

**TEST PROCEDURE**  
 for  
**STRUCTURAL PROOF TESTING**  
 of the  
**ACIS FLIGHT UNIT**  
**TCS SHADES, SUN & TELESCOPE**

**OPTION II**

Procedure Number: <b>ACIS-500-42-01</b>	Test Unit Title: <b>ACIS FU TCS SHADES</b>	Part Number: <b>849AC530026</b> <b>849AC530027</b>
Effectivity: <b>FU</b>	Dash Number: <b>-020, -020</b>	Serial Number: <b>N/A</b>
Prepared by: <b>R. Simon</b>	<b>04-01-96</b>	Phone: <b>1-9070</b>
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**APPROVALS**

This test procedure is used to perform tests on a subassembly of the ACIS unit. Customer approval is not required.

ORGANIZATION	APPROVAL	DATE	VALIDATION	DATE
ACIS Chief Engineer:				
ACIS Mechanical PIE:				
ACIS Program Manager:				
ACIS Test Engineer:				
Safety:				
Quality Assurance:				
Reqmts Verification:				

**REVISIONS**

PCN	DESCRIPTION	DATE



**PROCEDURE CHANGE NOTICE (PCN)**

PCN Revision: **New**

Sheet 1 of 1

Procedure Number:

**ACIS-500-42-01**

Test Unit Title:

**ACIS FU TCS SHADES**

Part Number:

**849AC530026**

**849AC530027**

Reason for Change:

**REVISIONS**

REVISED BY  
(C)HANGE  
(A)DDITION  
(D)ELETION

REVISED ITEM:  
PARAGRAPH  
FIGURE  
TABLE  
ETC.

DESCRIPTION OF REVISION

C

A

D

**APPROVALS**

ORGANIZATION

APPROVAL

DATE

ACIS Chief Engineer:

ACIS Mechanical PIE:

ACIS Program Manager:

ACIS Test Engineer:

Safety:

Quality Assurance:

Requirements Verification:

**REVISION RECORD**

<b>PCN</b>	<b>DATE</b>	<b>PARAGRAPHS AFFECTED</b>	<b>DESCRIPTION</b>
New		All	Initial release

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### Abbreviations and Acronyms

Unless otherwise specified, all common abbreviations are in accordance with MIL-STD-12D. Special ACIS acronym definitions are as follows:

ACRONYM	DEFINITION
ACIS	AXAF CCD Imaging Spectrometer
A/R	As Required
ALARA	As Low As Reasonably Achievable
Assy	Assembly
BCE	Bench Checkout Equipment
CAL	Calibration
CG	Center of Gravity
CH	Channel
Chk	Check Off Item
dB	Decibel
DWG	Drawing
ESD	Electrostatic Discharge
FWHM	Full Width at Half Maximum
FU	Flight Unit
GFP	Government furnished product
hrs	Hours
Hz	Hertz
ICD	Interface Control Drawing
ID	Identification
INT	Internal
IPA	Isopropyl Alcohol
kHz	kilohertz
Lbs	Pounds
min	Minutes
MFS	Maximum Full Scale
MSFC	Marshall Space Flight Center
MTL	Materials Test Laboratory
N/A	Not Applicable
OSH	Occupational Safety and Health
PCN	Procedure Change Notice
PP	Proof of Performance (test)
PVM	Performance Verification Matrix
QA	Quality Assurance (person)
RMS	Root Mean Square
RTD	Resistance Temperature Device
s	Seconds
SIT	Select in Test
SPT	System Performance Test
TBD	To Be Determined
TCS	Thermal Control Subsystem
TR&P	Test Requirements and Procedure
TP	Test Procedure
UUT	Unit Under Test

## 1.0 SCOPE

This document is a test procedure (TRP) for the structural proof testing of the ACIS Flight Unit (FU) Shades, Sun and Telescope. As such, it delineates the specifications to which the ACIS FU TCS Shades are to be tested and defines the criteria, requirements, documentation, and test methods necessary to perform the tests and evaluate the resulting data.

## 1.1 FUNCTIONAL DESCRIPTION

The purpose of the ACIS FU TCS Shades structural proof test is to demonstrate that:

- a. The ACIS FU TCS Shade designs can survive the proof-test level loads without structural failure, thereby satisfying the requirements of MSFC-HDBK-505 for non-metallic (composite) structure.

### 1.1.1 Failure Criteria

A failure of the ACIS FU TCS Shades is defined as structural failure, evidenced by:

- a. ruptured, cracked, or yielded parts - verified by visual inspection.
- b. face sheet or insert bond failure - verified by the post-test ultrasonic inspection.
- c. core or core-fill failure - verified by dynamic performance during acoustic testing. Acoustic testing will also re-verify items a) and b) above.

### 1.1.2 Test Item

The ACIS FU TCS Shades (Sun Shade: 849AC530027-020, Telescope Shade: 849AC530026-020) are a part of the Thermal Control Subsystem (TCS) subassembly of the ACIS instrument package which will fly on the AXAF-I mission. The TCS assists in passively cooling the ACIS detector to cryogenic operating temperatures. In particular, the Sun Shade shields the radiators from view of the sun, and the Telescope Shade shields the radiators from view of the telescope.

Figure 1 shows a sketch of the FU TCS Shades. The shades are of composite-honeycomb-sandwich construction with .030 or .020 inch thick quartz/cyanate face sheets and .625 inch thick nomex honeycomb core. Refer to the above drawings for detailed information on the shades.

## 2.0 APPLICABLE DOCUMENTS

The following documents of the specified revision form a part of this specification to the extent specified herein. In the event of a conflict between this specification and any referenced specification, the requirements of this procedure shall govern.

### 2.1 ACIS PROGRAM DOCUMENTS

<u>Document</u>	<u>Rev</u>	<u>Date</u>	<u>Title</u>
849AC530026	1-2	3/4/96	Telescope Shade, ACIS TCS
849AC530027	1-2	3/4/96	Sun Shade, ACIS TCS
849AC500003	New	3/26/96	ACIS TCS Installation Drawing
ACIS-36-02101	Latest		ACIS PTS Specification

### 2.2 GOVERNMENT

<u>Document</u>	<u>Rev</u>	<u>Date</u>	<u>Title</u>
MIL-STD-12	D	29 MAY 81	Abbreviations for use on Drawings and in Specifications, Standards and Technical Documents
MIL-STD-45662	Latest		Calibration System Requirements
MSFC-HDBK-505	A	JAN81	Structural Strength Program Requirements

### 2.3 MARTIN MARIETTA

<u>Document</u>	<u>Rev</u>	<u>Date</u>	<u>Title</u>
STP50305			Controlled Environment Limited Access Work Area and Work Station Requirements.
HR 4.02			Skill Certification Requirements
M-61-58			Safety Requirements Manual
M-64-125			System Safety Engineering Manual
96PROC03	New	3/27/96	MTL Test Procedure for ACIS Shades Proof Test

### 3.0 GENERAL REQUIREMENTS

#### 3.1 DATA REQUIREMENTS

##### 3.1.1 Data Package

The following shall be included in the data packages:

- a. The "as-run", filled in copy of this test requirements and procedure.
- b. All data gathered during the performance of the tests that is not included within the pages of this procedure; i.e., test equipment printer outputs and plotter outputs, manually gathered data, and data gathered on magnetic media.

##### 3.1.2 Data Annotation

All test data not included within this procedure shall be annotated with the following information:

- a. Test Requirements and Procedure Number.
- b. Performance date of test.
- c. Part Number and Dash Number.
- d. Test item designation (EU, FU).
- e. UUT environmental conditions; i.e., ambient temperature and ambient atmosphere (air, humidity, vacuum, etc.).
- f. If the data output is chronologically sequential (i.e., printer or strip chart output), the procedure step numbers shall be chronologically noted in the test data as they occur.

#### 3.2 SAFETY AND HANDLING

##### 3.2.1 General Safety Requirements

- a. The general safety requirements will be enforced as required during testing.
- b. All testing performed according to this procedure will be in accordance with the requirements of M-61-58, Safety Standards Manual, and M-64-125, Safety Engineering Manual.
- c. Where safety clothing or equipment is to be used, the test will not begin until such items are in the test area and ready for immediate use. Use will be ensured as required.
- d. Operational areas will be clean, orderly, and free of trash and combustibles.
- e. This procedure contains procedural steps that control critical test parameters. The performance of these steps requires continuous monitoring of the primary indicator(s) involved. Prior to the start of operations, the operator will read and understand the complete procedure noting those actions required to terminate any critical condition.
- f. The information written in a NOTE, CAUTION, or WARNING precedes the step(s) to which it applies. A WARNING alerts personnel to conditions or operations which might injure themselves or others, while a CAUTION warns against conditions or operations which might damage the test item or equipment.
- g. Deviations from the safety standards or regulations will occur only with the concurrence of safety.
- h. During testing, ensure that adequate ventilation is provided, as required.
- i. At the Test Readiness Review or other Pretest Meeting, the Test Conductor will brief all personnel of hazards which may be encountered during testing.
- j. All personnel involved in testing/operations will have reviewed the procedure prior to the



- beginning of testing and will understand what hazards may be encountered during testing.
- k. Upon the direction of Occupational Health and Safety, personnel working in the vicinity of pressurized systems will wear approved eye protection and /or hearing protection.
  - l. Unless otherwise noted, valves will be opened and closed slowly to avoid shocks to the system.
  - m. Safety will be notified a minimum of 24 hours prior to the start of testing/operations.

### 3.2.2 Electrical Equipment Safety Requirements

- a. Electrical connections shall not be connected or disconnected while energized or during the conduct of test operations.
- b. In the event of a commodity leak/spill, electrical power to the test area shall be killed. Operating personnel shall identify and be familiar with the circuit breaker controlling power to the test area.
- c. All electrical connections shall be examined prior to mating for damage, corrosion, and foreign materials. Excessive forces, which may result in bent pins, shall not be applied during mating.
- d. Wires/cables will be routed to avoid chafing, cuts, kinks, etc.
- e. Electrical equipment in systems using flammable commodities must be of an explosion proof configuration or enclosed with anti-static material and purged with an inert gas.

### 3.2.3 Test Conductor

- a. The test conductor shall take whatever immediate action is necessary to prevent injury to personnel and/or damage to equipment.
- b. The test conductor shall maintain control around the operating equipment.
- c. Any anomalies or deviations to this Test Procedure shall be dispositioned using a Flag Sheet and annotating the Flag on the Procedure History Sheet of this procedure.
- d. The test conductor will ensure that only properly trained and certified personnel participate in test operations.

### 3.2.4 Electrostatic Sensitive Parts

The TCS Shades are not ESD-sensitive hardware.

### 3.2.5 Handling

- a. Cleanliness: The TCS Shades and associate hardware will remain bagged up until actual proof testing to maintain cleanliness. Hardware in contact with the parts shall be first wiped clean with IPA (or other suitable solvent) and a lint-free cloth. Hand contact with the parts shall be done only using lint-free gloves per STP72115, Type I.
- b. Transportation/Installation/Removal: The TCS Shades shall be handled only by certified personnel.

### 3.2.6 Safety

There are no special safety issues involved with the TCS Shades. The test conductor will be responsible for the safety of personnel and equipment.

### 3.3 TEST CONDITIONS

#### 3.3.1 Laboratory Test Area

Structural proof testing shall be conducted at the LMA Material Test Laboratory (MTL).

#### 3.3.2 Laboratory Test Area Access

Access to the test area shall be controlled by the test conductor.

### 3.4 PERSONNEL CERTIFICATION

Personnel performing test operations shall be certified to perform the following functions in accordance with MMTI standard procedure HR 4.02:

Material Handling Awareness  
Torquing

### 3.5 EQUIPMENT CALIBRATION STATUS

**Note:** By MMTI standard procedure, the word "calibration" is reserved for functions performed or approved by the MMTI metrology laboratory. All other uses of the word "calibration" in this procedure are flagged by the use of an asterisk (\*).

All equipment used to take contractual data in this procedure either will be in current calibration at the time of test, or has Verify Prior to Use (VPU) status.

### 3.6 TEST PROCEDURE DEFICIENCIES

This test procedure may be redlined as needed with direction of the test engineer.

### 3.7 TEST ANOMALY

Deviation from the expected result for any given step or test or any other test anomaly shall be flagged and noted on a flag sheet. The proper course of action shall be determined by the test engineer. Testing may be continued if deemed acceptable by the test engineer.

### 3.8 TEST SEQUENCE

Testing within each section may be reordered if it is found to be expedient to do so per the direction of the test conductor.

**4.0 TCS SHADES PROOF TEST**

**4.1 TEST AND MEASUREMENT EQUIPMENT**

**4.1.1 Instrumentation**

- a. **Load:** a calibrated load cell shall be used to quantify all dead weights and fixturing weight used in the test.
- b. **Deflection:** deflection measurements shall be taken at the outboard tip of each shade for the Bending Moment Equivalent load cases only.

**4.1.2 Test Equipment List**

Description	Minimum Capability	Model Number	Equipment or Serial Number	Cal. Due Date	QC VERIFY

**4.1.3 Consumables**

Description	Quantity	Units
Lint Free Gloves	A/R	
IPA	A/R	
ACIS Logbook(s)	A/R	
Braycote 601 Lubricant	A/R	

## 4.2 PROOF TEST PROCEDURE

This procedure defines the steps for proof testing of the TCS Shades. It shall be used in conjunction with MTL procedure 96PROC03.

Completion of this Test Procedure complies with the requirements of the ACIS TCS Sun and Telescope Shade Engineering Drawings.

Fill in the following at the start of test.

### General Data

Date of Test:	Test Conductor:		
Location:	Lab. Temperature:	Lab. Humidity:	Chamber Temperature:

The following sequence of events for structural proof testing the TCS Shades may be modified at the discretion of the ACIS program test engineer.

PRETEST			
Step	Test Instructions	Value/Check	QC Verify
1.	Verify build folders for each part are complete and approved up to the proof testing step.		
2.	Measure weights of fixturing and dead weights to be used in testing using a calibrated scale or load cell.		
TEST			
	<b>SUN SHADE</b>		
	<b>+X LOAD: BENDING MOMENT EQUIVALENT</b>		
3.	Attach Sun Shade (849AC530027-020) to the test fixturing and support table per Figures 2 and 3 for +X loading. Use only the middle (5) attach points on the Sun Shade.  NOTE: Ensure #10-32 fasteners have a minimum of .30 inch of thread engagement. If lube is used, use Braycote 601 grease.		
4.	Torque the (5) #10-32 fasteners to 40-45 in-lbs (lubricated) above any resisting torque (50-55 in-lbs for dry).		
5.	Determine line-load location on shade for this load case from Table I and mark on shade.		
6.	Determine rubber pad length and location from Table I and center pad approximately at specified Z-distance and within 0.5 inch of Y-positions at the ends.		

7.	Position Load Spreader Bar over rubber pad so the load-line is within 0.1 inch of specified Z-distance at both ends. Center bar in Y-direction so the load center is at the center of the rubber pad.		
8.	Attach weight tray and slings to spreader bar if not already done so.		
9.	Add weights to tray to obtain the load value in Table I and log value.  <b>QC Verify total load.</b>  <div style="text-align: right;">Load: _____ lbs.</div>		
10.	Log deflection. Immediately remove weights from fixturing.		
11.	Inspect shade for any visible damage.		
	<b>+X LOAD: SHEAR LOAD EQUIVALENT</b>		
12.	Repeat Steps 5-9 using the appropriate values from Table I for the +X Shear load case, Sun Shade.		
13.	<b>QC Verify total load.</b>  <div style="text-align: right;">Load: _____ lbs.</div>		
14.	Immediately remove weights from fixturing.		
15.	Inspect shade for any visible damage.		
	<b>-X LOAD: BENDING MOMENT EQUIVALENT</b>		
16.	Remove (5) fasteners and remount Sun Shade to the test fixturing and support table per Figures 2 and 3 for -X loading, again using only the middle (5) attach points.  NOTE: Ensure #10-32 fasteners have a minimum of .30 inch of thread engagement. If lube is used, use Braycote 601 grease.		
17.	Repeat Steps 4-9 using the appropriate values from Table I for the -X Bending load case, Sun Shade.		
18.	<b>QC Verify total load.</b>  <div style="text-align: right;">Load: _____ lbs.</div>		
19.	Log deflection. Immediately remove weights from fixturing.		
20.	Inspect shade for any visible damage.		
	<b>-X LOAD: SHEAR LOAD EQUIVALENT</b>		
21.	Repeat Steps 5-9 using the appropriate values from Table I for the -X Shear load case, Sun Shade.		
22.	<b>QC Verify total load.</b>  <div style="text-align: right;">Load: _____ lbs.</div>		

23.	Immediately remove weights from fixturing.		
24.	Inspect shade for any visible damage.		
25.	Remove (5) fasteners and remove Sun Shade from the test fixturing and support table.		
	<b>+X LOAD: POST AXIAL LOAD</b>		
26.	Place Sun Shade over support plate such that the +Y post-attach location is centered (within 0.5 inch) over the 6.0" diameter cutout per Figures 1 and 3.		
27.	Attach test fixturing and load sling or post per Figure 3. Torque the #10-32 fasteners to 30-35 in-lbs (lubricated) above any resisting torque (35-40 in-lbs for dry). If lube is used, use Braycote 601 grease.		
28.	Add weights to fixturing to obtain the load value in Table I and log value.  QC Verify total load.  Load: _____ lbs.		
29.	Immediately remove weights from fixturing.		
30.	Repeat Steps 26-28 for the -Y post-attach location using the appropriate values from Table I.  QC Verify total load.  Load: _____ lbs.		
31.	Immediately remove weights from fixturing.		
32.	Inspect shade for any visible damage.		
	<b>-X LOAD: POST AXIAL LOAD</b>		
33.	Flip Sun Shade over for -X loading.		
34.	Repeat Steps 26-28 for the -X Post load case in Figure 3 and Table I (+Y post-attach location).  QC Verify total load.  Load: _____ lbs.		
35.	Immediately remove weights from fixturing.		
36.	Repeat Steps 26-28 for the -Y post-attach location using the appropriate values from Table I.  QC Verify total load.  Load: _____ lbs.		
37.	Immediately remove weights from fixturing.		
38.	Inspect shade for any visible damage.		

	<b>TELESCOPE SHADE</b>		
	<b>+X LOAD: BENDING MOMENT EQUIVALENT</b>		
39.	Attach Telescope Shade (849AC530026-020) to the test fixturing and support table per Figures 2 and 3 for +X loading using the (5) attach points.  NOTE: Ensure #10-32 fasteners have a minimum of .30 inch of thread engagement. If lube is used, use Braycote 601 grease.		
40.	Torque the (5) #10-32 fasteners to 40-45 in-lbs (lubricated) above any resisting torque (50-55 in-lbs for dry).		
41.	Determine line-load location on shade for this load case from Table I and mark on shade.		
42.	Determine rubber pad length and location from Table I and center pad approximately at specified Z-distance and within 0.5 inch of Y-positions at the ends.		
43.	Position Load Spreader Bar over rubber pad so the load-line is within 0.1 inch of specified Z-distance at both ends. Center bar in Y-direction so the load center is at the center of the rubber pad.		
44.	Attach weight tray and slings to spreader bar if not already done so.		
45.	Add weights to tray to obtain the load value in Table I and log value.  QC Verify total load.  Load: _____ lbs.		
46.	Log deflection. Immediately remove weights from fixturing.		
47.	Inspect shade for any visible damage.		
	<b>+X LOAD: SHEAR LOAD EQUIVALENT</b>		
48.	Repeat Steps 41-45 using the appropriate values from Table I for the +X Shear load case, Telescope Shade.		
49.	QC Verify total load.  Load: _____ lbs.		
50.	Immediately remove weights from fixturing.		
51.	Inspect shade for any visible damage.		
	<b>-X LOAD: BENDING MOMENT EQUIVALENT</b>		
52.	Remove (5) fasteners and remount Telescope Shade to the test fixturing and support table per Figures 2 and 3 for -X loading, again using only the middle (5) attach points.  NOTE: Ensure #10-32 fasteners have a minimum of .30 inch of thread engagement. If lube is used, use Braycote 601 grease.		

53.	Repeat Steps 40-45 using the appropriate values from Table I for the -X Bending load case, Sun Shade.		
54.	QC Verify total load.  Load: _____ lbs.		
55.	Log deflection. Immediately remove weights from fixturing.		
56.	Inspect shade for any visible damage.		
	<b>-X LOAD: SHEAR LOAD EQUIVALENT</b>		
57.	Repeat Steps 41-45 using the appropriate values from Table I for the -X Shear load case, Telescope Shade.		
58.	QC Verify total load.  Load: _____ lbs.		
59.	Immediately remove weights from fixturing.		
60.	Inspect shade for any visible damage.		
61.	Remove (5) fasteners and remove Telescope Shade from the test fixturing and support table.		
	<b>+X LOAD: POST AXIAL LOAD</b>		
62.	Place Telescope Shade over support plate such that the +Y post-attach location is centered (within 0.5 inch) over the 6.0" diameter cutout per Figures 1 and 3.		
63.	Attach test fixturing and load sling or post per Figure 3. Torque the #10-32 fasteners to 30-35 in-lbs (lubricated) above any resisting torque (35-40 in-lbs for dry). If lube is used, use Braycote 601 grease.		
64.	Add weights to fixturing to obtain the load value in Table I and log value.  QC Verify total load.  Load: _____ lbs.		
65.	Immediately remove weights from fixturing.		
66.	Repeat Steps 62-64 for the -Y post-attach location using the appropriate values from Table I.  QC Verify total load.  Load: _____ lbs.		
67.	Immediately remove weights from fixturing.		
68.	Inspect shade for any visible damage.		



	<b>-X LOAD: POST AXIAL LOAD</b>		
69.	Flip Telescope Shade over for -X loading.		
70.	Repeat Steps 62-64 for the -X Post load case in Figure 3 and Table I (+Y post-attach location).  QC Verify total load.  Load: _____ lbs.		
71.	Immediately remove weights from fixturing.		
72.	Repeat Steps 62-64 for the -Y post-attach location using the appropriate values from Table I.  QC Verify total load.  Load: _____ lbs.		
73.	Immediately remove weights from fixturing.		
74.	Inspect shade for any visible damage.  <b>NOTE:</b> Ultrasonic inspection of both shades will be performed per the subsequent process steps.		
75.	Re-bag both shades and place in shipping container.		
76.	Log in both build folders that proof testing is complete.		
77.	Verify structural proof testing is complete.  ACIS Test Engineer _____  MTL Test Engineer _____		

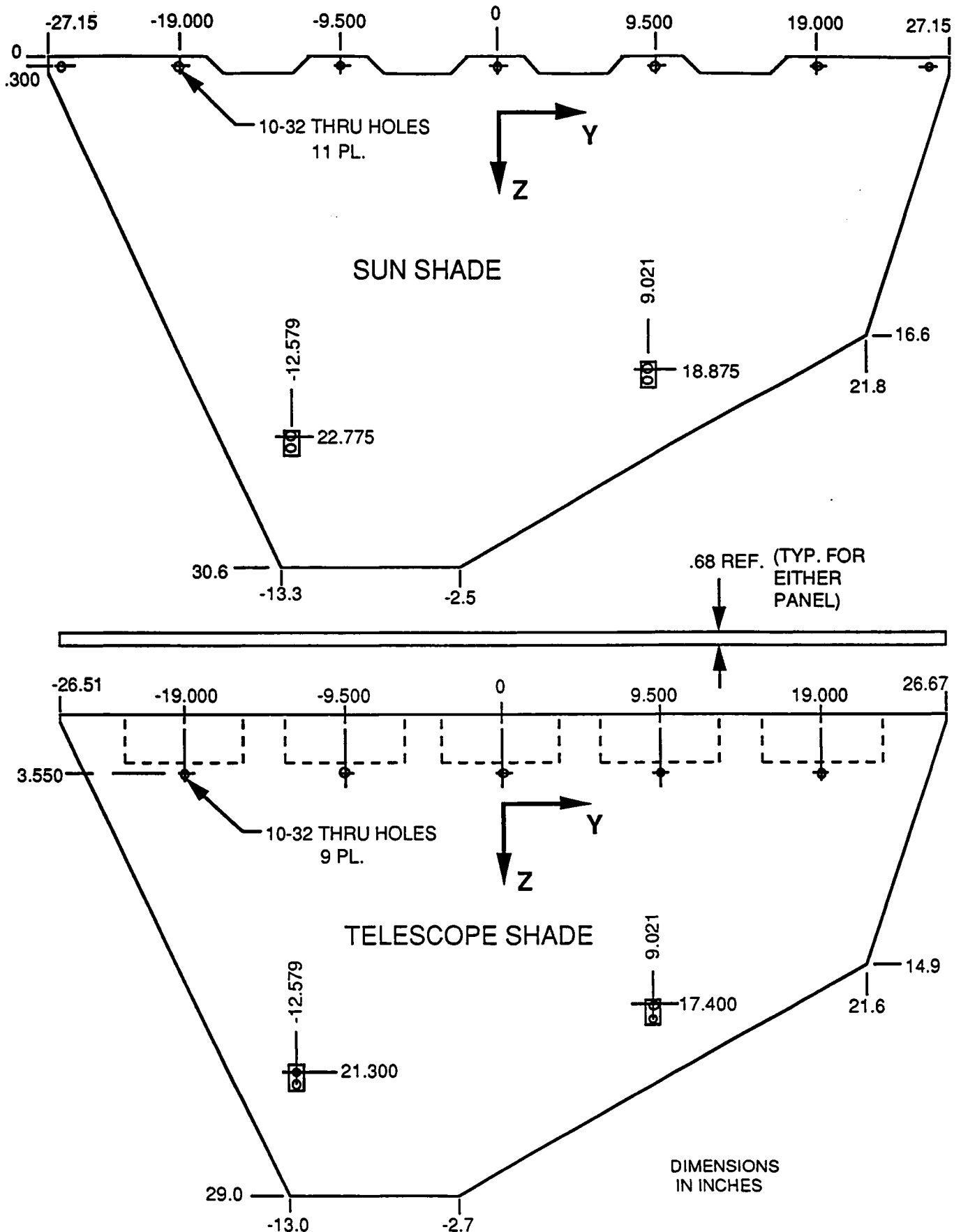
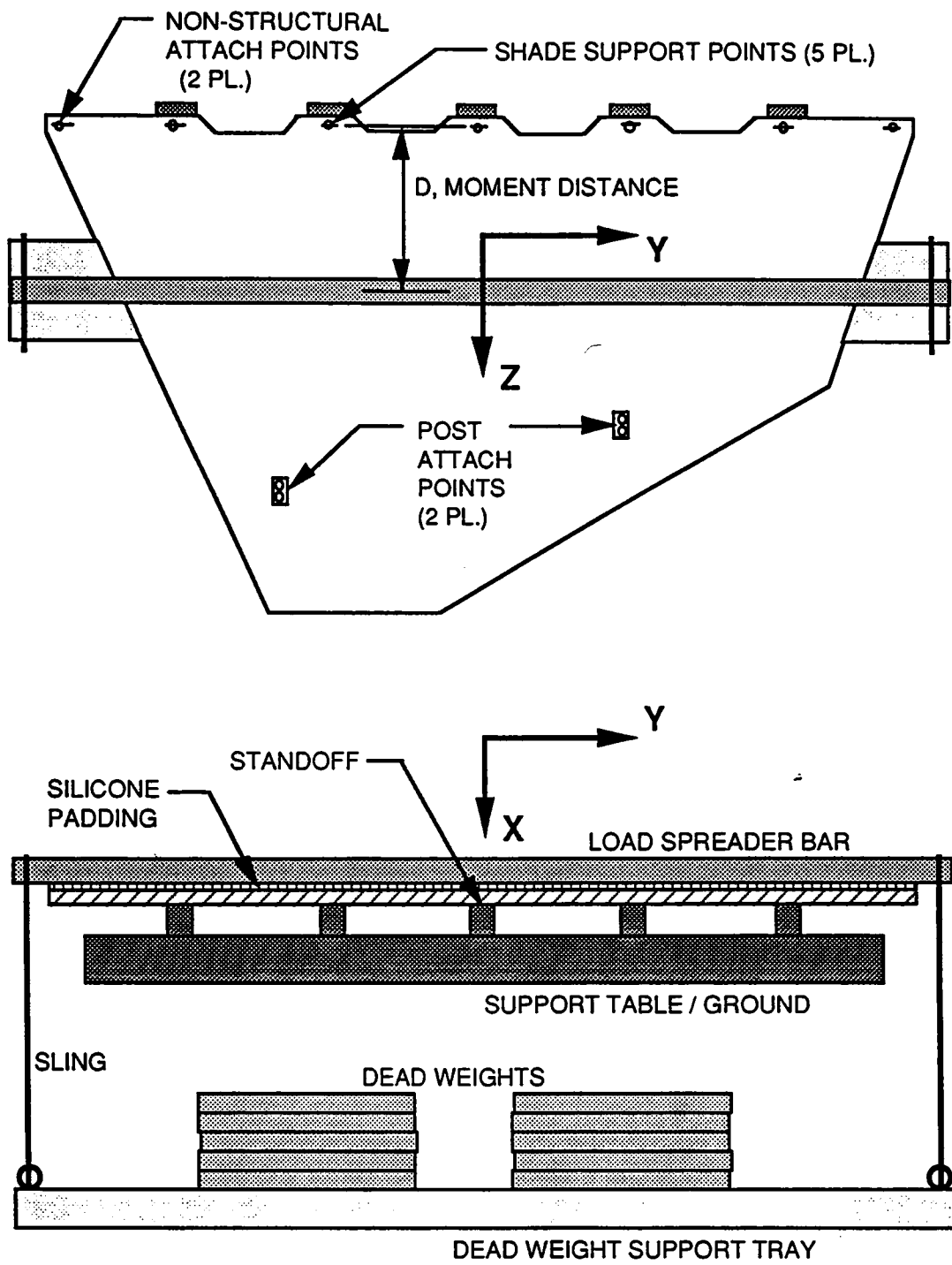
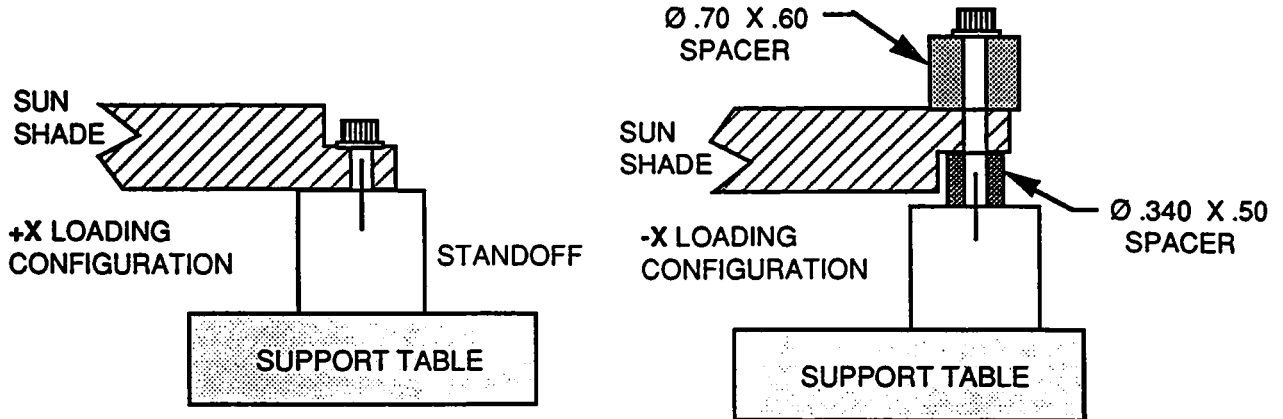


Figure 1. ACIS TCS Shades.

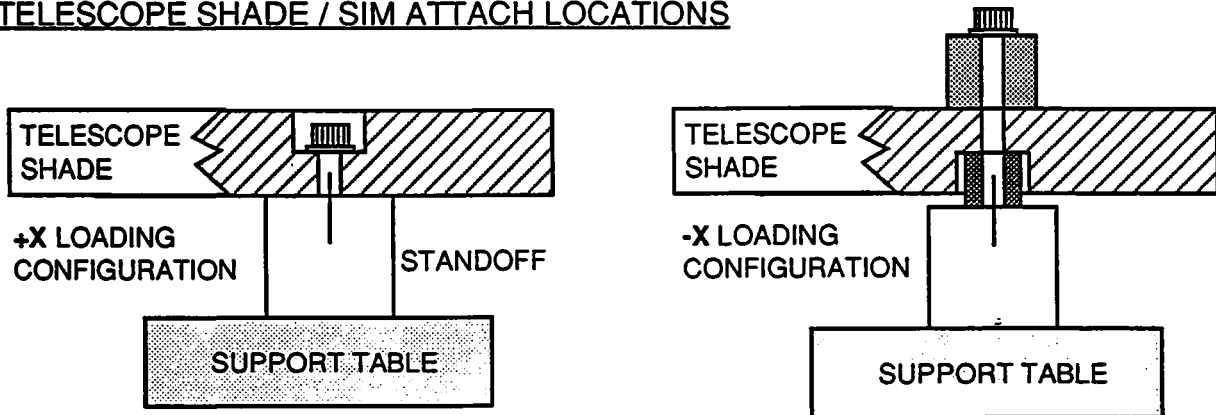


**Figure 2. ACIS Shades Proof Test Setup.**

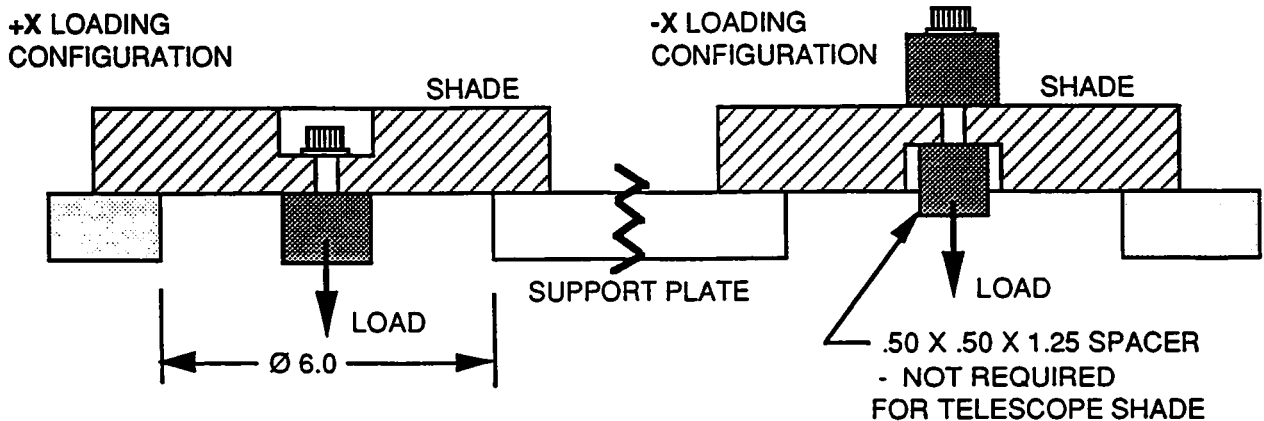
SUN SHADE / SIM ATTACH LOCATIONS



TELESCOPE SHADE / SIM ATTACH LOCATIONS



SHADE POST ATTACH LOCATIONS



**Figure 3. ACIS Shades Test - Mounting Details.**

**Table I. Shades Proof Test Loads.**

<u>Load Case</u>	<u>Load</u> (lbs)	<u>D, Z-dir.</u> <u>Distance</u> (inches)	<u>Rubber Pad</u>		
			<u>Length</u> (inches)	<u>Y-position</u> (inches)	
				<u>-Y</u>	<u>+Y</u>
<u>Sun Shade</u>					
+X Bending	150	10.0	40.0	-20.0	+20.0
+X Shear	500	3.0	44.0	-22.0	+22.0
-X Bending	150	10.0	40.0	-20.0	+20.0
-X Shear	500	3.0	44.0	-22.0	+22.0
+X Post (+Y,-Y)	420	---	---	---	---
-X Post (+Y,-Y)	420	---	---	---	---
<u>Telescope Shade</u>					
+X Bending	100	10.0	40.0	-20.0	+20.0
+X Shear	400	2.5	44.0	-22.0	+22.0
-X Bending	100	10.0	40.0	-20.0	+20.0
-X Shear	400	2.5	44.0	-22.0	+22.0
+X Post (+Y,-Y)	420	---	---	---	---
-X Post (+Y,-Y)	420	---	---	---	---

### 4.3 VERIFICATION TEST REPORT

This Data summary sheet will be provided later.