PREPARED BY:	*MULTIBAND IMAGING PHOTOMETER*	number M43P40	
C. DAVIDSON	*FOR SIRTF*	TYPE PROCEDURE	
APPROVALS			
ENGINEERING	UNIVERSITY OF ARIZONA STEWARD OBSERVATORY, IR GROUP	DATE 09/04/97	
QUALITY	**SPECIFICATION**	SUPERSEDES SPEC. DATED	
PI/DEPUTY PI		REV. NEW	PAGE 1 OF 9

TITLE

CONTAMINATION CONTROL

1.0 INTRODUCTION

1.1 PURPOSE

Contamination control will be practiced during all phases of the development, manufacture and test of Ge:Ga focal plane arrays (FPAs) for the Multiband Imaging Photometer (MIPS) program to ensure the end-product FPAs meet the specified cleanliness level necessary for product reliability in the Space Infrared Telescope Facility (SIRTF) application.

1.2 SCOPE

This Contamination Control procedure establishes responsibilities, requirements, and quality assurance provisions for the cleanrooms, clean work stations, and controlled areas in which product manufacture and testing are conducted.

The plan comprises the basic requirements of a contamination control procedure in accordance with MIL-STD-1246. Detailed requirements of the plan conform to the requirements of FED-STD-209 for monitoring air cleanliness.

2.0 APPLICABLE DOCUMENTS

The following documents, of the latest issue in effect, except as otherwise indicated, form a part of this specification to the extent specified. In the event of conflict between documents referenced herein and the contents of this specification, the contents of this specification shall take precedence.

2.1 Government Documents

FED-STD-209E	Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones
MIL-STD-1246C	Product Cleanliness Levels and Contamination Control

2.2 Non-Government Documents

University of Arizona, Steward Observatory, IR Group Documents

M43P60	MIPS Electrostatic Discharge (ESD) Control Procedure
	The University of Arizona Safety Manual

3.0 RESPONSIBILITY

3.1 Prescribing product cleanliness

The responsibility for determining the cleanliness level of the Ge:Ga focal plane arrays will reside with the MIPS Deputy Principal Investigator. The cleanliness level selected for the FPAs shall be consistent with attaining the cleanliness level for outgassing contamination and settled particulates as specified for the MIPS instrument, currently defined at a level of 400A or better upon delivery. The cleanliness level requirements will flow down from the next higher level build requirements to lower level assemblies, subassemblies, parts and components.

3.2 Achieving and maintaining product cleanliness

Responsibility for achieving and maintaining the cleanliness of the focal plane arrays will rest with the FPA Development/Test Engineer and the manufacturing team.

3.3 Assuring the integrity and continuity of the contamination control effort

The project's Quality Representative will be the designated point of contact for the contamination control effort and will assure that the FPAs meet the design and specification requirements.

3.4 Procedures for product cleanliness

The procedures for maintaining the required cleanliness level during the manufacture and test of the FPAs, subassemblies and component parts will be defined in the manufacturing traveler.

3.5 Access to Cleanrooms

Admission to cleanrooms shall be limited to MIPS personnel in proper cleanroom attire. Short-term visitors will be allowed access when properly attired and accompanied by a MIPS team member. Cleanroom attire requirements are described in paragraph 4.4.6. All MIPS team members will participate in a informal training session to review and discuss the contamination control provisions described herein.

4.0 REQUIREMENTS

4.1 Equipment

a. Particle counter (automated), designed for detection of airborne particles, capable of detecting particles 0.5 micron and larger, and having an air sampling rate of 1.0 cubic feet per minute (CFM) or greater. The particle counter probe shall be capable of sampling into the air stream.

b. Humidity indicator (automated) or a wet-and-dry bulb thermometer

c. Thermometer, mercury-in-glass or automated temperature indicator

d. Vacuum cleaner, certified for cleanroom use

e. Microscope

4.2 Materials

a. Wipes, low lint, low residue, Kimwipe EX-L or equivalent
b. Isopropyl alcohol, reagent grade or better
c. Acetone, reagent grade or better
d. Methyl Ethyl Ketone, reagent grade or better
e. Aqueous detergent, Alconox or equivalent

4.3 Safety

Any hazardous materials required herein will be handled, used and stored as specified in the University of Arizona Safety Manual, Material Data Safety Sheets or, when applicable, equivalent supplier procedures.

4.4 Cleanliness provisions

4.4.1 There shall be no eating, drinking or similar activities in clean rooms or within 1 meter of clean work stations.

4.4.2 Personal items, such as coats and purses shall be left outside of controlled areas.

4.4.3 Cleanroom garments shall be put on and removed in the changing areas only, and shall not be worn outside of cleanrooms and changing areas, or outside of 1 meter from clean work stations.

4.4.4 Proper cleanroom attire for the MIPS cleanroom and clean work stations shall include ESD-protective smocks and gloves. Wherever there is conductive flooring, conductive cleanroom shoe covers shall be worn. The use of the shoe cleaner is required prior to entry to the cleanroom.

4.4.5 Equipment and work surfaces shall be cleaned such that all external surfaces are visibly clean prior to transferring them into the cleanroom. Cleaning may be accomplished by isopropyl alcohol rinsing and wiping or blow-drying with nitrogen. Any equipment with a cooling fan shall be vacuumed using the cleanroom vacuum.

4.4.6 Paper documents, such as travelers and engineering drawings, shall be kept physically separate from the hardware in the cleanroom and clean work station areas. Paper is a significant source of airborne particulates.

4.4.7 Storage of clean hardware shall be in a nitrogen-purged desiccator, and, when appropriate, ESD-protective storage containers. Transportation of clean hardware outside of the cleanroom or work station shall occur only when hardware is adequately protected from contamination, using ESD-protective storage boxes, cleanroom bags or other suitable methods.

4.5 Cleanrooms.

4.5.1 Air cleanliness

The cleanroom areas shall conform to the air cleanliness class 10,000, requiring a maximum of 10,000 airborne particles (0.5 µm or larger) per cubic foot or air sampled, as defined in FED-STD-209, Table I.

4.5.2 Operational temperature

The operational temperature of a cleanroom shall conform to a specified temperature between 60 - 90°F (16 - 32°C).

4.5.3 Humidity level

The operational relative humidity of a clean room shall conform to a specified humidity level between 25 – 75% RH.

4.5.4 Air pressure

A positive pressure shall be maintained between a cleanroom and any adjacent area of less clean requirements with all entries closed. When entryways are open, adequate blower capacity should maintain an outward flow of air to minimize contamination migrating into the room.

4.5.5 Air velocity

Laminar flow cleanrooms shall be monitored for air velocity. For down-flow rooms, the air velocity shall be between 50 and 90 ft/min at any work station or operation being performed. For cross-flow rooms, the air velocity shall be between 75 and 115 ft/min at any work station or operation being performed.

4.5.6 Surface Cleanliness

Surfaces of component parts and hardware, as well as fixtures and assembly tools, used in the manufacture of the MIPS FPAs shall be cleaned prior to assembly operations, and inspected for surface cleanliness at 25 – 60X magnification and bright light illumination. Table 1 gives appropriate cleaning methods for various operations and hardware.

4.6 Clean work stations, laminar flow.

4.6.1 Air Cleanliness.

Laminar flow work benches may be used for any specified air cleanliness class. Air blowers shall be on at all times when in use.

4.6.2 Air Velocity

Air velocity inside a laminar flow work bench shall be from 75 to 115 ft/min at a distance of 12 ± 6 inches from the face of the filter.

4.6.3 Air leakage

Laminar flow work benches shall not leak through either the HEPA filter or the seals.

4.6.4 Temperature.

The operational temperature of a laminar flow work bench shall conform to a specified temperature between 60 - 90°F (16 - 32°C).

4.6.5 Relative Humidity

The operational relative humidity of a clean work station shall conform to a specified humidity level between 25 – 75% RH.

4.6.6 Surface Cleanliness

Surfaces of component parts and hardware, as well as fixtures and assembly tools, used in the manufacture of the MIPS FPAs shall be cleaned prior to assembly operations, and inspected for surface cleanliness at 25 – 60X magnification and bright light illumination, for all work conducted in the clean work station. See Table 1 for cleaning methods.

4.6.7 Maintaining cleanliness

Clean work station areas shall be visibly clean prior to starting any work. Isopropyl alcohol and low-lint wipes can be used to clean the work area surfaces. Hardware shall be removed or otherwise protected during area cleaning.

5.0 PROCEDURES

5.1 Surfaces of tools and equipment are cleaned using low-lint wipes and isopropyl alcohol. Gloves will be necessary to protect both the hardware from re-contamination, and the operator's skin from over-exposure to solvents.

5.2 Cleaning methods for the MIPS hardware are described in the representative manufacturing traveler. Methods include solvent washing using acetone, methyl ethyl ketone, isopropyl alcohol and others, and blow drying with clean, dry nitrogen gas.

5.3 Visual inspection for cleanliness occurs after surface cleaning for each manufacturing operation. Any evidence of particulates or film contamination will require re-cleaning.

5.4 Airborne particle counts in cleanrooms and clean work stations shall be determined daily, and recorded in the area logbook or Clean Area Environmental Record form, M43F50 (see appendix for example of form).

6.0 QUALITY ASSURANCE PROVISIONS

The MIPS Lead Process Engineer and Quality Representative shall be responsible for:

- auditing environmental records, actual work area conditions, and for compliance with these provisions.
- ensuring the manufacturing travelers contain appropriate cleaning methods for maintaining surface cleanliness.
- Providing disposition and corrective action for contamination occurrences.

Table 1
MIPS FPA cleaning methods

Material/Part/Hardware	Part Number	Array		Solvent Rinse(*)	Ultrasonic	Detergent (*)	Plasma
		32x32	2x20				
Detector wafer	MIPSD-065	x	x	x			
Detector die	MIPSD-067	x	x	x	x		
Dummy detector die		x		x			
Readout wafer	MIPSD-025	x	x	x	x		
Readout die	MIPSD-027	x	x	x	x		x
Fanout	MIPSD-060	x	x	x			x
Sapphire reflector bar	MIPSD-069	x	x	x	x		
Sapphire side bar	MIPSD-068	x		x	x		x
Optical concentrator	MIPSD-066	x		x			
Photomask (emulsion)		x				x	
Cable assembly (isopropanol only)	MIPSD-040	x		x	x		x
Frame clamp	MIPSD-048	x		x			
Molybdenum frame	MIPSD-049	x		x	x		
Fixtures				x	x		
Retainers				x	x		
Aluminum block				x	x		
Resistors	MST-35AN-20K-01-E	x	x	x			
Capacitors	700A102MC	x		x			
4x32 module assembly & wire bond		x		x			
Stress rig base	MIPSD-238		X	x	x		
Stress rig plate	MIPSD-236		X	x	x		
Feed horn assembly	MIPSD-242		X	x			
Screws (172)	MIPSD-240		X	x	x		
Indium balls			X				

* NOTE: Specific cleaning materials and instructions will be described in detail in the representative manufacturing travelers. Solvents and detergents acceptable for cleanroom use are listed in paragraph 4.2. Isopropyl alcohol may be used for any solvent rinsing of MIPS hardware. Acetone and MEK are appropriate only for metallic surfaces.

APPENDIX A

CLEAN AREA ENVIRONMENTAL CONDITIONS RECORD

FORM # M43F50

Location	Date	Time	Temperature (°F)	Rel. Humidity (%RH)	Particle Count