

Special Process: Heat Treat System Assessment

Facility Name: Atmosphere Heat Treating Inc.
Address: 30760 Century Drive
Wixom, MI 48393

Phone Number:	248-960-4700	Type(s) of Thermal Processing at this Facility:
Fax Number:	248-960-8173	
Number of Heat Treat Employees at this Facility: 30		Process Table A - Ferrous
Captive Heat Treater (Y/N):	N	Carburizing
Commercial Heat Treater (Y/N):	Y	Carbonitriding
Date of Assessment:	February 24, 2012	Carbon Correction
		Neutral Hardening
		Quench & Temper
		Austempering / Martempering
		Tempering
		Precipitation Hardening / Aging
Date of Previous Assessment:	September 10, 2011	

8/18/2011 Ford Motor Company annual review of Heat Treat Process and CQI-9 Medina Kaknjo Ford Motor Company Heat Treat Technical Specialist STA-Global Purchasing MPO Ste 203, MD425 15700 Lundy Parkway Dearborn, MI 48126 Ph # (313)805-2462 mkaknjo@ford.com	Process Table B - Ferrous
	Nitriding (Gas)
	Ferritic-Nitrocarburizing (Gas or Salt)
	Process Table C - Aluminum
	Aluminum Heat Treatment
Process Table D - Ferrous	
Induction Heat Treating	
Process Table E	
Annealing	
Normalizing	
Stress-Relieving	

Current Quality Certification(s): ISO/TS 16949:2002 Expiration date: August 16, 2012
Date of Re-assessment (if necessary): N/A

Personnel Contacted:

Name:	Title:	Phone:	Email:
Lee Price	President	248-960-4700	Lprice@austemperinc.com
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Steve Foss	Lab Tech.		Sfoss@atmosphereheatreat.com
Skip James	Maintenance Manager		Skipjames@atmospheretreat.com
Derick Sanford	Furnace Operator		
Max Pokryfky	Furnace Operator		

Auditors/Assessors:

Name:	Company:	Phone:	Email:
Gary Czopp*, Quality Director	Atmosphere Heat Treating	248-960-4700	Gczopp@atmosphereheatreat.com

*Auditors credentials: 27 years of Heat Treat process related experience, including Quality Systems, Metallurgy and Maintenance Supervision. TS 16949 and CQI-9 auditor training / certificate. Formal education in metallurgy.

Number of "Not Satisfactory" Findings:
None

Number of "Needs Immediate Action" Findings:
None

Number of "Fail" Findings in the Job Audit(s):
None

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				N/A	Satisfactory	Not Satisfactory
Section 1 - Management Responsibility & Quality Planning						
1.1	Is there a dedicated and qualified heat treat person on-site?	To ensure readily available expertise, there shall be a dedicated and qualified heat treat person on site. This individual shall be a full-time employee and the position shall be reflected in the organization chart. A job description shall exist identifying the qualifications for the position including metallurgical and heat treat knowledge. The qualifications shall include a minimum of 5 years experience in heat treat operations or a combination of a minimum of 5 years of formal metallurgical education and heat treat experience.	President / Plant Manager / Quality Director / Production Manager and Maintenance Manager all have over 27 years of service with the company. Job descriptions, Organization chart has required information.	XX		
1.2	Does the heat treater perform advanced quality planning?	The organization shall incorporate a documented advance quality planning procedure. A feasibility study shall be performed and internally approved for each part. Similar parts can be grouped into part families for this effort as defined by the organization. After the part approval process is approved by the customer, no process changes are allowed unless approved by the customer. The heat treater shall contact the customer when clarification of process changes is required. This clarification of process changes shall be documented.	Procedures QP 7-1 Contract Review, QP7 3 Manufacturing Design and Development. Feasibility review is done on every job quoted. From the product stand point, the quality team reviews the material, thickness and hardness. From the process stand point the quality team reviews furnace temp, quench temp, load rate and belt speed. From the testing stand point, hardness inspection is performed on all parts the same way unless customer specifies. The Quality Department obtains customer approval for all process changes. Procedures are in place for product/process changes. <i>Reviewed AHT quote #2275 Dated April 11, 2011 Team sign off complete</i>	XX		

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1.3	Are heat treat FMEA's up to date and reflecting current processing?	The organization shall incorporate the use of a documented Failure Mode and Effects Analysis (FMEA) procedure and ensure the FMEA's are updated to reflect current part quality status. The FMEA shall be written for each part or part family or they may be process-specific and written for each process. In any case, they shall address all process steps from part receipt to part shipment and all key heat treat process parameters as defined by the organization. A cross-functional team shall be used in the development of the FMEA. All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the FMEA.	FMEA is up to date. AHT uses generic process specific FMEA. High RPN's have evidence of improvement. Cross functional team is used including production personnel.	X		
1.4	Are heat treat process control plans up to date and reflecting current processing?	The organization shall incorporate the use of a documented Control Plan procedure and ensure the Control Plans are updated to reflect current controls. The Control Plans shall be written for each part or part family or they may be process-specific and written for each process. In any case, they 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. A cross-functional team, including a production operator, shall be used in the development of Control Plans, which shall be consistent with all associated documentation such as work instructions, shop travelers, and FMEA's. All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the Control Plans. Sample sizes and frequencies for evaluation of process and product characteristics shall also be addressed consistent with the minimum requirements listed in the Process Tables, Sections 3.0 and 4.0.	Detailed in procedure QP7-3 Manufacturing Process Development Reviewed Control Plan, all key process parameters are defined. The control plan points to the Part Master for each part which defines in detail the steps needed to achieve all customer specific requirements. AHT has established and maintains documented procedures for inspection and test activities in order to verify the specified requirements are met. Control plans are reviewed and updated when changes occur affecting product, manufacturing process, measurement, logistics, supply source or FMEA. Reviewed the following Process Flow Rev 04/11/2010 FMEA 03/15/2010 Rev 11 Control Plan 04/11/10 Rev 10	XX		

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1.5	Are all heat treat related and referenced specifications current and available? For example: SAE, AIAG, ASTM, General Motors, Ford, and DaimlerChrysler.	To ensure all customer requirements are both understood and satisfied, the organization shall have all related heat treat and customer referenced standards and specifications available for use and a method to ensure that they are current. Such standards and specifications include, but are not limited to, those relevant documents published by SAE, AIAG, ASTM, General Motors, Ford, and DaimlerChrysler. The organization shall have a process to ensure the timely review, distribution, and implementation of all customer and industry engineering standards / specifications and changes based on customer-required schedule. Timely review should be as soon as possible and shall not exceed two working weeks. The organization shall document this process of review and implementation, and it shall address how customer and industry documents are obtained, how they are maintained within the organization, how the current status is established, and how the relevant information is cascaded to the shop floor within the two-week period. The organization shall identify who is responsible for performing these tasks.	Detailed in procedure QP4-1 Control of documents. Quality Manager has primary responsibility for maintaining standards. <i>Review internal specifications, all current.</i>	X		
1.6	Is there a written process specification for all active processes?	The heat treater shall have written process specifications for all active processes and identify all steps of the process including relevant operating parameters. Examples of operating parameters include process temperatures, cycle times, load rates, atmosphere or gas flow settings, belt speeds, quench agitation speeds, etc. Such parameters shall not only be defined, they shall have operating tolerances as defined by the organization in order to maintain process control. All active processes should have a written process specification. These process specifications may take the form of work instructions, job card, computer-based recipes, or other similar documents.	HTAS Part masters are created for each part detailing all of the required process parameters. Computer system is accessible to all employees. Process sheets are generated for each order for reference by furnace operators. The process sheets have tolerances for each process parameter.	XX		

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1.7	Has a valid product capability study been performed initially and after process equipment has been relocated, or had a major rebuild?	To demonstrate each process is capable of yielding acceptable product the organization shall perform product capability studies for the initial validation of each process, after relocation of any process equipment, & after a major rebuild of any equipment. The organization shall define what constitutes a major rebuild. Initial product capability studies shall be conducted for all heat treat processes per furnace line defined in scope of work & in accordance with customer requirements. A furnace line may include a combination of equipment that is integrated in the performance of a heat treatment process, e.g., hardening, quenching, and tempering. Capability study techniques shall be appropriate for the heat treat product characteristics, e.g., tensile strength, case depth, hardness. Any specific customer requirements shall be met, in the absence of customer requirements, the organization shall establish acceptable ranges for measures of capability. An action plan shall exist to address the steps to followed in case capability indices fall outside customer requirements or established ranges.	All equipment is original install. Annual Capability study required in Procedure QP8-1-1 Statistical Techniques	XX		
1.8	Does the heat treater collect and analyze data over time, and react to this data?	The analysis of products and processes over time can yield vital information for defect prevention efforts. The organization shall have a system to collect, analyze, and react to product or process data over time. Methods of analysis shall include ongoing trend or historical data analysis of product or process parameters. The organization shall determine which parameters to include in such analysis.	HTAS computer system contains individual part processing history, including historical hardness trend data. Furnace process parameter trend data maintained on computer process monitoring system.	XX		

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1.9	Is management reviewing the heat treat monitoring system every 24 hours?	Management shall review the furnace monitoring systems at intervals not to exceed 24 hours. 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. The management review shall include efforts to detect out-of-control conditions or alarm conditions. The process of reviewing the furnace data shall be documented and this requirement also applies to computerized data.	24 hour review performance in accordance with work instruction QJP 220 Process Monitoring. Computerized furnace data logs are reviewed by quality every 24 hours. <i>Sign off on production logs by Steve Foss, Quality Tech.</i>	XX	
1.10	Are internal assessments being completed on an annual basis, at a minimum, using AIAG HTSA?	The organization shall conduct internal assessments on an annual basis, at a minimum, using the AIAG HTSA.	Procedure QP8-2.2 Internal Audits. Atmosphere Heat Treating conducts periodic internal audits to ensure that the quality system meets the requirements of the ISO/TS 16949 standard and has been effectively implemented and maintained. Product audits are also conducted at appropriate stages of production and delivery to verify conformance to all specified requirements. Layered Audits conducted in areas of high risk and has helped to drive improvements.	XX	
1.11	Is there a system in place to authorize reprocessing and is it documented?	The quality management system shall include a documented process for reprocessing that shall include authorization from a designated individual. The reprocessing procedure shall describe product characteristics for which reprocessing is allowed as well as those characteristics for which reprocessing is not permissible. Any reprocessing activity shall require a new processing control sheet issued by qualified technical personnel denoting the necessary heat treat modifications. Records shall clearly indicate when and how any material has been reprocessed. The Quality Manager or a designee shall authorize the release of reprocessed product.	Process for reprocessing is detailed in procedure QP8-3 Control of Nonconforming Product. Non-conforming product is tagged and quarantined in the Disposition area and a NCR is entered. Quality reviews the product and contacts the customer. Rework, if authorized, is performed using new process sheet. Reprocessed work must be approved by the Quality Manager or Quality Technician	XX	

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1.12	Does the Quality Department review, address, and document customer and internal concerns?	The quality management system shall include a process for documenting, reviewing, and addressing customer concerns and any other concerns internal to the organization. A disciplined problem-solving approach shall be used.	Customer concerns are input into the HTAS computer system. 8D format is utilized. Concerns are analyzed at Management Review Meetings. No open concerns.	XX		
1.13	Is there a continual improvement plan applicable to each process defined in the scope of the assessment?	The heat treated shall define a process for continual improvement for each heat treat process identified in the scope of the HTSA. The process shall be designed to bring about continual improvement in quality and productivity. Identified actions shall be prioritized and shall include timing (estimated completion dates). The organization shall show evidence of program effectiveness.	Continual improvement is defined in procedure QP8-5-1 Continual Improvement. Continual improvement is a topic in management Review Meetings; per Procedure QP5-2 Management Review. 2011 Continual Improvements are on track. Furnace line belt tracking system reducing furnace down time.	XX		
1.14	Does the Quality Manager or designee authorize the disposition of material from quarantine status?	The Quality Manager is responsible for authorizing and documenting appropriate personnel to disposition quarantine material.	Yes per procedure QP8-3 Control of Nonconforming Product. Disposition is made by the Quality Manager, taking into consideration inputs from other functions and/or the customer as necessary. If the product differs from that approved at PPAP, customer approval must be obtained prior to shipping	XX		
1.15	Are there procedures or work instructions available to the heat treat personnel that define the heat treating process?	There shall be procedures or work instructions available to heat treat personnel covering the heat treating process. 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. These procedures or work instructions shall be accessible to shop floor personnel.	Furnace operator manual (Work instruction 3QP160) contains required information. A manual is located at each furnace work station. Emergency procedures are posted in foreman's office	XX		

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1.16	Is management providing employee training for heat treating?	The organization shall provide employee training for all heat treating operations. All employees, including backup and temporary employees, shall be trained. Documented evidence shall be maintained showing the employees trained and the evidence shall include an assessment of the effectiveness of the training. Management shall define the qualification requirements for each function, and ongoing or follow-up training shall also be addressed.	Training provided as shown in procedure OP6-1 Training Records maintained on Form QA 150 Training Log. All employees receive OTJ training and regulatory training. Additional training is provided for new job positions or advancement. Training effectiveness is a topic at Management Review Meetings. <i>Reviewed training audit 2011, no concerns.</i>	XX		
1.17	Is there a responsibility matrix to ensure that all key management and supervisory functions are performed by qualified personnel?	The organization shall maintain a responsibility matrix identifying all key management and supervisory functions and the qualified personnel who may perform such functions. It shall identify both primary and secondary (backup) personnel for the key functions (as defined by the organization). This matrix shall be readily available to management at all times.	Responsibility and authority have been defined using the quality system procedures and the Organizational Chart. The Organizational Chart and Job Descriptions define the interrelation of personnel and some general responsibilities and authorities	XX		
1.18	Is there a preventive maintenance program? Is maintenance data being utilized to form a predictive maintenance program?	The organization shall have a documented preventive maintenance program for key process equipment (as identified by the organization). The program shall be a closed-loop process that tracks maintenance efforts from request to completion to assessment of effectiveness. Equipment operators shall have the opportunity to report problems, and problems shall also be handled in a closed-loop manner. 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. Furnaces and generators shall be scheduled for burn-out at frequencies determined by the organization (see Section 1 of the Process Tables). Maintenance data shall be collected and analyzed as part of a predictive maintenance program.	Preventative maintenance program documented in Procedure QP6-2 Maintenance and setup. Daily PM Checklist. 500 hour PM and 8000 hour PM Daily Report (QA 421) used for equipment and operator problem reporting. Furnace/Generator burn out not need due to strictly neutral hardening Maintenance data reviewed at Management Review Meetings. <i>Review down time records, improving</i>	XX		
1.19	Has the Heat Treater developed a critical spare part list and are the parts available to minimize production disruptions?	The heat treater shall develop and maintain a critical spare parts list and shall ensure the availability of such parts to minimize production disruptions.	Critical spare part list is maintained by Maintenance Department. Critical parts are stored in house, and the manufacturer of the furnace lines is located less than 1 mile away.	XX		

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Section 2 - Floor and Material Handling Responsibility						
2.1	Does the facility ensure that the data entered in the receiving system matches the information on the customer's shipping documents?	<p>It is critical that all customer requirements and lot identification be adequately transferred to internal heat treat documents. The facility shall ensure that the data entered in the receiving system match the information on the customer's shipping documents. Documented processes and evidence of compliance shall exist, e.g., shop travelers, work orders, etc. Sometimes the material received does not precisely correspond to customer shipping documents. The facility shall have a detailed process in place to resolve receiving discrepancies.</p> <p>The requirements stated above also apply to captive heat treat departments. This process refers to receiving and shipping the parts in and out of the heat treat department.</p>	<p>HTAS Computer system is used for order entry. Container tags are generated for each container and contain the customer's tracking information, such as lot numbers and shipper number. This information is verified when the tags are placed in the containers, and at each processing step. The HTAS program has the following mistake proofing features:</p> <p>If customer requirements do not match Part Master, shipping department will not be able to make a work order. If any out of control situation occurs, the computer alarms the operator and will not allow the parts to be shipped.</p> <p>Procedures QP7-4-3 Receiving Inspection and QP7-5-3 Product ID and traceability.</p>	XX		
2.2	Is product clearly identified and staged throughout the heat treat process?	<p>Procedures for part and container identification help to avoid incorrect processing or mixing of lots. Appropriate location and staging within the facility also help to ensure that orders are not shipped until all required operations are performed. Customer product shall be clearly identified and staged throughout the heat treat process. Non-heat treated, in-process, and finished product shall be properly segregated and identified. All material shall be staged in a dedicated and clearly labeled area.</p>	<p>Identification maintained according to procedure QP7-5-3 Identification and Traceability. There are separate staging areas for Green, in process, and finished work. Each container is identified with a container tag. Colored tags are used to show status of job. Job audit conducted 6/3/2011, no concerns</p>	XX		

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2.3	Is lot traceability and integrity maintained throughout all processes?	Out-going lot(s) shall be traceable to the incoming lot(s). The discipline of precisely identifying lots and linking all pertinent information to them enhances the ability to do root cause analysis and continual improvement.	For the purpose of tractability, Atmosphere Heat Treating uses the work order number to link specific Shippers, Process Control Charts, Hardness Certifications, Part Numbers, Production Runs and Part Numbers. Also by entering the product ID and shipper or lot numbers into the Heat Treat Administration system, we can trace the customer shipper number to the processes, process control charts, and operators that manufactured them. The charts identify process equipment, time of processing, and provide process performance data.	N/A	XX	
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. Procedures shall be adequate to prevent movement of non-conforming product into the production system. Procedures shall exist addressing proper disposition, product identification, and tracking of material flow in and out of the hold area. A non-conforming hold area shall be clearly designated to maintain segregation of such material.	Nonconforming material is controlled as detailed in procedure QP8-3. NCR's are entered into the HTAS for tracking and corrective action. Nonconforming product identified with Pink tags, soiled in segregated fenced hold area. (Improvement - hold area moved in 4/2011 closer formans office)		XX	
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 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. A system shall exist 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). The heat treated shall have documented procedures to identify and monitor trap points for each process/equipment. Monitoring of potential trap points shall occur for every part changeover.	Identified trap points are monitored and cleaned as part of the daily preventative maintenance program. HTAS Computer system identifies parts that may stick in conveyors. Operator monitored trap points are included in the Furnace Operators Manual (30P160).		XX	

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2.6	Are containers free of inappropriate material?	Containers handling customer product shall be free of inappropriate material. After emptying and before re-using containers, containers shall be inspected to ensure that all parts and inappropriate material have been removed. The source of inappropriate material shall be identified and addressed. This is to ensure that no nonconforming heat treated parts or inappropriate material contaminate the finished lot.	Daily layered audits included operator checking containers. Operators inspect tubs for foreign material after emptying and prior to use.	XX		
2.7	Is furnace loading specified, documented and controlled?	Furnace loading parameters shall be specified, documented, and controlled. Examples include feed rate, belt speed, number of parts per fixture, and load weight. Refer to Process Tables, Section 3.0, for frequency of checks.	Furnace parameters are stored in the HTAS computer system. Process sheets are generated for each order. Furnaces are automated, and set up is verified by furnace operators.	XX		
2.8	Are operators trained in material handling, containment action and product segregation in the event of an equipment emergency including power failure?	Unplanned or emergency downtime greatly raises the risk of improper processing. Operators shall be trained in material handling, containment action, and product segregation in the event of an equipment emergency including power failure. Training shall be documented. Work instructions specifically addressing potential types of equipment emergencies and failures shall be accessible to and understood by equipment operators. These instructions shall address containment actions related to all elements of the heat-treating process, e.g., loading, austenitizing, quenching, tempering.	Operator are trained in Emergency procedures including 3QP170 Non-normal Run, 3QP 180 Equipment malfunction, 3QP270 Power Failure. These procedures are included in the Furnace Operators Manual located at each work station.	XX		
2.9	Is the handling, storage and packaging adequate to preserve product quality?	Handling, storage, and packaging shall be adequate to preserve product quality. 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. 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.	Part handling uses vibrator feeding systems and hand loading of furnace depending on part requirements for dimensional control. Dimensional concerns are addressed in feasibility review and noted on quote form. Handling procedure QP7-5-5 Preservation of Product.	XX		

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2.10	Are plant cleanliness, housekeeping, environmental and working conditions conducive to control and improved quality?	Plant cleanliness, housekeeping, environmental, and working conditions shall be conducive to controlling and improving quality. The heat treater should evaluate such conditions and their effect on quality. A housekeeping policy shall be clearly defined and executed. 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.	Daily layed audits include housekeeping. Housekeeping procedure 3QP-120 Housekeeping. Plant is clean and organized.	XX		
2.11	Are parts free from contaminants that would be detrimental to the heat treatment of the product?	Many heat-treated parts are subjected to surface finish or appearance operations such as plating or coating after heat treatment. Parts shall be free from contaminants that are detrimental to subsequent processes or the product. Pre-wash (if applicable) and post-wash parameters shall be monitored and documented. Oils and other contaminants or residues can be difficult to remove once subjected to the heat treatment process. Review the chemical supplier's recommendation for cleaning the system. Parts shall be free of rust, burrs, chips, detrimental amounts of drawing compound, cutting fluids, rust preventing oils, lubricants, etc., prior to heat treat. Note: Refer to the appropriate heat treater's requirements and specifications to determine acceptability. Refer to Process Table, Section 5.0, for frequency of checking washer solutions.	Pre-wash not applicable. Parts inspected for rust or other contaminants during receiving inspection.	XX		

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2.12	Is the quenching system monitored, documented, and controlled?	The quenching system shall be monitored, documented, and controlled. The temperature, agitation, level, concentration (if applicable), time in the quenchant, and additions shall be controlled to the heat treater's specifications. Refer to Process Tables, Sections 3.0 and 5.0, for frequency of checks. Computer-monitoring equipment, with alarms and alarm logs, satisfy the verification requirement. Quench delay tolerance and alarm is required for furnaces with integral quench tanks. Temper delay time shall be specified by the heat treater for parts that are quenched and tempered, e.g., carburizing, carbonitriding, neutral hardening, solution treating and aging.	Continuous computer monitoring of temperature, time, and agitation is used with Alarms. Quench salt level checked daily - Preventative maintenance. Quench delay and temper delay not applicable to continuous mesh belt austempering furnaces.	XX		
2.13	Is soluble oil or other rust preventive monitored and controlled if applicable?	Parts are often dipped in or sprayed with rust preventive solutions immediately after the heat treating process. Soluble oil solutions or other rust preventive solutions shall be monitored and controlled, if applicable. The heat treater shall have and maintain documented tolerances for the solutions. Refer to Process Tables, Section 5.0, for frequency of checks.	Water-based rust inhibitor concentration monitored daily using control chart. Tolerance is 1.2%-1.7% - Preventative Maintenance. <i>Reviewed charts no concerns</i>	XX		
2.14	Are process control parameters monitored per frequencies specified in Process Tables?	Process control parameters shall be monitored per frequencies specified in Process Tables. Refer to Process Tables, Section 3.0. Computer monitoring equipment with alarms and alarm logs satisfy the verification requirement. A designated floor person shall verify the process parameters, e.g., by initialing a strip chart or data log. Management review is required per Question 1.9.	Computer Monitoring of all furnace parameters with Alarms. Operators verify every setting per job using process sheet. Microstructure / Lab Log Surface Hardness/ Job Certification	XX		
2.15	Are In-Process / Final Test Frequencies performed as specified in Process Tables?	In-Process / Final Test Frequencies shall be performed as specified in Process Tables. Refer to Process Tables, Section 4.0.	The Forman checks 3 parts when the load first begins to come out of the wash tanks. Forman continues to check samples at evenly spaced intervals of about 15-20 minutes throughout the load. The goal is to make sure these parts represent the whole lot, parts must be checked at the beginning, middle and end of each lot.	XX		

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2.16	Is product test equipment verified?	Product test equipment shall be verified. Test equipment shall be verified/calibrated per applicable customer-specific standard or per an applicable consensus standard such as those published by ASTM, DIN, EN, ISO, JIS, NIST, SAE etc. Verification/calibration results shall be internally reviewed, approved, and documented. Refer to Process Tables, Section 1.0, for frequency of checks.	Hardness testers verified with test blocks at the start of each shift. Data entered into the HTAS. Testers are calibrated every 90 Days. Procedure QP7-6 Control of Monitoring and Test Equipment.	XX		
Section 3 - Equipment						
3.1	Do furnaces, generators, and quench systems have proper process control equipment?	The heat-treat furnaces, generators, and quench systems shall have proper process controls and related equipment. Examples include temperature, carbon potential/dew point, gas flows, quench monitoring system including agitation, temperature control and quenching oil analysis, etc., as listed in the applicable Process Tables, Section 1.0.	Process controls comply with Process Table A where applicable. Automatic continuous computer monitoring of all process parameters.	XX		
3.2	Are process equipment calibrations and/or verification certified, posted, and current?	The calibration and certification of the process equipment shall be checked at regular specified intervals. Refer to the applicable Process Tables, Sections 1.0 and 2.0, for equipment calibration or certification time tables.	Calibrations comply with process Table A. Procedure detailed in Procedure QP7-6 Control of Monitoring and Test Equipment. Calibration verification sticker on furnace panel - all current.	XX		
3.3	Are thermocouples & protection tubes checked or replaced per Process Tables?	The thermocouples and protection tubes shall be checked or replaced in compliance to a preventive maintenance schedule. Refer to the applicable Process Tables, Section 2.0.	Thermocouples and protection tubes are inspected and calibrated monthly by out side source recognized by A2LA. Replaced per process table A	XX		
3.4	Are temperature uniformity surveys performed in Process Tables?	Temperature uniformity surveys shall be conducted per the requirements in the applicable Process Tables, Section 2.0. The frequency reductions allowed in AMS 2750D are not allowed under this document. Certain furnace designs, e.g., rotary retorts preclude direct temperature profiles. Alternate test methods per AMS 2750D 3.5.15 are acceptable for furnaces where temperature uniformity studies are not possible.	Temperature uniformity surveys conducted annually. Complies with process table A.	XX		

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3.5	Is the variation of the furnace controlled thermocouple from set point within the requirements in the Process Table?	The variation between the furnace-control thermocouple and the set point temperature shall be within the limits defined in the applicable Process Tables, Section 2.0. This does not apply to the first zone of a multi-zone continuous furnace.	Variation Complies with process table A. Variation +/- 15 F - work zones.	XX		
3.6	Are the process & equipment alarm checks being tested quarterly or after any repair or rebuild?	The heat treater shall have a list of heat treat process and equipment alarms. These alarms shall be independently tested quarterly at a minimum, and after any repair or rebuild. These checks shall be documented.	Tested each startup. Alarm horn checked daily. Belt load height alarm verified daily	XX		
3.7	Are generators and furnace atmospheres continuously monitored, automatically controlled, and documented?	Generator and furnace atmosphere carbon potential/dew point shall be continuously monitored, automatically controlled, and documented. This requirement is specific to Process Table 1, Sections 1.0 and 3.0, for carburizing, carbonitriding, and neutral hardening. Continuous monitoring and automatic control of the carbon potential/dew point is required for all generators and atmosphere furnaces except rotary retort and shaker furnaces that preclude in situ control and monitoring. For rotary retort and shaker furnaces, the method described in AMS 2750D 3.5.15.2 "Property Surveys" shall be used to ensure adequate control of the furnace atmosphere. If generators are not used, the flow rates of the supplied atmosphere gases shall be monitored and controlled. The assessor shall verify the effectiveness of the atmosphere control system per customer requirements, the heat treater's control plan, and internal procedures.	Carbon potential and dew point are continuously monitored and automatically controlled at furnace and generator. Back up method is dew point test performed daily. Computer data system. 3QP 220. Process monitoring procedure. Reviewed control charts, no concerns	XX		

Special Process: Heat Treat System Assessment					
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment	
				Satisfactory	Not Satisfactory
3.8	When the back-up verification check of the atmosphere does not agree or 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?		The quality technician tests the furnace atmosphere carbon potential of each furnace once per day using the dew point analyzer. The results are recorded on the Furnace Atmosphere Control Chart (Form Q.A. 110) carbon potential is maintained within +/- 0.05. If the carbon potential is out of tolerance, maintenance will be contacted immediately to start the process of isolating the specific cause or causes of the malfunction.	XX	

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
3.9	Are all ammonia lines equipped with quick disconnects or a three valve fail safe vent system?	<p>All ammonia lines to furnaces shall be equipped with quick disconnects or a three-valve fail-safe vent system. Normal valves may allow ammonia to leak through even when they are closed. This can be undesirable and detrimental in heat treat processes not specifying/requiring ammonia.</p> <ul style="list-style-type: none"> A quick disconnect shall be present in any ammonia line going to a furnace. This line shall be disconnected after carbonitriding (or any other process using ammonia) before another heat treating operation not specifying/using ammonia begins. An alternative three-valve ammonia "fail-safe" vent system is permitted. See the definition "Three Valve Fail-Safe Vent" and diagram in the glossary. Documentation shall show when ammonia lines are disconnected for non-ammonia bearing atmosphere processes. 	N/A	X		
3.10	For fasteners and small metal parts, is a minimum of 3 hours allocated for an oxidizing burn-out prior to processing product not requiring ammonia?	<p>This is applicable to fasteners and small metal parts. The heat treater shall perform a minimum 3 hours oxidizing burn-out prior to processing product not requiring ammonia as an addition. Ammonia pick-up can be undesirable in parts and heat treat processes not specifying/requiring ammonia as an addition. Log book, data logger, or other records shall document the actual oxidizing burn-out 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.</p>	N/A	X		
3.11	Do all atmosphere furnaces and generators have flow scopes or flow meters for all gases?	<p>All atmosphere furnaces and generators (output trim/adjustment gas) shall have flow scopes or flow meters for all gases. Flow scopes and meters shall be periodically serviced per the heat treater's preventive maintenance program. Cleaning and proper re-assembly procedures shall be documented.</p>	<p>Yes. Serviced as part of Preventative Maintenance Program: 500 hour PM checklist (form QA 380C). Reviewed PM checklist #1 furnace dated 4/28/11, 6/12/11, 8-5-11, no concerns.</p>		XX	

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
3.12	For threaded fasteners, are all continuous belt furnaces equipped with sight glass inspection ports and infrared pyrometers at discharge end of the hardening furnace?	Infrared temperature pyrometers are required at the exit end of continuous belt furnaces running threaded fasteners to monitor for under temperature parts. The temperature alarm shall be within 28C (50F) of the furnace set point temperature. Results shall be strip charted or continuously data logged. Infrared (IR) units shall be calibrated annually at a minimum and certified. All sight glasses shall be cleaned per the preventive maintenance schedule.	All furnaces have sight glass inspection ports. Glass cleaned by furnace operators as necessary. Glass inspected during daily preventative maintenance. IR pyrometers are not used at this time. Electronic load height curtains are installed at the front of all furnaces to prevent overloading of parts. Load height verification performed daily.		XX	
3.13	Is salt chemistry in the austenitizing salt bath monitored?	Applicable to ferritic-nitrocarburizing, austempering, and neutral hardening in salt. The heat treater shall check the salt chemistry in the austenitizing salt bath, or part decarburization, daily. Refer to the applicable Process Tables, Section 3.0, for frequency of checks.	N/A	X		
3.14	Is the quenching medium analyzed?	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. • The quench media characteristic tolerances shall be specified by the quench medium supplier or the heat treater. • Analysis shall be reviewed for conformance by the heat treater. This review shall be documented.	Quench Salt analyzed every 6 months by outside lab. EDS test used to look for contaminants. Melting point checked. Complies with process table A. <i>Reviewed analytical report - Carbonate content below specification of 1.5%</i>		XX	
FOR INDUCTION HEAT TREATING						
3.15	Is the positioning of each part being controlled?	A method to detect proper part position, such as the use of proximity switches, optical sensors, mechanical probes, etc., is required for each part.		X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
3.16	Does the heat treater control the energy or power for each part?	<p>The heat treater shall control the energy or power for each part.</p> <ul style="list-style-type: none"> • A signature monitor for each machine is preferred. A signature monitor gives the energy unit (voltage, kilowatt, etc.) vs. time or distance (for scanning systems). • An energy monitor or equivalent is acceptable if approved by the authorized customer representative. 		X		
3.17	Does the supplier have a coil management system? Coil refers to the heating coil and the quench plenum.	<p>The heat treater shall have a coil management system. Coil refers to the heating coil and the quench plenum.</p> <ul style="list-style-type: none"> • Spare coils for each part shall be available on-site. • Coils shall conform to the approved original design. • Engineering change approval from the customer is required whenever the coil design is changed. 		X		
3.18	Is quench system automatic?	<p>The quench system shall be an automatic operation. No manual quenching is allowed unless specifically approved by the authorized customer representative. Quenching shall be automatically initiated and controlled.</p>		X		
3.19	Does each lot of parts have first piece set-up?	<p>The heat treater shall perform first piece set-up for each lot of parts</p>		X		

Section 4 - Job Audit

Job Audit Date: 6/30/11

Job Identity:

Customer: XXXXXXXXXXXXX
 Purchase Order: 32225
 Order Number: 215095
 Part Number: 244
 Part Description: Bolt Retainer
 Material: sae 1050
 Heat Treat Requirements: HRC 42-50

Please note: Part number used in the Job Audit was selected randomly and may not be owned by the customer requesting this assessment. Atmosphere Heat Treat will be conducting periodic job audits to ensure that the quality system meets the requirements of CQI-9 standard. Gary Czopp - Quality Director

Clause #	Job Audit Clause	HTSA Clause #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
4.1	Are contract review, APQP, PFMEA, Control plans, etc., performed by competent individuals?	1.2 1.3 1.4 1.17	PPAP, Generic Control Plan, Process Flow, PFMEA, approved Part Master.	Quote 1561	PPAP, Generic Control Plan, Process Flow, PFMEA, three approvals in HTAS.	Pass
4.2	Does the heat treat facility have the customer specifications for the part?	1.5	Customer Print / Hardness Specification HRC 42-50, Customer P.O.	Customer Print (attachment 3)	Customer Print HRC 42-50	Pass
4.3	Is a shop traveler created to meet customer requirements?	1.6 2.1	Container tag and process sheet required for each order.	AHT Shipper Number 215095 Container Tag (Container Tag Attachment 5)	Part Master Process Sheet	Pass
4.4	Is material identification (part numbers, lot numbers, heat numbers, contract numbers, etc.) maintained throughout the heat treat process?	2.2 2.3 2.4	Part Number, Order Number Lot Number, Number of Pieces, Net Wt., Containers	AHT shipper # 215095 Container Tag Process Sheet Production Log (attachment 6)	Customer requirements entered into computer from shipper. Production Log (attachment 6)	Pass
4.5	Is there documented evidence of Receiving Inspection?	2.1	Signed Shipper	Customer shipper #32225	Signed Shipper in file	Pass
4.6	Are the Loading / Racking requirements identified?	1.6 2.7	Part Master - Loading Rate 1,000 Lb./Hr.	AHT Processing Sheet 1,000 Lb./Hr.	Lb./Hr. Process Sheet and Production Log 935 lbs./hr.	Pass

4.7	Is the proper recipe or process specification (cycle times, temperature, atmosphere, etc.) used? Refer to Process Tables, Section 3.0, for specific parameters. List parameters that were verified in this audit in the spaces provided below.	1.5 1.6 2.1 2.14 2.15	Yes, See Part Master and Process Sheet for customer process specifications and specific parameters (attachment 4)	Customer Shipper AHT Process Sheet	See items listed below: Production Logs Process Sheet Job Certification Job Histories Process Capability Hardness Capability (attachment 6)	Pass
	Furnace Temp		1550 +/- 10F	Process Sheet	1550F Process Sheet	Pass
	Belt Speed (In/Min)		26(in/ min)	Process Sheet	.26 Process Sheet	Pass
	Carbora Set		.50 Each lot	Process Sheet	..50 Process Sheet	Pass
	Quench Temp		654F	Process Sheet	655F Process Sheet	Pass
	Loading Rate		1000 lbs. hr.)	Process Sheet	935 Process Sheet	Pass
	Agitation on/off		off	Process Sheet	off	Pass
4.8	What are the product inspection requirements?	2.15			Verified /signed	Pass
.8.1	Requirement: (1)					
	Test Method:		Rockwell Hardness	AHT order # 197153	Job Certification	Pass
	Test frequency or quantity:		35 parts	AHT order # 19753	Samples in bag	Pass
	Selection of samples:		Beginning, Middle, End of Job	Beginning, Middle, End of Job	B/M/E observation and part in sample bag	Pass
	Specification		HRC 42-50		Actual HRC 45-46	Pass
.8.2	Requirement: (2)					
	Test Method:					
	Test frequency or quantity:					
	Selection of samples:					
	Specification					
.8.3	Requirement: (3)					
	Test Method:					
	Test frequency or quantity:					
	Selection of samples:					
	Specification					

Operator or Inspector Responsibilities

4.9	Were appropriate process steps signed off?	1.4 2.2 2.3 2.14		Operator verifies all process setups on Process Sheet. (attachment 9)	Shipper- Plant Foreman Process Set Up- Operator Job Certification-Quality Mgr. Dew Pt. Verification- Maint. Dock Audit - Quality Tech. AHT Shipper - Customer	Pass
4.10	Were all inspection steps, as identified in APQP, performed?	1.2 1.4	Control Plan/Process Sheet Lists inspection requirements	Control Plan, Quote, Team Feasibility (attachment 1 -10)	Control Plan Verified Job Cert lists testing done	Pass
4.11	Were steps/operations performed that were not identified during APQP?	1.2 1.4 1.6	No additional steps were performed	N/A	N/A	Pass
4.12	If additional steps were performed, were they authorized?	1.2 1.4 1.6 1.11 1.17	No additional steps were performed	N/A	N/A	Pass
4.13	Does the governing specification allow reprocessing or rework?	1.11	Steps in control Plan/Process Sheet	Rework allowed with customer authorization	No additional steps were performed	Pass
4.14	If the order was certified, did the certification accurately reflect the process performed?	2.14 2.15	Cert generated from furnace data HRC 42-50*	AHT Job Certification (attachment)	Furnace Data matches job certification information HRC45-46	Pass
4.15	Was the certification signed by an authorized individual?	1.17	Supervisor log into HTAS using ID.Password	AHT order # 215095 Certification	Sign electronically by Quality Manager	Pass
4.16	Are the parts and containers free of foreign objects or contamination?	2.6 2.11	Certification requires visual inspection	AHT order # 215095 certification	Visual inspection of Tub OK	Pass
Packaging Requirements						
4.17	Are packaging requirements identified?	2.9	Bulk pack as received unless otherwise specified	AHT order # 215095 Tub a414	Packed in customer supplied tub	Pass
4.18	Are parts packaged to minimize mixed parts (parts packed over height of container)?	2.6 2.11	Tubs Filled properly	AHT order # 215095 certification	Observation of tubs	Pass
Shipping Requirements						

4.19	Were the parts properly labeled?	2.3	Container Tag with Green OK TO SHIP tag	AHT order # 215095 Container tag	Container Tag, OK TO SHIP tags in tubs	Pass
	Were the containers properly labeled?	2.9	Container Tag with Green OK TO SHIP tag	AHT order # 215095 Container tag	Container Tag, OK TO SHIP tags in tubs	Pass

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral 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, etc. When performing the job audit, the auditor shall verify heat treater is conforming to the customer's requirements.

* Continuous furnace frequencies are per lot (work order) or as specified, whichever is more frequent.

** Does not apply to furnaces operating below 760C (1400F).

----- indicate "not applicable".

Item #	Related HTSA Question #	Category/Process Steps	Batch Furnace	Continuous Furnace *	Generators	Acceptable	Not Acceptable	N/A
1.0		PROCESS AND TEST EQUIPMENT REQUIREMENTS						
A1.1	3.1 3.7	All furnaces, generators and quench systems shall have temperature indicating instruments.	Yes	Yes	Yes	Yes		
A1.2	3.1 3.7	Continuous strip charts and/or data loggers are required for temperature and carbon monitoring unit, e.g., dew point, oxygen probe, IR gas analyzer, etc.	Yes	Yes	Yes	All process data recorded and stored for historical evaluations		
A1.3	1.18	A program for furnace and generator burnout is required (applies to carbon bearing atmospheres).	Yes	Yes	Yes			N/A
A1.4	3.2	Furnace weigh scales shall be verified quarterly and calibrated annually at a minimum.	Yes	Yes	-----	Furnace weight scales verified every 500 hours Documented on form QA 382C - Calibrated Semi-Annually		
A1.5	3.2	Dew pointers, 3-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.	-----	-----	-----	Dew point analyser calibrated annually		
A1.6	3.2	Verification of calibration of spectrometers, and carbon IR combustion analyzers, shall be checked daily or prior to use.	-----	-----	-----			N/A
A1.7	3.2	Verification of calibration of 3-gas analyzers with zero gas and span gas shall be performed weekly at a minimum.	-----	-----	-----			N/A

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral Hardening / Austempering / Martempering / Tempering / Precipitation Hardening - Aging

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* Continuous furnace frequencies are per lot (work order) or as specified, whichever is more frequent.
 ** Does not apply to furnaces operating below 760C (1400F).
 ----- indicate "not applicable".

Item #	Related HTSA Question #	Category/Process Steps	Batch Furnace Yes	Continuous Furnace * Yes	Generators	Acceptable	Not Acceptable	N/A
A1.8	3.2	Oxygen probe controllers shall be calibrated quarterly at a minimum.	-----	Yes	Yes	Oxygen probe controllers every 500 hours		
A1.9	2.16	All hardness test equipment (for each scale used) shall be calibrated semi-annually minimum, and verified daily minimum per the applicable ASTM standard.	-----	-----	-----	Verified Daily Calibrated Quarterly - Dur dates posted on equipment		
A1.10	2-Oct-09	Files shall be verified daily (or prior to use) with provers per SAE J864.	-----	-----	-----			N/A
A1.11	3.2	Refractometers (typically used to check polymer quenchants and washer solutions) shall be verified daily (with distilled water) and calibrated annually (per manufacturer's requirements) at a minimum.	-----	-----	-----	Verified Daily Calibrated per Manufacturers Requirements		

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral Hardening / Austempering / Martempering / Tempering / Precipitation Hardening - Aging

Item #	Related HTSA Question #	Category/Process Steps	Batch ° Furnace	Continuous Furnace *	Generators	Acceptable	Not Acceptable	N/A
2.0		PYROMETRY						
A2.1	3.2 3.3	Thermocouples and calibration of thermocouples shall conform to AMS 2750D.	Yes	Yes	Yes	Yes		
A2.2	3.2 3.3	Instrument Calibration per AMS 2750D shall be quarterly at a minimum. Frequency reductions per AMS 2750D are not allowed.	Yes	Yes	Yes	Monthly, conducted by outside A2LA service company		
A2.3	3.2 3.3	CQI-9 requires a comparative check of the control temperature sensor (CTS) in the Qualified Work Zone to a (1) calibrated test temperature sensor (CTTS) or, (2) resident thermocouple (R-T/C). (1) The CTS shall be within an operating temperature range of +/- 5C (or +/-10F) of the CTTS. This check shall be performed monthly. (2) Within the operating temperature range the difference between the CTS and R-T/C readings shall be no more than +/- 1C (or +/-2F) as determined at the time of the most recent temperature uniformity survey. This check shall be performed weekly. Any actions to correct a failing reading or validate a test result shall be documented. Additionally, Type K and N thermocouples shall be checked monthly for equipment operating at or above 760C (1400F) and changed annually at a minimum. Type K and N thermocouples shall be checked quarterly for equipment operating below 760C (1400F) and changed every two years at a minimum. Type R and S thermocouples shall be checked monthly for equipment operating at or above 760C (1400F) and changed every two years at a minimum. Protection Tubes shall be visually checked at the same frequency as thermocouples.	Yes	Yes	Yes	SAT done Monthly T/C Type K T/C checked Monthly T/C replaced as needed - by service report. Replaced annually. Recorded on 8000 PM sheet.		N/A

All requirements given below are subordinate to customer specific requirements.

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

* Continuous furnace frequencies are per lot (work order) or as specified, whichever is more frequent.

** Does not apply to furnaces operating below 760C (1400F).

----- indicate "not applicable".

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral 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, etc. When performing the job audit, the auditor shall verify heat treat is conforming to the customer's requirements.

* Continuous furnace frequencies are per lot (work order) or as specified, whichever is more frequent.
 ** Does not apply to furnaces operating below 760C (1400F).
 ----- indicate "not applicable".

Item #	Related HTSA Question #	Category/Process Steps	Batch Furnace	Continuous Furnace *	Generators	Acceptable	Not Acceptable	N/A
A2.4	3.4	<p>Temperature Uniformity Survey (TUS): refer to AMS 2750D for procedures. TUS frequency shall be annual and after major rebuild.</p> <p>Temperature uniformity tolerance for hardening furnaces shall be +/- 14 C (or +/- 25 F). Temperature uniformity tolerance for tempering furnaces shall be +/- 11 C (or +/- 20 F).</p> <p>Minimum and maximum temperature ranges shall be tested per AMS 2750D. Exception: If the operating range of the Qualified Work Zone is equal to or less than 85 C (153 F) then only one temperature is required to be tested. The temperature shall be within the operating range of the Qualified Work Zone.</p> <p>Frequency reductions per AMS 2750D are not allowed.</p>	Yes	Yes - In Qualified Work Zone	-----	TUS done Annually		

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral Hardening / Austempering / Martempering / Tempering / Precipitation Hardening - Aging

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

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 ** Does not apply to furnaces operating below 760C (1400F).
 ----- indicate "not applicable".

Item #	Related HTSA Question #	Category/Process Steps	Batch Furnace	Continuous Furnace *	Generators	Acceptable	Not Acceptable	N/A
A2.5	3.5	Recorded temperature(s) for austenitizing processes shall be controlled within +/- 9C (or +/- 15F) of the set point as evidenced by continuous recording pyrometers. Furnace temperature shall be controlled with soak times starting at the lower tolerance limit (as defined above).	Yes	Yes - In Qualified Work Zone		Within +/- 15°F		
A2.6	3.5	Recorded temperature(s) for tempering and precipitation hardening processes shall be controlled within +/- 6C (or +/- 10F) of the set point as evidenced by continuous recording pyrometers. Furnace temperature shall be controlled with soak times starting at the lower tolerance limit (as defined above).	Yes	Yes - In Qualified Work Zone				NA
A2.7	3.2	Infrared pyrometers shall be calibrated to a black body furnace annually.						N/A
3.0		PROCESS MONITOR FREQUENCIES						
A3.1	1.4 2.14	Monitor primary temperature control instrument(s).	Each batch or continuous recording with sign-off every 2 hours. Alarm systems satisfy the sign-off requirement.	Each lot or continuous recording with sign-off every 2 hours. Alarm systems satisfy the sign-off requirement	Each Shift	Continuous with Alarms, each ordered is verified by sign off using process sheet.		
A3.2	1.4 2.14 3.7	Monitor generator atmospheres.			Continuous	Continuous		

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral 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, etc. When performing the job audit, the auditor shall verify heat treater is conforming to the customer's requirements.

* Continuous furnace frequencies are per lot (work order) or as specified, whichever is more frequent.

** Does not apply to furnaces operating below 760C (1400F).

----- indicate "not applicable".

Item #	Related HTSA Question #	Category/Process Steps	Batch Furnace	Continuous Furnace *	Generators	Acceptable	Not Acceptable	N/A
A3.3	1.4 2.14 3.7	Monitor primary furnace atmosphere control(s)**.	Continuous recording with sign-off every 2 hours. Alarm systems satisfy the sign-off requirement.	Continuous recording with sign-off every 2 hours. Alarm systems satisfy the sign-off requirement.	-----	Continuous with Alarms, each ordered is verified by sign off using process sheet.		
A3.4	1.4 2.14 3.7	Verify primary atmosphere control method by back-up method**.	Daily	Daily	Daily	Daily Wire Resistance		
A3.5	1.4 2.14 3.13	For austenizing salt baths: Salt chemistry (soluble oxides) or decarburization on the parts shall be checked daily.	Daily	Daily	-----			N/A
A3.6	1.4 2.12	Quench Media Process Parameters - Temperature - Quench Level	Each batch or continuous recording with sign-off every 2 hours. Alarm systems satisfy the sign-off requirement. Daily	Each lot or continuous recording with sign-off every 2 hours. Alarm systems satisfy the sign-off requirement. Daily	-----	Continuous with Alarms, each ordered is verified by sign off using process sheet. Alarms		
		- Agitation	- Daily visual check is required. - Monitor each load in the absence of an alarm system.	- Daily visual check is required. - Monitor every 2 hours in the absence of an alarm system.	-----	Continuous with Alarms		

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral 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, etc. When performing the job audit, the auditor shall verify heat treater is conforming to the customer's requirements.

* Continuous furnace frequencies are per lot (work order) or as specified, whichever is more frequent.

** Does not apply to furnaces operating below 760C (1400F).

----- indicate "not applicable".

Item #	Related HTSA Question #	Category/Process Steps	Batch Furnace	Continuous Furnace *	Generators	Acceptable	Not Acceptable	N/A
A3.7	1.4 2.14	Monitor time in furnace, cycle time or belt speed.	Each batch	Twice/shift & after any change in the belt speed.	-----	Continuous with Alarms and Sign Off		
A3.8	1.4 2.7	Monitor load size or fixturing or loading rate as applicable.	Each batch	Twice/shift & after any change in loading rate.	-----	Continuous with Alarms		
A3.9	1.4 2.12	Quench Delay Time - Alarm system shall be based on the time that the load exits the furnace to the time the load is at the bottom of the quench tank.	Each batch	Each basket for pusher-type continuous furnaces. Not applicable for belt furnaces.	-----			N/A
4.0		IN-PROCESS/FINAL TEST FREQUENCIES						
A4.1	1.4 2.15	Microstructure	Daily per furnace	Daily per furnace	-----	Each Furnace Every 24 hrs.		
A4.2	1.4 2.15	Surface hardness	Each batch	Every 2 hours minimum	-----	3-6 parts every 15-20 min / lot		
A4.3	1.4 2.15	Core hardness (when specified)	Each batch	Every 4 hours	-----			N/A
A4.4	1.4 2.15	Case depth (when specified)	Each batch	Every 4 hours	-----			N/A

PROCESS TABLE A - Carburizing / Carbonitriding / Carbon Correction / Neutral 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, etc. When performing the job audit, the auditor shall verify heat treaters is conforming to the customer's requirements.

* Continuous furnace frequencies are per lot (work order) or as specified, whichever is more frequent.
 ** Does not apply to furnaces operating below 760C (1400F).
 ----- indicate "not applicable".

Item #	Related HTSA Question #	Category/Process Steps	Batch Furnace	Continuous Furnace *	Generators	Acceptable	Not Acceptable	N/A
5.0		QUEENCHANT AND SOLUTION TEST FREQUENCIES						
A5.1	2.12 3.14	Polymer Quench Media - Concentration - Quenchability Check; e.g., cooling curve, viscosity, or titration	Daily Every six months	Daily Every six months	----- -----			N/A N/A
A5.2	2.12 3.14	Water Quench Media - Suspended solids	Every six months	Every six months	-----			N/A
A5.3	2.12 3.14	Salt Quench Media - Analysis & Contaminants	Every six months	Every six months	-----			N/A
A5.4	2.12 3.14	Brine or Caustic Quench Media - Concentration and/or Specific Gravity.	Daily	Daily	-----	Semi-annually		N/A
A5.5	2.12 3.14	- Suspended solids Oil Quench Media - Water content, suspended solids, viscosity, cooling curve, total acid, and flash point.	Every six months Quarterly	Every six months Quarterly	-----			N/A
A5.6	2.13	Rust Preventive - Soluble Oil						
A5.7	2.11	- Concentration Washers - Concentration of cleaner - Temperature of solution (required if temperature is specified to be above ambient temperature).	2x / week Daily Each shift	2x / week Daily Each shift	-----	Daily		N/A N/A

Ford Specific CQI-9 requirements

Requirements and Guidance				Assessment			
W-HTX Element/Pg #	W-HTX Requirements and Guidance not included in CQI-9	CQI-9 section	Objective Evidence	NA	Satisfactory	Not Satisfactory	Needs Immediate Action
Scope (pg 7)	CQI-9 assessment and Ford Specific CQI-9 assessment is also to be completed for brazing and sintering.	Scope 1.2		N/A			
Carburizing/ Carbonitriding/ Carbon Correction (pg 24)	<ul style="list-style-type: none"> - Alarms, if used for process monitoring, must be set at acceptable control limits. - Quench media Soluble oil: Concentration must be checked daily. - Quench media Soluble oil: Suspended solids must be checked semi-annually. - Microstructure for batch heat treat must be checked per batch and when any of the process parameters are out of spec. 	Process Table A		N/A			
Neutral Hardening (pg 26)	<ul style="list-style-type: none"> - Alarms, if used for process monitoring, must be set at acceptable control limits. - Quench media Soluble oil: Concentration must be checked daily. - Quench media Soluble oil: Suspended solids must be checked semi-annually. 	Process Table A	Alarms set to match process requirements. N/A N/A		YES		
Tempering/Stress Relieving/ Annealing/Normalizing/ Solution Heat Treat/Age Hardening (pg 27, 29, 30)	<ul style="list-style-type: none"> - Alarms, if used for process monitoring, must be set at acceptable control limits. 	Process Table A and E		N/A			
Nitriding/ Nitrocarburizing (pg 28)	<ul style="list-style-type: none"> - Alarms, if used for process monitoring, must be set at acceptable control limits. - Dissociation of ammonia must be checked in gas nitriding twice a shift and after any change (or per batch). - Gas ratios for ferritic nitrocarburizing must be checked twice a shift and after any change (or per batch). 	Process Table B		N/A			
Brazing/Sintering (pg 31)	Assess Brazing/Sintering heat treat processes per Attachment 1 for WHTX - Brazing & Sintering Process Table.	Scope 1.2		N/A			
Vacuum Carburizing (pg 25)	Assess Vacuum Carburizing heat treat processes per Attachment 2 for WHTX - Vacuum Carburizing Process Table.	Scope 1.2		N/A			
Salt Bath (pg 32)	<ul style="list-style-type: none"> - Alarms, if used for process monitoring, must be set at acceptable control limits. - Bath activity and exhaust smoke analysis must be done every batch and after any change. - Visual condition of quench media must be checked each shift. - Quench media Soluble oil: Concentration must be checked daily. - Quench media Soluble oil: Suspended solids must be checked semi-annually. 	Process Table A and B		N/A			

	<ul style="list-style-type: none"> - Cycle time must be visually checked and logged twice a shift and after any change. - In the absence of an alarm system for high and low control limits quench media temperature must be checked and logged each shift and after any change. Quench level must be checked each shift and after any change. - Quench media Soluble oil: Concentration must be checked daily. - Quench media Soluble oil: Suspended solids must be checked on semi-annual bases. - Quench media Oil: Water content, Suspended solids, Viscosity, Quenchability, Flash and fire point must be checked on semi-annual bases. - Flame processes: Oxygen to fuel ratio shall be monitored and recorded. 	Process Table D						
Induction (pg 33)				N/A				
Loading rate and cycle parameters (pg 15)	Control plan must have maximum delay between quench and temper and it must be monitored and logged.	2.7; A3.8; B3.9; C3.4; E3.7		N/A				
Processing temperature (pg 11)	Overtemp/Undertemp (when applicable) must be set at 50 deg F over the process set temperature to protect material and furnace from overheating.	N/A	Overtemp set at 1675.		YES			
Monitor of carbon atmosphere (pg 11)	Dew point test is not acceptable for inverted delta parts.	3.7; 3.8; A3.3; A3.4; B3.2; B3.3; E3.3; E3.4	Wire Resistance test is used.		YES			
Furnace atmosphere (pg 12, 13)	2-Oct-09	3.7	Furnace checked for leaks each startup.		YES			
Condition of quench (pg 15)	Additions to quench systems must be recorded in logging record.	3.14	Recorded salt additions.		YES			
Rules for checking service T/C (SAT test) and temperature instrumentation (pg 34)	<p>The calibrated test thermocouple must be placed adjacent to the service thermocouple with the two junctions within 2 inches of each other. The test results of the instrument, thermocouple, and protection tube checks must be appropriately logged.</p> <p>The date that a given thermocouple or protection tube is replaced must be recorded. Service Thermocouples should be checked in place at their normal operating temperatures (not by removing the thermocouples from the normal operating temperature and checking them at a lower temperature).</p>	Item # 2.0 of the applicable Process Table	Test TC placed in same protection tube. Certifications provided. TC replacement dates recorded. TC checked in furnace at operating temperature.		YES			
Microstructure (pg 17, 22)	At the minimum, microstructure must be checked @ 100X and 500X. Visual standards are required. Results must be recorded.	Item # 4.0 of the applicable Process Table	Microstructure checked up to 1000X. Examples Microstructure Ref. Microstructure log.		YES			

Hardness (pg 18, 23)	<p>- When tempering is done immediately after the quenching, the testing may be done after tempering rather than after both quenching and tempering. The heat treater shall maintain average and range or other statistical charts as appropriate for hardness to detect trends in the process and to serve as a quality record. File, Rockwell, or Brinell scale shall be used as indicated on the Engineering Drawing unless the affected Product Engineering Office permits the use of an alternative hardness scale and the change is noted in the control plan. Surface hardness testing with files (refer to SAE J864), where an indentation hardness test is not specified and/or for purposes of correlation, shall only be used if authorized by the affected Ford Supplier Technical Assistance (STA) engineer. When checking the hardness tester with certified blocks the distance between the centers of two adjacent indentations shall be at least three times the diameter of the indentation and the distance to the edge of the test piece shall be at least two and a half times the diameter of the indentation.</p>	Item # 4 of the applicable Process Table	Hardness data stored electronically. Rockwell hardness used. scale based on part requirement. Files are not used. Hardness test blocks are used in accordance with ASTM E-18.		YES		
Case Depth (pg18, 23)	<p>Case depth checks may be made on production parts or test bars provided correlation to production parts has been established. However, case depth for induction and flame processes must be checked on production parts. Case depth records shall be maintained on average-range or other statistical charts as appropriate to detect trends in the process and to serve as a quality record.</p>	Item # 4 of the applicable Process Table		N/A			
Induction/Flame Pattern (pg 23)	<p>The surface and cross-sectional pattern shall be checked as required by the Engineering Drawing or in-process specification.</p>	Item # 4 of the Process Table D		N/A			

The objective of CQI-9 and WHTX is to define the requirements and to encourage Best Practices which will assure a quality part as well as promoting continuous improvement relative to quality and productivity. Exceptions to the CQI-9 and WHTX requirements or reductions of sampling strategies for control of heat treating processes may be used, provided they afford adequate protection of a process currently proven to be stable and capable, and have the concurrence of the affected Ford Supplier Technical Assistant (STA) engineer and/or Quality Planning Team and are documented in a control