



## Supplier Packaging and Handling Requirements

MSS08076-101-RQT

REV: A

Related AS9100D Clauses: 8.5.4

See JIRA Artifact for approvals: [MSS-12596](#)

ORIGINATED &  
APPROVED BY: Kevin E. Choi, Sr. Build Reliability Engineer

APPROVED BY: Kevin Choi, Sr. Director of Quality, Reliability, & EHS

APPROVED BY: Andrew Toache, Sr. Director of Global Supply Chain

APPROVED BY: JR Silva, Manager of Reliability Engineering & Quality

APPROVED BY: Katlyn Schubert, Trade Compliance

RELEASED BY: Document Control Management

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## 1.0 SCOPE

- 1.1 This document establishes the packaging and handling requirements and acceptance criteria that the seller **shall** follow for Millennium Space Systems' material, when this document is referenced on the Purchase Contract. It defines packaging material standards, labeling requirements, protection levels, and verification procedures to ensure parts arrive undamaged, maintain traceability, and comply with the drawing, specification, or quality clause requirements (reference MSS08012-204-RQT) associated with the hardware.

## 2.0 REFERENCE / RELATED DOCUMENTS

- 2.1 ASTM D3951-18 – Standard Practice for Commercial Packaging
- 2.2 IPC-1602 A – Printed Board Handling and Storage Guidelines
- 2.3 IPC-J-STD-033 – Handling, Packing, Shipping, and Use of Moisture-Sensitive Devices
- 2.4 IPC-J-STD-001 – Requirements for PCB Design and Fabrication
- 2.5 JPR 5322.1 – Contamination Control Requirements Manual
- 2.6 MSS08012-204-RQT – Millennium Space Systems Quality Clause Requirements

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### 3.0 DEFINITIONS / ACRONYMS

Antistatic	Prevents buildup of static electricity but does not protect parts from an external ESD event.
Electrostatic Discharge (ESD)	The rapid, spontaneous transfer of electrostatic charge is induced by a high electrostatic field. Note: Usually, the charge flows through a spark between two bodies at different electrostatic potentials as they approach one another. ESD can have very short duration high current levels and can cause damage to electronic components.
ESD Shielding	Prevents static buildup and shields parts from external electrostatic discharge.
Foreign Object Debris (FOD)	any substance, debris, or article alien to a system that would potentially cause damage. FOD includes, but not limited to: lubricants, solvents, tools, fasteners, washers, machined burrs, etc
Hazardous Material	Substances that pose a risk to health, safety, or the environment due to being flammable, explosive, toxic, corrosive, radioactive, or biologically infectious
Humidity Indicator Card	HIC
Seller	Party that sells or contracts to sell material or services to Millennium Space Systems: A Boeing Company. Interchangeable with the word "supplier" or "vendor".
Service	Intangible labor, process, digital documentation, testing and/or other non-physical action or activity contracted by a purchase contract
Shelf Life	The time period at specified storage conditions that a perishable material or chemical <b>shall</b> maintain its intended properties.
Nonconformance	A discrepancy where a requirement is not met or engineering/manufacturing judgement determines that damage could occur, workmanship is not sufficient, or the end product or service is at risk for any reason.
Material	Material <b>shall</b> mean Item(s) contracted by a purchase contract
Millennium Space Systems	MSS
Moisture-Sensitive Devices	MSD
Packaging & Handling Requirement	PR
PR Code	The code associated with the specific packaging & handling requirement
Printed Circuit Board / Assembly	PCB / PCBA
Personal Protective Equipment	PPE
Purchase Contract	The purchase order, subcontract, or contract. This may also incorporate by reference the standard terms and conditions (TC-001)

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#### 4.0 REQUIREMENTS

- 4.1 Preservation, packaging, packing, and marking furnished by the sellers **shall** meet or exceed the minimum requirements outlined by the Packaging & Handling Requirement (PR) Code definitions and requirements in this document. In the event of a conflict, the associated drawing shall take precedence.
- 4.1.1 Cleanliness – All items **shall** be free of dirt and other contaminants which would contribute to deterioration of the item or which would require cleaning by the customer prior to use. Coatings and preservatives, as dictated by the purchasing document or associated specifications or requirements, are not considered contaminants.
- 4.1.2 Preservation – All items susceptible to corrosion or deterioration **shall** be provided protection such as barrier protection, volatile corrosion inhibitors, or desiccated unit packs as dictated by the purchasing document or associated specifications or requirements.
- 4.2 Table 1 provides the definitions for each Packaging & Handling Requirement (PR) Code associated with the part’s master data. PR Codes are internally defined by Millennium Space Systems in accordance with internal packaging and handling standards and specifications.
- 4.3 The seller **shall** be responsible for ensuring that all packaging, handling, storage, and shipment activities comply with the applicable PR code requirements for the duration of supplier custody, including subcontracted operations. Reference Table 1 PR Code definitions and Section 5.0 for additional details.

*Table 1: Packaging & Handling Requirements Codes (PR Codes) Standard Text*

Code	Packaging Requirement	Standard Text (Definition)
PR1	Fragile 1	Items requiring protection from physical and mechanical damage or which are fragile <b>shall</b> be protected by wrapping, cushioning, pack compartmentization, cartonizing, or other means to mitigate shock and vibration to prevent damage during handling and shipment.
PR2	OMITTED	OMITTED
PR3	Electrostatic Discharge (ESD) Sensitive and Electronic Materials	Package with static-shielding material such as aluminum film/polyethylene terephthalate sealed bagging or closed plastic tote boxes. Refer to ANSI ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies, and Equipment for industry standard guidelines for ESD protection.
PR4	Moisture Sensitive Device (MSD)	Package in a sealed moisture-barrier bag with desiccant and humidity indicator card. Refer to IPC-J-STD-033 for more detail. Default to Level 2 moisture sensitivity level, unless otherwise specified.
PR5	Precision Cleaned	Package all cleaned and precision-cleaned items immediately after cleaning and drying in accordance with the packing methods per JPR 5322.1 “Contamination Control Manual.” To prevent galvanic corrosion, do not place metals dissimilar to the item in contact with the item. Do not use preservative materials on items, which have been precision-cleaned. Only break seal on packaging in clean environments.

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Code	Packaging Requirement	Standard Text (Definition)
PR6	Environmental Storage Conditions	Ensure material is stored per humidity and temperature conditions or other storage conditions per the material technical datasheet (TDS).
PR7	Shelf-Life Limited	Ensure material is clearly labelled with expiration date.
PR8	Printed Circuit Board	Part Commodity-Specific packaging requirements for PCBs that include all requirements from PR1; PR3; PR4; PR6
PR9	Printed Circuit Board Assembly	Part Commodity-Specific packaging requirements for PCBAs that include all requirements from PR1; PR3; PR4; PR6
PR10	Solar Arrays/Panels	Part Commodity-Specific packaging requirements for all solar arrays/panels (fully assembled or partial assembled) that may include PR1 and PR2 requirements. Fully assembled panels will include PR3.

## 5.0 GENERAL PACKAGING REQUIREMENT CODE DETAILS

The following Packaging and Handling Requirements **shall** be applicable when specified on the Purchase Contract. Part-specific packaging requirements on its associated drawing **shall** take precedence over the requirements below in the event of a conflict.

### 5.1 PR1 – Fragile 1

- 5.1.1 **PR1** Coded parts require protection from physical and mechanical damage. **Fragile 1** parts **shall** be protected by wrapping, cushioning, pack compartmentization, cartonizing, or other means to mitigate shock and vibration to prevent damage during handling and shipment.
- 5.1.2 Adhesives for packaging **shall** not be in direct contact with the hardware.
- 5.1.3 Parts with sharp edges or corners **shall** have its edges and corners protected to mitigate shock and vibration damage from shifting or impact during handling and shipment.
- 5.1.4 Cushioning and dunnage materials used to provide protection of goods during handling and transportation **shall** be in accordance with the industry standards described in ASTM D3951-18 Standard Practice for Commercial Packaging, Appendix X1.
- 5.1.5 Each part **shall** be individually wrapped to prevent damage. If each part is individually protected, it is permissible to place them together in the larger shipping container.

### 5.2 PR2 – Omitted

- 5.2.1 Omitted.

### 5.3 PR3 - Electrostatic Discharge (ESD) Sensitive and Electronic Materials

- 5.3.1 **PR3** Coded parts **shall** be packaged with adequate material to prevent electrostatic discharge and electrostatic damage. At a minimum, packaging **shall** include static-shielding material such as aluminum film/polyethylene terephthalate sealed bagging or ESD conductive shipping boxes.

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5.3.1.1 **PR3** parts **shall** not be in direct contact with anti-static polyurethane materials (also referred to as “pink poly”) without a static shield barrier in between.

5.3.2 **PR3** Coded parts **shall** be handled in ESD safe personal protective equipment (PPE) in an ESD safe environment.

5.3.3 Refer to ANSI ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies, and Equipment for industry standard guidelines for ESD protection.

#### **5.4 PR4 – Moisture Sensitive Device (MSD)**

5.4.1 **PR4** coded parts **shall** be packaged in accordance with in IPC-J-STD-033 – Handling, Packing, Shipping, and Use of Moisture-Sensitive Devices. Default to Level 2 moisture sensitivity levels unless otherwise specified.

#### **5.5 PR5 – Precision Cleaned**

5.5.1 **PR5** coded parts **shall** be packaged immediately after precision cleaning processes have been completed.

5.5.2 **PR5** coded parts **shall** have all packaging operations performed within an ISO Class 8 ECA clean room or better.

5.5.3 **PR5** coded parts **shall** not have dissimilar metals placed in contact with the item to prevent galvanic corrosion.

5.5.4 **PR5** coded parts **shall** be free of preservative materials on the item after having been precision cleaned.

5.5.5 **PR5** coded parts **shall** be packaging operations **shall** adhere to the standards outlined in the packaging methods and criteria described in JPR 5322-1 Contamination Control Requirements Manual.

#### **5.6 PR6 – Environmental Storage Conditions**

5.6.1 **PR6** coded parts **shall** be stored in humidity and temperature controlled environments, adhering to the materials’ respective technical datasheets, specification, or drawing requirements as applicable.

5.6.1.1 Suppliers **shall** maintain documented controls for environmental storage conditions and provide evidence upon request.

#### **5.7 PR7 – Shelf-Life Limited**

5.7.1 **PR7** coded parts **shall** have the expiration date and lot or serial number clearly labeled or affixed on the part’s outer packaging.

### **6.0 PART COMMODITY SPECIFIC PACKAGING REQUIREMENTS**

#### **6.1 PR8 – Printed Circuit Boards (PCB’s) – PR1; PR3; PR4; PR5; PR6**

6.1.1 **PR8** Coded parts **shall** be packaged in accordance with the requirements of this section in addition to **PR1; PR3; PR4; PR6**.

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- 6.1.2 PCB's **shall** be packaged to meet or exceed the industry standard guidelines in accordance with IPC-1602A – Printed Board Handling and Storage Guidelines as applicable for handling and storage.
- 6.1.2.1 PCB's **shall** adhere to the bake criteria provided in IPC-1602A to meet packaging requirements if baking is required.
- 6.1.2.2 All boards **shall** be dry packed according to IPC-1602A and **shall** be marked with a seal date on the packaging label.
- 6.1.2.3 PCB's **shall** be packaged in a moisture-sensitive bag (MSD Bag) with a desiccant and humidity indicator card (HIC) **inside** the bag.
- 6.1.2.3.1 The HIC **shall** be positioned so it is visible through the bag window for inspection upon receipt. It is permissible for the desiccant pouch to not be visible as long as it remains in the bag. Reference *Figure 1* as a reference example
- 6.1.2.4 The bag containing the PCB(s), desiccant, and humidity indicator card **shall** be vacuum sealed.
- 6.1.3 After vacuum sealing the PCB(s) in a moisture sensitive bag with a desiccant and HIC, an identification label **shall** be completed and affixed to the packaging in accordance with IPC-J-STD-033 – Handling, Packing, Shipping, and Use of Moisture-Sensitive Devices.
- 6.1.4 Adequate physical protective packaging material (i.e bubble bag or bubble wrap) **shall** be applied to each package with an appropriate, visible external label. Reference *Figure 1* as a reference example.



Figure 1: Reference Example of a PCB in vacuum-sealed MSD bag, wrapped with physical protective packaging

- 6.1.5 Packaged PCB's **shall** be stored in a temperature and humidity controlled environment.
- 6.2 **PR9 – Printed Circuit Board Assemblies (PCBAs) – PR1; PR3; PR4; PR5; PR6**
- 6.2.1 **PR9** Coded parts **shall** be packaged in accordance with the requirements of this section in addition to **PR1; PR3; PR4; PR6**

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- 6.2.2 PCBA's **shall** be packaged to meet or exceed the industry standard guidelines in accordance with IPC-1602A – Printed Board Handling and Storage Guidelines as applicable for handling and storage.
- 6.2.2.1 Unless otherwise specified, PCBA's **shall** be dry packed according to IPC-J-STD-033 Moisture Sensitivity Level 2.
- 6.2.3 PCBAs **shall** be individually packaged into an ESD Static Shielding bag. PCBA's **shall** not be in direct contact with anti-static polyurethane material (also known as “pink poly”).
- 6.2.4 The PCBA packed in an ESD bag **shall** maintain adequate physical protective packaging material (i.e bubble bag or wrap securely with bubble wrap) to each individually packaged PCBA with an appropriate, visible external label. Reference *Figure 2* for a reference example.
- 6.2.5 Packaged PCBA's **shall** be stored in a temperature and humidity controlled environment.



Figure 2: Reference example of a PCBA packaged in ESD shield bag, wrapped in physical protective material

- 6.2.6 If performing conformal coat or staking operations, suppliers **shall** adhere to IPC-J-STD-001 as applicable for handling and storage.
- 6.2.6.1 These parts **shall** retain the buyer's original packaging, in addition to any additional protective measures if necessary, so that the buyer can match the PCBAs to their original packaging upon return.
- 6.3 PR10 – Solar Arrays/Panels – PR1; PR3**
- 6.3.1 **PR11** Coded parts **shall** be packaged in accordance with the requirements of this section in addition to **PR1** and **PR3**.
- 6.3.2 Solar arrays **shall** be treated as **ESD sensitive hardware**. Reference **PR3** code details.
- 6.3.2.1 Fully assembled solar arrays **shall** be handled with ESD-safe gloves to prevent contamination and discharge, and only handled by their structural frames or edges, never by face sheets, solar cells, or electrical connectors.
- 6.3.3 Each solar array/panel **shall** each be individually packaged using an ESD static shielding bag.
- 6.3.3.1 The bagged panel **shall** be fully wrapped in bubble wrap to provide physical protection to each individually bagged panel, covering all surfaces, with an appropriate, visible external label.

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6.3.3.2 After applying the bubble wrap, affix corner guards to each of the four edges. Reference *Figure 3* as a reference example.



*Figure 3: Reference example of a packaged solar array panel with corner guards*

6.3.3.3 Fully assembled solar arrays **shall** be packaged and shipped in a pelican case with adequate cushion and protection inside the case.

6.3.3.4 It is permissible to ship unassembled or partial assembled solar arrays in shipping crates unless otherwise specified, ensuring adequate physical protection such as plank foam between the panels inside the container.

## 7.0 RECORDS

7.1 The seller **shall** maintain records and at a minimum be able to provide upon request:

7.1.1 Packaging methods or instructions used to perform packaging operations on associated parts based on the part's lot number, serial number, or purchasing document reference number.

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