

NAV 30 – FORGING PROCESS

FORGING PROCESS AUDIT CHECKLIST

Company: _____ **Supplier I.D.:** _____
Address: _____ **CAGE Code:** _____
City: _____ **Date:** _____
State, Zip: _____

Type of company ownership: _____

Business ownership/relationship with other organizations:

Company Personnel Contacted:

<u>Name</u>	<u>Title</u>	<u>Phone or e-mail</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Introduction:

A. Governing Specification

1. The material specifications for the items being forged contain the requirements for forging and sampling.
 - a. Most material specifications, both military and commercial, have only indirect requirements for the forging process. These include requirements for internal soundness, uniformity, grain size, and ability to be ultrasonically tested.
 - b. Very few material specifications have any requirements for percent reduction or forging temperature.
 - c. Sample location and orientation requirements are given in the material specification. Forging drawings depicting location of mechanical test samples is generally a customer requirement.
 - d. Military specifications often require the supplier to provide and maintain a comprehensive Process Control Procedure (PCP) proven by qualification / first article testing. The supplier and prime contractor representatives agree on the critical attributes during supplier qualification or first article and the supplier will usually retain the PCP at his facility to ensure consistent and repeatable results.
2. DFAR requirements limiting country of melt for the starting material apply.

B. Technical Concerns

1. The molten metal for the starting material for forgings can be cast into ingots or continuous cast into strands. The non homogeneous dendritic grains in the cast material normally have poor mechanical properties and may also contain voids or porosity. The cast ingot must be hot worked enough to break up the grain structure, close voids and, if annealed, effect complete re-crystallization.
2. Holding the material at too high a temperature or for too long will cause grain growth. This can adversely affect mechanical properties and limit ability of the ultrasonic waves to penetrate the forging.
3. Cooling rate and test specimen orientation with respect to the principal direction of metal flow can affect the mechanical test results. The intent is to have test specimen properties representative of the properties achieved during the production forging process.

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4. Improper thermal-mechanical processing can adversely affect corrosion resistance properties necessary for satisfactory service; corrosion resistance properties are rarely checked by specified lot acceptance tests.
5. Be aware that for commercial specifications some forging vendors take a very liberal view of what is considered a representative test specimen that has on occasion resulted in retesting or scrapping of parts because test specimen were not considered representative.

C. Known Process Problems

1. Insufficient hot working has resulted in forgings that could not pass Charpy V-notch impact tests.
2. Samples taken from areas of forgings that received more hot work or were cooled more rapidly than the remainder of the forging they represented had mechanical properties that satisfied specification minimum requirements. However, samples taken from other areas of the forging did not meet the specified requirements.
3. Forgings that had the direction of metal flow incorrectly oriented with respect to the way the forging was stressed have failed due to poor mechanical properties or leaks.
4. Forgings that did not receive enough hot working between heating cycles or were heated too high or for too long had large grains and could not be ultrasonically tested.
5. Test material was taken from incorrect locations or separate test coupons that did not represent the final forging in the amount of work, cross section, or heat treatment. This has occurred primarily with new vendors or with commercial specifications that do not require the vendor to provide a forging drawing.
6. Vendor used marking materials and forging lubricants that did not meet contract requirements for detrimental materials.
7. Deviations from customer approved product qualification or 1st Article test report.
8. Failure to obtain forging sketch and test specimen location approvals when required by contract.

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Item	Checklist Item			
Administrative information		Yes	No	N/A
1	Employee Information: 1) Is a degreed metallurgical engineer on staff? Name _____ 2) Number of employees: _____ 3) Number of Quality related personnel: _____ 4) Number of Process Engineering related personnel: _____	<input type="checkbox"/> 	<input type="checkbox"/> 	<input type="checkbox"/>
2	How are product requirements expressed and conveyed by customers to this facility?			
3	Briefly describe the Contract Review and Order Entry process. Procedure #			
4	Describe types of parts forged (physical description of size & configuration, material types & alloys) at this facility.			
5	Describe the application of the parts forged at this facility, if known.			
6	Do your customers supply military products?			
7	What specification requirements does the quality system meet at this facility? Quality System: <input type="checkbox"/> MIL-I-45208 <input type="checkbox"/> ISO 9001-2008 <input type="checkbox"/> Other: _____ Calibration System: <input type="checkbox"/> ISO 10012 <input type="checkbox"/> ANSI Z540 <input type="checkbox"/> MIL-STD-45662			
8	Has this facility and operation been audited by a third party for compliance with the stated quality system requirements and process control requirements: If yes, provide auditing party's name and date of audit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Are customer contract requirements flowed down into shop work instructions after order entry? 1) Who is responsible? a) Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Administrative information		Yes	No	N/A
10	Is a particular melt type (EAF, VAR, ESR, VIM, etc) and grade of material used to make forgings? 1) How is type and grade determined?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Melt source for the forging ingots/billets/bars: 1) Are specification requirements and effective revision communicated and controlled in the purchase order to sub-tier suppliers? a) Procedure # 2) Are material reduction and reduction ratios addressed in material purchase orders? 3) If a sub-tier melter is used, is performance by that sub-tier evaluated (receiving inspection results, on-site audit, mail-in survey, positive material inspection, alloy identity verification, source inspection, etc.)? 4) Are all applicable customer requirements (e.g., DFAR requirements) passed down in purchase orders to sub-tier suppliers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Item	Checklist Item			
Receiving Inspection		Yes	No	N/A
12	Receiving inspection of ingots / billets / bars:			
	1) Who performs the receiving inspection? a) Procedure #			
	2) Are inspections for physical markings, heat identification, visual and dimensional inspection performed? a) Sample objective evidence for prior receipts:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Is the chemistry of the starting material verified (alloy verification test, independent testing, MTR review, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Is this verification to ensure compliance with the specification requirements documented? Verify objective evidence. a) Who performs the verification? b) What actions are taken when defects are found?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Is the ingot / billet / bar (including “drops” and “cutoffs”) identification and traceability maintained during storage?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	If an ingot is to be cropped top and/or bottom, is a sufficient amount of metal removed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1) How is this verified?			

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Item	Checklist Item			
	Forging Process	Yes	No	N/A
15	Amount of reduction:			
	1) Who determines amount of ingot reduction to be performed during forging operation?			
	2) What factors are considered?			
	3) Is a calculation performed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Are the starting material condition, size, and reduction considered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	5) Is there a process procedure for determining the amount of reduction? a) Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Forging work instructions and procedures:			
	1) Paper traveler or on-line computer?			
	2) Who is responsible for preparing and approving forging instructions?			
	3) Is the issue of starting material for production controlled (heat, size, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Is weight and starting material size controlled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Is forging press or hammer size controlled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Forging Procedure #				
17	Work station review:			
	1) Are the instructions available at workstations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Do the instructions reference processing steps?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Do the instructions control identification traceability?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Review a sampling of in-process or completed work instructions. Does the information appear sufficient and correct? Check for operator signatures and dates. a) Sampled Work Instructions:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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	5) Are corrections or revisions to work instructions controlled by procedure and correctly documented? (Line out, initialed and dated by an authorized person.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Correction to document Procedure #			
18	Operation description: 1) Explain the actual hammer or press steps (approximate number of blows or strokes) in the forging (reduction) process being reviewed?			
	2) Is the percent reduction controlled for each step?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Is a minimum reduction required by the customer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Is the minimum reduction that is required measured and ensured? How?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Is it necessary to control the primary working direction (grain flow) of the final product? If yes, how?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	6) Is there heat conditioning (re-heating) between forging cycles? If Yes, How is temperature controlled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Maintain identification traceability: 1) Is the original mill traceability identification maintained during the forging operation on the traveler or on the work piece?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is the forging unique identification physically applied to provide traceability to the modified mechanical properties?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) How is the physical identification marking applied and who verifies proper marking?			
20	Surface Preparation: 1) Is the forged surface cleaned (de-scaled) and prepared for heat treatment or further processing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is there a procedure? a) Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Is shot blast used? a) If so, what type of medium is used? If steel shot is used, how is iron contamination of nonferrous forgings prevented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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	Forging Process	Yes	No	N/A
	4) Is it recycled, and is the same shot blast used on all alloys?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) If shot blast is not used, how are forgings cleaned after removal from the die or hammer?			
	6) Is pickling or other cleaning method used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	7) Is the physical forging identification marking verified after surface treatment, if applicable? a) Who verifies proper marking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Process Control: 1) Is there an observer or QC over check at the forging operation? a) Describe function and authority:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Are internal audits performed to verify procedure compliance? Verify by reviewing sample records. i) Sample records reviewed:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c) How are deviations handled?			
22	Method to obtain mechanical test specimen:			
	1) Is a forging drawing required for location of test specimen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) If so, is approval by the customer necessary and obtained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Verify the test samples conform to the forging drawing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Is a production forging or prolongation used to obtain test specimen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Is the sample location & orientation correct per the specification, forging drawing, or customer requirement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	6) Is a separate specimen forged specifically for mechanical testing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Same heat of material?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Same process steps as forging, as closely as possible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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	c) Same size (cross section) as forging?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	d) Representative of forging?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	7) Is the number of samples controlled (tensile tests, elevated tensile, charpy, hardness, grain size, micro cleanliness, corrosion, etc.) as required by specification?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	8) Is identification and traceability of test samples controlled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	9) Is the method for obtaining mechanical test specimen representative of the hammer operation(s) or press operation(s)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Forging furnace evaluation	Yes	No	N/A
23	1) Is the heating equipment satisfactory for the forging operation? a) Number of furnaces: _____ b) Size of furnaces: _____ c) Fuel & atmosphere: _____ d) Temperature ranges: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is the condition of the furnaces satisfactory for the operation being performed? a) Bottom, Burners, Seals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	1) Is heating controlled for the forging operation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Are there written instructions and /or procedures? a) Work Instruction/Procedure #:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Are heating rates, temperatures, hold times, and tolerances specified and controlled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Are the instructions readily available to the forging crew? a) Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Are the operators familiar with the instructions and procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	6) Are records maintained as objective evidence for process completion? Check dates and signatures of process instructions/records.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	7) Is a heat log or chart maintained to demonstrate compliance with specified requirements? a) Who reviews the log or chart?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	8) Is there an observer or QC over check of the process and documentation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	9) Are deviations identified and segregated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	10) Is identification maintained, including identification of material in the oven (location layout/map within the oven) if necessary?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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	Forging furnace evaluation	Yes	No	N/A
25	1) Do procedures specify limitations on heating cycles during forging operations (number of cycles and temperature)? a) What are the heating cycles?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is there a working temperature range for the work piece? a) How is the temperature range controlled, and what is the Objective Quality Evidence?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Are precautions in place to avoid coarse grains (temperature too high)? a) Describe:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	Instrumentation and controls for forging furnaces:			
	1) Are thermocouples used? a) If Yes, number and location:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Are controllers and recording instruments used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Is a calibration program in place with NIST traceable standards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Are instrumentation and gauging within calibration period?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Are calibration procedures and records available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	1) What is the allowed temperature deviation from set point? (± _____ degrees)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Item	Checklist Item			
	Forging heat treat evaluation	Yes	No	N/A
28	1) If heat treat is required, is it performed:			
	a) Internally (In-House)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Externally (Out-Sourced)? If Out-Sourced, identify outsource:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Do the heat treat parameters and operation meet specification or customer requirements for at least the following:			
	a) Atmosphere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Temperature, hold time, and tolerances	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c) Type of quench	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	d) Maximum furnace to quench time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	e) Furnace controls (surveys, thermocouples, calibration, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	f) Map identifying location of forgings within the furnace, if necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Instrumentation and control of heat treat furnaces:			
	1) Are thermocouples used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) If Yes, Number and Location:			
	2) Are controllers and recording instruments used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Is a calibration program in place with NIST traceable standards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Are recording and sensing instruments within calibration period?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Is temperature uniformity survey performed on the heat treat furnaces?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	6) What is the allowed temperature deviation from set point? (± _____ degrees)			
	7) Are deviations from set point addressed / evaluated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	8) Is there a procedure for performing surveys?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Procedure #:			
	9) Is a frequency of surveys specified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	10) Is the survey reviewed and approved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Who reviews the survey?			
30	Heat treat process and furnace controls:			

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Item	Checklist Item			
	Forging heat treat evaluation	Yes	No	N/A
	1) Are written instructions available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Are heating rates, temperatures, hold times, and tolerances specified and controlled? a) What is the objective quality evidence?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Are the procedures readily available to the heat treat crew? a) Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Are the operators familiar with the procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Are specification and customer required records maintained as evidence for process description and completion?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	Heat Treat Control:			
	1) Is there an observer or QC over check of the process and documentation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Are deviations addressed / evaluated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Is identification maintained, including identification of material in the furnace (location layout/map within the oven)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	1) Is it necessary to uniquely re-identify the forgings and test specimen to provide traceability to the final heat treated condition for mechanical properties verification? Can each forging be traced back to a particular heat treat furnace load?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is the unique heat treat physical identification marking applied?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Is the unique identification marking verified? If yes, who verifies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Item	Checklist Item			
	Final testing and inspection	Yes	No	N/A
33	Mechanical testing and disposition of the test specimen:			
	1) If performed in-house:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Are procedures or work instructions available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Are lab technicians trained and qualified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c) Is mechanical test equipment calibrated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) If out-sourced:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Does the forging supplier adequately describe in the purchase order the required testing and documentation required (material specification, customer requirements, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Does the forging supplier exercise controls for selecting and maintaining the test lab provider (audits, source inspections, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c) Are the testing facility/personnel qualified for the required testing (NADCAP, A2LA, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Does the forging organization verify that all testing results meet specification and customer requirements? Method of verification?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Is the verifying analyst trained and capable?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Are capabilities and the test result dispositions audited and/or validated periodically?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Is there a procedure for evaluating acceptability of test results? i) Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c) Does the procedure prevent release of material until mechanical test reports are approved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	d) Is the mechanical test specimen retained? For how long?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	1) Are certified material test reports generated for the mechanical properties?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Does a review of certified material test reports indicate they meet the specification and/or customer requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	1) Are the heat treated forgings cleaned?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is there a procedure? Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Item	Checklist Item			
	Final testing and inspection	Yes	No	N/A
	3) Is shot blast used? a) If so, what type of medium is used? If steel shot is used, how is iron contamination of nonferrous forgings prevented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Is it recycled, and is the same shot blast used on all alloys?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) If shot blast is not used, how are forgings cleaned after final heat treatment?			
	a) Is this covered in a procedure? Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Is the physical identification marking verified after surface cleaning / conditioning? Who verifies proper marking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	1) Are there NDT requirements for forgings?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is there evidence that they have been satisfied and are acceptable?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a) Specification?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Procedure approval?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c) Properly completed test report?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	d) Inspector/Operator qualification?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	Control of weld repairs:			
	1) Are weld repairs on forgings performed in-house?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) If not who performs the welding?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Are the correct weld procedures identified in work instructions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4) Are customer approved weld procedures required and available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5) Is filler material certified and controlled in storage, at issue, and during use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	6) If weld repairs are not allowed, how is this enforced?			
38	1) Is a final inspection/review performed to verify the forging conforms to the customer contract requirements prior to shipment? a) What items are included in the review? b) Who prepares the required documentation? c) Who is authorized to sign test reports?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Item	Checklist Item			
Other Item Areas of Interest		Yes	No	N/A
39	1) Is a preventive maintenance program documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2) Is there a documented training program to assure personnel are adequately trained in their assigned tasks prior to performing the task? a) Procedure #	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3) Are there controls to prevent contact with detrimental elements such as:			
	a) Marking materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b) Forging lubricants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	c) Other potentially detrimental materials that may come in contact with the forgings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><u>Additional comments and overall assessment:</u></p> 				
<p><u>Evaluation results:</u> Satisfactory: <input type="checkbox"/> Unsatisfactory: <input type="checkbox"/></p>				
<p>If required, Request for Corrective Action (SCAR#):</p>				
Lead Auditor's signature: _____		Date: _____		
Lead Auditor's Printed Name: _____		Phone #: _____		
Auditor's Signature: _____		Date: _____		
Auditor's Printed Name _____				
Auditor's Signature: _____		Date: _____		
Auditor's Printed Name _____				
Auditor's Signature: _____		Date: _____		
Auditor's Printed Name _____				
Auditor's Signature: _____		Date: _____		
Auditor's Printed Name _____				