

Special Process: Heat Treat System Assessment			
Facility Name: HTI" Heat Treat Specialists"			
Address: 500 W. Clinton Street			
Logansport, IN 46947			
Phone Number: 574-722-2814		Fax Number:	
Date of Assessment:	12/3/2025 & 12/4/2025	Date of Previous Assessment:	12/5/2024
Internal (Captive) Heat Treater (Y/N):	N	Commercial Heat Treater (Y/N):	Y
Type(s) of Thermal Processing at this Facility:			
Process Table A		Process Table D	
Carburizing	N/A	Induction Heat Treating	N/A
Carbonitriding	N/A	Process Table E	
Carbon Restoration	N/A	Annealing	N/A
Neutral Hardening (Quench and Temper)	N/A	Normalizing	N/A
Austempering / Martempering	Y	Stress-Relieving	Y
Tempering	Y	Process Table F	
Precipitation Hardening / Aging	N/A	Low Pressure Processing (Carburizing / Carbonitriding / Neutral Hardening)	N/A
Process Table B		Process Table G	
Nitriding (Gas)	N/A	Sinter Hardening	N/A
Ferritic-Nitrocarburizing (Gas or Salt)	N/A	Process Table H	
Process Table C		Ion Nitriding	N/A
Aluminum Heat Treatment	N/A	Process Table I	
		Hot Stamping	N/A
Current Quality Certification(s): ISO 9001:2015			
Date of Re-assessment (if necessary):			
Personnel Contacted:			
Name:	Title:	Phone:	Email:
Brandi Cook	Quality Manager	574-722-2814	bracoo@callhti.com
Auditors/Assessors:			
Name:	Company:	Phone:	Email:
Vince Rhodes	Small Parts Inc	574-739-6259	vinrho@smallpartsinc.com
Assisted by Brandi Cook	HTI		
Number of "Not Satisfactory" Findings:) 0			
Number of "Needs Immediate Action" Findings: 0			
Number of "Fail" Findings in the Job Audit(s): 0			

Section 1 - Management Responsibility and Quality Planning

Please describe Objective Evidence for each Requirement

1.1	Is there a dedicated and qualified heat treat person on-site?				
To ensure readily available expertise the following requirements shall be met.					
			Assessment		
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a dedicated and qualified full-time heat treat person on site.	Jack Henry at sister facility in town		X		
The position shall be reflected in the organization chart.	Org chart (12-2-24)		X		
A job description shall exist identifying the qualifications for the positions including appropriate metallurgical and heat treat knowledge for the individuals.	Job descriptions and off site metallurgist		X		
Evidence shall be available regarding the qualifications with a minimum of 5 years experience in heat treat operations or as a combination of a minimum of 5 years of formal metallurgical education and heat treat experience.	On site - Jack Henry (23 years)		X		
Comments:					

1.2	Does the heat treater perform advanced quality planning?				
The organization shall incorporate a documented advance quality planning process. A structured system for such process with the APQP elements is recommended, samples are available in the AIAG APQP manual or other equivalent national automotive industry standards. Similar parts can be grouped into part families for this effort as defined by the organization.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be documented advance quality planning procedure available.	Product Planning and Development process turtle (10-28-25)		X		
Feasibility studies shall be performed and internally approved for each part or group of similar parts.	APQP using HTI internal format - Viewed during audit.		X		
There shall be a documented system for process changes with approval by the customer.	Specification change procedure - Viewed during audit. To be combined with quality planning procedure. (12-1-20)		X		
Comments: Feasibility studies are customer driven.					

1.3	Are heat treat FMEAs up to date and reflecting current processing?				
Failure Mode and Effects Analysis (FMEA) for processes (PFMEA) is mandatory for the prevention of product/process failure modes and final product concerns. Examples of appropriate methods and standards include SAE J1739, AIAG & VDA FMEA Handbook.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a documented Failure Mode and Effects Analysis (FMEA) procedure with the present FMEAs updated and reflecting the current part quality status.	FMEA are available for all processes		X		
FMEAs shall address all process steps from part receipt to part shipment and all the key heat treat process parameters as defined by the organization.	Austemper PFMEA reviewed - REV 9 12-03-2025		X		
All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the FMEA.	Based on CSR's		X		
A cross-functional team shall be used in the development of the FMEA and shall be consistent with all associated documentation such as Control Plans, work instructions and shop travelers.	See FMEA		X		
Comments: FMEA review on schedule for 2025					

1.4	Are heat treat process control plans up to date and reflecting current processing?				
Reference automotive industry Control Plan guidelines. The Control Plan may be specific for each part or part family or it can be process specific and written for each process. In any case it describes required controls and actions for each process step as well as periodic requirements to assure process is in control.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall incorporate the use of a documented Control Plan reflecting the current process.	Austemper Control Plan REV 12-3-2025		X		
Control Plans shall address all process steps from part receipt to part shipment and identify all equipment used and all key heat treat process parameters as defined by the organization.	See austemper Control plan		X		
A cross-functional team shall be used in the development of the Control Plan and shall be consistent with all associated documentation such as FMEAs, work instructions and shop travelers.	See austemper Control plan		X		
All special characteristics as defined by the organization or its customers shall be identified, defined, and addressed in the applicable control plan.	CSRs are contained on specific part process sheet.		X		
Sample sizes and frequencies for evaluation of process and product characteristics shall be addressed and shall be consistent with the minimum requirements listed in the applicable Process Table.	See austemper Control plan		X		
Comments:					

1.5	Are all heat treat related and referenced specifications current and available? For example: Material standards, SAE, AIAG, ASTM, General Motors, Ford, and FCA.				
A document control system is pertinent for the handling and internal distribution of received customer specifications and to keep up to date with national or global standards related or close to heat treat processes.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall have a procedure and process to ensure the timely review, distribution and implementation of all customer and industry engineering standards/specifications and changes based on customer-required schedule.	Document and data control process defines this. (12-5-24)		X		
The organization shall have all related heat treat and customer referenced standards and specifications available for use, like but not limited to SAE, AIAG, ASTM, ISO, EN, JIS, General Motors, Ford, and FCA.	Central location for all standards viewed.		X		
The procedure shall include a 2-week distribution limit for cascading newly received and reviewed documents.	Documents reviewed by QM and application engineer upon receipt. Document and data control procedure. 12-5-24.		X		
Comments:					

1.6	Is there a documented system to create process specifications for all active processes?				
A documented system for creating process specifications is necessary for operating the heat treat process within the desired, requested process parameters to reach the final product specifications. Examples of process parameters include process temperatures, cycle times, load rates, atmosphere or gas flow settings, belt speeds, quench agitation speeds, etc.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Authorization shall be defined to a responsible person (see 1.1) for establishing process specification for the heat treatment of the products with the available equipment.	Business policy manual (10/28/2025)		X		
The heat treater shall have written process specifications for all active processes and identify all steps of the process including relevant process parameters.	Trac sheet defines all relevant process parameters by part.		X		
Parameters shall have operating tolerances as defined by the organization in order to maintain process control.	Trac sheet defines all relevant process parameters by part.		X		
Process specifications shall be available in the form of work instructions, job card, computer-based recipes, or other similar documents.	Trac sheet defines all relevant process parameters by part.		X		
All process specification changes shall be reviewed to the extent necessary to ensure continued conformity with customer requirements for process changes.	Process changes captured in NCM log		X		
All process specification changes shall be documented to include the date the process specification change was implemented and the person(s) approving the change.	Change log viewed. In conformance for date and approver		X		
Comments:					

1.7	Has the heat treat process been validated initially and after process equipment has been relocated, or had a major rebuild or modification?				
To demonstrate each heat treat process is capable of yielding acceptable product, the organization shall perform process validation as part of the initial validation of each process, after relocation of any process equipment or heat treat location change, and after a major rebuild of any equipment. Each process line may include a combination of equipment that is integrated in the performance of a heat treat process, e.g. hardening, quenching and tempering. (Heat treat process validation consists of robust heat treat equipment, rigorous process controlling and monitoring requirements and calibrations, appropriate test equipment calibrations, and strategic product sampling techniques.)					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall define what constitutes a major rebuild or modification that may impact product characteristics.	Criteria is known but not documented. Standalone WI to be created for this. Discussed 12-3-25		X		
Process validation shall be performed on full production load, or production run, with production intended fixturing and load configuration.	Office trac sheet for initial run		X		
An action plan shall exist if process control parameters or any of the product characteristics fall outside of the control tolerance limits or the heat treater does not conform to the respective Process Table.	Hold area and NC process in place for validation		X		
The heat treater shall demonstrate that all parts in the heat treat process (heat treat batch or production run) will meet customer specifications. Samples for these tests shall be selected that best represent the entire production load population. • An acceptable guideline for test sample locations is to use those loading locations prescribed for temperature uniformity surveys. • An acceptable guideline for induction hardening is to show a representative number of parts produced at the extremes of process parameter's tolerances meet customer specifications. Standard process capability indices may also be used to show compliance.	Process capability provided for evidence		X		
Comments:					

1.8	Does the heat treater collect and analyze data over time, and react to this data?				
The analysis of product characteristics (e.g. tensile strength) and processes parameters (e.g. temperature) over time can yield vital information for defect prevention efforts. Examples include but are not limited to product property trend charts, scrap trends, and variation in process parameter recordings.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall have a system to collect, analyze, and react to product or process data over time.	Datalyzer software program is used to store data for parts over time. Viewed online		X		
Methods of analysis shall include ongoing trend or historical data analysis of product characteristics or process parameters.	Trend data available for every run		X		
The organization shall determine which parameters are included in such analysis.	Per APQP/ Customer print		X		
Comments:					

1.9	Is the heat treat monitoring system reviewed by Qualified Personnel?				
This review is intended to be a second level review in addition to those performed by the heat treat operators. This review would be performed by qualified personnel as defined per question 1.17. The heat treat monitoring system includes but is not limited to temperature strip charts, atmosphere strip charts, computer data logs, furnace and operator logs, etc.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Qualified Personnel shall review the furnace monitoring systems at intervals not to exceed 24 hours.	Checks performed daily by maintenance. Leads check hourly furnace parameters		X		
The process of reviewing the furnace data shall be documented. This requirement also applies to computerized data.	Every order is verified prior to production run. Process parameters are checked every 2 hours. Evidence is in data trac.tial, Belt speed, Quench Temperature, Curtain Temperature and Agitation operation status are measured and retained by Furnace Line, Customer and PN. Signatures observed		X		
This second level review shall include detection and reaction to out of control conditions or alarms. This reaction shall be documented.	Datalyzer includes capability to add notes for alarm/control conditions. Tablet in place with a forms sheet that is filled out hourly.		X		
Comments:					

1.10	Are internal assessments being completed on an annual basis, at a minimum, using AIAG HTSA?				
The internal assessment includes a completed job audit and process table for each applicable process.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall conduct internal assessments on an annual basis, at a minimum, using the current revision of the AIAG HTSA.	On schedule. Internal audit agenda review (10-30-2025 thru 10-31-2025)		X		
Comments:					

1.11	Does the heat treater have a documented procedure for the rework/reprocessing of parts?				
Rework/Reprocessing of heat treated components can have a significant impact on the performance of the component. Reworking/Reprocessing in some cases is an acceptable practice. A rework/reprocessing procedure is key to identifying the rework/reprocessing practice. To be approved for rework/reprocessing, either on a case by case basis or pre-approved in the PPAP, the heat treater shall meet the following requirements.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Any change or addition to the rework/reprocessing procedure shall require notification and approval in accordance with the AIAG PPAP process. Any rework/reprocessing not previously approved and identified in the rework/reprocessing procedure is not allowed.	Re-processing is not conducted without authorization from the customer. Viewed- Control of non conforming product procedure (1-6-23), Corrective action procedure (1-6-23) and Preventative Action procedure (10-11-23)		X		
The OEM shall be notified by the Tier 1 supplier prior to rework/reprocessing product utilizing an unapproved process. If not Tier 1, the customer shall be notified.	Customers requiring notification are informed regarding the rework process		X		
The rework/reprocessing procedure shall be referenced in the heat treater's PPAP approved PFMEA and process control plan.	Rework procedure not referenced on PFMEA/CP. To be added latest by 1-19-26		X		
The rework/reprocessing procedure shall include the following: • A description of product characteristics for which rework/reprocessing is allowed and those characteristics for which rework/reprocessing is not permissible. • A requirement that all rework/reprocessing activity have a new process control sheet issued by qualified personnel; this new process control sheet shall include the heat treat parameter modifications. • A requirement that there is a record or log of all rework/reprocessing work. • A description of the sampling plan. • A requirement that the Quality Manager or a designee shall authorize the release of rework/reprocessed product.	Standalone reprocessing procedure viewed and in conformance		X		
Comments:					

1.12	Does the Quality Department review, address, and document customer and internal concerns?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The quality management system shall include a process for documenting, reviewing, and addressing customer concerns and any other concerns internal to the organization.	Corrective action Procedure (1-6-2023)		X		
A disciplined problem-solving approach shall be used.	5 why in use		X		
Comments:					

1.13	Does the organization have a Continual Improvement Plan (CIP)?				
Continual improvement is an ongoing effort in the organization to improve processes, services, or products. These efforts may seek incremental improvement over time or breakthrough improvement all at once. A CIP identifies specific continual improvement items, responsibilities and estimated completion dates. Downtime reports, scrap reports, preventive maintenance reports, energy consumption, use of medias, etc., may be used to develop a CIP.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall have continual improvement plan(s).	MPI has developed a countinuos improvement plan for the entire organization and now has a continupu improvement coordinator		X		
The CIP shall have specific action items, identify responsibilities and target completion dates for each action item.	CIP are documented in Management review report		X		
The organization shall show evidence of program execution.	CIP project verified in the deburr area of the facility		X		
Comments:					

1.14	Does the organization have a documented procedure for the control of nonconforming material?				
This practice is the responsibility of the manufacturers' quality management organization and their included personnel. The procedure should best describe the complete process with the handling of nonconforming or suspect products, beginning with detection and the authorization/obligation to quarantine those products up to the final decision and disposition in quarantine status.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The documented procedure shall specify the responsibilities for handling segregation and disposition of suspect or non-conforming products.	Control of Non-conforming Material procedure shared (1-6-2023)		X		
The organization shall keep records showing evidence of process being followed.	Nonconforming log viewed with years of historical evidence showing the process being followed.		X		
Comments:					

1.15	Are there procedures or work instructions available to the heat treat personnel that define the heat treating process?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be procedures or work instructions available to all employees involved in heat treating and inspection of heat treated product.	Standalone WI's reviewed.		X		
These procedures or work instructions shall include methods of addressing potential emergencies (such as power failure), equipment start-up, equipment shut-down, product segregation (See 2.8), product inspection, and general operating procedures.	Procedures in place "F-017-Shutdown for leads" reviewed and in conformance. Contingency plan in place as well.		X		
Comments:					

1.16	Is management providing employee training for heat treating?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall provide employee training (including follow up and ongoing training) for all heat treating and inspection operations, including backup and temporary employees.	Employees have individual training records separated by each job function		X		
Management shall define the qualification requirements for each function.	Qualifications defined for each role		X		
Documented evidence of training and training effectiveness shall be maintained.	Training records maintained and employees assigned a competency based on a scale		X		
Operators shall be trained in material handling, containment action, and product segregation in the event of an equipment emergency including power failure.	Training records shared and in conformance		X		
Comments:					

1.17	Are all key management and supervisory functions (in regards to Heat Treatment) performed by qualified personnel?				
Key management and supervisory functions, in regards to heat treatment, are critical to ensure both process stability and product quality. This can be accomplished in several different ways. Some examples to consider are a responsibility matrix, the organizational chart, job descriptions, or incorporation into other similar system documentation.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall define and document, key management and supervisory functions in regards to heat treatment.	Defined on business policy manual		X		
This documentation shall clearly identify both primary and secondary (backup) personnel.	Designated individuals for QM and Plant manager		X		
This information shall be readily available to appropriate personnel.	Available within ERP		X		
Comments:					

1.18	Is there a preventive maintenance program? Is maintenance data being utilized to form a predictive maintenance program?				
Preventive maintenance is essential to ensure equipment, machines and tools are kept in appropriate condition for the manufacturing of products at desired quality and capacity levels. The organization shall comply with the following requirements.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The organization shall have a documented preventive maintenance program for all heat treat process equipment.	E-Maintenance system contains PM program		X		
The program shall be a closed-loop process that tracks maintenance efforts from request to completion to assessment of effectiveness.	Work orders generated, tracked and completed in system		X		
Equipment operators shall have the opportunity to report problems, and the problems shall be handled in a closed-loop manner.	Breakdowns are entered in E-maintenance		X		
The company data (e.g. downtime, quality rejects, first-time-through capability, recurring maintenance work orders, and operator-reported problems) shall be used to improve the preventive maintenance program.	KPI's exist for PM related items(work orders open, etc)		X		
Maintenance data shall be collected and analyzed as part of the defined predictive maintenance program.	Results of PM jobs are documented and analyzed		X		
Comments:					

1.19	Has the Heat Treater developed a critical spare part list and are the parts available to minimize production disruptions?				
The critical spare parts list and available inventory is typically comprised of long lead time components such as (but not limited to) burners, fans, rolls, belts and other alloy parts. Availability of spare parts may be maintained on-site or off-site (for example, consignment) as identified by the heat treater.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall develop and maintain a critical spare parts list.	Critical spare part list in existence and inventory maintained quarterly. Updated to include location of items		X		
The heat treater shall ensure the availability of critical spare parts to minimize production disruptions.	Spare parts with min inventory maintained		X		
Comments:					

1.20	Is material from different heat lots which may preclude achieving the specified metallurgical properties prevented from being processed together?				
Batch to batch variation may have an adverse effect on metallurgical properties. This variation may require that batches be processed separately.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Where appropriate, the heat treater shall have a material product flow management system to prevent the processing of mixed batches.	Trac sheet defines staging . Chains used to separate product in furnace.		X		
Comments:					

Section 2 - Floor and Material Handling Responsibility

Please describe Objective Evidence for each Requirement

2.1	Does the heat treat responsible organization ensure that customer data entered in the process tracking system matches the customer order?				
It is critical that all customer requirements and lot identification be adequately transferred to internal heat treat documents. This also applies to captive heat treaters and their internal material flow.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall establish a documented product tracking system (e.g. shop travelers, work orders, etc.) which supports the heat treatment with relevant product and process information.	Customer tagging is transferred to in process containers and returned to dunnage prior to shipping.		X		
The heat treat organization shall establish a system to detect and resolve discrepancies on received products and corresponding customer information.	Lot # verification and NC process in place at receiving inspection		X		
Comments:					

2.2	Is product clearly identified and staged throughout the heat treat process?				
Product identification, process status and location of products with their process status are important to prevent incorrect processing or mixing of lots.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a procedure for part and container identification to avoid incorrect processing or mixing of lots.	Receiving tag is attached to containers. Trac sheets travel with each container		X		
Non-heat treated, in-process, and finished product shall be properly segregated in clearly identified locations.	Designated area for green and finished product in physically different locations		X		
Comments:					

2.3	Is lot traceability and integrity maintained throughout all processes?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Lot traceability shall be maintained throughout the entire process.	Traceability maintained for each container		X		
Comments:					

2.4	Are procedures adequate to prevent movement of non-conforming product into the production system?				
The control of suspect or non-conforming product is necessary to prevent inadvertent shipment or contamination of other lots.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Procedures shall exist addressing proper disposition, product identification, and tracking of material flow in and out of the hold area.	Control of Non-conforming Material procedure shared (1-6-2023)		X		
A non-conforming hold area shall be clearly designated to maintain segregation of such material.	Designated area exists for NC product		X		
Comments:					

2.5	Is there a system to identify trap points in the entire heat treat process to reduce risk of mixed parts (inappropriate, non-heat treated, or improperly heat treated parts)?				
Heat-treating furnaces and other processing equipment (including but not limited to baskets, conveyors, chutes, etc.) contain areas that have a risk of trapping or holding parts. Such trapping of parts can lead to damage, improperly processed parts or lot mixing/contamination.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall have procedures to identify and monitor trap points for each process/equipment.	Operation instructions		X		
Monitoring of potential trap points shall occur for every lot changeover.	Trac sheet defines trap point monitoring		X		
Comments:					

2.6	Are containers free of inappropriate material or free of heat treated parts mixed with non-heat treated parts?				
The purpose of the requirement is to reduce the risk of contaminating the finished lot with nonconforming parts or inappropriate material. Containers used for the transport of parts to be heat treated are often used for the same material after completion of the heat treat process. It is critical that the finished lot is not contaminated with non-heat treated parts or other inappropriate material remaining in the container.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a procedure that addresses the inspection of containers used for transporting non-heat treated and heat treated parts.	PRWI-003 Empty container verification REV02 (2-24-2022)		X		
The procedure shall include the inspection of containers after emptying and immediately before re-using to ensure that all parts and inappropriate material have been removed.	PRWI-003 includes photos of each container in use and refresher training has been completed.		X		
The source of inappropriate material shall be identified and addressed.	None observed during audit		X		
Comments:					

2.7	Is furnace loading specified, documented and controlled?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Furnace loading parameters shall be specified, documented, and controlled (including but not limited to the following examples: feed rate, belt speed, number of parts per fixture, load weight, etc.).	Parameters defined within the trac sheet		X		
Comments:					

2.8	Is there a procedure for material handling, containment action, and product segregation in the event of an equipment emergency including power failure?				
Unplanned or emergency downtime greatly increases the risk of improper processing.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a procedure for material handling, containment action, and product segregation in the event of an equipment emergency including power failure.	NCM log tracks abnormal events. Contingency plan defines reaction to equipment emergencies.		X		
The procedure shall address containment actions related to all elements of the heat-treating process, e.g. loading, austenitizing, quenching, tempering.	Control of non conforming product procedure defines containment		X		
The procedure shall define when this emergency plan is to be implemented.	Contained in emergency plan		X		
Comments:					

2.9	Is the handling, storage and packaging adequate to preserve product quality?				
Some equipment includes conveyors and other moving components that may not be able to handle all part configurations. Other practices such as stacking of overloaded containers can also increase the risk of part damage.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Handling, storage, and packaging shall be adequate to preserve product quality.	Packaging defined by customers which is listed on trac sheet		X		
The heat treater's furnace loading system, in-process handling, and shipping process shall be assessed for risk of part damage or other quality concerns.	Assessed during APQP		X		
Comments:					

2.10	Are plant cleanliness, housekeeping, environmental, and working conditions conducive to control and improve quality?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Plant cleanliness, housekeeping, environmental, and working conditions shall be conducive to controlling and improving quality.	Plant tour found good housekeeping practices and a well lit work space		X		
A housekeeping policy shall be clearly defined and executed.	5S practices in place and roles defined within organization for housekeeping		X		
The facility shall be reviewed for conditions that are detrimental to quality processing such as loose parts on floor, oil around quench tanks, inadequate plant lighting, smoke, etc.	No detrimental conditions observed. Area found to be in good condition.		X		
Comments:					

2.11	Are parts free from contaminants that would be detrimental to the heat treatment process?				
Oils, coatings and other contaminants or residues may adversely affect the heat treatment process or subsequent processes. Pre/Post wash or other methods of contamination removal may be required by customer or mandatory for process function.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
If applicable, cleaning parameters shall be monitored and documented.	Trac sheet		X		
The frequency for checking the cleaning parameters shall conform to applicable Process Table, Section 5.0	In conformance		X		
Comments:					

2.12	Is the quenching system monitored, documented, and controlled?				
Refer to Process Tables, Sections 3.0 and 5.0, for details and frequency of checks.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The quenching system shall be monitored, documented, and controlled. (Computer-monitoring equipment, with alarms and alarm logs, satisfy the verification requirement.)	Checks documented in data trac		X		
Quench delay time with alarm is required. Not applicable for belt, shaker, or pusher furnaces where parts free-fall into the quench.		X			
Temper delay time shall be specified by the heat treater for parts that are quenched and tempered (e.g. carburizing, carbonitriding, neutral hardening, induction hardening).		X			
Comments:					

2.13	Are soluble oil or other rust preventive solutions monitored and controlled if applicable?				
Parts are often dipped in or sprayed with rust preventive solutions immediately after the heat treating process. Refer to Process Tables, Section 5.0, for frequency of checks.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Soluble oil solutions or other rust preventive solutions shall be monitored and controlled, if applicable.	A PM in E Maint was created. 12-4-2025. Trac sheet defines use of preventive solutions, if necessary		X		
The heat treater shall have and maintain documented tolerances for the solutions.	Control plan documents tolerance		X		
Comments:					

2.14	Are process control parameters monitored per frequencies specified in Process Tables?					
Refer to Process Tables, Section 3.0.						
		Assessment				
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action	
Process control parameters shall be monitored per frequencies specified in Process Tables.	Data trac logs observed		X			
A designated floor person shall verify the process parameters, e.g. by initialing a strip chart or data log. (Computer monitoring equipment with alarms and alarm logs satisfy the verification requirement.)	Checks documented in data trac		X			
Comments:						

2.15	Are In-Process/Final Test Frequencies performed as specified in Process Tables?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
In-Process/Final Test Frequencies shall be performed as specified in Process Tables.	In conformance with process table		X		
Any exceptions to test frequencies specified in the process tables shall be approved by the Customer in writing.		X			
Comments:					

2.16	Is product test equipment calibrated and verified?				
Refer to Process Tables, Section 1.0, for frequency of checks.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Test equipment shall be calibrated and verified per applicable customer-specific standards or per an applicable consensus standard such as those published by ASTM, DIN, EN, ISO, JIS, NIST, SAE etc.	Rockwell and vickers testers observed during walkthrough.	X			
Calibration and verification results shall be internally reviewed, approved, and documented.	Plex system tracks calibration schedule. Calibrations is current.	X			
Comments:					

Section 3 - Equipment
Please describe Objective Evidence for each Requirement

3.1	Do furnaces, generators, and quench systems have proper process control equipment?				
Examples include temperature, carbon potential, dew point, gas flows, quench monitoring system including agitation, temperature control, etc., as listed in the applicable Process Tables, Section 1.0					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat-treat equipment including furnaces, generators, and quench systems shall have proper process controls.	Various process controls in place for furnaces. Temperature, cp, flow rates, salt, etc. Contained in CP and trac sheet	X			
Comments:					

3.2	Are process equipment calibrations, verifications and certifications current?				
Refer to the applicable Process Tables, Sections 1.0 and 2.0, for equipment calibration, verification and certification frequencies.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The calibrations, verifications and certifications of the process equipment shall be performed at regular intervals as specified in the applicable Process Table(s).	Plex system tracks calibration schedule. calibrations is current. viewed controller on line 2 due for calibration in January.		X		
Non-contact thermometry devices shall be calibrated as specified in the applicable Process Tables.	Plex system tracks calibration schedule. Calibrations is current.		X		
A documented offset procedure as defined in Section P3.2.3 shall exist.	WI-007- offset procedure (1-17-2025)		X		
The documented offset procedure shall indicate who has the authority to approve the use of offsets and how this approval is documented.	WI-007- offset procedure (1-17-2025)		X		
Offset or bias applied for the instrumentation calibration adjustment shall comply with P3.2.3.	Offset review showed values within allowable 5F for SAT, TUS and instrument corrections.		X		
Calibration labels shall meet the requirements established in Section P3.2.5.1.	Viewed Vickers tester-Label meets requirements due (7-2025)		X		
Calibration reports shall meet the requirements established in Section P3.2.5.2.	Viewed Vickers tester report-it meets requirements		X		
Comments:					

3.3	Are thermocouples and protection tubes checked or replaced per Process Tables?				
The accuracy of thermocouples is essential for good temperature control, the collection of accurate process data and the protection of furnace equipment.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Thermocouples shall be calibrated before first use, within the temperature range in which they will be used and meet the accuracy requirements of the Section P3.1 Tables.	Thermocouples are purchased from vendor with calibration		X		
Control, monitoring and recording thermocouples shall be SAT checked as per the applicable Process Table(s) and Section P3.3.	Probe method A employed. Results observed		X		
The insertion depth of Type K and Type E test thermocouples shall be documented when the thermocouple is reused as per Section P3.1.3.3.	Thermocouples are not reused	X			
System Accuracy Test records shall meet the requirements established in Section P3.3.5.	Records observed		X		
Protection tubes shall be checked or replaced in compliance to a documented preventive maintenance schedule.	Documented in PM schedule-E Maint program		X		
Comments:					

3.4	Are temperature uniformity surveys performed per requirements in Process Tables?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Temperature uniformity surveys shall be conducted per the requirements in the applicable Process Tables, Section 2.0.	Internal TUS per PM schedule. Outside vendor performs TUS annually.		X		
Actions that alter the temperature uniformity characteristics of a furnace shall be documented per section P3.4.1.2.	Maintenance log		X		
If used, alternate temperature uniformity test methods shall meet the requirements of Section P3.4.8.		X			
The upper temperature tolerance shall not be exceeded at any time. Exceptions may exist in systems where multiple process temperatures exist in a single process cycle per section P 3.4.5.1.	TUS did not exceed upper tolerance		X		
The organization's internal process specification shall define suitable soak time at temperature requirements for pass/fail determination as per Section P3.4.5.1.	Soak time defined based on section size		X		
Temperature uniformity survey reporting shall meet the requirements established in Section P3.4.7.	Method, empty/loaded, TC location, signature,soak included in report		x		
Comments:					

3.5	Is the variation of the furnace control thermocouple from set point within the requirements in the Process Table?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The variation between the furnace control thermocouple value and the set point temperature shall be within the limits defined in the applicable Process Tables, Section 2.0.	Observed in tracking software. No points observed outside of tolerance window.		X		
Comments:					

3.6	Are the process and equipment alarm checks being tested quarterly or after any repair or rebuild?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall have a list of alarms that, if not properly working, may have a high probability of producing non-conforming product.	PM for furnaces has alarm checks as a requirement		X		
The listed alarms shall be checked quarterly at a minimum or after any repair or rebuild.	Quarterly check		X		
Other alarms, including but not limited to safety-related, shall be checked per the heat treater's requirement.	Alarm checks observed		X		
These alarm checks shall be documented.	Maintenance log observed		X		
Comments:					

3.7	Are generators and furnace atmospheres continuously monitored, automatically controlled, and documented?				
For furnaces that preclude in-situ control and monitoring, use the method described in Section 3.4.5 "Property Surveys".					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Generator and furnace atmosphere carbon potential/dew point shall be continuously monitored, automatically controlled, and documented.	Continuous monitoring observed		X		
The recorded furnace carbon potential shall be controlled within ±0.05 of the set point.	Conformance observed		X		
The recorded dew point shall be controlled within acceptable limits as specified in the control plan or internal procedures.	Limits observed		X		
If generators are not used, the flow rates of the supplied atmosphere gases shall be monitored and controlled.		X			
The automatic and continuous atmosphere control system shall consist of sensors such as oxygen probes or on-line infrared (IR) gas analysis.	Oxygen probes in use		X		
The heat treater shall also have a back-up method of checking carbon potential/dew point.	Dew pointer or 3 gas analyzer and calibrated reference probe for verification		X		
Back up method verification frequencies shall be conducted according to the applicable process tables.	Dew pointer or 3 gas analyzer and calibrated reference probe for verification		X		
Comments:					

3.8	When the back-up verification check of the atmosphere does not correlate within pre-established limits with the primary control method (carbon potential/dew point reading), is correlation of the carbon-bearing atmosphere to the primary control method re-established?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The back-up atmosphere monitoring system reading and the primary control method atmosphere dew point/carbon potential reading shall be maintained within the correlation limits specified in the control plan or internal procedures.	Defined on control plan. Engineering is authorized to re-establish correlation in the event of a discrepancy		X		
The back-up carbon potential/dew point reading shall be established using one or more of the following methods: • Direct measurement of surface carbon of sample • Shim Stock • Gas Analyzer • Dew Point • Wire Resistance • Redundant Oxygen Probe	Dew point, 3 gas analyzer and redundant oxygen probe		X		
When a discrepancy has been detected, the correlation shall be re-established between the back-up and primary method and documented.	Documented in maintenance log		X		
The range tolerances for correlation between the two readings shall be in the control plan or internal procedures.	Correlation contained within maintenance work instructions		X		
Comments:					

3.9 Are all ammonia lines equipped with a fail-safe method to prevent the inadvertent introduction of ammonia into the furnace?					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
One of the following fail-safe methods shall be used to prevent inadvertent introduction of ammonia into the furnace. • A quick disconnect or physical separation of the lines • Three-valve ammonia "fail-safe" vent system is permitted. See the definition "Three Valve Fail-Safe Vent" and diagram in the glossary. • 1 manual and 2 electrical magnetic valves in series		X			
The disconnecting of ammonia atmosphere from non-ammonia bearing atmosphere shall be documented.		X			
Comments:					

3.10	Is there a minimum of 3 hour purge of the furnace atmosphere when switching from an ammonia bearing atmosphere to a non-ammonia bearing?				
Ammonia pick-up can be undesirable in parts and heat treat processes not specifying/requiring ammonia as an addition.					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall perform a minimum 3 hours purge prior to processing product not requiring ammonia as an addition.		X			
Any reduction of the 3 hour purge shall require conclusive test data of the atmosphere to show no significant amount of residual ammonia is present in the furnace atmosphere.		X			
Log book, data logger, or other records shall document the actual purge time and that sufficient time has been allocated to remove ammonia from the furnace prior to processing parts in heat treat processes not specifying ammonia.		X			
Comments:					

3.11 Do all atmosphere furnaces and generators have flow scopes or flow meters for all gases?					
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
All atmosphere furnaces and generators (output trim/adjustment gas) shall have flow scopes or flow meters for all gases.	Flow scopes/meters in use		X		
Flow scopes and meters shall be periodically serviced per the heat treater's preventive maintenance program.	Serviced quarterly per PM plan		X		
Cleaning and proper re-assembly procedures shall be documented.	Documented in maintenance log		X		
Comments:					

3.12	Is there a fail-safe system at the front of continuous belt furnaces for austenitizing to prevent non-uniform loading of parts?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Sight glass inspection ports shall exist for the visual evaluation of load distribution.	Sight glasses on every furnace		X		
Sight glass inspection ports shall be cleaned per the preventive maintenance schedule.	Cleaning occurs quarterly per PM plan		X		
There shall be a fail-safe system implemented on continuous belt furnaces to prevent non uniform loading of the parts.	Manual loading is defined by work instruction with training. Automatic loading controls placement and quantity of parts		X		
In the absence of a fail-safe system, a non-contact thermometry device shall be employed with the following requirements met: • A non-contact thermometry device shall be aimed at the center of product mass from the discharge end of the furnace (i.e. bulk head portal) in order to acquire part temperature immediately prior to quenching. • A non-contact thermometry device temperature alarm shall be -28°C (-50°F) maximum of the final zone set point temperature. • Non-contact thermometry device temperature data shall be continuously recorded.	All zones of furnace have alarms with recording present		X		
Comments:					

3.13	Is salt chemistry in the austenitizing salt bath monitored?					
This is applicable to salt bath heat treating processes listed in Process Tables A and B.						
		Assessment				
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action	
The heat treater shall check the salt chemistry in the austenitizing salt bath, or part decarburization.	Salt analysis performed twice per year as defined per the control plan		X			
The heat treater shall conform to the frequency of checks defined in the applicable Process Table Sections 3.	In conformance with requirements		X			
Comments:						

3.14	Is the quenching medium analyzed?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall periodically have the quenching medium analyzed for specific quenching characteristics, e.g. cooling curve, water content, salt concentration, as specified in the applicable Process Tables, Section 5.0.	Samples are tested by the supplier twice per year		X		
The quench medium characteristic tolerances shall be specified by the quench medium supplier or the heat treater.	Characteristics defined by supplier and purchased pre mixed		X		
Test results shall be reviewed for conformance and documented by the heat treater.	Reviewed by HTI personnel. Signature observed on test results shared in audit		X		
Comments:					

FOR INDUCTION HEAT TREATING

3.15	Is the positioning of each part being controlled?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a method to ensure proper part position such as the use of proximity switches, optical sensors or mechanical Poka-Yoke system.		X			
Comments:					

3.16	Does the heat treater control the energy or power for each part?				
		Assessment			
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall control the energy or power for each part.		X			
Signature monitor or energy monitor shall be used to monitor energy or power to the part and record all out of control events.		X			
Any alternative method shall be approved by the Customer.		X			
Comments:					

3.17	Does the supplier have a coil management system?				
Coil refers to the heating coil and the quench plenum.					
			Assessment		
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The heat treater shall have a coil management system.		X			
Spare coils for each part shall be available on-site.		X			
Coils shall conform to the customer approved design.		X			
Comments:					

3.18	Is quench system automatic?				
			Assessment		
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
The quench system shall be automatically initiated and controlled.		X			
Comments:					

3.19	Is there a procedure that addresses maintenance of the inductor and quench spray nozzle(s) (e.g. quench ring, quench shower)?				
			Assessment		
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a procedure that includes regular inspection and cleaning of the inductor and quench spray nozzle(s).		X			
Comments:					

3.20	Is there a procedure to purge the air pockets from the quench lines?				
After downtime of the induction heating system, air pockets may form in the quench lines. These air pockets will cause interrupted quenching at start-up. Factors such as quench line diameter, length, geometry, etc., should be considered when establishing the time limit of the downtime.					
			Assessment		
Requirements	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
There shall be a procedure to purge the quench lines after downtime.		X			
The Heat treater shall establish the time limit (of the downtime) when this procedure is to be followed.		X			
Comments:					

Section 4 - Job Audit

Job Identity: SPI 439570
Customer: Small Parts Inc
Shop Order Number: PO# 13542-36306
Part Number: 572900
Part Description: Washer
Material: 1074
Heat Treat Requirements: Austemper

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / NA
4.1	Does the heat treat facility have the customer specifications for the part?	1.5	Customer	Trac sheet	Certification reviewed	PASS
4.2	Is material identification (part numbers, lot numbers, heat numbers, contract numbers, etc.) maintained throughout the heat treat process?	2.2 2.3 2.4	Internal	Trac sheet	Storage locations, WIP and finished goods observed	PASS
4.3	Are the Loading/Racking requirements identified?	1.6 2.7 2.9	Internal	Trac sheet	Loading method is on the Trac Sheet	PASS
4.4	Is the proper recipe or process specification (cycle times, temperature, atmosphere, etc.) used? Refer to Process Tables, Section 3.0, for specific parameters.	1.5 1.6 2.1 2.14 2.15	Internal	Trac sheet	Recipe observed on trac sheet	PASS
4.5	What are the product inspection requirements per the Control Plan?	2.15	Customer	Trac sheet	Hardness	PASS
4.5.1	Requirement: (1)					
	Test Method:			Direct test	Rockwell tester	PASS
	Test frequency or quantity:			30		PASS
	Selection of samples:			Beginning, Middle, and End of order		PASS
	Specification:			R30N- 73.0-77.5	Average-75.56	PASS
4.5.2	Requirement: (2)					
	Test Method:			N/A		
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					
4.5.3	Requirement: (3)					
	Test Method:			N/A		
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					
4.5.4	Requirement: (4)					
	Test Method:			N/A		
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					
Operator or Inspector Responsibilities						

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / NA
4.6	Were appropriate process steps signed off?	1.4 2.2 2.3 2.14	Internal	Office trac	Operations confirmed in office trac and initials on paper trac sheet	PASS
4.7	Were all inspection steps, as documented in the control plan performed?	1.2 1.4	Internal	Certification	Hardness results recorder in Datalyzer and on trac sheet	PASS
4.8	Were steps/operations performed that were not documented in the control plan?	1.2 1.4 1.6				NA
4.9	If additional steps were performed, were they authorized?	1.2 1.4 1.6 1.11 1.17				NA
4.10	Does the governing specification allow reprocessing or rework?	1.11	Customer	Trac sheet: no rework without customer approval	No rework necessary for this order	PASS
4.11	If the order was certified, did the certification accurately reflect the process performed?	2.14 2.15	Internal	Certification	Hardness indicates successful process	PASS
4.12	Was the certification signed by an authorized individual?	1.17	Internal	Certification	Quality Technicians performing hardness verification before order can move to the next process	PASS
4.13	Are the parts and containers free of inappropriate objects or contamination?	2.6 2.11	Internal	PRWI-003 in place	Containers observed empty	PASS
Packaging Requirements						
4.14	Are packaging requirements identified?	2.9	Internal	Packaging is specified on the trac sheet	Parts were packaged in container specified	PASS
4.15	Are parts packaged to minimize mixed parts (for example, parts packed over height of container)?	2.9	Internal	Each order is placed on separate skids	Order was placed on a skid and moved out of area when complete	PASS
Shipping Requirements						
4.16	Were the parts properly identified?	2.3 2.9	Internal	Tagging	The next operation is internal/ parts were labeled correctly	PASS
4.17	Were the containers properly labeled?	2.3 2.9	Internal	Tagging	The next operation is internal/ parts were labeled correctly	PASS

PROCESS TABLE A – Carburizing / Carbonitriding / Carbon Restoration / Hardening / Austempering / Martempering / Tempering / Precipitation Hardening - Aging			
All requirements given below are subordinate to customer specific requirements. The Customer may have additional requirements, e.g. inspection testing, greater frequencies. When performing the job audit, the auditor shall verify heat treater is conforming to the Customer's requirements. Continuous furnace frequencies for item numbers A4.2, A4.3, and A4.4 are per lot (work order) or as specified, whichever is more frequent. OK - Complies to requirement NOK - Does not comply to requirement (Explain noncompliance in 'Related HTSA Question #') NA - Requirement not applicable			
Item #	Related HTSA Question #	Category/Process Steps	
1.0		PROCESS AND TEST EQUIPMENT REQUIREMENTS	OK / NOK / NA
A1.1	3.1 3.7	Recording instruments are required for temperature controlling devices and protective atmosphere monitoring unit, e.g. dew point, oxygen probe, or other atmosphere controlling devices.	OK
A1.2	1.18	A program for furnace, generator, and oxygen probe burnout is required (applies to carbon bearing atmospheres).	OK
A1.3	3.2	Furnace loading weigh scales shall be verified quarterly and calibrated annually at a minimum.	OK
A1.4	3.2	Dew pointers, gas analyzers, spectrometers, and carbon IR combustion analyzers (shim stock/foil analysis), used to verify carbon potential in furnaces, shall be calibrated annually at a minimum.	OK
A1.5	3.2	Verification of spectrometers and carbon IR combustion analyzers (shim stock/foil analysis) shall be performed daily or prior to use.	NA
A1.6	3.2	Verification of gas analyzers with zero gas and span gas when used as the back-up verification shall be performed weekly at a minimum. When used for primary control of the carbon-bearing atmospheres, verification shall be daily.	OK
A1.7	3.2	Atmosphere controllers shall be calibrated quarterly (single-point or multi-point calibration). A six month calibration interval is allowed if multi-point calibration is utilized.	OK
A1.8	2.16 3.2	Laboratory and Test equipment used for product and process testing shall be calibrated annually at a minimum, per the applicable national standard (e.g. ASTM, EN, JIS) or approved equivalent standard, and verified per internal procedure if not specified in the applicable standard.	OK
A1.9	2.16	Files for testing hardness shall be verified per the Customer requirement.	NA
A1.10	3.2	Refractometers typically used to check polymer quenchants and washer solutions shall be verified prior to use with distilled water.	NA

Item #	Related HTSA Question #	Category/Process Steps	
2.0		PYROMETRY	OK / NOK / NA
A2.1	3.2 3.3	Thermocouples and calibration of thermocouples shall conform to Section P3.1.	OK
A2.2	3.2 3.3	Calibration of instrumentation shall conform to Section P3.2.	OK
A2.3	3.2 3.3	System Accuracy Test (SAT) for all control, monitoring, and recording thermocouples shall conform to Section P3.3.	OK
A2.4	3.4	Temperature Uniformity Survey (TUS) shall be performed annually and after major rebuild per Section P3.4. Temperature uniformity tolerance for austenitizing furnaces shall be +/- 15°C (or +/- 25°F). Temperature uniformity tolerance for tempering and precipitation hardening furnaces shall be +/- 10°C (or +/- 20°F).	OK
A2.5	3.5	Temperature(s) for austenitizing processes shall be controlled within +/- 10°C (or +/- 15°F) of the set point as evidenced by recording instruments. Furnace temperature shall be controlled with soak times starting at the lower tolerance limit (as defined above). For Continuous Furnaces, this requirement applies to the Qualified Work Zone.	OK
A2.6	3.5	Temperature(s) for tempering and precipitation hardening processes shall be controlled within +/- 5°C (or +/- 10°F) of the set point as evidenced by recording instruments. Furnace temperature shall be controlled with soak times starting at the lower tolerance limit (as defined above). For Continuous Furnaces, this requirement applies to the Qualified Work Zone.	OK
A2.7	3.2	Non-contact thermometry devices used for temperature monitoring (e.g. infrared pyrometer, thermal imaging camera) shall be calibrated annually at a minimum in the temperature range to be used utilizing a blackbody device or per the manufacturer's recommended procedure.	OK

Item #	Related HTSA Question #	Category/Process Steps				
3.0		PROCESS MONITORING PARAMETERS	REQUIREMENTS / FREQUENCY			OK / NOK / NA
			Batch (Chamber) Furnace	Continuous Furnace	Atmosphere Generation	
A3.1	1.4 1.6 2.14	Monitor primary temperature control instrument(s).	Continuous recording with alarm system set per limits in A2.5 and A2.6. In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.	Continuous recording with alarm system set per limits in A2.5 and A2.6. In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.	Generators shall be continuously monitored and recorded. Sign-off required for each shift for generators. An alarm system will satisfy the sign-off requirement.	OK
A3.2	1.4 2.14 3.7 3.11	Monitor atmosphere generation as applicable.			Generators shall be continuously monitored and recorded. Other systems, such as nitrogen-methanol systems, may either be continuously monitored and alarmed, or sign-off every 2 hours.	OK
A3.3	1.4 1.6 2.14 3.7	Monitor primary furnace atmosphere control(s).	Continuous recording with alarm system. In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.	Continuous recording with alarm system. In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.		OK
A3.4	1.4 2.14 3.7 3.8	Verify primary atmosphere control method by back-up method.	Daily	Daily	Daily	OK
A3.5	1.4 2.14 3.13	For austenitizing salt baths: Salt chemistry (soluble oxides) or decarburization on the parts shall be checked.	Daily	Daily		OK
A3.6	1.4 2.14	Monitor time in furnace, cycle time, or belt speed.	Each batch or furnace load.	Sign-off twice/shift and after any change in the belt speed. Alarm systems (if set per acceptable limits) or continuous recording satisfy this requirement.		OK
A3.7	1.4 2.7	Monitor load size, fixturing, or loading rate as applicable.	Each batch or furnace load.	Sign-off twice/shift and after any change in loading rate. Alarm systems (if set per acceptable limits) or continuous recording satisfy this requirement.		OK

Item #	Related HTSA Question #	Category/Process Steps				
A3.8	1.4 2.12	Quench Media Process Parameters - Liquid				
		Temperature	Continuous recording with sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours. Alarm systems (if set per acceptable limits) satisfy the sign-off requirement.	Continuous recording with sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours. Alarm systems (if set per acceptable limits) satisfy the sign-off requirement.		OK
		Quench Level ☐	Continuous monitor with alarm or daily verification.			OK
		Agitation	Daily visual check, or monitor the agitation during the quenching operation with alarm systems set at acceptable limits.			OK
A3.9	1.4 2.12	Quench Media Process Parameters - Gas				
		Pressure in the quench cell.	Monitor each load. Alarm system is required.			NA
		Fan speed or power.	Monitor each load. Alarm system is required.			NA
		Cooling water temperature and flow rate.	Monitor each load. Alarm system is required.			NA
A3.10	1.4 2.12	Quench Delay Time	Each batch or furnace load.	Each basket for pusher-type continuous furnaces where the loaded basket is quenched. Not applicable for belt, shaker, or pusher furnaces where parts free-fall into the quench.		NA
A3.11	1.4 2.12	Temper Delay Time - The maximum delay time between quenching and tempering shall be specified on the control plan and monitored.	Each batch or furnace load.	Each load.		NA

Item #	Related HTSA Question #	Category/Process Steps				
4.0		IN-PROCESS/FINAL TEST PARAMETERS	REQUIREMENTS / FREQUENCY			OK / NOK / NA
			Batch (Chamber) Furnace	Continuous Furnace	Atmosphere Generation	
A4.1	1.4 2.15	Microstructure shall be checked at a low magnification of 100X and a high magnification of 400X or above. Microstructure visual references shall be available.	Daily per furnace unless specified by Customer to be checked with greater frequency, e.g. each batch.	Daily per furnace unless specified by Customer to be checked with greater frequency, e.g. each load.		OK
A4.2	1.4 2.15	Surface hardness (when specified).	Each batch or furnace load.	Each lot or every 2 hours.		OK
A4.3	1.4 2.15	Core hardness (when specified).	Each batch or furnace load.	Each lot or every 4 hours.		OK
A4.4	1.4 2.15	Case Depth (when specified).	Each batch or furnace load.	Each lot or every 4 hours.		NA
5.0		QUENCHANT AND SOLUTION TEST PARAMETERS	REQUIREMENTS / FREQUENCY			OK / NOK / NA
			Batch (Chamber) Furnace	Continuous Furnace	Atmosphere Generation	
A5.1	2.12 3.14	Polymer Quench Media				
		Concentration	Daily	Daily		NA
		Cooling Curve Analysis	Every six months (complete replacement of the quench media and cleaning of the quench tank within six months satisfies this requirement).	Every six months (complete replacement of the quench media and cleaning of the quench tank within six months satisfies this requirement).		NA
A5.2	2.12 3.14	Water Quench Media				
		Suspended solids	Every six months (complete replacement of the quench media and cleaning of the quench tank within six months satisfies this requirement).	Every six months (complete replacement of the quench media and cleaning of the quench tank within six months satisfies this requirement).		NA
A5.3	2.12 3.14	Salt Quench Media				
		Analysis and Contaminants	Every six months.	Every six months.		OK
A5.4	2.12 3.14	Brine or Caustic Quench Media				
		Concentration and/or Specific Gravity	Daily	Daily		NA
		Suspended solids	Every six months (complete replacement of the quench media and cleaning of the quench tank within six months satisfies this requirement).	Every six months (complete replacement of the quench media and cleaning of the quench tank within six months satisfies this requirement).		NA

Item #	Related HTSA Question #	Category/Process Steps				
A5.5	2.12 3.14	Oil Quench Media				
		Water content, suspended solids, viscosity, cooling curve, maximum cooling rate, total acid, and flash point.	Every six months.	Every six months.		NA
A5.6	2.13	Rust Preventive - Soluble Oil				
		Concentration	2x/week	2x/week		OK
A5.7	2.11	Cleaning Solution				
		Concentration of cleaner	Daily	Daily		NA
		Temperature of solution (required if temperature is specified to be above ambient temperature).	Each shift.	Each shift.		NA

PROCESS TABLE E – Annealing / Normalizing / Stress-Relieving

All requirements given below are subordinate to customer specific requirements.

The Customer may have additional requirements, e.g. inspection testing, greater frequencies. When performing the job audit, the auditor shall verify heat treater is conforming to the Customer's requirements.

Continuous furnace frequencies for item numbers E4.2 and E4.3 are per lot (work order) or as specified, whichever is more frequent.

OK - Complies to requirement

NOK - Does not comply to requirement (Explain noncompliance in 'Related HTSA Question #')

NA - Requirement not applicable

Item #	Related HTSA Question #	Category/Process Steps	
1.0		PROCESS AND TEST EQUIPMENT REQUIREMENTS	OK / NOK / NA
E1.1	3.1 3.7	Recording instruments are required for temperature controlling devices and protective atmosphere monitoring unit, e.g. dew point, oxygen probe, or other atmosphere controlling devices.	OK
E1.2	1.18	A program for furnace, generator, and oxygen probe burnout is required (applies to carbon bearing atmospheres).	NA
E1.3	3.2	Furnace weigh scales shall be verified quarterly and calibrated annually at a minimum.	OK
E1.4	3.2	Dew pointers, gas analyzers, spectrometers, and carbon IR combustion analyzers (shim stock analysis), used to verify carbon potential in furnaces, shall be calibrated annually at a minimum. This is applicable when used in controlling carbon-bearing atmospheres.	NA
E1.5	3.2	Verification of spectrometers and carbon IR combustion analyzers (shim stock/foil analysis) shall be performed daily or prior to use.	NA
E1.6	3.2	Verification of gas analyzers with zero gas and span gas when used as the back-up verification shall be performed weekly at a minimum. When used for primary control of the carbon-bearing atmospheres, verification shall be daily.	NA
E1.7	3.2	Atmosphere controllers shall be calibrated quarterly (single-point or multi-point calibration). A six month calibration interval is allowed if multi-point calibration is utilized.	NA
E1.8	2.16 3.2	Laboratory and Test equipment used for product and process testing shall be calibrated annually at a minimum, per the applicable national standard (e.g. ASTM, EN, JIS) or approved equivalent standard, and verified per internal procedure if not specified in the applicable standard.	OK
E1.9	3.2	Refractometers typically used to check polymer quenchants and washer solutions shall be verified prior to use with distilled water.	NA

Item #	Related HTSA Question #	Category/Process Steps	
2.0		PYROMETRY	OK / NOK / NA
E2.1	3.2 3.3	Thermocouples and calibration of thermocouples shall conform to Section P3.1.	OK
E2.2	3.2 3.3	Calibration of instrumentation shall conform to Section P3.2.	OK
E2.3	3.2 3.3	System Accuracy Test (SAT) for all control, monitoring, and recording thermocouples shall conform to Section P3.3.	OK
E2.4	3.4	Temperature Uniformity Survey (TUS) shall be performed annually and after major rebuild per Section P3.4. Temperature uniformity tolerance for furnaces operating at or above 680°C (1250°F) shall be +/- 15°C (or +/- 25°F). Temperature uniformity tolerance for furnaces operating below 680°C (1250°F) shall be +/- 10°C (or +/- 20°F).	OK
E2.5	3.5	For processes at or above 680°C (1250°F): Process temperature(s) shall be controlled within +/- 10°C (or +/- 15°F) of the set point as evidenced by recording instruments. Furnace temperature shall be controlled with soak times starting at the lower tolerance limit (as defined above). For Continuous Furnaces, this requirement applies to the Qualified Work Zone.	OK
E2.6	3.5	For processes below 680°C (1250°F): Process temperature(s) shall be controlled within +/- 5°C (or +/- 10°F) of the set point as evidenced by continuous recording instruments. Furnace temperature shall be controlled with soak times starting at the lower tolerance limit (as defined above). For Continuous Furnaces, this requirement applies to the Qualified Work Zone.	OK

Item #	Related HTSA Question #	Category/Process Steps				
3.0		PROCESS MONITORING PARAMETERS	REQUIREMENTS / FREQUENCY			OK / NOK / NA
			Batch (Chamber) Furnace	Continuous Furnace	Atmosphere Generation	
E3.1	1.4 2.14	Monitor primary temperature control instrument(s).	Continuous recording with alarm system set per limits in E2.5 and E2.6 In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.	Continuous recording with alarm system set per limits in E2.5 and E2.6. In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.	Generators shall be continuously monitored and recorded. Sign-off required for each shift for generators. An alarm system will satisfy the sign-off requirement.	OK
E3.2	1.4 2.14 3.7	Monitor generator atmospheres.			Generators shall be continuously monitored and recorded. Other systems, such as nitrogen-methanol systems, may either be continuously monitored and alarmed, or sign-off every 2 hours.	NA
E3.3	1.4 2.14 3.7	Monitor primary furnace atmosphere control(s).	Continuous recording with alarms set per acceptable limits. In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.	Continuous recording with alarms set per acceptable limits. In absence of alarm system, sign-off every 2 hours and at the end of the cycle, or each cycle for processes under 2 hours satisfies this requirement.		OK
E3.4	1.4 2.14 3.7 3.8	Verify primary atmosphere control method by back-up method.	Daily	Daily	Daily	NA
E3.5	1.4 2.14	Monitor time in furnace, cycle time, or belt speed.	Each batch or furnace load.	Sign-off twice/shift and after any change in the belt speed. Alarm systems (if set per acceptable limits) or continuous recording satisfy this requirement.		OK
E3.6	1.4 2.7	Monitor load size, fixturing, or loading rate as applicable.	Each batch or furnace load.	Sign-off twice/shift and after any change in loading rate.		OK
E3.7	2.14	Monitor cooling rate (start temp, end temp, °F/min), as applicable	Each batch or furnace load	Once per shift		NA

Item #	Related HTSA Question #	Category/Process Steps				
4.0		IN-PROCESS/FINAL TEST PARAMETERS	REQUIREMENTS / FREQUENCY			OK / NOK / NA
			Batch (Chamber) Furnace	Continuous Furnace	Atmosphere Generation	
E4.1	1.4 2.15	Microstructure shall be checked at a low magnification of 100X and a high magnification of 400X or above (when specified). Microstructure visual references shall be available.	Daily per furnace unless specified by Customer to be checked with greater frequency, e.g. each batch.	Daily per furnace unless specified by Customer to be checked with greater frequency, e.g. each batch.		NA
E4.2	1.4 2.15	Surface hardness (when specified).	Each batch or furnace load.	Each lot or every 4 hours.		OK
E4.3	1.4 2.15	Core hardness (when specified).	Each batch or furnace load.	Each lot or every 4 hours.		OK
5.0		SOLUTION TEST PARAMETERS	REQUIREMENTS / FREQUENCY			OK / NOK / NA
			Batch (Chamber) Furnace	Continuous Furnace	Atmosphere Generation	
E5.1	2.13	Rust Preventive - Soluble Oil				
		Concentration	2x/week	2x/week		OK
E5.2	2.11	Cleaning Solution				
		Concentration of cleaner	Daily	Daily		NA
		Temperature of solution (required if temperature is specified to be above ambient temperature).	Each shift.	Each shift.		NA