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SOR-70-060
Revision E

JANUARY 1972

PREPARED FOR NASA MANNED
SPACECRAFT CENTER UNDER
CONTRACT NAS9-11528
DRL 58, DRD RA-085T

CONTAMINATION CONTROL PROGRAM PLAN

FOR THE

ULTRAVIOLET SPECTROMETER EXPERIMENT S169

T 72-19227

The Johns Hopkins University
Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland

SOR-70-060
Revision E

JANUARY 1972

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ULTRAVIOLET SPECTROMETER EXPERIMENT S169

The Johns Hopkins University
Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland

CR-128575

SOR-70-060
Revision E
January 1972

CONTAMINATION CONTROL PROGRAM PLAN

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ULTRAVIOLET SPECTROMETER EXPERIMENT S169

Prepared for
NASA Manned Spacecraft Center
under Contract NAS9-11528
DRL 58, DRD RA-085T

Prepared by: D B Gilmore
D. B. Gilmore, Supervisor
Reliability Assessment &
Part Standards Project

Approved by: T Wyatt
T. Wyatt
Project Engineer

Date: 20 Jan 72

Approved by: R. W. Cole 1/20/72
R. W. Cole, Group Supervisor
Satellite Reliability Control

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The Johns Hopkins University
Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland

CHANGE NO. 2

MARCH 1972
SOR-70-060
Revision E

MSC CONTRACT NAS9-11528
DRL 58, DRD RA-085T

CONTAMINATION CONTROL PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169

THIS CHANGE NUMBER TWO IS SUBMITTED TO AMEND REVISION E OF THE CONTAMINATION CONTROL PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169. INSTRUCTIONS FOR INCORPORATING THIS CHANGE INTO THE PLAN ARE AS FOLLOWS:

1. Insert this new page into the plan, following the present sign-off title page.

2. Insert the accompanying new "List of Effective Pages" into the plan in place of the present "List of Effective Pages".

3. Replace the present Page 2 with the accompanying new Page 2, and the present Page 6 with the new Page 6.

PREPARED BY: _____
D. B. Gilmore
Supervisor, Reliability Assessment

APPROVED BY: T. Wyatt
T. Wyatt
Project Engineer

DATE: 27 Mar 1972

APPROVED BY: R. W. Cole
R. W. Cole, Group Supervisor
Satellite Reliability Control

The Johns Hopkins University
Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland

CHANGE NO. 1

FEBRUARY 1972
SOR-70-060

MSC CONTRACT NAS9-11528
DRL 58, DRD RA-085T

CONTAMINATION CONTROL PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169

THIS CHANGE NUMBER ONE IS SUBMITTED TO AMEND REVISION E OF THE CONTAMINATION CONTROL PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169. INSTRUCTIONS FOR INCORPORATING THIS CHANGE INTO THE PLAN ARE AS FOLLOWS:

1. Insert this new page into the plan, following the present sign-off title page.

2. Insert the accompanying new "List of Effective Pages" into the plan following this page.

3. Replace the present Page 24 with the accompanying new Page 24.

PREPARED BY: D. B. Gilmore
Supervisor, Reliability Assessment

APPROVED BY: T. Wyatt
Project Engineer

DATE: 8 Feb 72

APPROVED BY: R. W. Cole 2/7/72
R. W. Cole, Group Supervisor
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LIST OF EFFECTIVE PAGES

PAGE NUMBER	CHANGE NUMBER	PAGE NUMBER	CHANGE NUMBER
i	Original	14	Original
ii	Original	15	Original
1	Original	16	Original
2	Two	17	Original
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4	Original	19	Original
5	Original	20	Original
6	Two	21	Original
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9	Original	24	One
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1.0 SCOPE

This Contamination Control Program Plan delineates the cleanliness requirements to be attained and maintained, and the methods to be utilized, in the fabrication, handling, test, calibration, shipment, pre-installation checkout and installation for the Ultraviolet Spectrometer Experiment S169 for prototype, qualification and flight equipment.

2.0 APPLICABILITY

This plan is applicable to the UVS experiment equipment as follows:

a. Electronic and signal conditioning module, prior to integration with the main housing assembly.

b. Main housing assembly, including all parts and components, prior to integration with the electronic and signal conditioning module.

c. The completed instrument, after integration.

3.0 APPLICABLE DOCUMENTS AND MATERIALS

The following documents and materials are applicable to the extent specified herein:

MSC-SPEC-C-3, Decals, Certification and Cleanliness

MSC-SPEC-C-8, Spacecraft On-Board Equipment, Cleanliness, Specification for

MSC-SPEC-C-12A, Precision Clean Packaging, Specification for

MSFC-SPEC-234A, Specification, Nitrogen, Space Vehicle Grade*

MSFC-SPEC-237A, Precision Cleaning Agent, 1,1,2-Trichloro - 1,2,2-Trifluoroethane

NAA Specification MA 0115-012, Environmentally Controlled Work Area

APL Specification 7232-0016, UVS Handling Procedure

PPP-T-66 Tape, Pressure-Sensitive Type I, Adhesive, Waterproof - for Class B Packaging and Sealing

Solvent, Trichloroethane 1,1,1 - Inhibited, Instrument Grade

Micro-Dusters (Dichlorodifluoromethane)

Polyurethane Sponge Wipers (Scott Paper Company, or equivalent)

Nylon 6, 2 mil thickness, bags and film

Polyethylene, tinted, anti-static, film bags, 6 mils thick, (conforming to FED-SPEC-L-P-378)

2-Propanol (Iso propyl Alcohol $CH_3OH\ CH_3$) Electronic Grade

Gloves, Nylon Stretch (Angelica 6855, 6856 or equivalent)

NOTE: *Purchase from Air Products and Chemicals, Inc., P.O. Box 153C; Washington, D. C. 20013, as: "Pre-purified, high purity (99.997%), cryogenic pumped, 3 PPM maximum moisture, 5 PPM maximum oxygen and 4 PPM maximum total hydrocarbons (by volume). Certificate of analysis of moisture content and Certificate of Compliance as to oxygen content, total hydrocarbon content, and purity required." This nitrogen exceeds all purity requirements of Paragraph 3.2.1 and Table 1 of MSFC-SPEC-234A for Type I nitrogen.

4.0 GENERAL

The assembled Ultraviolet Spectrometer must be protected, to the maximum extent feasible, from any of the following contaminating factors:

a. Any type of smoke (including industrial gases and tobacco smoke).

b. Any oil vapors of any type, or any solvents capable of leaving a residue on the optical surfaces.

c. Any polyethylene type material in physical contact with the optics (see Note 1, Paragraph 8.0).

d. Any polyvinyl tape materials in the vicinity of the UVS. Commercial electronic test equipment, which normally uses polyvinyl chloride wire insulation, will be located outside of the clean bench area. Such equipment will be physically located so that air passing over the equipment, or being expelled from the equipment by blowers or self generated heat, will not be directed toward the UVS.

e. Any breathing or coughing upon the optical surfaces. Clean room masks shall be worn by all personnel within six feet of exposed optics (and at any distance upstream if the optics are in a horizontal laminar flow clean room).

f. Any atmosphere of worse than class 10,000 level, as defined by NAA Specification MA 0115-012, unless otherwise stated herein (see Paragraph 7.2.1).

g. Exposure to conditions of temperature and humidity wherein condensation of moisture on the optical surfaces is possible (see Figure 1).

h. Any handling of optical components without the wearing of clean room gloves. Any touching of or contact with the coated optical surfaces at any time.

i. Any photoflash or strong ultraviolet radiation.

j. Atmosphere containing high concentrations of helium or hydrogen.

k. High intensity x-ray or electromagnetic fields.

5.0 CONTAMINATION CONTROL REQUIREMENTS FOR THE ELECTRONIC AND SIGNAL CONDITIONING MODULE

The electronic and signal conditioning module will be fabricated using normal APL/JHU production procedures for spacecraft hardware. These include:

a. Fabrication of welded sub-modules in an air conditioned area provided with a continuously active electrostatic precipitator and with controlled temperature (75° ± 3°F) and humidity (30% - 50% R.H.).

b. Assembly of soldered sub-modules in air conditioned areas.

c. Cleaning of soldered modules after assembly using propanol, trichloroethane and a dichlorodifluoromethane Micro-Duster, under an exhaust hood.

d. Inspection, by Quality Assurance Inspectors, of the completed sub-modules for workmanship and cleanliness.

e. Sealing of all sub-modules, immediately after final inspection, in closed polyethylene bags. Each sub-module will remain in the sealed bag until removed for the next assembly operation.

f. Assembly, cleanliness/workmanship inspections and potting operations, to be conducted in air conditioned areas.

g. Cleaning of each successive assembly, using a dichlorodifluoromethane Micro-Duster under an exhaust hood, immediately followed by sealing in polyethylene bags.

h. Prior to being sent to controlled storage to await assembly to the UVS front plate, cleaning of the completed electronic and signal conditioning module with liquid Precision Cleaning Agent per MSFC-SPEC-237A, followed by drying with a dichlorodifluoromethane Micro-Duster (in a Class 100 laminar flow bench, per NAA Specification MA 0115-012).

i. Packaging of the completed electronic and signal conditioning module in a Type I closure per MSC-SPEC-C-12A. The following requirements, excerpted from MSC-SPEC-C-12A apply:

1. Film Cushioning - Heavy items or items having threads, sharp points, edges, etc., which may puncture

or otherwise damage the barrier bags, shall be overwrapped with a sufficient amount of 2 mils thick Nylon 6 film to form a cushion. The cushioning film shall be secured with an approved tape (Federal Specification PPP-T-66, Type I, Class B) whose adhesive shall not come in contact with the body of the precision-cleaned item.

2. Inner Bag - Each cushioned item shall be placed into a barrier bag of Nylon 6 two mils thick material.

3. Purging - Interior of carrier bag and cushioned item contained therein shall be purged with an inert gas* immediately prior to heat sealing.

4. Purging Process - Purging shall be accomplished by directing a stream of nitrogen into the bag and over the contents for a sufficient length of time to replace the entrapped air with the gas. As a minimum, purging shall be continued until a volume of nitrogen equal to ten (10) times the internal volume of the bag has been used. During this process, the bag shall be heat sealed in close proximity to the item. A vacuum may be pulled on the bag prior to sealing, if desired.

*Nitrogen per MSFC-SPEC-234A shall be used. (See Note, Page 2 and Note 5, Paragraph 8.0.)

5. Sealing Techniques - Bag sealing techniques shall assure that the volume of gas sealed in the bag is the minimum possible, thus permitting room for expansion of entrapped gas during air shipment.

6. Certification Decal - The bagged item shall be identified with a membrane-type decal containing identification, inspection, and certification of cleanliness information. Decals described in MSC-SPEC-C-3 shall be used for this purpose. Decals shall be applied to the seal on the inner bag in such a manner as to detect opening or tampering with the inner bag.

7. Outer Bags - The sealed inner bag shall be placed into an outer bag of tinted antistatic polyethylene film 6 mils thick. The outer bag shall be purged and sealed in the same manner as the interior bag per Paragraphs 5.i.3, 4 and 5.

6.0 CONTAMINATION CONTROL REQUIREMENTS FOR THE MAIN HOUSING ASSEMBLY

The main housing assembly, including the optics, will be visibly clean, as defined in Specification MSC-SPEC-C-8.

Ray Lee Instruments will fabricate the mechanical portions of the main housing assembly. Chemical treatment of metal parts (passivation, Alodyne, Anodize) will be performed at APL/JHU, using APL/JHU standard procedures and controls.

All metal parts will be vapor degreased and the system assembled for fit check in the Ray Lee clean assembly area. The assembly will be packaged in a sealed polyethylene bag (the drive motor and optics are not installed in the assembly) and installed in an APL/JHU-supplied shipping container for shipment to APL/JHU. The polyethylene bag will be removed prior to entry of the assembly into the APL clean area.

The main housing will be completed, disassembled and cleaned at APL, in accordance with the following procedures, prior to final assembly of the Ultraviolet Spectrometer.

These operations will be performed in a clean room area controlled to at least Class 10,000 per NAA Specification MA 0115-012.

6.1 DETAIL SHEET AND EXTRUDED METAL PARTS, MACHINED PARTS, NON-LUBRICATED FASTENERS, ETC.

Note: Nylon cloth gloves will be worn whenever hand contact is required after initial cleaning.

All detail sheet and extruded metal parts, machined parts, non-lubricated fasteners, etc. fabricated at APL will be cleaned by vapor degreasing or solvent cleaned using 1,1,1 - trichloroethane. They will then be inspected visually for contamination under 3X magnification, with any doubtful details resolved by magnification up to 10X. Floodlights, aimed

across the field of vision, shall be used in this inspection. Ultraviolet light will be used to aid visual examination for oily contaminants. Any visual evidence of contamination is cause for recleaning and reinspection. Each part will be placed in a Type I Closure per MSC-SPEC-C-12A (see Paragraph 5.0.i) and sent to the controlled stockroom for storage until required for assembly.*

6.2 METAL PARTS REQUIRING PAINTING

Note: Nylon cloth gloves will be worn whenever hand contact is required after initial cleaning.

All metal parts to be painted will be cleaned prior to surface preparation and painting, using filtered compressed air or nitrogen gas. Parts will then be vapor degreased or all surfaces will be manually cleaned, using 1,1,1 - trichloroethane dispensed from a glass bottle onto clean polyurethane sponge wipers. Wipers will be squeezed nearly dry to prevent run-down or dripping of the liquid. Parts will be visually inspected after cleaning under 3X magnification, using up to 10X magnification to resolve doubtful details. Floodlights, aimed across the field of vision, shall be used in this inspection. Visual evidence of contamination is cause for recleaning and reinspection.

*Parts cleaned immediately prior to assembly need not be so packaged.

After painting, parts other than internal, optically painted surfaces will be recleaned, using liquid Precision Cleaning Agent per MSFC-SPEC-237A, and reinspected as above. They will then be placed in Type I Closures per MSC-SPEC-C-12A (see Paragraph 5.0.i) and sent to the controlled stockroom for storage until required for assembly.*

Internal surfaces, including the inner face of the baffle, which are optically painted (i.e. with non-reflective paint) shall be cleaned only by blowing with dry nitrogen. Any exception to this rule requires the specific consent of the Project Engineer. These surfaces are not to be touched unless absolutely necessary. All personnel handling parts with optically painted surfaces must wear nylon cloth gloves.

6.3 PURCHASED PARTS (OTHER THAN OPTICAL PARTS)

a. Purchase Documents - Specifications, specification control drawings, and purchase instructions for parts will include cleaning and packaging requirements consistent with the requirements of this plan. Requirements will be determined and specified by the Satellite Reliability Group, dependent upon the nature of the item. Purchase documents will require that inner sealed packages be externally marked so that they will remain sealed until transported to a clean area for opening.

*Parts cleaned immediately prior to assembly need not be so packaged.

b. Handling and Incoming Inspection

Note: Nylon cloth gloves will be worn whenever hand contact is required.

Sealed packages will be cleaned, using a dichlorodifluoromethane Micro-Duster, or by careful wiping, prior to entry into the clean area.

All incoming parts will be opened, inspected and re-packaged in a laminar flow bench or clean room area controlled to at least Class 10,000 per NAA Specification MA 0115-012. Parts will be inspected for mechanical dimensions, finish, marking and other purchase document requirements. Visual examination will be made under 3X magnification, using up to 10X magnification to resolve doubtful details. Floodlights, aimed across the field of vision, shall be used in this inspection. Ultraviolet light will be used to check for oil contamination of metal parts. Any visual evidence of contamination is cause for recleaning and reinspection, or for rejection of the part. Accept/reject decisions and recleaning methods (where applicable) will be determined by the supervisor of the quality assurance project, in consultation with engineering personnel designated by the Project Engineer.

Parts passing incoming inspection will be repackaged while still in the clean area. The original clean packaging material will be used wherever possible. When the

original container cannot be resealed, parts may be placed in Type I Closures per MSC-SPEC-C-12A (see Paragraph 5.0.i). After repackaging, parts will be sent to the controlled stockroom until needed for assembly.

6.4 OPTICAL PARTS

Optical parts will be cleaned and packaged by the manufacturers, using standard optical procedures.

a. Mirrors - The procedure used by the manufacturer in initial cleaning and packaging of the mirrors* consists of the following steps:

1. Remove surface particulates by blowing with clean filtered air.

2. Remove any residual particles by brushing with a camel's hair brush.

3. Flush with demineralized water at room temperature.

4. Rub down with sterile cotton and mild detergent solution.

5. Re-rinse with demineralized water.

6. Blow dry with clean filtered air.

7. Wipe edges as necessary with sterile cotton to remove droplets.

*Steps 1 through 7 are applicable to uncoated mirrors only.

8. <u>If mirror is not to be coated immediately</u>. Install form-fitting plexiglass cap so designed as to prevent contact with the mirror surface; seal and secure with Scotch low vapor pressure tape, and place in covered clear plexiglass box.

9. <u>After coating</u>. The only cleaning permitted after coating is the removal of surface particulates by blowing with dry nitrogen (see Note, Page 2 and Notes 3 and 5, Paragraph 7.0).

10. Install (or reinstall) and seal form-fitting plexiglass cap (see Item 8).

11. Wrap in white jeweler's paper.

12. Overwrap in white quilted cellulose packaging.

13. Overwrap with brown Kraft wrapping paper, and seal with tape.

The outer packaging shall be removed immediately prior to entry into the clean area for assembly. Jeweler's tissue and plexiglass cap are to be removed only within the assembly clean area.

b. Diffraction Gratings - The procedure used by the manufacturer (prior to coating) for initial cleaning of the diffraction gratings consists of the following steps:

a. Install a form-fitting plexiglass cover, designed to prevent the cover from touching the ruled surface. Seal and secure with Scotch low vapor pressure tape.

b. Install in a transparent box with appropriate supports to prevent movement during shipping. Seal with Scotch low vapor pressure tape.

c. Pack in shipping box with resilient foam padding to prevent undesired free movement within the container and physical damage due to shock and vibration.

The grating may be removed from its outer packaging immediately prior to entry into the clean area for assembly. The grating shall be removed from its plexiglass transparent box and the plexiglass cover removed only within the assembly clean area.

7.0 CONTAMINATION CONTROL REQUIREMENTS FOR THE COMPLETED INSTRUMENT

7.1 ASSEMBLY

All assembly and alignment operations will be conducted in a clean room controlled to Class 10,000 or better per NAA Specification MA 0115-012.

Sealed packages will be removed from the controlled stockroom and will be cleaned immediately before entering the clean room area. This cleaning will be accomplished by blowing with pressurized dry nitrogen or by careful wiping or brushing to remove surface contaminants.

Clean packaging or wrapping will be removed, within the clean room, immediately prior to the assembly step requiring the use of the part (see Note 1, Paragraph 8.0). Nylon cloth gloves will be worn whenever hand contact is required. Optical surfaces will not be touched, even while wearing gloves.

After assembly and alignment operations have been completed, and while still within the clean room area, an optically transparent dust cap will be installed over the baffle opening to prevent entry of contaminants into the main housing assembly through the entrance slit. A dust cap will also be provided for the electronics module housing vent. From this point in time forward, the physical handling of the UVS will be as specified in APL/JHU Specification 7232-0016, "UVS Handling Procedure". The caps will be removed only during vacuum testing, calibration in the calibration test equipment (CTE), and prior to final pre-launch closure of the SIM bay door. Immediately after the vacuum test and calibration operations, the caps will be replaced (see Note 3, Paragraph 8.0).

7.2 TEST AND CALIBRATION OPERATIONS

7.2.1 At APL/JHU

Optical alignment and operational verification operations at APL/JHU will be performed in a Class 10,000 clean room.

Contamination control during environmental tests will be provided as follows:

a. Physical Tests. The spectrometer will be protected by being enclosed in a sealed Nylon 6 bag, purged with dry nitrogen (see Note, Page 2 and Note 5, Paragraph 7.0) during vibration tests. Balance, weight and center of gravity tests will be conducted in a Class 10,000 clean room.

b. Thermal-Vacuum Tests. Prior to the installation of the spectrometer, the test chamber will be subjected to a 24-hour vacuum-bakeout cycle, followed immediately by a 24-hour vacuum test run, utilizing test mirrors and salt cells as contamination indicators. After the bakeout, the salt cells will be evaluated by the Environmental Test Laboratory and the test mirrors by the Principal Investigator. If these evaluations are satisfactory, the spectrometer will be installed in the thermal-vacuum chamber. Protective covering (Type I closure per MSC-SPEC-C-12A or sealed transport case purged with dry nitrogen) will be removed immediately prior to installation and transfer of the spectrometer to the chamber will be made rapidly, to avoid unnecessary exposure to the uncontrolled laboratory atmosphere. The dust cap protecting the baffle opening will remain in place until immediately before the closure of the test chamber, and will

be inspected, cleaned if necessary (see Paragraph 8.0, Note 4) and sealed in a Nylon 6 bag after removal.

The Johns Hopkins Physics Department will provide a supply of UV coated mirrors to APL and will periodically check these mirrors for reflectivity. These mirrors will be placed in the environs of the UVS during storage and testing, to provide a realistic contamination monitor.

Following thermal-vacuum tests, the test chamber will be back filled with dry nitrogen prior to opening. The dust cap will be removed from the Nylon 6 bags and reinstalled prior to removal of the spectrometer from the test chamber.

The spectrometer will be removed from the test chamber and immediately placed in its transport case. The case will then be sealed and purged with dry nitrogen (see Note, Page 2 and Note 5, Paragraph 8.0). Purging shall be continued until a volume of nitrogen at least equal to ten (10) times the internal volume of the container has been used. Whenever the spectrometer is to be installed in the transport case, the case will be inspected under 3X magnification, using floodlight illumination. The case will be pre-cleaned if required.

The spectrometer will be removed from the Environmental Test Laboratory in the transport case. The

case will not be opened except in an atmosphere controlled to at least Class 10,000 per NAA Specification MA 0115-012.

7.2.2 At JHU/Physics Department

Two UVS test operations will be performed at the Physics Department on the Homewood Campus. Shipment of the UVS and associated BTE and GSE will be in accordance with the UVS Logistics Plan DRL 25, DRD LS-064T.

The test operations at the Physics Department will include an optical verification and component testing. The control for these test operations shall be as specified in the calibration test procedures for Apollo 17 UVS Experiment S169, DRD-JHU-3-UVS, and as specified in this document.

7.2.3 At KSC

7.2.3.1 General - All test operations at KSC prior to the installation of the spectrometer in the SIM shall be conducted without removal of the spectrometer dust cap. The spectrometer will be kept within its transport container, whenever tests are not actually being conducted. It shall be removed from the transport container only in a clean bench, which must be supplied at KSC, and must be cleaned and rebagged immediately prior to return to the transport container (see Paragraph 7.4). When it is absolutely necessary to transport the spectrometer, without

protective covering, through an inadequately controlled atmosphere (e.g. during SIM installation), the transfer shall be made as rapidly as possible. The length of time in the uncontrolled atmosphere and the prevailing conditions shall be recorded on the accompanying documentation. The dust cap shall be removed as late as possible before flight.

7.2.3.2 Purging - A purging port (quick disconnect fitting) will be available on the spectrometer access door. Prepurified, cryogenic-pumped, bone-dry nitrogen shall be supplied to purge the spectrometer at a rate of approximately 5-7 cfh whenever possible during and after installation in the SIM. Purging shall be maintained after installation whenever the SIM bay door is open.

7.2.3.3 Other Precautions - Precautions must be taken to avoid:

a. The direct impingement of x-rays or other radiation sources on the spectrometer.

b. The uncontrolled use or presence of contaminating materials (e.g. smoke, oil vapors, chlorinated solvents) in the vicinity of the spectrometer.

c. Exposure of the spectrometer to photoflash or strong ultraviolet radiation.

d. Exposure of the spectrometer to atmospheres containing high helium or hydrogen concentration.

7.3 PACKAGING FOR TRANSPORT AND SHIPMENT

Prior to the removal of the assembled experiment from the clean rooms for any reason, it shall be examined for cleanliness (see Paragraph 7.4) and then packaged as follows:

a. Heat seal, Type I Closure per MSC-SPEC-C-12A (see Paragraph 5.0.i).

b. Place in transport or shipping container.

The transport or shipping container shall be so designed as to have a continuous, smooth inner surface and to have no sharp internal corners to collect particulate matter. The outer cover of the container shall provide a dust-tight seal. The interior of the container, prior to installation of cushioning, blocking or bracing materials shall have been cleaned by blowing with dry nitrogen, followed by detergent wash and rinse or manual solvent cleaning, as applicable. Cushioning, blocking or bracing materials shall be so designed as to prevent puncturing or tearing of the spectrometer's protective closure. All such materials shall be maintained in a clean condition by heat sealing in a Type I closure per MSC-SPEC-C-12A until needed.

7.4 RECLEANING AND REPACKAGING

After any operation which requires removal of the assembled spectrometer from its clean packaging, the external surface shall be visually examined under 3X magnification, using floodlight illumination, and under ultraviolet light. Any evidence of contamination shall be reported to the Experiment Project Engineer, who alone may authorize recleaning.

When recleaning has been authorized, it shall first be ascertained that the baffle dust cap is in place. All external surfaces of the spectrometer shall then be carefully cleaned by blowing with dry nitrogen. Where required, Precision Cleaning Agent per MSC-SPEC-237A may be used for manual cleaning. The solvent shall be dispensed from a glass bottle onto clean polyurethane sponge wipers. Squirter tubes, if used, will be of teflon. Wipers shall be squeezed nearly dry to prevent run-down of the liquid.

After cleaning, the spectrometer shall be reinspected and repackaged for shipment as specified in Paragraph 7.3.

All recleaning and repackaging operations shall take place within the clean room area.

8.0 NOTES

1. Care must be taken in all operations where optics are open to the clean room/bench atmosphere. Outer polyethylene bags shall be removed downstream from the exposed optics and then physically removed from the clean room. Personnel shall remain downstream from the exposed optics at all times during all operations including assembly, test, alignment and calibration. Clean room masks shall be worn by all personnel within six feet of exposed optics (and at any distance upstream).

2. Care must be taken to prevent touching of optical components after having touched any contaminated surface or phthate-producing material (e.g. polyvinyl chloride).

3. Mirrors, once contaminated, shall be recoated. Gratings, once contaminated, shall be replaced. Contaminated gratings may be washed with Precision Cleaning Agent per MSFC-SPEC-237A. They may then be recalibrated and, if no deterioration is evident, be set aside as spares. Such spares may be used as flight equipment only if no unwashed spares are available and only upon approval of the Experiment Project Engineer.

4. The dust cap and plugs shall have been cleaned by washing in clean detergent solution, followed by deionized water rinsing and drying with pressurized dry nitrogen. They

shall then have been packaged in Type I Closures per MSC-SPEC-12A (see Paragraph 5.0.i) and held in the controlled stockroom until needed.

5. Lines to be used for nitrogen purging shall be pre-washed, using Precision Cleaning Agent per MSFC-SPEC-237A. They will then be blown dry with clean nitrogen (see Note, Page 2) prior to use.

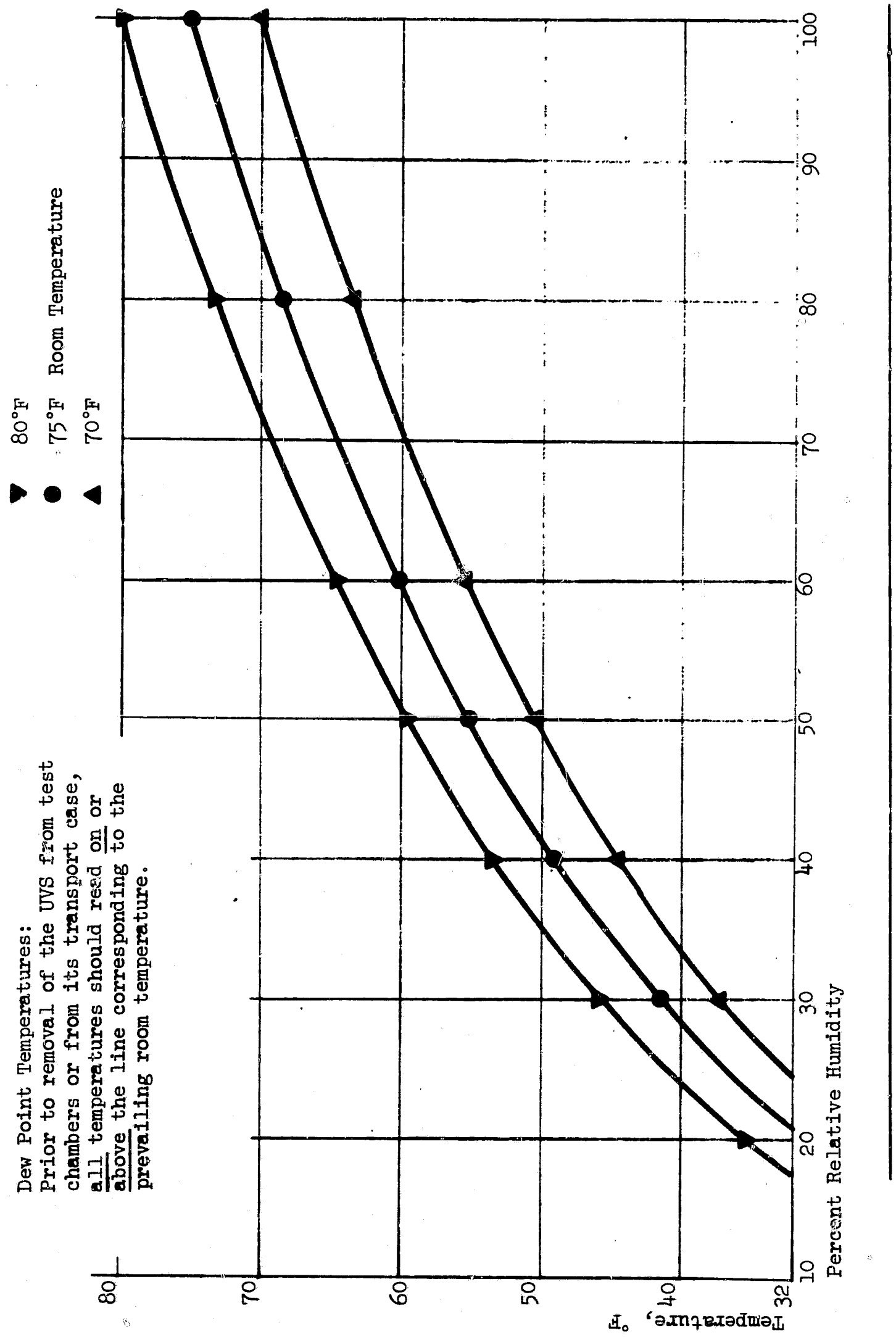

FIGURE I

Dew Point Temperatures:
Prior to removal of the UVS from test chambers or from its transport case, all temperatures should read on or above the line corresponding to the prevailing room temperature.