

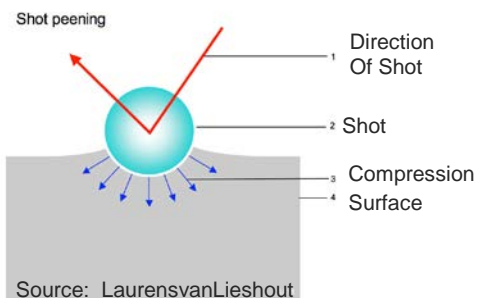
“Thirteen Things Item #4 – Case Studies”

Verify processes are in place to ensure work coming from special processors is to the correct specification and that the processors are in good standing

Example #1

Shot Peening

The process of shot peening involves impacting the surface of metallic parts with shot (metal, glass, or ceramics) to produce a compressive surface layer, which improves the resistance to metal fatigue. Engineering specification BAC5730, *Shot Peening*, provides the processing requirements, and process specification departures (PSD) provide requirements unique to subcontractors and/or Boeing aircraft models. In this example, machine shops contracted with shot peen processors for Boeing Philadelphia product, which requires a processor to be listed in D1-4426, *Approved Process Sources*, and approved to Process Code 506 (BAC5730, Boeing Helicopter designs). The subcontracted processors were not approved for D1-4426, process code 506. Additionally, neither the shot peen processors nor the machine shops performed an adequate contract review of the purchasing information or D1-4426 to correctly apply the engineering departure. This violation of Quality requirements by the machine shops (not using customer approved sources) and the shot peen processors (inadequate contract review) resulted in a violation of Engineering requirements (failing to implement PSD) causing product escapes.



BAC 5730	Shot Peening	500
BAC 5730	Shot Peening (Boeing Helicopters only)	506
BAC 5730-1	Shot Peen Forming	501
BAC 5730-2	Shot Peening - Self Contained	502

D1-4426
Approved Process Sources

Corrective Action & Process Improvement

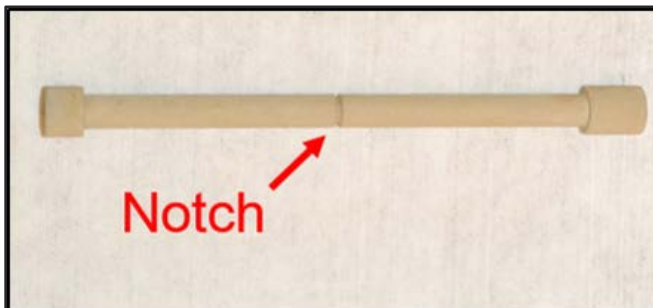
Although the machine shops failed to evaluate and select suppliers, they did provide enough purchasing information for the shot peen processors to determine they were not approved in D1-4426 for the contracted process and product. Subcontracting of special processes can be complex which can require flowing down not only the process specification, but additional information about the Boeing model, the raw material information, pre or post processing information, etc. to adequately perform contract review. D1-4426 requires purchasers and processors to assess contracts to a list of flow down requirements prior to processing. Corrective action for the shot peen processors included (a) the implementation of Contract Review per the requirements of D1-4426, (b) the use of a Contract Review checklist, (c) revised internal procedures, (d) D1-4426 training, and (e) internal audits.

Quality clauses (such as Q29-BCA, Q19 & Q20-BDS) on Boeing contracts state suppliers are obligated to flow the use of D1-4426 approved sources on their contracts. D1-4426 has requirements for the processors, but also requirements for the Boeing supplier. All suppliers, when performing assessments of the subcontractors need to assess if D1-4426 flow down requirements are included in the procurement processes.

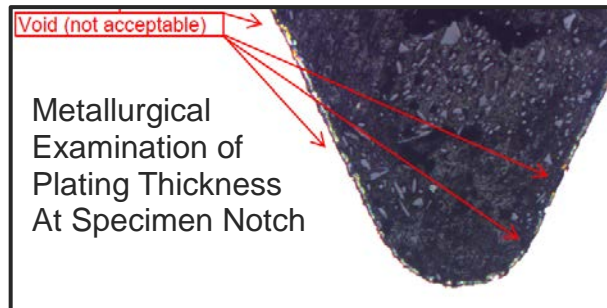
Example #2

Notched Tensile Testing

Engineering specification BAC5804, *Low Hydrogen Embrittlement Cadmium-Titanium Alloy Plating*, requires the processor to perform a hydrogen embrittlement process control test to validate proper maintenance of the plating solutions and tanks. This is typically performed using a Hydrogen Detection Instrument (HDI), and if the HDI becomes inoperative the process control is performed using notched tensile testing. The notched tensile specimens are cylindrical specimens with a notch at the center. After plating the specimens, they are mechanically tested in a tensile loading condition to determine if the specimen will fracture at the notch. After mechanical testing is complete, a specimen is cross-sectioned for metallurgical examination. The specimen must have complete plating in the notch, otherwise the tensile test results are considered invalid. Testing requirements were not properly flowed to the laboratory and the notched tensile specimens were not cross-sectioned for metallurgical examination. The validity of the hydrogen embrittlement test could not be determined and all product since the last successful test had to be rejected, with notification of escape issued to the customer.



Notched Tensile Specimen



Corrective Action and Process Improvements

Special processes are not verifiable during end item inspection and therefore many engineering specifications have process control testing. Some processors have captive laboratories and others use independent test labs. Although the process specification may reference a separate test method, it may also specify additional requirements important to the lab. When flowing requirements to laboratories it may be required to also flow such items as test methods, acceptance criteria, material alloy/temper, environmental requirements, specimen identification, and specimen retention requirements. Additionally, when planning for risk the processor needs to consider the frequency of tests. Since all product is at risk since the last successful process control test, a failed test could cause significant inventory of product to be affected, production stoppage, and product escapes. In this specific example, the corrective action was to ensure proper flow down of the metallurgical examination requirements and an increase in testing frequencies.

Learning Resources

Special process flow down requirements are found in D1-4426, User Requirements & Instructions, Appendix D

Lessons Learned

Special processes are complex. Processors must comprehend and consume the engineering requirements in order to properly plan the statement of work.

- The processor will not be successful unless all the necessary information is flowed on the purchase order. This can include such items as the Boeing program to correctly apply engineering departures, material condition, and pre or post processing requirements.
- Customer approved sources for special processors must be used. Boeing contractually flows D1-4426, *Approved Process Sources*, and suppliers are obligated to flow D1-4426 to their supply chain. D1-4426 has requirements which apply to both the supplier and their subcontracted processor.

Summary

- Every organization is responsible for the conformity of all products purchased from suppliers, including product from sources defined by the customer (AS9100 §7.4.1). For special processes, this requires using D1-4426 approved sources and flowing purchasing information as defined in D1-4426 Appendix D.

What Would You Do?

After reading the examples, consider the following discussion questions.

They can be used in a team setting to generate dialogue around the “13 Things” or to help individual employees think about the situation from different perspectives.

1. Does your process for supplier/processor selection include the use of customer defined sources and does the purchasing organization understand the D1-4426 User Requirements and Instructions?
2. Does your contract review process ensure the flow down of relevant technical data to the processor (such as aircraft model, material condition, and pre or post processing requirements)?
3. Does your configuration control process provide the processor the required specifications, drawings, documents, revisions status, and engineering departures to enable planning of product realization?
4. Does your risk management processes identify process control testing with sufficient actions to mitigate the impact of failures?