Supplier Quality Assurance Requirements

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1. Introduction

1.1 Purpose

This instruction shall apply to suppliers and their sub-tiers (as applicable) fulfilling Crane Aerospace & Electronics (CA&E) purchase orders. By reference on the purchase order or contract, this document forms a part of said purchase order or contract.

By acceptance of the purchase order, the supplier shall certify that materials and processes supplied under the purchase order shall be or have been controlled and inspected in accordance with the purchase order and that they meet the specified order requirements, application specifications, and drawings.

This instruction provides requirements for a Supplier's Quality Assurance System where the supplier manufactures or procures parts and/or services that will be provided to CA&E for the incorporation into CA&E products.

Nothing in this instruction shall be interpreted as a waiver of any other provision(s) of the purchase order of which this document forms a part.

In case of doubt as to the applicability of this instruction or its interpretation, the supplier shall notify CA&E Supplier Quality via the appropriate CA&E buyer prior to actions that may affect hardware or its documentations.

Note: The Federal Aviation Administration (FAA) shall be notified of plans to use foreign suppliers for the manufacturer of FAA/PMA products or articles, to allow determination of the FAA's ability to perform surveillance.

1.2 Order of Precedence

In the event of conflict between the requirements of this specification and other requirements of the applicable device specification, the precedence in which requirements shall govern, in descending order is as follows:

a. Applicable CA&E Purchase Order

b. CA&E specification or drawing

c. Applicable Statement of Work

d. This instruction

e. Specifications, standards, and other documents referenced herein

1.3 Applicability

This document applies to all employees of CA&E. All CA&E sites will be compliant with the requirements of this procedure. Any deviation to this shall be covered by a specific site procedure.

1.4 Policy

It is the CA&E policy to:
Ensure that externally provided processes, products and services conform to requirements. The organization shall identify and manage the risks associated with the external provision of processes, products, and services, as well as the selection and use of external providers. The organization shall require that external providers apply appropriate controls to their direct and sub-tier external providers, to ensure that requirements are met.

1.5 Abbreviations and Acronyms

AAM: Acceptance Authority Media
AEF: Aerospace and Electronics Form
AEP: Aerospace and Electronics Procedure
AGIS: Aerospace Group Instruction System
AQL: Acceptable Quality Limit
AQMS: Aerospace Quality Management System
CA&E: Crane Aerospace & Electronics
CB: Certification Body
CFR: Code of Federal Regulations
CMM: Coordinate Measurement Machine
COPQ: Cost of Poor Quality
COTS: Commercial Off The Shelf
CPPAP: CA&E Production Part Approval Process
DCMA: Defense Contract Management Agency
DLA: Defense Logistics Agency
DMAIC: Define, Measure, Analyze, Improve and Control
ECM/EDM: Electro-chemical machining / Electro-discharge machining
ECO: Engineering Change Order
ESDS: Electro-Static Discharge Sensitive
FAA: Federal Aviation Administration
FAA/PMA: Federal Aviation Administration/Parts Manufacturer Approval
FAI: First Article Inspection
FAIR: First Article Inspection Requirements
FMEA: Failure Mode and Effects Analysis
FOD: Foreign Object Debris/Damage
FPY: First Pass Yield
GSI: Government Source Inspection
IAQG: International Aerospace Quality
IAQG OASIS: International Aerospace Quality Group Online Aerospace Supplier Information System
IAQG SCMH: International Aerospace Quality Group Supply Chain Management Handbook
ICOP: Industry Controlled Other Party
KPI: Key Performance Indicator
M&TE: Measuring and Test Equipment
MRB: Material Review Board
Nadcap: National Aerospace and Defense Contractors Accreditation Program
NOE: Notice of Escape
PCI: Process Continuous Improvement
PFMEA: Process Failure Mode and Effects Analysis
PPAP: Production Part Approval Process
PPM: Parts per Million
PWB: Printed Wiring Board
QIP: Quality Improvement Plan
QML/QPL: Qualified Manufacturers List / Qualified Products List
QMS: Quality Management System
R&O: Repair and Overhaul
RFQ: Request for Quotation
SCAR: Supplier Corrective Action Report
SCD: Source Control Drawing
SIP: System Integrated Programs
SRR: Supplier Rejection Report

1.6 Related Documents

CA&E Specifications:

- AGIS 40-007: Request for Quotation Process
- AGIS 40-018: Supplier Request for Change Process
- AEP 40-011: Counterfeit Electronic Parts Risk Management Plan
- AEP 40-022: System Integrated Programs and Subcontract Management
- AGIS 40-028: CA&E Production Part Approval Process
- AEF 74-102-01: CA&E Corrective Action Report

Industry Specifications:

- ISO 9001: Quality Management Systems - Requirements
- ISO 10012: Measurement Management Systems – Requirements for Measurement Processes and Measuring Equipment
- ISO/IEC 17025: General Requirements for the Competence of Testing and Calibration Laboratories
- AC7004: Quality Management System Requirements for Nadcap Accredidation
- AS13000: Problem Solving Requirements for Suppliers
- AS9003: Inspection and Test Quality Systems Requirements for Aviation, Space, and Defense Organizations
- AS9006: Deliverable Aerospace Software Supplement for AS100A Quality Management Systems – Aerospace – Requirements for Software
- AS9100: Quality Management Systems – Requirements for Aviation, Space and Defense
- AS9102: Aerospace First Article Inspection Requirement
- AS9103: Quality Management Systems – Variation Management of Key Characteristics
- AS9115: Quality Management Systems – Requirements for Aviation, Space and Defense Organizations – Deliverable Software
- AS9120: Quality Management Systems – Requirements for Aviation, Space and Defense Distributors
- AS9138: Quality Management Systems Statistical Product Acceptance Requirements (supersedes SAE ARP 9013)
- AS9146: Foreign Object Damage (FOD) Prevention Program – Requirements for Aviation, Space and Defense Organizations
- ARP 9134: Supply Chain Risk Management Guideline
- NCSL Z540.1: Calibration Laboratories and Measuring & Test Equipment Requirements

1.7 References

http://www.craneae.com/scm/vendors.aspx
https://www.sae.org/?PORTAL_CODE=IAQG
http://www.sae.org
http://standards.sae.org/
http://www.aia-aerospace.org/standards/
http://www.sae.org/iaqg/handbook/scmhtermsofuse.htm
http://www.dcma.mil/POLICIES/

2. Instructions

The following set of general quality requirements applies to all Suppliers.

2.1 Quality Management System (QMS) Requirements

Suppliers shall maintain a QMS suitable to the products and services provided to CA&E. The system should be certified by an accredited third-party certification body to the latest version of one or more of the following items below, as applicable:

- Distributors/Stockists - shall establish and maintain a QMS that is in compliance with AS9120/EN9120, AS/EN/JISQ 9100 or the latest revision of ISO 9001.
- Calibration Suppliers - shall establish and maintain a measurement management system that is in compliance with either:
  - ANSI/NCSL Z540.1: Calibration Laboratories and Measuring & Test Equipment Requirements; or
  - ISO 10012: Requirements for Measurement Processes and Measuring Equipment; or
  - ISO/IEC 17025: General Requirements for the Competence of Testing and Calibration Laboratories
- Special Process Suppliers - shall establish and maintain a QMS that is in compliance with AS/EN/JISQ 9100, AS9003 or PRI/NADCAP AC7004.
- Software Suppliers (Deliverable Software Only) - shall establish and maintain a QMS that is in compliance with RTCA/DO-178, AS9006 and the Software Engineering Institute Capability Maturity Model guidelines of Level 3, prior to CA&E approval.
- Commercial Off The Shelf Suppliers (COTS) - Suppliers that provide commercial products shall establish a QMS in compliance with the latest revision of ISO 9001, or equivalent.
- All Other Suppliers - shall establish and maintain QMS that is in compliance with AS/EN/JISQ 9100, and a measurement management system which meets the requirements of either ANSI/NCSL Z540.1 or ISO 10012.

Suppliers registered in accordance with AS9104 shall be listed in the International Aerospace Quality Group (IAQG) Online Aerospace Supplier Information System (OASIS) database.

In the absence of an accredited third-party certification the CA&E Buyer and Quality representative may authorize the supplier's QMS is suitable to the products and services provided to CA&E. Evidence for authorization may include second-party (CA&E) audit or first-party (self) assessment to the applicable criteria above, or to a set of alternative basic quality requirements.

CA&E reserves the right to:

- Make final determination regarding compliance to CA&E requirements.
- Change CA&E approval status of Supplier based on Supplier contract compliance.
- Terminate CA&E recognition of Supplier's certification, regardless of previous or current recognition and regardless of Supplier's certification status.
- Conduct assessment of Supplier's QMS.

When Supplier utilizes Certification Body (CB) Aerospace Quality Management System (AQMS) certification as evidence of compliance, the Supplier must ensure the following:

- The CB is accredited to perform AQMS assessments. The CB must use approved auditors and operate in accordance with the IAQG Industry Controlled Other Party (ICOP) certification scheme

as defined in AS/EN/SJAC 9104-001, “Requirements for Aviation, Space, and Defense Quality Management System Certification Programs”.

- Note: Reference IAQG OASIS database for listing of accredited CBs: https://www.sae.org/?PORTAL_CODE=IAQG

- The Supplier maintains objective evidence of CB certification on file at Supplier’s facility. Objective evidence must include:
  - The accredited AQMS certificate(s).
  - The audit reports, including all information pertaining to the audit results in accordance with the applicable certification scheme.
  - Copies of all CB finding(s), objective evidence of acceptance of corrective action, and closure of the finding(s).

Note: Certification records must be maintained in accordance with contractually specified quality record retention requirements.

CA&E recognition of Supplier’s AQMS certification does not affect the right of CA&E to conduct audits and issue findings at the Supplier’s facility.

CA&E reserves the right to provide CA&E identified quality system findings, associated quality system data, and quality performance data to the Supplier’s CB.

2.2 Quality Manual

Upon request, the Supplier shall furnish CA&E with a copy of the Supplier’s QMS Manual, which is to be current and approved by the Supplier's management, and shall include or make reference to related documents. The QMS documentation shall include Supplier’s statements of a quality policy and quality objectives. All QMS documentation exchanged with CA&E shall be written in English. Top management shall define quality objectives and measurements which should address customer expectations and be achievable within a defined period of time. The Supplier shall promptly notify the CA&E Buyer of any substantive changes to the Supplier’s QMS or personnel.

2.3 Compliance to Contractual Requirements

Upon accepting a CA&E contract, the Supplier is responsible for compliance to all contract (e.g., engineering drawing, specification, purchase order) requirements. All documents, drawings and specifications, regardless of origin, are applicable to the Supplier when specified in the contract or documents referenced in the contract, and shall be used at all levels of the supply chain, as provided per AGIS 40-007, Request For Quotation (RFQ) Process. All quality documentation containing units of measure shall be communicated in the unit of measure from sources identified above. Unless otherwise specified in the contract, the document revision in effect on the date of issue of the contract applies to the contract. Neither audit, surveillance, inspection or tests made by CA&E, representatives of CA&E or its customer(s), at Supplier's facilities, at any sub-tier facilities, or upon receipt at CA&E, relieves the Supplier of the responsibility to furnish acceptable products or services that conform to all contract requirements; nor does it preclude subsequent rejection by CA&E or its customers.

2.4 Customer Access Rights

CA&E, CA&E Customers and regulatory agencies reserve the right to have unlimited access to the Supplier's and relevant sub-tier supplier’s facility and records as necessary. The Supplier is subject to initial and periodic reviews including but not limited to onsite audits, offsite reviews of quality documents, quality system surveys and source inspections in order to verify and validate the effectiveness of the QMS. The Supplier shall provide all necessary information, facilities, equipment, documentation and personnel required to perform said activities at no additional cost to CA&E. These reviews will be used to

determine the approval status of all CA&E suppliers. Failure to accommodate the above mentioned reviews may result in the disqualification of the Supplier for future CA&E purchase orders.

2.5 Franchised Distributors

Franchised distributors for electronic components are only authorized to provide components from manufacturers with whom they have a franchise license. The procurement of electronic components from a non-franchised distributor (i.e., broker), by and Crane supplier shall be approved by CA&E Component Engineering group and such approval shall be documented via AEP 40-011, Counterfeit Electronic Parts Risk Management Plan, Form AG70-045 (Attachment C) “Counterfeit Risk Assessment / Broker Purchase Request”.

2.6 Control of Sub-Tier Suppliers

The Supplier, as the recipient of the contract, is responsible for meeting all requirements, including work performed by the Supplier's sub-tier Suppliers (also known as Sub-Suppliers or subcontract Suppliers). When the Supplier uses sub-tier sources to perform work on products and/or services scheduled for delivery to CA&E, the Supplier shall include (flow-down) on contracts to its sub-tier sources, all of the applicable technical and quality requirements contained in the CA&E contract This includes quality system requirements, regulatory requirements, the use of CA&E designated sources, and the requirement to document and control 'key characteristics' and/or 'key processes,' and to furnish certifications and test reports as required. CA&E, its customers and Regulatory Authorities reserve the right of entry to sub-tier facilities, subject to proprietary considerations.

Changes from one approved sub-tier supplier to another, within that commodity type requires CA&E notification. The CA&E supplier is responsible for obtaining and maintaining First Article Inspection Requirements (FAIR) from these sub-tier suppliers as required in 3.2 herein.

2.7 Special Process Suppliers

Special processes are defined as processes for which the results cannot be fully verified by subsequent inspection and testing of product. Suppliers (including-sub tier suppliers) performing special processes on CA&E designed parts shall be Nadcap accredited, or the supplier shall have been audited and approved for the special process by the CA&E. Suppliers listed on the Boeing or GE approved processors list (for use on Boeing and GE product only) for the specific processes are exempt from this requirement as are those suppliers that have been audited and approved by CA&E for the special processes.

2.8 Risk Management

The Supplier shall establish a risk management program in accordance with the guidelines established by SAE ARP9134 (or equivalent) to effectively assess those elements from all aspects of the business that could affect the quality of the products and/or services scheduled for delivery to CA&E. A copy of the Supplier’s risk management program shall be furnished to the CA&E Buyer upon request.

2.9 Control and Release of CA&E Furnished Documents

Documents furnished by CA&E to the Supplier are furnished solely for the purpose of doing business with CA&E. Proprietary documents may be furnished to the Supplier in hard copy, electronic or other media. The Supplier is responsible for controlling and maintaining such documents to preclude improper use, loss, damage, alteration and/or deterioration.

Unless authorized by the CA&E Buyer in writing, the Supplier may not transmit or furnish any CA&E furnished documents, or copies of such documents, to anyone outside the Supplier's business organization except to a sub-tier source used by the Supplier for performance of work on the CA&E contract.

2.10 Electronic Documents

The accuracy and authenticity of electronic documents and forms submitted to CA&E is of highest importance. The following rules apply and may be subject to review by CA&E at Suppliers facilities:

- The issue of electronic documents and application of electronic signatures must be under the direct control of the individual whose name appears on the electronic document
- The electronic signatures may only be applied at the place where the individual is located and the individual must have direct access and responsibility for the products or services described in the electronic document
- The application of the electronic signature certifies that the signature (individual) represents an authorized company representative

The use of electronic forms and signatures must be described in and governed by Supplier's documented procedures.

2.11 Application of Acceptance Authority Media (AAM)

Supplier shall comply with the AS/EN/JISQ 9100 requirements and 14CFR Part 21.2 regarding the application of the Acceptance Authority Media (AAM) requirements.

Supplier shall, within its organization and its supply chain, ensure that the use of AAM is clearly defined within its QMS.

Supplier shall, upon CA&E request, be able to demonstrate evidence of communication to its employees and to its supply chain.

Supplier shall maintain compliance to the AAM requirements by assessing its process and supply chain as part of its internal audit activities. The areas of focus of this assessment shall include but not limited to:

- Authority Media Application Errors (i.e. Omission, Typos, Legibility, etc.)
- Authority Media Application Untimely Use (i.e. Documentation is not completed as planned, "Stamp/Sign as you go", etc.)
- Authority Media Application Misrepresentation (i.e., Uncertified personnel, Falsification of documentation, Work not performed as planned, etc.)
- Authority Media Application Training Deficiencies (i.e. Ethics, Culture awareness, Proper use of authority media, etc.)

2.12 Federal Aviation Administration Regulations

The following requirements apply (3.10.1 and 3.10.2) when the contract specifies that it is for products/services to be performed for CA&E Repair and Overhaul (R&O). Any work performed for CA&E R&O is considered safety sensitive work (14CFR Part 145).

2.12.1 Anti-Drug and Alcohol Misuse Prevention Program

All Supplier employees (including any Supplier's sub-tier employees) performing maintenance or inspection of products scheduled for delivery to CA&E shall be included and part of a FAA approved Anti-Drug and Alcohol Misuse Prevention Program. The requirement applies both to pre-employment and random testing of current employees in accordance with the requirements of 14 CFR Part 121, Appendix "I" and Appendix "J". Evidence of compliance to this requirement shall be made available to CA&E upon request.

2.12.2 Duty Time Limitations

Any person performing maintenance or preventive maintenance functions on customer owned equipment shall be relieved for a period of at least twenty-four (24) consecutive hours during any seven (7) consecutive days, or the equivalent thereof within any one (1) calendar month as required by 14 CFR 121.377.

2.13 Business Continuity

The Supplier shall have a business continuity plan which would allow for the safeguarding, storage and recovery, of engineering drawings, electronic media, and production tooling in the event of damage or loss. This plan should also contain contingency plans to satisfy CA&E requirements in the event of significant utility interruptions, labor shortages, equipment failure and field returns.

2.14 Personnel Awareness

The supplier shall ensure their employees and sub-tier suppliers are aware of their contribution to product or service conformity, to product safety, and the importance of ethical behavior.

2.15 Training and Competency

The supplier shall ensure their employees and sub-tier suppliers are qualified and trained (internally or externally) as applicable to ensure product or service conformity. Records of this qualification or training shall be maintained and made available upon request.

3. Product Qualification

This section defines the generic requirements for production part qualification and approval. The purpose is to determine if all CA&E design and specification requirements are properly understood by the Supplier and that the manufacturing processes have the capability to consistently meet these requirements. In all instances where a product is manufactured to a new design, for a new system, or for a new application, it is important that Supplier and CA&E allocate responsibility for assuring that all performance, endurance, maintenance, safety and warning requirements are met.

3.1 Design and Development Control of System Integrated Programs (SIP)

When required by the CA&E contract, supplier(s) providing a supplier designed product to a CA&E Design Specification, the supplier shall have a process to ensure compliance to all specified requirements (e.g. compliance matrix) and documented validation activities (e.g. Qualification by Analysis, Qualification Testing, Qualification by Similarity). Refer to AEP 40-022, System Integrated Programs and Subcontract Management for additional requirements.

3.2 First Article Inspection Requirements (FAIR)

The FAIR process is used to demonstrate the adequacy of supplier gauging, manufacturing and inspection processes and to ensure that all design and specification requirements have been understood, accounted for, verified and documented.

See AS/EN/SJAC 9102 “Aerospace First Article Inspection Requirement” for hardware FAIR. CA&E has adopted AS9102 as its supplier requirement for applicable purchased hardware FAIR, as flowed by the purchase document.

Note: Existing hardware FAIR records created prior to an AS9102 flow down are not required to be updated to meet the standard. However, the current FAIR process and any subsequent partial or re-accomplishment records shall be compliant.

All dimensional characteristics specified and any special testing performed, that are documented on AS9102 Form 3, the tool(s) used for measurement and/or testing shall be identified in column 10.

The supplier is required to document all characteristics represented on the CA&E drawing, on a representative part and/or assembly selected from the initial production process.

A copy of all FAIR documentation is to be provided to CA&E with the initial shipment of parts. If the representative part on which the FAIR was performed is to be included in the shipment to CA&E, the part should be clearly identified. In special circumstances, CA&E may require that first article documentation

and representative part be submitted prior to delivering production parts. All shipments that contain FAIR documents should be clearly labeled on the outside container as containing First Article Documentation.

3.2.1 Printed Wiring Board (PWB) FAIR

When required by the CA&E contract, in addition to the General First Article requirements specified in this section, PWB manufactures shall also submit, as part of the First Article, the following:

- Acceptance Test data (Group A or IPC Acceptance Test results as applicable).
- Laminate and Prepreg material Certificate of Conformances.

Note: In Process Inspection data is not required.

For PWB breakaway tabs, the detail dimensions of the tabs need only be verified and documented for one detail area.

On panel drawings, positions of breakaway tabs on each board need only be verified on one board per panel.

3.2.2 First Article Inspection (FAI) Software

When required by the CA&E contract, see AS9115 “Quality Management Systems - Requirements for Aviation, Space and Defense Organizations - Deliverable Software” for software FAI. (Note: AS9102 does not apply to software.) CA&E has adopted AS9115 as its supplier QMS requirement supplement for applicable purchased software, as flowed by the purchase document. Requirements for FAI of software are embedded in AS9115 under the Control of Production and Service Provision.

3.2.3 Component Testing or Screening FAI

When required by the CA&E contract, suppliers providing electronic components that are tested or screened in accordance with General Specification or Source Control Drawing (SCD) requirements do not require an AS9102 FAI but must provide the following:

- First time set-up part numbers require burn-in schematics and test routing. The schematics and routing must be submitted to CA&E Component Engineering group for approval.
- Supplier shall submit a 5 piece datalog prior to the shipment of any new device to verify the test software performance. This shall be submitted to CA&E Component Engineering for approval.
- Any major software change, such as moving to a new test platform, will require a resubmission of the 5 piece datalog to Component Engineering for approval.

3.3 Production Part Approval Process (PPAP)

When required by the CA&E contract, the Supplier shall submit to CA&E a qualification package, CA&E Production Part Approval Process (CPPAP) as defined in AGIS 40-028.

3.4 Manufacturing Process Documentation

When required by the CA&E contract, the Supplier shall submit to CA&E a Manufacturing Process Documentation package, which shall consist of the following:

A. Process Flow Diagram
The Supplier shall have a visual diagram of the proposed or current process. This diagram shall clearly describe the production process steps and sequence, and meet the specified CA&E needs, requirements and expectations.

B. Failure Mode and Effects Analysis (FMEA)
Suppliers with product design responsibility shall develop a Design FMEA in accordance with, and compliant to, CA&E-specified requirements. A single Design FMEA may be applied to a family of similar parts or materials. Suppliers shall develop a Process FMEA in accordance with, and compliant

to, CA&E-specified requirements. A single Process FMEA may be applied to a process manufacturing a family of similar parts or materials if reviewed for commonality by the Supplier.

C. Control Plan
The Supplier shall have a Control Plan that takes into account the output from the FMEA and defines all methods used for process monitoring and control of special product/process characteristics. The control plan covers pre-launch and production phases. A single control plan may apply to a group or family of products that are produced by the same process at the same source.

Supplier may utilize a process consistent with Process FMEA and Control Plans as defined by AS13004, Process Failure Mode and Effects Analysis (PFMEA) and Control Plans.

4. Process Control

This section defines the basic necessities for Suppliers to control their manufacturing processes.

4.1 Test Reports

When specified on the CA&E drawing, specification or purchase order, Inspection measurements and/or electrical test results (i.e., Groups A, B, C, D, solderability etc.) of items listed on the purchase order shall be taken and included with each purchase order shipment. Actual data to be recorded shall be as specified in the detailed specification/drawing or purchase order. The supplier shall ensure that products failing to meet performance requirements are not shipped to CA&E unless otherwise specified in writing by CA&E. As a minimum, test data shall include:

- The CA&E part number and revision.
- The CA&E Purchase Order number.
- Supplier's Acceptance Test Procedure number (as applicable) and revision date.
- Characteristic(s) measured.
- Date of test completion
- Evidence of test acceptance by Supplier.

4.2 Foreign Object Debris/Damage (FOD)

The supplier shall establish and maintain a FOD prevention program. The prevention program shall include the review of design and manufacturing processes to identify and eliminate foreign object entrapment areas and paths through which foreign objects can migrate. The supplier shall ensure that work is accomplished in a manner preventing foreign objects or material in deliverable items.

Recommended documents for a FOD programs are:

- AS/EN/SJAC 9146, "Foreign Object Damage (FOD) Prevention Program – Requirements for Aviation, Space, and Defense Organizations.
- D6-85622, "Foreign Object Debris/Foreign Object Damage (FOD) Prevention Requirements for Boeing Suppliers"
- NAS 412, "Foreign Object Damage / Foreign Object Debris (FOD) Prevention". NAS 412 is a National Aerospace Standard (NAS) developed and published through the Aerospace Industries Association (AIA).
- International Aerospace Quality Group (IAQG) Supply Chain Management Handbook (SCMH) Section 3.4, "Foreign Object Debris". IAQG/SCMH Section 3.4 is published through the IAQG.
- For issued under Defense Contract Management Agency (DCMA) provisions, Policy 8210-1 (aka 8120.1), "Contractor's Flight and Ground Operations" applicable sections addressing FOD. DCMA 8210-1 is a Defense contract Management Agency policy published through the DCMA.

4.3 Software Control Requirements

Non-deliverable software that is used to inspect physical characteristics or attributes of the product (e.g. CMM) and software used in the manufacture of the product (e.g. NC machines, automated test systems) shall be controlled by the supplier to ensure that the software development (i.e., procedure(s) authorizations, methods of acceptance etc.), testing (i.e., validation, adequate for intended use etc.), documentation (i.e., test criteria, allowing for subsequent software maintenance etc.), and library control (i.e., revisions identified, no unauthorized use etc.) are adequately controlled and maintained.

4.4 Key Characteristics

When key characteristics are specified by the contract or drawing, the Supplier shall demonstrate conformity to those key characteristics designated by CA&E through means of documentation and appropriate control methods. In addition to any key characteristics identified by CA&E, the Supplier shall also review, identify, document, and control other product and process characteristics that are key to achieving quality. Unless otherwise specified in the PO, contract or drawing, the Suppliers variation management program shall be in compliance with requirements of AS/EN/SJAC9103.

4.5 Control of Monitoring and Measuring Devices

The Supplier shall determine the monitoring and measurement to be undertaken and the monitoring and measuring devices needed to provide evidence of conformity of product to determined requirements. As a minimum, where necessary to ensure valid results, measuring equipment shall:

a. be calibrated or verified at specified intervals, or prior to use, against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification shall be recorded; and

b. be identified to enable the calibration status to be determined.

Unless otherwise specified by contract, the Supplier shall establish procedures to control Measuring and Test Equipment (M&TE) that are in compliance with the requirements of ANSI/NCSL Z540-1 or ISO 10012.

4.6 Preventive Maintenance

The Supplier should identify key process equipment and provide resources for machine/equipment maintenance activities and develop an effective planned total preventive maintenance system.

4.7 Source Inspection

When required by the CA&E contract, supplier's products or services may be subject to source inspection by CA&E, representatives of CA&E or applicable government or regulatory agencies. Source inspection requirements may apply to any and all operations performed by the Supplier or the Supplier's sub-tier sources, including prior to delivery of products to CA&E. The Supplier shall provide the necessary access, equipment and resources required to effectively accomplish the source inspection.

4.7.1 CA&E Source Inspection

When CA&E Source Inspection of completed article(s) to be delivered under the subcontract/purchase order is required, the supplier shall notify the appropriate CA&E buyer at least forty-eight (48) hours in advance of article(s) being ready for CA&E Source Inspection. At the time of source inspection, the supplier shall furnish:

- Copy of the latest revision of the purchase order.
- Complete manufacturing inspection records for the article(s) including First Article documentation if applicable.
- All applicable drawings, specifications, and standards
- Necessary facilities including equipment and personnel qualified to demonstrate conformance of the article(s) to all purchase order/detail specification requirements.

At CA&E's option, Source Inspection may be waived at any time during the life of the order. In such case written documentation from the CA&E Supplier Quality Engineering indicating said waiver shall be obtained by the supplier and included or referenced with each shipment of covered article(s).

4.7.2 Government Source Inspection (GSI)

When government source inspection is required on the contract, it must be performed prior to shipment from the Supplier's facility. Upon receipt of the purchase order, promptly notify the Government Representative who normally services your facility so that appropriate planning for Government inspection can be accomplished. If authorized by the Government Representative, copies of the purchase order are to be furnished directly by the supplier to the Government Representative at the supplier's facility. In this event, the following statement applies: "On receipt of this order, promptly furnish a copy of this order to the Government Representative who normally services your facility, or if none, to the nearest Army, Air Force, or Defense Logistics Agency (DLA) inspection office. In the event the representative of office cannot be located, the CA&E buyer shall be notified immediately."

4.8 Limited Shelf Life Materials

When required by the CA&E contract, the supplier shall identify all materials and articles that have definite characteristics of quality degradation with age or environment. The supplier shall affix this information directly on the material container or article. This identification shall indicate the date useful life was initiated and the date or cycle at which the useful life will be expended. When environment is a factor in determining useful life, the identification shall include the storage conditions (i.e., temperature, humidity, etc.) required to achieve the stated life. When supplier is manufacturing or procuring (distributor) to an CA&E Material Specification, the useful shelf life remaining shall be equal to or greater than the minimum shelf life specified in the applicable specification.

Age sensitive elastomeric items shall have a minimum of 5 years useful life remaining upon receipt.

4.9 Sampling Inspection

The Supplier is responsible for 100% verified quality for all items delivered to CA&E. When the Supplier elects to use statistical methods for the acceptance of products or processes, such methods shall be in compliance with the requirements established by SAE ARP9013, 9013/1, 9013/2, 9013/3 and 9013/4 as applicable, except that in all cases the sample sizes shall be AQL 4.0 or higher (e.g., AQL 1.0, .65) and the criteria for lot acceptance as zero (i.e., C=0). A copy of Suppliers statistical process control plan shall be furnished to CA&E upon request.

4.10 Verification of Raw Materials and Procurement Limitations

When specified on the purchase order or contract, the first shipment from a new material lot must include a test coupon suitable for chemical and physical analysis. Optionally, the supplier may send the coupon to an independent testing facility agreeable to CA&E and forward the test results with the parts. Test reports must contain lot number, material description, and actual values of all properties.

4.11 Electro-Static Discharge Sensitive (ESDS) Materials

The following requirements apply to materials, devices, or assemblies identified by CA&E drawing or by purchase order as ESDS and capable of being degraded, damaged, or destroyed by electrostatic charges or discharges.

A. Manufacturers:

All items shall be preserved, packaged, and packed in such a manner as to prevent exposure to the generation or discharge of electrostatic voltages

B. Distributors:

Packaging shall be compliant to either JEDEC 108 (Distributor Requirements for Handling Electrostatic-Discharge Sensitive Devices) or EIA 625 (Requirements for Handling Electrostatic-

Discharge-Sensitive (ESDS) Devices) requirements. Parts shall be clearly marked or labeled to indicate that the contents are subjected to damage or degradation by electrostatic discharge.

C. All Suppliers:

Supplier shall maintain a documented system for the control and handling of ESDS materials.

4.12 Control of CA&E Supplied Product

Upon receipt of the CA&E furnished Material, the supplier shall conduct identification and damage inspection of materials. Any CA&E product that is damaged or is otherwise unsuitable for use shall be documented and reported to the CA&E buyer within three working days of receipt.

4.13 Casting and Forging Fabricators

Weld repair is not permitted without the prior written authorization of the CA&E Buyer and Supplier Quality Engineering.

4.14 Restrictions on Acquisition of Specialty Metals per DFARS 252.225-7008 and Certain Articles Containing Specialty Metals per DFARS 252.225-7009

Raw materials that are specialty metals, or articles containing specialty metals, received by suppliers from international sources with the intent to be delivered to CA&E, shall be approved, in writing, by the appropriate CA&E Supply Chain Manager prior to shipment to CA&E.

All government contracts and subcontracts include the clauses entitled Restriction on Acquisition of Specialty Metals (DFARS 252.225-7008) and/or Restriction on Acquisition of Certain Articles Containing Specialty Metals (DFARS 252.225-7009).These clauses require that any specialty metals (as defined in the clause) or specialty metals incorporated into products delivered under the subcontract be melted or produced in the United States, its outlying areas, or qualifying country. Compliance with this requirement is mandatory unless the exceptions contained in the clause are applicable.

4.15 Restrictions on Acquisition of Ball and Roller Bearings per DFARS 252.225-7016

Ball bearings received by suppliers from international sources with the intent to be delivered to CA&E shall be approved, in writing, by the appropriate CA&E Supply Chain Manager prior to shipment to the CA&E.

Each ball and roller bearing shall be manufactured in the United States, its outlying areas, or Canada; and for each ball or roller bearing, the cost of the bearing components mined, produced, or manufactured in the United States, its outlying areas, or Canada shall exceed 50 percent of the total cost of the bearing components of that ball or roller bearing.

5. Change Control

The Supplier is responsible for controlling changes and notifying the CA&E Buyer of all changes to the approved part design, manufacturing process, or site.

5.1 Change Control Process

The Supplier shall have a process to ensure that relevant versions of applicable documents furnished by CA&E (as well as those specified of external origin) are available at the applicable points of use. Internal documentation used to build product must comply with the applicable CA&E specification or drawing requirements.

The Supplier is responsible for the timely review of all CA&E engineering standards/specifications and changes in accordance with the schedule required by CA&E. Implementation of changes shall be in

accordance with the CA&E Engineering Change Order (ECO) or disposition sheet or the applicable revisions specified on the PO. The Supplier shall maintain a record of the date on which each change is implemented in production. Implementation shall include updated documents.

5.2 Supplier Change Requests

Suppliers shall not make changes which may affect product design, form, fit or function, without written approval from the CA&E Buyer. Such changes may include, but are not limited to, changes to their processes, location, facilities, equipment, material, or product design.

Suppliers shall use the forms and procedures detailed in AGIS 40-018 Supplier Request for Change Process, to communicate requests for changes to CA&E. Formal approval by CA&E shall be obtained prior to implementation of the change.

The supplier shall notify the CA&E buyer for any of the following changes:

Product modified by an engineering change to design records, specifications, or materials; or

Any planned changes by the Supplier to the design, process, or manufacturing location, such as:

a) Use of other material than was used in previously approved part or product
b) Production from new, additional, replacement or modified tools, dies, molds, patterns, etc.
c) Production following upgrade or rearrangement of existing tooling or equipment
d) Production from tooling and equipment transferred to a different plant site or from an additional plant
e) Change of sub-tier Supplier for parts, nonequivalent materials, or services (e.g. heat treating, plating, etc.)
f) Product produced after tooling has been inactive for production for 12 months or more
g) Change to test/inspection method – new technique (no effect on acceptance criteria)
h) For bulk materials: new source of raw material from new or existing Supplier, or change in product appearance attributes, etc.
i) Use of any non-conventional manufacturing methods such as electro-discharge machining (EDM), electro-chemical machining (ECM), laser or abrasive water jet metal cutting, flame spray coatings, etc.
j) Change in manufacturing facility.

When change approval is required, before submitting a permanent change request to CA&E for a Supplier-controlled design, the Supplier shall review the FMEA and Control Plan, as applicable, to ensure that all process-related issues have been addressed and resolved. CA&E may require the Supplier to submit an updated FMEA and Control Plan prior to approval of such permanent changes. CA&E may also require other portions, or all, of the related qualification process to be repeated.

6. Control of Nonconforming Material

For nonconforming products supplied to CA&E, including those that reach a CA&E customer, the Supplier must cover all costs to correct the nonconformance.

6.1 Submittal of Non-Conforming Material

The Supplier Rejection Report (SRR) provides a means for the supplier to report part non-conformances prior to delivery to CAE. The supplier shall not submit discrepant parts prior to disposition of the SRR unless specifically instructed to do so in writing by CAE Purchasing Department. The form/process

provides for predisposition of such parts or material prior to handling at the CAE facility and to obtain corrective action to prevent recurrence of such non-conformances.

If non-conforming material is submitted in multiple shipments, a copy of the signed-off SRR form shall accompany each shipment.

In all cases, the supplier certification of conformance or pack slip shall indicate that the material is non-conforming and shall reference the SRR by number. Any parts shipped to CA&E that have been approved for deviation shall be clearly identified as such on the shipping documentation. Inside of each box shall contain a copy of the CA&E-Approved SRR.

6.2 Re-Submittal of Material Rejected by CA&E

All items rejected by CA&E and subsequently re-submitted by the supplier, shall be shipped segregated and accompanied by a copy of the original rejection report. Any certifications or test reports originally required with the shipment shall also be included with the re-submitted material.

6.3 Supplier Containment

For product quality problems reported by CA&E to the Supplier, until formal corrective action has been taken and approved, the Supplier shall provide documented evidence with subsequent shipments that such product has been inspected for the identified non-conformances and meets all applicable requirements. In addition, nonconforming product may be returned to the Supplier at Supplier expense, or the Supplier may be required to sort any suspect product already shipped to CA&E sites or be charged back for the cost of sorting by CA&E.

6.4 Material Review Board (MRB) Authority

At no time shall supplier assume MRB authority without the expressed written authorization from CA&E Supplier Quality Engineering. Dispositions not authorized include Repair to Variation and Accept for Use.

6.5 Notice of Escape (NOE)

In the event that a non-conformance is discovered at any time following shipment of the product, the applicable CA&E Supply Chain Manager shall be notified immediately. As a minimum, the notification shall include the following:

- Part Number
- Purchase Order Number(s)
- Quantity
- Dates shipped and/or date code information as required to identify non-conforming parts
- Defect description
- Containment of Condition
- Recommended disposition
- Root cause of defect
- Corrective action taken to prevent reoccurrence of the non-conformance

7. Packaging, Labeling, Delivery & Record Retention

Preservation, packaging, labeling, and shipping methods must comply with common industry practices and CA&E requirements specified on the contract.

7.1 Preservation

In order to prevent deterioration, the condition of product in stock should be assessed at appropriate planned intervals.

7.2 Packaging

The supplier is responsible for assuring that all items are delivered without damage or deterioration and are efficiently and economically packed for the method of transportation and type of handling involved. Unit and intermediate packaging shall be employed as necessary to prevent damage or deterioration.

7.3 Labeling

Each shipping container and intermediate package shall be identified with:

- Purchase Order Number
- Part number
- Quantity
- Manufacturer name and Cage Code (if known)
- ESDS warning (when applicable)
- Cautionary Handling Instructions (as applicable)
- The requirements of CFR 49 if the item being delivered is classified “HAZARDOUS”.

7.4 Drop Shipment of CA&E Product From Supplier to CA&E Customer (CA&E-Verification at Supplier Premises)

In the event that the supplier is required to deliver product directly to a CA&E customer, the supplier and CA&E shall agree, in writing, to the terms, conditions, and associated requirements applicable for ensuring full compliance to CA&E customer requirements. The documentation will include product verification arrangements, integrity of product while in shipment, and the method of product release. The written and agreed upon document shall be attached to all appropriate CA&E purchase orders to supplier.

7.5 Certificate of Conformance

The Contractor shall submit with each shipment a certificate by the Supplier/Contractor's Quality Representative that the materials furnished to CA&E Electronics are in conformance with applicable requirements of the contract, drawings and specifications and that supporting documentation is on file and will be made available to the CA&E Electronics or Government representatives upon request.

Military Specifications and standards referenced shall be to the latest revision level in effect on the date of this order, unless specified otherwise.

The C of C shall include a statement that the items meet the requirements of the purchase order and/or specifications referenced on the drawing and/or purchase order. CA&E requires that this requirement be included in Sellers direct supply contracts as well as the obligation that it be flowed to the sub-tier supply chain. C of C's must include, as a minimum, the following information:

- Supplier name and address
- Serial number(s), as applicable
- CA&E Electronics purchase order number
- Quantity of parts in shipment
- Part number on purchase order
- Statement certifying product compliance
- Part revision on purchase order
- Signature, stamp, or Electronic ID of authorizing agent
- Date code(s) or lot number(s) covering all items and quantity for each date code/lot number
- Date of C of C

A. For Manufacturers of off the shelf industry standard parts, assemblies or materials; Franchised Distributors and/or Brokers (i.e. non-franchised supplier dealing with discontinued or hard to find

parts); and suppliers of Materials/parts produced to Government or Industry Specifications that have identified approved sources (e.g. QPL, QML, DESC, CA&E SCD):

- If the supplier is not the product manufacturer, the supplier shall furnish either a certificate identifying the manufacturer who was a qualified source at the time of the purchase, or objective evidence of the manufacturers' identity.

B. For Subcontract Manufacturers providing products produced to CA&E drawings a Certificate of Conformance shall be submitted with each order specifically referencing the serial numbers of all units in the shipment (when applicable) and the work order number(s) that they were produced against.

C. For Fabricators and Casting Fabricators providing products produced to CA&E drawings: a Certificate of Conformance shall be submitted with each order. The material(s) used and processes performed as specified on the CA&E drawing shall be specifically referenced on the Certificate of Conformance. Where any material has been provided by a sub-tier supplier, or processes have been performed by sub-tier suppliers, the supplier shall provide copies of the sub-tier supplier's certifications for materials and/or processes provided / performed.

- Certifications for cast products shall reference actual chemical and physical properties of the items being delivered.

D. For Fabricators of PWBs produced to CA&E drawings a Certificate of Conformance shall be submitted with each order.

- In addition the following is required once per date code:
    - Laminate Certificate of Conformance
    - Cross Section Analysis detailing requirements of the specification referenced on the drawing. (may be submitted on Supplier's form)
    - With the exception of First Article requirements, Certificate of Conformance of Prepreg laminate identified on the CA&E drawing is not required to be submitted with the shipment.

E. For Processors, Special Services and Screening Facilities:

A Certificate of Conformance shall be submitted with each order that specifically reference all part, test and process specifications on the purchase order, and/or include certifications from any sub-tier suppliers for the processes they have performed.

Note: Completed test data submitted with order may be used in lieu of Certificate of Conformance statements.

F. For Suppliers Providing Raw Materials:

Certificate of Conformance shall be submitted with each order that references the referenced specification with revision/amendment and actual chemical/physical properties, including values or lot traceability to the melt (lot, heat, melt number, production date or item serial number.)

G. Commercial Off The Shelf Parts (COTS):

The Contractor shall submit with each shipment a certificate by the Supplier's Quality Representative that the materials furnished to CA&E Electronics meet the requirements of the purchase order. Date code(s) or lot number(s) are not required on the certificate of conformance.

7.6 Record Retention

The Supplier shall maintain all records that provide objective evidence of compliance to CA&E contract requirements for a minimum of calendar year plus ten (10) years, or as defined by contract, after last delivery of products and/or services on the contract. Upon request, the Supplier shall be capable of retrieving and delivering required records to CA&E within forty-eight hours from time of request by CA&E.

Prior to discarding, transferring to another organization, or destruction of such records, the Supplier shall notify the CA&E Buyer in writing and give CA&E the opportunity to gain possession of the records. These requirements are applicable to records generated by Supplier's sub-tier sources.

The supplier shall retain documented information, including records, of inspection and tests performed in the course of providing materials and services against this purchase order. This documented information shall be on file subject to examination by CA&E representatives.

8. Continual Improvement

Suppliers should define a process for continual improvement. A copy of the Supplier's continual improvement program shall be furnished to CA&E upon request.

8.1 Problem Solving Process

Suppliers should use a closed-loop problem solving process whenever a problem is encountered internally or upon request from CA&E. Examples include 8D methodology, DMAIC, 5-Why, etc.

8.2 Supplier Corrective Action

CA&E may issue a request for a Supplier Corrective Action Report (SCAR) to the Supplier when nonconforming material, components, or assemblies are found. When a formal reply is requested (whether hard copy or electronic media), the Supplier should use Corrective Action Report (Form AEF 74-102-01) or a process consistent with 8D methodology as defined by AS13000, Problem Solving Requirements for Suppliers.

The Supplier shall promptly acknowledge receipt of notification and communicate to CA&E the immediate containment actions to be taken. ***Within 1 business day.***

The Supplier shall provide an update of the containment plan to protect CA&E during the interim period between containment and corrective action completion. This update must include:

- Confirmation that the Supplier has identified all suspect product in process, in stock, in transit, and potentially at any CA&E site by lot number or serial number, CA&E contract number, and quantity. Additional specific containment actions needed to be taken by the Supplier and/or CA&E. ***Within 3 business days.***

The Supplier must submit the completed SCAR indicating the permanent actions taken, or to be taken, to prevent recurrence of the same problem, to prevent the occurrence of similar problems, and the applicable effectivity dates. ***Within 30 business days.***

CA&E reserves the right to reject any containment, root cause and/or corrective action submittal provided by the Supplier, and may request additional investigation to complete supplier correction action.

8.3 Quality Improvement Plans

A Quality Improvement Plan (QIP) is used to drive improvements through the CA&E supply chain. QIP deployment may occur based on supplier performance, risk analysis of the CA&E supply chain or driven by specific quality events. The QIP is a focused tool used to plan and report against continuous improvement activities focused on improving a supplier's performance and limiting escapes.

The plan is developed and owned by the supplier with approval by the CA&E Supplier Quality Engineer. The ownership of plan completion lies with the supplier with monitoring and support provided by CA&E. The supplier shall conduct an analysis of gaps in their current system and create an action plan to address gaps.

Supplier Quality Improvement Form 104-225 may be used to implement the QIP. Suppliers may also use their own forms with the following minimum requirements:

- Section headings linking actions to the gap analysis or improvement metric
- Detailed tasks
- Owners
- Planned due dates
- Actual completion dates

Leadership at the supplier shall sign off on the QIP and delegate resources. The delegated resource is responsible for maintaining the plan and reporting status to CA&E.

The supplier is responsible for conducting an analysis of their current quality performance. The analysis may use, but is not limited to, tools such as Pareto analysis, 5-why's, cause and effect diagrams. Based on the analysis of the supplier's quality performance; gaps, root cause and corrective actions shall be identified in the QIP.

Additionally, a QIP Key Performance Indicator (KPI) included should reflect the improvement areas and may include:

- Notice of Escape (NOE)
- Parts Per Million (PPM)
- Cost of Poor Quality (COPQ)
- First Pass Yield (FPY)
- Process capability

QIPs shall be reviewed periodically with the CA&E Supplier Quality Engineer with a frequency appropriate to improvement made.

9. Supplier Performance

CA&E's evaluation system uses a number of factors, such as Quality, Delivery, and Process Continuous Improvement (PCI) to develop an overall Supplier performance rating. This rating serves as an objective measure to determine whether CA&E expectations are being met.

9.1 Performance Measures

CA&E evaluates supplier performance in the areas of quality, schedule and cost as applicable.

CA&E expectation is:

A. Supplier will monitor quality and deliver performance using key performance indicators
B. 100% quality performance, and 100% on-time and in-full delivery performance
C. Supplier will monitor the implementation of QIPs and evaluate the effectiveness of the results

Supplier is expected to analyze non-satisfactory performance and implement actions to drive continual improvement in Quality and Delivery performance.

The supplier is responsible for complying with quality system requirements noted herein and for meeting performance expectations. Failure to comply with requirements or to achieve an acceptable performance level may result in an on-site audit or additional source inspection oversight at the supplier's expense. Crane reserves the right to debit or invoice supplier accounts to compensate for inspection or related activities that take place as a result of supplier responsible non-conformances.

10. RACI

Responsibilities, **A**ccountabilities, **C**onsult or **I**nform Chart

Accountable: Delegates and Assigns Work *Responsible: Those Who Do the Work*
Consult: Subject Matter Experts *Inform: Kept Up-to-date on Progress*

Tasks	CAE Source	Buyer	SQE	Supplier	Supply Chain Manager
1. Identify Requirements	R	I	R	-	I
2. Collect Requirements	-	R	I	-	A
3. Issue PO to Supplier (40-009)	-	R	I	-	A
4. (Via PO) Issue Supplier Quality Assurance Requirements (40-002)	-	R	I	-	A
5. Supplier PO/40-002 Compliance review	-	C	C	R	C
6. Supplier PO acknowledgement	-	I	I	R	I
7. Buyer documents PO acknowledgement	-	R	I	-	A
8. Maintain QMS	-	I	I	A, R	-
9. Product Qualification	C, I	I	I	A, R	-
10. Process Control	-	I	I	A, R	-
11. Change Control	I	I	I	A, R	-
12. Control of Nonconforming Material	-	I	I	A, R	-
13. Packaging, Labeling, Delivery & Record Retention	-	I	I	A, R	-
14. Continual Improvement	-	A	A	A, R	I
15. Maintain Supplier Performance	-	A	A	A, R	I