

How to Conduct a Heat Treat Audit

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Audits of the heat treating department are a vital part of any good quality program—either as part of a self-assessment or ISO program for a captive shop or—of equal importance—as part of an evaluation of the capabilities of a commercial heat treat supplier. In either case, the audit process needs to be formal in nature and follow specific guidelines.

The audit process should be designed to ask basic questions, such as:

- Who is performing the heat treatment and are they competent?
- What procedures are being used to carry out the heat-treating operation?
- Are they adequate to assure proper quality?
- Where is the work being done?
- Is the shop performing the work capable of performing the required task(s)?
- When was the last assessment?
- Was it representative of current practice?
- Why is an assessment required at this time? i.e.—did a quality issue or problem trigger the event? If so, will the audit questions help resolve it?
- How will the audit be performed; are the right personnel in place to reach meaningful conclusions?

What Constitutes a “Good” Audit?

Most audits that “fail” do so because they do not reveal the true nature of what is happening within the heat treatment operation. Care must be taken to look at both the quality aspects (forms, instructions, compliance) and the performance aspects (process control, work handling, etc.). Too often, audits focus their attention on the former and give a cursory look at the latter. This disconnect is the reason many organizations are confused as to why their departments or suppliers fail to achieve continuous improvement.

To be useful, heat treat audits need to ask tough and realistic questions—not just be forms in which the auditor fills in the blanks. The true story is

revealed only in the details. It is critical that audits “drill down” to the level that the work is being done; meaning, a good heat treat audit spends less time in the office than on the shop floor. Finally, auditors must reward well-run operations and not hesitate to give them top scores when deserved. Here’s a look at some of the critical information necessary for conducting a meaningful, comprehensive audit.

General (company/department profile)

- A. Date, supplier’s name and plant location
- B. Key contact information, including corporate contacts (if appropriate), plant manager, quality manager, metallurgist and—first-, second- and third-shift supervisors
- C. Financial viability

Capabilities (general requirements)

- A. List all part numbers, cross-indexing them to their corresponding engineering drawings, specifications (including all testing requirements) and special needs (e.g., distortion concerns, handling concerns, dimensional tolerances, etc.).
- B. List the types of materials that the heat treater is qualified to run.
- C. List the heat treat processes capable of being run; be sure to tie each heat treat process with the specific equipment involved by part number.
- D. List each heat treat cycle, including the type of quench; be sure to identify all relevant process and equipment variables.

Instructions (for auditors)

- A. Clearly define what will be required in the heat treat audit and communicate this information to the intended parties well in advance of the physical audit so that the necessary information can be gathered ahead of time.
- B. Create a consistent and fair rating guideline (see below) and adhere to the categories and questions selected.

- C. Be sure that both parties agree to corrective actions and completion dates, and that responsibilities are clearly delineated.
- D. Follow up personally within the specified time frame.

Sample Rating Guidelines (for audit questions)

- A. If a required activity is not being performed (rating = 0)
- B. If there is only rudimentary activity (rating = 1); or if the activity is being performed and documented but has minor deficiencies (rating = 2)
- C. If the activity is inadequate for the task required (rating = 3); or if the activity is properly documented but not properly performed (rating = 4)
- D. If the activity is being adequately performed and is documented (rating = 5); and if, in addition, includes evidence that the activity achieves the task(s) required (rating = 6)
- E. If the activity is well-documented and is adequately performed (rating = 7); and if, in addition, continuous improvement is evident (rating = 8)
- F. If the activity is well-documented and beyond expectations (rating = 9); and if continuous improvement is overwhelming (rating = 10)

Continuous Improvement Program (areas to review)

- A. Good-Better-Best practices related to heat treatment and testing
- B. Process parameter variability is being controlled
- C. Equipment variability is being controlled
- D. Laboratory best practices are being used
- E. Scrap-Reject-Rework plans and procedures being used
- F. Documented planned preventive maintenance

Audit FAQs

- A. Are heat treat part handling, processing and storage adequate to preserve product integrity and quality?

- B. Are adequate controls employed to ensure that the processing and inspection status of the product are known throughout the heat treating operation? Are process/product monitoring and controls functions (and responsibilities) clearly defined?
- C. Is both the responsibility for and practice of heat treat process (recipe) development, testing methods and quality planning clearly defined?
- D. Does the heat treater have available—and use—a procedure for reviewing part design and specifications in relation to method of loading, as well as heat treat process parameter and equipment selection?
- E. Are process verification and/or capability studies conducted on all new part numbers?
- F. Are control plans and process (FMEAs) used as a basis for establishing quality programs for heat treat processes?
- G. What procedures are in place, and how does the heat treater react to customer concerns (internal or external indicators)?
- H. Are controls in place and being used on the shop floor to effectively monitor the process?
- I. If necessary, are statistical process control (SPC) methods utilized for key product parameters?
- J. Are written procedures/work instructions defining heat treat and quality functions available and in use on the shop floor (i.e., is the quality manual a living document)?
- K. Are adequate, in-process monitoring and inspections/tests performed, and are there adequate records?
- L. If on-site, does the testing or metallurgical laboratory have the tools, procedures and expertise to accurately determine part quality? If off-site, is the testing laboratory properly accredited?
- M. If part testing and/or PPAPs are performed, are records available with supporting documentation for the relevant heat treated products?

- N. Are documented and verifiable heat treating reject, reprocessing and/or scrap records available?
- O. Is there an effective preventive maintenance program in place for both the heat treating and process monitoring equipment?
- P. Does the heat treater have an effective system for ensuring the quality from his suppliers and service providers (instrumentation calibrations, quench oil checks, etc.)?
- Q. Is plant cleanliness, housekeeping, environmental and working conditions conducive to a safe, efficient operation in which continuous improvement can take place?

Non-Conformance (document, in detail)

- Major and minor non-conformances
- Pertinent general and specific observations

Corrective Action (for each supplier location)

- A. Issue statement
- B. Corrective action(s) required
- C. Responsibility
- D. Implementation date
- E. Root cause found
- F. Follow-up plan (actions and dates)


A Look at CQI-9

A new automotive industry action group (AIAG) heat treat audit guideline—CQI-9, Special Process: Heat Treat System Assessment—was released in March 2006. It is intended to help standardize the heat treat audit process. The HTSA supports the automotive process approach as described in ISO/TS 16949:2002.

Within each audit area, the major sections covered are: (1) process and test equipment requirements; (2) pyrometry; (3) process monitoring frequencies; (4) in-process/final test frequencies; and (5) quenchant and solution test frequencies.

Summing Up

Heat treat audits are so important that, in this writer's opinion, they need to be

conducted by trained and certified heat treat personnel—not just auditors skilled in the procedures involved. Both captive and commercial heat treatment organizations should demand that this aspect of their business be given the attention and respect it deserves. A standardized audit guideline with fixed frequency-of-compliance is long overdue. With ever-increasing product performance demands from customers, only continuous improvement will assure the heat treatment industry of continued growth and prosperity. 

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