

Special Process: Heat Treat System Assessment			
Facility Name:		H&S Heat Treating	
Address			
133 South Street North, PO Box 160, Port Robinson, Ontario, L0S 1K0			
Phone Number:	905-384-9355	Type(s) of Thermal Processing at this Facility:	
Fax Number:	905-384-9110	Process Table A - Ferrous	
Number of Heat Treat Employees at this Facility: 48		Carburizing	YES
		Carbonitriding	YES
Captive Heat Treater (Y/N): NO		Carbon Correction	YES
		Neutral Hardening	YES
Commercial Heat Treater (Y/N): Yes		Quench & Temper	YES
		Austempering / Martempering	NO
Date of Assessment: October, 2011		Tempering	YES
		Precipitation Hardening / Aging	YES
Date of Previous Assessment:		October 2010	
		Process Table B - Ferrous	
		Nitriding (Gas)	N/A
		Ferritic-Nitrocarburizing (Gas or Salt)	N/A
		Process Table C - Aluminum	
		Aluminum Heat Treatment	N/A
		Process Table D - Ferrous	
		Induction Heat Treating	YES
		Process Table E	
		Annealing	YES
		Normalizing	YES
Stress-Relieving	YES		

Current Quality Certification(s):	ISO/TS 16949:2009 ISO 9001:2008
Date of Re-assessment (if necessary):	

Personnel Contacted:			
Name:	Title:	Phone:	Email:
Rick Clift	Quality Assurance Manager	905-384-9355	qa@hsheat.com
Pat Quam	Maintenance Manager		
Rick Mills	Plant Manager		

Auditors/Assessors:			
Name:	Company:	Phone:	Email:
Rick Clift	H&S Heat Treating	905-384-9355	qa@hsheat.com
Stephen Hurley	H&S Heat Treating	905-384-9355	

Number of "Not Satisfactory" Findings:	0
---	---

Number of "Needs Immediate Action" Findings:	0
---	---

Number of "Fail" Findings in the Job Audit(s):	0
---	---

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				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.	Rick Clift, P. Eng - QA Manager, Metallurgical Engineer with 30+ years of industrial experience	X		
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.	COP 12 - Product Quality Planning system developed and used. Organization follows AIAG requirements for PPAP submissions, in conjunction with customer supplied requirements.	X		
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.	PFMEA's are completed as part of the PPAP submissions to customer. COP 12 references PFMEA's. Customer Requirement Matrix Form-010 created. PFMEA documents are reviewed as part of annual validation process and after any documented customer complaint.	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.4	Are heat treat process control plans up to date and reflecting current processing?	<p>The organization shall incorporate the use of a documented Control Plan procedure and ensure the Control Plans are updated to reflect current controls.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>Control Plans are developed internally with input from all related departments.</p> <p>Customer requirements are incorporated into control plans. Procedure covered in COP 12.</p>	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	MOP 03 - Control of documents and engineering specifications. ISO Systems manager maintains document revision log. Quality Assurance manager has current issues of society standards. Updated and reviewed Customer specs are filed.	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.	System of Process Standards is part number driven. All Process standards are controlled documents with list of revisions and manager sign-offs.	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.7	Has a valid product capability study been performed initially and after process equipment has been relocated, or had a major rebuild?	<p>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.</p>	<p>Capability studies are performed on all identified key parameters as part of the PPAP submissions. Annual validation studies are performed on identified parameters studied in PPAP submissions (customer driven requirement). Capability studies also performed at various other times, as required to validate process parameters.</p>	X		
1.8	Does the heat treater collect and analyze data over time, and react to this data?	<p>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.</p>	<p>Customer specific and part specific parameters are recorded in SQC Pak (SPC Software). Quality Assurance Technologists record results of inspection in SQC software and maintain the data. Monthly capability studies of key parameters are completed and reviewed by Senior Management.</p>	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	All heat treating operations are reviewed and documented by various levels of management at least once every 24 hours via LPA reports.	X		
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.	A schedule for annual review and completion of the CQI-9 Heat Treat Assessment has been established.	X		
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.	COP 08 - Control of Non Conforming Product.	X		
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.	COP 08 - Control of Non Conforming Product.	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.13	Is there a continual improvement plan applicable to each process defined in the scope of the assessment?	The heat treater 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.	A. Continuous Improvement plan has been developed and established in conjunction with TS 16949 requirements.	X		
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.	COP 08 - Control of Non Conforming Product.	X		
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.	Control Plans and Process Standards are in place for every process performed. Equipment Work Instructions (WI) and Lab Work Instructions (LWI) are in place for all pieces of equipment and lab functions respectively. QA Inspection Procedures in place for all inspection methods. All documents are controlled with revision levels and sign off.	X		
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.	All employees receive orientation training. Furnace operators receive specialized on the job training. Training is signed off by Production manager once completed. Records of training histories on file for all employees. Lab QA employees receive detailed training on inspection techniques. All training is recorded on employee's permanent training record.	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	A responsibility matrix has been established and documented.	X		
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.	SOP 03 - Preventative and Predictive Maintenance procedure.	X		
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.	Maintenance has identified and documented a list of critical pieces of equipment within the plant.	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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. 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>	COP 03 - Shipping/Receiving	X		
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 defined area.</p>	COP 03 - Shipping/Receiving, COP 05 - Manufacturing (heat treating) governs this requirement. All product on the shop floor is identified during processing.	X		
2.3	Is lot traceability and integrity maintained throughout all processes?	<p>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.</p>	COP 03 - Shipping/Receiving, COP 05 - Manufacturing (heat treating). Furnace lot/tray lot identification assigned to all product processed through shop.	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	COP 08 - Control of Non Conforming Product.	X		
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 treater 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.	Maintenance department evaluates trap points when maintenance is done to furnaces. For continuous furnaces, operators inspect furnace line between part #'s / heats / lots and document inspection on Furnace Chart Report.	X		
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.	Customers are encouraged to use separate and different containers for handling heat treated and non-heat treated product. Part specific Process Standards outline the use of different containers for heat treated and non-heat treated product. When customers cannot use separate containers, containers are visually inspected prior to reuse.	X		

Special Process: Heat Treat System Assessment

Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment			
				N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
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.	Part specific Process Standards give loading requirements by part number.		X		
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.	COP 05 - Manufacturing (heat treating), Equipment Work Instructions include instructions on containment to cover equipment emergencies such as power failure or furnace shutdowns.		X		
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.	COP 05 - Manufacturing (heat treating), Process Standards details handling and packaging of product, Customer specific requirements are captured on part specific Work Instructions. Daily LPAs are completed for all areas of the plant to verify storage and packaging.		X		
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.	Operators are encouraged to keep their work areas clean. Plant cleanliness is reviewed and documented as part of the daily LPA.		X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
2.11	Are parts free from contaminants that would be detrimental to the heat treatment of the product?	<p>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.</p> <p>Note: Refer to the appropriate heat treaters' requirements and specifications to determine acceptability. Refer to Process Table, Section 5.0, for frequency of checking washer solutions.</p>	<p>Parts are cleaned/ pre-washed as required, based on either customer specific requirements or internal requirements. Part specific Process Standards outline requirements for pre-washing and/or cleaning prior to heat treatment. Maintenance program in place for monitoring soap concentration and cleanliness of washers.</p>	X		
2.12	Is the quenching system monitored, documented, and controlled?	<p>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 treaters' 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.</p>	<p>Quench systems are monitored (LPAs & Charge Reports). Products sensitive to cracking are identified during APQP and Process Standards contain instructions to minimize delays before quench.</p>	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	Process Standards include requirements for rust inhibitor usage. Concentration checks are performed on a regular basis and logged by operator.		X	
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.	Layered Process Audits (LPA) are performed at least once every 24 hours by management. Operators regularly check process parameters. Computer monitors are used on some furnaces in addition to operator review.		X	
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.	Process Standards contain requirements for in-process and final inspection, based on customer specific requirements.		X	
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.	SOP 05 - Control and Measuring Devices. Lab Work Instructions (WI) and Calibration Procedures (CAB)		X	

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	All heat treat equipment has appropriate process control equipment installed.	X		
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.	Calibration of process control equipment is done per a documented schedule. GaugePak software monitors this schedule as well. Calibration Procedures (CAB) on file for all equipment.	X		
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 are replaced on a set schedule conforming to Process Tables Section 2. Protection tubes are inspected when thermocouples are replaced, and are replaced, as needed.	X		
3.4	Are temperature uniformity surveys performed per requirements 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 reports precludes direct temperature profiles. Alternate test methods per AMS 2750D 3.5.15 are acceptable for furnaces where temperature uniformity studies are not possible.	TUS are scheduled to be performed on an annual basis or after major furnace rebuild. Furnaces are surveyed per requirements of AMS 2750D.	X		
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.	Variations of FCE control thermocouples are within requirements set forth in the Process Tables. This is being charted on FCE chart recorders.	X		

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	M-005 Furnace Alarm Checklist. System in place for quarterly alarm inspection and testing.	X		
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 re-rot and shaker furnaces that preclude in situ control and monitoring. For rotary re-rot 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.	Atmosphere furnaces and generators have in-situ carbon probes for control of furnace atmosphere. Chart recorders continuously record carbon potential and generator temperature/FCE temp. Back up systems exist for monitoring carbon potential values (NOVA dew pointers, shim stock). Some furnaces have had a second, monitoring carbon probe installed to act as a backup device for the controlling carbon probe.	X		
		The atmosphere control system shall maintain the atmosphere dew point/carbon potential set point within the parameters specified in the control plan or internal procedures. The heat treater shall have a back-up method of checking the carbon potential/dew point. Examples are dew point, electrical wire resistance, gas analysis, shim stock, carbon bar, etc. The automatic and continuous atmosphere control system shall consist of sensors such as oxygen probes or on-line Infrared (IR) gas analysis. See Process Table A, Sect. 3.0 for verification frequencies.				

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	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?	<p>This issue is specific to Process Table 1, carburizing, carbonitriding, and neutral hardening. 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), the heat treater shall resolve the out-of-limit discrepancy. The back-up atmosphere monitoring system reading and the automatically controlled atmosphere dew point/carbon potential reading shall be maintained within the correlation limits specified in the control plan or internal procedures. These range tolerances vary with the specific heat treat process and the equipment used. The heat treater shall make appropriate technical adjustments and corrections and then re-establish/demonstrate the correlation of the actual atmosphere carbon potential/dew point reading to the primary control and back-up atmosphere reading. The range tolerances for correlation between the two readings shall be in the control plan or internal procedures. The back-up carbon potential/dew point reading shall be established using:</p> <ul style="list-style-type: none"> • Carbon bar or slug • Shim stock • 3-gas analyzer • Dew point • Hot wire resistance 	<p>CAB 10 - Calibration procedure, verification of Furnace Atmospheres. Process factors are adjusted on carbon controllers to re-establish correlation between controller and shim stock analysis.</p>	X		

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. 	All controlled atmosphere furnaces are equipped with ammonia quick disconnect lines.	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>		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>	All furnaces are equipped with flow meters for all furnace atmosphere gases.	X		

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.		X		
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.		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. <ul style="list-style-type: none"> 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. 	Oil quench media is checked by an independent laboratory on a quarterly basis. Results are reviewed by QA and filed. Results are also entered into SQC Pak software (SPC software).		X	

Special Process: Heat Treat System Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
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.	Proximity switches are used to confirm a part is present and custom made bases locate part.		X	
3.16	Does the heat treater control the energy or power for each part?	The heat treater shall control the energy or power for each part. • 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.	Energy monitors are installed on all induction power supplies.		X	
3.17	Does the supplier have a coil management system? Coil refers to the heating coil and the quench plenum.	The heat treater shall have a coil management system. Coil refers to the heating coil and the quench plenum. • 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.	A documented coil management system is in place and maintained. Induction coils are serialized and their usage tracked. Spare coils which conform to approved design are maintained in-house.		X	
3.18	Is quench system automatic?	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.	Quench systems are controlled by PLC.		X	
3.19	Does each lot of parts have first piece set-up?	The heat treater shall perform first piece set-up for each lot of parts	A First-Off inspection procedure is in place for all induction cells.		X	