Nadcap

AUDIT CRITERIA

AC7109 REV. F

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Superseding AC7109 Rev. E

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TO BE USED ON AUDITS STARTING ON OR AFTER 3-DEC-2017

Nadcap
AUDIT CRITERIA FOR
COATINGS

Editorial change made on 20-Nov-2017 to add numbers to 7.4.1.2.1-7.4.1.2.7

1. SCOPE

AC7109 is intended for use to survey all facilities seeking accreditation by Nadcap for coating processes. AC7109 is supplemented by Audit Criteria [called checklists] for specific coating processes to be accredited. The four primary coating special processes addressed by the Audit Criteria checklists are Thermal Spray (/1), Vapor Deposition [PVD and CVD] (/2), Diffusion (/3), and Coating Evaluations (/5). The remaining Audit Criteria [Stripping (/4), Plating (/6), Heat Treating (/7), and Grinding of Coatings (/8)] support the four primary coating special processes.

The purpose of the Audit Criteria is to provide a means to verify and document that systems are in place to control the process, and that the process procedures are being followed.

The subtext [called objective evidence] to the questions serves to clarify requirements and provide possible means of meeting these requirements. There may be other methods to meet requirements which are not described.

Notes on specific coating systems:

Spray or dip aluminide diffusion coatings (e.g. Sermaloy®) are covered by AC7109/3 Diffusion Coatings.

The class of ceramic/metallic corrosion protection coatings that are applied by spray methods and subsequently thermal treated (e.g. Sermatel®) are covered by AC7108/1.

The application of dry film lubricants are covered by AC7108/1.

Application of ceramic/metallic corrosion protection coatings and or dry film lubricants per the AC7108/1 may be added to the scope of a Coatings audit if one of the four primary coating special processes is included in the audit scope. Otherwise the AC7108/1 must be scheduled as a Chemical Processing audit.

Painting and Ion Vapor Deposition of Cadmium and Aluminum are not covered by the Coatings Audit Criteria. These special processes are part of the Chemical Processing AC7108 Audit Criteria.

2. GENERAL INSTRUCTIONS

2.1 Prior to the Audit

2.1.1 The Auditee shall complete a self-audit to AC7109 and all applicable checklists in preparation for this audit. All nonconformances should be corrected prior to the actual audit. Nonconformances of a technical nature found during the actual audit may, at the Task Group's discretion, require a follow-up audit at the Auditee's expense.

2.1.1.1 During the self-audit, the Auditee must note procedure numbers and locations for all documentation required. It is recommended that all documentation required by the Nadcap auditor is readily available to facilitate the audit process.

2.1.2 The Task Group has compiled a set of tools to assist in the preparation and execution of a Nadcap audit. It is strongly recommended to utilize these tools both before and after the audit. The tools can be found in eAuditNet/Public Documents/Coatings.

2.1.3 All audits require a "Job Audit Tracker", herein referred to as the Tracker, to be attached to the audit in eAuditNet. This Tracker is automatically compiled from data entered into the job audit sections of the checklists by the auditor. The Tracker is a tool used by Subscribers to ensure that all processes, tests, specifications, operators, equipment, and Subscribers in the scope of the audit are reviewed over a period of time.

The test method section of the tracker for AC7109/5 requires that all tests in the scope of the audit are witnessed over the course of 3 consecutive audits. The tracker must be considered in audit preparation to ensure witness tests are available during the audit so that all tests are witnessed over the 3 audit period. Witness tests will be identified as live job audits in the Tracker. Verification tests will be indicated as paper job audits.

The Coatings Task Group previously used its own Tracker, which was called the “Job Audit and Test Method Tracker” before the current standardized Tracker was introduced. The previous Coatings Tracker is to be referenced in conjunction with the current Tracker, until sufficient data (4 audits) is compiled in the current Tracker.

2.2 During the Audit

2.2.1 The Auditee should provide for an in-briefing for the auditor and arrangements for a brief plant tour prior to the start of the audit. Key members of the applicant's staff should attend the in-briefing so the audit purpose, methods and assessment processes, can be discussed.

2.2.2 Working space for the auditor with desks or tables, chairs, telephones, etc. and reproduction services are to be provided as required. This is not a full time assignment.

2.2.3 An out-briefing will be conducted at the end of each audit day to discuss the status of the audit and any non-conformances found that day.

A final out-briefing will be conducted at the completion of the audit. Each nonconformance report (NCR) will be reviewed and the Auditee will be given the opportunity to discuss proposed corrective action or to provide any additional information. Drafts of each NCR will be provided to the Auditee. NOTE: The Coatings Task Group may, upon review, change the auditor's determination of finding or observation. Responses must be provided for all NCRs except for NCRs accepted on site by the Auditor.

2.2.4 Responses shall be submitted according to Nadcap procedures.

2.2.5 All operating parameters and tolerances used to control the process must be available for review during the audit. For instance, if the coating process is controlled by a program number and the parameters used in the program are controlled in an off-site location; a copy of the parameters must be available at the time of the Nadcap special process audit. If this information is not available, an NCR must be written against the requirement for defining process controls and tolerances of process parameters.

2.2.6 The expectation is that a satellite audit will be conducted by means of the same requirements as a main audit: the AC7109 checklist must be filled out completely. A separate job tracker must be completed and attached to the AC7109 checklist for the satellite audit; and the number of jobs audits required by the Compliance Section of this document must be met at the satellite. For the case where an AQS audit is included with the Coatings audit, the AC7004 checklist must be completed for the satellite audit as well as the main audit.

2.3 Review of the Audit Report

The auditor will advise the Auditee when their audit report will be submitted and when corrective action will be due. Responsibility for meeting this date rests with the Auditee. Failure to comply with specified dates will result in significant delays in accreditation.

PRI staff or the Task Group may, after review of the audit report, require additional information or may elect to issue additional findings.

NOTE: Final authority over the audit report, acceptability of corrective actions, and accreditation recommendation rests with the Task Group.

3. AUDITEE INFORMATION

3.1	The auditor must attach a copy of the previous Coatings Job Audit and Test Method Tracker that includes all Subscribers and specifications for which the Auditee is approved/processing. This document does not need to be updated but must be attached until sufficient data (4 audits) is compiled in the current Tracker.			
3.2	Has the Auditee informed Nadcap of all changes that will affect the Auditee's status of operation as defined in OP 1107? •*NA applies when there have been no changes*	YES	NO	NA
3.3	Were corrective actions from previous audits implemented effectively? •*The auditor is required to verify all findings from the previous audit* •*For OP 1122 Subscriber Accreditation Option B audits, if the previous audit was not done by PRI, verify corrective actions from the prior internal audit performed by the Subscriber* •*If there are any repeat findings, the answer is No* •*NA if this is an initial audit or if there were no NCRs in the previous audit.*	YES	NO	NA
3.4	Self-Audit			
3.4.1	Was a self-audit completed to AC7109 and all applicable checklists since the last Nadcap CT audit (or prior to an initial audit)?	YES	NO	
3.4.2	Did the Auditee make a copy of their completed self-audit available to the auditor at least 30 days prior to the audit – utilizing the version of the checklist(s) applicable to this audit? •*The self-audit must be uploaded to the upcoming Nadcap audit in eAuditNet*	YES	NO	
3.4.3	For each question in the checklist, has the supplier identified where the means of compliance or evidence* of compliance may be found. (*= procedure, checklist, physical location of evidence, etc.) •*Nadcap recommends the self-audit be performed 90-120 days prior to the scheduled audit. In the event of checklist revisions, Nadcap publishes the checklist(s) and sends out a notification 90 days prior to the checklist(s) becoming effective. In this case, an audit against the changes is acceptable if it supplements the existing self-audit performed prior to the release of the revised checklist(s).* •*Export Controlled information must not be provided in the completed self-audit* •*The means of compliance could be statements such as "physical observation"*	YES	NO	
3.4.4	Does the self-audit include job audits as required by the Task Group? •*For the self-audit, a minimum of one job audit is required for each checklist other than AC7109/5. A minimum of two total coating process job audits must be performed: If the scope of the audit only contains*	YES	NO	

one coating process checklist (AC7109/1, /2, /3), two job audits must be performed for that checklist. At least one of the job audits must be an in-process job audit with the preference being that all job audits are in-process work. Staff Engineer and/or Nadcap Coatings Task Group approval are required for performing fewer job audits than required.
•For AC7109/5, the self-audit requirement is that all tests listed in the scope of the audit will be witnessed or verified (completed test) during each audit with a minimum of one witness test being performed.

4. GENERAL QUALITY SYSTEMS

4.1 The Nadcap Coatings Task Group recognizes all quality systems approvals, as addressed in PD 1100. If the Auditee has been audited and approved by Nadcap or any other Nadcap recognized agency addressed in PD 1100, then no further assessment for quality systems will be required. Although specific audit criteria for evaluation of the general quality system are not included within the text of this checklist, the requirements of PD 1100 approved quality systems do form a part of the standard used in the Nadcap Coatings Accreditation program. As such, auditors may identify and record nonconformances related to the quality system. These nonconformances must be addressed by the Auditee in order to obtain Nadcap Accreditation.

4.1.1 The auditor shall verify the Auditee has a valid quality system certificate or otherwise in compliance with Nadcap procedures. A copy of the certificate does not need to be attached in the audit report, but the following data from the quality certificate must be recorded below:

4.1.1.1 Auditing/Certifying Agency: _____

4.1.1.2 Audit Criteria or Standard: _____

4.1.1.3 Certificate Issue Date: _____

4.1.1.4 Certificate Expiration Date: _____

4.1.1.5 Does the name and address of the facility match the information on the certificate? YES NO

4.1.1.6 The above certificate/information has been reviewed, recorded in this checklist, and verified by the auditor. ☐

4.1.2 Is the Auditee compliant with approved Quality System as observed in the scope of this audit? YES NO
•A No would be for any quality system violation which is identified which is not addressed by other questions in the checklists
•Example: Uncontrolled document

4.1.3 Auditee personnel associated with the audit aside from the Auditee Audit Contact: _____

4.1.4 NCR's requiring special attention: _____

4.1.5	General Impression of Auditee: _____			
4.2	Organization			
4.2.1	Is there a designated technical authority, and a back-up, documented in the Auditee's system for each process performed (as defined by each checklist listed in the scope of the audit in eAuditNet on the audit details page)? •*Some reference in the organization chart or by specific job title that there is a person by name or title that has production technical authority over these processes.*	YES	NO	
4.2.2	Are technical/engineering personnel available to support production processes? •*Availability is a relative term. The preference is to be on site. Accessibility is the real issue; determine if there is a capability for immediate if not same day response.*	YES	NO	
4.2.3	Are all of the designated coating operators (thermal spray, vapor deposition, diffusion) currently certified (when required by the customer) or otherwise approved in accordance with Auditee procedures? •*Department training records, personnel file. Must be some certification or approval on record.*	YES	NO	
4.2.4	Are the coating operators re-qualified every 24 months? •*This can be done on production parts.* •*Training records, certification records, check for requirement in procedure.*	YES	NO	
4.2.5	Does a defined representative approve all active coating operators?	YES	NO	
4.2.6	Are records maintained for all active coating operators?	YES	NO	
4.3	Contract Review & Process Planning			
4.3.1	Do procedures require the Auditee to determine if customer approval is required prior to use of specific materials and processes? •*Contract review procedure, actual check sheet for contract review of PO's that has a specific reference to the customer approval (frozen process control and approval).*	YES	NO	
4.3.2	Do procedures assure that the Auditee verifies they have the required approvals prior to performing the process? •*Some denotation in the system that approval is required before production may proceed. Could be note on router, procedure for issuing router, part of the First Article Inspection Report (FAIR) approval process or specific reference in procedure for frozen process control.*	YES	NO	
4.3.3	Are coating trials conducted prior to initial use of coating on production parts to ensure the coating will meet material/process specifications?	YES	NO	NA

	•This is for both a frozen or non-frozen process by the customer. Each coating system should have some development trial outcome with an approval on record in the lab or a master job file. *•NA applies when coating processes are not in the scope of the audit.*			
4.3.4	Do coating trials meet all applicable customer requirements? *•If applicable, look for customer approval. Otherwise, review documentation and verify.* *•NA applies when coating processes are not in the scope of the audit.*	YES	NO	NA
4.3.5	Does the Auditee have approved work instructions/processes for parts, including customer approval when required? *•Looking for more definition of the process than simply a router listing. Each critical operation should have functional requirements specified by process and/or configuration. Could be in the form of both higher level procedures and part specific work instructions.*	YES	NO	
4.3.6	Are all procedures referenced in the task-specific work instructions available to the operator? *•Looking for a direct reference to the procedure in the router or the work instructions. Verify that procedures are available to the individual performing the task.*	YES	NO	
4.4	Job Documentation			
4.4.1	Do procedures require that documentation (e.g., traveler) detailing each operation accompanies each job? *•Looking for a reference in procedures as to what functional requirements are stated at the manufacturing level either by departmental procedures or job specific operation sheets.*	YES	NO	
4.4.2	Are relevant work instructions available in each work area? *•Work instructions can be embedded in router, posted at the booth, available at a computer workstation in the area or master book of operational procedures in the department.*	YES	NO	
4.5	Drawings, Documentation, and Changes			
4.5.1	Does the Auditee have a procedure, including appropriate marking of shop job documents, which assures that frozen process changes are made only after receipt of required approvals from the customer? *•Review document control procedure, router revision control documents, FAIR or frozen process change control procedures.* *• NA if no frozen process is required by the customer.*	YES	NO	NA
4.5.2	Can the Auditee demonstrate evidence of process approval? *•Looking for letters of approval from the customer, such as certificate of approval, approved subcontractor list on the website, or release documents for each controlled process and/or part.* *•NA if no process approval is required by the customer.*	YES	NO	NA
4.6	Product Identification and Traceability			

4.6.1	Do individual products or batches have a unique identification for traceability that is recorded by the Auditee? •*Lot number control procedure should be consistent with shop floor records. Review routers and certifications for specific reference to lot by routing or spray batch.*	YES	NO	
4.7	Sampling Plans		SECTION NA	
4.7.1	Are sampling plans documented? •*Could be in the form of customer approval, internal approval. Each job on sampling should have some statistical detail in file as proof of evaluation for sampling, unless sampling is 100%.*	YES	NO	
4.7.2	Do records demonstrate that samples are taken in accordance with the specified sampling plan?	YES	NO	
5.	**PREVENTATIVE MAINTENANCE, GENERAL PROCESS INSPECTION, AND CALIBRATION**			
5.1	Preventative Maintenance of Equipment (Process and Laboratory Equipment)			
5.1.1	Do procedures or systems require maintenance at a specified frequency or condition by qualified personnel (employees or vendors) in accordance with specifications and customer requirements?	YES	NO	
5.1.2	Are there records that indicate that maintenance is performed in accordance with the procedures?	YES	NO	
5.2	Test Materials and Specimens			
5.2.1	Is there a procedure that specifies the control and identification of test materials and specimens, as well as when and where they are to be used? •*Procedure and work instruction review, looking for a specific reference on control of test material, check for meeting customer requirements.* •*Specimen must be identifiable to material type* •*Labeled bins, color coding, different sizes, etc. are examples of acceptable control and identification*	YES	NO	
5.2.2	Are coated test specimens traceable to the work order, part(s), process validation or equipment at least until testing is complete? •*Traveler, envelope, etc.* •*The test specimen must be traceable back to the work which it represents* •*Validate that test material as it is separated from the parts for evaluation has proper designation to relate back to the production batch or lot.*	YES	NO	
5.2.3	Is retention of metallographic specimens in accordance with customer requirements?	YES	NO	NA

	•*Not Applicable if no metallographic evaluations are required or no customer requirements for retention*			
5.2.4	Is production coating evaluation, applicable to PRI AC7109/5, with the exception of microanalysis of coating composition, performed by a PRI AC7109/5 Nadcap-accredited laboratory? •*This requirement applies to tests performed internally and tests that are subcontracted. For example, if the tensile test is subcontracted, the lab performing the tensile test must be accredited to AC7109/5.*	YES	NO	
5.2.4.1	Is microanalysis of coating composition of aluminide and aluminide-derivative coatings by energy or wavelength dispersive spectroscopy performed by a PRI AC7109/5 Nadcap–accredited laboratory or a laboratory authorized by the customer? •*NA applies if microanalysis of coating composition is not required* •*For a lab authorized by the customer, look for a record of communication [email, deviation, letter] from the customer indicating use of the lab is authorized.*	YES	NO	NA
5.2.4.2	For testing performed externally, is there evidence of a system for reviewing reported test results for compliance to customer requirements? •*NA applies when tests are not performed externally* •*Method employed that verifies results are evaluated as acceptable/unacceptable. (tick marks, record, procedure, stamp/sign-off or other methods such as electronic verification)*	YES	NO	NA
5.3	Calibration			
5.3.1	Is there a documented calibration program that ensures calibration for:			
5.3.1.1	All shop equipment used to control or monitor control of a process? •*Specific equipment calibration requirements are referenced in the applicable audit criteria e.g. AC7109/1 Appendix A.* •*Calibration is required over the range of use except in cases where there are no commercially available standards that cover the entire range of use.* •*Calibration is not required for tape measures or rulers used to measure standoff distance.* •*The expectation is timers must be calibrated when seconds are important. An example where calibration is required: timer [e.g. stop watch] used to determine powder feed rate. An example where calibration is not required: timer [wall clock] used to determine the elapsed time between grit blast and thermal spray operations.*	YES	NO	
5.3.1.2	All test and inspection equipment used to accept product or control a process? •*Calibration is not required for specimen preparation equipment used in AC7109/5.* •*The expectation is that surface profilometers are to be calibrated.*	YES	NO	
5.3.2	Are pre- and post-calibration data recorded when adjustments are made?	YES	NO	NA

•*Not Applicable if no adjustments have been made*

5.3.3	Is there record of actions taken in the event calibration is found outside of allowed tolerance? •*Not applicable if no out of tolerance calibrations have occurred*	YES	NO	NA

6. MATERIAL HANDLING AND PROTECTION

6.1	Is there evidence that the Auditee has provided the methods and means of handling and protection from receiving through shipping? •*Examples such as soft rubber cover on tables, handling tools for heavy parts, support to seat unstable parts, corrosion protection, etc.*	YES	NO

7. STRIPPING OF COATINGS **SECTION NA**

This section is inclusive of all methods of stripping of coatings, whether subcontracted or performed on site.

7.1	Does the Auditee have a method for controlling the stripping of coatings? If stripping of coatings is performed on site by methods other than machining, grinding or water jet, an audit to AC7109/4 must be performed unless the processor is Nadcap-accredited to PRI AC7108 and/or AC7108/14 for the appropriate stripping method. AC7108 and AC7108/14 are not acceptable alternatives for media blasting. If stripping of coatings is performed by a subcontractor using methods other than machining, grinding or water jet, the subcontractor performing the removal must be Nadcap-accredited to PRI AC7109/4 and/or PRI AC7108/14 (for appropriate stripping method).	YES	NO
7.2	Are the number of strip cycles approved and are they each documented and traceable to the parts? •*Customer and specification requirements for cycles that may include approval of method in general or part specific approval*	YES	NO
7.3	Are the reasons for the stripping of coating recorded on the individual part/lot documentation, the reprocessing properly authorized and the need for corrective action considered? •*Documentation may include Non-Conformance Report (NCR) form, reprocessing form, or incoming paperwork where stripping of coatings is part of work scope.* •*Proper authorization may vary depending on the reason for the stripping of coating. For example, stripping of coating due to an in-process rework of original equipment, may require authorization from the design authority. For Maintenance, Repair, and Overhaul situations, proper authorization may be the customer order.* •*Corrective action must be considered only in the case where coating is stripped due to in-process rework of discrepant coating.*	YES	NO
7.4	Stripping of Coatings Performed on Site	SECTION NA	

7.4.1	Equipment and Facilities			
7.4.1.1	Does the Auditee have the necessary equipment to perform the stripping?	YES	NO	
7.4.1.2	Stripping of Coatings Methods Used:			
7.4.1.2.1	Chemical		☐	
7.4.1.2.2	Electrolytic		☐	
7.4.1.2.3	Media Blast		☐	
7.4.1.2.4	Molten Salt		☐	
7.4.1.2.5	Machining		☐	
7.4.1.2.6	Grinding		☐	
7.4.1.2.7	Water Jet		☐	
7.4.2	Process Planning			
7.4.2.1	Does the Auditee have approved (internal or by customer when required) procedures and/or work instructions for each stripping method, describing each step in the stripping process? •*Chemical stripping generally requires customer approval* •*Validate a stripping procedure has been evaluated and approved either by customer, design authority or internal authority.*	YES	NO	
7.4.2.2	Do these procedures/work instructions include the following:			
7.4.2.2.1	Preparation of stripping equipment/materials/solutions before stripping coatings?	YES	NO	
7.4.2.2.2	Methods of preparing parts before stripping?	YES	NO	NA
7.4.2.2.3	Masking methods?	YES	NO	NA
7.4.2.2.4	Stripping process procedure including process parameters? •*Tolerance is not required for machining/grinding parameters.*	YES	NO	
7.4.2.2.5	Details of post stripping treatments?	YES	NO	NA
7.4.2.2.6	Methods of protection against corrosion with appropriate time limits for protecting parts?	YES	NO	NA
7.4.2.3	Does the Auditee use control methods to monitor significant operational parameters? •*Any charting or recording of parameters, electronic controller, software, regulator*	YES	NO	

7.4.2.4	Does the Auditee have defined inspection procedures to evaluate stripped parts? •*Described on router and/or in procedure or work instruction*	YES	NO
7.4.2.4.1	Do these include accept/reject criteria?	YES	NO
7.4.2.4.2	Does it include an inspection for complete stripping of coating?	YES	NO
7.4.3	Are controls (e.g., inspection, frozen parameters, training, documented procedures) in place to ensure the substrate is protected from excessive erosion during stripping of coating?	YES	NO
7.4.4	Post-Strip Cleaning		
7.4.4.1	Are procedures used for post-strip cleaning clearly defined (e.g., compressed air/water spray rinse)?	YES	NO
7.5	Embrittlement Relief Bake	SECTION NA	
7.5.1	If the Auditee performs embrittlement relief, are they accredited to PRI AC7109/7 or PRI AC7102?	YES	NO

8. COMPLIANCE

A minimum of one job audit is required for each checklist other than AC7109/5. A minimum of two total coating process job audits must be performed: If the scope of the audit only contains one coating process checklist (AC7109/1, /2, /3), two job audits must be performed for that checklist. At least one of the job audits must be an in-process job audit with the preference being that all job audits are in-process work. Staff Engineer and/or Nadcap Coatings Task Group approval are required for performing fewer job audits than required.

For AC7109/5, the expectation is that all tests listed in the scope of the audit will be witnessed or verified (completed test) during each audit with **all tests witnessed** over 3 audits.

If a test is not witnessed over the span of 3 audits, that test will be removed from the scope of accreditation.