MRA Systems, LLC

QUALITY SPECIFICATION

SPECIFICATION **M1000**
REVISION NUMBER -
REVISION DATE *04/29/2019*
DATE ISSUED 04/29/2019

MRA Systems, LLC (MRAS) QUALITY SYSTEM REQUIREMENTS FOR SUPPLIERS

This specification is in addition to and in no way limiting, superseding, or abrogating any contractual obligation as required by the applicable procurement document.

Table of Contents

A. Applicability

This specification applies when flowed down via purchase order or long-term agreement.

Throughout this document, UKAS will be accepted in place of ANSI for non-US suppliers.

B. Introduction

A. This document establishes the minimum quality system requirements necessary for production suppliers to MRA Systems, LLC (hereafter referred to as MRAS). Final interpretation of this specification lies with MRAS.

B. Manufacturers, as identified by MRAS, shall meet this document and AS/EN/JISQ 9100/9110.

C. Material suppliers, as identified by MRAS, that provide raw material or applied material shall meet this document and ISO9001.

D. Processors/Special Processors, as identified by MRAS, shall meet this document and either AS/EN/JISQ 9100 or Nadcap AC7004. Processors performing only Non-Destructive Evaluation (NDE) may meet this requirement with ISO/IEC 17025 certification.

E. Distributors and Warehouses shall meet this document and SAE AS 9120.

F. When third party quality management system or special process certification is obtained or renewed, the supplier shall provide MRAS a copy of the issued certificate. The supplier shall also provide any requested quality management system audit/survey documentation (i.e. self-assessment) during initial and re-approval of the supplier's quality management system.

G. The Supplier will manufacture parts to the drawing revision in effect on the current revision of the Purchase Document.

H. In the event of conflict in MRAS quality system requirements, the order of precedence shall be:
   i. Procurement Document or Contractual Agreement (excluding this document)
   ii. Applicable drawing
   iii. MRAS Engineering Specifications/Standards referenced on the drawing
   iv. Industry Standards referenced on the drawing
   v. This document (M1000)

I. Certificate of Conformance (C of C)
   i. A Certificate of Conformance (C of C) shall be provided with each lot. The C of C shall include a statement that the items meet the requirements of the purchase order and specifications referenced on the drawing and/or purchase order. C of Cs must include, as a minimum, the following information:
   ii. Supplier name and address
   iii. Serial number(s), if applicable
   iv. MRAS purchase order number
   v. Quantity of parts in shipment
   vi. Part number on purchase order
   vii. Statement certifying product compliance
   viii. Applicable Specifications including revision
   ix. Part revision
   x. Signature or stamp of authorizing agent
   xi. Date code(s) or lot number(s), if applicable
   xii. Original Manufacturer name and site of manufacture
   xiii. Date of C of C
   xiv. Shelf life, if applicable
   xv. Description
   xvi. Customer name
   xvii. Reference to applicable MRAS approved supplier nonconforming material report forms.

J. Right of Access/Entry

The supplier shall grant right of access to MRAS, its customers and associated regulatory authorities to the applicable areas of all facilities and levels of the supply chain involved with the purpose of the visit. This access shall provide, at no increase in price, cost, or fee to MRAS, MRAS customers, or regulatory agencies, suitable facilities at Supplier's and Sub-tier Supplier's manufacturing location to perform inspections, surveys, or surveillance and access to all applicable records.

K. Changes

i. For MRAS designed product or product designed exclusively for MRAS (custom product), the supplier shall notify and obtain approval from MRAS for changes in design, manufacturing or assembly processes, manufacturing location or source of supply of their products, whenever such changes affect applicable MRAS orders, prior to the contemplated change. (Also reference M).

ii. For supplier designed product, irrespective of whether it has been designed to a MRAS or supplier specification, the supplier shall submit all proposed changes to MRAS, together with any necessary supporting data, to MRAS for review and classification. All changes must be approved and classified by MRAS prior to their implementation and incorporation into product shipped to MRAS.

iii. For custom product, no design activity shall be sub-contracted by the supplier without the prior approval of MRAS. In all cases, the relevant MRAS design requirements shall be flowed down and verified by the supplier.

L. Language Requirement

All documentation and correspondences submitted to MRAS shall be in English unless otherwise authorized by the MRAS QR.

M. Counterfeit Products

A counterfeit parts protection program shall be established by each supplier meeting the requirements of AS 5553, AS 6081, and AS 6496 for electronic suppliers and AS 6174 for non-electronic suppliers.

N. An obsolescence part management program shall be established in accordance with the requirements in IEC 62402.

O. The following documents form a part of this document to the extent specified herein.

SOCIETY OF AUTOMOTIVE ENGINEERS/AEROSPACE/INDUSTRY STANDARDS	
AS 5553	Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition
AS 6081	Fraudulent/Counterfeit Electronic Parts: Avoidance, Detection, Mitigation, and Disposition – Distributors
AS 6174	Counterfeit Materiel; Assuring Acquisition of Authentic and Conforming Materiel
AS 6496	Fraudulent/counterfeit electronic parts: Avoidance, detection, mitigation, and disposition – Authorized/franchised distribution
AC7004	Nadcap Audit Criteria for Inspection and Test Quality System
AS/EN/JISQ 9100/9110	Quality Management Systems- Requirements for Aviation, Space and Defense Organizations
AS 9102	Aerospace First Article Inspection Requirement
AS 9120	Quality Management Systems - Aerospace Requirements for Stocklist Distributors
AS 9146	Foreign Object Damage (FOD) Prevention Program- Requirements for Aviation, space and Defense Organizations
ISO 9001	Quality Management Systems
ISO 17025	General Requirements for the Competence of Testing and Calibration Laboratories
ISO 19011	Guidelines for Auditing Management Systems
J-Std-001	Requirements for Soldered Electrical and Electronic Assemblies
J-Std-002	Solderability Test for Component Leads, Terminations, Lugs, Terminals and Wires
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
IPC-A-610	Acceptability of Electronic Assemblies
IPC/WHMA-A-620A	Requirements and Acceptability for Cable and Wire Harness Assemblies
IDEA-STD-1010	Acceptability of Electronic Components Distributed in the Open Market
ANSI/ESD S20.20	Electrostatic Discharge Control Program
NCSL Z540.1	Requirements for the Calibration of Measuring and Test Equipment
NCSL Z540.3	Requirements for the Calibration of Measuring and Test Equipment
ANSI/ESD S541	Packaging Materials for ESD Sensitive Items
MIL – STD - 1686	Electrostatic Discharge Control Program
JEDEC Standard No. 625A	Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices
EIA-649	National Consensus Standard for Configuration Management

MRAS SPECIFICATIONS/DOCUMENTS	
M1200	MRAS CONTROLLED LIST OF SPECIAL PROCESSES
M1000	MRAS QUALITY SYSTEM REQUIREMENTS FOR SUPPLIERS
M1002	MRAS SUPPLIER REQUIREMENTS FOR CHARACTERISTIC ACCOUNTABILITY, VERIFICATION AND QUALITY PLANNING
SQ-1000	UNUSUAL VISUAL CONDITION FORM
SQ-1100	SUPPLIER PROBLEM REPORTING FORM
SQ-1200	SUPPLIER SUBMITTED MRB FORM
SQ-1300	SUPPLIER CORRECTIVE ACTION REQUEST

P. In addition to the requirements in this document, suppliers shall also ensure that their employees and sub-tiers are aware of their importance to product and process conformity, product safety, and their ethical behavior.

C. Design Documents

A. Configuration Control

i. Drawings, specifications and related documents, including referenced specifications and instructions, contained in the Purchase Document or revisions mutually agreed upon by both parties, shall be applicable to the Purchase Document, Electronic Data Interchange or other legal contractual conveyance document.

ii. Engineering Change Notice (ECN) shall be introduced and planned in accordance with the instructions.

iii. Supplier Designed Components

1. The supplier shall have a system where:
    a. All design changes are submitted to MRAS for change in design issuance and classification approval
    b. Design changes rejected are not incorporated into the supplier's drawing and into hardware shipped to MRAS
    c. All requested Design Changes will be kept on file (Accepted or Rejected) per administrative record retention requirements at the supplier

iv. Assure manufacturing and quality plan revisions are accomplished in accordance with the issued ECN.

v. See for handling requests for interpretation of drawings/specifications and approval of drawing/specification options.
vi. The Purchaser's requirements shall be recognized as such only when specified by the Purchaser's purchase document or when stipulated in a special contractual agreement between the supplier and the purchaser.

D. Manufacturing, Raw Material, and Special Processes

A. For all processing (work) performed by sub-tier suppliers:
   i. The manufacturer must ensure that all MRAS requirements applicable to the processes, characteristics, and/or material contracted to the sub-tier supplier are specified in the purchasing document
   ii. The manufacturer is responsible for the flow-down of any change in MRAS requirements that affect the processing performed by a sub-tier supplier. This includes ensuring that sub-tier suppliers have the latest revision of the necessary drawings and specifications, including this document.
   iii. When MRAS drawings identify Source Control in the title block of the MRAS drawing, the requirement is to use only the approved source(s) of supply and cage cade(s) identified within when supplying hardware intended for MRAS end use.

B. Purchased Raw Material and Special Processes:
   i. The supplier’s material and special process control system shall ensure that:
      1. Material and Special Process Test Reports (i.e., material certifications, certificate of tests) are available and maintained on file for all material received. Testing shall be performed by an ISO17025 or Nadcap certified laboratory.
      2. Material and Special Process Test results shall reflect all requirements of the drawing and/or specification and conform to drawing and/or specification limits. Documented evidence of this conformity shall include a listing of each material element or test result in the applicable test report. The applicable test report, which shall be signed by a cognizant test laboratory person, shall clearly describe whichever of the following is correct (equivalent wording is permitted):
         a. All tests and inspections have been performed and results meet the drawing and/or specification requirements, or
         b. All tests and inspections have been performed and the results meet all the drawing and/or specification requirements, except _____, which does not meet requirements, or
         c. All tests and inspections have been performed and the results meet all drawing and/or specification requirements, except test(s) _____, which was not performed per the drawing and/or specification requirements.

3. Material received is the material represented by the Material or Special Process Test Report, and properly identified per drawing and/or specification.
4. Material shall remain identified until its identity is necessarily obliterated by processing.
5. Excess processing material will not be returned to storage until its proper identification has been re-established and restored.
6. Material shipped as the final product shall be validated by test reports and subsequent processing.
7. Personnel responsible for the review of material and special process test reports shall be trained to read and confirm test results.
8. The method employed to evaluate material and special process test report results shall be documented and shall provide for the review of each test as required per the applicable drawing and/or specification. The methodology to be employed may be subject to Purchaser disapproval.

ii. When material or special process services are subcontracted, the supplier shall provide the sub-contractor with a procurement document that reflects the applicable drawing and/or specification number and revision, test requirements to be performed, and a request for a certified report of all tests performed.

iii. Suppliers shall institute an audit testing plan for material not tested by an ISO 17025 or Nadcap certified material testing laboratory to ensure data received is representative of the raw material and the material is in conformance with requirements. The plan is subject to Purchaser disapproval and shall include the following minimum requirements:

1. Provisions shall be established for:
    a. Initial testing requirements to qualify for auditing (qualification shall be by material specification and material source).
    b. Subsequent auditing requirements.
    c. Criteria for disqualification to audit and for re-qualification.
    d. Incorporation of specific acceptance testing requirements when defined through the procurement document.
2. Audit testing shall be performed by a testing laboratory other than the one used by the material source.
    a. When audit tests are performed, for the alloy types listed below, full testing to the specification is not necessarily required. The following tests may be used in lieu of full specification testing:
        i. Nickel & Cobalt-Elevated and/or room temperature tensile, chemistry and microstructure.

ii. Titanium, Iron & Aluminum-Room temperature tensile, chemistry and microstructure.

b. All other raw materials (not listed above) shall be tested to the extent required to verify full compliance with the material specification.

iv. When a material test report received from the material source has not been generated by an approved material testing laboratory, testing shall be performed on each raw material lot as defined by the applicable specification.

v. If material is procured from a source other than the raw material manufacturer (i.e., from a distributor, etc.) identification testing is required on each lot of raw material if it is not subject to more complete testing.

1. Such material, which still has the original raw material marking (roll stamp, punch stamp, etc.) and is directly traceable to the certified testing laboratory material certificates does not require the identification testing.
2. If material identification is lost, the material cannot be used on items that have a traceability requirement (i.e., serial number or lot number) without Purchaser's prior approval. This material may be used on items without traceability requirement if subjected to full specification testing.

vi. MRAS supplied material

1. When material is supplied directly from MRAS, the supplier shall verify that the material arrived in good condition. No additional inspection or certificate is required; however, evidence is required that the material was shipped from a MRAS facility, e.g. Shipping Document.
2. If material is purchased by MRAS and drop-shipped directly from a manufacturer, the supplier is responsible to verify that the shipment has evidence of release.

E. Quality Assurance Planning

A. Sampling of nondestructive testing (NDT) is not permitted when the NDT is performed to fulfill a drawing or specification requirement. This does not apply to in-process NDT used to increase yield

B. All characteristics on all parts must be accounted for and verified on products provided to MRAS. Requirements for characteristic accountability, verification, and product acceptance are defined in MRAS Quality Specification M1002

C. When requested by MRAS, suppliers shall complete and submit Process Failure Mode and Effects Analysis (pFMEA) documentation on requested parts

D. When requested by MRAS, suppliers shall collect and submit Statistical Process Control (SPC) or Cpk data.

E. NC program changes, including administrative changes, shall be verified on the processes prior and after the program changes
F. Incorporate safe guards that will stop errors in manual offsets; i.e. verification step that would identify extreme offset errors
G. If a First Article (or Delta First Article) Inspection Report (FAIR) is required, the FAIR will be documented and submitted to MRAS in accordance with M1002

F. Identification and Traceability

Serial number and lot/batch number control requirements are as follows:

A. Acceptance records shall be traceable to each other. If serialized or lot numbered parts are manufactured from serialized or lot numbered material, then traceability shall be maintained to those details and their product acceptance records.
B. Serialized or lot/batch numbered assemblies/items (Purchaser or Supplier designed):
    i. Each serialized or lot/batch numbered assembly/item shall be traceable to the product acceptance records that are associated with the overall assembly/item. The assembly/item shall also be traceable to each serialized or lot/batch numbered sub-assembly or part and their product acceptance records. If serialized or lot/batch numbered sub-assemblies/item contain serialized or lot numbered parts, then traceability shall by maintained to those details and their product acceptance records.
C. Cross Referencing
    i. Traceability is accomplished by cross-referencing records to individual parts for serial numbered parts or lots (batches) for lot/batch-controlled parts. When serial number or lot/batch control is required, the following cross-reference information shall be included in the records.
        1. Part Identification Number
        2. Serial Number, if required by drawing, specification or purchase order
        3. Part Name
        4. Material Specifications and Revision Designation
        5. Order Number
        6. Heat Number or Batch Number
        7. Heat Treat Number
        8. Heat Treat Designation
        9. Casting or forging supplier and serial number when marked on the part
        10. Raw Material supplier when required by drawing, specification or purchase order
        11. Manufacturer’s identification on finished parts if required by drawing, specification or purchase order
        12. Lot/Batch number

13. Date Code

D. Serial Numbers
   i. MRAS Serial Number Requirements
      1. Each MRAS drawing that specifies serial number marking requires that the item be marked in accordance with the marking specification identified in the drawing, with a unique serial number applied at the drawing level.

      NOTE- MRAS serial numbers that were required by a lower level drawing shall not be removed or remarked unless so required by the drawing.

E. MRAS Serial Numbers
   i. Letters, I, O, Q, X and Z shall not be used.
   ii. Serial numbers for each part number shall not be duplicated.
   iii. MRAS assigned serial number shall be used only for items that are to be supplied to MRAS or their agent.
   iv. Serial numbers shall be assigned using a documented and issued procedure. This procedure is subject to review and disapproval by the Purchaser.
   v. Once a serial number has been used to identify an item, (i.e., either a unique piece of hardware or an associated paperwork), it shall only be changed under controlled conditions and when there is a clear documented process that maintains the proper traceability including original serial number, newly assigned serial number and reason for change.

F. Serial Number Assignment Requirements
   i. The system for assigning serial numbers shall provide the following information:
      1. Purchaser's part or assembly identification numbers
      2. Date of assignment
      3. Explanation for deviations from expected sequence or practice
      4. Record of serial numbers assigned to rejected items

G. Lot Numbers
   i. Requirements
      1. When a drawing or a specification referenced on a drawing requires the application of a lot number, that lot shall be as defined herein.
   ii. Lot Information
      1. Lots shall be formed by grouping items which have the same part number, and which are manufactured under essentially the same conditions, and at essentially the same time. Typical lots would be formed from a single heat, or a single melt or single heat treat batch.
   iii. Once a lot number has been used to identify an item, (i.e., either a unique piece of hardware or an associated paperwork), it shall only be changed under controlled conditions and when there is a

clear documented process that maintains the proper traceability including original lot number, newly assigned lot number and reason for change.

iv. When lot numbers are included as part marking, the five letters, I, O, Q, X and Z shall not be used.

H. Date Code

i. If the applicable drawing or specification requires the marking of a date code, year and week format shall be used (YYWW) unless otherwise approved by MRAS.

I. Acceptance Authority Media (AAM)

i. When acceptance authority media are used (e.g., stamps, electronic signatures, passwords), the supplier shall establish controls for the media.

ii. The supplier shall maintain compliance to the AAM requirements by assessing its process and sub-tier suppliers as part of its internal audit activities. The areas of focus of this assessment shall include but not limited to:

iii. Authority Media Application Errors (i.e. Omission, Typos, Legibility, etc.)

iv. Authority Media Application Untimely Use (i.e. Documentation is not completed as planned, “Stamp/Sign as you go”, etc.)

v. Authority Media Application Misrepresentation (i.e., uncertified personnel, Falsification of documentation, Work not performed as planned, etc.)

vi. Authority Media Application Training Deficiencies (i.e. Ethics, Culture awareness, Proper Use of authority media, etc.)

G. Records and Retention

Records shall be maintained in accordance with APPENDIX B -.

H. Nonconforming Material / Corrective Action

A. Escape Notification

Notification to MRAS is required within 24 hours of detection of a possible quality escape. Subsequently, the supplier is required to confirm the quality escape within 48 hours of initial discovery and communicate to MRAS as follows:

i. MRAS Design

When the determination has been made that non-conforming product has been inadvertently released, the supplier shall notify MRAS using the MRAS “Supplier Submitted Disclosure” form, followed by email or phone communication with assigned PQE.

ii. Source Design

When the design authority determines product with a non-conformance to supplier design has been inadvertently released beyond the supplier’s control and was not properly processed by

the supplier's Quality System, regardless of affect to the Purchaser's requirements, the supplier shall promptly notify MRAS PQE using the MRAS "Supplier Submitted Disclosure" form, followed by email or phone communication with assigned PQE.

B. Nonconformances shall be documented in accordance with APPENDIX C -.
C. The supplier is responsible for implementing a documented corrective action program
D. When requested by MRAS, the supplier will be required to provide prompt and effective written corrective action using form SQ-1300 or equivalent form approved for use by the MRAS QR.
E. When a Sub-tier Supplier is responsible for the root cause, the prime Supplier shall flow down a request for corrective action to the Sub-tier Supplier.
F. When the Supplier's corrective action program is ineffective in reducing or eliminating the correctable root causes of nonconformance, MRAS may elect to reject items or lots until effective corrective action has been implemented and verified.

I. Preparation for Shipment

A. The system shall ensure that material is packaged in accordance with the applicable requirements and is accompanied by the required shipping and technical documents. See APPENDIX D -.

J. Software

A. Software shall be controlled in accordance with APPENDIX E -.

K. Conformance Audits

A. In accordance with AS/EN/JISQ 9100, the supplier must have documented procedures for planning and implementing their internal Quality Audit Program. (See ISO 19011 "Guidelines for auditing management systems") Internal, registrar, or customer (other than MRAS) quality system conformance audit findings that have a potential or direct impact on product being produced for delivery to MRS must be promptly reported to the Purchaser.

L. Distributor and Warehouse Controls

A. Distributors (excluding Brokers) and Warehouses shall ensure traceability and flow down of traceability requirements all purchased products to the source of manufacture and their related acceptance documents. The actual source of all material shall be identified. Distributors and Warehouses shall provide the Manufacturer's (Original Equipment Manufacturer/OEM) C of C, intermediary C of C's, along with their own (reference B.I) for each lot/date code of parts shipped to MRAS. Distributors and Warehouses providing COTS parts may retain the manufacturer and intermediary C of Cs (in lieu of sending the manufacturer and intermediary C of Cs with the shipment) when allowed by the MRAS Purchase Order or with written consent from the MRAS QR. Material from different manufacturing

sources shall be stored in a manner that the material does not become intermixed and that the manufacturing source identity and material identity is maintained.

B. Distributors and Warehouses shall not modify, rework, or repair material in-house or by subcontracting unless approved by the Purchaser (i.e. Drawing, Specification, or Purchase Document) or the work is performed by the actual manufacturing source of the material.

C. Distributors and Warehouses may employ sampling plans provided their use ensures fulfillment of Purchaser's requirements. Acceptance sampling of critical characteristics is not acceptable under any circumstances; however, demonstration of process control using SPC and an assurance of a capability index (Cpk) greater or equal to 1.33 is an acceptable means of verifying conformance of critical characteristics.

   i. All attribute lot-by-lot sampling plans must conform to zero acceptance number (C=0 - the number of rejects allowed in an acceptable lot).

   ii. When non-conforming characteristics are found in the lot sample, the sampled lot will require 100 percent inspection of the nonconforming characteristic(s) in the lot. Results of the 100 percent inspection shall require the nonconformance to be submitted through the Nonconforming Material System or the return of the hardware to the manufacturer.

D. When a distributor procures hardware that is source controlled:

   i. The distributor shall only provide items from the approved source(s) of supply listed on the MRAS Source Control drawing or other MRAS document. The approved source Contract and Government Entity (CAGE) code and the manufacturer part identification information must be listed correctly on the MRAS drawing or document. If the approved source of supply or part identification information is not listed, the Distributor shall contact MRAS Sourcing or MRAS Quality Representative to request a change to the MRAS drawing or document.

   ii. Non-conforming material shall be properly documented for disposition per APPENDIX C -by the Distributor.

E. Non-Franchised/Independent Resellers/Distributor (Broker)

(These requirements may be waived by MRAS for COTS parts)

   i. Brokers shall meet the same requirements as Franchised/Authorized Distributors for traceability (reference L.A). The Broker must certify that the parts are new, unused, and have not been previously programmed, altered, refurbished, repaired, or used by any customer. The original manufacturer’s (OEM) C of C and any intermediary C of C’s must be shipped along with the Broker’s C of C (reference B.I) for each lot and date code shipped to MRAS.

   ii. If traceability cannot be met or if the broker cannot provide the manufacturer’s C of C, MRAS must be notified. MRAS reserves the right to cancel the order, request or perform additional testing, or develop a plan for acceptance.

iii. Marking Permanency Test - The broker shall perform a marking solvency test using acetone. The test will be performed on one component from each date or lot code using IDEA-STD-1010-A or similar method as a guide. Any component where the OEM's marking can be removed using this method will be grounds for rejection of the entire lot.

iv. Orders placed through brokers may be subject to additional functional and/or physical validation when the order arrives at the MRAS location. MRAS reserves the right to reject the lot(s) for any indication of a functional and/or physical deviation to the manufacturer's specification.

F. Acceptance of this order by the broker constitutes an agreement that the broker will reimburse MRAS for the total price of the purchase agreement if the parts are found, through inspection and test methods used by MRAS and/or MRAS authorized test facilities, to be non-conforming. Parts found to be counterfeit or otherwise illegal will not be returned to the broker but will be offered to local law enforcement or appropriate bodies for destruction.

M. Prime Supplier Responsibility

A. In addition to complying with all requirements listed in this document, suppliers are required to flow down applicable portions of this document to sub-tier sources.

i. Changes to facilities

1. Suppliers/Manufacturers of MRAS designed material, material altered for MRAS, or material specifically designed for MRAS shall notify MRAS of any manufacturing location change or change in process locations ninety (90) days prior to the change.
2. Changes in distribution center locations shall be provided prior to the initial distribution of the material.
3. All other suppliers shall provide notification to MRAS Sourcing and MRAS QR of manufacturing location changes.
4. Prior to a move to a new facility or equipment move, contact the MRAS QR to determine if there is a need for re-audit, re-qualification of equipment, or other validation activity. Other validation activity may include submission of full FAI on unique parts, product family or as otherwise specified per M1002, AS9102 and/or the MRAS QR.

B. The following is required for documents sent to MRAS:

i. Forms – Unless otherwise directed by the form, all form fields must include one of the following entries:

ii. Specific data/information as specifically required

iii. N/A (indicating not applicable)

iv. N/R (indicating not required)

Note: If specific restrictions exist relative to acceptable entries, they shall be clearly defined in the documentation requiring form completion.

C. The use of “ditto” marks, lines drawn through specific entry fields, etc. are not recognized as acceptable logging of information.
D. Electronic/on-line form completion – The requirement for entry into any field will be identified and controlled by the specific electronic application.
    i. If a specific entry format is required, the application will assure proper entry.
    ii. If the entry format is not specified, entries identified as acceptable in Manual forms, specific data/information apply.
E. Functional gages (go/no-go gages, thread, etc.) shall be utilized in all areas where possible (i.e. hole diameters), in addition to standard hand tools and CMMs.
F. CMM programs shall be verified with an independent inspection method (i.e. flat plate) for all program changes unless otherwise approved by MRAS QR
G. Raw material and in-process material shall always be physically isolated and controlled so that the risk of intermixing is minimized
H. Operations requiring pressure testing shall have a safe guard added to the operation to ensure the required pressure test is performed prior to operation sign-off

N. Unusual Visual Condition

A. An unusual visual condition (UVC) can exists when an MRAS product contains a technically acceptable visual appearance, which could result in unfavorable reaction or questions from a customer.
B. Examples include, but are not limited to:
    i. Discoloration
    ii. Uneven surface condition
    iii. Evidence of rework/repair
    iv. Result of process change which alters the appearance of the part from parts shipped prior to the process change)
C. If the visual appearance violates an engineering requirement or is a result of a repair, see APPENDIX C - for documentation instructions.
D. If the visual appearance does not violate engineering requirements, but is considered an “Unusual Visual Appearance”, the manufacturing source must contact the responsible MRAS QR, who will work with Engineering for concurrence prior to the part being shipped. The manufacturing source should complete the UVA form (SQ-1000) to provide the MRAS QR a complete understanding of the appearance.

O. Shelf Life Items

A. Items with a limited shelf life shall be marked on the item, package, or container with the manufactured date and expiration date, as well as storage temperature and special handling requirements of the items as applicable. When items are fabricated of rubber, the cure date of the rubber is to be shown in lieu of the

date of manufacture. All identification markings shall be placed in accordance with applicable specifications.

B. Unless otherwise authorized via purchase order, MRAS will not accept materials with less than 80% of shelf life remaining without prior written approval. Approval can be obtained through use of form SQ-1100 or SQ-1200 as directed by the MRAS QR

P. Foreign Object Damage/Debris (FOD)

A. The Supplier shall develop and maintain a Foreign Object Damage (FOD) prevention program in accordance with AS9146 (or equivalent). The FOD program shall include design, manufacturing, and process controls to prevent Foreign Object Debris (FOd) in deliverable items. The program shall also provide initial and periodic FOD prevention awareness training.

B. All occurrences of product rejections due to FOD shall be documented and investigated to determine the root cause of the FOD and implement actions to prevent any recurrence.

C. Delivered material must be clean and free from any FOd.

D. The Supplier shall ensure that FOD program requirements are flowed down to the supplier's sub-contractor/sub-tier suppliers.

E. The Supplier's FOD program is subject to audit by MRAS and may be disapproved

Q. Electrostatic Discharge (ESD) Control

A. Suppliers who manufacturer or handle in any way devices that are sensitive to damage caused by electrostatic discharge shall implement an ESD control program. The control program shall follow the requirements established by ANSI/ESD S20.20 and JEDEC-Standard No. 625A or Mil-Std-1686. The control program is subject to review and disapproval by MRAS.

B. The control program must contain the following elements at a minimum:

C. Training (initial and recurring/refresher)

D. Signage

E. ESD dissipation (ground straps, workstations)

F. Proper static shielding packaging during movement, transportation, and/or storage

R. Soldered Electrical and Electronic Components and Assemblies

A. Paragraph R.A applies to MRAS designs, components designed for MRAS, or assemblies produced for MRAS:

   i. Soldering and solder processes shall be in accordance with J-STD-001 Class 3.

   ii. Components not available with lead (Pb) in the finish shall not be utilized or delivered unless processed in accordance with MRAS written instructions.

iii. Workmanship for soldered electrical / electronic assemblies shall be in accordance with the latest revision of IPC-A-610, Class 3, and Acceptability of Electronic Assemblies.
iv. Solder shall be Pb63Sn37 or Pb60Sn40 in accordance with J-STD-006.
v. Flux, Solder Paste and Solder shall conform to activity levels L0 and L1 for Rosin (RO) and Resin (RE) in accordance with J-STD-004, J-STD-005, and J-STD-006, unless otherwise flown down by Drawing or PO requirements.
vi. Workmanship for cables and wire harnesses shall be in accordance with the latest revision of IPC/WHMA-A-620, Class 3, Requirements for Cable and Wire Harness Assemblies.

B. Paragraph R.B applies to all electronic components and assemblies:
i. Pure tin shall not be used as a base metal or as a plating material on solderable component leads.
ii. Solderability shall meet the requirements of J-STD-002 or component solderability requirements of the specification for which they are procured.
iii. Supplier shall meet the requirements of AS5553.

S. Control/Calibration of Measuring and Test Equipment

A. Calibration Services and Calibration Systems shall meet this document and NCSL/UKAS Z540.3, or Z540.1 and ANSI ISO/IEC 17025.

B. Equipment used to monitor, measure and/or test product or process conformity will be calibrated or verified (or both) at intervals necessary to ensure continued accuracy. All reference standards used in calibration shall be traceable back to National Standards. Records will be maintained and made available upon request.

NOTE: Equipment also includes, but is not limited to: test hardware, test software, automated test equipment (ATE) and plotters. It also includes personally owned equipment.

C. Control, care, and calibration of MRAS furnished measuring/test equipment and tooling shall be the responsibility of the Supplier.

T. Special Processes/Processors

A. Special Processes as defined in M1200 shall be in accordance with specifications and standards stated on the MRAS drawing or purchase order.

B. When the MRAS drawing or purchase order requires a special process categorized under M1200 List A be performed in accordance with an industry standard, the special processor shall be Nadcap certified for the process. The MRAS QR may permit deviation to this requirement when allowed by MRAS customer contract/requirements.

C. When special processes categorized by M1200 List B are defined with an MRAS or industry standard and when special processes categorized by M1200 List A are defined by an MRAS standard, these processes may be subject to MRAS review.

D. For testing facilities, 3rd party certification is required to ISO/IEC 17025, Nadcap or any appropriate certification for the work being performed.
E. Special Process sub-tier supplier selection may be subject to disapproval by MRAS.
F. If a customer defined special process is listed on an MRAS or MRAS customer (Boeing, Lockheed, Airbus, Sikorsky, etc.) drawing, the requirements of that customer for special processes/processors will be flowed to the processor via Drawing, and or unique purchase order requirements. (In this case Nadcap may not be an acceptable substitute, unless it is allowed by the MRAS Customer requirements).
G. The Supplier remains responsible to deliver acceptable material or parts in accordance with the contractual requirements of the MRAS purchase document.

U. Definitions

See APPENDIX F -

Appendix

APPENDIX A - Supplier Problem Reporting Process

1. The SPR form (SQ-1100) is the preferred communication tool between the supplier and MRAS for problems or questions related to MRAS design documents. The SPR form shall be used for:
    a. Interpretation of a Drawing or Specification
    b. Documented approval for the selection between specified options
    c. Producibility requests
    d. MRAS Drawing change requests (due to errors, improvements, etc.)
2. SQ-1100 is available from the MRAS QR.
3. Procedure
    a. The supplier will complete the SPR and submit the form to the MRAS QR.
    b. A completed response with the appropriate MRAS signatures (physical or digital) will become part of the source quality records for reasons 1.A and 1B.
    c. A completed response with the appropriate MRAS signatures (physical or digital will become part of the supplier's administrative records for reasons 1.C. and 1.D.

    Note: The SPR process is not a substitute for drawing, specification, or significant operation changes controlled by other requirements (i.e. engineering change control, etc.).

APPENDIX B - Records

1. Scope

    This appendix establishes requirements for identifying and maintaining quality related records identified in 2.b below.

2. Requirements
    a. General
        i. Records are to be documented in a manner or medium that, if altered, would be obvious that changes were made. Permanent ink shall be used, preferably blue or black. Changes to records shall be made by lining out the old data, entering the correct data, then initialed (or signed) and dated by authorized personnel. No erasures or "white-out" allowed.
    b. Types of Records
        i. Product Acceptance Records:
        ii. Certificates of test and other laboratory results.
        iii. Inspection and test results (includes Nondestructive Testing (NDT), First Article Inspection Reports (FAI) and functional/environmental test data).

iv. Manufacturing, assembly and inspection operation sheets.
v. Records of the completion of manufacturing, assembly and inspection operations.
vi. Inspection and statistical acceptance procedures.
vii. Material Review Board (MRB) disposition documents and repair procedures.
viii. Source Problem Reports; Requests for Interpretation of Drawing/Specification option.

3. Serial and Lot Number Assignment

   The following records are required when serial numbers and/or lot numbers are a drawing requirement: assignment of individual serial numbers and lot numbers; identification number of the part or assembly; date of assignment.

4. Administrative Records associated with the administrative control of the quality system, are as follows:
   a. System, process and hardware audit results (including audit laboratory tests and metallographic mounts)
   b. Corrective action responses/nonconformance reports
   c. Certification of processes and personnel
   d. Tool, gage, and instrument control records
   e. NDT maintenance records
   f. MRB administration
   g. Employee inspection and stamp assignment records
   h. Source Problem Reports
5. Availability
   a. General
      i. Records shall be readily available for on-site Purchaser, MRAS customer and/or Regulatory Agency review within one day. If the Purchaser requests records to be furnished for review, these records shall be made available for delivery within three working days of notification by the Purchaser.
      ii. Creation, maintenance and storage of records will be such that when requested for review, they are legible and interpretable.
   b. Retention Period
      i. Records retention timeline (from date of record creation):

System, process and audit hardware results (including laboratory certificates)	Five (5) Years
Corrective action responses/nonconformance reports	Five (5) Years
Certification of processes and personnel	Five (5) Years
Tool, gage & instrument control records	Five (5) Years
NDT maintenance records	Five (5) Years
MRB administration	Five (5) Years

Employee inspection and process stamp assignment records	Five (5) Years
Product Acceptance Records and all other Records not defined above	Ten (10) years

c. Delivery of Data

The delivery of data to MRAS does not release the supplier from any requirements herein with respect to that data except as agreed to in writing by MRAS

6. Termination
   a. A supplier who ceases operations (i.e., goes out of business) shall contact the MRAS QR to make arrangements for the transfer of all quality records to MRAS for storage.
   b. A supplier who discontinues acceptance of MRAS purchase documents, but whose business remains intact, shall be responsible for the archival of all quality-related records for the time periods specified in 5.a.ii above and/or the purchase order.
7. Computer Generated Records
   a. Information Resources Physical Security Requirements: The supplier must establish the responsibilities and requirements for the physical security of computer centers that retain Quality related records.
   b. Control of computer Systems Access and Data Access Requirements: The supplier must establish the responsibilities and requirements for system and data access of computer centers that retain Quality related records.
   c. Disaster Recovery Planning Requirements: The supplier must establish a Disaster Recovery Planning Program (or a similar sub-tier document) for computer centers that retain Quality related records.

APPENDIX C - Supplier Nonconforming Material: Review and Disposition

1. Scope
2. This appendix establishes requirements for identification, documentation, evaluation of corrective action, control, disposition, and repair of nonconforming material.
3. Nonconformance Documentation
    a. Internal Documentation – When any departure to requirements (i.e., nonconformance or departure to an in-process characteristic) is initially identified, it must be documented
    b. Disposition Request (MRB) – Any dispositions requested must be documented in the supplier's Quality System. The supplier nonconformance must be reported on Form SQ-1200 (Supplier Submitted MRB Form) and forwarded to the MRAS QR and/or buyer. The form is available from the MRAS Supplier Resources page at:

        https://www.mras-usa.com/support-services/supplier-resources

    c. Documentation must be complete, legible, and understandable by a non-technical independent third party.
    d. Minimum Requirements for Documentation:
        i. Form Completion:
            1. Supplier Name
            2. Supplier Site (City, Site Code, etc.)
            3. Name of Submitter (Individual at Supplier)
            4. Date of Submittal
            5. Defect Summary Description
            6. PO Number
            7. Serial Numbers (If Applicable)
            8. Part Number
            9. Quantity
            10. Drawing Number
            11. Drawing Sheet Identifier
            12. Drawing Requirement
            13. Requirement Description
            14. Root Cause
            15. Corrective Action
    e. Document is not applicable for nonconforming hardware shipped prior to disposition
    f. Only violations to engineering drawing/specification requirements will be documented using this form
4. Physical Control of Nonconforming Material
    a. Identification – Nonconforming material must be conspicuously marked, tagged or referenced on the product's paperwork

b. Material Control – Nonconforming material pending MRB disposition shall be controlled to preclude its unauthorized processing, use, or shipment
c. Scrap Material
    i. Destruction or conspicuous marking is required for all scrap product or material.
    ii. Scrap may be shipped to other internal locations for accumulation prior to destruction or marking
    iii. When destruction or marking is to be performed externally, the Supplier will maintain and follow a procedure to outline the requirement for destruction and ensure that scrap requiring destruction or conspicuous marking is not sold for any other purpose. This procedure is subject to review and disapproval by the MRAS QR

5. Items of Special Interest
    a. Nonconforming hardware that is identified to contain a UVC (Unusual Visual Condition) will be reported on SQ-1000
    b. Parts with Special Cleaning Requirements - For parts with cleaning requirements noted on the drawing the rework/repair procedure shall adhere to those requirements. Cleaning steps must be documented on the repair procedure.
6. Approval of Preliminary Review (PR/MRB) Personnel
    a. Requirements – Prior to performing the PR/MRB function, supplier personnel shall be knowledgeable of the manufacturing processes and attend a training session based on the below requirements.
    b. PR/MRB Training – The supplier is responsible for preparing the PR/MRB training package, including training and administration of the PR/MRB process. The training package shall include, as applicable:
        i. Documentation and control of nonconforming material.
        ii. PR/MRB review, evaluation and disposition.
        iii. PR/MRB issues affecting raw material and special processes.
    c. Maintaining PR/MRB Approval - PR/MRB personnel shall complete periodic refresher training to maintain PR/MRB authorization.
    d. PR/MRB Membership – The supplier is responsible for authorization of PR/MRB personnel at their facility and shall maintain documentation of those authorized to perform PR/MRB including their status (e.g., active, inactive) per the retention requirements.
    e. The requirements in this paragraph do not apply to COTS items.
7. Preliminary Review / MRB Responsibility
    a. Authorized Personnel- The disposition must be documented and signed/stamped by an approved PR/MRB person before the action is taken.
    b. Dispositions not requiring MRAS approval – Any disposition that results in conforming product being shipped to MRAS or prevents non-conforming product from being shipped to MRAS. Examples include Rework, Continue-to-Process (CTP), Scrap and Return to Vendor. Rework or CTP instructions must be documented and must define inspection activities to verify conformity of rework.

c. Dispositions requiring MRAS Approval – Any disposition that results in product being shipped to MRAS with one or more non-conformances to MRAS design requirements. Written approval must be obtained prior to shipment using form SQ-1200. Non-conforming parts must be segregated when shipped together with conforming parts. These Approved dispositions include:
    i. Use-as-is
        1. Non-conformance information shall be submitted to MRAS using form SQ-1200. Any non-conforming product shipped to MRAS must be accompanied by a SQ-1200 form signed by MRAS (either physically or digitally).
    ii. Repair
        1. Non-conformance information shall be submitted to the MRAS using form SQ-1200, and the supplemental proposed repair procedure shall be submitted as an attachment. Repair activities are not to be started until the MRB disposition is provided by MRAS Engineering. Any repaired product shipped to MRAS must be accompanied by the closed MRB tag from MRAS.

8. Evaluation of Corrective Action
    a. Responsibility - The supplier has the responsibility to develop, document and maintain a corrective action system to reduce the amount of nonconforming product.
    b. Consideration - Every nonconformance requires consideration for corrective action. The final decision as to the appropriateness of the supplier corrective action decision and plan, relative to nonconformances submitted to the purchaser for review and disposition, shall rest with the purchaser.
    c. Supplier Documentation – When a Corrective Action Request has been issued by MRAS, the supplier shall respond using MRAS form SQ-1300 or an alternative that is approved by the MRAS QR. All Corrective actions shall be documented and shall include, as a minimum, the following:
        i. Pertinent information describing the problem requiring corrective action.
        ii. Root cause analysis (e.g. 3x5 why, fishbone diagram, 8-D etc.).
        iii. The required planned or taken corrective action(s).
        iv. The functions or individuals responsible for implementing the corrective action.
        v. When the corrective action will be implemented.
    d. Effectivity - The supplier shall follow up on corrective actions to ensure effective implementation.
9. Notice of Escape (NOE)
    a. When it has been discovered (regardless of who) that nonconforming material has been inadvertently shipped to MRAS, in addition to all other requirements associated with nonconforming material, the supplier shall also:
        i. Issue an internal corrective action containing the elements of APPENDIX C - 8.c and document the nonconformance.

ii. Determine impact to other product/material previously shipped or in-process. The supplier shall also determine and document the nonconformance magnitude.

iii. Support MRAS engineering and quality in related investigation activities, including but not limited to failure analysis, disposition, preventive and other corrective action, etc. Include a 3x5 why problem-solving chart in any corrective action response. Alternate or equivalent problem-solving tools/charts may be used if approved by the MRAS QR in advance.

10. Supplier Design

a. Any characteristic found nonconforming that is documented on the MRAS or Supplier's drawings and specifications is required to go through MRAS's the purchaser's MRB system. Any other product nonconformances will be subject to the Supplier's internal nonconforming material control system. The supplier's nonconforming material control system shall be the same as outlined in APPENDIX C -except as follows:

i. MRAS reserves the right to disapprove the supplier's internal MRB system with respect to the allowances listed herein. Additionally, an 'accept' or 'repair' disposition of any nonconforming characteristic on a detail part, sub-assembly, or assembly defined by a supplier drawing that could affect performance, design, use, life, reliability, or maintainability of such part, sub-assembly or assembly, must also include approval from MRAS design engineering and quality. The supplier's organization shall ensure that the extent of such MRAS involvement is incorporated into their non-conforming material control system.

ii. Material Review Board (MRB) Responsibility - As a minimum, the MRB shall consist of a Quality chairperson and one representative of the Engineering function that is responsible for product design.

iii. Nonconformance Documentation

1. The nonconformance document used shall be capable of being utilized for internal MRB disposition. The nonconformance document may be designed to accommodate both PR and MRB dispositioning.
2. Repairs – A detailed repair procedure (e.g. work instructions) must be documented for each Repair disposition.
    a. Repair Procedure Content - The repair procedure will document, in detail, the exact method to be followed during the repair process, (i.e. restrictions or limitations for use of the repair, related characteristics to be re-inspected after completion of the repair, tooling, special process inspection or test requirements, FOd detection and removal, and any other special requirements or considerations). The repair procedure must be signed off by the personnel performing the repair once the repair is complete.

b. Revisions to Repair Procedures - A revision to a repair procedure after being approved by MRB require re-approval by all signers and/or the certifying agent where applicable. Strictly administrative changes do not need to go through the review process but must be signed for by the MRB chairperson.

b. Incorrect Parts

i. The Material Review Board will not be utilized to accept a part that is inadvertently installed into an assembly (inseparable or otherwise) or end item configuration which is different from the bill of material or parts list. The Material Review Board will not be utilized to accept an end item configuration or assembly that is missing a part or component from the bill of material or parts list. A design change rather than a waiver/concession shall always be used to introduce a new part number to a product model once the baseline configuration has been established. The Material Review Board will not be utilized to disposition shipped product. A waiver/concession may be used when the item (part number) is required to complete an approved MRB Repair Procedure. (For example: Using an insert, or a larger insert than is called for on the parts list, to repair a hole that has been drilled oversize, while still using the correct bolt that is called out on the parts list.)

11. Source Inspection (Additional Controls)

a. Source Inspection (SI) may be implemented when MRAS determines that a supplier does not have the necessary safeguards and controls in place preventing non-conforming products from reaching MRAS manufacturing locations or its customers. There are 2 levels of Source Inspection (SI).

i. Source Inspection, Level I (SI I) is performed at the supplier location by the supplier's employees. This Source Inspection process is an additional inspection and must be performed in a controlled area of the plant. SI I inspection data/results must be collected, inspected product must be certified by the inspector and the data/results provided to MRAS with the shipped product.

ii. Source Inspection, Level II (SI II) includes SI I, with an added inspection by a 3rd party. The 3rd party is selected by the supplier, approved by MRAS and paid directly by the Supplier. In some instances, MRAS may require the 3rd party inspection to be performed outside of the supplier's facility, either at a 3rd party location, or at the MRAS facility receiving parts.

b. Based on the severity of the incident, MRAS may elect to go directly to SI II.

c. The MRAS Supplier Quality Representative will the authorize implementation of and removal of the Source Inspection in writing.

APPENDIX D - Preparation and Identification of Suppliers of Shipment

1. Scope

a. This appendix provides direction for preparation and identification of supplies for shipment.

2. Requirements

a. Shipments cannot be made until a Purchase Document is received from the Purchaser. Specific attention shall be given to the following areas:
    i. Packaging/ Shipping materials and methods for electronic discharge sensitive devices shall meet ANSI/ESD S541 or equivalent requirements.
    ii. When packing slips are used, a copy must be on the outside of the box/container, not only the inside unless otherwise allowed.
    iii. If bar coded shipping label is used for the shipment of a single box/container, a removable bar code label, as well as a permanent label shall be affixed to the outside of the box/container When multiple boxes/containers comprise a shipment, the first box or container shall have a removable master bar code label, as well as a permanent master bar code label affixed to it and all additional boxes/containers shall have a single permanent bar code label affixed to them.
        1. A removable bar code label may be affixed to the outside of their applicable box or container by placing it inside a transparent enclosure or envelope that will allow for the clear display of the label.
        2. Bar coded shipping labels shall not be used for shipment of product to MRAS, unless required by purchase order.
    iv. Examine carefully the Purchase Document/Contract requirements for the parts/material to be shipped. If authorization for shipment is required to be performed by the MRAS QR, MRAS Delegated Quality Representative (DQR), end-customer and/or the government representative, make sure that all necessary inspections have been performed and signatures obtained before the parts/material are presented for review.
    v. When a shipment has an approved SQ-1200 waiver/deviation, ensure that the approved form is included with the shipment paperwork.
    vi. Boxes and containers must be properly marked per the Purchase Document requirements. All markings on boxes and containers must be clear and legible.
    vii. When a shipment is made using more than one box/container, each box/container must be labeled 1 of____, 2 of____, etc. Packing slips or removable master bar coded shipping labels attached to the box/container must also be labeled 1 of ____.
    viii. Ensure that packages, cartons, boxes, containers and packaging material are suitable to adequately protect the parts/material contained within.

APPENDIX E - Requirements for Supplier Software Control

1. Scope

The purpose of this appendix is to set forth the minimum requirements for a Software Quality Assurance (SQA) Program for which a supplier must implement for MRAS product software or software developed or used in the design, manufacture, inspection, or test of MRAS products.

2. Applicability and Scope
    a. This appendix applies to software that is generated and/or used in fulfillment of Purchase Document requirements.
    b. This appendix covers the following CLASSES of source software: Class I: Software which comprises all or part of a product which will be delivered to MRAS or a MRAS Customer; Class II: software used to create/control/inspect/test characteristics on MRAS product, that are validated by virtue of the software being under an approval and change control system. For both Class I and Class II software, the supplier is responsible for notifying MRAS of proprietary right claims, in writing, prior to execution of the Purchase Document.
3. Requirements
    a. These requirements are in addition to other Purchase Document requirements.
4. General Requirements
    a. The objective of the software quality program shall be to ensure the quality of:
        i. Software and its documentation.
        ii. The process used to produce software.
    b. Supplier personnel responsible for ensuring compliance with the software quality program requirements shall have the resources, responsibility, authority, and organizational freedom to permit objective evaluations and to initiate and verify corrective actions. The persons conducting software quality evaluations of a product or activity shall not be the persons who developed the product, performed the activity, or are responsible for the product or activity, (this does not preclude members of the development team from participating in these evaluations). The supplier shall assign responsibility for the fulfillment of, and for ensuring compliance with, the software quality program requirements.
    c. The software quality program, including procedures, processes, and products, shall be documented. The software quality program is subject to review by MRAS and may be disapproved by MRAS whenever the program does not meet the requirements of the Purchase Document.
    d. A complete review of the Purchase Document to identify and make timely provision for acquiring or developing the resources and skills required for implementing the software quality program shall be conducted. The product/process source shall prepare plans for applying the documented software quality program to the Purchase Document. These plans shall be documented in a MRAS format, when so specified in the Purchase Document. Authorized personnel shall issue plans with a revision history maintained.
    e. The software quality program shall be implemented in accordance with the documented software quality plans and shall adhere to the program for the duration of the Purchase Document. The software quality program shall be fully integrated with the activities required by the Purchase Document.

f. The supplier shall conduct on-going evaluations of the processes used in software development and the resulting software and associated documentation to ensure that all supplier requirements have been met and that internal coordination has been conducted in accordance with the software plans.

g. The supplier shall prepare and maintain records of software quality program activities required by the purchase document.

   i. A software quality evaluation record shall be prepared for each evaluation required by the Purchase Document. These records shall be in the product/process source's format and shall contain the following items as a minimum:

      1. Evaluation date
      2. Evaluation participants
      3. Evaluation criteria
      4. Evaluation results, including detected problems, with reference to the appropriate software problem reports, as applicable.
      5. Recommended corrective action. (Generally, this type of record is maintained for Class I software).

   ii. All other software quality records shall be prepared in the suppliers' format. (Generally, this type of record is maintained for Class II software).

h. When a software-related problem or non-conformance has been detected, it shall be documented and shall serve as input for software corrective action. The supplier shall:

   i. Ensure that action is initiated to correct the defect and the cause of the defect, and that adverse trends are identified and reversed.
   ii. Monitor and track the software corrective actions to ensure timely and positive corrective action.
   iii. Management shall review the software quality program at intervals as specified in the software quality program.
   iv. Ensure that applicable subcontracted software meets the requirement of this specification, as well as additional Purchase Order requirements.
   v. Prior to the introduction of new or revised support software (e.g., compilers, operating systems, etc.) which is used for the computation, interpretation, assembly, linkage, or working environment of Class I or Class II software, a documented evaluation to determine the impact on the Class I or Class II software shall be conducted.
   vi. Software and software quality records shall be maintained in accordance with M1000, APPENDIX B -.

5. Class I Software Requirements

   a. A Software Quality Assurance program for all Class I software covered by the Purchase Document shall be documented and maintained in the form of a Software Quality Assurance Program Plan. This plan may be in supplier format unless otherwise specified in the Purchase Document.

b. The software quality assurance program shall provide for the performance of the following activities by personnel as defined in paragraph 4.b of this appendix:
    i. The performance of both scheduled and non-scheduled evaluations of the software development, library control, corrective action, testing and software configuration management activities to ensure compliance with all applicable requirements, plans, procedures, and programming standards and conventions.
    ii. The independent review, prior to release to MRAS, of all contractually or regulatory required software plans, procedures, code, and documentation for:
        1. Completeness
        2. Compliance with applicable standards and conventions
        3. Assurance that all approved and only approved changes are implemented
        4. Traceability of requirements from one document to another
        5. All necessary approvals
        6. Compliance to additional purchase order requirements
        7. Action items shall be documented, and the disposition verified for all identified discrepancies
    iii. The participation in any scheduled software design reviews. All identified problems from these reviews shall be documented and have corrective action disposition, prior to the approval of the design.
c. The assurance that an analysis of software requirements for testability has been performed.
d. The review of test plans, specifications, and procedures for compliance with design requirements, and to ensure that all approved, and only approved changes are incorporated.
e. The monitoring or participation in the testing activities to ensure adherence to approved plans and procedures, to ensure that the identification of the software version has been documented, and to ensure the test results are accurately documented. The test results shall be reviewed for compliance to the test criteria.
f. The assurance that test related media and documentation are maintained.
g. The assurance that all software and software documentation released to MRAS conforms to all software related Purchase Document requirements.
h. The participation in any scheduled software configuration audits. All identified problems from these audits shall be documented and have corrective action disposition before production release of the software to MRAS.
i. The assurance that the software's integrity during handling, storage, preservation, packaging, marking, and shipping.

6. Class II Software Requirements

a. A Software Quality Assurance program for all CLASS II software shall be documented and maintained. This program shall include:
    i. Software Requirements Definition: Prior to designing and coding, the quality assurance program shall ensure that an approved requirements definition document exists, (e.g. drawings/specifications).
    ii. Design Code Instructions/Documentation: The Software Quality Assurance program shall ensure properly structured and adequately documented software. This may be done through documented software development standards.
    iii. Test Program Validation: The quality assurance program shall ensure that the software performs as intended. Objective evidence of the validation process shall be maintained for new and revised software. For revised software, re-validation must be performed to the portion of the code that has been modified. Records shall be maintained of the test program validation activity including approval to release for use.
    iv. Software Identification/Change Control: The quality assurance program shall ensure that the software is uniquely identified. All software changes must be appropriately reviewed. The change control procedure for the software shall be documented, and a revision history maintained.
    v. Identification of Software at Operations: The quality assurance program shall ensure that the software is uniquely identified in the appropriate work instructions.
    vi. Software Media Control: The quality assurance program must protect the software media from unauthorized changes. Protection methods could include, but are not limited to, password protection, write protect labels, checksums, quality audits, object-only code releases. Access to obsolete software for design, manufacture, inspection, or test of MRAS products shall be prevented.

APPENDIX F - Definitions

ACCEPT - A disposition provided by the purchaser when it is determined that the nonconforming product meets the definition of a minor nonconformance in its existing condition without any special handling, tooling, or procedures.

ATTRIBUTE – Measurement of a characteristic or property to determine if it conforms to a given requirement (PASS or FAIL, GO, NO/GO, ACCEPT/REJECT - etc.)

CERTIFICATION BODY- a third party organization who conducts certification conformity

CERTIFIED - The initial and periodic qualifications of suppliers who have been subjected to an on-site evaluation of facilities, processes, procedures, personnel and controls and have satisfactorily demonstrated their ability to meet the applicable specification requirements. Includes third party certifications to applicable national/international industry standards.

CHARACTERISTIC - Dimensional, visual, functional, electrical, chemical, mechanical and material features or properties which describe and constitute the design of the item and can be measured, observed and identified to determine conformance to the requirements.

COMMERCIALLY AVAILABLE SOFTWARE - Deliverable or non-deliverable software that has been developed for general use and is supplied in an "off the shelf" manner.

COMMERCIAL OFF THE SHELF (COTS) - one or more pieces, mechanical or electrical, developed for multiple commercial consumers, whose design and/or configuration is controlled by the supplier's specification or industry standard.

CORRECTIVE ACTION – The action taken to eliminate the cause of a noncompliance or nonconformance to prevent recurrence. The corrective action may be:

Containment – Short term actions taken to:

(1) Prevent escapes of nonconforming hardware (for example: through nonconformance document and purges).

(2) Address the immediate cause of the nonconformance or noncompliance (For example: replace the bad tools/gage, correct documentation, etc.)

Fix – long term action taken to prevent or reduce the likelihood of recurrence by addressing the root cause of nonconformance or noncompliance (for example: trough process and/or procedural change, error-proofing)

COUNTERFEIT PARTS - A part or assembly that is a copy or substitute without legal right or authority to do so or one whose material, performance, or characteristics are knowingly misrepresented by a supplier in the supply chain. Reference AS 5553 and/or AS6081 for additional information and definitions.

CRITICAL CHARACTERISTIC – A characteristic of an item which, if nonconforming, may result in a hazardous or unsafe condition for personnel using, maintaining or depending on the unit-of- product; or which may prevent or seriously affect the satisfactory operation or functioning of the unit-of-product.

DEVIATION/PRODUCTION PERMIT - A specific written authorization, granted prior to the manufacture of an item, to temporarily depart from a particular performance or design requirement of a specification, drawing or other document for a specific number of units or a specific period of time. A deviation/production permit differs from an engineering change in that an approved engineering change requires corresponding revision of the documentation defining the item, whereas a deviation/production permit does not normally contemplate revision of the applicable specification or drawing.

Note: Prior to the manufacture of an item means prior to the implementation of all planned process related elements necessary to produce the item. These elements may include but are not limited to material, tools, dies, molds, processes and procedures, etc.

DISTRIBUTOR (authorized or franchised) - Franchised distributor or agent, individual or corporate organization that is legally independent from the franchiser (in this case the electronic component manufacturer or OCM) and who agrees under contract to distribute products using the franchiser's name and sales network. Distribution activities are carried out in accordance with standards set and controlled by the franchiser. Shipments against orders placed can be dispatched either

direct from the OCM or the franchised distributor or agent. In other words, the franchised distributor enters into contractual agreements with one or more electronic component manufacturers to distribute and sell said components. Distribution agreements may be stipulated according to the following criteria: geographical area, type of clientele (avionics for example), maximum manufacturing lot size. Components sourced through this route are protected by the OCM's warranty and supplied with full traceability.

DISTRIBUTOR/BROKER DISTRIBUTOR - an independent reseller/distributor that typically acquires parts from non-authorized sources, including excess inventories of both customers of parts and other distributors. They often work in a "just in time" environment whereby potential customers contact the broker distributor / reseller with the component requirements, identifying the part number, quantity, target price and date required. The broker distributor searches the industry and locates parts that meet the target price and other customer requirements and then attempts to buy them. A broker distributor usually does not obtain and store parts.

ECN - Engineering Change Notice: any change notice from MRAS which authorizes a change to the MRAS drawing or specification via the change management system

ELECTRONIC DATA INTERCHANGE (EDI) - The electronic transfer of Purchase Document or certification data between MRAS and their suppliers.

FOREIGN OBJECT (FO) - An alien substance or article (e.g., tools, consumables, hardware, product protective devices, personal items, product process debris, operations debris, environmental debris) that could potentially enter and/or migrate into/on the product or system becoming FOd and potentially cause FOD, if not removed and controlled.

FOREIGN OBJECT DAMAGE (FOD) - Any damage attributed to FOd that can be expressed in physical or economic terms, which could potentially degrade the product or system's required safety and/or performance characteristics.

FOREIGN OBJECT DEBRIS (FOd) - Any FO that has entered and/or migrated into/on the product or system, and could potentially cause FOD, if not removed and controlled.

MRAS QUALITY REPRESENTATIVE (MRAS QR) - An MRAS employee or authorized representative with the authority to represent MRAS Sourcing Quality. Also known as Product Quality Engineer (PQE) or Supplier Quality Engineer (SQE).

GROUND SUPPORT EQUIPMENT SUPPLIER - A supplier that only supplies tooling, test equipment, process equipment, and repair tools required for the development, production and maintenance of GE aircraft engines.

IDENTIFICATION TESTING - Those raw material acceptance tests necessary to qualitatively assure correct material and correct condition.

IN-PROCESS CHARACTERISTIC - An intermediate characteristic that does meet or will meet the engineering requirement prior to final delivery or use. Examples are machining stock, intermediate welds, engineering characteristics held to reduced tolerances and characteristics that will meet engineering requirements as a result of further processing.

LIBRARY CONTROL - The collection and control of software and related documentation designed to aid in software development, use or maintenance.

LIMITED SHELF LIFE ITEM - Material such as adhesives, paint, sealant, coatings that the manufacturer specifies the length of time a material can be stored under specified environmental conditions, and will continue to meet all applicable specification requirements and/or remain suitable for its intended function

LOT NUMBER - A unique identifier used to control and identify a definite number of items that have been produced by the same manufacturing cycle and usually submitted for acceptance at one time or place (i.e. acceptance lot). Typically, lot numbers are heat lot number, heat treat lot number, and melt lot number, which are usually associated with raw material, castings, or forgings.

MAJOR/MINOR – This definition refers to changes to the design and is also known as Class I/II. A minor change is defined as a change that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics or other characteristics affecting the airworthiness of the product. All other changes to the design are major.

MAJOR CHARACTERISTIC - A drawing or specification feature, which if nonconforming, may result in operational or functional failure of the item, or may materially reduce the usability, physical or functional interchangeability or durability of the MRAS end product for its intended purpose. Identified on MRAS drawings and specifications with symbols.

MANUFACTURER - A supplier that makes parts complete or assembles parts into a sub-assembly (including suppliers of castings and forgings).

MATERIAL - Raw material, parts, or assemblies.

MATERIALS SUPPLIER - A supplier that only supplies materials used in the manufacture of components (This includes suppliers of weld wire, braze and thermal powders, chemicals, dry film lube, paint, plating materials, bar stock, sheet metal, non-metallic/composite material, melters and converters, and the like.)

MAY- Indicates a course of action which is permissible within the limits of the requirement

MINOR CHARACTERISTIC (No Symbol) - A drawing or specification feature, which if non-conforming, does not materially reduce the usability, physical or functional interchangeability or durability of the product, or are departures from established standards having no significant bearing on the effective use or Operation of the product.

MINOR NONCONFORMANCE - A nonconformance that shall not affect the usability of a MRAS product or material for its intended purpose. Minor nonconformances do not adversely affect health or safety; performance; interchangeability, reliability or maintainability; effective use or operation; weight or appearance (when a factor).

MRB - Material Review Board. A board consisting of a chairperson and an Engineering representative responsible for reviewing, evaluating, and determining or recommending disposition of nonconforming MRAS product referred to it.

Nadcap- National Aerospace and Defense Contractors Accreditation Program

NDE/NDT – Non-destructive evaluation/Non-destructive testing. Any test method that does not destroy or damage a product.

NONCONFORMANCE - A failure of a characteristic to conform to the requirements specified in the contract, drawings, specifications, or other approved MRAS product description. The failure to perform all material tests and inspections

required by the approved MRAS product description and/or the failure to perform tests and inspections required in the approved product description.

NONCONFORMANCE DOCUMENTATION – A record of a nonconformance either documented on a form or entered into a computerized system, which can contain all pertinent information associated with the nonconformance.

NONCONFORMANCE MANAGEMENT SYSTEM - The system for disposition of supplier nonconformances. This system includes review, disposition, trending measurement, corrective action request, traceability and record retention.

NONCONFORMING MATERIAL - Any MRAS product containing one or more nonconformances

NOTICE OF ESCAPE (NOE)- Communication from supplier in the form of a nonconformance document which reports to MRAS that nonconforming material/product has been delivered to MRAS

OEM/OCM- Original Equipment Manufacturer/Original Component Manufacturer- the manufacturer of the new/original part or item.

OPEN NONCONFORMANCE DOCUMENT - A nonconformance document is considered "Open" when material and/or additional documentation is required to be sent to the purchaser for review prior to final disposition.

PRELIMINARY REVIEW (PR) - An initial evaluation of a nonconformance (or a departure to an in-process characteristic) to determine the appropriate disposition.

PRIME SUPPLIER – Prime Supplier is a supplier on the Purchase Document from the Purchaser.

PROCESSOR - A supplier that performs operations, or processes, on hardware owned by other companies (including special processes and machining) but does not make any parts complete for MRAS.

PURCHASER - The procuring activity of MRAS that issued the procurement document invoking this document. When this document is invoked by a U.S. Government purchasing activity (or such activity's designee), the purchaser shall mean such activity or designee.

PURCHASE DOCUMENT - The formal legal contract between MRAS and a supplier covering the purchase of materials and services. PDs are typically hard copies with approval signatures, but some PDs are transmitted electronically (EDI) or may take the form of a legal contractual conveyance document.

PURE TIN- base metal or finish which contains less than 3% lead or other metal/alloy.

RAW MATERIAL - Metallic or non-metallic material in its basic form (i.e., sheet, bar, wire, powder, etc.), including castings and forgings used to fabricate MRAS products, and which remains present in whole, or in part, in the finished product.

REPAIR - A procedure which may be applied to MRAS product with one or more nonconformances when it has been determined that the product does not meet the definition of a minor nonconformance in its existing condition without any special handling, tooling or procedures. The purpose of the repair is to bring nonconforming product into an acceptable condition.

Note: Repair is distinguished from rework in that the item after repair does not completely conform to the applicable engineering requirements.

REWORK - A procedure applied to a nonconformance that will completely eliminate it and result in a characteristic that conforms completely to engineering requirements (i.e., drawings, specifications, etc.).

SCRAP - Nonconforming material that is not usable for its intended purpose and cannot be economically reworked or repaired.

SERVICES - Processing operations performed on material (i.e., inspection, heat treat, joining, plating, forming, machining, etc.).

SHALL- Indicates a requirement.

SHOULD- Offers a guideline or recommendation that might be used or helpful to assure compliance.

SOFTWARE - Computer programs associated internal data, and related documentation.

SOFTWARE CONFIGURATION MANAGEMENT - The process of identifying and defining the functional and physical characteristics of software items, controlling the release and change of these items throughout the life cycle, recording and reporting the status of these items and change requests, and verifying the completeness and correctness of the items.

SOFTWARE QUALITY ASSURANCE - A planned and systematic pattern of all actions necessary to provide adequate confidence that software conforms to established requirements and standards, and that it achieves satisfactory performance over the entire life cycle.

SPECIAL PROCESSES - Those processes which modify or change the inherent physical, chemical, electrical or metallurgical properties of an item, or non-conventional methods which remove or deposit material on an item during or after fabrication which cannot be fully evaluated by nondestructive means, or those used to maintain process control such as nondestructive testing. These processes may require a demonstration of operator or equipment capability or proficiency and require special controls for monitoring per specification. Means for compliance are contained in individual specifications. Typical processes will be listed by MRAS, customers and approved sources.

STANDARD REPAIR PROCEDURE - A repair demonstrated to be technically adequate and cost effective which may be applied to a nonconforming MRAS product under defined conditions. Defined conditions shall include an expiration date or a finite limit on the number of applications, or both.

SUB-TIER SUPPLIER – Any supplier performing operations, processes or providing raw material for a manufacturer.

SUPPLIER - Sources (including distributors, warehouses, revenue share participants and supplier participants) other than MRAS, who supply material, parts, processes, assemblies or services for incorporation into MRAS products.

TRACEABILITY (COMPONENT) - term used herein for components with full traceability back to the original manufacturer. This traceability means that every supplier in the supply chain is prepared to legally declare in writing that they know and can identify their source of supply, which goes back to the original manufacturer and can confirm that the components are brand new and were handled with appropriate ESD and MSD (moisture sensitive device) handling precautions. This authenticates the components being supplied are unused, brand new components with no ESD, MSD or other damage. This ensures that the components are protected by any manufacturer’s warranties, have all of their useful life remaining

and function according to the manufacturer's published datasheet, exhibiting the expected component life in the application for the OEM's reliability predictions and product warranty.

UKAS - United Kingdom Accreditation Service. May be used by non-US suppliers in lieu of ANSI.

WAIVER/CONCESSION - A written authorization to accept a configuration item or other designated items, which during production or after having been submitted for inspection, are found to depart from specified requirements, but nevertheless is considered suitable for "use as is" or after repair by an approved method.