systems

50% humidity maximum

c. Components

(See 3.1.9 b)

3.2 Agena Burn Phase

3.2.1 Sinusoidal Vibration

Negligible

3.2.2 Random Vibration

Negligible

3.2.3 Acceleration

a. Complete Payload

5 g's axial
1 g lateral
at Agena Shut Off

3.2.4 Shock at Agena/Payload Interface

a. Payload Separation

Pyrotechnic Event

(Under investigation)____ all axes

3.2.5 Pressure

10^{-2} - 10^{-13} mm Hg

3.2.6 Temperature

Note: All temperatures are decreasing after the Thorad Phase and are not critical.

3.2.7 Radiation

Negligible

3.3 Orbital Flight

All environmental stresses except temperature pressure and radiation are negligible.

3.3.1 Temperature

a. Complete Payload

Maximum orbital skin temperatures are uniform longitudinally, varying overall between 140°F and 220°F. Differentials on opposite ends of lateral axes are 150°F maximum. The temperatures are cyclic and a function of the orbit.

b. Internal Systems

The heat sink for internal systems shall be maintained at 65 ± 30°F, thus providing an effective environment of 70 ± 30°F.

c. Components

See 3.3.1 b.

3.3.2 Pressure

a. Complete Payload

10^{-13} mm Hg external

b. Systems

20 - 100 microns internally

c. Components

See 3.3.2 b.

3.3.3 Radiation

a. Complete Payload System

Electron dose of 1.6×10^{-3} rads per day.

Trapped particle dose of 2×10^{-1} rads per day.

3.4 Re-entry (Recovery System only)

3.4.1 Vibration

Negligible

* 3.4.2 Acceleration (Reference Figure 2)

12.5 g's axial

5 g's lateral (concurrently for 35 seconds duration)

* 3.4.3 Shock

a. Air Recovery

13 g's longitudinal (individually)

5 g's lateral

b. Separation pyrotechnic events (at the SRV interface)

All axes

3.4.4 Temperature (Reference Figure 1)

125°F max. inside recovery capsule skin (at parachute deployment).

3.4.5 Pressure (Reference Figure 2)

a. De-orbit & Separation - 10^{-13} mm Hg - 5×10^{-7} mm Hg

b. Re-entry - 5×10^{-7} - 5.6 in Hg

c. Recovery - 5.6 in Hg - 30.5 in Hg

* Based on a fully loaded recovery system.

4.0 TEST REQUIREMENTS

Recoverable units must endure non-recoverable stresses. If the non-recoverable stress is more severe than that specified for recoverable units, the non-recoverable stress shall apply. If a non-recoverable stress is omitted in the recoverable schedule of tests, the omitted stress shall automatically apply to the recoverable unit.

4.1 Vibration Testing

a. The equipment shall be loaded and operated in accordance with the equipment qualification test specification prior and subsequent to testing. The specimen shall be inspected for damage and defects resulting from vibration at the conclusion of test periods, as specified in the equipment qualification specification.

b. Resonances at frequencies other than those in the range from 15 - 20 cps shall be monitored and used to limit the input of the shaker to accelerations such that individual components shall not receive greater than their specified levels. Resonances in the 15 - 20 cps range shall subject the equipment to further design review.

c. The test fixture shall be vibrated alone and the resonant frequencies noted. The fixture shall be modified until all resonant frequencies are above 400 cps for small systems and components and 100 cps for assemblies over 75 lbs. The equipment shall be secured at its mounting points to the fixture and 1/4 - 1/2 g resonance searches of the fixture-equipment combination shall be conducted in all 3 axes.

d. All accelerometers specified shall be monitored to determine resonance of the units on which they are mounted.

Induced vibration along axes other than those being excited principally shall be measured.

e. Sinusoidal vibration shall be applied separately along each of three mutually perpendicular axes at the amplitude values specified. The test along each axis shall consist of a single sinu-

soidal sweep, starting at the lowest frequency limit and proceeding at a sweep rate of 3 minutes per octave to the highest frequency limit in not less than 25 minutes. All resonant frequencies shall be noted and recorded.

Resonant frequencies shall be determined by observation of increased acceleration amplitudes or displacements of equipment being tested. Specific dwell at resonance is not required.

f. Input cross talk in normal axes shall not exceed 100% of the specified input.

g. Input shall be applied as near as possible to the CG of the equipment being tested. Attachment points shall be monitored.

h. Axes refer to vehicle axes.

4.1.1 Sinusoidal Testing

4.1.1.1 System Vibration

a. Recoverable systems weighing 75 lbs or less

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.5 inches peak to peak
15 - 20	7.0 g's, 0 - peak
20 - 400	5.0 g's, 0 - peak
400 - 2000	7.5 g's, 0 - peak

Lateral Axes

Frequency (cps)	Level
11 - 2000	3.0 g's, 0-peak

If specimen axis is not defined, longitudinal axis levels shall be used.

b. Non-recoverable systems weighing 75 lbs or less

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.5 inches, peak-to-peak
15 - 20	7.0 g's, 0 - peak
20 - 400	5.0 g's, 0 - peak
400 - 2000	7.5 g's, 0 - peak

4.1.1.1 (Continued)

Lateral Axes

Frequency (cps)	Level
11 - 2000	3.0

c. Recoverable Systems weighing from 76 lbs. through 250 lbs.

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.38 inches peak-to-peak
15 - 20	4.0 g's, 0 - peak
20 - 400	3.0 g's, 0 - peak
400 - 2000	3.5 g's, 0 - peak

Lateral Axes

Frequency (cps)	Level (g's)
11 - 2000	2.0

d. Non-recoverable systems weighing from 76 lbs. through 250 lbs.

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.38 inches peak to peak
15 - 20	4.0 g's,0 - peak
20 - 400	3.0 g's,0 - peak
400 - 2000	3.5 g's,0 - peak

Lateral Axes

Frequency (cps)	Level (g's)
11 - 2000	2.0

e. Recoverable systems weighing more than 250 lbs.

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.38 inches peak to peak
15 - 20	4.0 g's,0 - peak
20 - 400	3.0 g's,0 - peak
400 - 2000	3.5 g's,0 - peak

Lateral Axes

Frequency (cps)	Level (g's)
11 - 2000	2.0

f. Non-recoverable systems weighing more than 250 lbs.

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.18 inches peak to peak
15 - 20	3.0 g's, 0 - peak
20 - 400	1.5 g's, 0 - peak
400 - 2000	3.0 g's, 0 - peak

Lateral Axes

Frequency (cps)	Level (g's 0 - peak)
11 - 2000	1.0

4.1.1.2 Structures Vibration

a. Recoverable Structures

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.4 inches peak-to-peak
15 - 400	5 g's 0 - peak
400 - 2000	10 g's 0 - peak

Lateral Axes

Frequency (cps)	Level
15 - 2000	3.0

b. Non-recoverable Structures

Longitudinal Axis

Frequency (cps)	Level
5 - 15	0.4 inches peak to peak
15 - 400	5 g's 0 - peak
400 - 2000	10 g's 0 - peak

Lateral Axes

Frequency (cps)	Level
15 - 2000	3.0

4.1.1.3 Components and Minor Subassembly Vibration

The component shall be hard-mounted on the vibration exciter.

a. Recoverable Components - All axes

Frequency (cps)	Level
5 - 20	0.5 inches peak to peak
15 - 20	7.0 g's 0 - peak
20 - 400	5.0 g's 0 - peak
400 - 2000	10.0 g's 0 - peak

b. Non-Recoverable and Minor Subassembly Components - All Axes

Frequency (cps)	Level
5 - 20	0.5 inches peak to peak
15 - 20	7.0 g's 0 - peak
20 - 400	5.0 g's 0 - peak
400 - 2000	10.0 g's 0 - peak

4.1.2 Random Vibration

The random vibration shall be conducted in the frequency range of 20 - 2000 cps. The method may be either broad or narrow band. The equipment shall be vibrated for 180 seconds in each of the three mutually perpendicular axes at maximum level specified. Paragraphs 4.1 a, c, d, f, g and h shall apply.

4.1.2.1 System Vibration

a. Recoverable systems weighing 75 lbs. or less

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20 - 400	0.05	
400 - 2000	0.12	14.5

b. Non-recoverable systems weighing 75 lbs. or less

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20 - 400	0.05	
400 - 2000	0.12	14.5

c. Recoverable systems weighing from 76 lbs. to 250 lbs.

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20 - 400	0.05	
400 - 2000	0.12	14.5

d. Non-recoverable systems weighing from 76 lbs. to 250 lbs.

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20 - 400	0.05	
400 - 2000	0.12	14.5

e. Recoverable systems weighing more than 250 lbs.

No requirement.

f. Non-recoverable systems weighing more than 250 lbs

No requirement

4.1.2.2 Structures Vibration

a. Recoverable Structures

No requirement

b. Non-recoverable structures

No requirement

4.1.2.3 Components and Minor Subassembly Vibration

a. Recoverable Components

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20 - 400	0.05	
400 - 2000	0.18	17.5

b. Non-recoverable Components

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20 - 400	0.05	
400 - 2000	0.18	17.5

4.2 Acceleration Testing

a. The equipment shall be secured to the test fixture by its mounting points. The equipment shall then be subjected to specified values of acceleration, in each direction along each of the indicated axes for a period of 10 minutes unless otherwise specified.

b. The equipment shall be loaded and operated in accordance with the applicable qualification specification.

c. The acceleration forces shall be applied at the CG of the specimen.

d. No combination of radial and tangential forces shall exceed specified levels.

e. Equivalent static load testing may be substituted for dynamic acceleration if the combined effect of acceleration and dynamic loading is taken into account.

4.2.1 System Acceleration*

a. Recoverable Systems weighing 250 lbs. or less

Longitudinal Axis (+ indicates ascent)

Level (g's)	Direction
11.0 15.0	±

Lateral Axes

Level (g's)	Direction	(Not to be performed concurrently)
6.0	±	15

[redacted]

* Systems weighing over 250 lbs. may be tested by static load [illegible] with limit loads shown in Para. 4.2.1

b. Non-Recoverable system weighing 250 lbs. or less

Longitudinal Axis

Level (g's)	Direction
11.0	±

Lateral Axes

Level (g's)	Direction
2.0	±

4.2.2 Structures Acceleration

a. Recoverable Structures

Longitudinal Axis

Level (g's)	Direction
~~15.0~~ 22.0	±

Lateral Axes

Level (g's)	Direction
8.0	±

b. Non-Recoverable Structures

Longitudinal Axis

Level (g's)	Direction
15.0	Plus only

Lateral Axes

Level (g's)	Direction
2.5	±

4.2.3 Component Acceleration

a. Recoverable Components

All Axes

Level (g's)	Direction
22	±

Lateral Axes

Level (g's)	Direction
6.0	± (If component orientation is established)

b. Non-Recoverable Components

All Axes

Level (g's)	Direction
15	±

Lateral Axes

Level (g's)	Direction
2.5	± (If component orientation is established)

4.3 Load Application as a Substitute for Dynamic Acceleration Testing

4.3.1 Recoverable and Non-recoverable Structure Load Testing

Tests shall be conducted to limit and ultimate loads. The load level at both limit and ultimate load shall be held from 5 to 10 seconds. The test may be conducted in either of two methods:

a. Incremental Loading: Up to limit load, the test loading shall be applied in increments of not more than 10% of limit load. After application of 100% limit load, all loads shall be reduced to zero. The specimen and data shall be carefully examined and any evidence of yielding documented and evaluated prior to continuing tests. The test load increments from limit to ultimate load shall not exceed 5% of limit load. The load shall be applied for a maximum of 10 seconds at each load increment.

b. Continuous Loading: Up to limit load, the test loading shall be applied at a constant rate of 2% of limit load per second. After application of 100% limit load, all loads shall be reduced to zero. The specimen and data shall be carefully examined and any evidence of yielding documented and evaluated prior to continuing tests. The test load to ultimate load shall be applied at a constant rate of 2% of limit load per second.

4.4 Thermal Altitude Testing

The equipment shall be loaded, instrumented, and operated as specified in the applicable detail qualification test specification during all phases of testing.

4.4.1 System Orbital Simulation

The complete payload system shall be subjected to an orbital simulation in which dynamic thermal programming shall reproduce the effects of various orbit solar incidence angles (Beta) at vacuums equivalent to those found in typical orbits. Temperature and pressure at all critical areas, both internal and external, shall be measured. Payload external surface patterns shall be correct for the orbits being simulated. If contingencies make this impossible, the thermal programming shall be adjusted to compensate for such lack of patterns .

All payload thermal masses such as parachutes and retro rockets shall be installed or simulated.

The payload shall be in orbital configuration.

a. After installation of the payload in the thermal altitude chamber, an interval vacuum of at least 10^{-4} mm Hg shall be achieved. During pump-down, all equipment normally operated during ascent and injection shall be energized.

b. The duration of the test shall equal the maximum planned mission of the payload.

c. During the course of the test, orbital solar incidence angles of 0°, $\pm 40^{\circ}$, $\pm 70^{\circ}$, shall be programmed.

d. The system shall be operated in all modes as specified in the applicable detail qualification specification.

e. At the conclusion of the programmed thermal test, the entire payload temperature shall be stabilized at 50°F and the system operated continuously for its maximum design continuous duty cycle period.

f. The test specified in paragraph e. shall be repeated with the payload temperature stabilized at 90°F.

g. The chamber shall be returned to room ambient conditions (Para. 5.1) and tests made as specified in the detail specification.

4.4.2 Non-Recoverable System Thermal Altitude Testing

These tests shall apply to systems subsidiary to the complete payload.

a. After the system is installed in the chamber, a vacuum of at least 10^{-5} mm Hg shall be achieved. The temperature of the system shall be stabilized at 105°F.

b. The system shall be operated continuously for its maximum design duty cycle period. (See Note 1, para. 4.4.4 d.)

c. The temperature shall be elevated to 110° and the system soaked non-operating for 8 hours.

d. The equipment shall be returned to ambient conditions (See Para. 5.0) and tests performed as specified in the detail qualification specification (See Para. 1.3).

e. The test shall be repeated using a temperature of 35°F for the operational test of Para. 4.4.2 b. and 20°F for the non-operational test of Para. 4.4.2 c.

4.4.3 Recoverable System Thermal Altitude Testing

The tests specified in Para. 4.4.2 shall be performed with the following exceptions.

a. The high-temperature operational test shall be performed at 105°F (Para. 4.4.2 a and b)

b. The high-temperature non-operational test shall be performed at 110°F (Para. 4.4.2 c)

c. The low-temperature operational test shall be performed at 30°F. (Para. 4.4.2 e)

d. The low-temperature non-operational test shall be performed at 0°F. (Para. 4.4.2 e)

4.4.4 Non-recoverable Components Thermal Altitude testing

a. After installation of the component in the thermal altitude chamber, a vacuum of at least 10^{-3} mm Hg shall be achieved in 180 seconds. During this period, the maximum pressure reduction rate shall be 15 mm Hg per second for a maximum period of 30 seconds. Pressure reduction shall continue until

a pressure of 10^{-5} mm Hg or less is achieved.

b. Temperature change shall be started at approximately the same time as evacuation.

c. The temperature of the component stabilized at 125°F.

d. The component shall be operating normally during evacuation and temperature change. Ascent equipment shall be de-energized when 10^{-3} mm Hg pressure level has been reached. Orbital equipment shall be soaked inoperative for 4 hours and operated for 1.25 times the orbital mission duty cycle. (See Note 1)

Note 1: For duty cycles longer than 1 hr., operation periods for each test shall be 50% of the time specified.

e. The chamber shall be returned to room conditions and the equipment shall be tested according to applicable component specifications.

f. The tests specified in Para. 4.4.4 a - 4.4.4 e shall be re-performed, with the exception that the temperature shall be 0°F.

4.4.5 SRV Component Thermal Altitude Testing

4.4.5.1 The component shall be placed in the test chamber and the pressure reduced to 10^{-5} mm Hg or lower. While maintaining the reduced pressure, the temperature shall be cycled as follows:

Cycle	Temperature	Time
1	125°F	10 days
2	0°	4 days

At the end of the first cycle, while at 125°F and 10^{-5}, mm Hg or lower, the component shall be subjected to a performance test in accordance with the requirements of the applicable component specification.

At the end of the second cycle, while at 0°F and 10^{-5} mm Hg or lower, the component shall be subjected to a performance test in accordance with the requirements of the applicable component specification.

4.4.6 Recoverable and Non-Recoverable System and Component Leakage Testing

The container shall be purged with helium and then charged to the required pressure before being sealed. The sealed container shall then be placed in a suitable high-vacuum test chamber and elevated to its maximum operating temperature. The chamber shall then be evacuated to 10^{-3} mm Hg as quickly as possible. A suitable helium leakage detector shall be used for measurements. For containers with equipment that must be operational for more than a one-day period in orbit, the test chamber shall be maintained below 10^{-3} mm Hg for a minimum of 4 hours. The test item shall be maintained at its maximum specified operating temperature during this 4-hour period. The maximum allowable leakage rate shall be predicated on the maximum stand time of the unit being tested.

4.5 Shock Testing

a. The equipment shall be operated prior and subsequent to the following shock tests, and a performance record shall be made in accordance with the applicable qualification specification. Equipment shall be operative in test if it is operative during the launch or recovery phases of the mission. Shocks shall be applied thru the normal mounting points of the equipment in each direction along 3 mutually perpendicular axes. The shock wave form for ascent shall approximate a half sine wave with a duration of 6 ms. The magnitude of the shock shall be measured at the interface of the equipment and the test fixture. Induced secondary accelerations shall be measured along the two transverse axes.

As a test goal, the deceleration rate shall be no greater than one-half the initial input acceleration when the velocity is maximum at the end of the input shock.

b. Tests shall be performed on equipment susceptible to pyrotechnic shock environments. The test shall be capable of providing a pyrotechnic

environment that simulates payload pyrotechnic events. The environment shall originate from the detonation of pyrotechnic devices equivalent in a manner to that found in the payload.

4.5.1 Systems Shock Testing

4.5.1.1 Recoverable System Weighing 75 lbs. or less

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
20	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
6	6	3

4.5.1.2 Non-Recoverable Systems weighing 75 lbs. or less

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
20	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
5	6	3

4.5.1.3 Recoverable Systems Weighing 76 lbs. to 250 lbs.

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
20	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
5	6	3

4.5.1.4 Non-Recoverable Systems Weighing 76 lbs. to 250 lbs.

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
14	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
5	6	3

4.5.1.5 Recoverable Systems Weighing over 250 lbs.

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
15	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
5	6	3

4.5.1.6 Non-recoverable System Weighing over 250 lbs.

No requirement

4.5.1.7 SRV System Launch Configuration

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
20	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
4	6	3

4.5.2 Structures Shock Testing

4.5.2.1 Recoverable Structure

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
25	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
6	6	3

4.5.2.2 Non-recoverable Structure

No requirement

4.5.3 Component Shock Testing

4.5.3.1 Recoverable Components

All Axes

Level (g's)	Duration (ms)	Number (each)
35	6	3

4.5.3.2 Non-recoverable Components

Level (g's)	Duration (ms)	Number (each)
20	6	3

4.5.4 Pyrotechnic Shock Testing

Due to the difficulty of specifying pyrotechnic loads, pyrotechnic shock tests shall consist of the firing of actual pyrotechnic devices with the equipment in design configuration. Special pyrotechnic devices producing an average of 1.25 times normal load shall be used.

4.5.4.1 Payload System Complete Pyrotechnic Shock Testing

a. Pyrotechnic testing, as limited by para. 4.5 (b), shall be conducted in the payload system complete configuration by accomplishing a total of three shocks per test.

4.5.4.2 Structures Pyrotechnic Shock Testing

No requirement

4.5.4.3 Component Pyrotechnic Shock Testing

No requirement

4.6 Payload System Complete Acceptance Testing

4.6.1 Vibration

A low-level vibration environment shall be imposed during the acceptance testing of all systems. The specified vibration may be utilized for the purpose of detecting possible manufacturing and assembly defects, such as loose fasteners and cold solder joints. This test will not reflect the qualification environment. The equipment should be operating during testing if operative during launch*, and as many functional checks may be performed as required in the detail acceptance specification. Either random or sinusoidal vibration should be imposed along the longitudinal axis as follows:

a. Random Vibration: The system shall be subjected to random vibration for a period of 2 minutes at the following levels:

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20 - 400	0.025	
400 - 2000	0.09	13.0

*Pyrotechnics and other one-shot devices excluded.

b. Sinusoidal [redacted]

a single sweep of [redacted]

equivalent to 36 seconds [redacted]

The time for a single sweep from 15 to 2000 cps will be approximately 3.5 minutes.

15 - 400 cps [redacted] g zero-to-peak acceleration

400 - 2000 cps [redacted] g zero-to-peak acceleration

System resonant response [redacted] limited to two times the input acceleration.

4.6.2 Thermal Altitude

An acceptance thermal altitude test [redacted] system shall simulate the thermal vacuum conditions in which the system is expected to operate.

Note: Flight thermal shields shall not be used in altitude testing.

The chamber walls shall [redacted] 120°F and also 200°F [redacted] chamber pressure equal [redacted]

Thermal gradients shall not be programmed.

5.0 TOLERANCES AND CONDITIONS (Unless otherwise specified)

5.1 Atmospheric Conditions (Ambient)

a. Temperature:

b. Pressure: [redacted]

c. Relative Humidity: [redacted]

5.2 Tolerances

a. Temperature (°F): [redacted]

b. Barometric Pressure [redacted]

c. Relative Humidity: [redacted] of R_H

d. Vibration Amplitude (g or inches), sinusoidal and random: [redacted] 10%

e. Vibration Frequency (cycles) [redacted]

f. Shock (g or sec) Ascent and Recovery [redacted]

[redacted]

g.	Acceleration (g):	± 5% (at ref. point)
h.	Regulated 28 VDC (positive):	+27.85 VDC to +28.9 VDC
i.	Unregulated 28 VDC:	+21.5 VDC to +29.5 VDC
k.	115V, 400-cycle VAC: (1-Phase or 3-Phase)	113.7 - 117.3 VAC

l. 115V, 400-cycle frequency may vary between 399.996 and 400.004 cps

6.0 RECORDING AND REPORTING REQUIREMENTS

6.1 Performance Records

The equipment shall be operated under the conditions of 5.1 and a record made of all data necessary to determine compliance with qualification requirements in detail equipment specifications prior to conducting any of the tests specified herein. A comparison shall be made between data obtained under 5.1 and those obtained during and after testing. This comparison shall determine compliance with criteria for qualification. Variations from performance requirements shall be within limits acceptable to the Contractor, but shall not be in conflict with the contractual agreements between the Procuring Agency and the Contractor.

6.1.1 Detailed log books, test data, failure data, calibrations, and supporting analyses shall be provided in documented form accompanying the deliverable hardware. After acceptance, the payload equipment and SRV's shall be provided as government-furnished equipment (GFE) to the payload contractor for integration into the payload section of the satellite vehicle. Assembly of the integrated payload shall be in accordance with the requirements of the payload specification, including all applicable interface requirements. The payload section of the satellite vehicle shall then be acceptance tested as a complete unit, and offered for delivery to the procuring

agency. Specifications, test plans, and procedures shall be subject to review and approval by the procuring agency. A/P will agree to having all test data, calibrations, etc., accompany the delivered hardware to the procuring agency. The payload test philosophy shall be documented in a test matrix by the payload contractor. The test matrix shall minimize unnecessary redundant testing, disassembly and handling of the payload section components at the factory areas and at the launch base. The test matrix shall provide the basis for approval modifications to implement changes to optimize the payload test plan.

6.2 Failure During Test

The test shall be stopped if a part or component fails during testing. No replacement, adjustment, maintenance, or repairs are authorized during tests. This requirement does not prevent the replacement or adjustment of equipment that has exceeded its design operating life during tests, provided that after such replacement the equipment is then given as many tests as are necessary to assure its proper operation. A complete record of any exception taken to this requirement shall be included in the test report.

6.3 Test Reports

Preparation of test reports shall be the responsibility of the testing agency. Each report shall document the test arrangement and test conditions in detail. The description shall include sufficient detail so that the test can be repeated independently of other information sources. Photographs of the test arrangement shall be included. The report shall contain a record of all measurements and observations, including laboratory ambient conditions. The sequence of testing shall be recorded. Degradation of equipment performance during testing shall be recorded even though still within tolerance limits at the conclusion of testing. Any failures experienced during testing shall be reported together with action taken to correct the efficiency.

6.4 Test Facilities

The test facilities and apparatus used in conducting the environmental

tests shall be capable of producing and maintaining the test conditions required.

6.4.1 Volume

The volume of the test facilities shall be such that the bulk of the equipment under test shall not interfere with the generation and maintenance of test conditions.

6.4.2 Heat Source

The heat source of the test facilities shall be so located that intense radiant heat shall not fall directly on the equipment under test, except where application of radiant heat is a test requirement.

6.5 Measurement

All measurements shall be made with laboratory instruments whose accuracy has been certified. The accuracy of these instruments should be such that their tolerances are better than 0.1 times those tolerances specified in 5.2.

6.6 Equipment Operation

Equipment shall be operated during testing if this equipment will also be operated under similar environmental conditions in its actual application.

6.7 Controlled Environmental Equipment

Controlled-environment equipment shall be subjected to the environmental tests while installed in its associated container, when applicable.

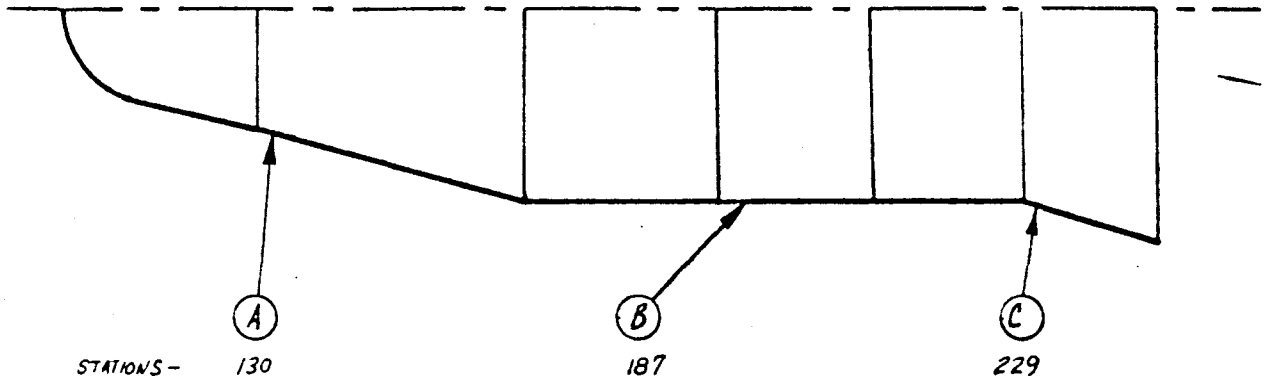
6.8 Sequence of Tests

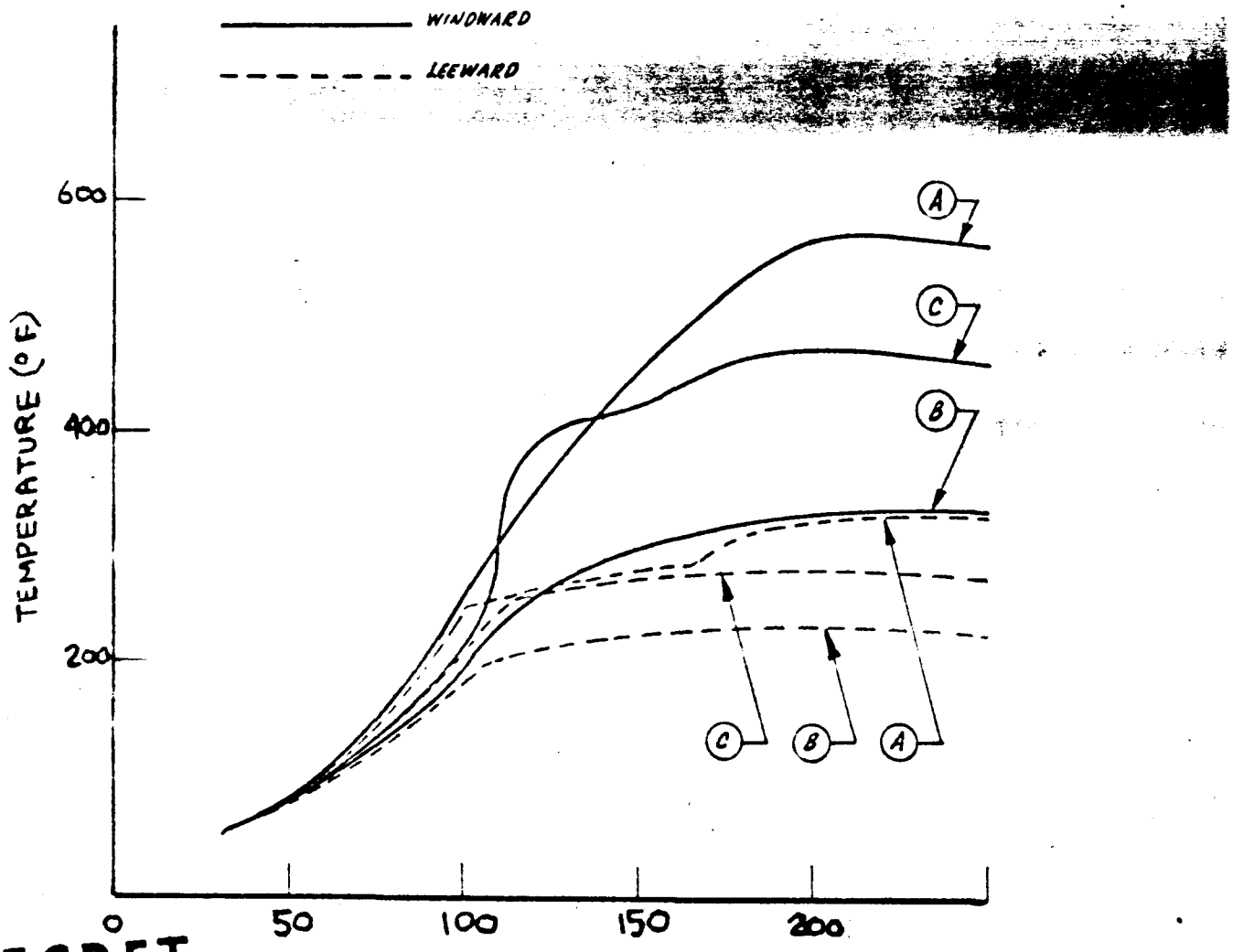
The environmental tests shall be conducted in the order specified in the applicable detail equipment specification.

FIGURE 1

TYPICAL SKIN TEMPERATURE HISTORIES FOR THE HOTTEST MISSION (PALC)

(90 NM / 65° INCL)





SECRET

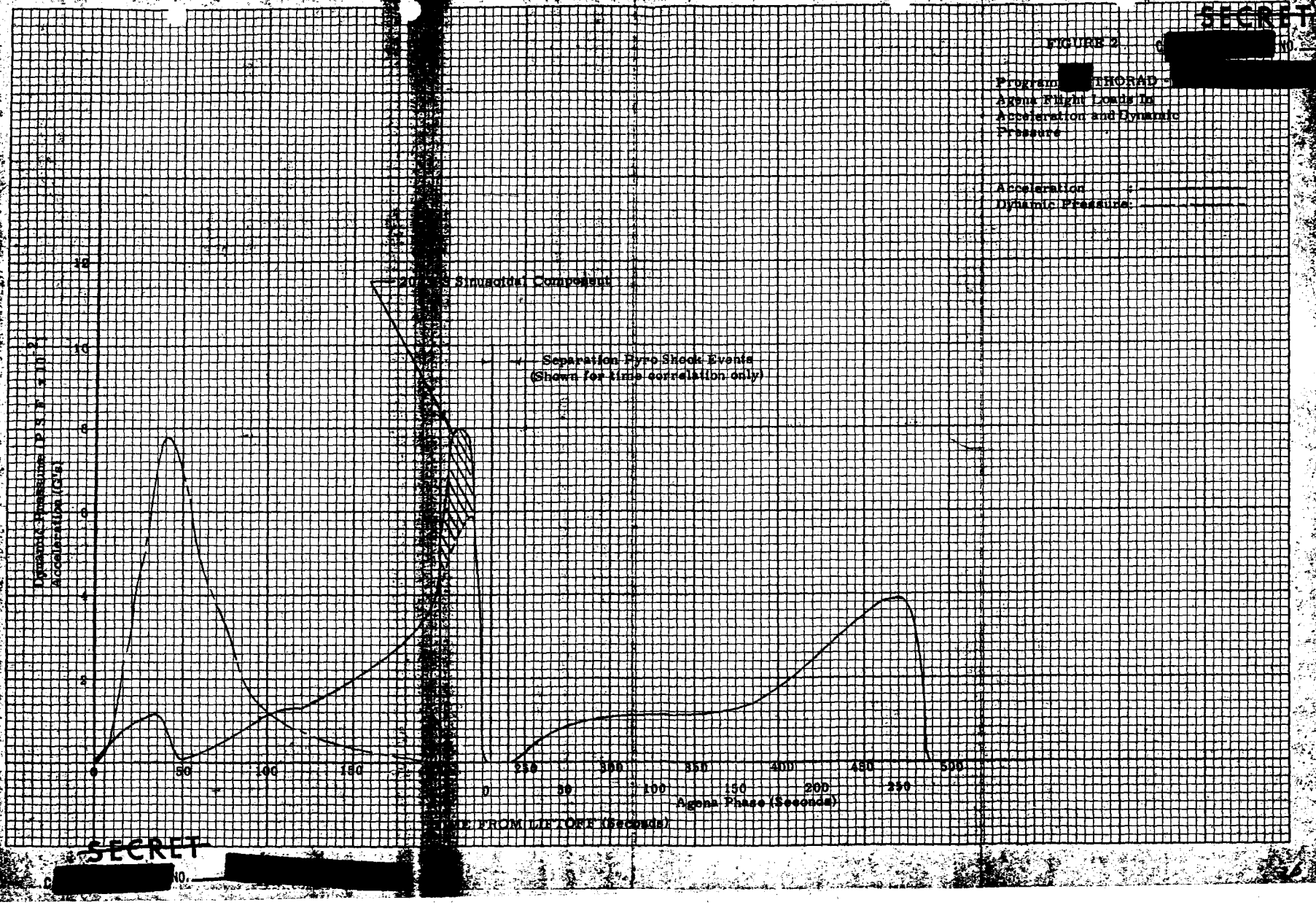
FIGURE 2 [redacted] NO. [redacted]

Program [redacted] THORAD [redacted]

Agena Flight Loads In Acceleration and Dynamic Pressure

Acceleration : ——————

Dynamic Pressure: - - - - - - -



SECRET

[redacted] NO. [redacted]

-3 CONFIGURATION

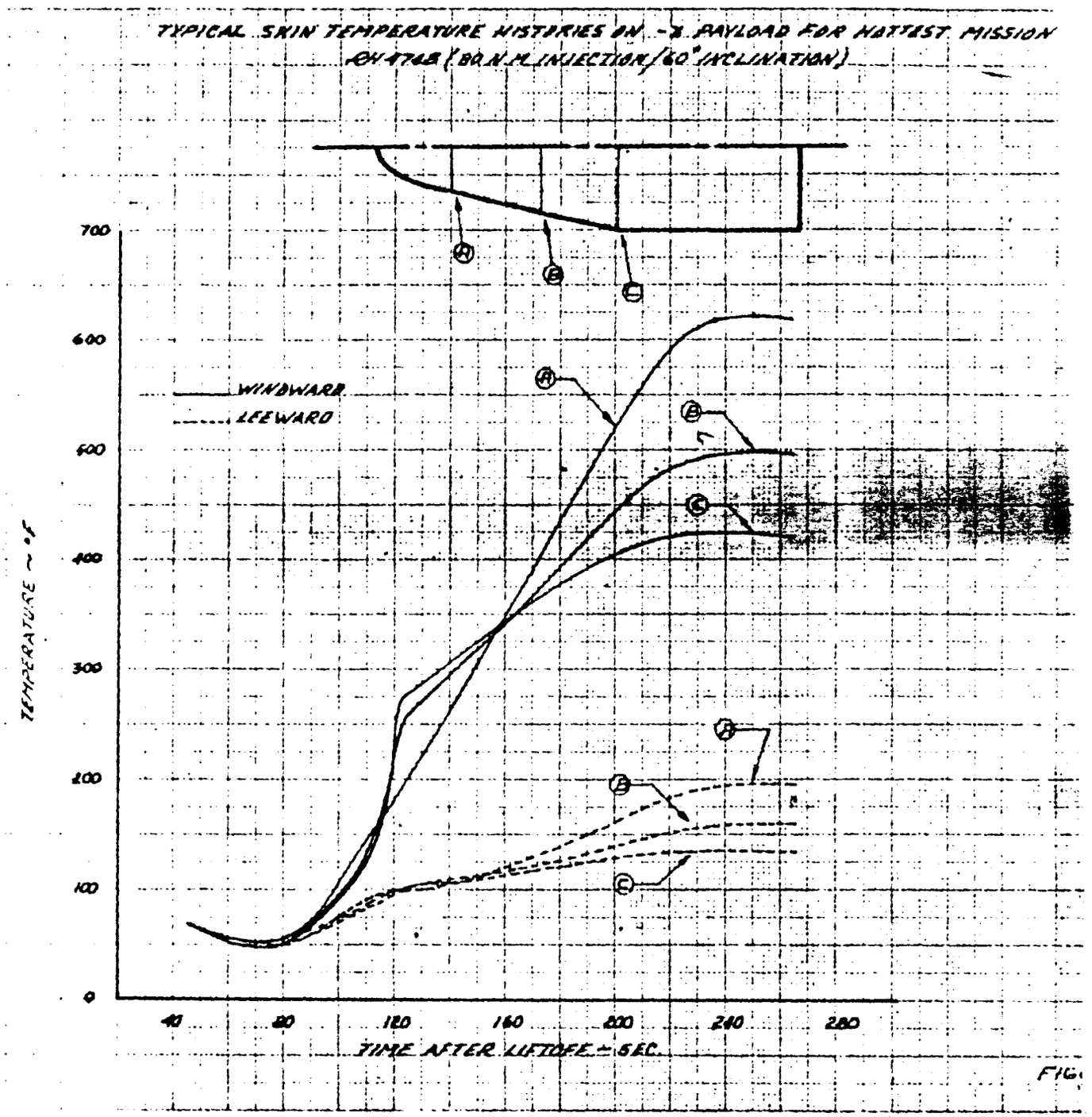


FIGURE 1A

SECRET

Change Initiated By: [redacted]

Reason For Change: [illegible]

[redacted]

[redacted]

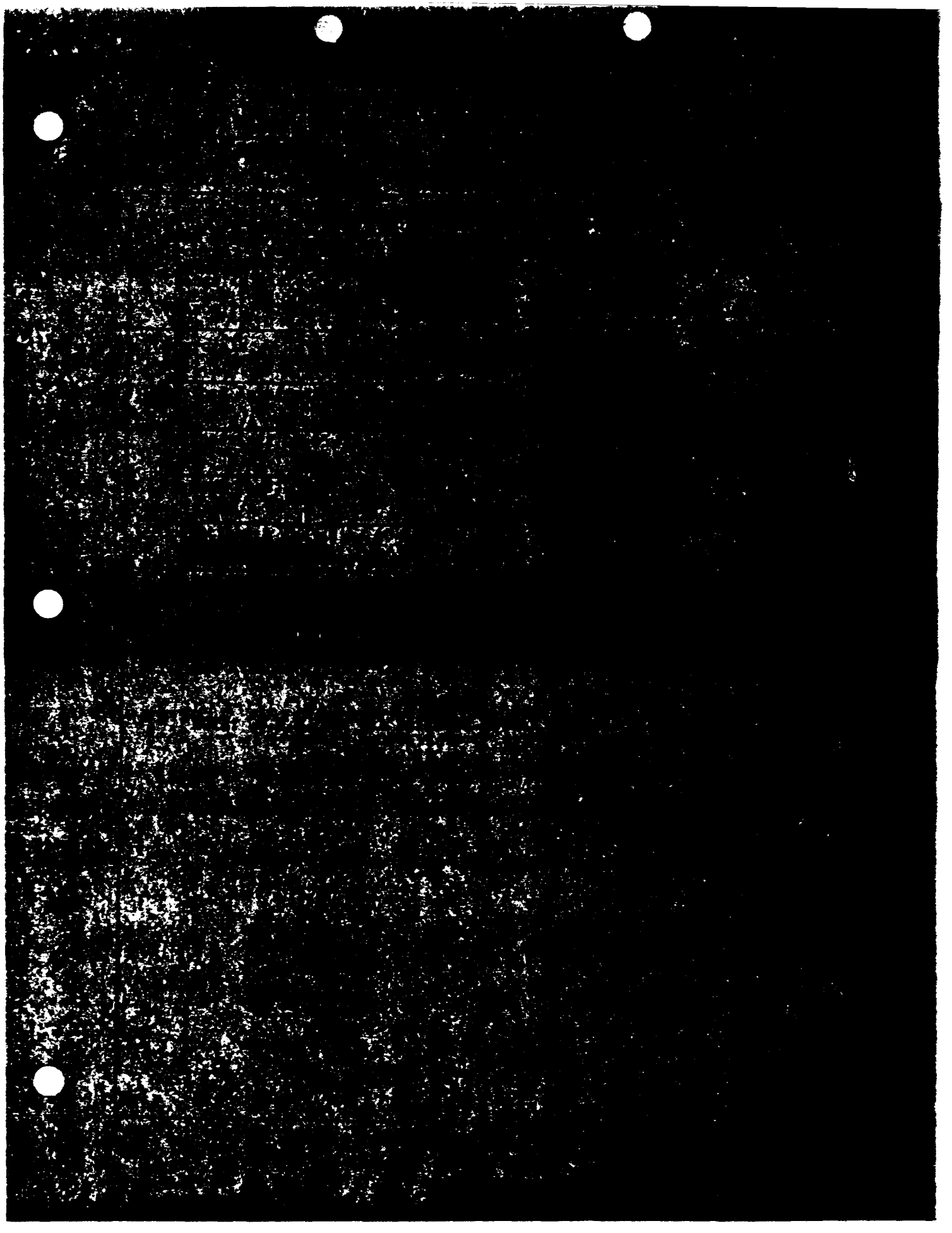
[redacted]

Change:

Rev 13, Part. [illegible]

SECRET

[redacted]



~~SECRET~~

[redacted] NO. [redacted]

SCN No. A-3

Date: 21 Nov 1966

Specification Change Notice

Spec. T3-6-002 Rev. A

Dated: 9 June 1966

Orig. Doc. Prep. By [redacted]

Title: General Spec for Payload Qual and Acceptance

Program: J-3 Effectivity: J-3 Configuration

Change Initiated by: [redacted] Date: 21 November 1966

Reason for Change: (1) Correct error (2) clarification (3) flight forebody

Approvals: [redacted] A/P is the primary alignment reference [redacted] Associates

[redacted] Payload Integration, 60-61	11-22-66 Date	[redacted] Boston	11/22/66 Date
[redacted] Engineering, 60-65	28 Nov 66 Date	[redacted] (TELECON 11/23/66)	11/24/66 Date
[redacted] System Test, 60-64	11/22/66 Date	[redacted] New York	Date
[redacted] Operations & Analysis, 60-62	11/22/66 Date	[redacted] Philadelphia	12/15/66 Date
[redacted] A/P Manager	12-15-66 Date	Resident Officer	Date

Change:

1. Para. 4.2.1 (b)

WAS:

Longitudinal Axis Level (g's)	Direction
11	±

IS:

Longitudinal Axis Level (g's)	Direction
11	Plus only

2. Para 4.6

WAS: (titled): Payload System Complete Acceptance Testing

IS: (titled): Acceptance Testing (Systems and Components)

3. Para 4.6.2

DELETE: "Note: Flight thermal shields shall not be used in altitude testing"

~~SECRET~~

[redacted] NO. [redacted]