



NONCONVENTIONAL MACHINING

Nonconventional Machining (NM) addresses different critical processes in the Aerospace industry used to cut metallic parts. Some of these processes have been in use since the 1930s. The main processes covered by NM are ElectroChemical Machining which includes the sub methods of ElectroChemical Drilling, Precision Electrochemical Machining, Shaped Cathode ElectroChemical, and Shaped Tubed ElectroChemical Machining. A similar process is ElectroChemical Grinding, which is also covered under NM. The most widely used NM process is by far Electrical Discharge Machining, which has sub methods sinker, rotating electrode (or Fasthole), and wire. A similar process to this, also covered by NM, is Spark Erosion Grinding. Laser Beam Machining, which was developed throughout the 1970s, is used for cutting,

drilling, and marking operations. The final process covered under NM is Abrasive Water Jet Machining (AWJM). The similarity to these processes is that all of them (excluding AWJM) cause detrimental areas along the cut, which are more susceptible to cracks and failure. Therefore, NM processes must be tightly controlled as a special process.

The NM Task Group's first audits occurred in 2002 to control this process in Aerospace applications. In the late 2000s, because the NM and SE Task Groups were of a comparable size, the groups were combined into the NMSE Task Group and oversight was provided by the same group of Subscribers. Today, the NM Task Group performs approximately 275 audits annually and holds 402 supplier accreditations.

INDUSTRY SUPPORT

Participating Stakeholders:

- Airbus*
- Bombardier*
- Collins*
- GE Aerospace*
- GE Avio*
- GKN Aerospace Sweden
- Honeywell*
- Leonardo Helicopters*
- Leonardo Divisione Velivoli
- Liebherr Aerospace
- MTU
- Parker*
- Pratt & Whitney*
- Rolls Royce*
- Safran*
- Spirit Aerosystems* (* mandates)

BUSINESS BENEFITS

- Reduced costs associated with product malfunction, returns, complaints, and equipment failure
- Improved reputation and credibility in the industry
- Customer attrition due to inability to satisfy requirements
- Improved on-time delivery
- Improved control of supply chain
- Mitigated in-service risk of product failure
- Reduced scrap and rework
- Improved product quality

AUDIT CRITERIA

1. AC7116 – Nonconventional Machining
2. AC7116/1 – ElectroChemical Machining
3. AC7116/2 – ElectroChemical Grinding
4. AC7116/3 – Electrical Discharge Machining
5. AC7116/4 – Laser Beam Machining
6. AC7116/5 – Laser Part Marking
7. AC7116/6 – Spark Erosion Grinding
8. AC7116/7 – Abrasive Water Jet Machining

TECHNICAL BENEFITS

Reduction in nonconforming product by ensuring a more in-depth review of . . .

- The equipment calibration processes and requirements
- Operator qualification and training
- The process of hardware inspection, including part set-up and fixturing
- Part programming and software use
- Metallographic examinations
- Equipment maintenance in supporting fixture and asset care to prevent use of dirty/damaged/unfit for purpose equipment
- Equipment operational environment
- Dielectric conductivity measurements
- Arcing inspection
- Electrolyte Temperature Conversions

COMMON INDUSTRY ISSUES

- Improper documentation of the process
- Failure of program and software controls
- Improper process for conductivity calibration
- No reverification of equipment after measurement of calibration setup
- Calibration of equipment – lack of calibration, out of tolerance, lack of flow down of requirements to calibration house, lack of recurring calibration
- Operator qualification – no evidence or documentation of training/qualifications, or process of training/qualification
- Failure to verify part programs
- Use of unapproved chemicals

COMMON NONCONFORMANCES FOUND DURING AN AUDIT

NCR 1 - Did the Auditee upload a copy of its completed self-audit to eAuditNet at least 30 days prior to the audit utilizing the version of the checklist(s) applicable to this audit? Compliance Assessment Guidance: 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).

NCR 2 - Is the operator following the workstation instructions?

NCR 3 - Is the dielectric flushing method on the machine the same as it is described in the workstation instructions?

NCR 4 - Are all the controls on the EDM power supply set within limits listed in the workstation instructions or within the part program (including revision level) referenced in the workstation instructions?

NCR 5 - Is the operator following the part loading and verification method described in the workstation instructions?

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GET INVOLVED

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