

Special Process: Heat Treat System Assessment

Facility Name: State Heat Treating
 Company
 Address: 520 32nd St SE, Grand Rapids, MI 49548

Phone Number:	616.243.0178	Type(s) of Thermal Processing at this Facility:	
Fax Number:	616.243.6337	Process Table A - Ferrous	
		Carburizing	Yes
		Carbonitriding	Yes
Number of Heat Treat Employees at this Facility: 21		Carbon Restoration	No
Internal (Captive) Heat Treater (Y/N):	N	Neutral Hardening (Quench and Temper)	Yes
Commercial Heat Treater (Y/N):	Y	Austempering / Martempering	No
		Tempering	Yes
Date of Assessment:	23-Oct-2019	Precipitation Hardening / Aging	Aging Only
Date of Previous Assessment:	1-Nov-2018		

		Process Table B - Ferrous	
		Nitriding (Gas)	No
		Ferritic-Nitrocarburizing (Gas or Salt)	No
		Process Table C - Aluminum	
		Aluminum Heat Treatment	Yes
		Process Table D - Ferrous	
		Induction Heat Treating	No
		Process Table E	
		Annealing	Yes
		Normalizing	Yes
		Stress-Relieving	Yes
		Process Table F	
		Low Pressure Carburizing	No
		Process Table G	
		Sinter Hardening	No
		Process Table H	
		Ion Nitriding	No

Current Quality Certification(s):	ISO-9001:2015		
Date of Re-assessment (if necessary):	01/24/2020	Surveillance	
		1/23/2022 Re-Certification	

Personnel Contacted:			
Name:	Title:	Phone:	Email:
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Jesse Massengill	President and Owner	616.243.2800	jmassengill@garichards.com

Auditors/Assessors:			
Name:	Company:	Phone:	Email:
Brad Bukowski	American Systems Registrar	616-240-5542	brad@asrworldwide.com

Number of "Not Satisfactory" Findings:	
2	

Number of "Needs Immediate Action" Findings:	

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

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Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment			
				N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
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.	JD-009 (Quality Technician) require education and five years of heat treat 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.	Every new part is reviewed and processed per a family FMEA and control plan. Every part receives its own process with all changes and modifications recorded in the Part Master File. See WI-7-001 Product Process and Realization. APQP required fields are utilized in the ERP software.		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.	FMEAs are done for families of parts and processes. Each plan is reviewed yearly with all changes recorded on the FMEA located in their respective parts families.		x		

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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. 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>	Control Plans are done for families of parts and processes. Each plan is reviewed yearly with all changes recorded on the Control Plan located in their respective parts families.		x		
1.5	Are all heat treat related and referenced specifications current and available? For example: Industry and customer specific specifications such as SAE, AIAG, ASTM, ISO, EN, JIS, General Motors, Ford, and Chrysler.	<p>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, ISO, EN, JIS, General Motors, Ford, and Chrysler. 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.</p>	<p>All specifications used for any given process will be indicated on the control plan and will be updated along with the review of the plan at its yearly review.</p> <p>All customer specifications will be reviewed at receipt and will not be controlled. Print revisions, if provided, will be recorded on our internal process and verified at order entry.</p> <p>Should any changes be needed, the ERP will be updated to reflect any requested changes.</p>		x		

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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.	Review Process Variables annually. All written process specs and BOM is listed in ERP Master Parts File; and all revisions are recorded in the change history. Process Variables are reviewed annually and listed on the control panel next to each furnace. All active processes are in the form of Work Orders and computer-based recipes. See WI-7-001 Product Process and Realization.		x		
1.7	Has a valid process 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 process 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 process 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.	Lab results tell us if we are in control of each process based on the specifications required from each part. We perform capability studies on each furnace line for each process family that is associated with that line. We also do capability studies at level 2 inspections. Operators will also do capability studies if they run out of room on work orders.		x		
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.	Ongoing data collection is done on significant parameters for each process family. Each job that does not meet the requirements is recorded in the Customer Complaint Log and reviewed with the required functions. See WI-8-003 Customer Complaint Log.		x		
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 equipment with electronic data collection is reviewed daily via computer and furnace monitoring software.		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.	The Heat Treat Porcess Assessment is reviewed and updated yearly.		x		

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1.11	Is the OEM customer notified when parts are reprocessed?	<p>The OEM shall be notified when parts are reprocessed in the heat treat operation. It is preferred that the notification be on a case-by-case basis. However, it is understood that some reprocessing (such as but not limited to re-tempering operations) may be pre-approved during the APQP or PPAP phase. To be pre-approved for reprocessing, the heat treater shall meet the following requirements:</p> <ul style="list-style-type: none"> • The heat treater shall submit for approval by the OEM customer the reprocessing procedure and this procedure shall be referenced in the heat treater's FMEA and process control plan • The procedure shall describe product characteristics for which reprocessing is permissible 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 process modifications. • Records shall clearly indicate when and how any material has been reprocessed. • The Quality Manager or a designee shall authorize the release or reprocessed product. 	<p>Any part processed that does not meet the customers spec is placed on hold and reviewed by authorized people. A rework instruction is required for reprocessing. All reworked parts are final inspected by plant manager or quality. All rework instructions and results are documented on a new work order and recorded. See WI-8-002 Controlling Nonconforming.</p>		x		
1.12	Does the Quality Department review, address, and document customer and internal concerns?	<p>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.</p>	<p>All internal and external problems are put in the Customer Complaint Log. and dealt with through our internal review process. See WI-8-003 - Problem Analysis and WI-8-001-B Nonconformity Form (or customer form).</p>		x		
1.13	Is there a continual improvement plan applicable to each process defined in the scope of the assessment?	<p>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.</p>	<p>The review of the Control Plan and PFMEA will show what is being done to improve quality and will be shown by the RPN numbers going lower with given improvements. Any major Continual Improvement project will be controlled by Work Instruction WI-8-004 Continual Improvement and WI-8-001-C Improvement Form. This is also tied to the Problem analysis process.</p>		x		
1.14	Does the Quality Manager or designee authorize the disposition of material from quarantine status?	<p>The Quality Manager is responsible for authorizing and documenting appropriate personnel to disposition quarantine material.</p>	<p>Quality manger and plant manager are authorized to release "ON HOLD" product and will document this on the new rework work order or a Material Deviation report. See WI-8-002 Controlling Nonconforming.</p>		x		

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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.	All elements of our process flow have written procedures and are part of all employees training. These are located in Level 4 of the QMS.		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.	WI-6-001-F Employee Qualification - Level 5, and WI-6-001-O Operator Training Matrix - Level 5. Testing is individual function based (forklift, Rockwell hardness, Level 1 inspect test, Level 2 inspect test, etc...)		x		

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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.	Responsibilities have been identified and delegation and training to take place within 90 days of submission.			x	
1.18	Is there a preventive maintenance program for all heat treat equipment? Is maintenance data being utilized to form a predictive maintenance program?	The organization shall have a documented preventive maintenance program for all heat treat process equipment. 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. Maintenance data shall be collected and analyzed as part of a predictive maintenance program.	A full and complete preventive maintenance program (MaintiMizer) is written and used. All maintenance purchasing and inventory is maintained within this program. All critical parts are listed and purchased from approved suppliers only. See WI-7-002-B Approved Vendor List. See Maintenance Work Instructions MI-001 - MI-005.		x		

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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 Parts in Inventory MI-003.		x		
1.20	Is material from different steel mill heats or metals which may preclude achieving the specified metallurgical properties prevented from being processed together?	Different steel mill heats or metals which require different heat treat parameters, such as but not limited to, austenitizing, quenching, or tempering times and/or temperatures shall be processed separately in order to achieve specified metallurgical properties.	All orders are run separately and lot controlled. Each Purchase Order receives a new Work Order per part number and lot segregation is enforced. APQP is performed to ensure proper recipes, Work Orders are created to ensure proper recipes and cycle per part are used, and scheduling is performed to run parts requiring similar atmosphere in efficient orders, but not mixed.		x		

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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?	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.	All incoming product is reviewed for accuracy at receiving. All information provided is verified with our process and recorded on the customers' document. Any discrepancies are documented and product is placed on hold pending a review by Management. See WI-7-001-C and WI-7-001-D. See SHP-003 (WO) and SHP-013 (Receipt of CSP).		x		
2.2	Is product clearly identified and staged throughout the heat treat process?	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.	All product is staged in set areas waiting for processing. During processing it is identified by load tags and with the work order and the furnace log. All finished product is in a "done ready to ship" area with all parts identified with the work order. See WI-7-003-A Work order/data sheet guide lines. WI-7-003-B - customer supplied product tags. All work in the facility is identified by a work order and all product is audited for work orders, CSP, load tags, and basket markings via Weekly Plant Audit WI-7-003-V.		x		
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.	All lots have their own work order. All work orders are kept separate during processing and remain so during shipment back to the customer. See WI-7-003-B CSP, WI-7-003-A. Customer PO=>Incoming Paperwork=>CSP=>Work Order=>Shipper=>Invoice		x		
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.	All product that does not meet the customers specifications will be red tagged / and or rejected on the work order and placed in the "hold area". All product in the hold area shall be logged using WI-8-002-A - Hold Area Log. Hold area log is audited weekly via WI-7-003-T Dock Audit. Product shall be logged in the Customer Complaint Log via WI-8-003. See Controlling of Non-conforming WI-8-002 and use the Material Deviation Suspect form for the customer if applicable with WI-7-003-P.		x		

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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.	The preventative maintenance program generates a work order for a review of each lines operation for frequent furnace review to identify trap points bi-annually. Monitoring trap points in the Operator Work Instructions OI-037 and discipline to monitoring trap points.		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.	Each container is removed from the loading area and looked at prior to returning to the finished parts area. Any foreign material is removed. Small parts in boxes with folding edges are loaded into plastic bags lining the container to prevent parts mixing from being stuck anywhere within the container. OI-037 A weekly Dock Audit is conducted via WI-7-003-T to review in-process containers in the plants.		x		
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.	All process's have loading requirements documented on the work order. The operator logs the loading on the furnace log each order and at shift change. This is verified by shift supervisor and reviewed by management daily via the Layered Process Audit WI-7-003-C. Also controlled by the load height gages by the furnace. See WI-7-003 Production.		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.	Our Work in Process rejection procedure covers all nonconforming situations and is part of all employees regular training. See W-18-002 Controlling Non-conforming. See WI-6-001 Human Resources and WI-6-001-F Employee Qualification. See OI-037: Operator Instructions for non-conforming instructions.		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.	Each process that is assessed to potentially damage a part during loading, processing, unloading and transport has special processing for hand load, hand unload, special racking instructions, and / or special shipping instructions. See WI-7-001 Product Process and Realization. See also WI-6-002-A Condition of Facility See also WI-7-003-T Dock Audit		x		

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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.	A plant survey is done by an internal auditor monthly to evaluate the plant for building maintenance, lighting, cleanliness, and organization using Condition of facility form see WI-6-002 A, This is a management responsibility see WI-6-002 Infrastructure.		x		
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.	Any part with detrimental amounts of oils or drawing compounds are prewashed and all product is post washed prior to temper. All washers are on a preventive maintenance program and checked daily. All washer concentrations are verified by the soap supplier quarterly or as needed. There is a daily PM for checking furnace washer solution.		x		
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.	There is a daily PM for checking the quench system in our furnace level checks. The temperature, agitation speed, time in the quench are all automatically controlled. All furnaces have high temp alarms. WI-7-001 Product Process and Realization for specification.		x		
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.	The rust prevention is controlled by new additions of product and by supplier once every 6 months. Product is pre-titrated by the supplier prior to being added into our tank. Maintenance puts out a work order for this.		x		

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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.	All required process control parameters are continuously recorded and signed off by the operator at shift change at least every 8 hours. This is recorded on furnace log sheets. Temperature is continuously monitored and logged using the furnace monitoring software. Audited daily by management via Layered Process Audit WI-7-003-C.		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.	Yes, there is an inspection sampling plan at every work station which matches or surpasses section 4 table. This is also found in the lab.		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.	An outside service performs the calibrations on all test equipment quarterly. All test equipment is verified internally on a daily basis. See WI-7-001 E, G, I . Also WI-6-002-B.		x		

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Section 3 - Equipment							
3.1	Do furnaces, generators, and quench systems have proper process control equipment?	The heat-treat equipment including 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, etc. as listed in the applicable Process Tables, Section 1.0.	All equipment has automatic temperature controls, cycle timers, agitation control, carbon control, oil temperature and flow scopes for each zone. All controls are calibrated semi-annually. All temperature and carbon controllers are monitored through our software.		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.	All calibrations are posted at/on the control or equipment being certified. All internal verifications are also posted at the 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.	All thermocouples are changed out per our PM program semiannually. All protection tubes are evaluated at the same time. Preventative Maintenance Work Order templates are built for semi-annual checking and replacement.		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. Certain furnace designs, e.g., rotary retorts & some continuous pusher furnaces preclude direct temperature profiles. Alternate test methods per Section 3.4.5 are acceptable for furnaces where temperature uniformity studies are not possible. TUS studies are not required for Ion Nitriding. Refer to Process Table H Item # H2.4 for specific requirements.	We use the ongoing capability studies to assure ourselves that the equipment can meet the requirements. TUS surveys are preformed per requirements of CQI-9 or more frequently.		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 value and the set point temperature shall be within the limits defined in the applicable Process Tables, Section 2.0. For Ion nitriding refer to Process Table H Item # H2.5 for specific requirements.	Data collection program shows the temperatures to be with-in the given range. Calibrated to run with in CQI-9 requirements. This is monitored hourly by management. Quaterly SAT from outside supplier also calibrates within the given tolerance.		x		
3.6	Are the process & equipment alarm checks being tested for proper function?	The heat treater shall have a list of heat treat process and equipment alarms that, if not properly working, may have a high probability of producing non-conforming product. These alarms shall be checked quarterly at a minimum or after any repair or rebuild. Other alarms, including but not limited to safety-related, shall be checked per heat treater's requirement. These alarm checks shall be documented.	Process alarms are being improved as a 2020 initiative through mechanical and software related means.			x	
		Generator and furnace atmosphere carbon potential/dew point shall be continuously					

Special Process: Heat Treat System Assessment							
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment			
				N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
3.7	Are generators and furnace atmospheres continuously monitored, automatically controlled, and documented? NOTE: This requirement is specific to Process Tables A, B, E, F, and G; Sections 1.0 and 3.0.	monitored, automatically controlled, and documented. Recorded carbon potential shall be controlled within +/- 0.05 of the set point. Recorded dew point shall be controlled within acceptable limits specified in the control plan or internal procedures. NOTE: For rotary retort and shaker furnaces that preclude in situ control and monitoring, the method described in Section 3.4.5 "Property Surveys" shall be used. If generators are not used, the flow rates of the supplied atmosphere gases shall be monitored and controlled. The automatic and continuous atmosphere control system shall consist of sensors such as oxygen probes or on-line Infrared (IR) gas analysis. The heat treater shall also 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. See Process Tables, Sect. 3.0 for verification frequencies of primary and back up method.	All furnaces are automatically controlled and recorded. The carbon controllers are verified by dew point daily. The generators are monitored continuously and recorded as well as dewpoint checks. Also, our software records this information and logs it continuously.		x		
3.8	A back up verification of the atmosphere is required. When the back-up verification check of the atmosphere does not correlate within pre-established limits with the primary control method (carbon potential/dew point reading), is correlation of the carbon-bearing atmosphere to the primary control method re-established? NOTE: This requirement is specific to Process Tables A, B, E, F, and G; Sections 1.0 and 3.0.	When the back-up verification check of the atmosphere does not correlate within pre-established limits with the primary control method (carbon potential/dew point reading), 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 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 one or more of the following methods: • Carbon bar, slug, or surface carbon of part • Shim stock • 3-gas analyzer • Dew point • Hot wire resistance	All back-up checks are recorded on the data collection program and a maintenance work order will record the problem and the correction. The data collection program will show the correlation between the two readings. Daily PM's for dewpoint are required and logged and management continuously monitors the software to gage primary against the back up method.		x		
3.9	Are all ammonia lines equipped with a fail-safe method to prevent ammonia leaks into the furnace?	One of these fail-safe methods shall be used to prevent ammonia to leak into the furnace: • A quick disconnect or physical separation of the lines • Three-valve ammonia "fail-safe" vent system is permitted. See the definition "Three Valve Fail-Safe Vent" and diagram in the glossary. • 1 manual and 2 electrical magnetic valves in series The heat treater shall show evidence that ammonia lines were disconnected for non-ammonia bearing atmosphere processes.	All equipment with ammonia available have quick disconnects installed and used. The furnace log sheet will show the addition or removal of the line.		x		

Special Process: Heat Treat System Assessment							
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment			
				N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
3.10	Is there a minimum of 3 hour purge of the furnace atmosphere when switching from an ammonia bearing atmosphere to a non-ammonia bearing?	<p>Ammonia pick-up can be undesirable in parts and heat treat processes not specifying/requiring ammonia as an addition.</p> <p>The heat treater shall perform a minimum 3 hours purge prior to processing product not requiring ammonia as an addition. Reduction of 3 hours purge requires conclusive test data of the atmosphere to show no significant amount of residual ammonia is present in the furnace atmosphere.</p> <p>Log book, data logger, or other records shall document the actual purge time and that sufficient time has been allocated to remove ammonia from the furnace prior to processing parts in heat treat processes not specifying ammonia.</p>	<p>Procedure OI-008 instructs the operator to have the ammonia off for 4 hrs prior to running any neutral hardening work.</p> <p>Log sheet records when ammonia is shut off.</p>		x		
3.11	Do all atmosphere furnaces and generators have flow scopes or flow meters for all gases?	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 and generators have flow scopes for all gases.</p> <p>A PM is in place for inspection and servicing of flow scopes.</p>		x		
3.12	<p>Is there a rigorous fail-safe at the front of the furnace to prevent non-uniform loading of parts?</p> <p>In absence of a rigorous fail-safe, are all continuous belt furnaces equipped with sight glass inspection ports and infrared temperature pyrometers at discharge end of the hardening furnace?</p>	<p>In absence of a rigorous fail-safe at the front of the furnace to prevent non-uniform loading of parts (this includes the combustion system maintenance/adjustments to ensure proper efficiencies and physical limitation for part loading), then the heat treater shall have an infrared temperature pyrometer at the exit end.</p> <p>The infrared temperature pyrometers are required at the exit end of continuous belt furnaces to monitor for under temperature parts. The temperature alarm shall be within 28°C (50°F) of the furnace set point temperature. Results shall be strip charted or continuously data logged. Infrared temperature pyrometers shall be calibrated annually at a minimum and certified. All sight glasses shall be cleaned per the preventive maintenance schedule.</p>	<p>All process load requirements on the work order and verified on the log sheet.</p> <p>Daily LPA from management to audit loading and log sheets as well.</p>		x		

Special Process: Heat Treat System Assessment							
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment			
				N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
3.13	<p>Is salt chemistry in the austenitizing salt bath monitored?</p> <p>Note: This is applicable to salt bath heat treating processes listed in Process Tables A & B.</p>	<p>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.</p>	N/A	X			
3.14	<p>Is the quenching medium analyzed?</p>	<p>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. This does not include Process Table G & H.</p> <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. 	<p>All furnaces have the quenchant checked by an outside lab 4 times per year.</p> <p>PM and documentation are logged.</p>		X		

Special Process: Heat Treat System Assessment							
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment			
				N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
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			
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. <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.	The heat treater shall have a coil management system. Coil refers to the heating coil and the quench plenum. <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?	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.		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.		x			
3.20	Is there a procedure that addresses maintenance of the inductor and quench spray nozzle(s) (for example, quench ring, quench shower)?	Procedure shall include regular inspection and cleaning of the inductor and quench spray nozzle(s).		x			
3.21	Is there a procedure to purge the air pockets from the quench lines?	After downtime of the induction heating system, air pockets may form in the quench lines. These air pockets will cause interrupted quenching at start-up. The Heat treater shall establish the time limit (of the downtime) when this procedure is to be followed. [Example: The quench lines shall be purged after induction heating system is down greater than 4 hours.] Factors such as quench line diameter, length, geometry, etc. shall be considered.		x			

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
4.1	Are contract review, advance quality planning, FMEA, control plans, etc., performed by qualified individuals?	1.2 1.3 1.4 1.17	Customer Requirement	Incoming paperwork: P.O. with description from customer shipping department.	Paperwork kept physically and records kept electronically in ERP system.	Pass
4.2	Does the heat treat facility have the customer specifications for the part?	1.5	Customer Requirement	Stated on customer incoming paperwork.	Incoming paperwork attached.	Pass
4.3	Is a shop traveler created to meet customer requirements?	1.6 2.1	Internal Requirement	Work order is created in Shipping and Receiving.	Work order attached.	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	Internal Requirement	Product is identified by customer part and by the incoming paperwork to produce the work order and the Customer Supplied Product tag.	Customer Supplied Product tag is attached to the container and load markers are used in the furnace. Work order stays with the product.	Pass
4.5	Is there documented evidence of Receiving Inspection?	2.1	Internal Requirement	Order #3 is referenced on our Work Order 420070 and on the weight slip attached to the customer incoming paperwork.	ENT'D 10/24/2019 stamp on incoming paperwork.	Pass
4.6	Are the Loading / Racking requirements identified?	1.6 2.7 2.9	Internal Requirement	Work order 420070 lists hand load blast; all special requirements listed on work order.	Work order attached.	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	Solution, Age, Hand Load Blast	Work order 420070 lists both the process (BOM) steps and also the receipt at the bottom.	Work order attached.	Pass

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
4.8	What are the product inspection requirements?	2.15	BHN 75 MIN			Pass
4.8.1	Requirement: (1)		Surface Hardness	Work order 420070	Work order attached.	Pass
	Test Method:		BHN			Pass
	Test frequency or quantity:		3 pieces per basket	Only 1 piece checked; 3 required per basket.	420070	Fail
	Selection of samples:		Random			Pass
	Specification:		BHN 75 MIN			Pass
4.8.2	Requirement: (2)					
	Test Method:					
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					
4.8.3	Requirement: (3)					
	Test Method:					
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					
4.8.4	Requirement: (4)					
	Test Method:					
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
Operator or Inspector Responsibilities						
4.9	Were appropriate process steps signed off?	1.4 2.2 2.3 2.14	Internal Requirement	Work order 420070	Yes; work order attached.	Pass
4.10	Were all inspection steps, as documented in the control plan performed?	1.2 1.4	Internal Requirement	Work order 420070; only 1 piece checked instead of 3.	Yes; work order attached.	Fail
4.11	Were steps/operations performed that were not documented in the control plan?	1.2 1.4 1.6			No	Pass
4.12	If additional steps were performed, were they authorized?	1.2 1.4 1.6 1.11 1.17			N/A	N/A
4.13	Does the governing specification allow reprocessing or rework?	1.11		N/A	No	Pass
4.14	If the order was certified, did the certification accurately reflect the process performed?	2.14 2.15			N/A	N/A
4.15	Was the certification signed by an authorized individual?	1.17			N/A	N/A
4.16	Are the parts and containers free of inappropriate objects or contamination?	2.6 2.11		Visual inspection and random process audits.	Yes	Pass

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
Packaging Requirements						
4.17	Are packaging requirements identified?	2.9		Work order 420070	1 Crate	Pass
4.18	Are parts packaged to minimize mixed parts (for example, parts packed over height of container)?	2.9		N/A	Work order 420070	Pass
Shipping Requirements						
4.19	Were the parts properly identified?	2.3 2.9		Shipping/Receiving personnel compares shipper to work order after job is complete (prior to shipment).	Yes - Work order 420070 compared to shipper 260464	Pass
4.20	Were the containers properly labeled?	2.3 2.9	Internal Requirement	Incoming paperwork is weighed up and given an order on the weight receipt; that order # is transferred to the work order and the Customer Supplied Product tag on the crate.	Work order 420070 and CSP order #3.	Pass

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
4.1	Are contract review, advance quality planning, FMEA, control plans, etc., performed by qualified individuals?	1.2 1.3 1.4 1.17	Customer Requirement	Incoming paperwork: P.O. with description from customer shipping department.	Paperwork kept physically and records kept electronically in ERP system.	Pass
4.2	Does the heat treat facility have the customer specifications for the part?	1.5	Customer Requirement	Stated on customer prints: verified on incoming paperwork.	Print and incoming paperwork attached.	Pass
4.3	Is a shop traveler created to meet customer requirements?	1.6 2.1	Internal Requirement	Work order is created in Shipping and Receiving.	Work order attached.	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	Internal Requirement	Product is identified by customer part and by the incoming paperwork to produce the work order and the Customer Supplied Product tag.	Customer Supplied Product tag is attached to the container and load markers are used in the furnace. Work order stays with the product.	Pass
4.5	Is there documented evidence of Receiving Inspection?	2.1	Internal Requirement	Order #24 is referenced on our Work Order 419944 and on the weight slip attached to the customer incoming paperwork.	ENT'D 10/18/2019 stamp on incoming paperwork.	Pass
4.6	Are the Loading / Racking requirements identified?	1.6 2.7 2.9	Internal Requirement	Work order 419944 lists vertical; all special requirements listed on work order.	Work order attached.	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	Harden, Wash, Temper, Special Packaging	Work order 419944 lists both the process (BOM) steps and also the receipt at the bottom.	Work order attached.	Pass

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
4.8	What are the product inspection requirements?	2.15	HRC 30-35			Pass
4.8.1	Requirement: (1)		Surface Hardness as Quenched	Work order 419944	Work order attached.	Pass
	Test Method:		Rockwell C			Pass
	Test frequency or quantity:		First Load, Last Load, Every 4 hours for run continuous runs	2 pieces required and checked. (2 loads)	419944	Pass
	Selection of samples:		Random			Pass
	Specification:		HRC 30-35			Pass
4.8.2	Requirement: (2)		Surface Hardness after Temper	Work order 419944	Work order attached.	Pass
	Test Method:		Rockwell C			Pass
	Test frequency or quantity:		3 pieces per order	3 pieces required and checked.	419944	Pass
	Selection of samples:		Random			Pass
	Specification:		HRC 30-35			Pass
4.8.3	Requirement: (3)					
	Test Method:					
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					
4.8.4	Requirement: (4)					
	Test Method:					
	Test frequency or quantity:					
	Selection of samples:					
	Specification:					

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
Operator or Inspector Responsibilities						
4.9	Were appropriate process steps signed off?	1.4 2.2 2.3 2.14	Internal Requirement	Work order 419944	Yes; work order attached.	Pass
4.10	Were all inspection steps, as documented in the control plan performed?	1.2 1.4	Internal Requirement	Work order 419944; yes.	Yes; work order attached.	Pass
4.11	Were steps/operations performed that were not documented in the control plan?	1.2 1.4 1.6			No	Pass
4.12	If additional steps were performed, were they authorized?	1.2 1.4 1.6 1.11 1.17			N/A	N/A
4.13	Does the governing specification allow reprocessing or rework?	1.11		N/A	No	Pass
4.14	If the order was certified, did the certification accurately reflect the process performed?	2.14 2.15			N/A	N/A
4.15	Was the certification signed by an authorized individual?	1.17			N/A	N/A
4.16	Are the parts and containers free of inappropriate objects or contamination?	2.6 2.11		Visual inspection and random process audits.	Yes	Pass

Question #	Job Audit Question	Related HTSA Question #	Customer or Internal Requirement	Job (Shop) Order or Reference Documentation Requirement	Actual Condition (Objective Evidence)	Pass / Fail / N/A
Packaging Requirements						
4.17	Are packaging requirements identified?	2.9		Work order 419944	1 Drum	Pass
4.18	Are parts packaged to minimize mixed parts (for example, parts packed over height of container)?	2.9		N/A	Work order 419944	Pass
Shipping Requirements						
4.19	Were the parts properly identified?	2.3 2.9		Shipping/Receiving personnel compares shipper to work order after job is complete (prior to shipment).	Yes - Work order 419944 compared to shipper 260408	Pass
4.20	Were the containers properly labeled?	2.3 2.9	Internal Requirement	Incoming paperwork is weighed up and given an order on the weight receipt; that order # is transferred to the work order and the Customer Supplied Product tag on the crate.	Work order 419944 and CSP order #24.	Pass