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Space Administration

**CxP 70145**

**BASELINE**

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# **CONSTELLATION PROGRAM CONTAMINATION CONTROL REQUIREMENTS**

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### REVISION AND HISTORY PAGE

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## 1.0 INTRODUCTION

CxP 70145, Constellation Program Contamination Control Requirements, presents common contamination control requirements to ensure consistent design, development, and verification of Constellation Program (CxP) space vehicles, flight hardware, and ground support facilities, equipment and hardware. This document has been approved by the Constellation Program and is available for use by the National Aeronautics and Space Administration (NASA) and associated contractors. All projects and associated interfaces of the Constellation Program must adhere to these requirements.

### 1.1 PURPOSE

The purpose of this document is to establish common, minimum requirements and controls necessary to establish and maintain effective contamination control for ground systems and for flight hardware for the Constellation Program (CxP). Constellation missions to the International Space Station (ISS) should also be consistent with the contamination control requirements specified in SSP 30426, Space Station External Contamination Control Requirements.

### 1.2 APPLICABILITY

This document contains the contamination control requirements applicable to all NASA organizations and CxP projects that are responsible for operational use of environmentally controlled areas and for designing, developing, manufacturing, maintaining (rework/renovation/reuse), inspecting, packing and packaging for shipment, and testing of space vehicles and ground, flight and flight-related equipment and hardware for the Constellation Program. "Ground" in this context includes both facility and Ground Support Equipment (GSE) systems.

### 1.3 DEFINITIONS

To promote common understanding, the following definitions are provided:

Airborne Particulate Matter - Particulate matter suspended in the ambient atmosphere.

Cleanroom - A cleanroom is an enclosed area employing control over particulate matter in air with air flow, temperature, humidity, and differential pressure control, as required.

Clean Work Area (CWA) - Laboratories, special workrooms, vacuum chambers, or other facilities and portions of facilities that employ defined environmental controls and operational restraints to maintain a high level of cleanliness.

Clean Work Station - A clean work station is a work bench or similar working enclosure characterized by having its own filtered air or gas supply.

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Cleanliness Level - An established maximum of allowable contaminants based on size distribution or quantity on a given area or in a specific volume.

Contaminant - Any unwanted matter that exceeds maximum allowable which could be detrimental to the required operation, reliability, or performance of a part, component, subsystem, or system.

Critical and/or Significant Surface - A surface which requires precision cleanliness for verification of surface cleanliness.

Fiber - A particle whose length-to-width ratio is in excess of 10 to 1 (minimum length of 100 micrometers).

Fluid - A liquid or gaseous material.

Foreign Object Debris (FOD) - Foreign Object Debris (FOD) is a substance, debris, or article alien to a system that would potentially cause damage to the product.

Generally Clean (GC) - Free from manufacturing residue, dirt, oil, grease, processing debris or other extraneous contamination. This level can be achieved by washing, wiping, blowing, vacuuming, brushing, or rinsing.

Micron/Micrometer - A unit of measurement equal to  $1 \times 10^{-6}$  meters ( $3.93 \times 10^{-5}$  inches). 25 microns is equal to approximately one-thousandth of an inch. The symbol  $\mu\text{m}$  is commonly used for this quantity.

Molecular Contaminants - Non-particulate vapor-phase contaminants comprised of four categories: acids, bases, condensables and dopants.

Nonvolatile Residue (NVR) - Soluble or suspended material and insoluble particulate matter remaining after controlled evaporation of a filtered volatile liquid.

Particle - Matter with observable length, width, and thickness usually measured in micrometers. This definition includes fibers.

Particulate Matter - The general term applied to matter with observable length, width, and thickness, as contrasted to non-particulate films without definite dimension.

Piece Parts - Individual parts or components that are used to assemble a subsystem or a system.

Precision Cleaning - Final or fine cleaning accomplished in a controlled environment to achieve precision cleanliness.

Precision Cleanliness - The degree of freedom from contaminants that cannot normally be detected by visual means. This cleanliness level is verified by quantitative methods.

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Precision Clean Packaging - Packaging or protection used to preserve precision cleanliness for a specific period and condition.

Visibly Clean (VC) - The absence of all particulate and non-particulate matter visible to the normal unaided (except corrected vision) eye.

Visibly Clean Plus Ultraviolet (VC + UV) - Visibly Clean (VC) and inspected with the aid of an Ultraviolet (UV) light.

Visual Cleanliness Levels - A category which includes VC, VC + UV, and GC cleanliness levels.

Volatile Hydrocarbons - Gaseous hydrocarbons dispersed in the atmosphere typically generated by decomposition, combustion and volatile solvents, paints and internal combustion engines.

#### **1.4 ACRONYMS AND SYMBOLS**

Acronyms and symbols for terminology used in this document are contained in Appendix A.

#### **1.5 WAIVERS AND DEVIATIONS**

Each user is responsible for complying with the requirements of this document. The implementation of the requirements of this document shall be by the contamination control plan in Section 3.1. If compliance with the requirements of this document is not possible, the responsible technical organization shall initiate a request for a waiver or deviation from the CxP Program Change Control Board.

#### **1.6 CHANGE AUTHORITY/RESPONSIBILITY**

Proposed changes to this document shall be submitted by a Constellation Program Change Request (CR) to the appropriate Constellation Control Board for consideration and disposition.

All such requests will adhere to the Constellation Program Configuration Management Change Process.

The appropriate NASA Office of Primary Responsibility (OPR) identified for this document is CxP Safety Reliability and Quality Assurance (SR&QA).

## **2.0 DOCUMENTS**

### **2.1 APPLICABLE DOCUMENTS**

ISO 14644-1                      Cleanrooms and associated controlled environments. Part 1:

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Classification of air cleanliness, Table 1

IEST-STD-CC1246D	Product Cleanliness Levels and Contamination Control Program, Table 1
MSFC-SPEC-164B	Specification for Cleanliness of Components for Use in Oxygen, Fuel, and Pneumatic Systems, Table 1
NAS 412	Foreign Object Damage/Foreign Object Debris (FOD) Prevention, Complete document
NASA-STD-(I)-6016	Standard Materials and Processes Requirements for Spacecraft, Section 4.2.6.6

## 2.2 REFERENCE DOCUMENTS

The documents listed in this section provide the necessary guidelines for effective contamination control.

CxP 70154 (Baseline Pending)	Constellation Program Contamination Control Plan
ASTM E1548-03	Standard Practice for Preparation of Aerospace Contamination Control Plans
IEST-RP-CC003.3	Garment System Considerations for Cleanrooms and Other Controlled Environments
IEST-RP-CC006.2	Testing Cleanrooms
ISO 14644-2	Cleanrooms and associated controlled environments. Part 2: Specifications for testing and monitoring to prove continued compliance with ISO 14644-1
ISO 14644-3	Cleanrooms and associated controlled environments. Part 3: Metrology and test methods
ISO 14644-4	Cleanrooms and associated controlled environments. Part 4: Design, construction and start-up
JPR 5322.1F	Contamination Control Requirements Manual
JPR 8730.1	Electrostatic Discharge Control Requirements for the protection of Electronic Components and Assemblies



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NASA-STD-5005	Ground Support Equipment
NPR 6000.1	Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components
SSP 30426	Space Station External Contamination Control Requirements

### **3.0 REQUIREMENTS**

#### **3.1 CONTAMINATION CONTROL PLAN**

The purpose of a contamination control plan is to ensure product cleanliness. The requirement for a contamination control plan that includes the specific requirements of this document shall be included in procurements and internal task agreements for ground facility support for contamination-sensitive Constellation systems, as required by Section 4.2.6.6 of NASA-STD-(I)-6016, Standard Materials and Processes Requirements for Spacecraft.

NOTE: CxP 70154, Constellation Program Contamination Control Plan and ASTM E1548, Standard Practice for Preparation of Aerospace Contamination Control Plans provide guidelines for the preparation of contamination control plans. JPR 8730.1, Electrostatic Discharge Control Requirements for the Protection of Electronic Components and Assemblies provides Electrostatic Discharge (ESD) control requirements for protection of ESD-sensitive items that must be processed under contamination control. The individual project elements may use their internal contamination control and ESD regulations, specifications, standards, documented procedures and work instructions with prior approval from the Constellation Program Office (CxPO).

#### **3.2 DESIGN**

To assure the most effective contamination control, the designer shall provide for the following features.

- a. Reduction of design sensitivity of the product to contamination
- b. Incorporation of features which will minimize or eliminate self-generation of contamination
- c. Materials compatibility for contamination and corrosion control
- d. Incorporation of suitable design features (such as filtration) for contamination control during system operation

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- e. Maintainability features to facilitate contamination monitoring and removal during maintenance
- f. Assembly and processing operations to minimize contamination

Upon selection of the design, the individual projects shall establish:

- a. The cleanliness levels required by the design and in accordance with Section 3.4
- b. Manufacturing and processing environmental requirements
- c. Assembly, processing, and test requirements pertaining to contamination control
- d. Cleanliness preservation and storage requirements

Compliance with these requirements shall be by review of the design, the contamination control plan, and the materials/processes plan, as well as NASA audits of contamination control and material/processes activities, confirmation of NASA approvals on engineering drawings, use of a control board for contamination-related issues, and NASA approvals of Material Usage Agreements (MUAs) and Material Identification and Usage Lists (MIULs).

NOTE: Implementation of contamination control during the design phase is of the utmost importance. To prevent unnecessarily stringent and costly cleanliness requirements, the design's sensitivity to contamination must be considered when designating the cleanliness level of the hardware.

### **3.3 PROCUREMENT**

The requirement initiator shall include applicable contamination control requirements in procurement documents for space vehicles, Extravehicular Activity (EVA) systems, flight equipment, Ground Support Equipment (GSE), environmental test facilities, facility fluid systems, precision-cleaned packaging materials, process support materials, and cleanroom garment maintenance services.

The following are the minimum procurement quality assurance activities that shall be performed for procurement activities related to contamination control.

- a. Review and approve the procurement of critical flight hardware and GSE.
- b. Impose procurement quality requirements on purchase orders.
- c. Review drawings to ensure the inclusion of quality sensitive requirements.

#### **3.3.1 Accompanying Documentation**

The certification documentation accompanying precision, VC + UV, or VC level cleaned items shall be reviewed for compliance with applicable contract requirements, including

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any certification of cleanliness. Such documentation and/or item certification shall be maintained as a permanent record traceable to the item received.

### **3.4 SURFACE CLEANLINESS LEVELS**

The responsible design or user organization shall select cleanliness levels from the following two categories that meet a wide range of cleanliness needs.

- a. Visible cleanliness
- b. Precision cleanliness

#### **3.4.1 Visual Cleanliness Level Requirements**

- a. Generally Clean (GC) Level

Piece parts cleaned to GC level shall be free of manufacturing residue, dirt, oil, grease, processing debris, or other extraneous contamination.

NOTE: Heat-sealed bagging protection is not required, but normal protection is required for handling, shipping, and storage. The GC level should be specified for hardware that is not sensitive to contamination and is easily and quickly cleaned or re-cleaned.

- b. Visibly Clean (VC) Level

VC level cleaned hardware shall meet the requirements of the GC Level. In addition, VC cleaned hardware shall be cleaned and qualitatively verified to be free of all particulate and non-particulate material visible to the normal unaided eye. Hardware cleaned to VC levels shall be continuously protected using heat-sealed double bagging. Items which cannot be heat sealed because of size, weight or configuration and which have VC cleaned critical surfaces shall be prepackaged to cover all exposed critical surfaces. Three levels of VC requirements are defined within the VC cleanliness category based on incident light levels and inspection distances.

1. VC Standard: Incident light level  $\geq 500$  lumens/m<sup>2</sup> (50 ft-candles). Inspection distance not more than 3 m (10 feet).
2. VC Sensitive: Incident light level  $\geq 500$  lm/m<sup>2</sup> (50 ft-candles). Inspection distance not more than 1.2 m (4 feet).
3. VC Highly Sensitive: Incident light level  $\geq 1000$  lumens/m<sup>2</sup> (100 ft-candles). Inspection distance not more than 0.45 m (1.5 feet).

NOTES: 1. For all VC levels, areas of suspected contamination may be inspected at closer distances than specified above.

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2. VC level inspections are limited to exposed and accessible surfaces. The use of inspection aids such as wipes, mirrors or tape lifts is permissible for those areas of suspect condition with limited or no direct line of sight.

c. Visibly Clean + Ultraviolet (VC + UV) Level

For the VC + UV cleanliness level, the hardware shall be free of all visible particulate and non-particulate contamination augmented by inspection under UV light (Ultraviolet light of 3,200 to 3,800 angstroms wavelength). If the surface to be inspected is inaccessible, a wipe test shall be performed and the wiping medium shall be inspected under UV light. All items cleaned to VC + UV level shall be continuously protected using heat-sealed double bagging. Items which cannot be heat sealed because of size, weight or configuration and which have VC cleaned critical surfaces shall be prepackaged to cover all exposed critical surfaces.

The following minimum visible cleanliness levels shall be required for CxP hardware:

1. All flight hardware internal pressurized volume (NOTE: The only exceptions are internal elements that are sealed and that would not be exposed to external CWA volume under designed conditions)
2. All flight hardware external surfaces while in the CWA
3. GSE that contacts flight hardware internal pressurized volume
4. GSE that contacts flight hardware external surfaces while in the CWA
5. GSE that interfaces with a flight CWA

Piece parts: GC level

Assembled systems: VC sensitive level

GSE that interfaces or contacts flight hardware shall as a minimum meet the cleanliness level of the flight hardware. Prior to integration, piece parts and sub-assemblies shall as a minimum meet the VC level requirements of the next higher assembly (build clean).

NOTE: If proximity to assembled and integrated flight hardware is restricted or limited to greater than the VC Sensitive distance criteria, inspections can be conducted in accordance with the VC Standard level or on a best effort basis.

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### **3.4.2 Precision Cleanliness Level Requirements**

The user shall select the precision cleanliness levels for fluid systems from the levels defined in IEST-STD-CC1246D, Product Cleanliness Levels and Contamination Control Program or MSFC-SPEC-164, Specification for Cleanliness of Components for Use in Oxygen, Fuel, and Pneumatic Systems for particles and NVR. Evidence of inspection and acceptance shall be documented.

### **3.5 ENVIRONMENTALLY CONTROLLED AREAS (ECAs)**

Areas designated as Environmentally Controlled Areas (ECAs) include cleanrooms, laminar flow clean workstations, and Clean Work Areas (CWAs). All ECAs used for final cleanliness verification, assembly, testing, and packaging of precision, VC + UV, and VC level cleaned articles shall be certified by a documented procedure to meet the requirements in this section.

The operation, maintenance and housekeeping of all ECAs shall be controlled by approved documented procedures.

NOTE: Examples of cleanroom monitoring and apparel requirements are found in JPR 5322.1, Contamination Control Requirements Manual; ISO 14644-2, Cleanrooms and associated controlled environments, Part 2: Specifications for testing and monitoring to prove continued compliance with ISO 14644-1; and IEST-RP-CC003.3, Garment System Considerations for Cleanrooms and Other Controlled Environments.

#### **3.5.1 Classification of ECAs**

##### **a. Clean Work Area (CWA) Classification**

Laboratories, special workrooms, vacuum chambers, other facilities or portions of facilities that require environmental and contamination controls, which are not cleanrooms but do meet the minimum requirements of Section 3.5.2, shall be identified as Clean Work Areas (CWAs).

##### **b. Laminar Flow Clean Work Stations**

Laminar flow clean workstations shall be certified and maintained to the ISO cleanliness classification level (defined in Table 1 of ISO 14644-1, Cleanrooms and associated controlled environments, Part 1: Classification of air cleanliness) determined by its application within the user organization.

##### **c. Cleanrooms**

Cleanliness classification for cleanrooms shall comply with the airborne particle cleanliness requirements in Table 1 of ISO 14644-1.

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### 3.5.2 Cleanroom Requirements

Cleanroom operating requirements shall be established to ensure effective contamination control of the item to be processed. The items described below are mandatory for cleanrooms.

#### a. Air Filtration

Testing shall be performed in accordance with a documented procedure to ensure the integrity and continued operation of the air filtration system.

#### b. Airborne Particle Monitoring

Airborne particle monitoring shall be performed to ensure continued compliance with Table 1 of ISO 14644-1.

#### c. Positive Pressure

The minimum positive pressure differential between the cleanroom and any adjacent area subject to lesser cleanliness requirements shall be 0.508 millimeters (0.02 inches) of water with all entryways closed.

#### d. Temperature Range

The temperature in the cleanrooms shall be maintained in the range 19-24 °C (67-75 °F)

NOTE: The systems integration groups are responsible for developing test and certification plans and establishing requirements on hardware processing. These requirements should identify the temperature for processing. The above temperature range may be waived in those ECAs and laboratories for which other temperatures are actually identified for the items being processed.

#### e. Relative Humidity (RH)

The RH in cleanrooms shall be maintained between 30% and 65% unless other ranges are actually required for the items being processed.

NOTE: At high RH corrosion of parts can occur. At low RH, surface static charge on dielectric materials or parts can result in particle deposition on the surface due to electrostatic attractive forces.

The cleanroom certification level shall be verified at least annually and whenever an out-of-compliance condition is found or whenever facility maintenance is performed that disrupts cleanroom operations.

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- NOTES: 1. Test methods and procedures for performing the certification tests to show continued compliance with the requirements are provided in ISO 14644-2 Cleanrooms and associated controlled environments, Part 2 specifications for testing and monitoring to prove continued compliance with ISO 14644-1; ISO 14644-3, Cleanrooms and associated controlled environments, Part 3: Metrology and test methods; and IEST-RP-CC006.2, Testing Cleanrooms.
2. Particle fallout, air flow and air exchanges should also be controlled and monitored at levels consistent with maintaining the surface cleanliness level of the hardware. ISO 14644-4 provides recommendations of the number of air exchanges for each cleanroom classification.

### 3.5.3 Laminar Flow Clean Work Station Requirements

In addition to the Air Filtration and Airborne Particle Monitoring requirements specified in Section 3.5.2, airflow velocity shall be maintained at 27.5 meters per minute (90 ft per minute) average with a uniformity of  $\pm 20\%$  across the entire area of the exit.

The laminar flow clean work stations shall be recertified at least annually for continued operation.

## 3.6 PACKAGING REQUIREMENTS

### 3.6.1 Visual Cleanliness

All visually cleaned items shall be packaged in accordance with the following requirements.

a. GC Level

The GC cleanliness level has no specific contamination control packaging requirements. Protective packaging shall be provided during handling, shipping, and storage for GC hardware for subsequent space flight and for GC hardware in transit between facilities. Packaging shall be performed in an area where the cleanliness integrity of the article being processed is not jeopardized, preferably in a CWA.

b. VC Level

The VC cleanliness level requires the use of double bags. The *inner* packaging bag shall be cleaned and visually verified to the VC level as a minimum. All packaging operations shall be performed within a CWA or better. Items which cannot be double bagged because of size, weight or configuration and which have VC cleaned critical surfaces shall be prepackaged to cover all exposed critical surfaces.

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c. VC + UV Level

The VC + UV cleanliness level requires the use of double bags. The *inner* packaging bag shall be cleaned and visually verified to the VC + UV level as a minimum. All packaging operations shall be performed within a CWA or better. Items which cannot be double bagged because of size, weight or configuration and which have VC + UV cleaned critical surfaces shall be prepackaged to cover all exposed critical surfaces.

### 3.6.2 Precision Cleanliness

All precision cleaned items shall be packaged in double bags immediately after cleaning and drying. The *inner* packaging bag shall be cleaned to the appropriate precision cleanliness level of the hardware. All packaging operations shall be performed in a CWA of equivalent cleanliness level in which the items were precision cleaned. Integrity seals shall be provided for all precision cleaned fluid components, assemblies and systems configured for flight at the final integration facility at the launch site.

### 3.6.3 Packaging Materials

Packaging materials (including labels) selected for packaging VC, VC + UV, and precision cleaned components shall exhibit the following characteristics.

- a. Compatibility with the surface cleanliness level required of the item.
- b. Inner packaging materials compatible with the fluids in which the hardware will be used.
- c. Packaging materials used to maintain cleanliness of ESD-sensitive items shall meet the ESD protection requirements for the packaged item or shall not compromise the ESD protection requirements of inner ESD protection packaging.

NOTE: Examples of approved packaging materials are included in JPR 5322.1. These packaging materials are characterized by low outgassing properties and high resistance to particle sloughing or shedding.

#### 3.6.3.1 Cleanliness Level

Outer packaging material shall meet the same specification as the inner packaging material for VC, VC + UV and precision cleanliness level. Inner packaging material shall meet the appropriate VC or precision cleanliness level in accordance with the hardware cleanliness requirements.



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All bags, sheeting, tubing, roll stock, and other cleaned packaging material shall be double bagged. The inner bag shall be constructed of the same material as the one being packaged (for example, nylon film packaged in nylon bags).

### **3.6.3.2 Visual Inspection**

Visual inspection shall be performed with the unaided eye in accordance with Section 3.4.1. No evidence of oil, grease, water, solvents, paints, ink, dirt, metal chips, labels, preservatives, or other foreign matter shall be permitted on the external surfaces or the internal surfaces of intimate packaging materials. This requirement also applies to the internal surfaces of the over wrap packaging.

### **3.6.3.3 Certification**

The supplier shall furnish certification with each package, showing evidence of compliance with these requirements as specified in the procurement documents.

NOTE: CxP shall ensure proper packaging of hardware as defined in NPR 6000.1, Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components.

## **3.7 STORAGE AND HANDLING OF PRECISION CLEANED AND VC ITEMS**

All VC or precision cleaned items shall be stored in an enclosed area where temperature and humidity are controlled. Precision cleaned items shall be protected from contamination during any processing that follows cleaning. Fluid line connections shall be integrity sealed when not in use to ensure equipment cleanliness integrity. Upon completion of all required processing, the cleaned item or assembly shall be double bagged.

NOTE: NASA-STD-5005, Ground Support Equipment provides requirements for handling and processing of GSE.

## **3.8 FOREIGN OBJECT DEBRIS (FOD) PREVENTION**

An FOD prevention program shall be established per NAS 412, Foreign Object Damage/Foreign Object Debris (FOD) Prevention in accordance with Section 4.2.6.6 of NASA-STD-(I)-6016.

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## APPENDIX A ACRONYMS AND ABBREVIATIONS AND GLOSSARY OF TERMS

### A1.0 ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
CWA	Clean Work Area
CxP	Constellation Program
CxPO	Constellation Program Office
ECA	Environmentally Controlled Area
ESD	Electrostatic Discharge
EVA	Extravehicular Activity
FOD	Foreign Object Debris
ft	foot/feet
GC	Generally Clean
GFE	Government Furnished Equipment
GSE	Ground Support Equipment
IEST	Institute of Environmental Sciences and Technology
ISO	International Standards Organization
ISS	International Space Station
JPR	Johnson Space Center Procedural Requirements
m	meter
mm	millimeter
MSFC	George C. Marshall Space Flight Center
MIUL	Material Identification and Usage List
MUA	Material Usage Agreement
NAS	National Aerospace Standard
NASA	National Aeronautics and Space Administration
NPR	NASA Procedural Requirement
NVR	Nonvolatile Residue
RH	Relative Humidity
SR&QA	Safety Reliability and Quality Assurance

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UV                      Ultraviolet

VC                      Visibly Clean

VC + UV              Visibly Clean Plus Ultraviolet

µm                      micrometer

°C                      degrees Centigrade

°F                      degrees Fahrenheit

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## A2.0 GLOSSARY OF TERMS

<b>Term</b>	<b>Description</b>
None	

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## APPENDIX B OPEN WORK

### B1.0 TO BE DETERMINED

Table B1-1 lists the specific To Be Determined (TBD) items in the document that are not yet known. The TBD is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBD item is numbered based on the section where the first occurrence of the item is located as the first digit and a consecutive number as the second digit (i.e., <**TBD 4-1**> is the first undetermined item assigned in Section 4 of the document). As each TBD is solved, the updated text is inserted in each place that the TBD appears in the document and the item is removed from this table. As new TBD items are assigned, they will be added to this list in accordance with the above described numbering scheme. Original TBDs will not be renumbered.

**TABLE B1-1 TO BE DETERMINED ITEMS**

TBD	Section	Description
None		

### B2.0 TO BE RESOLVED

Table B2-1 lists the specific To Be Resolved (TBR) issues in the document that are not yet known. The TBR is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBR issue is numbered based on the section where the first occurrence of the issue is located as the first digit and a consecutive number as the second digit (i.e., <**TBR 4-1**> is the first unresolved issue assigned in Section 4 of the document). As each TBR is resolved, the updated text is inserted in each place that the TBR appears in the document and the issue is removed from this table. As new TBR issues are assigned, they will be added to this list in accordance with the above described numbering scheme. Original TBRs will not be renumbered.

**TABLE B2-1 TO BE RESOLVED ISSUES**

TBR	Section	Description
None		