

Title Control of Critical Components		Book Identification SQRM		Number Control SQR 5.0	
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1.0 Control of Critical Components

- 1.1 All critical components require qualification by KAC.
 - 1.1.1 The requirements of this document shall be enforced whenever KSD 0408 is referenced on the KAC drawing, Purchase Order, and/or Vendor Instruction.
 - 1.1.2 **Following initial KAC qualification, the supplier shall not change manufacturing method, sequence, or site location of a qualified item without KAC approval.**
 - 1.1.3 Table 1 lists examples of typical processes and process elements, which may require control. Final decisions relative to the assignment as a controlled process rests with KAC. Any question concerning whether a process requires this control shall be referred to KAC Purchasing.
- 1.2 The supplier shall define a system for controlling processes and process changes and it shall address:
 - a. Responsibility and methods for identifying controlled processes,
 - b. The method used to obtain KAC approval of process data including manufacturing sequence,
 - c. Coordinating internal approval of process change (controlled and non-controlled), and
 - d. Methods to assure changes are not introduced in the manufacturing cycle without formal approval.
- 1.2.1 The supplier shall maintain records of original KAC approval of process data and approval of changes to controlled processes. Process changes not identified as controlled must be documented for the supplier's record, but do not require KAC approval.
- 1.2.2 The supplier shall prepare and maintain routing sheets for the step-by-step sequence of all processes used in producing the component.
- 1.2.3 The supplier shall select controlled processes using Table 1 as a guide, and identify these on the routing sheets.
 - 1.2.3.1 If only certain portions of such a process are considered controlled, they may be identified instead of the entire operation.
- 1.2.4 The supplier shall identify any processes deemed proprietary and obtain agreement from KAC prior to manufacture.
- 1.3 The supplier shall submit to KAC Purchasing:

- a. Routing sheets with controlled operations identified, and
- b. Process sheets for each operation identified as controlled and a completed Controlled Process List (K922). A copy of this form can be found at the end of this document.

1.3.1 KAC acceptance of the proposed processing or any requirements for additional data or changes shall be relayed to the supplier via the K922.

1.3.2 The KAC Vendor Instruction shall define any specific laboratory analyses required from the supplier or the need for submitting lab samples. Any lab samples shall be processed to the established routing and processing defined and approved in paragraphs 1.3 and 1.3.1. Samples may be taken from a nonconforming part as long as the non-conformances do not alter results, and KAC has agreed.

1.4 The supplier shall complete and document a first article inspection including every characteristic listed on the KAC drawing in accordance with section 9.0 of this manual.

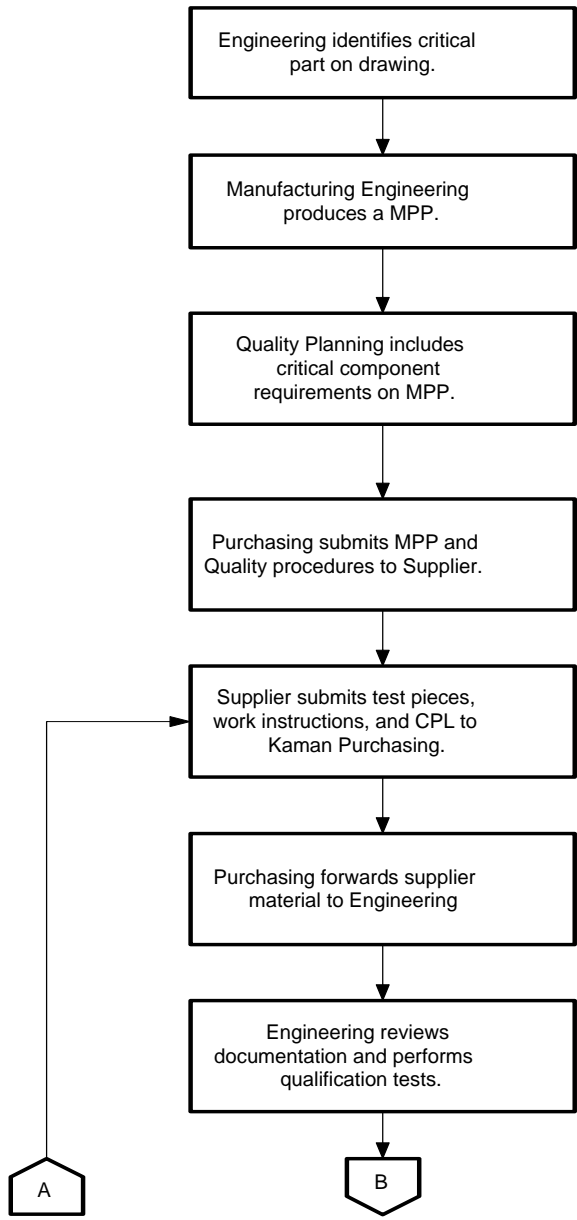
1.5 The supplier shall obtain KAC approval, via KAC Purchasing, of any subsequent change in controlled process sequence, controlled processes, or supplier of controlled processes. A Controlled Process Change Request (K927) shall be submitted to KAC before introducing any of the above. A copy of this form can be found at the end of this document. When submitting process change requests, the supplier shall identify the old and new processing method in sufficient detail to permit evaluation of the proposed change.

1.5.1 KAC shall determine the acceptability of the proposed changes and notify the supplier of this decision on the K927. A copy of the approved change must be filed with the processing data discussed in paragraph 1.2.

1.6 The supplier is permitted to incorporate changes in processes and sub-tier suppliers, if said processes are not designated as controlled. The supplier is required to maintain documentation as specified in paragraph 1.2.

2.0 Records

2.1 Controlled Process Approval System Flow and List of Critical Processes



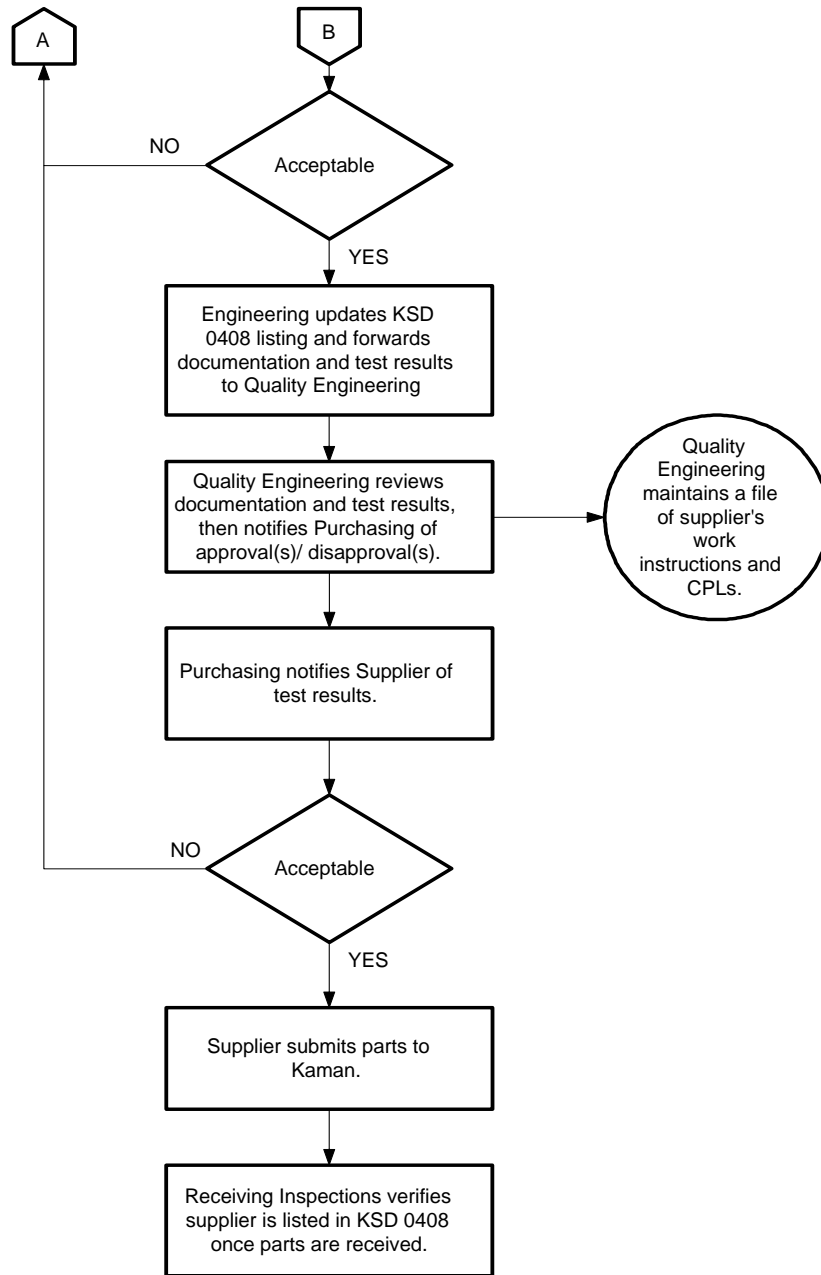


TABLE I

TYPICAL CONTROLLED PROCESS CHECKLIST

I. CHEMICAL CLEANING PROCESSES

- a. Degreasing compounds used.
- b. Cleaning and/or etching compound used.
- c. Cleaning and/or etching compound controls (i.e.; storage, contamination, temperature used, cycle time used).

- d. Method of neutralizing after chemical cleaning.
- e. Cleaning sequence used.
- f. Pre or post cleaning preparation.

II. MECHANICAL CLEANING PROCESSES USING ENERGIZED MEDIA (VAPOR BLAST, DRY GRIT BLAST, TUMBLING AND ALLIED PROCESSES)

- a. Cleaning media used (type: AL₂O₃, Sand, Shot, etc.).
- b. Sizes of cleaning media used.
- c. Method of applying energy to media (i.e.; air pressure, mechanical, etc.).
- d. Liquid vehicle used (water, additives, etc.).
- e. Cleaning sequence and operating parameters used.
- f. Pre- or post-cleaning preparation.

III. WELDING PROCESSES

- a. Geometry of weld joint.
- b. Preparation of weld joint including cleaning.
- c. Control and type of coverage and backup atmosphere used.
- d. Weld sequence and schedules used.
- e. Type of method of welding used.
- f. Type and control of filler material used (size, form, chemistry, cleaning).
- g. Speed and/or ram pressure used (inertia welding).
- h. Control of vacuum used (EB welding).

IV. BRAZING PROCESSES

- a. Surface preparation used (cleaning, etching, etc.).
- b. Fit up and/or joint geometry.
- c. Location of and form of alloy used.
- d. Flux media used.
- e. Brazing temperature and time cycle used.
- f. Furnace temperature and control of atmosphere used (vacuum, etc.).
- g. Brazing sequence used.
- h. Flux removal process used.
- i. Stop-off system used including compounds and their control.
- j. Prebrazing furnace control and preparation.

V. SOLDERING PROCESSES

- a. Joint preparation used (tinning, dip, etc.).
- b. Fit up or joint geometry.
- c. Flux media and system used.
- d. Soldering method used (dip, resistance, etc.).
- e. Pre and post preparation and cleaning.

- f. Soldering alloy used.

VI. CASTING PROCESSES

- a. Melting practice used.
- b. Mold or investment constituents used (wax, sand, etc.).
- c. Number and position of parts per mold.
- d. Pouring temperatures used.
- e. Mold cooling techniques used.
- f. Gating and riser locations used.
- g. Casting method used (permanent mold, sand mold, centrifugal, etc.).
- h. Mold temperature and control used.
- i. Melting or casting atmosphere used (vacuum, inert gas, etc.).
- j. Number and location of chill bars used.
- k. Source and kind of raw material used.
- l. Post casting treatment used (chemical, mechanical, etc.).

VII. FORGING PROCESSES

- a. Forging temperature used.
- b. Number of and temperature of reheats used during forging.
- c. Number of strikes or amount of reduction per strike and reheats.
- d. Total percentage of reduction during the forging process.
- e. Type of forging die used.
- f. Forging method used (drop forge, pressure forge, ring rolling, etc.).
- g. Cropping method used.
- h. Billet size or shape used.
- i. Source and/or process of ingot to billet conversion process used.
- j. Die insulation and/or lubricant used.
- k. Canning or block down process used.
- l. Post forging treatment process used.
- m. Forging press rate.

VIII. HEAT TREATMENT AND SURFACE HARDENING PROCESSES

- a. Preheat treat cleaning process used.
- b. Preheat treat coating used.
- c. Furnace preparation, atmosphere and control used.
- d. Furnace temperature and/or time cycles used.
- e. Heat treat sequence used.
- f. Cooling cycles and/or cooling rates used.
- g. Quenching media and control used.

h. Use and control of subzero stabilization processes.

IX. METAL ELECTROPLATING PROCESSES

- a. Plating parameters and control (voltage, current, agitation rate, etc.).
- b. Solution makeup and control limits.
- c. Pre and post plating processes (heating, chemical cleaning, etc.).
- d. Use and evaluation of test specimens.
- e. Stripping and re-plating procedures.
- f. Anode and fixture control.

X. PROTECTIVE FINISHING PROCESSES

- a. The application and control of:
 - 1. Hot Dip Coatings
 - 2. Metal Spraying
 - 3. Oxide Coating
 - 4. Phosphate Coating
 - 5. Paints, Varnishes, Lacquers, Enamels
 - 6. Rust Inhibitors
 - 7. Ceramic Coatings
 - 8. Silicates
 - 9. Epoxies
 - 10. Plastics
- b. Pre and post part treatment processes.
- c. Coating testing procedures.
- d. The control and thermal processes when used.
- e. Stripping and recording processes.

XI. METAL FORMING PROCESSES (including Thread Rolling)

- a. Die control.
- b. Pre, in-process, or post heat treatment controls.
- c. Process sequence.
- d. Die lubricant used and control.

XII. STRESS FREE GRINDING PROCEDURES

- a. Speeds and feed used.
- b. Type of abrasive used.
- c. Type and control of coolant used.

XIII. TOOLING

- a. Use of low melting point (high volatile) material where impurities could remain on high nickel alloys.

- b. Equipment which could affect part properties such as dies, winding machines, etc.
- c. Temporary tooling which could affect chemical, electrical, physical or mechanical properties of the material.

XIV. PEENING PROCESSES

- a. Type and size of media used.
- b. Type of equipment used.
- c. Control of peening parameters (pressure, nozzle size, etc.).
- d. Almen strip placement for intensity control.

XV. ELECTROCHEMICAL MACHINING PROCESSES (CAVITY SINKING, DRILLING, GRINDING, ETC.)

- a. Electrolyte and Electrode
 - 1. Type and control of electrolyte used.
 - 2. Type of electrode used.
- b. Operation
 - 1. Feed and speed rates used.
 - 2. Operating voltage limits and controls.
 - 3. Sequence of operations.
 - 4. Operating pressure of electrolyte.
 - 5. Electrolyte operating temperature limits.
 - 6. Sludge build up rate and limits.

XVI. ELECTRO-DISCHARGE MACHINING (EDM)

- a. Dielectric Fluid and Electrode
 - 1. Type of dielectric fluid used.
 - 2. Type of electrode used.
- b. Operation
 - 1. Type of feed rate used (vibrating, rotating, pulsing, etc.).
 - 2. Voltage, frequency, polarity, wave shape, spark duration, and related parameters used.
 - 3. Sludge build up rate and limits.
 - 4. Control of dielectric fluid (temperature, contamination, etc.).

XVII. ELECTRO-STREAM DRILLING (ESD)

- a. Electrolyte
 - 1. Type of and control of electrolyte used.
- b. Operation
 - 1. Feed rate used.
 - 2. Operating voltage and control parameters used.
 - 3. Tool design and/or nozzle diameter used.

4. Sequence of operations.
5. Electrolyte operating temperatures and pressure used.

XVIII. LASER DRILLING

- a. Maximum charge voltage or beam output energy.
- b. Number of pulses per hole.
- c. Internal packing material.
- d. Anti-splatter coating material.

XIX. PROCESS/OPERATION SEQUENCE

- a. Process/operation sequence which, if changed or adjusted, could result in a change in the part physical, chemical, electrical or mechanical properties.

XX. COMPOSITE CONSTRUCTION PROCESSES

- a. Bonding Adhesives
 1. Type of adhesive used.
 2. Adhesive application method used.
 3. Form of adhesive used.
 4. Source of adhesive supply.
 5. Type of adhesive primer used.
 6. Acceptance and requalification requirements.
 7. Storage control of adhesive (self life, storage temperature, etc.).
- b. Bonding - Cleaning
 1. Cleaning solution type, strength, time and temperature control.
 2. Pre and post cleaning part controls.
- c. Bonding - Processing
 1. Bond times, temperatures, pressure and atmosphere controls.
 2. Bond facility and controls (clean room, etc.).
 3. Part handling controls.
- d. Bonding - Tooling
 1. Tool configuration and control.
 2. Tool qualification and requalification.

XXI. ELECTRICAL COMPONENT PROCESSES

- a. Coil winding
- b. Molding
- c. Potting
- d. Swaging
- e. Crimping and staking
- f. Curing
- g. Water-proofing

h. Insulating

i. Slicing

XXII. COLD WORKING (BENDING, STRAIGHTENING, TWEAKING, HAMMERING, ETC.) after:

a. Final heat treatment

b. Shot peening

c. Brazing

d. Welding

e. Plating

f. Coating

XXIII. MANUFACTURING USING ELECTRONIC DIGITAL DATA.

a. Complete procedural flow.

b. Procedure approval.

c. Software security measures.

d. Approved manufacturing plans.

e. Approved inspection plans.

APPROVAL:

Robin Ledger

Manager, Supplier Quality – Signature on file with Quality Administration

K927 – Controlled Process Change Request

For instructions and copy of form, please contact your buyer or Kaman Supplier Quality.

CONTROLLED PROCESS CHANGE REQUEST		
Vendor:	_____	Date: _____
Vendor Address:	_____	
Part No:	_____	Part Name: _____
<input type="checkbox"/> Process Source Change?		
<input type="checkbox"/> Process Sequence Change?		
<input type="checkbox"/> Process Site Location Change?		
<input type="checkbox"/> Process Method Change?		
Present Controlled Process		
_____ _____ _____		
Proposed Revision to Controlled Process		
_____ _____ _____		
Engineering	Quality	Purchasing