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1 Purpose

The following clauses, when specifically referenced in the Purchase Order (PO) by number, form a part of the PO in addition to all other clauses, terms, and conditions, drawings, and specifications, which are made a part of the PO. Unless otherwise specified, specifications referenced herein shall be of the issue in effect on the date of the request for quotation.

2 Supplier Quality Clauses

2.1 Quality Management System (QMS) Requirements

The supplier shall maintain a QMS that has been deemed acceptable by LCR's Quality department at the time of inclusion in LCR's Approved Supplier List (ASL).

The supplier shall notify LCR in writing within 7 days of any changes in ownership or key personnel.

The supplier shall notify LCR in advance of any changes in location of manufacturing, process, products, or services including changes of external providers.

The supplier shall notify LCR in their quote if they plan to subcontract some or all the manufacturing of products on this PO.

2.1.1 3rd Party Certification of QMS

If the supplier submitted evidence of 3rd party certification to a QMS Standard such as AS9100, ISO9001, NADCAP, etc., the supplier shall notify LCR by email within 7 days of:

- Renewal of 3rd party certification (please send a copy of your new certificate).
- Change of registrars or name (please send a copy of your updated certificate).
- Withdrawal or suspension of 3rd party certification.

2.1.2 Inspection System


The supplier shall be able to provide evidence of a Quality System that at a minimum includes an inspection system that assures that all products and services conform to the requirements and specifications whether performed at the supplier's location or procured from subcontractors or vendors. The supplier must maintain adequate records of all inspections and tests. Records shall indicate the nature and number of observations made, the number and type of deficiencies found, and the quantity approved and rejected.

2.1.3 Right of Access

The supplier agrees LCR, their customers, and regulatory authorities have right of access to the applicable areas of all facilities, at any level of the supply chain involved in the order and all applicable records. Right of access will be with adequate notice.

2.1.4 Production Safety & Ethical Behavior

The products you supply LCR will be incorporated into aircraft and directly affect the safety of people flying in those aircraft. Because of this it is important that your employees and any suppliers you work with to produce products for LCR are aware of:

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- Their contribution to product or service conformity.
- Their contribution to product safety.
- The importance of ethical behavior.

2.1.5 Standards of Workmanship and Competency

The supplier shall maintain written standards of workmanship directly applicable to the nature and level of work to be performed under the PO. In addition, the supplier shall develop, implement, and maintain training programs as deemed necessary by the supplier's management to maintain acceptable areas of performance in quality control, purchasing, and manufacturing. Upon request, a copy of the workmanship standard and applicable training or competency records shall be supplied to LCR for review.

2.1.6 Solder Quality Requirements

2.1.6.1 Competency

All personnel performing solder under this contract shall maintain an active IPC J-STD-001 certification.

All personnel inspecting solder joints under this contract shall maintain an active IPC-A-610 certification.

2.1.6.2 IPC Class 2

All products delivered under this PO shall meet the requirements of IPC-A-610 Class 2.

2.1.7 Quality Flow Down to Sub-Tier Suppliers

The supplier shall ensure all relevant PO requirements are flowed down to their sub-tier suppliers. The supplier's sub-tier suppliers are responsible to comply with the same specifications and requirements specified on the PO.

2.1.8 Certificate of Compliance (CofC)

Seller shall provide a CofC with each delivery of product. This CofC is acknowledgement by the supplier that the requirements of the purchase order/subcontract have been fully met, and any required chemical / physical analysis has been performed with substantiating evidence/data on file and available upon request LCR.

The CofC shall contain:


- LCR's part number
- Quantity in the shipment
- Date of shipment
- Traceability including serial number, lot number or date code (as applicable)
- Signature of an authorized representative of the company certifying the products meet all requirements.

2.1.9 Packing and Shipping

Items delivered under this PO shall be packaged and shipped following best commercial practices in a manner that will assure protection against corrosion, oxidation, deterioration, ESD damage and physical damage during shipment to LCR. If damage occurs during transportation, the supplier shall rework or replace the damaged item at no cost to LCR.

2.1.10 Limited Shelf-Life Material

All items with a limited shelf-life shall be delivered with at least 75% of usable shelf-life and accompanied by documentation defining the expiration date.

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2.1.11 Change Notification

Items furnished under this PO shall be identical in form, fit and function to product previously approved by LCR, except for first time purchases. The supplier shall notify LCR of changes to products, materials, and changes which affect form, fit and/or function.

2.1.12 Obsolescence Management

The supplier shall notify LCR within five working days upon receipt of information that a part/material has or will become obsolete, including its sub-tier suppliers' parts and materials. The Supplier may identify and propose alternate sources, replacement parts, or optional part numbers for parts and materials that become obsolete.

2.1.13 Notice of Escape

The supplier shall notify LCR within five working days upon receipt of information about a nonconformance that may affect parts sold to LCR under this PO. The supplier will assist LCR in their investigation of the impact of this nonconformance on fielded products.

2.1.14 Supplier Corrective Action Requests (SCAR)

When requested, the supplier shall conduct and document a thorough root cause analysis of the defects/failures found, containment (could other products be affected by this nonconformance), actions taken to correct the nonconformity and actions taken to prevent future nonconformities. This information shall be documented in LCR's form (LCR249) or eight disciplines (8D).

If the supplier is unable to complete their investigation within the time frame requested by LCR, the supplier's request for an extension shall be accompanied by a copy of the current draft of the SCAR response or 8D template.

2.1.15 Counterfeit Part Avoidance


The supplier shall have a counterfeit part detection and avoidance system that complies, at a minimum, with AS5553, AS6081, or equivalent. The supplier's system must be fully documented and is subject to review and approval by LCR.

Suppliers shall be required to procure parts from Original Component Manufacturers (OCMs), Original Equipment Manufacturers (OEMs), or Authorized/Franchised Distributors that comply with the requirements of AS5553, AS6081, or equivalent. Parts procured from OCMs/OEMs, or Authorized/Franchised Distributors are required to have documented Certificates of Conformance that are traceable by lot to the OCM.

Parts shall NOT be procured from Independent Distributors (IDs)/Brokers without the express written approval from LCR's Quality Assurance Department documented on LCR's Supplier Exception Mitigation Plan (LCR280) and approved by LCR.

2.1.16 Calibration of Testing and Measurement Tools

The supplier's calibration system shall conform to ISO 10012-1, ANSI/NCSL Z540-2 or equivalent. Only tools that have current calibration records shall be used to verify conformance to requirements for products shipped to LCR. All test equipment under calibration control shall be calibrated to NIST traceable standards. Where no such standards exist, the basis used for calibration or verification shall be documented.

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2.1.17 Control of Nonconforming Material/Material Review Authority

The supplier shall have a documented process for controlling nonconforming material that includes provision to identify, segregate and control nonconforming materials to ensure the supplier does not ship nonconforming materials to LCR. Supplier is not authorized to make "Use As Is" or "Repair" disposition. Use As Is or Repair disposition requests shall be requested in advance of delivery by submitting a waiver request using the latest version of LCR form number LCR806. This form is available on LCR's Supplier Resource website.

Delivery of nonconforming material that has been approved by LCR shall be identified as such on the product's CoC and accompanied by the approved Supplier Waiver. Suppliers shall flow down this requirement to applicable lower-tier suppliers.

2.1.18 Record Retention

All records related to the manufacturing, testing and inspection of parts supplied to a LCR will be maintained for a minimum of seven (7) years from delivery and final payment. These records shall be accessible, upon request, to LCR, LCR's customer, or to regulatory and statutory authorities.

2.1.19 Foreign Object Debris/Damage (FOD)

The supplier shall develop and maintain a FOD policy and/or program using AS9146, NAS 412, or equivalent as a guideline. The policy shall as a minimum provide for effective housekeeping management of material, inspection of in process and final assemblies. Supplier employees performing operations on FOD sensitive products shall be provided with FOD control training. Upon request, the supplier shall provide a copy of the policy to LCR for review.

2.1.20 Return Material Authorization (RMA)

Supplier material delivered on the PO that is rejected and returned to the supplier on a supplier Return Material Authorization (RMA) for evaluation and rework/replacement, shall be shipped by the Supplier with a rework/replacement report that documents the failure description, detailed failure causes, and actions taken to restore the material to the PO requirements. The Supplier shall reference the RMA number on the shipping documents.

2.1.21 Export Control

The supplier shall comply with all US Export Regulations.

2.2 Electronic Components

2.2.1 Non-Authorized Distributor


The supplier is required to notify LCR if they are not the Original Component Manufacturers (OCMs) or Authorized/Franchised Distributor.

2.2.2 Electrostatic Discharge Sensitive Devices (ESDS)

All ESDS shall be sealed inside ESD packaging that has discharge shielding properties consistent with ANSI/ESD S20.20-2021 table 4 and an ESD warning label.

2.2.3 Control of Part Aging

Parts with a date code older than 3 years shall not be delivered to LCR.

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2.2.4 Moisture Sensitive Surface Mount Devices

Surface mount devices with a Moisture Sensitivity Level above 1 shall be shipped from the supplier in a dry packed Moisture Barrier Bag with a Moisture Sensitivity Identification label on the outside consistent with J-STD-003.

When Bottom Termination Components (BTCs) with hidden solder connections are present by design, solder coverage less than 50% of the thermal pad area is a defect, and not a process indicator. Exceptions to this would be per LCR's drawing.

2.3 Printed Circuit Board (PCB) Manufacturing

Printed Circuit Boards shall be IAW IPC-6011 and IPC-6012 compliant unless otherwise specified on the drawing, PO or if Quality Clause 2.6.1 is also required. The supplier shall complete the required inspections/tests and deliver them to LCR with the PCB. Micro-sections or coupons of each panel shall be maintained for seven (7) years and provided to LCR upon request.

2.3.1 Material Certs

When material requirements are called out on the drawing, all parts shall ship with certificates of conformance from the OEM to prove conformance to the drawing.

2.3.2 Test and Inspection Records

All parts delivered under this PO shall be accompanied by test and inspection records that verify the part meet all necessary requirements.

2.3.3 First Article Inspection (FAI)

The supplier shall perform FAI in the supplier's preferred format.

2.4 Printed Circuit Assembly Manufacturing

2.4.1 ESD Process

Suppliers are required to have an Electrostatic Discharge (ESD) Control Program in compliance with the requirements of MIL-STD-1686 or ANSI / ESD S20.20 (latest edition).

2.4.2 Moisture Sensitive Device Control Plan

The supplier shall have a documented procedure for handling moisture or process sensitive components (as classified by J-STD-020, J-STD-075) consistent with J-STD-033 or equivalent.

2.4.3 Competency and Training


All operators who perform solder on LCR products shall maintain an active certification to J-STD-001.

All operators who perform solder inspection on LR products shall maintain an active certification to IPC-A-610.

Copies of J-STD-001 and IPC-A-610 shall be present and available where the work is being performed.

2.4.4 Control of Aging Parts

Parts with a date code older than drawn from storage that exceed lot dates older than four years shall be evaluated for solderability and any other applicable tests to ensure that the part has not deteriorated.

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2.4.5 Solder Alloys

The supplier shall not use lead free solder on any products produced under this PO. Solder used in production of products under this PO shall be certified to the requirements of J-STD-006 or equivalent.

2.4.6 Solder Paste

Solder paste used in production of products under this PO shall be certified to meet the requirements of J-STD-005 or equivalent.

2.4.7 Flux

Flux used in production of products under this PO shall be certified to meet the requirements of J-STD-004 or equivalent.

2.4.8 Material Certs

Products shall ship with certificates of conformance from the OEM for all material requirements defined in the drawing notes.

2.4.9 Inspection

The supplier shall conduct 100% inspection of all solder joints. Workmanship shall be IPC-610 Class 2 compliant unless otherwise defined on the drawing, PO or if Quality Clause 2.6.1 is also required.

2.4.10 Test and Inspection Records

All parts delivered under this PO shall be accompanied by test and inspection records that verify the part meet all necessary requirements.

2.4.11 Environment

The soldering facility is enclosed, temperature and humidity controlled and maintained at a positive pressure.

The humidity level of the soldering facility is controlled to allow soldering (including solderability maintenance) and assembly materials (e.g., conformal coating) to function correctly.

2.4.12 First Article Inspection (FAI)

The supplier shall perform FAI in the supplier's preferred format.

2.5 Cable Assembly Manufacturing

2.5.1 Competency and Training

All operators who perform solder on LCR products shall maintain an active certification to J-STD-001.


All operators who perform solder inspection on LCR products shall maintain an active certification to IPC-A-610.

All operators who inspect cables and cable assemblies for LCR products shall maintain an active certification to IPC-A-620.

Copies of J-STD-001, IPC-A-620, and IPC-A-610 certificates shall be present and available where the work is being performed.

2.5.2 Solder Alloys

The supplier shall not use lead free solder on any products produced under this PO. Solder used in production of products under this PO shall be certified to the requirements of J-STD-006 or equivalent.

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2.5.3 Solder Paste

Solder paste used in production of products under this PO shall be certified to meet the requirements of J-STD-005 or equivalent.

2.5.4 Flux

Flux used in production of products under this PO shall be certified to meet the requirements of J-STD-004 or equivalent.

2.5.5 Inspection

Workmanship shall meet the requirements of IPC-A-620, Class 2 unless otherwise defined on the drawing, PO or if Quality Clause 2.6.1 is also required.

The supplier shall conduct 100% inspection of all solder joints.

2.5.6 Environment

The soldering facility is enclosed, temperature and humidity controlled and maintained at a positive pressure.

The humidity level of the soldering facility is controlled to allow soldering (including solderability maintenance) and assembly materials (e.g., conformal coating) to function correctly.

2.6 Advance Solder Quality Requirements

This clause supersedes all other IPC Class requirements.

2.6.1 IPC Class 3

All products delivered under this PO shall meet the requirements of IPC-A-610 Class 3 and IPC-A-620 Class 3.

2.6.2 X-Ray Inspection

The supplier shall implement the following additions/modifications to the IPC-J-STD-001 requirements.

When devices with hidden solder connections (BGA, BTCs, D-Pak's and Solder Charged Terminations) are present in designs, 100% X-ray inspection is mandatory for these hidden soldered connections. Process validation and control are not acceptable substitutes for 100% X-ray inspection unless part of a documented Process Control Program approved by LCR.

Product shall ship with either a CofC confirming all solder joints met the required IPC class requirements during x-ray inspection, or the x-rays themselves.


2.7 Fabricated Mechanical Parts/Assemblies

2.7.1 Specialty Metals

Specialty metals as defined in DFARS 252.225-7009 included in items delivered for this PO must have been melted in the United States or a qualifying country per requirements of DFARS 252.225-7009.

2.7.2 Material and Special Process Certifications

When material requirements and/or special processes are called out on the LCR drawings for parts shipped under this PO, all shipments shall be accompanied by special process certificates and material test reports for raw materials.

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2.7.2.1 Touchup Paint

Painted parts should be accompanied by (or shipped simultaneously) a small container of touchup paint & catalyst. Both bottles should have an expiration label and a Safety Datasheet.

2.7.2.2 Special Process Certificate of Conformance

The CofC shall be from the special process supplier and shall include the following:

- Special Process Supplier's name and address.
- Quantity and part number or material on which the process was performed.
- The exact Industry or Military standard list on the LCR drawing including all types, classes, grades and/or methods.
- The signature of an authorized representative of the company certifying the process meets all requirements.

Special Processes include Chem Film, Painting, Priming, Anodizing, Plating, Brazing, Heat Treatment, and Welding.

2.7.2.3 Raw Material Reports

CofC and material test reports must show the material meets the exact Industry or Military standard list on the LCR drawing including hardness. The CofC shall be from the original raw material supplier and include original supplier, lot number, material specification, tests conducted, and any other relevant information needed to identify the raw material. Acceptable examples include foundry report, mill report, dimension/ description, temper/hardness, alloy, and condition, as well as composition and test reports for ink and paint. The supplier shall maintain the original mill certification and any secondary independent test laboratory certification(s) if any additional process was done after original mill certification for procured metallic material that shall include physical properties, chemical analysis, and lot number(s).

For plastics and other "proprietary" materials, a CofC from the OEM / OCM stating the material is proprietary or providing only the material properties and characteristics to that material specification is acceptable.

2.7.3 Cosmetic Acceptance Rejection Criteria

IP108, Cosmetic inspection and Rejection Criteria, can be found on the LCR' Supplier Resource. IP108 defines LCR's acceptance criteria and guidelines for the finish of fabricated mechanical parts and assemblies. This guideline shall not override or supersede any applicable specification or drawing requirement.


2.8 NADCAP or Customer Approved Suppliers

All special processes performed on products delivered under this PO are required to be performed by suppliers who are NADCAP or Customer Approved for that special process.

2.8.1 NADCAP Approval for Industry Standard

Please note the supplier's NADCAP certification must cover the specific industry standard called out on the engineering drawing.

For example, when a supplier is approved for Chemical Processing (i.e., Passivation, Anodizing, Plating, etc.) through NADCAP accreditation, material may only be accepted if the industry standard defined in the drawing

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notes matches the industry standard stated in the scope of the Special Processor's accreditation. NADCAP accredited supplier's listings can be found at www.eauditnet.com.

2.9 Conflict Minerals

The supplier shall develop and maintain a conflict mineral program consistent with industry standard. LCR requires the seller to:

- Perform sufficient due diligence into their respective supply chains to determine whether products sold to LCR on this PO contain tin, tantalum, tungsten, or gold, and, if so, whether and to what extent those metals are sourced from conflict-free smelters.
- Report to LCR on a Conflict Minerals Reporting Template (CMRT 6.22) the results of such due diligence.
- Commit to being or becoming "conflict-free," so that any such metals are sourced only from conflict-free smelters.

2.10 Test and Inspection Records

All parts delivered under this PO shall be accompanied by test and inspection records that verify the part meet all necessary requirements.

2.11 Extended Record Retention

2.11.1 Ten Years

All records related to the manufacturing, testing and inspection of parts supplied to a LCR will be maintained for a minimum of ten (10) years from delivery and final payment. These records shall be accessible, upon request, to LCR, LCR's customer, or to regulatory and statutory authorities.

This clause supersedes the record retention requirements specified in Section 2.1.

2.11.2 Fifteen Years

All records related to the manufacturing, testing and inspection of parts supplied to a LCR will be maintained for a minimum of fifteen (15) years from delivery and final payment. These records shall be accessible, upon request, to LCR, LCR's customer, or to regulatory and statutory authorities.

This clause supersedes the record retention requirements specified in Section 2.1.


2.12 First Article Inspection (FAI)

This clause supersedes all other FAI requirements.

The supplier shall perform a First Article Inspection (FAI) on LCR controlled drawings and specifications in accordance with AS9102 latest revision for this purchase order if any of the following apply:

- First time submission (part or new supplier).
- Change in Bill of Material (BOM) or Drawing.
- A change in any manufacturing process.
- Change in manufacturing location (facility).
- 24 months or longer have passed since the supplier is last produced part.

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- As requested by LCR.

All first article inspections performed by the supplier will be delivered with a First Article Inspection Report (FAIR) and all other approved documentation showing conformance to the contract, PO, drawing, or performance requirements specified by LCR including:

- AS9100 forms 1, 2, and 3.
- Copy of drawing with characteristics ballooned.
- Raw Material CofC for all specified materials.
- CofC for finishes and/or special process listed on the LCR drawing.
- Component / Hardware CofC for each item on the Bill of Materials, includes COTS items.
- PO requirements – Flow down of any specific requirements/instructions.
- CofC.
- Test Report, if applicable.
- Approved LCR waiver for nonconformances, if applicable.

2.12.1 Partial FAI

A partial FAI may be submitted in lieu of a complete FAIR when any of the following occur:

- Change in BOM or Drawing.
- A change in any manufacturing process.

Partial FAIs must meet the requirements of the latest version of AS9102.

2.13 Control of Unclassified Information (CUI)


The supplier shall safeguard CUI from unauthorized disclosure and establish a System Security Plan (SSP) in accordance with NIST Special Publication 800-171, Rev2 (NIST.SP.800-171r2).

2.14 Qualified COTS Parts

This part has been used by LCR or our customer to qualify our system for suitability for use. The supplier shall not change any drawing, process, material (including sub-tier supplier parts), or procedure without prior LCR's written approval, if such drawing, process, material, or procedure was used to qualify items or which was used by the supplier to become a qualified source.

3 Abbreviations/Terms

Term	Definition
QMS	Quality Management System
FOD	Foreign Object Debris or Damage
NOE	Notice of Escape


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FAI	First Article Inspection
FAIR	First Article Inspection Report
ESD	Electrostatic Discharge
RMA	Return Material Authorization
SCAR	Supplier Corrective Action Request
OCM	Original Component Manufacturer
OEM	Original Equipment Manufacturer
ID	Independent Distributor
PO	Purchase Order
CofC	Certificate of Conformance
BOM	Bill of Material
CUI	Control Unclassified Information
SSP	System Security Plan

4 Referenced Documents and Resources

Document Number	Document Title
IP108	Cosmetic Inspection and Rejection Criteria
AS9100	Quality Management System – Requirements for Aviation, Space and Defense Organizations
ISO9001	Quality Management System Requirements
AS9102	Aerospace Services – First Article Inspection Requirements
LCR249	LCR's Supplier Corrective Action Report (SCAR)
AS5553	Counterfeit Electrical, Electronic, and Electromechanical (EEE) Parts; Avoidance, Detection, Mitigation and Disposition
AS6081	Fraudulent/Counterfeit Electronic Parts: Avoidance, Detection, Mitigation, and Disposition - Distributors
LCR280	LCR's Supplier Exception Mitigation Plan
LCR806	LCR's Supplier Request for Waiver form
AS9146	Foreign Object Damage (FOD) Prevention Program – Requirements for Aviation, Space, and Defense Organizations
NAS 412	Foreign Object Damage (FOD) Prevention Guidance Document

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ANSI/ESD S20.20-2021	Protection of Electrical and Electronic Parts, Assemblies and Equipment
J-STD-001	Requirement for Soldering Electrical and Electronic Assemblies
IPC-A-610	Acceptability of Electronic Assemblies
IPC-A-620	Requirements and Acceptance for Cable and Wire Harness Assemblies
J-STD-004	Requirements for Soldering Fluxes
J-STD-005	Requirements for Soldering Pastes
J-STD-006	Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications
J-STD-033	Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices.
J-STD-020	Moisture/Reflow Sensitive Classification for Nonhermetic Surface Mount Devices
J-STD-075	Classification of Non-IC Electronic Components for Assembly Processes
ISO 10012-1	Quality Assurance Requirements for Measuring Equipment - Part 1: Metrological Confirmation System for Measuring Equipment
ANSI/NCSL Z540-2	Requirements for the Calibration of Measuring Test Equipment
CMRT 6.22	Conflict Minerals Reporting Template
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment
IPC-6011	Generic Performance Specification for Printed Boards
IPC-6012	Qualification and Performance Specification for Rigid Printed Boards
NIST.SP.800-171r2	NIST Special Publication 800-171, Rev2
NADCAP accredited supplier's listings	www.eauditnet.com
LCR's Supplier Resource Website	https://www.lcrembeddedsystems.com/supplier-resources/

5 Authorization

Title	Name	Signature	Date
Quality Director	Molly Levy	On File	6/11/2025
Global Sourcing Manager	William Dunkerley	On File	6/11/2025

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6 Revision History

Revision	Reason for Change	Desc. of Change	By Whom
5/20/2024	Initial Release	NA	M. Levy
6/4/2024	Identified missing requirements.	Added requirements for material certs and test reports for PCBs and PWAs	M. Levy
11/20/2024	Updated text printed on the PO.	Added section 2.1.2 which was removed from the PO.	M. Levy
1/17/2025	Added reference to IP108 – missing requirement	Renamed section 2.7 and added section 2.7.3 to reference IP108.	M. Levy
3/3/25	Missing reference to IPC-A-620	Added requirement for IPC-A-620 Class 2 to section 2.5.5 and Class 3 to section 2.6.1.	M. Levy
3/14/2025	CA462	Added Section 2.14 Qualified COTS Parts	M. Levy
6/11/2025	Touch up paint & x-ray inspection	Added section 2.7.2.1 to request touchup paint. Added shipping documentation requirements for x-ray inspection of solder joints to section 2.6.2. Added NADCAP and LCR Supplier Resource websites to table in section 4.	M. Levy