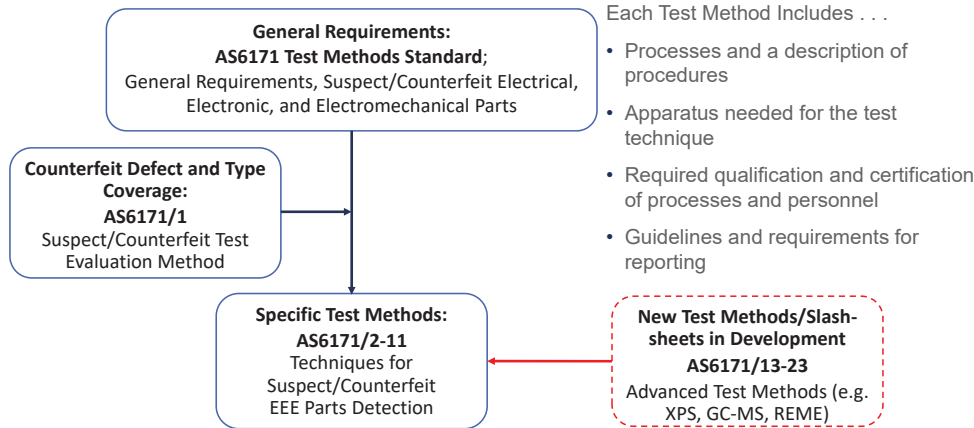
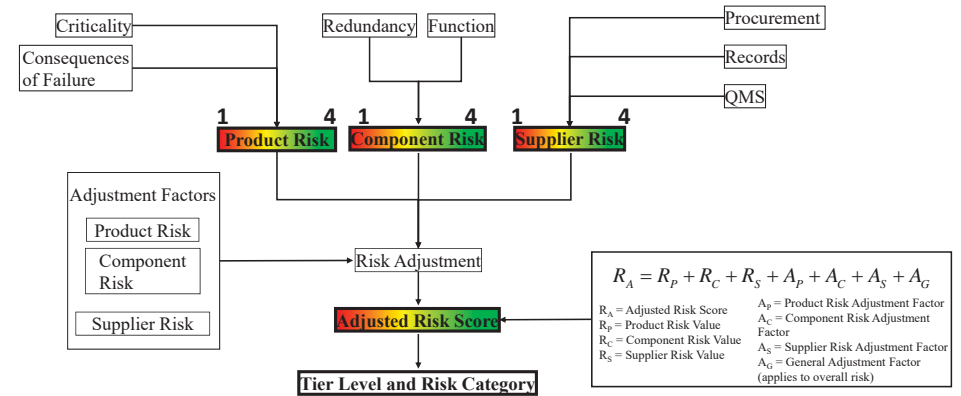




# Organization of AS6171



# AS6171 – Risk Based Testing Criteria



Establish a risk level to determine level of testing

# Test Methods in AS6171

- **AS6171/2: External Visual Inspection (EVI)** (incl. remarking, resurfacing, weight, dimensions, SEM)
- **AS6171/3: X-Ray Fluorescence (XRF)** (incl. lead finish, thickness)
- **AS6171/4: Delid/Decapsulation Physical Analysis (DDPA)**
- **AS6171/5: Radiological Inspection (RI)**: X-ray imaging
- **AS6171/6: Acoustic Microscopy (AM)**: external and internal
- **AS6171/7: Electrical Test**: Curve Trace, Full DC, Key Electrical Parameters for AC, Switching, and Functional Tests; ambient or over temperature (incl. environmental, burn-in, seal)
- **AS6171/8: Raman Spectroscopy**: materials identification
- **AS6171/9: Fourier Transform Infrared Spectroscopy (FTIR)**: materials identification
- **AS6171/10: Thermogravimetric Analysis (TGA)**: material analysis
- **AS6171/11: Design Recovery (DR)**: device layout and function

# AS6171 – Proposed SME Detection Test Flow

Steps	Physical/Environmental/Electrical Inspections/Tests	4 Critical Risk	3 High Risk	2 Moderate Risk	1 Low Risk	0 Very Low Risk
1	External Visual Inspection, EVI <sub>G</sub> (General, Full Lot)	M	M	M	M	M
2	External Visual Inspection, EVI <sub>S</sub> (Detailed, Sample)	M	M	M	M	M
3	Remarking, part of EVI Inspection	M	M	M	M	M
4	SEM	AN	AN	AN	AN	AN
5	XRF	R	R	R	R	R
6	Radiological Test	R	R	R	R	N/A
7	Delid/Decapsulation Physical Analysis (DDPA)	R	R	R	R	N/A
8	Acoustic Microscopy (AM)	R	R	R	R	N/A
9	Miscellaneous (FTIR, Raman, TGA, Design Recovery)	AN	AN	AN	AN	N/A
10	Thermal Shock, Pre and Post Electricals	AN	N/A	N/A	N/A	N/A
11	Value Measurement At Ambient Temp	R	R	R	R	R
12	Key Electrical Parameters At Ambient Temp	R	R	R	N/A	N/A
13	Key Electrical Parameters Over Temp	R	R	N/A	N/A	N/A
14	Burn-In and Final Electricals with Limits and Delta Limits	R	N/A	N/A	N/A	N/A
15	Seal (hermetic devices)	AN	AN	AN	AN	N/A
16	User/Requester (examples: PIND etc.)	AN	AN	AN	AN	AN

Key: M – Mandatory, R – Recommended, test performed; AN-As necessary, when specified by the User/Requester

## AS6171 – Current Status

- AS6171 General Requirements and Slash Sheets AS6171/1 - AS6171/11 were published by SAE in October 2016.
- Update published to AS6171/2 (EVI) in May 2017.
- Update published to AS6171 in April 2018.
- AS6810 on Accreditation of Test Labs published in May 2018.
- AS6171 was adopted by Defense Logistics Agency (DLA) Land and Maritime in March 2017:
- Ongoing activities concerning new test methods and counterfeit types, as well as revisions to existing documents. . .

## AS6171 – Slash-sheets in Development (1)

Document	Description	Current Status
AS6171/4A	Delid/Decapsulation/Physical Analysis (DDPA)	Undergoing revision
AS6171/6A	Acoustic Microscopy (AM) Test Method being updated to include capacitors	Balloted January 2019
AS6171/13	Secondary Ion Mass Spectroscopy (SIMS) Test Method	Two ballots completed; undergoing revision
AS6171/14	Radiated Electromagnetic Emission (REME) Test Methods	First ballot completed; undergoing revision
AS6171/15	Part Packaging Test Methods	Under development
AS6171/16	Netlist Assurance Test Methods	Under development
AS6171/17	Laser Scanning Microscopy (LSM) Test Methods	First ballot completed; undergoing revision
AS6171/18	Thermomechanical Analysis (TMA) Test Methods	Under development

## AS6171 – Slash-sheets in Development (2)

Document	Description	Current Status
AS6171/19	Auger Electron Spectroscopy (AES) Test Method	Under development
AS6171/20	X-Ray Photoelectron Spectroscopy (XPS) Test Method	Under development
AS6171/21	Gas Chromatography/Mass Spectrometry (GC/MS) Test Methods	Under development
AS6171/22	Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray Spectroscopy (EDS) Test Methods	Under development
AS6171/23	EEE Assemblies	Under development
AS6171/A	General Requirements	Revision published April 2018
AS6171/2A	External Visual Inspection	Revision published May 2017

The requirements in AS6171 apply to accredited test laboratories, and are intended to ensure consistent and competent workmanship in the performance of the test methods.

## AS6810 – Requirements for Accreditation Bodies

- Published in May 2018.
- AS6810 is an industry specific scheme that governs the accreditation process to AS6171.
- The SAE G-19A committee developed AS6810 to ensure that accreditation is performed according to a consistent and accepted set of standard requirements, by Accreditation Bodies operating under the requirements of ISO/IEC 17025.
- Defines criteria utilized by an Accreditation Body that is a signatory to the ILAC Mutual Recognition Arrangement (MRA), to establish conformance with AS6171 Test Methods Standard.

## AS5553B Counterfeit EEE Part Avoidance

Counterfeit Electrical, Electronic, and Electromechanical (EEE) Parts; Avoidance, Detection, Mitigation, and Disposition – SAE G-19CI Committee

Purpose	<ul style="list-style-type: none"> <li>This Standard was created to provide uniform requirements, practices and methods to improve the likelihood of only acquiring authentic and conforming EEE parts and is for use by organizations that procure and/or integrate and/or repair EEE parts and/or assemblies containing such items, including maintenance, repair and overhaul (MRO) organizations.</li> </ul>
Target Audience	<ul style="list-style-type: none"> <li>Original Equipment Manufacturers and Users/Integrators that purchase and/or manufacture products with electrical components.</li> <li>The requirements are intended to be flowed down through the supply chain, to organizations that procure EEE parts and/or assemblies.</li> </ul>
Uses	<ul style="list-style-type: none"> <li>Counterfeit EEE Parts Control Plan</li> <li>Purchasing Process</li> <li>Verification of Purchased EEE parts</li> <li>Material Traceability and Control, Reporting</li> </ul>
Status	<ul style="list-style-type: none"> <li>AS5553B published September 2016. AS5553C currently at Aerospace Council for ballot, expected to be published shortly.</li> <li>ARP6328A in development. This document contains guidance for implementing a counterfeit mitigation program in accordance with AS5553.</li> </ul>

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## AS6174A – Counterfeit Materiel Standard

Counterfeit Materiel; Assuring Acquisition of Authentic and Conforming Materiel – SAE G-21 Committee

Purpose	<ul style="list-style-type: none"> <li>This standard was created to provide uniform requirements, practices and methods for (a) materiel/parts and supply chain management, procurement, inspection, test/evaluation, and (b) response strategies when suspect or confirmed counterfeit materiel is discovered.</li> </ul>
Target Audience	<ul style="list-style-type: none"> <li>Suppliers, processors, and end product organizations.</li> </ul>
Uses	<p>This standard was created in response to a significant and increasing volume of counterfeit materiel (in violation of intellectual property laws) entering the supply chain, posing significant performance, reliability, and safety risks.</p>
Status	<ul style="list-style-type: none"> <li>AS6174A published July 2014. All materials and parts except EEE parts.</li> <li>G-21R committee produced standard on refrigerants – AS6886 released 21 June 2015.</li> <li>AS6174/1 Verification Matrix published April 2017.</li> <li>AS6174/2 Fasteners slash sheet in development.</li> <li>AS6174B Bearings slash sheet in development.</li> <li>G-21B Counterfeit and Substandard Battery Risk Mitigation Committee established January 2019.</li> </ul>

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## AS6081 – Independent Distribution Standard

Fraudulent/Counterfeit Electronic Parts: Avoidance, Detection, Mitigation, and Disposition – Independent Distribution - SAE G-19D Committee

Purpose	<p>Standardizes practices to:</p> <ul style="list-style-type: none"> <li>Procure parts from reliable sources;</li> <li>Assess and mitigate risk of distributing counterfeit parts</li> <li>Control suspect or confirmed counterfeit parts.</li> <li>report suspect and confirmed counterfeit parts.</li> <li>assess, mitigate, control, and report parts which have been used, refurbished, or reclaimed, but represented as new.</li> </ul>
Target Audience	<ul style="list-style-type: none"> <li>Independent Distributors/Brokers of Electronic Components</li> </ul>
Uses	<ul style="list-style-type: none"> <li>Requirements for a Counterfeit Mitigation Program</li> <li>Intended to be used for Certification of Distributors</li> </ul>
Status	<ul style="list-style-type: none"> <li>Published – November 2012. Rev. A in development</li> </ul>

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## Other Standards Focused on Counterfeits

- **IDEA-STD-1010-B Independent Distributors of Electronics Association (IDEA) - IDEA-STD-1010 Inspection Standard**
  - Includes tiers of inspection – packaging inspection and visual examination
  - Advanced tier includes x-ray, XRF, C-SAM and decapsulation
  - Emphasis on training.

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## Summary

- The SAE G-19 Standards, combined with the new FARs, focus on authorized distribution channels for counterfeit parts avoidance.
  - Risks of authorized distribution channels being contaminated still remain
  - Inspections need a golden sample for comparison
  - Cost, time, risk of part damage due to inspection
  - Incomplete information from device manufacturers
- With the integration of complex hardware, software, and firmware, new risks are coming from threats that can exploit vulnerabilities.
  - Newer slash-sheets in AS6171 address some, but not all these threats.

## Acknowledgements

- GSFC Risk and Reliability Branch (Nancy Lindsey - Branch Chief)
- GSFC Safety and Mission Assurance Directorate (Richard Barney - SMA Director)
- NEPP NASA Electronics Parts Program (Michael Sampson - Program Manager)

## Questions?

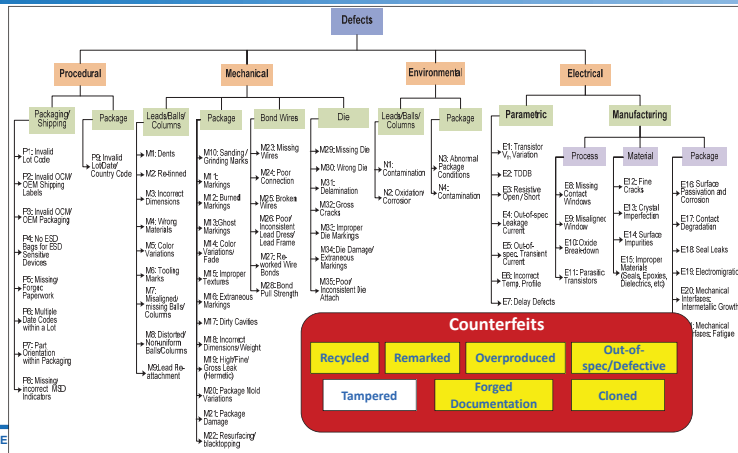


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Backup

# AS6171 – Defect Taxonomy



Note:  
Tampered is not addressed in the current release of AS6171, but will be included in future releases.

# Sampling Plan (Overview)

- Derived from the General Specification for Microcircuits, MIL-PRF-38535, Appendix D
- Uses the sample size method series with an accept number  $c=0$ .
  - $c=0$  denotes no indications that the part is suspect counterfeit
  - If an indication is detected and a part is determined to be a suspect/counterfeit part in accordance with Section 3.7.1 of AS6171, then this part is considered to have failed the test and the testing of the lot is halted.
  - User/Requestor can resume testing and should decide if increased sampling or 100 percent of the lot should be tested.

# Sampling Plan (Continued)

- Each lot is handled independently.
- Any lot subjected to testing should be received in a single shipment (procurement lot) and contains parts that all have the same lot or date code.
  - A future shipment of devices of the same date code are considered a new lot.
- Prescreening (to remove defective parts prior to sample selection) is not allowed.
- Test samples are selected at random
  - For lots with mixed date codes, the devices are separated into separate lots of each date code.
- In the case when the quantity of devices for a given date code is less than the specified sample size, then it becomes a small lot and it will be tested according to the small lot sampling plan.

# Sampling Plan (Continued)

- From each lot, one part (minimum) is left untouched in original packaging (i.e. tape and reel) for potential use in surface analysis
  - Prevents contamination or alteration of the surface chemistry.
- If the parts are programmable devices, then for electrical tests the Test Laboratory utilizes a sampling plan identified in the Electrical test method, AS6171/7.
- For devices with no known programming heritage, or the sample size may be increased to a tighter inspection criterion as defined in MIL-PRF-38535, Appendix D or to 100% inspection, at the option of the User.

## Sampling Plan for Lots >200 Parts

Test / Inspection	Test Sample Size
External Visual, General Criteria	Inspect all devices in Lot
External Visual, Detailed Criteria	119 devices, c=0
Remarking & Resurfacing*	3 devices, c=0
Part Dimensions	3 devices, c=0
Radiological, AM	45 devices, c=0
XRF, lead finish	3 devices, c=0
DDPA	3 devices, c=0
Electrical Tests	116 devices, c=0
Burn-In	45 devices, c=0
Thermal Shock Temperature Cycling Seal Test	22 devices, c=0

\* - same devices may be used for remarking/resurfacing, DDPA, XRF

## Small Lot Sampling Plan

Test / Inspection	Test sample size
External Visual, General Criteria	Inspect all devices in Lot
External Visual, Detailed Criteria	100% or as specified in Table 10 plus 3 devices, c=0
Remarking & Resurfacing	3 devices, c=0
Part Dimensions	3 devices, c=0
Radiological, AM	100% or as specified in Table 10, c=0
XRF, lead finish	3 devices, c=0
DDPA	3 devices, c=0
Electrical Tests	100% or as specified in Table 10, c=0
Burn-In	100% or as specified in Table 10, c=0
Thermal Shock Temperature Cycling Seal Test	100% or as specified in Table 10, c=0

## Detailed Lot Sampling Plan (Small Lots)

Lot Size Range (N)	External Visual, Detailed and Electrical (except Post-Test) (2% defective)	Burn-In, Radiological, and AM (5% defective)	Temp Cycling, Thermal Shock, Seal, and Post-Test Electrical (10% defective)
190-200	107	45	22
180-189	102	44	22
170-179	102	44	22
160-169	102	44	22
150-159	102	44	22
140-149	102	44	22
130-139	95	44	22
120-129	90	44	22
110-119	90	44	22
100-109	90	43	22
90-99	90	43	22
80-89	Test all for lots of less than 81; test 81 for lots of 81 or more	42	22
70-79	Test all for lots of less than 72; test 72 for lots of 72 or more	42	22
60-69	Test all for lots of less than 63; test 63 for lots of 63 or more	40	22
50-59	Test all for lots of less than 54; test 54 for lots of 54 or more	40	22
40-49	Test All	36	21
30-39	Test All	Test all for lots of less than 36, test 36 for lots of 36 or more	21
20-29	Test All	Test all for lots of less than 27, test 27 for lots of 27 or more	20
10-19	Test All	Test All	Test all for lots of less than 18; test 18 for lots of 18 or more
10	Test All	Test All	Test All