SAMPLING INSPECTION (SUPPLEMENT) PRATT & WHITNEY

1.0 PURPOSE

1.1 The purpose of this procedure is to supplement QCP 15.1 and to provide for sampling inspection of those items specifically produced for Pratt & Whitney.

1.2 The basis of this sampling plan will be a single sampling of all lots, with a criteria of acceptance based on no defectives in the sample lot.

2.0 SCOPE

This procedure provides sampling requirements for P&W designed articles, P&W specified dimensions of Argo-Tech designed articles, and Argo-Tech specified dimensions considered most important to the design.

3.0 APPLICABLE DOCUMENTS

	PW-QA 6084	Supplier Sampling Requirements
	PWA 397	Classification of Characteristics
	QCP 15.0	Statistical Quality Control
	Form ATC-005	Certified Operator's Log
	ARG-23456	Nonconformance Report
φ	FC 9171	Rework/Salvage Log

3.1 CPW 109 - Quality Assurance Requirements for Acceptance Sampling - Although Pratt & Whitney Canada has a slightly different sampling plan identified in CPW109, Argo-Tech has been given approval to use Pratt & Whitney specifications PW-QA-6084 as an alternative and equivalent sampling plan per Pratt & Whitney Canada letter dated January 7, 1993.

4.0 DEFINITIONS

Double Zero Sampling Plans

These special types of P&W attribute sampling plans are always identified by four digits. The first two digits are always 00. These two digits emphasize the fact that these plans will never accept a lot when a sample reveals any nonconformance whatsoever. The last two digits represent the controlling extent expressed as a percent of the total tolerance. A plan labeled 0025 is a Double Zero (00) Plan, controlling the maximum nonconformance to .25% AQL.

5.0 **GENERAL** Most Important Characteristics

Characteristics of the design classified as Critical in accordance with PW-QA 6084.

5.1 When using the following lot by lot attribute plan, 100% inspection is to be performed whenever the required sample size is greater than the lot size.

5.2 Double Zero Sampling Plans

0025 Plan

		NORMAL PLAN		TIGHTENED PLAN		REDUCED PLAN	
	Lot Size	Sample	Accept	Sample	Accept	Sample	Accept
Lot Size	Code	Size	No.	Size	No.	Size	No.
1-17	A	ALL	0	ALL	0	ALL	0
18-65	B	44	0	51	0	17	0
66-110	C	60	0	67	0	18	0
111-180	D	67	0	91	0	19	0
181-300	E	73	0	104	0	19	0
301-500	F	78	0	114	0	20	0
501-800	G	80	0	120	0	20	0
801-2500	H	85	0	130	0	21	0

0050 Plan

		NORMAL PLAN		TIGHTENED PLAN		REDUCED PLAN	
	Lot Size	Sample	Accept	Sample	Accept	Sample	Accept
Lot Size	Code	Size	No.	Size	No.	Size	No.
1-12	A	ALL	0	ALL	0	ALL	0
13-65	B	20	0	27	0	12	0
66-110	C	21	0	31	0	12	0
111-180	D	22	0	33	0	12	0
181-300	E	23	0	34	0	12	0
301-500	F	23	0	35	0	12	0
501-800	G	24	0	36	0	12	0
801-2500	H	25	0	39	0	14	0

5.3 Nondestructive Testing (NDT) Lot Acceptance Plans

	NDT - L1		NDT L2		NDT L3	
Lot Size	Sample	Accept	Sample	Accept	Sample	Accept
Code	Size	No.	Size	No.	Size	No.
1-7	ALL	0	ALL	0	ALL	0
8-65	44	0	2O	0	2	0
66-110	60	0	21	0	2	0
111-180	67	0	22	0	4	0
181-300	73	0	23	0	4	0
301-500	78	0	23	0	4	0
501-800	80	0	24	0	4	0
801-2500	85	0	25	0	4	0

5.4 FIGURE I (SAMPLING PLAN TOLERANCE CHART) shall be used to determine the appropriate plan for all P&W designed articles, P&W specified dimensions of Argo-Tech designed articles, and Argo-Tech specified dimensions considered most important to the design.

6.0 PREPARATION FOR INSPECTION

6.1 Prior to Inspection, the inspector must have the following data or documents:

A. Part Drawing

B. Standard Operating Practices authorized by Quality Assurance

C. Sampling Plan Tolerance Chart (Figure I)

D. Copy of Purchase Order - Receiving Inspection Only

E. Receiving Inspection Report - Receiving Inspection Only

F. Lot Card - Final Inspection Only

G. Characteristic Inspection Record

6.2 Normal, Tightened, or Reduced Inspection

Normal inspection shall be used at the start of inspection unless otherwise specified.

6.2.1 For a given lot size, determine the number of samples to be selected from the Double Zero Sampling Plan requirements, para. 5.2.

6.2.2 Randomly select from the lot the required number of samples. Use the sample size for NORMAL inspection. The normal plan shall be used unless the requirements for TIGHTENED or REDUCED sampling have been met by the following:

A. Go from NORMAL to REDUCED inspection if there are no nonconformances for the characteristic in the last:

. 10 consecutive lots within a calendar year totaling a minimum of 850 parts inspected to the 0025 plan.

. 5 consecutive lots within a calendar year totaling a minimum of 125 parts inspected to the 0050 plan.

6.2.3 Go from REDUCED to NORMAL if a nonconformance is found within the sample for the characteristic inspected.

6.2.4 The sample plan shall be switched from NORMAL to TIGHTENED if two or more of the last five consecutive lots contained nonconformances.

6.2.5 Go from TIGHTENED to NORMAL if there are no nonconformances in the last five consecutive lots.

6.2.6 The sample plan shall be switched from TIGHTENED to 100% for military engine parts if on TIGHTENED for ten consecutive lots (unless the characteristic was conforming in the last five lots).

6.2.7 Go from 100% to TIGHTENED if corrective action has been taken and the characteristic is conforming in the last three lots.

7.0 PROCEDURE

7.1 Determine from the SOP or Sampling Plan Tolerance Chart, the number of samples to be inspected.

7.2 Randomly select from the lot the required number of samples.

7.3 Inspect all sample pieces in accordance with the requirements of the applicable part drawing and SOP's.

7.4 Indicate the results of inspection on the required inspection report forms. (Reference para. 6.1 [E] and [G])

8.0 DISPOSITION OF LOT

8.1 If no defects are found in the sample lot, release the entire lot to stock.

8.2 If one or more defects are found in the sample lot, release the defect-free samples to stock and forward the defective samples to Material Review. Screening inspection on Argo-Tech manufactured items is to be performed on the remaining pieces of the lot, for that specific characteristic found defective and the defective pieces forwarded to the Material Review Department for disposition. Pieces dispositioned acceptable are to be held in the Material Review Department and submitted to P&W on a SRON for all P&W designed articles or P&W specified dimensions on Argo-Tech designed articles.

8.3 Screening inspection of purchased items is not to be performed unless specifically authorized by the supervisor of Receiving Inspection. Purchased items will, normally, be returned to the source of manufacture for screening inspection, but will not be returned to that source until the Material Review Board has passed judgment on the defective sample pieces.

9.0 PERIODIC INSPECTION PLAN

As an alternate to the P&W double zero sampling plan, the following periodic inspection plan may be used for the on-line inspection of in-process P&W parts where characteristics are produced on controlled tooling that has demonstrated high levels of accuracy, repeatability, and minimal chance of operator error.

9.1 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. Eligible characteristics for periodic inspection must demonstrate process capability spreads ($\pm$ 3 sigma) of 75% or less of the drawing tolerance.

9.2 Periodic inspection may be applied to characteristics designated "critical" by P&W specification or drawing only when specifically authorized by P&W Quality Engineering.

9.3 The inspection lot shall consist of all pieces in a group manufactured under essentially the same conditions and at essentially the same time (i.e., same shift). In no case shall the inspection frequency be less than one per one hundred pieces.

9.4 The decision to accept the lot (total number of pieces run per shift) shall be based on the original sample piece. Other sample pieces shall not be exchanged for the original to change the acceptance decision.

9.5 Documentation of each piece inspected shall be maintained through the use of the Certified Operator's Log (Form ATC-005) and Layout Reports to provide evidence that part to part variation for a drawing requirement is consistently controlled by the manufacturing method.

9.6 Layout inspection shall make a set-up check of the first piece and any subsequent pieces 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. In addition, layout will make process verification checks (PVC) of one piece per shift through the manufacturing run.

φ 9.7 An inspection of the first piece run on each shift shall be performed by the Certified Operator/Bench Inspector per the Inspection SOP and Certified Operator Log. Pieces submitted for inspection which are not part of the current machine run will be inspected 100% on all characteristics or as directed by an accompanying NCR (Form ARG-23456) or Rework/Salvage Log (Form FC 9171).

9.8 Parts within a lot detected as nonconforming by the machine operator, layout inspector or tollgate inspector will be segregated and 100% screening will be performed on discrepant characteristics of all pieces run previous to and after the discrepant piece. Screening shall continue until acceptable pieces are found. In addition, the periodic inspection plan for the discrepant characteristic(s) shall be suspended and replaced with 100% inspection until effective corrective action has been demonstrated.

9.9 New, altered, or repaired tooling associated with periodic inspection shall be referred to the Central Tool Inspection Department, where it will be checked for conformance to tool drawings, as well as for workmanship and proper functioning.

9.10 P&W QAR approval is required for initial application of periodic inspection to each part number.

10.0 RESPONSIBILITIES

10.1 The initiation and maintenance of this procedure will be the responsibility of the Quality Assurance Department who will:

A. Provide surveillance for compliance to this procedure
B. Approve modifications to this procedure
C. Inform suppliers, through the Purchasing Department, of quality problems
D. Inform manufacturing departments of quality problems
E. Follow-up on corrective actions

FIGURE I
SAMPLING PLAN TOLERANCE CHART

1.0 MECHANICAL REQUIREMENTS

	SAMPLING PLAN
1.0.1 Dimensional Total Tolerances:	
.001" or less on CCC parts (1)	100%
.001" or less on other than CCC parts	0025
.0011" through .004" on all parts	0025
Greater than .004" on all parts	0050
1.0.2 Single Feature Characteristics:	
Cylindricity, Flatness, Roundness, Straightness, Profile of a line or surface 100%	
.001" FIR or less on other than CCC parts	0025
.0011" through .004" FIR on all parts	0025
Greater than .004" FIR on all parts	0050
1.0.3 Related Features:	
Circular Runout, Angularity, Parallelism, Perpendicularity, Concentricity, True Position	
.001" total or less on CCC parts	100%
.001" total or less on other than CCC parts	0025
.0011" through .004" total on all parts	0025
Greater than .004" total on all parts	0050

NOTE: (1) Parts that contain critical characteristics (CCC)

1.0.4 Angle Total Tolerance:	
10 minutes or less on CCC parts	100%
10 minutes or less on other than CCC parts	0025
11 minutes through 1° on all parts	0025
Greater than 1° on all parts	0050
1.0.5 Plating or Coating (See para. 1.0.10 for Hard Coat)	
Gaging Requirements (Dimensional)	0050
Critical or major characteristic or CCC designated parts	0025
1.0.6 Surface Finish Roughness:	
Waviness	0025
10AA or finer (CCC parts)	0050
11AA through 31AA (CCC parts) and 31AA or finer (other than CCC parts)	Measure one piece and visually compare with lot at 0025
. Rougher than 31AA - see par. 3.0.5 below	
1.0.7 Thread Characteristics:	
ANPT	0025
Specified Engineering Drawing total tolerance up through .002"	0025

		SAMPLING PLAN
	Specified Engineering Drawing total tolerance greater than .002"	0050
	Unspecified Engineering Drawing tolerance controlled by PW 355 or H28 Handbook	0050
1.0.8	Characteristics inspected by spline gages	0025
1.0.9	Performance inspection at an elevated temperature	1 piece/lot
1.0.10	Hard Coat Thickness	0050
1.0.11	Pull Tests	0050
1.0.12	Spring-load Checks	0050
1.0.13	Torque Testing of Thread or Braze	0050
1.0.14	Dimensions with only maximum or minimum values:	
	Dimensions that directly control material thickness of weldments, castings, or forgings and at least one surface is machined	100%
	For blade and vane dimensions having one limit specified as maximum or minimum which directly controls thickness, when approved by P&W Quality Assurance (QAR) with the concurrence of P&W Quality Engineering	Not less than 0025
	Clearance envelopes	0050
	All other dimensions except the above	0050
1.0.15	Inspection of tab washer clearance dimensions after locking installations	100%
1.0.16	Diameter requirements of any surface and adjacent fillet radii that mates with a main bearing at assembly	100%
1.0.17	Gaging high production, standard made parts, when approved by P&W Quality Assurance Representative (QAR) with the concurrence of P&W Quality Engineering	0050
1.0.18	When it is difficult to tell visually that an operation has been omitted, and a gage is used on the operation that will identify the missing operation.	Same plan as par. 3.0.13
1.0.19	Other requirements unless proposed application and sampling plan approved by P&WA Statistical Systems	100%
2.0	**Method of Inspection Items**	
2.0.1	Optical Flats	0025
2.0.2	Bluing of Conical Seats	
	Detail which will be welded or brazed into an assembly	0025
	All other details and all assemblies	100%

		SAMPLING PLAN
2.0.3	Dimensions where a cast is necessary for measurements	5 pieces/lot
3.0	**Visual Requirements**	
3.0.1	Internal passages that must be free from obstructions:	
	Fuel holes and oil holes: visual and probe	100%
	Coolant passages in parts such as blades, vanes and disks: visual inspect and/or probe to maximum extent permitted by part geometry	100%
3.0.2	Inspection of locking installations (Key washers, snap rings, etc.)	100%
3.0.3	Welds or brazes	100%
3.0.4	Inspection of plating or coating	0025
3.0.5	Surface Finish Roughness:	
	Rougher than 31AA	0050
	Lay	0050
3.0.6	All markings and acceptance symbols	100%
3.0.7	Mechanical inspection replaced by visual	Same plan as used for mechanical
3.0.8	Visual inspection replaced by mechanical	Same plan as used for visual
3.0.9	Visual checks on characteristics requiring 100% dimensional check	100%
3.0.10	Inspection to Visual Inspection Standard (VIS) except those described in 3.0.12 below	100%
3.0.11	Inspection for surface defects, missing operations and foreign material, except those described in 3.0.12	100%
3.0.12	Visual inspection of parts that are produced exclusively by die or stamp operation:	
	With dimensional total tolerances all greater than .004" and/or 1°	0025
	With total tolerances of one or more dimension equal to or less than .004" and/or 1°	100%
3.0.13	All other visual inspection	100%

4.0 Hardness Requirements

		SAMPLING PLAN
4.0.1	All case hardness requirements except those described in 4.0.2 below	100%
4.0.2	Case hardness requirements of Ra 79-85 or Ra 81-85	0025
4.0.3	Core hardness of parts when case hardness is also a requirement	Assign plan per hardness sampling instructions of par. 4.0.4

4.0.4 When hardness sampling is applicable:
A. Convert hardness requirement into equivalent Rb or Rc reading
B. Assign one of the following sampling plans based on the minimum hardness requirement and the tolerance:

	TOLERANCE (HARDNESS UNITS)			
	2.9	3.0	4.1	10
Minimum Requirements	or Less	to 4.0	to 9.9	or more
	Plan Assignment			
100Rb or less	0025	0025	0050	0050
Rc15 - 27.9	0050	0050	0050	0050
Rc28 - 43.9	0025	0025	0050	0050
Rc44 - 47.9	0025	0025	0025	0050
Rc48 - 62.9	100%	0025	0025	0025
Rc63 & up	100%	100%	0025	0025

If requirement is maximum or minimum only with no range, assign sampling plan as follows:

Requirement	Minimum Only	Maximum Only
	Plan Assignment	
Up to Rc43.9	0050	0050
Rc44 & greater	0025	0050

		SAMPLING PLAN
4.0.5	All other parts thermally treated (including stress relief) without evidence of processing in unit batches	100%

5.0 Raw Material or Semi-finished Requirements

5.0.1	Characteristics to be processed or formed before final inspection	0050
5.0.2	Thickness of sheet stock before being processed or formed, which has been previously accepted by Raw Material Inspection	0050

6.0 Destructive Testing Requirement

6.0.1	Stripping of plating to determine plating thickness	5 piece check per lot except one piece for lots of 10 pieces or less

		SAMPLING PLAN
6.0.2	Chisel type bond test	5 piece check per lot except one piece for lots of 10 pieces or less
6.0.3	Other destructing testing	(DS-A [Ref: 3.6])

7.0 Nondestructive Testing Requirement

All NDT inspection frequencies shall be 100% unless sampling is authorized below or by P&W Quality Engineering. Casting grade listed below are as referenced in the drawing and in Specification P&W 321, 331, 341 or any other similar specification which describes graded castings.

		SAMPLING PLAN
7.0.1	Radiographic Inspection	
	Brazed joints on transfer pipes and other tubes which carry fuel or hydraulic fluid	100%
	All other brazed joints	NDT-L2
	Fusion welded joints	100%
	Casting Grade A areas	NDT-L1
	Casting Grade B areas	NDT-L2
	Casting Grade C areas	NDT-L3
	Casting Grade D areas	NDT-L3
	Nongraded Castings	NDT-L3
	When Radiographic Inspection is used to replace mechanical gaging, the following shall apply:	
	Dimensional Tolerance	
	Up through .004" total	NDT-L1
	.0041" total and up	NDT-L2
	Maximum or minimum requirement	NDT-L2
	Minimum wall thickness of blades	100%
7.0.2	Magnetic Particle Inspection (MPI) or Fluorescent Penetrant (FPI):	
	Casting Grade A areas	NDT-L1
	Casting Grade B areas	NDT-L2
	Casting Grade C and D areas	NDT-L3
	Non Graded Castings	NDT-L3
	Sand or Centrifugal Castings and parts fabricated from these castings	NDT-L2
	Threaded fasteners not requiring alloy type test	NDT-L2
7.0.3	Etch Inspection:	
	Surface Temper when required by P&W Engineering Drawing/QAD	100%
	All other surface temper	NDT-L3
	Blue etch anodize	100%
7.0.4	Ultrasonic Inspection:	
	All Ultrasonic Inspection unless sampling is authorized by P&W Statistical Systems	100%

		SAMPLING PLAN
	When Ultrasonic Inspection is used to replace mechanical gaging, the following shall apply:	
	Dimensional Tolerance	
	Up through .004" total	NDT-L2
	.0041" total and up	NDT-L2
	Maximum or minimum requirement	NDT-L2
	Minimum wall thickness of blades	100%
7.0.5	Vacuum Testing:	
	All vacuum testing	100%
7.0.6	Pressure Testing:	
	Pressure test which has been previously performed on parts so identified	0025
	All other pressure testing	100%
7.0.7	Eddy Current Inspection	100%