BSR 4159

Laser Geodynamic Satellite Thermal/Optical/Vibrational Analyses and Testing

Final Report

Volume II
Technical Report

Book 3

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Contract NAS 8-30658

October 1974

Prepared for:

George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, Alabama 35812

Bendix Aerospace Systems Division

Ann Arbor, Michigan

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VOLUME II

BOOK 3

This Book 3 of Volume II contains Appendices R, S, T, U and V.

LAGEOS Phase B Thermal/Optical Vibration Analysis and Test Program

- Test Plan -

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1.0 INTRODUCTION

The Bendix LAGEOS Phase B Program is a 6-month effort devoted to Laser Geodynamic Satellite (LAGEOS) thermal/optical/vibrational analyses and testing. The purpose of this effort is to verify, through analysis and test, that the MSFC-defined design of the LAGEOS inherently provides a retro-reflector thermal environment which maintains acceptable retroreflector internal thermal gradients.

The specific study objectives are as follows:

- Develop a LAGEOS thermal model and conduct thermal analysis, using this model, to predict retroreflector thermal behavior.
- Procure and fabricate test hardware required to simulate the LAGEOS design for the purpose of conducting environmental tests.
- Accomplish thermal, optical, and mechanical vibration tests to verify that the thermal model and thermal analysis predictions are representative of actual satellite performance.

This plan describes the test program which is intended to provide test results which will contribute to meeting these study objectives.

This updated version of the test plan reflects the decisions made at the First Program Review (17-18 April 1974) to select the circular-faced retroreflector configuration and to delete the Early Vibration and Early Thermal/Optical Tests and expand the Final Thermal/Optical tests. In addition, the plan update includes incorporation of MSFC-recommended test conditions and the changes in the test fixtures which are required to implement these test conditions.

2.0 SCOPE AND OBJECTIVES

This section describes the scope and objectives of this test plan.

2.1 SCOPE

This document establishes the overall plan for the Bendix LAGEOS Phase B Thermal/Optical/Vibration test program. The plan describes the objectives, methods, and conditions for each test and identifies the test article, test fixtures, test equipment and expendables, instrumentation and data to be employed. Schedules for the overall program; test procedures and tests; design, fab and assembly of the test articles and test fixtures; and the need dates for test equipment and expendables are also included.

2.2 OBJECTIVES

The objectives of this plan are to describe the overall plan for accomplishing the various tests required to achieve the program objectives and tasks of the Bendix LAGEOS Phase B Program, as defined in the revised Study Plan, LAGEOS-8, (Rev. B), dated 6-28-74. The requirements for each test are identified for the purpose of program review (to ensure that program objectives are to be met), for the design and fabrication of the required test article and test fixtures, for the allocation of test facilities, equipment and expendables and for the generation of the detail test procedures by which the specified data will be obtained at specified test conditions. The plan includes the current detailed Bendix internal test program schedules, by which the various individual preparatory subtasks are to be accomplished to ensure that the individual tests will be conducted within the time period required to meet Phase B program objectives.

3.0 TEST PROGRAM DESCRIPTION

The Bendix LAGEOS Phase B test program consists of thermal/optical tests, a vibration test, and post-vibration thermal/optical tests.

3.1 THERMAL/OPTICAL TESTS

3.1.1 Test Objectives

The objective of these tests is to obtain optical performance data for the LAGEOS retroreflector under isothermal conditions and for various thermal gradients, including predicted orbital worst-case thermal gradients. Optical performance data will be obtained for various laser field angles and retro-reflector orientations. Optical performance data will be obtained prior to, and after, subjecting the test article to the LAGEOS worst-case dynamic environments.

3.1.2 Test Article

The LAGEOS test article will be utilized to support the LAGEOS retroreflectors under conditions which simulate those of the LAGEOS satellite. The configuration of the Test Article panel, in which the retro-reflector is to be mounted, is shown in Figure 3-1; the configuration of the total Test Article assembly, with the retroreflectors in place, is shown in the assembly drawing, Figure 3-2.

The criteria for the design of the test article are as follows:

a. Provide the test conditions necessary to simulate the factors which affect the retroreflector thermal/optical performance, when installed in the LAGEOS satellite. The following factors are represented in the test article or the test conditions to correspond directly to those presently defined for the satellite:

   1. Retroreflector mount design

   2. Cavity design

   3. Retroreflector recession (1mm)

   4. Retroreflector design

   5. Mount retainer ring surface finish (machined aluminum)

6. Cavity inside surface finish (machined aluminum, ϵ = 05)

7. Solar heating of the retroreflector and mount

8. Earth IR heating of the retroreflector and mount.

Since the effects of the satellite spherical shape, cavity pattern and outside surface finish can be represented directly only by providing the total spherical satellite (with a retroreflector in each cavity), the net effect of these factors, as determined by analysis, is provided in terms of the cavity core (test article structure) temperature level.

b. Provide mounting for 6 LAGEOS retroreflectors procured for this test program. The retroreflector configuration selected for LAGEOS is the circular-faced tab-mounted configuration.

c. Provide a cavity pattern which locates the retroreflectors in two (2) rows of three (3) each. This permits the sequential alignment of the three retroreflectors in the laser beam by the thermal/optical test fixture (i.e., linear motion along the axis of rotation for each test set-up) and provides an acceptable target for the solar simulation lamp. The arrangement also provides close proximity of the six test retroreflectors to a pair of ALSEP retroreflectors instrumented with thermocouples and mounted on the test fixture. The arrangement also results in a reasonably-sized test article which does not impose difficult design requirements on the test fixture used to support the test article in the thermal/vacuum chamber.

d. Provide cavity spacing of .060 minimum to simulate the minimum cavity spacing on the satellite.

e. Provide sufficient tie-down bolt holes to ensure no relative motion of the test article during dynamic tests, with respect to the vibration test fixture. This is to ensure that the intended LAGEOS dynamic environment is imposed on the retroreflector/ mount assemblies.

f. Fabricate the test article from the same type of material as selected by MSFC for the satellite. The satellite outside surface coating characteristics are represented by the test article structure temperature and thus no coating is required on the test article outside surface.

g. The overall dimensions of the test article panel were determined early in the program to support test fixture design and Early Test Article design (now deleted). At the time, the configuration of the LAGEOS retroreflector had not been selected and both the circular-faced (ALSEP-type) and hexagonal-faced (GEOS-type) configurations were being considered. The front face dimensions are based on the cavity diameter required for the circular-faced retroreflector, an assumed maximum cavity spacing and tie-down considerations. The test article height is based on requirements for the hex-faced retroreflector mount and maximum recessing of 1 cm.

h. Provide threaded holes in the cavities for orientation of the retroreflectors as shown in Table 3-1 for each test condition. It is planned to provide two sets of threaded holes in two of the cavities and to change retroreflector orientation as shown in Figure 3-2.

3.1.3 Test Method

The test arrangement for the thermal/optical tests is shown in Figure 3-3.

The LAGEOS Test Article is to be mounted in the Thermal/Optical Test Fixture for the Thermal/Optical Tests.

Thermal control of the test article is provided by a thermal control shroud on the test fixture, consisting of heat exchanger coils, a copper base-plate and a multilayer insulation blanket. A liquid heat transfer medium is pumped to the coils from the heat exchanger outside of the Vacuum Chamber. The Test Fixture will provide the means for controlling the LAGEOS Test Article angular orientation about the horizontal axis-of-rotation, which is inline with the front faces of the retroreflectors, to vary the incident laser beam field angle. The Test Fixture will also provide the means for placing any one of the three retro-reflector cavity locations, on the rotational axis, in-line with the laser beam at the chamber center-line. Control of angular orientation and longitudinal location will be accomplished manually from outside the chamber. Each group of three retroreflectors is manually set-up on the rotational axes prior to their respective tests.

Thermal data is to be obtained by means of thermocouples mounted on the Test Article panel and on ALSEP retroreflectors and mounting hardware installed in a small panel (Figure 3-4) mounted on the test fixture, as shown in Figure 3-5. Thermocouples, utilizing #40 gage Chromel-constantan wire, will be mounted at the apex, front-face center and tab outer edge on each ALSEP retroreflector and on its mounting rings. Thermocouples, utilizing #30 gage Chromel-constantan wire, will be mounted on the front-face of the Test Article panel. Thermocouples will be bonded in place, utilizing Eastman 910 adhesive and on the retroreflectors will, in addition, be covered by a small patch of reflective mylar insulation to better simulate the non-instrumented retroreflectors. Thermal data will also be obtained at various locations on the vacuum chamber as shown in Figure 3-3.

A solar radiometer is to be mounted on the fixed arm of the thermal/optical test fixture to provide intensity data for the solar simulator beam at the test article. A separate radiometer is mounted on the fixture to provide intensity data for the IR simulator mounted at the laser end.

The Test Fixture will rotate the Test Article to face the solar simulator and the earth IR simulators. Solar incidence angles will be varied, by rotating the Test Article in the Test Fixture, to vary retroreflector absorbed heating and retroreflector temperature gradients. The Thermal/Optical Test Fixture design is shown in Figure 3-6 through 3-8.

In addition to the thermal control shroud, thermal conditions (i.e., temperature gradients) in the test retroreflectors are to be achieved by the combination of vacuum chamber cold-walls, simulated solar heating in the beam from a Generaco solar lamp outside the far end of the chamber and two earth-IR simulator lamps, one mounted at the laser end of the chamber and one mounted at the solar lamp end of the chamber.

An optical-quality window is required at the Far-Field Diffraction Instrument (FFDI) end of the vacuum chamber to permit the laser beam to be transmitted to the test article and the retro-reflected return beam to enter the FFDI. Requirements for this optical window, fabricated of BK-7 glass, are defined in Requirements Document LAG-2 and the window is being procured from Zygo Corporation. The optical window is installed in the vacuum chamber as part of the optical window assembly. Thermal control of the optical (laser) window is required to maintain the window BK-7 glass at isothermal conditions. A shield, designed to have an L/D of 4.0 and to include a heater, thermal control coating and aluminized mylar insulation, will provide the necessary thermal control. The resulting design is shown in Figure 3-9.

Test conditions for these tests are summarized in Table 3-1 and Figure 3-10. Test data and the means for obtaining this data at each test condition are described in Section 3.1.4. Optical performance data is to be obtained for each LAGEOS retro-reflector. The ALSEP retroreflectors and mounting rings on the test fixture are to be instrumented to obtain temperature gradient data for correlation with the optical performance data. In addition, the laser polarization angle is to be controlled as specified in Table 3-1. The tests to be conducted after the vibration tests are identified in Table 3-1 and are limited to those required to identify any residual effects of the exposure to the LAGEOS worst-case dynamic environment.

The total number of test conditions has been expanded from those originally proposed, and from those identified in the initial issue of this test plan (and in the Program Review). These conditions reflect the changes described in the Study Plan (Rev. B), ECP Bx-LA-2, dated 6-28-74.

3.1.4 Test Data and Instrumentation

Optical performance data will be obtained, at each test condition, using the Bendix Far-Field Diffraction Instrument (FFDI). Requirements for the FFDI are defined in Requirements Document LAG-2 and the FFDI is being fabricated by the Zygo Corporation. This instrument is depicted schematically in Figure 3-11 and is mounted on the leveling plate shown in Figure 3-12. It contains the necessary equipment for generating a linearly-polarized laser beam and projecting the beam at the test article. It accepts the return beam from the test article and provides a visual display of the far-field diffraction pattern, provides a photograph of the pattern and provides a means of measuring the relative intensity of the return pattern, in a selected annular region. It also measures the relative intensity of the transmitted beam and provides a measure of the ratio of the return beam intensity to the transmitted beam intensity. The orientation of the linearly polarized beam may be controlled and a circularly-polarized beam may also be selected for transmission to the test article. The test data is then in three forms: (1) a visual display, (2) a Polaroid photograph and (3) relative intensity data, for each test condition in Table 3-1. Test article orientation, for laser field angles, is read directly from the Test Fixture.

Thermocouples will be mounted at the apex, the front-face center and the tab-outer edge of the ALSEP retroreflectors, on the mounting rings and on the Test Article, as described in 3.1.3 above. Thermocouples will be mounted at various locations on the vacuum chamber as shown in Figure 3-2.

A pair of solar radiometers mounted on the fixed arm of the Test Fixture will provide data on the intensity of the solar simulator beam and the IR lamp output at the Test Article.

3.1.5 Test Fixtures, Equipment and Expendables

The requirements for these tests are summarized as follows:

a. LAGEOS Thermal/Optical Test Fixture

b. Optical Window and Shield Assembly

c. Far-Field Diffraction Instrument (FFDI)

d. FFDI Support Plate

e. Support Table

f. Thermocouples #40 gage and #30 gage (chromel-constantan wire)

g. Thermal-Vacuum Chamber and control system

h. Genarco Solar Simulators

i. Hycal Radiometers

j. Tenney Heat Exchanger

k. Data Acquisition System

l. Optical Alignment Instrumentation

m. Polaroid camera and film

n. Earth IR simulator lamps

o. Liquid N_2

p. Carbon Rods

3.2 VIBRATION TESTS

3.2.1 Test Objective

The objective of these tests is to subject the LAGEOS Test Article to the LAGEOS worst-case dynamic environment. The residual effects are to be identified by a comparison of optical performance, obtained before and after the Test Article has been subjected to the dynamic environment and by a visual inspection.

3.2.2 Test Article

The LAGEOS Test Article will be utilized for these tests. The configuration is the same as described in Section 3.1.2 and Table 3-1.

3.2.3 Test Method

The test article, as described in 3.1.2 above, will be mounted on the LAGEOS Vibration Test Fixture, tied-down by six 1/4-inch cap-head bolts. The Vibration Test Fixture has provisions for threaded holes to accept these six tie-down bolts and additional 3/8 dia. through-holes for attaching the Vibration Fixture to the Bendix vibration test system shaker head and slip plate. The through-hole pattern is compatible with the existing threaded-hole patterns on the shaker head and slip plate. The Vibration Test Fixture is shown in Figure 3-13.

The test article, mounted on the vibration shaker head for the vertical axis and on the slip plate (driven by the shaker) for the lateral axes, shall be subjected to the sinusoidal and random vibration spectra as defined in Table 3-2.

3.2.4 Test Data and Instrumentation

A control accelerometer will be mounted on the Test Article and oriented in the axis of the input vibration to monitor the input for control purposes.

The signal from the control accelerometer will be recorded and displayed in real-time on an x-y plotter. During sinusoidal excitation, the real-time plot will consist of an analog plot of input G-peak versus frequency. During the random excitation, the real-time plot will consist of an analog plot of a sampled scan of power spectral density (G^2/H_Z) versus frequency output from the ASDE-80 Equalizer/Analyzer. A T-RMS meter will be used to measure g-rms input.

A visual inspection will be made after each vibration exposure for each axis.

3.2.5 Test Fixture, Equipment and Expendables

The requirements for these tests are summarized as follows:

a. LAGEOS Vibration Test Fixture

b. Bendix Vibration Test System

c. Endevco accelerometer (1) (Model #2221)

d. Polaroid camera and film.

4.0 TEST PROCEDURES

Separate test procedures will be prepared for each of the two (2) tests described in Section 3.0. The test procedures will describe the test objectives; identify applicable documents, required participants, and required fixtures, equipment and instrumentation; and describe the procedure to be followed, including instrumentation locations, test conditions and data to be recorded.

A master copy of the procedure will be used during the test to record the equipment identification nomenclature, the accomplishment of each step of the procedure and additional notations to reflect how the test was actually run. This "as-run" procedure, together with the recorded data, will become a documented record of the test.

Test procedures shall be approved by cognizant LAGEOS program personnel,as defined by the LAGEOS Program Manager, prior to the start of tests. Test procedures will be released for record purposes. Variations to the test procedures may be made by, or with the approval of, the same cognizant LAGEOS program personnel. Back-up approval authority will be provided to minimize test delays while the tests are in-process.

5.0 TEST PROGRAM SCHEDULES

This section includes the Bendix internal overall program schedule and detail schedules for the test plan and test procedures, the test article, the FFDI and optical window, the various special test fixtures and the test equipment and expendables need dates. These schedules are normally updated weekly and distributed separately to program personnel. Updated schedules will only be incorporated in this test plan at the time of updated plan issuance.

Table 3-1

THERMAL/OPTICAL TEST CONDITIONS

Test	Description	Retro Orientation θ A	B	C	D	E	F	Vac Chamber Press (Torr)	Test Article Temperature	Chamber Cold Temperature	Solar Condition	Total Laser Field Angles (α) Per Test *
1	Iso/Amb	0	90	0				Amb.	Amb.	Amb.	N/A	8**
2	Iso/Vacuum	0	90	80				1×10^{-6}	Amb.	Amb.	N/A	15***
3	Thermal/Vacuum	0	90	80				1×10^{-6}	+30°C	-185°C	No Sun (No IR)	15***
4	Thermal/Vacuum	0	90	80				1×10^{-6}	+30°C	-185°C	1 Sun Normal (No IR)	8**
5	Thermal/Vacuum	0	90	80				1×10^{-6}	+30°C	-185°C	1 Sun +50° (No IR)	8**
6	Thermal/Vacuum	0	90	80				1×10^{-6}	+30°C	-185°C	No Sun 1 Earth IR	8**
7	Thermal/Vacuum	0	90	80				1×10^{-6}	-30°C	-185°C	No Sun (No IR)	15***
8	Thermal/Vacuum	0	90	80				1×10^{-6}	-30°C	-185°C	1 Sun Normal (No IR)	8**
9	Thermal/Vacuum	0	90	80				1×10^{-6}	-30°C	-185°C	No Sun 1 Earth IR	8**
10	Iso/Amb				60	40	20	Amb	Amb	Amb	N/A	8**
11	Iso/Vacuum				60	40	20	1×10^{-6}	Amb	Amb	N/A	8**
12	Thermal/Vacuum				60	40	20	1×10^{-6}	+30°C	-185°C	No Sun (No IR)	15***
VIBRATION TEST												
13	Iso/Vacuum				60	100	20	1×10^{-6}	Amb	Amb	N/A	8**
14	Thermal/Vacuum				60	100	20	1×10^{-6}	+30°C	-185°C	No Sun (No IR)	11****

*Laser Polarization: Linear in Laser Field Angle Plane (Vertical Plane)

**A, D: α = 0, +30, +15, -15, -30
B, E: α = 0, +15
C, F: α = 0

***A, B, C, D, E, F:
α = 0, +30, +15, -15, -30

****D, E:
α = 0, +30, +15, -15, -30
F: α = 0

Table 3-2

LAGEOS TEST PROGRAM WORST-CASE DYNAMIC ENVIRONMENT

Sinusoidal Vibration (2 Oct/Min) (Three Axes - One Sweep per Axis)

5-16 Hz	2.3 g-Peak	
16-22	6.8	
22-100	2.3	
100-200	2.3	Equivalent Shock Environment
200-2000	5.0	

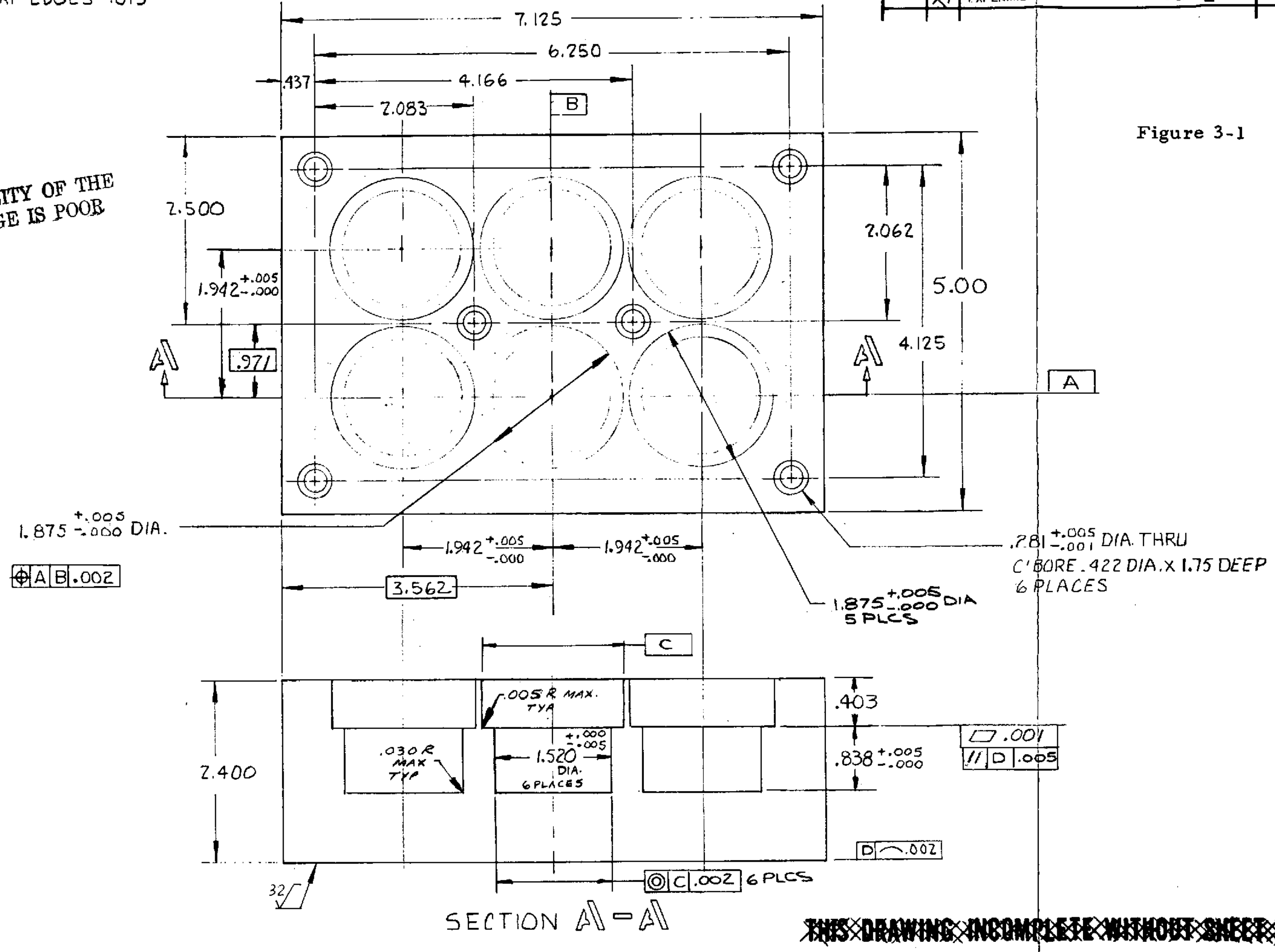
Random Vibration Duration: 2 min. (Three Axes)

20-300 Hz	+3 dB/Oct.	9.8 g-rms
300-2000 Hz	0.05 G^2/Hz	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	CONFIG MGT-APPV'D
	X1	EXPERIMENTAL RELEASE ER 1922-2	5-15-74	

NOTES
1. BREAK ALL SHARP EDGES .015

Figure 3-1



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TOLERANCES
DECIMAL .X ± — ; .XX ±.01 ; .XXX ±.005 ; ANGLES ± 1° ; CHAMFER ± 5°
FINISH MICROINCHES RHR
MATERIAL: 6061-T6

CONTR NO.		
DRAWN		5-15-74
CHECKED		5-15-74
STRESS/WT		
DSGN SUPV		
PROJ ENGR		5-15-74
QUAL CONT		
SYS SPT		
RELIABILITY		
MFG		
CUSTOMER		

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TITLE PANEL, TEST ARTICLE LAGEOS

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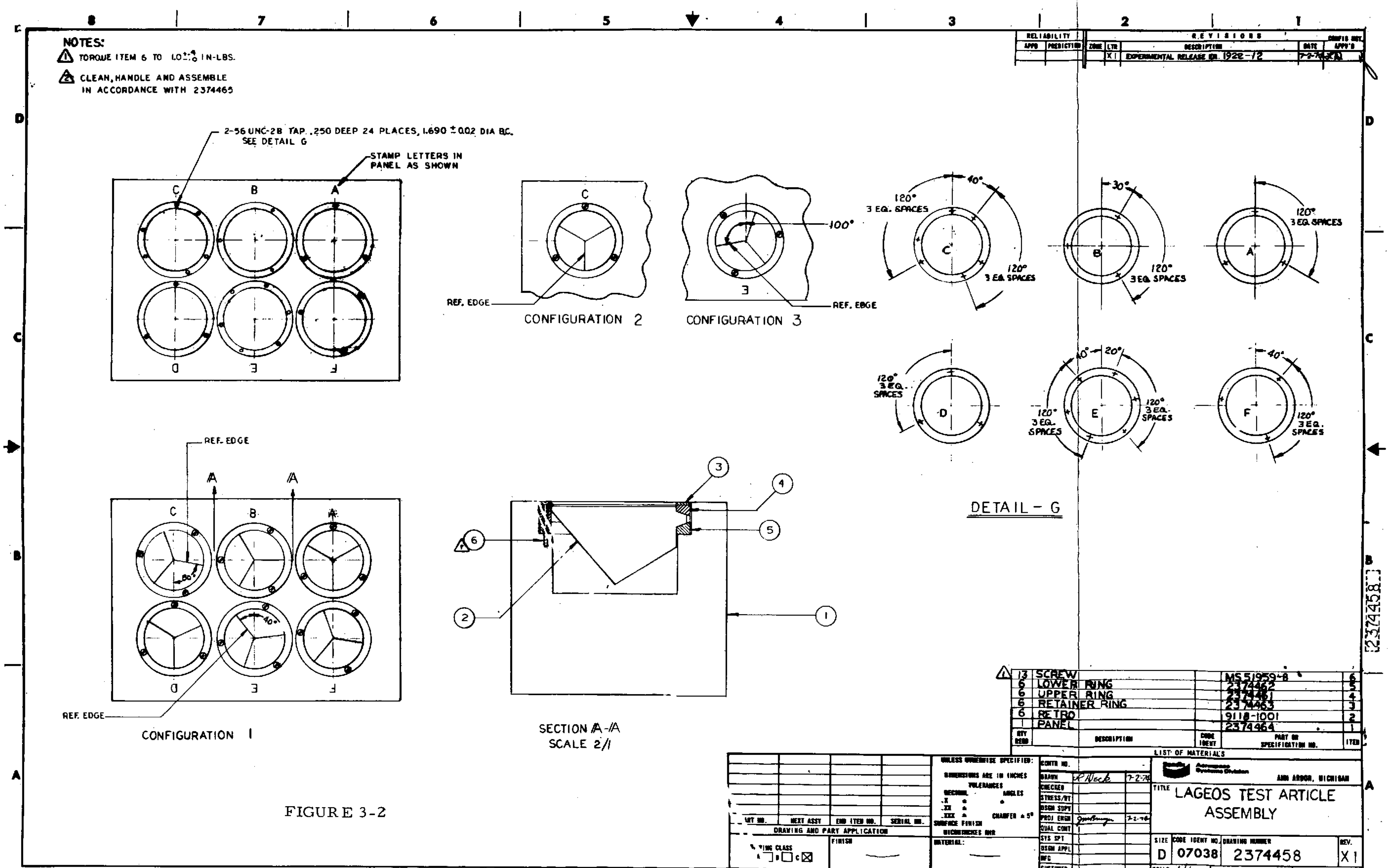

FIGURE 3-2

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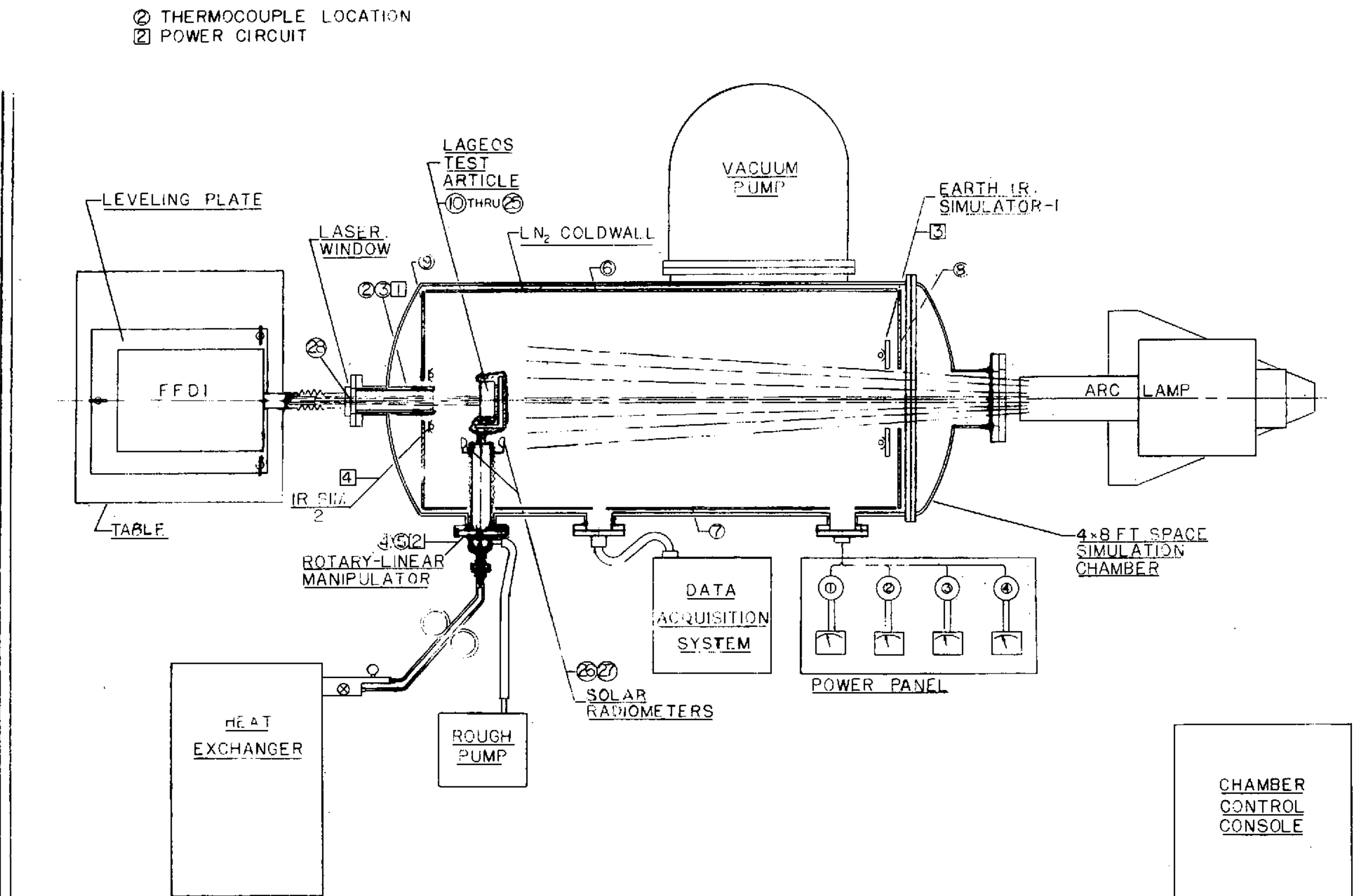

FIGURE 3-3

REVISIONS				
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	X2	REVISED PER CCN X-2	7-8-74	

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TITLE: LAGEOS TEST SETUP - THERMAL-VACUUM

SIZE D | CODE IDENT NO. 07038 | DRAWING NUMBER 2374451 | REV. X2

SHEET 1 of 1

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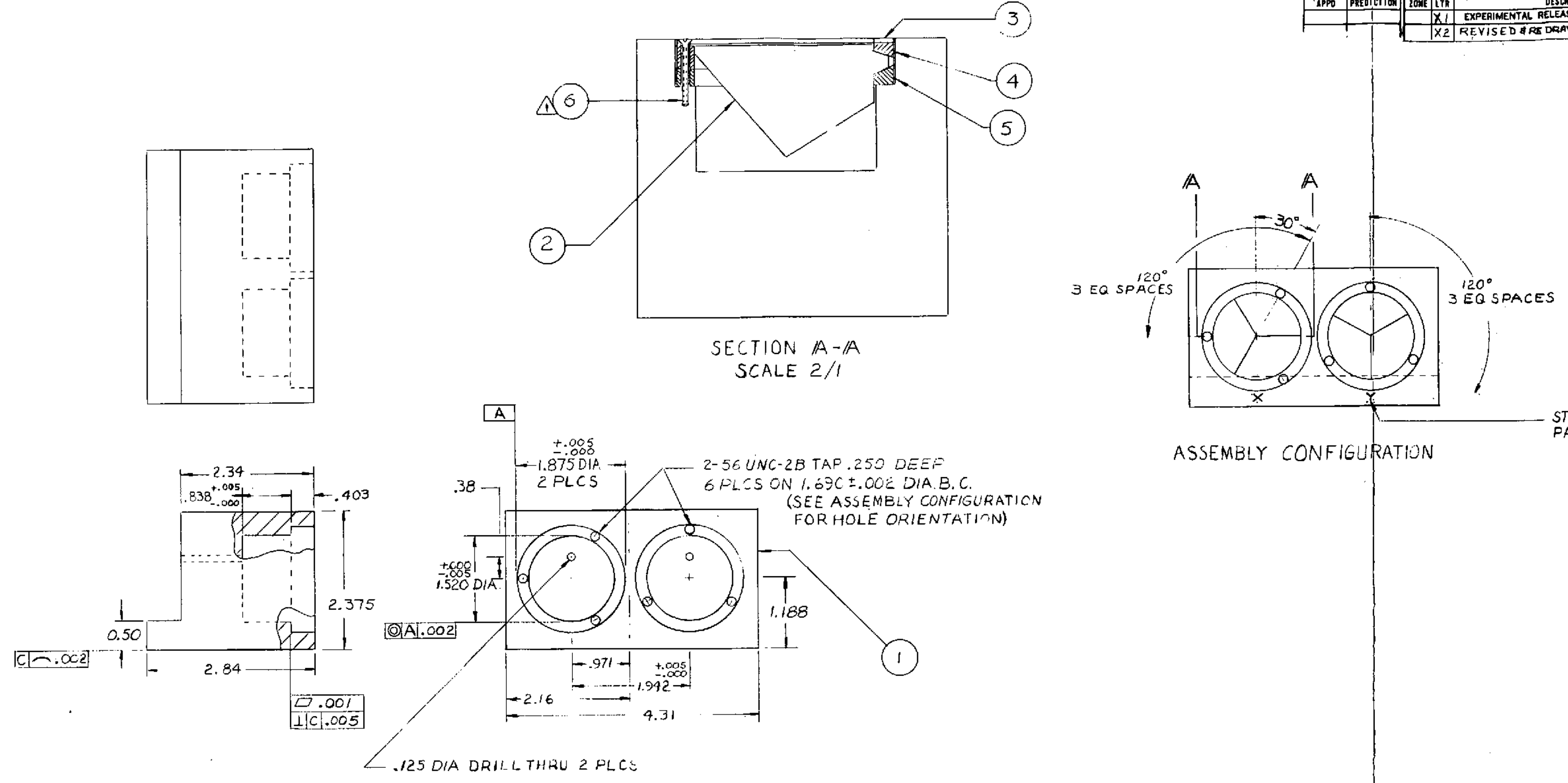
			X2	REVISED & REDRAWN WITH CHANGE	7-8-74	



NOTES:

1. TORQUE ITEM 6 TO 1.0 $^{+.4}_{-0}$ IN-LBS
2. CLEAN, HANDLE AND ASSEMBLE IN ACCORDANCE WITH 2374465

FIGURE 3-4.

QTY REQD	DESCRIPTION	CODE IDENT	PART OR SPECIFICATION NO.	ITEM
6	SCREW		MS 51959-8	6
2	LOWER RING		2374462	5
2	UPPER RING		2374461	4
2	RETAINER RING		2374463	3
2	RETRO, DUMMY ALSEP LRRR		100-2664-002	2
1	PANEL		2374466-1	1

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES DECIMAL .X ± .XX ±.01 .XXX ±.005 ANGLES ± CHAMFER ± 5°

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TITLE THERMOCOUPLE FIXTURE LAGEOS

SIZE	CODE IDENT NO.	DRAWING NUMBER	REV.
D	07038	2374466	X2

SCALE 1/1 SHEET 1 OF 1

FOLDOUT FRAME

REVISIONS

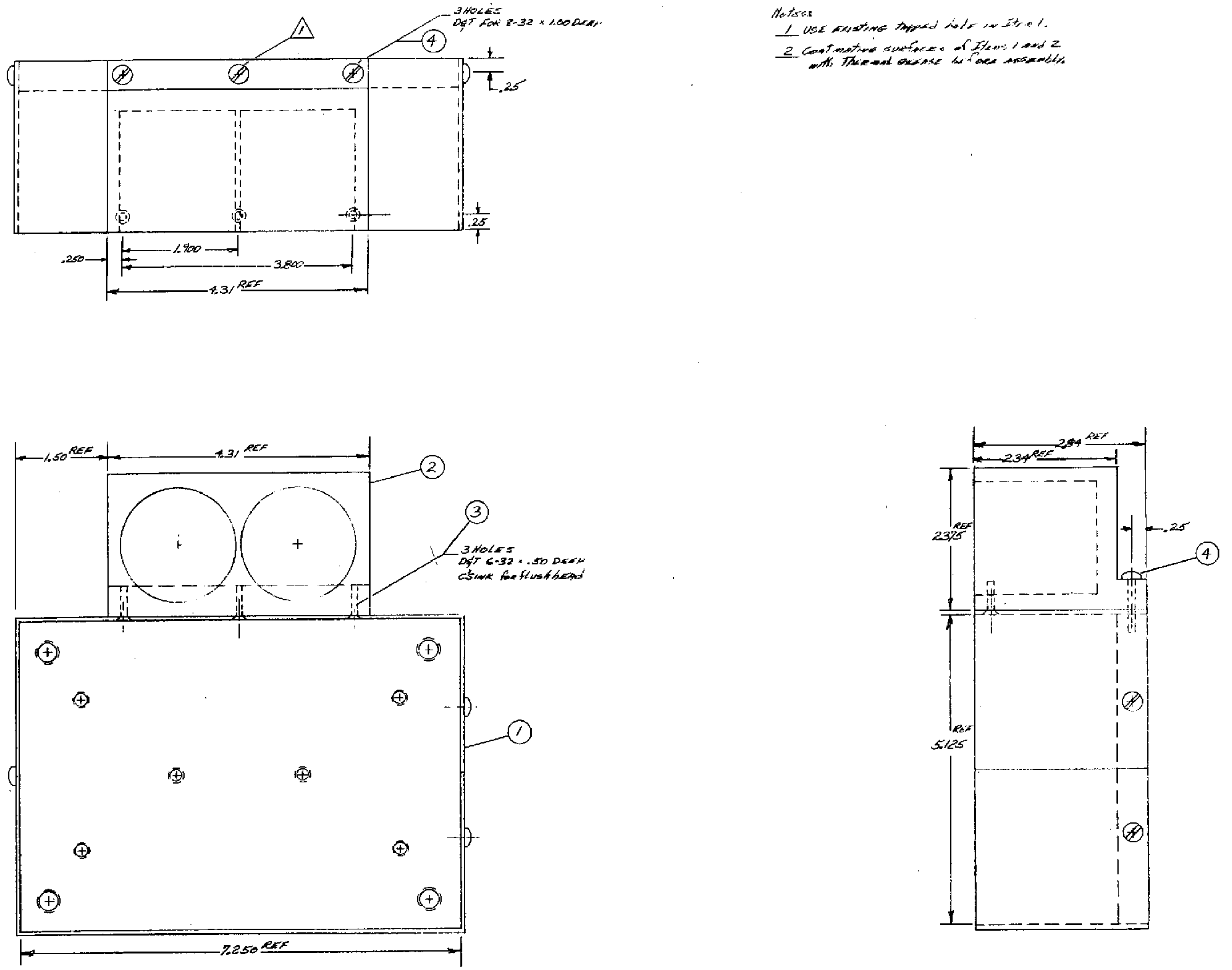
ZONE	LTR	DESCRIPTION	DATE	APPR'D
		EXPERIMENTAL RELEASE ER 1922-3	5-16-74	

Notes:

1 Use existing tapped hole in Item 1.

2 Coat mating surfaces of Items 1 and 2 with thermal grease before assembly.

FIGURE 3-5



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QTY REQD	DESCRIPTION	CODE IDENT	PART OR SPECIFICATION NO.	ITEM
3	PAN HD SCREW		8-32 UNC x 1.0 Lg	4
3	FLATHEAD SCREW		6-32 x .50	3
1	THERMOCOUPLE FIXTURE			2
1	Fixture Thermal Assy		2374460-23	1

LIST OF MATERIALS

PART NO.	NEXT ASSY	END ITEM NO.	SERIAL NO.

DRAWING AND PART APPLICATION

DRAWING CLASS A ☐ B ☐ C ☐

FINISH

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMAL .X ±.1 .XX ±.03 .XXX ±.006 ANGLES ± CHAMFER ± 5°
SURFACE FINISH MICROINCHES RHR
MATERIAL:

CONTR NO.		
DRAWN		5-15-74
CHECKED		
STRESS/WT		
DSGN SUPV	E. Branholm	5-16-74
PROJ ENGR		5-16-74
QUAL CONT		
SYS SPT		
DSGN APPL		
MFG		
CUSTOMER		

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TITLE: INSTALLATION, THERMOCOUPLE FIXTURE

SIZE D | CODE IDENT NO. 07038 | DRAWING NUMBER 2374459 | REV. X

SCALE | WEIGHT | SHEET 1 OF 1

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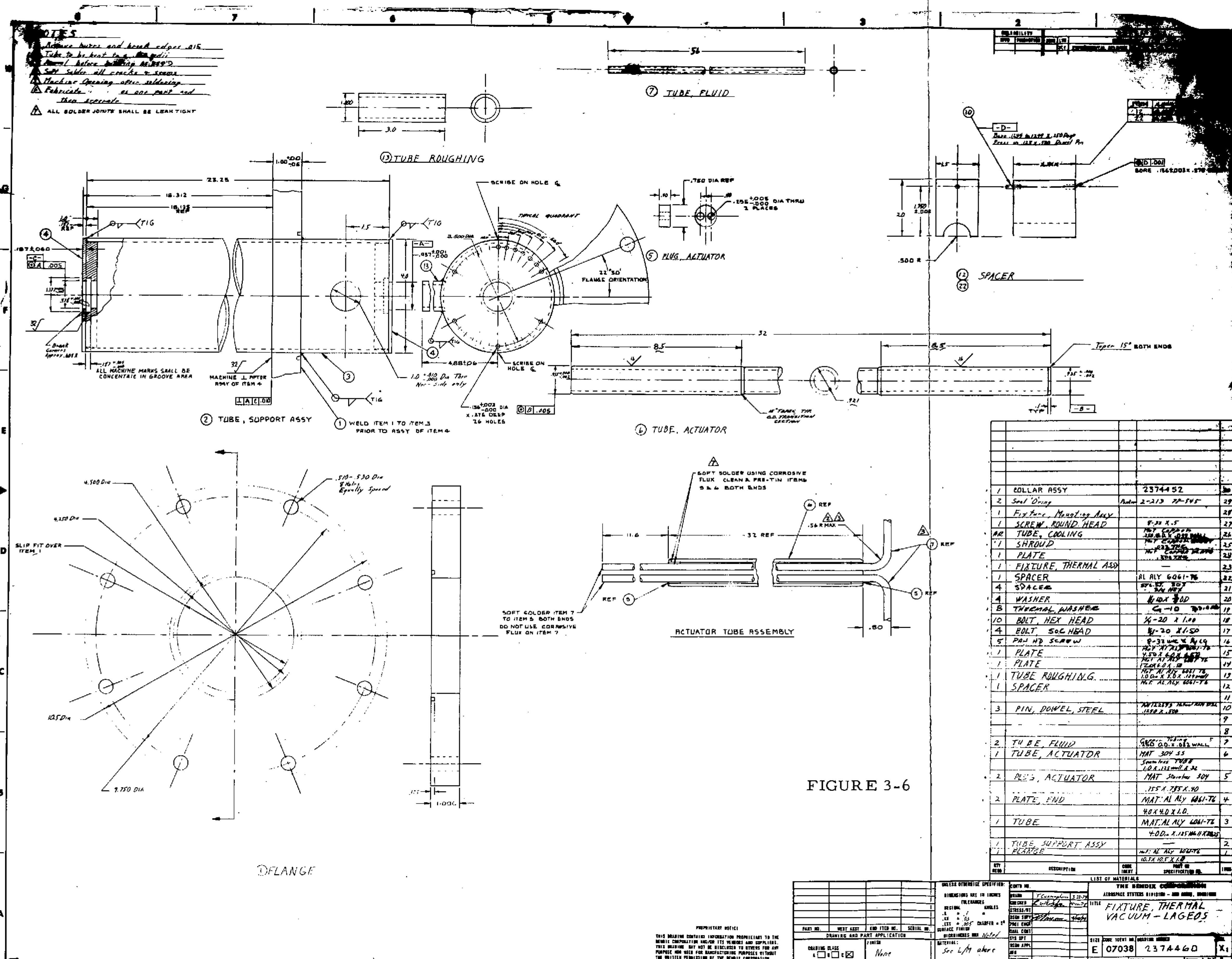

FIGURE 3-6

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FIGURE 3-7

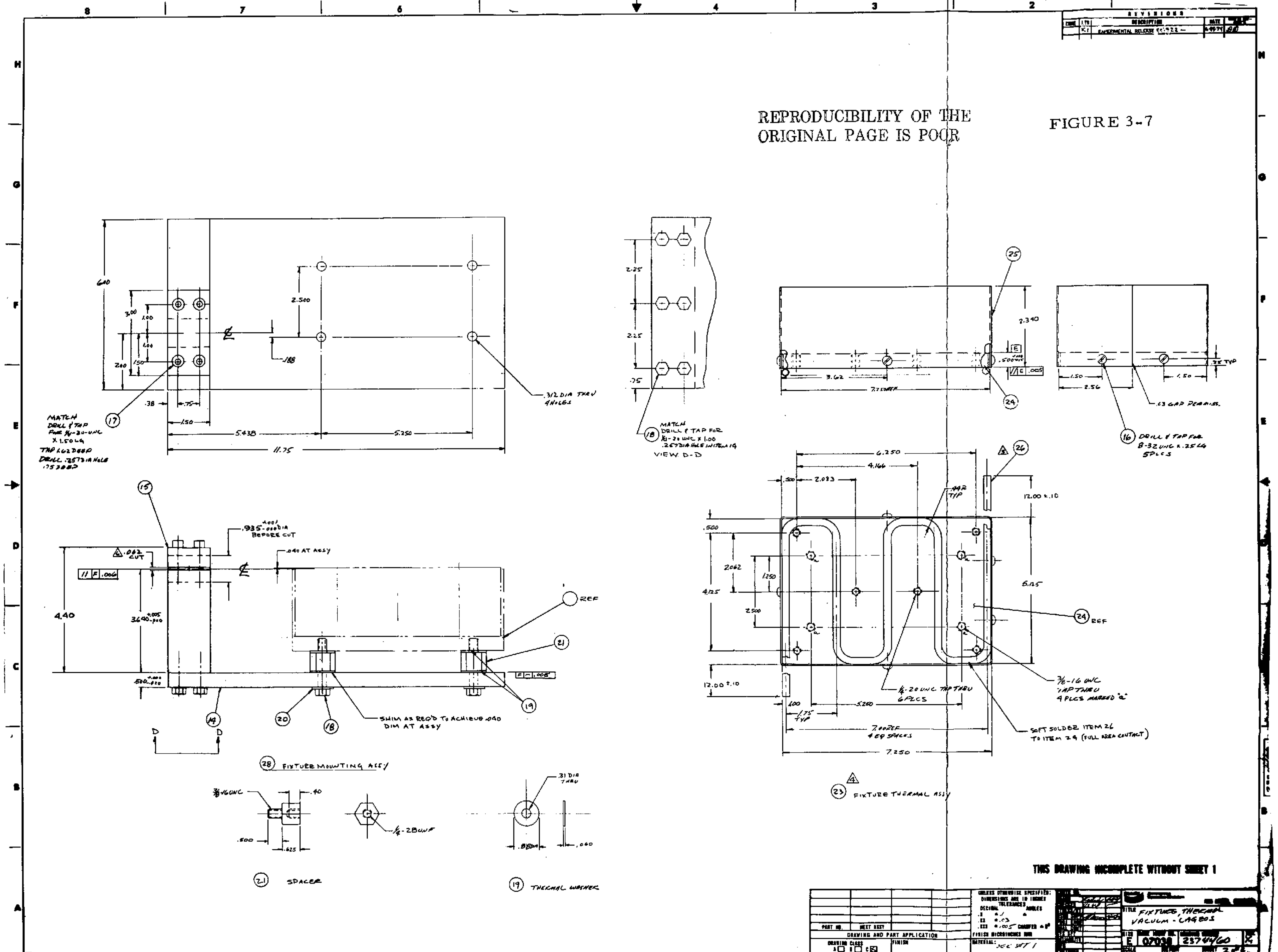

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FIGURE 3-8

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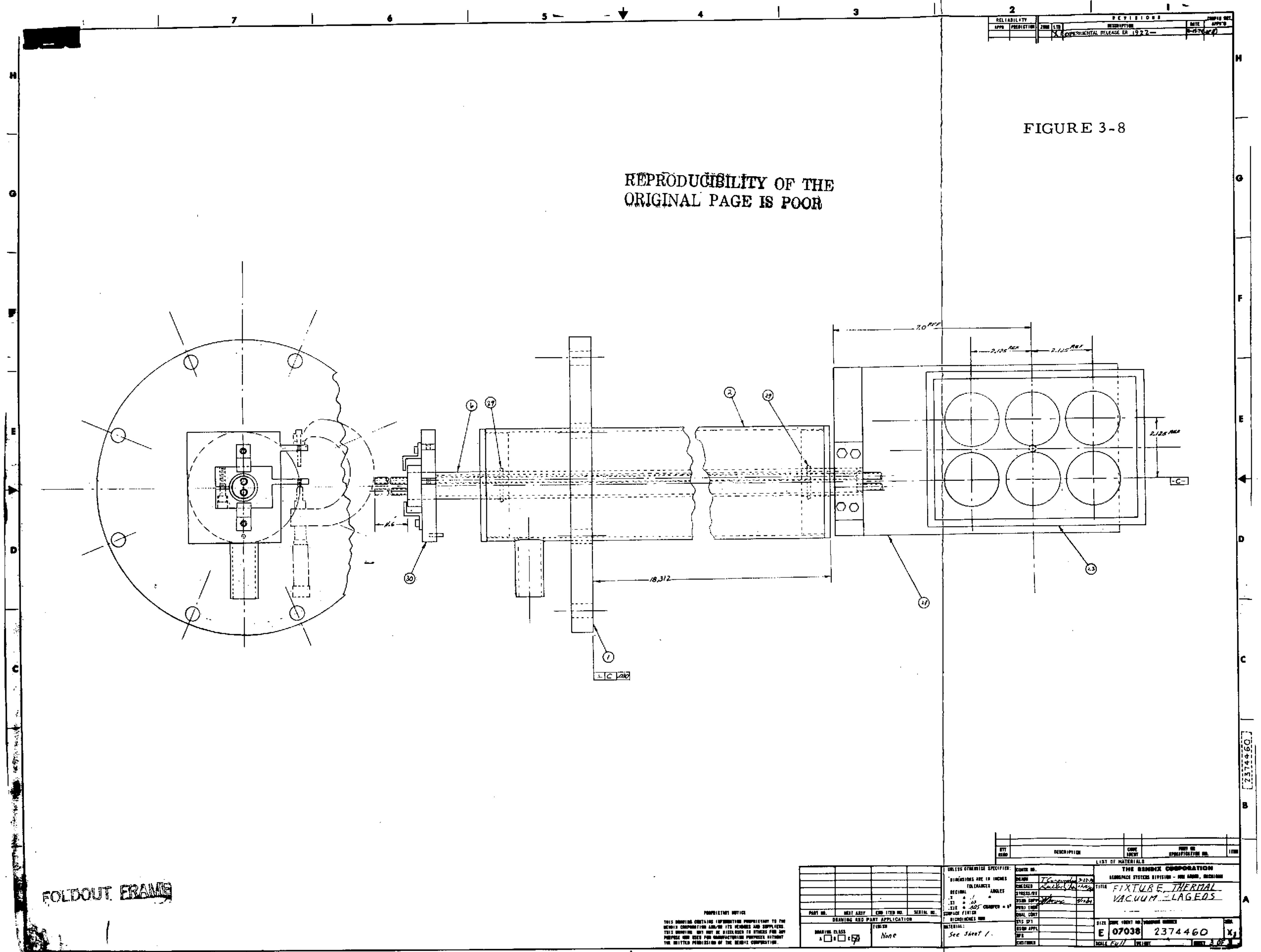

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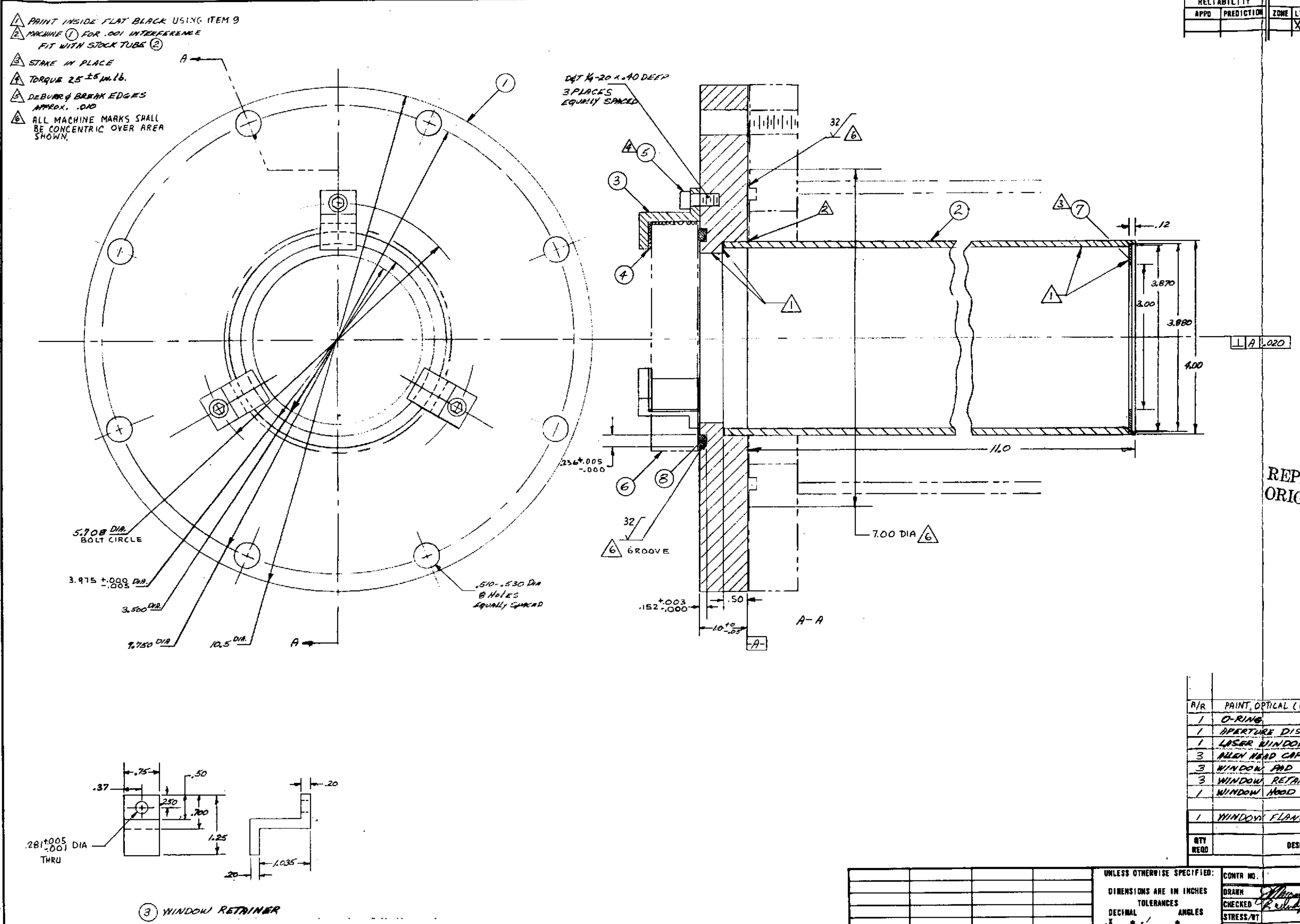
FOLDOUT FRAME 2

FIGURE 3-9



REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPV'D
	X1	EXPERIMENTAL RELEASE ER 1922-	4-15-74	

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QTY REQD	DESCRIPTION	CODE IDENT	PART OR SPECIFICATION NO.	ITEM
A/R	PAINT, OPTICAL (BLACK)	3M	NEXTEL 101	9
1	O-RING		PARKER 2-345 77-545	8
1	APERTURE DISK		ALUM 3.870 DIA x .06	7
1	LASER WINDOW - ZYGO CORP		2201-1000	6
3	ALLEN HEAD CAP SCREW		1/4-20 x .50	5
3	WINDOW PAD		NEOPRENE 60DUR .75x1.50x.060	4
3	WINDOW RETAINER		ALUM	3
1	WINDOW HOOD		Mat: AL Aly 6061-T6	2
			4.0 Dia x .125 Wall x 11.5	
1	WINDOW FLANGE		Mat: AL Aly 6061-T6	1
			10.5 DIA. x 1.0	

LIST OF MATERIALS

PART NO. | NEXT ASSY | END ITEM NO. | SERIAL NO.

DRAWING AND PART APPLICATION

DRAWING CLASS A ☐ B ☐ C ☒

FINISH

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMAL .X ± .1 .XX ± .03 .XXX ± .005 ANGLES ± CHAMFER ± 5°
SURFACE FINISH MICROINCHES RHR
MATERIAL:

CONTR NO.
DRAWN 4-3-74
CHECKED 4-10-74
STRESS/WT
DSGN SUPV
PROJ ENGR
QUAL CONT
SYS SPT
DSGN APPL
MFG
CUSTOMER

THE BENDIX CORPORATION
AEROSPACE SYSTEMS DIVISION – ANN ARBOR, MICHIGAN

TITLE LASER WINDOW FEEDTHRU - LAGEOS T-V TEST

SIZE D | CODE IDENT NO. 07038 | DRAWING NUMBER 2374453 | REV. X

SCALE | WEIGHT | SHEET

FOLDOUT FRAME

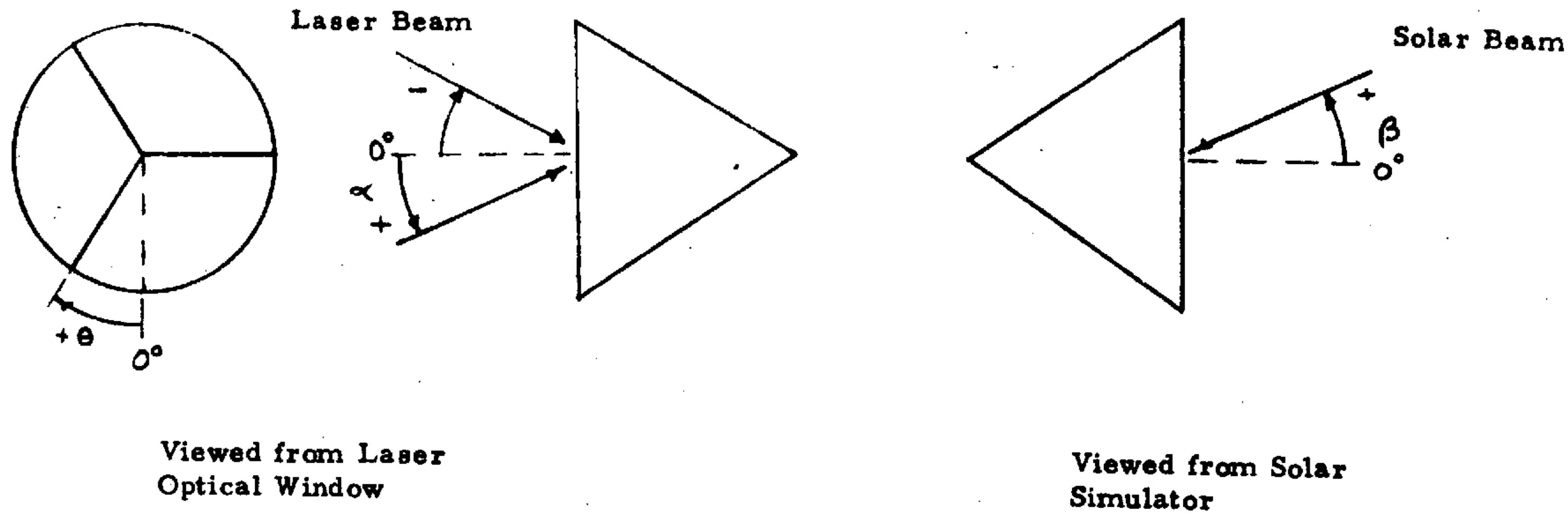

FIGURE 3-10

SOLAR AND LASER FIELD ANGLES AND RETROREFLECTOR ORIENTATION

FIGURE 3-11

FAR FIELD DIFFRACTION INSTRUMENT SCHEMATIC

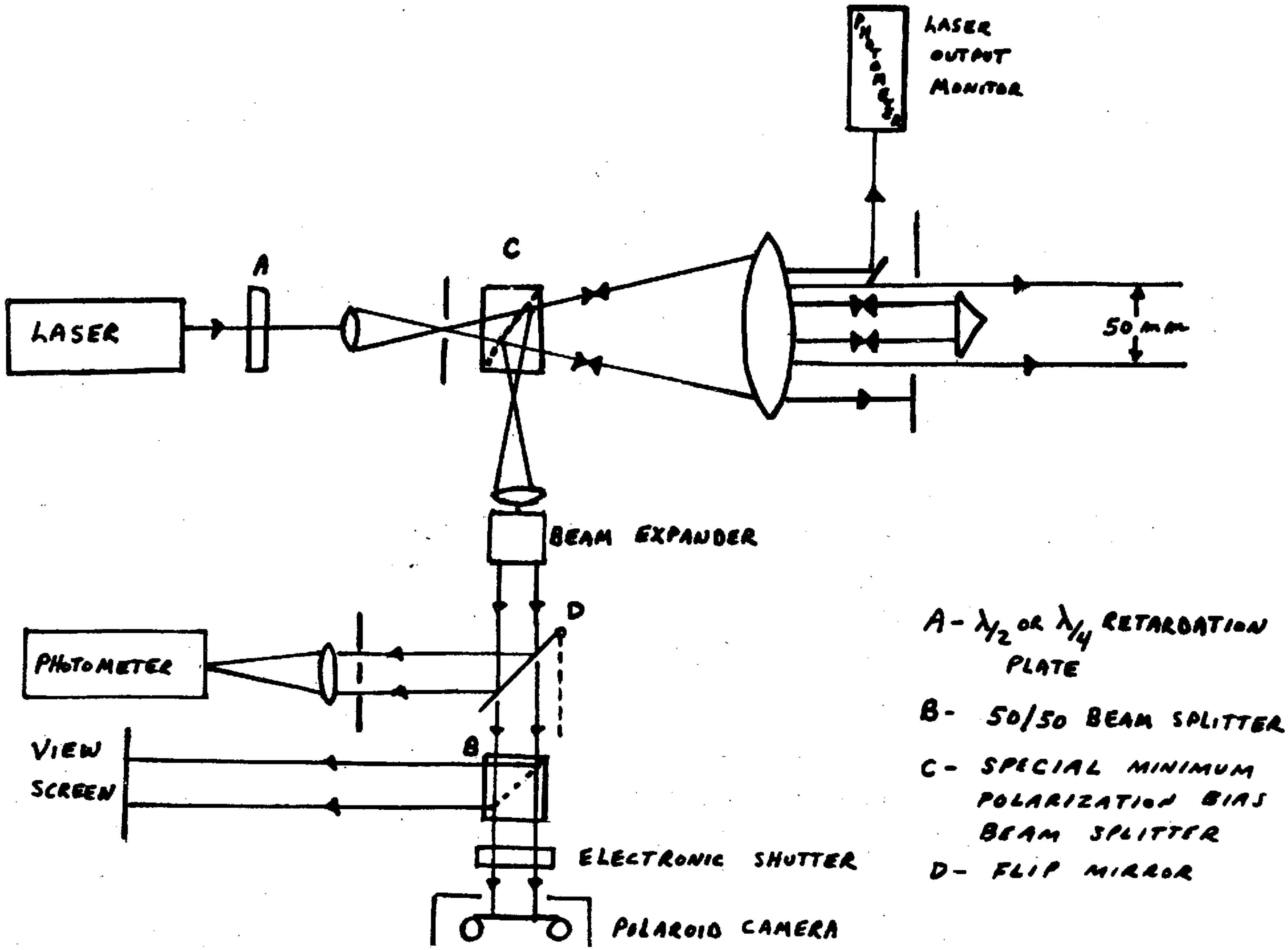

FIGURE 5-1

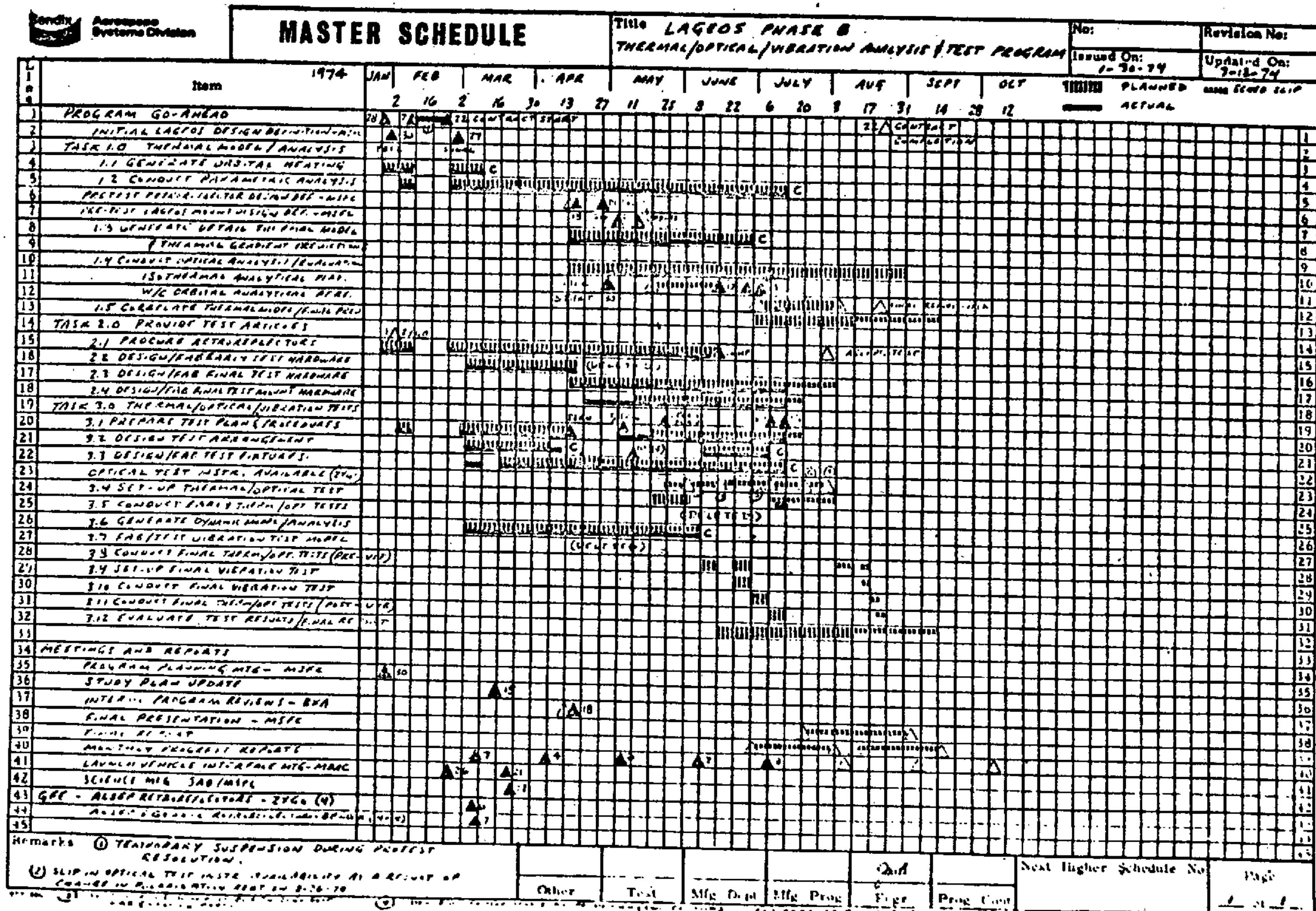

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FIGURE 5-2

Bendix Aerospace Systems Division

MASTER SCHEDULE

Title: TEST PLAN AND TEST PROCEDURES
LAGEOS - THERMAL/OPTICAL & VIBRATION TEST

No: TASK 9.1 | Revision No:
Issued On: 4-2-74 | Updated On: 7-12-74

Line	Item	1974: FEB	MAR	APR	MAY	JUNE	JULY	AUG.
		2, 16	2, 16, 30	13, 27	11, 25	8, 22	6, 20	3, 17, 31
1	TEST PLAN							
2	INITIAL RELEASE							
3	UPDATE RELEASES							
6	EARLY VIBRATION TEST PROCEDURE	DELETED X						
9	EARLY THERMAL/OPTICAL TEST PROCEDURE	DELETED X						
12	FINAL THERMAL/OPTICAL TEST PROCEDURE							
13	RELEASE						C	
14	TESTS (REF.)							②
15	FINAL VIBRATION TEST PROCEDURE							
16	RELEASE							
17	TEST (REF.)							②

Remarks ① Decision made at program review [illegible]
EARLY TESTS and [illegible]
② [illegible]
[illegible]

Other | Test | Mfg. Dept. | Mfg. Prog. | Eng. | Prog. Con. | Next Higher Schedule No. | Page

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

FIGURE 5-3

Aerospace Systems Division

MASTER SCHEDULE

Title: TEST ARTICLE DESIGN/FAB/TEST LAGEOS – FINAL TESTS

No: TASK 2.3 | Revision No:

Issued On: 4-2-74 | Updated On: 7-12-74

1974: FEB, MAR, APR, MAY, JUNE, JULY, AUG

Line	Item
1	FINAL TEST ARTICLE
2	DEFINE REQTS.
3	PREL. MOUNT DESIGN / TO MSFC
4	COORD. MOUNT DESIGN W/MSFC / AGREEMENT
5	CAVITY DESIGN & SPACING - DEFINED BY MSFC
6	DESIGN – FINAL TEST ARTICLE ASSY
7	PANEL
8	RETROREFLECTOR MOUNT HARDWARE
9	UPPER & LOWER RINGS
10	RETAINER RING
11	MOUNT SCREWS – SELECTION
12	FASTENERS - ASSY TIE DOWN + SELECTION
13	
14	FAB/ASSY - FINAL TEST ARTICLE
15	PANEL
16	RETROREFLECTOR MOUNT HARDWARE
17	UPPER RING (6)
18	LOWER RING (6)
19	RETAINER RING (6)
20	MOUNT SCREWS (18)
21	
22	RETROREFLECTORS (6) T/C (2 YRS)
23	FASTENERS - ASSY TIE DOWN (STOCK)
24	
25	FINAL THERMAL/OPTICAL TEST
26	PRE-VIB T/O TESTS
27	VIB TESTS
28	POST-VIB T/O TESTS
29	
30	OPTICAL TEST INSTR. (FFOS) AVAILABLE
31	SET-UP THERMAL OPTICAL TEST
32	EARLY THERMAL/OPTICAL TEST (DELETED)
33	
34	
35	THERMOCOUPLE FIXTURE (2374466)
36	DESIGN
37	FAB/ASSY
38	BLOCK
39	UPPER RING (2)
40	LOWER RING (2)
41	RETAINER RING (2)
42	SCREWS
43	RETROREFLECTOR (2) (ALTER) - GFE
44	MATCH DRILL ON TEST FIXTURE
45	

Remarks: SCHEDULE UPDATE ON 4-29-74 ... SELECTION OF CIRCULAR-FACED RETROREFLECTOR & EXPANDED FINAL TEST PANEL.
(1) FINAL TEST ARTICLE ... CONFIGURATION ...
(2) SELECT RETROREFLECTOR ... W/ ...
(3) SELECT RETROREFLECTOR MOUNT ... WITH MSFC
(4) UPDATE ... MSFC MOUNT ...
(5) ...
(6) ... WITH RETROREFLECTOR ...

Other	Test	Mfg Dept	Mfg Prog	Engr	Prog Cont	Next Higher Schedule No	Page 1 of 1
				[signature]			

R-29

FIGURE 5-4

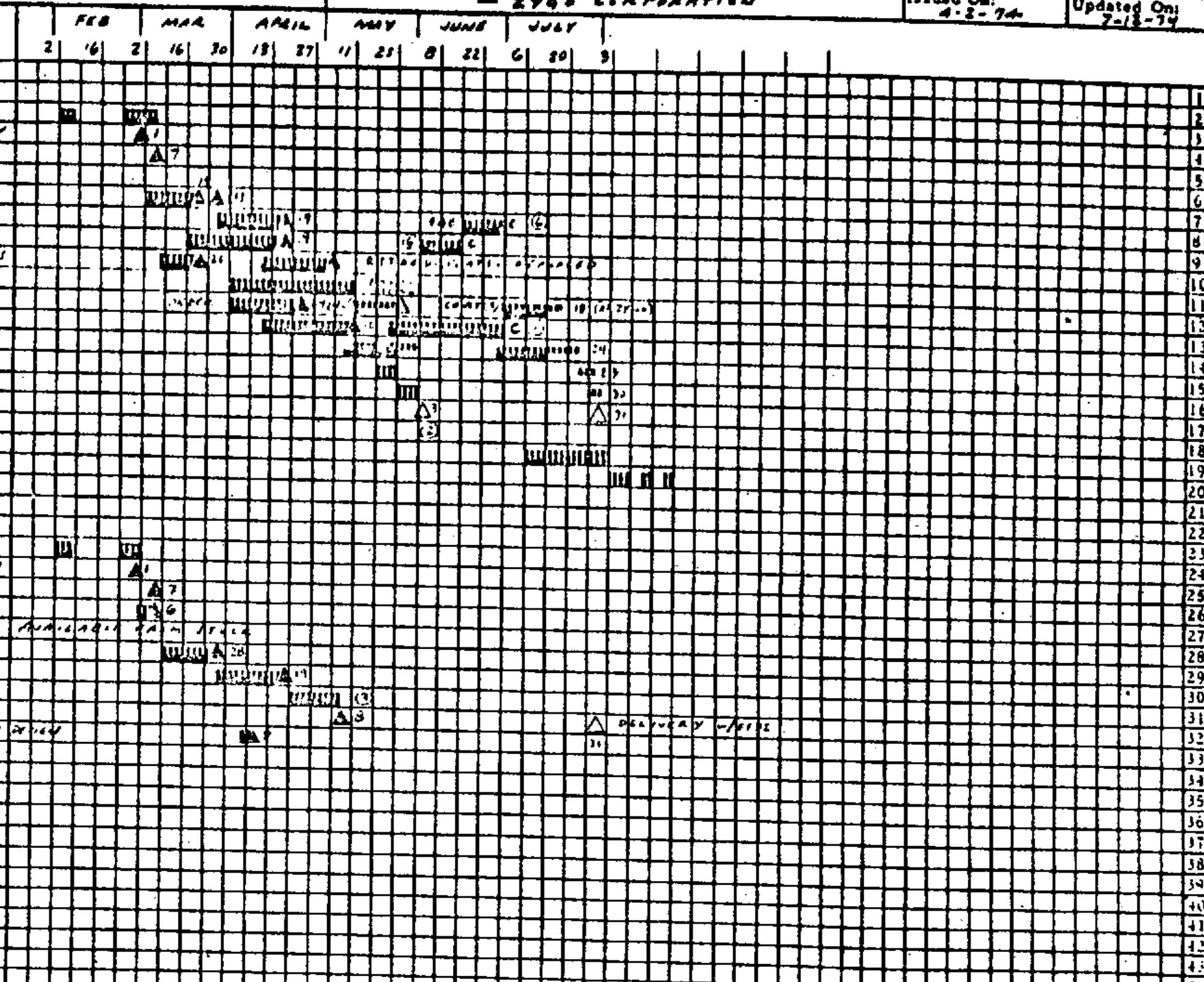
Bendix Aerospace Systems Division

MASTER SCHEDULE

Title: FAR-FIELD DIFFRACTION INSTRUMENT & OPTICAL WINDOW SCHEDULES — ZYGO CORPORATION

No: CAPITAL [illegible] PROCUREMENT | Revision No:
Issued On: 4-2-74 | Updated On: 7-18-74

Line	Item (1974)
1	FAR-FIELD DIFFRACTION INSTRUMENT
2	PRE-CONTRACT REQTS DEFINITION
3	& PREL. DESIGN
4	REQUIREMENTS DOCUMENT & SOW REVIEW
5	T/C GO-AHEAD
6	DESIGN
7	LAYOUT - CIRCULARLY POLARIZED
8	LAYOUT - LINEARLY POLARIZED
9	DETAIL DRAWINGS
10	PROCURE LASER & CRITICAL OPTICAL PARTS
11	BREADBOARD ASSY & TEST
12	PROCURE OTHER PARTS
13	FAB MECHANICAL PARTS
14	ASSEMBLE INSTRUMENT
15	CHECK-OUT & TEST INSTRUMENT
16	DEMONSTRATION TEST
17	DELIVER - TO BENDIX
18	
19	THERMAL/OPTICAL TEST SET-UP (BXS)
20	TESTS
21	
22	OPTICAL WINDOW
23	PRE-CONTRACT REQTS. DEFINITION
24	& PREL. DESIGN
25	REQUIREMENTS DOCUMENT & SOW REVIEW
26	T/C GO-AHEAD
27	COMPLETE DESIGN
28	PROCURE MATERIAL
29	FABRICATE
30	COATING (BY VENDOR)
31	CHECK-OUT & TEST
32	DELIVER TO BENDIX
33	ZYGO REVIEW - [illegible] BENDIX OPT. WND. ASSY DESIGN
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	



Remarks: * REVISE BASIC DESIGN FROM CIRCULARLY-POLARIZED BEAM TO LINEARLY-POLARIZED BEAM PER BENDIX-NASA/MSFC AGREEMENT
** ZYGO - "BEST EFFORT" SCHEDULE
*** [illegible]

Other	Test	Mfg Dept	Mfg Prog	Engr	Prog Cont	Next Higher Schedule No	Page 1 of 1

FIGURE 5-5

Bendix Aerospace Systems Division

MASTER SCHEDULE

Title: TEST FIXTURES-DESIGN/FAB/CHECKOUT LAGEOS

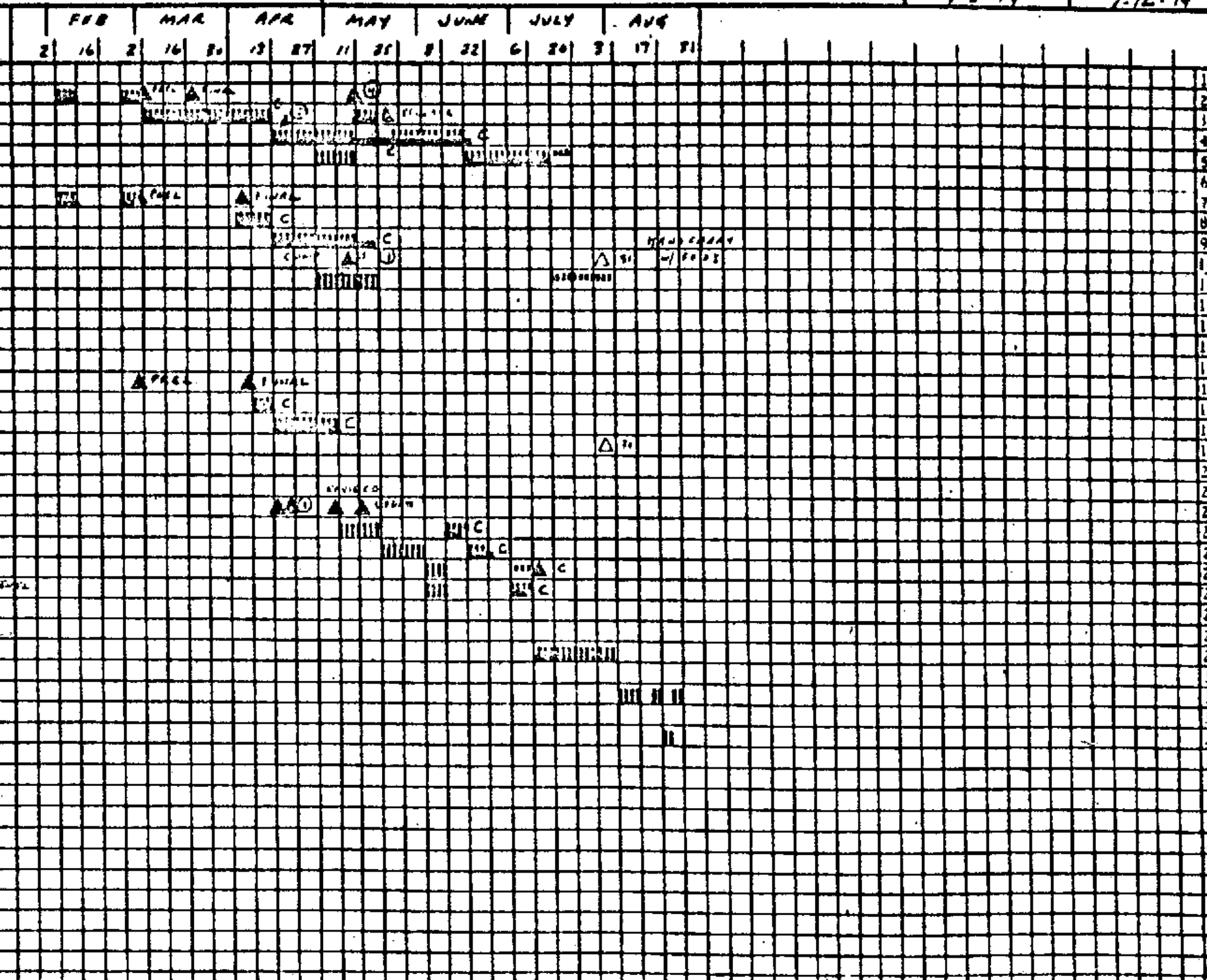
No: TASK 3.3

Revision No:

Issued On: 4-8-74

Updated On: 7-12-74

Line	Item (1974)
1	THERMAL/OPTICAL TEST FIXTURE
2	DEFINE REQTS.
3	DESIGN
4	FAB PARTS
5	ASSY & CHECK-OUT ON T/V CHAMBER
6	OPTICAL WINDOW & SHIELD ASSY
7	DEFINE REQTS.
8	DESIGN
9	FAB PARTS
10	WINDOW DELIVERED BY ZYGO
11	ASSY. & CHECKOUT ON T/V CHAMBER
12	
13	
14	
15	FFDI SUPPORT PLATE
16	DEFINE REQUIREMENTS
17	DESIGN
18	FAB/ASSY
19	FIT-CHECK ON FFDI
20	
21	VIBRATION TEST FIXTURE
22	DEFINE REQTS.
23	DESIGN
24	FAB
25	FIT-CHECK ON VIB. SYSTEM
26	FIT-CHECK WITH TEST ARTICLE PANEL
27	
28	
29	THERMAL/OPTICAL TEST SET-UP (REF)
30	
31	THERMAL/OPTICAL TESTS (REF)
32	
33	VIBRATION TEST (REF)
34–45	



Remarks: ① ACTION ITEM AT [illegible] REVIEW TO [illegible] TEST ARTICLE CAVITY SPACING, IMPACTS REQTS OF VIB TEST FIXTURE ② ACTION ITEM TO REVISE TEST ARTICLE SPACING IMPACTS [illegible] FIXTURE; PUT HOLD ON PARTS UNTIL [illegible] DESIGN DET. FROM TEST [illegible] REVISED CAVITY SPACING. SPACING DEFINED 5-8-74 ③ DELAY SHIPPING UNTIL FFDI [illegible] ④ [illegible]

Other	Test	Mfg Dept	Mfg Prog	Engr	Prog Cont
				[illegible signature]	

Next Higher Schedule No

Page 1 of 1

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

FIGURE 5-6

Bendix Aerospace Systems Division

MASTER SCHEDULE

Title: TEST EQUIPMENT NEED SCHEDULE
LAGEOS - THERMAL/OPTICAL/VIBRATION TESTS

No: TASK 3.1
Revision No:
Issued On: 4-2-74
Updated On:

Line	Item (1974)	
1	TEST EQUIPMENT	
2	THERMAL/VACUUM CHAMBER (NEB)	(ADS)
3	(ASSOCIATED CONTROL EQUIPMENT	
4	GENERAL SOLAR SIMULATORS (3)	(AVAILABLE)
5	CHECKOUT	
6	HYCAL RADIOMETER (P-8410)	(AVAILABLE)
7		
8	HEAT EXCHANGER	(ADS)
9		
10	CAVENDISH (TEST ARTICLE INSTR.	
11	THERMOCOUPLES	(BUY
12	ACCELEROMETERS	(ADS)
13		
14	DATA ACQUISITION SYSTEM	(ADS)
15		
16	OPTICAL ALIGNMENT INSTRUMENTATION	(ADS)
17		
18	SUPPORT TABLE	(AVAILABLE)
19		
20	POLAROID CAMERA	(ADS)
21		
22	VIBRATION TEST SYSTEM	(ADS)
23		
24	EARTH IR SIMULATORS	(AVAILABLE)
25		
26		
27		
28		
29		
30		
31		
32	EXPENDABLE ITEMS	
33	LIQUID N_2	AVAILABLE IN STOCK
34		
35	CARBON RODS	AVAILABLE IN STOCK
36		
37	MAGNETIC TAPE	AVAILABLE IN STOCK
38		
39	POLAROID FILM	AVAILABLE IN STOCK
40		
41		
42		
43		
44		
45		

Time scale (1974): FEB 2, 16; MAR 2, 16, 30; APR 13, 27; MAY 11, 25; JUNE 8, 22; JULY 6, 20; AUG 3, 17, 31

Remarks: ADS = AVAILABLE ... SCHEDULE

Other	Test	Mfg Dept	Mfg Prog	Engr	Prog Cont	Next Higher Schedule No

RELIABILITY		REVISIONS			CONFIG MGT.
APPD	PREDICTION	LTR	DESCRIPTION	DATE	APPV'D
			EXPERIMENTAL RELEASE ER 1922-16	7-11-74	
			1		

APPENDIX S

TABLE OF CONTENTS

TEST DATES
8-6-74 TO 8-16-74

DRAWING AND PART APPLICATION			
SERIAL NO.	END ITEM NO.	NEXT ASSY	PART NO
N/A	N/A	N/A	2374455

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.

MATERIAL:

DRAWING CLASS
A ☐ B ☐ C ☒

CONTR NO.		
DRAWN		
CHECKED		
STRESS/WT		
DSGN SUPV		7-9-74
PROJ ENGR		7-9-74
QUAL CONT		
SYS SPT		
DSGN APPL		
MFG		
CUSTOMER		

THE BENDIX CORPORATION
AEROSPACE SYSTEMS DIVISION - ANN ARBOR, MICHIGAN

TITLE
LAGEOS PHASE B
THERMAL-OPTICAL TEST PROCEDURE

SIZE	CODE IDENT NO.	DRAWING NUMBER	REV
A	07038	TP 2374455	X1
SCALE	WEIGHT	SHEET 0 of 48	

1.0 PURPOSE

The purpose of this test is to: (1) determine the optical performance of the LAGEOS Retroreflectors under simulated orbit environment conditions and (2) to verify that the results obtained from previously-conducted thermal/optical analyses are representative of retroreflector orbital performance.

2.0 SCOPE

This document specifies the procedures and equipment necessary to perform the thermal-optical tests. A series of test sequences will be performed under varied conditions of atmospheric pressure, coldwall and test article temperature, and Earth IR and solar radiation, while observing, photographing and measuring intensity of retroreflector far field diffraction patterns. Selected conditions will be repeated after vibration testing to assess the effects of the dynamic environment on retroreflector performance.

3.0 APPLICABLE DOCUMENTS

LAGEOS Thermal/Optical/Vibrational Analyses and Testing Study Plan (Rev. B)
LAGEOS Phase B T/O/V Test Plan (Rev. B)

2374458	LAGEOS T/O/V Test Article
STM 1036	Operating Procedure for NRC 4x8 Vacuum Chamber
STM 1005	Tenny-Kold Pak Operating Procedure
STM 1019	Operating Procedure for Solar Simulator
STM 1017	Operating Procedure for HP Data Acquisition System
STM 1008	Operating Procedure for NesLab Temperature Control
---	Operating Manual for Zygo Far Field Diffraction Instrument

4.0 PARTICIPANTS

LAGEOS Engineering Representative
Environmental/Quality Test Conductor
E/QT Thermal-Vacuum Engineer
E/QT Instrumentation Engineer

5.0 EQUIPMENT REQUIRED

Item	Manufacturer	Part No. or Model	*Serial No.	*Calib. Date
4x8 Chamber	NRC	N/A	BSD9894	N/A
Heat Exchanger	Tenney	C4W-B2-9000	6575	12-10-74
Data Acquisition System	HP	2010J	14329	12-29-74
Recorder	~~Sanborn~~ H-P	7700	14926	1-12-75
Roughing Pump	N/A	N/A	N/A	N/A
Reference Oven	RI Controls	RJ4081	13722	5-22-75
Temperature Controller	Neslab	KL242.60-2-720	N/A	N/A
FFDI	Zygo	N/A	N/A	N/A
Arc Lamp	Genarco	ME-6	N/A	N/A
Fixture	BxA	2374460	N/A	N/A
Window Feed Thru	BxA	2374453	N/A	N/A
Leveling Plate	BxA	2374454	N/A	N/A
Earth IR Simulator	BxA	N/A	N/A	N/A
Radiometer #1	Hy Cal	9410-A-02-072	44045	N/A
Radiometer #2	Hy Cal	9410-A-02-072	44195	N/A
Variac (4) Panel	N/A	N/A	N/A	N/A
Laser, Boresight	EOA	P-104	403	N/A
Vacuum Gage	NRC	751	50627	9-13-74
Alignment Targets	BxA	N/A	N/A	N/A
Torque Wrench	Snap-on	BSD-10886	N/A	9-5-74

*To be completed prior to testing. Equipment substitutions and additions shall be listed above.

6.0 PRE-TEST VERIFICATION

6.1 Test Setup

7/23/74

6.1.1 Install the No. 2 Earth IR Simulator in the 4x8 chamber as shown in Figures 1 and 7. ✓

6.1.2 Install the thermal-vacuum test fixture, 2374460, in the 4x8 chamber at the location shown in Figure 1 and in accordance with Figures 2, 3 and 4. Do <u>not</u> install the LAGEOS Test Article. ✓

6.1.3 Connect the fixture thermal assembly cooling lines to the actuator tube. ✓

6.1.4 Perform helium leak check of entire fixture cooling circuit. ✓

6.1.5 Install window feedthru assembly, 2374453, on port at rear of chamber. The Zygo window will <u>not</u> be installed at this time. ✓

6.1.6 Install a standard chamber window on the window feedthru. This window is to have a thermocouple, #28, attached to its inside surface at the approximate center. ✓

6.1.7 Connect the following thermocouples, via a feedthru to the outside instrumentation: window hood TC, manipulator tube TC, window TC, thermal assy TC, Coldwall TC's. ✓

6.1.8 Connect the window hood and manipulator heaters to their respective power sources. ✓

6.1.9 Install the (2) radiometers, as shown in Figures 1 and 7. Connect their cooling lines, thermocouples, and signal leads per 10.1 Instrumentation Summary. ✓

6.1.10 Install the No. 1 Earth IR Simulator as shown in Figures 1 and 7. ✓

6.1.11 Install the Coldwall door panel and connect its thermocouple to the instrumentation. ✓

6.1.12 Connect roughing pump to the fixture roughing port. ✓

6.1.13 Connect the Tenney heat exchanger to the fixture cooling circuit. ✓

6.1.14 Connect the Neslab temperature controller to the radiometer cooling circuit. Connect radiometer signal outputs to the outside instrumentation. ✓

6.2 Verification Procedure

6.2.1 Start fixture roughing pump and chamber vacuum pumps per STM 1036. ✓

6.2.2 When the chamber is sufficiently evacuated, start the Tenney heat exchanger, the Neslab temperature controller, and the chamber coldwall. ✓

1240 7/25/74

6.2.3 Adjust the Neslab temperature controller to maintain the radiometer sink temperatures at 38 ± 2°C. ✓

6.2.4 Adjust the Tenney heat exchanger, per STM 1005, to stabilize the fixture thermal assembly at -30 ± 5°C. ✓

6.2.5 Apply power, via Variac #1, to the Window Hood heater and adjust as necessary to maintain the window thermocouple, #28, reading at 24 ± 2°C. ✓

6.2.6 Apply power, via Variac #2, to the manipulator tube heater and adjust as necessary to maintain the manipulator tube temperature at 24 ± 2°C. ✓

6.2.7 When all environmental parameters have stabilized, record the following data:

Chamber pressure	6.6×10^{-7}	Torr
Window Temperature	+21.7	°C
Window Heater	9.58	VAC
Manipulator Temperature	+22.2	°C
Manipulator Heater	14.99	VAC
Thermal Assy Temperature	-30	°C
Coldwall Average Temperatures	-195	°C

1530 HRS
7/25/74

6.2.8	Obtain background readings for the radiometers. Radiometer No. 1 [redacted] (-) -3.76 mv Radiometer No. 2 [redacted] (-) -3.71 mv 3.76 − .50 = 3.26 3.71 − .5 = 3.21	✓
6.2.9	Apply power, via Variac #3, to the No. 1 Earth IR simulator. Adjust so that radiometer No. 1 indicates 0.5 mv (1/20 S.C.) radiant input from the simulator. Record the simulator voltage. Turn off the IR simulator.	41.76 VAC
6.2.10	Apply power, via Variac #4, to the No. 2 Earth IR simulator. Adjust so that radiometer No. 2 indicates 0.5 mv (1/20 S.C.) radiant input from the simulator. Record the simulator voltage. Turn off the IR simulator.	34.08 VAC
6.2.11 Item 4	Return all environmental parameters to ambient conditions per STM 1086. CAUTION: Maintain Tenney and Neslab operation until the coldwall warms up to avoid freezing of internal lines.	7/25/74 ✓
6.2.12	Remove the instrumented window from the window feed thru.	✓ 7/29/74
6.2.13	Remove the fixture thermal assy and the fixture mounting assy. (items 23 & 28, Figure 3) from the test setup.	✓ 7/29/74

7.0 TEST SETUP AND ALIGNMENT

Item 17 ~~7.1 Install Zygo window on the window feedthru.~~ ✓✓

7.2 Install alignment targets on the Zygo window and on the chamber door center window. See Figure 5. 7/30/74

7.3 Set up the boresight laser. ✓

7.4 Adjust the boresight laser positioning so that its beam is centered on the center aperture of both alignment targets. ✓

NOTE: After positioning is complete, avoid disturbing the setting of the boresight laser.

CAUTION: PROTECT PERSONNEL FROM DIRECT OR REFLECTED IMPINGEMENT OF LASER BEAM ON THE EYES.

~~Item 3 Alternate assy of Test Article complete.~~

7.5 Verify that retroreflectors A, B and C have been installed in the Test Article Panel, and that the thermal assembly has been shimmed to place the retroreflector front faces on the manipulator rotating axis. (See Figures 3 and 9.)

Item 17

7.6 Verify that thermocouples have been installed on the ALSEP retroreflectors X and Y and on the Test Article Panel and Thermocouple Fixture per Figure 6.

7.7 Verify that retroreflectors D, E and F are installed in the Test Article Panel. (See Figure 9).

7.8 Mount the first surface mirror, using double-sided Scotch tape, on the Test Article panel so that it is centered over retroreflector A. ✓

7.8.1 Mount the position target, using Scotch tape, on the Test Article block so that it is centered over retroreflector B. ✓

7.9 Set the manipulator rotationally so that it is indexed to a solar angle of 0 degrees. Set the vernier drive to 0.400 on the micrometer. ✓

7.10 Attach the Test Article/Thermal Fixture/Support Fixture assembly to the actuator tube so that the Test Article front face is vertical and facing the chamber door. Use a spirit level to obtain the front face verticality. 7/30/74

7.10.1 Place the spacer block, 2374469-1, on the outside end of the support tube. Verify that the boresight laser spot is horizontally centered on the position target for the B retroreflector.

7.10.2 If horizontal positioning in 7.10.1 is not correct, move the collar assembly axially on the actuator tube to obtain correct horizontal positioning. Verify Test Article front face verticality as in 7.10.

7.10.3 Remove the spacer block.

~~7.11 Secure the Test Article thermocouple leads to the manipulator fixed part allowing a flex loop for a minimum of 300° of rotary freedom.~~

ITEM 17

~~NOTE: All operations hereafter for rotating the manipulator from solar to field view, or vice versa, will be "over the top".~~

~~7.12 Rotate the manipulator from 60° below horizontal solar angle to 60° below horizontal field view angle to verify the freedom of thermocouple lead wires.~~

7.13 Set the rotary index to the 0 degree field view point.

7.14 Turn on the boresight laser.

CAUTION: PROTECT PERSONNEL FROM DIRECT OR REFLECTED IMPINGEMENT OF LASER BEAM ON THE EYES.

7.15 Adjust the rotary vernier to vertically center the reflected laser spot on the Zygo window alignment target. Record the vernier setting. 7/30/74 ✓

Rotary Zero Vernier Reading .270

7.16 Verify that the reflected laser spot is horizontally within 1/4 inch (0.3°) of the alignment target center. ✓ 1/8"

7.17 If horizontal centering is not within 1/4 inch, proceed as follows:

7.17.1 Adjust the rotary vernier to 0.400. N/A

7.17.2 Change shims(item 19, Figure 3) between the thermal fixture assy (item 23) and the support fixture assy (item 28) to obtain horizontal centering of the reflected laser spot within 1/4 inch (0.3°) on the Zygo window alignment target. N/A

NOTE: Shims to be added and removed equally to rotate the Test Article about its center line.

7.17.3 Loosen the support fixture saddle clamp and turn the support fixture/thermal fixture/Test Article assembly on the manipulator tube so as to vertically center the reflected laser spot within 1/4 inch on the alignment target. Re-tighten the saddle clamp. N/A

Item 2 Repeat 7.10.1 and 7.10.2 N/A

7.17.4 Repeat Step 7.15 and record the new rotary zero reading. N/A

~~7.18 Remove the boresight laser from its position in the test set up; its usage is completed.~~

Item 17

~~7.19 Install the Far Field Diffraction Instrument (FFDI) on the leveling plate, 2374454, and position it on a wooden top work bench as shown in Figure 1.~~

~~7.19.1 Set manipulator axes for viewing the first surface mirror.~~

7.18 Adjust the boresight laser positioning so that its beam is centered on the center aperture of both alignment targets. ✓ 8/5/74

NOTE: After positioning is complete, avoid disturbing the setting of the boresight laser.

CAUTION: PROTECT PERSONNEL FROM DIRECT OR REFLECTED IMPINGEMENT OF LASER BEAM ON THE EYES.

7.18.1 Verify that Addendum I, assembly of the test article/fixture and installation of thermocouples has been completed. ✓

7.18.2 Mount the first surface mirror, using double-sided Scotch tape, on the Test Article panel so that is is centered over retroreflector A. ✓

7.18.3 Mount the position target, using Scotch tape, on the Test Article block so that it is centered over retroreflector B. ✓

7.18.4 Attach the test article/thermal fixture assembly to the support fixture using shims as shown in Figure 10. ✓

7.18.5 Connect the cooling lines from the thermal fixture to the actuator tube. ✓ 8/6/74

7.18.6 Secure the Test Article thermocouple leads to the manipulater fixed part, allowing a flex loop for a minimum of 300° of rotary freedom.

NOTE: All operations hereafter for rotating the manipulator from solar to field view, or vice versa, will be "over the top". ✓ 8/6/74

7.18.7 Rotate the manipulator from 60° below horizontal solar angle to 60° below horizontal field view angle to verify the freedom of thermocouple lead wires. ✓ 8/6/74

7.18.8 Verify that the optical node of retro-reflector A is located on the actuator rotary axis as follows. ✓

7.18.9	Set up a transit approximately five feet away in front of the 4' x 8' chamber so that it is located on the chamber center line.	8/5/74 ✓
7.18.10	While viewing retro-reflector A thru the transit, rotate the actuator ± 20 degrees about the 0^{o} solar angle position, observing for apparent motion of the retro apex.	✓
7.18.11	Add or remove shims, at all four support spacers A-D (see Figure 10) equally, to minimize or eliminate the apparent retro apex movement. Enter shim changes in Figure 10.	✓
7.18.12	Place the spacer block, 2374469-1, on the outside end of the support tube. Verify that the boresight laser spot is horizontally centered on the position target for the B retro-reflector.	1/16"
7.18.13	If horizontal positioning is not correct, move the collar assembly axially on the actuator tube to obtain correct horizontal positioning.	N/A
7.18.14	Remove the spacer block.	✓
7.18.15	Set the rotary index to the 0 degree field view point.	✓
7.18.16	Turn on the boresight laser.	
CAUTION:	PROTECT PERSONNEL FROM DIRECT OR REFLECTED IMPINGEMENT OF LASER BEAM ON THE EYES.	
7.18.17	Adjust the rotary vernier to vertically center the reflected laser spot on the Zygo window alignment target. Rotary Zero Vernier Reading 0.252	✓
7.18.18	Verify that the reflected laser spot is horizontally within 1/4 inch (0.3^{o}) of the alignment target center.	.75 ~~.25~~

8/5/74

7.18.19 If horizontal centering is not within 1/4 inch, proceed as follows:

7.18.20 Adjust the rotary vernier to 0.400.

7.18.21 Change shims (item 19, Figure 3) between the thermal fixture assy (item 23) and the support fixture assy (item 28) to obtain horizontal centering of the reflected laser spot within 1/4 inch (0.3°) on the Zygo window alignment target. Enter shim changes in table of Figure 10.

NOTE: Shims to be added and removed equally to rotate the Test Article about its center line.

7.18.22 Loosen the support fixture saddle clamp and turn the support fixture/thermal fixture/Test Article assembly on the manipulator tube so as to vertically center the reflected laser spot within 1/4 inch on the alignment target. Re-tighten the saddle clamp. Repeat 7.18.12, 7.18.13 and 7.18.14.

7.18.23 Repeat Step 7.18.17 and record the new rotary zero reading. 0.252

7.18.24 Remove the boresight laser from its position in the test set up; its usage is completed.

7.18.25 Install the Zygo window on the window feedthru.

7.19 Install the Far Field Diffraction Instrument (FFDI) on the leveling plate, 2374454, and position it on a wooden top work bench as shown in Figure 1.

7.19.1 Set manipulator axes for viewing the first surface mirror.

7.20 Adjust the leveling plate position, height, and leveling screws so that both the incident and reflected FFDI spots are centered on the Zygo window alignment pattern. 8/6/74 0100hrs ✓

NOTE: It may be necessary to rotate (index) the Test Article away from, then back to, the zero view angle in order to differentiate between incident and reflected spots.

7.21 Verify that the FFDI incident spot is centered on the alignment target within ± 1/16 inch. ✓ +1/64 Right

7.22 Verify that the FFDI reflected spot is centered on the alignment target within ± 1/4 inch. ✓ ±0

7.23 Remove the mirror and position target from the Test Article. ✓

Item 17 ~~7.24 Connect the cooling lines from the thermal assy to the actuator tube. Perform a helium leak check of the cooling circuit.~~

~~7.25 Install the superinsulation blanket on the thermal fixture assembly.~~ Item 5

NOTE: Use care to avoid damaging the thermocouple leads from the Test Article.

DO NOT GET FINGERPRINTS OR OTHER CONTAMINATION ON THE RETROREFLECTORS.

7.26 Verify that the radiometers do not interfere with the rotational freedom of the manipulator assy and the Test Article thermocouple leads. ✓

7.27 Connect window hood heaters, manipulator heaters, and Earth IR heaters to their respective Variacs outside the chamber and to the DAS. See Data Sheet 10.1 ✓

7.28	Connect all thermocouples to the thermocouple reference oven/DAS, per Data Sheet 10.1.	✓
7.29	Connect the radiometer signal outputs to the DAS and to the chart-recorder, per Data Sheet 10.1.	✓
7.30	Perform verification/continuity check of all power circuits and data channels.	✓
7.31	Remove alignment targets from chamber window.	✓
7.32	Close chamber door and locate and connect the Arc Lamp Solar Simulator.	✓
7.33	Verify that the test setup is complete.	✓ 8/6/74

8.0 THERMAL-OPTICAL PROCEDURE

Item 28

A series of Thermal-Optical tests are to be performed as summarized in Figure 8. Section 10.2, Test Condition and Data Log, specifies the planned test conditions and optical data for each test. Actual test conditions and optical data will be entered in Section 10.2. The test article is shown in Figure 9.

Each test is a discrete element in the series; however, environmental conditions common to preceding tests may be maintained without re-cycling the environmental control systems. The sequence of tests 3 thru 9, Figure 8, may be altered by the Test Conductor.

The following temperature stabilization criteria shall be used as guidelines in conducting the series of thermal-optical tests. All criteria apply to ALSEP retroreflector, X and Y, temperatures.

a. Setting up initial test conditions; 2°C/Hour

Item 6

b. Taking optical data; stop and restabilize if radial and axial temperature gradients change more than ~~10%~~ 15%; e.g., a 2.0°C gradient goes beyond ~~1.8~~ 1.7 or ~~2.2~~ 2.3°C.

c. Restabilization after gradient change as in (b); return to original radial and axial gradients within ± 0.1°C and to original temperature within ± 5°C.

For verification of the scale of FFDI images during the tests, place the reference retroreflector in the laser beam, between the FFDI and the chamber window, and obtain optical data. Number the photograph and record on appropriate data sheet in Section 10.2. Perform this test at the following times:

Item 7

Prior to start of test No. 1
After test No. 4
After test No. 9
Prior to test No. 10
After test No. 12
Prior to test No. 13
After test No. 14

8.1 Turn on electrical power to all test instruments and recorders. Allow adequate warm-up time before starting tests. Do not apply power to Variacs 1 thru 4. 8/6/74 ✓

8.2 Set DAS operating controls per STM 1017. Initiate one data printout. ✓

8.3 Adjust the Sanborn recorder on the radiometer channel for a sensitivity of 1.0 mv/centimeter with 10.0 mv at center scale. ✓

8.4 Test No. 1 Isothermal/Ambient

8.4.1 Test conditions are to be at ambient. Initiate one DAS data printout. ✓

8.4.2 Log actual test conditions in Section 10.2, Test No. 1 Data Sheet. ✓

– Item 8 8.4.2.1 Obtain an FFDI verification photo using the reference retroreflector. Number the photo & enter number in Test Data Sheet. ✓

8.4.3 In accordance with the FFDI Operating Manual, obtain optical data for the retroreflectors at the field angles indicated. Number the photographs sequentially and enter the numbers in the Test No. 1 Data Sheet. ✓

8.4.4 Obtain, from the DAS printout, a single set of retroreflector temperature readings and enter in the Test No. 1 Data Sheet. ✓

8.4.5 Remove and rotate retroreflector C in the Test Article Panel, about its axis and reinstall in the 80 degree orientation angle (as shown in Dwg. No. 2374458). 8/6/74 0700 ✓

CAUTION: No not touch, mar or contaminate the retroreflector surfaces.

8.4.6 Install door coldwall and connect its thermocouple. ✓

8.5 Test No. 2 Isothermal/Vacuum

8.5.1 Start the fixture roughing pump and the chamber vacuum pumps, per STM 1036. Do not start the coldwall, fixture & window heaters, and IR Simulators. 0714 hrs ✓

ITEM 24

8.5.2 When the chamber is evacuated to a pressure less than ~~1 x 10-6~~ 2 x 10-5 torr, enter the actual test conditions in Section 10.2, Test No. 2 Data Sheet. ✓

8.5.3 Initiate one DAS data printout. ✓

8.5.4 Obtain optical data as indicated by the Test No. 2 Data Sheet. Number the photographs sequentially (continuing from the last photo number in 8.4.3) and enter the numbers in the Data Sheet. ✓

8.5.5 Obtain, from the DAS printout, a single set of retroreflector temperature readings and enter in the Data Sheet. ✓

8.6 Test No. 3 Thermal/Vacuum

8.6.1 Initiate DAS data printout at 10 minute intervals.

8.6.2 Start the Tenney Heat Exchanger per STM 1005 and adjust for a Test Article Panel temperature of +30 ± 2°C. 1140 TEST NO. 4 8/6/74 ✓ 8/10/74 ✓

8.6.3 Start the Nesjab ~~temperature~~ bath per STM 1008 and adjust as needed to maintain the ~~radiometer~~ temperature at 38 ± 2°C ✓ ✓

8.6.4 Turn on Variac #1 and set to 9.58 VAC. Refer to paragraph 6.2.7, Window heater voltage. ✓ ✓

8.6.5 Turn on Variac #2 and set to 14.99 VAC. Refer to paragraph 6.2.7, manipulator heater voltage. ✓ ✓

Readjust as needed to maintain the manipulator temperature at 24 ± 5°C.

8.6.6 Initiate coldwall operation. 1207 ✓ ✓

ITEM 26

8.6.7 ~~When all environmental parameters have stabilized, set DAS to print channels 14 thru 25 at 10 second intervals.~~

~~8.6.8 Obtain optical data as indicated by Test No. 3 Data Sheet. When retro temperature stabilization degrades beyond the specified limits, (see paragraph 8.0) stop data-taking and restabilize temperatures.~~ ____

~~8.6.9 Reset the DAS to print all channels at 10 minute intervals during restabilizing.~~ ____

Item 26

~~8.6.10 Perform 8.6.7 thru 8.6.9 repetitiously until all optical data have been obtained.~~ ____

~~8.6.11 Obtain retroreflector temperature data from the DAS print-outs and enter in Test No. 3 Data Sheet. Number all FFDI photographs and enter photo numbers in the Data Sheet.~~ ____

8.7 Test No. 4 Thermal/Vacuum

8.7.1 Set/verify the following:

a. DAS printout at 10 minute intervals. 1139 8-6-74 ✓
b. Tenney/Test Article Panel temperature per Data Sheet
c. Neslab /Radiometers at 38 ± 2°C SEE 8.6.3 ✓
d. Variac #1/Window Hood Heater at proper voltage SEE 8.6.4 ✓ 9.60 VAC
e. Variac #2/Manipulator Heater at proper voltage SEE 8.6.5 ✓ 14.92 VAC
f. Coldwall operating SEE 8.6.6 ✓

TDR 04006

8.7.2 When all environmental parameters have stabilized, per Test No. 4 Data Sheet, obtain a radiometer No. 1 back-ground reading and enter in the Data Sheet. ✓

~~8.7.3 Deleted.~~

~~8.7.4 Deleted.~~

~~8.1 Turn on electrical power to all test instruments and recorders. Allow adequate warm-up time before starting tests. Do not apply power to Variacs 1 thru 4.~~

~~8.2 Set DAS operating controls per STM 1017. Initiate one data printout.~~

~~8.3 Adjust the Sanborn recorder on the radiometer channel for a sensitivity of 1.0 mv/centimeter with 10.0 mv at center scale.~~

8.4 Test No. ~~1~~ 16 Isothermal/Ambient

8.4.1 Test conditions are to be at ambient. Initiate one DAS data printout. 8/7/74 1132 ✓

8.4.2 Log actual test conditions in Section 10.2, Test No. ~~1~~ 16 Data Sheet. 8/8/74 1607 hrs ✓

#8 8.4.2.1 Obtain an FFDI verification photo using the reference retroreflector. Number photo & enter number in Test Data Sheet. ✓

8.4.3 In accordance with the FFDI Operating Manual, obtain optical data for the retroreflectors at the field angles indicated. Number the photographs sequentially and enter the numbers in the Test No. ~~1~~ 16 Data Sheet. 8/8/74 ✓ 1430 hrs

8.4.4 Obtain, from the DAS printout, a single set of retroreflector temperature readings and enter in the Test No. ~~1~~ 16 Data Sheet. 8/8/74 ✓ 1633 hrs

~~8.4.5 Remove and rotate retroreflector C in the Test Article Panel about its axis and reinstall in the 80 degree orientation angle (as shown in Dwg. No. 2374458).~~

~~CAUTION: No not touch, mar or contaminate the retro-reflector surfaces.~~

8.4.6 Install door coldwall and connect its thermocouple. ✓ 8/7/74 1130

8.5 Test No. ~~2~~ 17 Isothermal/Vacuum

8.5.1 Start the fixture roughing pump and the chamber vacuum pumps, per STM 1036. Do not start the coldwall, fixture & window heaters, and IR Simulators. 8/7/74 1715 HRS

(20)

ITEM #24

8.5.2 When the chamber is evacuated to a pressure less than ~~1 x 10^-6~~ 2 x 10^-5 torr, enter the actual test conditions in Section 10.2, Test No. ~~2~~ 17 Data Sheet. 8/8/74 1922 hrs ✓ 1.8 x 10^-5

8.5.3 Initiate one DAS data printout. 1922 hrs

8.5.4 Obtain optical data as indicated by the Test No. ~~2~~ 17 Data Sheet. Number the photographs sequentially (continuing from the last photo number in 8.4.3) and enter the numbers in the Data Sheet. 8/8/74 2011

8.5.5 Obtain, from the DAS printout, a single set of retroreflector temperature readings and enter in the Data Sheet. 2011

8.6 Test No. 3 Thermal/Vacuum

8.6.1 Initiate DAS data printout at 10 minute intervals. ✓

8.6.2 Start the Tenney Heat Exchanger per STM 1005 and adjust for a Test Article Panel temperature of +30 ± 2°C. ✓

8.6.3 Start the Neslab temperature bath per STM 1008 and adjust as needed to maintain the radiometer temperature at 38 ± 2°C ✓

8.6.4 Turn on Variac #1 and set to 9.6 VAC. Refer to paragraph 6.2.7, Window heater voltage. ✓

8.6.5 Turn on Variac #2 and set to 15 VAC. Refer to paragraph 6.2.7, manipulator heater voltage. ✓

Readjust as needed to maintain the manipulator temperature at 24 ± 5°C.

8.6.6 Initiate coldwall operation. ✓

8.6.7 When all environmental parameters have stabilized, set DAS to print channels 14 thru 25 at 10 second intervals. ✓

8.6.8 Obtain optical data as indicated by Test No. 3 Data Sheet. When retro temperature stabilization degrades beyond the specified limits, (see paragraph 8.0) stop data-taking and restabilize temperatures. ✓

8.6.9 Reset the DAS to print all channels at 10 minute intervals during restabilizing. NA

8.6.10 Perform 8.6.7 thru 8.6.9 repetitiously until all optical data have been obtained. N/A

8.6.11 Obtain retroreflector temperature data from the DAS printouts and enter in Test No. 3 Data Sheet. Number all FFDI photographs and enter photo numbers in the Data Sheet. ✓

8.7 Test No. 4 Thermal/Vacuum

8.7.1 Set/verify the following: 8-9-74 1500

a. DAS printout at 10 minute intervals. ✓ ✓
b. Tenney/Test Article Panel temperature per Data Sheet ✓ ✓
c. Neslab /Radiometers at 38 ± 2°C ✓ ✓
d. Variac #1/Window Hood Heater at proper voltage ✓ ✓
e. Variac #2/Manipulator Heater at proper voltage ✓ ✓
f. Coldwall operating ✓

8.7.2 When all environmental parameters have stabilized, per Test No. 4 Data Sheet, obtain a radiometer No. 1 background reading and enter in the Data Sheet. ✓

8.7.3 Deleted.

8.7.4 Deleted.

8/9/74

8.7.5 Turn on the Sanborn/radiometer recorder. ✓

8.7.6 Set the manipulator for the required sun angle. ✓

8.7.7 Start the Arc Lamp, per STM 1019, and adjust for 1.0 solar constant (S.C.) as indicated by radiometer No. 1. Adjust as needed to maintain 1.0 S.C. during stabilization. ✓

8.7.8 When all environmental parameters have stabilized, set the DAS to print channels 14 thru 25 at 10 second intervals. ✓

8.7.9 Obtain optical data as indicated by Test No. 4 Data Sheet. When retro temperature stabilization degrades beyond the limits, (see paragraph 8.0) stop data-taking and restabilize temperatures. ✓

8.7.10 Reset the DAS to print all channels at 10 minute intervals during restabilizing. ✓

8.7.11 Perform 8.7.6 thru 8.7.10 repetitiously until all optical data have been obtained. N/A

8.7.12 Obtain retroreflector temperature data from the DAS print-outs and enter in Test No. 4 Data Sheet. Number all FFDI photographs and enter photo numbers in the Data Sheet. ✓ 8/9/74

KNS 8.7.13 Obtain FFDI verification photo using the reference retro-reflector. Number the photo & enter number in Test Data Sheet. ✓ 2000

8.8 Test No. 5 Thermal/Vacuum

8.8.1 Using the Test Conditions specified in Test No. 5 Data Sheet, repeat steps 8.7.1 thru 8.7.12. 8.7.1 ✓ N/A ~~8.7.2~~ N/A ~~8.7.3~~ ~~8.7.6~~ N/A ~~8.7.7~~ N/A 8.7.8 ✓ 8.7.9 ✓ 8.7.10 ✓ ~~8.7.11~~ N/A 8.7.12 ✓ 8/12/74 ✓

8.9 Test No. 6 Thermal/Vacuum

8.9.1 Using the Test Conditions specified in Test No. 6 Data Sheet, repeat steps 8.7.1 thru 8.7.~~4~~ 2. 8.7.1 ✓ 2014 hrs 8.7.2 ✓ 8/9/74 ✓

8.9.2 Set the manipulator for viewing the No. 1 Earth IR Simulator. ✓

8.9.3 Turn on Variac No. 3/Earth IR Simulator No. 1 and adjust for 1/20 S.C. as indicated by Radiometer No. 1. ✓

8.9.4 Repeat steps 8.7.8 thru 8.7.12. 8.7.8 ✓ 8.7.9 ✓ 8.7.10 ✓ 8.7.11 ✓ 8.7.12 ✓ ✓

8.10 Test No. 7 Thermal/Vacuum

8.10.1 Using the Test Conditions specified in Test No. 7 Data Sheet, repeat steps 8.6.1 thru 8.6.11. 8.6.1 ✓ 8.6.2 ✓ 8.6.3 ✓ 8.6.4 ✓ 8.6.5 ✓ 8.6.6 ✓ 8.6.7 ✓ 8.6.8 ✓ 8.6.9 ✓ 8.6.10 ✓ 8.6.11 ✓

8.11 Test No. 8 Thermal/Vacuum

8.11.1 Using the Test Conditions specified in Test No. 8 Data Sheet, repeat steps 8.7.1 thru 8.7.12. 8.7.1 ✓ 8.7.2 ✓ ~~8.7.3~~ ~~8.7.4~~ 8.7.5 ✓ 8.7.6 ✓ 8.7.7 ✓ 8/9/74 0001 8.7.8 ✓ 8.7.9 ✓ 8.7.10 ✓ 8.7.11 ✓ 8.7.12 ✓ 8-9-74 ✓ 1456 hrs

8.12 Test No. 9 Thermal/Vacuum

8.12.1 Using the Test Conditions specified in Test No. 9 Data Sheet, repeat steps 8.9.1 thru 8.9.4. 8.9.1 ✓ 8.9.2 ✓ 8.9.3 ✓ 8.9.4 ✓

Item 3 8.12.2 Obtain EFDI verification photo using the reference retro-reflector. Number the photo & enter number in Test Data Sheet. ✓

8.13 Return all environmental control systems to ambient conditions. PER STM 1036. SHUT DOWN IR LAMP 8.12.3 STM ✓ ✓

Item 4

8.14 Remove the Test Article Panel from the fixture, turn it end-for-end so that retroreflectors D, E & F are on the viewing axis, and re-install it in the fixture. 8/12/74 ✓ 2150

8.15 Test No. 10 Isothermal/Ambient

8.15.1 Using the Test Conditions specified in Test No. 10 Data Sheet, repeat steps 8.4.1 thru 8.4.4. ✓ 8/12/74 2215

Item 8 8.15.2 Obtain EFDI verification photo using the reference retro-reflector. Number the photo & enter number in Test Data Sheet. ✓ 8/12/74

8.16 Test No. 11 Isothermal/Vacuum

8.16.1 Using the Test Conditions specified in Test No. 11 Data Sheet, repeat steps 8.5.1 thru 8.5.5. ✓ 0053 8/13/74

Item 32 8.16.2 Test No. 19 Thermal/Vacuum

8.16.2.1 Using the Test Conditions specified in Test No. 19 Data Sheet repeat steps 8.6.1 thru 8.6.11. ✓ 8/13/74

(−30±2°C) →

8.6.1 ✓	8.6.5 ✓	8.6.9 ✓
8.6.2 ✓	8.6.6 ✓	8.6.10 N/A
8.6.3 ✓	8.6.7 ✓	8.6.11 N/A
8.6.4 ✓	8.6.8 ✓	

8.6.1 ✓ 8.6.5 ✓ 8.6.9 N/A
8.6.2 ✓ 8.6.6 ✓ 8.6.10 N/A
8.6.3 ✓ 8.6.7 N/A 8.6.11 ✓
8.6.4 ✓ 8.6.8 N/A

8.17 **Test No. 12 Thermal/Vacuum**

8.17.1 **Using the Test Conditions specified in Test No. 12 Data Sheet, repeat steps 8.6.1 thru 8.6.11.** 8/13/74 ✓

Item 9 8.17.2 Obtain EPDE reconstruction photo using the reference retro-reflector. Number the photo & enter number in Test Data Sheet. ✓

8.18 **Return all environmental control systems to ambient conditions** PER STM 1036. ✓ 8/13/7 2300
Item 4

8.19 **Remove the Test Article Panel from the fixture.** ✓ 8/14/74 0930

NOTE: Retain the existing thermal-vacuum test setup configuration for additional testing after vibration tests are completed.

Item 10 ~~8.20 Inspect the Test Article Assembly for visual evidence of degradation due to previous testing. For each of the six retroreflectors, loosen the #2 mounting screws and re-torque to the specified value. To avoid breakage of any "frozen" screws, loosening torque shall not exceed in.-lb. Mark screw heads so that any turning may be detected.~~

Item 34

Item 35 8.21 Inspect the Test Article Assembly for visual evidence of degradation due to previous testing. ✓

Item 35 8.22 Remove the #2 stainless screws and replace with #2 aluminum screws, MS35202-8. Torque to $1.4^{+0}_{-0.2}$ in. lb. ✓ 8/14/74 1000

Ref. TPR 0006 8.22 RE-GLUE TC 14 to retro X front face ✓ 8/14/74 1500

9.0 **POST-VIBRATION THERMAL-OPTICAL PROCEDURE**

Item 12 9.1 Verify that ~~Remove the rotate~~ retroreflector E in the Test Article Panel ~~about its axis and~~ reinstall in the 100 degree orientation ~~(as shown in Dwg. No. 2374458)~~. See Figure 9. — 8/14/74 ✓

Insert A 9.2 Install the Test Article Panel in the fixture so that retroreflectors D, E & F are on the viewing axis. — 8/19/74 ✓

9.3 Repeat steps 8.0 thru 8.3. — ✓

Item 8 9.3.1 Obtain FPBI verification photo using the reference retroreflector. Number the photo & enter number in Test 13 Data Sheet. — ✓

9.4 Test No. 13 Isothermal/Vacuum

9.4.1 Using the Test Conditions specified in Test No. 13 Data Sheet, repeat steps 8.5.1 thru 8.5.5. — ✓

Item 38 9.4.2 Test No. 21 Thermal-Vac. Using Test Data sheet 21 Repeat 8.7.8 8.7.9 8.7.10 8.7.12 — ✓ 8/15/7

9.5 Test No. 14 Thermal/Vacuum

9.5.1 Using the Test Conditions specified in Test No. 14 Data Sheet, repeat steps 8.6.1 thru 8.6.11. — 8/15/74 ✓

Item 8 9.5.2 Obtain FPBI verification photo using the reference retroreflector. Number the photo & enter number in Test Data Sheet. — ✓

9.6 Return all environmental control systems to ambient conditions. PER STM 1036. — ✓ 8/16/7 0800

Item 29.C.1 Obtain Isothermal/Amb data per Data Sheets 23 & 24 for Retroreflectors D,E,F and A,B,C respectively. — ✓ 8/16/74

9.7 Remove the Test Article Panel from the fixture. — ✓

Item 11 9.8 Inspect the Test Article Assembly for visual evidence of degradation due to previous testing. Verify the retroreflector retaining screw tightening torque has not decreased from the specified value. — 8/16/74 ✓

INSERT A

9.2.1 Repeat Steps 8.0 thru 8.1 — ✓ 1716

Item 37 9.2.2 Test No. 20 Isothermal-Ambient.

9.2.2.1 Using the Test Conditions specified in Test No. 20 Data Sheet, repeat steps 8.4.1, 8.4.2, 8.4.2.1, 8.4.3 & 8.4.4 — TDR04010 ✓

✓ ✓ ✓ TDR04010

INSERT-B 9.5.3 TEST NO. 22 THERMAL-VACUUM USING TEST DATA SHEET-22 REPEAT 8.6.1 THRU 8.6.11. — ✓ 8/15/74 1430 hrs

Item# 41

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

RELIABILITY APPD	PREDICTION	ZONE	LTR	DESCRIPTION	DATE	APPR'D
			X1	EXPERIMENTAL RELEASE ER 1922	6-15-74	
			X2	REVISED PER CEN X-2	7-8-74	

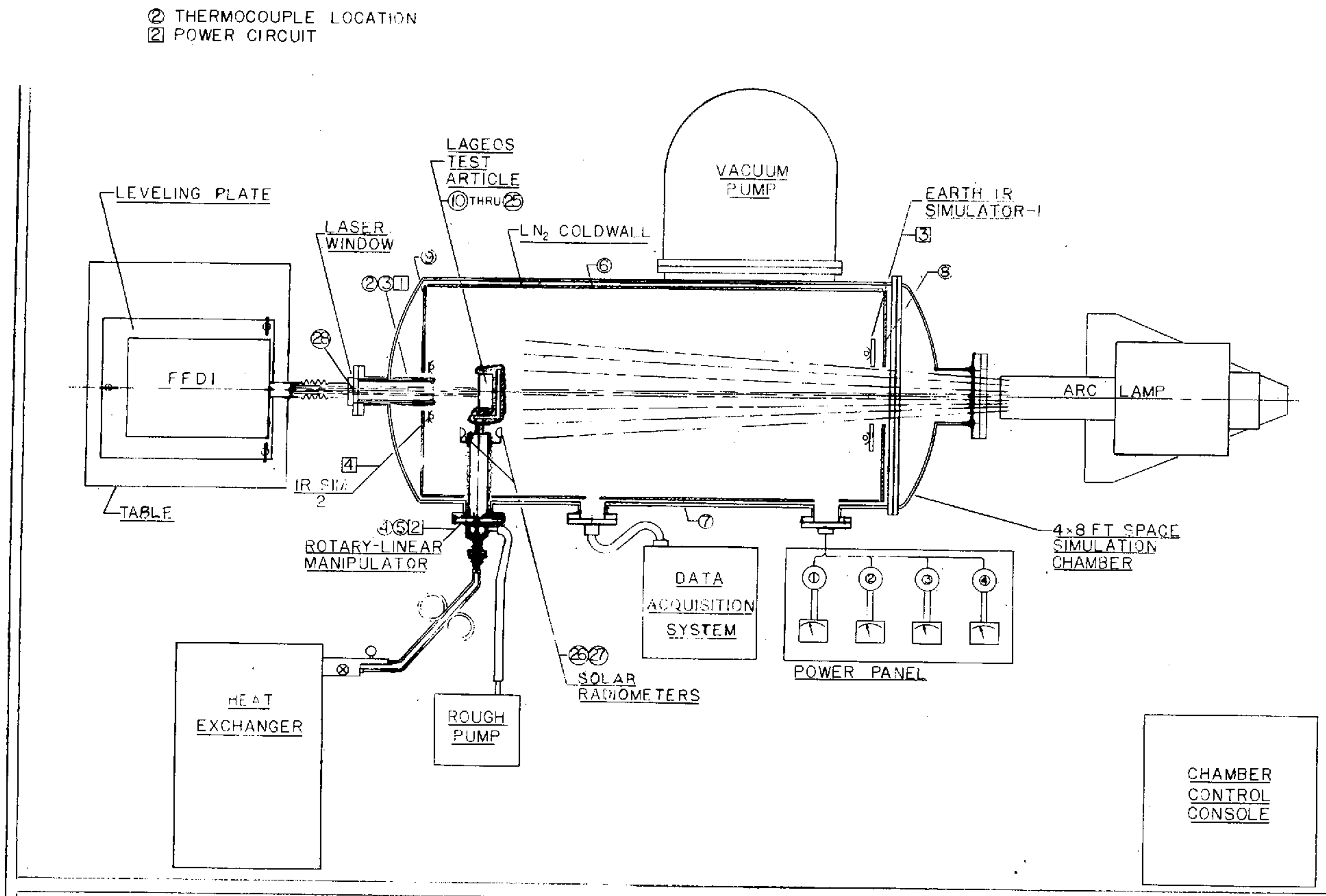


FIGURE 1

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LIST OF MATERIALS

CONTR NO. NAS 8-30658

THE BENDIX CORPORATION
AEROSPACE SYSTEMS DIVISION – ANN ARBOR, MICHIGAN

TITLE LAGEOS TEST SETUP - THERMAL-VACUUM

SIZE D CODE IDENT NO. 07038 DRAWING NUMBER 2374451 REV. X2

FOLDOUT FRAME

FOLDOUT FRAME 2

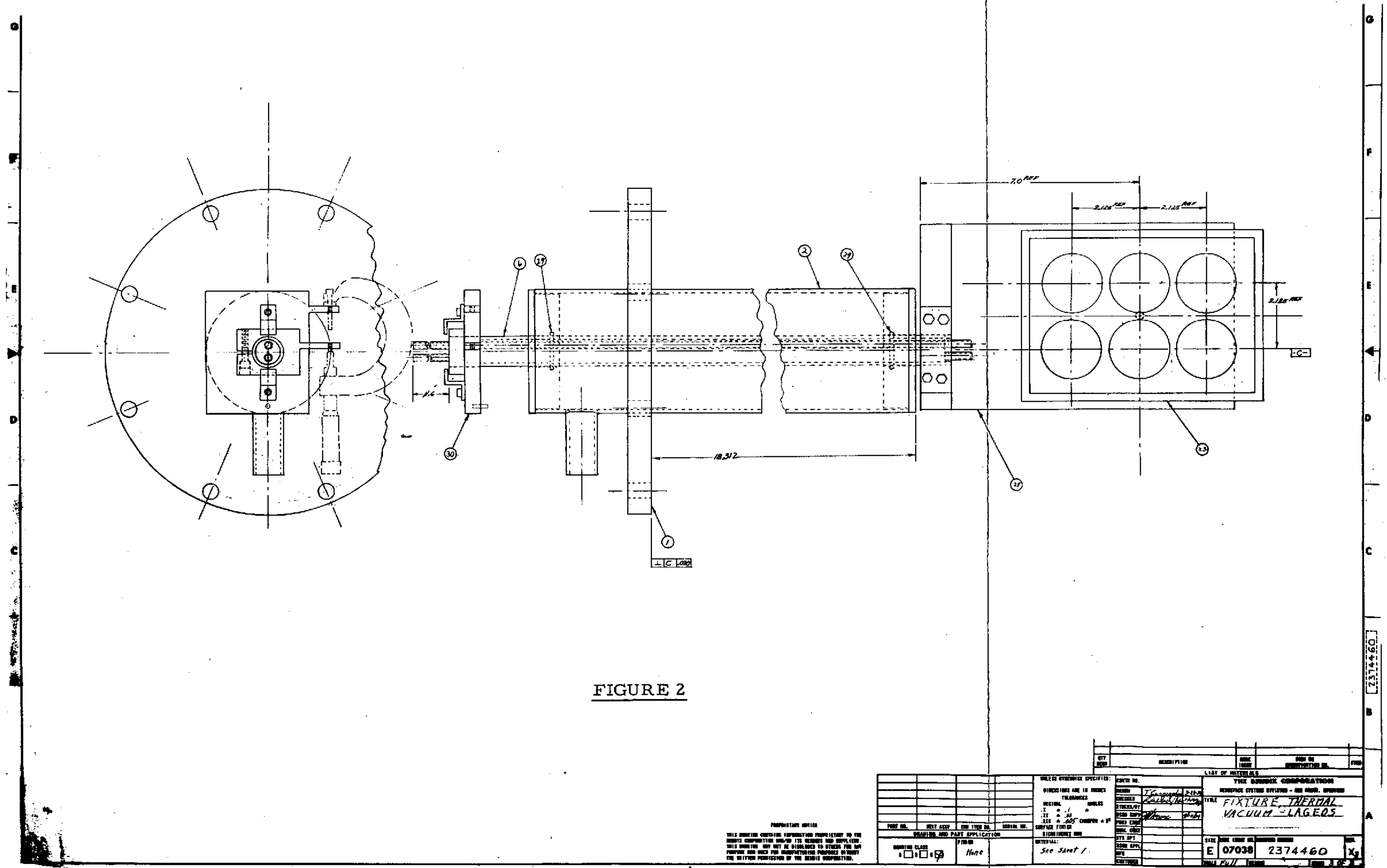


FIGURE 2

FOLDOUT FRAME 1

FOLDOUT FRAME 2

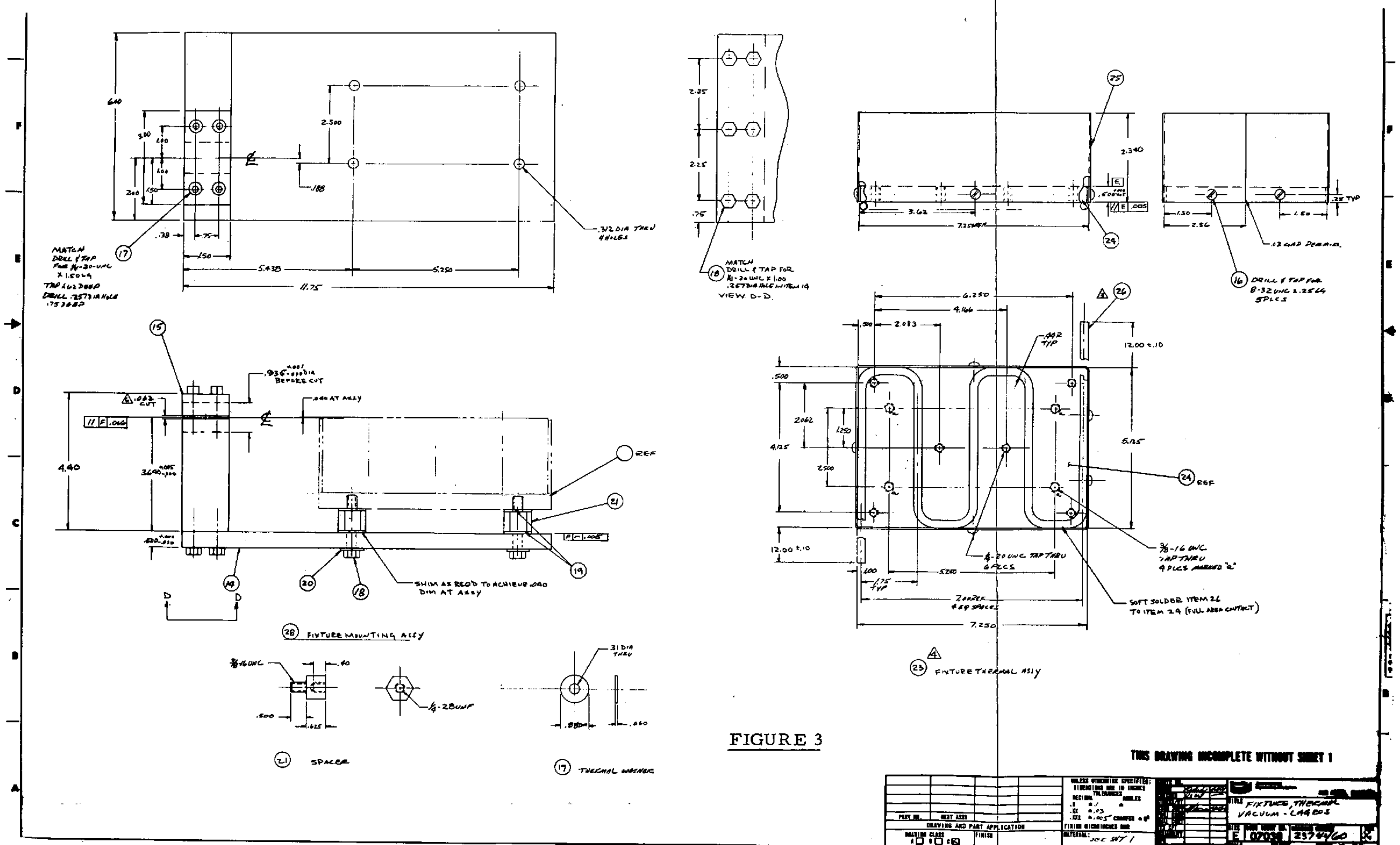
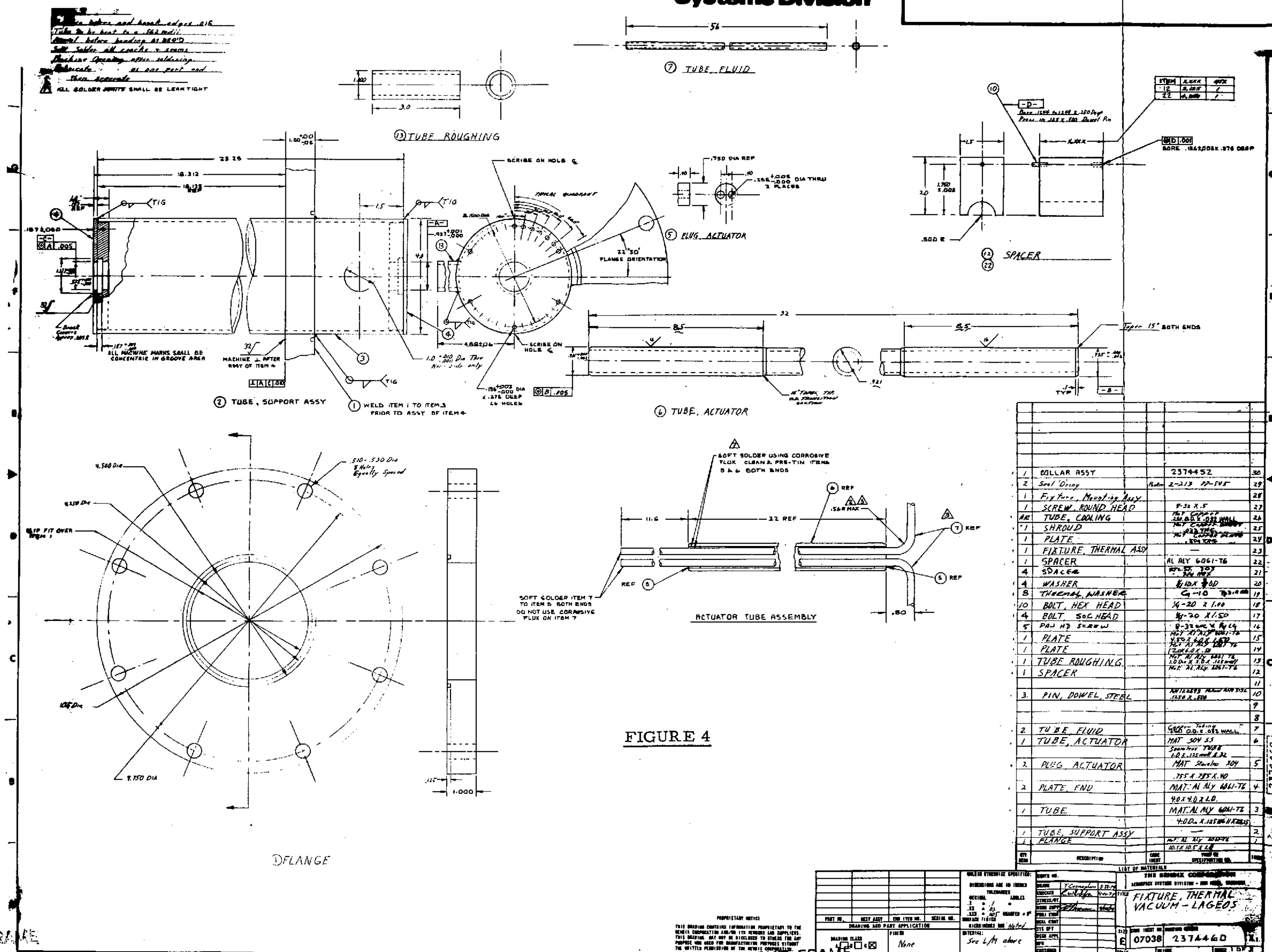


FIGURE 3

FOLDOUT FRAME 1

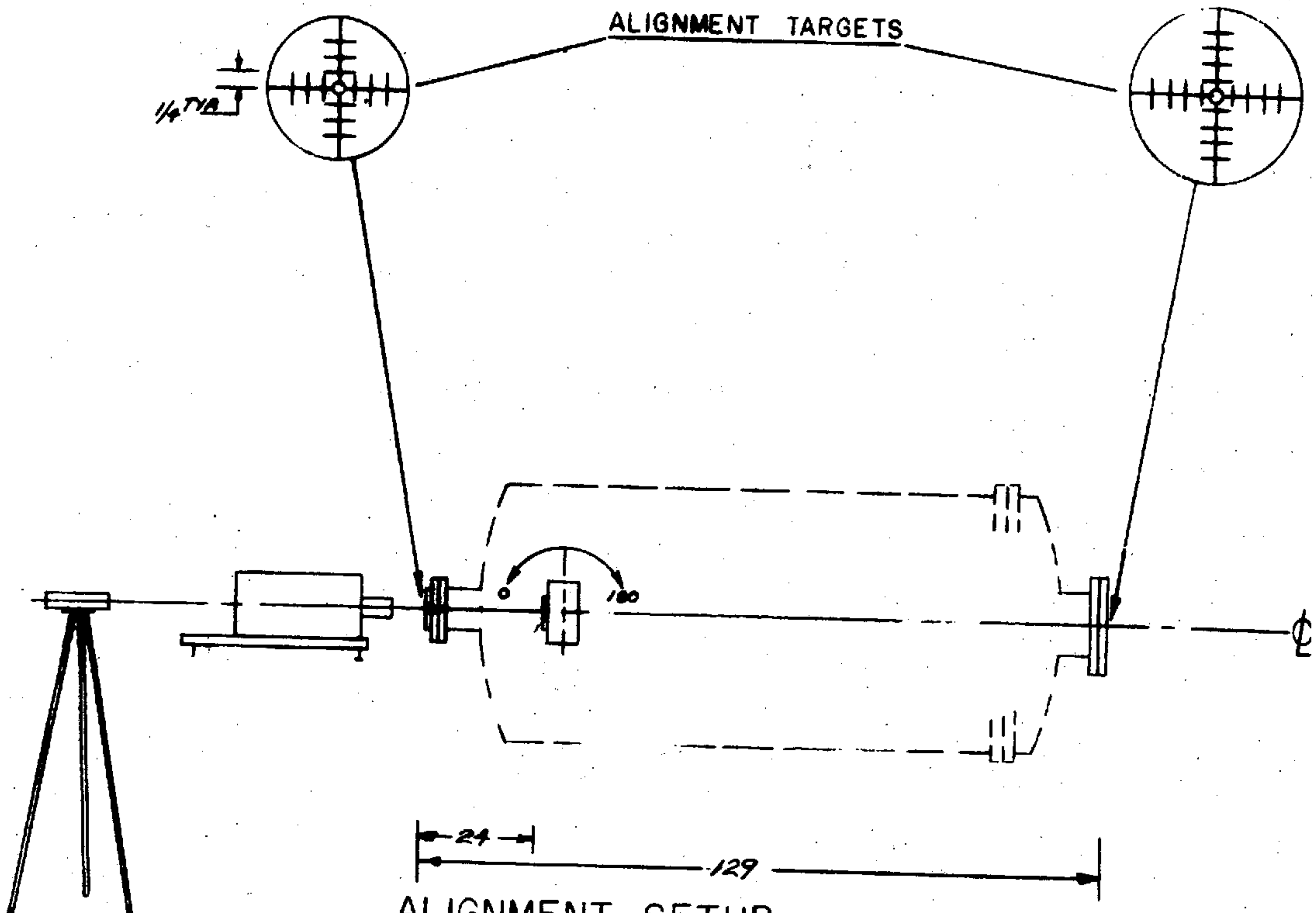
FOLDOUT FRAME 2



QTY REQD	DESCRIPTION	CODE IDENT	PART OR SPECIFICATION NO.	ITEM
1	COLLAR ASSY		2374452	30
2	Seal 'O'ring	Parker	2-213 77-545	29
1	Fixture, Mounting Assy			28
1	SCREW, ROUND HEAD		8-32 X .5	27
AR	TUBE, COOLING		Mat Copper .250 O.D. X .032 WALL	26
1	SHROUD		Mat Copper sheet .032 THK	25
1	PLATE		Mat Copper plate .500 THK	24
1	FIXTURE, THERMAL ASSY		—	23
1	SPACER		AL ALY 6061-T6	22
4	SPACER		[illegible]	21
4	WASHER		[illegible]	20
8	THERMAL WASHER		G-10 [illegible]	19
10	BOLT, HEX HEAD		1/4-20 X 1.00	18
4	BOLT, SOC HEAD		1/4-20 X 1.50	17
5	PAN HD SCREW		8-32 UNC X [illegible] LG	16
1	PLATE		Mat Al Aly 6061-T6 4.50 X 6.0 X [illegible]	15
1	PLATE		Mat Al Aly 6061-T6 12.0 X 6.0 X .[illegible]	14
1	TUBE ROUGHING		Mat Al Aly 6061-T6 1.0 Dia X 3.0 X .125 wall	13
1	SPACER		Mat Al Aly 6061-T6	12
				11
3	PIN, DOWEL, STEEL		[illegible] .1250 X .500	10
				9
				8
2	TUBE, FLUID		Copper Tubing .250 O.D. X .032 WALL	7
1	TUBE, ACTUATOR		MAT 304 SS Seamless TUBE 1.0 X .125 wall X 32	6
2	PLUG, ACTUATOR		MAT Stainless 304 .755 X .755 X .40	5
2	PLATE, END		MAT: Al Aly 6061-T6 4.0 X 4.0 X 1.0	4
1	TUBE		MAT: Al Aly 6061-T6 4.0 Dia X .125 wall X [illegible]	3
1	TUBE, SUPPORT ASSY		—	2
1	FLANGE		Mat: Al Aly [illegible] 10.5 X 10.5 X 1.0	1

LIST OF MATERIALS

FIGURE 4



ALIGNMENT SETUP

FIGURE 5

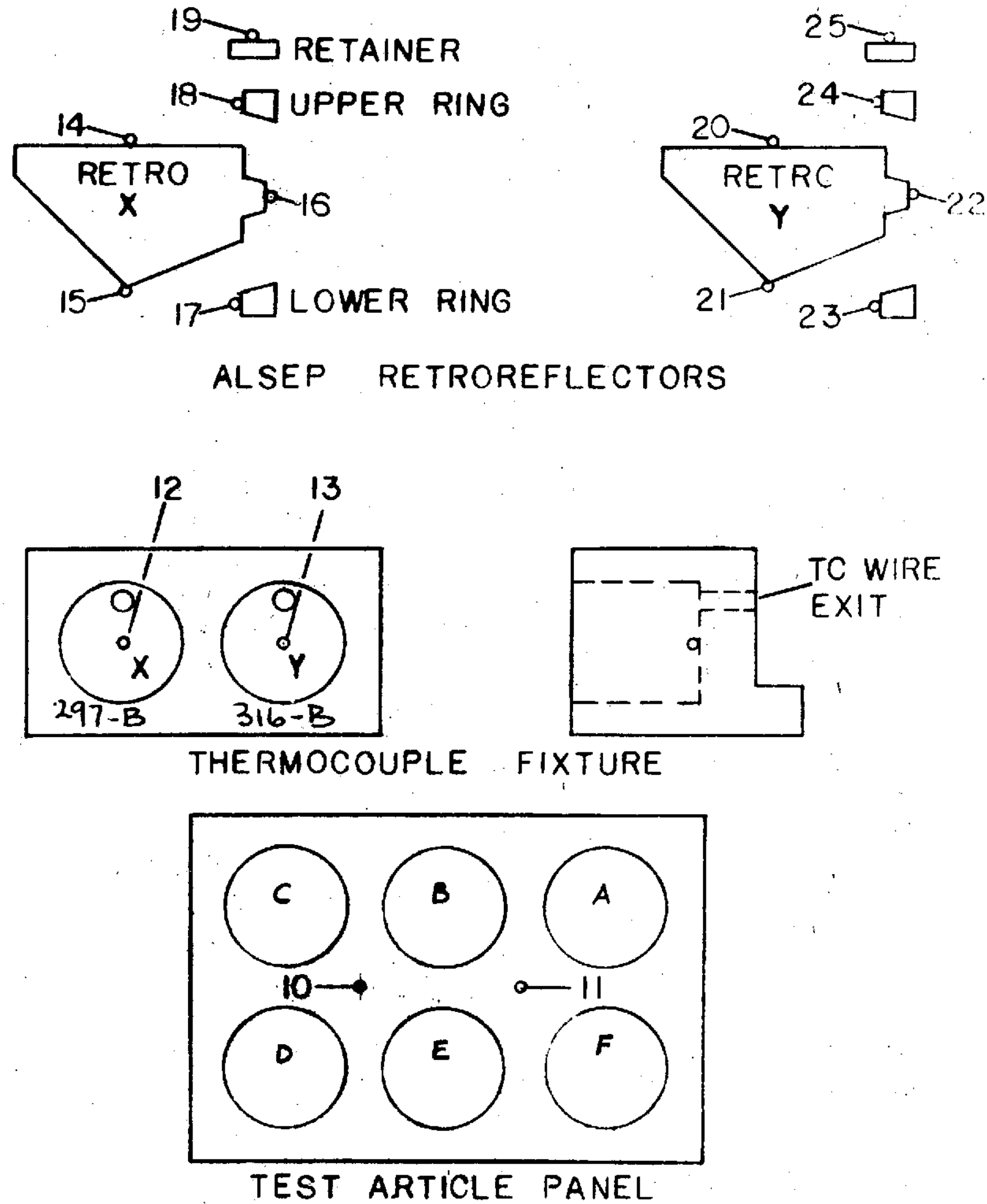


FIGURE 6 THERMOCOUPLE LOCATIONS

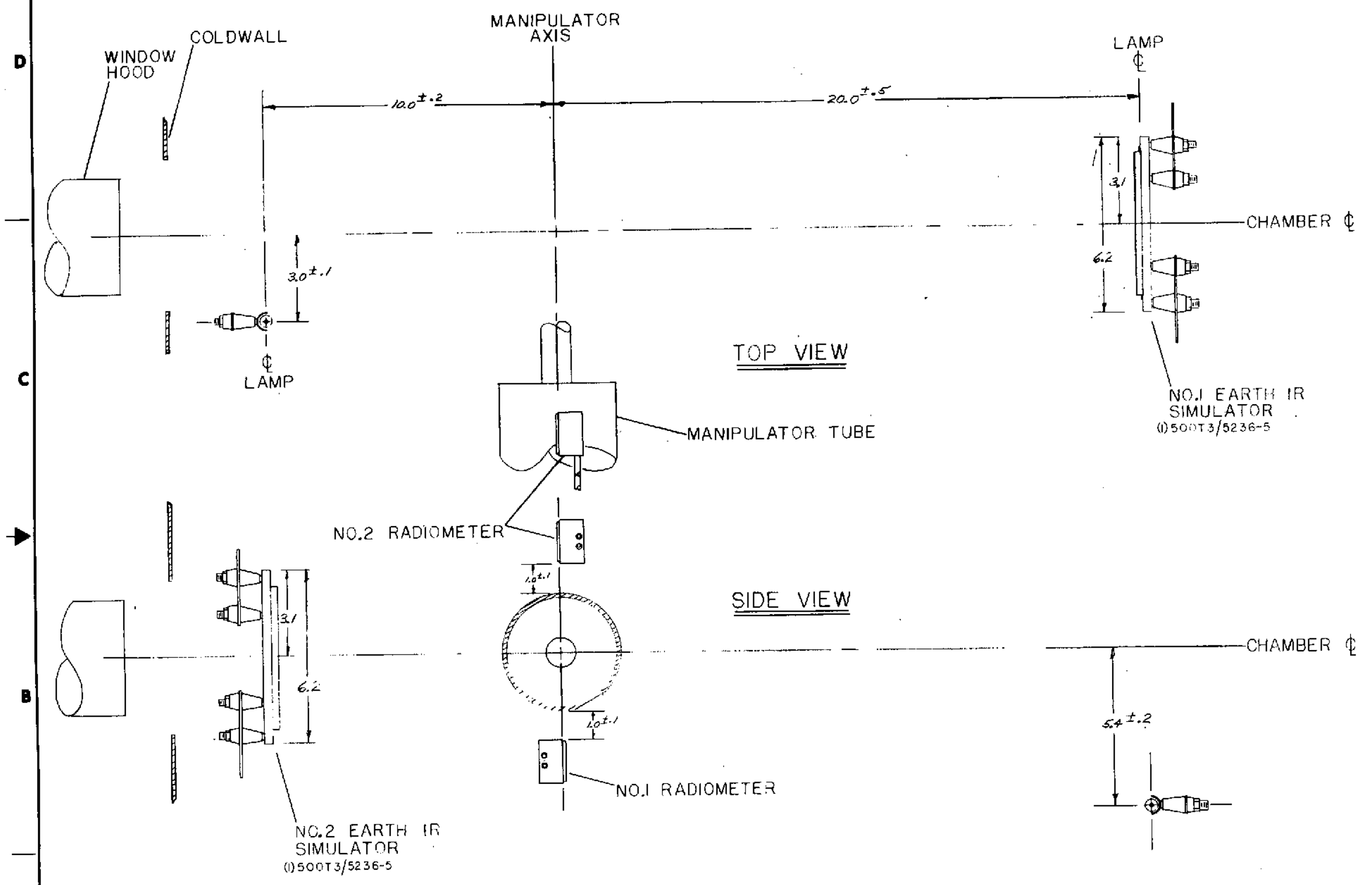


FIGURE 7

QTY REQD	DESCRIPTION	CODE IDENT	PART OR SPECIFICATION NO.	ITEM

LIST OF MATERIALS

PROPRIETARY NOTICE
THIS DRAWING CONTAINS INFORMATION PROPRIETARY TO THE BENDIX CORPORATION AND/OR ITS VENDORS AND SUPPLIERS. THIS DRAWING MAY NOT BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSES WITHOUT THE WRITTEN PERMISSION OF THE BENDIX CORPORATION.

PART NO.	NEXT ASSY	END ITEM NO.	SERIAL NO.

DRAWING AND PART APPLICATION

DRAWING CLASS A ☐ B ☐ C ☐ | FINISH

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMAL .X ± .XX ± .XXX ± | ANGLES ± | CHAMFER ± 5°
SURFACE FINISH MICROINCHES RMR
MATERIAL:

CONTR NO. / DRAWN / CHECKED / STRESS/WT / DSGN SUPV / PROJ ENGR / QUAL CONT / SYS SPT / DSGN APPL / MFG / CUSTOMER

THE BENDIX CORPORATION
AEROSPACE SYSTEMS DIVISION — ANN ARBOR, MICHIGAN

TITLE
LOCATION—EARTH IR SIMULATORS & RADIOMETERS LAGEOS T-V TEST

SIZE D | CODE IDENT NO. 07038 | DRAWING NUMBER | REV.
SCALE | WEIGHT | SHEET

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FIGURE 8A

THERMAL/OPTICAL TEST CONDITIONS

TDR #4007

16 Iso-Amb.
17 Iso-Vac.
18 Iso-Vac.

PARA.	Test	Description	Retro Orientation θ A	B	C	D	E	F	Vac Chamber Press (Torr)	Test Article Temperature	Chamber Cold Temperature	Solar Condition	Total Laser Field Angles Per Test *	
8.4	1	Iso/Amb	0	90	0				Amb.	Amb.	Amb.	N/A	8**	
8.5	2	Iso/Vacuum	0	90	80				1×10^{-6}	Amb.	Amb.	N/A	15***	
8.6	3	Thermal/Vacuum	0	90	80				1×10^{-6}	+30°C	-185°C	No Sun (No IR)	15***	
	15	Iso-Amb.	0	90	80									
8.7	4	Thermal/Vacuum	0	90	80				1×10^{-6}	+30°C	-185°C	1 Sun Normal (No IR)	8**	
8.8	5	Thermal/Vacuun.	0	90	80				1×10^{-6}	+60°C ~~+30°C~~	-185°C	No Sun ~~1 Sun +50~~° (No IR)	15*** ~~8**~~	Item 31
8.9	6	Thermal/Vacuum	0	90	80				1×10^{-6}	+30°C	-185°C	No Sun 1 Earth IR	8**	
8.10	7	Thermal/Vacuum	0	90	80				1×10^{-6}	-30°C	-185°C	No Sun (No IR)	15***	
8.11	8	Thermal/Vacuum	0	90	80				1×10^{-6}	-30°C	-185°C	1 Sun Normal (No IR)	8**	
8.12	9	Thermal/Vacuum	0	90	80				1×10^{-6}	-30°C	-185°C	No Sun 1 Earth IR	8**	
8.15	10	Iso/Amb				60	40	20	Amb	Amb	Amb	N/A	8**	
8.16	11	Iso/Vacuum				60	40	20	1×10^{-6}	Amb	Amb	N/A	~~8**~~ 15***	Item 33
	19	Thermal/Vac							1×10^{-6}	-30°C	-185°C	No Sun/No IR	15***	Item 32
8.17	12	Thermal/Vacuum				60	40	20	1×10^{-6}	+30°C	-185°C	No Sun (No IR)	15***	
		VIBRATION TEST												
	20	Iso/Amb				60	100	20	Amb	Amb	Amb	N/A	15***	ITEM 37
9.4	13	Iso/Vacuum				60	100	20	1×10^{-6}	Amb	Amb	N/A	15 ~~8**~~	
	21	THERMAL/VAC				60	100	20	1×10^{-6}	-30°C	-185°C	No Sun No #2	15***	ITEM 38
9.5	14	Thermal/Vacuum				60	100	20	1×10^{-6}	+30°C	-185°C	No Sun (No IR)	15 ~~11~~****	
	22.	THERMAL/VAC.				60	100	20	1×10^{-6}	+90°C	-185°C	No Sun No IR	15	ITem 39; Item 41
	23	Iso/AMB				60	100	20	Amb	Amb	Amb			Item 42
	24	Iso/AMB	0	90	80				Amb	Amb	Amb			Item 42

* Laser Polarization: Linear in Laser Field Angle Plane (Vertical Plane)

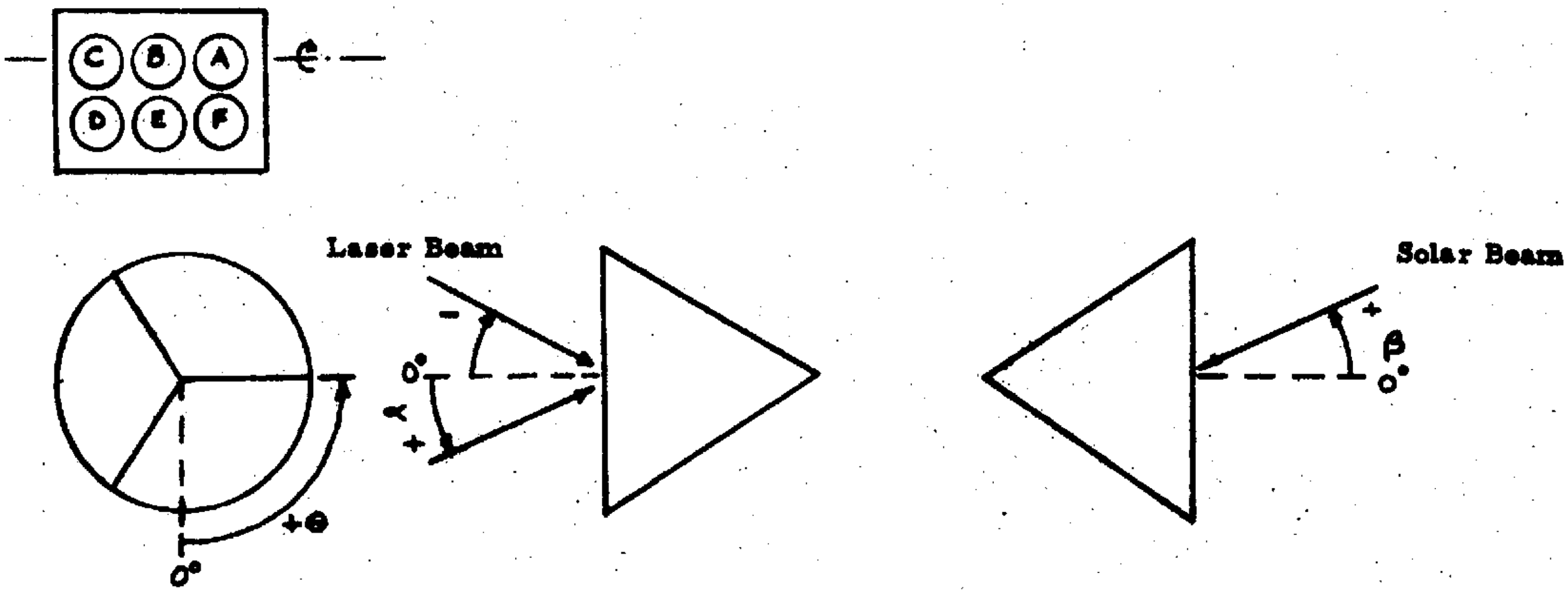
** A, D: α = 0, +30, +15, -15, -30
B, E: α = 0, +15
C, F: α = 0

*** A, B, C, D, E, F:
= 0, +30, +15, -15, -30

**** D, E:
= 0, +30, +15, -15, -30
F: = 0

FOLDOUT FRAME 1

FOLDOUT FRAME 2



Viewed from Laser Optical Window

Viewed from Solar Simulator

FIGURE 8B

SOLAR AND LASER FIELD ANGLES AND RETROREFLECTOR ORIENTATION

Bendix Aerospace Systems Division ER1922-19 7-31-74

CHANGE REQUEST/NOTICE

SHEET 1 OF ___

☐ L/C ☐ CR/N NO.

☐ ECN 2?7-1435 ☐ SCN REV. X2

PROJECT	PART S/N EFFECTIVITY	CEI S/N EFFECTIVITY	NEXT ASSY	☐ DWG NO. ☐ SPEC NO.	REV.
LAGEOS	N/A	N/A	N/A	2374453	X1

TITLE: LAGEOS TEST ARTICLE ASSY

IMPACTS:	YES	NO		YES	NO		YES	NO
INTERCHANGEABILITY	☐	☒	WEIGHT	☐	☒	TEST PROC.	☒	☐
DRAWINGS	☒	☐	TECH ORDERS	☐	☒	QUAL TEST	☐	☒
SPECIFICATIONS	☐	☒	MANUALS	☐	☒	ACCEPT.TEST	☐	☐
SPARES	☐	☒	ICD	☐	☒	TOOLS	☐	☐

HARDW. DISPOSITION: ☐ REWORK ☐ SCRAP ☐ RETEST ☐ CONFORMS

DESCRIPTION OF CHANGE (INCLUDE "WAS,–IS" DESCRIPTION AND OTHER DRAWING NUMBERS IMPACTED)

CHANGE NOTE △1 AS FOLLOWS:

WAS: △1 TORQUE ITEM 6 TO $1.0^{+.4}_{-.0}$ IN-LBS.

IS: △1 TORQUE ITEM 6 TO 2.2 ± 0.3 IN-LBS.

Page 27A Item 19

JUSTIFICATION: DRAWING ERROR

REQUESTED BY: J. MASZATICS

PROJ. ENGR. [signature]

REQUESTOR DO NOT WRITE BELOW THIS LINE

INSTRUCTIONS:
ENGR. COMPL. ___
PROC. COMPL. ___
MFG COMPL. ___
INCORP. COMPL. ___
TEST COMPL. ___
☐ CUSTOMER APPVL REQ'D
☐ OUTSTANDING ECN
☐ INCORP. ON DWG.
☐ MFG INCORP INTO HDW.
☐ INCORP. INTO T.P.
☐

DISPOSITION:
☒ APPROVED
☐ APPROVED AS NOTED
☐ DISAPPROVED

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INCORPORATE: ☐ IN PRODUCTION ☐ RETROFIT

DOCUMENT REQMTS. ☐ TCTO ☐ ECP ☐ TCTR ☐ CCP

CHANGE CLASSIFICATION ☐ RECORD ☐ CLASS I ☒ CLASS II

CHAIRMAN [signature]

DATE 7-?-74

PREPARED BY	STRESS/WT.	QUALITY	SYS. SUPP.	CONTRACTS	CUSTOMER
J. Maszatics					
CHECKED	RELIABILITY	MFG	TEST	CMG	
[signature]				[signature]	

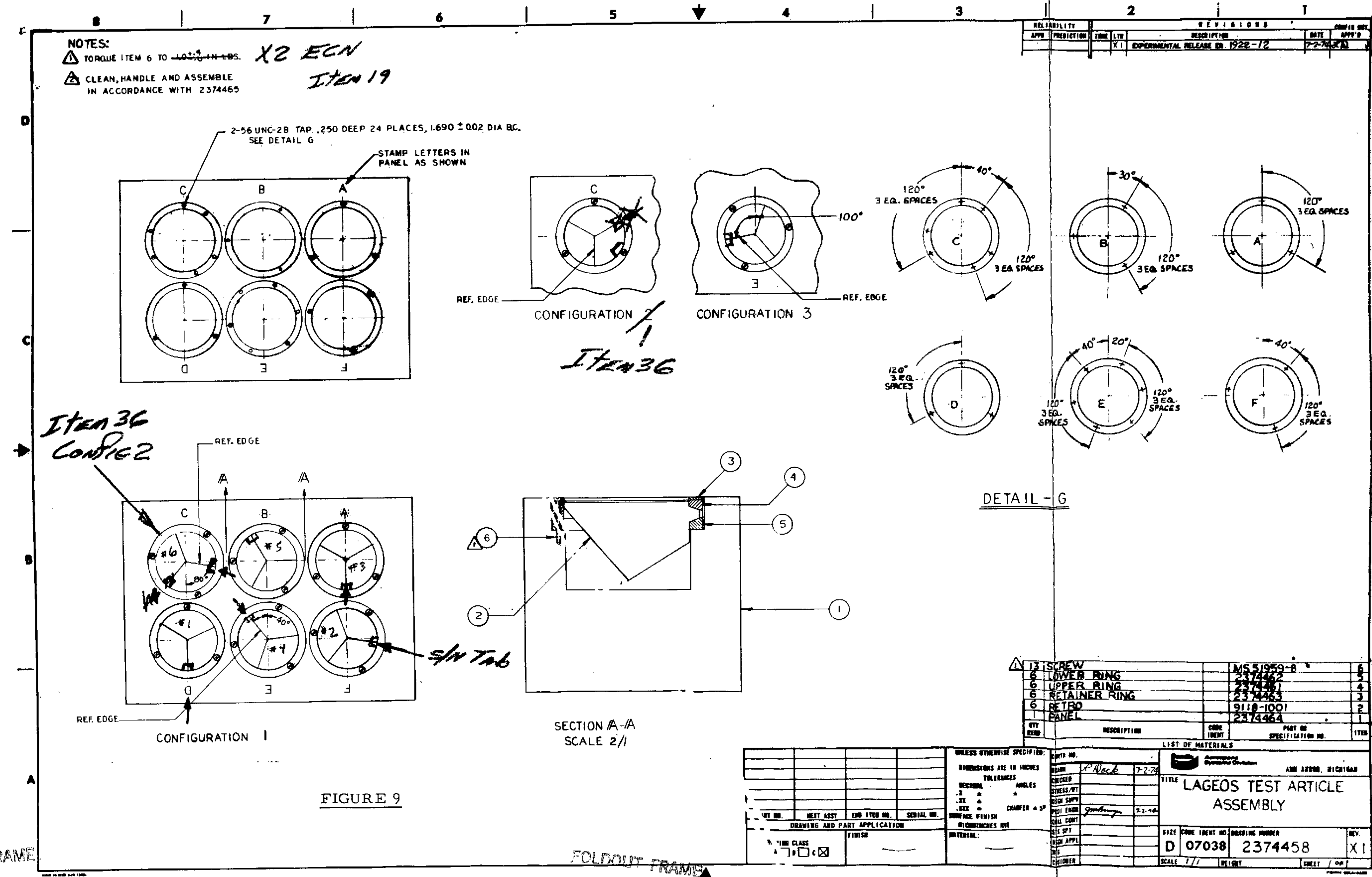
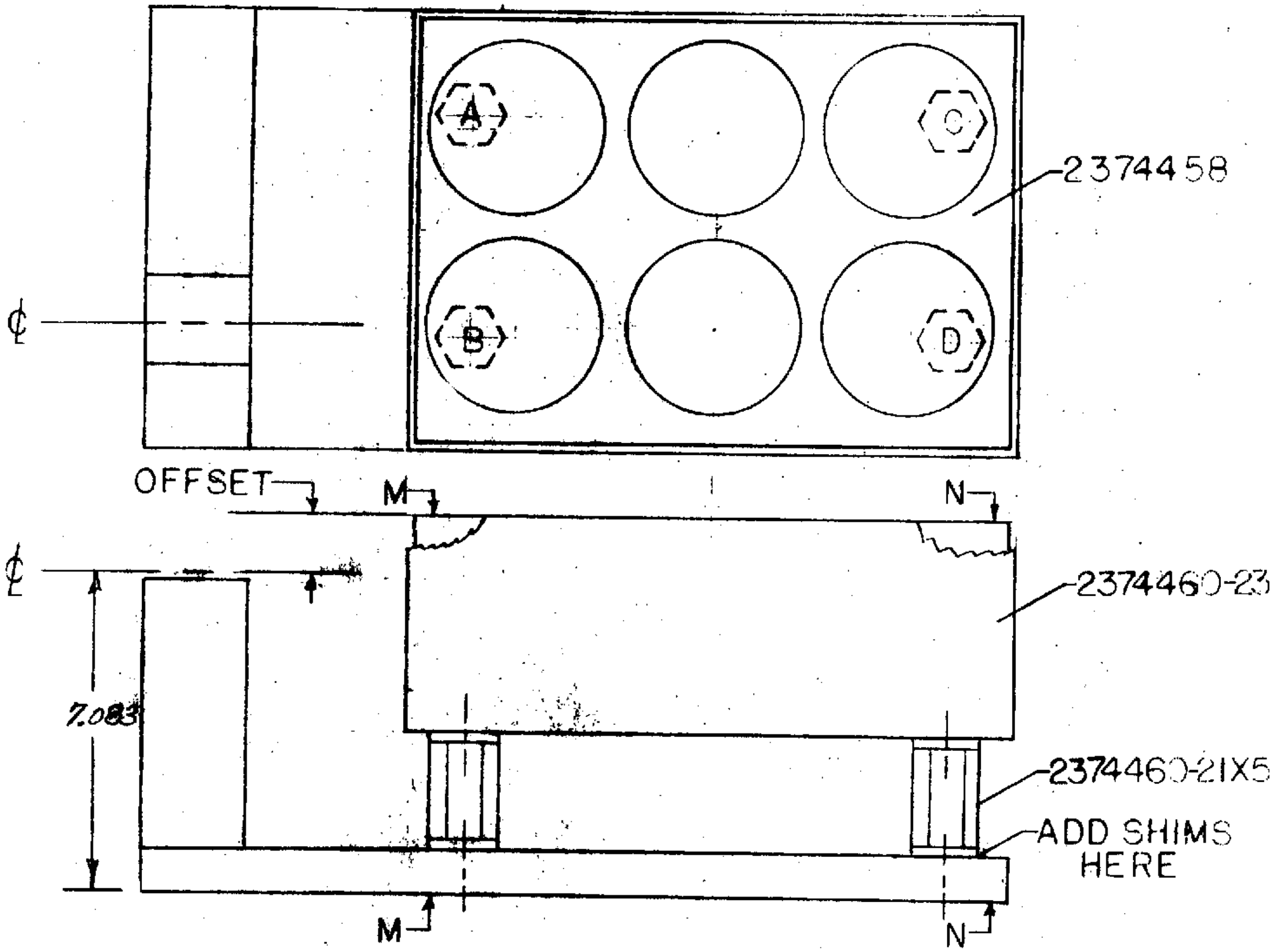

NOTES:
1 TORQUE ITEM 6 TO ~~10±.5 IN-LBS.~~ X2 ECN
2 CLEAN, HANDLE AND ASSEMBLE IN ACCORDANCE WITH 2374465
Item 19
2-56 UNC-2B TAP .250 DEEP 24 PLACES, 1.690 ±.002 DIA B.C. SEE DETAIL G
STAMP LETTERS IN PANEL AS SHOWN
REF. EDGE
CONFIGURATION 2
CONFIGURATION 3
Item 36
Item 36 Config 2
S/N Tab
CONFIGURATION 1
SECTION A-A SCALE 2/1
DETAIL - G
120° 3 EQ. SPACES
13 SCREW MS51959-8 6
6 LOWER RING 2374462 5
6 UPPER RING 2374461 4
6 RETAINER RING 2374463 3
6 RETRO 9118-1001 2
1 PANEL 2374464 1
LIST OF MATERIALS
LAGEOS TEST ARTICLE ASSEMBLY
D 07038 2374458 X1
EXPERIMENTAL RELEASE ER 1922-12
FOLDOUT FRAME

FIGURE 9



WITH 2374460-21X5 SPACER: M-M=7.827; N-N=7.828
OFFSET=0.744

OPTICAL NODE NOMINAL ~~.773~~ .744 BELOW 2374458 SURFACE

SHIM TABULATION

SEQ	A	B	C	D
1	~~.015~~	~~.015~~	~~.015~~	~~.015~~
2	~~.010~~	~~.020~~	~~-0-~~	~~-0-~~
3	.020	.030	-.060	-.060
4				
5				
6				
7				

8/5/74
Final

FIGURE 10 SHIM LOG

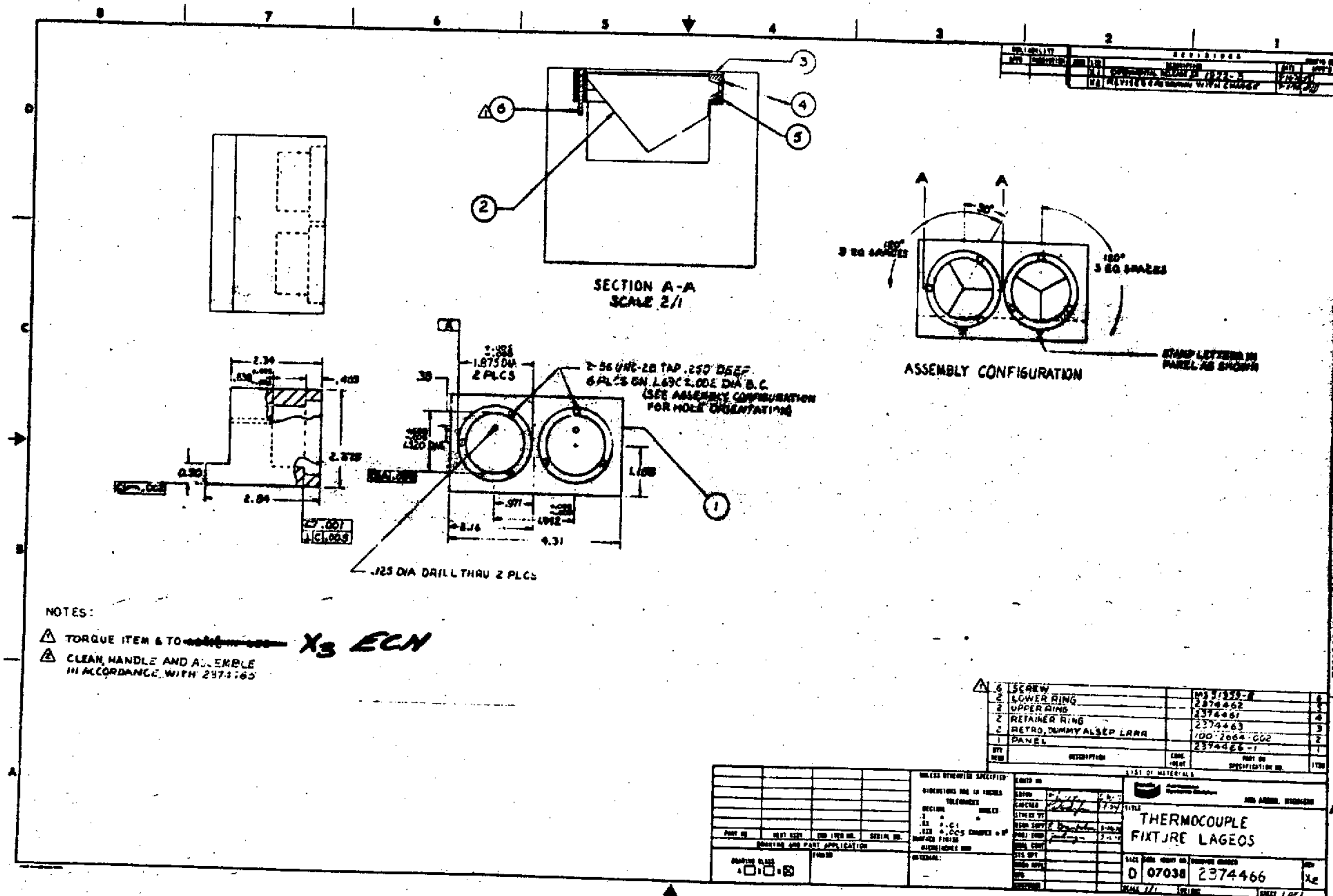


FIGURE 11

Page 28 B

Item 20

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Bendix Aerospace Systems Division

ER1922-19
7-31-74

CHANGE REQUEST/NOTICE

☐ L/C ☐ CR/N NO.

SHEET 1 OF ___

☒ ECN 2371466 ☐ SCN

☒ DWG NO. ☐ SPEC NO.

PROJECT	PART S/N EFFECTIVITY	CEI S/N EFFECTIVITY	NEXT ASSY
LAGEOS	N/A	N/A	N/A

TITLE: THERMOCOUPLE FIXTURE LAGEOS

IMPACTS:

	YES	NO
INTERCHANGEABILITY	☐	☒
DRAWINGS	☒	☐
SPECIFICATIONS	☐	☒
SPARES	☐	☒
WEIGHT	☐	☒
TECH ORDERS	☐	☒
MANUALS	☐	☒
ICD	☐	☒
TEST PROC.	☒	☐
QUAL TEST	☐	☒
ACCEPT. TEST	☐	☒
TOOLS	☐	☒

HARDW. DISPOSITION: ☐ REWORK ☐ SCRAP ☐ RETEST ☐ CONFORMS

DESCRIPTION OF CHANGE (INCLUDE WAS - IS DESCRIPTION AND OTHER DRAWING NUMBERS IMPACTED)

CHANGE NOTE △1 AS FOLLOWS:

WAS: △1 TORQUE ITEM 6 TO $1.0 {}^{+.4}_{-.0}$ IN-LBS.

IS: △1 TORQUE ITEM 6 TO 2.2 ± 0.3 IN-LBS

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Page 28C
Item 20

JUSTIFICATION: DRAWING ERROR

REQUESTED BY: J. MASZATICS

PROJ. ENGR.:

REQUESTOR DO NOT WRITE BELOW THIS LINE

INSTRUCTIONS:

ENGR. COMPL. ___
PROC. COMPL. ___
MFG COMPL. ___
INCORP. COMPL. ___
TEST COMPL. ___

☐ CUSTOMER APPVL REQ'D
☒ OUTSTANDING ECN
☐ INCORP. ON DWG.
☐ MFG INCORP INTO HDW.
☐ INCORP. INTO T.P.
☐

DISPOSITION:
☒ APPROVED
☐ APPROVED AS NOTED
☐ DISAPPROVED

INCORPORATE:
☐ IN PRODUCTION
☐ RETROFIT

DOCUMENT REQMTS.: ☐ TCTO ☐ TCTR ☐ ECP ☐ CCP

CHANGE CLASSIFICATION: ☐ RECORD ☐ CLASS I ☒ CLASS II

PREPARED BY	STRESS/WT.	QUALITY	SYS. SUPP.	CONTRACTS	CUSTOMER
J.M. BRUECKER					
CHECKED	RELIABILITY	MFG	TEST	CMG	
S. DECK				7/31/74	

CHAIRMAN:

DATE: 7-31-74

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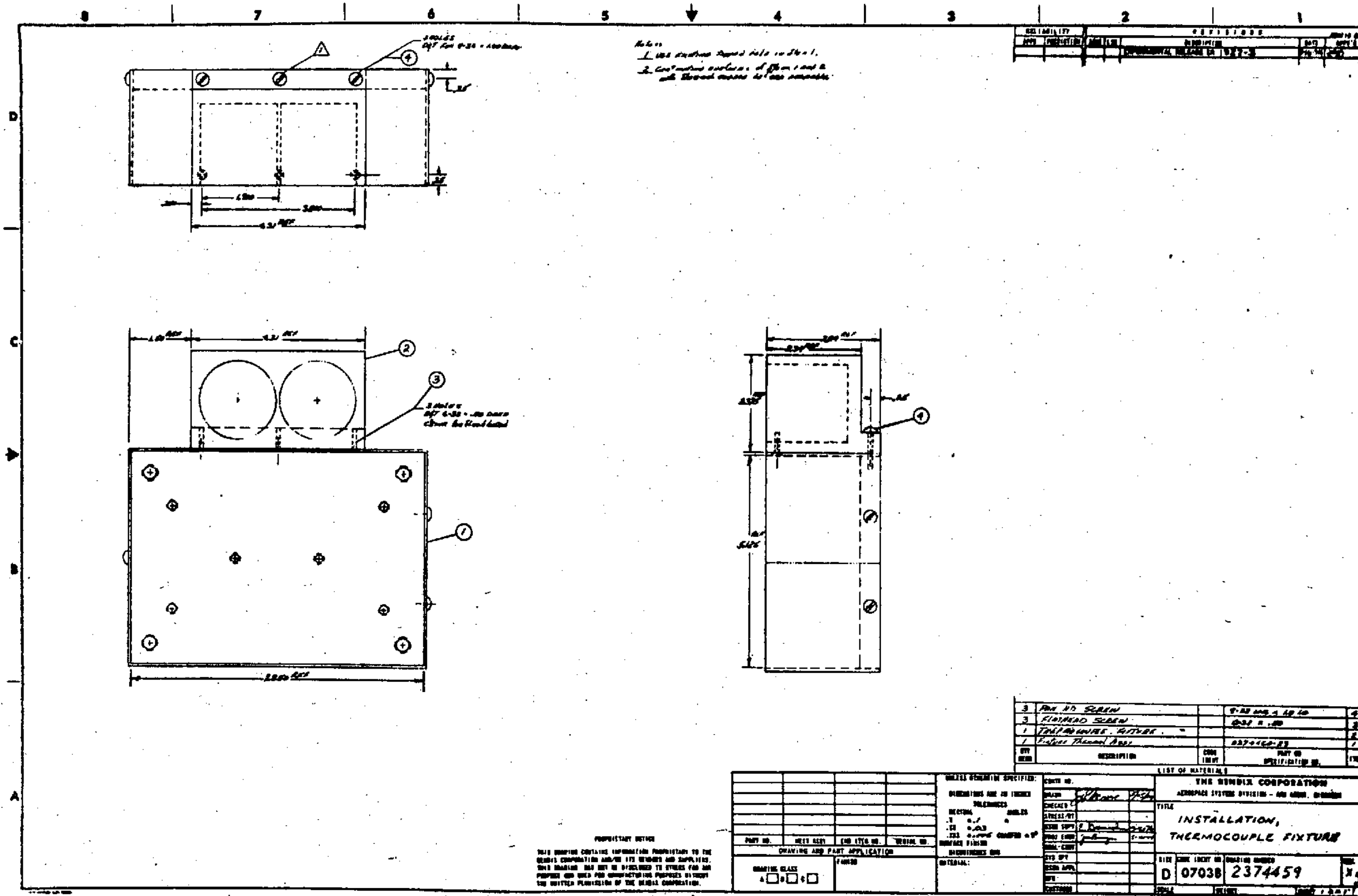

FIGURE 12

Page 28 D

ITEM 20

(40)

LAGEOS

THERMAL-OPTICAL TEST

NO. TP2374455 REV. NO.

PAGE 29 OF 49

DATE 9 July 1974

(41)

10.1 INSTRUMENTATION INTERCONNECT SUMMARY - THERMOCOUPLES

TC Item 16
Feedthru

	TC #	LOCATION	DAS	NOTES
Item 1	1	FFDI Ambient	1	
1	2	Window Hood	2	
Item	~~3~~	~~Window Hood~~	~~3~~	~~Backup~~
2	4	Manipulator	4	
3	5	Manipulator	5	Backup
4	6	Coldwall - West 2	6 open	
5	7	Coldwall - East 4	7	
6	8	Coldwall - Door	8	
7	9	Coldwall - South	9	
8	10	Test Article Panel	10	Fig. 6
9	11	Test Article Panel	11	Back-up Fig. 6
10	12	Thermocouple Fixture	12	Fig. 6 Retro X ~~Cavity~~
11	13	Thermocouple Fixture	13	Fig. 6 Retro Y Cavity
12	14	Retro X Face	14	Fig. 6
13	15	Retro X Apex	15	Fig. 6 ~~ΔT Axial TC15 - TC14~~ Item 27
14	16	Retro X Edge	16	Fig. 6 ~~ΔT Radial TC16 - TC14~~
Item 23 15	17	~~Retro X Lower Mtg. Ring~~	17	~~Fig. 6~~
16	18	Retro X Upper Mtg. Ring	18	Fig. 6
17	19	Retro X Retainer Ring	19	Fig. 6
18	20	Retro Y Face	20	Fig. 6

10.1 INSTRUMENTATION INTERCONNECT SUMMARY – THERMOCOUPLES (CONT.)

Item 16

TC Feedthru	TC #	LOCATION	DAS	NOTES
19	21	Retro Y Apex	21	Fig. 6, ΔT Axial, TC21 - TC20
20	22	Retro Y Edge	22	Fig. 6, ΔT Radial, TC22 - TC20
21	23	Retro Y Lower Mtg Ring	23	Fig. 6
22	24	Retro Y Upper Mtg Ring	24	Fig. 6
23	25	Retro Y Retainer Ring	25	Fig. 6
24	26	Radiometer #1	26	Sink Temperature
25	27	Radiometer #2	27	Sink Temperature
12	28	Verification Window	3	during Pre-Test Verif. Only
Item 1	29	Ice Point Reference	0	
Item 15 8	30	Thermal Fixture	10	Verif. test only
9	31	Thermal Fixture	11	Verif. test only

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10.1 INSTRUMENTATION INTERCONNECT SUMMARY

Item	Identification	Data	Recorder Channel	Sensitivity
Variac	1	Window Hood Heater	DAS 28	VAC
Variac	2	Manipulator Heater	29	VAC
Variac	3	Earth IR Sim. #1	30	VAC
Variac	4	Earth IR Sim. #2	31	VAC
ITEM 1 Radiometer ~~44095~~ #1		Solar/IR Intensity	DAS ~~32~~ 33/Chart 1	10 mv/S. C.
Radiometer ~~44195~~ #2		IR Intens. - #2 Sim.	DAS ~~35~~ 34	10 mv/S. C.
Blank 10K Ω		Isolation Channel	DAS 32	— — —

10.2 TEST CONDITION AND DATA LOG

Item 28

Item 22 TEST SEQUENCE: AS-RUN SUMMARY

Test No.	Photo No.	Description	Date	Start Time	End Time
1	1/9	Isothermal-ambient	8/6/74	0500	0525
2	10/24	Isothermal-Vacuum	8/6/74	0714	1133
4		Thermal-Vacuum	8/6/74	1139	TDR 04006 1600
15	25	Isothermal-Ambient	8/6/74	TDR 04007 2215	TDR 04006 2229
16	26/36	Isothermal-ambient	—	8-7-74 1132 TDR 04008	8-8-74 1700
17	37/51	Isothermal-Vacuum	8-8-74	1713	2011
7	52/66	Thermal-Vacuum	8-8-74	2020	8-9-74 0237
9	67/75	T-V/IR	8-9-74	0330	0711
8	76/83	T-V/Solar	8-9-74	0730	1456
4	84/92	T-V/Solar	8-9-74	1500	2000
6	93/101	T-V/IR	8-9-74	2014	2330
3	102/117	T-V (+30C)	8-10-74	0000	0226
18	118/133	Isothermal-Vacuum	8-12-74	0845	0910
5	134/148	Thermal-Vacuum	8-12-74	0920	1621
10	149/157	Isothermal-Amb	8-12-74	2151	2215
11	158/173	Isothermal-Vacuum	8-12-74	2220	8-13-74 0053
19	174/189	T-V (-30°C)	8-13-74	0100	0723
12	190/205	T-V (+30°C)	8-13-74	0740	1320
20	206/210	Isothermal-Amb.	8-14-74	1416	TDR 04010 1728

10.2 TEST CONDITION AND DATA LOG Item 28

Item 22 TEST SEQUENCE: AS-RUN SUMMARY

Test No.	Photo No.	Description	Date	Start Time	End Time
20A	212/226	Isothermal-Amb	8-14-74	1730	1753
13	227/242	Isothermal-Vac	8-14-74	1816	2016
21	243/258	T-V (-30C)	8-14-74	2016	0152
14	259/274	T-V (+30C)	8-15-74	0200	0656
22	275/290	T-V (~~+90C~~) (+60C)	8-15-74	0700	1430
23	291/306	Isothermal-Amb (D,E,F)	8-16-74	0820	0854
24	307/321	Isothermal-Amb (A,B,C)	8-16-74	1030	1052
N/A		Annular Arc Survey	8-13-74	1920	2045

Bendix

Aerospace
Systems Division

LAGEOS
THERMAL-OPTICAL
TEST

(40)

2374455

Page ______ of ______

Date 8-8-74

10.2 DATA LOG

CALIBRATION CUBE PHOTOMETRIC DATA

LASER = 0.94

FFDP ANNULAR = 0.17

RATIO ANNULAR = 0.18

RATIO FULL FIELD = 1.22

* CUBE ORIENTED WITH WRITING ON REAR SIDE HORIZONTAL and UPWARDS

8-8-74 1815 HRS

BxA - 7/74

Bendix Aerospace Systems Division

LAGEOS
THERMAL-OPTICAL TEST

(49)

No. TP2374456 | Rev. No.
Page 33 of 48
Date 9 July 1974

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		AMB	AMB.
TEST ARTICLE TEMP – °C		AMB	AMB.
COLDWALL TEMP – °C (avg)		AMB	AMB.
SOLAR SIMULATION	ANGLE	N/A	N/A
	BACKGND	N/A	N/A
	INTENSITY	N/A	N/A
EARTH IR SIMULATION	BACKGND	N/A	N/A
	INTENSITY	N/A	N/A

Ref FFDI Verification photo no. 1

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 1

TEST DATE: 8-6-74 TEST TIME: FROM 0500 TO 0525

NOTES: (1) Photo #7 was re-taken (and labeled #7a) per J. Zurasky request
(2) optical data taken by E. Granholm & J. Morgothis
(1, 2, 3 & 4) (5, 6, 7, 8 & 9)
(3) OPTICAL MEASUREMENTS INCLUDE BIAS OF .005 (ON 10X SCALE) SUBTRACTION.

OPTICAL DATA ± 25 ARC SEC FIELD

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
A	PHOTO NO.	2	3	4	5	6
	LASER	1.27	1.29	1.28	1.28	1.29
	FFDP-ANNULAR	0.20	0.088	.005	.090	.047
	RATIO-ANNULAR	0.16	0.068	.003	.068	.035
	± RATIO-FULL FIELD	0.79	0.42	.016	.44	.17
B	PHOTO NO.	7	8	NA	NA	NA
	LASER	1.29	1.29	NA	NA	NA
	FFDP-ANNULAR	.09	.054	NA	NA	NA
	RATIO-ANNULAR	.07	.041	NA	NA	NA
	± RATIO-FULL FIELD	.48	.26	NA	NA	NA
C	PHOTO NO.	9	NA	NA	NA	NA
	LASER	1.29	NA	NA	NA	NA
	FFDP-ANNULAR	.20	NA	NA	NA	NA
	RATIO-ANNULAR	.15	NA	NA	NA	NA
	± RATIO-FULL FIELD	.76	NA	NA	NA	NA

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C (#0536)

STABIL. SEQ.	RETRO X FACE DAS 14	RETRO X ΔT AX DAS 15	RETRO X ΔT RAD DAS 16	RETRO Y FACE DAS 20	RETRO Y ΔT AX DAS 21	RETRO Y ΔT RAD DAS 22
1 STRT	24	0	0	24	0	0
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

Bendix

Aerospace Systems Division

LAGEOS

THERMAL-OPTICAL TEST

(48)

No.	Rev. No.
TP2374455	

Date 9 July 1974

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 2

TEST DATE: 8/6/74 TEST TIME: FROM ~~1045~~ 0714 TO 1133

NOTES: OPTICAL DATA TAKEN BY J. BRUCKER

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$< 1 \times 10^{-6}$	1.3×10^{-5}
TEST ARTICLE TEMP – °C		AMB	AMB
COLDWALL TEMP – °C (avg)		AMB	AMB
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

OPTICAL DATA

* INCLUDES BIAS .006

** INCLUDES BIAS .004

≠ 25 ARC SEC FIELD

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30	
A	PHOTO NO.	10	11	12	13	14	
	LASER	1.39	1.38	1.38	1.38	1.38	
	FFDP-ANNULAR	.19	~~.08~~ .094	.008	.090	.047	*
	RATIO-ANNULAR	.14	.064	.006	.062	.034	**
	≠ RATIO-FULL FIELD	.71	.38	.018	.39	.15	
B	PHOTO NO.	15	16	17	18	19	
	LASER	1.37	1.36	1.36	1.35	1.34	
	FFDP-ANNULAR	.090	.048	.01	.05	.009	*
	RATIO-ANNULAR	.062	.036	.007	.036	.007	**
	≠ RATIO-FULL FIELD	.44	.22	.023	.26	.02	
C	PHOTO NO.	20	21	22	23	24	
	LASER	1.34	1.33	1.33	1.31	1.30	
	FFDP - ANNULAR	.17	.089	.015	.087	.009	*
	RATIO - ANNULAR	.13	.066	.011	.065	.007	**
	≠ RATIO - FULL FIELD	.61	.34	.041	.36	.021	

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT	21	0	0	21	0	0
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP	21	0	0	21	0	0

Additional ~~Isothermal-~~Ambient Optical Check

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 15

TEST DATE: 8/6/74 TEST TIME: FROM 2200 TO 2230

NOTES: THIS ADDITIONAL TEST WAS RUN TO DETERMINE THE EXTENT OF RETRO OPTICAL PERFORMANCE DEGRADATION DUE TO CONTAMINATION OF THE GLASS.

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE			AMBIENT
TEST ARTICLE TEMP – °C			76°F
COLDWALL TEMP – °C (avg)			AMBIENT
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

* .005 BIAS
** .006 BIAS
‡ 25 ARC SEC FIELD

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	–15	–30
A	PHOTO NO.	25	—	—	—	—
	LASER	1.04	1.04	1.06	1.10	1.10
	FFDP-ANNULAR	.10	*[illegible]	**.007	*.059	*.031
	RATIO-ANNULAR	.10	*.053	**0.007	*.054	*.029
	‡ RATIO-FULL FIELD	.52	.28	*.015	.31	.11
B	PHOTO NO.		—	30°		
	LASER	1.10	1.10	1.10		
	FFDP-ANNULAR	.46	*.039	*.077		
	RATIO-ANNULAR	.42	*.036	*.072		
	‡ RATIO-FULL FIELD		.20	.43		
C	PHOTO NO.	—				
	LASER	1.10				
	FFDP-ANNULAR	.13				
	RATIO-ANNULAR	.12				
	‡ RATIO-FULL FIELD	.57				

RATIO = FFDP/LASER OUTPUT

FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT						
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		Amb	
TEST ARTICLE TEMP – °C		Amb	
COLDWALL TEMP – °C (avg)		Amb	
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

10.2 TEST CONDITIONS ~~AND~~ DATA LOG

Isothermal Ambient

TEST NO. 16

TEST DATE: 8-7-74 / 8-8-74 TEST TIME: FROM 1132 (8-7-74) TO 1700 (8-8-74)

NOTES: ± 25 ARCSEC Full Field

*.005 BIAS

FFDI Verification photo no. 26 — 28 8/8/74 1607 hrs

OPTICAL DATA

TDR 04008

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30	0
A	PHOTO NO.	27	30	31	32	33	29
	LASER	1.15	.95	.95	.95	.95	.95
	FFDP-ANNULAR	[illegible]	.062	.007*	.062	.032	.13
	RATIO-ANNULAR	[illegible]	.064	.007*	.063	.034	.14
	# RATIO-FULL FIELD		.37	.019*	.39	.14	.74
B	PHOTO NO.	34	35				
	LASER	.95	.95				
	FFDP-ANNULAR	.065	.038				
	RATIO-ANNULAR	.069	.039				
	# RATIO-FULL FIELD	.46	.23				
C	PHOTO NO.	36					
	LASER	.95					
	FFDP-ANNULAR	.13					
	RATIO-ANNULAR	.14					
	# RATIO-FULL FIELD	.72					

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT						
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP	0°	+15	+30	−15	−30	ang
~~4 STRT~~	1.17	.74	.036	.74	.33	A
4 STOP	1.16	.68				B
5 STRT	1.16					C
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

Ratio Full Field no Field Restd

Item 24
2×10^{-5}

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Isothermal - Vacuum
10.2 TEST CONDITIONS AND DATA LOG TEST NO. ~~8~~ 17

TEST DATE: 8-8-74 TEST TIME: FROM 1713 TO 2011

NOTES: chamber pressure ~1.4×10⁻⁵ at end of data taking

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		~~1×10^{-6}~~	4.8×10^{-5}
TEST ARTICLE TEMP – °C		Amb	Amb.
COLDWALL TEMP – °C (avg)		Amb.	Amb.
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

*.005 BIAS

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
A	PHOTO NO.	37	38	39	40	41
	LASER	.95	.94	.94	.94	.94
	FFDP-ANNULAR	.14	*.066	*.008	~~.26~~ *.063	~~.035~~ .033*
	RATIO-ANNULAR	.15	*.070	*.008	*.067	.035*
	RATIO-FULL FIELD	1.17	.73	*.036	.74	.33
B	PHOTO NO.	42	43	44	45	46
	LASER	.95	.94	.94	.95	.94
	FFDP-ANNULAR	*.074	*.041	*.007	*.038	*.009
	RATIO-ANNULAR	*.083	*.042	*.008	*.040	*.010
	RATIO-FULL FIELD	1.17	.69	*.049	.78	*.070
C	PHOTO NO.	47	48	49	50	51
	LASER	.94	.94	.94	.94	.94
	FFDP - ANNULAR	.14	*.070	*.013	*.082	*.009
	RATIO - ANNULAR	.15	*.073	*.014	*.082	*.010
	RATIO - FULL FIELD	1.15	.68	*.098	.82	*.046

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT						
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

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LAGEOS

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TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		< 1X10-6	1.6x10-7
TEST ARTICLE TEMP – °C		–30±2 °C	–30.6°c
COLDWALL TEMP – °C (avg)		–185 °C	–193°c
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 7

TEST DATE: 8-8-74 / 8-9-74 TEST TIME: FROM 2020 TO 0237

NOTES:

OPTICAL DATA

Bias .005

RETRO	DATA	FIELD ANGLES 0	+15	+30	–15	–30	+15
A	PHOTO NO.	52	53	54	55	56	[illegible]
	LASER	.95	.94	.94	.94	.94	.94
	FFDP-ANNULAR	~~1.35~~ .12	.059	.007	.055	.028	.056
	RATIO-ANNULAR	~~1.34~~ .13	[illegible] .038	.007	.057	.030	.061
	RATIO-FULL FIELD	1.15	.72 ~~.69~~	.033	.73	.32	.73
B	PHOTO NO.	57	58	59	60	61	
	LASER	.94	.94	.94	.94	.94	
	FFDP-ANNULAR	.069	.036	.006	.029	.008	
	RATIO-ANNULAR	.071	.038	.007	.031	.008	
	RATIO-FULL FIELD	1.16	.67	.046	.77	.068	
C	PHOTO NO.	62	63	64	65	66	
	LASER	.94	.94	.94	.94	.94	
	FFDP - ANNULAR	.12	.058	.012	.069	.008	
	RATIO - ANNULAR	.13	.061	.012	.072	.009	.004 Bias
	RATIO - FULL FIELD	1.17	.67	.095	.80	.044	

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT				-58.8	+.190mv	+.043mv
1 STOP				-58.8	+.187mv	+.044 mv
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1\times10^{-6}$	1.6×10^{-7}
TEST ARTICLE TEMP – °C		-30 ± 2 °C	−30°C
COLDWALL TEMP – °C (avg)		−185 °C	−193°C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND	N/A	−3.72
	INTENSITY	1/20 S.C.	−3.22

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 9

TEST DATE: 8-9-74 TEST TIME: FROM 0330 TO 0711

NOTES:

[illegible] FFDI verification photo number 67

Bias = .004

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
A	PHOTO NO.	68	69	70	71	72
	LASER	.94	.94	.94	.94	.94
	FFDP-ANNULAR	.13	.063	.007	.061	.031
	RATIO-ANNULAR	.14	.065	.007	.064	.032
	RATIO-FULL FIELD	1.16	.73	.033	.013	.32
B	PHOTO NO.	73	74			
	LASER	.94	.94			
	FFDP-ANNULAR	.08	.042			
	RATIO-ANNULAR	.083	.043			
	RATIO-FULL FIELD	1.15	.67			
C	PHOTO NO.	75				
	LASER	.94				
	FFDP-ANNULAR	.14				
	RATIO-ANNULAR	.15				
	RATIO-FULL FIELD	1.14				

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	time
1 STRT	−48.2	−39.6	−43.4	−48.5	+2.7	+0.9	0704
1 STOP	−51.2	−40.6	−44.4	−47.5	+3.9	+0.9	0711
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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10.2 TEST CONDITIONS AND DATA LOG TEST NO. 8

TEST DATE: 8-9-74 TEST TIME: FROM 0730 TO ~~1435~~ 1456

NOTES: SETUP 1.0 SC AT 0907 8/9/74 ; Photo 78 @ 12:18:57 Photo 76 @ 12:08:21
Radial Grad. (25°) is very low & goes out of tolerance immediately when changed to FFDI View.
Photo 79, 80, 81, 82, 83 (start 1430:19 stop 1435:31)

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1 \times 10^{-6}$	1.2×10^{-7}
TEST ARTICLE TEMP – °C		-30 ± 2 °C	−30.6 °C
COLDWALL TEMP – °C (avg)		−185 °C	−195 °C
SOLAR SIMULATION	ANGLE	0°	0°
	BACKGND	N/A	−3.70
	INTENSITY	1.0 S.C.	1.0
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

~~BACKGND~~ ~~−3.70~~

OPTICAL DATA

* Bias .007 .008
' Bias .006

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
A	PHOTO NO.	77	78	79	80	81
	LASER	.91	.91	.91	.91	.90
	FFDP-ANNULAR	.15	.071'	* .018 ~~.007~~	.074'	.039 ~~.32~~'
	RATIO-ANNULAR	.16	.076'	* .018 ~~.008~~	.082'	.042'
	RATIO-FULL FIELD	1.23	.77	.039	.80	.35 ~~.35~~
B	PHOTO NO.	82	83			
	LASER	.91	.91			
	FFDP-ANNULAR	.103'	.055'			
	RATIO-ANNULAR	.108'	.061'			
	RATIO-FULL FIELD	1.25	.73			
C	PHOTO NO.	76				
	LASER	.91				
	FFDP-ANNULAR	.15 ~~.016~~				
	RATIO-ANNULAR	.16				
	RATIO-FULL FIELD	1.19				

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

Photos	STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
96, 77, 78	1 STRT	+1	−31	−37.5	−43.5	+2.00	+0.15
	1 STOP	+9	−30.5	−38	−43	+2.77	−0.49
79, 80, 81, 82 & 83	2 STRT	0	−29.5	−35.5	−42.5	+2.96	+0.81
	2 STOP	−47	−35.0	−37.5	−43.5	+2.53	+0.83
	3 STRT						
	3 STOP						
	4 STRT						
	4 STOP						
	5 STRT						
	5 STOP						
	6 STRT						
	6 STOP						
	7 STRT						
	7 STOP						
	8 STRT						
	8 STOP						

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LAGEOS THERMAL-OPTICAL TEST

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10.2 TEST CONDITIONS AND DATA LOG TEST NO. 4

TEST DATE: 8-9-74 TEST TIME: FROM 1600 TO 2000

NOTES: #84 photo at 19:29:51 hrs; #91 photo at 19:38:31
See attached Note sheet, AS-RUN proc #56

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		<1X10⁻⁶	1.6 x10⁻⁷
TEST ARTICLE TEMP - °C		+30±2 °C	+29.5°C
COLDWALL TEMP - °C (avg)		-185 °C	-191°C
SOLAR SIMULATION	ANGLE	0°	0°
	BACKGND	N/A	-3.71 mv
	INTENSITY	1.0 S.C.	~~-3.21 mv~~
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Trial FFDI verification photo no. 92

OPTICAL DATA

Bias .009 (+15), Bias .009 (+30)

RETRO	DATA	FIELD ANGLES 0	+15	+30	-15	-30
A	PHOTO NO.	84	85	86	87	88
	LASER	.95	.91	.91	.91	.91
	FFDP-ANNULAR	~~.004~~ .18	.093	.012	.089	.045
	RATIO-ANNULAR	.19	~~.009~~ .89	.013	.098	.049
	RATIO-FULL FIELD	1.35	~~.09~~ .96	.043	.88	.41
B	PHOTO NO.	89	90			
	LASER	.91	.91			
	FFDP-ANNULAR	.09	.054			
	RATIO-ANNULAR	.09	.058			
	RATIO-FULL FIELD	1.35	.80			
C	PHOTO NO.	91				
	LASER	.91				
	FFDP-ANNULAR	.15				
	RATIO-ANNULAR	.17				
	RATIO-FULL FIELD	1.35				

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES — °C

Photo Nos.	STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
ALL	1 STRT	-24	-2.0	-12.0	-20.0	6.06	1.96
	1 STOP	-25.5	-2.0	-13.0	-20.5	6.07	1.77
	2 STRT						
	2 STOP						
	3 STRT						
	3 STOP						
	4 STRT						
	4 STOP						
	5 STRT						
	5 STOP						
	6 STRT						
	6 STOP						
	7 STRT						
	7 STOP						
	8 STRT						
	8 STOP						

(56)

(8-8-74 1015 hrs)

original $\frac{.18 \text{ annulus}}{1.22 \text{ full field}} = 0.148$

(photo 92)
after +30 - Solar $\frac{.22 \text{ annulus}}{1.37 \text{ full field}} = 0.161$
zero sun angle

A check of the calibration cube at the initiation of the test showed the results labelled original. These measurements were made again after the test +30°C with solar. The ratio at this time has changed along with a slight decrease in laser power. The laser power decrease can't account for this fact. Since there has been a change in the temperature the anomaly could be caused by a change in position of the beam when it strikes the laser power monitor mirror. The uniformity of the beam incident on the CCR is still very good.

* Could also be caused by the temperature of the calibration cube.

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 6

TEST DATE: 8-9-74 TEST TIME: FROM 2014 TO 2330

NOTES:

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1 \times 10^{-6}$	1.2×10^{-7}
TEST ARTICLE TEMP - °C		$+30 \pm 2$ °C	+30 °C
COLDWALL TEMP - °C (avg)		-185 °C	-196 °C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND	N/A	-3.71 mV
	INTENSITY	1/20 S.C.	

FFDI Verification Photo No. 93

OPTICAL DATA

RETRO	DATA	FIELD ANGLES (Bias = .007) 0	+15	+30	-15	-30
A	PHOTO NO.	94	95	96	97	98
	LASER	.90	.90	.90	.90	.90
	FFDP-ANNULAR	.16	.084	.011	.083	~~.04~~ .042
	RATIO-ANNULAR	.18	.093	.012	.091	.046
	RATIO-FULL FIELD	1.30	.84	.039	.83	.34
B	PHOTO NO.	99	100			
	LASER	.90	.90			
	FFDP-ANNULAR	~~.97~~ .088	.050			
	RATIO-ANNULAR	~~1.08~~ .097	.055			
	RATIO-FULL FIELD	1.28	.75			
C	PHOTO NO.	101				
	LASER	.90				
	FFDP - ANNULAR	.15				
	RATIO - ANNULAR	.16				
	RATIO - FULL FIELD	1.26				

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES - °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT	-20.5	+0.5	-10	-13.5	+5.12	+1.74
1 STOP	-23.5	-1.0	-11	-14.5	+5.30	+1.63
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

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TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1 \times 10^{-6}$	1.8×10^{-7}
TEST ARTICLE TEMP – °C		+30±2 °C	30°C
COLDWALL TEMP – °C (avg)		–185 °C	– 196°C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 3

TEST DATE: ~~8-9-74~~ TEST TIME: FROM 0000 TO 0226

NOTES: 8-10-74

FFDI Verif. Photo No. 102
1 Bias = .006

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	–15	–30
A	PHOTO NO.	103	104	105	106	107
	LASER	.90	.90	.90	.91	.91
	FFDP-ANNULAR	.15	.070'	.009'	.067'	.036'
	RATIO-ANNULAR	.16	.076'	.010	.073	.039
	RATIO-FULL FIELD	1.25	.78	.036	.80	.36
B	PHOTO NO.	108	109	110	111	112
	LASER	.91	.90	.90	.90	.90
	FFDP-ANNULAR	.059'	.035'	.008'	.030	.008'
	RATIO-ANNULAR	.063	.038	.009	.033	.009
	RATIO-FULL FIELD	1.24	.73	.051	.84	.075
C	PHOTO NO.	113	114	115	116	117
	LASER	.90	.90	.90	.90	.90
	FFDP - ANNULAR	.11	.062'	.013'	.073'	.010'
	RATIO - ANNULAR	.12	.068	.015	.080	.011
	RATIO - FULL FIELD	1.24	.73	.104	.88	.049

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT	-34.5	-6.0	-18.5	-23.5	+6.41	+1.70
1 STOP	-34.0	-5.5	-18.5	-23.0	+6.46	+1.86
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

JM

Isothermal - Vacuum Item No. 30

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 18

TEST DATE: 8/12/74 TEST TIME: FROM 0845 TO 0910

NOTES: ____

TEST CONDITIONS Item 24

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		2×10^{-6}	6×10^{-6}
TEST ARTICLE TEMP - °C		Amb	Amb
COLDWALL TEMP - °C (avg)		Amb.	Amb
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

FFDI Verification Photo 118

**.004 Bias
*.005 Bias

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
A	PHOTO NO.	119	120	121	122	123
	LASER	.91	.91	.91	.91	.91
	FFDP-ANNULAR	.14	.064	*.007	*.064	.033
	RATIO-ANNULAR	.16	*.070	*.007	*.063	.037
	RATIO-FULL FIELD	1.22	.77	.034	.78	.34
B	PHOTO NO.	124	125	126	127	128
	LASER	.91	.91	.91	.91	.91
	FFDP-ANNULAR	.070 ~~.006~~	.039	*.006	*.038	*.008
	RATIO-ANNULAR	.078	.042	*.007	**.042	*.009
	RATIO-FULL FIELD	1.20	.71	.047	.82	.072
C	PHOTO NO.	129	130	131	132	133
	LASER (.13)	.91	.91	.91	.91	.91
	FFDP - ANNULAR	.13 ~~.13~~	.067	*.012	*.078	*.008
	RATIO - ANNULAR	.14	.072	*.013	*.084	*.009
	RATIO - FULL FIELD	1.2	.71	.097	.85	.046

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES - °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22
1 STRT						
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

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TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1 \times 10^{-8}$	1.6×10^{-9}
TEST ARTICLE TEMP – °C		+60 ±2 °C	+61 °C
COLDWALL TEMP – °C (avg)		−185 °C	−193 °C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

10.2 TEST CONDITIONS AND DATA LOG

5 Jun 31

TEST NO. 5

TEST DATE: 8-12-74 TEST TIME: FROM 0920 TO 1621

NOTES: ___

BIAS = .006

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
A	PHOTO NO.	134	135	136	137	138
	LASER	.89	.89	.89	.89	.89
	FFDP-ANNULAR	.15	.072	.009	.067	.036
	RATIO-ANNULAR	.16	.079	.010	.077	.040
	RATIO-FULL FIELD	1.24	.78	.036	.80	.36
B	PHOTO NO.	139	140	141	142	143
	LASER	.89	.89	.88	.89	.88
	FFDP-ANNULAR	.078	.040	.009	.041	.010
	RATIO-ANNULAR	[illegible]	.045	.010	.046	.011
	RATIO-FULL FIELD	1.23	.72	.051	.85	.076
C	PHOTO NO.	144	145	146	147	148
	LASER	.89	.89	.88	.88	.88
	FFDP - ANNULAR	.14	.074	.014	.088	.011
	RATIO - ANNULAR	.17	.082	.016	.098	.012
	RATIO - FULL FIELD	1.24	.73	.098	.87	.050

RATIO = FFDP/LASER OUTPUT

FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	TIME
1 STRT	−18.6	+17	+2.5	−1	+8.34	+2.74	16:03:01
1 STOP	−18.5	+19	+3	0	+8.09	+2.79	16:19:31
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		AMB	Amb
TEST ARTICLE TEMP – °C		AMB	Amb
COLDWALL TEMP – °C (avg)		AMB	Amb
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

10.2 TEST CONDITIONS AND DATA LOG TEST NO.10

TEST DATE: 8-12-74 TEST TIME: FROM 2150 TO 2215

NOTES:

149 FFDI Verification photo no. 149

OPTICAL DATA

*.007 B.03

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	150	151	152	153	154
	LASER	.89	.89	.89	.89	.88
	FFDP–ANNULAR	.12	.05	*.02	.04	*.008 .08
	RATIO–ANNULAR	.14	.06	*.02	.05	*.009
	RATIO–FULL FIELD	1.24	.76	.33	.82	.035 — changed
E	PHOTO NO.	155	156			
	LASER	.88	.88			
	FFDP–ANNULAR	.12	.06			
	RATIO–ANNULAR	.14	.07			
	RATIO–FULL FIELD	1.26	.78			
F	PHOTO NO.	157				
	LASER	.88				
	FFDP – ANNULAR	.10				
	RATIO – ANNULAR	.12				
	RATIO – FULL FIELD	1.24				

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	Time
1 STRT	21	20	21	21	0	−.3	2150
1 STOP	20	20	20	20	0	−.1	2214
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		2×10^{-5}	62×10^{-6}
TEST ARTICLE TEMP – °C		~~Ambient~~	Amb -5
COLDWALL TEMP – °C (avg)		Amb	Amb
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

FFDI Verification Photo No. 158

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 11

TEST DATE: 8-12-74 to 8-13-74 TEST TIME: FROM 2220 TO 0053

NOTES: original data log required 8 field angle/data point. Test variation #33 increased requirement to 15. JM

Item #33 OPTICAL DATA Bias = .006

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	159	160	161	162	163
	LASER	.89	.89	.89	.88	.89
	FFDP-ANNULAR	.103	.050	.031	.048	.008
	RATIO-ANNULAR	.116	.055	.034	.053	.008
	RATIO-FULL FIELD	1.25	.77	.33	.82	.038
E	PHOTO NO.	164	165	166	167	168
	LASER	.89	.89	.89	.89	.89
	FFDP-ANNULAR	.11	.066	.012	.061	.009
	RATIO-ANNULAR	.12	.074	.014	.065	.010
	RATIO-FULL FIELD	1.28	.79	.084	.81	.052
F	PHOTO NO.	169	170	171	172	173
	LASER	.89	.89	.89	.89	.89
	FFDP-ANNULAR	.102	.046	.007	.056	.013
	RATIO-ANNULAR	.116	.051	.008	.061	.014
	RATIO-FULL FIELD	1.25	.79	.039	.80	.10

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	TIME
1 STRT	19.0	20.5	20.0	19.5	+0.4	+.05	00:20
1 STOP	19.5	21.0	20.5	20.0	+0.4	+.05	00:53
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1\times10^{-6}$	1.5×10^{-7}
TEST ARTICLE TEMP - °C		-30±2°C	-30
COLDWALL TEMP - °C (avg)		-185°C	-194°C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 22

10.2 TEST CONDITIONS AND DATA LOG TEST NO. 19

TEST DATE: 8-13-74 TEST TIME: FROM 0100 TO 0723

NOTES:

JM

FFDI Verification photo No. 174

OPTICAL DATA

Bias = .006

RETRO	DATA	FIELD ANGLES 0	+15	+30	-15	-30
D	PHOTO NO.	175	176	177	178	179
	LASER	.89	.89	.88	.89	.88
	FFDP-ANNULAR	.10	.043	.028	.043	.008
	RATIO-ANNULAR	.10	.047	.031	.051	.009
	RATIO-FULL FIELD	1.26	.76	.33	.82	.038
E	PHOTO NO.	180	181	182	183	184
	LASER	.89	.88	.89	.88	.88
	FFDP-ANNULAR	.103	.056	.011	.053	.009
	RATIO-ANNULAR	.11	.061	.013	.060	.010
	RATIO-FULL FIELD	1.27	.78	.082	.81	.052
F	PHOTO NO.	185	186	187	188	189
	LASER	.88	.88	.88	.88	.88
	FFDP-ANNULAR	.093	.043	.007	.048	.012
	RATIO-ANNULAR	.102	.047	.008	.054	.013
	RATIO-FULL FIELD	1.25	.78	.039	.80	.10

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES - °C

STABIL. SEQ.	RETRO X FACE DAS 14	RETRO X ΔT AX DAS 15	RETRO X ΔT RAD DAS 16	RETRO Y FACE DAS 20	RETRO Y ΔT AX DAS 21	RETRO Y ΔT RAD DAS 22	time
1 STRT	-93	-47	-54	-62.5	+6.3	+1.1	0704
1 STOP	-90	-47	-53	-62	+6.2	+1.1	0723
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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10.2 TEST CONDITIONS AND DATA LOG TEST NO. 12

TEST DATE: 8-13-74 TEST TIME: FROM 0730 TO 1320

NOTES:

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1\times10^{-6}$	2.2×10^{-8}
TEST ARTICLE TEMP – °C		+30±2 °C	+29 °C
COLDWALL TEMP – °C (avg)		−185 °C	−195 °C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Lux 9 FFDI Verification photo No. 190 **.008 BIAS

*.007 BIAS

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30	+30
D	PHOTO NO.	191	192	193	194	195	
	LASER	.87	.87	.87	.87	.87	
	FFDP-ANNULAR	*.096	**.047	.030 ~~.027~~**	.046	**.009	
	RATIO-ANNULAR	.10	.052	.034 ~~.031~~**	.053	**.010	
	RATIO-FULL FIELD	1.27	.78	.34	.83	.040	
E	PHOTO NO.	196	197	198	199	200	
	LASER	.87	.87	.87	.87	.87	
	FFDP-ANNULAR	.11	.067	.013**	**.063	.011	
	RATIO-ANNULAR	.12	.075	.015	.070	.012	
	RATIO-FULL FIELD	1.29	.80	.086	.83	.053	
F	PHOTO NO.	201	202	~~203~~	204	205	203
	LASER	.87	.88	~~.88~~	.87	.87	.87
	FFDP-ANNULAR	.094 ~~.097~~	.046	~~.037 .033~~	**.054	**.014	.009
	RATIO-ANNULAR	.11	.052	~~.042 .038~~	.062	.016	.010
	RATIO-FULL FIELD	1.26	.80		.82	.10	.041

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	TIME
1 STRT	-68	-9	-23	-27	+2.93	+2.27	13:02:01
1 STOP	-63	-8	-22	-26	+5.86	+2.13	13:19:41
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		Amb.	Amb.
TEST ARTICLE TEMP - °C		Amb.	Amb.
COLDWALL TEMP - °C (avg)		Amb.	Amb.
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 9 FFDI Verification Photo No. 206

10.2 TEST CONDITIONS AND DATA LOG

Item 37
TEST NO. 20

TEST DATE: 8-14-74 TEST TIME: FROM ~~0519~~ 1717 TO ~~0528~~ 1728

NOTES: Rotary vernier lock observed to be loose.
Repeat optical data - Test 20A

TDR 0A010

OPTICAL DATA

Bias = .006

RETRO	DATA	FIELD ANGLES 0	+15	+30	-15	-30
D	PHOTO NO.	207	208	209	210	
	LASER	.87	.87	.87	.87	
	FFDP-ANNULAR	.11	.056	.029	.054	
	RATIO-ANNULAR	.12	.059	.033	.064	
	RATIO-FULL FIELD	1.24	.74	.31	.86	
E	PHOTO NO.					
	LASER					
	FFDP-ANNULAR					
	RATIO-ANNULAR					
	RATIO-FULL FIELD					
F	PHOTO NO.					
	LASER					
	FFDP - ANNULAR					
	RATIO-ANNULAR					
	RATIO-FULL FIELD					

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES - °C

STABIL. SEQ.	RETRO X FACE DAS 14	RETRO X ΔT AX DAS 15	RETRO X ΔT RAD DAS 16	RETRO Y FACE DAS 20	RETRO Y ΔT AX DAS 21	RETRO Y ΔT RAD DAS 22
1 STRT						
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

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10.2 TEST CONDITIONS AND DATA LOG   TEST NO. 20A

TEST DATE: 8-14-74   TEST TIME: FROM ~~0530~~ 1730 TO ~~0552~~ 1753

NOTES:

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		Amb	Amb
TEST ARTICLE TEMP – °C		Amb	Amb
COLDWALL TEMP – °C (avg)		Amb	Amb
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 9 - FFDI Verification Photo No. 206

* Bias = ~~.006~~ .007

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	212	213	214	215	216
	LASER	.87	.87	.87	.87	.87
	FFDP-ANNULAR	.11	.054*	.031*	.050*	.008*
	RATIO-ANNULAR	.12	.059*	.035*	.056*	.009*
	RATIO-FULL FIELD	1.27	.78	.34	.93	.039*
E	PHOTO NO.	217	218	219	220	221
	LASER	.87	.87	.87	.87	.87
	FFDP-ANNULAR	.12	.073*	.009*	.064*	.015*
	RATIO-ANNULAR	.13	.075*	.011*	.075*	.017*
	RATIO-FULL FIELD	1.29	.76	.046*	.86	.10
F	PHOTO NO.	222	223	224	225	226
	LASER	.87	.87	.87	.87	.87
	FFDP-ANNULAR	.10	.049*	.008*	.058*	.014* ~~.006~~
	RATIO-ANNULAR	.11	.057*	.009*	.067*	.016* ~~.010~~
	RATIO-FULL FIELD	1.27	.81	.040*	.81	.11

RATIO = FFDP/LASER OUTPUT   FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	RETRO X ΔT AX DAS 15	RETRO X ΔT RAD DAS 16	RETRO Y FACE DAS 20	RETRO Y ΔT AX DAS 21	RETRO Y ΔT RAD DAS 22
1 STRT						
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

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10.2 TEST CONDITIONS AND DATA LOG   TEST NO. 13

TEST DATE: 8/14/74   TEST TIME: FROM 1816 TO 2016

NOTES:

TEST CONDITIONS   Item 24

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		2×10^{-6}	1.6×10^{-5}
TEST ARTICLE TEMP – °C		Amb	Amb
COLDWALL TEMP – °C (avg)		Amb	Amb
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 9 FFDI Verification photo 227

OPTICAL DATA   # BIAS = .007

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	228	229	230	231	232
	LASER	0.88	0.88	0.88	0.88	0.88
	FFDP-ANNULAR	0.10	0.059 #	0.032 #	0.049 #	0.008 #
	RATIO-ANNULAR	0.12	0.063 #	0.036 #	0.053 #	0.009 #
	RATIO-FULL FIELD	1.28	0.78	0.35	0.82	0.039 #
E	PHOTO NO.	233	234	235	236	237
	LASER	0.88	0.88	0.88	0.88	0.88
	FFDP-ANNULAR	0.12	0.064 #	0.009 #	0.063 #	0.015 #
	RATIO-ANNULAR	0.15	~~0.063~~ .072 #	0.010 #	0.071 #	0.016 #
	RATIO-FULL FIELD	1.28	0.77	0.047 #	0.85	0.10
F	PHOTO NO.	238	239	240	241	242
	LASER	0.88	0.88	0.88	0.88	0.88
	FFDP-ANNULAR	0.10	0.049 #	0.008 #	0.057 #	0.014 #
	RATIO-ANNULAR	0.11	0.054 #	0.009 #	0.063 #	0.015 #
	RATIO-FULL FIELD	1.27	0.81	0.040 #	0.81	0.10

RATIO ≡ FFDP/LASER OUTPUT   FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	ΔT AX DAS 15	ΔT RAD DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	
1 STRT	21.5	22.0	21.5	21.4	+.3	0	18:44
1 STOP	21.5	22.0	21.5	21.5	+.2	0	20:16
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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10.2 TEST CONDITIONS AND DATA LOG   TEST NO. 21

TEST DATE: 8-14-74 to 8-15-74   TEST TIME: FROM 2016 TO 0152

NOTES:

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1 \times 10^{-6}$	1.9×10^{-7}
TEST ARTICLE TEMP – °C		-30 ± 2 °C	−31°C
COLDWALL TEMP – °C (avg)		−185°C	−185°C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 9 FFDI Verification photo 243

OPTICAL DATA

Bias = .006

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	244	245	246	247	248
	LASER	.88	.88	.88	.88	.88
	FFDP-ANNULAR	.010	.043	.028	.042	.008
	RATIO-ANNULAR	.11	.048	.031	.047	.009
	RATIO-FULL FIELD	1.27	.78	.34	.82	.038
E	PHOTO NO.	249	250	251	252	253
	LASER	.88	.88	.88	.88	.88
	FFDP-ANNULAR	.099	.054	.009	.049	~~.10~~ .014
	RATIO-ANNULAR	.12	.059	.010	.055	.015
	RATIO-FULL FIELD	1.27	.76	.046	.85	.10
F	PHOTO NO.	254	255	256	257	258
	LASER	.88	.88	.88	.88	.88
	FFDP-ANNULAR	.095	.043	.007	~~.70~~ .045	.012
	RATIO-ANNULAR	.11	.048	.008	.051	.013
	RATIO-FULL FIELD	1.26	.80	.040	.81	.10

RATIO = FFDP/LASER OUTPUT   FFDI METER READ...

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	
1 STRT	−57.5	−48	−53.5	−62.5	+8.5	+1.0	01:37 8/15/74
1 STOP	−57.5	−48	−53.5	−62.5	+8.4	+1.0	01:52
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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10.2 TEST CONDITIONS AND DATA LOG TEST NO. 14

TEST DATE: 8-15-74 TEST TIME: FROM 0200 TO 0656

NOTES:

JM

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		<1 x 10^-6	1.4x10^-7
TEST ARTICLE TEMP – °C		+30 ± 2°C	+30°C
COLDWALL TEMP – °C (avg)		-185°C	-196°C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 9 – FFDI Verification Photo No. 259

OPTICAL DATA BIAS = .007

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	260	261	262	263	264
	LASER	.88	.88	.87	.88	.88
	FFDP-ANNULAR	.081	.042	.028	.039	.008
	RATIO-ANNULAR	.091	.047	.032	.045	.009
	RATIO-FULL FIELD	1.27	.78	.35	.92	.038
E	PHOTO NO.	265	266	267	268	269
	LASER	.88	.87	.87	~~.88~~ .87	.87
	FFDP-ANNULAR	.098	.057	.009	.052	.014
	RATIO-ANNULAR	.10	.064	.011	.059	.016
	RATIO-FULL FIELD	1.28	.76	.047	.85	.10
F	PHOTO NO.	270	271	272	273	274
	LASER	.88	.88	.87	.87	.87
	FFDP - ANNULAR	.084	.040	.007	.046	.013
	RATIO - ANNULAR	.096	.045	.008	.052	.014
	RATIO - FULL FIELD	1.27	.81	.040	.81	.10

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	time
1 STRT	-28	-8.5	-22	-27	+16.8	+2.4	0635
1 STOP	-27	-7.5	-21.5	-26	+16.4	+2.2	0656
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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10.2 TEST CONDITIONS AND DATA LOG TEST NO. 22

TEST DATE: 8-15-74 TEST TIME: FROM 0700 TO 1430

NOTES:

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		$<1 \times 10^{-6}$	1.2×10^{-7}
TEST ARTICLE TEMP – °C		+60 ± 2 °C	59 °C
COLDWALL TEMP – °C (avg)		−185 °C	−193 °C
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 9 FFDI Verification Photo No. 275

OPTICAL DATA

*.010 BIAS

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	276	277	278	279	280
	LASER	.87	.87	.87	.87	.87
	FFDP-ANNULAR	.12	*.068	*.038	*.065 ~~.065~~	*.012
	RATIO-ANNULAR	.13	.077	.043	.073	.013
	RATIO-FULL FIELD	1.38	.86	.39	.91	.046
E	PHOTO NO.	281	282	283	284	285
	LASER	.87	.87	.87	.87	.87
	FFDP-ANNULAR	.13	*.084	*.013	.083	.019
	RATIO-ANNULAR	.15	.095	.016	.094	.022
	RATIO-FULL FIELD	1.39	.84	.064	.95	.12
F	PHOTO NO.	286	287	288	289	290
	LASER	.87	.87	.87	.87	.87
	FFDP - ANNULAR	.13	.064	*.011	.070	*.018
	RATIO - ANNULAR	.14	.070	.012	.080	.020
	RATIO - FULL FIELD	1.38	.90	.047	.89	.12

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	
1 STRT	−6.5	16.5	0	−2.5	+17.9	+2.91	14:12:41
1 STOP	−6.0	16.0	+.5	−3.0	+17.05	+2.76	14:30:01
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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10.2 TEST CONDITIONS AND DATA LOG TEST NO. 23

TEST DATE: 8-16-74 TEST TIME: FROM 0820 TO 0854

NOTES: ____

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		Amb.	Amb
TEST ARTICLE TEMP – °C		Amb.	~~Amb~~ 37.5°C
COLDWALL TEMP – °C (avg)		Amb.	Amb
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

Item 9 FFDI Verification Photo 291
**.007 BIAS
*.006 BIAS

OPTICAL DATA

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
D	PHOTO NO.	292	293	294	295	296
	LASER	.87	.88	.88	.88	.87
	FFDP-ANNULAR	.10	*.045	**.033	*.048	**.008
	RATIO-ANNULAR	.12	*.058	**.036	*.059	**.009
	RATIO-FULL FIELD	1.28	.78	.35	.82	**.039
E	PHOTO NO.	297	298	299	300	301
	LASER	.88	.88	.87	.87	.87
	FFDP-ANNULAR	.11	*.060	.009** ~~.009~~	*.061	**.014
	RATIO-ANNULAR	.13	*.078	.011** ~~.009~~	*.065	**.016
	RATIO-FULL FIELD	1.28	.75	.096**	.85	.10
F	PHOTO NO.	302	303	304	305	306
	LASER	.88	.88	.87	.87	.87
	FFDP-ANNULAR	*.093	*.030	**.008	*.054	**.013
	RATIO-ANNULAR	.10	*.095	**.008	*.061	**.015
	RATIO-FULL FIELD	1.26	.80	**.040	.81	.10

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	~~ΔT AX~~ DAS 15	~~ΔT RAD~~ DAS 16	RETRO Y FACE DAS 20	ΔT AX DAS 21	ΔT RAD DAS 22	
1 STRT	36	37.5	36	35.5	+.1	.73	08:55:55
1 STOP							
2 STRT							
2 STOP							
3 STRT							
3 STOP							
4 STRT							
4 STOP							
5 STRT							
5 STOP							
6 STRT							
6 STOP							
7 STRT							
7 STOP							
8 STRT							
8 STOP							

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10.2 TEST CONDITIONS AND DATA LOG TEST NO. 24

TEST DATE: 8-16-74 TEST TIME: FROM 1030 TO 1052

NOTES:

TEST CONDITIONS

ENVIRONMENT		PLANNED	ACTUAL
CHAMBER PRESSURE		Amb	Amb
TEST ARTICLE TEMP – °C		Amb	Amb
COLDWALL TEMP – °C (avg)		Amb	Amb
SOLAR SIMULATION	ANGLE		
	BACKGND		
	INTENSITY		
EARTH IR SIMULATION	BACKGND		
	INTENSITY		

OPTICAL DATA

*.007 BIAS

RETRO	DATA	FIELD ANGLES 0	+15	+30	−15	−30
A	PHOTO NO.	307	308	309	310	311
	LASER	.86	.86	.86	.87	.87
	FFDP-ANNULAR	.14	*.068	*.009	*.065	.035*
	RATIO-ANNULAR	.16	*.078	*.010	*.075	.040*
	RATIO-FULL FIELD	1.27	.80	*.038	.81	.36
B	PHOTO NO.	312	313	314	315	316
	LASER	0.87	0.87	0.86	0.87	0.87
	FFDP-ANNULAR	0.077*	0.041*	0.008*	0.041*	0.010*
	RATIO-ANNULAR	0.088*	0.046*	0.010*	0.047*	0.012*
	RATIO-FULL FIELD	1.27	0.74	0.053*	0.85	0.075*
C	PHOTO NO.	317	318	319	320	321
	LASER	0.87	0.86	0.86	0.86	0.86
	FFDP-ANNULAR	0.13	0.067*	0.013*	0.081*	0.010*
	RATIO-ANNULAR	0.15	0.077*	0.015*	0.092*	0.012*
	RATIO-FULL FIELD	1.23	0.73	0.096*	0.88	0.050*

RATIO = FFDP/LASER OUTPUT FFDI METER READINGS

RETROREFLECTOR TEMPERATURES – °C

STABIL. SEQ.	RETRO X FACE DAS 14	RETRO X ΔT AX DAS 15	RETRO X ΔT RAD DAS 16	RETRO Y FACE DAS 20	RETRO Y ΔT AX DAS 21	RETRO Y ΔT RAD DAS 22
1 STRT						
1 STOP						
2 STRT						
2 STOP						
3 STRT						
3 STOP						
4 STRT						
4 STOP						
5 STRT						
5 STOP						
6 STRT						
6 STOP						
7 STRT						
7 STOP						
8 STRT						
8 STOP						

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START CALIBRATION CUBE
FFDP .17
RATIO .19
FULLFLD 1.25

8/13/74

FINISH CALIBRATION CUBE
FFDP .15
RATIO .16
FULLFIELD 1.19

Measurements Made With Sections of Annulus

TEST PARAMETER DATA RECORD

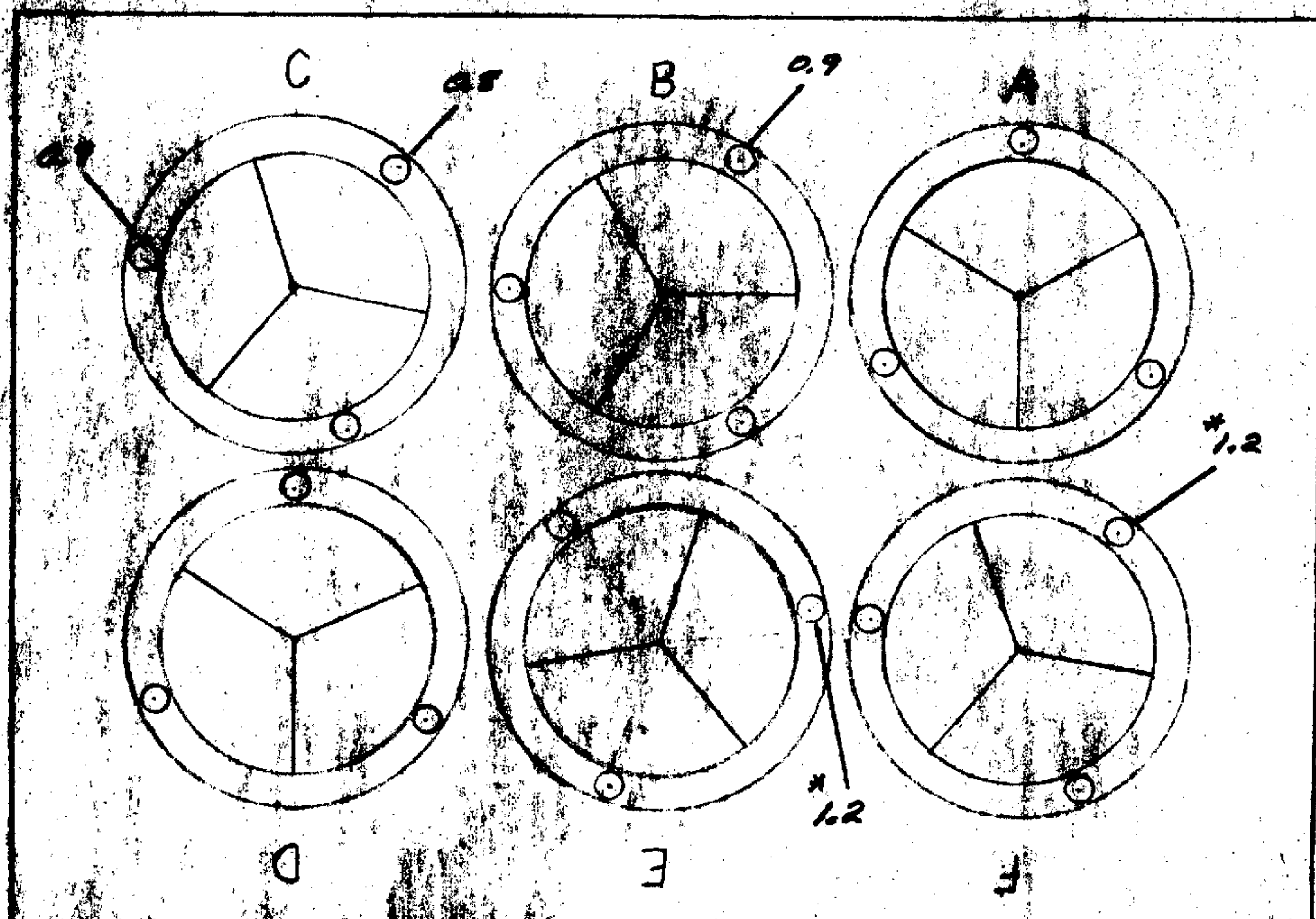
Date	Time (0-24Hr)	Full	1/2	0-60	60-120	120-180	180-240	240-300	300-360	Full		Full	1/2	0-60	60-120	120-180	180-240	240-300	300-360	Full					
START	19:20	.007	.049	.006 .005	.007	.006 .005	.001	.004 .002	.003	.001		.000	.006 .004	.005	.003 .002	.004	.005	.005	.005	.005					
D	FFDP	.11	.072	.022	.020	.027	.019	.022	.032		E	.14	.077	.026	.020	.029	.021	.026	.046						
	0 FULL	1.28								1.26		1.28								1.28					
	15	.062	.035	.012	.017	.016	.009	.013	.011			.080	.042	.017	.012	.020	.018	.018	.016						
		.78								.77		.80								.80					
	30	.037	.021	.010	.011	.010	.007	.008	.006			.011	.008	.006	.003	.005	.007	.007	.006						
		.34								.34		.082								.053					
	-15	.059	.032	.012	.014	.019	.010	.007	.016			.072	.038	.013	.015	.018	.019	.013	.019						
		.84								.83		.82								.82					
	-30	.009	.008	.006	.007	.006	.002	.003	.003			.008	.007	.006	.003	.005	.006	.006	.006						
		.40								.035		.050								.050					
			MAY BE WRONG DECIMAL POINT																						
BREAKTHROUGH				.066		BREAKTHROUGH							.006 .005	.005 .004	.005	.005	.006	.006	.006	.015		BR:	AKTI		
F	1-25	.28	+25	.076	E	-25	.08	+25	.20	F	0	.12	.070	.024	.016	.018	.024	.022	.039		D	0	127		
												1.26								1.26		+10	.74	1.00	-10
	-20	.62	+20	.18		-20	.27	+20	.63		+15	.057	.029	.013	.010	.014	.015	.010	.015			+15	.78	.84	-15
												.80								.80		+20	.62	.15	-20
	-15	.79	+15	.82		-15	.82	+15	.80		+30	.007	.006	.004	.006	.005	.006	.006	.006			+30	.34	.02	-30
												.038								.040		+40	.11	.016	-40
	-10	.97	+10	.98		-10	.99	+10	.97		-15	.068	.035	.017	.014	.013	.018	.014	.014			+50	.01	.008	-50
												.81								.81		+60	.010	.008	-60
	-5	1.15	+5	1.13		-5	1.16	+5	1.13		-30	.014	.010	.007	.007	.006	.008	.007	.007						
												.10								.10			.006	.007	
	0																								
		1.27				1.28																			

* Enter appropriate data system termination symbol for each test parameter to be monitored.

COMPLETE 20:45

10.3 Post Test Torque Verification
Ref: Paragraph 9.8
Original Torque = 1.4 in.lb. - per para 8.22
Changes shown below; all others remained at 1.4 in.lb.

* Within original tolerance.



10.4 FFDI POLAROID FILM EXPOSURE TABLE

	FIELD ANGLE				
RETRO	0	+15	+30	-15	-30
A	1/250	1/250	1/8	1/250	1/60
B	1/250	1/125	1/15	1/250	1/30
C	1/250	1/250	1/30	1/250	1/30
D	1/250	1/250	1/60	1/125	1/8
E	1/250	1/250	1/15	1/125	1/15
F	1/250	1/250	1/8	1/250	1/15

10.5 TEMPERATURE DATA LOG

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TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25
		[illegible]	Window Hood	Manip	Manip.	C.W	C.W	C.W	CW	[illegible]	[illegible]	[illegible]	[illegible]	X PACE	ΔTA	ΔTB	Upp Hts	Ret	Y PACE	ΔTA	ΔTC	Lo Hts	Hi Hts	Ret
8/6/70	1230	-2.74	-2.59	-2.29	-2.29	-10.61	-7.62	-12.49	-9.91	-5.21	-5.58	-5.41	-4.99	-3.31	+0.38	+0.28	-2.45	-2.43	-3.08	+0.15	+0.05	-2.39	-2.46	-2.56
		+71	+76	+85	+85	-208	-87	-310	-177	-5	-17	-12	+3	+54	+.3	—	+80	+80	+61	—	-	+82	+80	+77
	1300	-2.74	-2.62	-2.26	-2.27	-12.38	-12.55	-12.54	-12.56	-10.63	-11.21	-10.23	-10.06	-9.23	+.492	+.380	-2.69	-2.59	-3.94	+.187	+.073	-2.57	-2.69	-2.75
		+71	+76	+86	+86	-303	-314	-314	-315	-209	-237	-190	-183	+26	—	—	+73	+76	+35	—	-	+76	+73	+71
	1330	-2.72	-2.62	-2.26	-2.26	-12.46	12.63	12.61	12.63	-13.25	-13.99	-11.40	-12.70	-4.78	+.579	+.444	-2.80	-2.65	-4.46	+.194	+.081	-2.66	-2.79	-2.79
		+72	+76	+86	+86	-308	-319	-319	-319	-294		-246		+9	—	-	+69	+74	+19	—	—	+74	+70	+70
	1400	-2.43	-2.63	-2.26	-2.26	-12.46	-12.63	-12.61	-12.63	-14.47	-15.30	-8.96	-13.99	-5.09	+.582	+.453	-2.87	-2.69	-4.82	+.214	+.088	-2.72	-2.88	-2.85
		+80	+74	+86	+86	-308	-319	-319	-319			-138		-1	-	-	+67	+73	+7	—	-	+72	+67	+68
	1500	-2.44	-2.65	-2.11	-2.12	-12.48	-12.64	-12.63	-12.64	-17.16	-18.2	-9.35	-16.68	-5.19	+.721	+.489	-1.57	-1.23	-4.93	+.318	+.126	-1.20	-1.57	-1.44
														-4					+4					

Rated ... TC ...

To ... °F

* Enter appropriate data system termination symbol for each test parameter to be monitored.

°F

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	26 Radiometer 1	27 Rad 2	28 Window Heat Heater	29 Kampuram Heater	30 IR Sim 1	31 IR Sim 2	32 10 K Ω	33 Rad 1	34 Rad 2
8/6/70	1230	-1.81	-1.80	9.74	15.12	.40	.46	–	-3.36	-3.24
		+99	+99	–	–	–	–	–	–	–
	1300	-1.83	-1.82	9.72	15.04	.41	.45	–	-3.68	-3.67
		+98	+98	–	–	–	–	–	–	–
	1330	-1.82	-1.82	9.71	15.02	.41	.44	–	-3.67	-3.68
		+98	+98	–	–	–	–	–	–	–
	1400	-1.83	-1.83	9.70	14.99	.41	.45	–	-3.70	-3.69
		+98	+98	–	–	–	–	–	–	–

* Enter appropriate data system termination symbol for each test parameter to be monitored.

oF

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	14*	15*	16*	19*	20*	21*	22*
06	1705	-3.20	-2.87	-2.60		-2.98	-2.72	-2.87
		58	67	75		64	72	67
	1711	-3.21	-2.88	-2.62		-3.00	-2.74	-2.89
		57	67	75		64	71	67
	1800	-3.00	-2.77	-2.54		-2.85	-2.65	-2.76
		64	70	77		68	74	71
	1920	-2.22	-2.18	-2.06		-2.20	-2.11	-2.17
		87	88	91		87	90	88
	2010	-1.92	-1.87	-1.86		-1.92	-1.87	-1.85
		96	97	97		96	97	98
	1720	-3.08	-2.78	-2.53	-2.25	-2.97	-2.68	-2.81
		61	70	78	86	64	73	69

* Enter appropriate data system termination symbol for each test parameter to be monitored.

°F

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	10 *	11 *	12 *	13 *	14 *	15 *	16 *	18 *	19 *	20 *	21 *	22 *	23 *	24 *	25 *	*	*	*	*	*	*	*	*
07	1651	-2.87	-2.86	-2.87	2.87	2.80	2.85	2.82	2.84	2.84	2.80	2.82	2.82	2.84	2.64	2.84								
		67	67	67	67	69.5	67.8	68.5	69	68	69.5	65.5	68.5	69	69	68								
	1703	2.85	2.85	2.86	2.85	2.81	2.84	2.82	2.84	2.94	2.81	2.83	2.83	2.84	2.84	2.84								
		67.8	67.9	67	67	69	69	69.7	69	65	69.7	69.5	69.5	68	69	68								
	1732	2.90	2.90	2.80	2.90	2.77	2.79	2.78	2.79	2.79	2.78	2.78	2.78	2.78	2.79	2.79								
		69.5	69.5	69.5	69.5	70	70.2	70	70.2	70.6	70	70	70	70	70	70								

* Enter appropriate data system termination symbol for each test parameter to be monitored.

°C

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	14	15	16	18	19	20	21	22	23	24	25
		X FACE	X APEX	X TAB	Y UP RING	Y DN RING	Y FACE	Y AXIAL	Y RAD	Y LO RING	Y UP RING	Y DN RING
08/08/74	21:30	-5.74	-5.33	-5.28	-5.62	-5.68	-5.14	+.022	+.008	-5.62	-5.58	-5.77
		-30.0	-22.5	-22.0	-28.0	-29.0	-19.5	+.39	+.14	-28.0	-27.0	-30.5
	22:00	-6.45	-5.93	-6.02	-5.85	-5.85	-5.96	+.083	+.019	-5.78	-5.82	-5.91
		-35.0	-27.1	-31.5	-26	-26	-29.1	+1.54	+.35	-23	-25	-28.0
	22:30	-6.88	-6.26	-6.44	-5.97	-5.94	-6.46	+.120	+.028	-5.86	-5.96	-5.99
		-51.0	-40.0	-43.0	-34.5	-34.0	-43.5	2.22	.52	-32.5	-34.0	-35.0
	2300	-7.10	-6.45	-6.69	-6.05	-6.00	-6.78	+.148	+.034	-5.92	-6.05	-6.04
		-55.5	-43.0	-48.0	-36.0	-35.0	-49.5	2.79	0.64	-33.0	-36.0	-35.5
08/09/74	0005	-7.32	-6.61	-6.90	-6.08	-6.01	-7.10	+.180	+.038	-5.92	-6.10	-6.04
		-60.0	-46	-52.0	-36.5	-35.0	-55.5	3.40	.72	-33.4	-37	-35.5
	0033	-7.36	-6.64	-6.95	-6.10	-6.03	-7.18	+.179	+.038	-5.95	-6.14	-6.07
		-60.8	-47	-52.8	-37.0	-35.0	-57.2	3.38	.72	-34.0	-37.5	-36.0
	0100	-7.37	-6.65	-6.96	-6.10	-6.02	-7.21	+.187	+.044	-5.95	-6.14	-6.06
		-61.0	-47	-52.8	-37.0	-35.0	-58.1	3.53	.83	-34	-37.5	-36
	0130	-7.39	-6.67	-6.98	-6.11	-6.03	-7.24	+.190	+.044	-5.97	-6.15	-6.07
		-61.5	-47.5	-53.7	-37	-35.5	-58.3	3.58	.83	-34	-37.5	-36
	0152	-7.39	-6.67	-6.99	-6.12	-6.03	-7.26	+.190	+.043	-5.97	-6.15	-6.07
		-61.5	-47.5	-53.7	-37	-35.5	-58.8	3.58	.82	-34	-37.5	-36
	0237	-7.37	-6.66	-6.97	-6.11	-6.03	-7.25	+.187	+.044	-5.97	-6.15	-6.07
		-61.0	-47.2	-53.0	-37	-35.5	-58.8	3.53	.83	-34	-37.5	-36
	0300	-7.37	-6.67	-6.98	-6.12	-6.04	-7.27	+.189	.044	-5.98	-6.16	-6.08
		-61.0	47.2	-53.0	-37	-35.5	-59	3.55	.83	-34	-37.5	-36

Start of test 7

End of test 7

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	00 ICE REF.	01 FPDI AMB.	02 WINDOW HOOD	04 MANIPULATOR	05 MANIPULATOR	06 COLDWALL WEST	07 COLDWALL EAST	08 COLDWALL DOOR	09 COLDWALL SOUTH	10 TEST ARTICLE PANEL	11 TEST ARTICLE PANEL	12 THERMOCOUPLE FIXTURE	13 THERMOCOUPLE FIXTURE	~~14~~	26 ~~15~~ RADIOMETERS	27 ~~16~~ RADIOMETERS	28 ~~18~~ AC VOLTS WINDOW HOOD HEATER	29 AC VOLTS MANIPULATOR HEATER	
08/08/74	2020	-4.02	-2.59	-2.78	-2.78	-2.78	-2.81	-2.84	-2.90	-2.84	-2.84	-2.83	-2.84	-2.84		-1.76	-1.75	.51	-.49	
		~~-4.02~~ 33	~~-2.59~~ 76	~~-2~~ 70	70	70	69	68	66	68	68	69	68	68		100	101			
	2040	-4.02	-2.58	-2.69	-2.65	-2.64	-6.35	-3.41	-12.47	-3.11	-4.15	-4.15	-3.97	-3.98		-1.78	-1.79	9.5	15.3	
		33	76	73	74	74	-42	+51	-309	+60	29	29	34	34		100	99			
	2110	-4.02	-2.60	-2.65	-2.89	-2.67	-12.27	-12.56	-12.53	-12.57	-5.68	-5.67	-5.67	5.67		-1.82	-1.82	9.6	15.4	
		33	75	74	73	73	-296	-315	-313	-315	-20	-20	-20	-20		99	99			
	2130	-4.02	-2.61	-2.66	-2.80	-2.79	-12.37	-12.59	-12.56	-12.59	-5.75	-5.74	-5.75	-5.75		-1.83	-1.82	9.6	15.3	
		33	75	73	69	70	-302	-316	-315	-316	-22	-22	-22	-22		98	99			
	22:00	-4.02	-2.61	-2.66	-2.91	-2.89	-12.39	-12.57	-12.55	-12.58	-5.79	-5.79	-5.79	-5.79		-1.82	-1.82	9.59	15.4	
		33	75	73	66	67	-304	-315	-314	-316	-24	24	-24	-24		99	99			
	22:30	-4.02	-2.62	-2.68	-2.99	-2.98	-12.40	-12.57	-12.54	-12.57	-5.82	-5.81	-5.80	-5.81		-1.84	-1.83	9.53	15.3	
		32	75	73	64	64	-304	-316	-314	-316	-25	-24	-24	-24		98	98			
	2300	-4.03	-2.64	-2.71	-3.06	-3.05	-12.41	12.58	12.55	-12.58	-5.85	-5.84	-5.82	5.83		-1.84	1.84	9.47	15.2	
		32	74	72	62	62	-305	-316	-314	-316	-25	-25	-25	-25		98	98			
08/09/74	0005	-4.02	-2.66	-2.74	-3.13	-3.12	-12.40	-12.57	-12.54	-12.57	-5.76	-5.75	-5.76	-5.76		-1.82	-1.82	9.53	15.3	* INCREASED MANIPULATOR HEATER VARIAC SETTING TO ≈ 20V
		33	74	71	60	60	-304	-316	-314	-316	-23	-22	-23	-23		99	99			
	0038	-4.02	-2.66	-2.66	-2.99	-2.97	-12.41	-12.57	-12.55	-12.57	-5.80	-5.79	-5.78	-5.79		-1.85	-1.84	9.50	19.95	
		33	74	74	64	64	-305	-316	-314	-316	-24	-24	-23	-24		98	98			
	0100	-4.02	-2.67	-2.79	-2.73	-2.72	-12.40	-12.56	12.53	-12.56	-5.79	-5.78	-5.78	-5.78		1.84	1.84	9.55	20.04	
		33	73	70	71	72	-304	-315	-313	-315	-24	-23	-23	-23		98	98			
	0130	-4.02	-2.69	-2.81	-2.63	-2.62	-12.42	-12.59	-12.56	-12.59	-5.78	-5.77	-5.77	-5.77		1.84	1.84	9.52	19.99	* DECREASED MANIPULATOR HTR VARIAC SETTING TO ≈ 18V
		33	73	69	75	75	-305	-316	-313	-317	-23	-23	-23	-23		98	98			
	0152	-4.03	-2.71	-2.83	-2.69	-2.68	-12.44	-12.61	-12.59	-12.61	-5.77	-5.77	-5.76	-5.78						
		32	72	68	73	73	-307	-318	-317	-318	-23	-23	-23	-23						

* Enter appropriate data system termination symbol for each test parameter to be monitored.

End of test 7

°F

Bendix Aerospace Systems Division

LAGEOS THERMAL-OPTICAL TEST

NO. TP2374455 REV.NO. (8)

PAGE 6 OF ____ PAGES

TEST PARAMETER DATA RECORD

ICE — FPOI — WINDOW HOOD — MANIP. — Manipul. — Coldwall: W, E, Door, S — T.A. — T.C. Fixture — Rad. — Window Hood Heater — Man. Heater — IR #1 — RAD. #1

End of Test #7

TE #9

Date	Time (0-24Hr)	00	01	02	04	05	06	07	08	09	10	11	12	13		26	27	AC V. 28	ACV 29	ACV. 30		33		
08/9/74	0237	-4.02	-2.64	-2.85	-2.80	-2.78	-12.43	-12.60	-12.57	-12.60	-5.76	-5.75	-5.76	-5.77		-1.85	-1.84	+9.45	18.27					
		33	74	68	69	70	-306	-317	-316	-317	-23	-23	-23	-23		98	98							
	0300	-4.02	-2.64	-2.87	-2.79	-2.78	-12.45	-12.61	-12.59	-12.60	-5.77	-5.76	-5.77	-5.78		-1.85	-1.84	9.5	18.30					
		33	74	67	70	70	-307	-318	-317	-317	-23	-23	-23	-23		98	98							
	0400	-4.02	-2.63	-2.86	-2.76	-2.75	-12.28	-12.59	-12.58	-12.60	-5.75	-5.75	-5.76	-5.77		-1.84	-1.83	10.01	18.43	57.28		-3.23		
		33	75	68	71	71	-296	-317	-316	-317	-22	-22	-23	-23		98	98							
	0430	-4.02	-2.63	-2.86	-2.75	-2.74	-12.27	-12.58	-12.58	-12.60	-5.75	-5.74	-5.75	-5.76		-1.84	-1.83	9.94	18.31	57.37		-3.19		
		33	75	68	71	71	-296	-317	-316	317	-22	-22	-22	-23		98	98							
	0500	-4.02	-2.63	-2.86	-2.74	-2.74	-12.28	-12.60	-12.57	-12.61	-5.76	-5.76	-5.76	-5.76		-1.83	-1.83	9.97	18.35	55.36		-3.16		
		33	75	68	71	71	-296	-317	-317	-318	-23	-23	-23	-23		98	98							
	0530	-4.02	-2.62	-2.85	-2.74	-2.73	-12.28	-12.59	-12.58	-12.60	-5.78	-5.78	-5.77	-5.77		-1.84	-1.83	9.95	18.17	57.32		-3.19		
		33	75	68	71	72	-296	-317	-316	-317	-23	-23	-23	-23		98	98							
	0600	-4.02	-2.62	-2.85	-2.73	-2.73	-12.28	-12.60	-12.58	-12.60	-5.79	-5.78	-5.78	-5.78		-1.84	-1.84	9.94	18.05	57.28		-3.21		
		33	75	68	72	72	-296	-317	-316	-317	-23	-23	-23	-23		98	98							

* Enter appropriate data system termination symbol for each test parameter to be monitored.

°C

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	14	15	16	18	19	20	21	22	23	24	25	~~26~~
		XFace	XAnns	XTAB	Xspring	Xret.	YFace	YAnnul	Yrad.	YLoRng	Yspring	Yret.	
8/9/74	0400	-7.00	-6.46	-6.74	-6.00	-5.94	-6.99	+.160	+.034	-5.92	-6.04	-5.97	-
		-54	-43	-48.5	-35	-34	-54	+3.13	+.66	-33.5	-35.5	-34	
	0430	-6.89	-6.37	-6.62	-5.97	-5.91	-6.85	+.150	+.035	-5.90	-6.00	-5.95	
		-51.5	-42	-46.5	-34.5	-33	-51	+2.94	+.69	-33	-35	-34	
	0500	-6.82	-6.31	-6.54	-5.95	-5.90	-6.75	+.141	+.034	-5.87	-5.97	-5.93	
		-50	-40.5	-45	-34	-33	-49	2.66	+.64	-32.5	-34.5	-33.5	
	0530	-6.78	-6.28	-6.50	-5.93	-5.88	-6.69	+.139	+.033	-5.87	-5.96	-5.92	
		-49.5	-40.0	-44	-33.5	-32.5	-48	+2.62	+.62	-32.5	-34	-33.5	
	0600	-6.75	-6.26	-6.48	-5.93	-5.88	-6.65	+.132	+.033	-5.87	-5.95	-5.92	
		-49.0	-39.5	-43.5	-33.5	-32.5	-47.0	2.49	+.62	-32.5	-34.0	-33.5	
	0910	-4.68	-6.11	-6.55	-5.52	-5.12	-6.81	+.178	+.024	-5.75	-5.59	-5.13	
		-11	-37	-45	-26	-19	-50	+3.36	+.45	-30	-27	-19	
	0940	-4.53	-5.97	-6.37	-5.39	-5.00	-6.69	+.174	+.024	-5.70	-5.51	-5.07	
		-8.5	-34	-42	-24	-17	-48	+3.28	+.45	-29	-26	-18	
	1010	-4.19	-5.88	-6.27	-5.35	-4.95	-6.61	+.169	+.016	-5.69	-5.48	-5.08	
		-2.0	-32	-40	-23	-16	-46	+3.15	+.30	-29	-25	-17	
	1040	-4.44	-5.86	-6.22	-5.35	-4.97	-6.57	+.166	+.017	-5.68	-5.49	-5.08	
		-7	-32	-39	-23	-16	-45	+3.13	+.32	-29	-25	-18	
	1110	-4.26	-5.82	-6.19	-5.32	-4.93	-6.54	+.164	+.015	-5.66	-5.47	-5.05	
		-4	-32	-38	-23	-16	-45	+3.09	+.28	-29	-25	-18	
	1140	-4.13	-5.81	-6.17	-5.31	-4.91	-6.49	+.162	+.013	-5.65	-5.41	-4.93	
		-2	-31.5	-38	-22.5	-15	-44	+3.06	+.25	-28.5	-24	-15.5	
	1200	-3.98	-6.77	-6.14	-5.27	-4.85	-6.47	+.159	+.008	-6.64	-5.39	-4.88	
		+1	-31	-37.5	-21.5	-14	-43.5	+3.00	+.15	-28.5	-24	-14.5	

Test #9

Solar on

Test #10 Std Seq 1

<RUN 5 DATAPOINTS

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST PARAMETER DATA RECORD

Solar on Test #8

Date	Time (0-24Hr)	14 Xrace	15 Xrear	16 XTab	18 Xrkw	19 Xadi.	20 Yrace	21 Yrr	22 Yrab	23 Yrkw	24 Yrkw	25 Yad.	33 S.C.	
8/9/79	1230	-3.781	-5.738	-6.125	-5.228	-4.806	-6.428	+.149	-.016	-5.630	-5.314	-4.706	.963	
		+5	-30	-37	-21	-13	-43	+2.81	-.28	-28	-22.5	-11.5		
	1300	-3.384	-5.671	-6.054	-5.158	-4.714	-6.357	+.143	-.017	-5.611	-5.345 ~~-5.408~~	-4.615	.891	
		+11	-29	-36	-19	-12	-41.5	+2.70	-.32	-28	-21.5	-10		
	1320	-3.145	-5.628	-6.011	-5.140	-4.689	-6.310	+.140	-.021	-5.600	-5.274	-4.589	.902	
		+15	-28	-35	-19	-11	-40.6	+2.64	-.40	-27.5	-21	-9.5	~~.922~~	
	1340	-3.449	-5.650	-6.009	-5.181	-4.761	-6.311	+.139	-.015	-5.605	-5.275	-4.625	.942	
		+10	-28.5	-35	-20	-12.5	-41	+2.62	-.28	-27.5	-21.5	-11.5		
	1400	-3.840	-5.685	-6.024	-5.227	-4.825	-6.330	+.140	-.014	-5.630	-5.331	-4.821	1.04	
		+3.5	-29	-350	-20.5	-14	-41	+2.64	-.08	-28	-23	-13.5		
	1420	-3.857	-5.689	-6.025	-5.219	-4.817	-6.337	+.143	-.007	-5.627	-5.324	-4.794		
		+3.0	-29	-35.5	-20.5	-17.5	-41	+2.70	-.13	-28	-21.5	-13		
	1430/11	-4.04	-5.70	-6.04	-5.23	-4.90	-6.40	+.157	+.043	-5.63	-5.37	-5.02		
		0	-29.5	-35.5	-21.0	-15.0	-42.5	2.96	0.81	-28.0	-23.0	-17.0		
	1435/31	-6.65	-6.01	-6.15	-5.59	-5.58	-6.47	+.134	+.044	-5.73	-5.69	-5.67		1.45% Δ in axial
		-47.0	-35.0	-37.5	-22.0	-27.0	-43.5	2.53	0.83	-30.0	-29.5	-29.5		2.57% Δ in RADIAL

Stab scan

2nd Data Set

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST #4

F

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	10	11	12	13	14	15	16	[illegible]	18	19	20	21	22	23	24	25	SC 33
		T.P.		TC Block		X Fwd	X Mount	X Tab		X Up Bug	X Ref.	Y Fwd	Y Aft	Y Mount	Y Lo Bug	Y Up Bug	Y Ref.	Add. Ck 7.71 Vdc
4/9/74	1542	-2.14	2.15	2.15	2.16	-3.30	4.46	-5.52	~~-2.60~~	-2.53	-1.79	-6.01	+.497	+.068	-2.91	-2.69	-1.92	
		31.5	+31.5	31.5	31.5	+12	-7	-26	—	+25	+37.5	-35	+9.2	+1.26	+22	+22	+35	
	1600	-2.177	-2.192	-2.166	-2.184	-3.957	-4.257	-5.225		-2.382	-1.663	-5.689	+.438	+.084	-2.649	-2.559	-1.902	6.35
		+31	+31	31.5	31	+10	-3.5	-20.5		+27.5	+39.5	-29	+8.0	+1.55	+23.5	+25	+35.5	
	1630	-2.28	-2.29	-2.29	-2.31	-3.92	-4.16	-4.95		-2.56	-1.99	-5.37	+.383	+.095	-2.75	-2.74	-2.32	5.85
		29.5	29.5	29.5	29.0	+2.0	-2.0	-16.0		25.0	34.0	-23.5	6.84	1.70	21.5	21.5	28.5	
	1700	-2.29	-2.30	-2.30	-2.32	~~-4.35~~	-4.20	-4.88		-2.70	-2.32	-5.25	+.359	+.093	-2.75	-2.78	-2.31	6.93
		29.0	29.0	29.0	29.0	+10.0	-3.0	-14.5		22.5	28.5	-21.0	6.41	1.66	21.5	21.0	29.0	
	1730	-2.28	-2.29	-2.28	-2.30	-3.24	-3.97	-4.72		-2.45	-1.84	-5.05	+.335	+.075	-2.67	-2.59	-2.06	6.12
		29.5	29.5	29.5	29.0	13.5	1.0	-12.0		26.5	31.5	-17.5	5.98	1.34	23.0	24.0	33.0	
	1800					-3.82	-3.99	-4.69		-2.56	-2.05	-5.06	+.341	+.103	-2.72	-2.75	-2.46	5.86
						3.5	0	-11.5		25.0	33.0	-18.0	6.09	1.84	22.0	21.5	26.5	
	1830					-4.02	-4.01	-4.69		-2.60	-2.13	-5.12	+.346	+.113	-2.74	-2.79	-2.52	6.17
						0	0	-11.5		+24.0	32.0	-19.0	6.18	2.02	21.5	21.0	25.5	
	1900	-2.27	-2.27	-2.28	-2.30	-4.14	-4.02	-4.70		-2.62	-2.16	-5.15	+.353	+.117	-2.74	-2.81	-2.54	6.28
		+29.5	29.5	29.5	29.0	-2.0	0	-11.5		+24.0	31.0	-19.5	6.30	2.09	21.5	20.5	25.0	
	1927					-5.15	-4.11	-4.73		-2.65	-2.32	-5.19	+.340	+.119	-2.76	-2.83	-2.67	
						-19.5	-1.0	-12.0		23.0	28.5	-20.0	6.07	2.13	21.5	20.0	23.0	
	19:29:51					-5.39	-4.14	-4.74		-2.74	-2.50	-5.19	+.339	+.110	-2.77	-2.86	-2.74	
						-24	-2.0	-12.0		21.5	26.0	-20.0	6.05	1.96	21.0	20.0	21.5	
	19:38:31					-5.48	-4.18	-4.79		-2.88	-2.67	-5.21	+.340	+.099	-2.81	-2.93	-2.82	
						-25.5	-2.0	-13.0		19.5	23.0	-20.5	6.07	1.77	20.5	18.5	20.5	

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST #6

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	TA 10	11	TC Block 12	13	X Face 14	X Back 15	X Tab 16	X Spring 18	X ext. 19	Y Face 20	Y Back 21	Y Rad 22	Y Spring 23	Y Spring 24	Y ext 25	should be 3.2 IR 33
8/9/74	2030	-2.37	-2.36	-2.35	-2.35	-5.44	-4.23	-4.89	-2.90	-2.67	-5.14	+.326	+.091	-2.82	-2.94	-2.81	-3.18
		28	28	28	28	-24.5	-3.5	-15	19	23	-19.5	5.82	1.63	20.5	18.5	20.5	
	2100	-2.31	-2.30	-2.29	-2.30	-5.36	-4.14	-4.79	-2.84	-2.62	-5.03	+.321	+.091	-2.76	-2.88	-2.77	-3.18
		29	29	29	29	-23	-1.5	-13	+20	+24	.17	5.73	1.63	+21.5	+19.5	+21.5	
	2130	-2.31	-2.30	-2.28	-2.29	-5.28	-4.08	-4.70	-2.81	-2.61	-4.92	+.311	+.092	-2.73	-2.84	-2.75	-3.19
		29	29	29	29	-22	-.5	-11.5	20.5	24	-15.5	5.55	1.64	22	20	21.5	
	2200	-2.32	-2.30	-2.30	-2.30	-5.25	-4.06	-4.66	-2.81	-2.61	-4.86	+.303	+.093	-2.74	-2.84	-2.75	-3.16
		29	29	29	29	-21	-.5	-11	20.5	24	-14.5	5.32	1.63	21.5	20	21.5	
	2230	-2.30	-2.29	-2.28	-2.29	-5.22	-4.04	-4.63	-2.80	-2.60	-4.82	+.301	+.090	-2.73	-2.83	-2.74	-3.19
		29	29	29	29	-20.5	0	-10	20.5	24	-13.5	5.27	1.58	22	20	21.5	
	2300	-2.31	-2.31	-2.30	-2.30	-5.22	-4.03	-4.63	-2.80	-2.61	-4.80	+.294	+.093	-2.72	-2.83	-2.74	-3.23
		29	29	29	29	-20.5	0	-10	20.5	24	-13	5.15	1.63	22	20	21.5	
start	23:11:21					-5.21	-4.02	-4.62	-2.81	-2.61	-4.81	+.292	+.099	-2.73	-2.83	-2.76	
						-20.5	.5	-10	+20.5	24	-13.5	5.12	1.74	22	20.2	21.5	
END	23:18:41					-5.37	-4.09	-4.68	-2.85	-2.66	-4.87	+.302	.093	-2.74	-2.86	-2.80	
						-23.5	-1.0	-11	+20	23	-14.5	5.30	1.63	22	20	20.5	
	2321	-2.31	-2.30	-2.29	-2.29	-5.26	-4.06	-4.67	-2.82	-2.63	-4.85	+.297	+.092	-2.74	-2.84	-2.76	-3.15
		29	29	29	29	-21	-.4	-11	+20	23.5	-14	5.21	1.61	22	20	21	

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST # 3

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	TA 10	TA 11	TC Block 12	TC Block 13	← X → Face 14	Apex 15	Tab 16	Up Ring 18	Ret 19	← Y → Face 20	Axial 21	Rad. 22	Lo Ring 23	Up Ring 24	Ret 25
8/14/74	0000	-2.33	-2.32	-2.31	-2.31	-5.59	-4.23	-4.87	-2.90	-2.69	-5.08	+.322	+.092	-2.78	-2.92	-2.84
		28.5	28.5	29	29	-27.5	-3	-14.5	+19	+22.5	-18	+5.75	+1.64	+21	+19	+20
	0030	-2.26	-2.25	-2.23	-2.24	-5.70	-4.30	-4.99	-2.87	-2.65	-5.22	+.342	+.092	-2.75	-2.90	-2.80
		29.5	30.0	30.0	30.0	-29.5	-4.5	-16.5	+19.5	+23.5	-20.5	+6.11	+1.64	+21.5	+19.0	+20.5
	0100	-2.24	-2.23	-2.22	-2.22	-5.92	-4.34	-5.04	-2.86	-2.64	-5.29	+.351	+.095	-2.75	-2.89	-2.79
		30	30	30.5	30.5	-33.5	-5.0	-17.5	+20.0	+23.5	-22.0	+6.27	+1.69	+21.5	+19.0	+21.0
	0130	-2.23	-2.22	-2.21	-2.22	-5.95	-4.37	-5.09	-2.87	-2.64	-5.34	+.357	+.097	-2.75	-2.91	-2.79
		30	30.5	30.5	30.5	-34.0	-5.5	-18.5	+19.5	+23.5	-23.0	+6.37	+1.73	+21.5	+19.0	+21.0
	0200	-2.24	-2.23	-2.22	-2.23	-5.98	-4.39	-5.11	-2.88	-2.65	-5.37	+.365	+.100	-2.76	-2.91	-2.80
		30	30	30.5	30	-34.5	-6.0	-18.5	+19.5	+23.5	-23.5	+6.52	+1.79	+21.5	+19.0	+20.5
Test #3 Start	0206	-2.24	-2.23	-2.22	-2.22	-5.97	-4.38	-5.10	-2.87	-2.64	-5.37	+.359	+.095	-2.75	-2.91	-2.79
		30	30	30.5	30.5	-34.5	-6.0	-18.5	-19.5	+23.5	-23.5	+6.41	+1.70	+21.5	+19	+21
End	0226	-2.23	-2.22	-2.21	-2.22	-5.94	-4.36	-5.09	-2.87	-2.64	-5.35	+.362	+.104	-2.75	-2.89	-2.78
		30	30.5	30.5	30.5	-34	-5.5	-18.5	-19.5	+23.5	-23.0	+6.46	+1.86	21.5	+19	+21

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	6*	7*	8*	9*	10*	11*	12*	13*	28*	29*	30*	31*	Chamb Pres*
8/14/74	0634	-6.31	-7.06	-4.95	-6.55	-2.08	-207	-208	-208	9.86	8.96	~~.40~~ .4	.07	
		-41	-67	+3	-49	+91	+91	+91	+91	-	-	-	-	
"	0700	-5.53	-6.46	-4.73	-5.46	2.00	-1.99	-2.00	-2.00	9.92	9.03	.4	.08	
		-15	-46	+26	-29	+93	+93	+93	+93	-	-	-	-	
	0730	-4.90	-5.60	-3.80	-5.17	1.89	1.88	1.89	1.90	9.81	8.96	.4	.08	
		+11	-18	+39	-3	+96	+96	+96	+96	-	-	-	-	
	0800	-4.19	-4.80	-3.60	-4.56	-1.80	-1.79	-1.80	-1.80	9.8	8.9	.4	.08	
		+28	+8	+44	+16	+100	+100	+100	+100	-	-	-	-	
	0900	-3.59	-3.94	-3.32	-3.79	1.63	-1.63	1.63	1.64	9.8	8.9	.4	.09	1 Torr
		+46	+35	+54	+40	+104	+104	+104	+104	-	-	-	-	
	0910	-3.52	-3.84	-3.28	-3.71	-2.05	-2.05	-1.99	1.99	9.8	8.9	.4	.07	
		+53	+38	+55	42	+91	91	94	94	-	-	-	-	
		Temp y off			Ves Los		off	Variac's			off			1 Torr
	0920	3.47	-3.75	-3.25	363	-2.09	-2.09	2.09	2.09	0	0	0	0	1 Torr
		+50	+41	+56	+44	91	91	91	91	-	-	-	-	

* Enter appropriate data system termination symbol for each test parameter to be monitored.

°C

CW °F

TEST PARAMETER DATA RECORD

Test #5 chart

Date	Time (0-24Hr)	6	7	8	9	10	11	12	13	28	29	30	31	26	27
0630	8/12/74	-2.76	2.77	2.77	-2.77	-2.76	-2.76	-2.76	-2.76	–	–	–	–		
		+21	+21	+21	+21	+21	+21	+21	+21						
8/12/74	0940	-6.98	-3.65	-12.47	-3.23	-2.31	-2.30	-2.30	-2.31	10.08	15.19	–	–	-1.79	-1.79
		-54°F	+44°F	-3.09	+56	+28	+28	+28	+28	–	–	–	–	38	+38
"	1000	-11.79	-12.48	-12.52	-11.39	-2.29	-2.28	-2.28	-2.28	9.9	15.0	–	–	-1.82	-1.81
		-267	-301	-312	-246	+29	29	29	29	–	–	–	–	+37	+37
	1020	-12.28	12.62	-12.60	12.62	-2.29	2.26	2.26	2.27	9.9	14.99			1.63	1.62
		-296	-319	-317	-319	+29	29	29	29	–	–			37	37
		-12.32	-12.64	-12.59	-12.62	-2.26	-2.26	-2.29	-2.27	9.9	14.96			1.63	1.64
		-299	-319	-317	-319	+30	+30	+30	+30	–	–			37	37

* Enter appropriate data system termination symbol for each test parameter to be monitored.

Test No. 5

TEST PARAMETER DATA RECORD

		T/A		T/c Block		X					Y						
						Face	Apex	Tab	Valve	Ref.	Face	Apex	Tab	Valve	Valve	Ref.	
Date	Time (0-24Hr)	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25	
8/11/74	1030	-2.28	-2.27	-2.27	-2.27	-4.99	-3.55	-3.95	-2.68	-2.56	-4.10	+.343	+.095	-2.58	-2.70	2.71	
		+30	+30	+30	+30	-16	+8	+1	+23	+25	-1	5.91	1.64	+25	23	23	
-	1100	-2.31	-2.30	-2.29	-2.29	-5.45	-3.92	-4.43	-2.80	-2.63	-4.61	+.411	+.106	-2.67	-2.81	-2.78	
		+29	+29	+29	+29	-25	+2	-7	+21	+23	-10	7.09	1.83	+23	+20	+21	
	1130	-2.29	-2.28	-2.24	-2.28	-5.69	-4.14	-4.71	-2.85	-2.66	-4.92	+.454	+.111	-2.72	-2.89	-2.61	11:33 Tommy adjusted to +60°C.
		+29	+29	+29	+24	-29	-2	-12	+20	+23	-15	7.96	1.95	+22	+20	+20	
	1150 1200	-.720	-.701	-.762	-.765	-5.75	-3.76	-4.96	-1.93	-1.61	-5.00	+.665	+.132	-1.56	-1.91	-1.79	
		+54	+54	+54	+54	-30	+5	-12	+35	+40	-17	11.67	2.32	+41	+35	+38	
	1200	-.552	-.536	-.537	-.542	-5.69	-3.63	-4.66	-1.57	-1.22	-4.91	+.685	+.150	-1.30	-1.56	-1.42	
		+57	+57	+57	+57	-29	+7	-11	+41	+46	-15	12.02	2.63	+45	+41	+43	
	1230	-.493	-.476	-.476	-.478	-5.49	-3.44	-4.40	-1.42	-1.09	-4.64	+.627	+.162	-1.19	-1.41	-1.29	
		58	58	57	58	-25	+10	-6	+43	+48	-10	11.00	2.84	+47	+43	+45	
	1300	-.437	-.419	-.436	-.441	-5.38	-3.33	-4.25	-1.39	-1.07	-4.47	+.544	+.159	-1.15	-1.57	-1.27	
		59	59	59	59	-23	+12	-4	+44	+49	-7	9.38	2.74	+48	+44	46	
	1330	-.296	-.283	-.267	-.274	-5.26	-3.17	-4.10	-1.20	-.890	-4.32	+.533	+.165	-.979	-1.19	-1.10	
		61	61	61	61	-21	+15	-1	+46	52	-5	9.19	2.84	+50	+47	+48	
	1400	-.288	-.274	-.264	-.269	-5.19	-3.10	-4.01	-1.18	-.881	-4.22	+.516	+.163	-.960	-1.17	-1.09	
		60.5	61	61	61	-20	+16	0	+47	+52	-3	8.90	2.81	+50.5	+47	+48	
	1430	-.288	-.276	-.264	-.272	-5.15	-3.07	-3.95	-1.17	-.881	-4.16	+.506	+.164	-.956	-1.16	-1.09	
		60.5	61	61.5	61.5	-19.5	+16	+1.5	+47	+52	-2	8.72	2.83	+50.5	+47	+48	
	1500	-.288	-.275	-.265	-.271	-5.13	-3.05	-3.93	-1.17	-.878	-4.13	+.499	+.163	-.949	-1.15	-1.09	
		61	61	61.5	61	-19	+16	+2	+47	+52	-2	8.60	2.81	+51	47	48	
8/12/74	1530	-.298	-.287	-.268	-.275	-5.12	-3.03	-3.91	-1.16	-.875	-4.10	+.495	+.162	-.944	-1.15	-1.08	1.6×10^{-7}
		61	61	61.5	61.5	-19	+17	+2	+47	+52	-1	8.53	2.79	+51	+47	+48	

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST PARAMETER DATA RECORD

		C.W.				T.A.		TC Block		X Face	Apex	Tab	UpRing	Ret.	Y ΔT Face	ΔT Apex	ΔT Tab	LoRing	UpRing	Ret.
Date	Time (0-24Hr)	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25
8/12/74	1600	-12.43	-12.65	12.63	-12.66	-.278	-.266	-.258	-.260	-5.10	-3.02	-3.89	-1.16	-.869	-4.09	+.495	+.163	-.936	-1.14	-1.08
						+61.5	+61.5	+61.5	+61.5	-18.5	+17	+2.5	+47	+52	-1	+8.53	+2.81	+51	+47.5	+48
Test #5 Data start	16:03:31									-5.10	-3.01	-3.90	-1.16	-.870	-4.09	+.484	+.159	-.941	-1.14	-1.08
										-18.5	+17	+2.5	+47	+52	-1	+8.34	+2.74	+51	+47.5	+48
stop	16:19:31									-5.10	-2.92	-3.87	-1.14	-.867	-4.05	+.469	+.162	-.936	-1.13	-1.06
										-18.5	+19	+3	+46.5	+52	0	+8.09	+2.79	+51	+47.5	+49
		C W °F																		
	1680	-12.43	-12.66	12.63	12.67															
			12.59	=	-317°															
	1700	-12.76	-12.36	-12.63	-12.23															
			12.37	=	-302															
	1710 ~~1730~~	12.09	12.19	12.53	11.99	Change Press	°F Change													
			12.2	=	-292		10°													
	1720	-10.77	11.81	12.38	11.35															
			11.57	=	-255	1.4^{-7}	39°													
	1930	-9.42	11.28	11.52	10.67															
			10.72 =		-213	1.6^{-7}	42°													
	1940	8.38	10.58	8.33	9.91															
			9.3 =		-152	2.6^{-7}	61°													
	1950	-7.55	-9.92	-6.64	-9.08															
			8.29		-111	2.2^{-7}	57°													
	1800	-6.82	-9.31	-5.72	-8.12															
			7.51 =		-83	1.3^{-6}	28°													

* Enter appropriate data system termination symbol for each test parameter to be monitored.

CW °F

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	WEST 6	EAST 7	DOOR 8	SOUTH 9	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25	CHAMP PRESS			
8/12/74	1810	-6.17	-8.67	-5.17	-7.37	-.259	-.243	-.239	-.240	-4.23	-260	-.335	-.101	-.938	-3.47	+.393	+.150	-.829	-.990	-.915				
			6.85		-59°	61	62	62	62	-3	+24	+12	+49	+54	+10	+5			+50	+51	1.2^{-6}	24°F		
	1820	-5.59	-8.02	-4.82	-6.65																			
			6.27		+40°																2.2^{-6}	19°F		
	1830	-5.13	-7.41	-4.58	-6.06																			
		-2	-79	+15	-33																2.5^{-6}	16°F		
	1840	-4.70	-6.79	-4.40	-5.53																			
		+11	-57	+21	-15																3.2^{-6}	14°F		
	1850	-4.31	-6.20	-4.26	-5.04																			
		+24	-37	+25	0	Diff Pmp off															4.5^{-6}			
	1900	-3.98	-5.64	-4.16	-4.59																1×10^{-4}			
		+34	-19	+29	+15																			
	1910	-3.70	-5.11	-4.10	-4.16																30μ			
		+42	-2	+30	+28																			
	1920	-3.43	-4.62	-4.04	-3.77																34μ			
		+51	+14	+32	+40																			
	1930	-3.20	-4.20	-3.96	-3.43	-.226	-.216	-.227	-.230	-2.30	-1.20	-1.86	-.818	-.722	-2.00	+.320	+.143	-.627	-.781	-.800	34μ			
		+57	+27	+34	+51	62	62	61	62	28	47	36	53	54	34			56	53	53				
	1940	-2.99	-3.83	-3.88	-3.14																			
		64	39	37	59																			
	1950	-2.81	-3.51	-3.79	-2.87					-1.93					-1.62									
		69	48	40	67					35					40						STARTED BACKFILL			
	2000	-2.74	-3.26	-3.72	-2.69					-1.85					-1.14									
		71	56	42	73					48					48									

* Enter appropriate data system termination symbol for each test parameter to be monitored.

°C °F

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	T/A		T/C		X FACE	X APEX	X TAB	X UP RING	X RET.	Y FACE	Y AXIAL	Y RADIAL	Y LO RING	Y UP RING	Y RET		WINDOW HOOD	MANIPULATOR 71-79	MANIPULATOR	COLDWALL WEST	COLDWALL EAST	COLDWALL DOOR	COLDWALL SOUTH
Date	Time (0-24Hr)	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25		2	4	5	6	7	8	9
TEST #10 08/12/74	2150	-2.85	-2.85	-2.85	-2.85	-2.79	-2.83	-2.80	-2.82	-2.83	-2.78	.003	.021	-2.82	-2.82	-2.87		-2.79	-2.69	-2.76	-2.69	-2.70	N/A	-2.69
		20	20	20	20	21	20	21	21	20	21	0	.30	21	21	20		70	73	72	73	72		73
	2214	-2.85	-2.85	-2.86	-2.87	-2.85	-2.85	-2.85	-2.86	-2.86	-2.85	+.001	-.005	-2.85	-2.86	-2.86								
		20	20	20	19.5	20	20	20	20	20	20	0	-.10	20	20	20								
TEST #11 08/13/74	0020	-2.66	-2.66	-2.67	-2.67	-2.90	-2.81	-2.85	-2.72	-2.69	-2.86	+.026	+.003	-2.70	-2.72	-2.71		-2.82	-2.78	-2.79	-2.96	-2.92	-2.95	-2.91
		23	23	23	23	19	20.5	20	22	22.5	19.5	+0.4	+0.05	22.5	22	22		69	70	70	66	66	65	66
	0053	-2.66	-2.66	-2.66	-2.66	-2.87	-2.79	-2.82	-2.70	-2.68	-2.83	+.024	+.003	-2.68	-2.70	-2.70								
		23	23	23	23	19.5	21	20.5	22.5	22.5	20	+0.4	+.05	22.5	22.5	22.5								
Test #19 8/13/74	0200	-5.62	-5.62	-5.62	-5.62	-7.65	-5.13	-5.06	-5.45	-5.52	-4.97	+.010	+.033	-5.43	-5.42	-5.64		-2.68	-2.83	-2.82	-12.32	-12.57	-12.55	-12.58
		-28	-28	-28	-28	-67	-19	-18	-25	-26	-16	+0.2	+.6	-24.5	-24.5	-28		73	69	69	-299	-315	-314	-316
	0230	-5.68	-5.69	-5.66	-5.66	-8.18	-5.77	-5.85	-5.71	-5.71	-5.82	+.110	+.042	-5.64	-5.68	-5.78		-2.69	-2.95	-2.93	-12.36	-12.58	-12.55	-12.58
		-29	-29	-28.5	-28.5	[illegible]	-30.5	-32	-29.5	-29.5	-31.5	+2.0	+0.78	-28.5	-29	-30.5		73	65	66	-301	-316	-317	[illegible]
	0300	-5.79	-5.79	-5.77	-5.78	-8.50	-6.18	-6.33	-5.93	-5.90	-6.37	+.161	+.043	-5.83	-5.91	-5.95		-2.66	-2.95	-2.94				
		-31	-31	-30.5	-31	[illegible]	-38	-41	-33.5	-33	-42	+3.0	+0.79	-32	-33	-34		74	65	65				
	0330	-5.81	-5.81	-5.79	-5.80	-8.68	-6.41	-6.63	-6.03	-5.98	-6.76	+.211	+.050	-5.91	-6.02	-6.01		-2.67	-2.96	-2.95				
		-31.5	-31.5	-31	-31	[illegible]	-42.5	-47	-35.5	-34	-49	+4.0	+0.9	-33	-35	-35		73	65	65				
	0400	-5.78	-5.79	-5.78	-5.78	-8.79	-6.54	-6.80	-6.08	-6.01	-7.01	+.248	+.053	-5.94	-6.08	-6.04		-2.67	-2.90	-2.89				
		-31	-31	-31	-31	-90.5	-45	-50	-36.5	-35	-54	+4.86	+1.0	-34	-36.5	-35.5		73	66	67				
	0430	-5.74	-5.75	-5.73	-5.74	-8.84	-6.60	-6.89	-6.07	-5.99	-7.17	+.278	+.056	-5.93	-6.08	-6.02		-2.68	-2.88	-2.87				
		-30	-30	-30	-30	-92	-46	-52	-36	-34.5	-57	+5.56	+1.1	-33.5	-36.5	-35		73	67	67				

* Enter appropriate data system termination symbol for each test parameter to be monitored.

Bendix Aerospace Systems Division

LAGEOS THERMAL-OPTICAL TEST

NO. TP2374455 | REV. NO. 9

PAGE 18 OF ______

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°F

TEST PARAMETER DATA RECORD

TEST #19

		T/A		T/C		← X → FACE	APEX	TAB	UP RING	RET	Y → FACE	AXIAL	RADIAL	LO RING	UP RING	RET		WINDOW	MANIPULATOR		— COLDWALL —				
Date	Time (0-24Hr)	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25		2	4	5	6	7	8	9	
08/13/74	0500	-5.76	-5.76	-5.75	-5.75	-8.87	-6.64	-6.94	-6.09	-6.01	-7.27	+.291	+.057	-5.95	-6.11	-6.03		-2.69	-2.76	-2.75					
		-30.5	-30.5	-30	-30	-92.	-47	-52.5	-37	-35	-59	+5.7	+1.1	-34	-37	-35.5		73	71	71					
	0530	-5.75	-5.75	-5.74	-5.74	-8.89	-6.66	-6.97	-6.10	-6.01	-7.34	+.302	+.059	-5.96	-6.12	-6.04		-2.70	-2.70	-2.69					
		-30	-30	-30	-30	-93	-47	-53	-36.5	-35	-60.4	+6.0	+1.2	-34	-37	-35.5		72	72	73					
	0600	-5.74	-5.75	-5.73	-5.74	-8.90	-6.67	-6.99	-6.10	-6.01	-7.38	+.310	+.059	-5.96	-6.13	-6.04		-2.70	-2.67	-2.67					
		-30	-30	-30	-30	-93	-47	-53.5	-36.5	-35	-61.2	+6.2	+1.2	-34	-37	-35.5		72	73	73					
	0630	-5.75	-5.76	-5.74	-5.74	-8.91	-6.68	-7.00	-6.10	-6.01	-7.42	+.314	+.058	-5.96	-6.14	-6.05		-2.70	-2.66	-2.65					
		-30	-30	-30	-30	-93	-47	-54	-36.5	-35	-62.0	+6.3	+1.2	-34	-37.5	-36		72	74	74					
	0704	-5.75	-5.76	-5.74	-5.75	-8.92	-6.68	-7.01	-6.11	-6.02	-7.44	+.314	+.057	-5.97	-6.15	-6.05		-2.71	-2.65	-2.64					
		-30	-30	-30	-30	-93	-47	-54	-36.5	-35	-62.5	+6.3	+1.1	-34	-38	-36		+72	74	74					
	0723	-5.74	-5.75	-5.73	-5.74	-8.72	-6.66	-6.98	-6.09	-6.00	-7.41	+.309	+.056	-5.96	-6.13	-6.04		-2.71	-2.65	-2.64	-12.44	-12.64	-12.62	-12.64	
		-30	-30	-30	-30	-90	-47	-53	-37	-35	-62	+6.2	+1.1	-34	-37.5	-35.5		72	74	74	-307	-320	-319	-320	Av=31
			0745	ADJUST TERREY T + 30°C																					

- Enter appropriate data system termination symbol for each test parameter to be monitored.

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TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	2 *	4 *	5 *	6 ~~10~~ *	7 ~~11~~ *	8 ~~12~~ *	9 ~~13~~ *	10 *	11 *	12 *	13 *
8-13-74	0800	-2.70	-2.55	-2.54	-12.44	-12.63	-12.61	-12.63	-3.94	-3.97	-4.15	-4.15
		+22	25	25		12.57	-1	13C	+2	+1	-2	-2
	0830	-2.69	-2.23	-2.23					-2.49	-2.51	-2.47	-2.48
		+22	30	30					+26	+25	+26	+26
	0900	-2.66	-2.41	-2.41					-2.43	-2.44	2.44	-2.42
		+23	+27	+27					+27	+27	+27	+27
	0910	-2.66	-2.43	-2.43					-2.44	-2.44	-2.42	-2.42
		+23	+27	+27					+27	+27	+27	+27
	0920	-2.65	-2.44	-2.44					-2.34	-2.35	-2.32	2.33
		+23	+27	+27					+28	+28	+29	+29
	0930	-2.65	2.44	2.44					-2.31	-2.32	-2.30	-2.30
		+23	+27	+27					+29	+29	+29	+29

* Enter appropriate data system termination symbol

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TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25
8-13-74	0940	-2.32	-2.33	-2.29	-2.30	-7.94	-4.82	-5.73	-3.06	-2.77	-6.15	+.601	+.131	-2.99	-3.11	-2.96
		+29	+29	+29	+29	-73	-13.5	-30	+16	+21	-38	+11.13	+2.43	+19.5	+16	+18
	1000	-2.32	-2.33	-2.29	-2.30	-7.88	-4.75	-5.62	-3.04	-2.77	-6.00	+.570	+.130	-2.97	-3.08	-2.95
		+29	+29	+29	+29	-72	-12	-28	+16	+21	-35	+10.56	+2.40	+18	+16	+18
	1030	-2.32	-2.33	-2.29	-2.30	-7.81	-4.68	-5.51	-3.02	-2.76	-5.84	+.541	+.128	-2.94	-3.05	-2.93
		+29	+29	+29	+29	-70	-11	-26	+17	+21	-32	+10.01	+2.37	+18	+16	+18.5
	1100	-2.31	-2.32	-2.29	-2.29	-7.71	-4.63	-5.43	-3.00	-2.75	-5.73	+.522	+.129	-2.92	-3.03	-2.92
		+29	+29	+29	+29	-68	-10	-24.5	+17.5	+21.5	-30	+9.49	+2.31	+19	+17	+19
	1130	-2.29	-2.31	-2.28	-2.29	-7.74	-4.60	-5.38	-2.99	-2.74	-5.61	+.510	+.128	-2.91	-3.02	-2.91
		+29	+29	+29	+29	-69	-10	-24	+18	+21.5	-28	+9.27	+2.33	+19	+17	+19
	1200	-2.30	-2.32	-2.29	-2.29	-7.73	-4.58	-5.36	-2.99	-2.74	-5.62	+.499	+.126	-2.91	-3.01	-2.91
		+29	+29	+29	+29	-68	-9	-23	+17	+22	-28	+9.07	+2.29	+19	+17	+19
	1230	-2.31	-2.32	-2.29	-2.30	-7.71	-4.57	-5.34	-2.99	-2.74	-5.58	+.497	+.125	-2.90	-3.01	-2.91
		+29	+29	+29	+29	-68	-9	-23	+18	+21.5	-27	+9.04	+2.27	+19	+17	+19
	13:02:01					-7.71	-4.57	-5.33	-2.99	-2.75	-5.57	+.491	+.125	-2.91	-3.02	-2.92
						-68	-9	-23	+18	+21.5	-27	+8.93	+2.27	+19	+17	+19
	13:19:41					-7.48	-4.52	-5.29	-2.98	-2.73	-5.52	+.459	+.117	-2.89	-2.99	-2.89
						-65	-8	-22	+18	+22	-26	+8.25	+2.13	+19	+17.5	+19
	1330	-2.32	-2.33	-2.29	-2.30	-7.69	-4.53	-5.30	-2.98	-2.74	-5.53	+.467	+.126	-2.90	-3.01	-2.91
		+29	+29	+29	+29	-69	-8.5	-22	+18	+21.5	-26	+8.49	+2.29	+19	+17	+19

Test Data

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST PARAMETER DATA RECORD

Date	Time (0-24Hr)	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25
8/13/74	1330	-12.44	-12.60	-11.60	-12.56	-2.32	-2.31	-2.29	-2.30											
			-12.55	=	-314	°F	+28	29	29											
	1400	-12.17	-12.18	-12.52	-12.06	-2.32	2.32	-2.29	-2.30											
			-12.23		-293	°F 21	+28	+29	+29											
	1430	-9.59	-11.02	-8.69	-10.83															
			-10.03		-182	°F														
	1500	-7.86	-9.78	-5.33	-9.43															
			-8.1		-105	°F														
	1530	-6.62	-8.61	-4.49	-7.89															
			-6.90		-61°	F														
	1600	-4.74	-6.76	-4.12	-5.93															
		+10	-56	+30	-28°F															
	1630	-3.57	-5.02	-3.88	-4.28															
		+46	+1	+37	+25°					-4.18	-3.62	-4.03	-2.66	-2.47	4.10	+.199	+.053	-2.63	-2.66	2.54
										-2 02	+7	0	23	26	-1			24	23	25
	1700	-2.61	-3.72	-3.67	3.15					-3.52	-3.27	-3.58	-2.55	-2.90	-3.62	+.146	+.036	-2.53	-2.55	-2.49
		+69	+41	+43	+59					+8	+13	+8	+25	+27	+7			+25	+25	+27
	1800	-3.32	-3.54	-3.56 3.59	3.38				2.26	3.23	2.91	3.09	2.47	2.35	3.12	+.087	+.025	2.44	2.46	2.42
		+54 +54	+47	+53	+52				85.5	56.5	66.5	61	79.5	52	60					
	1900	3.224	3.385	3.17	3.31	2.24	2.24	2.24	2.25	3.08	2.74	2.87	2.41	2.35	2.40	+.074	+.022	2.35	2.41	2.38
						86	86	86	85.5	61	71	62.5	81	82.5	66					

* Enter appropriate data system termination symbol for each test parameter to be monitored.

Bendix Aerospace Systems Division

LAGEOS THERMAL-OPTICAL TEST

NO. TP2324455 REV. NO.

TEST PARAMETER DATA RECORD

TEST #21

Date	Time (0-24Hr)	WINDOW	MANIPULATOR	MANIPULATOR	PANEL	PANEL	TC FIXTURE	TC FIXTURE	X FACE	X APEX	X TAB	X UP RING	X RET RING	Y FACE	ΔT AXIAL	ΔT RADIAL	Y LOWER RING	Y UPPER RING	Y RET RING
		2	4	5	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25
8/14/74	2100	-2.86	-3.26	-3.25	-5.60	-5.62	-5.58	-5.58	-4.27	-4.43	-4.21	-5.12	-5.28	-4.16	-.090	+.033	-5.14	-5.12	-5.40
		+20	+13	+13	-28	-28	-27	-27	-4	-7	-3	-19	-22	-2			-19	-19	-24
	2130	-2.66	-2.92	-2.91	-5.70	-5.71	-5.69	-5.69	-5.52	-5.41	-5.39	-5.60	-5.65	-5.31	+.037	+.034	-5.56	-5.57	-5.72
		+23	+19	+19	-29	-30	-29	-29	-26	-24	-24	-28	-28	-22			-27	-27	-30
	2200	-2.63	-2.78	-2.77	-5.72	-5.74	-5.71	-5.72	-6.21	-5.95	-6.06	-5.82	-5.81	-6.05	+.136	+.043	-5.73	-5.78	-5.84
		+24	+21	+21	-30	-30	-30	-30	-39	-34	-36	-32	-32	-36			-30	-31	-32
	2230	-2.62	-2.75	-2.74	-5.73	-5.75	-5.72	-5.73	-6.61	-6.26	-6.44	-5.94	-5.90	-6.54	+.242	+.051	-5.82	-5.91	-5.92
		+24	+22	+22	-30	-30	-30	-30	-46	-40	-43	-34	-33	-45			-32	-33	-33
	2300	-2.63	-2.75	2.74	-5.76	-5.77	-5.74	-5.75	-6.84	-6.44	-6.68	-6.02	-5.95	-6.86	+.030	+.056	-5.89	-6.00	-5.98
		+24	+22	+22	-30	-30	-30	-30	-51	-43	-48	-35	-34	-51			-33	-35	-35
	2336	-2.63	-2.76	-2.76	-5.76	-5.78	-5.74	-5.77	-7.02	-6.56	-6.83	-6.07	-5.99	-7.10	+.362	+.059	-5.94	-6.06	-6.02
		+24	+22	+22	-30	-31	-30	-30	-54	-45	-50	-36	-35	-56			-34	-36	-35
8/15/74	0001	-2.64	-2.77	-2.76	-5.78	-5.79	-5.75	-5.77	-7.08	-6.61	-6.90	-6.09	-6.01	-7.23	+.381	+.057	-5.97	-6.09	-6.04
		+23	+21	+22	-31	-31	-30	-31	-55	-46	-52	-37	-35	-58			-34	-37	-36
	0030	-2.65	-2.79	-2.78	-5.77	-5.77	-5.76	-5.77	-7.14	-6.65	-6.96	-6.11	-6.02	-7.31	+.406	+.057	-5.99	-6.13	-6.06
		+23	+21	+21	-30.5	-30.5	-30	-30.5	-56.5	-47	-53	-37	-35	-60			-34.5	-37	-36
	0100	-2.66	-2.80	-2.79	-5.78	-5.80	-5.15	-5.77	-7.17	-6.67	-6.98	-6.12	-6.03	-7.39	+.402	+.059	-6.00	-6.14	-6.07
		+23	+21	+21	-31.0	-31.0	-30	-30.5	-57.0	-47	-53.5	-37	-35	-61.5			-35	-37.5	-36
	0130	-2.66	-2.81	-2.80	-5.78	-5.79	-5.75	-5.77	-7.19	-6.69	-7.00	-6.13	-6.04	-7.43	+.428	+.059	-6.01	-6.15	-6.08
		23	21	21	-31	-31	-30	-30	-57.5	-48	-53.5	-37.5	-35.5	-62.0	+8.5	+1.0	-35	-37.5	-36.5
Start #21	0137	-2.67	-2.81	2.81	-5.77	-5.79	-5.75	-5.77	-7.19	-6.69	-7.00	-6.13	-6.03	-7.44	+.429	+.061	-6.01	-6.15	-6.07
		23	21	21	-30.5	-31	-30	-30	-57.5	-48	-53.5	-37.5	-35	-62.5	+8.5	+1.0	-35	-37.5	-36
end #21	0152	-2.67	-2.84	-2.83	-5.78	-5.79	-5.75	-5.77	-7.19	-6.68	-6.98	-6.11	-6.03	-7.44	+.420	+.055	-6.01	-6.14	-6.07
		23	20	20	-31	-31	-30	-30	-57.5	-48	-53.5	-37	-35	-62.5	+8.4	+1.0	-35	-37.5	-36

* Enter appropriate data system termination symbol for each test parameter to be monitored.

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Bendix Aerospace Systems Division	LAGEOS THERMAL-OPTICAL TEST	NO. TP2374455	REV. NO.
		PAGE 73 OF ____ PAGES	

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TEST PARAMETER DATA RECORD

	Date	Time (0-24Hr)	WIND. * 2	MAN. * 4	MAN. * 5	PANEL * 10	PANEL * 11	TC FIXT. * 12	TC FIXT. * 13	X FACE * 14	X APEX * 15	X TAB * 16	X UP RING * 18	X RET. RING * 19	Y FACE * 20	Y ΔT-AX * 21	Y ΔT-RAD * 22	Y LOW RING * 23	Y UP RING * 24	Y RET. RING * 25	*	*	*	*	*
test #14	8-19-74	0300	-2.66	-2.46	-2.46	-2.32	-2.34	-2.30	-2.33	-6.53	-5.15	-6.21	-3.18	-2.88	-6.81	+1.24	+.131	-3.16	-3.27	-3.06					
										-45					-50										
		0330	-2.65	-2.59	-2.58	-2.28	-2.29	-2.23	-2.26	-6.21	-4.90	-5.88	-3.06	-2.76	-6.39	+1.15	+.133	-3.03	-3.12	-2.97					
										-39					-42										
		0400	-2.65	-2.60	-2.60	-2.25	-2.26	-2.22	-2.24	-6.01	-4.75	-5.67	-3.01	-2.73	-6.09	+1.07	+.138	-2.98	-3.06	-2.92					
			23	24	24	30	29.5	30.5	30	-35	-12.5	-29	16	22	-36.5	+19.8	+2.6	+17.5	16.5	19					
		0430	-2.64	-2.59	-2.59	-2.25	-2.27	-2.21	-2.28	-5.86	-4.65	-5.53	-2.97	-2.71	-5.89	+1.01	+.131	-2.94	-3.03	-2.89					
			+23.5	+24	+24	30	29.5	30	30	-32	-10.5	-26	18	22	-33	+18.7	+2.5	18	17	19					
		0500	-2.64	-2.58	-2.58	-2.26	-2.27	-2.21	-2.24	-5.96	-4.59	-5.45	-2.96	-2.70	-5.75	+.976	+.129	-2.91	-3.00	-2.89					
			+23.5	24	24	29.5	29.5	30	30	-30.5	-9.5	-24.5	18	22	-30	+18.1	+2.4	19	17	19					
		0530	-2.64	-2.57	-2.57	-2.24	-2.26	-2.21	-2.24	-5.70	-4.55	-5.37	-2.94	-2.69	-5.65	+.953	+.135	-2.90	-2.99	-2.87					
			+23.5	24	24	30	29.5	30	30	-29.5	-9.0	-23	+18	+22	-28.5	+17.3	+2.5	+19	+17	+19.5					
		0600	-2.64	-2.57	-2.57	-2.27	-2.28	-2.22	-2.25	-5.66	-4.54	-5.34	-2.94	-2.69	-5.60	+.936	+.133	-2.89	-2.98	-2.88					
			23.5	24	24	29.5	29.5	30.5	30	-28.5	-9	-23	18	22	-27.5	+17.0	+2.4	19	17	19					
		0630	-2.64	-2.57	-2.57	-2.25	-2.27	-2.22	-2.24	-5.64	-4.53	-5.31	-2.94	-2.69	-5.57	+.931	+.136	-2.88	-2.97	-2.87					
			23.5	24	24	30	29.5	30.5	30	-28	-8.5	-22	18	22	-27.0	+16.9	+2.5	+19	+18	+19.5					
start data		0635	-2.64	-2.57	-2.56	-2.25	-2.26	-2.22	-2.22	-5.69	-4.53	-5.31	-2.94	-2.69	-5.57	+.926	+.134	-2.89	-2.97	-2.87					
			23.5	24	24.5	30	+29.5	30.5	30.5	-28	-8.5	-22	18	22	-27	+16.8	+2.4	19	+18	19.5					
end data		0656	-2.63	-2.55	-2.55	-2.25	-2.27	-2.22	-2.22	-5.58	-4.48	-5.27	-2.93	-2.67	-5.51	+.901	+.129	-2.87	-2.94	-2.85					
			23.5	25	25	30	+29.5	30.5	30.5	-27	-7.5	-21.5	18.5	23	-26	+16.4	+2.2	19.5	18.5	20					

* Enter appropriate data system termination symbol for each test parameter to be monitored.

S-100

°C

TEST PARAMETER DATA RECORD

TEST #22

Date	Time (0-24Hr)	WIND. 2	MAN. 4	MAN. 5	PANEL 10	PANEL 11	TC FIXT. 12	TC FIXT 13	X FACE 14	X APEX 15	X TAB 16	X UP RING 18	X RET. RING 19	Y FACE 20	ΔT Y ΔT-AX 21	ΔT Y ΔT-RAD 22	Y LOW RING 23	Y UP RING 24	Y RET. RING 25	
8-15-74	0730	-2.63	-2.40	-2.40	+.529	+.495	+.418	+.388	-5.43	-3.51	-5.02	-1.27	-.824	-5.32	+1.54	+.172	-.842	-1.22	-1.06	
		24	27	27	74	73	72	71.5	-25	9	-17	46	53	-23	+27.5	[illegible]	52	46	49	
	0800	-2.63	-2.01	-2.01	+1.56	+1.53	+1.59	+1.55	-4.62	-2.57	-4.10	+.088	+.31	-4.44	+1.69	+.278	+.427	+.111	+.213	
		24	34	34	89	89	90	89	-11	25	-1	79	73	-7	[illegible]	[illegible]	72	67	69	
	0900	-2.62	-1.63	-1.64	+1.59	+1.57	+1.64	+1.61	-3.60	-1.81	-3.00	+.387	+.692	-3.20	+1.34	+.330	+.702	+.416	+.391	
		24	40	40	90	90	91	90	+9	37	~~+16~~ 17	72	76	+14	+22.3	+5.50	77	72	72	
	0930	-2.63	-1.56	-1.56	+1.57	+1.56	+1.67	+1.64	-3.20	-1.58	-2.68	+.493	+.722	-2.96	+1.28	+.326	+.773	+.500	+.446	
		24	41	41	+89.5 ~~91~~	+89	+91	+90.5	+14	40.5	27.5	73	76.5	18.5	+21.3	+5.43	77.5	73.5	72.5	
	1000	-2.62	-1.51	-1.51	+1.67	+1.66	+1.73	+1.70	-3.00	-1.42	-2.35	+.590	+.743	-2.82	+1.25	+.378	+.821	+.546	+.481	Change Temp to +60°C (from +90°C)
		24	42	42	91	91	92	91.5	17.5	43.5	28	74	77	20.5	+20.8	+5.3	78	74	73	
	1030	-2.61	-1.61	-1.62	-.347	-.386	-.289	-.314	-.314	-2.12	-2.70	-.909	-.767	-3.01	+.770	+.212	-.814	-.917	-1.02	
		24	40.5	40.5	60.5	59.5	61	61	15 ~~61~~	32	23	51.5	53.5	17	+12.8	+3.53	53	51	49.5	
	1100	-2.61	-1.79	-1.79	-.423	-.465	-.384	-.412	-2.66	-2.59	-3.27	-1.19	-1.01	-3.51	+.846	+.164	-1.04	-1.17	-1.25	
		24	37	37	59	58.5	59.5	59	6.5	24	13	47	49.6	9	+14.3	+2.78	49	47	46	
	1130	-2.60	-1.86	-1.86	-.430	-.470	-.385	-.411	-3.99	-2.83	-3.59	-1.26	-1.05	-3.82	+.918	+.165	-1.10	-1.23	-1.28	
		24	36.5	36.5	59	58.5	59.5	59	+0.5	20	7.5	45.5	49	3.5	+15.6	+2.80	48	46	45.5	
	1200	-2.60	-1.92	-1.93	-.436	-.470	-.395	-.417	-4.19	-2.98	-3.79	-1.31	-1.08	-4.01	+.961	+.167	-1.14	-1.27	-1.31	
		24	35.5	35.5	59	58.5	59.5	59	-2.5	17.5	4	45	48.5	+0.5	+16.3	+2.83	47.5	45.5	46	
	1230	-2.58	-2.15	-2.15	-.398	-.438	-.361	-.388	-4.29	-3.04	-3.89	-1.31	-1.07	-4.10	+.991	+.169	-1.13	-1.27	-1.30	
		24	31.5	31.5	59.6	58.5	60	60	-4	16.5	2.5	45	48.5	-1.	+17.1	+2.91	47.5	45.5	45	
	1300	-2.68	-2.23	-2.23	-.421	-.458	-.375	-.401	-4.36	-3.09	-3.96	-1.33	-1.08	-4.16	+1.00	+.170	-1.16	-1.29	-1.32	
		24	30	30	59	58.5	60	59	-5.5	16	1.0	45	48.5	-2	+17.24	+2.93	47	45.5	45	
	1330	-2.58	-2.29	-2.29	-.429	-.466	-.379	-.407	-4.40	-3.12	-4.00	-1.34	-1.09	-4.20	+1.01	+.170	-1.16	-1.30	-1.32	
		24	29	29	59	58.5	60	59	-6	15.5	0	44.5	48	-3	+17.3	+2.93	47	45	45	

* Enter appropriate data system termination symbol for each test parameter to be monitored.

TEST PARAMETER DATA RECORD

		T.A.		Tc Block		X					Y					
						Face	Apex	Tab	Up Ring	Ref. Ring	Face	ΔT Az	ΔT El	Lo Ring	Up Ring	Ref. Ring
Date	Time (0-24Hr)	10*	11*	12*	13*	14*	15*	16*	18*	19*	20*	21*	22*	23*	24*	25*
Test #22 8-15-74	1400	-.426	-.466	-.377	-.405	-4.43	-3.13	-4.02	-1.34	-1.09	-4.22	+1.01	+.169	-1.16	-1.30	-1.32
		59	58.5	60	59.5	-6.5	15.6	+0.5	44.5	48	-3	+17.4	+2.91	47	45	45
TEST	14:12:41	-.419	-.456	-.379	-.406	-4.42	-3.11	-4.03	-1.34	-1.11	-4.23	+1.04	+.169	-1.18	-1.31	-1.32
		59	58.5	59.5	59.5	-6.5	15.5	0	44.5	48.0	-3.5	+17.9	+2.91	47	45	45
DATA	14:30:01	-.435	-.479	-7.88	-.415	-4.39	-3.08	-4.02	-1.34	-1.10	-4.21	+.989	+.160	-1.18	-1.31	-1.31
		59	58.5	N.G.	59	-6.0	16.	.5	44.5	48.	-3.	+17.05	+2.76	47	45	45
T-T #13 8-16-74	8:55:55	-1.76	-1.76	-2.50	-1.76	-1.91	-1.78	-1.86	-1.83	-1.82	-1.91	+.066	+.044	-1.78	-1.82	-1.83
	°F	100	100	?.	100	96	100	97	98	98	96	+1.°F	+.73°C	100	98	98

* Enter appropriate data system termination symbol for each test parameter to be monitored.

11.0 VARIATION SHEET

LAGEOS
THERMAL-OPTICAL TEST

#	Reference Paragraph	Variation Description	BxA T.C.	Therm Eng.	Prog. Mgr.
1	10.1 Sht 31 10.1 Sht 29 10.1 Sht 30	Change DAS Recorder channels for radiometers to DAS ~~32~~ 33 & DAS 34. DAS 32 is isolation channel. TC #1 assigned to FFDI Ambient. Add TC #29 Ice Point Reference, DAS 0	[signature]	EAB	JMB
2	7.17.3	Add "Repeat 7.10.1 & 7.10.2	[signature]	EAB	JMB
3	~~After 7.~~	~~Add ADDENDUM 1, Test Article-Fixture Assembly Operations~~	[signature]	EAB	JMB
4	6.2.11 8.13 8.18 9.6	Add " - - - per STA 1036	[signature]	EAB	JMB
5	7.25	Delete this paragraph	[signature]	EAB	JMB
6	8.0 b.	Change gradient temperature change to 15% & example to read "a 2.0°C gradient goes beyond 1.7 or 2.3°C".	[signature]	EAB	JMB
7	8.0	Delete check-off blanks for reference retroreflector photos	[signature]	EAB	JMB

Aerospace Systems Division

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NO. TP2374455

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DATE 9 July 1974

REV. NO.

11.0 VARIATION SHEET

#	Reference Paragraph	Variation Description	BxA T.C.	Therm Eng.	Prog. Mgr.
8	8.4.2.1 8.7.13 8.12.2 8.15.2 8.17.2 9.3.1 9.5.2	Add step: "Obtain an FFDI verification photo using the reference retroreflector. Number the photo & enter number in Test Data Sheet."	JWM	EAS	JMB
9	Test Data Sheets 1, 4, 9, 10, 12, 13, 14	Add data blank for FFDI verification photo number.	JWM	EAS	JMB
~~10~~	~~8.20~~	~~Add paragraph: Inspect the Test Article Assembly for visual evidence of degradation due to previous testing. For each of the six retroreflectors, loosen the #2 mounting screws and re-torque to the specified value. To avoid breakage of any "frozen" screws, loosening torque shall not exceed 3.5 in.-lb. Mark screw heads so that any turning may be detected.~~	JWM		
11	9.8	Add paragraph: Inspect the Test Article Assembly for visual evidence of degradation due to previous testing. Verify that the retroreflector #2 mounting screw tightening torque has not decreased from the specified value.	JWM	EAS	JMB

LAGEOS
THERMAL-OPTICAL TEST

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11.0 VARIATION SHEET

#	Reference Paragraph	Variation Description	BxA T.C.	Therm Eng.	Prog. Mgr.
12	9.1	Change to read: "Verify that retroreflector E in the Test Article Panel has been reinstalled in the 100 degree orientation. See Figure 9.	[illegible]	EaG	JmB
13	Addendum 2.7.1	Change to read: "- - - - mylar side up."	[illegible]	EaG	JmB
14	10.1 sht 29	Delete TC #3 Window Hood Backup	[illegible]	EaG	JmB
15	10.1 sht 30	Add TC 30 & 31 on Thermal Fixture for Pre-Test Verification only.	[illegible]	EaG	JmB
16	10.1 sht 29 & sht 30	Add Thermocouple (TC) Feedthru channel numbers	[illegible]	EaG	JmB
17	On page 6; 7.1, Item 3, 7.5, 7.6, 7.7 — on page 7; 7.11 & 7.12 — on page 8; 7.18, 7.19, 7.21 Variation Item 3 at page 9; 7.24	Delete as listed.	[illegible]	EaG	JmB
18	—	Add pages 8A, 8B & 8C Add page 28A, Figure 10	[illegible]	EaG	JmB
19	—	Add page 27A, DWG 2374458 X2 ECN	[illegible]	EaG	JmB
20	—	Add DWGS 2374466 w/X3 ECN & 2374459 as Figures 11 & 12 respectively - pages 28B, C, D	[illegible]	EaG	JmB

LAGEOS
THERMAL-OPTICAL TEST

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11.0 VARIATION SHEET

#	Reference Paragraph	Variation Description	BxA T.C.	Therm Eng.	Prog. Mgr.
21	Addendum I 2.6	Change callout to DWG 2374466-X3.	[signature]	EAG	JMB
22	PAGE 32 10.2	Add Test Sequence - As Run Summary	[signature]	EAG	JMB
23	PAGE 29 10.1	TC#17 Lead wire inaccessible in insulation blanket. Delete requirement for TC#17, RetroX lower mounting ring, thermal data	[signature] 8-6-74 0400	EAG	JMB
24	Paragraph #8.5.2	Change 1×10^{-6} Torr to 2×10^{-5} Torr	C7 8/6/74 1035	EAG	JMB 8/6/74 1045
25	PARA. 8.7	Perform test no. 4 out-of-sequence, before test no. 3	[signature]	EAG	JMB 8/6/74 1140
26	8.7.2	Add sheets 14A, 14B, 14C. Delete para 8.6.7, sht 13; 8.6.8 thru 8.6.11, sht 14; and 8.7.3 & 8.7.4, sht 14. Ref. TDR 04007	[signature]	EAG 8/8/74	JMB 8/7/74
27	sht 29 10.1	Reconnect thermocouples 15, 16 for individual absolute measurements instead of ΔT measurements. Ref. TDR 04006	[signature]	EAG 8/8/74	JMB 8/9/74
28	8.0 & sht 32 10.2	Sequence of tests may be altered at the discretion of the Test Conductor with concurrence of the LAGEOS Program Mgr & Thermal Eng'r. As-Run sequence to be logged on sht 32.	[signature] 8/8/74	EAG 8/8/74	JMB 8/9/74

LAGEOS
THERMAL-OPTICAL TEST

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#	Reference Paragraph	Variation Description	BxA T.C.	Therm Eng.	Prog. Mgr.
29	8.12	ADD 8.12.3 SHUT DOWN IR LAMP	[signature]	EAS	JmB 8-9-74
30	10.2 Data Sheet 18	Repeat operations of Test No. 2 in order to provide baseline data after interrupting test for the weekend.	[signature]	EAS	JmB
31	Fig 8A sheet 26 and 10.2 sheet 37	Test No. 5 change Test Article temperature to +60°C and delete solar radiation. Take optical data for 15 view angles.	[signature]	EAS	JmB
32	Fig 8A sheet 26 and 10.2 Data Log & 8.16.1	Add Test No. 19 Thermal vacuum Add paragraphs 8.16.2 & 8.16.2.1	[signature]	EAS	JmB
33	FIG. 8A (SHEET 26) & SECT. 10.2 (DATA LOG)	TOTAL LASER FIELD ANGLES FOR TEST # 11: "WAS" 8** "IS" 15***	JM 8-13-74	EAS	JmB
34	Variation Item 10	DELETE VARIATION ITEM 10.	[signature] 8-13-74	EAS	JmB
35	8.21 8.22	Add paragraph: Inspect the Test Article Assembly for visual evidence of degradation due to previous testing. Remove the #2 stainless screws and replace with #2 aluminum screws, MS35202-8. Torque to $1.4^{+0}_{-0.3}$ in. lb.	[signature]	EAS	JmB
36	Fig 9, sht 28	Re-identify C retro configurations to agree with Figure 8A.	[signature]	EAS	JmB

11.0 VARIATION SHEET

#	Reference Paragraph	Variation Description	BxA T.C.	Therm Eng.	Prog. Mgr.
37	FIG. 8A & 9.2.1	Add Test No. 20 Iso/Amb Add 10.2 Data Log, Add para. 9.2.1, 9.2.2, 9.2.2.1	JM	EAG	jms
38	FIG. 8A & 9.4.2	Add Test No. 21 Thermal-Vacuum Add 10.2 Data Log	JM	EAG	jms
39	FIG. 8A; 10.2 Test No. 13 & Test No. 14	Change view angles from 8 to 15 total for each Test, #13 & #14.	JM	EAG	jms
40	P. 46A	MSFC RAN PHOTOMETRIC MEASUREMENTS USING 1/2 ANNULUS AND 60° PIE SHAPED MASKS TO DETERMINE DISTRIBUTION OF LASER RETURN ENERGY. THIS DATA IS FOUND ON P. 46A.	JM	EAG	jms
41	FIG. 8A & 9.5.3	ADD TEST NO. 22 THERMAL-VACUUM AT ~~-20°C~~ +60°C ADD 10.2 DATA LOG 8/15 1000	JM 8-15-74	EAG	jms
42	FIG. 8A; 9.6.1 & Data Sheets 23 & 24	Add Tests 23 & 24. Obtain optical data for retros D, E, F and A, B, C respectively at isothermal/ambient conditions.	JM 8-15-74	EAG	jms

LAGEOS
THERMAL-OPTICAL TEST

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QUALITY ASSURANCE DEPT.
TEST DISCREPANCY REPORT

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TDR 1014dd

8 TEST PROCEDURE NO.	REV.	19 PART NAME	32 SERIAL NO.	38 MO. DAY YR.
2374455	XV	LAGEOS TOV TA	- - - -	08 06 74

44 NAME OF TEST	58 PROGRAM NO.	63 LOC.	PARA NO.	PART NO.	REV
THERMAL-VACUUM	63651	TV	~~8.5.7~~ 8.7.2		

DESCRIPTION OF ANOMALY

Thermocouples 10, 11, 12 & 13, on Test Article Panel and Thermocouple Fixture are reading much colder than any temperature source in the chamber. These four instrumentation circuits are not operating correctly. ALSO, THERMOCOUPLE 14 APPEARS TO BE GIVING AN ERRONEOUS READING.

ORIGINATOR J.P. Monroe

SUMMARY OF TROUBLESHOOTING/RESOLUTION

Return chamber to ambient conditions and troubleshoot the four TC circuits (TC'S 10, 11, 12 & 13). VISUALLY INSPECT THERMOCOUPLE 14 TO DETERMINE LOCATION OF BEAD AND INTEGRITY OF BOND.

Drive Test Article temperature hot (+100°F) via IR Lamp and Tenney, while obtaining retro X&F temperature data. Analysis of data indicates TC 15 not giving reliable data.

8/14/75 TC 14 observed to be lifted from glass. re-glue with Eastman 910.

1	TEST OPERATOR	5	CONTRACT-PURCHASED FUNCTIONAL TEST EQUIP.
2	BXA FACILITY DEFECT	6	TEST FIXTURING DESIGN ERROR
3	TEST SET-UP	7	FACILITY OPERATION PROCEDURE ERROR
4	TEST PROCEDURE	8	HARDWARE DISCREPANCY (CONVERTED TO DR)
65 CODE		0	OTHER (EXPLAIN)=

(ENTER ONE OF THE ABOVE)

CAUSE OF ANOMALY:

Wires reversed in TC connectors on TC 10, 11, 12, 13.

TC 14 visual inspection ok. 8/14/75 re-inspection shows loss of bonding.

CLASSIFICATION OF DEFECT

CR	CRITICAL
MA	MAJOR
MI	MINOR
PA	PAPERWORK

67 CODE MI

DR	DISCREPANCY REPORT	RR	RWK OR REPAIR EQUIP.
WR	WORK REQUEST	CT	CONTINUE TEST
CRD	CHANGE REQUEST DIRECTIVE	OT	OTHER EXPLAIN
TDR	TEST DISCREPANCY REPORT		(ENTER IN BLOCK 69)

LOCATION CODES (ENTER IN BLOCK 63 ABOVE)

CT = COMPONENT TEST LAB	TV = THERMAL-VACUUM LAB
SA = SUBASSEMBLY TEST LAB	VL = VIBRATION LAB
ET = EXPERIMENT TEST LAB	CL = CALIBRATION LAB
ST = SYSTEM TEST LAB	EM = EMI/SCREEN ROOM
TL = TRANSMITTER LAB	CC = CLIMATIC CHAMBER
PL = P.S.E. LAB	HB = HIGH BAY AREA
	OP = OUT OF PLANT

69 CODE TDR

S-109

TEST CONDUCTOR	BXA QA REPRESENTATIVE	GOV'T SOURCE REPRESENTATIVE
J.P. Monroe	C.F. Shizzy	N/A

Special TC Tests ref TDR 04006

@ II

Bendix Aerospace Systems Division

NO. | REV. NO. II

PAGE ___ OF ___

TDR 04006
Attachment

TEST PARAMETER DATA RECORD

X Y

IR ON

Tenney ON

Date	Time (0-24Hr)	11*	12*	13*	14*	15*	16*	18*	19*	20*	21*	22*	23*	24*	25*	*	*	*	*	*	*	*	*	*
8-7-74	14 55				-2.43	.007	.016			-2.39	.004	.008												
					-2.33	.007	.018			-2.25	.005	.010												
						.008	.018			-2.24	.006	.010												
					-2.33	.07	.18	-2.44		-2.25	.05	.09		-2.42										
						2.40	2.51				2.30	2.34												
													A 2.0	P .9		1.0	1.5							
					2.41	2.48	2.45			2.37	2.39	2.41												
					2.34	2.47	2.40			2.28	2.33	2.35												
					2.32	2.45	2.37			2.24	2.30	2.33												
					28.5	26.5	28			30	29	28.5												
			2.32	2.32	2.45	2.35	2.43			2.43	2.41	2.42												
			83	83	80	83	80			80	81	81												
			2.16	2.16	2.41	2.22	2.36			2.40	2.36	2.35												
			88	88	81	86.5	82.5			81.5	82.5	83.0												
					2.33	2.06	2.24			2.32	2.26	2.24												
			1.97	1.97	2.32	2.06	2.24	2.15	2.10	2.32	2.26	2.24	2.03	2.12	2.09									
			94	94	83	91.5	86	89	90	93	85.5	86	92	[illegible]	91									
8-7-74	1602		1.86	1.86	2.22	1.94	2.13	2.03	1.98	2.22	2.15	2.13	1.92	1.99	1.97									
			97	97	96.5	95	89	92	94	96.5	89	89	95.5	93	94									

Error

* Enter appropriate data system termination symbol for each test parameter to be monitored.

EQA
RAC OK TO PROCEED WITH TEST

(111)

QUALITY ASSURANCE DEPT.
TEST DISCREPANCY REPORT

Page ___ of ___

TDR 1 94

TEST PROCEDURE NO.	REV.	PART NAME	SERIAL NO.	MO. DAY YR.
2374455	X1	LAGEOS TOV TA	- - -	08 06 74

NAME OF TEST	PROGRAM NO.	LOC.	PARA NO.	PART NO.	REV
THERMAL-VACUUM	63651	TV	8.7.2		

DESCRIPTION OF ANOMALY

LAGEOS RETROREFLECTORS APPEAR TO HAVE CONTAMINA[TION] ON SURFACES. RETROREFLECTORS A, C, E & F ARE AFFECTED.

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

ORIGINATOR [signature]

SUMMARY OF TROUBLESHOOTING/RESOLUTION

REMOVE TEST ARTICLE FROM TEST SETUP; DISASSEMBLE & CLEA[N] ALL PARTS. RE-ASSEMBLE & INSTALL IN TEST SETUP. REPEAT TEST NO. 1 AND NO. 2 OPTICAL TESTS (DESIGNATE AS TESTS NO. 16 AND 17, RESPECTIVELY.) AS REFERENCE DATA. RETROREFLECTOR C IS TO BE IN THE 80° POSITION, BUT TE[ST] CLEANING OF PARTS SHALL BE TO 2374465 MODIFIED, AS MARKED UP.

8/7/74 0530 CLEANING COMPLETED AND TEST ARTICLE REASSEMBLED PER TEST NO. 2 CONFIGURA[TION]

1	TEST OPERATOR	5	CONTRACT-PURCHASED FUNCTIONAL TEST EQUIP.
2	BXA FACILITY DEFECT	6	TEST FIXTURING DESIGN ERROR
3	TEST SET-UP	7	FACILITY OPERATION PROCEDURE ERROR
4	TEST PROCEDURE	8	HARDWARE DISCREPANCY (CONVERTED TO DR)
		0	OTHER (EXPLAIN)*

CODE 04 (ENTER ONE OF THE ABOVE)

CAUSE OF ANOMALY:

Inadequate cleaning of parts prior to original assembly, due to cleaning procedure. Rev 2374465 to add operations.

CLASSIFICATION OF DEFEC[T]

CR	CRITICAL
MA	MAJOR
MI	MINOR
PA	PAPERWOR[K]

CODE

DR	DISCREPANCY REPORT	RR	RWK OR REPAIR EQUIP.
WR	WORK REQUEST	CT	CONTINUE TEST
CRD	CHANGE REQUEST DIRECTIVE	OT	OTHER EXPLAIN
TDR	TEST DISCREPANCY REPORT		(ENTER IN BLOCK 69)

CODE TDR

LOCATION CODES (ENTER IN BLOCK 63 ABOVE)

CT = COMPONENT TEST LAB
SA = SUBASSEMBLY TEST LAB
ET = EXPERIMENT TEST LAB
ST = SYSTEM TEST LAB
TL = TRANSMITTER LAB
PL = P.S.E. LAB
TV = THERMAL-VACUUM LAB
VL = VIBRATION LAB
CL = CALIBRATION LAB
EM = EMI/SCREEN ROOM
CC = CLIMATIC CHAMBER
HB = HIGH BAY AREA
OP = OUT OF PLANT

S-111

TEST CONDUCTOR	BXA QA REPRESENTATIVE	GOV'T SOURCE REPRESENTATIVE
[signature]	[signature]	N/A

(118)

QUALITY ASSURANCE DEPT.
TEST DISCREPANCY REPORT

Page 1 of 2

1 C 4 0 0 [illegible]

8 TEST PROCEDURE NO.	REV.	19 PART NAME	32 SERIAL NO.	38 MO. DAY YR.
2 3 7 4 4 5 5	X 1	LAGEOS TOV TA		0 8 0 7 7 4

44 NAME OF TEST	58 PROGRAM NO.	63 LOC.	PARA NO.	PART NO.	REV
THERMAL VACUUM	C 3 C 5 1	T V	8.7.2		

DESCRIPTION OF ANOMALY

Photometric data from FFDI is reading low.

ORIGINATOR: [signature]

SUMMARY OF TROUBLESHOOTING/RESOLUTION

Survey of FFDI exit beam shows non-uniformity across beam.

Re-adjusted beam pinhole in FFDI to obtain uniform beam intensity. Additional adjustments necessitate repeat retro @ 0° readings, Test #16, and obtain the rest of the required data.

1	TEST OPERATOR	5	CONTRACT-PURCHASED FUNCTIONAL TEST EQUIP.	
2	BXA FACILITY DEFECT	6	TEST FIXTURING DESIGN ERROR	
3	TEST SET-UP	7	FACILITY OPERATION PROCEDURE ERROR	
4	TEST PROCEDURE	8	HARDWARE DISCREPANCY (CONVERTED TO DR)	
		0	OTHER (EXPLAIN)=	

65 CODE **02** (ENTER ONE OF THE ABOVE)

CAUSE OF ANOMALY: Beam pinhole out of adjustment.

CLASSIFICATION OF DEFECT

CR	CRITICAL
MA	MAJOR
MI	MINOR
PA	PAPERWORK

67 CODE

DR	DISCREPANCY REPORT	RR	RWK OR REPAIR EQUIP.
WR	WORK REQUEST	CT	CONTINUE TEST
CRD	CHANGE REQUEST DIRECTIVE	OT	OTHER EXPLAIN
TDR	TEST DISCREPANCY REPORT		(ENTER IN BLOCK 69)

69 CODE **TDR**

LOCATION CODES (ENTER IN BLOCK 63 ABOVE)

CT = COMPONENT TEST LAB
SA = SUBASSEMBLY TEST LAB
ET = EXPERIMENT TEST LAB
ST = SYSTEM TEST LAB
TL = TRANSMITTER LAB
PL = P.S.E. LAB
TV = THERMAL-VACUUM LAB
VL = VIBRATION LAB
CL = CALIBRATION LAB
EM = EMI/SCREEN ROOM
CC = CLIMATIC CHAMBER
HB = HIGH BAY AREA
OP = OUT OF PLANT

S-112

TEST CONDUCTOR	BXA QA REPRESENTATIVE	GOV'T SOURCE REPRESENTATIVE
[signature]	C7 [signature]	N/A

(113)

QUALITY ASSURANCE DEPARTMENT
TEST DISCREPANCY REPORT

CONTINUATION SHEET	TDR NO. 04008 Page 2 of 2
Test Procedure No. 2374455-X1	Date 8 AUG 74

Trouble Shooting Procedure:

Re-adjustment of beam pinhole did not correct the FFDI malfunction. Manufacturer's rep. called in.

8-8-74 Action by Zygo rep.

1. Re-adjusted pinhole
2. Re-adjusted laser beam uniformity
3. Reduced intensity to laser monitor
4. Removed one (of two) neutral density filter from camera leg.
5. Dusted all optics.

310-78-2

(114)

QUALITY ASSURANCE DEPT.
TEST DISCREPANCY REPORT

Page 1 of 1

1 TDR 644

8 TEST PROCEDURE NO.	REV.	19 PART NAME	32 SERIAL NO.	38 MO. DAY YR.
2374455	X1	LAGEOS TOV TA		08 14 74

44 NAME OF TEST	58 PROGRAM NO.	63 LOC.	PARA NO.	PART NO.	REV
THERMAL-OPTICAL	63651		9.2.2.1		

DESCRIPTION OF ANOMALY

After taking the first 5 data points, it was observed that the fixture vernier adjustment was off by approximately +1 degree field view angle.

ORIGINATOR [signature]

SUMMARY OF TROUBLESHOOTING/RESOLUTION

Re-adjust vernier to proper setting.
Post warning sign to check setting before & after each test data group.
Repeat all measurements for Test No. 20 and continue test. Identify Test Data Log as "Test 20A.

1	TEST OPERATOR	5	CONTRACT-PURCHASED FUNCTIONAL TEST EQUIP.
2	BXA FACILITY DEFECT	6	TEST FIXTURING DESIGN ERROR
3	TEST SET-UP	7	FACILITY OPERATION PROCEDURE ERROR
4	TEST PROCEDURE	8	HARDWARE DISCREPANCY (CONVERTED TO DR)
		0	OTHER (EXPLAIN)*

65 CODE 03 (ENTER ONE OF THE ABOVE)

CAUSE OF ANOMALY: Gradual back-off of vernier stop.

CLASSIFICATION OF DEFECT

CR	CRITICAL
MA	MAJOR
MI	MINOR
PA	PAPERWORK

67 CODE MI

DR	DISCREPANCY REPORT	RR	RWK OR REPAIR EQUIP.
WR	WORK REQUEST	CT	CONTINUE TEST
CRD	CHANGE REQUEST DIRECTIVE	OT	OTHER EXPLAIN
TDR	TEST DISCREPANCY REPORT		(ENTER IN BLOCK 69)

LOCATION CODES (ENTER IN BLOCK 63 ABOVE)

CT = COMPONENT TEST LAB
SA = SUBASSEMBLY TEST LAB
ET = EXPERIMENT TEST LAB
ST = SYSTEM TEST LAB
TL = TRANSMITTER LAB
PL = P.S.E. LAB
TV = THERMAL-VACUUM LAB
VL = VIBRATION LAB
CL = CALIBRATION LAB
EM = EMI/SCREEN ROOM
CC = CLIMATIC CHAMBER
HB = HIGH BAY AREA
OP = OUT OF PLANT

69 CODE TDR

S-114

TEST CONDUCTOR	BXA QA REPRESENTATIVE	GOV'T SOURCE REPRESENTATIVE
[signature]	C. Sheppy	N/A

12.0 TEST SIGN-OFF SHEET

C.F. Sheggy 8/19/74

Environmental/Quality Test T-V Engineer

J.P. Monroe 8-19-74

Environmental/Quality Test Conductor

E.A. Granholm 8-19-74

LAGEOS Thermal Engineer

J.M. Bensinger 8-19-74

LAGEOS Program Manager

1.0 This addendum specifies the LAGEOS Test Article and Fixture assembly operations. Hardware items included are: Test Article Panel, PN 2374464; Thermocouple Fixture, PN 2374466; Fixture Thermal Assembly, PN 2374460-23; LAGEOS Retroreflectors (6); and ALSEP Retroreflectors (2).

2.0 ASSEMBLY OPERATIONS

2.1 Clean the Test Article Panel, Thermocouple Fixture, and the Fixture Thermal Assembly per Dwg. 2374465. 7/30/74

2.2 Attach the Thermocouple Fixture to the Fixture Thermal Ass'y. using the machine screws provided. Thermal grease is to be applied on the interface surfaces. 8/5/74

2.3 Attach thermocouples, 12 and 13, to the Thermocouple Fixture. See Figure 6. Dress leads thru the access holes. 8/1/74

2.4 Attach thermocouples, 10, and 11, to the Test Article Panel. See Figure 6. Dress leads across the block between the rows of retro cavities. 8/5/74

2.5 Bond thermocouples, 15 thru 19 and 21 thru 25, onto the ALSEP retros and mounting rings. See Figure 6. 8/2/74

2.6 Install the ALSEP retros in the Thermocouple Fixture per Dwg. 2374466-X~~2~~ 3. Dress leads thru the ~~cavity~~ access holes. See Figure 6. 8/2/74

tcn 21

2.7 Bond thermocouples, 14 and 20, to the front face center of the ALSEP Retros. See Figure 6. Dress leads across block to nearest edge. 8/2/74

2.7.1 When adhesive of 2.7 is dry, apply a small dot of adhesive on top of the thermocouple and emplace a 1/8 inch diameter spot of aluminized mylar with the ~~aluminized~~ mylar side up. 8/2/74

Item 13

2.8 Cut an aluminized mylar insulation blanket and fit to the assembly. The blanket is to fold into the Fixture Thermal Assembly approximately one inch on all four sides. 8/5/74

2.9 Install the Test Article Panel into the Fixture Thermal Assembly after applying thermal grease to the interface surfaces. Secure with the 1/4 - 20 machine screws provided. ✓ 8/5/74

Use CAUTION to avoid tearing the insulation blanket.

2.10 Install the six LAGEOS retros in the Test Article Panel for the Test No. 1 configuration. See Figures 8 and 9. ✓ 8/5/74

2.11 Fit the insulation blanket loosely around the entire assembly. ✓ 8/5/74

3.0 On completion of assembly operations, place the assembly in a plastic bag for temporary storage protection. N/A

APPENDIX T

LAGEOS RETROREFLECTOR ACCEPTANCE DATA

CERTIFICATES OF COMPLIANCE

ZYGO CORPORATION

Dated August 1, 1974

NOTE: Photograph Scale Factor:
1.00 MM in appendix photo = 1.04 MM in original photo.

ZYGO

CERTIFICATE OF COMPLIANCE

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 1

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Specifications:

1) Material (T-19 Suprasil 1 Special) — OK
2) Figure Tolerance R1, R2, R3 ($\lambda/10$) R4 ($\lambda/8$) — OK
3) Far Field Diffraction Pattern (See attached photo) — OK
4) Wavefront Flatness of Each Sector (See attached Interferogram) — OK
5) Protective Bevels — OK
6) Physical Dimensions — OK
7) Workmanship — OK

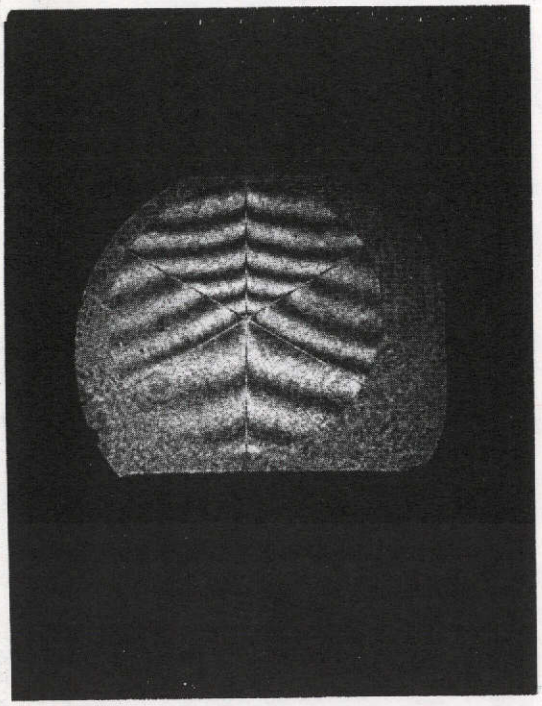
This is to certify that the cube corner, I. D. No. 1 is in conformance with all the specifications and drawings of ghe Bendix purchase order T-2954.

C. A. Zanoni

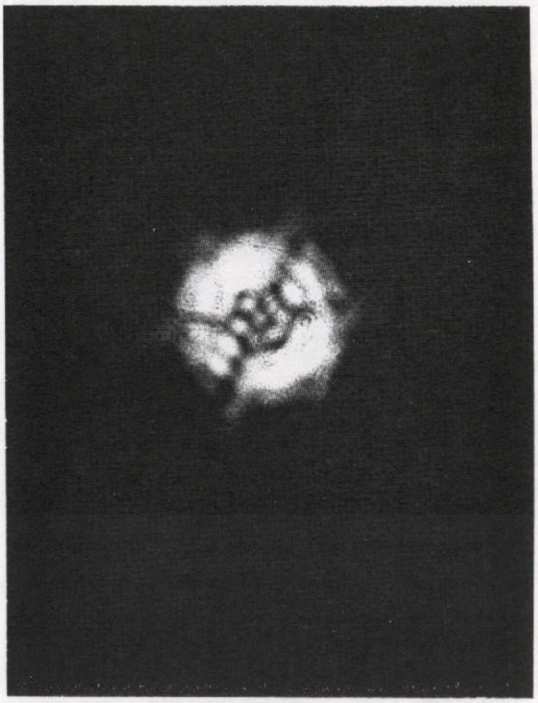
ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO



ZYGO CORPORATION
T-G Interferogram
Item No.: #1
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
(R1, R2 + R3) Chemically Silvered



ZYGO CORPORATION
Far Field Diffraction Pattern
Item No. #1
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
Scale: 1.47 arc sec/mm
Uncoated Surfaces

ZYGO

DATA SHEET

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 1

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Data:

1) Wavefront Deviation of each Sector (Sector 1 is at one o'clock. Count CW)

λ = 632.8nm

Sector 1	0.2 λ
Sector 2	0.15 λ
Sector 3	0.10 λ
Sector 4	0.12 λ
Sector 5	0.10 λ
Sector 6	0.15 λ

2) Dihedral Angles

R1-R2	2.00 arc sec
R2-R3	0.92 arc sec
R1-R3	1.24 arc sec

3) Diameter of Annulus Centroid 22.0 arc sec

Carl Zanoni
C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO

CERTIFICATE OF COMPLIANCE

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 2

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Specifications:

1) Material (T-19 Suprasil 1 Special)	OK
2) Figure Tolerance R1, R2, R3 ($\lambda/10$) R4 ($\lambda/8$)	OK
3) Far Field Diffraction Pattern (See attached photo)	OK
4) Wavefront Flatness of Each Sector (See attached Interferogram)	OK
5) Protective Bevels	OK
6) Physical Dimensions	OK
7) Workmanship	OK

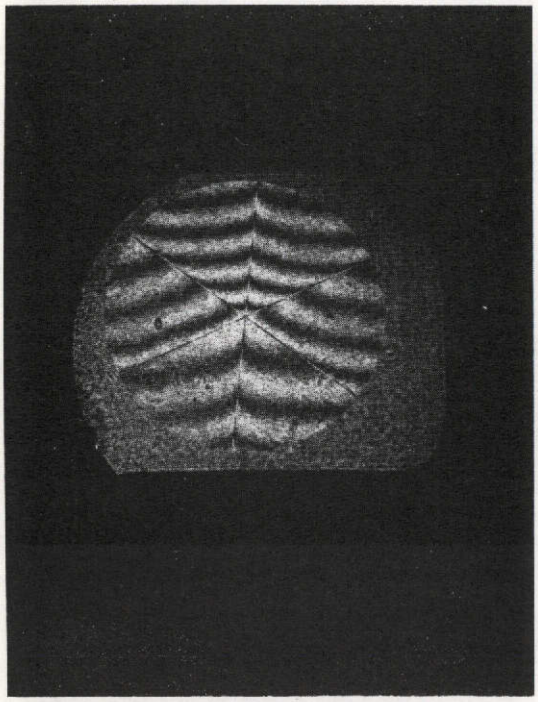
This is to certify that the cube corner, I. D. No. 2 is in conformance with all the specifications and drawings of ghe Bendix purchase order T-2954.

C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO



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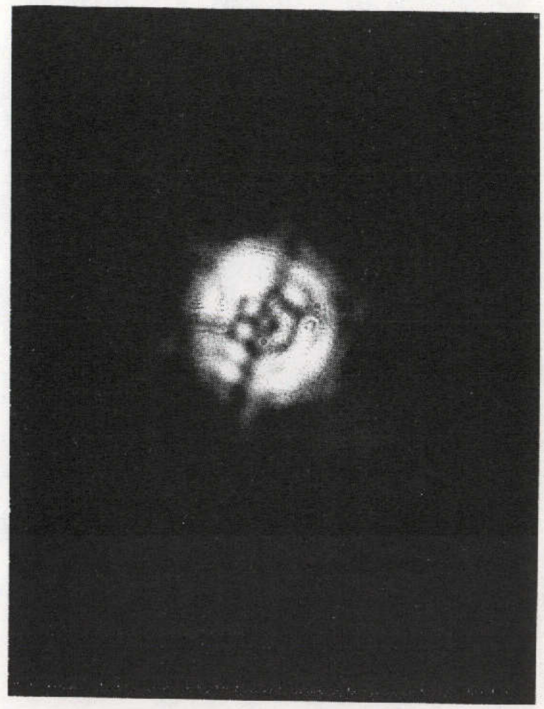


ZYGO CORPORATION
T-G Interferogram
Item No.: #2
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
(R1, R2 + R3) Chemically Silvered

ZYGO CORPORATION
Far Field Diffraction Pattern
Item No. #2
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
Scale: 1.47 arc sec/mm
Uncoated Surfaces

ZYGO

DATA SHEET

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 2

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Data:

1) Wavefront Deviation of each Sector (Sector 1 is at one o'clock. Count CW)

$\lambda = 632.8nm$

Sector 1	0.20 λ
Sector 2	0.15 λ
Sector 3	0.17 λ
Sector 4	0.20 λ
Sector 5	0.10 λ
Sector 6	0.20 λ

2) Dihedral Angles

R1-R2	2.05 arc sec
R2-R3	1.54 arc sec
R1-R3	1.83 arc sec

3) Diameter of Annulus Centroid 19.8 arc sec

C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO

CERTIFICATE OF COMPLIANCE

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 3

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Specifications:

1) Material (T-19 Suprasil 1 Special)	OK
2) Figure Tolerance R1, R2, R3 ($\lambda/10$) R4 ($\lambda/8$)	OK
3) Far Field Diffraction Pattern (See attached photo)	OK
4) Wavefront Flatness of Each Sector (See attached Interferogram)	OK
5) Protective Bevels	OK
6) Physical Dimensions	OK
7) Workmanship	OK

This is to certify that the cube corner, I. D. No. 3 is in conformance with all the specifications and drawings of ghe Bendix purchase order T-2954.

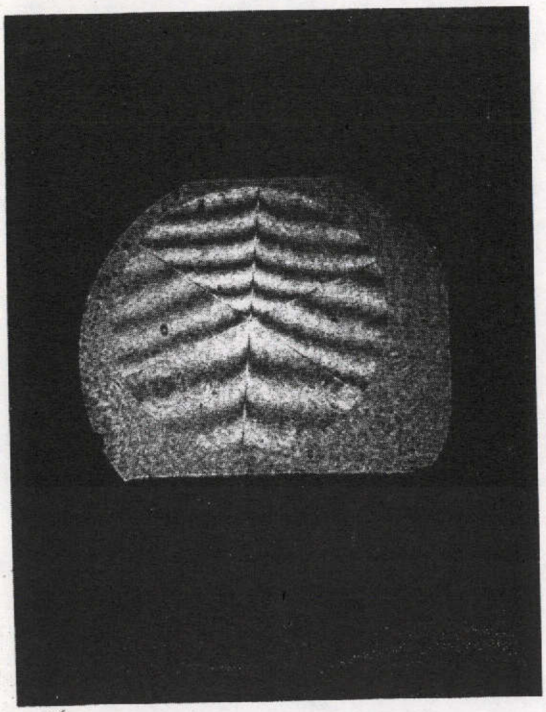
Carl Zanoni

C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

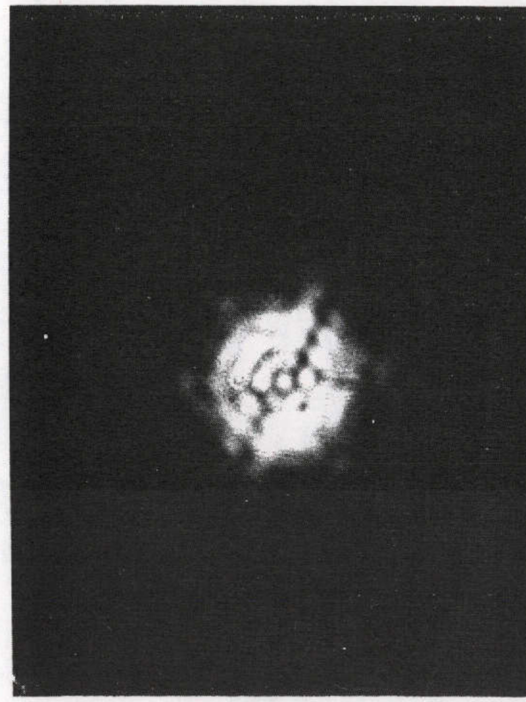
Date: August 1, 1974

ZYGO



#3

ZYGO CORPORATION
T-G Interferogram
Item No.: #3
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
(R1, R2 + R3) Chemically Silvered



ZYGO CORPORATION
Far Field Diffraction Pattern
Item No. #3
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
Scale: 1.47 arc sec/mm
Uncoated Surfaces

ZYGO

DATA SHEET

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 3

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Data:

1) Wavefront Deviation of each Sector
(Sector 1 is at one o'clock. Count CW)

λ = 632.8nm

Sector 1	0.15 λ
Sector 2	0.15 λ
Sector 3	0.10 λ
Sector 4	0.10 λ
Sector 5	0.10 λ
Sector 6	0.10 λ

2) Dihedral Angles

R1-R2	1.81 arc sec
R2-R3	1.08 arc sec
R1-R3	1.42 arc sec

3) Diameter of Annulus Centroid 17.6 arc sec

Carl Zanoni
C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO

CERTIFICATE OF COMPLIANCE

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 4

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Specifications:

1) Material (T-19 Suprasil 1 Special)	OK
2) Figure Tolerance R1, R2, R3 (λ/10) R4 (λ/8)	OK
3) Far Field Diffraction Pattern (See attached photo)	OK
4) Wavefront Flatness of Each Sector (See attached Interferogram)	OK
5) Protective Bevels	OK
6) Physical Dimensions	OK
7) Workmanship	OK

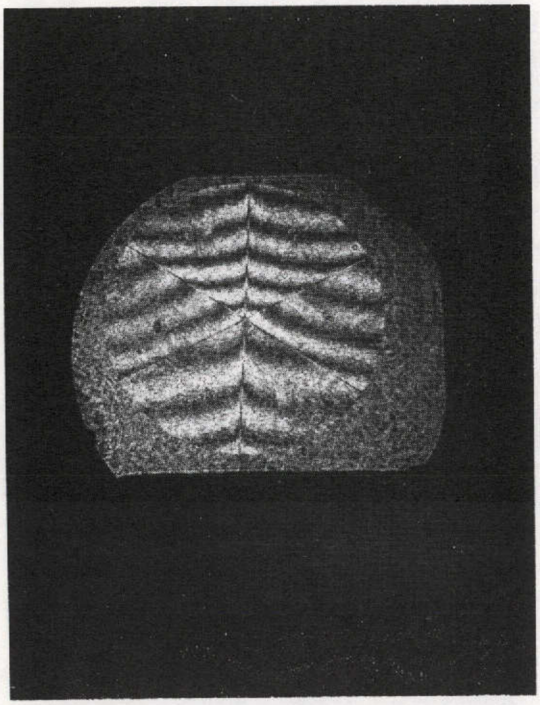
This is to certify that the cube corner, I. D. No. 4 is in conformance with all the specifications and drawings of ghe Bendix purchase order T-2954.

Carl Zanoni
C. A. Zanoni

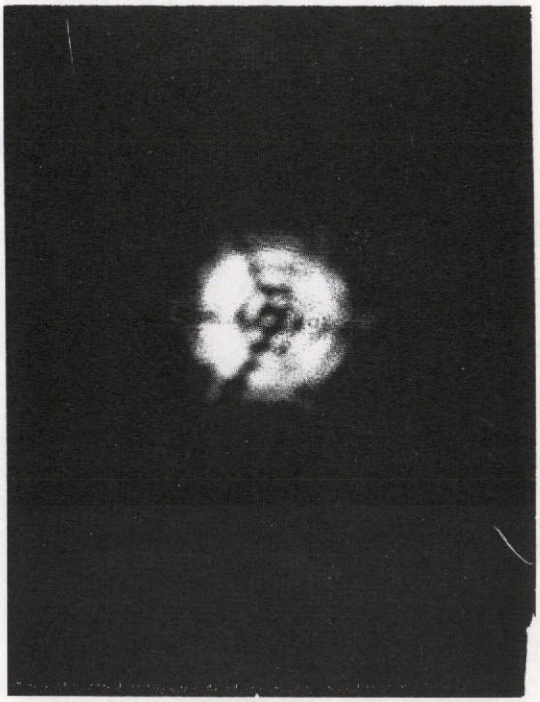
ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO



ZYGO CORPORATION
T-G Interferogram
Item No.: #4
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
(R1, R2 + R3) Chemically Silvered



ZYGO CORPORATION
Far Field Diffraction Pattern
Item No. #4
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
Scale: 1.47 arc sec/mm
Uncoated Surfaces

ZYGO

DATA SHEET

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 4

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Data:

1) Wavefront Deviation of each Sector
(Sector 1 is at one o'clock. Count CW)

$\lambda = 632.8nm$

Sector 1	0.20	λ
Sector 2	0.10	λ
Sector 3	0.20	λ
Sector 4	0.15	λ
Sector 5	0.15	λ
Sector 6	0.20	λ

2) Dihedral Angles

R1-R2	2.00	arc sec
R2-R3	1.60	arc sec
R1-R3	1.57	arc sec

3) Diameter of Annulus Centroid 20.6 arc sec

C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO

CERTIFICATE OF COMPLIANCE

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 5

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Specifications:

1) Material (T-19 Suprasil 1 Special)	OK
2) Figure Tolerance R1, R2, R3 ($\lambda/10$) R4 ($\lambda/8$)	OK
3) Far Field Diffraction Pattern (See attached photo)	OK
4) Wavefront Flatness of Each Sector (See attached Interferogram)	OK
5) Protective Bevels	OK
6) Physical Dimensions	OK
7) Workmanship	OK

This is to certify that the cube corner, I. D. No. 5 is in conformance with all the specifications and drawings of ghe Bendix purchase order T-2954.

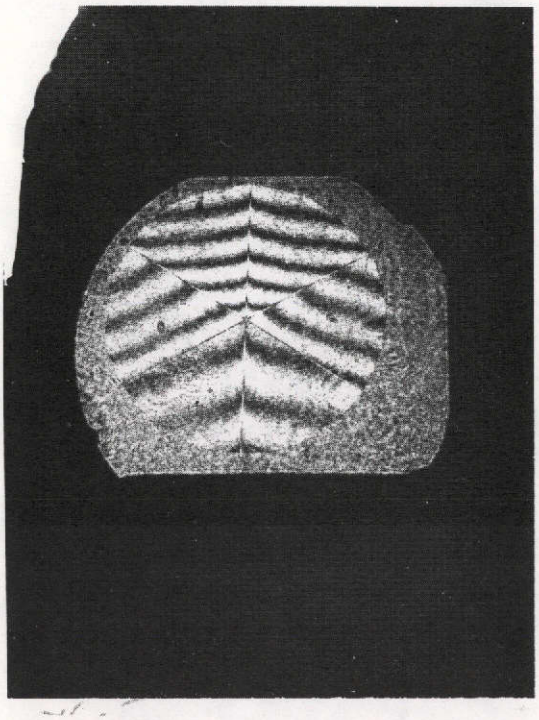
Carl Zanoni

C. A. Zanoni

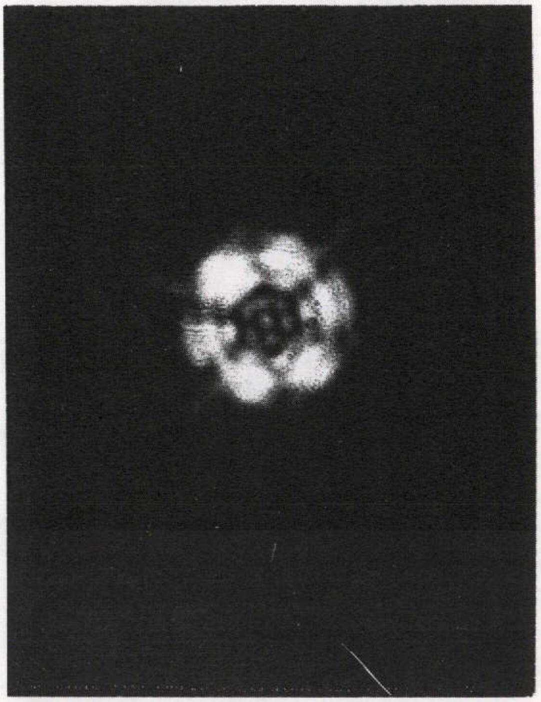
ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO



ZYGO CORPORATION
T-G Interferogram
Item No.: #5
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
(R1, R2 + R3) Chemically Silvered



ZYGO CORPORATION
Far Field Diffraction Pattern
Item No. #5
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
Scale: 1.47 arc sec/mm
Uncoated Surfaces

ZYGO

DATA SHEET

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 5

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Data:

1) Wavefront Deviation of each Sector (Sector 1 is at one o'clock. Count CW)

λ = 632.8nm

Sector 1	0.10	λ
Sector 2	0.20	λ
Sector 3	0.10	λ
Sector 4	0.10	λ
Sector 5	0.10	λ
Sector 6	0.10	λ

2) Dihedral Angles

R1-R2	2.07	arc sec
R2-R3	1.90	arc sec
R1-R3	1.80	arc sec

3) Diameter of Annulus Centroid 23.5 arc sec

Carl Zanoni

C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO

CERTIFICATE OF COMPLIANCE

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 6

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Specifications:

1)	Material (T-19 Suprasil 1 Special)	OK
2)	Figure Tolerance R1, R2, R3 ($\lambda/10$) R4 ($\lambda/8$)	OK
3)	Far Field Diffraction Pattern (See attached photo)	OK
4)	Wavefront Flatness of Each Sector (See attached Interferogram)	OK
5)	Protective Bevels	OK
6)	Physical Dimensions	OK
7)	Workmanship	OK

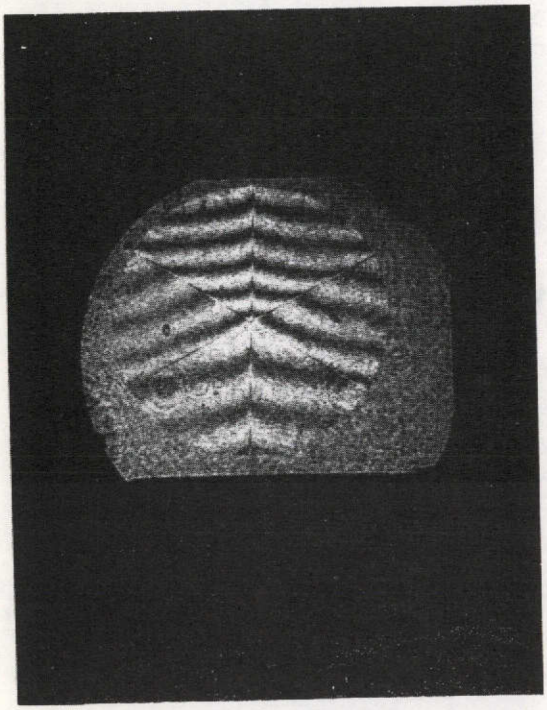
This is to certify that the cube corner, I. D. No. 6 is in conformance with all the specifications and drawings of ghe Bendix purchase order T-2954.

Carl Zanoni
C. A. Zanoni

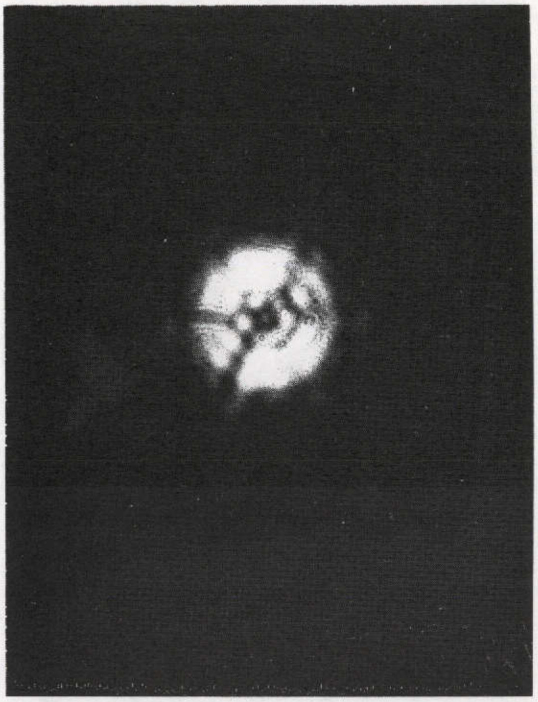
ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

ZYGO



ZYGO CORPORATION
T-G Interferogram
Item No.: #6
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
(R1, R2 + R3) Chemically Silvered



ZYGO CORPORATION
Far Field Diffraction Pattern
Item No. #6
Contract No.: T-2954
Cube Corner: LAGEOS
Phase B
Date: August 1, 1974
Scale: 1.47 arc sec/mm
Uncoated Surfaces

ZYGO

DATA SHEET

Item: Cube Corner; LAGEOS - Phase B

Item I. D. No.: 6

Contract No.: T-2954

Applicable Documents:

1) Drawing No.: 9118-1001 Rev. B (Zygo)
2) Specification: LAG-1 (Bendix)

Data:

1) Wavefront Deviation of each Sector (Sector 1 is at one o'clock. Count CW)

λ = 632.8nm

Sector 1	0.10 λ
Sector 2	0.12 λ
Sector 3	0.10 λ
Sector 4	0.10 λ
Sector 5	0.10 λ
Sector 6	0.15 λ

2) Dihedral Angles

R1-R2	1.30 arc sec
R2-R3	1.00 arc sec
R1-R3	1.16 arc sec

3) Diameter of Annulus Centroid 18.4 arc sec

Carl Zanoni
C. A. Zanoni

ZYGO CORPORATION
Laurel Brook Road
Middlefield, Connecticut 06455

Date: August 1, 1974

APPENDIX U

LAGEOS Thermal/Optical Test Data -

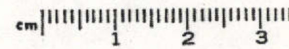
Far-Field Diffraction Pattern Photographs

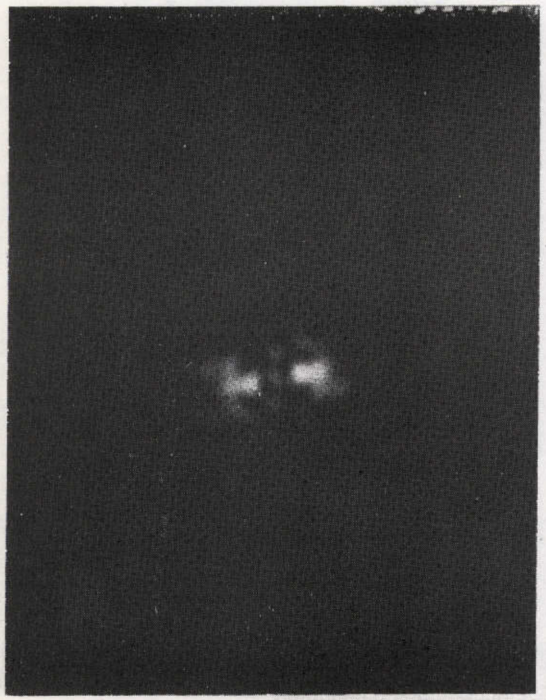
NOTE:

a) This data is identified by Test Number and Photograph Number; test conditions for each photograph are identified in Appendix R.

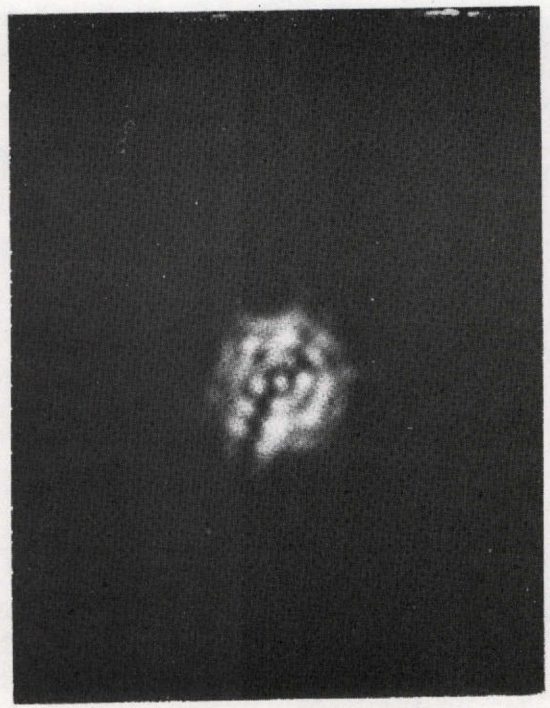
b) The FFDI scale factor is 1.47 arc sec/mm. The centimeter scale provided on each page must be used for any length measurement.

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

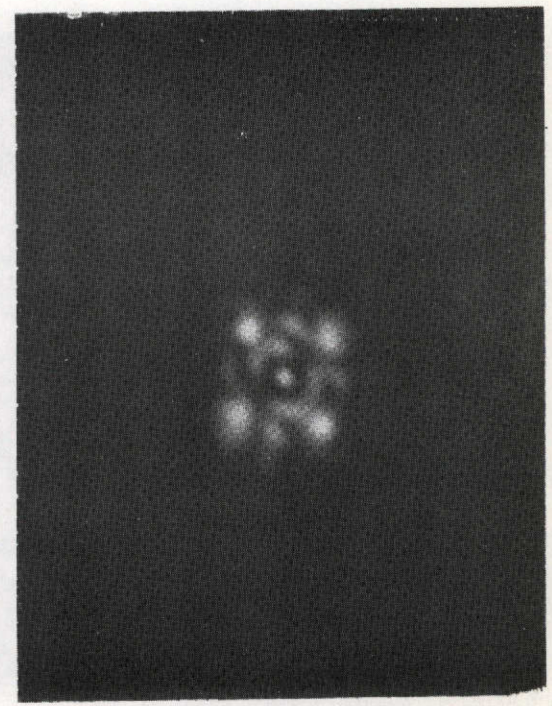




Test No. 1
Retro: CALIB.
Photo No. 1
Exposure Time: 1/250 SEC

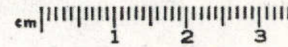


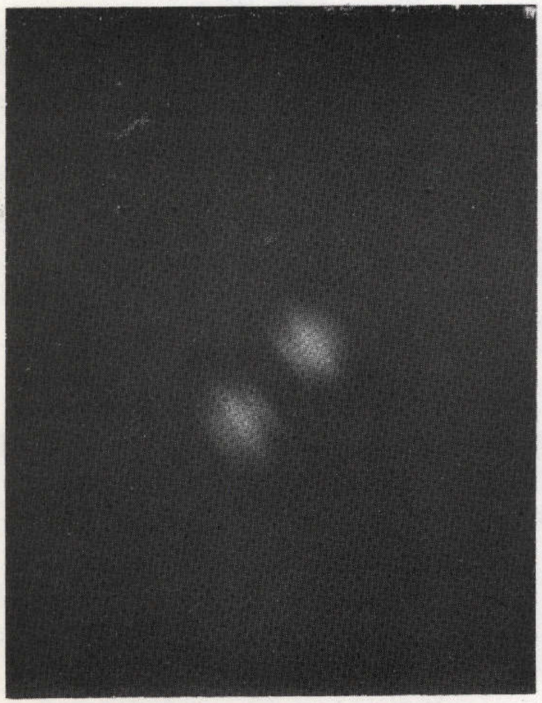
Test No. 1
Retro: A
Photo No. 2
Exposure Time: 1/125 SEC



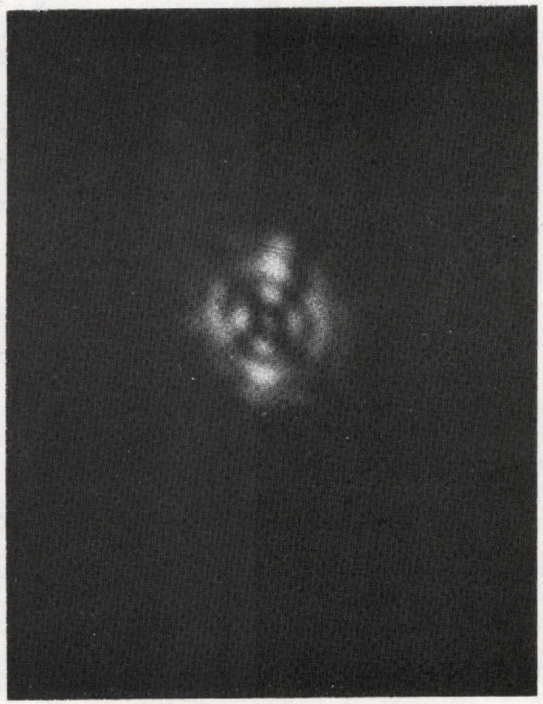
Test No. 1
Retro: A
Photo No. 3
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





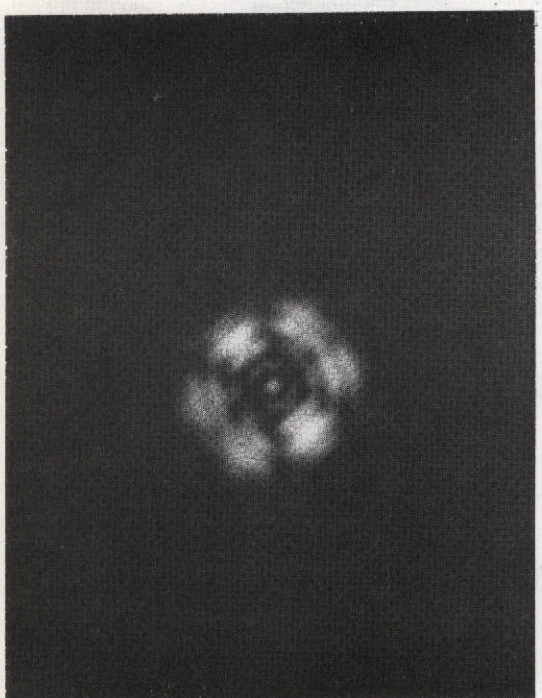
Test No. 1
Retro: A
Photo No. 4
Exposure Time: 1/8 SEC



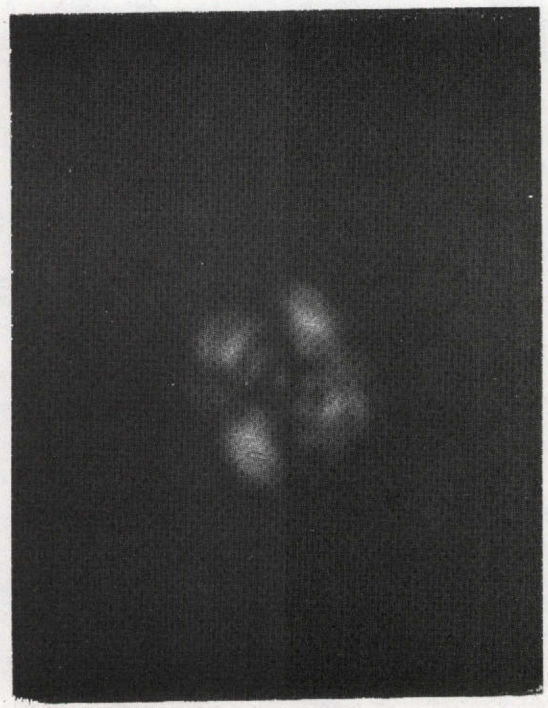
Test No. 1
Retro: A
Photo No. 5
Exposure Time: 1/125 SEC

Test No. 1
Retro: A
Photo No. 6
Exposure Time: 1/125 SEC

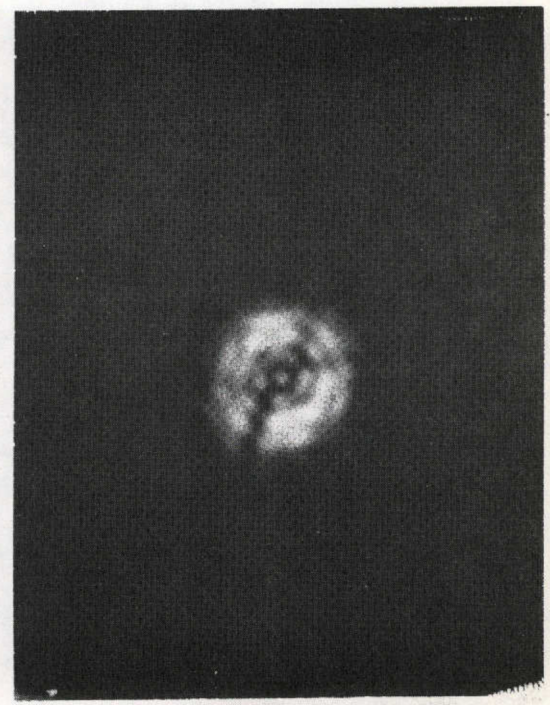
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 1
Retro: B
Photo No. 7
Exposure Time: 1/125 SEC



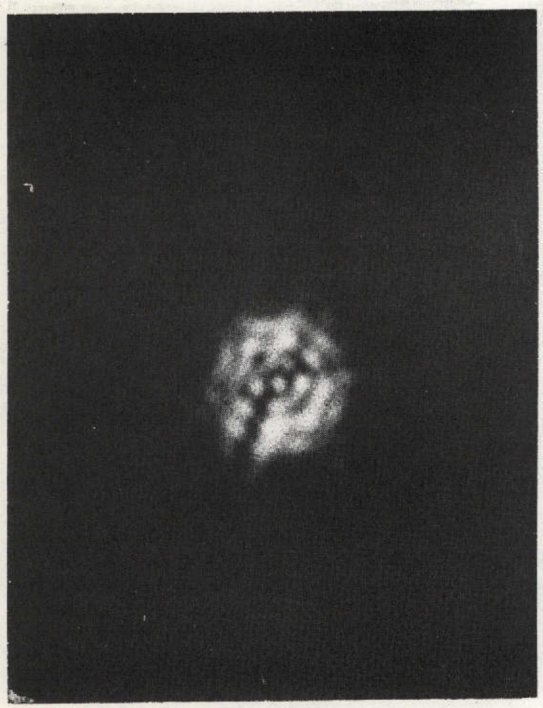
Test No. 1
Retro: B
Photo No. 8
Exposure Time: 1/30 SEC



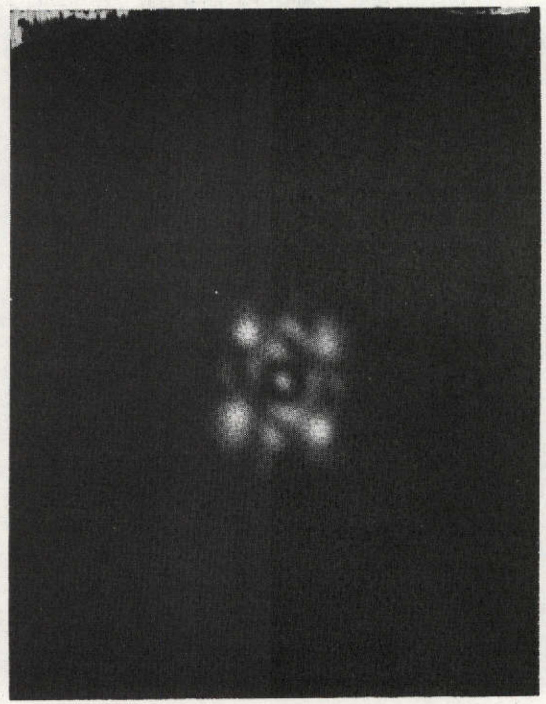
Test No. 1
Retro: C
Photo No. 9
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

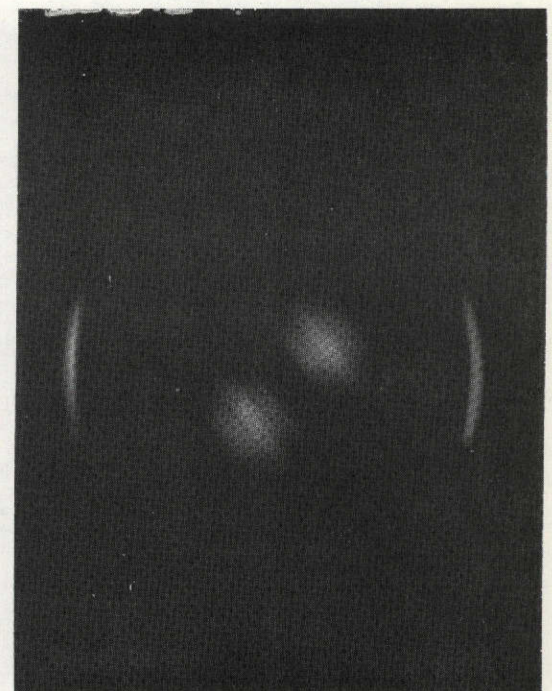
cm 1 2 3



Test No. 2
Retro: A
Photo No. 10
Exposure Time: 1/125 SEC

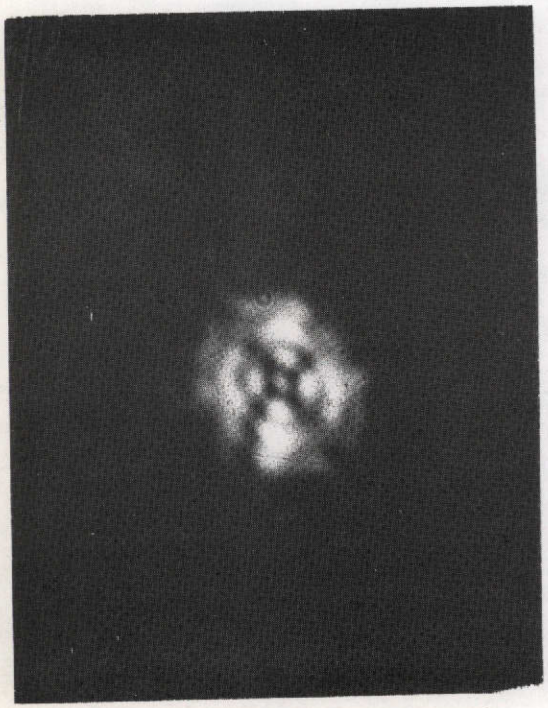


Test No. 2
Retro: A
Photo No. 11
Exposure Time: 1/125 SEC

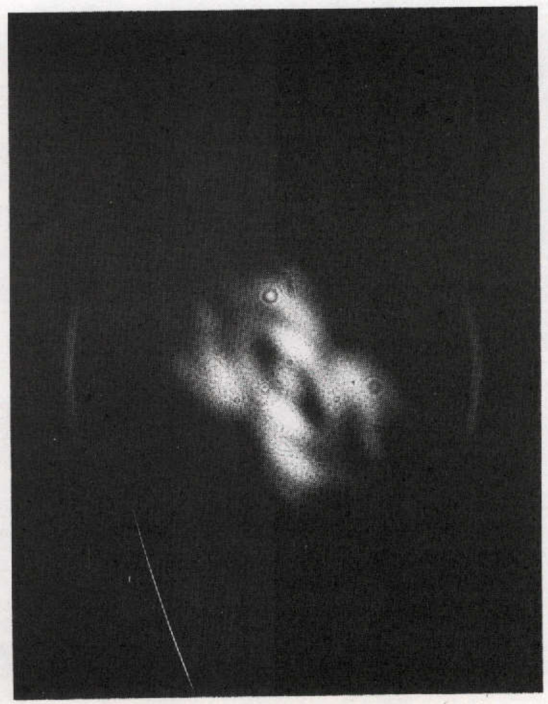


Test No. 2
Retro: A
Photo No. 12
Exposure Time: 1/8 SEC

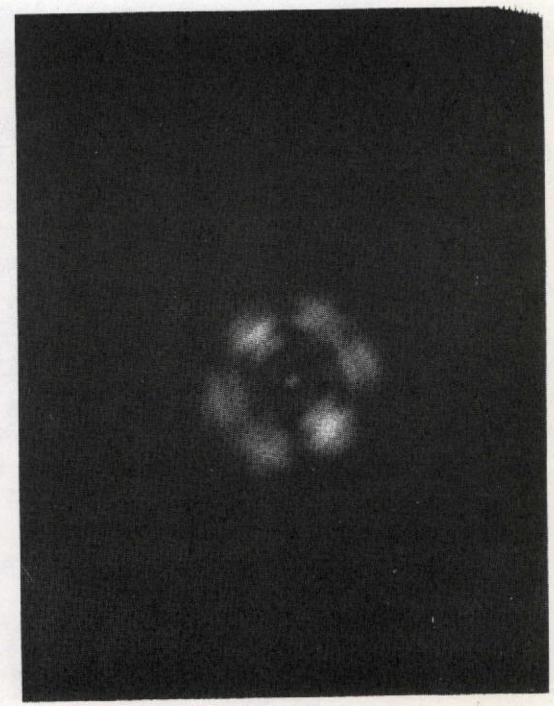
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 2
Retro: A
Photo No. 13
Exposure Time: 1/60 SEC



Test No. 2
Retro: A
Photo No. 14
Exposure Time: 1/15 SEC

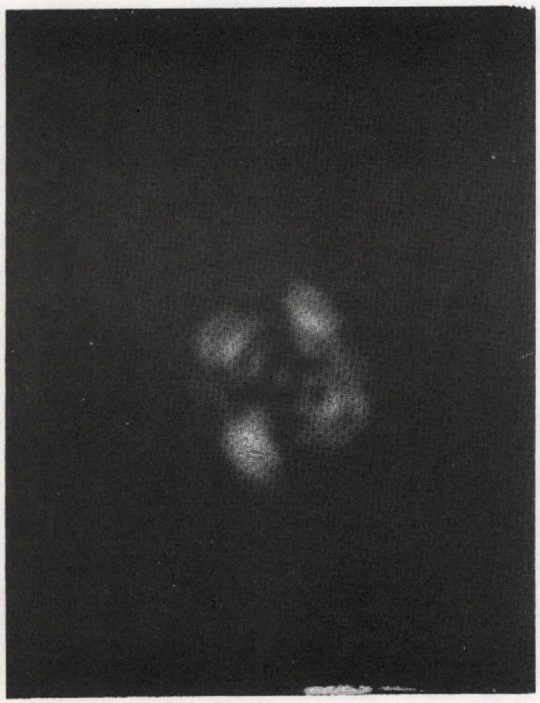


Test No. 2
Retro: B
Photo No. 15
Exposure Time: 1/125 SEC

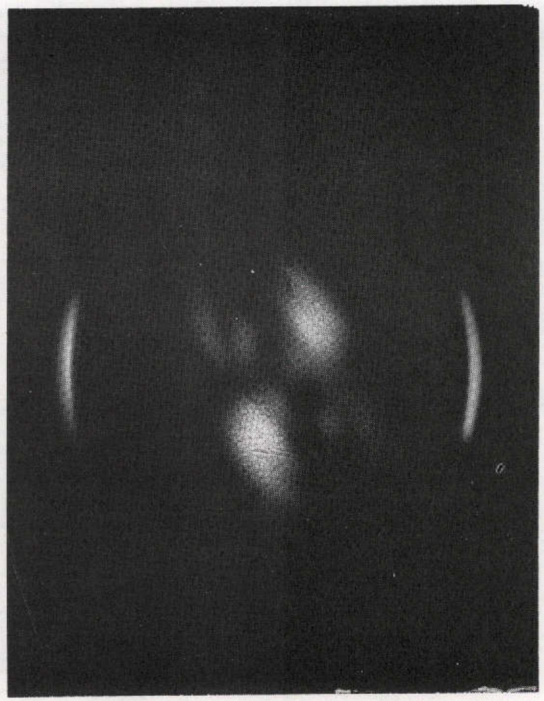
C-5

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

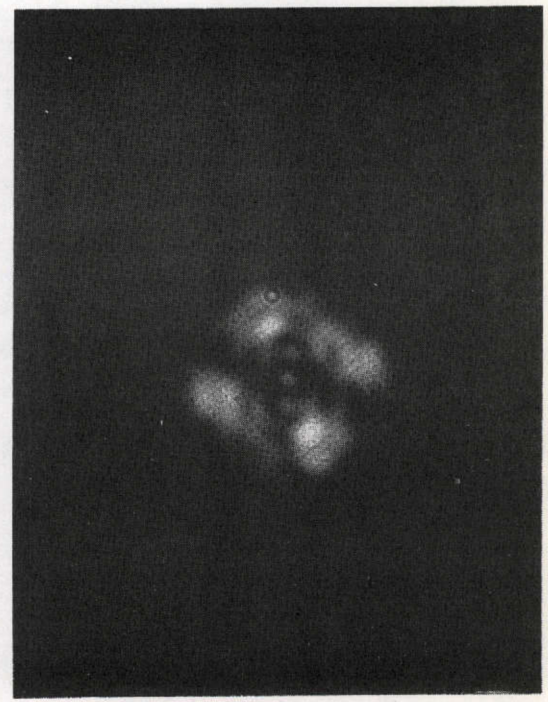
cm 1 2 3



Test No. 2
Retro: B
Photo No. 16
Exposure Time: 1/60 SEC

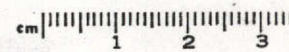


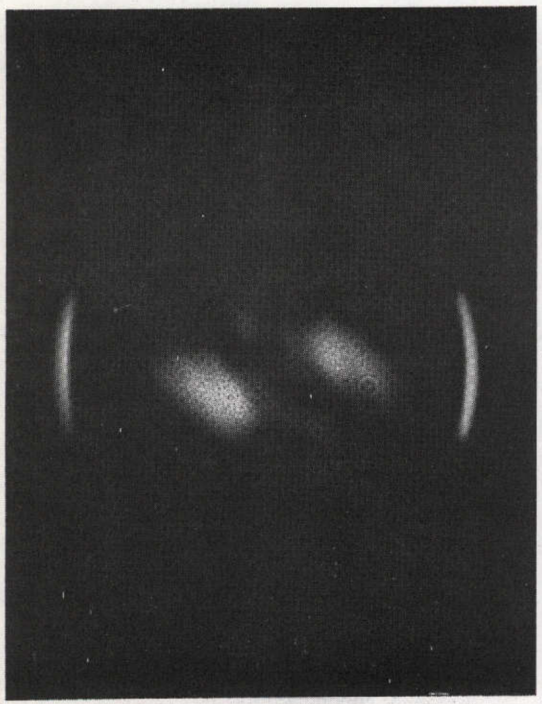
Test No. 2
Retro: B
Photo No. 17
Exposure Time: 1/4 SEC



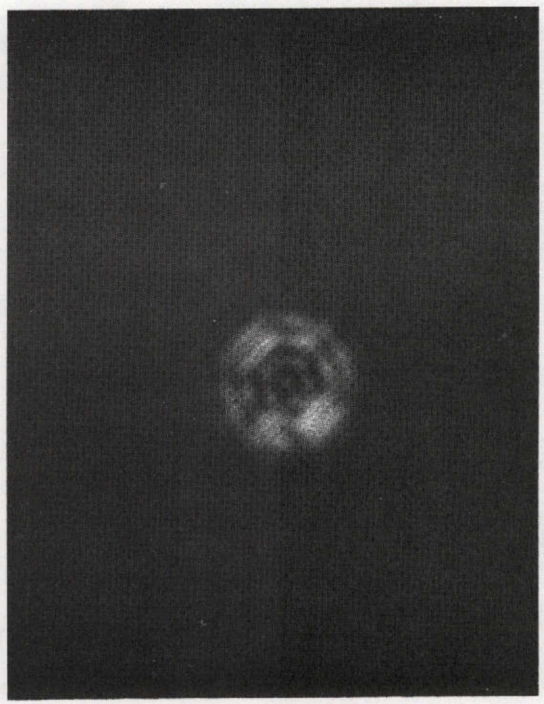
Test No. 2
Retro: B
Photo No. 18
Exposure Time: 1/60 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





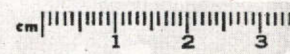
Test No. 2
Retro: B
Photo No. 19
Exposure Time: 1/4 SEC



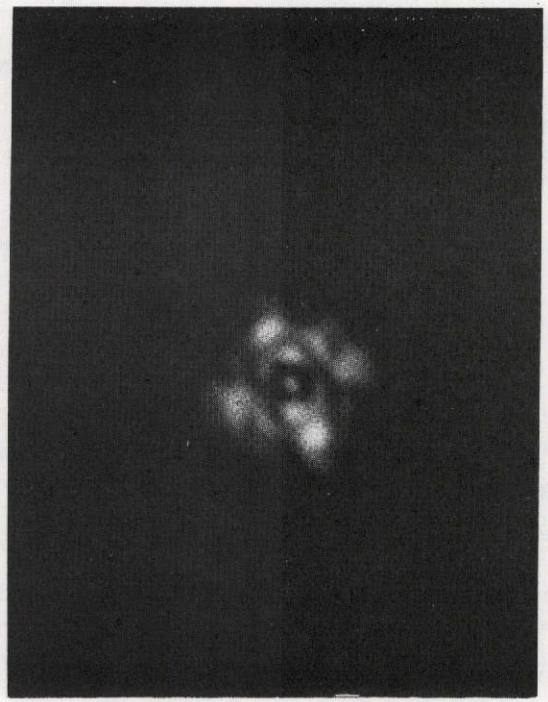
Test No. 2
Retro: C
Photo No. 20
Exposure Time: 1/125 SEC

Test No. 2
Retro: C
Photo No. 21
Exposure Time: 1/30 SEC

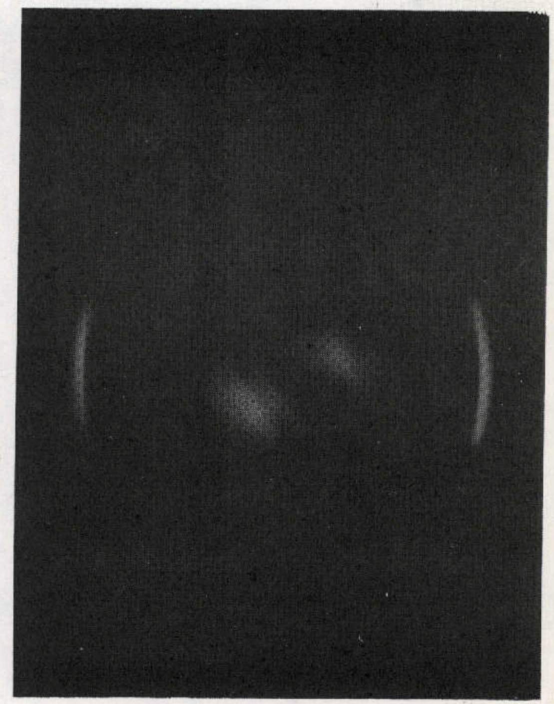
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 2
Retro: C
Photo No. 22
Exposure Time: 1/4 SEC



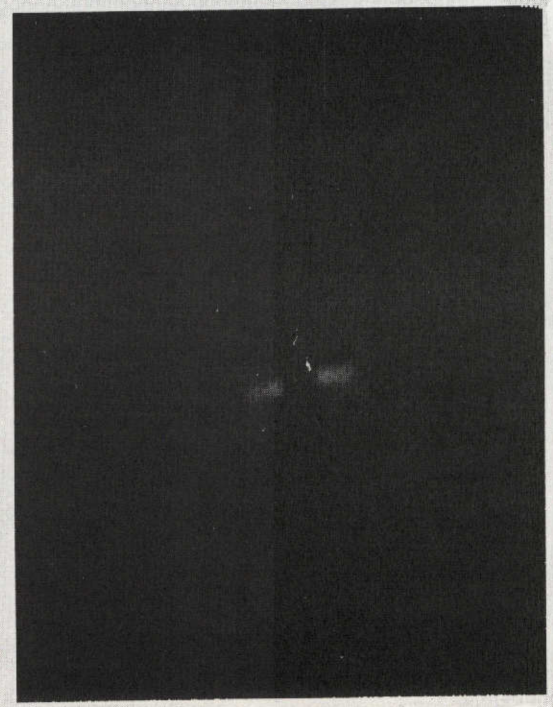
Test No. 2
Retro: C
Photo No. 23
Exposure Time: 1/60 SEC



Test No. 2
Retro: C
Photo No. 24
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 15
Retro: A
Photo No. 25
Exposure Time: 1/125 SEC

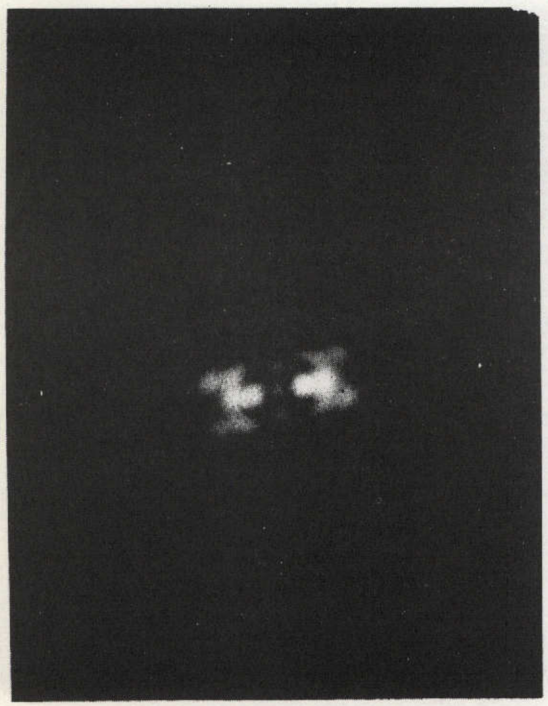


Test No. 16
Retro: CALIB.
Photo No. 26
Exposure Time: 1/500 SEC

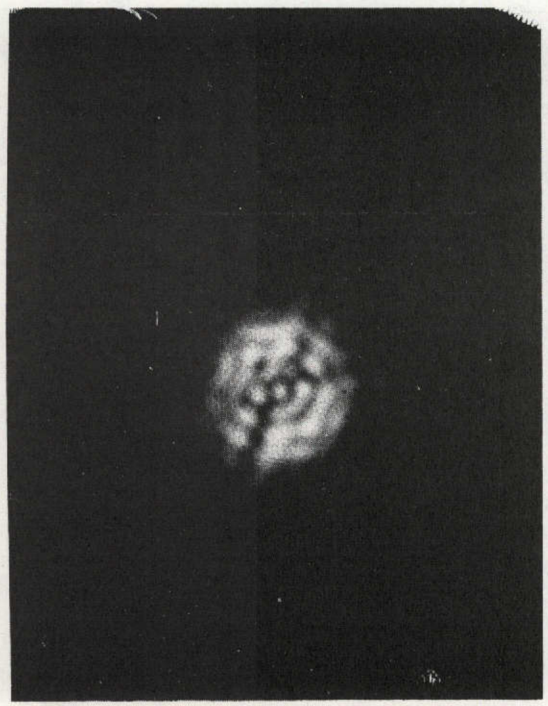
Test No. 16
Retro: A
Photo No. 27
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

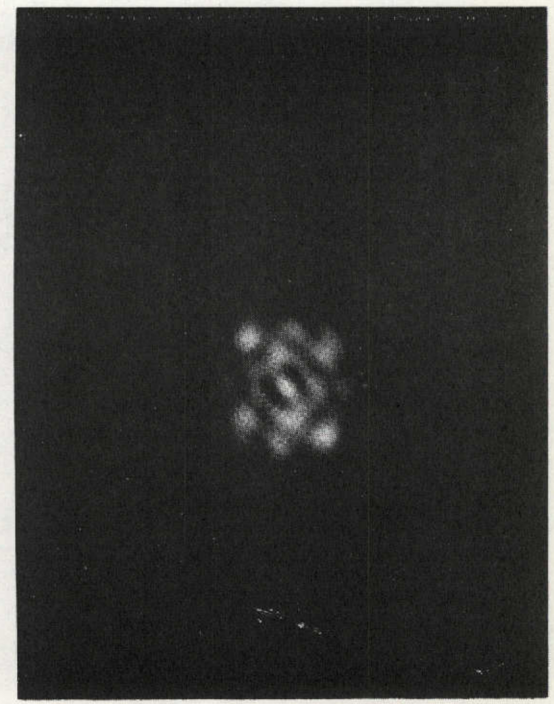
cm 1 2 3



Test No. 16
Retro: CALIB.
Photo No. 28
Exposure Time: 1/500 SEC

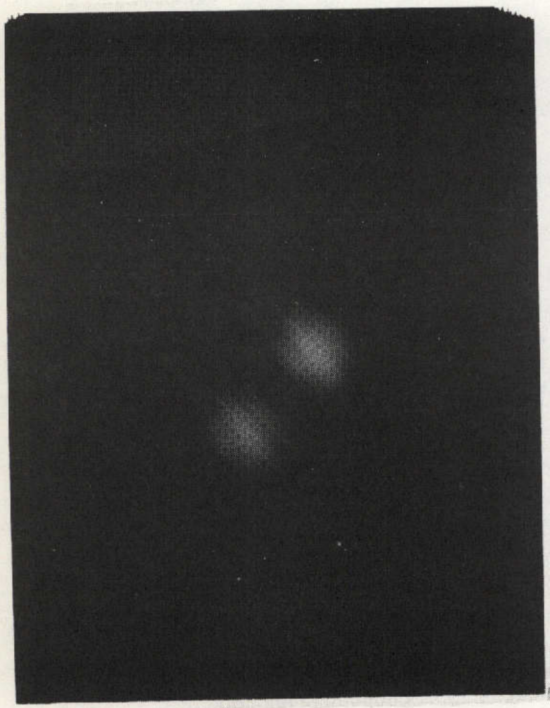


Test No. 16
Retro: A
Photo No. 29
Exposure Time: 1/250 SEC

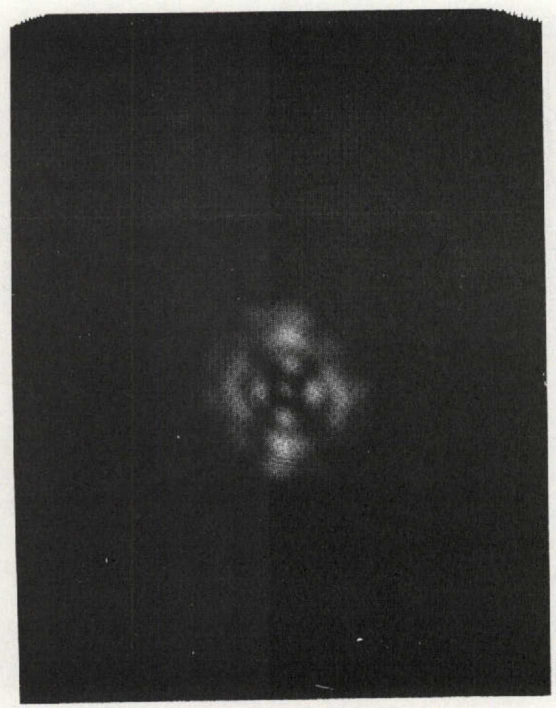


Test No. 16
Retro: A
Photo No. 30
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



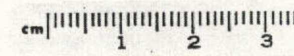
Test No. 16
Retro: A
Photo No. 31
Exposure Time: 1/15 SEC

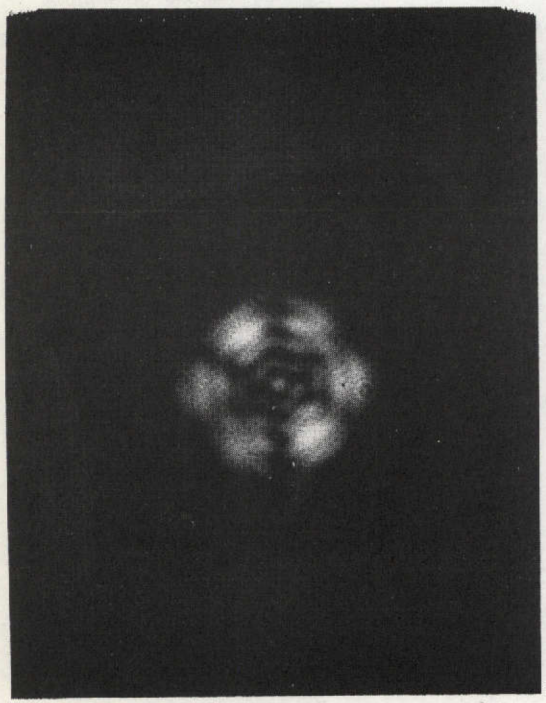


Test No. 16
Retro: A
Photo No. 32
Exposure Time: 1/250 SEC

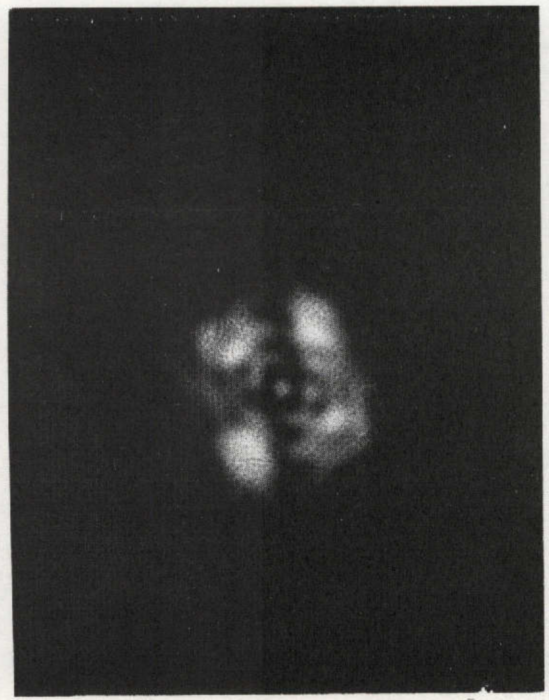
Test No. 16
Retro: A
Photo No. 33
Exposure Time: 1/60 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

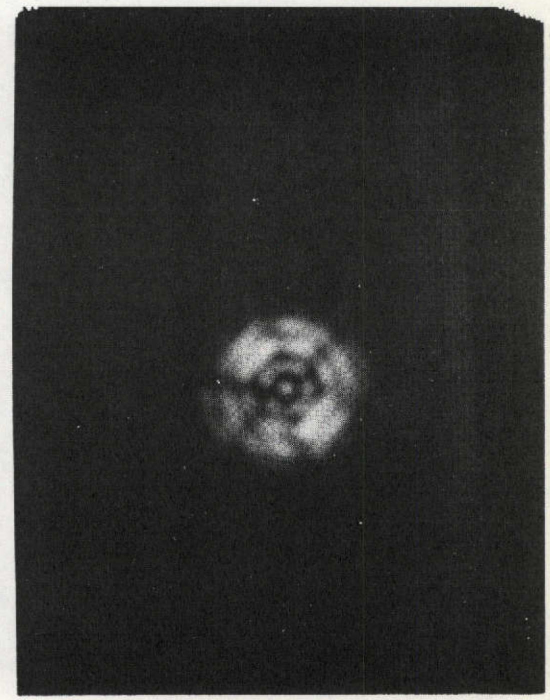




Test No. 16
Retro: B
Photo No. 34
Exposure Time: 1/250 SEC

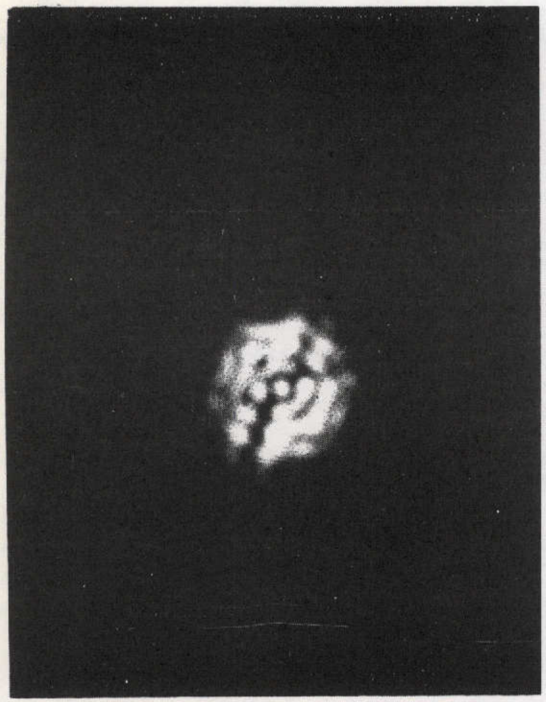


Test No. 16
Retro: B
Photo No. 35
Exposure Time: 1/125 SEC

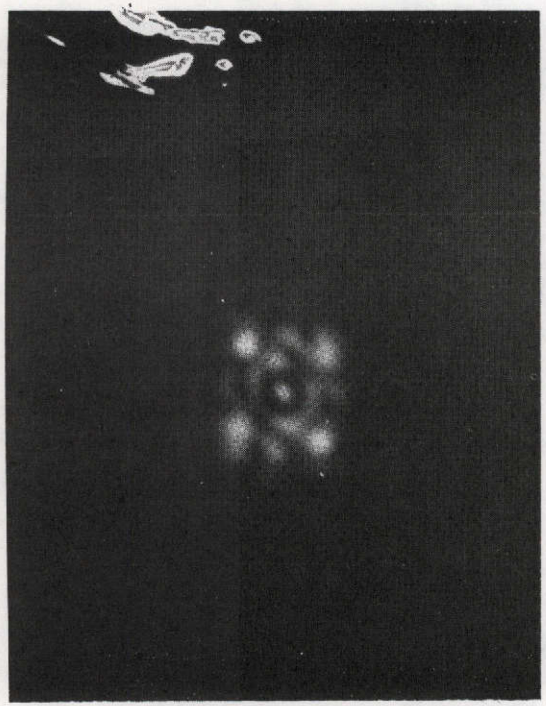


Test No. 16
Retro: C
Photo No. 36
Exposure Time: 1/250 SEC

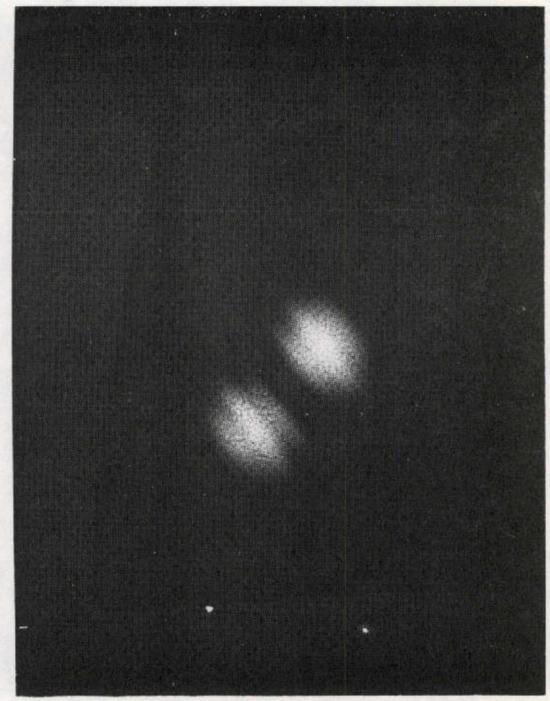
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 17
Retro: A
Photo No. 37
Exposure Time: 1/250 SEC

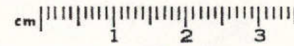


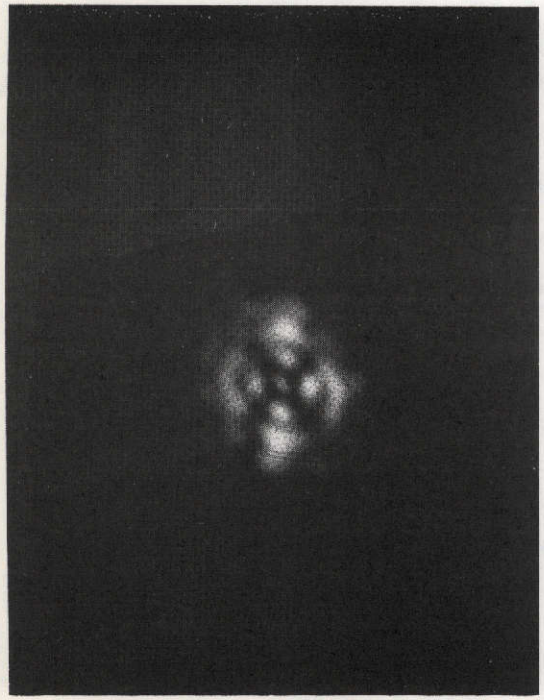
Test No. 17
Retro: A
Photo No. 38
Exposure Time: 1/250 SEC



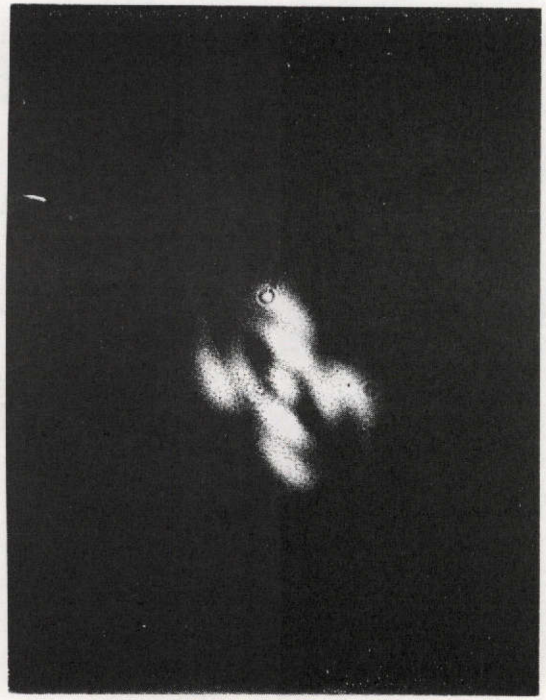
Test No. 17
Retro: A
Photo No. 39
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

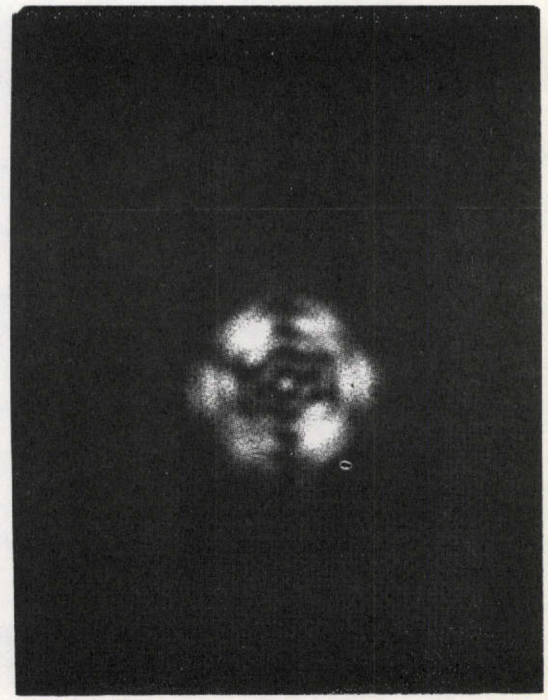




Test No. 17
Retro: A
Photo No. 40
Exposure Time: 1/250 SEC

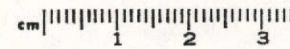


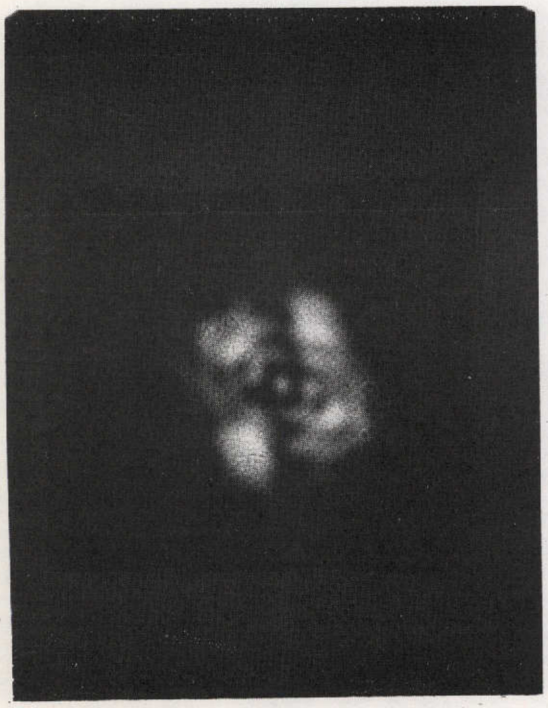
Test No. 17
Retro: A
Photo No. 41
Exposure Time: 1/60 SEC



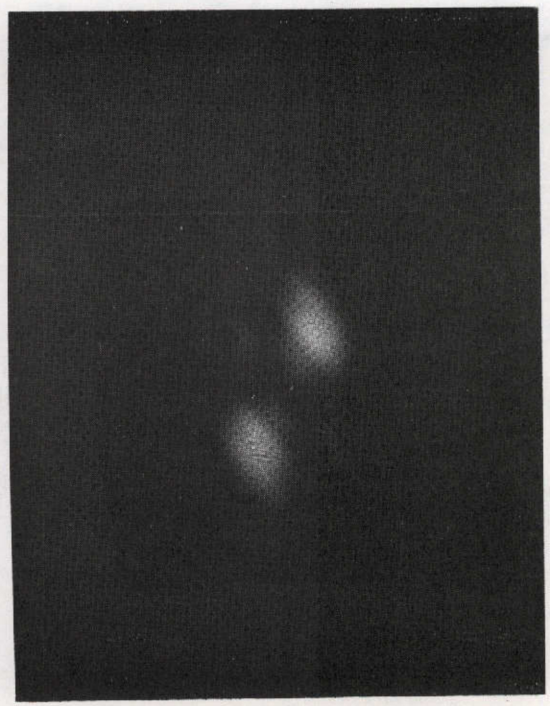
Test No. 17
Retro: B
Photo No. 42
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





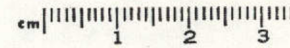
Test No. 17
Retro: B
Photo No. 43
Exposure Time: 1/125 SEC

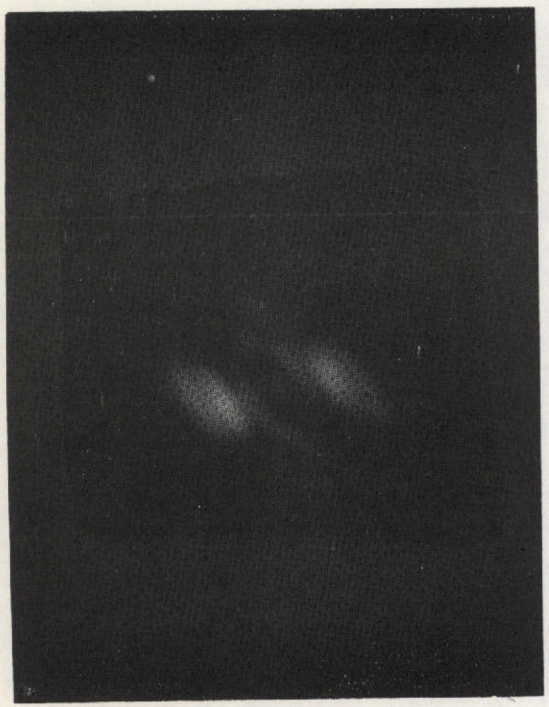


Test No. 17
Retro: B
Photo No. 44
Exposure Time: 1/15 SEC

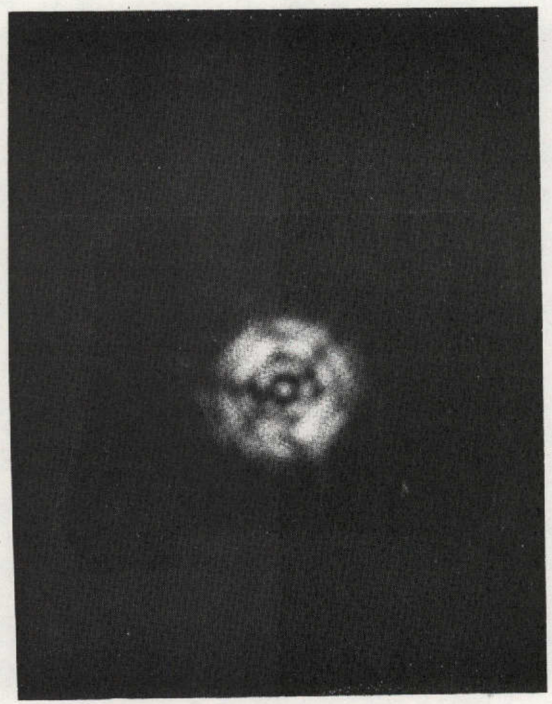
Test No. 17
Retro: B
Photo No. 45
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





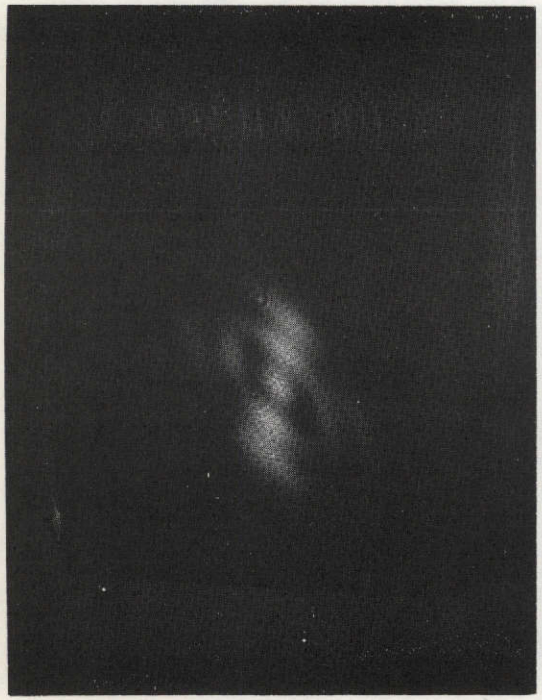
Test No. 17
Retro: B
Photo No. 46
Exposure Time: 1/30 SEC



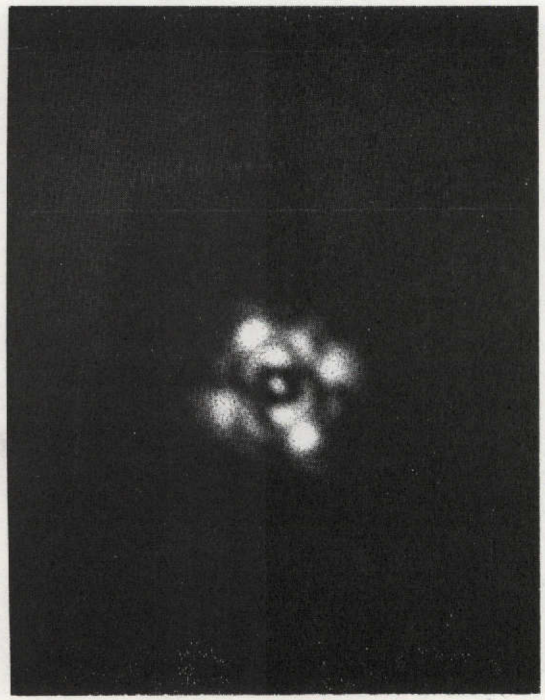
Test No. 17
Retro: C
Photo No. 47
Exposure Time: 1/250 SEC

Test No. 17
Retro: C
Photo No. 48
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



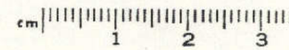
Test No. 17
Retro: C
Photo No. 49
Exposure Time: 1/30 SEC

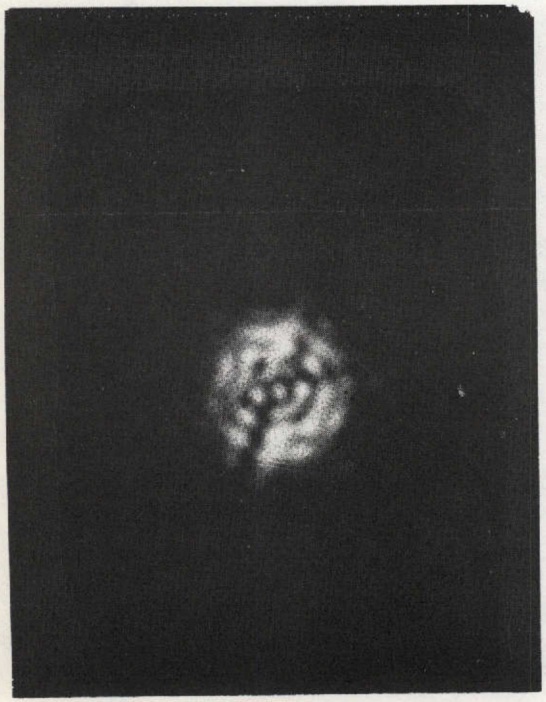


Test No. 17
Retro: C
Photo No. 50
Exposure Time: 1/250 SEC

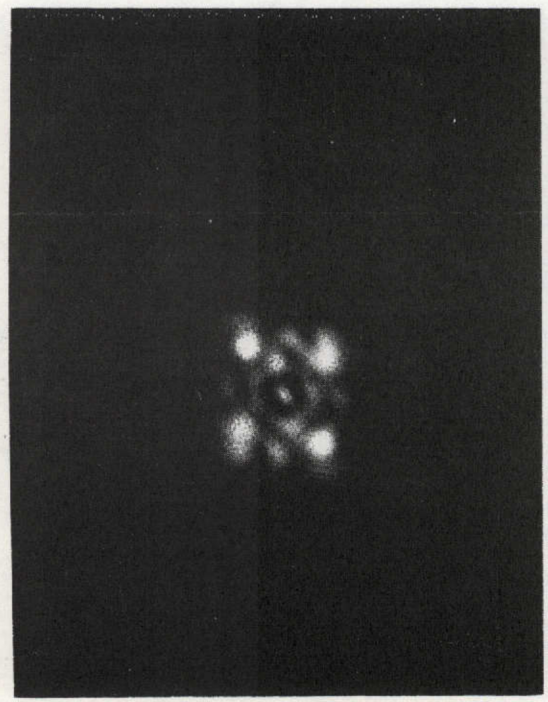
Test No. 17
Retro: C
Photo No. 51
Exposure Time: 1/30 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

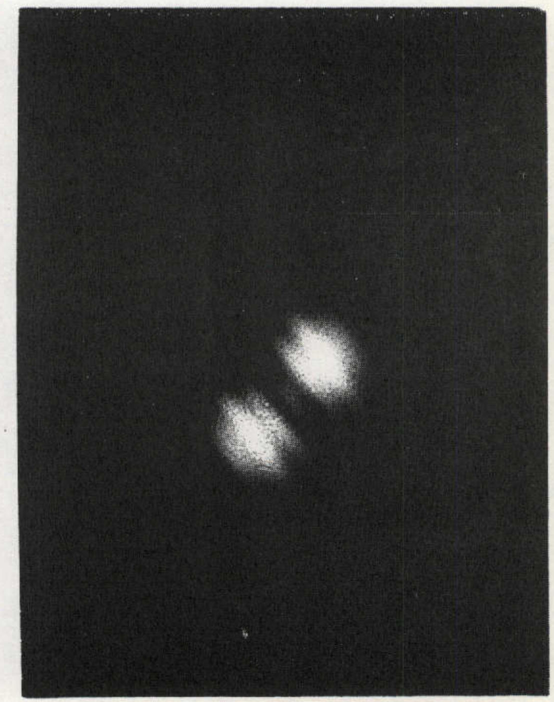




Test No. 7
Retro: A
Photo No. 52
Exposure Time: 1/250 SEC

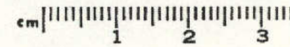


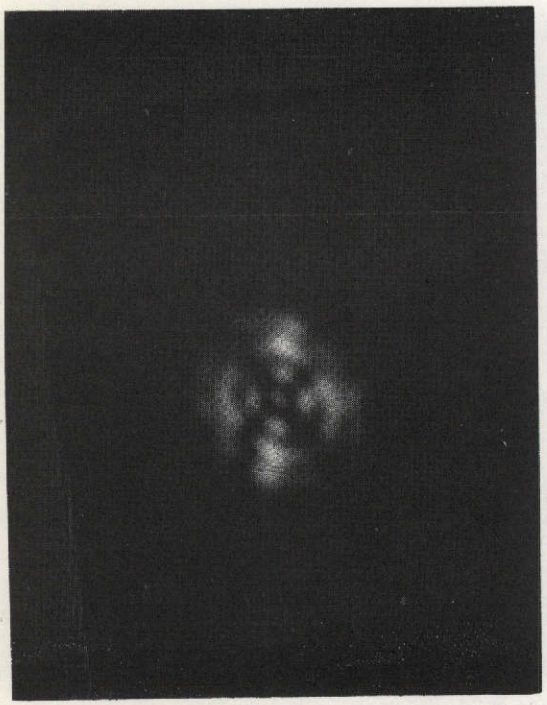
Test No. 7
Retro: A
Photo No. 53
Exposure Time: 1/250



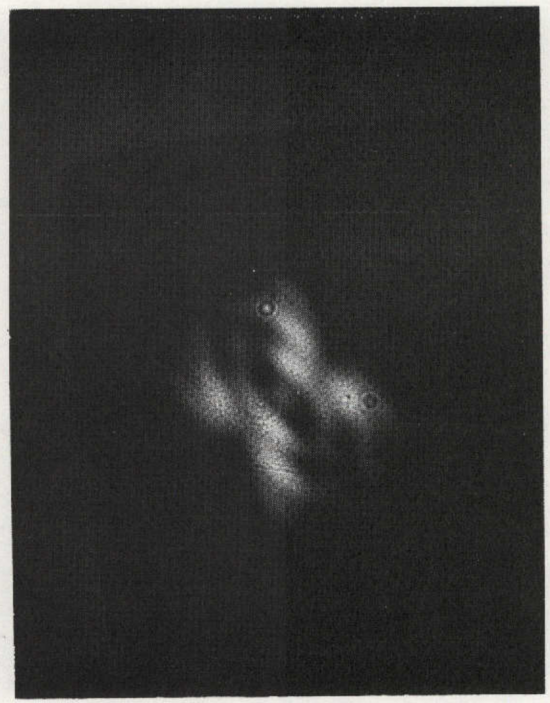
Test No. 7
Retro: A
Photo No. 54
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

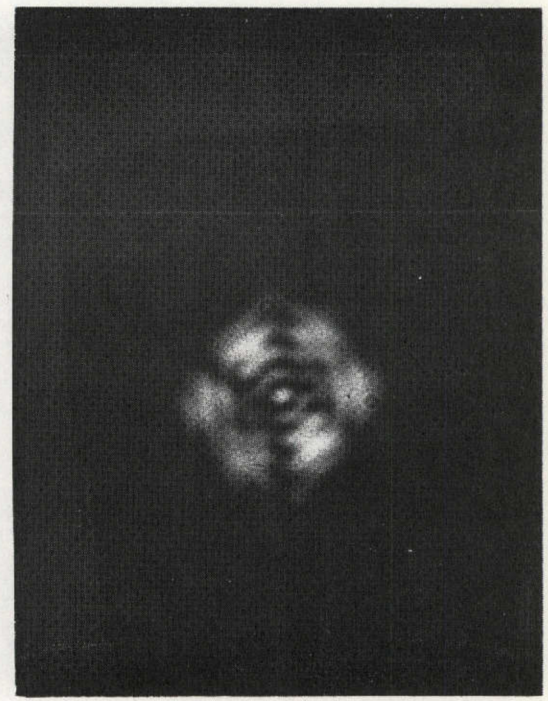




Test No. 7
Retro: A
Photo No. 55
Exposure Time: 1/250 SEC

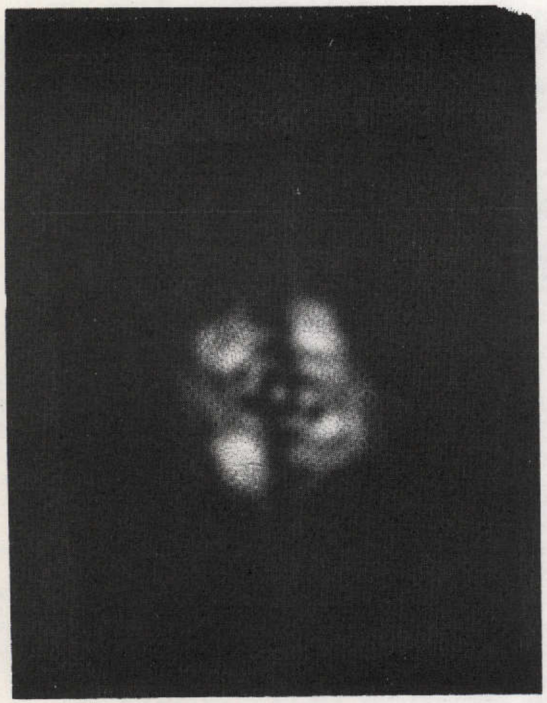


Test No. 7
Retro: A
Photo No. 56
Exposure Time: 1/60 SEC

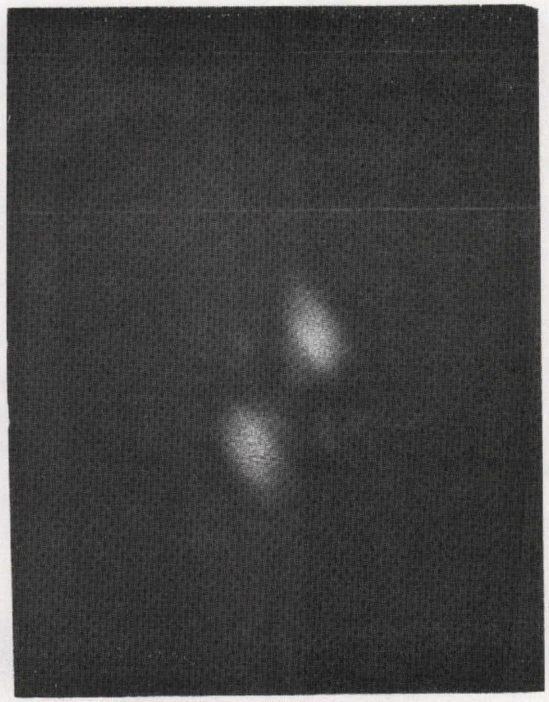


Test No. 7
Retro: B
Photo No. 57
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 7
Retro: B
Photo No. 58
Exposure Time: 1/125 SEC

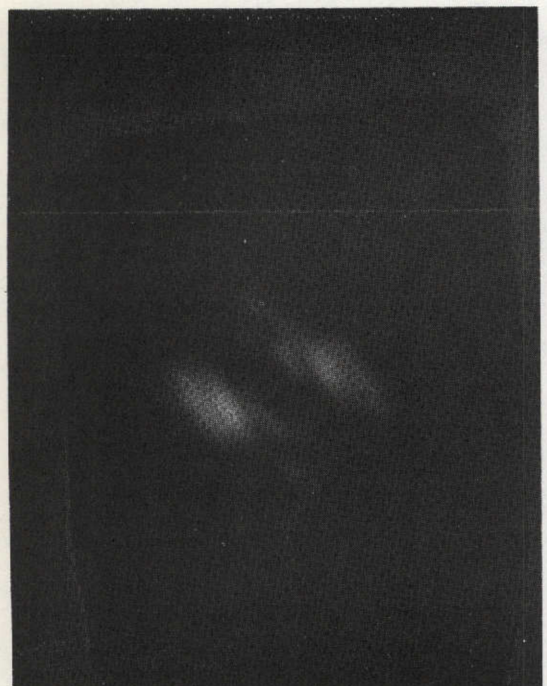


Test No. 7
Retro: B
Photo No. 59
Exposure Time: 1/15 SEC

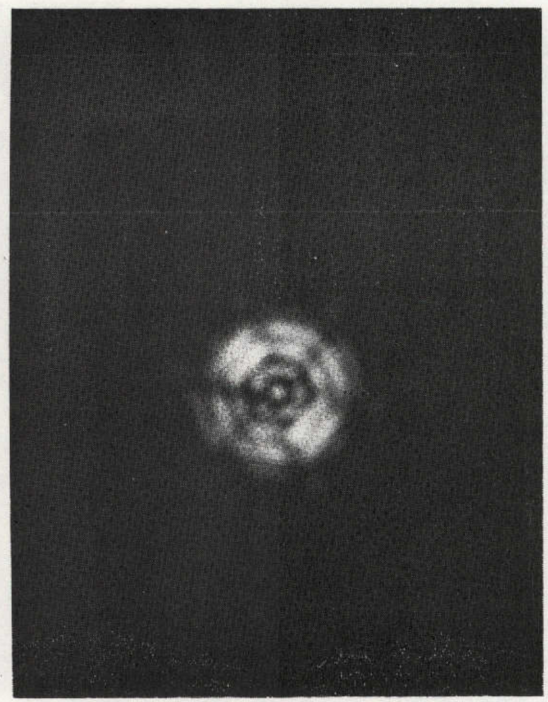
Test No. 7
Retro: B
Photo No. 60
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3



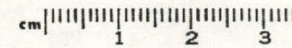
Test No. 7
Retro: B
Photo No. 61
Exposure Time: 1/30 SEC

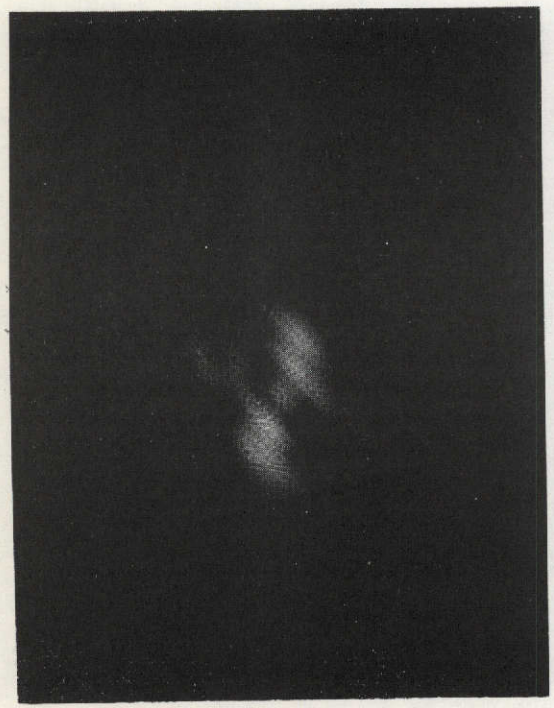


Test No. 7
Retro: C
Photo No. 62
Exposure Time: 1/250 SEC

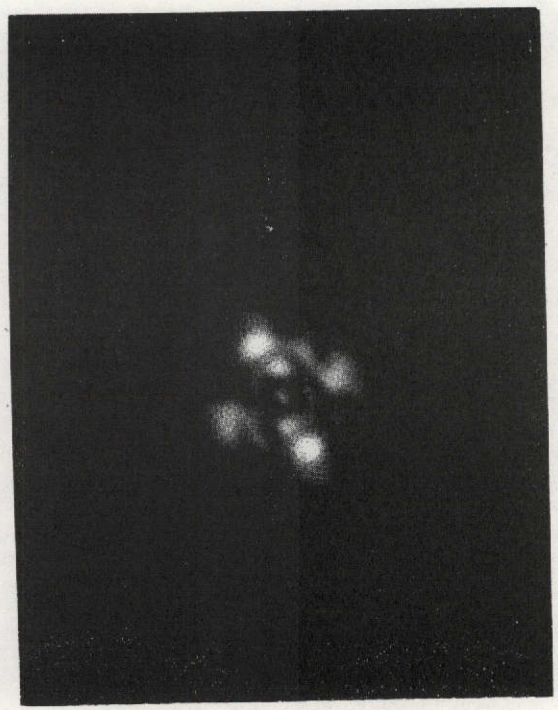
Test No. 7
Retro: C
Photo No. 63
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

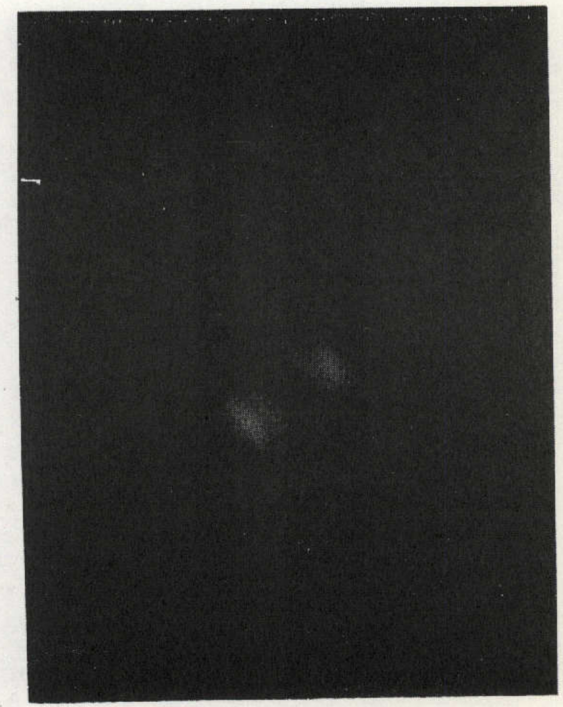




Test No. 7
Retro: C
Photo No. 64
Exposure Time: 1/30 SEC

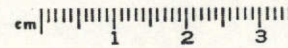


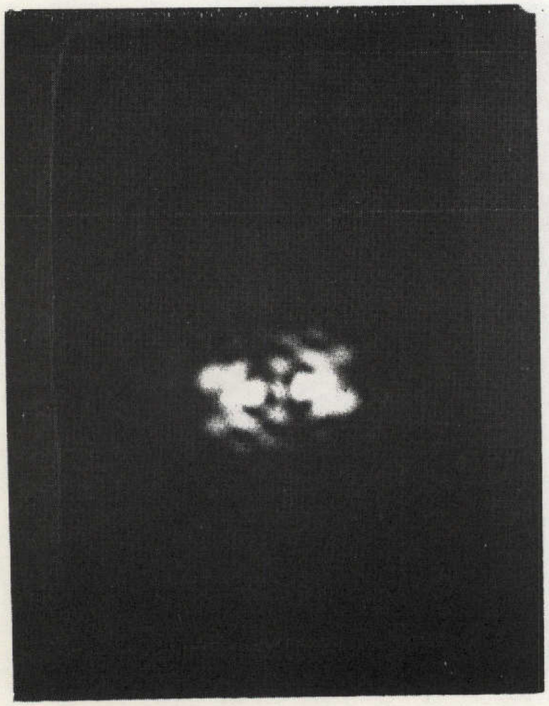
Test No. 7
Retro: C
Photo No. 65
Exposure Time: 1/250 SEC

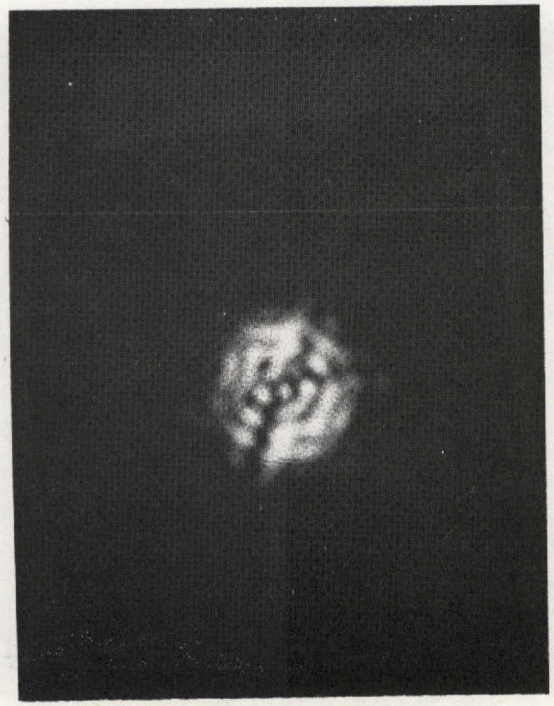


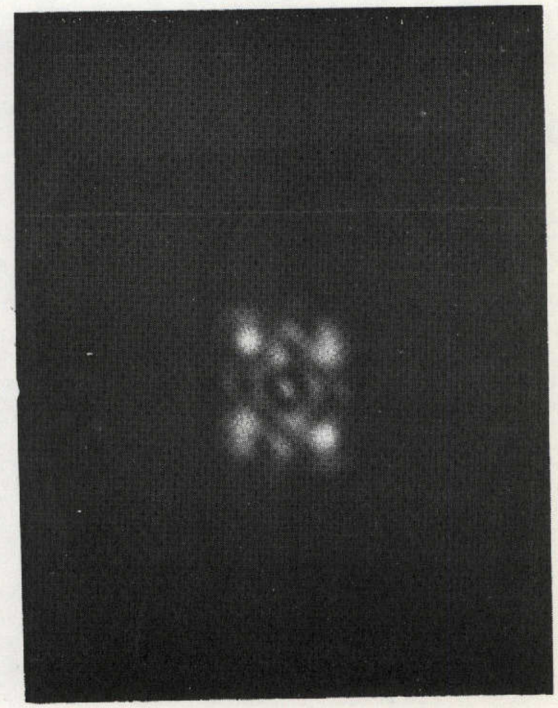
Test No. 7
Retro: C
Photo No. 66
Exposure Time: 1/30 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI









Test No. 9
Retro: CALIB.
Photo No. 67
Exposure Time: 1/250 SEC

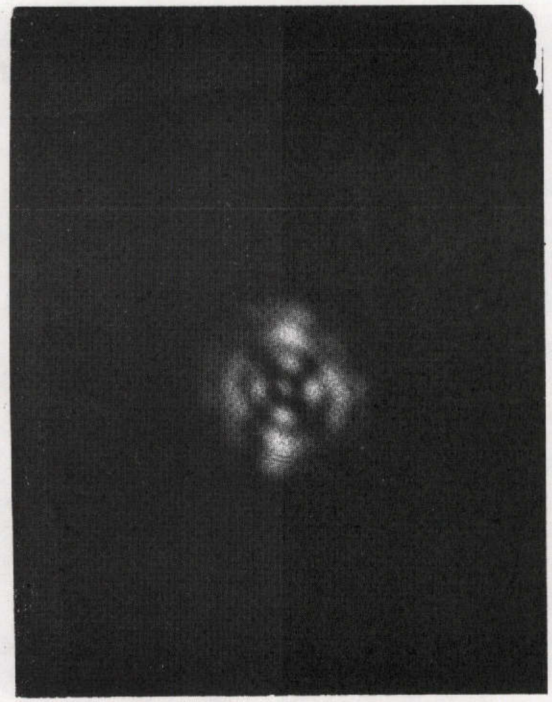
Test No. 9
Retro: A
Photo No. 68
Exposure Time: 1/250 SEC

Test No. 9
Retro: A
Photo No. 69
Exposure Time: 1/250 SEC

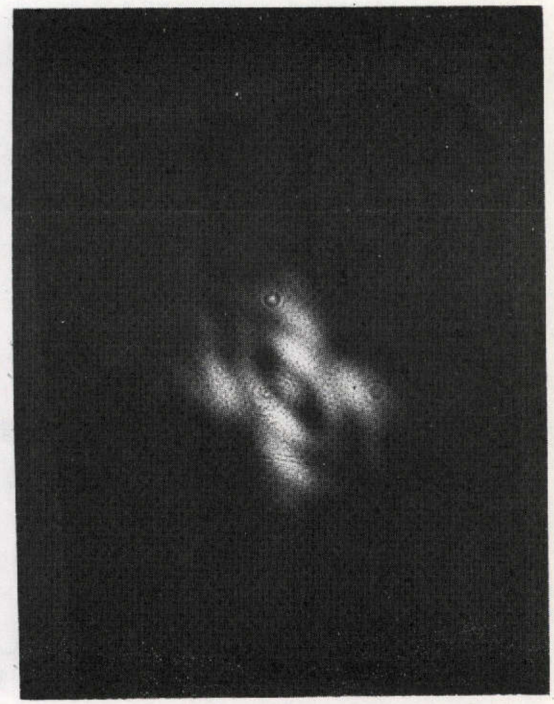
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3

Test No. 9
Retro: A
Photo No. 70
Exposure Time: 1/8 SEC

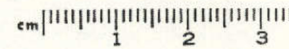


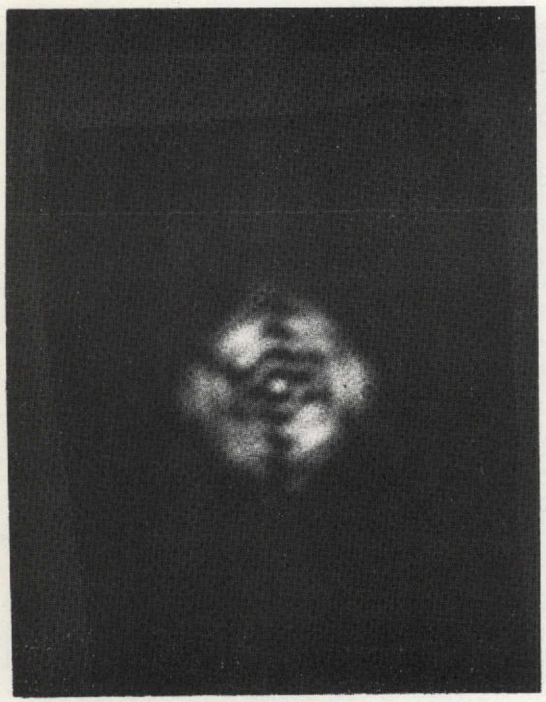
Test No. 9
Retro: A
Photo No. 71
Exposure Time: 1/250 SEC



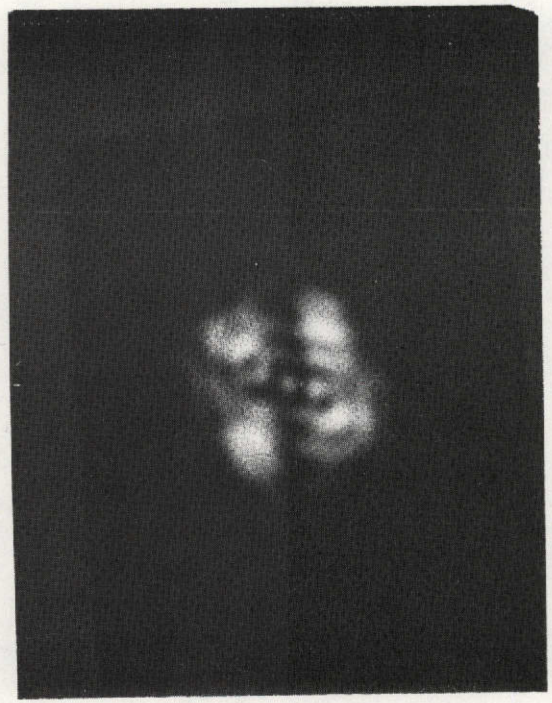
Test No. 9
Retro: A
Photo No. 72
Exposure Time: 1/60 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

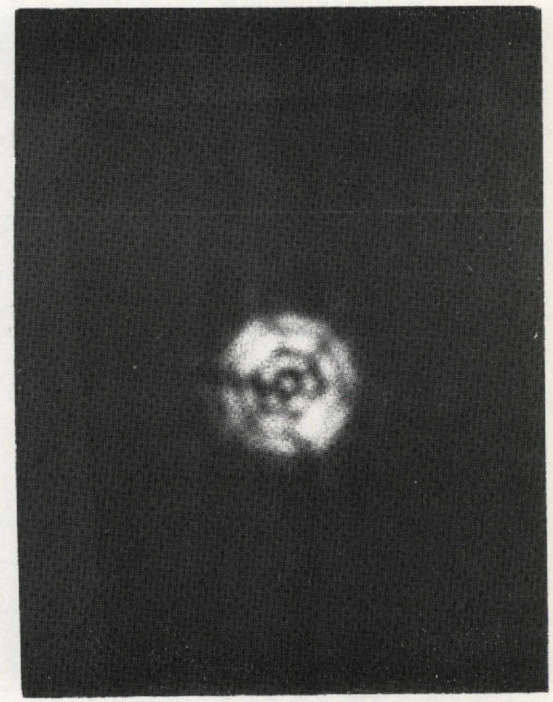




Test No. 9
Retro: B
Photo No. 73
Exposure Time: 1/250 SEC



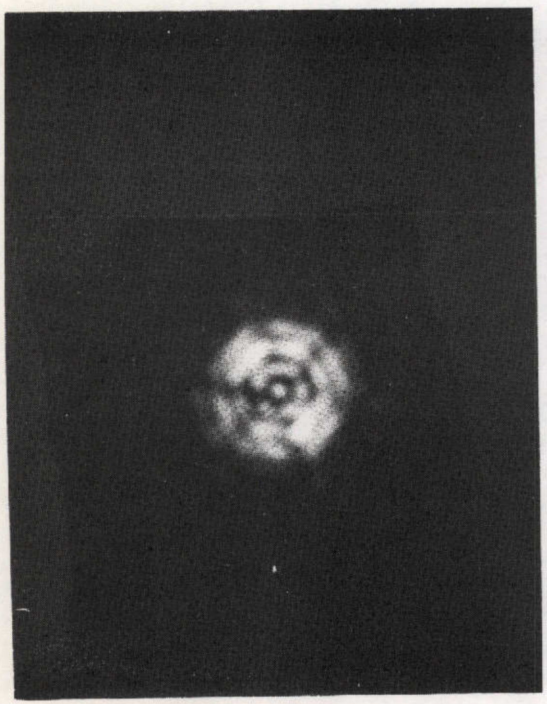
Test No. 9
Retro: B
Photo No. 74
Exposure Time: 1/125 SEC



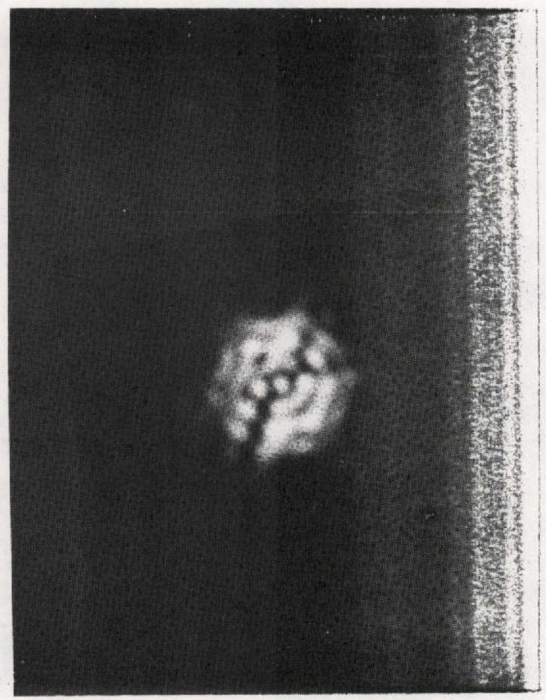
Test No. 9
Retro: C
Photo No. 75
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

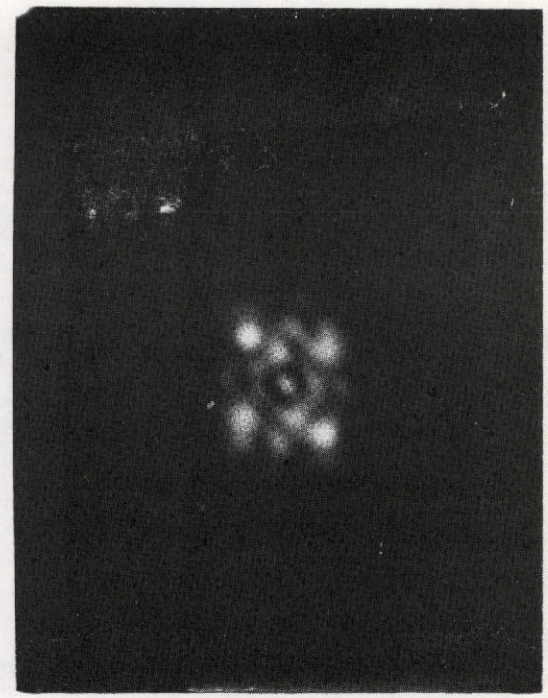
cm 1 2 3



Test No. 8
Retro: C
Photo No. 76
Exposure Time: 1/250 SEC

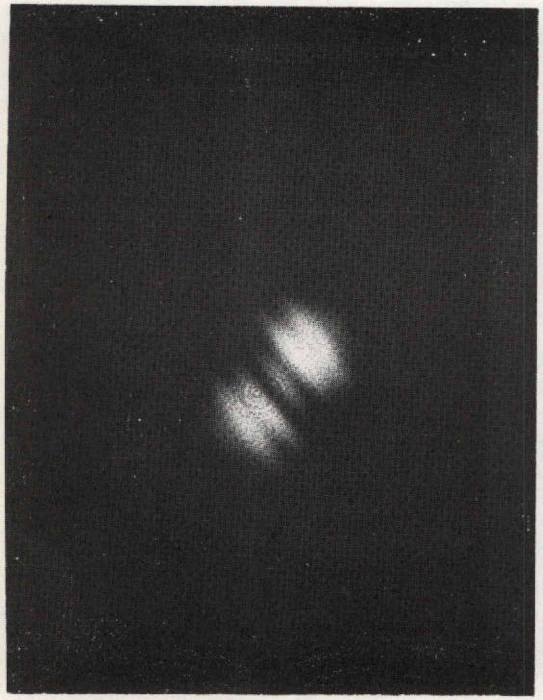


Test No. 8
Retro: A
Photo No. 77
Exposure Time: 1/250 SEC

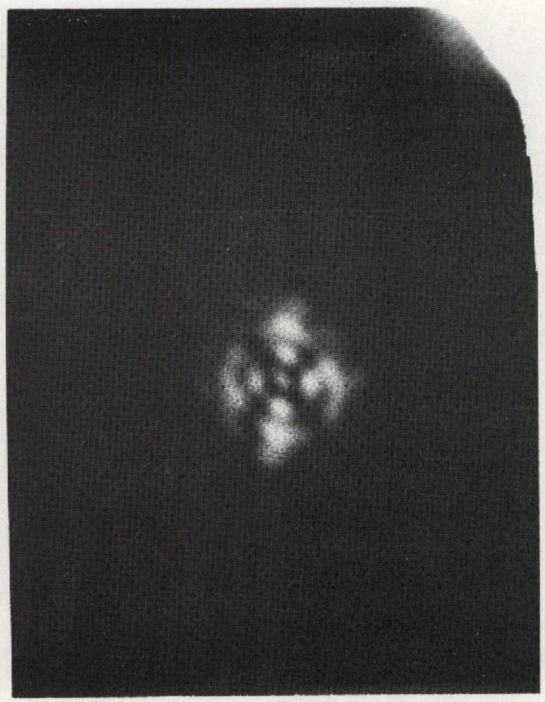


Test No. 8
Retro: A
Photo No. 78
Exposure Time: 1/250 SEC

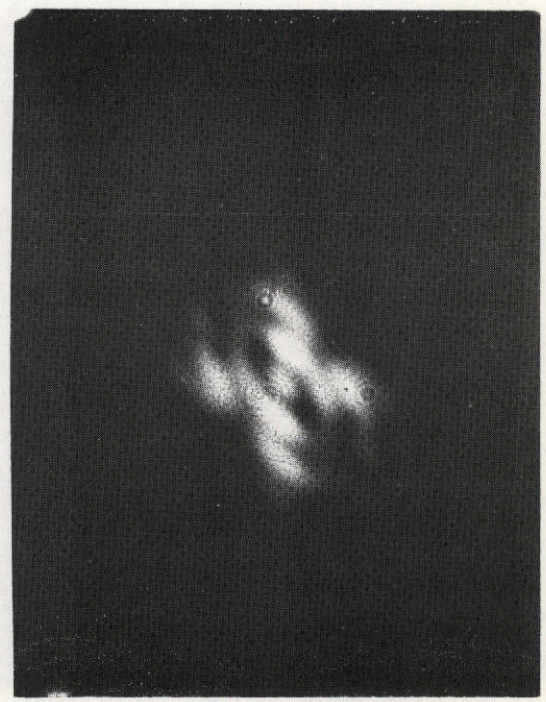
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 8
Retro: A
Photo No. 79
Exposure Time: 1/8 SEC



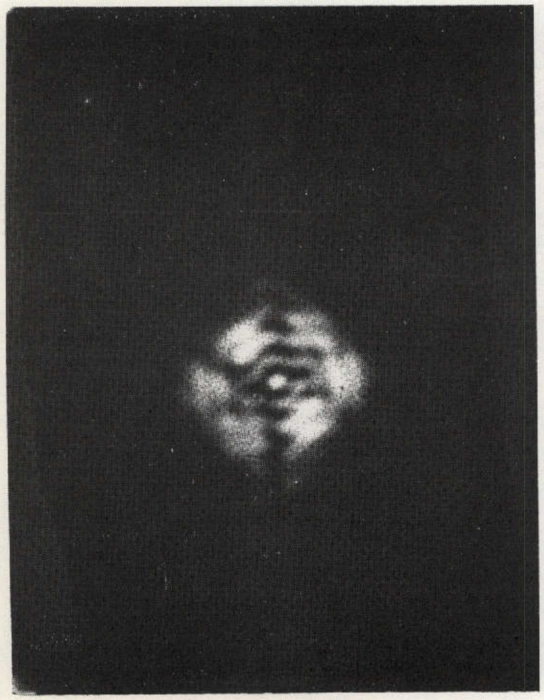
Test No. 8
Retro: A
Photo No. 80
Exposure Time: 1/250 SEC



Test No. 8
Retro: A
Photo No. 81
Exposure Time: 1/60 SEC

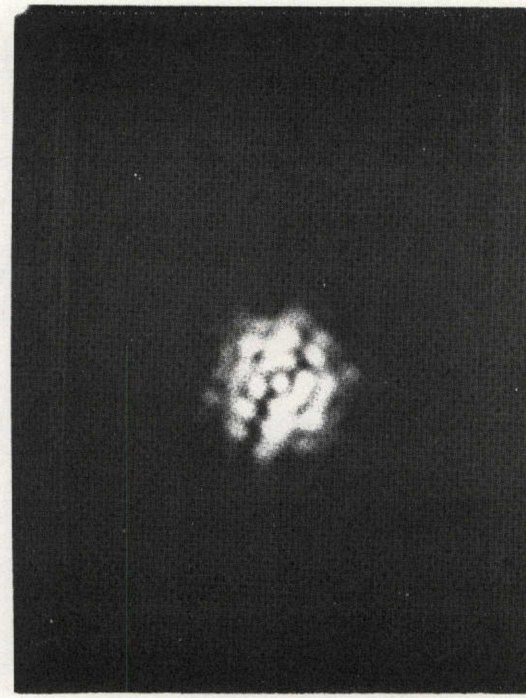
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3



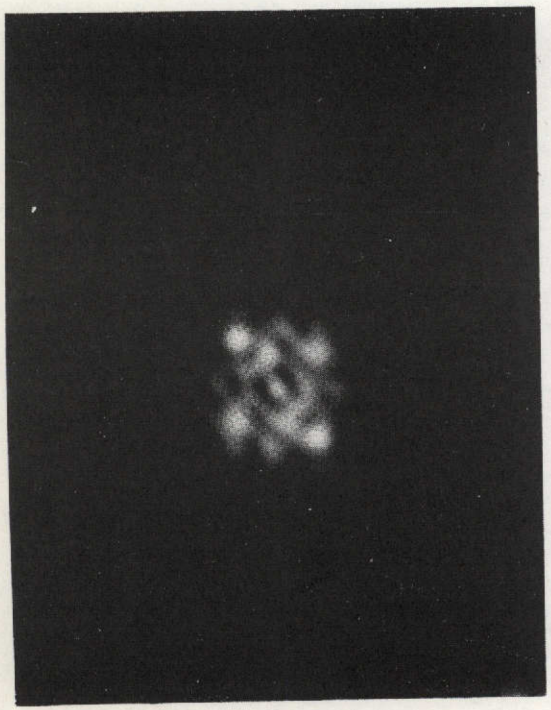
Test No. 8
Retro: B
Photo No. 82
Exposure Time: 1/250 SEC

Test No. 8
Retro: B
Photo No. 83
Exposure Time: 1/125 SEC

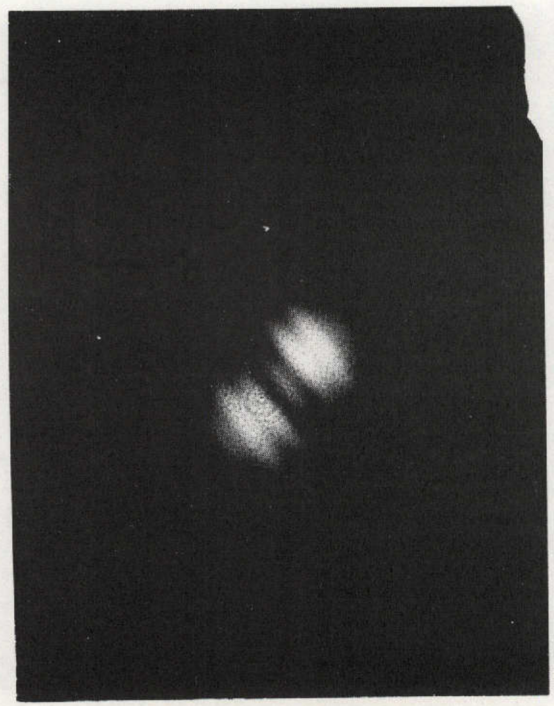


Test No. 4
Retro: A
Photo No. 84
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 4
Retro: A
Photo No. 85
Exposure Time: 1/250 SEC

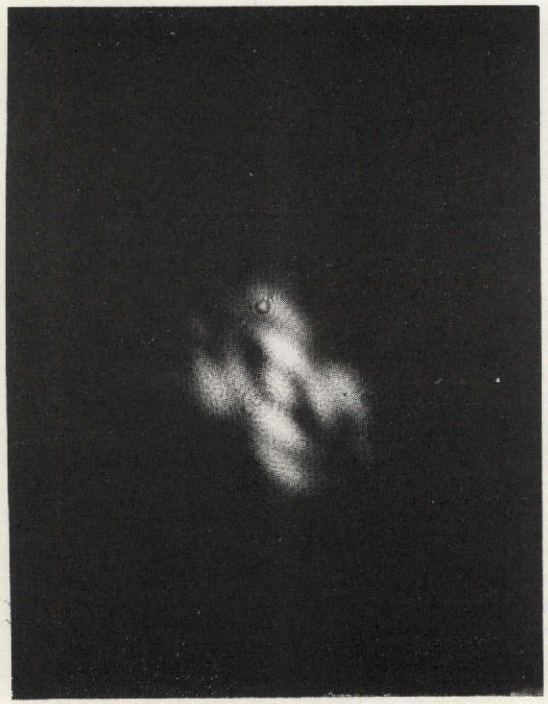


Test No. 4
Retro: A
Photo No. 86
Exposure Time: 1/8 SEC

#87 1/250

Test No. 4
Retro: A
Photo No. 87
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

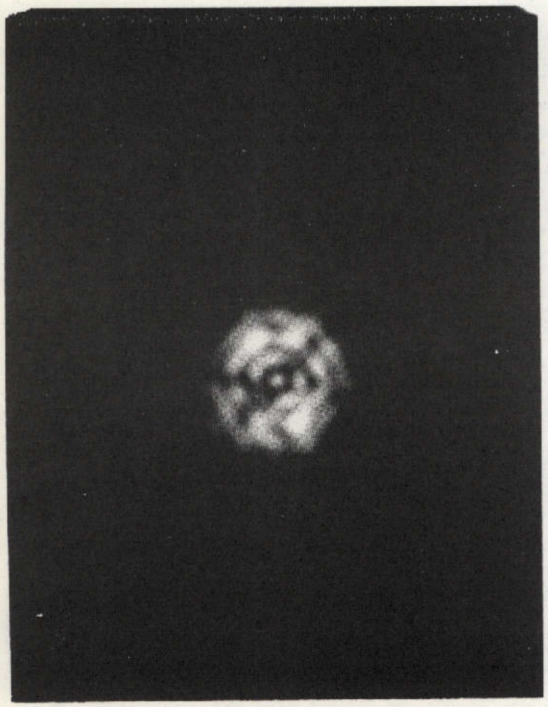


Test No. 4
Retro: A
Photo No. 88
Exposure Time: 1/60 SEC

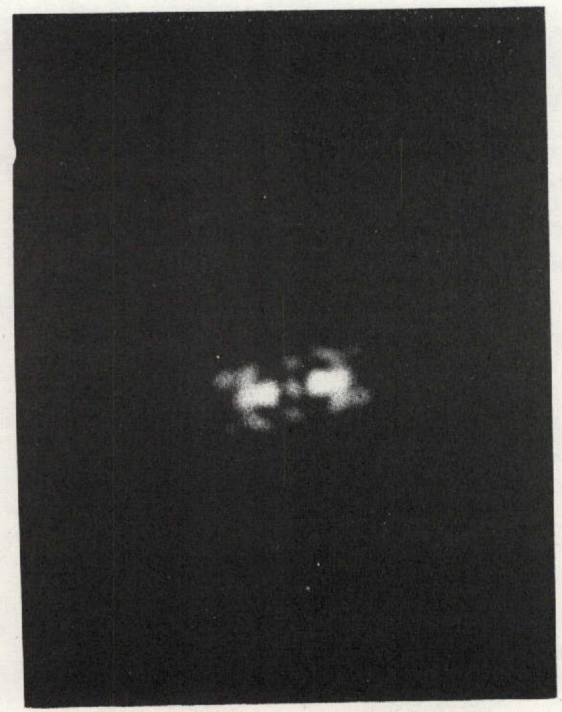
Test No. 4
Retro: B
Photo No. 89
Exposure Time: 1/250 SEC

Test No. 4
Retro: B
Photo No. 90
Exposure Time: 1/125

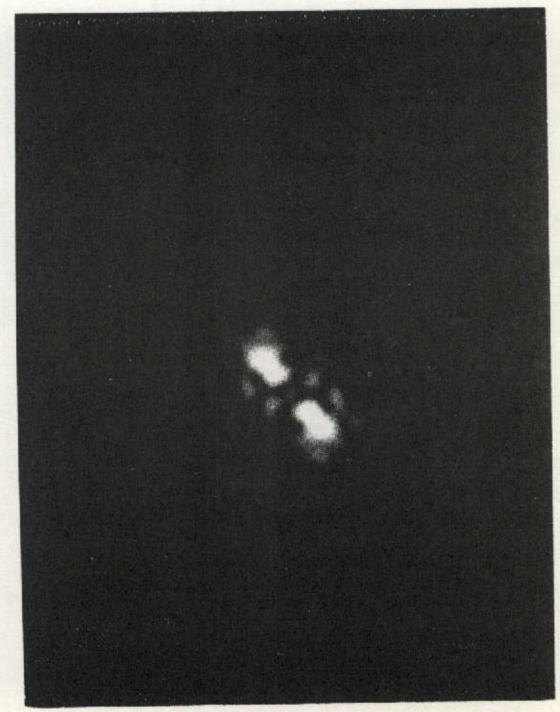
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 4
Retro: C
Photo No. 91
Exposure Time: 1/250 SEC

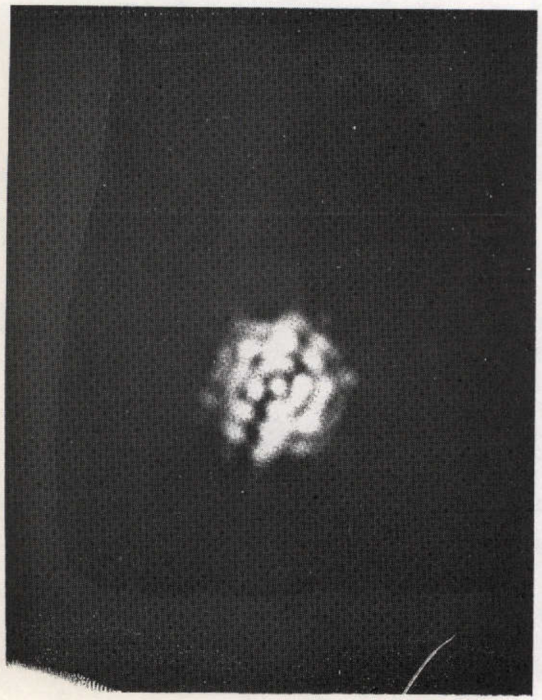


Test No. 4
Retro: CALIB.
Photo No. 92
Exposure Time: 1/500 SEC

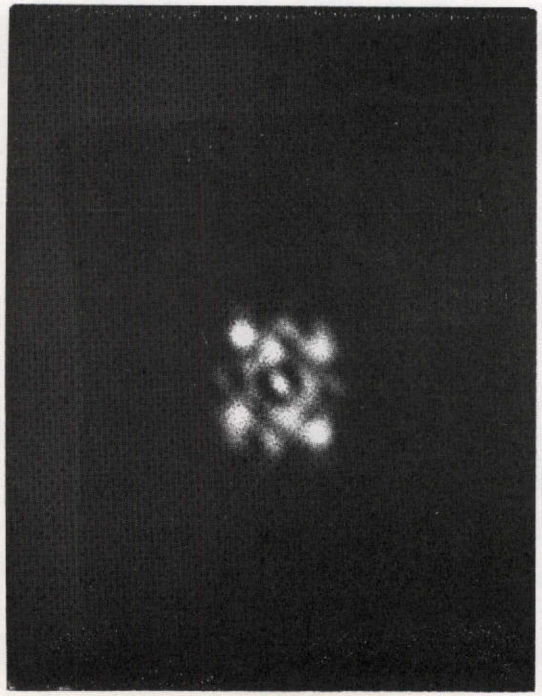


Test No. 6
Retro: CALIB.
Photo No. 93
Exposure Time: 1/500 SEC

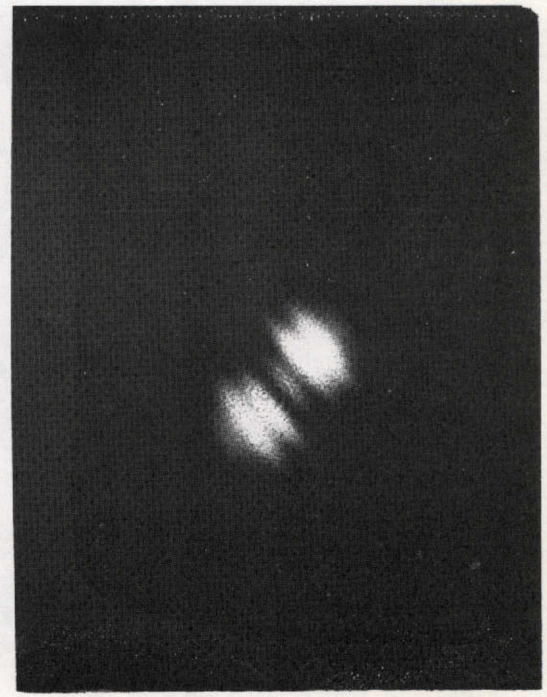
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 6
Retro: A
Photo No. 94
Exposure Time: 1/250 SEC

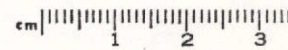


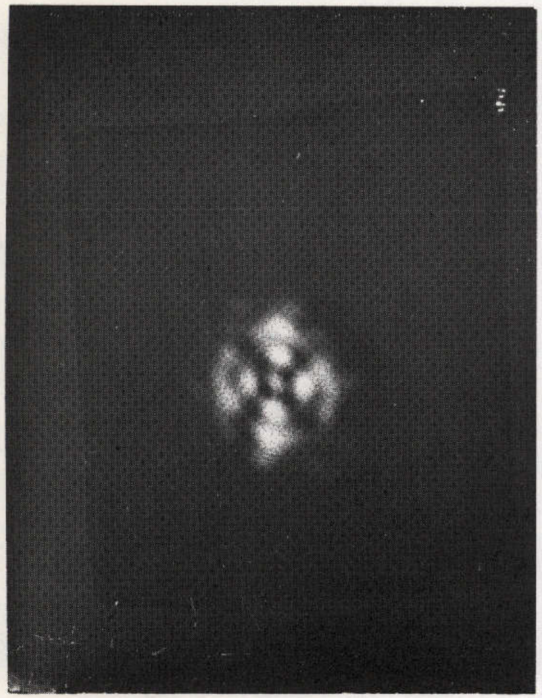
Test No. 6
Retro: A
Photo No. 95
Exposure Time: 1/250 SEC



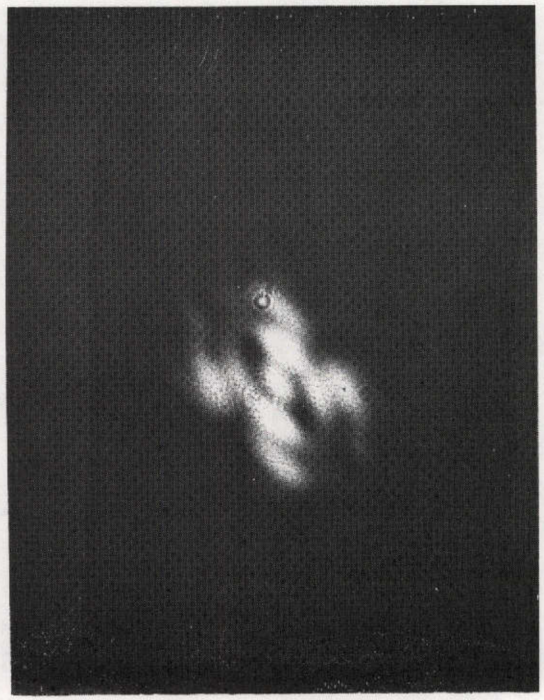
Test No. 6
Retro: A
Photo No. 96
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





Test No. 6
Retro: A
Photo No. 97
Exposure Time: 1/250 SEC



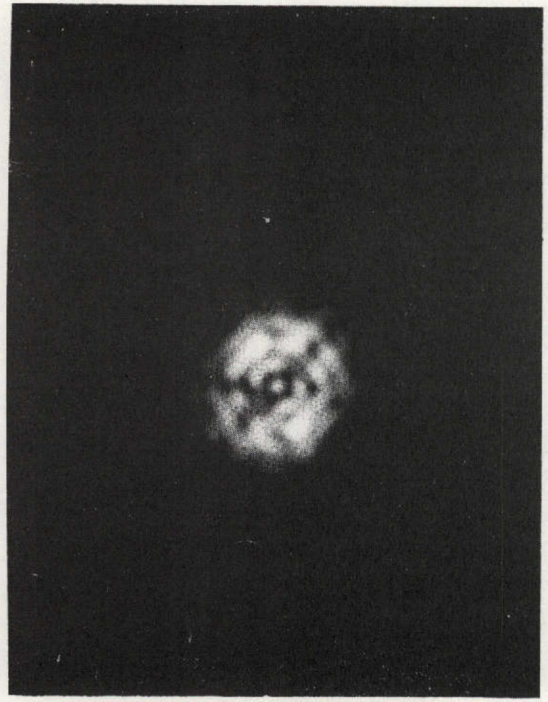
Test No. 6
Retro: A
Photo No. 98
Exposure Time: 1/60 SEC

Test No. 6
Retro: B
Photo No. 99
Exposure Time: 1/250 SEC

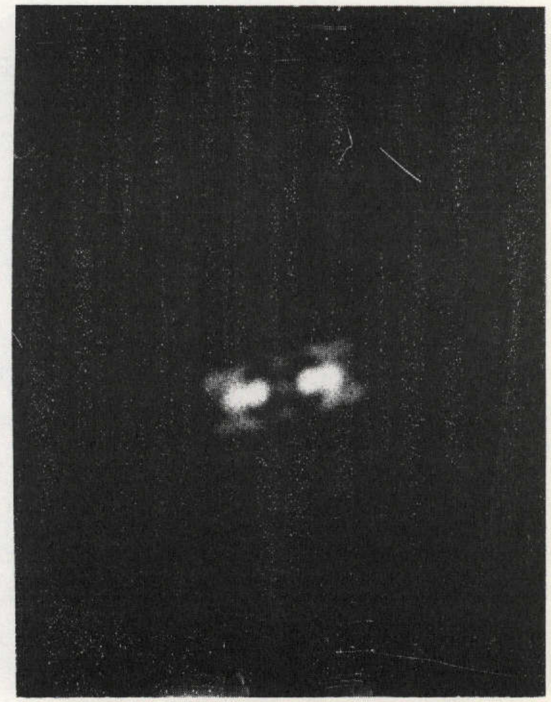
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3

Test No. 6
Retro: B
Photo No. 100
Exposure Time: 1/125 SEC

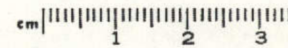


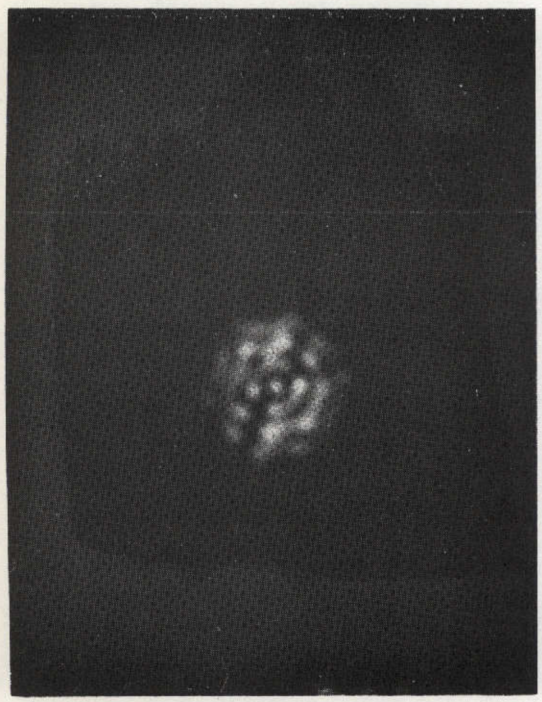
Test No. 6
Retro: C
Photo No. 101
Exposure Time: 1/250 SEC

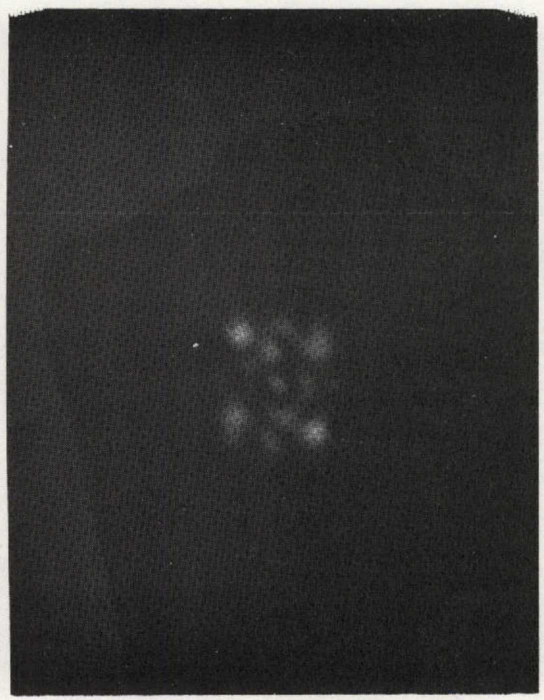


Test No. 3
Retro: CALIB.
Photo No. 102
Exposure Time: 1/500 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI







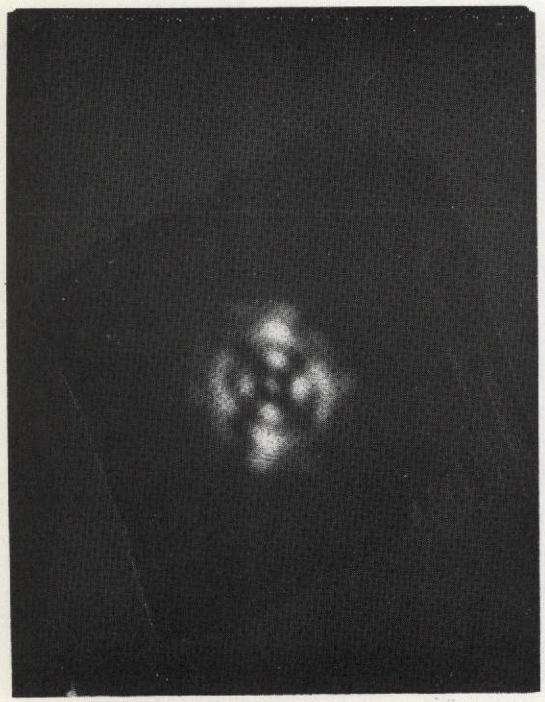
Test No. 3
Retro: A
Photo No. 103
Exposure Time: 1/500 SEC

Test No. 3
Retro: A
Photo No. 104
Exposure Time: 1/500 SEC

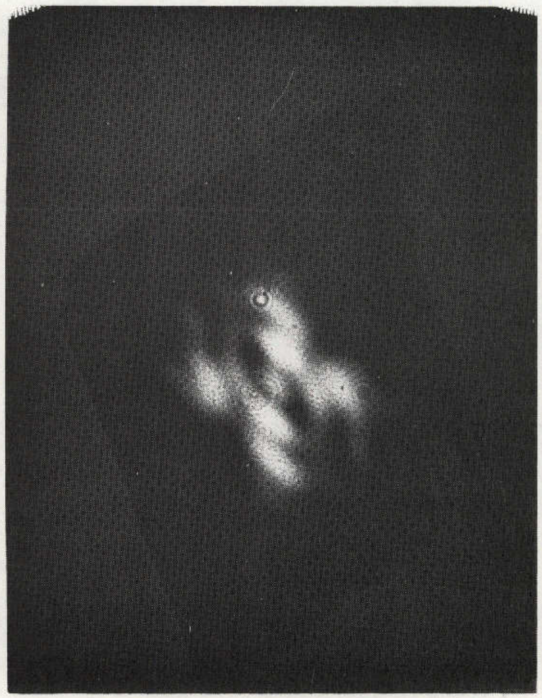
Test No. 3
Retro: A
Photo No. 105
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

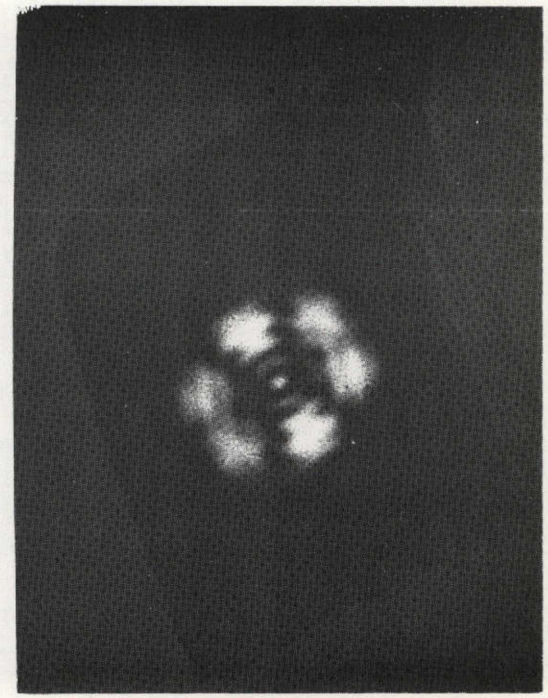
cm 1 2 3



Test No. 3
Retro: A
Photo No. 106
Exposure Time: 1/250 SEC



Test No. 3
Retro: A
Photo No. 107
Exposure Time: 1/60 SEC



Test No. 3
Retro: B
Photo No. 108
Exposure Time: 1/250 SEC

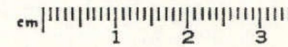
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 3
Retro: B
Photo No. 109
Exposure Time: 1/125 SEC

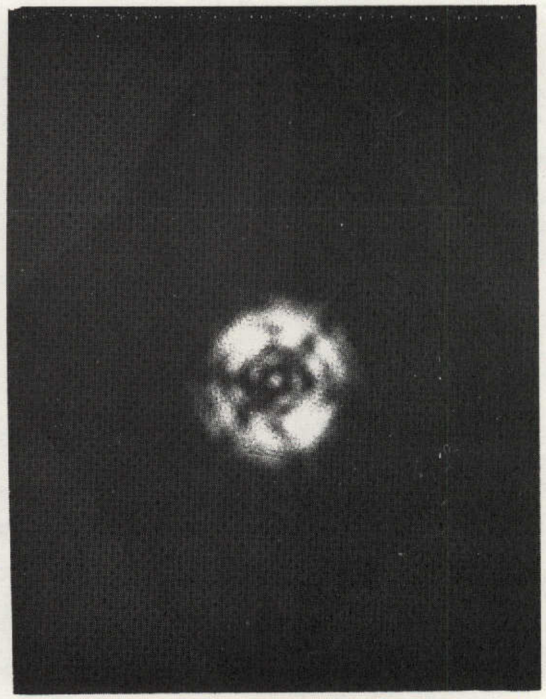
Test No. 3
Retro: B
Photo No. 110
Exposure Time: 1/15 SEC

Test No. 3
Retro: B
Photo No. 111
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



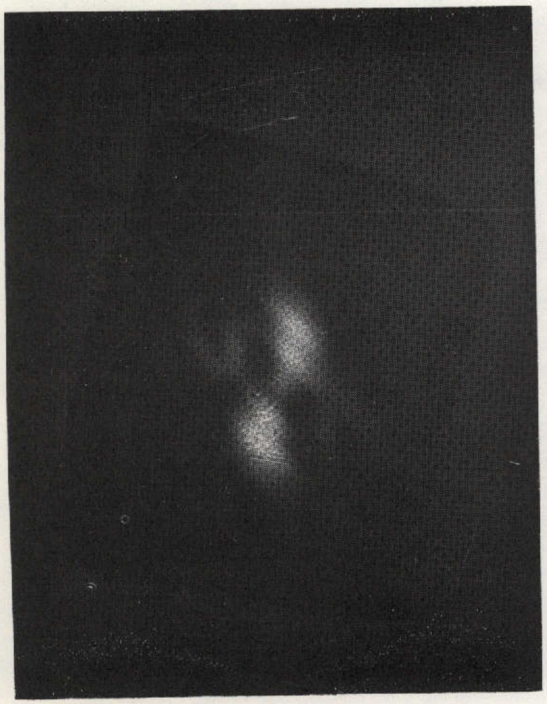
Test No. 3
Retro: B
Photo No. 112
Exposure Time: 1/30 SEC



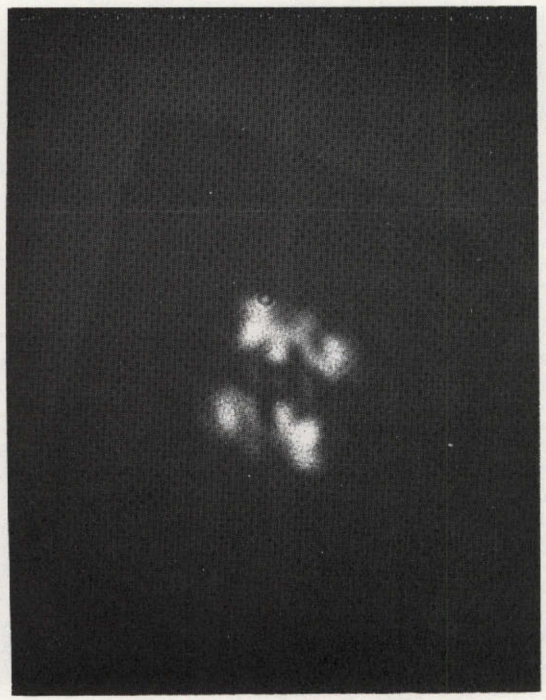
Test No. 3
Retro: C
Photo No. 113
Exposure Time: 1/250 SEC

Test No. 3
Retro: C
Photo No. 114
Exposure Time: 1/250 SEC

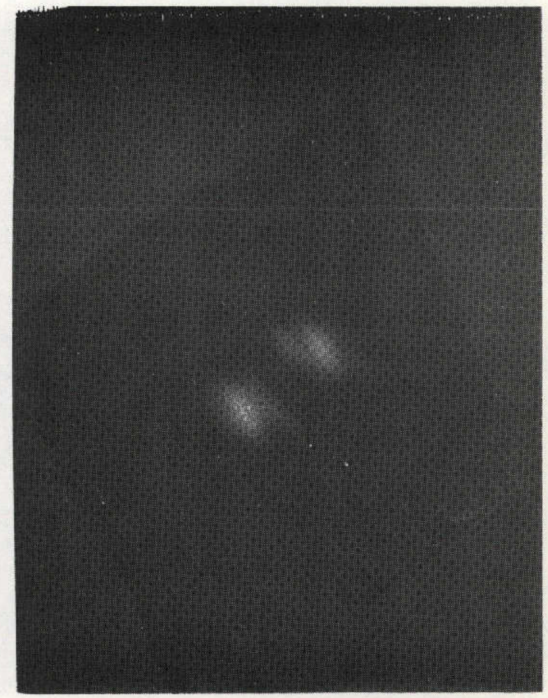
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 3
Retro: C
Photo No. 115
Exposure Time: 1/30 SEC

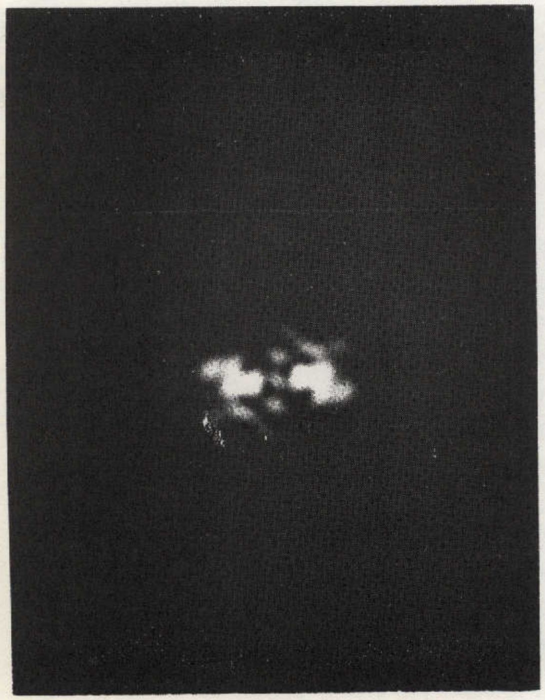


Test No. 3
Retro: C
Photo No. 116
Exposure Time: 1/250 SEC

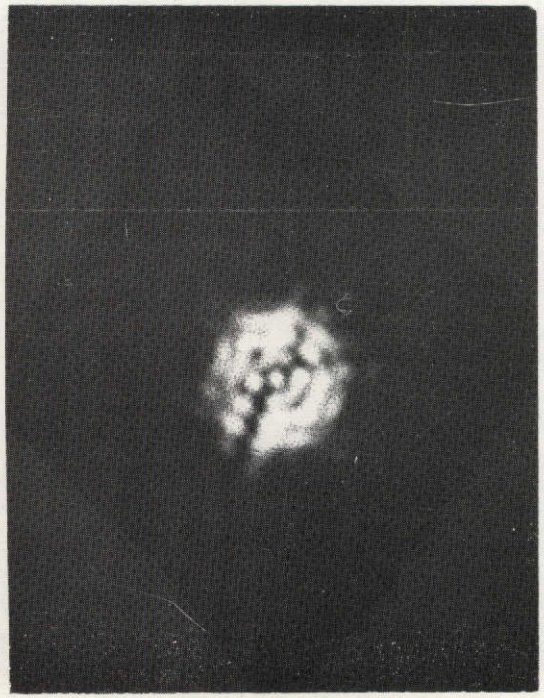


Test No. 3
Retro: C
Photo No. 117
Exposure Time: 1/30 SEC

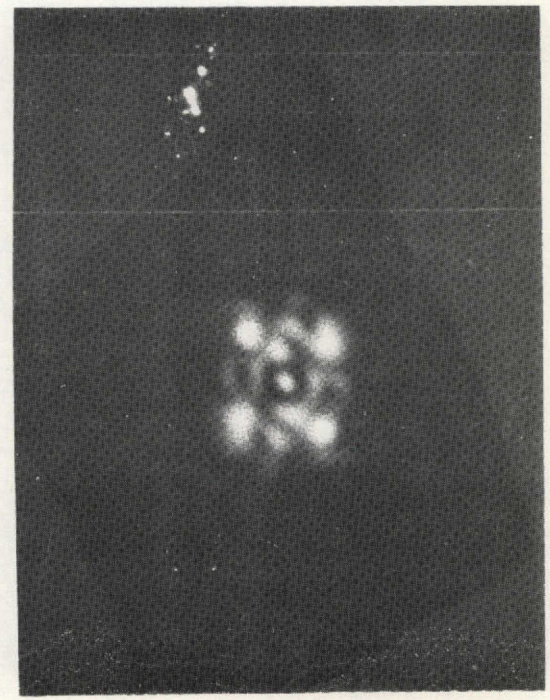
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 18
Retro: CALIB.
Photo No. 118
Exposure Time: 1/500 SEC

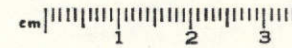


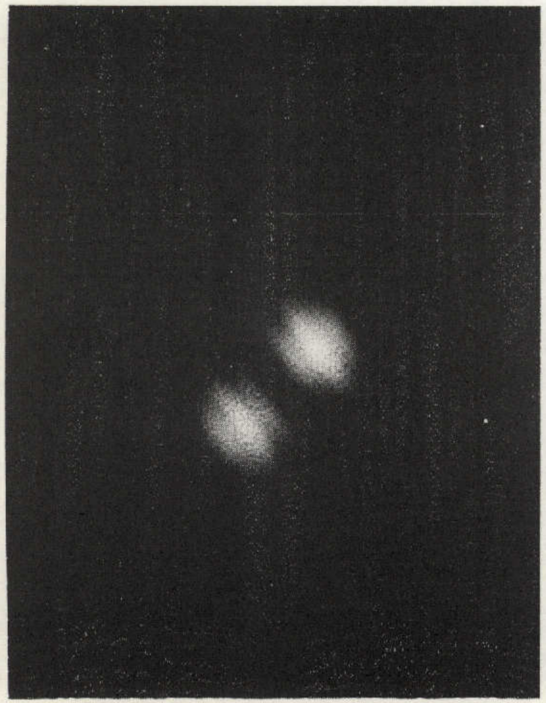
Test No. 18
Retro: A
Photo No. 119
Exposure Time: 1/250 SEC



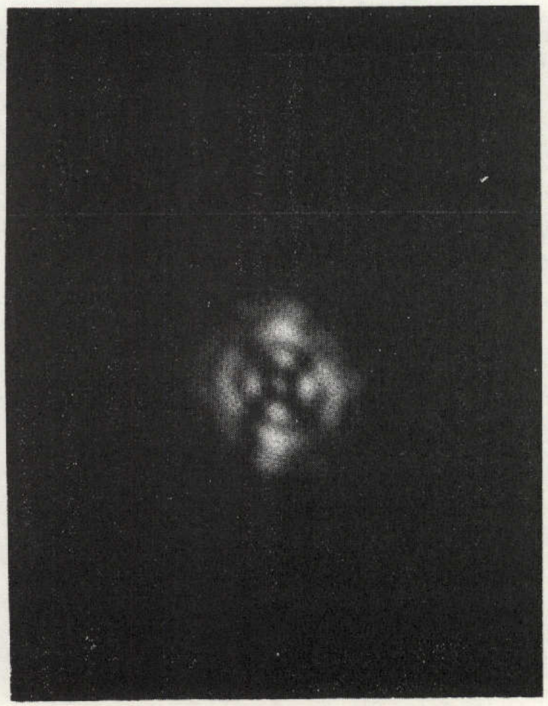
Test No. 18
Retro: A
Photo No. 120
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





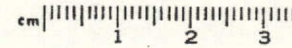
Test No. 18
Retro: A
Photo No. 121
Exposure Time: 1/8 SEC

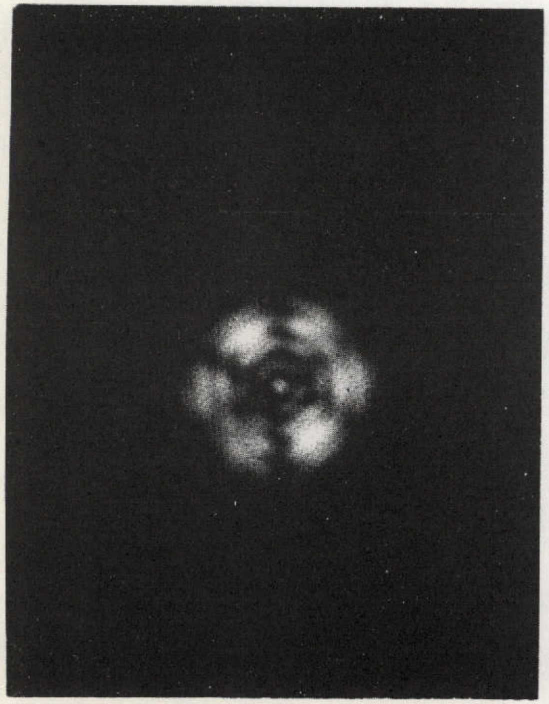


Test No. 18
Retro: A
Photo No. 122
Exposure Time: 1/250 SEC

Test No. 18
Retro: A
Photo No. 123
Exposure Time: 1/60 SEC

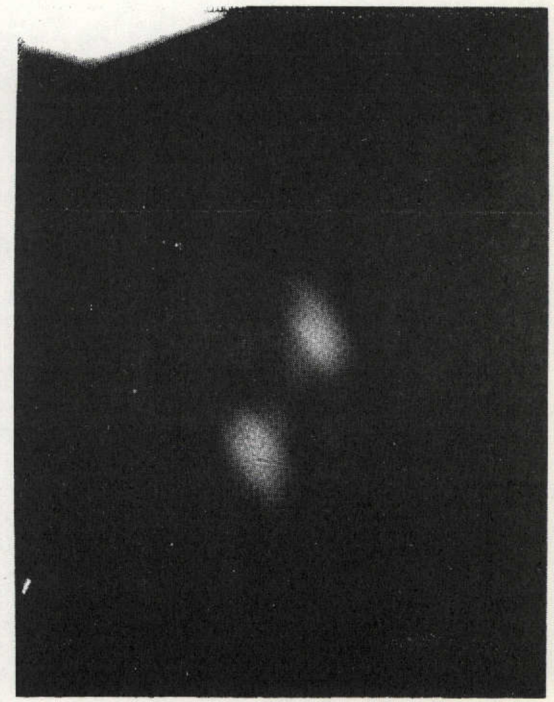
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





Test No. 18
Retro: B
Photo No. 124
Exposure Time: 1/250 SEC

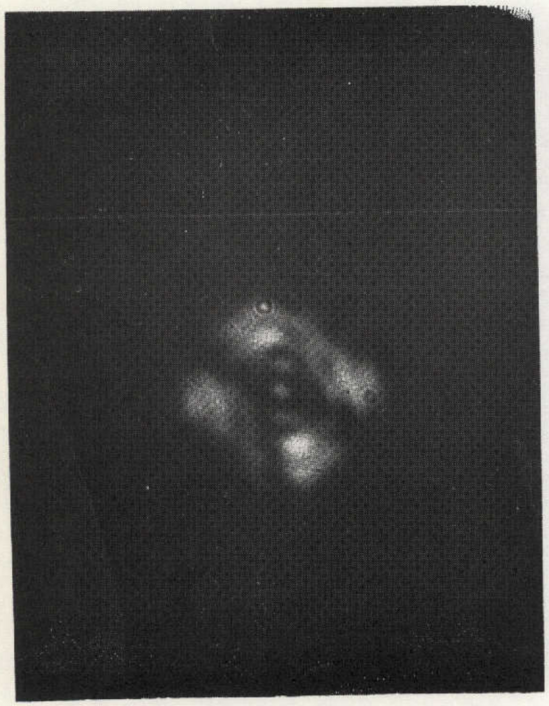
Test No. 18
Retro: B
Photo No. 125
Exposure Time: 1/125 SEC



Test No. 18
Retro: B
Photo No. 126
Exposure Time: 1/15 SEC

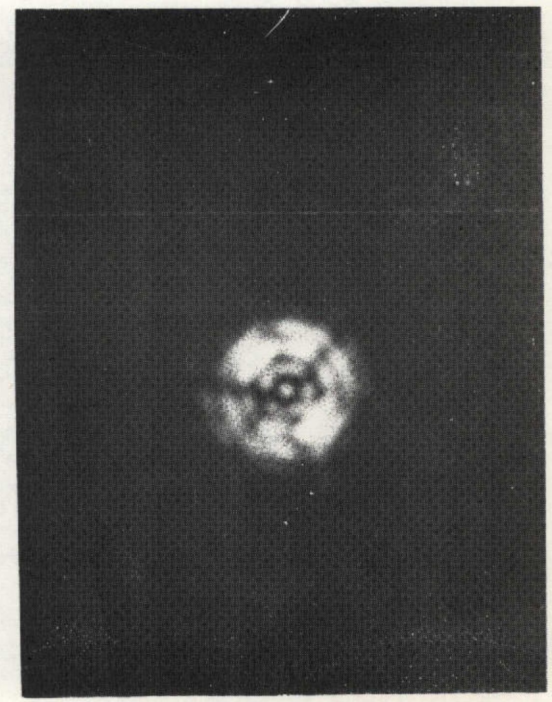
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3



Test No. 18
Retro: B
Photo No. 127
Exposure Time: 1/250 SEC

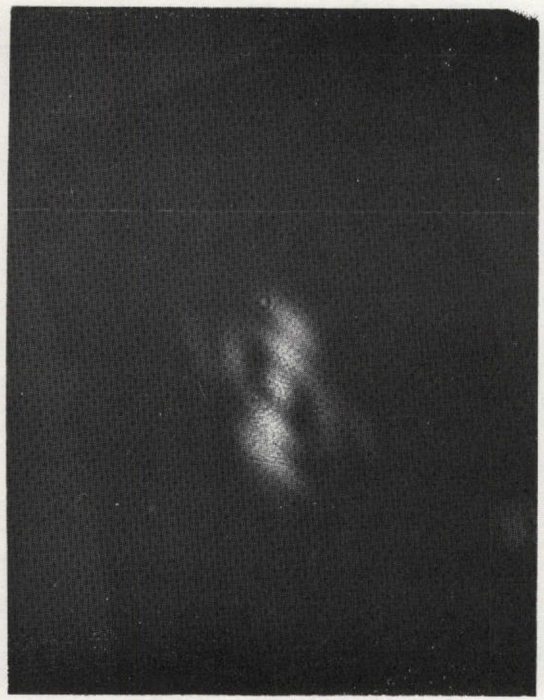
Test No. 18
Retro: B
Photo No. 128
Exposure Time: 1/30 SEC



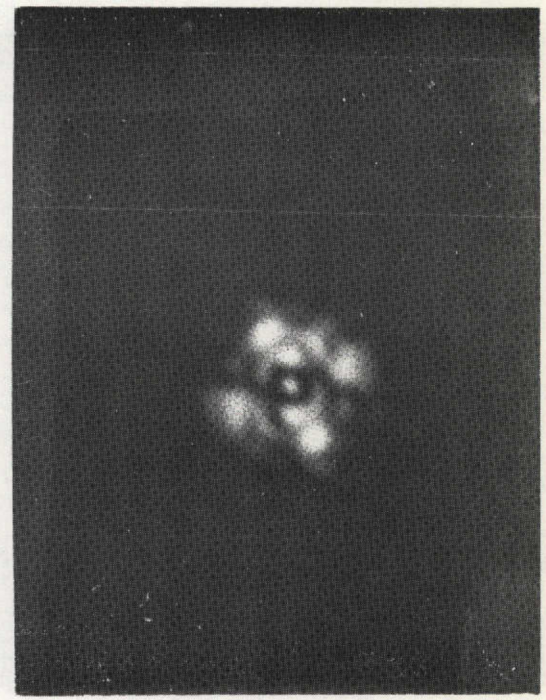
Test No. 18
Retro: C
Photo No. 129
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 18
Retro: C
Photo No. 130
Exposure Time: 1/250 sec



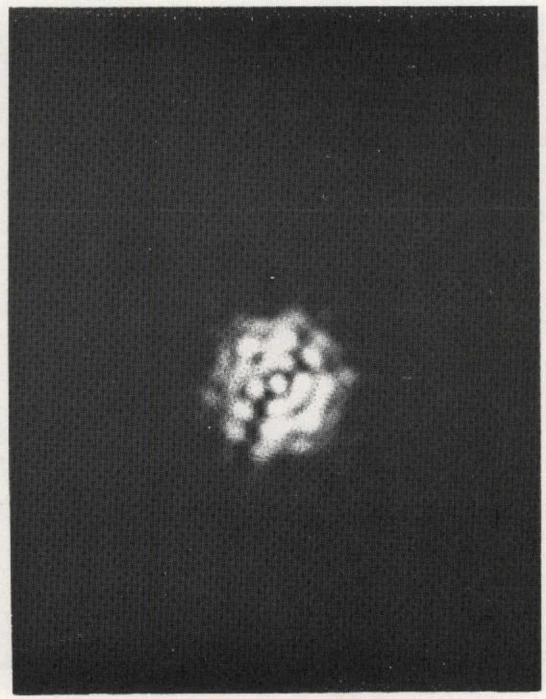
Test No. 18
Retro: C
Photo No. 131
Exposure Time: 1/30 sec



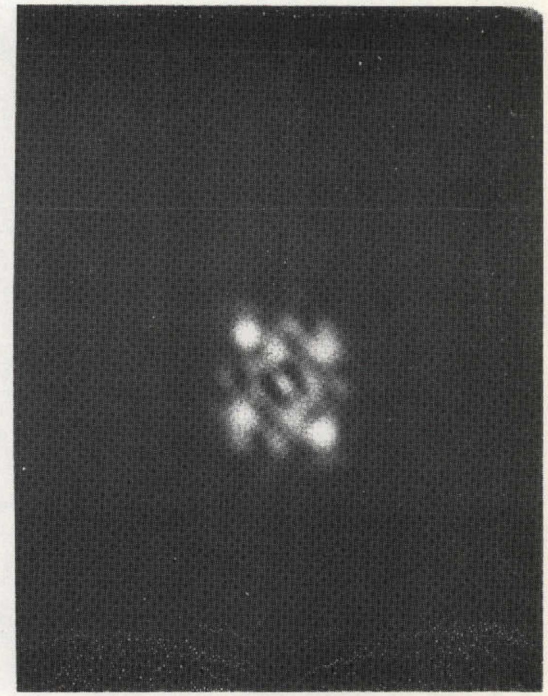
Test No. 18
Retro: C
Photo No. 132
Exposure Time: 1/250 sec

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 18
Retro: C
Photo No. 133
Exposure Time: 1/30 SEC

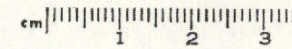


Test No. 5
Retro: A
Photo No. 134
Exposure Time: 1/250 SEC

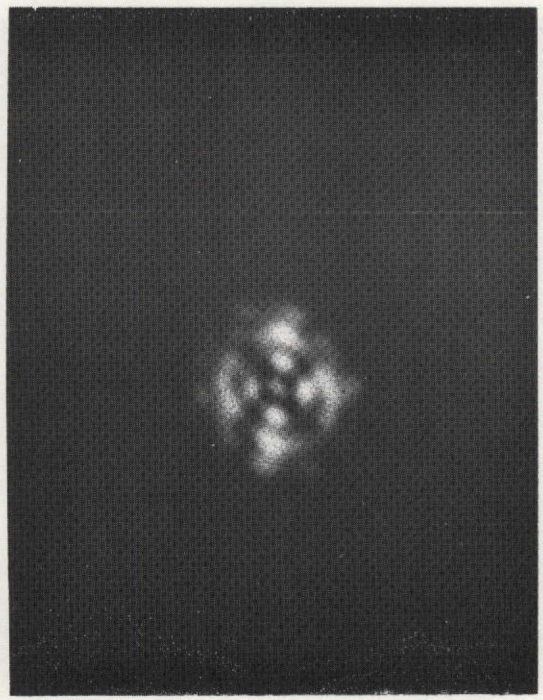


Test No. 5
Retro: A
Photo No. 135
Exposure Time: 1/250 SEC

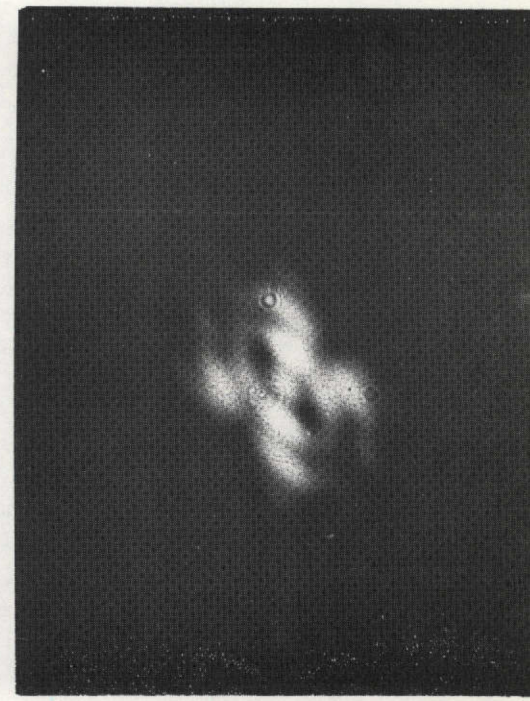
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 5
Retro: A
Photo No. 136
Exposure Time: 1/8 SEC

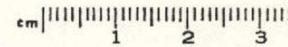


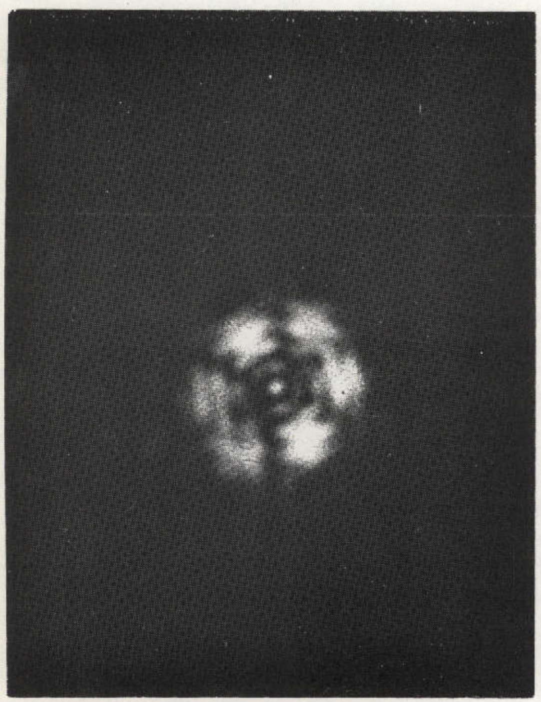
Test No. 5
Retro: A
Photo No. 137
Exposure Time: 1/250 SEC



Test No. 5
Retro: A
Photo No. 138
Exposure Time: 1/60 SEC

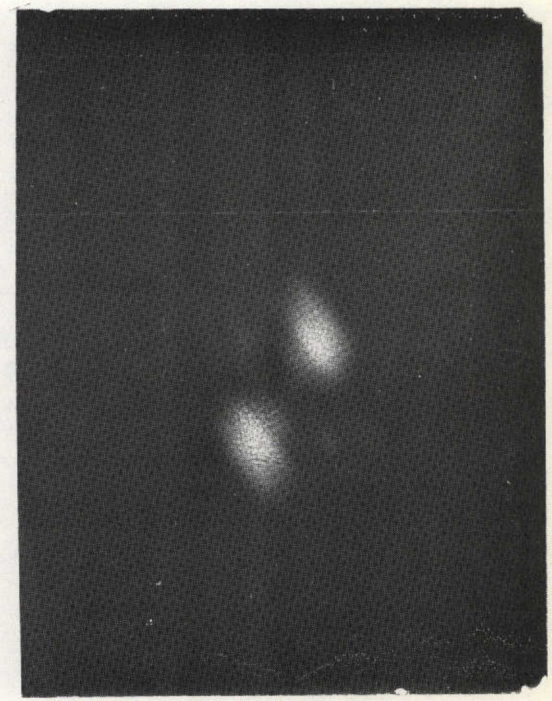
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





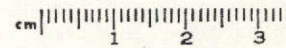
Test No. 5
Retro: B
Photo No. 139
Exposure Time: 1/250 SEC

Test No. 5
Retro: B
Photo No. 140
Exposure Time: 1/125 SEC

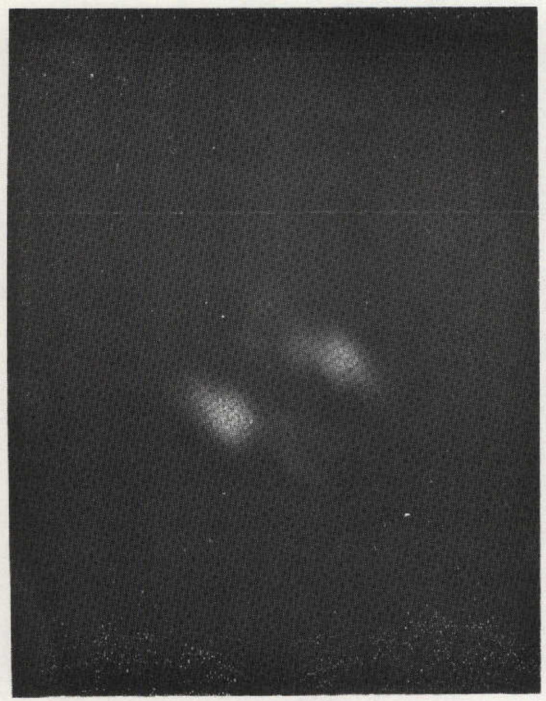


Test No. 5
Retro: B
Photo No. 141
Exposure Time: 1/15 SEC

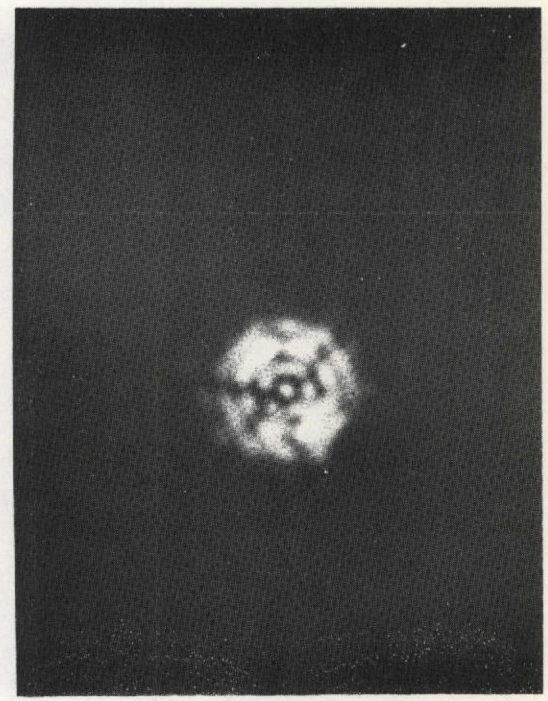
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 5
Retro: B
Photo No. 142
Exposure Time: 1/250 SEC

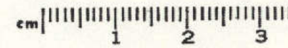


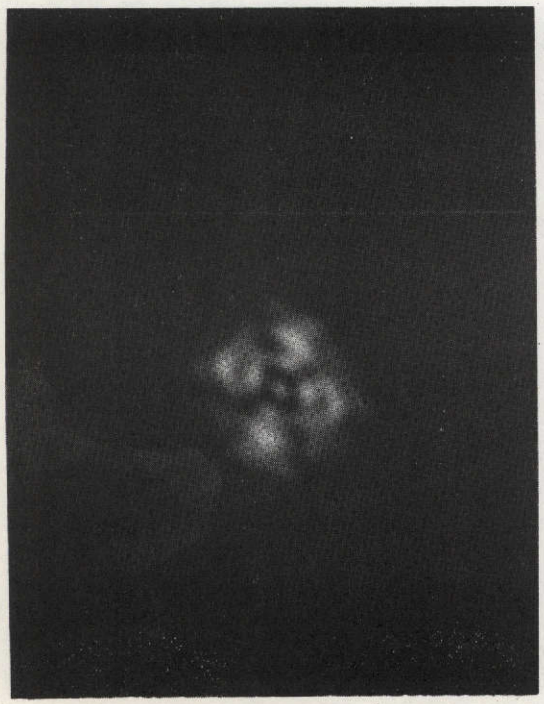
Test No. 5
Retro: B
Photo No. 143
Exposure Time: 1/30 SEC



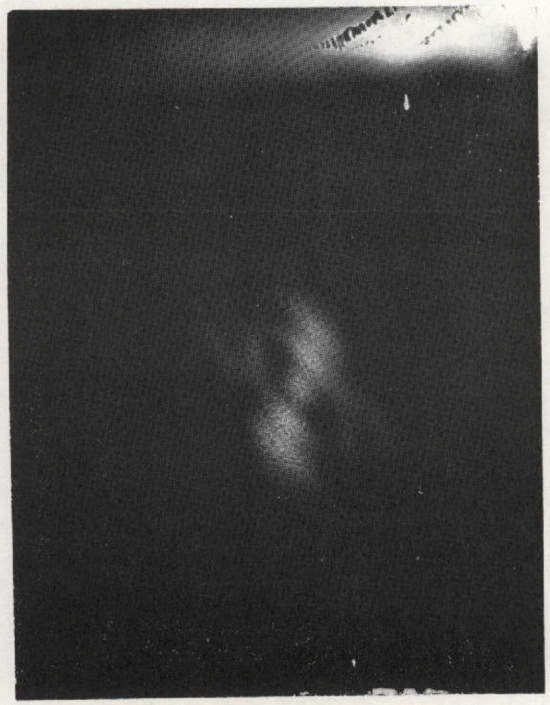
Test No. 5
Retro: C
Photo No. 144
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

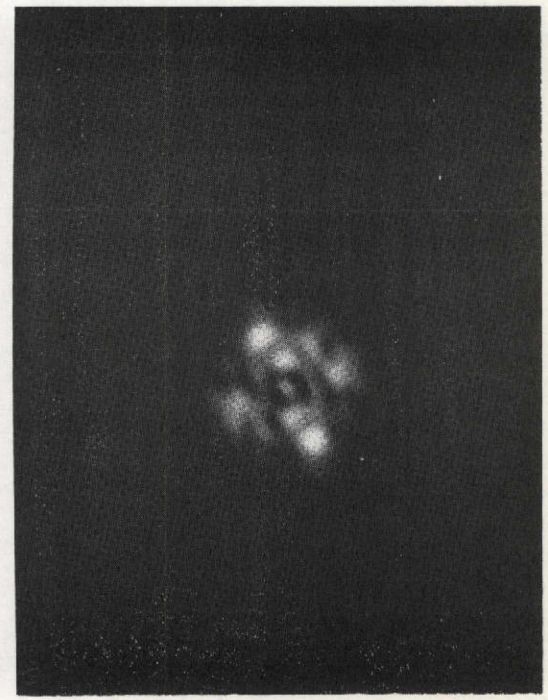




Test No. 5
Retro: C
Photo No. 145
Exposure Time: 1/250 SEC

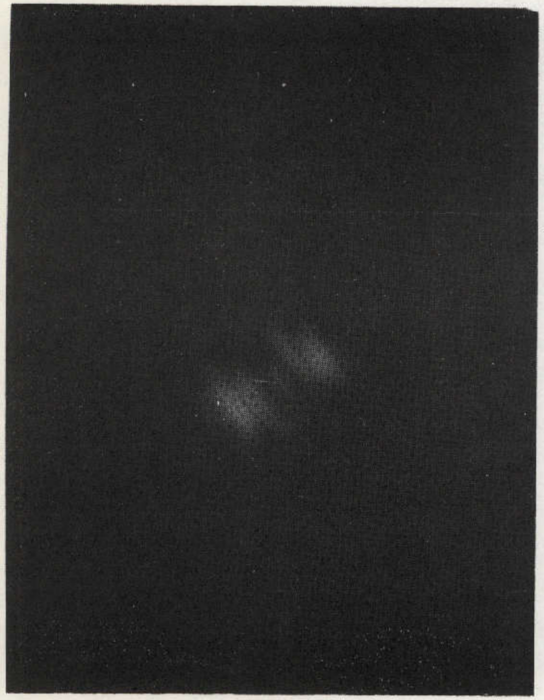


Test No. 5
Retro: C
Photo No. 146
Exposure Time: 1/30 SEC

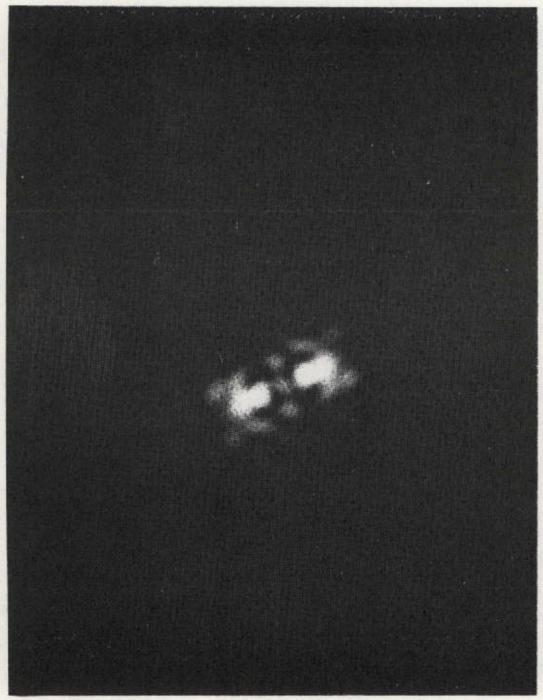


Test No. 5
Retro: C
Photo No. 147
Exposure Time: 1/250 SEC

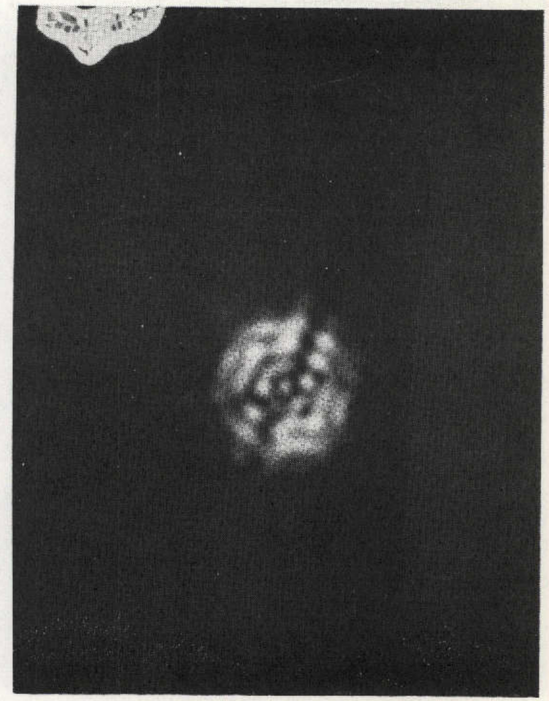
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 5
Retro: C
Photo No. 148
Exposure Time: 1/30 SEC



Test No. 10
Retro: CALIB.
Photo No. 149
Exposure Time: 1/500 SEC



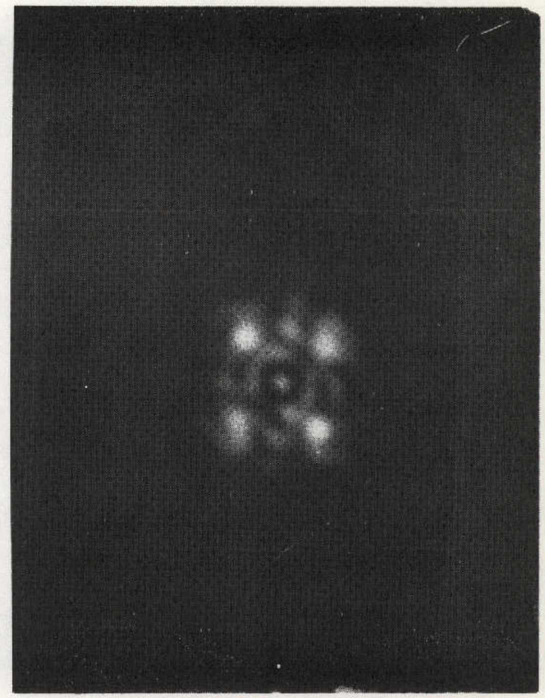
Test No. 10
Retro: D
Photo No. 150
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3

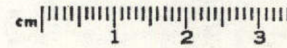
Test No. 10
Retro: D
Photo No. 151
Exposure Time: 1/250 SEC

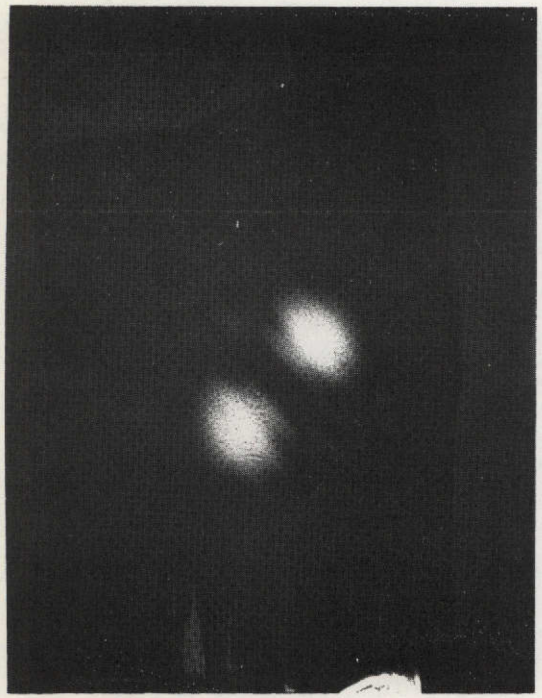
Test No. 10
Retro: D
Photo No. 152
Exposure Time: 1/30 SEC



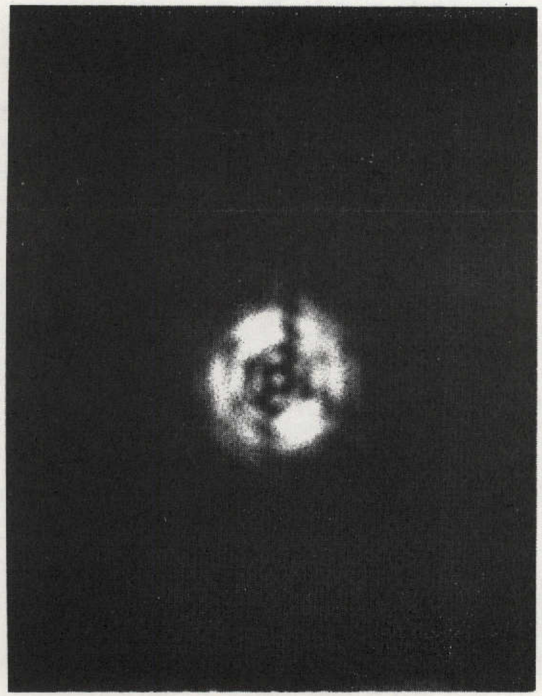
Test No. 10
Retro: D
Photo No. 153
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

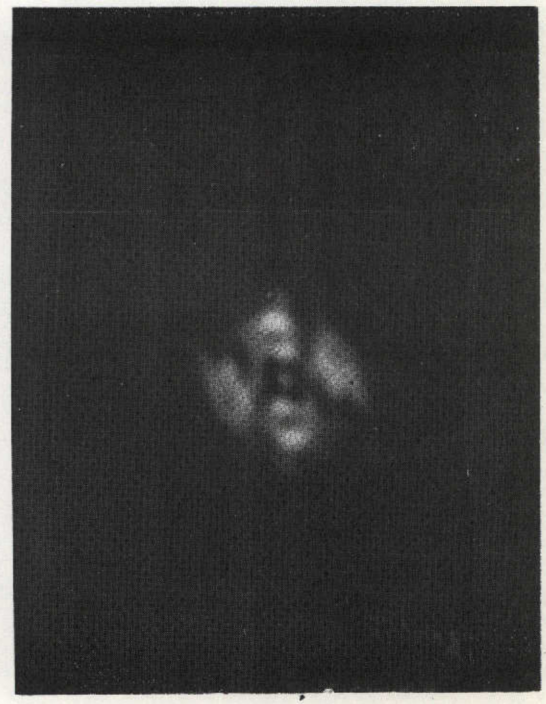




Test No. 10
Retro: D
Photo No. 154
Exposure Time: 1/8 SEC

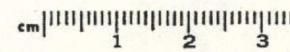


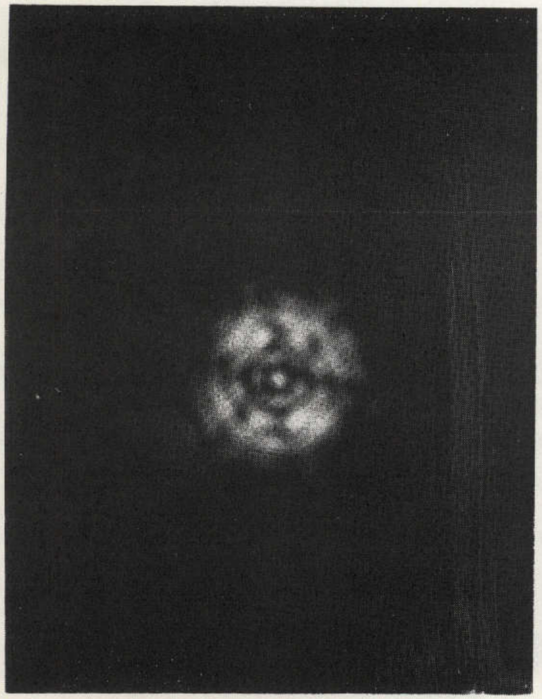
Test No. 10
Retro: E
Photo No. 155
Exposure Time: 1/250 SEC



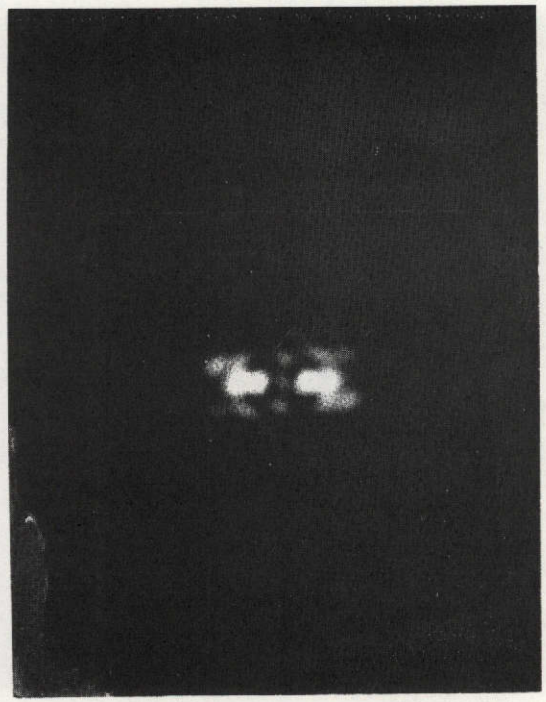
Test No. 10
Retro: E
Photo No. 156
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

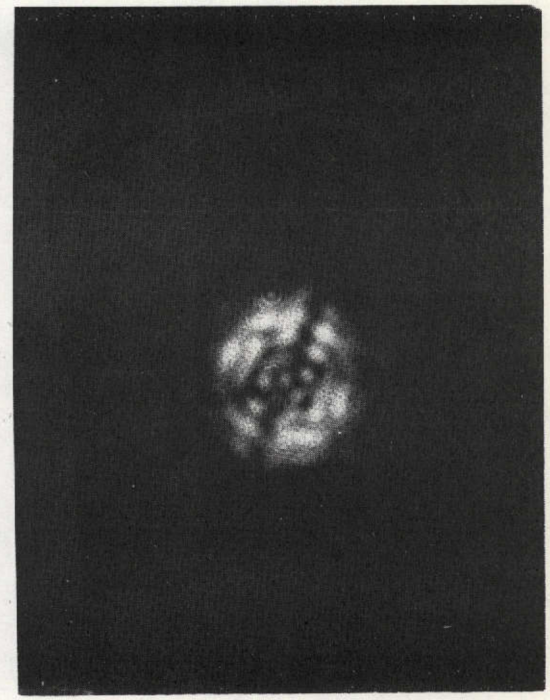




Test No. 10
Retro: F
Photo No. 157
Exposure Time: 1/250 SEC

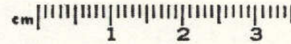


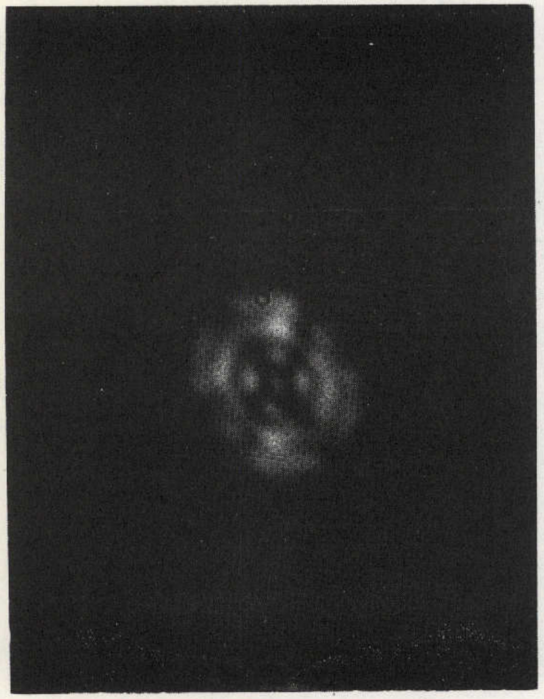
Test No. 11
Retro: CALIB.
Photo No. 158
Exposure Time: 1/500 SEC



Test No. 11
Retro: D
Photo No. 159
Exposure Time: 1/250 SEC

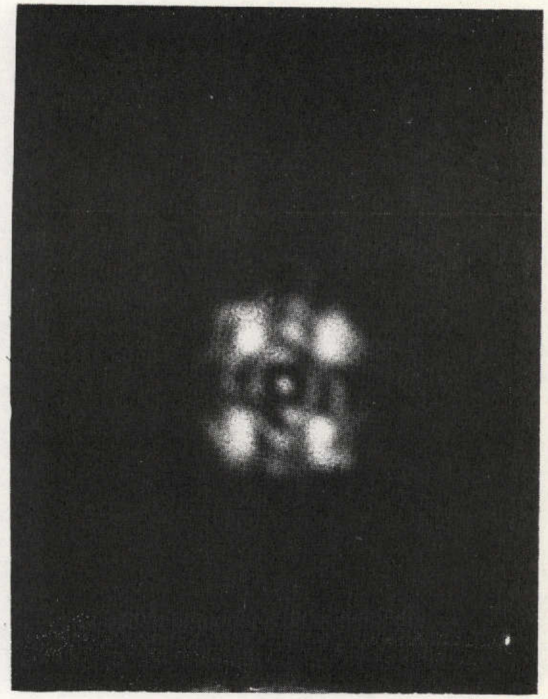
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





Test No. 11
Retro: D
Photo No. 160
Exposure Time: 1/250 SEC

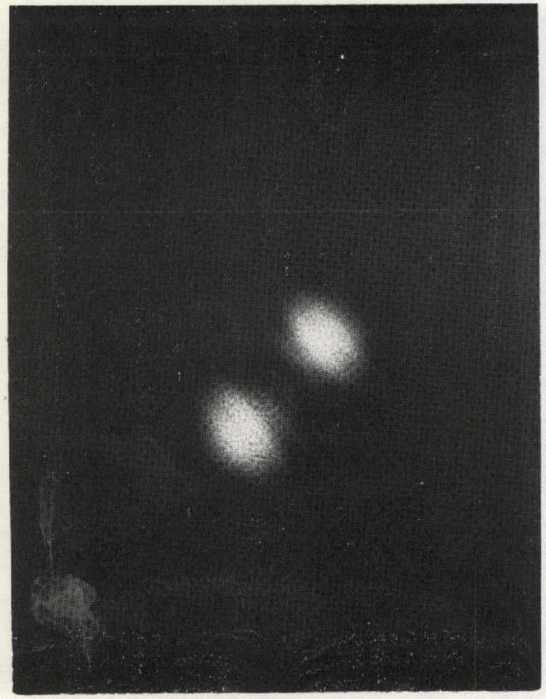
Test No. 11
Retro: D
Photo No. 161
Exposure Time: 1/60 SEC



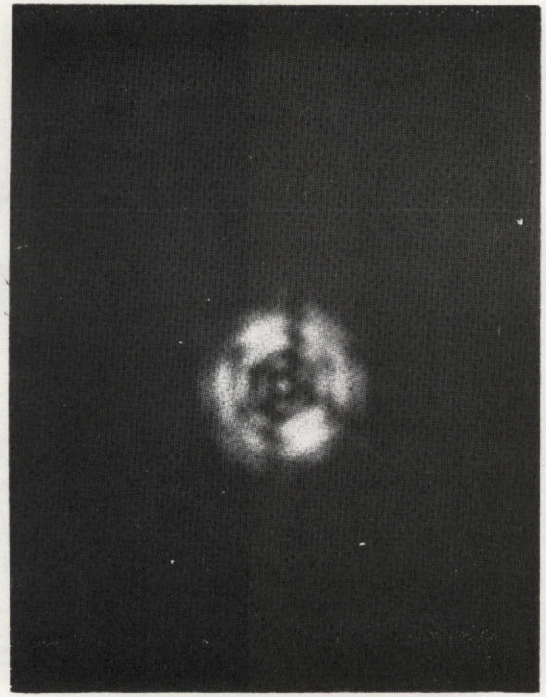
Test No. 11
Retro: D
Photo No. 162
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

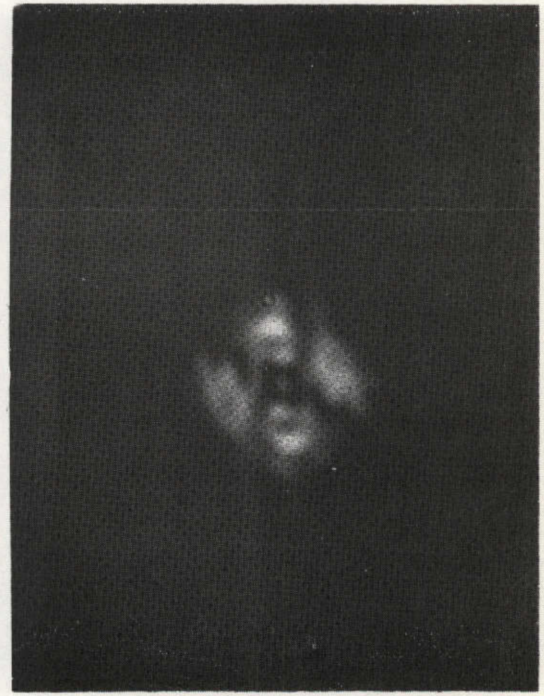
cm 1 2 3



Test No. 11
Retro: D
Photo No. 163
Exposure Time: 1/8 SEC

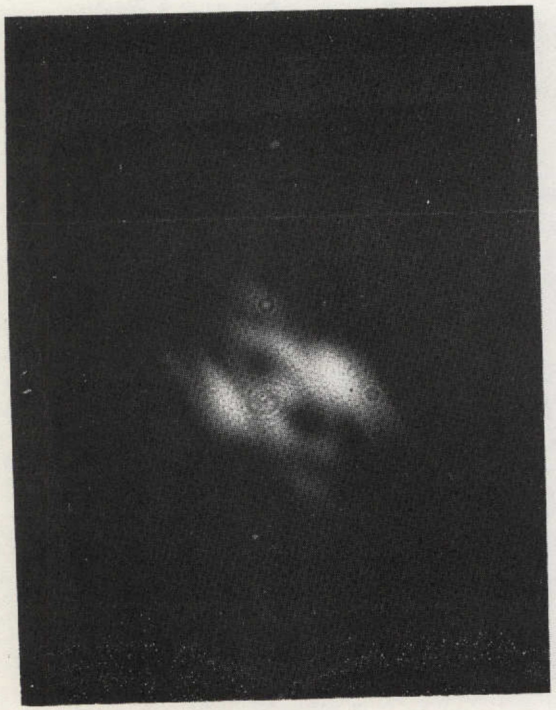


Test No. 11
Retro: E
Photo No. 164
Exposure Time: 1/250 SEC



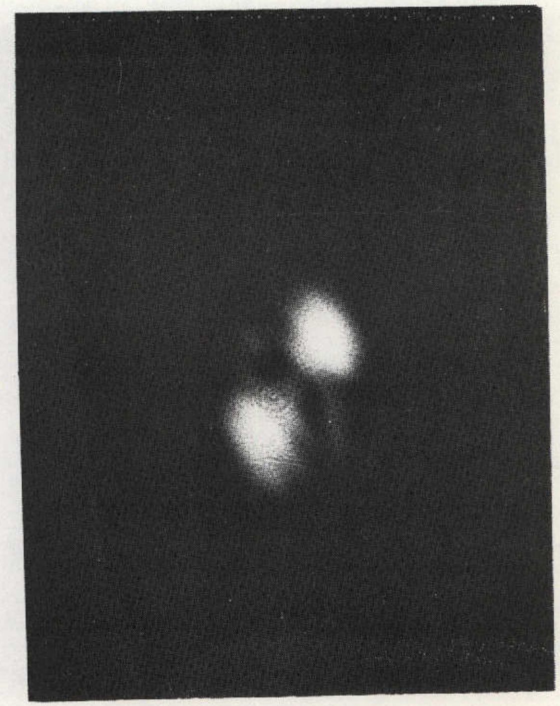
Test No. 11
Retro: E
Photo No. 165
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



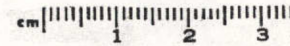
Test No. 11
Retro: E
Photo No. 166
Exposure Time: 1/15 SEC

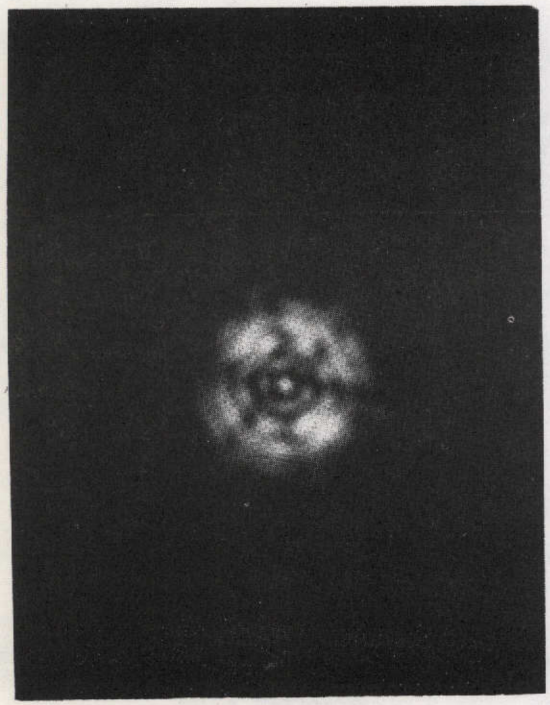
Test No. 11
Retro: E
Photo No. 167
Exposure Time: 1/125 SEC



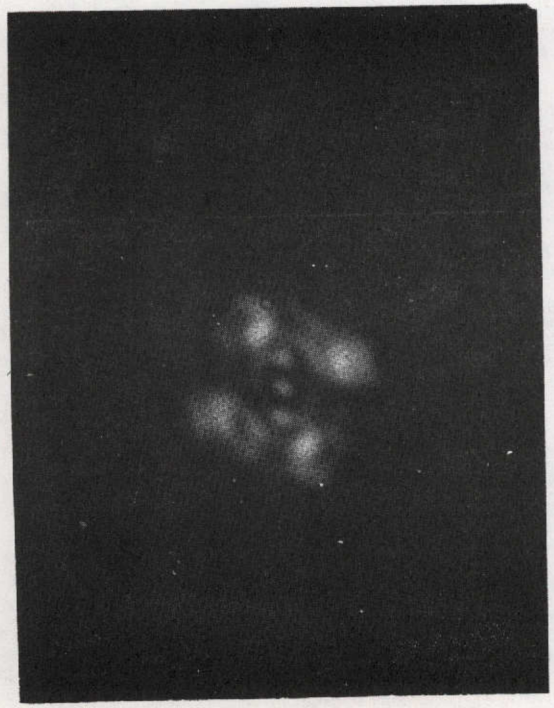
Test No. 11
Retro: E
Photo No. 168
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

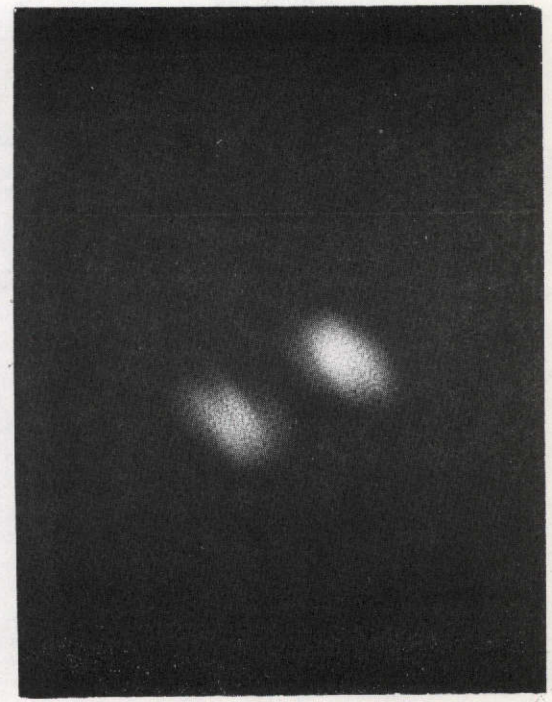




Test No. 11
Retro: F
Photo No. 169
Exposure Time: 1/250 SEC



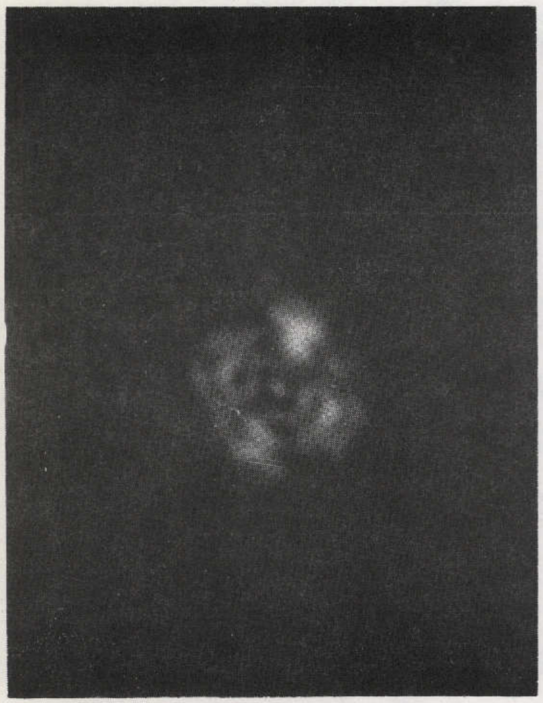
Test No. 11
Retro: F
Photo No. 170
Exposure Time: 1/250 SEC



Test No. 11
Retro: F
Photo No. 171
Exposure Time: 1/8 SEC

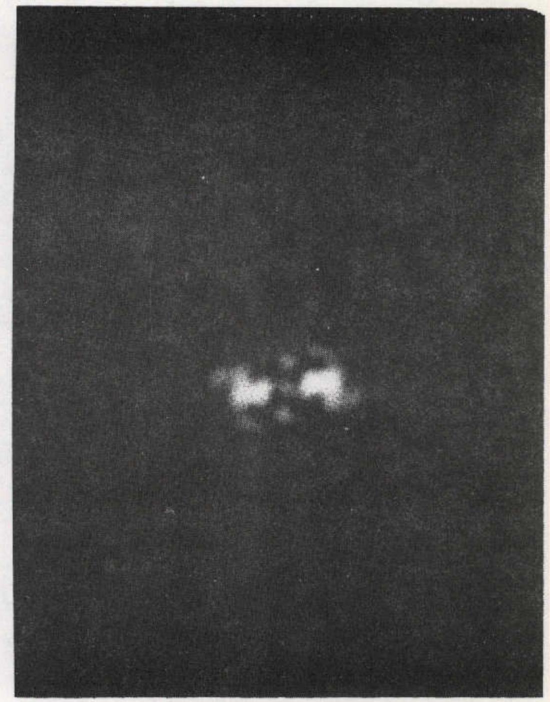
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3



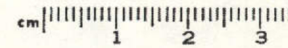
Test No. 11
Retro: F
Photo No. 172
Exposure Time: 1/250 SEC

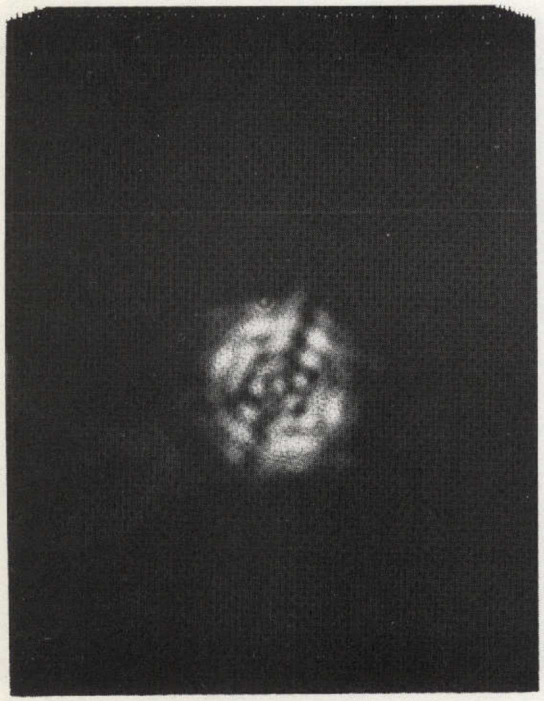
Test No. 11
Retro: F
Photo No. 173
Exposure Time: 1/15 SEC



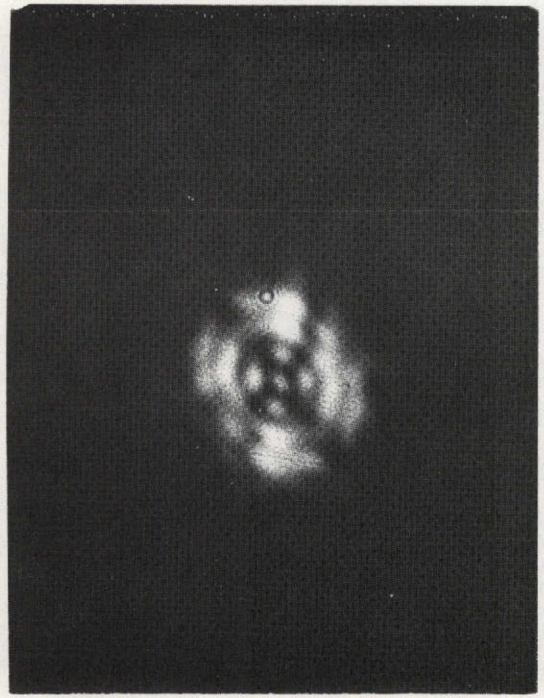
Test No. 19
Retro: CALIB.
Photo No. 174
Exposure Time: 1/500 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





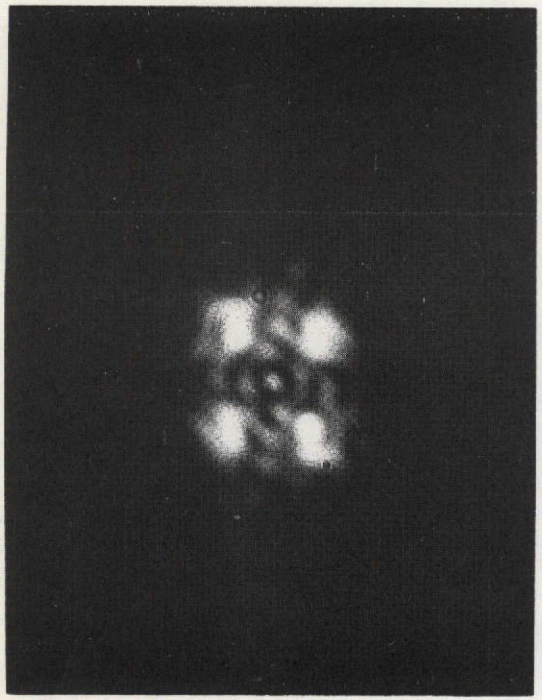
Test No. 19
Retro: D
Photo No. 175
Exposure Time: 1/250 SEC



Test No. 19
Retro: D
Photo No. 176
Exposure Time: 1/250 SEC

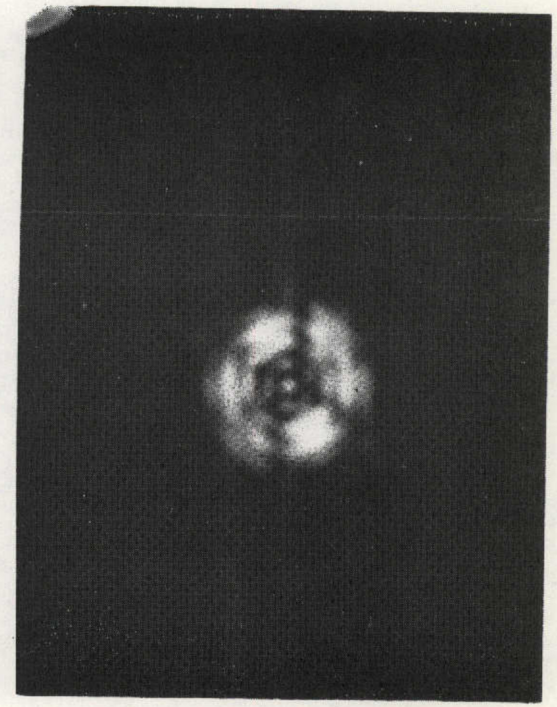
Test No. 19
Retro: D
Photo No. 177
Exposure Time: 1/60 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 19
Retro: D
Photo No. 178
Exposure Time: 1/125 SEC

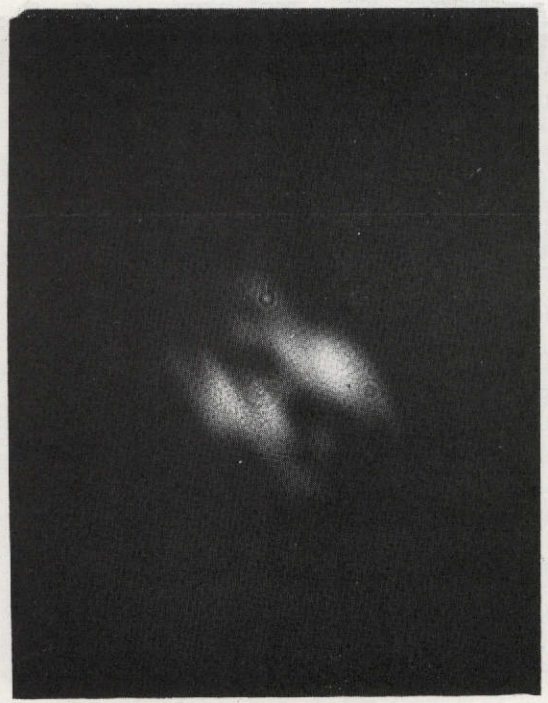
Test No. 19
Retro: D
Photo No. 179
Exposure Time: 1/8 SEC



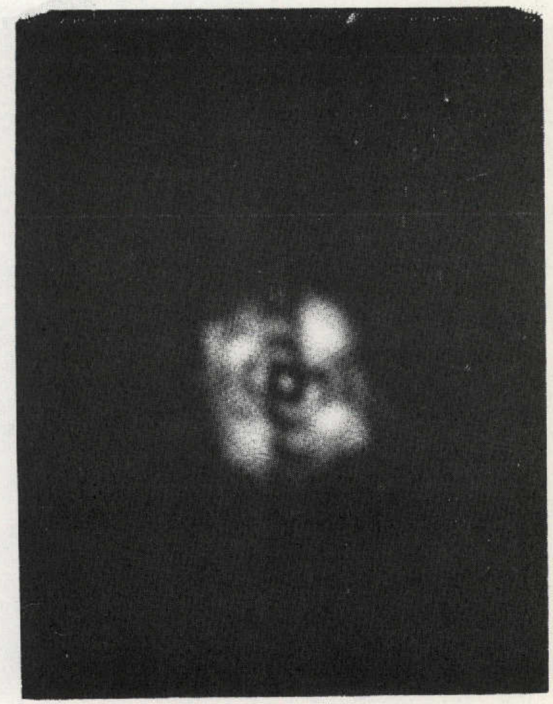
Test No. 19
Retro: E
Photo No. 180
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 19
Retro: E
Photo No. 181
Exposure Time: 1/250 SEC

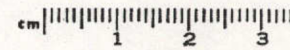


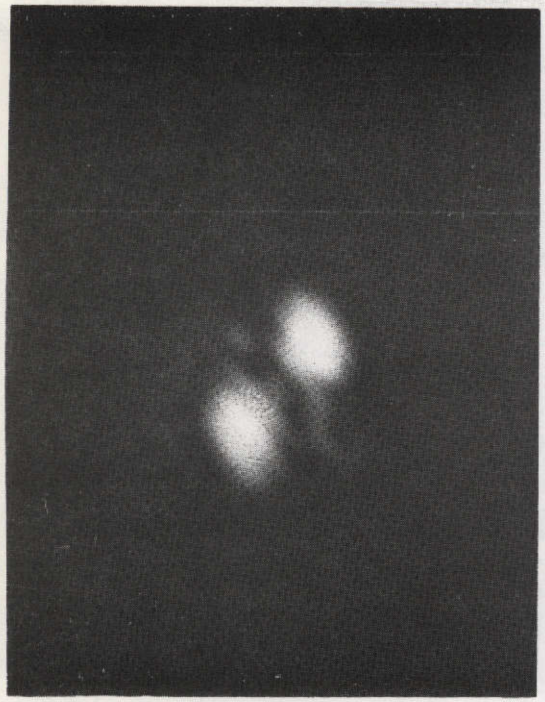
Test No. 19
Retro: E
Photo No. 182
Exposure Time: 1/15 SEC



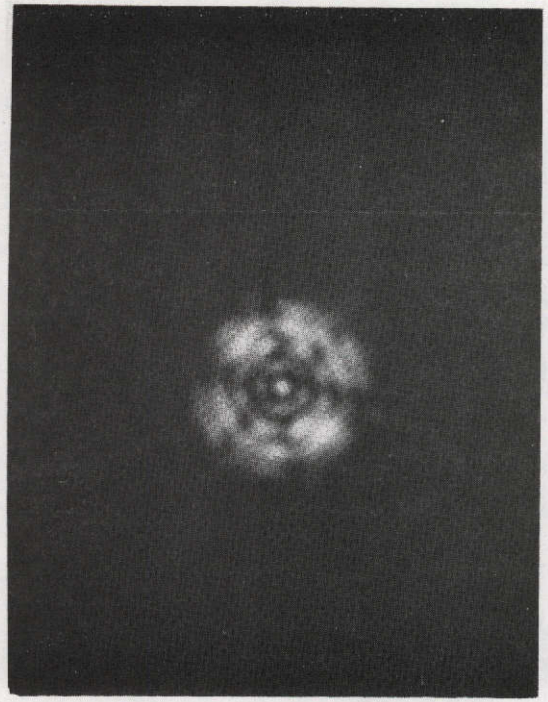
Test No. 19
Retro: E
Photo No. 183
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

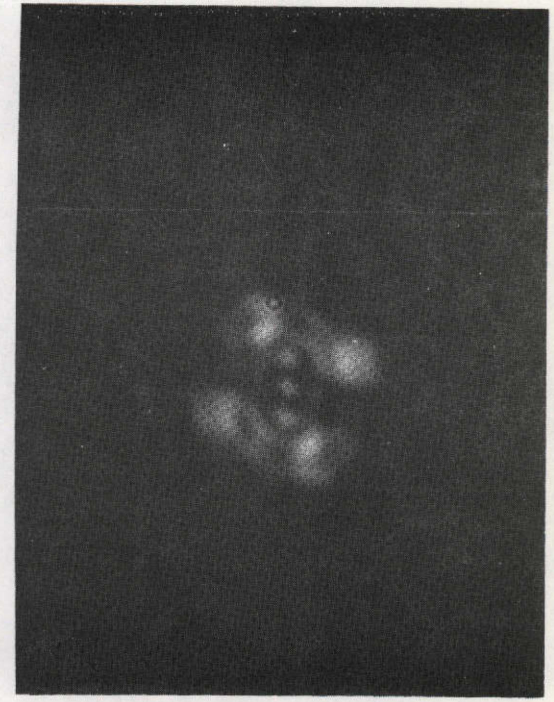




Test No. 19
Retro: E
Photo No. 184
Exposure Time: 1/8 SEC

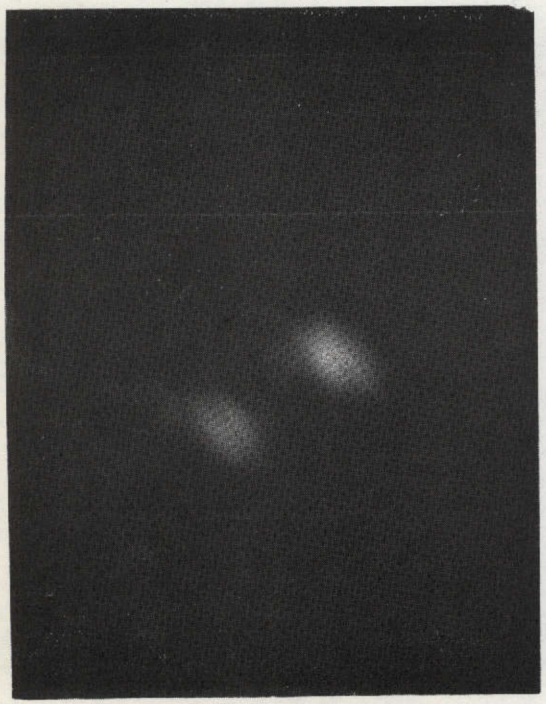


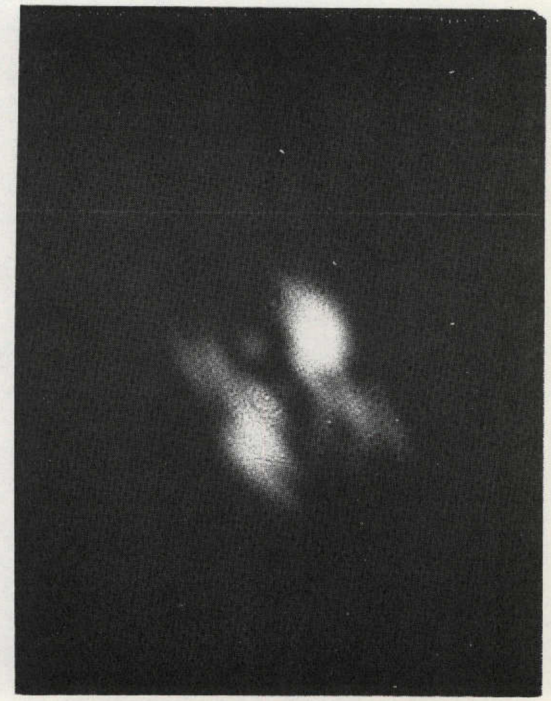
Test No. 19
Retro: F
Photo No. 185
Exposure Time: 1/250 SEC



Test No. 19
Retro: F
Photo No. 186
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



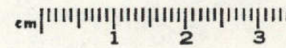


Test No. 19
Retro: F
Photo No. 187
Exposure Time: 1/15 SEC

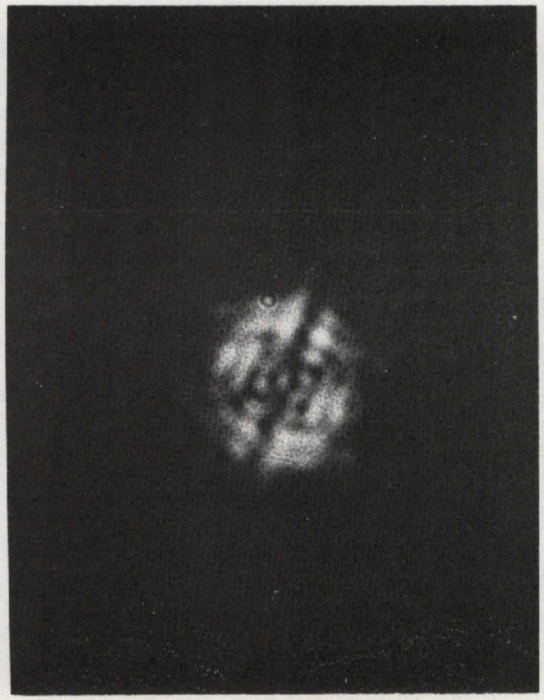
Test No. 19
Retro: F
Photo No. 188
Exposure Time: 1/250 SEC

Test No. 19
Retro: F
Photo No. 189
Exposure Time: 1/15 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



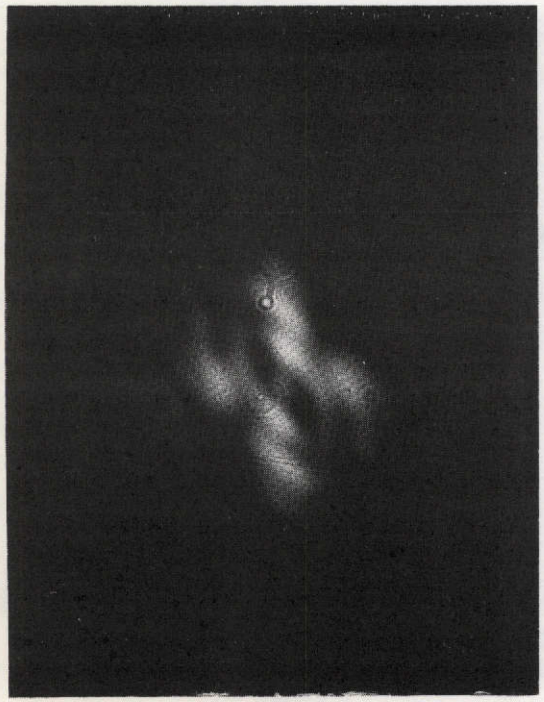
Test No. 12
Retro: CALIB.
Photo No. 190
Exposure Time: 1/500 SEC



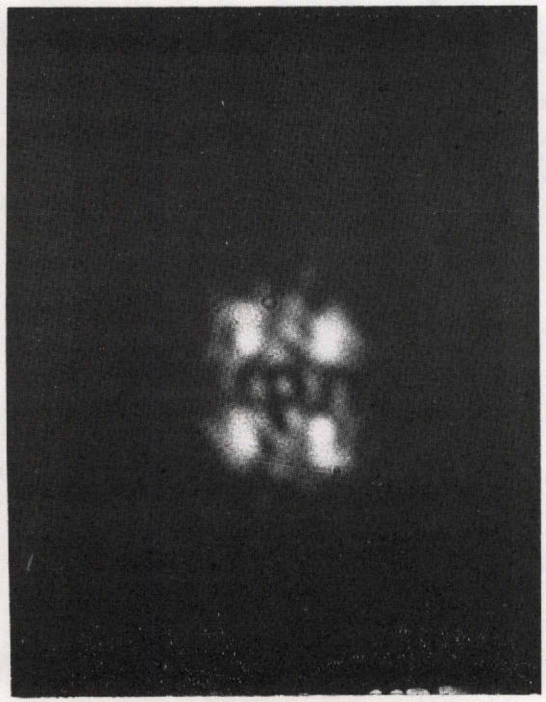
Test No. 12
Retro: D
Photo No. 191
Exposure Time: 1/250 SEC

Test No. 12
Retro: D
Photo No. 192
Exposure Time: 1/250 SEC

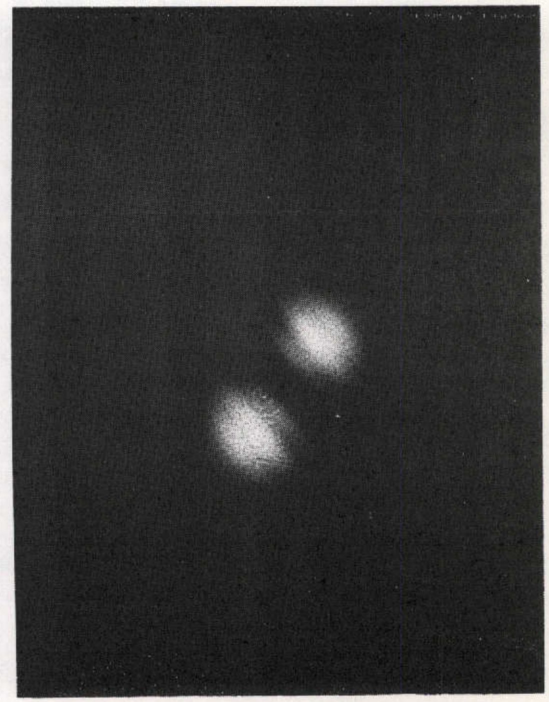
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 12
Retro: D
Photo No. 193
Exposure Time: 1/60 SEC

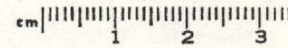


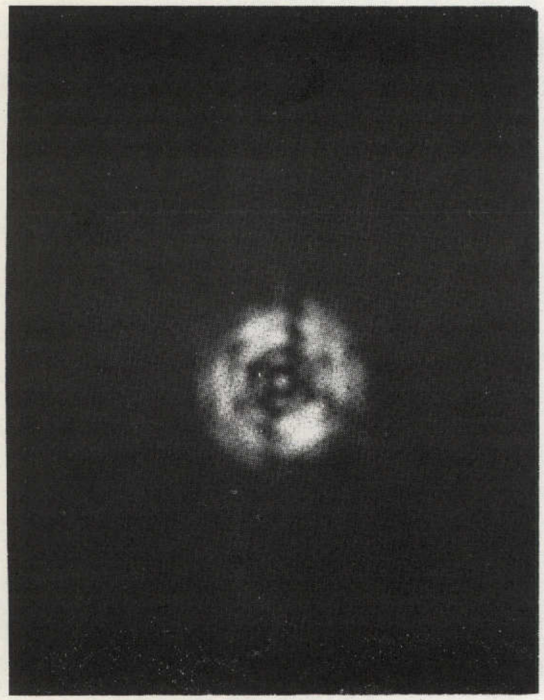
Test No. 12
Retro: D
Photo No. 194
Exposure Time: 1/125 SEC



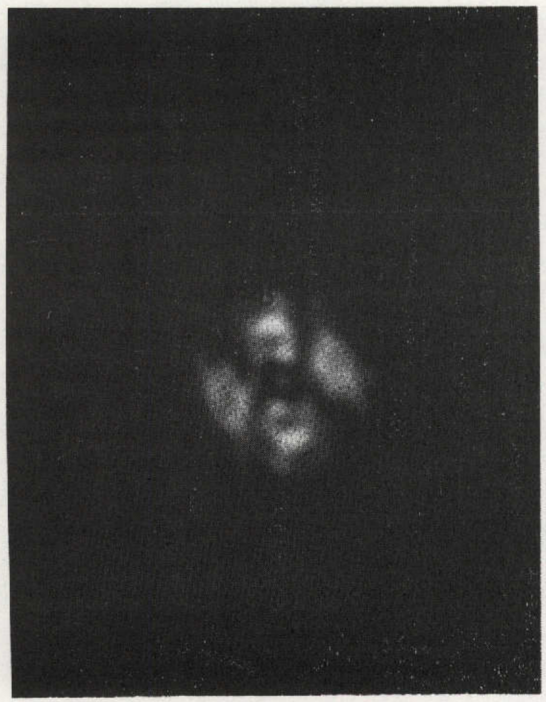
Test No. 12
Retro: D
Photo No. 195
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





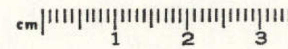
Test No. 12
Retro: E
Photo No. 196
Exposure Time: 1/250 SEC



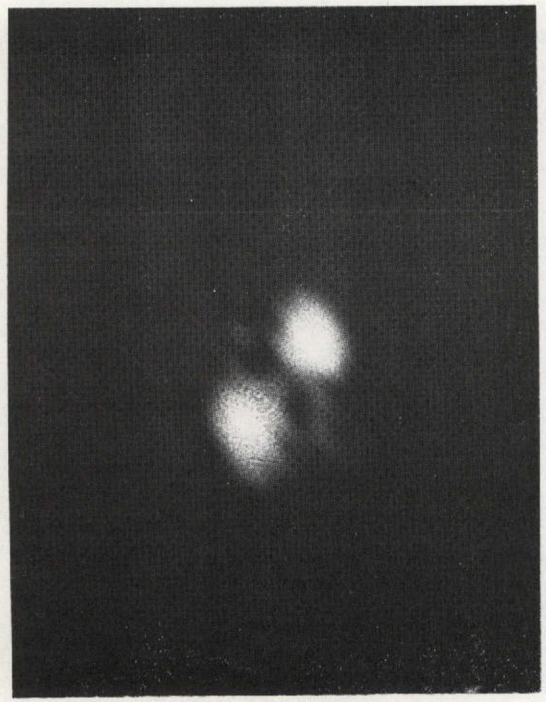
Test No. 12
Retro: E
Photo No. 197
Exposure Time: 1/250 SEC

Test No. 12
Retro: E
Photo No. 198
Exposure Time: 1/15 SEC

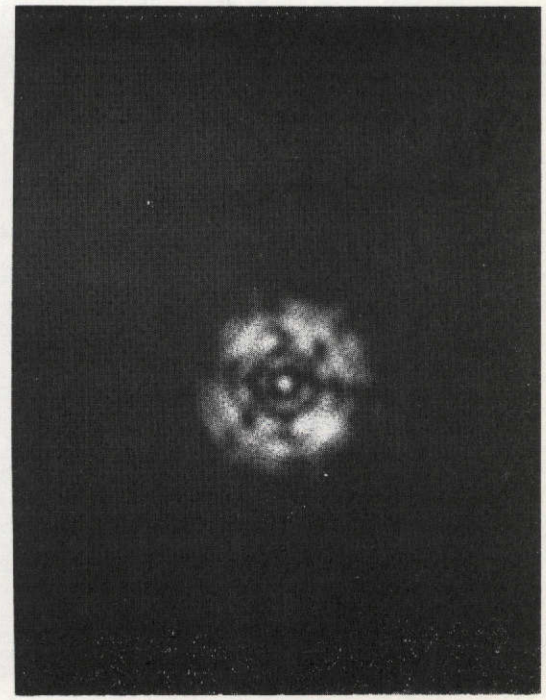
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 12
Retro: E
Photo No. 199
Exposure Time: 1/125 SEC



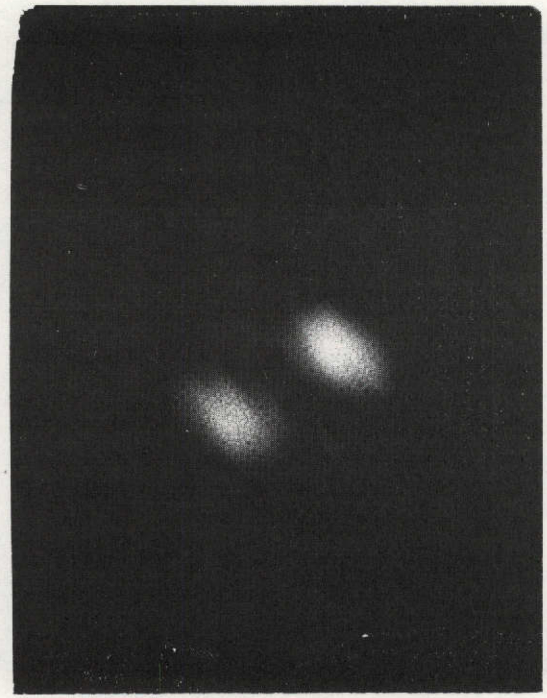
Test No. 12
Retro: E
Photo No. 200
Exposure Time: 1/8 SEC



Test No. 12
Retro: F
Photo No. 201
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

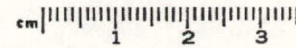
Test No. 12
Retro: F
Photo No. 202
Exposure Time: 1/250 SEC

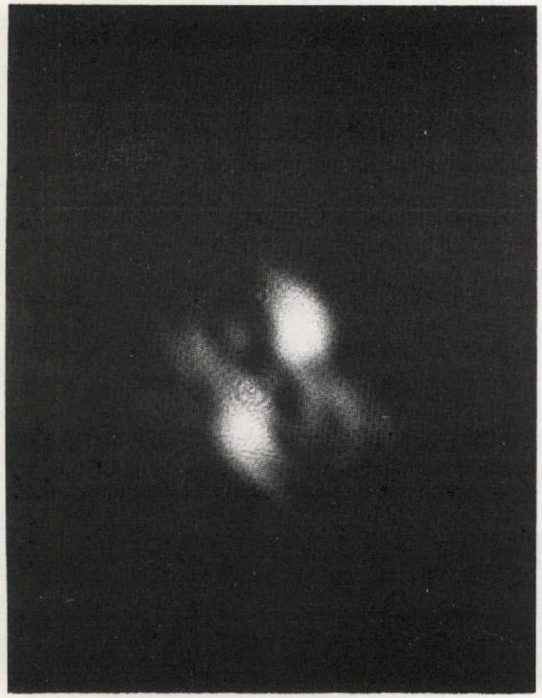


Test No. 12
Retro: F
Photo No. 203
Exposure Time: 1/8 SEC

Test No. 12
Retro: F
Photo No. 204
Exposure Time: 1/250 SEC

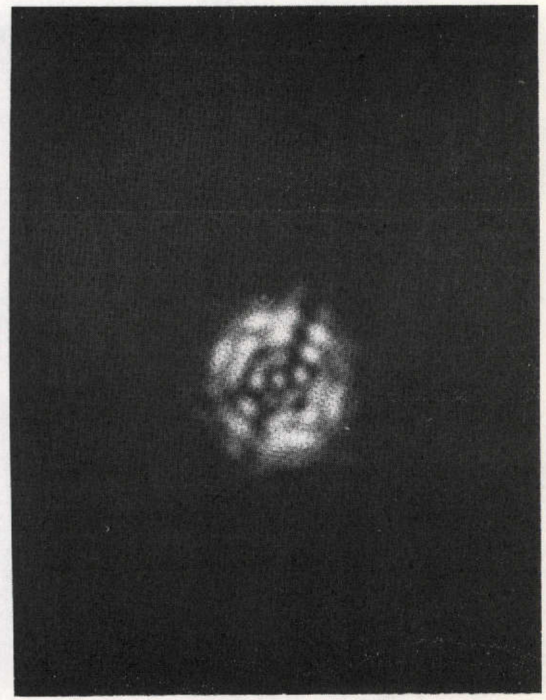
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





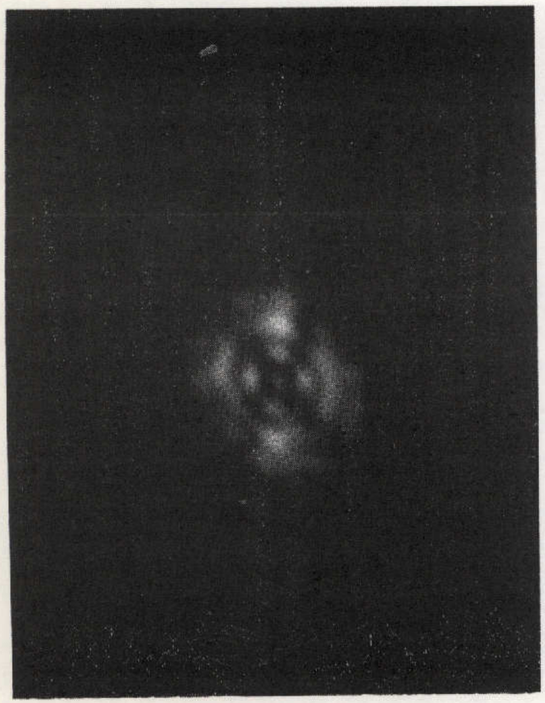
Test No. 12
Retro: F
Photo No. 205
Exposure Time: 1/15 SEC

Test No. 20
Retro: CALIB.
Photo No. 206
Exposure Time: 1/500 SEC

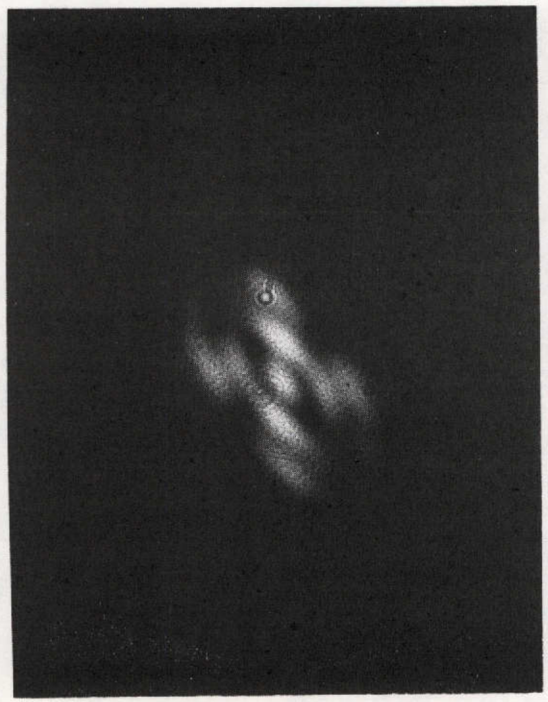


Test No. 20
Retro: D
Photo No. 207
Exposure Time: 1/250 SEC

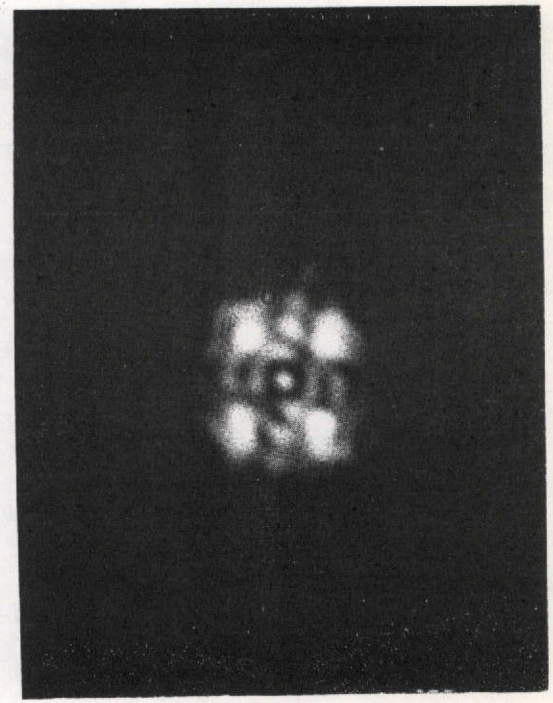
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 20
Retro: D
Photo No. 208
Exposure Time: 1/250 SEC

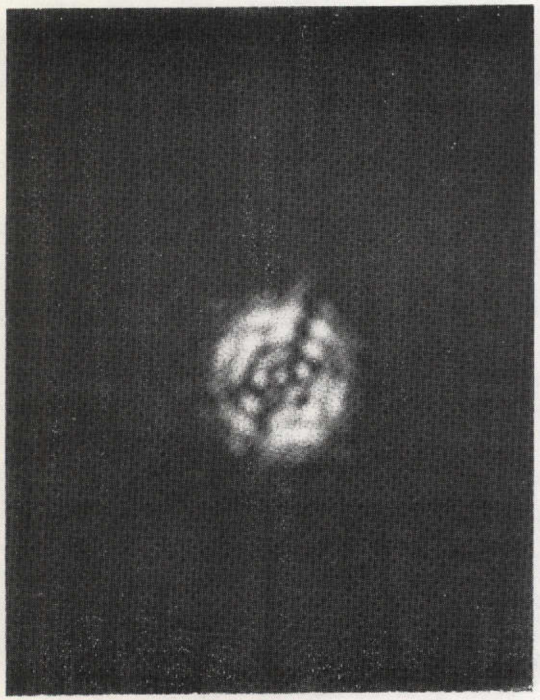


Test No. 20
Retro: D
Photo No. 209
Exposure Time: 1/60 SEC



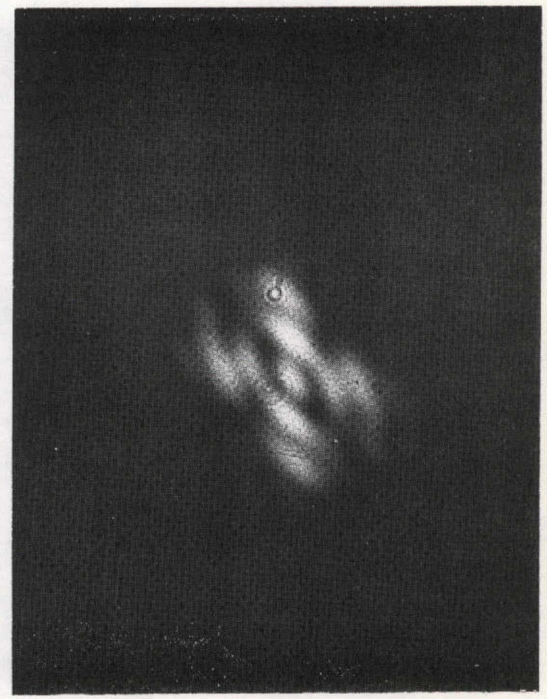
Test No. 20
Retro: D
Photo No. 210
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 20A
Retro: D
Photo No. 212 *
Exposure Time: 1/250 SEC

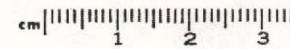
Test No. 20A
Retro: D
Photo No. 213
Exposure Time: 1/250 SEC

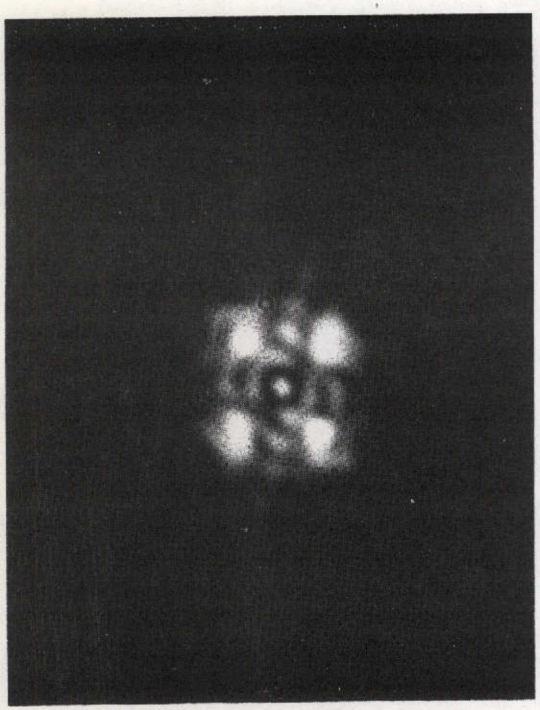


Test No. 20A
Retro: D
Photo No. 214
Exposure Time: 1/60 SEC

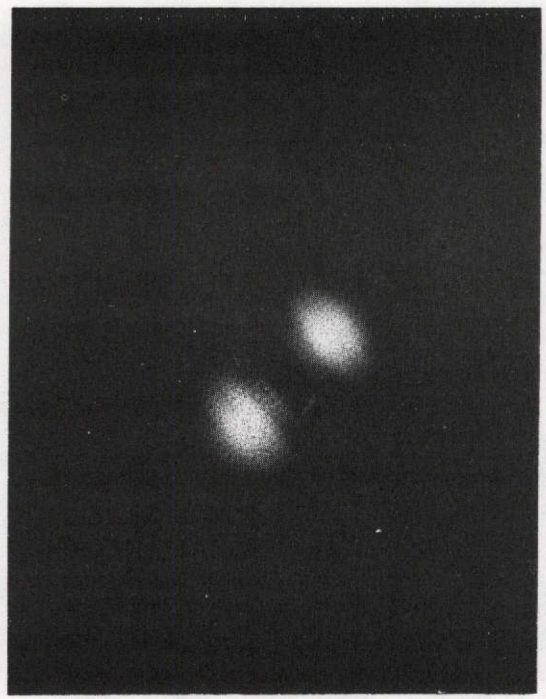
* NO. 211 NOT USED

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

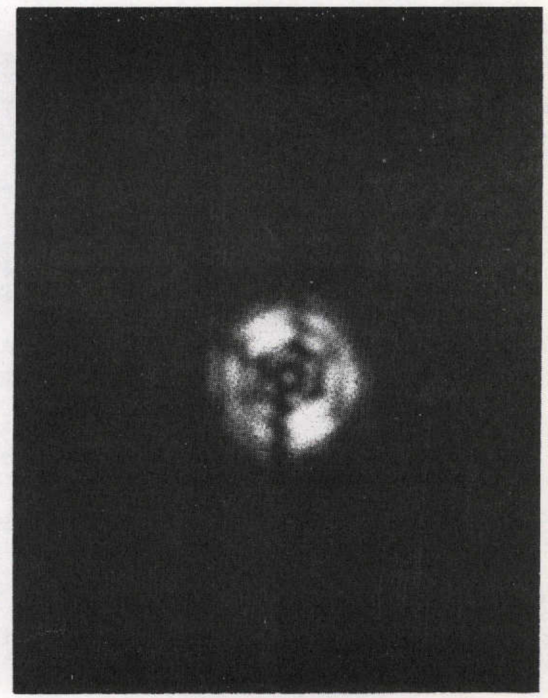




Test No. 20A
Retro: D
Photo No. 215
Exposure Time: 1/125 SEC



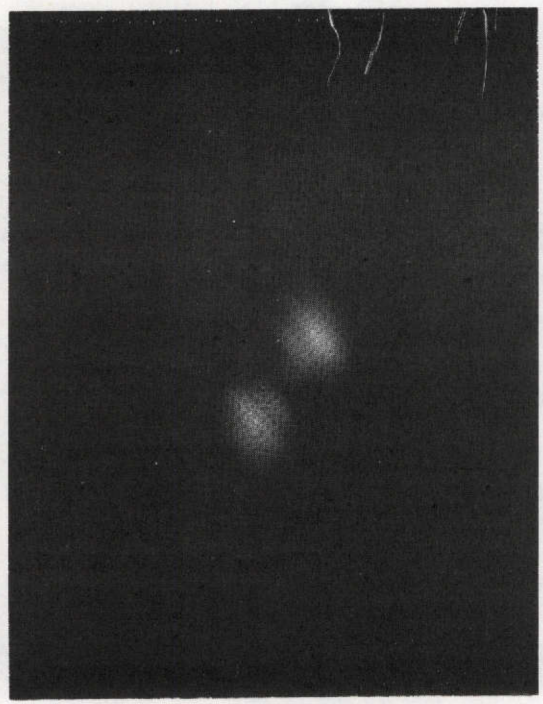
Test No. 20A
Retro: D
Photo No. 216
Exposure Time: 1/8 SEC



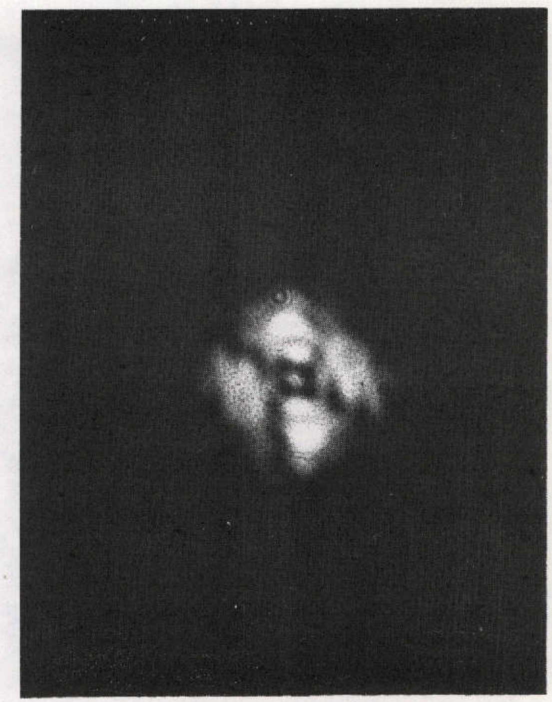
Test No. 20A
Retro: E
Photo No. 217
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 20A
Retro: E
Photo No. 218
Exposure Time: 1/250 SEC

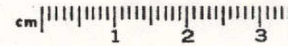


Test No. 20A
Retro: E
Photo No. 219
Exposure Time: 1/15 SEC

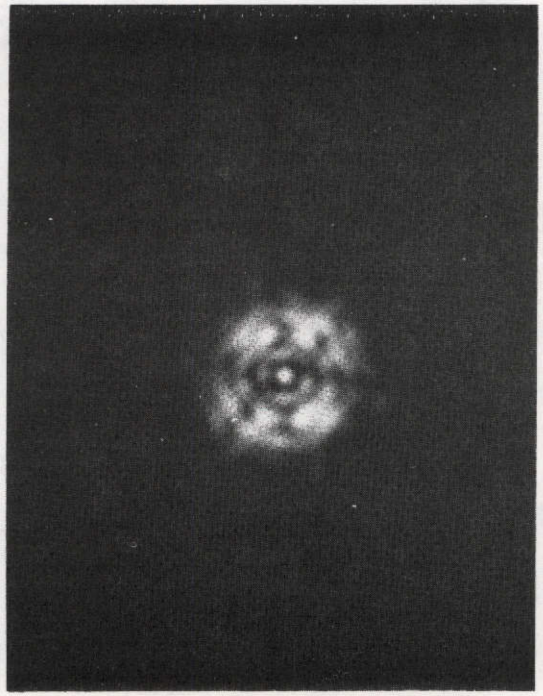


Test No. 20A
Retro: E
Photo No. 220
Exposure Time: 1/125 SEC

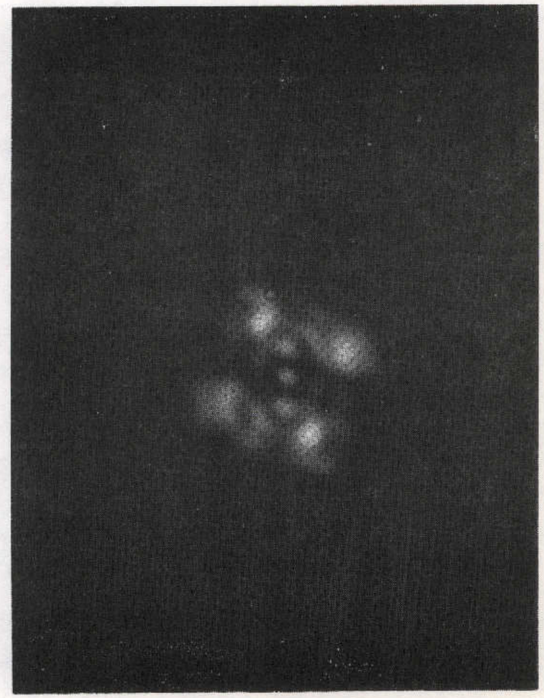
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 20A
Retro: E
Photo No. 221
Exposure Time: 1/8 SEC

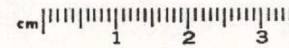


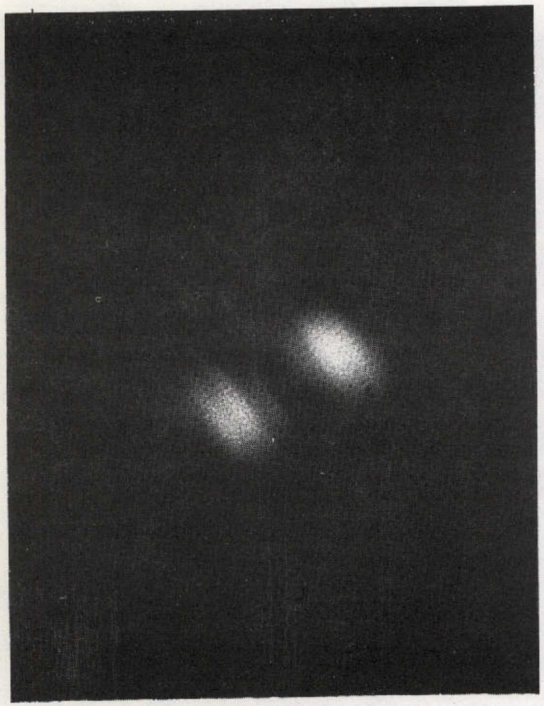
Test No. 20A
Retro: F
Photo No. 222
Exposure Time: 1/250 SEC



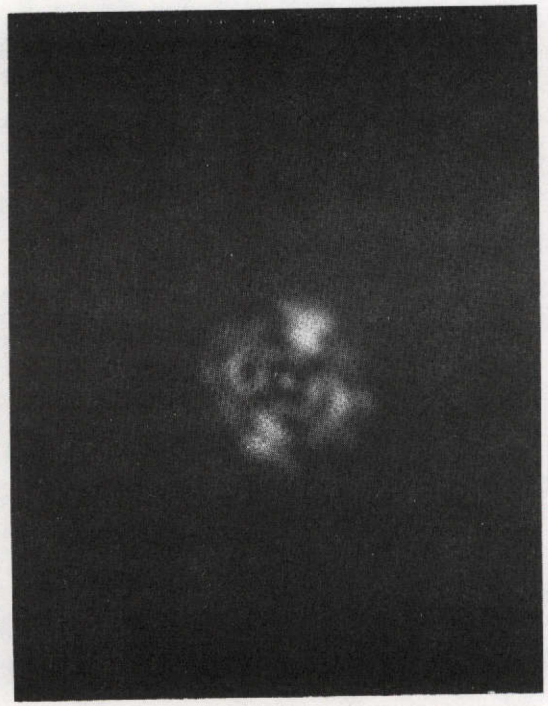
Test No. 20A
Retro: F
Photo No. 223
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

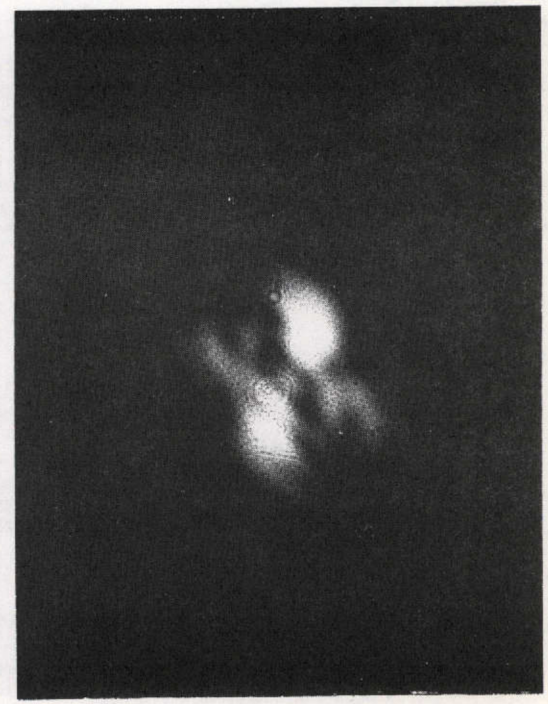




Test No. 20A
Retro: F
Photo No. 224
Exposure Time: 1/8 SEC

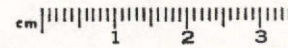


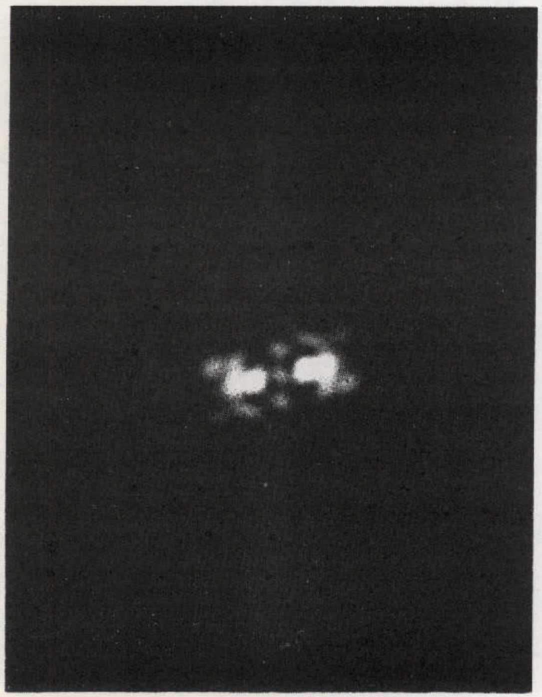
Test No. 20A
Retro: F
Photo No. 225
Exposure Time: 1/250 SEC



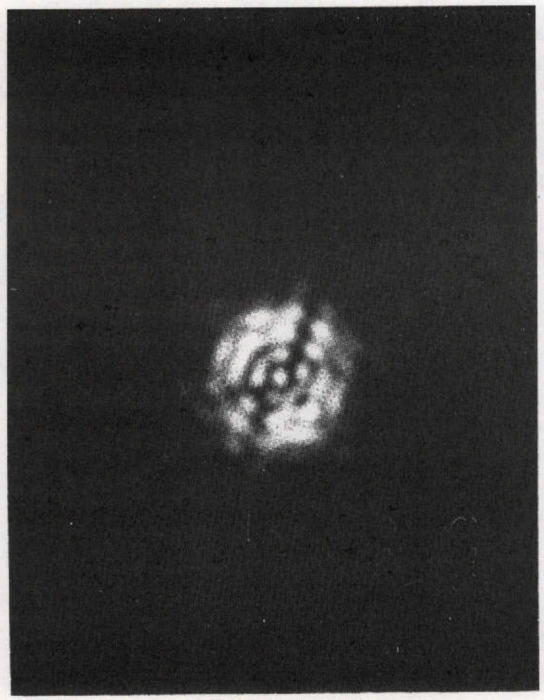
Test No. 20A
Retro: F
Photo No. 226
Exposure Time: 1/15 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

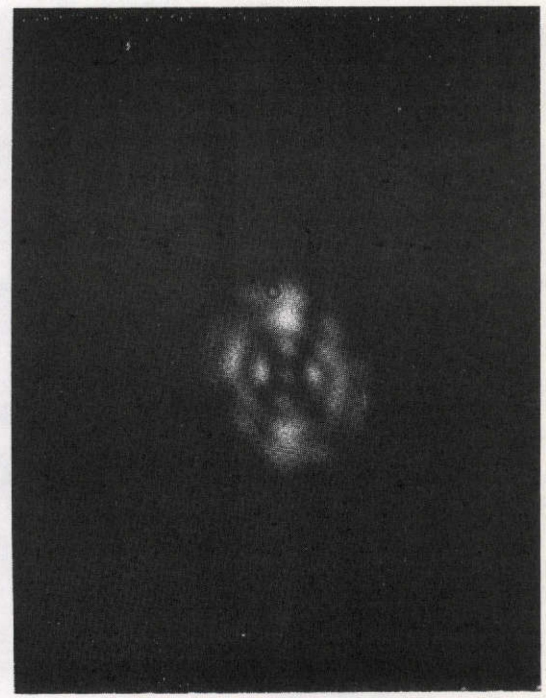




Test No. 13
Retro: CALIB.
Photo No. 227
Exposure Time: 1/500 SEC

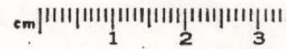


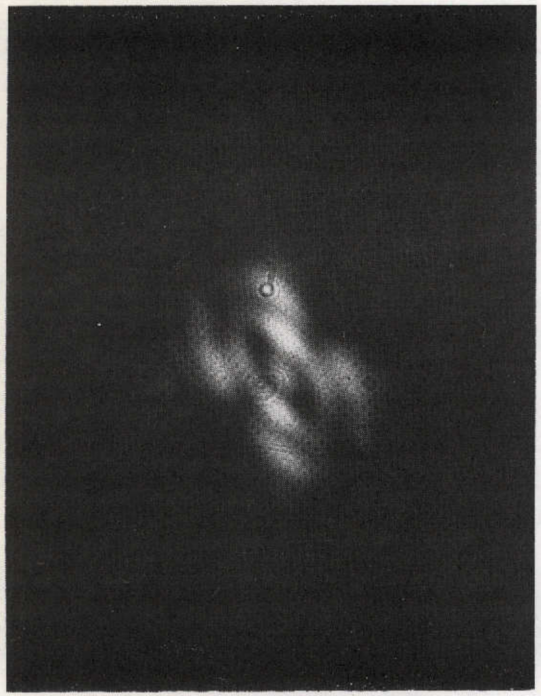
Test No. 13
Retro: D
Photo No. 228
Exposure Time: 1/250 SEC



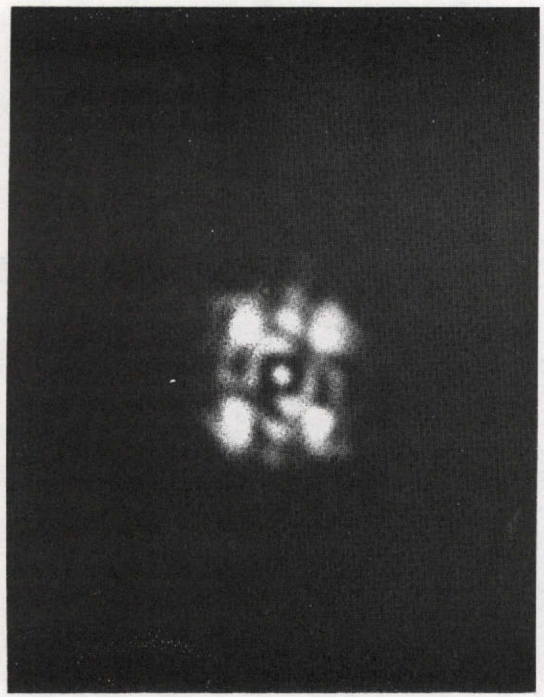
Test No. 13
Retro: D
Photo No. 229
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

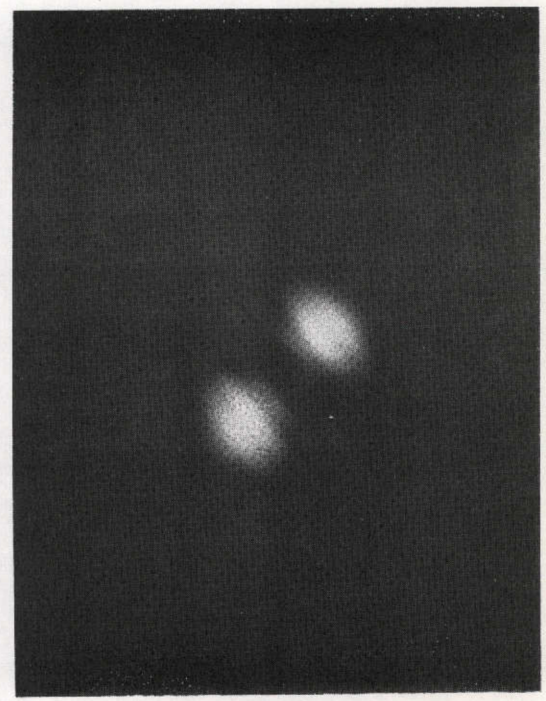




Test No. 13
Retro: D
Photo No. 230
Exposure Time: 1/60 SEC

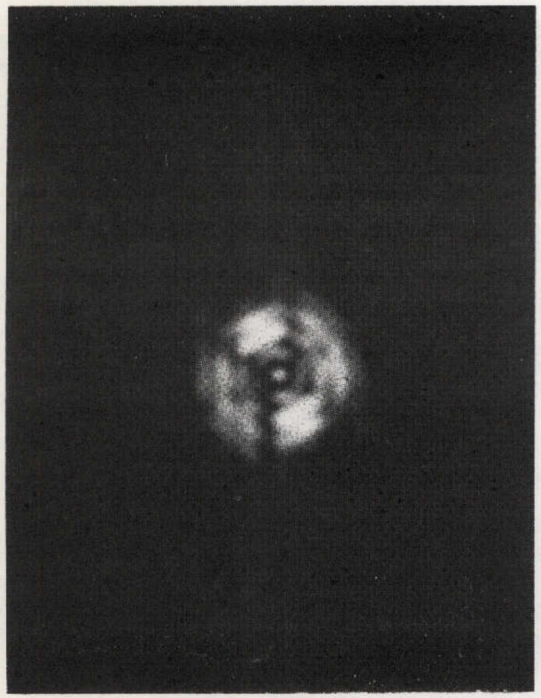


Test No. 13
Retro: D
Photo No. 231
Exposure Time: 1/125 SEC

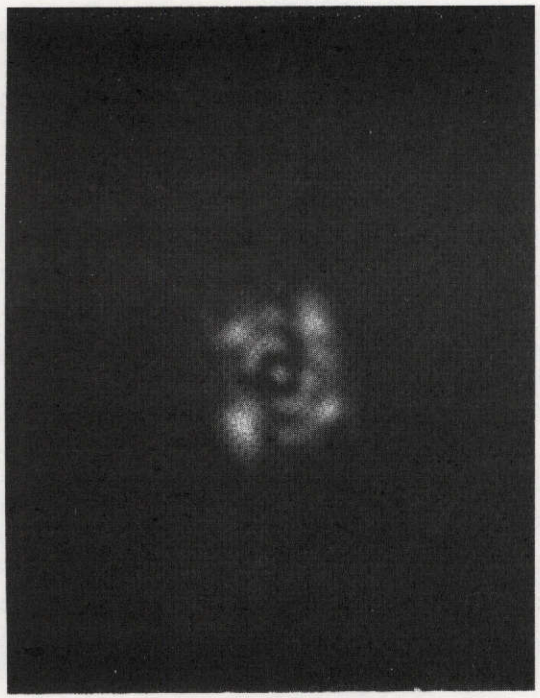


Test No. 13
Retro: D
Photo No. 232
Exposure Time: 1/8 SEC

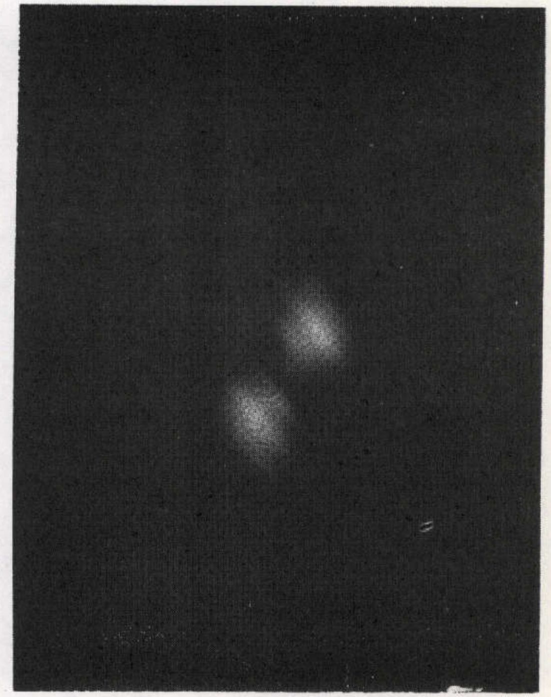
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 13
Retro: E
Photo No. 233
Exposure Time: 1/250 SEC

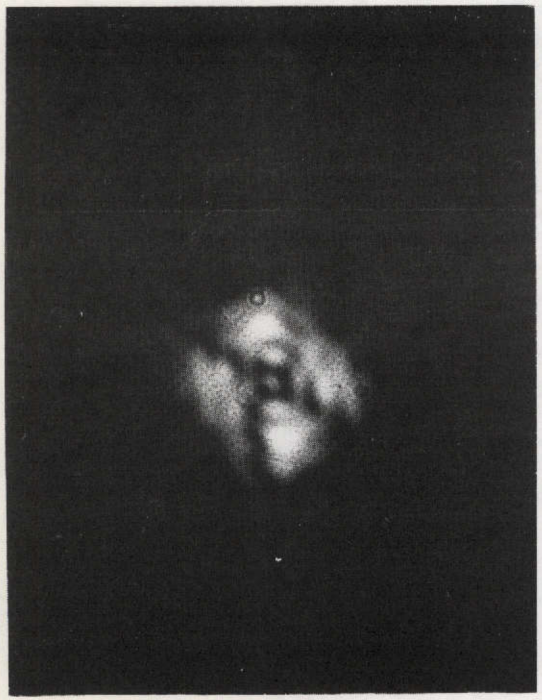


Test No. 13
Retro: E
Photo No. 234
Exposure Time: 1/250 SEC



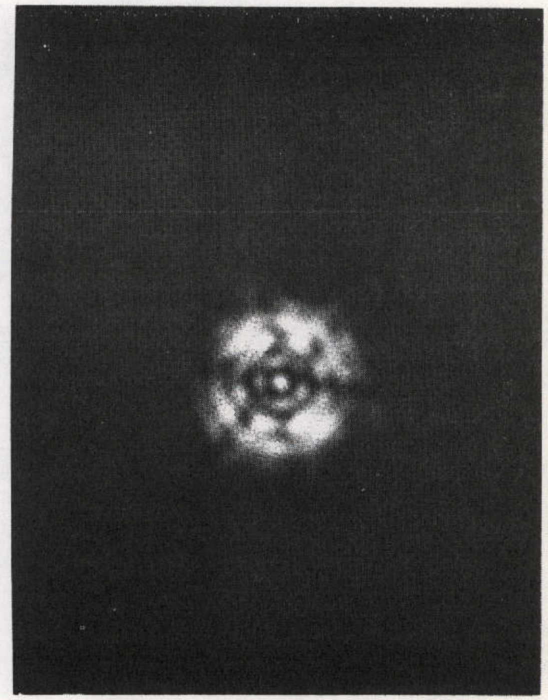
Test No. 13
Retro: E
Photo No. 235
Exposure Time: 1/15 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



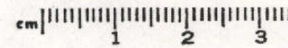
Test No. 13
Retro: E
Photo No. 236
Exposure Time: 1/125 SEC

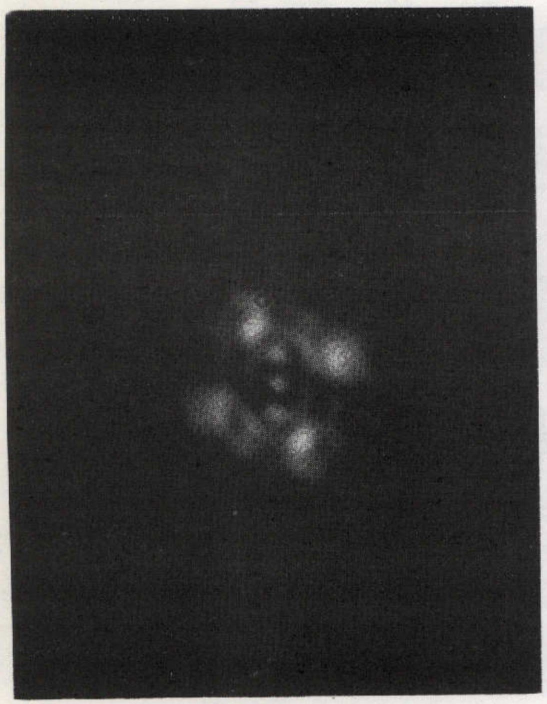
Test No. 13
Retro: E
Photo No. 237
Exposure Time: 1/15 SEC



Test No. 13
Retro: F
Photo No. 238
Exposure Time: 1/250 SEC

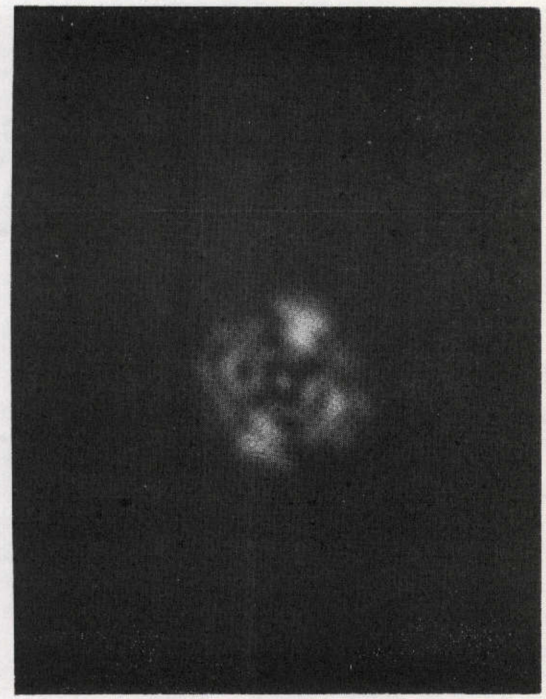
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





Test No. 13
Retro: F
Photo No. 239
Exposure Time: 1/250 SEC

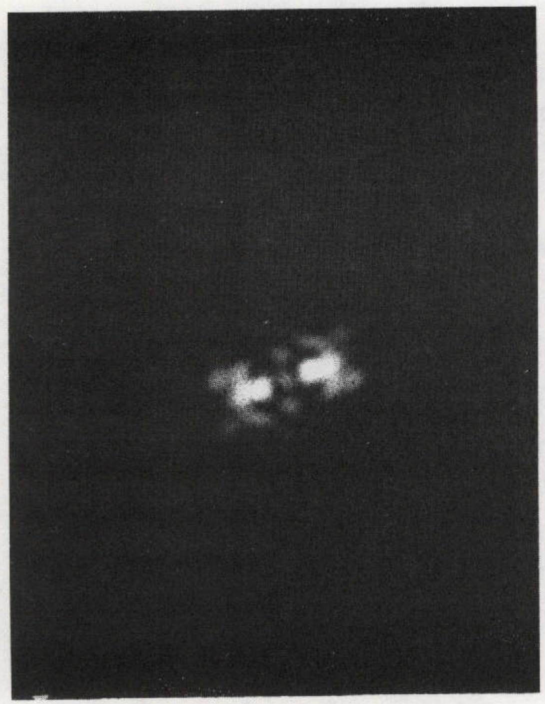
Test No. 13
Retro: F
Photo No. 240
Exposure Time: 1/8 SEC



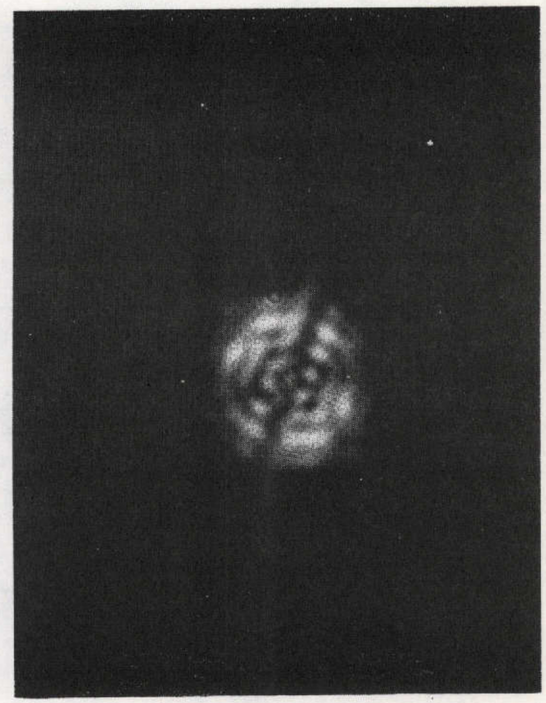
Test No. 13
Retro: F
Photo No. 241
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 13
Retro: F
Photo No. 242
Exposure Time: 1/15 SEC



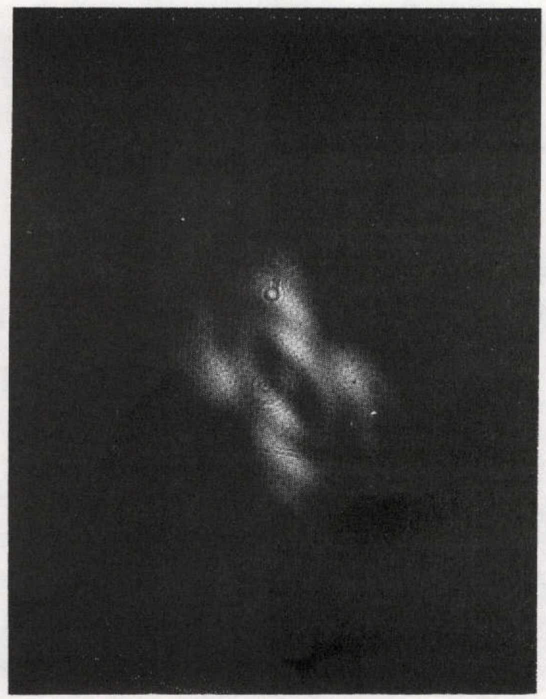
Test No. 21
Retro: CALIB.
Photo No. 243
Exposure Time: 1/500 SEC



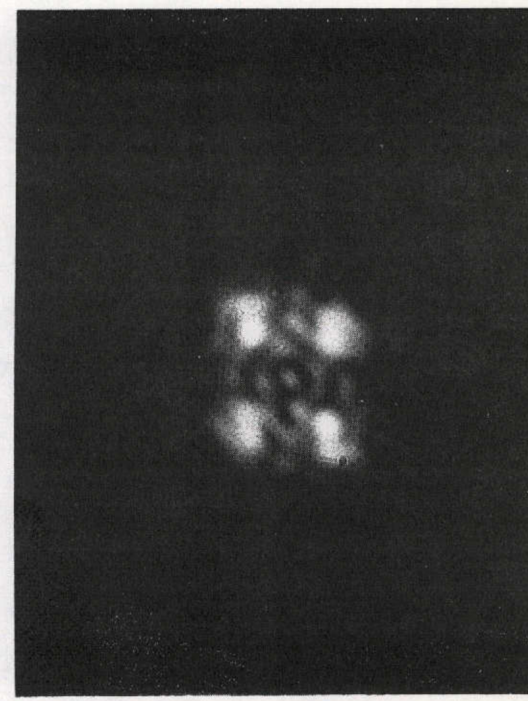
Test No. 21
Retro: D
Photo No. 244
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 21
Retro: D
Photo No. 245
Exposure Time: 1/250 SEC

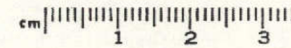


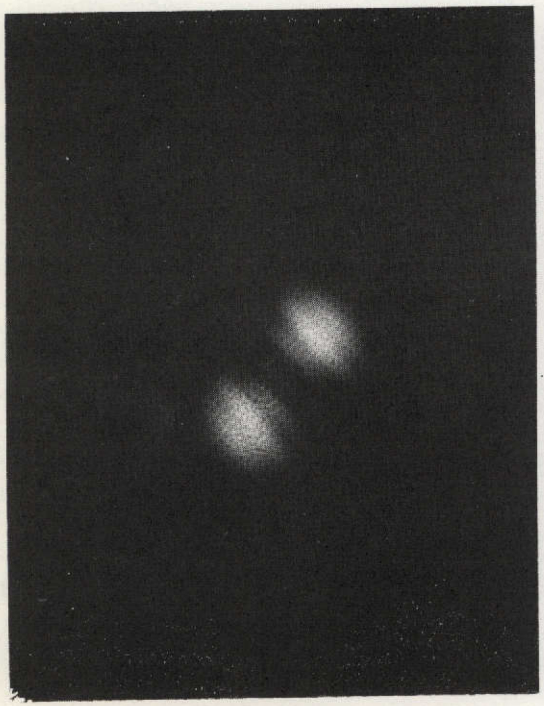
Test No. 21
Retro: D
Photo No. 246
Exposure Time: 1/60 SEC

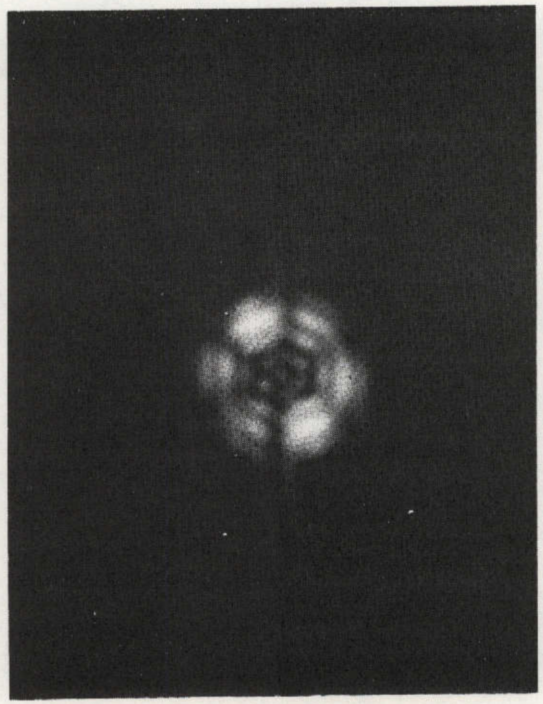


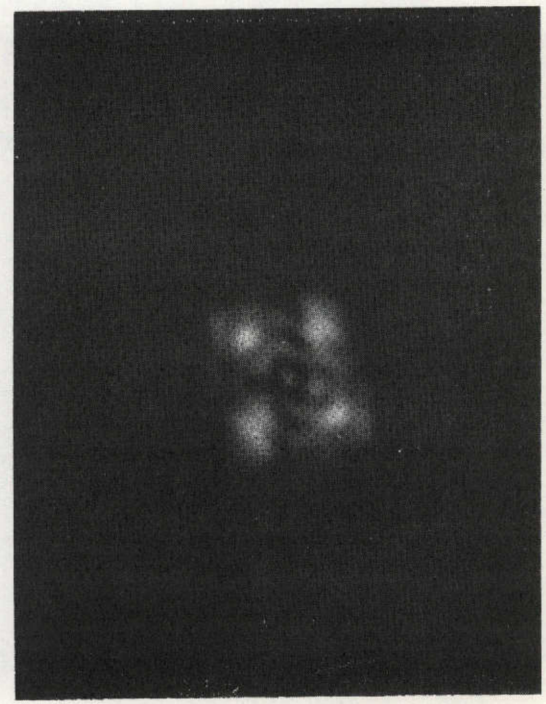
Test No. 21
Retro: D
Photo No. 247
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI







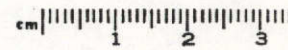


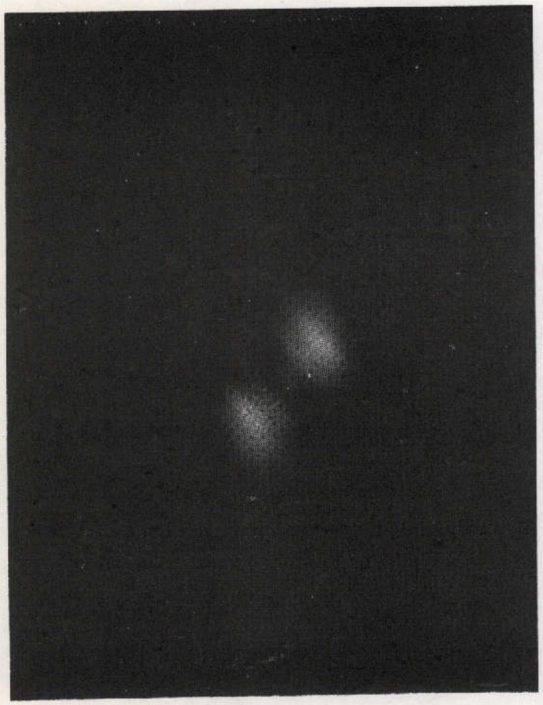
Test No. 21
Retro: D
Photo No. 248
Exposure Time: 1/8 SEC

Test No. 21
Retro: E
Photo No. 249
Exposure Time: 1/250 SEC

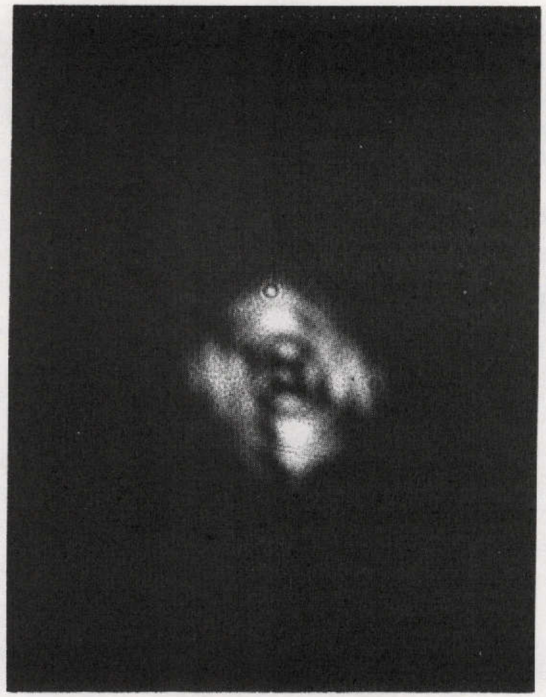
Test No. 21
Retro: E
Photo No. 250
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

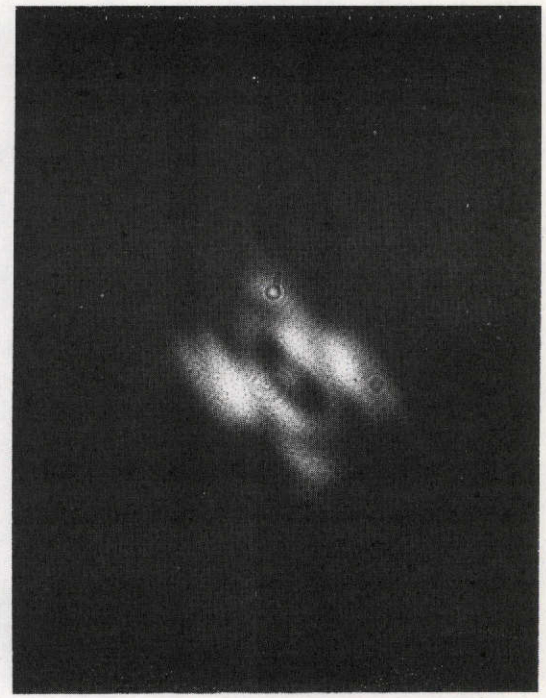




Test No. 21
Retro: E
Photo No. 251
Exposure Time: 1/15 SEC

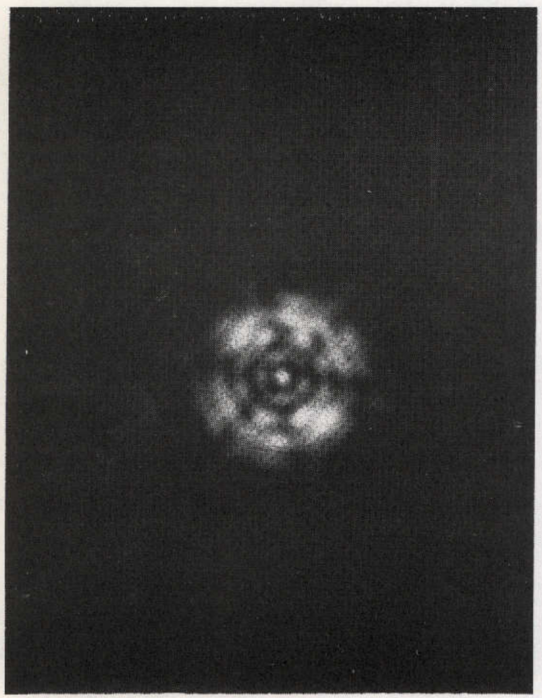


Test No. 21
Retro: E
Photo No. 252
Exposure Time: 1/125 SEC

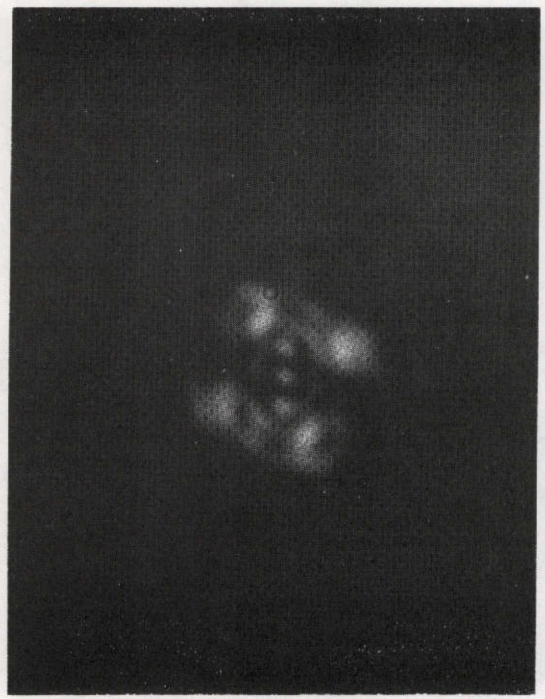


Test No. 21
Retro: E
Photo No. 253
Exposure Time: 1/15 SEC

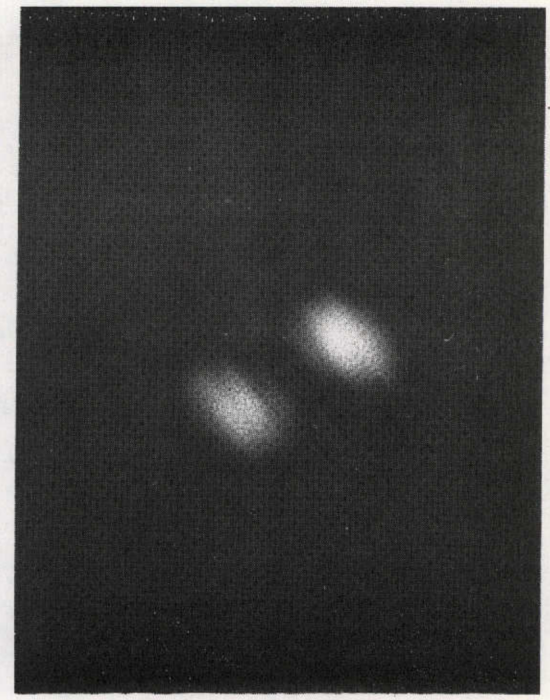
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 21
Retro: F
Photo No. 254
Exposure Time: 1/250 SEC

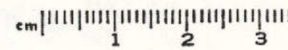


Test No. 21
Retro: F
Photo No. 255
Exposure Time: 1/250 SEC



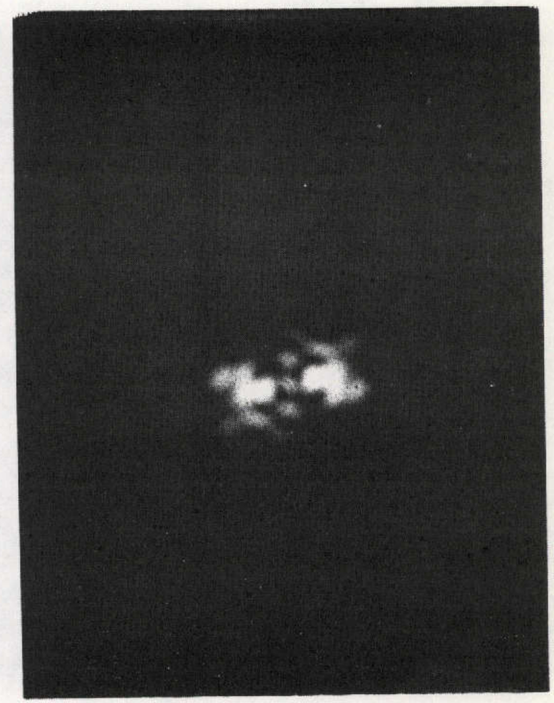
Test No. 21
Retro: F
Photo No. 256
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



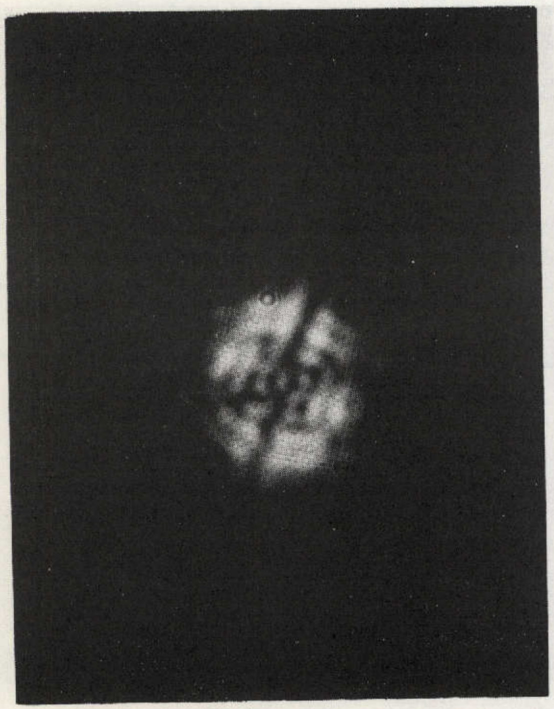
Test No. 21
Retro: F
Photo No. 257
Exposure Time: 1/250 SEC

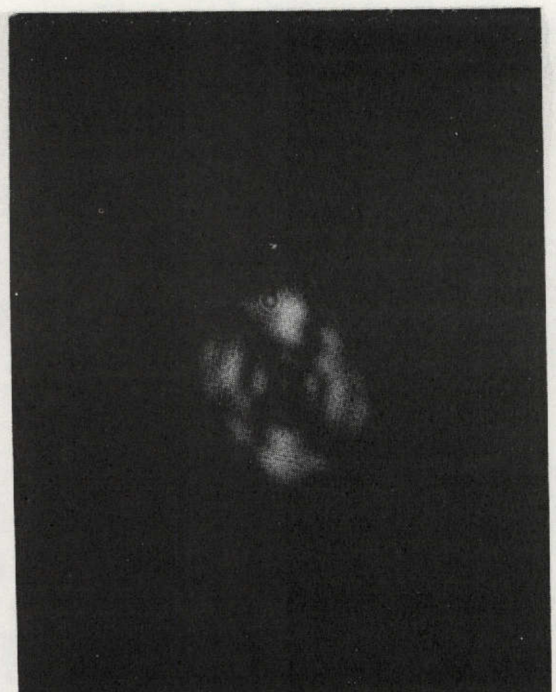
Test No. 21
Retro: F
Photo No. 258
Exposure Time: 1/15 SEC

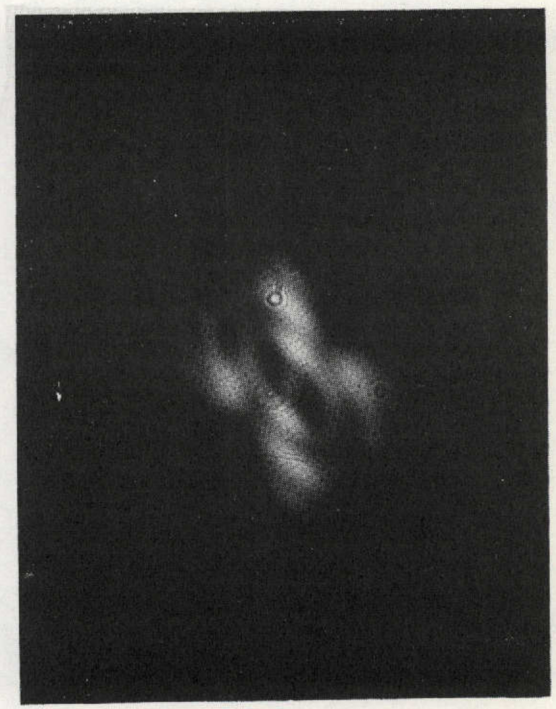


Test No. 14
Retro: CALIB.
Photo No. 259
Exposure Time: 1/500 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





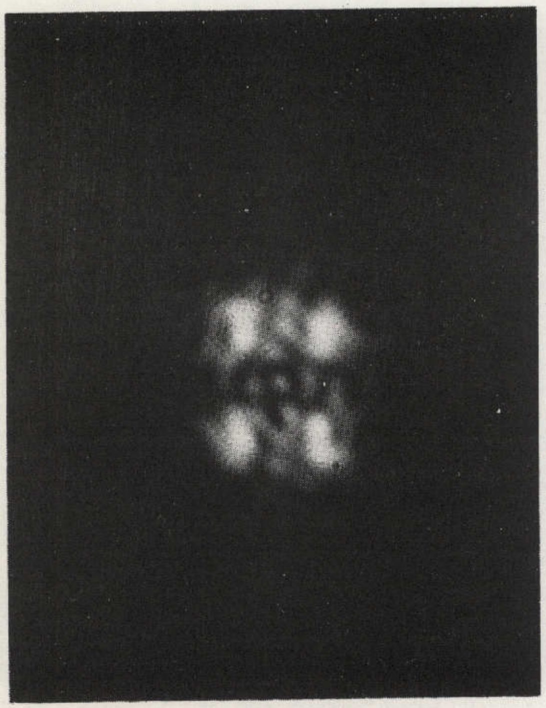


Test No. 14
Retro: D
Photo No. 260
Exposure Time: 1/250 SEC

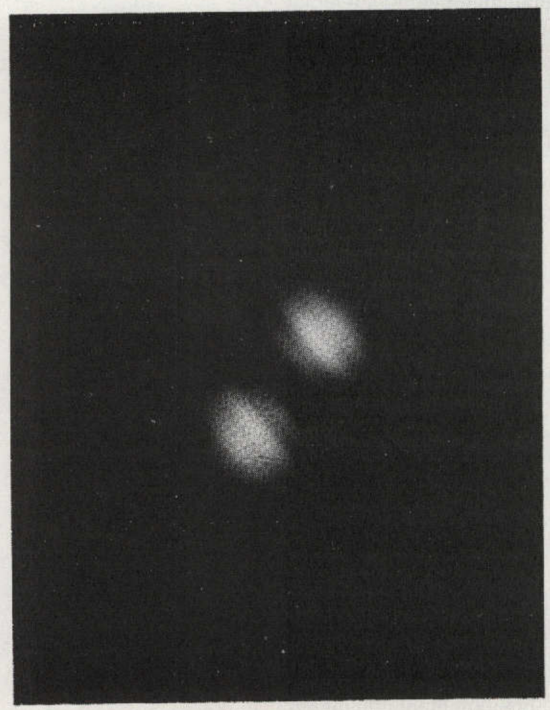
Test No. 14
Retro: D
Photo No. 261
Exposure Time: 1/250 SEC

Test No. 14
Retro: D
Photo No. 262
Exposure Time: 1/60 SEC

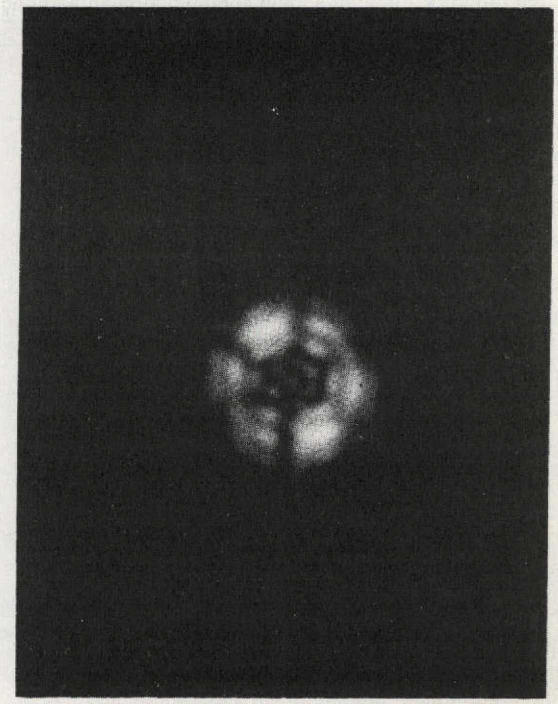
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 14
Retro: D
Photo No. 263
Exposure Time: 1/125 SEC

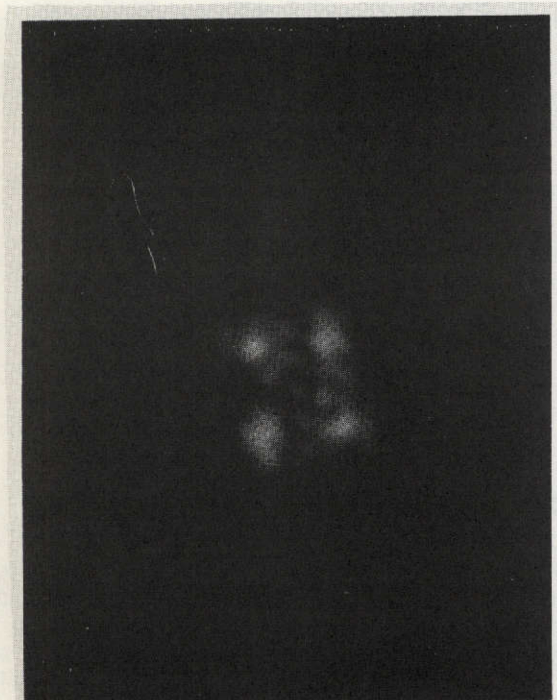


Test No. 14
Retro: D
Photo No. 264
Exposure Time: 1/8 SEC

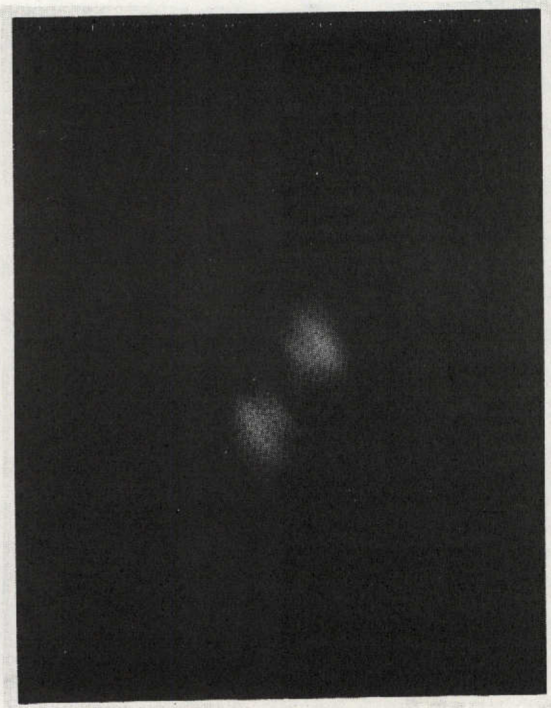


Test No. 14
Retro: E
Photo No. 265
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 14
Retro: E
Photo No. 266
Exposure Time: 1/250 SEC

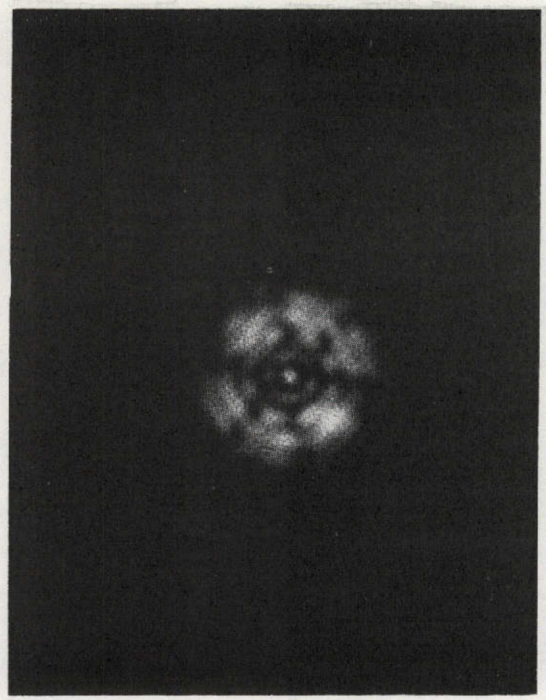


Test No. 14
Retro: E
Photo No. 267
Exposure Time: 1/15 SEC

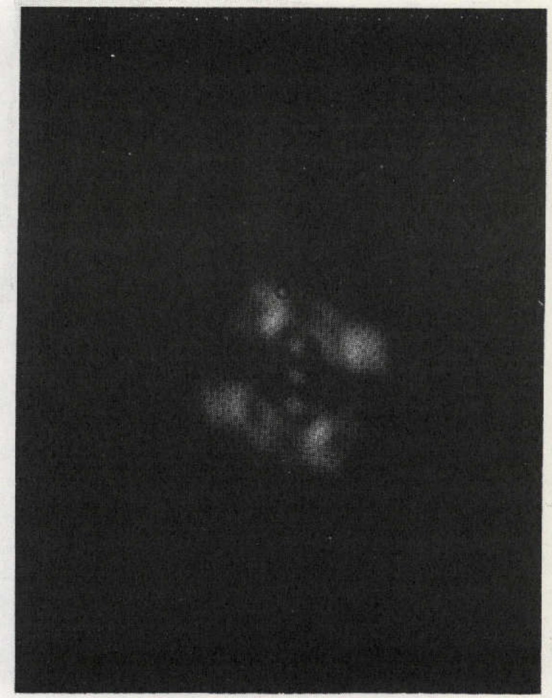
Test No. 14
Retro: E
Photo No. 268
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 14
Retro: E
Photo No. 269
Exposure Time: 1/15 SEC

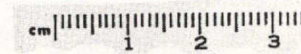


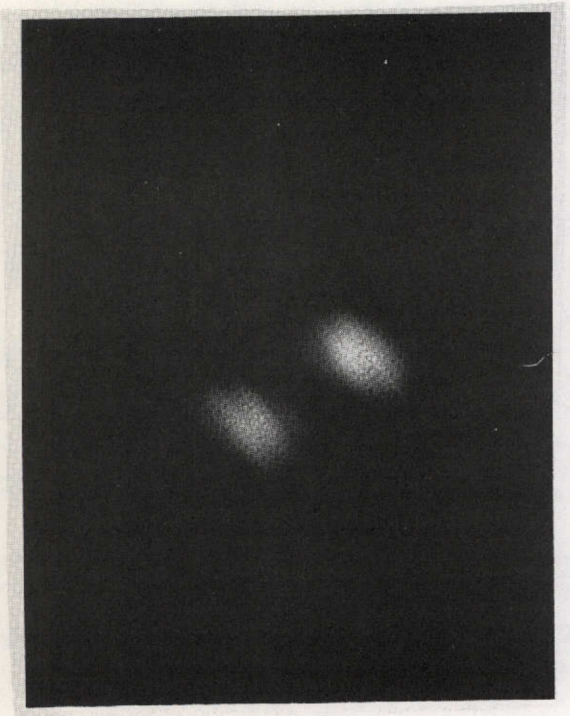
Test No. 14
Retro: F
Photo No. 270
Exposure Time: 1/250 SEC



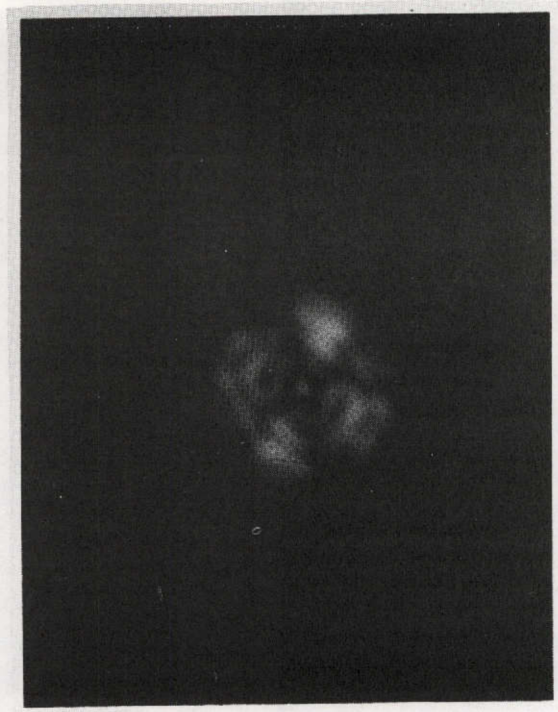
Test No. 14
Retro: F
Photo No. 271
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





Test No. 14
Retro: F
Photo No. 272
Exposure Time: 1/8 SEC

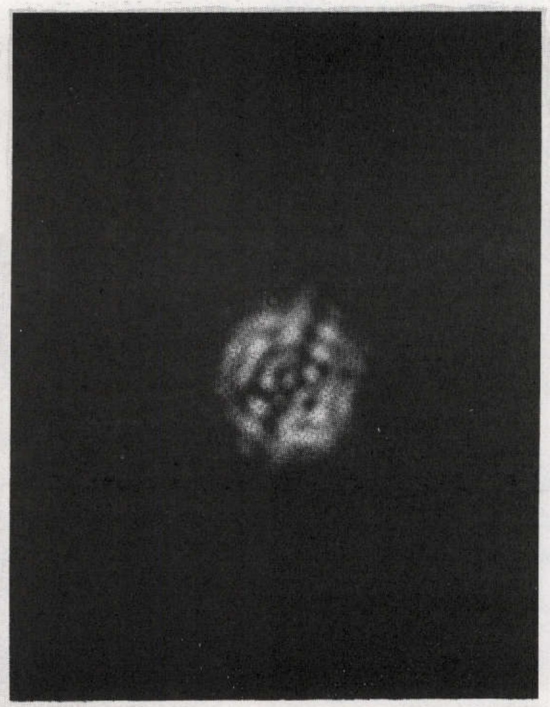


Test No. 14
Retro: F
Photo No. 273
Exposure Time: 1/250 SEC

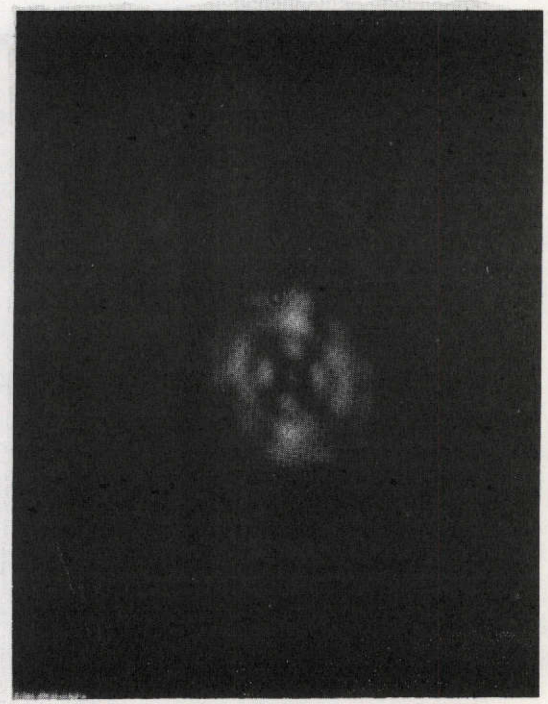
Test No. 14
Retro: F
Photo No. 274
Exposure Time: 1/15 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 22
Retro: CALIB.
Photo No. 275
Exposure Time: 1/500 SEC



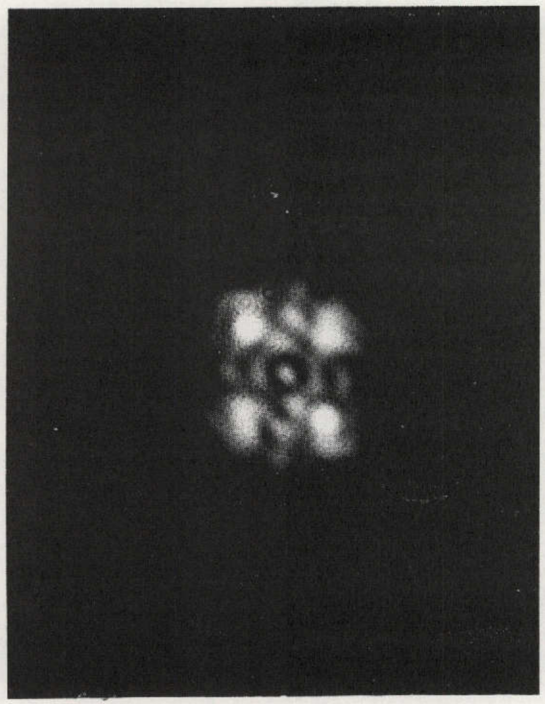
Test No. 22
Retro: D
Photo No. 276
Exposure Time: 1/250 SEC



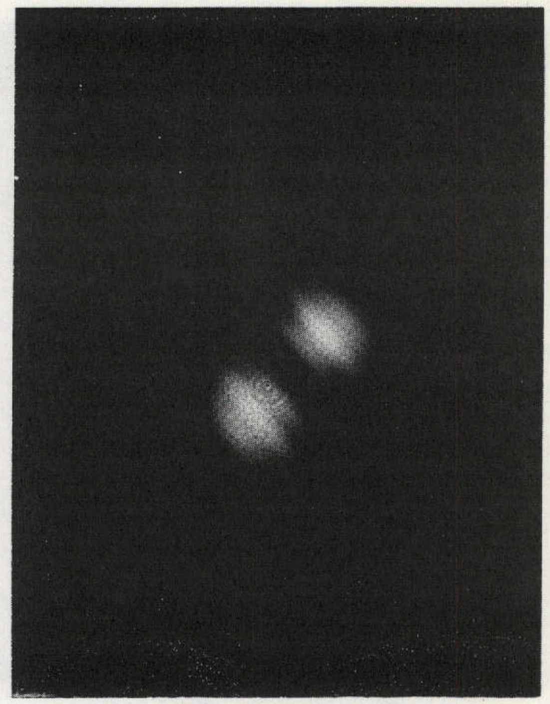
Test No. 22
Retro: D
Photo No. 277
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

Test No. 22
Retro: D
Photo No. 278
Exposure Time: 1/60 SEC

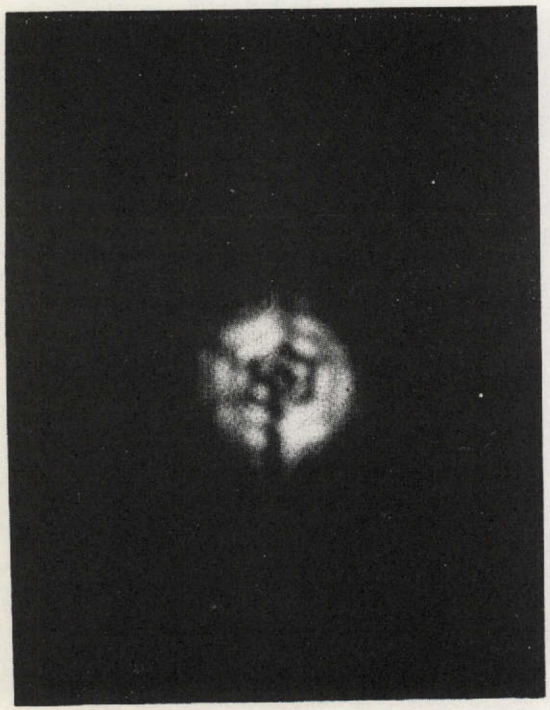


Test No. 22
Retro: D
Photo No. 279
Exposure Time: 1/125 SEC

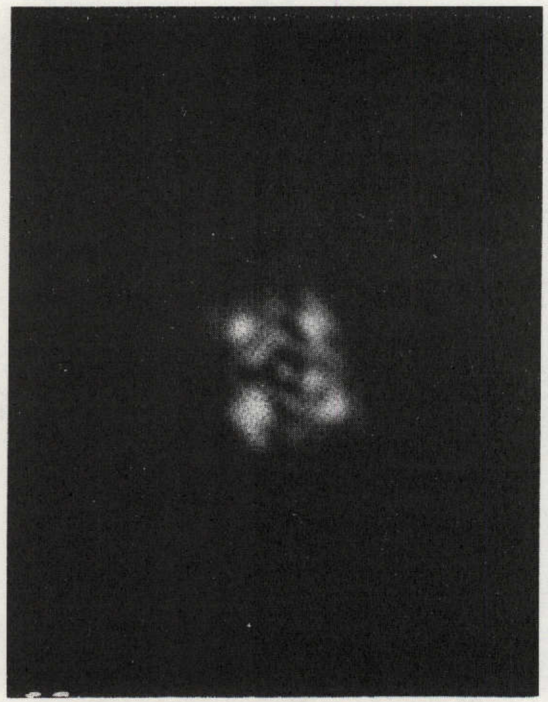


Test No. 22
Retro: D
Photo No. 280
Exposure Time: 1/8 SEC

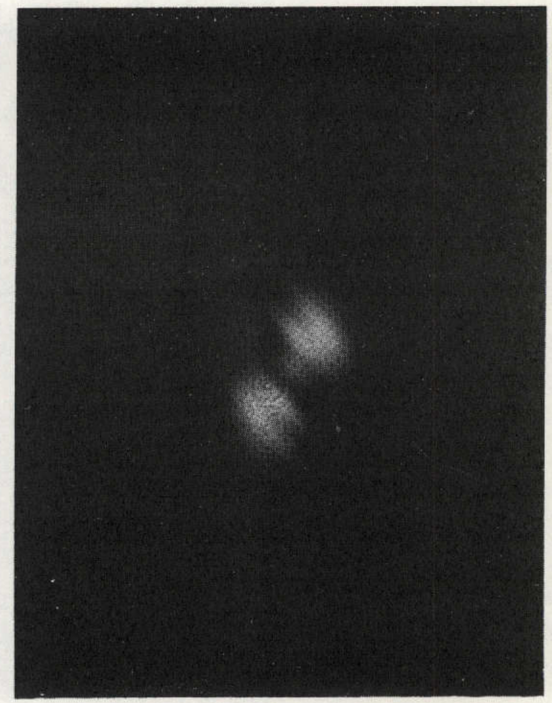
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 22
Retro: E
Photo No. 281
Exposure Time: 1/250 SEC

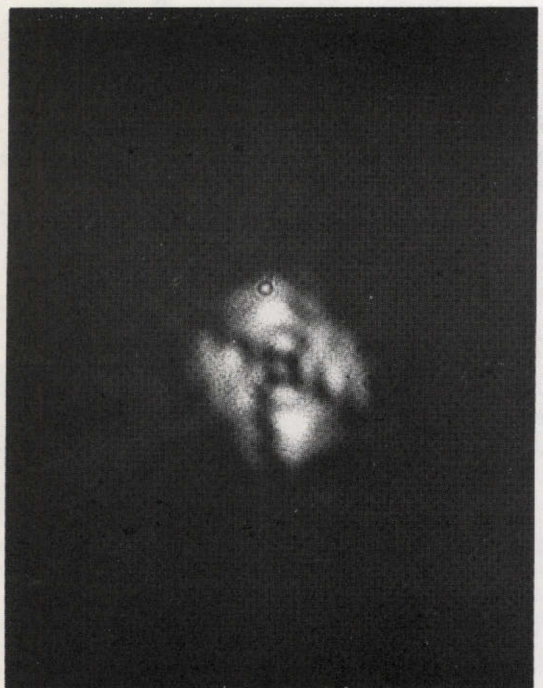


Test No. 22
Retro: E
Photo No. 282
Exposure Time: 1/250 SEC

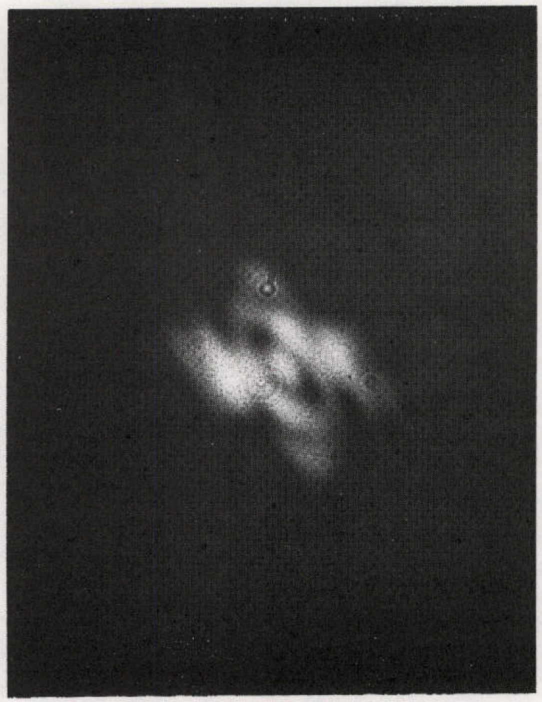


Test No. 22
Retro: E
Photo No. 283
Exposure Time: 1/15 SEC

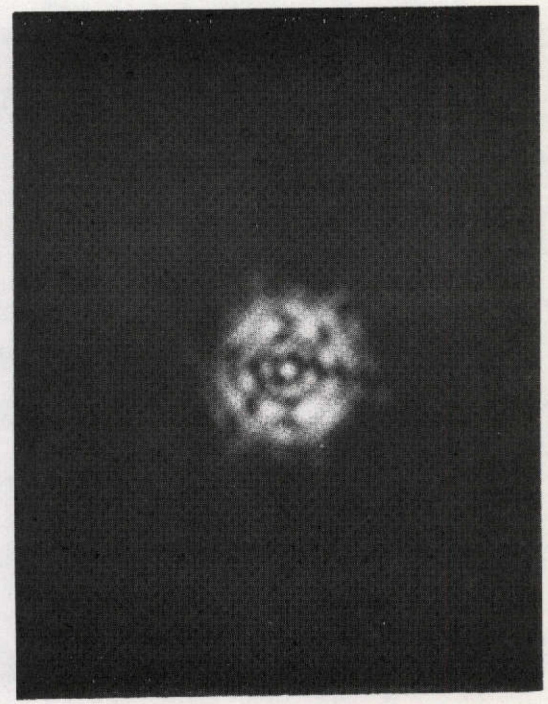
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 22
Retro: E
Photo No. 284
Exposure Time: 1/125 SEC



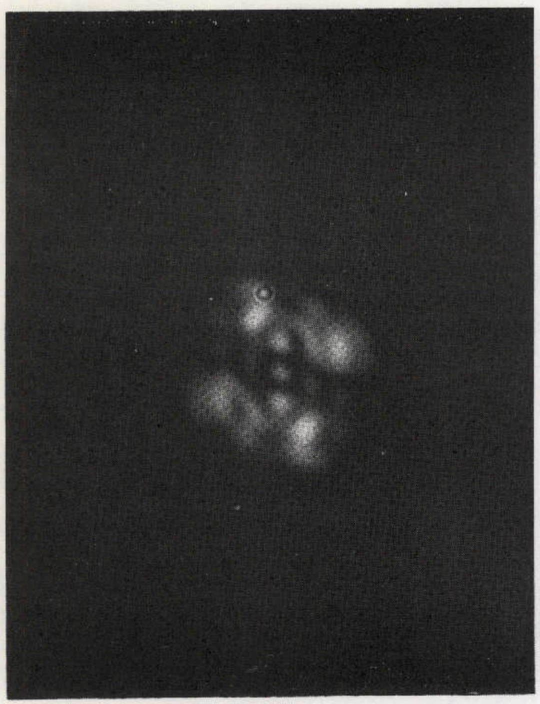
Test No. 22
Retro: E
Photo No. 285
Exposure Time: 1/15 SEC



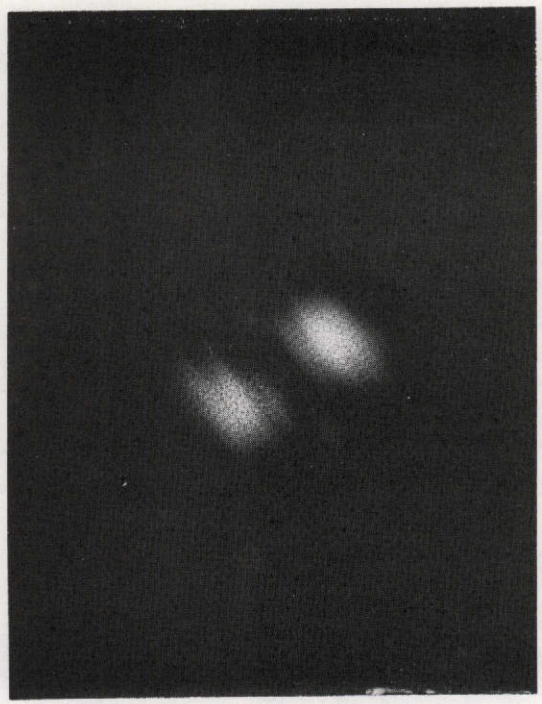
Test No. 22
Retro: F
Photo No. 286
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3



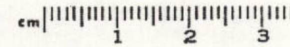
Test No. 22
Retro: F
Photo No. 287
Exposure Time: 1/250 SEC



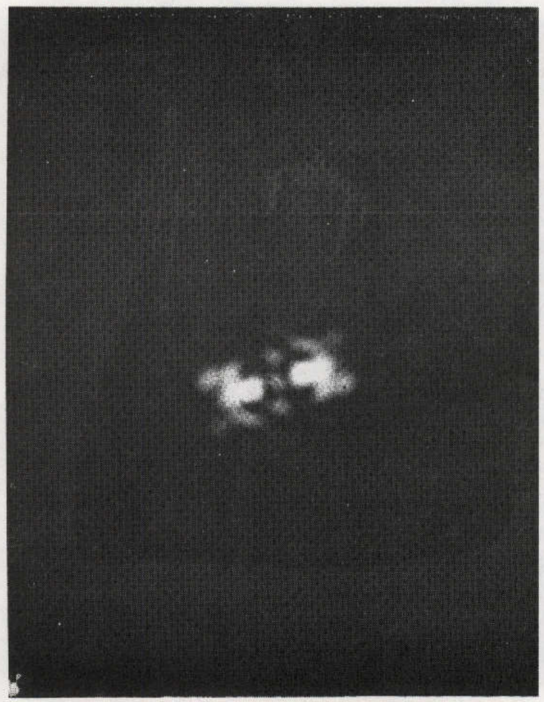
Test No. 22
Retro:
Photo No. 288
Exposure Time: 1/8 SEC

Test No. 22
Retro:
Photo No. 289
Exposure Time: 1/250 SEC

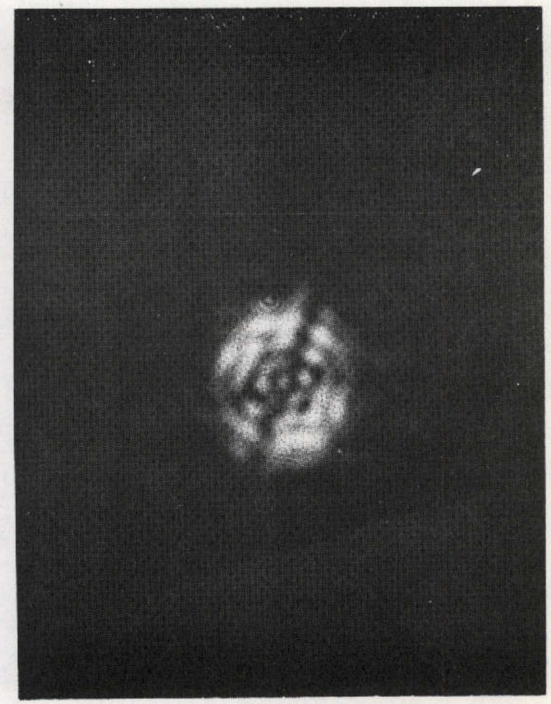
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 22
Retro: F
Photo No. 290
Exposure Time: 1/15 SEC

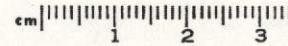


Test No. 23
Retro: CALIB.
Photo No. 291
Exposure Time: 1/500 SEC

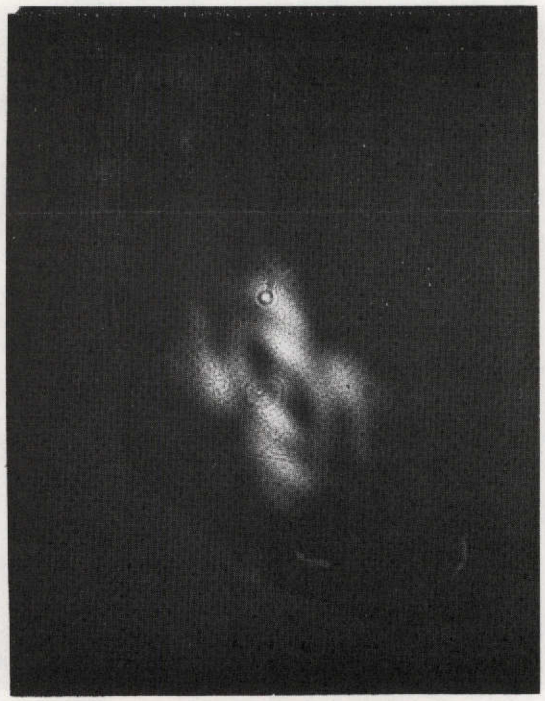


Test No. 23
Retro: D
Photo No. 292
Exposure Time: 1/250 SEC

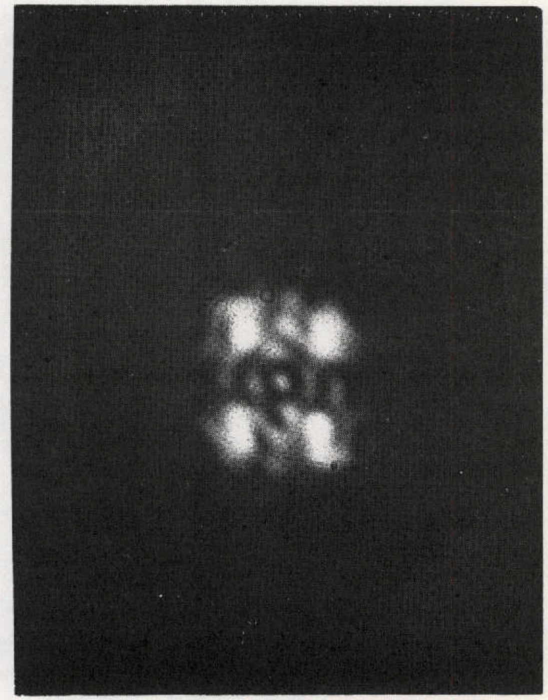
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 23
Retro: D
Photo No. 293
Exposure Time: 1/250 SEC

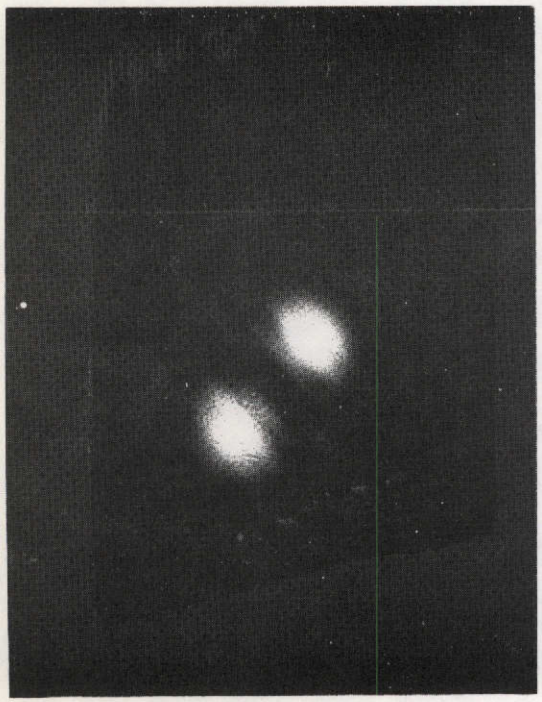


Test No. 23
Retro: D
Photo No. 294
Exposure Time: 1/60 SEC

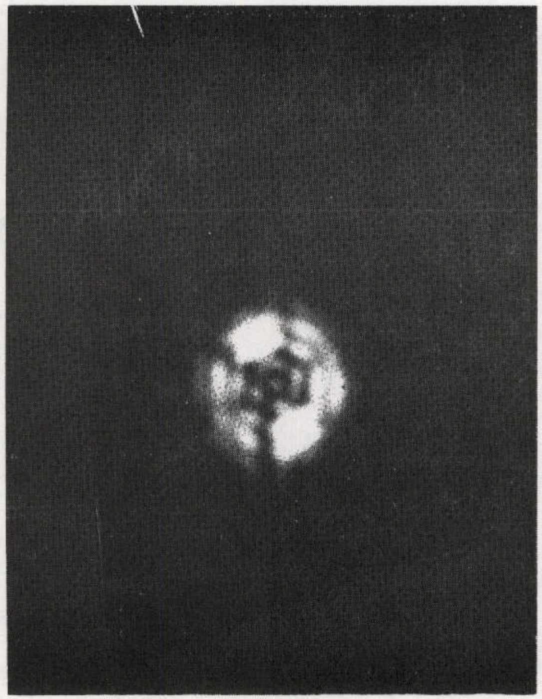


Test No. 23
Retro: D
Photo No. 295
Exposure Time: 1/25 SEC

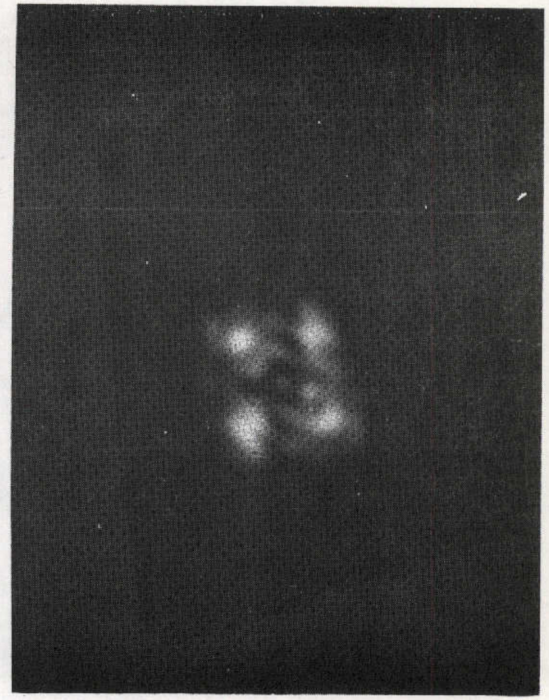
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 23
Retro: D
Photo No. 296
Exposure Time: 1/8 SEC

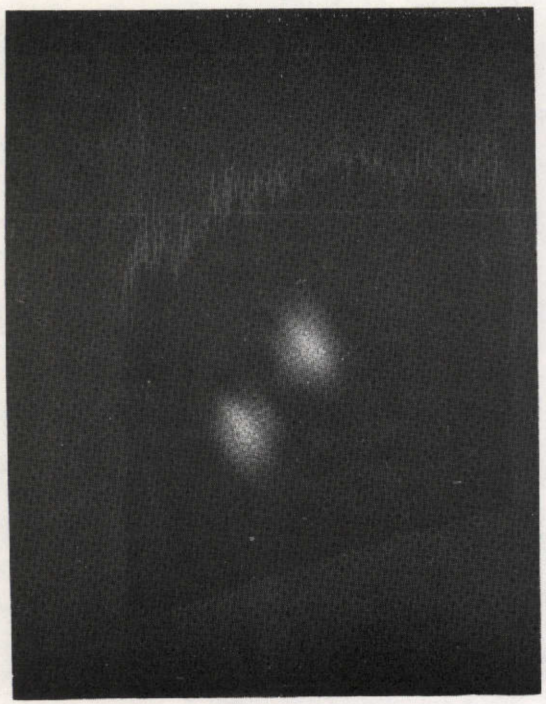


Test No. 23
Retro: E
Photo No. 297
Exposure Time: 1/250 SEC

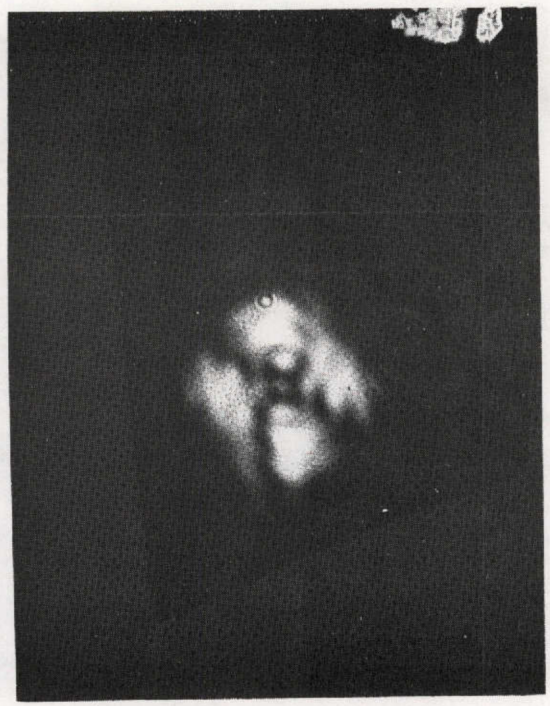


Test No. 23
Retro: E
Photo No. 298
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



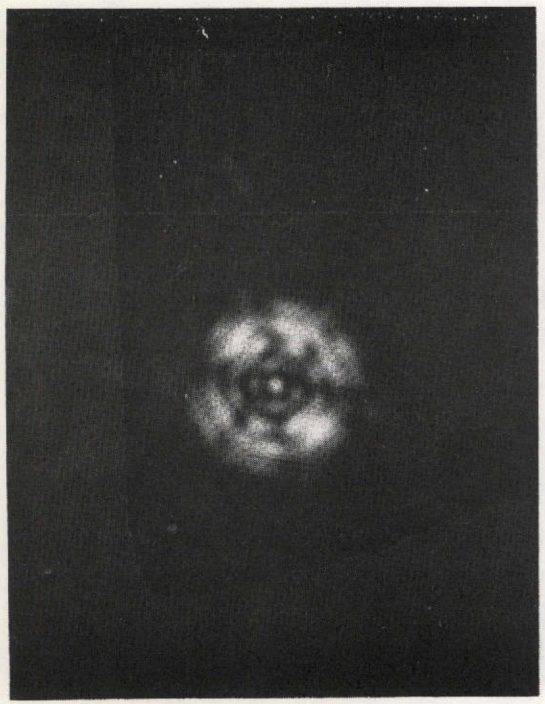
Test No. 23
Retro: E
Photo No. 299
Exposure Time: 1/15 SEC



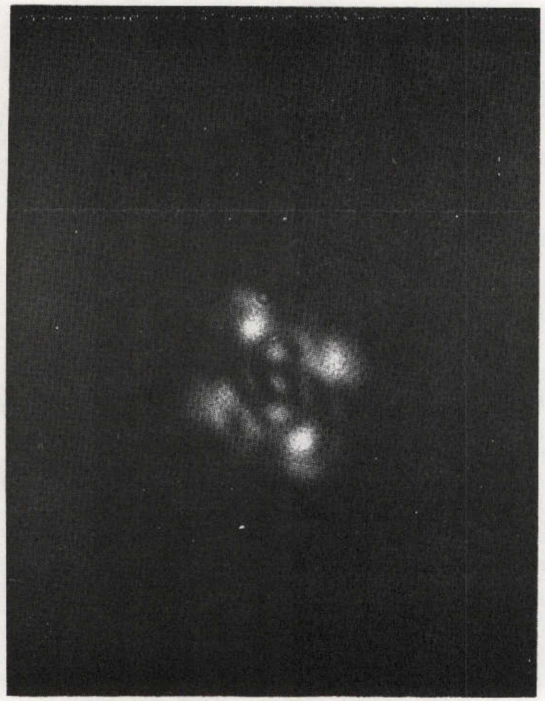
Test No. 23
Retro: E
Photo No. 300
Exposure Time: 1/125 SEC

Test No. 23
Retro: E
Photo No. 301
Exposure Time: 1/15 SEC

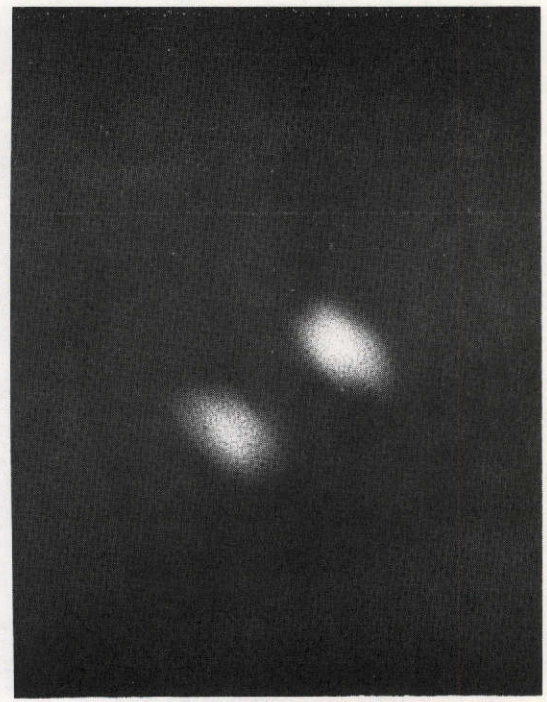
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 23
Retro: F
Photo No. 302
Exposure Time: 1/250 SEC



Test No. 23
Retro: F
Photo No. 303
Exposure Time: 1/250 SEC

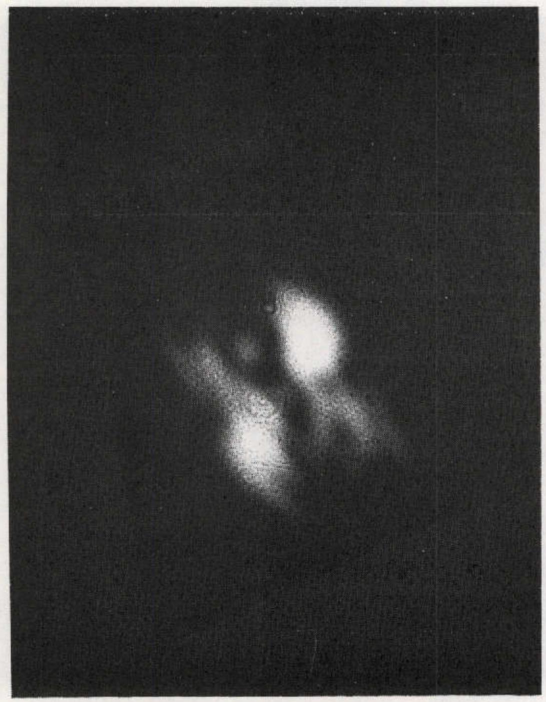


Test No. 23
Retro: F
Photo No. 304
Exposure Time: 1/8 SEC

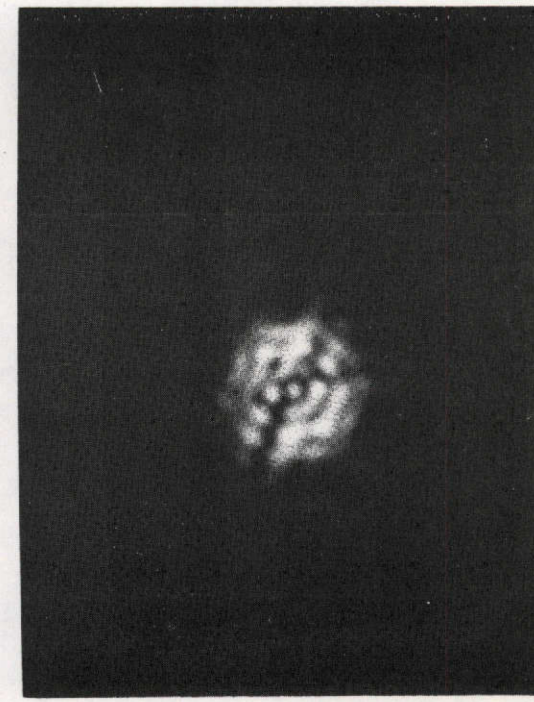
LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

cm 1 2 3

Test No. 23
Retro: F
Photo No. 305
Exposure Time: 1/250 SEC



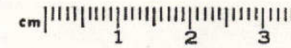
Test No. 23
Retro: F
Photo No. 306
Exposure Time: 1/15 SEC

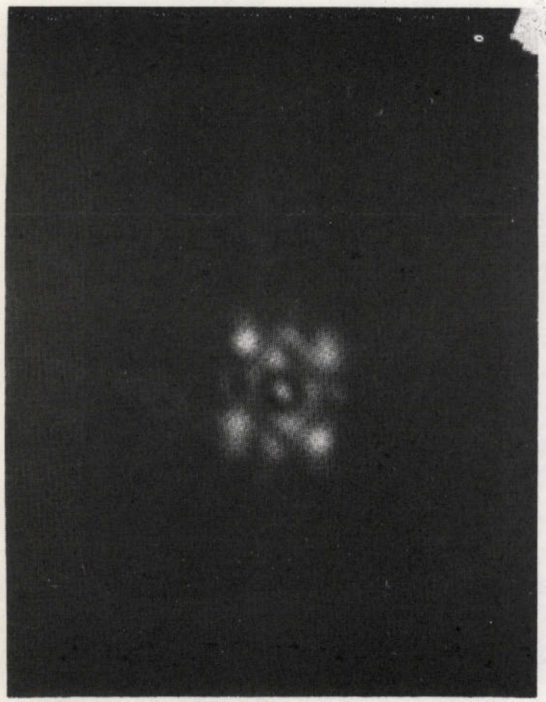


Test No. 24
Retro: A
Photo No. 307
Exposure Time: 1/250 SEC

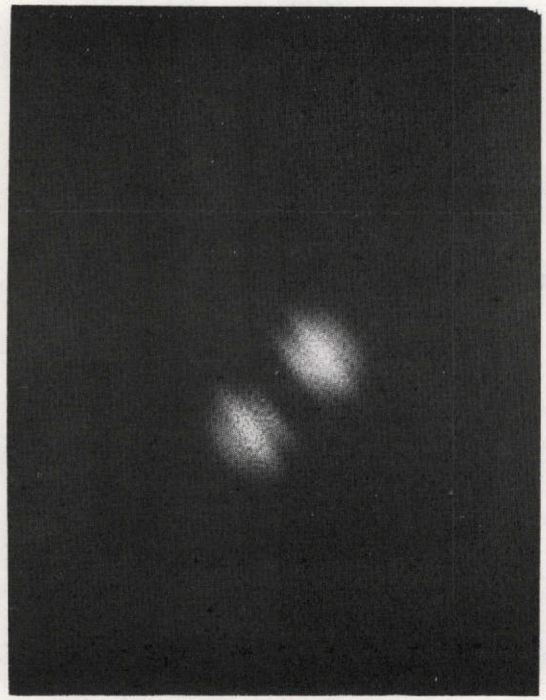
C-4

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

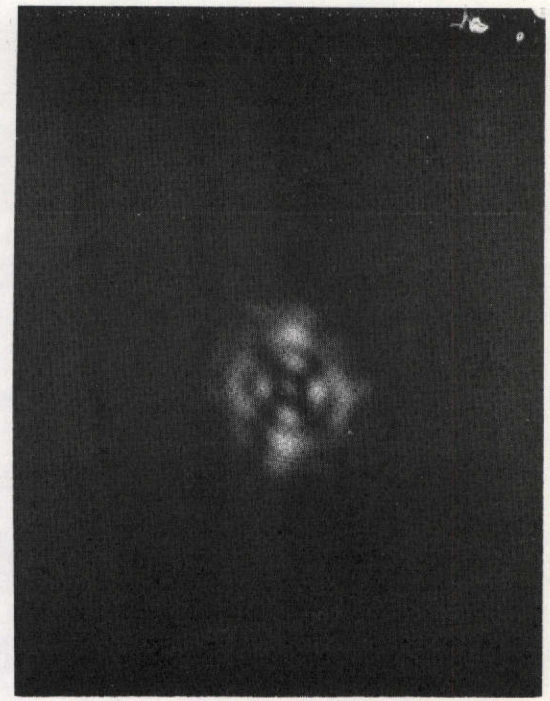




Test No. 24
Retro: A
Photo No. 308
Exposure Time: 1/250 SEC

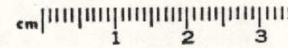


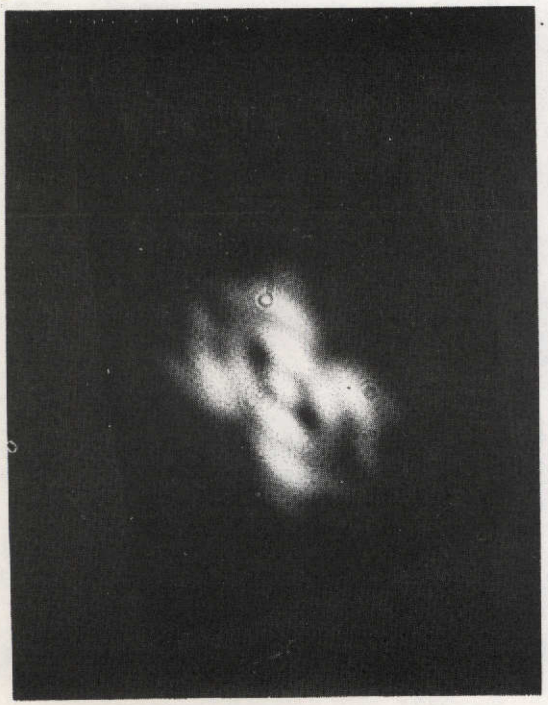
Test No. 24
Retro: A
Photo No. 309
Exposure Time: 1/8 SEC



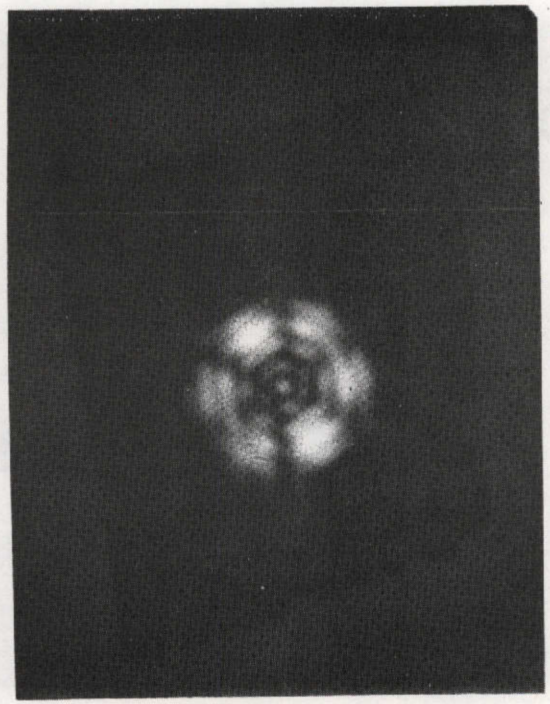
Test No. 24
Retro: A
Photo No. 310
Exposure Time: 1/250 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI





Test No. 24
Retro: A
Photo No. 311
Exposure Time: 1/30 SEC

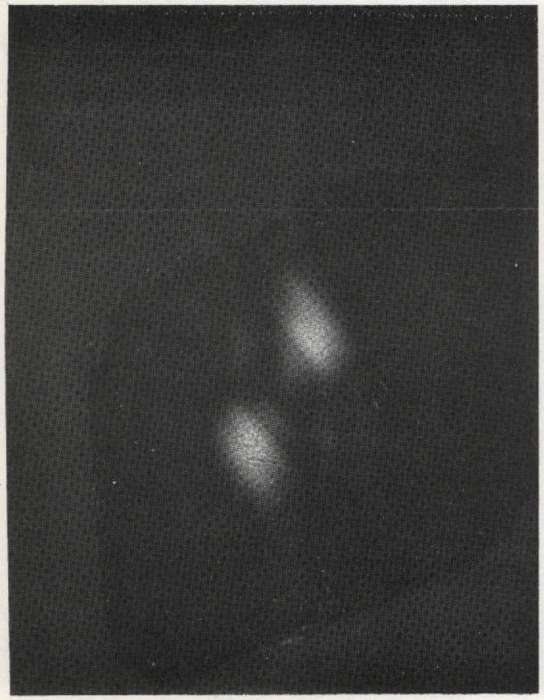


Test No. 24
Retro: B
Photo No. 312
Exposure Time: 1/250 SEC

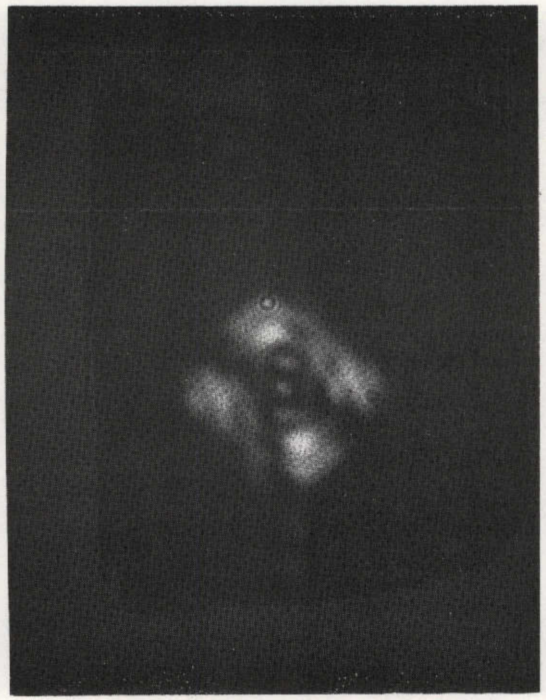
Test No. 24
Retro: B
Photo No. 313
Exposure Time: 1/125 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

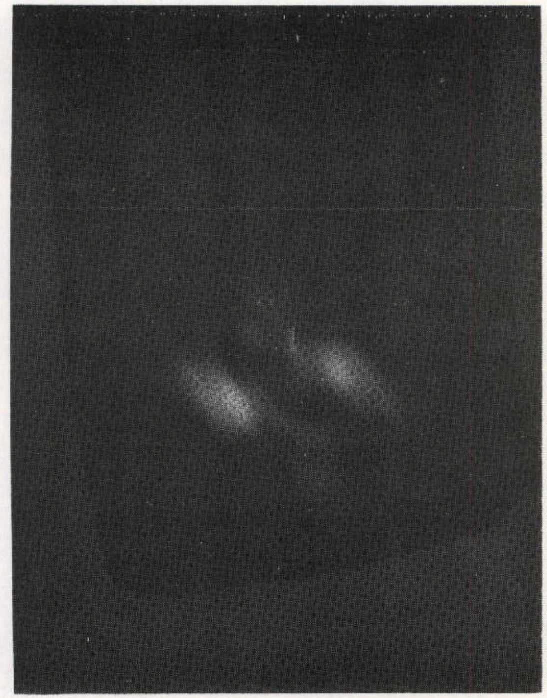
cm 1 2 3



Test No. 24
Retro: B
Photo No. 314
Exposure Time: 1/15 SEC

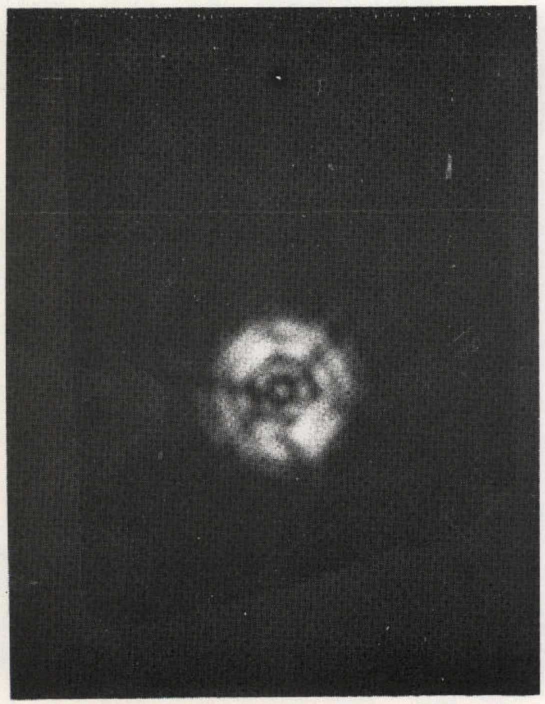


Test No. 24
Retro: B
Photo No. 315
Exposure Time: 1/250 SEC



Test No. 24
Retro: B
Photo No. 316
Exposure Time: 1/30 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI

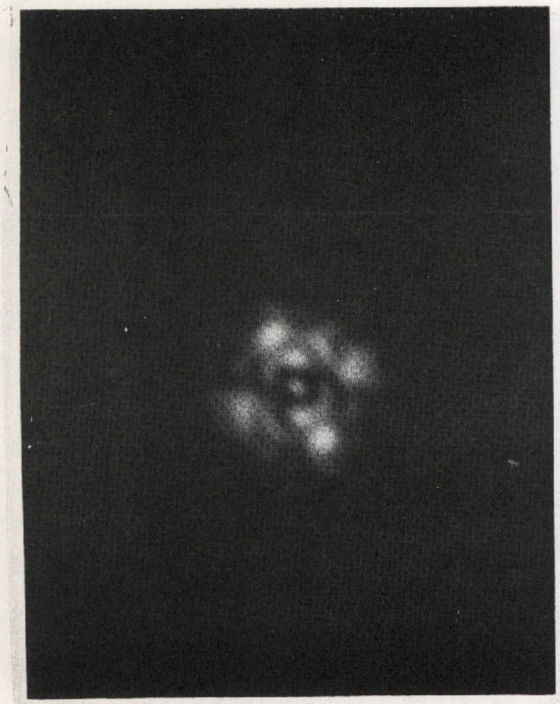


Test No. 24
Retro: C
Photo No. 317
Exposure Time: 1/250 SEC

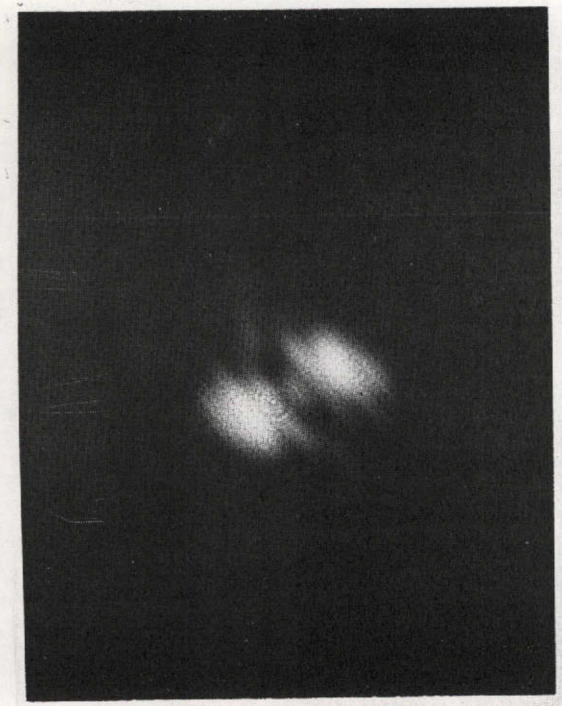
Test No. 24
Retro: C
Photo No. 318
Exposure Time: 1/250 SEC

Test No. 24
Retro: C
Photo No. 319
Exposure Time: 1/8 SEC

LAGEOS THERMAL/OPTICAL TESTS
FAR-FIELD DIFFRACTION PATTERN
PHOTOGRAPHIC OUTPUT - FFDI



Test No. 24
Retro: C
Photo No. 320
Exposure Time: 1/250 SEC



Test No. 24
Retro: C
Photo No. 321
Exposure Time: 1/8 SEC

Test No. ______
Retro: ______
Photo No. ______
Exposure Time: ______

RELIABILITY		REVISIONS			
APPD	PREDICTION	LTR	DESCRIPTION	DATE	CONFIG MGT APPV'D
		X1	EXPERIMENTAL RELEASE ER 1922-13	7/8/74	
		X2	REVISED PER NASA/BYA T.R.R.	7/24/74	

(1)

APPENDIX V

TABLE OF CONTENTS

DRAWING AND PART APPLICATION

PART NO	NEXT ASSY	END ITEM NO.	SERIAL NO.
2374464	N/A	N/A	N/A

Test Date 8-14-74

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.

MATERIAL:

DRAWING CLASS A ☐ B ☐ C ☒

CONTR NO. NAS 8-30658		
DRAWN	[illegible]	7/26/74
CHECKED	[illegible]	7/29/74
STRESS/WT		
DSGN SUPV		
PROJ ENGR	[illegible]	7/26/74
QUAL CONT		
SYS SPT		
DSGN APPL		
MFG		
CUSTOMER		

THE BENDIX CORPORATION
AEROSPACE SYSTEMS DIVISION - ANN ARBOR, MICHIGAN

TITLE: VIBRATION TEST PROCEDURE FOR THE LAGEOS TEST ARTICLE

SIZE	CODE IDENT NO.	DRAWING NUMBER	REV
A	07038	TP 2374457	X2
SCALE	WEIGHT	SHEET 1 of 17	

1.0 OBJECTIVE

THE PURPOSE OF THE TEST IS TO VERIFY THE STRUCTURAL INTEGRITY OF THE LAGEOS TEST ARTICLE WHEN SUBJECTED TO THE SPECIFIED QUALIFICATION LEVEL VIBRATION ENVIRONMENTS. SUBSEQUENT TO VIBRATION, THE TEST ARTICLE WILL BE VISUALLY INSPECTED FOR DAMAGE (CHIPS, CRACKS, DEFORMATIONS, FRACTURES, ETC.) THEREAFTER, OPTICAL TESTS WILL BE CONDUCTED TO DEMONSTRATE THAT THE VIBRATION TESTING DID NOT DEGRADE OPTICAL PERFORMANCE. SUCCESSFUL COMPLETION OF VIBRATION, INSPECTION, AND OPTICAL TESTS WILL ESTABLISH THAT THE LAGEOS DESIGN MARGINS ARE SUFFICIENT TO INSURE A HIGH DEGREE OF CONFIDENCE IN THE LAGEOS CAPABILITY TO SURVIVE THE LAUNCH VEHICLE DYNAMIC LOADS.

2.0 APPLICABLE DOCUMENTS

LAGEOS-14 (REV. B) "LAGEOS PHASE B THERMAL/OPTICAL/VIBRATION ANALYSIS AND TEST PROGRAM"

STM-1010 "ENVIRONMENTAL LABORATORIES RANDOM VIBRATION TESTING - AUTOMATIC EQUALIZER/ANALYZER SYSTEM

STM-1011 "SETUP AND OPERATIONS PROCEDURE FOR SINE VIBRATION TEST"

3.0 PARTICIPANTS REQUIRED

ENVIRONMENTAL/QUALITY TEST CONDUCTOR

LAGEOS ENGINEERING REPRESENTATIVE

4.0 EQUIPMENT REQUIRED

ITEM	MANUFACTURER	PART NO. OR MODEL	*SERIAL NO.	*CALIB. DATE
~~VIBRATION SYSTEM~~	~~LING~~	~~249~~	~~13/30~~	~~N/A~~
TEST FIXTURE - LAGEOS	BXA	2374456	N/A	N/A
RECORDER, X-Y	MOSELEY	2D	10010	2-6-75
LOGARITHMIC CONVERTER	MOSELEY	60D	12415	11-06-74
LOGARITHMIC CONVERTER	MOSELEY	7561	14289	08-27-74
ACCELEROMETER	ENDEVCO	2221	VR59	7-3-75
EXCITER CONTROL	LING	SCO-100	14569	10-29-74
TRMS VOLTMETER	B&K	2409	51642	10-15-74
TAPE RECORDER	SANBORN	3900	13943	10-26-74
CHARGE AMPLIFIER	ENDEVCO	2614C	51471	11-07-74
EQUALIZER/ANALYZER	LING	ASDE-80	14296	09-23-74
LO-PASS FILTER	LING	LP-10	50930	01-08-75
DYNA-MONITOR	ENDEVCO	2702	09633	09-07-74
DYNA-MONITOR	ENDEVCO	2702C	NOT	USED

*TO BE COMPLETED PRIOR TO TESTING. EQUIPMENT SUBSTITUTIONS AND ADDITIONS SHALL BE LISTED BELOW.

TORQUE WRENCH	PROTO LIVERMONT	6015G	05369	09-13-74
TORQUE WRENCH	SNAPON	TE12FU	51960	12-4-74
RECORDER, X-Y	MOSELEY	2DR-2A	14287	10-17-74
VIBRATION SYSTEM	MB	C-10	484	N/A

5.0 TOLERANCES AND CONTROLS

THIS PROCEDURE UTILIZES ENVIRONMENTAL LABORATORIES STANDARD TEST METHODS FOR OPERATION OF FACILITY AND INSTRUMENTATION EQUIPMENT.

5.1 MONITORING TOLERANCE

INSTRUMENTATION DEVICES OR SYSTEMS SHALL BE CALIBRATED SO AS TO PROVIDE MONITORING ACCURACIES AS FOLLOWS:

a. VIBRATION DISPLACEMENT: ±5%

b. VIBRATION ACCELERATION: ±3%

c. VIBRATION FREQUENCY: ±2 HZ, 5 TO 40 HZ
±5%, ABOVE 40 HZ

5.2 CONTROL TOLERANCE

THE MAXIMUM ALLOWABLE VARIATION IN THE CONTROL OF THE SPECIFIED LEVELS DURING VIBRATION TESTING SHALL BE:

VIBRATION AMPLITUDE:	SINUSOIDAL	±10%
	RANDOM PSD	±3 DB
	RANDOM G-RMS	±10%
VIBRATION FREQUENCY:		±2HZ, 5 TO 40 HZ ±5%, ABOVE 40 HZ

THESE TOLERANCES APPLY TO THE CONTROL OF THE INPUT TO THE SPECIMEN AS MONITORED WITH A SINGLE ACCELEROMETER. THE SWEEP RATE FOR SINUSOIDAL VIBRATION MAY BE REDUCED NEAR THOSE FREQUENCIES WHERE THE TOLERANCE BECOMES DIFFICULT TO MAINTAIN IN ORDER TO ALLOW THE SERVO TO RESPOND.

5.3 OVER-G CUT-OFF AND NO SIGNAL DETECTION

PRIOR TO THE START OF EACH TEST, THE OVER "G" CUT-OFF SHALL BE SET AT 50% OVER THE MAXIMUM SPECIFIED LEVEL AND ITS OPERATION VERIFIED BY SIGNAL INJECTION.

THE NO-SIGNAL DETECTOR OPERATION WILL BE VERIFIED AT THE START OF THE TEST FOR RANDOM AND SINUSOIDAL LEVELS WITHOUT THE TEST ITEM INSTALLED.

BOTH WILL BE RESET FOR SINUSOIDAL AND RANDOM AS REQUIRED.

6.0 TEST LEVELS

PERFORM THE FOLLOWING VIBRATION TESTS. THE AXES MAY BE TESTED IN ANY ORDER, AND THE SEQUENCE OF THE RANDOM AND SINUSOIDAL SHALL BE DETERMINED BY THE QUALITY TEST CONDUCTOR.

6.1 SINUSOIDAL VIBRATION

THE REQUIRED SINUSOIDAL VIBRATION LEVELS (SHOWN IN FIGURE 1) ARE:

FREQUENCY RANGE	LEVEL
5-12 HZ	0.3 IN. DBL. AMPL.
12-16	2.3 G-PEAK
16-22	6.8 G-PEAK
22-200	2.3 G-PEAK
200-2000	5.0 G-PEAK

ONE SWEEP (5-2000 HZ) IS REQUIRED PER AXIS, DEFINED IN FIGURE 2, AT A SWEEP RATE OF 2 OCTAVES PER MINUTE.

6.2 RANDOM VIBRATION

THE REQUIRED RANDOM VIBRATION LEVELS (SHOWN IN FIGURE 3) ARE:

FREQUENCY RANGE	LEVEL
5-300	+3 DB/OCT
300-2000	0.05 G^2/HZ

SINUSOIDAL VIBRATION

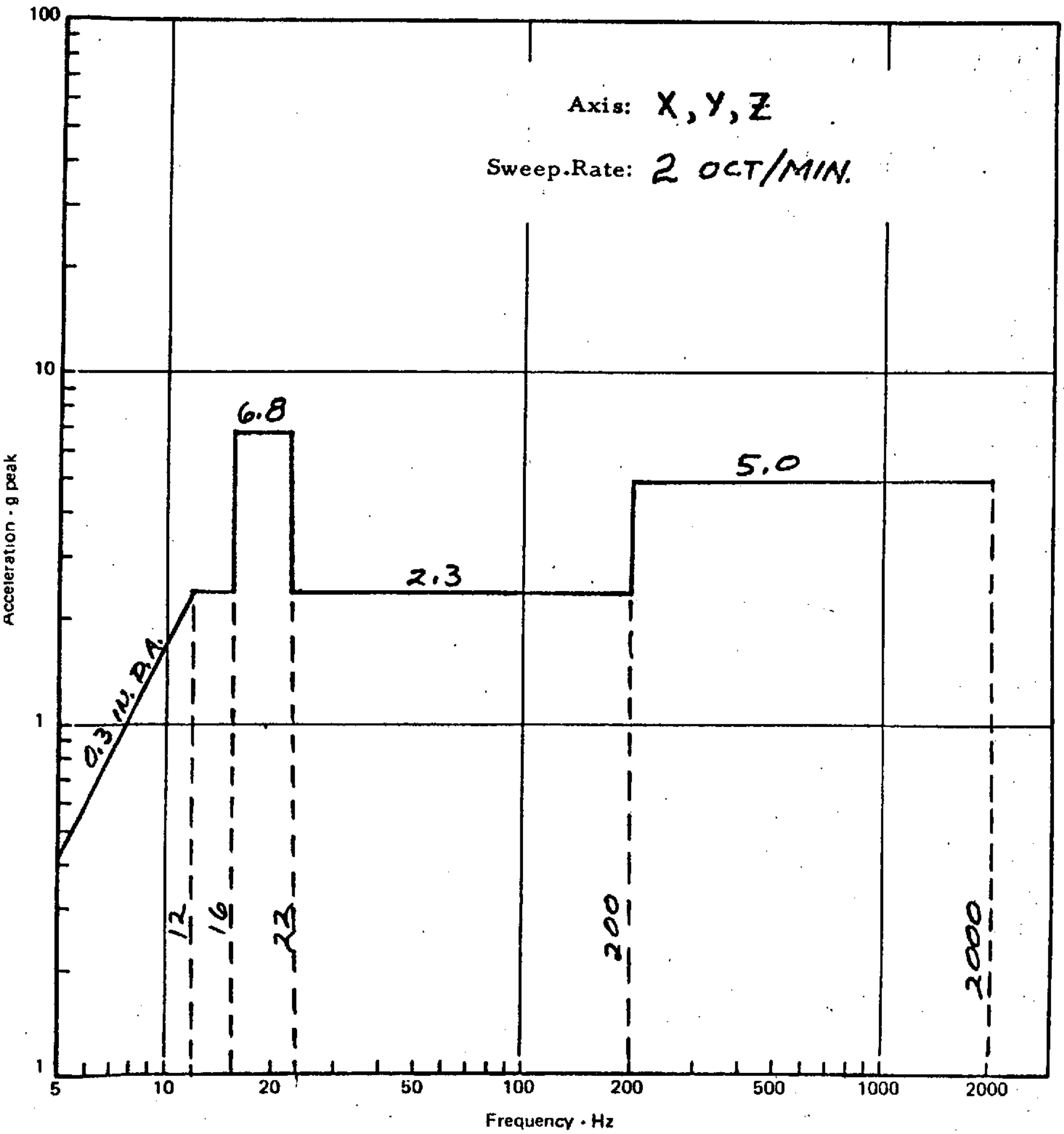


FIGURE 1

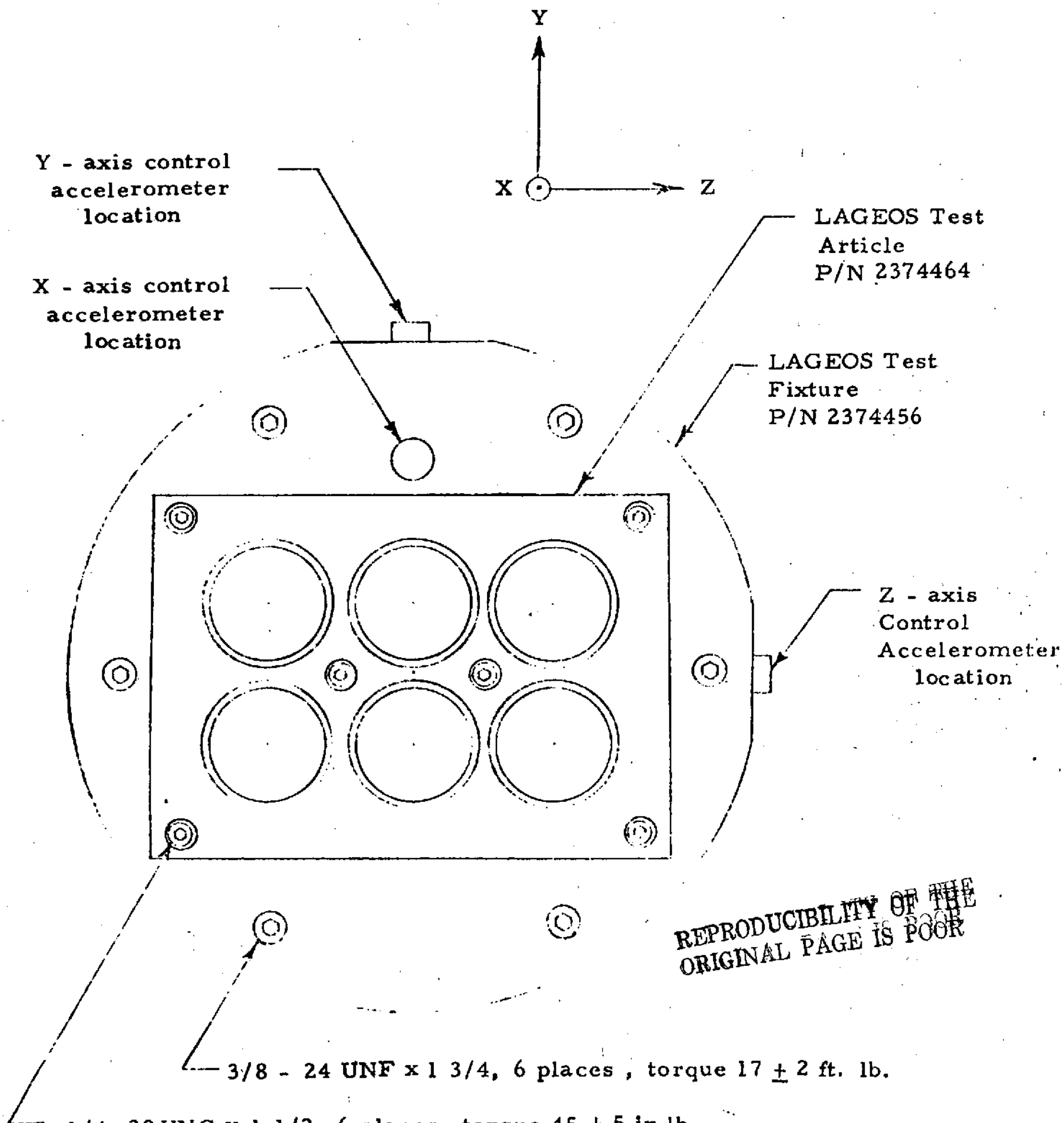

Y
X
Z
Y - axis control accelerometer location
X - axis control accelerometer location
LAGEOS Test Article P/N 2374464
LAGEOS Test Fixture P/N 2374456
Z - axis Control Accelerometer location
3/8 - 24 UNF x 1 3/4, 6 places , torque 17 ± 2 ft. lb.
1/4 - 20 UNC x 1 1/2, 6 places, torque 45 ± 5 in lb.

FIGURE 2

Bendix
Aerospace
Systems Division

VIBRATION TEST PROCEDURE FOR
THE LAGEOS TEST ARTICLE

NO.	REV. NO.
TP2374457	

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DATE

(10)

RANDOM VIBRATION SPECTRUM

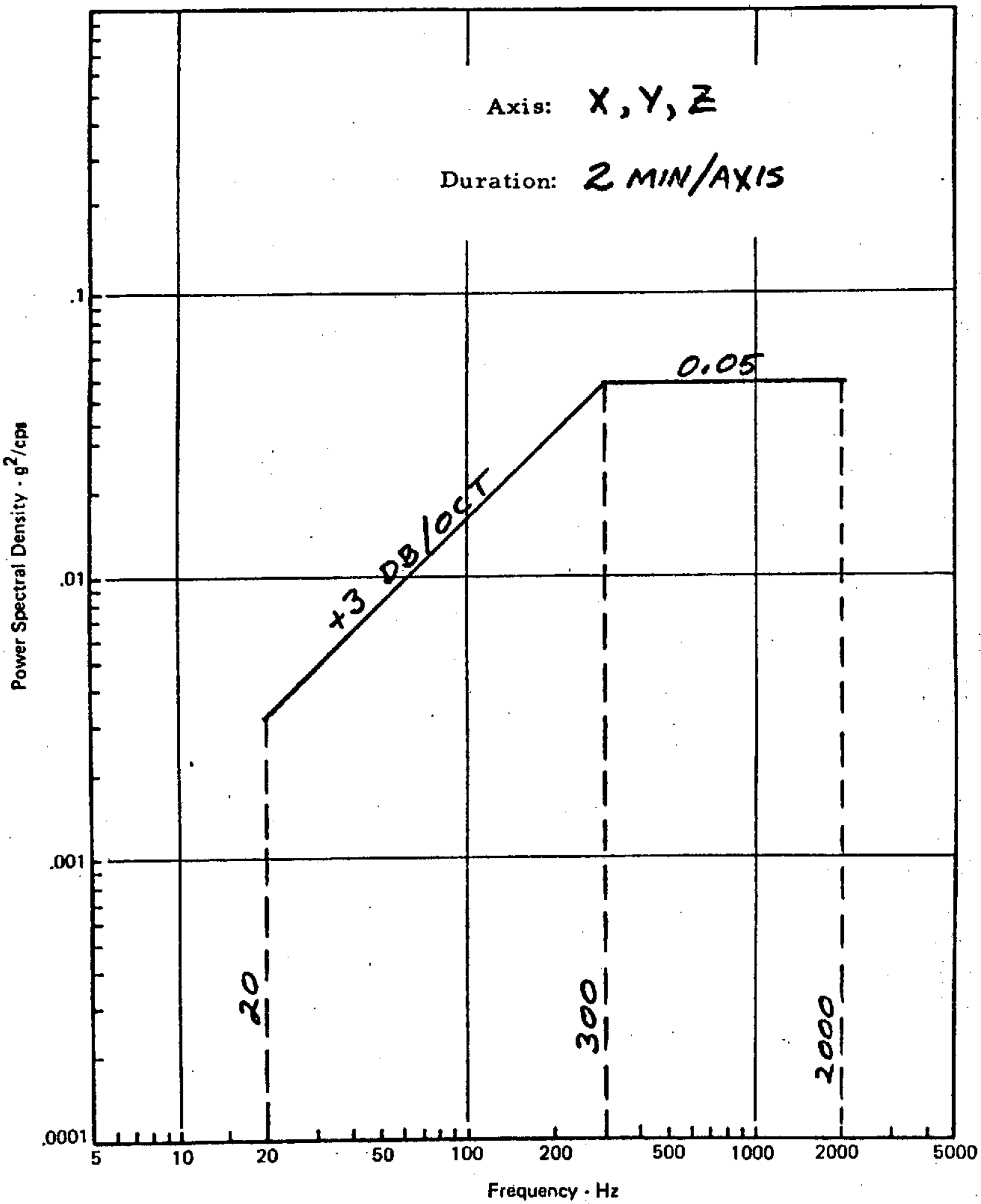


FIGURE 3

THESE LEVELS WILL BE MAINTAINED FOR A DURATION OF 2.0 MINUTES FOR EACH AXIS DEFINED IN FIGURE 2. THE CORRESPONDING ROOT-MEAN-SQUARE ACCELERATION IS 9.6 G.

7.0 TEST PROCEDURE

7.1 VERIFY PROPER NO-SIGNAL DETECTOR OPERATION.

✓ X ✓ Y ✓ Z

7.2 INSTALLATION

7.2.1 REMOVE THE COVER AND INSTALL THE LAGEOS TEST ARTICLE ON THE VIBRATION FIXTURE USING SIX 1/4-20UNC-2A BY 1 1/2 IN SCREWS WITH WASHERS. ✓

7.2.2 REPLACE THE LAGEOS COVER. ✓

7.2.3 INSTALL THE VIBRATION FIXTURE ON THE VIBRATION EXCITER USING SIX 3/8-24UNF BY 1 3/4 IN. SCREWS WITH WASHERS.

✓ X ✓ Y ✓ Z

7.2.4 ATTACH THE CONTROL ACCELEROMETER ON THE VIBRATION FIXTURE PER FIGURE 2. ✓ X ✓ Y ✓ Z

7.2.5 PHOTOGRAPH THE TEST SET-UP AND ATTACH PHOTOGRAPH TO DATA LOG.

✓ X ✓ Y ✓ Z

7.3 ADJUST THE NECESSARY EQUIPMENT PER STM 1011 TO APPLY THE SINE VIBRATION OF FIGURE 1.

✓ X ✓ Y ✓ Z

7.4 SET THE OVER "G" CUTOFF TO 10.2 G-PEAK AND VERIFY ITS OPERATION BY SIGNAL INJECTION.

✓ X ✓ Y ✓ Z

7.5 REMOVE THE COVER AND APPLY THE SINUSOIDAL VIBRATION OF FIGURE 1. RECORD THE CONTROL ACCELEROMETER SIGNAL. ATTACH X-Y RECORDING TO DATA LOG.

✓ X ✓ Y ✓ Z

7.6 VERIFY ACTUAL LEVELS ARE WITHIN SPECIFICATION LIMITS. (NOTE: X-Y RECORDING FOR REFERENCE ONLY BELOW 20 HZ.)

✓ X ✓ Y ✓ Z

7.7 VISUALLY INSPECT THE CCR AND MOUNT FOR DAMAGE (WITHOUT DISASSEMBLY). REPLACE THE COVER.

✓ X ✓ Y ✓ Z

TDR 4009 8-14-74

~~DRAC 9625~~ ~~8-14-74~~ Voided 8-15-74

7.8 ADJUST THE NECESSARY EQUIPMENT PER STM 1010 TO APPLY THE RANDOM VIBRATION OF FIGURE 3.

✓ X ✓ Y ✓ Z

7.9 SET THE OVER "G" CUTOFF AT 14.4 RMS AND VERIFY ITS OPERATION BY SIGNAL INJECTION.

✓ X ✓ Y ✓ Z

7.10 REMOVE THE COVER AND APPLY THE RANDOM VIBRATION OF FIGURE 3 FOR 120 SECONDS. RECORD THE CONTROL ACCELEROMETER SIGNAL. ATTACH X-Y RECORDING TO THE DATA LOG.

✓ X ✓ Y ✓ Z

7.11 VERIFY ACTUAL LEVELS ARE WITHIN SPECIFICATION LIMITS.

✓ X ✓ Y ✓ Z

7.12 VISUALLY INSPECT THE CCR AND MOUNT SYSTEM FOR DAMAGE (WITHOUT DISASSEMBLY). REPLACE THE COVER.

✓ X ✓ Y ✓ Z

7.13 REMOVE THE FIXTURE FROM THE EXCITER.

✓ X ✓ Y ✓ Z

7.14 REPEAT PARAGRAPHS 7.1 THROUGH 7.13 FOR THE NEXT DESIRED AXIS. ✓

7.15 REPEAT PARAGRAPHS 7.1 THROUGH 7.13 FOR THE FINAL AXIS OF VIBRATION. ✓

7.16 REMOVE THE MOUNTING SCREWS AND WASHERS AND REMOVE THE LAGEOS TEST ARTICLE FROM THE VIBRATION FIXTURE. ✓

7.17 REMOVE CCR "E" FROM THE TEST ARTICLE AND VISUALLY INSPECT FOR DAMAGE. ✓

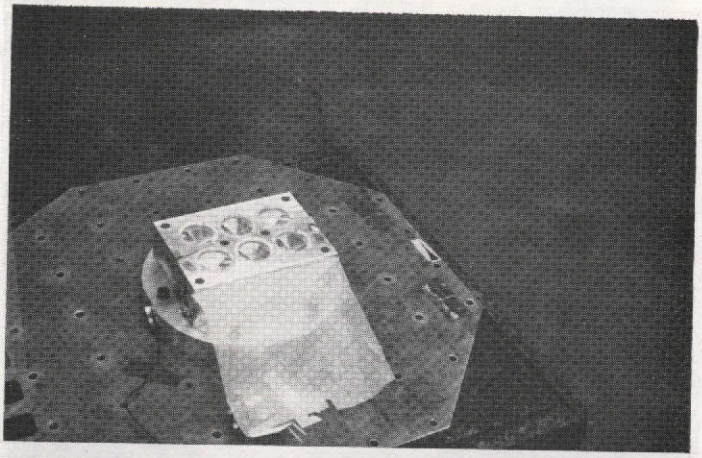
7.18 REPLACE CCR "E" IN THE $\theta = 100$ DEG. ORIENTATION (REF. DWG. 2374458). TORQUE #2-56 UNC SCREWS (3)

tem#1 TO ~~1.8 ± 0.2~~ 1.4 $^{+0.0}_{-0.2}$ IN. LB. ✓

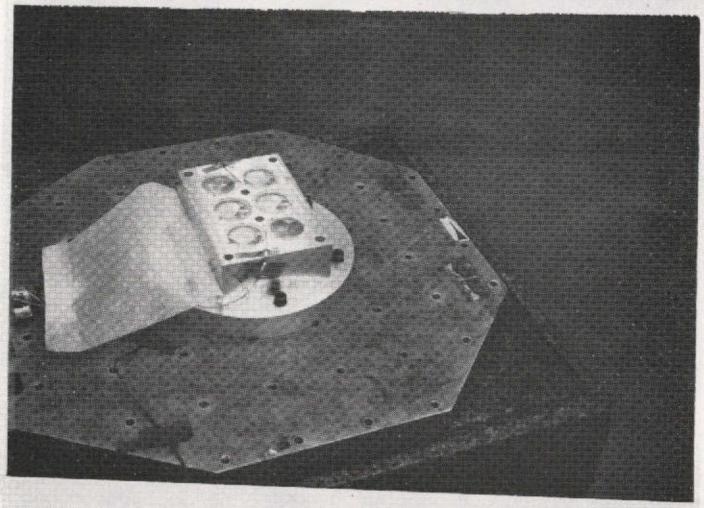
8.0 <u>DATA SHEETS</u>

a) INSERT G-PEAK VS. FREQUENCY PLOTS (SINUSOIDAL)
b) INSERT PSD PLOTS (RANDOM)
c) LIST FAILURES OR OUT-OF-TOLERANCE CONDITIONS
d) ATTACH TEST SET-UP PHOTOGRAPHS OF EACH AXIS
e) ATTACH ADDITIONAL DATA SHEETS AS REQUIRED.

Test Setup Photographs



Z Axis



Y Axis

X Axis

Bendix Aerospace Systems Division

SYSTEMS TEST DEPARTMENT

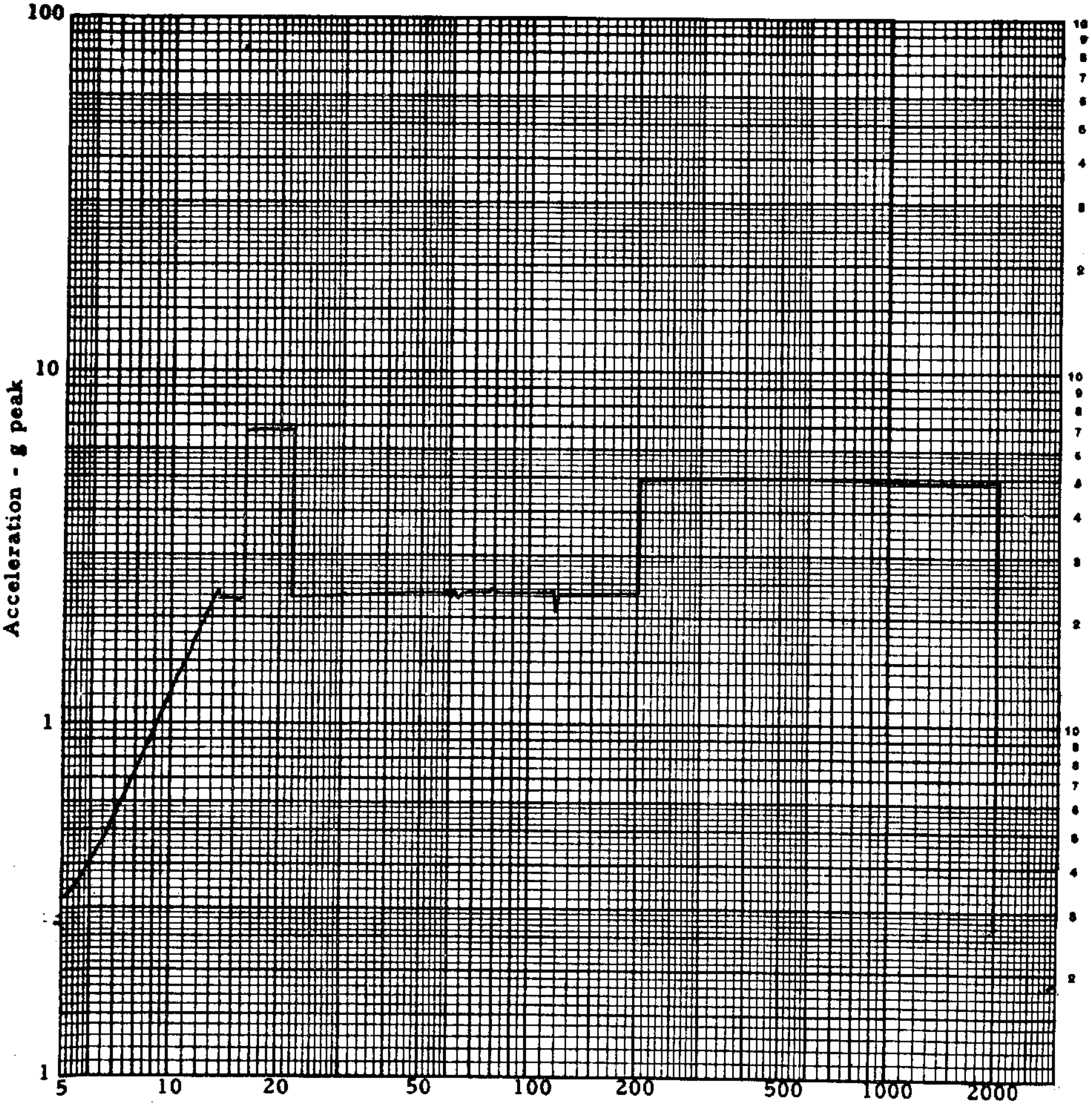
TR
FIGURE

16

VIBRATION LEVELS

Test Item: LAGEOS TEST ARTICLE
Test Date: 08-14-74

Serial Number:
Input Axis: X
Response Axis:



440-8 A

Bendix Aerospace Systems Division

SYSTEMS TEST DEPARTMENT

TR
Figure

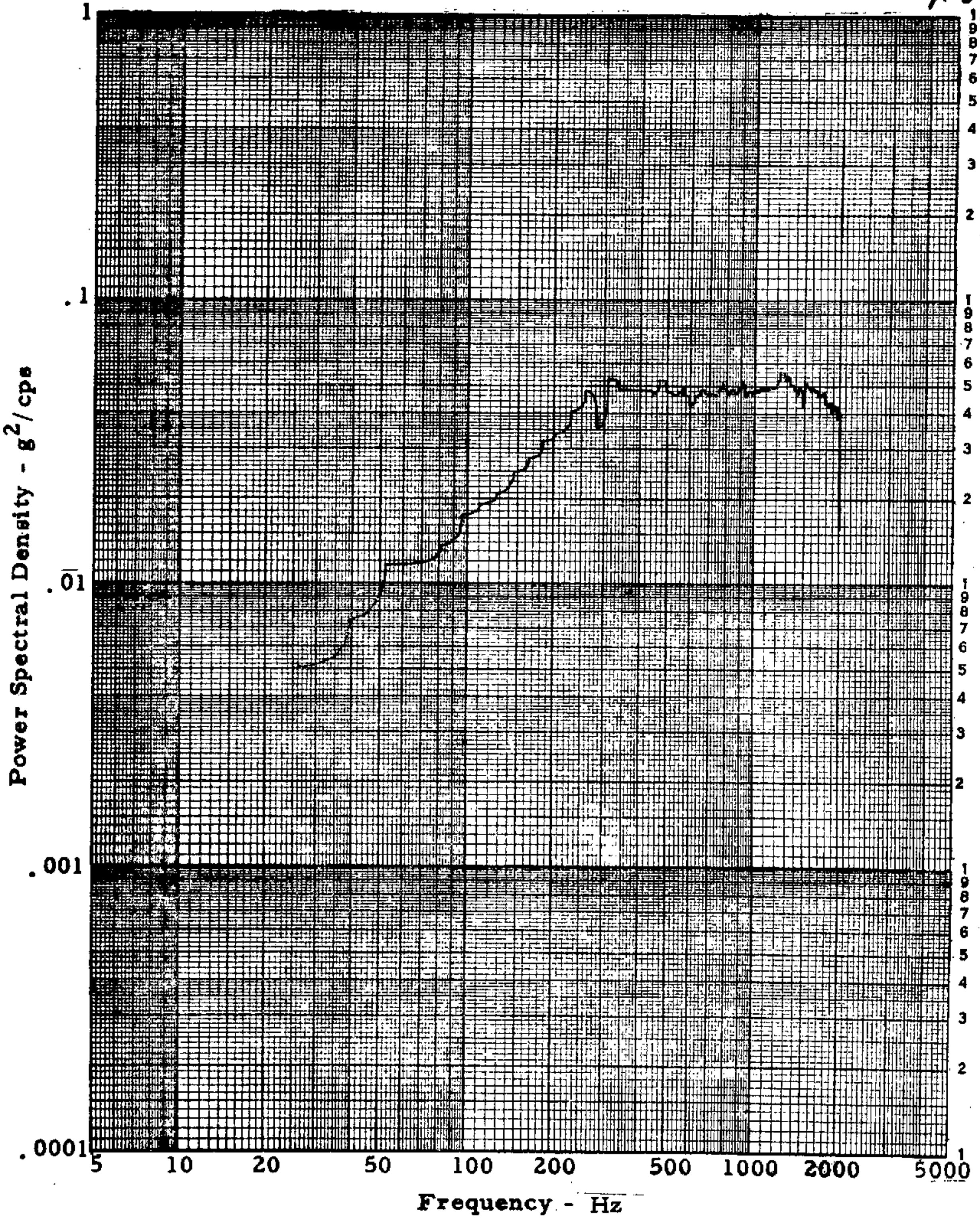
RANDOM VIBRATION SPECTRUM

(17)

Test:
Test Item: LAGEOS TEST ARTICLE
Test Date: 08-14-74

SN:
Axis: Z

9.5 grms



440-13A

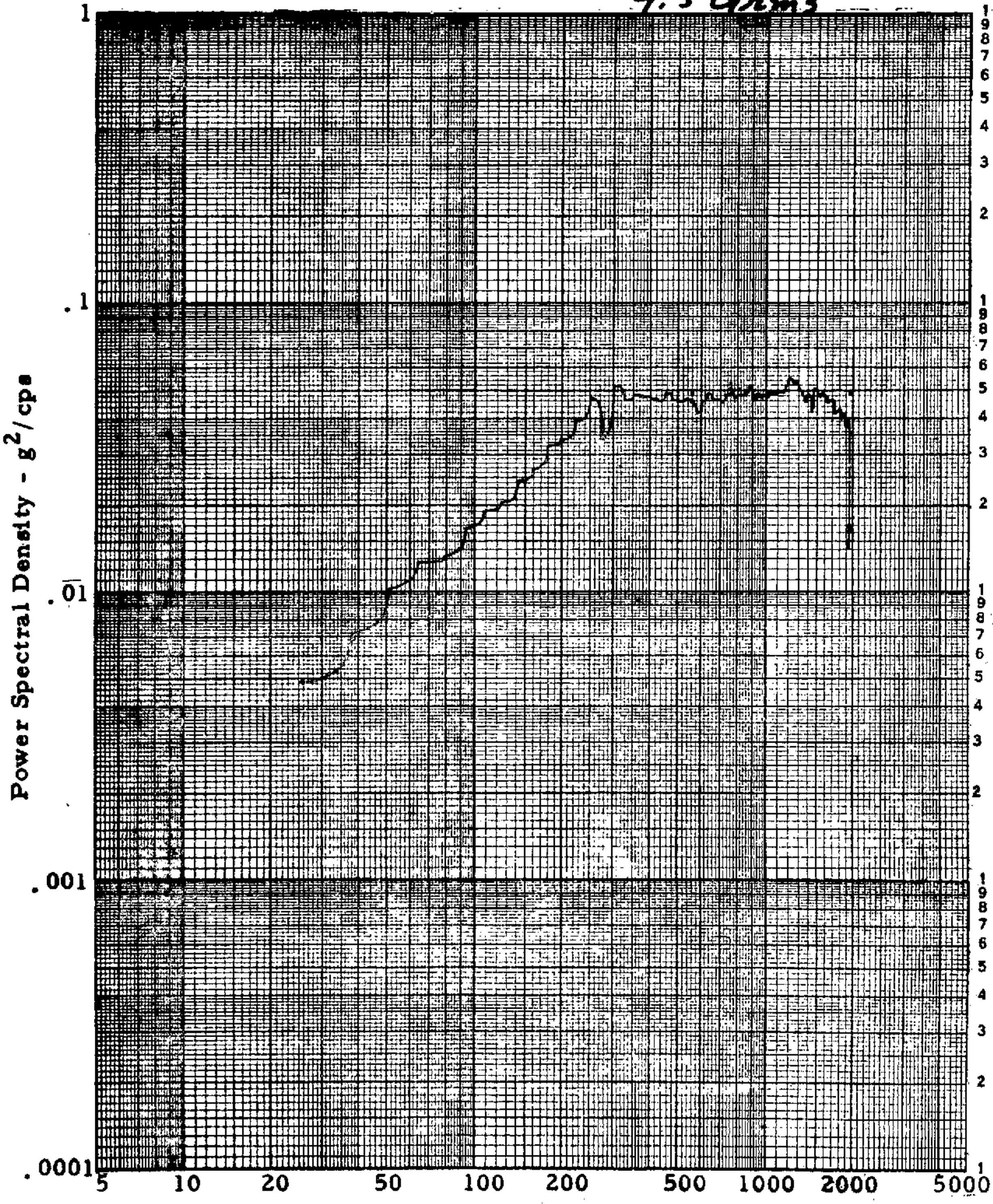
RANDOM VIBRATION SPECTRUM

(18)

Test:
Test Item: LAGEOS TEST ARTICLE
Test Date: 08-14-74

SN:
Axis: Y

9.5 Grms

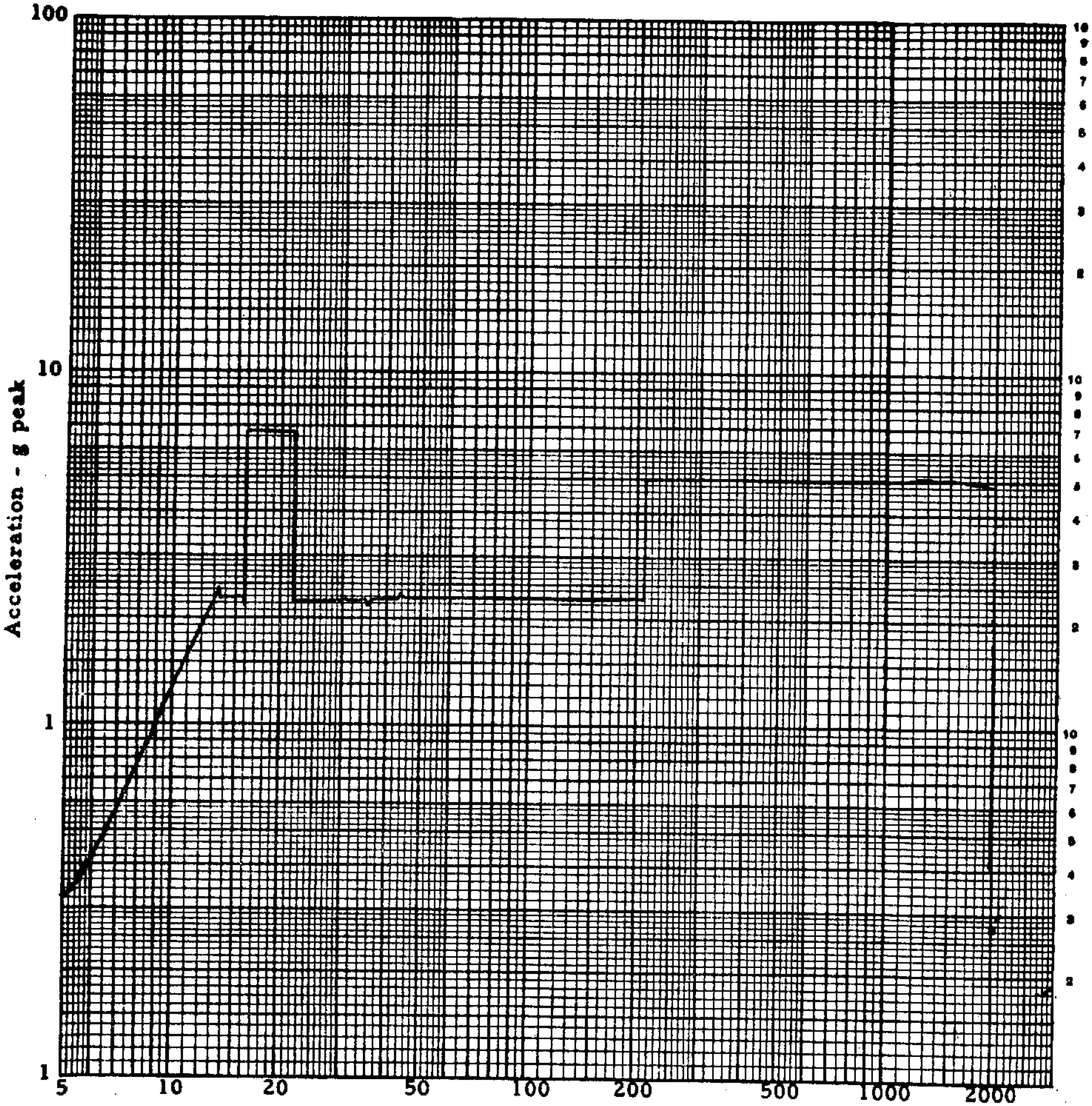


(19)

VIBRATION LEVELS

Test Item: LAGEOS Test Article
Test Date: 08-14-74

Serial Number:
Input Axis: Z
Response Axis:



Aerospace Systems Division

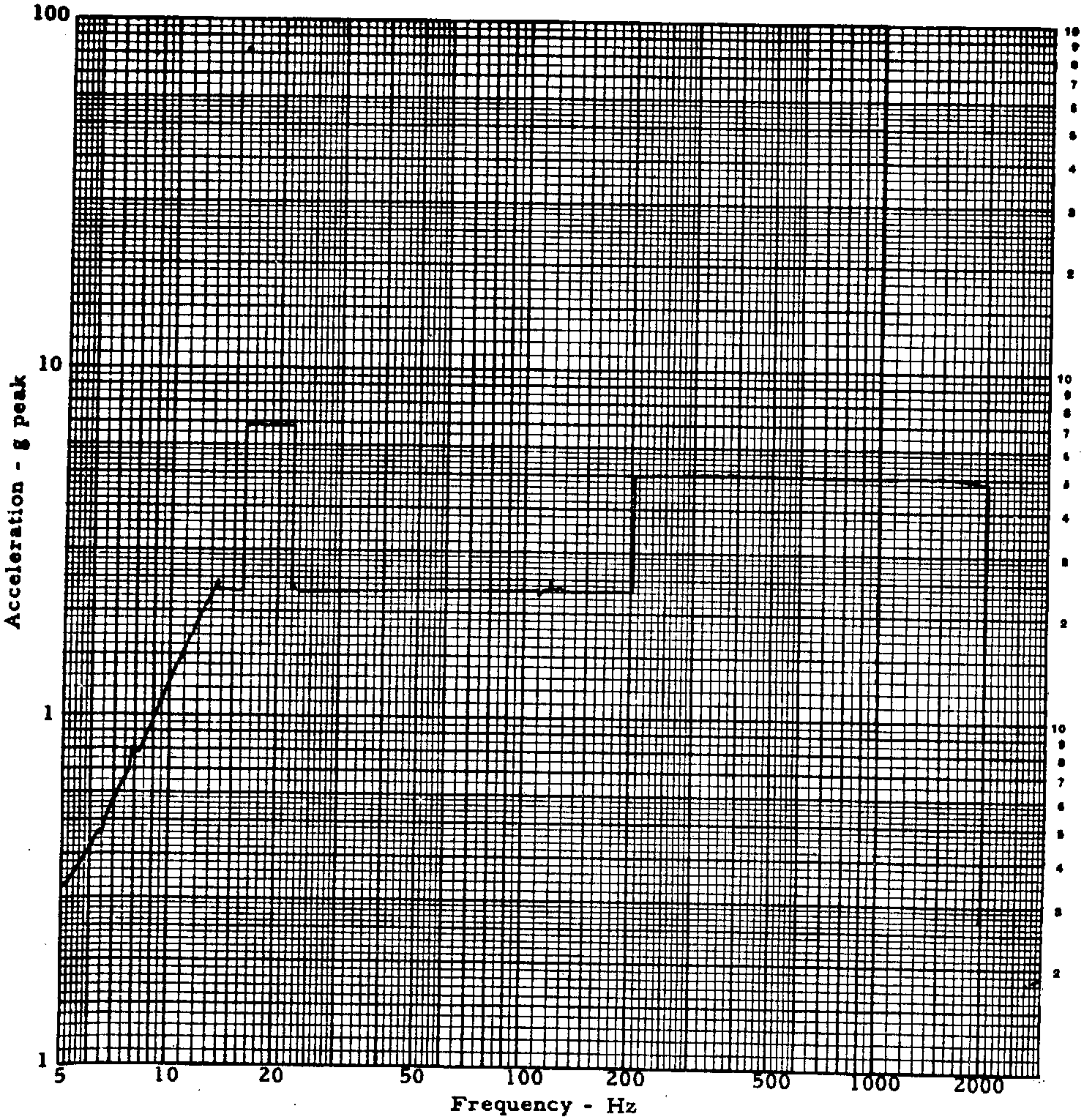
SYSTEMS TEST DEPARTMENT

TR
FIGURE 20

VIBRATION LEVELS

Test Item: LAGEOS Test Article
Test Date: 02-14-74

Serial Number:
Input Axis: Y
Response Axis:



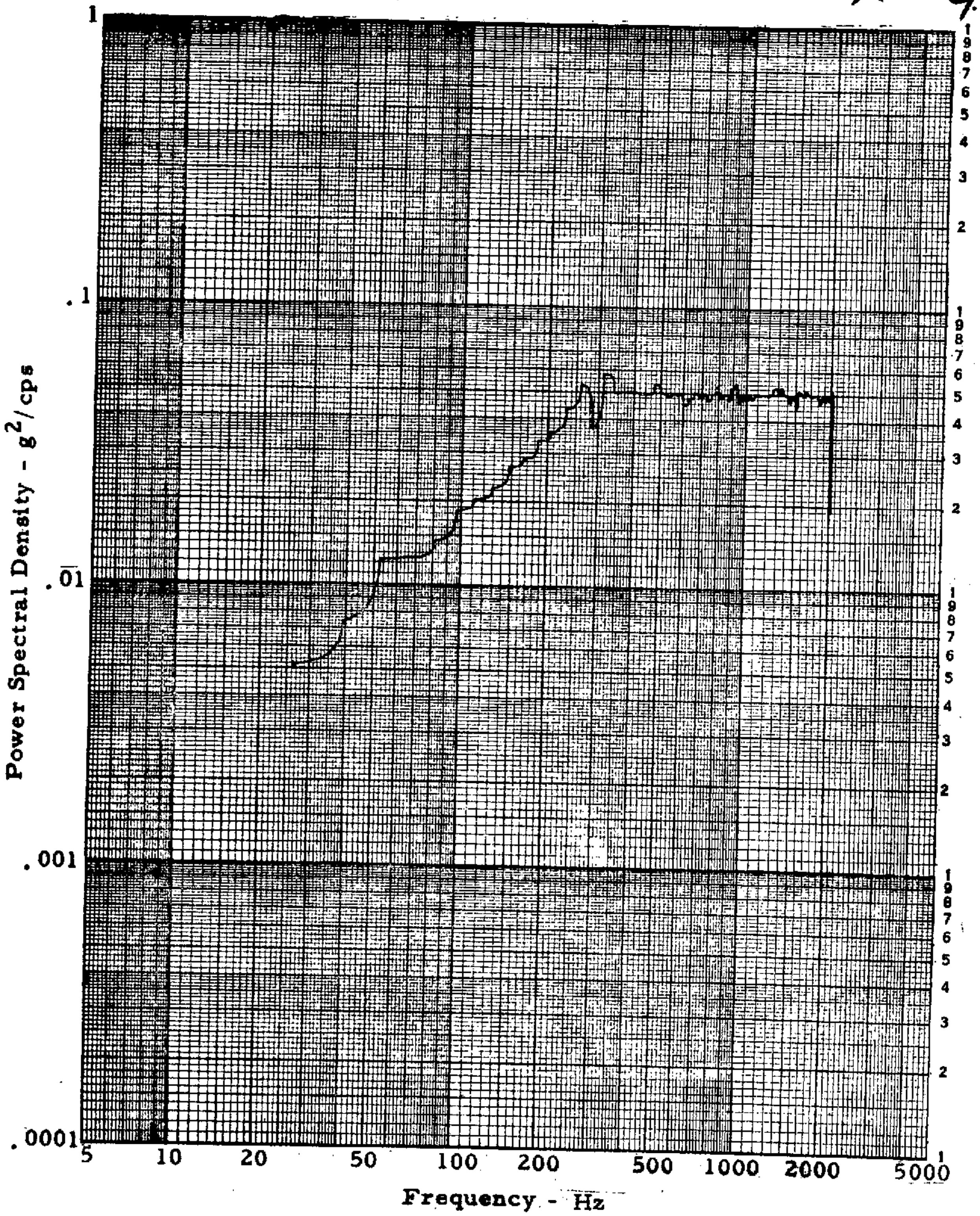
440-8 A

RANDOM VIBRATION SPECTRUM

(21)

Test:
Test Item: LAGEOS TEST ARTICLE
Test Date: 08-14-74

SN:
Axis: X 9.7grms



22

9.0 VARIATION SHEET

#	Reference Paragraph	Variation Description	BxA QT.	BxA Engr.	Temp Perm
1	7.1.8	SCREW TORQUE "WAS" 1.8 ± 0.2 IN.LB "IS" $1.4 {}^{+0.0}_{-0.2}$ IN.LB	8-14-74	JM 8-14-74	TTO

QUALITY ASSURANCE DEPT.
TEST DISCREPANCY REPORT

Page ____ of ____

(23)

TDR 09069

TEST PROCEDURE NO.	REV.	PART NAME	SERIAL NO.	MO. DAY YR.
2374457	X2	LAGEOS T A		08 14 74

NAME OF TEST	PROGRAM NO.	LOC.	PARA NO.	PART NO.	REV
VIBRATION	C3651	VL	7.7 (Z-AXIS)		

DESCRIPTION OF ANOMALY

POSSIBLE FRACTURE NOTED ON THE "C" RETROREFLECTOR - ADJACENT TO THE TAB ON THE COUNTER-CLOCKWISE SIDE OF THE S/N TAB.

ORIGINATOR J Mazzatis

SUMMARY OF TROUBLESHOOTING/RESOLUTION

REMOVE THE "C" RETROREFLECTOR AND INSPECT FOR DAMAGE. NOTE ORIENTATION FOR PROPER RE-INSTALLATION. Obtain microphotos. Re-install in T.A. Panel. Continue test.

Torque check of 2" mounting screws shows 1.4 in. lb.

1	TEST OPERATOR	5	CONTRACT-PURCHASED FUNCTIONAL TEST EQUIP.
2	BXA FACILITY DEFECT	6	TEST FIXTURING DESIGN ERROR
3	TEST SET-UP	7	FACILITY OPERATION PROCEDURE ERROR
4	TEST PROCEDURE	8	HARDWARE DISCREPANCY ~~(CONVERTED TO DR)~~
		0	OTHER (EXPLAIN)

CODE 08 (ENTER ONE OF THE ABOVE)

CAUSE OF ANOMALY:

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

CLASSIFICATION OF DEFECT

CR	CRITICAL
MA	MAJOR
MI	MINOR
PA	PAPERWORK

CODE MI

DR	DISCREPANCY REPORT	RR	RWK OR REPAIR EQUIP.
WR	WORK REQUEST	CT	CONTINUE TEST
RD	CHANGE REQUEST DIRECTIVE	OT	OTHER EXPLAIN
DR	TEST DISCREPANCY REPORT		(ENTER IN BLOCK 69)

CODE ~~DR AC 1625~~ voided

LOCATION CODES (ENTER IN BLOCK 63 ABOVE)

CT = COMPONENT TEST LAB
SA = SUBASSEMBLY TEST LAB
ET = EXPERIMENT TEST LAB
ST = SYSTEM TEST LAB
TL = TRANSMITTER LAB
PL = P.S.E. LAB
TV = THERMAL-VACUUM LAB
VL = VIBRATION LAB
CL = CALIBRATION LAB
EM = EMI/SCREEN ROOM
CC = CLIMATIC CHAMBER
HB = HIGH BAY AREA
OP = OUT OF PLANT

V-23

TEST CONDUCTOR

BXA QA REPRESENTATIVE Fuller M. Shiai 8/15/74

GOV'T SOURCE REPRESENTATIVE N/A

10.0 TEST DISCREPANCY REPORT LIST

TDR No.	Paragraph	Entered By	Accept LAGEOS	DR		
4009	7.7 Z Axes	8-14-74		~~AC9626~~ Voided 8-15-74		

11.0 TEST WITNESS SIGNATURE SHEET

TEST ITEM Lageos Phase B Test Article

SERIAL NUMBER N/A

PART NUMBER N/A

THE ABOVE LISTED ITEM HAS BEEN TESTED AND WITNESSED IN ACCORDANCE WITH THE FOREGOING PROCEDURE.

Lyle M. Shjei — 8-15-74

ENVIRONMENTAL/QUALITY TEST CONDUCTOR — DATE

J Maszatics — 8-14-74

LAGEOS ENGINEERING REPRESENTATIVE — DATE