

REVISIONS

Letter	ECO No.	Description	Checked	Approved	Date
A	36-394	INITIAL RELEASE	MWB	RFG	11/3/95
B	36-451	INCORPORATE VENDOR COMMENTS	WFM	RFG	12/22/95
C	36-454	ADD 90 μ CURIE SOURCE	WFM	RFG	12/28/95
D	36-584	ADD 2 μ CURIE SOURCE	<i>BK</i>	<i>RFG</i>	4/18/96

NAME	DATE	MASSACHUSETTS INSTITUTE OF TECHNOLOGY CENTER FOR SPACE RESEARCH			
Drawn: BRIAN KLATT	11/3/95	RADIOACTIVE SOURCE, Fe⁵⁵			
Checked: M. W. BAUTZ	11/3/95				
Approved: R. F. GOEKE	11/3/95				
Released: W. MAYER	11/3/95				
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		T	80230	36-02350	D
		Scale: NONE		Sheet: 1 of 7	

1.0 SCOPE

This specification details the design, performance, test, and packaging requirements for Iron (Fe^{55}) sources to be used with 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 55 (Fe^{55}) calibration sources. One source is to be mounted inside the ACIS detector housing and the second will be external to the detector housing. The principal purposes of these sources are to monitor the soft x-ray detection efficiency and the energy scale of selected ACIS CCD detectors. This will be done during ground testing and on-orbit operations. For these purposes, it is essential that the source produce a known, temporally stable photon output in the Mn K (5.9 and 6.5 keV) and Mn L (0.64 and 0.65 keV) characteristic X-ray lines. The goal is to measure the ratio of the L-line to K-line output with an accuracy of one percent (1%). The source must function in a hard vacuum $<1 \times 10^{-6}$ Torr over a broad temperature range, without detectable leakage. The source must not contaminate the ACIS CCD detectors with either particulates or molecular contaminants, and is 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

36-10202.0201

MIT Drawing: Fe^{55} 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 Fe⁵⁵ shall be deposited on a nickel substrate. The substrate shall be mounted in a standard A-2 capsule as detailed in 36-10202.0201. See figure 1. The Fe⁵⁵ shall be overcoated with a protective layer of sputtered gold with a thickness of 50 ±10 micrograms/cm². When the source is installed in the A-2 capsule, the radioactive Fe⁵⁵ shall be contained within a 1.0 mm diameter circle, concentric with the symmetry axis of the capsule. The thickness of the gold coating shall be verified by the manufacturer.

3.1.1 Plating Fe⁵⁵ shall be plated by the electro-plating process using Isotope Products Laboratories (IPL) process number LP3-4.

3.2 Radioactivity Sources shall be procured at three (3) activity levels, as specified below. Aside from the specified differences in activity, and associated marking differences, the sources shall be identical.

- Type 1 (low activity, internal source) The activity of the source shall be 10 micro-curies ±20%.
- Type 2 (high activity, internal source) The activity of the source shall be 50 micro-curies ±20%.
- Type 3 (external source) The activity of the source shall be 90 micro-curies ±20%.
- Type 4 (very low activity, internal source) The activity of the source shall be 2 micro-curies ±20%.

The activity of the source shall be verified by the manufacturer to an accuracy of 5%. The method of measurement of the activity level must be submitted to MIT for approval.

3.3 Leakage The source must be leak tested and must be leak free at a level of 2 X 10⁻⁴ microcuries. Leak testing shall be done by the liquid immersion method.

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 -110°C to +60°C.

3.5.2 Vibration Fe⁵⁵ sources shall survive without detectable leakage and function after exposure to random vibration applied to the A-2 capsule, while it is mounted inside the detector housing and is at an absolute pressure of 10 Torr or less.

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 detectable leakage and function after exposure to acoustic pressure applied to the outside of the detector housing while the source is mounted inside and is at an absolute pressure of 10 Torr or less.

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

3.6.1 Part Number The MIT part number of the Fe⁵⁵ sources shall be as follows:

36-02350.01	low level activity per 3.2 herein (10 μCi)
36-02350.02	high level activity per 3.2 herein (50 μCi)
36-02350.03	external source per 3.2 herein(90 μCi)
36-02350.04	very low level activity per 3.2 herein (2 μCi)

3.6.2 Serialization and Marking Each Fe⁵⁵ source shall be individually serialized with a three (3) digit number. MIT P/N 36-02350.01 (low level) serial numbers shall start with 101. MIT P/N 36-02350.02 (high level) serial numbers shall start with 201. MIT P/N 36-02350.03 (external source) serial numbers shall start with 301. MIT P/N 36-02350.04 (very low level) serial numbers shall start with 401. 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 A-2 capsule. Other required markings shall be by the bag-and-tag method.

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, and 3.3. 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.

4.5 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.

4.7 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 the first article is ready for MIT Inspection. (call area code 617, phone 253-7555 or 258-8852).

4.8 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.

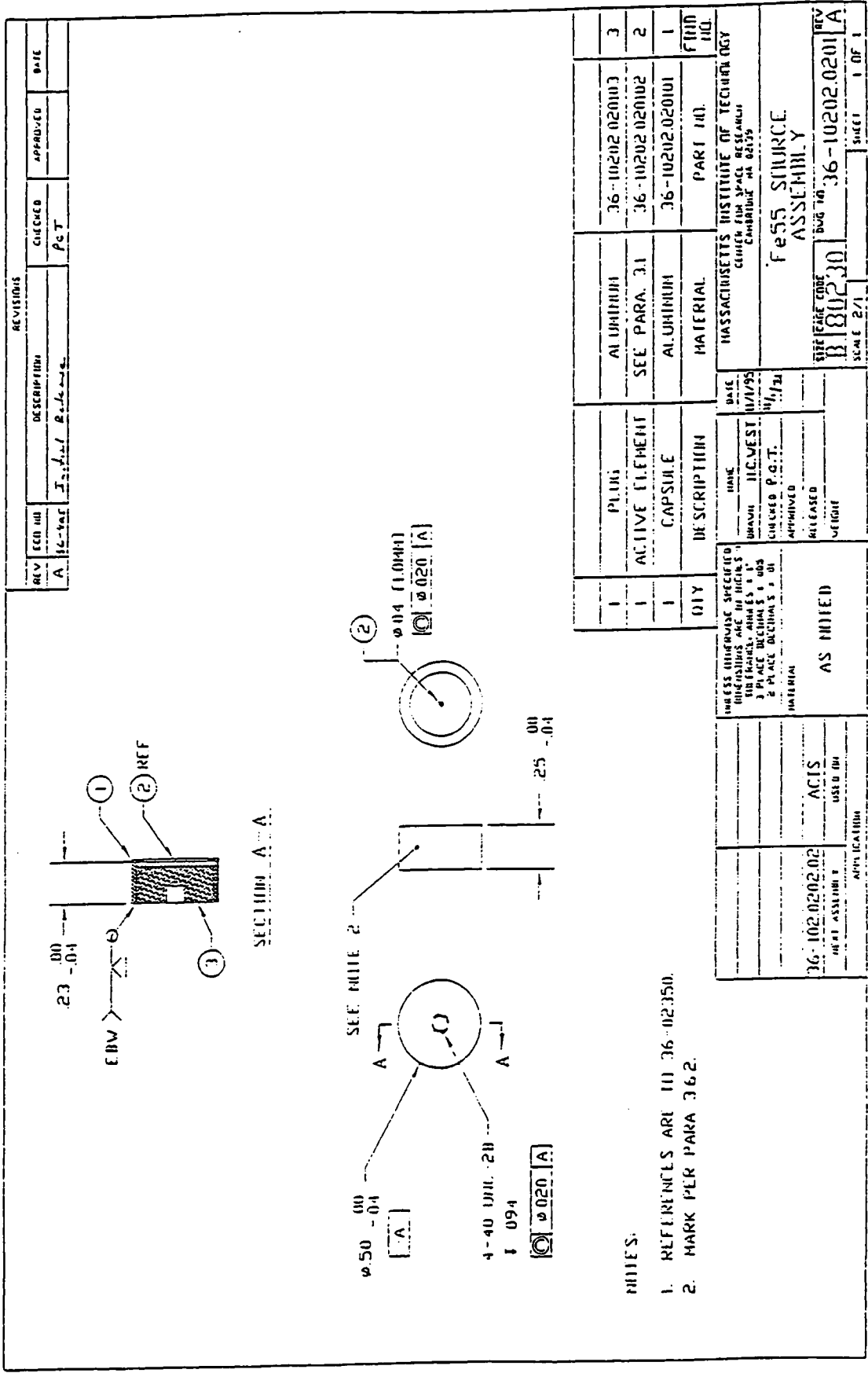
5.3 Marking In addition to any special marking required by this specification, unit packages shall be marked in compliance with DOT regulation 49 CFR 171-179, AEC, and MIL-M-19590 requirements.

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

Cage Code: TBD



A-2 Capsule
PACKAGE DRAWING
Figure 1