

REVISIONS

Letter	ECO No.	Description	Checked	Approved	Date
A	36-843	INITIAL RELEASE	FJK	RFG	2/4/97
B	36-866	INCORPORATE VENDOR COMMENTS	FJK	WFM	3/7/97
C	36-890	CHANGE NICKEL TARGET TO COPPER	FJK	<i>[Signature]</i>	4/12/97

NAME	DATE	MASSACHUSETTS INSTITUTE OF TECHNOLOGY CENTER FOR SPACE RESEARCH			
Drawn: BRIAN KLATT	1/28/97	RADIOACTIVE SOURCES, Fe⁵⁵, EXTERNAL			
Checked: F. J. KASPARIAN	2/4/97				
Approved: R. F. GOEKE	2/4/97				
Released: D. GAGE	2/4/97				
		Size	Code Identification No.	Drawing No.	Rev.
		T	80230	36-02352	C
		Scale: NONE		Sheet: 1 of 7	

1.0 SCOPE

This specification details the design, performance, test, and packaging requirements for external (Fe^{55}) sources to be used on the AXAF CCD Imaging Spectrometer (ACIS) Instrument. This instrument will be in an elliptical Earth orbit at an altitude of 10,000 km. by 140,000 km.

- 1.1 Purpose The AXAF CCD Imaging Spectrometer (ACIS) instrument requires radioactive iron (Fe^{55}) calibration sources to be mounted so as to illuminate the ACIS CCD detectors when the instrument is not at the AXAF telescope focus. The principal purposes of these sources are to calibrate the energy scale, spectral resolution and detection efficiency of the ACIS CCD detectors. It is essential that each source produces a known, temporally stable X-ray photon output. The sources must function in a hard vacuum (1×10^{-6} Torr) over a broad temperature range, without detectable leakage. The sources must not contaminate the AXAF optical surfaces or ACIS CCD optical blocking filters, with either particulates or molecular contaminants, and are therefore subject to contamination control requirements.

2.0 APPLICABLE DOCUMENTS

- 2.1 Drawings The following documents form a part of this specification to the extent specified herein.

STANDARDS

MIL-STD-129

Marking for Shipment and Storage

MIL-STD-1246B

Cleanliness Requirements for Contamination Sensitive Space Equipment

OTHER

36-40201.02

MIT Drawing: Low Energy Source Assembly

49 CFR 171-179

Department of Transportation Rules and Regulations for the Transportation of Explosives and Other Dangerous Materials.

3.0 REQUIREMENTS

- 3.1 Source Construction and Geometry Fe^{55} shall be deposited on a nickel substrate. The substrate shall be mounted in a capsule as detailed in 36-40212.02. See figure 1. The Fe^{55} shall be overcoated with a protective layer of sputtered gold with a thickness of 50 - 100 micrograms/cm². The thickness of the gold coating shall be verified by the manufacturer. When the source is installed in the capsule, the radioactive Fe^{55} shall illuminate the target material as defined in table 1.

Metal targets shall be at least 99.99% pure, as measured on a metals basis. The purity shall be verified by analysis.

- 3.1.1 Plating Fe⁵⁵ shall be plated by the electro-plating process using Isotope Products Laboratories (IPL) process number LP 3-4.
- 3.2 Radioactivity The activity of the source shall be verified by the manufacturer to an accuracy of 5%.
- 3.3 Leakage The source must be leak tested and must be leak free at a level of 2×10^{-4} microcuries. Leak testing shall be done by the flushing method, using 20 cc of isopropyl alcohol at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$. The effluent shall be put through a Millipore filter and the filter then tested for activity.
- 3.4 Contamination Control The source must be capable of being cleaned to Level 100A of MIL-STD-1246B. Cleaning will be performed by MIT.
- 3.5 Environmental Sources must survive thermal-vacuum and vibroacoustic environments of launch and on-orbit operation without leakage or change in photon output.
- 3.5.1 Temperature The temperature range shall be -60°C to $+50^{\circ}\text{C}$
- 3.5.2 Vibration Fe⁵⁵ sources shall survive without measurable leakage and function after exposure to random vibration applied to the capsule.
- | | |
|------------------------|---------------|
| Power Spectral Density | 11.3 "g" rms |
| Frequency Range | 20 to 2000 Hz |
| Duration per axis | 1 minute |
| Number of axes | 3 |
- 3.5.3 Acoustic Fe⁵⁵ sources shall survive without measurable leakage and function after exposure to acoustic pressure.
- | | |
|----------------------|-----------------|
| Sound Pressure level | 139 dB |
| Frequency Range | 20 to 10,000 Hz |
| Duration | 1 minute |
- 3.5.4 Humidity Fe⁵⁵ sources shall withstand storage in air with relative humidity between 30% and 80%.
- 3.6 Identification/Part Number The MIT part number of the Fe⁵⁵ sources shall be in accordance with Table 1.

Table 1

MIT Part Number	Target Material	Nominal Output (photons/second/steradian)
36-02352.01	Aluminum	1.8 X 10 ⁴ @1.5 Kev
36-02352.02	Titanium	1.8 X 10 ⁴ @4.5 Kev
36-02352.03	Copper	1.0 X 10 ³ @.93 Kev

3.6.1 Serialization and Marking Each Fe⁵⁵ source shall be individually serialized with a three (3) digit number. MIT P/N 36-02352.01 (aluminum target) serial numbers shall start with 701. MIT P/N 36-02352.02 (titanium target) serial numbers shall start with 801. MIT P/N 36-02352.03 (copper target) serial numbers shall start with 901. In addition, each Fe⁵⁵ source shall be identified with the MIT part number, activity level, month, day, and year of activity verification, the manufacturers name or logo, and the manufacturers part number (if applicable). Serial numbers shall be engraved, etched, or vibro-etched on the side of the capsule. Other required markings shall be by the bag-and-tag method.

3.7 Nominal photon Output The nominal photon output for each source is listed in Table 1. Output shall be measured by MIT, and shall be within ±25% of the nominal value listed in Table 1.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection Unless otherwise specified in this document, the Fe⁵⁵ Source manufacturer is responsible for all inspection requirements and examinations as specified herein. Cleanliness and stability in environment shall be verified by MIT.

4.2 Responsibility for compliance All items submitted for acceptance to MIT shall meet all requirements of this specification, except as detailed in paragraph 4.1 above.

4.3 Acceptance Each Fe⁵⁵ source shall be subjected to the measurements, tests and inspections in paragraphs 3.1, 3.2, 3.3, and 3.7. Conformance to the requirements shall be recorded on a test data sheet which contains the part number, the order number, the serial number of the part tested, the date of the test, and the test results. The test data sheet may be in the manufacturer's standard format and shall be stamped or signed by the manufacturer's representative.

- 4.4 Inspection and Test Records Test data for all acceptance tests shall be submitted to MIT with the delivery of each Fe⁵⁵ source. In addition, the source manufacturer shall maintain inspection and test records for 36 months after hardware delivery to MIT. The total strength of the Fe⁵⁵ shall be identified in the test records.
- 4.5 MIT Source Inspection MIT Performance Assurance will impose a mandatory inspection point at final test and inspection at the Fe⁵⁵ source manufacturer's facility. Source inspection will include documentation review and witnessing of verification tests detailed in paragraphs 3.2 and 3.3. Notify MIT two (2) weeks before articles are ready for MIT Inspection. (call area code 617, phone 253-7555).
- 4.6 Product Uniformity All Fe⁵⁵ sources delivered to a single part number shall be made with the same design, materials, processes, and procedures, and shall be tested and inspected to the same criteria conforming to this specification.

5.0 PREPARATION FOR DELIVERY

- 5.1 Packaging, level C The radioactive source shall be packaged to afford adequate protection against deterioration and damage in shipment from the supply source to MIT for immediate use. Packaging shall be in compliance with applicable rules and regulations of the Department of Transportation (DOT) and the Atomic Energy Commission (AEC).
- 5.2 Packing, level C The radioactive sources, packaged as specified in 5.1 above, shall be packed in accordance with applicable requirements specified in DOT regulation 49 CFR 171-179, to insure carrier acceptance and safe delivery to MIT. Containers shall comply with Uniform Freight Classification rules or regulations of other carriers applicable to the mode of transportation.
- 5.3 Marking In addition to any special marking required by this specification, unit packages shall be marked in compliance with DOT regulation 49 CFR 171-179 and Atomic Energy Commission (AEC) requirements.
- 5.4 Shipping Radioactive sources shall be shipped to:

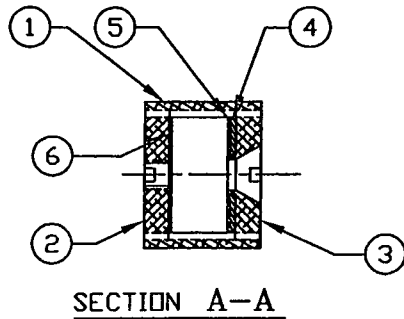
Mr. Donald L. Haes Jr.
Radiation Protection Officer
MIT 20C-207
77 Massachusetts Avenue
Cambridge, MA 02139

6.0 NOTES

- 6.1 Approved Source of Supply The manufacturer listed below is the only approved source for products described herein.

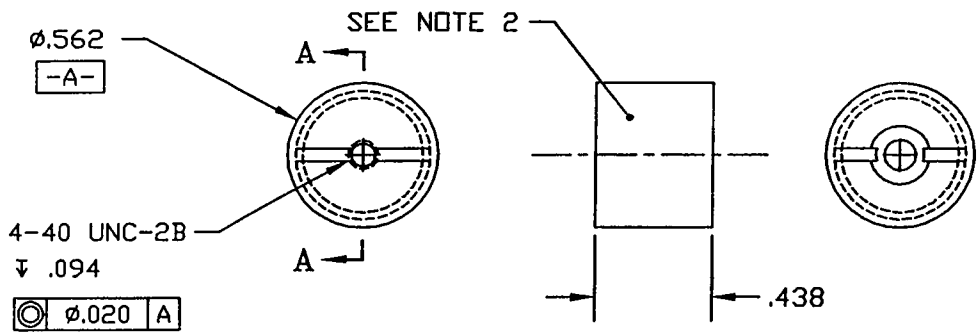
Isotope Products Laboratory Inc.
1800 N. Keystone Street
Burbank, CA 91504

PACKAGE DRAWING
 Figure 1
 Page 7



REVISIONS					
REV.	ECD NO.	DESCRIPTION	CHECKED	APPROVED	DATE
A					

PART NO.	TARGET
36-40212.02	ALUMINUM
36-40212.03	TITANIUM
36-40212.04	NICKEL



NOTES:

- REFERENCES ARE TO 36-02352.
- MARK PER PARA 3.6.2.
- BOND F/N 6 TO F/N 2 USING F/N 7.
- BOND F/N 5 TO F/N 4 AND F/N 4 TO F/N 3 USING F/N 7.
- ASSEMBLE F/N 2 INTO F/N 1 FLUSH AS SHOWN AND SPOTBOND WITH F/N 7 IN SLOT.
- ASSEMBLE F/N 3 INTO F/N 1 AND ADJUST GAP. SPOTBOND WITH F/N 7 IN SLOT.

36-40201	ACIS
NEXT ASSEMBLY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCE: ANGLES $\pm 1^\circ$
 3 PLACE DECIMALS $\pm .005$
 2 PLACE DECIMALS $\pm .01$

MATERIAL
 AS NOTED

FIND NO.	QTY RECD	NAME	MATERIAL
7	A/R	EPOXY	HYSOL EA 9394
6	1	TARGET	SEE TABLE
5	1	SOURCE	GOLD / Fe 55
4	1	SHIELD	TITANIUM
3	1	HOLDER	ALUMINUM 6061-T6
2	1	PLUG	ALUMINUM 6061-T6
1	1	BODY	ALUMINUM 6061-T6

LIST OF MATERIALS

NAME	DATE	MASSACHUSETTS INSTITUTE OF TECHNOLOGY CENTER FOR SPACE RESEARCH CAMBRIDGE, MA 02139		
DRAWN P.C.Tappan	2/4/97	Fe55 LOW ENERGY SOURCE ASSEMBLY		
CHECKED		SIZE	CAGE CODE	REV. A
APPROVED		B 80230	DWG. NO.	36-40212.02
RELEASED		SCALE 2/1	SHEET 1 OF 1	
WEIGHT				