AS6171 COMPARISON TO AS6081

Advanced Component Testing

ISO 17025 ACCREDITED LABORATORY

How AS6171 Improves Identification of Suspect Counterfeit Parts

Towards the end of 2016, SAE released AS6171: its standard for laboratory test methods for identifying suspect counterfeit EEE parts. AS6171 provides uniform requirements, practices and test methods and thus is more stringent than the AS6081 counterfeit avoidance protocol for distributors. Not only does AS6171 require a number of inspections and tests that AS6081 does not, it defines unique test sequences for its five defined risk levels and provides greater details about methods for inspection and testing.

Although AS6081 is likely to reflect the higher AS6171 standards in the future; significant differences currently exist between the two, including who can perform the actual testing. The vast majority of test labs have not earned the ISO17025 accreditation necessary to be deemed a "responsible tester" for full compliance to AS6171. ACT is one of a select few that has, to date.

AS6171 Advantages

- Additional tests and inspections required (see table) for more thorough screening
- Unique test sequences for 5 defined risk levels
- More detailed guidelines on methods provided

		AS6171	AS6081	Extra Risk Mitigation
"RESPONSIBLE TESTER" REQUIREMENTS				
Accreditations		ISO 17025 for technical competence	QMS to ISO 9001	Evidence of technical competence to execute tests to which accredited by a 3rd party *versus* conformance to underlying industry standards for a quality management system.
TESTS & INSPECTIONS for devices classified up to Moderate Risk Level, Model 2				
Documentation & Packaging Inspection		✕	✕	
External Visual Inspection		✕	✕	
Marking Permanency Solvent Test		✕	✕	
RESURFACING TESTS	Non-Aggressive Acetone	✕	✕	
	Aggressive Acetone	✕		More aggressive form of the above test may reveal blacktopping that resists transference with lighter swiping.
	IM2P Solvent Test	✕	✕	
	Commercial Solvent (Dynasolve) Test	DS 711, 750, 715 or 760	DS 750	AS6171 allows use of slightly different solutions tailored to remove coating on various devices including aluminum-safe and NMP-free versions.
	Mechanical Scrape Test	✕		Clearcoat applied by counterfeiters that is unaffected by solvents may flake off when scraped to reveal signs of resurfacing.
XRF Test for Lead Finish		✕	✕	
XRF Test for Materials		✕		Inconsistencies in composition and characteristics (and/or OCM specs) might go undetected without this internal exam.
X-Ray Inspection		✕	✕	
Delid/Decap Inspection		active + passives	active parts	A lack of markings on passives devalues visual and solvent inspection, making DDPA critical to revealing anomalies.
DC Electrical Testing at Ambient Temperature *on Active Devices*		✕		Electrical tests (or value measurements) to parameters to identify suspect parts, which might pass other inspections although refurbished, salvaged, cloned or classified as rejects.

A discussion of each of the differentiating tests follows:

Aggressive Acetone Resurfacing Test

Acetone is a solvent used for determining if non-epoxy blacktop has been applied to a part by swiping it and checking for a transfer of color between the device and the swab. There are two forms of this acetone solvent test: a non-aggressive form (using light swipes) and an aggressive version. AS6081 specifies only the less aggressive form, while AS6171 requires both. As per AS6171 5.3.3.4.2.b, a swab wetted with acetone is "aggressively rubbed on the surface. The swab may need to be wetted several times and pressure applied to the same location multiple times before any effect is noted."

In some cases, the blacktopping applied may resist the less aggressive version of the acetone solvent test while also being impervious to the other solvents used in other required AS6171 resurfacing tests. Evidence of sanding, blacktopping and possibly the original markings may be revealed via this aggressive form of the test, after remaining obscured subsequent to the milder testing.

Commercial Solvent Resurfacing Test

Both the AS6081 and AS6171 standards require a resurfacing test using a commercial epoxy solvent. The difference is that AS6081 mandates that Dynasolve 750 be used, while AS6171 allows a choice amongst four different solvents to better suit specific devices and applications. This includes options free of N-Methylpyrrolidone (NMP)—to comply with current/future restrictions related to this toxic substance and/or internal safety policies—and that are aluminum safe and thus better suited for use with devices that contain aluminum, as do some capacitors.

Within SAE AS6171, these solvents are referred to as Commercial Solvent 1 and Commercial Solvent 2 and the Dynasolve products detailed in the table below qualify as the abovementioned type of solvent.

Dynasolve Epoxy Solvent Product	Description	Aluminum Safe	NMP-Free	Active Ingredients	Method
750	Reactive solvent used *for removal of several types of polymers*			propylene glycol mono-methyl ether, methyl alcohol, and potassium hydroxide	Heat to 105°C ± 5°C for 45 minutes max.
711	Same as above (750)	✓		Same as above (750)	Same
760	*Aggressive* reactive solvent *for removal of epoxy and several types of polymers*		✓	methyl alcohol, potassium hydroxide, sulfinylbis-methane, 1-phenoxy-2-propanol, and 1-Methoxy-2-Propanol	Heat to 115 to 120°C for 20 minutes max.
715	Same as above (760)	✓	✓	Same as above (750)	Same

Mechanical Scrape Resurfacing Test

As per AS6171 5.3.3.4.2.b, with plastic parts this test entails scraping “the surface with the sharp edge of a knife or blade back and forth over the surface to produce flaking and/or to reveal evidence of sanding or hidden part markings.”

This simple test may uncover evidence of resurfacing that would otherwise remain concealed under a special coating applied by crafty counterfeiters in order to circumvent solvent tests. Although clearcoating may be impervious to acetone and the other solvent tests required by AS6171, it may flake off when scraped with a knife to reveal signs of resurfacing and possibly the original markings.

XRF Test for Materials

While the AS6081 standard does require XRF analysis, it is solely of the exposed lead finish. In contrast, AS6171 expands the scope of XRF analysis by mandating X-ray fluorescence testing of “other exposed surfaces including the component body,” including the base material.

The practical difference is that XRF spectrum and thickness analysis may uncover material issues and lot inconsistencies with elemental composition, plating, finishes and layer thickness as compared to the manufacturer’s spec sheet or known authentic/golden part. These telling anomalies, above and beyond the composition of the lead finish and the presence or absence of lead, *might not* be uncovered via other test methods and may indicate that a part is substandard and potentially counterfeit.

Delidding & Decapping Inspection

Counterfeit risk mitigation efforts have traditionally focused on semiconductors and other active devices as opposed to passive ones. Although active parts are more likely to have a greater impact on device performance, substandard/counterfeit passive components such as resistors, capacitors, inductors and connectors can also affect the performance of the final product or system within which it is embedded. Due to the fact that passives often bear no distinctive internal markings (as do active devices), the external visual inspections and solvent tests required earlier in the AS6171 test sequence are not likely to indicate that a passive part is problematic, even if it is counterfeit. Unlike AS6081, AS6171 addresses this issue by requiring DDPA of passive devices.

Examining a passive’s internal structure can help lead to a determination as to whether or not the part appears to be authentic. DDPA testing within AS6171 includes not only decapping and delidding but also cross sectioning, which may be more revealing with passives that lack dice but *do contain* internal structures of a very specific nature. The internal construction should, ideally, be compared to a golden part although verification against manufacturer spec sheets and drawings is also an option.

Electrical Testing/Measurement at Ambient Temperature

SAE's AS6171 standard for laboratories *requires* robust electrical testing unlike the current version of AS6081, which *does not mandate* any electrical testing (although it may be done upon customer request). Electrical testing per AS6171 will vary based on commodity type, risk level, and the parameters specified on manufacturer spec sheets and drawings, MIL-PRFs and other provided (including customer) documents. Failure to meet OCM electrical specs for a specific part, such as deviations from speed and memory specs, may be evidence that a part is not the authentic OCM part it is purported to be. This may either support findings in prior visual, solvent and/or radiographic testing that indicate a part is suspect or it may serve as the first indication that a part is suspect counterfeit.

Some devices may not raise any red flags earlier in the process because counterfeiters can rework a package and solder its leads so that it passes visual inspection. In such cases, electrical testing may be the first and only indication of a suspect part as it elicits results that are inconsistent with OCM part specs. Die salvaged devices are best detected with electrical testing, as are manufacturing rejects that make it into the supply chain. These rejects will bear true OCM markings and may appear fine until they fall short on some electrical parameters.

Per AS6171, section 4.2, electrical testing includes "DC Electrical test[s] for Active Devices or value measurements for Passive Devices. At the minimum level the tests shall be performed at ambient temperature, which is defined as +25 °C." In addition, DC electrical tests on transistors, amplifiers, TRIACS and other active devices must comply with MIL-STD-883, Method 5005, Group A, Subgroup 1. For passive devices (including capacitors, inductors and resistors) only value measurements are required.

Summary

In summary, SAE's AS6171 standard provides more detailed and rigorous test and inspection methods for identifying suspect electronic components than does AS6081. It also provides clear guidance on establishing the risk associated with a particular device and then factors in that risk to define the appropriate test sequence. At the moderate risk level, AS6171 requires additional resurfacing solvent and mechanical testing, XRF analysis, DDPA, and electrical testing as compared to AS6081 as it currently stands, although SAE is slated to update the product verification section to align more closely with AS6171. In the meantime, anyone seeking to utilize or buy an EEE part lacking full traceability to its manufacturer may want to make sure that these devices are thoroughly screened to the higher AS6171 standards by a test facility that is qualified to be a bona fide "responsible tester"—and thus is ISO17025 accredited for all required test and inspection methods.

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