
TITLE

Supplier Sampling Requirements

WARNING

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1. PURPOSE AND SCOPE

This document defines requirements for supplier sampling and/or distributor inspection of selected characteristics permitted by this procedure for product, material or services supplied to a Member company.

2. APPLICATION

- 2.1 Supplier quality requirements defined in this document are agreed upon by and applicable to the following UTC Aerospace Business Entities (also known as Members):

| | |
|------------------------|-----|
| Hamilton Sundstrand | HS |
| Pratt & Whitney | PW |
| Pratt & Whitney Canada | PWC |
| Sikorsky Aircraft | SAC |

Note: *These identifiers include all Original Equipment Manufacturing (OEM) and Aftermarket Operations (AO).*

- 2.2 This specification applies to suppliers and their subcontractors who furnish product, material or services (as a manufacturer or maintenance provider) to any of the above members as a contract requirement regardless of supplier's industry, regulatory accreditation, or certification status.

3. DEFINITIONS

- 3.1 **Acceptable Quality Level (AQL):** The maximum percent defective for a vendor process that a consumer would consider to be acceptable as a process average. Usually the fraction defective at which the probability of accepting a lot is 95 percent. The AQL specifies the required sample size and an acceptance number of zero is required for samples selected from the lot.
- 3.2 **Airfoils For PWC & PW:** Airfoils on integral bladed rotors, centrifugal impellers, blades and vanes.
- 3.3 **Ball Bearing Critical Characteristics For PW:** Internal radial clearance, axial

play, contact angle (angular contact bearings only), inner bore diameter, outer ring outer diameter, diametral cage clearance on land riding surface, end flushness, cross corner, and step height of split inner rings (where required).

- 3.4 Bearing Balls For PW:** A spherical rolling element used as a component of a ball bearing assembly.
- 3.5 Case Hardness:** The surface of a part after a treatment (i.e., carburizing, nitriding and induction brazing).
- 3.6 Characteristic:** A property that helps to differentiate between items of a given sample or population. The differentiation may be either quantitative (by variables) or qualitative (by attributes).
- 3.7 Continuous Process:** A homogeneous process in which the product flows into the inspection station in essentially the order of manufacture and accumulation of identifiable lots may be impossible.
- 3.8 Core Hardness:** The core is the portion under the case, which is not affected by the treatment. This is the hardness of the material before the treatment, lower than the case hardness. Core hardness requirements are specified when case hardness is also a requirement.
- 3.9 Critical Part For PWC:** A selected item whose Supplementary Product Data (SPD) sheet or Supplementary Material Data (SMD) is identified with the words "Critical Part", or "Critical Rotating Part" (Reference [ASQR-09.1](#)). A Critical Part can also be an Engine Structural Integrity Program (ENSIP) Critical Part. In this case, the drawing will be identified with the words "Critical Rotating Part" or "Critical Part" and "ENSIP Critical Part" and the SPD or SMD sheet will be identified "ENSIP & Critical Part"
- 3.10 Critical Characteristic:** A characteristic that if nonconforming could cause an unsafe condition in the end product. (Reference [ASQR-09.1](#)).
- 3.11 Critical Characteristic KPC1 for PW:** A part, assembly or process feature that can lead to one of the following three adverse consequences if it is not produced within prescribed limits:
- Uncontained, High Energy events
 - Non-recoverable operability events
 - Un-commanded Engine shutdown for single engine application
- 3.12 Defects Per Million (DPM):** A metric that equals total characteristics nonconforming divided by total characteristics inspected times a million.

- 3.13 Electro-Discharge Metal Removal (EDMR) for PW:** A process by which metal is removed by discharging electrical energy between the tool (electrode) and the part. Both the part and the electrode are submerged in an electrically non-conducting dielectric fluid and connected to a DC power supply.
- 3.14 Engine Structural Integrity Part (ENSIP) Critical Part for PWC:** A selected item whose drawing is identified with the words "ENSIP Critical Part" and the SPD or SMD sheet is identified with the words "ENSIP Part" (Reference ASQR-09.1). An ENSIP Critical Part can also be a Critical Part. In this case, the item's drawing will be identified with the words "ENSIP Critical Part" & "Critical Rotating Part" or "Critical Part" and the SPD or SMD sheet will be identified with the words "ENSIP & Critical Part".
- 3.15 Formation:** The procedure of collecting, segregating or delineating production units into homogenous identifiable groups according to type, grade, class, size, composition or condition of manufacture.
- 3.16 Hardening:** Increasing hardness by suitable treatment, usually involving heating and cooling. When applicable, the following more specific terms should be used such as, annealing, precipitation heat treat or stress relief.
- 3.17 Hardness:** Resistance of material to plastic deformation or indentation, usually measured by an indentation test, such as, Rockwell, Brinell or Vickers.
- 3.18 Homogeneous Lot:** A group of parts manufactured at approximately the same time that are expected to share similar quality levels for selected characteristics. These parts should come from one production run.
- 3.19 Inspection by Attributes:** Inspection whereby either the product or product characteristics are classified as conforming or nonconforming, or the number of nonconformances in the unit of product is counted, with respect to a given measurement.
- 3.20 Inspection by Variables:** Inspection wherein certain quality characteristics of samples are evaluated with respect to a continuous scale and expressed as precise points along this scale. Variable inspection records the degree of conformance or nonconformance of the unit to specified requirements.
- 3.21 Level Zero:** Applies to Continuous Sampling Plan tables only and is the initial level required before sampling inspection may begin.
- 3.22 Lot or Batch:** A collection of units of product bearing identification and treated as a unique entity from which a sample is to be drawn and inspected to determine conformance with the acceptability criteria.
- 3.23 Lot Diameter Variation:** The difference between the average diameters of the largest and smallest balls in a finished batched lot.

- 3.24 Major Characteristic:** A characteristic that if nonconforming could jeopardize the usability, proper assembly or manufacturability of the unit of product. If not within the prescribed acceptance limits, it is most likely to result in functional problems which can impair performance, where unsafe conditions for persons are unlikely.
- 3.25 Major Characteristic KPC2 for PW:** A part, assembly or process feature that can lead to durability deterioration if it is not produced within prescribed limits.
- 3.26 Major Rotating Parts For PW:** Turbine and compressor hubs, shafts, disks, free turbine couplings and turbine disk side plates (full rings) that have a heat code and suffix number.
- 3.27 Minor Characteristic:** Comprise all characteristics not designated as critical or major. Minor characteristics are important for general product quality, but if nonconforming, are unlikely to result in significant impairment of performance.
- 3.28 Mold:** The body containing the cavity in which castings, composites and laminated parts are formed.
- 3.29 Mold Control:** Features of the mold that are inspected to verify acceptance of the part.
- 3.30 Part:** Any item, detail or assembly, etc., which is defined by an engineering drawing or specification.
- 3.31 Prime Reliable Parts For PW:** Disks, Rotors, Hubs, Integral Bladed Rotors (IBR), Major Rotating Seals and Spacers. Airfoil portions on IBRs may be sample inspected (reference Table B).
- 3.32 Product of the Mold:** Parts produced from the mold that are inspected to accept the part.
- 3.33 Process:** The combination of people, material, machines, tools, environment, measuring & test equipment, and work instructions necessary to produce a product or service.
- 3.34 Ra:** Arithmetic average deviation from the measured profile.
- 3.35 Roller Bearing Critical Characteristics For PW & PWC:** Internal radial clearance, roller end clearance, roller corner radius runout (mainshaft bearings only), roller end runout (mainshaft bearings only), diametral cage clearance on land riding surface, ring out of roundness for preload (where required), inner bore diameter, and outer ring outer diameter.
- 3.36 Sample:** One or more units of product drawn from a lot or batch. The units of the sample shall be selected at random, without regard to their quality.
- 3.37 Sampling Plan:** A statement of the sample size or sizes to be used and the associated acceptance and rejection criteria.
- 3.38 Set-Up:** To put in proper machining or measuring position. For the purpose of

this procedure the term “set-up” is defined as the installation of the die and details thereof in proper position on the machine in preparation for producing part characteristics. This check requires 100% of all tool or part inspection features, as applicable.

- 3.39 Shearography:** Laser based interferometric which images surface strain displacements.
- 3.40 Single Ball Diameter Variation:** The difference between the largest and the smallest single diameters of one ball.
- 3.41 SPC Characteristics:** A characteristic generally selected for in-process data collection and control using SPC tools.
- 3.42 Special Process:** Certain processes that may affect the structural or functional integrity of parts or assemblies and where the results of these processes may not be fully verified by subsequent inspection are designated as special processes.
- 3.43 Statistical Process Control (SPC):** The condition describing a process in which variation is controlled and monitored using the appropriate control charts.
- 3.44 Total Tolerance:** The total tolerance indicated on the engineering drawing for both unilateral and bilateral tolerances.

4. REQUIREMENTS

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4.1 General Requirements for Use of Sampling Plans

- 4.1.1 Acceptance sampling is a method to reduce cost of inspection while ensuring an acceptable quality level. Acceptance sampling can only be used as a means of ensuring conformance to requirements, not for quality improvement.
- 4.1.2 Sampling requirements contained in this document shall not be construed as permitting defective parts to be sold to a Member. It is expected that all purchased parts be 100% conforming to all requirements of the Purchase Order, Engineering Drawing and/or product definition requirements.

- 4.1.3** Product acceptance inspection must be 100% for all characteristics, unless characteristics classified per paragraph 4.2 and sampling plans specified per paragraph 4.3 are used, or an alternate sampling plan is approved per paragraph 4.5.
- 4.1.3.1** The use of Operator Certification (OpCert) or other special manufacturing methodologies (e.g., manufacturing controlling features, die/mold control and method of manufacturing, etc.) approved by [ASQR-01](#) and/or an applicable Member per paragraph 4.5 of this document may supersede the sampling plans herein.
- 4.1.3.2** For Rocket Engine hardware, the use of sampling and periodic inspections must be approved by the appropriate Quality Program Manager(s). In the case of the Space Shuttle Main Engine Alternate Turbopump (SSME-AT) Program, customer's approval is also required.
- 4.1.3.3** Sampling and periodic inspection is not allowed for SSME-AT Critical Items List (CIL) characteristics as defined in PWA-SP 306.
- 4.1.3.4** For overhaul and repair facilities the use of sampling and periodic inspection must be approved by the applicable Member prior to implementation.
- 4.1.6** The supplier must maintain records of sampling usage per [ASQR-01](#). Documentation shall be available and subject to review by each Member.
- 4.1.7** Inspection personnel must be trained in the application of sampling methods.
- 4.1.8** All plans must have a "zero acceptance" number. The lot shall be rejected if a nonconformance is discovered in the sample. If a nonconformance is found in the sample, inspect all pieces in the lot for the nonconformance that had been noted and remove all nonconforming pieces from the lot.
- 4.1.9** Sampling inspection is not permitted for characteristics affected by repair and rework Material Review Board (MRB) dispositions.
- 4.1.10** Sample must be randomly selected and representative of the population. No additions or exchanges may be made to the original sample.
- 4.1.11** The lot must be homogeneous and produced under essentially the same conditions and at the same time. If not, the items shall be segregated and treated as a separate lot.
- 4.1.12** Sampling requirements contained in this document shall not be construed as permitting defective parts to be sold and/or delivered to Members.
- 4.1.13** Critical characteristics as defined herein must be inspected 100%, unless otherwise specified per paragraph 4.2.2.
- 4.1.14** Sampling inspection as defined herein is for detail or final product acceptance.
- 4.1.15** Sampling inspection by an operator is not allowed for the OpCert program












(reference [ASQR-01](#)) unless approved by applicable Member's Quality Group, per paragraph 4.5.

- 4.1.16** For lots known to contain nonconformances during the production process, the nonconforming pieces shall be segregated.
- 4.1.16.1** Characteristics known to be nonconforming shall be inspected 100%. The remaining characteristics shall be inspected per the appropriate sampling plan for that characteristic.
- 4.1.16.2** If parts are identified as nonconforming, but the nonconforming characteristics are not identified, the parts shall be inspected 100%.
- 4.1.17** When a Member detects a nonconformance not reported by the supplier or a Member's audit determines incorrect application of sampling, previous and/or subsequent lots shall be inspected as specified by the applicable Member
- 4.1.18** An acceptable First Article Inspection (FAI) per [ASQR-01](#) is required before sampling inspection may be applied.
- 4.1.19** To qualify to use a .65% or 2.5% AQL sampling plan, a minimum of 25 consecutive pieces are required to be inspected and no nonconformances detected. (reference paragraphs 4.2.4 & 4.3.1.1).
- 4.1.20** To qualify for continuous and variable sampling inspection plans refer to paragraphs 4.3.2 and 4.3.3 respectively.



4.2 Classification of Characteristics

- 4.2.1** Characteristics are classified by Members and suppliers as Critical, Major, or Minor characteristics.
- 4.2.2** For Member designed product, the characteristic identification method for each Member is defined in [Table A](#). For characteristics not identified in [Table A](#), use tables specified per paragraph 4.2.4.
- 4.2.3** For supplier designed product, characteristics classified by the supplier (reference paragraph 4.2.1) must be treated as follows:
 - a. Critical Characteristics require 100% inspection
 - b. Major characteristics require a .65% AQL
 - c. Minor characteristics require a 2.5% AQL
- 4.2.3.1** When requested, suppliers shall submit characteristic classification to appropriate Member for approval.
- 4.2.3.2** The supplier must use the Tables in paragraph 4.2.4 when determining sampling inspection criteria and characteristic classification.

- 4.2.3.3** The supplier must also classify interface characteristics specified as critical or major using the characteristic identification methods of paragraph 4.2.2. The supplier must use the tables in paragraph 4.2.4 when determining sampling inspection criteria and characteristic classification for interface characteristics.
- 4.2.3.4** For suppliers with full design and MRB authority, alternate C=0 sampling plans (reference Figure 1) (e.g., Boeing D1-8007) may be applied with applicable Member's Quality Group approval per paragraph 4.5.

| Table A - Member Designed Product Characteristic Identification | | | |
|---|---|---|--|
| | Critical | Major | Minor |
| HS | (a)  Black Star ★    |   | All other characteristics not critical or major or not listed in para 4.2.4  |
| PW |  Or ⊕ adjacent to blueprint feature, or "CLC" per QAD or Fracture Critical Part Characteristics or "<C> for SSME" |  Or ⊖ adjacent to blueprint feature and also see para 4.2.4 | Characteristics specified this Table, Item D and all other characteristics not critical or major or not listed in para. 4.2.4 |
| PWC |  Or characteristic per para. 4.2.2 Table A, Item C, I and para. 4.2.4 and all interface characteristics |  Or classify per para. 4.2.4 | |
| SAC | Black Five Pointed Star ★ per para. 4.2.2 Table A, Item B below adjacent to blueprint feature | Dimensional Total Tolerances less than or equal to .020 inches; see para. 4.2.4 | All other characteristics not critical or major or not listed in para. 4.2.4 |

Note: Symbols in this Table are shown on Member's engineering drawings and/or specifications.

- A. For HS, a (★) is used for flight safety characteristics per HS-15000. Applicable Purchase Order, Drawings, and Specifications identify HS Flight Safety Parts. The  symbol is used for characteristics designated as Vital. A  designates a production critical characteristic. These characteristics are also inspected 100%.
- B. For Sikorsky, a (★) is used for production drawings. Critical Characteristics for the out of production S-61 models including the U.S. Navy H-3 Series are listed on Form SA-5193.
- C. For PW and PWC, 100% inspection is required for all characteristics on Critical Rotating Parts, Major Rotating Parts, Prime Reliable Parts, KPC1 and other critical characteristics except as noted in D, E, F, G and H below. Also 100% inspection is required on selected critical Ball and Roller Bearing Characteristics (reference the Definitions Section herein).
- D. Raw material characteristics including those on Critical Rotating Parts and Major Rotating Parts and Prime Reliable Parts that will be further processes or formed require a 2.5% AQL.
- E. Centrifugal Impeller Airfoil sections and Prime Reliable Integral Bladed Rotor Airfoil sections may be sample inspected upon meeting the qualification requirements as specified per Table B for IBR and centrifugal impeller requirements.
- F. Major Rotating Parts and Prime Reliable Parts Element Inspection of broached slots, threads, splines and edges of broached slots (radii) may be sample inspected by qualified inspection personnel when approved by applicable Members' Quality Group per para. 4.5.
- G. For PW KPC1 and other critical characteristics that are produced by product of the die (e.g., investment castings, etc.), impractical to measure, (e.g., radii inspection etc.), or when destructive testing may be required, an alternate inspection plan may be applied when approved by applicable Member's Quality Group per paragraph 4.5.
- H. For PWC, dimensions with a total tolerance over .001 (.025mm) sampling is allowed, except for KPC1 and characteristics identified as critical.
- I. For PWC 100% inspection is required for critical characteristics of an ENSIP Critical Part. No sampling is permitted. ENSIP Critical Part characteristics are identified on the drawing as ENSIP critical locations (ECL). All characteristics within the ECL are critical unless otherwise specified. Additional Non Destructive Testing (NDT) is required for ENSIP critical parts. NDT for ENSIP critical parts is identified on the SPD sheet or on the SMD sheet. No NDT sampling is permitted.

4.2.4 Characteristic Requirements for Sampling Determinations – The following tables contain characteristic requirements when identified on the engineering drawing or related product definition documents and must be used in conjunction with paragraphs 4.2.2 & 4.2.3 for sampling determinations. To qualify to use .65% or 2.5% AQL plans, a minimum of 25 consecutive pieces are required to be inspected for characteristics being produced with no nonconformances detected (reference paragraph 4.3.1.1) unless otherwise specified in the following tables (reference Table B through Table Y).

| Table B - Mechanical Requirements | Inspection Level or AQL |
|--|--|
| Dim. Total Tolerance Range less than or equal to .004 inches <i>Note: For SAC, see Table A for total tolerance requirement</i> | .65% |
| Radii less than .010 inches Total Tolerance Range | .65% |
| Angle Total Tolerance Range less than or equal to 1 degree | .65% |
| Surface Finish Waviness | .65% |
| Surface Finish Roughness (Ra) less than or equal to 20 micro inches | .65% |
| Flatness Carbon Face Seals using optical flats | 100% |
| Threaded parts: <ul style="list-style-type: none"> Internal Profile Pre-load Locking Straight screw threads - total tolerance on pitch diameter AN & MS parts or MH electrical connectors All other thread applications/characteristics | .65% .65% 2.5% .65% |
| Splines (all characteristics) | .65% |
| Gears (all characteristics) | .65% |
| Dimensions with only maximum or minimum values which directly control material thickness of weldments, castings or forgings and at least one surface is machined. | 100% |
| Absence of magnetism | .65% |
| Spring Rate | .65% |
| Balancing | 100% |
| Cored passages requiring mass airflow testing | 100% |
| PW Turbine blade minimum wall thickness <i>Note: A .65% AQL sampling plan may be applied for Turbine Blade minimum wall thickness when approved by applicable Member's Quality Group per paragraph 4.5 when process controls are in place and quality history shows 4600 consecutive pieces were processed (part number specific) and no nonconformances were detected.</i> | 100% |
| Ball Check For brazed & welded tube assemblies | 100% |
| Dimensional characteristics for Integral bladed rotors and Centrifugal Impellers require 100% inspection except for major and minor characteristics for airfoil sections as specified below: <ul style="list-style-type: none"> To qualify for the following sampling plan, a minimum of two (2) integral bladed rotors or two (2) centrifugal impellers, as applicable, are required to be inspected for all blade airfoil sections with no nonconformances detected. When qualified, centrifugal impellers and Integral Bladed Rotors Airfoil Sections may be inspected as follows: <ul style="list-style-type: none"> Inspect a minimum of 2 blades for each part at approximately 0 and 180 degrees. Inspect 50% of the sections on the first blade and the balance of the remaining sections on the other blade. | 100% 100% 2 Blades per Part. Direction is provided in the table to the left |

| | |
|---|--|
| <ul style="list-style-type: none"> ○ If a nonconformance is detected, inspect part 100% for that characteristic(s) ○ If the same nonconformance is detected on two (2) consecutive parts, requalify as described above. | |
| <p>PW Bearing Balls - Finished Batch Lot - Metal Balls (Steel Only)</p> <ul style="list-style-type: none"> ● Single ball diameter variation less than .25 inches (diameter ball): minimum sample size of 32 balls is required per finished batch lot. ● Single ball diameter variation greater than or equal to .25 inches (diameter ball): minimum sample size of 25 balls is required per finished batch lot. ● Lot diameter variation less than .25 inches (diameter ball): minimum sample size of 32 balls is required per finished batch lot. ● Lot diameter variation greater than or equal to .25 inches (diameter ball): minimum sample size of 25 balls is required per finished batch lot. ● Surface Finish lot size not to exceed 2500: minimum sample size of 5 balls per lot is required per finished batch lot. ● Surface Finish lot size greater than 2500 but not to exceed 10,000: minimum sample size of 10 balls per lot is required per finished batch lot. | <p>← (Refer to bulleted items)</p> |

4.2.4.1 Visual Inspection – shall be performed after all manufacturing operations have been completed and must be performed on all parts in the lot (see examples below).

Note: Reference applicable PO for specific visual inspection instructions (e.g., visual standards, prior to packaging requirements, etc.).

| Table C – Visual Inspection Requirements | Inspection Level or AQL |
|--|-------------------------|
| Part marking (including serialization) and acceptance symbols | 100% |
| Completeness of assembly | 100% |
| Damage | 100% |
| Existence of similar physical features | 100% |
| Orientation and alignment | 100% |
| Number of bearing rollers/balls | 100% |
| Inspection of locking installations | 100% |
| Welds or Brazes | 100% |
| Presence of sealants and lubricants | 100% |
| Presence of protective end caps (tubes, hoses, electrical connectors) | 100% |
| Plating, Coating, Surface Treatment and Protective Finishes | 100% |
| Fuel holes and oil holes/passages | 100% |
| Cleanliness | 100% |
| Corrosion | 100% |
| Adhesive bond | 100% |
| Evidence of staking | 100% |
| Contamination and freedom of debris in internal passages | 100% |
| Coolant passages for blades, vanes and disks | 100% |
| Radii | 100% |
| Surface Finish Cosmetic Appearance (e.g. scratches, fingerprints, uniform color, etc.) | 100% |

| Table D - Functional Test Inspection | Inspection Level or AQL |
|--------------------------------------|-------------------------|
|--------------------------------------|-------------------------|

| | |
|--|------|
| Flow | 100% |
| Pressure/leak | 100% |
| Vacuum | 100% |
| Electrical | 100% |
| Seal Face Load check (P&W Specification DCS-3) | 100% |

4.2.4.2 When specified on the drawing or PO, suppliers must use only sources approved by the specific member company to perform these special processes (each special process supplier must obtain initial approval from each specific member company). Use of approved sources does not relieve the supplier or subcontractor performing the special process of the responsibility for ensuring conformance to requirements. Examples include: surface treatment (e.g., black oxide, phosphate, anodizing, DOW 17, etc.), plating (e.g., cadmium, chromium, nickel, etc.), shot peening, plasma spray, bonding, titanium processing, and welding.

| Table E - Special Processes (Other than NDT) | Inspection Level or AQL |
|--|-------------------------|
| All special process characteristics | .65% |
| <i>Note: For hardness requirement, see Table P</i> | |

4.2.4.3 ***Nondestructive Testing (NDT) Inspection*** – Sampling shall not be used when the intent of the NDT is to look for isolated type nonconformances.
Note: *Sampling may be applied to each separate exposure for radiographic inspection.*

| Table F - Radiographic Inspection | Inspection Level or AQL |
|---|-------------------------|
| Turbine Blades and Vanes | 100% |
| Raw Material (Casting) Turbine Blade Root Areas Note: <i>A .65% AQL sampling plan may be applied for Raw Material (Casting) Turbine Blade Root Areas when approved by applicable Member's Quality Group per paragraph 4.5 when process controls are in place and quality history shows 4600 consecutive pieces were processed (part number specific) and no nonconformances were detected.</i> | .65% |
| PW Raw Material (Casting) Turbine Blades and Vanes – Neutron Radiographic Standard (NRS-1) Note: <i>To qualify for a .65% AQL Sampling Plan for Raw Material (Casting) Turbine Blades and Vanes - Neutron Radiographic Standard (NRS-1), a minimum of 500 consecutive pieces are required to be inspected with no nonconformances reported and authorized for Engineering Source Approval per PWA 370 and PW Form 4692. If a significant process change is documented per PWA 370 and PW Form 4692, requalification is required unless otherwise specified.</i> | .65% |

| | |
|---|------|
| Brazed Joints: | |
| • On transfer pipes and other tubes which carry fuel, oil, or hydraulic fluid | 100% |
| • All other brazed joints | 2.5% |



| | |
|---|------|
| Resistance Welding | 2.5% |
| Fusion Welded Joints: (100% unless otherwise specified below) | 100% |
| • Classes A & B | 100% |
| • Classes C & D 100% visual inspection required only | 100% |
| • that are accessible on both sides and also require MPI or FPI of the weld joint | 2.5% |
| Casting Grades: | |
| • A, B, C and D that are specified Class 1 per AMS - STD 2175, otherwise; | 100% |
| • Grade A area | .65% |
| • Grades B, C and D areas | 2.5% |
| Wall Thickness: | |
| • Turbine blades | 100% |
| • Compressor blades | .65% |
| • Turbine and Compressor Vane Rings and Segments | 2.5% |
| Electron Beam (E.B.) Welds: | |
| • Class 1 | 100% |
| • Classes 2 & 3 | 2.5% |
| Core cleanliness for castings | 100% |
| All other Radiographic Inspection | 100% |

| Table G - Magnetic Particle Inspection (MPI) or Fluorescent Penetrant Inspection (FPI) | Inspection Level or AQL |
|---|--------------------------------|
| Turbine Blades and Vanes | 100% |
| Fusion Welded Joints | 100% |
| Steel Compressor Vanes | .65% |
| Brazed Valve Seats and Silver Brazed Joints | 100% |
| Turbine Vane baffles | .65% |
| Threaded fasteners not requiring alloy type test | .65% |
| All other MPI or FPI Inspection | 100% |

| Table H - Etch Inspection | Inspection Level or AQL |
|--|--------------------------------|
| Surface Temper, Gears/Splines | 100% |
| Surface Temper on Mainshaft Balls | 100% |
| Surface Temper on accessory components including bearings anti-friction and electron beam (E.B.) welds class 3 | 2.5% |
| Blue Etch Anodize | 100% |
| All other Etch Inspection | 100% |

| Table I - Ultrasonic Inspection | Inspection Level or AQL |
|---|-------------------------|
| Minimum Wall Thickness of turbine blades Note: For PW a .65% AQL Sampling Plan may be applied when the requirements of paragraph 4.4.5 are met. | 100% |
| Minimum Wall Thickness of compressor blades | .65% |
| Minimum Wall Thickness of turbine and compressor vanes | 2.5% |
| When ultrasonic inspection is used to replace mechanical inspection for PW part numbers other than specified above the following shall apply: <ul style="list-style-type: none"> • Minimum or maximum requirement • Dimensional Total Tolerances less than or equal to .004 • Dimensional Total Tolerances .0041 and up | 2.5% .65% 2.5% |
| All other Ultrasonic Inspection | 100% |

| Table J - Eddy Current Inspection | Inspection Level or AQL |
|-----------------------------------|-------------------------|
| ECM Code 4 Method PC | 100% |
| All other Eddy Current Inspection | 100% |

| Table K - Salt Residue Inspection | Inspection Level or AQL |
|-----------------------------------|-------------------------|
| Salt brazed joints | 100% |

| Table L - Holography Inspection | Inspection Level or AQL |
|---------------------------------|-------------------------|
| Holography Inspection | 100% |

| Table M - Shearography Inspection | Inspection Level or AQL |
|-----------------------------------|-------------------------|
| Shearography Inspection | .65% |

| Table N - Alloy Type Test | Inspection Level or AQL |
|---------------------------|-------------------------|
| Alloy Type Test | 100% |

| Table O – PW Thickness Determination Method TDM-10 | Inspection Level or AQL |
|--|-------------------------|
| Verify the presence of coating | 100% |

| Table P - Hardness Requirements | Inspection Level or AQL |
|---|-------------------------|
| Case hardness requirements of Ra 79 -85 or Ra 81 - 85 | .65% |
| All other case hardness requirements | 100% |
| Core hardness requirements when case hardness is also a requirement | See paragraph 4.2.4.4 |
| Parts where hardness is a requirement (i.e., annealing, precipitation heat treat or stress relief) and all parts have been thermally treated in unit batches | See paragraph 4.2.4.4 |
| <p>Note: For hardness requirements of high volume hardware (i.e., nuts, bolts, shims, washers, small miscellaneous parts) when size/configuration of parts does not permit nondestructive hardness testing, or when hardness indentation (mark) is not allowed per engineering drawing resulting in a scrap part, use the destructive test sampling requirements per paragraph 4.3.4</p> <p>Note: For PWC, a hardness test to a part is considered a destructive test except when an indentation mark on the part is permitted per its drawing or removed by subsequent processing. See section 4.3.4 for additional information.</p> | |

4.2.4.4 When hardness sampling is applicable, convert hardness requirement into equivalent Rb or Rc reading (reference P&W Specification HIM-1 for Rockwell Conversion Chart Numbers). Assign one of the following sampling plans or 100% based on the minimum hardness requirement and the tolerance as specified in Table Q below.

| Table Q - Tolerance (HARDNESS UNITS) | | | | |
|--------------------------------------|-------------------------|------------|------------|------------|
| Minimum Requirements | 2.9 or Less | 3.0 to 4.0 | 4.1 to 9.9 | 10 or more |
| | Inspection Level or AQL | | | |
| 100Rb or less | .65% | .65% | 2.5% | 2.5% |
| Rc15 - 27.9 | 2.5% | 2.5% | 2.5% | 2.5% |
| Rc28 - 43.9 | .65% | .65% | 2.5% | 2.5% |
| Rc44 - 47.9 | .65% | .65% | .65% | 2.5% |
| Rc48 - 62.9 | 100% | .65% | .65% | .65% |
| Rc63 & Up | 100% | 100% | .65% | .65% |

4.2.4.5 For maximum or minimum requirements only (with no range), assign the applicable AQL per Table R below. All other parts thermally treated (including stress relief) without evidence of processing in unit batches requires 100% inspection.

| Table R - Tolerance (HARDNESS UNITS) | | |
|--------------------------------------|--------------|--------------|
| Requirement | Minimum Only | Maximum Only |
| | AQL | |
| Up to Rc43.9 | 2.5% | 2.5% |
| Rc44 & Greater | .65% | 2.5% |

4.3 Approved Sampling Plans

4.3.1 Attribute (i.e., Go/No-Go, Good/Bad Evaluations) Sampling Plans:

4.3.1.1 To qualify for attribute sampling plans per Figure 1 or ANSI/ASQC Z1.4 attribute sampling plan, 25 consecutive pieces are to be inspected for the characteristic being produced with no nonconformances detected. Historical data (i.e., in-process or final inspection record of 25 consecutive conforming pieces) may be used to meet this requirement or objective evidence that meets the requirements of industry standard ANSI/ASQC Z1.4 relating to AQL and process average. The process average should be less than or equal to AQL.

4.3.1.2 The C=0 sampling plans (Figure 1) should be applied to characteristics as follows:

- a. **Critical:** 100% Inspection shall be assigned unless otherwise specified in paragraph 4.2.2 Table A
Major: .65% AQL Level shall be assigned unless otherwise specified per Figure 1
Minor: 2.5% AQL Level shall be assigned
- b. TNR (Tightened, Normal, Reduced) characteristics switching rule chart, see Figure 2. AQL levels for tightened and reduced inspection shall be one level above and below .65% AQL for major characteristics and 2.5% for minor characteristics, respectively.
- c. Sampling inspection shall begin at Normal. However, Tightened and Reduced levels of inspection are optional (See Figure 2).

When sampling inspection begins at Normal inspection and Tightened level of inspection is skipped, it is required to switch to 100% inspection if two or more of the last 5 consecutive lots contained nonconformances as shown per Figure 2.

4.3.1.3 ANSI/ASQC Z 1.4 is an approved alternate to the C=0 sampling plan when it includes the requirements as specified per Table S below:

| Table S - ANSI Z1.4 Single Sample | | |
|-----------------------------------|-----------------|--------------------------|
| Characteristic | AQL | General Inspection Level |
| Critical | 100% Inspection | Not Applicable (N/A) |
| Major | .65% | II |
| Minor | 2.5% | II |

1. All plans must have a zero accept number.
2. Switching rules for tightened and reduced levels apply as required by the sampling plan.

4.3.1.4 Identical Characteristic (IC) Application:

1. ICs are characteristics which appear more than once on a single part and are uniformly manufactured to the same engineering drawing requirements for that operation (i.e., holes, slots, rivets). ICs do not apply to geometric characteristics such as parallelism, squareness, concentricity or true position.
2. ICs may be combined for purposes of computing lot and sample size. Combining shall not apply to operator dependent characteristics (i.e., welded joints, hand drilled holes).
3. For ICs, combined lot size is the number of times the characteristic appears on one part, multiplied by the number of parts in the original lot. The sample size shall be the sample size required for the combined lot.
4. IC sample size shall be applied to the master sample (largest sample size required for inspection of a lot).

| If... | Then... |
|---|---|
| Sample size is less than the master sample | Inspect one random location per part until sample size is satisfied |
| Sample size is greater than the master sample | Inspect at least one random location on all parts in the master sample and additional locations randomly distributed amongst the master sample, as necessary, to satisfy the required sample size |

4.3.2 Continuous Sampling Plans:

- 4.3.2.1 The following single or multiple continuous attribute sampling plans shall be used only when items are manufactured by a continuous process. Any nonconformance or significant interruption in the process (i.e., set-up change, electrical shutdown) shall require reverting to 100% inspection to requalify for sampling. The number of consecutive pieces required is specified per Level Zero in the following table before sampling can be applied.
- 4.3.2.2 Continuous sampling is applied when accepting product one unit at a time. All continuous plans include one or more 100% phases until some sequence of units is inspected without any nonconformance or nonconformities being found. When not on 100% inspection, a fraction of the units are sampled and inspected. The continual flow of individual items of product must not have any known source of variation or quality risk other than those operating on the first and last units of the production run.

| Table T - Single Continuous Attribute Sampling Plan | | | | | | |
|---|------------|------|-----|------|------|-----|
| Classification | LEVEL | f | i | OR | f | i |
| Critical | 100% | N/A | N/A | | N/A | N/A |
| Major | Level Zero | 100% | 114 | | 100% | 161 |
| | Level 1 | 1/3 | - | | 1/10 | - |
| Minor | Level Zero | 100% | 32 | 100% | 75 | |
| | Level 1 | 1/3 | - | 1/10 | - | |

f = sample frequency
i = consecutive items required to proceed to next sample level. If a nonconformance is found, return to Level Zero (reference definitions section)

Example:

- For major characteristics upon completion of 114 pieces at Level Zero, proceed to $\frac{1}{3}$ Level 1 category
- For minor characteristics upon completion of 32 pieces at Level Zero, proceed to $\frac{1}{3}$ Level 1 category

| Table U - Multiple Continuous Attribute Sampling Plan | | | | |
|---|-------|-----|-------|----|
| LEVEL | MAJOR | | MINOR | |
| | f | i | f | i |
| 0 | 100 % | 269 | 100 % | 43 |
| 1 | 1/3 | 269 | 1/3 | 43 |
| 2 | 1/9 | 269 | 1/9 | 43 |
| 3 | 1/27 | 269 | 1/27 | 43 |
| 4 | 1/81 | -- | 1/81 | -- |

f = sample frequency
i = consecutive items required to proceed to next sample level. If a nonconformance is found, return to Level Zero (reference definitions section)

Example:

- For major characteristics upon completion of 269 pieces at Level Zero, proceed to $\frac{1}{3}$ Level 1 category. Upon completion of the next 269 conforming pieces out of a total of 807 pieces produced, proceed to the 1 in 9 level.
- For minor characteristics upon completion of 43 pieces at Level Zero, proceed to $\frac{1}{3}$ Level 1 category. Upon completion of the next 43 conforming pieces out of a total of 129 pieces produced, proceed to the 1 in 9 level.

4.3.3 Variable Sampling Plans:

4.3.3.1 Variable plans are used to inspect a single characteristic by measuring it on a continuous numerical scale. The distribution of measurements provides more information than could be obtained if the same size sample were subject to attribute inspection.

4.3.3.2 Variable sampling is applicable only when the normality of the distribution is ensured. A minimum sample size of fifty (50) pieces is required for normality test (ref. ANSI/ASQC Z1.9 Normality Assumption) to initially qualify for this plan. ANSI/ASQC Z1.9 is an approved variable sampling plan document.

| Table V - ANSI Z1.9 Single Sample | | |
|-----------------------------------|-----------------|--------------------------|
| Characteristic | AQL | General Inspection Level |
| Critical | 100% Inspection | Not Applicable (N/A) |
| Major | .65% | II |
| Minor | 2.5% | II |

4.3.4 Destructive Sampling Plans – Destructive Sampling plans should be used only when there is no other practicable method of verifying the conformance of a quality characteristic.

| Table W - Destructive Sample | |
|------------------------------|--|
| Lot Size | Sample Size |
| 1-100 | 1 |
| 101-500 | 2 |
| 501-2500 | 3 |
| 2501 and up | Divide into 3 subgroups and select 3 from each subgroup (lot accept/reject based on results from all 3 groups) |

Note: In special cases (i.e., small lots or expensive pieces) use a test piece(s) representative of the actual parts.

4.4 Sampling and Periodic Inspection Plans Requiring Member Approval

4.4.1 Statistical Process Control (SPC) Sampling Plans:

4.4.1.1 When Process Certification is in place and meets the requirements of paragraph 4.4.1.2 and 4.4.1.3, a five (5) piece product acceptance sampling will be permitted in lieu of a .65% AQL or 2.5% AQL sampling plan for major and minor characteristics, respectively.

1. This five (5) piece sampling plan is not applicable for critical characteristics.
2. The sampling plan specifies a random sample of 5 pieces per lot to verify the average and process variation. The average of the 5 pieces selected must be within 50% of engineering drawing tolerance and all 5 pieces must be within the engineering drawing tolerance.
3. The plan may progress to a 1 in 5 skip lot level after 10 consecutive acceptable lots with no nonconformances detected.

4.4.1.2 SPC Sampling can be assigned when the [UTCQR-09.1](#), *Process Certification Requirements*, are in place and applicable process has been certified to a minimum Cpk of 1.33 as required per [UTCQR-09.1](#) and SPC sampling product acceptance methodology is approved by applicable Member’s Quality Group per paragraph 4.5.

- 4.4.1.3** The SPC product acceptance methodology shall include the following:
1. To qualify to use the 5 piece sampling plan at final inspection, a minimum of 25 consecutive pieces for applicable process controlled characteristics are required to be inspected with no nonconformances detected.
 2. Select a random sample of five (5) pieces per lot. The average or median piece of the five (5) pieces selected must be within 50% percent of the engineering drawing tolerance and all 5 pieces must be within the engineering drawing tolerance. Lot size shall not exceed 2500 pieces.
 3. If a nonconformance is detected when using the five (5) piece sampling plan, inspect the lot 100% for that nonconforming characteristic and requalify as described above in paragraph 1.
 4. When inspection is notified that the process goes out-of-control or the Cpk falls below 1.33, or when nonconformances are detected, then the characteristics must be 100% inspected or be 100% control charted until statistical control and a Cpk of 1.33 are reestablished per [UTCQR-09.1](#).
 5. The work instruction shall include a reference to a process control system that is in place at the supplier.

4.4.2 *Periodic Inspection Plans:*

- 4.4.2.1** Periodic inspection plans are those plans that permit true position requirements of holes, lugs, and slots (not dimensional features) to be accepted when these characteristics are produced on controlled tooling that have demonstrated high levels of accuracy, repeatability, and minimal chance of operator error, and first piece and subsequent periodic inspections are acceptable.
- 4.4.2.2** Periodic inspection plans require approval by an authorized Member's supplier quality representative for initial application and reinstatement of periodic inspection or by submittal to the applicable Member's Quality group per paragraph 4.5.1 if a supplier quality representative is not available. This approval is based upon meeting the requirements of paragraphs 4.4.2.3 thru 4.4.2.6.
- 4.4.2.3** Periodic inspection may be used when documentation is available to provide evidence that part-to-part variation for a drawing requirement is consistently controlled by the manufacturing method utilizing dies, fixtures, jigs or numerically controlled machines.
- 4.4.2.4** Characteristics for periodic inspection must demonstrate a Cpk of 1.33 or greater for variable data based on a statistical study of the first 25 consecutively produced pieces, or an equivalent DPM level (63 DPM) for attribute data, be in a state of statistical process control and have a documented plan that ensures the required Cpk or DPM level is maintained.
For PW product where the characteristic is not targeted at nominal as a result of the process set-up, a Cp of 1.33 or greater within Engineering Drawing tolerance is allowed with approval of the supplier quality representative.

- 4.4.2.5** Periodic checks shall be documented and results monitored by the supplier's personnel. Periodic inspection plans may not be applied to characteristics identified as critical.
- 4.4.2.6** Periodic inspection procedures shall include the following:
- a. A qualification check for initial control of new, altered or repaired tooling.
 - b. A set-up check of first part and any subsequent parts manufactured until an accept is received on each new tape, computer program, or new set-up of a fixture, die, or jig on the machine.
 - c. A periodic inspection of parts after an acceptable set-up check at a frequency not to exceed one in one hundred pieces.
 - d. In all cases, the maximum calendar interval between periodic checks shall not exceed three months.
 - e. A provision to ensure timely adjustment, repair or replacement of the die, fixture, jig or numerical control media before a nonconformance occurs (e.g., process control charts or an acceptance criteria that the measured characteristic must be within 75% of tolerance).
 - f. A requirement concerning the reinspection of previously produced articles and inspection of subsequently produced articles when a nonconformance is found. In addition, the periodic plan shall be suspended and replaced by applicable attribute sample plans outlined in this specification until effective corrective action is demonstrated and, when applicable, reinstatement to periodic inspection is approved by the Member's quality representative.
- 4.4.3 *PW Mold Control Periodic Inspection Plans:***
- 4.4.3.1** Mold Control periodic inspection plans may be applied when the supplier's procedure contains the requirements specified in paragraphs 4.4.3.2 through 4.4.3.4 and is approved by the applicable Member's Quality Group per paragraph 4.5.
- 4.4.3.2** After careful study of the manufacturing process to confirm that the process is accurate and repeatable with minimal chance of operator error, determine what parts and characteristics are to be placed under mold control, and the frequency of periodic checks. Factors that should be considered and included in the supplier's procedure and/or manufacturing operation sheets are:
- Type of material being molded
 - Tolerances
 - Tools used in the process
- 4.4.3.3** Mold control shall not be applied to characteristics identified as critical per the engineering drawing.

- 4.4.3.4** Where a mold operation is dependent on an operator function (such as properly closing a mold prior to a cure operation), provide for inspection of one or more part characteristics by gaging methods to ensure that dimensions affected by operator functions are maintained.
- 4.4.3.5** When mold control periodic inspection plan is used, ensure the method of inspection and the manufacturing operation sheet contains a requirement for a first piece check, when applicable. The manufacturing operation sheet shall also include the elements below:
- Identify as "Mold Control"
 - Identify as "First piece check is required"
 - Operation number where mold is used
 - Frequency of periodic check
 - Characteristics that are mold controlled
 - List of mold(s) to be controlled by tool number
 - A sequence to verify an acceptable check for first piece, set-up or periodic inspection
- 4.4.3.6** *Qualification Requirements for Product of the Mold:* Inspect the first five consecutive pieces (minimum for each product of the mold). Parts shall be inspected until all characteristics produced by the mold are found acceptable at which time production may begin. This check is repeated only when the mold is altered, repaired or replaced by a new mold.
- 4.4.3.7** *Qualification Requirements for Mold Control:* Inspect lay-up mold control features for new and modified molds for five consecutive pieces (minimum for each mold). The mold shall be inspected until all characteristics are found acceptable, at which time production may begin. This check is repeated only when the mold is altered, repaired or replaced by a new mold.
- 4.4.3.8** *Periodic Inspection Plan Requirements for Mold Control:*
- If the part characteristic is within 75% of engineering drawing tolerance, proceed to 1/50 periodic inspection level.
 - If the part characteristic is within 85% of the engineering drawing tolerance, proceed to 1/25 periodic inspection level.
 - If the part characteristic is within 95% of the engineering drawing tolerance, proceed to 1/10 periodic inspection level. Production quantities not reaching the above quantity will require periodic 3-month inspection on active molds for provided schedule requirements.
 - If production is required from a mold that consumed >95% of part tolerance, 100% inspection of all characteristics for every part produced is required.

- 4.4.3.9** If inspection data in paragraph 4.4.3.8 shows that mold wear is no greater than 5% for a total of 500 pieces produced, the limits specified below may be applied on a part number basis when approved by applicable Member's Quality group per paragraph 4.5.
- If the part/mold characteristic is within 75% of the engineering drawing tolerance, proceed to 1/500 periodic inspection level.
 - If the part/mold characteristic is within 85% of the engineering drawing tolerance, proceed to 1/300 periodic inspection level.
 - If the part/mold characteristic is within 95% of the engineering drawing tolerance, proceed to 1/150 periodic inspection level. Production quantities not reaching the above quantity will require periodic 3-month inspection on active molds for provided schedule requirements.
 - If production is required from a mold that has consumed >95% of the part tolerance, 100% inspection of all characteristics for every part produced is required.

- 4.4.3.10** Production quantities not reaching those reflected in paragraph 4.4.3.9 will require periodic 3-month inspection on active molds for provided schedule requirements. If production is required from a mold that has consumed >95% of the part tolerance, 100% inspection of all characteristics for every part produced is required.

4.4.4 *PW Electro-Discharge Metal Removal (EDMR) Hole Location Feature Inspection Plans:*

- 4.4.4.1** Sampling inspection may be applied for EDMR turbine blade hole location features when the supplier's procedure contains the following requirements and is approved by the Member's Quality group per paragraph 4.5:
- A capable homogenous process that is able to consistently produce features within tolerance, with total hole pattern true position not exceeding 75% of tolerance.
 - A mistake proof process with tooling and/or fixtures that prevent relying on operator adjustment (no tinkering allowed).
 - Process is adequately monitored to provide feedback using reliable gaging and/or inspection methodology that is accurate enough to ensure the process stays targeted.
 - Electrodes are inspected prior to producing parts to ensure tolerance is maintained.
 - Evaluation of x and y true position errors during initial setup and adjustment of EDM process as necessary to nominal.

- 4.4.4.2** The following inspection requirements apply subsequent to an acceptable 1st piece check and results have been certified by qualified inspection personnel.
- a. Maintain a logbook for each machine/brass tag number, part number/operation number combination and record part quantities produced to indicate when submittals for inspection are required.
 - b. Qualify process by inspecting 23 consecutive pieces 100% for each part number hole location feature using variable measurement equipment (i.e., optical comparator, coordinate measuring machine [CMM]) If no nonconformances are detected for these 23 pieces, proceed to the 1/25 continuous sampling level for product acceptance.
 - c. For all parts dimensionally inspected, including 1/25 periodic checks, record and monitor x-error and y-error using an applicable control chart (i.e., x bar and range chart) and record total hole pattern true position using a process control record (i.e., rainbow chart).
 - d. Notify Manufacturing and Quality Engineers when x-error or y-error exceed control limits or when total hole pattern true position exceeds more than 75% of tolerance.
 - e. If a nonconformance is detected, inspect all previous parts for that hole location feature until the last acceptable inspection check. The Quality Engineer and Manufacturing Engineer shall re-evaluate the process and initiate appropriate corrective action, as applicable.
 - f. To re-qualify nonconforming characteristic for sampling inspect the next 23 consecutive pieces.
 - g. Attribute or variable (template) gaging, as applicable, must also be used 100% by the Operator to detect gross error assignable causes or shifts in the process.
 - h. For parts failing the template gage, visually compare to a known dimensionally acceptable part (or Tam tool template blade) using the template gage to determine part acceptance.
 - i. When gross errors (i.e., missing holes, hole out of position within a pattern) are detected, notify supervisor or delegate to determine the extent of the problem and submit part for CMM hole location check equipment. If CMM hole location check equipment verifies suspect nonconformance detected during 100% attribute or variable template check, then the nonconforming characteristic must be requalified for sampling by inspecting the next 23 consecutive pieces.

4.4.4.3 *First Piece Check Requirements:*

- Inspect the first piece of each part number produced or after a change in the EDM operation or other correction to the EDM machine.
- Inspect the part in the machine at the time a power and/or equipment failure occurs and the first part produced after that failure.
- Inspect the first part produced after changing machine settings due to corrections made after a nonconforming part is discovered.

4.4.4.4 The following single and multiple continuous sampling plans may be used in place of the 1/25 continuous sampling level plan with the approval of the Member's supplier quality representative.

When applying multiple level continuous type sampling plans, approval of the Member's supplier quality representative in writing is required prior to proceeding to the next level.

| Table X - EDMR Single Level Continuous Type Sampling Plan | | | | | | | | |
|---|-------|-----|-------|------|-----|-------|------|-----|
| S1 | | | S2 | | | S3 | | |
| Level | f | i | Level | f | i | Level | f | i |
| 0 | 100% | 36 | 0 | 100% | 29 | 0 | 100% | 23 |
| 1 | 1/100 | --- | 1 | 1/50 | --- | 1 | 1/25 | --- |

f = sample frequency
i = number of consecutive items inspected and found acceptable required to proceed to next sample level. If a nonconformance is found return to Level 0 and re-qualify to paragraph 4.4.4.2 requirements.

| Table Y - EDMR Multiple Level Continuous Type Sampling Plan | | | | | | | | | | | |
|---|-------|-------------------|-----|-------|-------|-------------------|-----|-------|-------|-------------------|-----|
| M1 | | | | M2 | | | | M3 | | | |
| Level | f | Accumulated Parts | i | Level | f | Accumulated Parts | i | Level | f | Accumulated Parts | i |
| 0 | 100% | 37 | 37 | 0 | 100% | 30 | 30 | 0 | 100% | 24 | 24 |
| 1 | 1/100 | 3700 | 37 | 1 | 1/50 | 1500 | 30 | 1 | 1/25 | 600 | 24 |
| 2 | 1/200 | 7400 | 37 | 2 | 1/100 | 3000 | 30 | 2 | 1/50 | 1200 | 24 |
| 3 | 1/400 | 14800 | 37 | 3 | 1/200 | 6000 | 30 | 3 | 1/100 | 2400 | 24 |
| 4 | 1/800 | | --- | 4 | 1/400 | | --- | 4 | 1/200 | | --- |

f = sample frequency
i = number of consecutive items inspected and found acceptable required to proceed to next sample level.
Accumulated Parts = the number parts required to be manufactured before proceeding to next sample level.
If a nonconformance is found return to Level 0 and requalify to paragraph.4.4.4.2 requirements.

4.4.5 PW Ultrasonic Inspection Turbine Blade Airfoil Thickness Sampling Plans:

4.4.5.1 To reduce inspection frequency for ultrasonic inspection from 100% to a .65% AQL, the methodology in paragraph 4.4.5.3 may be used as a guideline by suppliers to establish an alternate sampling plan for turbine blade wall thickness points.

4.4.5.2 This alternate sampling plan must be approved per paragraph 4.5, applied by inspection personnel and shall not apply to the OpCert program.

4.4.5.3 Guidelines for establishing an alternate sampling plan:

- a. An Engineering Source Approved (ESA) process for the part number is on file. This applies to each wax die and/or core die combination as a unique process population.
- b. Process controls are in place and a minimum of 4600 consecutive pieces are processed (part number specific) with no nonconformances detected.
- c. Wall thickness points meet the requirements of [UTCQR - 09.1](#).
- d. Meets the criteria of paragraph 4.4.5, items a.through c above, as well as the requirements of UTCQR-09.1 for these wall points, and also completed the following for each part number wall inspection point:
 - A minimum of three, 25 piece process capability studies from three consecutive conforming lots and
 - Achieved a minimum of 1.33 Cpk for each wall point
- e. A .65% AQL sampling plan is applied for all qualified wall points
- f. Samples selected per 65% AQL sampling plan for each lot produced are conforming and the Cpk value calculated for each wall point is greater than or equal to a Cpk of 1.33.
- g. Wall points that fall below a Cpk of 1.33 are re-qualified to Item d and 100% inspection is required until points are re-qualified, corrective action is taken and assignable cause is identified.

4.5 Alternate Sampling Plan Approval Process

4.5.1 To apply for approval of alternate sampling plans other than that specified by this procedure, submit a written request in accordance with [ASQR-01](#) to applicable Member's Quality Group, via Procurement Department. (See Figure 3).

Note: *Members strongly recommend the use of approved sampling plans described herein.*

Note: *Alternate sampling plans are not allowed on SSME-AT Program parts.*

Note: *If an alternate sampling plan was previously approved by a Member's Quality Group prior to issuance of ASQR-20.1, resubmittal is required.*

- 4.5.2** Requests shall include the following information, when applicable:
- a. Description of unique alternate plan and procedure
 - b. Names of Members affected
 - c. Part number / name / commodity / engine model
 - d. Average inspection lot size for the subject parts (characteristics)
 - e. Characteristic type (e.g., dimension, diameter, minimum wall, nondestructive test, etc.)
 - f. Criticality of characteristic as defined by applicable Member supplier engineering drawing or specification (i.e., critical, major or minor)
 - g. Characteristic quality history (i.e., nonconformance data)
 - h. Sequence of in-process and final inspections
 - i. Description of manufacturing control at the operation to ensure that good quality will be maintained (e.g., process capability, control charts, control plan, etc.)
 - j. Additional supplier data or information as requested by applicable Member
 - k. Evidence of review by Member supplier quality representative to ensure above data is provided
- 4.5.3** The applicable Member's Quality Group will authorize the use of an acceptable alternate plan via issuance of a documented approval in accordance with [ASQR - 01](#). Approval forms must be retained for a minimum of four years after use of the alternate sampling plan is discontinued.

5. RECORDS/FORMS

Completed Quality records generated electronically or on paper shall be retained per the requirements of [ASQR - 01](#).

6. REFERENCES

- 6.1** It is the responsibility of the supplier to obtain copies of non-UTC documents specified herein. These include, but may not be limited to the following:

| Document | Title |
|----------------|---|
| ANSI/ASQC Z1.4 | Sampling Procedures and Tables for Inspection by Attributes |
| ANSI/ASQC Z1.9 | Sampling Procedures and Tables for Inspection by Variables |
| Boeing D1-8007 | Approval Guide for Supplier Statistical Sampling Plans |
| PWA-SP 306 | SSME Alternate Turbopump Classification of Characteristics |

- 6.2** Member specifications needed, shall be requested from the applicable Member's Procurement organization. Documents referenced in this specification include but may not be limited to:

| Document | Title |
|------------------------------|---|
| ASQR - 01 | Aerospace Supplier Quality Requirements |
| ASQR - 09.1 | Flight Safety Parts Program |
| UTCQR - 09.1 | Process Certification Requirements |

7. NATURE OF CHANGE

This document has been completely rewritten, major changes include:

- Removed reference to UTC Fuel Cells as they no longer apply
- Para. 3.9 revised - added reference to ENSIP Critical Part
- Para. 3.14 – added definition for ENSIP Part for PWC
- Table A revised – item I added
- Table P revised – added a Note
- Deleted redundant paragraphs
- Reformatted to current template – some paragraphs renumbered
- Editorial changes for clarification

Figure 1: Attribute, Accept on Zero (C=0) Sampling Plan

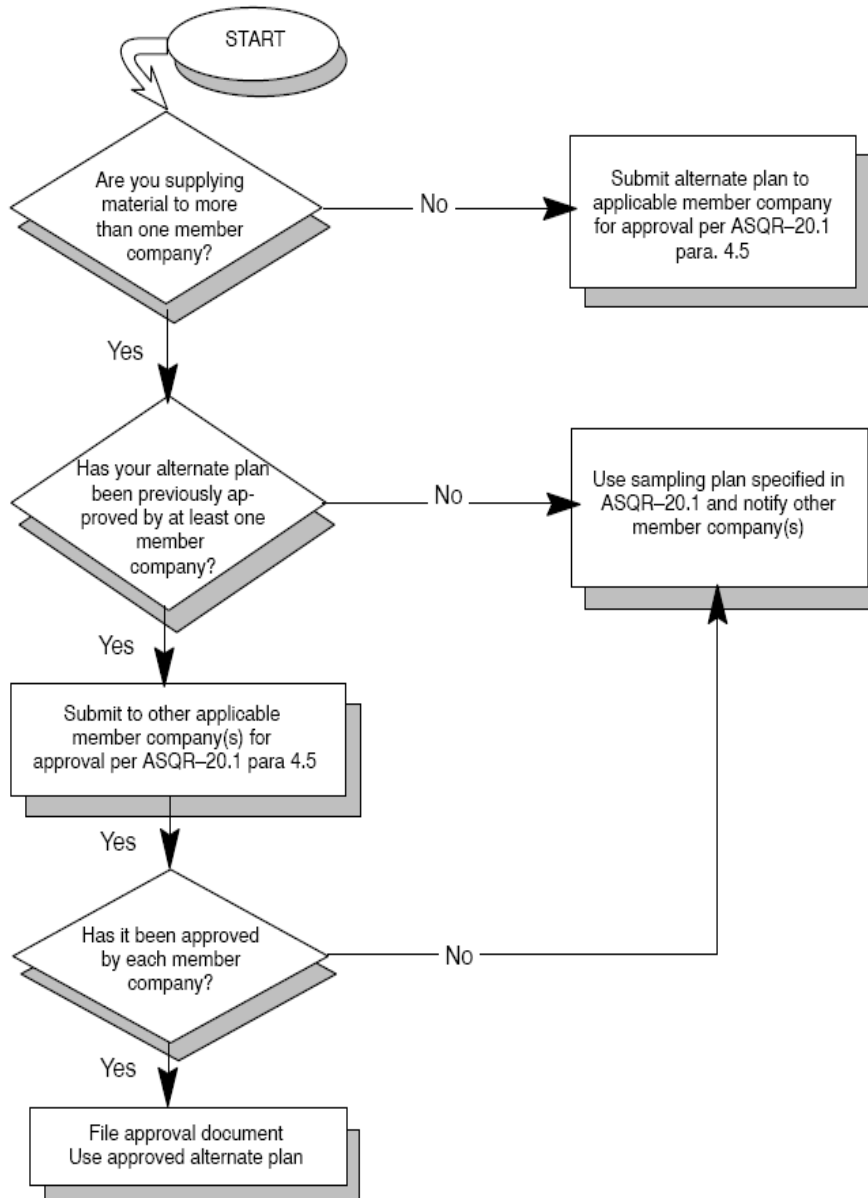
| Acceptable Quality Level (AQL) Percent | | | | | | | | | | | | | | | | |
|--|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Lot Size | .010 | .015 | .025 | .040 | .065 | .10 | .15 | .25 | .40 | .65 | 1.0 | 1.5 | 2.5 | 4.0 | 6.5 | 10.0 |
| 2-8 | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | 5 | 3 | 3 | 3 |
| 9-15 | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | 13 | 8 | 5* | 3 | 3 | 3 |
| 16-25 | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | 20 | 13 | 8 | 5* | 3 | 3 | 3 |
| 26-50 | ALL | ALL | ALL | ALL | ALL | ALL | ALL | ALL | 32 | 20 | 13 | 8 | 7 | 7 | 5 | 3 |
| 51-90 | ALL | ALL | ALL | ALL | ALL | ALL | 80 | 50 | 32 | 20 | 13 | 11 | 11 | 8 | 5 | 4 |
| 91-150 | ALL | ALL | ALL | ALL | ALL | 125 | 80 | 50 | 32 | 20 | 13 | 13 | 11 | 9 | 6 | 5 |
| 151-280 | ALL | ALL | ALL | ALL | 200 | 125 | 80 | 50 | 32 | 29 | 29 | 19 | 13 | 10 | 7 | 6 |
| 281-500 | ALL | ALL | ALL | 315 | 200 | 125 | 80 | 50 | 48 | 47 | 29 | 21 | 16 | 11 | 9 | 7 |
| 501-1200 | ALL | 800 | 500 | 315 | 200 | 125 | 80 | 75 | 73 | 47 | 34 | 27 | 19 | 15 | 11 | 8 |
| 1201-3200 | 1250 | 800 | 500 | 315 | 200 | 125 | 120 | 116 | 73 | 53 | 42 | 35 | 23 | 18 | 13 | 9 |
| 3201-10000 | 1250 | 800 | 500 | 315 | 200 | 192 | 189 | 116 | 86 | 68 | 50 | 38 | 29 | 22 | 15 | 9 |
| 10001-35000 | 1250 | 800 | 500 | 315 | 300 | 294 | 189 | 135 | 108 | 77 | 60 | 46 | 35 | 29 | 15 | 9 |
| 35001-150000 | 1250 | 800 | 500 | 490 | 476 | 294 | 218 | 170 | 123 | 96 | 74 | 56 | 40 | 29 | 15 | 9 |
| 150001-500000 | 1250 | 800 | 750 | 715 | 476 | 345 | 270 | 200 | 156 | 119 | 90 | 64 | 40 | 29 | 15 | 9 |
| 500001-Over | 1250 | 1200 | 1112 | 715 | 556 | 435 | 303 | 244 | 189 | 143 | 102 | 64 | 40 | 29 | 15 | 9 |

NOTES:

- (1) ALL indicates that the entire lot must be inspected
- (2) **Critical** characteristics require 100% inspection
- (3) **Major** characteristics require .65% AQL unless otherwise specified **
- (4) **Minor** characteristics require 2.5% AQL Unless Otherwise Specified
- (5) AQL levels for tightened and reduced inspection shall be one level above and below 0.65% AQL for major characteristics and one level above and below 2.5% AQL for minor characteristics, respectively.
- (6) Extracted from "Zero Acceptance Number Sampling Plans" (ISBN 0-87389-305-0). Selected elements of this table have been modified by UTC. Reprinted with permission of the American Society for Quality.
- (7) Contact Member for information about sampling risks (e.g., Operating Characteristic Curves etc.).

* **For Hamilton Sundstrand:** The sample size required is six relating to a 2.5% AQL for lot sizes 9 to 25.

** **For Hamilton Sundstrand:** The AQL required for Major Characteristics shall be .10%

Figure 3: Alternate Sampling Plan Approval Process


***** End of Document *****