SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS5553

Issued 2009-04

Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition

RATIONALE

This standard was created in response to a significant and increasing volume of counterfeit electronic parts entering the aerospace supply chain, posing significant performance, reliability, and safety risks.

This standard was created to provide uniform requirements, practices and methods to mitigate the risks of receiving and installing counterfeit electronic parts.

FOREWORD

To assure customer satisfaction, aerospace industry organizations must produce, and continually improve, safe, reliable products that meet or exceed customer and regulatory authority requirements. The globalization of the aerospace industry and the resulting diversity of regional/national requirements and expectations has complicated this objective. End-product organizations face the challenge of assuring the quality and integration of product purchased from suppliers throughout the world and at all levels within the supply chain. Aerospace suppliers and processors face the challenge of delivering product to multiple customers having varying quality expectations and requirements.

This document standardizes requirements, practices, and methods related to: parts management, supplier management, procurement, inspection, test/evaluation, and response strategies when suspect or confirmed counterfeit parts are discovered.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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1. SCOPE

1.1 Purpose

This SAE Aerospace Standard standardizes practices to:

a. maximize availability of authentic parts,

b. procure parts from reliable sources,

c. assure authenticity and conformance of procured parts,

d, control parts identified as counterfeit,

e. and report counterfeit parts to other potential users and Government investigative authorities.

1.2 Application

This document is intended for use in aviation, space, defense, and other high performance/reliability electronic equipment applications. This standard is recommended for use by all contracting organizations that procure electronic parts, whether such parts are procured directly or integrated into electronic assemblies or equipment. The requirements of this standard are generic and intended to be applied/flowed down to all organizations that procure electronic parts, regardless of type, size, and product provided.

2. APPLICABLE DOCUMENTS

The following publications for a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

The requirements of this document are intended to supplement the requirements of a higher level quality standard (e.g., AS9100) and other quality management system documents. They are not intended to stand alone, supersede, or cancel requirements found in other quality management system documents, requirements imposed by contracting authorities, or applicable laws and regulations unless an authorized exemption/variance has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA and Canada), www.sae.org.

AS9003 Inspection and Test Quality System

ARP9009 Aerospace Contract Clauses

AS9100 Quality Systems – Aerospace – Model for Quality Assurance in Design, Development, Production, Installation and Servicing

AS9120 Quality Management Systems – Aerospace Requirements for Stocklist Distributors

2.2 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI/ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)

EIA-4899 Standard for Preparing an Electronic Components Management Plan

2.3 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://assist.daps.dla.mil/quicksearch/.

MIL-PRF-19500 Semiconductor Devices, General Specification For

MIL-PRF-38534 Hybrid Microcircuits, General Specification For

MIL-PRF-38535 Integrated Circuits (Microcircuits) Manufacturing, General Specification For

MIL-STD-202 Electronic and Electrical Component Parts

MIL-STD-750 Test Methods for Semiconductor Devices

MIL-STD-883 Test Method Standard - Microcircuits

MIL-STD-1580 Destructive Physical Analysis for Electronic, Electromagnetic, and Electromechanical Parts

OMB Policy Letter 91-3 Reporting Nonconforming Products (not available through the ASSIST database; it may be obtained using the following link: http://whitehouse.gov/omb/procurement_policy_letter_91-3/)

SD-22 Diminishing Manufacturing Sources and Material Shortages (DMSMS) Guidebook

2.4 Commercial Publications

GEIA GEB1 Diminishing Manufacturing Sources and Material Shortages (DMSMS) Management Practices

IDEA-STD-1010 Acceptability of Electronic Components Distributed in the Open Market

JEDEC JESD22-B107C Marking Permanency

JEDEC JESD31 General Requirements for Distributors of Commercial and Military Semiconductor Devices

IEC TS 62239 Process Management for Avionics – Preparation of an Electronic Components Management Plan

2.5 ISO Publications

ISO 9000 Quality Management Systems - Fundamentals and Vocabulary

ISO 9001 Quality Management Systems - Requirements

3. TERMS AND DEFINITIONS

For the purposes of this document, the terms and definitions stated in ISO 9000 and the following shall apply:

3.1 Suspect Part

A part in which there is an indication by visual inspection, testing, or other information that it may have been misrepresented by the supplier or manufacturer and may meet the definition of counterfeit part provided below.

3.2 Counterfeit Part

A suspect part 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. Examples of counterfeit parts include, but are not limited to:

a. Parts which do not contain the proper internal construction (die, manufacturer, wire bonding, etc.) consistent with the ordered part.

b. Parts which have been used, refurbished or reclaimed, but represented as new product.

c. Parts which have different package style or surface plating/finish than the ordered parts.

d. Parts which have not successfully completed the Original Component Manufacturer's (OCM)'s full production and test flow, but are represented as completed product.

e. Parts sold as upscreened parts, which have not successfully completed upscreening.

f. Parts sold with modified labeling or markings intended to misrepresent the part's form, fit, function, or grade.

Parts which have been refinished, upscreened, or uprated and have been identified as such, are not considered counterfeit.

3.3 Related Definitions

AFTERMARKET MANUFACTURER: A manufacturer that meets one or more of the following four criteria:

1. The manufacturer is authorized by the OCM to produce and sell replacement parts, usually due to an OCM decision to discontinue production of a part. Parts supplied are produced from dice that have been

   a. transferred from the OCM to the aftermarket manufacturer, or

   b. produced by the aftermarket manufacturer using OCM tooling and intellectual property (IP).

2. The manufacturer produces parts using semiconductor dice or wafers, manufactured by and traceable to an OCM, that have been properly stored until use and are subsequently assembled, tested, and qualified using processes that meet technical specifications without violating the OCM's intellectual property rights, patents, or copyrights.

3. The manufacturer produces parts through emulation, reverse-engineering, or redesign, that match the OCM's specifications and satisfy customer needs without violating the OCM's intellectual property rights (IPR), patents, or copyrights.

In any case, the aftermarket manufacturer must label or otherwise identify its parts to ensure that the 'as shipped' aftermarket manufactured part should not be mistaken for the part made by the OCM.

APPROVED SUPPLIER: Suppliers that are formally assessed, determined to provide low risk of providing counterfeit parts, and entered on a register of approved suppliers.

AUTHORIZED SUPPLIER: Aftermarket manufacturers as defined above, and OCM authorized sources of supply for a part (i.e., franchised distributors).

BROKER: In the independent distribution market, brokers are professionally referred to as independent distributors. See definitions for “broker distributor” and “independent distributor”.

BROKER DISTRIBUTOR: A type of independent distributor that works in a “Just in Time” (JIT) environment. Customers contact the broker distributor with 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.

CERTIFICATE OF CONFORMANCE (C of C, CoC): A document provided by a supplier formally declaring that all buyer purchase order requirements have been met. The document may include information such as manufacturer, distributor, quantity, lot and/or date code, inspection date, etc., and is signed by a responsible party for the supplier.

CERTIFICATE OF CONFORMANCE AND TRACEABILITY (CoCT): A certificate of conformance required by certain military specifications which requires documented traceability from the QPL/QML manufacturer through delivery to the Government if the material is not procured directly from the approved manufacturer.

DESTRUCTIVE PHYSICAL ANALYSIS (DPA): A systematic, logical, detailed examination of parts during various stages of physical disassembly, conducted on a sample of completed parts from a given lot, wherein parts are examined for a wide variety of design, workmanship, and/or processing problems. Information derived from DPA may be used to:

a. preclude installation of inauthentic parts or parts having patent or latent defects

b. aid in disposition of parts that exhibit anomalies

c. aid in defining improvements or changes in design, materials, or processes

d. evaluate supplier production trends

DISPOSITION: Decisions made by authorized representatives within an organization concerning future treatment of nonconforming material. Examples of dispositions are to scrap, use-as-is (normally accompanied by an approved variance/waiver), retest, rework, repair, or return-to-supplier.

ERAI: A privately held global trade association that monitors, investigates, reports, and mediates issues affecting the global supply chain of electronics, including supply of counterfeit and substandard parts.

FRANCHISED DISTRIBUTOR: A distributor with which the OCM has a contractual agreement to buy, stock, re-package, sell and distribute its product lines. When a distributor does not provide products in this manner, then for the purpose of this document, the distributor is considered an independent distributor for those products. Franchised distributors normally offer the product for sale with full manufacturer flow-through warranty. Franchising contracts may include clauses that provide for the OCM's marketing and technical support inclusive of, but not limited to, failure analysis and corrective action, exclusivity of inventory, and competitive limiters.

GIDEP (GOVERNMENT-INDUSTRY DATA EXCHANGE PROGRAM): A cooperative activity between government and industry participants seeking to reduce or eliminate expenditures of resources by sharing technical information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment.

INDEPENDENT DISTRIBUTOR: A distributor that purchases new parts with the intention to sell and redistribute them back into the market. Purchased parts may be obtained from original equipment manufacturers (OEMs) or contract manufacturers (typically from excess inventories), or from other independent distributors. Re-sale of the purchased parts (re-distribution) may be to OEMs, contract manufacturers, or other independent distributors. Independent distributors do not have contractual agreements or obligations with OCMs.

IDEA: Independent Distributors of Electronics Association, a non-profit trade association representing independent distributors that have formally committed to adhere to prescribed quality and ethical standards. The stated purpose of IDEA is to promote the independent distribution industry through media advocacy; to improve the quality of products and services through a quality certification program, educational seminars and conferences; and to promote the study, development, and implementation of techniques and methods to improve the business of independent distributors.

OPEN MARKET: The trading market that buys or consigns primarily OEM and contract manufacturer's excess inventories of new electronic parts and subsequently utilizes these inventories to fulfill supply needs of other OEMs and contract manufacturers, often due to urgent or obsolete part demands.

ORGANIZATION: In the context of this document, it refers to procurement entities (government and contractor), and sub-tier equipment suppliers and producers.

ORIGINAL COMPONENT MANUFACTURER (OCM): An organization that designs and/or engineers a part and is pursuing or has obtained the intellectual property rights to that part.

Notes:

1. The part and/or its packaging are typically identified with the OCM's trademark.

2. OCMs may contract out manufacturing and/or distribution of their product.

3. Different OCMs may supply product for the same application or to a common specification.

PACKAGING (COMPONENT): Component packaging refers to the manner in which electronic parts are packaged in preparation of use by electronic assemblers. The determination of packaging types is determined by product sensitivities such as moisture, physical (lead pitch, co-planarity), electrostatic discharge (ESD), as well as the method (manually, or by use of automated equipment) to be used to place parts on the printed circuit board. There are four main types of packaging: bulk, trays, tubes, and tape and reel.

REFINISHED: Using post-manufacture plating methods (such as solder dipping) to alter the plating composition on a part's leads.

REFURBISHED: Parts that have been brightened, polished or renovated in an effort to restore them to a "like new" condition. Refurbished parts may have had their leads realigned and re-tinned.

STOCKING DISTRIBUTOR: A type of independent distributor that stocks large inventories typically purchased from original equipment manufacturers (OEMs) and contract manufacturers. The handling, chain of custody, and environmental conditions for parts procured from stocking distributors are generally better known than for product bought and supplied by broker distributors.

SUPPLIER: Within the context of this document, a blanket description of all sources of supply for a part (e.g., OCM, franchised distributor, independent distributor, broker distributor, stocking distributor, aftermarket manufacturer, Government Supply Depot).

SUPPLY CHAIN TRACEABILITY: Documented evidence of a part's supply chain history. This refers to documentation of all supply chain intermediaries and significant handling transactions, such as from OCM to distributor, or from excess inventory to broker to distributor.

UNUSED (NEW SURPLUS): Electronic parts that have not been previously used (i.e., attached to a board or powered up since leaving the supply chain). A shipment of unused material can contain mixed date codes, lot codes, or countries of origin, and should be received in unused factory or third party packaging. The material may have minor scratches or other physical defects as a result of handling, but the leads should be in good condition and should not be refurbished. The material should be guaranteed to meet the manufacturer's full specifications. Unused programmable parts should be unprogrammed.

UPRATED: Assessment which results in the extension of a part's ratings to meet the performance requirements of an application in which the part is used outside the manufacturer's specification range.

UPSCREENED: Additional part testing performed to produce parts verified to specifications beyond the part manufacturer's operating parameters. Examples are Particle Impact Noise Detection (PIND) testing, temperature screening, Radiation Hardness Assurance testing, etc.

USED (REFURBISHED OR PULLED): Product that has been electrically charged and subsequently pulled or removed from a socket or other electronic application. Used product may be received in non-standard packaging (i.e., bulk), and may contain mixed lots, date codes, be from different facilities, etc. Parts may have physical defects such as scratches, slightly bent leads, test dots, faded markings, chemical residue or other signs of use, but the leads should be intact. Used product may be sold with a limited warranty, and programmable parts may still contain partial or complete programming which could impact the part's functionality. Used parts marketed as refurbished should be declared as such.

4. REQUIREMENTS

4.1 Counterfeit Electronic Parts Control Plan

The organization shall develop and implement a counterfeit electronic parts control plan that documents its processes used for risk mitigation, disposition, and reporting of counterfeit parts. The control plan shall include the processes described in paragraphs 4.1.1 through 4.1.7 below.

4.1.1 Parts Availability

The processes shall maximize availability of authentic, originally designed and/or qualified parts throughout the product's life cycle, including management of parts obsolescence. Information and guidance for ensuring parts availability is provided in Appendix A, Parts Availability.

4.1.2 Purchasing

The processes shall:

a. Assess potential sources of supply (including electronic parts, assembly, and equipment suppliers) to determine the risk of receiving counterfeit parts. Assessment actions may include surveys, audits, review of product alerts (e.g., GIDEP, ERAI), and review of supplier quality data to determine past performance.

b. Maintain a register of approved suppliers, including the scope of the approval, to minimize the risk of counterfeit parts supply. Information and guidelines for source assessment and approval/selection are provided in Appendix B, Purchasing Process.

c. Specify a preference to procure directly from OCMs or authorized suppliers who are on the approved supplier register.

d. Assure that approved/ongoing sources of supply are maintaining effective processes for mitigating the risks of supplying counterfeit electronic parts. Assurance actions may include surveys, audits, review of product alerts, and review of supplier quality data to determine past performance.

e. Assess and mitigate risks of procuring counterfeit parts from sources other than OCMs or authorized suppliers. This shall be accomplished and documented for every application when it is necessary to procure from other than the OCM or an authorized supplier.

f. Specify supply chain traceability to the OCM or aftermarket manufacturer that identifies the name and location of all of the supply chain intermediaries from the part manufacturer to the direct source of the product for the seller. If this traceability is unavailable or the documentation is suspected of being falsified, a documented risk assessment is required. Guidance and information regarding supply chain traceability are provided in Appendix C, Supply Chain Traceability.

g. Specify flow down of applicable requirements of this document to applicable contractors and their sub-contractors. In the event that one or more supply chain intermediaries do not have a counterfeit part control plan compliant to this document, a risk analysis shall be required for every application of the part.

4.1.3 Purchasing Information

The documented process shall specify contract/purchase order quality requirements to minimize the risk of being provided counterfeit parts. Examples of procurement quality requirements and clauses are provided in Appendix D, Procurement Contract Requirements.

4.1.4 Verification of Purchased Product

The documented processes shall assure detection of counterfeit parts prior to formal product acceptance. The rigor of the verification process shall be commensurate with product risk. Product risk is determined by the criticality of the part and the assessed likelihood of receiving a counterfeit part. Examples of verification actions include: review of data deliverables, visual inspection, measurements, non-destructive evaluation and destructive testing (e.g., marking permanency, x-ray, destructive physical analysis, thermal cycling, hermeticity, burn-in). Guidelines concerning the performance of risk-based product assurance are provided in Appendix E, Product Assurance.

4.1.5 In Process Investigation

The documented processes shall address the detection, verification, and control of in-process (post acceptance) and in-service suspect counterfeit parts.

4.1.6 Material Control

The documented processes shall specify methods to:

a. Control excess and nonconforming parts to prevent them from entering the supply chain under fraudulent circumstances.

b. Control suspect or confirmed counterfeit parts to preclude their use or reentry into the supply chain.

Guidelines for control of parts are provided in Appendix F, Material Control.

4.1.7 Reporting

The documented processes shall assure that all occurrences of counterfeit parts are reported, as appropriate, to internal organizations, customers, government reporting organizations (e.g., GIDEP), industry supported reporting programs (e.g., ERAI), and criminal investigative authorities. Information and guidelines for reporting counterfeit parts are provided in Appendix G, Reporting.

5. NOTES

5.1 A change bar (|) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

APPENDIX A - PARTS AVAILABILITY

A.1 DESIGN, PROPOSAL, AND PROGRAM PLANNING

During design, proposal and program planning efforts, organizations should assess the long term availability of authentic parts and part sources for production and support of systems. When assessments indicate availability risks, organizations should take the steps necessary to reduce exposure to counterfeit parts, including, for example:

a. Lifetime buy

b. System redesign

c. Alternate/multiple sources

d. Substitutions

e. Planning for adequate procurement lead times

A.2 OBSOLESCENCE MANAGEMENT

Obsolescence can increase the risk of acquiring counterfeit electronic parts. To reduce the likelihood of purchasing counterfeit parts, electronic equipment manufacturers should proactively manage the life cycle of their products through the use of a Diminishing Manufacturing Sources and Material Shortages (DMSMS) management plan.

The following Government and Industry documents provide guidance with regard to managing DMSMS:

a. SD-22: Department of Defense (DOD) Diminishing Manufacturing Sources and Material Shortages (DMSMS) Guidebook

b. GEIA GEB1: Diminishing Manufacturing Sources and Material Shortages (DMSMS) Management Practices, Government Electronics and Information Technology Association

c. EIA-4899: Standard for Preparing an Electronic Components Management Plan

d. IEC TS 62239: Process Management for Avionics – Preparation of an Electronic Components Management Plan

APPENDIX B - PURCHASING PROCESS

B.1 PROCUREMENT APPROACH

B.1.1 General

B.1.1.1 Electronic parts should be purchased, whenever possible, directly from OCMs or from authorized suppliers. Independent distributors should be used only after consideration of alternate parts, redesign, schedule adjustments and a reasonable search for material from franchised/authorized sources has been conducted and approval has been obtained from a designated authority.

B.1.1.2 OCM franchise agreements typically include provisions that protect the user by ensuring product integrity and traceability, such as:

a. original manufacturer warranty.

b. proper handling, storage and shipping procedures.

c. failure analysis and corrective action support.

d. certificates of conformance and acquisition traceability.

Independent distributors do not have warranty or product support agreements with the OCM and, therefore, have limited means to ensure product integrity and traceability. Broker distributors, in particular, may only act as scouting agencies for hard-to-find parts and may not maintain quality assured inventories.

B.1.1.3 Franchised distributors should provide product acquired through franchise agreements with OCMs. When a distributor does not provide products in this manner, then for the purpose of this document, the distributor is considered an independent distributor for those products.

B.1.1.4 Procurement assurance processes for avoiding counterfeit product should begin prior to the tendering of a contract for the product. The extent of these processes should be commensurate with risks related to the source of supply and product criticality. Figure B1 depicts overall risk as a function of supplier reliability and product criticality. Figure B2 identifies factors for assessing and mitigating supplier risk.

B.1.2 Supplier Approval and Source Selection

B.1.2.1 Supplier approval and source selection considerations should include:

a. the buyer's historical experience with the source.

b. previously documented problems noted by external sources (e.g., GIDEP, ERAI, IDEA, customer referrals).

c. how long the source has been in business.

d. the source's demonstrated adherence and/or certification to higher-level quality standards such as the following:

- assembly/equipment/system providers: AS9100

- OCMs, aftermarket manufacturers: AS9100, ISO 9001, AS9003

- distributors: AS9120

- test facilities: ISO 9001

e. the source's demonstrated adherence to applicable provisions of this Aerospace Standard.

f. the results of audits performed per section B.1.3 below.

g. acceptable documented purchasing and product acceptance processes and practices for verifying the authenticity of parts supplied.

h. use of outsourced or in-house laboratory testing.

i. use of quality inspectors that have been trained and qualified concerning types and means of electronic parts counterfeiting and how to conduct effective product authentication.

j. membership in associations with rigorous business, ethical, and quality standards intended to avoid acquiring and reselling counterfeit goods (e.g., IDEA).

k. terms of the supplier warranty, return policy and product liability.

B.1.2.2 Buyers should ensure that independent distributors have established documented processes and the financial means to support any contractual guarantees expected. Purchase agreements should include product certifications and contractual remedies such as financial penalties if inaccuracies are found.

B.1.2.3 Buyers should investigate independent distributors through reporting sources such as GIDEP and ERAI in advance of procurement activity to ensure suspect counterfeiting incidents have not occurred.

B.1.2.4 An industry standard that can be used to help evaluate the suitability of an independent distributor is JEDEC Standard JESD31, General Requirements for Distributors of Commercial and Military Semiconductor Devices. JESD31 includes a number of provisions that protect the user by ensuring product integrity and traceability.

B.1.2.5 The cost of product inspections, tests, and supplier assurance actions (e.g., audits/surveys) should be factored into a determination of total procurement costs in order to fully evaluate and compare costs to be incurred by offerer proposals.

B.1.2.6 Figure B3 provides a procurement risk mitigation flow diagram.

B.1.3 Audits

B.1.3.1 Audits demonstrating that the supplier's quality management system incorporates adequate documented processes to prevent the purchase, acceptance, use, and delivery of counterfeit parts should be performed before purchasing product, and periodically thereafter (note: typical audit certifications apply to specific facilities, so multiple sites may require multiple audits). These audits should occur at intervals sufficient to determine that the supplier's quality management system incorporates a program compliant with this Aerospace Standard (for equipment/system providers, where invoked), and/or other invoked contract requirements related to counterfeit parts risk mitigation. Audits may be performed by a qualified independent third party.

B.1.3.2 Using the results of audits performed by other private sector or Government organizations is an acceptable alternative to second or third party auditing provided the auditing process, attributes, and auditor qualifications are evaluated and deemed adequate to assure compliance with this document and/or other invoked requirements.

B.1.3.3 Audit scope and frequency should be commensurate with the assessed risk of the source. Audit requirements may range from completion of a survey assessment of the source's processes and controls (procurement, quality, handling, test, etc.), to a full facility audit of these processes.

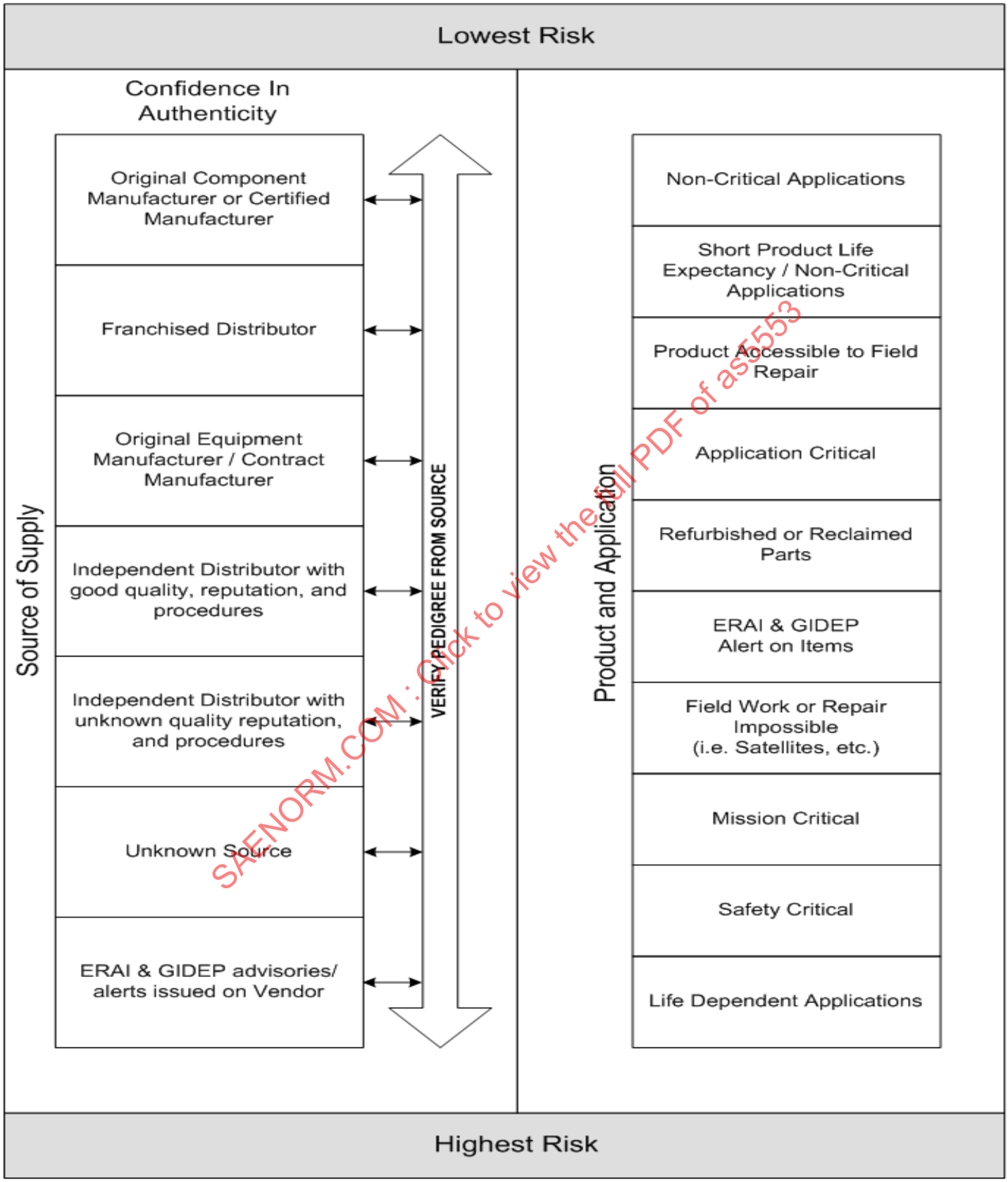

FIGURE B1 - RISK STACK CHART

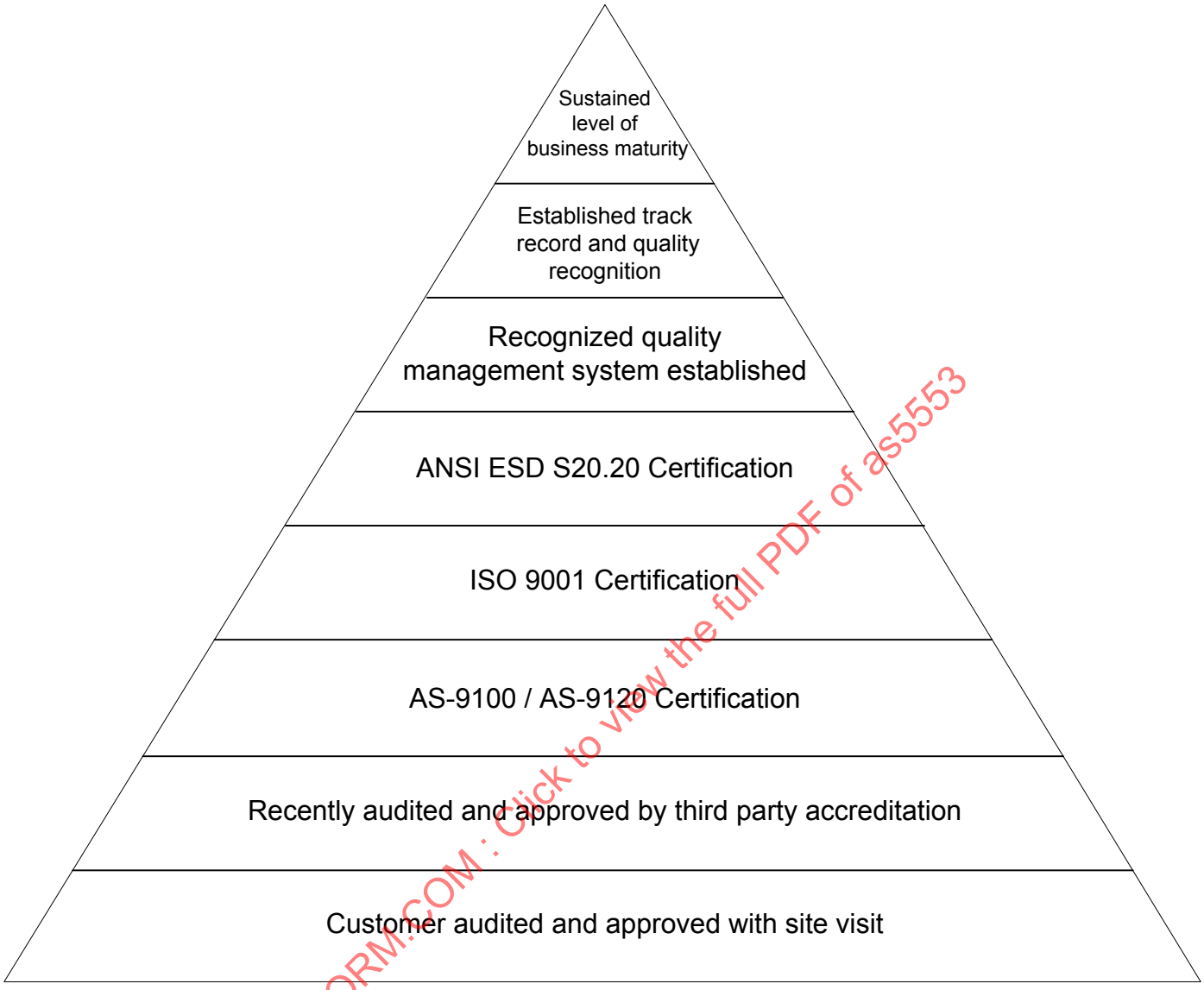

FIGURE B2 - SUPPLIER ASSESSMENT PYRAMID

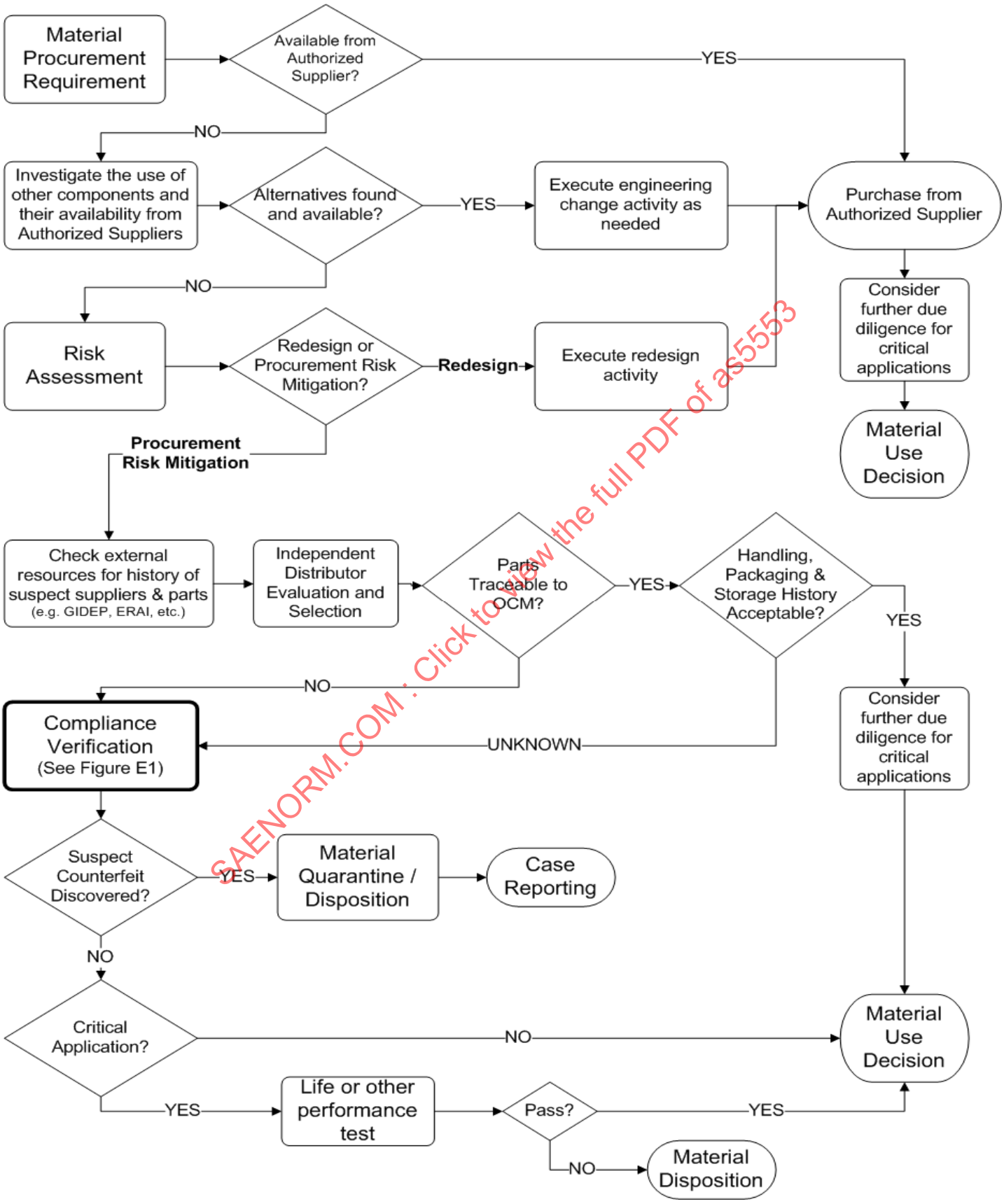

FIGURE B3 - PROCUREMENT RISK MITIGATION

APPENDIX C - SUPPLY CHAIN TRACEABILITY

C.1 OCMs and distributors (franchised and independent) should be required to provide certificates of conformance and acquisition traceability; otherwise the purchaser assumes unknown risks (Note: such documentation has the potential to be forged or falsified). Acquisition traceability consists of the name and location of all supply chain intermediaries from the part manufacturer to the direct source of the product. The organization should ensure that these requirements are clearly stated as deliverable data within the procurement documents, regardless of which level of the supply chain provides the parts. If traceability is unknown or documentation is suspect, appropriate risk mitigation should be used as described in this document.

C.2 MIL-PRF-38535, General Specification for Integrated Circuits (Microcircuits) Manufacturing, includes requirements for certification of conformance and acquisition traceability provided by the original manufacturer and the manufacturer's franchised distributors. Similar requirements are included in MIL-PRF-19500, General Specification for Semiconductor Devices.

C.3 In order to assure supply chain traceability when parts are purchased through franchised distribution, the documentation in the following paragraphs should be required. Note that there is a distinction regarding the level of documentation to be supplied when buying parts manufactured to U.S. military standards and aerospace specifications versus parts made to commercial or industrial standards.

C.3.1 For procurement of product for commercial or industrial use, product delivered by the manufacturer to the franchised distributor is not normally required to contain a formal certificate of conformance. In such cases, the accompanying documentation is a commercially acceptable packing list. This document normally identifies the manufacturer, distributor to whom the parts were supplied, distributor purchase order number, part number, and quantity. Additional information, such as date code or statement of compliance, may be provided but is not normally required. This document is maintained on file by the distributor and not supplied to the end customer. Shipments of commercial and industrial parts are typically accompanied by a distributor packing list and/or certificate of conformance. Purchase orders should require that material purchased through franchised distribution be acquired directly from OCMs or authorized suppliers.

C.3.2 For procurement of product for military or US Government use, a manufacturer certification to a specified military or aerospace specification or standard is required. This documentation should contain at a minimum the manufacturer, distributor, distributor purchase order number, part number, quantity, and date code of each quantity supplied. Additional information, as required by governing specifications, may also be provided. A copy of this document must accompany shipment of parts to the end customer and, for parts procured through franchised distributors, must be accompanied by a certificate of conformance showing proper supply chain traceability.

C.4 While it is prudent to request independent distributors to provide these certificates of conformance and acquisition traceability, independent distributors often do not have this documentation. Traceability to the OCM may not have been maintained, is lost, or is unavailable. An independent distributor's inability to provide certificates of conformance and acquisition traceability does not indicate wrongdoing or that the products offered are noncompliant, however, in these circumstances the procuring organization assumes unknown levels of risk regarding product authenticity and must take appropriate risk mitigation actions.

C.5 Examples of procurement clauses requiring certificates of conformance and supply chain traceability are provided in Appendix D of this Aerospace Standard.

APPENDIX D - PROCUREMENT CONTRACT REQUIREMENTS

D.1 CONTRACT REQUIREMENTS - GENERAL

D.1.1 In order to minimize the risk of procuring counterfeit product, the buyer's procurement contract language should include requirements which will help ensure that conforming, authentic material is provided. The seller's responsibilities should be plainly stated and agreed upon, including:

a. Product traceability - Per Appendix C of this Aerospace Standard, the seller should be capable of providing full traceability for the parts being purchased, including names and addresses of prior sources (if any). Both buyer and seller should maintain records containing date and/or lot codes, and any serialization associated with the purchase order and invoice.

b. Tests and inspections - The seller should be notified of all tests and inspections that they will be required to perform to assure product authenticity, including development of accept/reject criteria and qualification of test/inspection personnel.

c. Quality management system - The seller should be required to comply with, and/or be certified to, an appropriate higher level quality standard (e.g., AS9100, AS9120, ISO 9001, and AS9003).

d. Acceptance of financial responsibility - The seller should be notified that they may be liable for remedial costs associated with provision of counterfeit product. Procurement contracts should state that the buyer is not under obligation to return suspect or confirmed counterfeit product. The buyer may request proof of financial responsibility, such as a product liability/completed operations certificate of insurance (e.g., ACORD Certificate of Liability Insurance) issued from the seller's insurance agent or broker. Limits of at least $1,000,000 per occurrence and $1,000,000 annual aggregate are common. The buyer may also request similar evidence of professional liability and/or product recall insurance with similar limits from the seller if the cost is commercially feasible for the seller.

e. Length of obligation - The seller should be informed of the specific time period for which their responsibility applies. Terms and conditions between buyer and seller should allow for a reasonable time period for the buyer to detect, quarantine, and confirm counterfeit or substandard product. The buyer should perform a level of inspection or test sufficient to detect gross or common indications of counterfeiting before the time expires.

f. Required documentation - The seller should be provided with clear and specific instructions concerning deliverable documentation. Documentation requirements, including certificates of conformance and test/inspection data, should be included in the contract terms and conditions.

g. Penalties associated with fraud - The seller should be notified of potential Federal penalties associated with fraud and falsification.

D.1.2 The sample contract clauses provided in this appendix are intended to supplement, not duplicate or replace, quality clauses/requirements contained in other Aerospace Quality Standards such as AS9100, AS9120, and ARP9009. These documents should be referred to during the selection and development of comprehensive procurement contract requirements related to assuring product quality.

D.2 SAMPLE CONTRACT CLAUSES - CONTRACTS ISSUED TO ASSEMBLY/EQUIPMENT/SYSTEM PROVIDERS

D.2.1 Guarantee of Product Source(s)

"The seller shall ensure that only new and authentic materials are used in products delivered to <BUYER>. The Seller may only purchase parts directly from Original Component Manufacturers (OCMs), OCM franchised distributors, or authorized aftermarket manufacturers. Use of product that was not provided by these sources is not authorized unless first approved in writing by <BUYER>. The seller must present compelling support for its request (e.g., OCM documentation that authenticates traceability of the parts to the OCM), and include in its request all actions to ensure the parts thus procured are authentic/conforming parts."

D.2.2 Supply Chain Traceability

“The seller shall maintain a method of item traceability that ensures tracking of the supply chain back to the manufacturer of all Electrical, Electronic, and Electromechanical (EEE) parts included in assemblies and subassemblies being delivered per this order. This traceability method shall clearly identify the name and location of all of the supply chain intermediaries from the manufacturer to the direct source of the product for the seller and shall include the manufacturer's batch identification for the item(s) such as date codes, lot codes, serializations, or other batch identifications.”

D.2.3 Certificate of Conformance and Traceability (Government Contracts)

“This clause is applicable to all contracts for QPL or QML integrated circuits or hybrid semiconductor devices procured in accordance with MIL-PRF-38534 or MIL-PRF-38535 and semiconductor devices procured in accordance with MIL-PRF-19500. This clause applies regardless of the point of inspection designated in the contract award. This clause applies both to contracts awarded directly to a manufacturer listed on the applicable QPL/QML and to suppliers (e.g., distributors) not listed as approved manufacturers on the applicable QPL/QML.

The parts supplied must be in strict conformance to the requirements set forth and/or referenced in the item description, including applicable revisions and slash sheets. To ensure this conformance, the contractor must provide a Certificate of Conformance and Traceability (CoC/T) with the information and documentation required by the applicable military specification. This documentation must reference the contract number and include a certification signed by the approved QPL/QML manufacturer. In addition, if the material is not procured directly from the approved manufacturer, all additional documentation required by the specification must be provided to establish traceability from the QPL/QML manufacturer through delivery to the Government. The CoC/T is required to determine acceptability of the supplies. If the CoC/T is not provided, is incomplete or otherwise unacceptable, the supplies will be determined not to meet contract requirements and will be rejected.

If the contract requires inspection and acceptance at origin, the contractor shall furnish the original and two copies of the CoC/T to the Government Quality Assurance Representative (QAR) with the items offered for acceptance. The CoC/T must clearly reference the applicable contract number. Upon acceptance, the QAR shall sign all copies indicating approval of the certification and acceptance of the supplies. The contractor shall submit one signed copy to DSCC-FMTA. The second copy shall be retained by the QAR. The original shall be maintained by the contractor.

If the contract requires inspection and acceptance at destination, the contractor shall mail one copy of the CoC/T to DSCC-FMTA upon shipment/delivery. The CoC/T must clearly reference the applicable contract number.”

D.3 SAMPLE CONTRACT CLAUSES - CONTRACTS ISSUED TO INDEPENDENT DISTRIBUTORS

D.3.1 Test and Inspection Requirements

“The seller shall establish and implement test and inspection activities necessary to assure the authenticity of purchased product, including:

- Traceability and documentation verification,
- Visual examination
- [see Appendix E of this Aerospace Standard for examples and descriptions of test and inspection activities]

Tests and inspections shall be performed in accordance with clearly delineated accept/reject criteria provided or approved by <BUYER>. The seller shall prepare and provide to the <BUYER> records evidencing tests and inspections performed and conformance of the product to specified acceptance criteria.

Tests and inspections shall be performed by persons that have been trained and qualified concerning types and means of electronic parts counterfeiting and how to conduct effective product authentication.”

D.3.2 Supply Chain Traceability

"The seller shall maintain a method of item traceability that ensures tracking of the supply chain back to the manufacturer of all Electrical, Electronic, and Electromechanical (EEE) parts included in assemblies and subassemblies being delivered per this order. This traceability method shall clearly identify the name and location of all of the supply chain intermediaries from the manufacturer to the direct source of the product for the seller, and shall include the manufacturer's batch identification for the item(s) such as date codes, lot codes, serializations, or other batch identifications."

D.3.3 Certificate of Conformance

"The seller shall approve, retain, and provide copies of Electrical, Electronic, and Electromechanical (EEE) part Manufacturer Certificates of Conformance (CoC).

Manufacturer CoCs shall, at minimum, include the following:

a. Manufacturer name and address

b. Manufacturer and/or buyer's part number and dash number

c. Batch identification for the item(s) such as date codes, lot codes, serializations, or other batch identifications.

d. Signature or stamp with title of seller's authorized personnel signing the certificate.

NOTE:Distributors shall, in addition to the above, include their name for each part shipped."

D.3.4 Quality Management System

"The seller shall have a quality management system that complies with Society of Automotive Engineers (SAE), AS9120 Quality Management Systems - Aerospace - Requirements for Stockist Distributors. Independent certification/registration is not required unless specified by buyer.

Organizations that obtain certification/registration to AS9120 and subsequently change certification/registration bodies (CRB), lose registration status, or are put on notice of losing registration status, shall notify the buyer's procuring organization(s) within three days of receiving such notice from its CRB."

D.3.5 Product Impoundment and Financial Responsibility

"If counterfeit parts are furnished under this purchase agreement, such items shall be impounded. The seller shall promptly replace such items with items acceptable to the <BUYER> and the seller may be liable for all costs relating to impoundment, removal, and replacement. <BUYER> may turn such items over to US Governmental authorities (Office of Inspector General, Defense Criminal Investigative Service, Federal Bureau of investigation, etc.) for investigation and reserves the right to withhold payment for the items pending the results of the investigation."

D.3.6 Federal Penalties Associated with Fraud

“This purchase order and activities hereunder are within the jurisdiction of the United States Government. Any knowing and willful act to falsify, conceal or alter a material fact, or any false, fraudulent or fictitious statement or representation in connection with the performance of work under this purchase order may be punishable in accordance with applicable Federal statutes.

Seller employees engaged in the performance of work under this purchase order shall be informed in writing prior to performance of work that there is a risk of Federal criminal penalties associated with any falsification, concealment, or misrepresentation in connection with work performed under this purchase order.

Seller shall include the following statement preprinted on each Certificate of Conformance initiated by the seller and provided to the buyer in conjunction with this purchase order:

NOTE:The recording of false, fictitious or fraudulent statements or entries on this document may be punishable as a felony under Federal statute.

Seller shall include all provisions of this contract clause, including this sentence, in all lower tier contracts under this order. Any inability or unwillingness of a lower-tier supplier to comply with this provision should be documented in writing and submitted to <BUYER>.”

APPENDIX E - PRODUCT ASSURANCE

E.1 COUNTERFEIT PART DETECTION

For cases where procurements must be made from other than authorized suppliers, or there is reason to doubt a part's authenticity, additional tests and inspections should be performed, as necessary, to detect counterfeits. The following mitigation methods can be applied to reduce the risk of receiving counterfeit electronic parts. These methods may not definitively distinguish authentic parts from counterfeit parts, but when properly used will minimize the risk of counterfeit parts entering the production system. For high risk applications, it may be necessary to perform life testing and other static, dynamic and functional testing as additional tests in order to attain the requisite confidence level. Questionable test results may require performance of comprehensive failure analysis.

The process flow shown in Figure E1 is a recommended flow for assessing the authenticity of a part. This suite of tests and inspections is intended to supplement, not to replace, product acceptance procedures applied by the organization. It assumes that there is capability for a full set of tests. It is recommended that a sequential flow similar to this be followed for each procurement. The risk stack chart provided in Figure E2 illustrates the concept of performing tests and inspections commensurate with product risk. Product risk is determined by supplier reliability and product criticality. The higher the product risk, the greater the sample size and the more definitive/invasive the testing techniques should be.

E.1.1 Documentation and Packaging Inspection

The supplier should provide an unbroken chain of documentation (certifications, packing slips, etc.) tracing the movement of the parts back to the OCM, and certification that the parts have not been salvaged, reclaimed, otherwise used, or previously rejected for any reason.

Any Certificates of Conformance or other documentation should be examined for originality and applicability to the delivered material, including:

a. Lot and/or date codes on the packaging do not match the lot and/or date codes on the parts.

b. Manufacturer's logo or label is absent, or does not match that shown on their website or on previous shipments.

c. Poor use of English, misspelled words, alterations, or changes to the documentation.

d. Bar coding does not match the printed part number.

e. Package materials are inconsistent with the description on the datasheet.

If there is an elevated concern for product integrity, it may be possible to verify with the OCM that date, lot codes, reel sizes, and quantities listed on the documentation are valid.

E.1.2 Visual Inspection

Visual examinations should be performed on 100% of incoming parts at a magnification appropriate to the attribute under examination (Note: Some indicators of counterfeiting may not be detectable below 40X magnification). IDEA-STD-1010A, Acceptability of Electronic Components Distributed in the Open Market, provides detailed guidelines for conducting visual inspection to detect counterfeit characteristics. Examples include, but are not limited to:

a. Uneven top and/or bottom coating of the part, or inconsistent texture or color between top and bottom side coating (mold compound).

b. Bent leads or inconsistent lead plating coverage.

c. Poor quality part ink or laser marking.

d. Chipouts on the package corners which may indicate excessive or careless handling.

e. Rough surface texture in the normally smooth Pin 1 indicator area.

f. Scratches on the surface of the package.

g. Cracks in the package that may signify thermal stress.

h. Presence of numerous date codes on one reel, tube, tray, etc.

i. Lot or date codes reflecting a date of manufacture after the last date of manufacture by the OCM.

j. Terminal finishes on the part not consistent with the terminal finish designator in the part number.

k. Country of manufacturer not associated with OCM assembly locations.

l. Markings not consistent with standard OCM marking content and format.

m. Lot or date codes not consistent with OCM production records.

n. Partially filled reels, trays, etc.

o. Inconsistent package physical dimensions.

E.1.3 Inspection for Evidence of Remarking or Resurfacing

For parts with product identification and/or other identifying/traceability markings, a representative sample based on a determination of product risk should be examined from each lot (date code) for evidence of remarking or resurfacing. Industry and government standard “resistance to solvents” test methods can be effective, but more aggressive methods may be necessary to reveal forged markings and to remove coatings applied to disguise sanding marks, and to reveal other indications that the original device marking has been removed. Other methods include the use of acetone or scraping the surface of the part to remove markings and coatings or to detect original part numbers under a resurfaced and remarked part.

E.1.4 X-Ray Inspection

X-ray analysis should be performed on all parts to verify that the internal package or die construction is consistent with a known authentic part. Analysis should compare die size, general shape, leadframe construction, wire bond gauge and routing.

E.1.5 X-Ray Fluorescence

X-Ray fluorescence testing should be performed on all parts to confirm the presence or absence of lead or other constituent elements, where required.

E.1.6 Destructive Physical Analysis

Destructive physical analysis (DPA) should be performed on a representative sample in accordance with MIL-STD-1580 or MIL-STD-883. Representative sample sizes should be determined based on determination of product risk or contract requirements.

E.1.7 Thermal Cycle Testing

Thermal cycling should be performed on 100% of the parts proposed for delivery. Continued verification processing should not continue unless directed in writing by the procuring activity. Thermal Cycling can be performed in accordance with the following:

a. Microelectronics (Microcircuits) - MIL-STD-883, Method 1010, Condition C, 10 cycles minimum.

b. Semiconductors - MIL-STD-750, Method 1051, Condition C, 20 cycles minimum.

If other methods are used, they should be documented.

Upon completion of the required thermal cycles and a basic visual examination of the parts for evidence of marking deterioration or other physical damage, the parts should be electrically tested.

E.1.8 Electrical Testing

Comprehensive electrical testing should be performed on all parts in facilities with test equipment and test engineering expertise suitable for the specific part type. The acquiring activity should approve all test facilities and test methodologies. For reference, the Defense Supply Center Columbus (DSCC) publishes a listing of commercial laboratories who have demonstrated suitability to test to military specifications.

E.1.9 Burn-In

Pre Burn-In and Post Burn-In electrical testing should be performed on all parts. Burn-in test should be performed in accordance with MIL-STD-883, MIL-STD-750, MIL-STD-202, or the appropriate procurement specification, as applicable. The steps involved in performing burn-in test are described below.

a. Pre Burn-In Electrical Performance Testing - Parts should undergo comprehensive electrical testing to the applicable performance data sheet.

b. Burn-In - Parts (100%) should undergo a powered burn-in at the part's maximum rated temperature.

c. Post Burn-In Electrical Performance Testing - Parts should undergo comprehensive electrical testing to the applicable performance data sheet.

E.1.10 Hermeticity Verification (Fine and Gross Leak)

Parts that are intended to be hermetic such as metal cans and ceramic packaged parts should undergo 100% fine and gross leak testing in accordance with MIL-STD-883, MIL-STD-750, or MIL-STD-202, as applicable.

E.1.11 Other Tests

Other tests may be helpful in detecting counterfeit parts. Scanning Acoustic Microscopy, for example, may be used to detect original laser-etched part numbers under a resurface and remarked part.

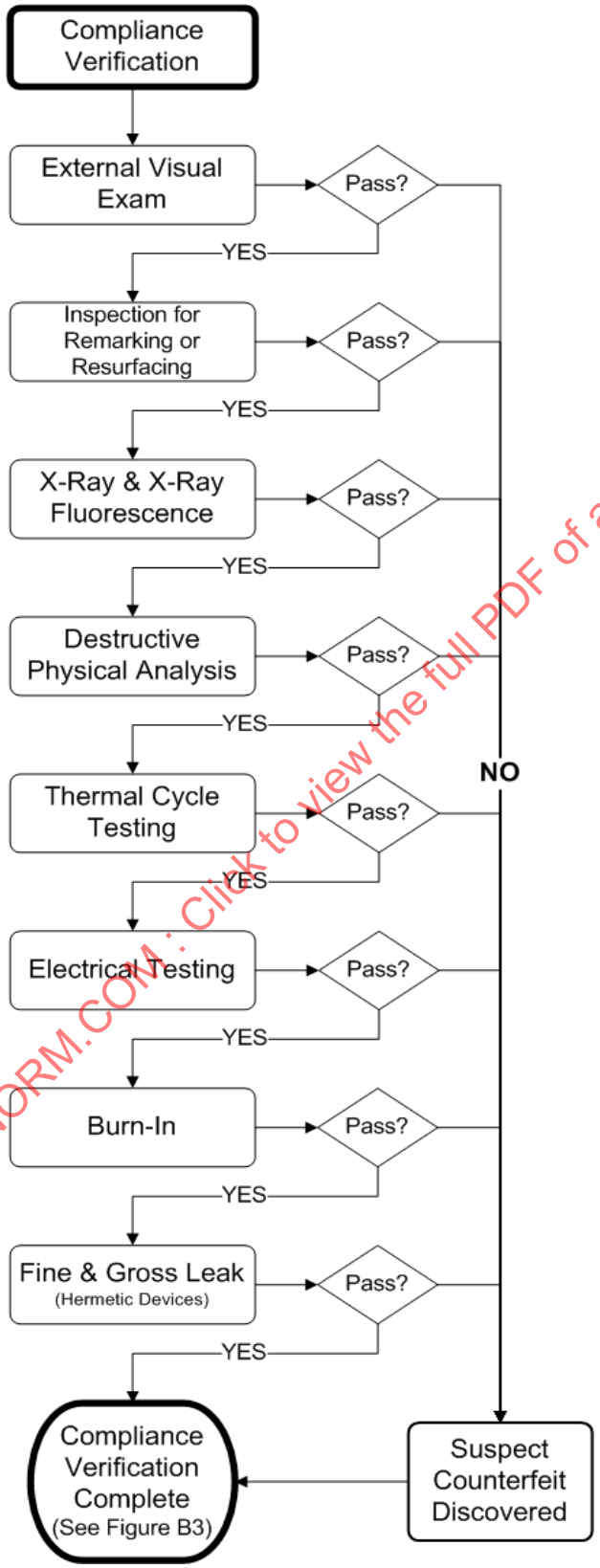

FIGURE E1 - SAMPLE AUTHENTICITY VERIFICATION PROCESS FLOW

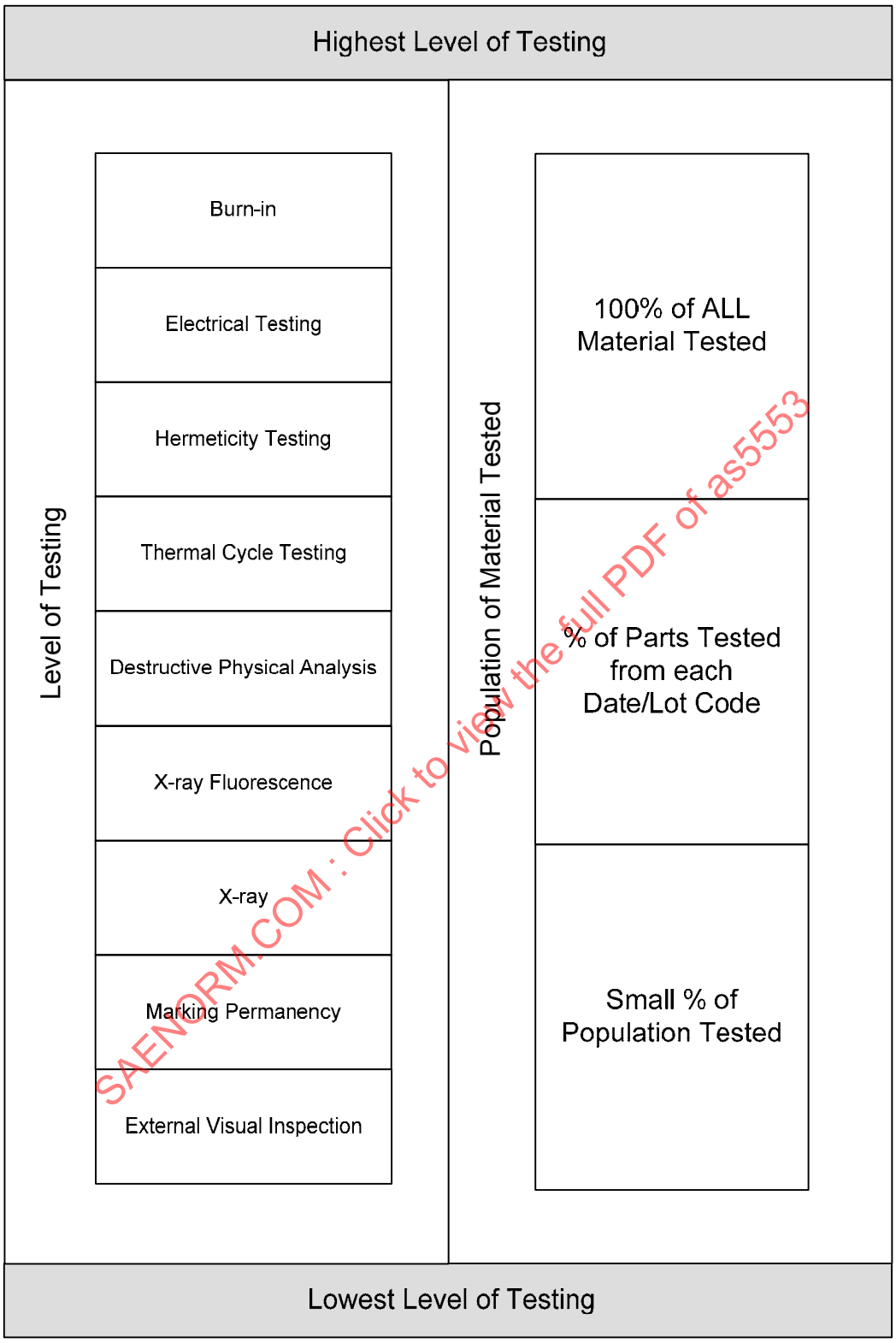

FIGURE E2 - TEST EVALUATION RISK STACK CHART

APPENDIX F - MATERIAL CONTROL

F.1 CONTROL OF SCRAP OR SURPLUS PARTS OR ASSEMBLIES

F.1.1 Scrap Product

Electronic parts that have been found to be nonconforming or otherwise unsuitable for use should be physically identified (e.g., tag, label, mark), segregated from conforming material, and rendered unusable by physical destruction (e.g., grinding, breaking, or crushing) prior to disposal. Suspect counterfeit parts should not be handled as scrap material. Paragraph F.1.4 below discusses the control of suspect or confirmed counterfeit parts.

F.1.2 Surplus Product

Excess inventory or surplus parts originally procured for use in deliverable product should only be re-sold or dispositioned to external organizations with demonstrated adherence to higher level quality standards, this Aerospace Standard, and/or rigorous business, ethical, and quality standards intended to avoid acquiring and reselling counterfeit goods.

F.1.3 Return Product

In order to mitigate the risk of counterfeit parts returning to the supply chain through supplier acceptance of returns, steps should be taken to permit supplier validation of authenticity. The parts should be returned with:

a. Part number to be returned

b. Name of manufacturer

c. Purchase order number under which parts were supplied

d. Quantity to be returned

e. Date/lot code of parts to be returned

f. Reason for return

Returns should not be made to suppliers without proper return material authorization. After receipt of return material authorization, the returned parts should include copies of the original paperwork.

F.1.4 Control of Suspect or Confirmed Counterfeit Parts

In the event that product assurance actions, in-process inspections/tests, or product failure experiences indicate that parts may be counterfeit, the following steps should be implemented:

a. Physically identify the parts as suspect/counterfeit product (e.g., tag, label, mark).

b. Physically segregate the parts from acceptable non-suspect parts and place in quarantine. Quarantine should consist of physical barriers and controlled access.

c. Do not return the parts to the supplier for refund, replacement, etc., except under controlled conditions which would preclude resale of the suspect counterfeit parts into the supply chain, and to allow the supplier to conduct internal investigation.

d. Confirm the authenticity of the parts. This may include further part-level testing, communications with the part's supposed OCM, third-party analysis, etc.

e. Upon confirmation that a part is counterfeit, identify and place on "Hold" all potential additional counterfeit parts in storage and installed in product pending disposition by appropriate authorities.

f. Report counterfeit parts in accordance with guidelines provided in Appendix G, Reporting.