DOCKET NO. SA-515

EXHIBIT NO 8H

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, DC

ANE-180 EVALUATION REPORT OF PRATT & WHITNEY QUALITY SYSTEM

September 30, 1996

ATTACHMENT 2
PHASE II REPORT (VOLVO)

(23 PAGES)

PHASE II

REPORT

ANE-100
FAA

Subject: ACTION: Pratt & Whitney - Volvo Special Audit Date: August 20, 1996

From: ASI, NE-MIDO-45 Reply to Attn. of: J. Varoli [redacted]

To: Donald Plouffe
Manager, Manufacturing Inspection, ANE-180

A special audit of Pratt & Whitney supplier control activities of Volvo in Trollhatten, Sweden was conducted from August 13 to August 16, 1996.
The audit team was composed of:

John Varoli, Team Leader
Richard Gidius, Aviation Safety Inspector, P. I.
Daniel Kerman, Aerospace Engineer, ANE-141

The audit plan was as presented in the P.I.'s memo, entitled, "Audit Plan for Volvo Flygmotor, Trollhatten, Sweden, JT8D-200 series engine, Fan Hub Investigation". A copy of the plan is attached as well as a copy of the In-Briefing Presentation at Volvo, which covered the Audit Plan and the guidelines for the auditing process. The audit guidelines consisted of the use of the ACSEP criteria as aids in the evaluation of the subjects defined by the audit plan. As a result, the criteria utilized which were adapted to the plan, were: Manufacturing Processes, Special Processes, Design Data Control, Nonconforming Material, Supplier Control, Internal Audit and Non-Destructive Inspection.

The Volvo Level 1 policy quality document and the Level 2 quality document, which contained the division specific systems requirements, were in English. The Level 3 document which contained the procedures and Level 4 document which contained the work instructions were in Swedish.

Three groups were formed with composition made-up of FAA, Volvo and PWA personnel. Assignments were made as follows:

1. Engineering Source Approval	D. Kerman
2. Manufacturing Operations	R. Gidius
3. Blue Etch Inspection	R. Gidius

(2)

4. Fluorescent Penetrant Inspection	J. Varoli
5. Final Inspection / MRB Dispositions	R. Gidius
6. P & W Specification File	J. Varoli
7. Material Certifications	J. Varoli

CONCLUSIONS:

As a result of the evaluation, the team documented three (3) findings and two (2) observations. In addition there were two (2) special emphasis items noted to the Principal Inspector.
The findings and observations were recorded using the Audit Plan as a guide. Consequently the three findings were documented regarding the Engineering Source Approval. However, from an ACSEP perspective two were recorded in the Manufacturing Processes subsystem and the third was recorded in the Internal Audit subsystem. One finding was documented because it was found that the photo-micrographs required by PWA 370 for hole processing was not done in all instances. The other manufacturing finding was documented because a number of process changes that were significant were improperly classified as "insignificant". The third finding was documented because it was found that the Volvo internal audit schedule had not been followed.

The two observations were recorded at Final Inspection in the Manufacturing Processes subsystem. One observation was recorded for an isolated incident of not having an inspection stylus, used to inspect for excessive spiral tool marks in the tie bolt holes, in the inspection area. The other observation was documented for conflicting notation of surface finish requirements in various documents.

One special emphasis item was documented for the lack of a definition of tool sharpness, while the ESA refers to post machining metallurgical acceptability as a function of tool sharpness.
The other special emphasis item was a note to the P.I.. to review the P&W files regarding the supplier approval status of Cameron as a hub forging supplier, at the time of delivery, since this could not be concluded at Volvo.

Attached are the 8100-6 ACSEP Forms, the Executive Summary used at the close-out, the Audit Plan used for the evaluation and the Daily Journal.

[redacted]
John Varoli

Attachments

File:

SPECIAL AUDIT

PRATT & WHITNEY - VOLVO

EXECUTIVE SUMMARY

FINDINGS / OBSERVATIONS:

During this evaluation the team documented three (3) findings and two (2) observations.

1. ENGINEERING SOURCE APPROVAL:

There were three findings and no observations recorded regarding this subject. The first finding was concerned with non-submittal of substantiating data for the tie bolt hole drilling process phase of the manufacturing processes. The second finding was concerned with the submittal of multiple changes to process parameters, tool design and tool supplier, as insignificant. In accordance with PWA ESA 370 requirements, the changes should be significant.
The third finding was in regard to noncompliance to ESA quarterly auditing requirements.

2. MANUFACTURING OPERATIONS:

There were no findings or observations recorded regarding this subject.

3. BLUE ETCH INSPECTION PROCESS:

There were no findings or observations recorded regarding this subject.

4. FLUORESCENT PENETRANT PROCESS:

There were no findings or observations recorded regarding this subject.

5. FINAL INSPECTION:

There were two observations regarding final inspection.
One was involved with a missing inspection stylus at the inspection station.
The other observation was in regard to conflicting surface finish tie bolt hole requirements.

6. P & W SPECIFICATION FILES:

There were no findings or observations recorded regarding this subject

7 MATERIAL CERTIFICATIONS;

There were no findings or observations recorded regarding this subject

[redacted]

John Varoli Team Leader

8/15/96
Date

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U.S. Department of Transportation
Federal Aviation Administration

ACSEP Record of Findings / Observations

ACSEP No:

Project No: PE 13 NE-D

Evaluation Criteria Number:	Controlling Document:	Applicable FAR Section:
4 E 2	PWA ESA 370, Rev. F Volvo Quality Manual, 5/96	21.165 (a)

FINDING [X] System [ ] Safety No. 21

OBSERVATION [ ] System [ ] Isolated [ ] FAR No. ___

Required Condition:

.PWA 370 "Engineering Source Approval" establishes engineering requirements for substantiation of new manufacturing processes. For the JT8D fan hub P/N 5000501 engineering requirements for substantiation of hole processing requires the following: "The metallurgical acceptability of all procedures used to produce all holes, must be determined through the use of both transverse and planar micros" (photo micro-graphs).

Encountered Condition: [X] *Discussed with Fac*

Review of Volvo qualification reports for original ESA approval of hole manufacturing revealed that such a qualification was not accomplished for the "drilling" process and had only been done for the boring and honing aspects of hole manufacturing. Further review of tool (drill) changes revealed several new drills where such a metallurgical evaluation was not performed and several drill changes where it was performed.

Signature of Evaluator:	Office Symbol	Date
Daniel Kerman [redacted]	ANE-171	8/15/96

FAA Form 8100-6 (12-93)

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artment of Transportation al Aviation Administration	**ACSEP Record of Findings / Observations**	ACSEP No: Project No: PE 13 NE-D

aluation Criteria Number: 4 P 1	Controlling Document: PWA 370, Rev. F 11/12/92 Volvo Quality Manual, 5/96	Applicable FAR Section: 21.165

FINDING [X] System [ ] Safety No. 2 | OBSERVATION [ ] System [ ] Isolated [ ] FAR No. ___

Required Condition:

. Paragraph 3.3 (significant change in processes) of PWA 370 "Engineering Source Approval", requires that a process approval record form # 4692 be issued for significant changes.

Significant changes include new tooling, sequence of operations, and a change in any process which could result in cracking or location within a plant.

Encountered Condition: [X] *Discussed with Fa*

Review of manufacturing process parameter changes and tooling changes for hole drilling of PWA fan hub p/n 5000501 found the following. From 1988 to 1996 Volvo processed 12 insignificant process changes to hole drilling in which tool design, tool source or process parameters were changed. The changes should have been classified as significant with subsequent process qualifications performed as necessary.

Attached: List of changes

Signature of Evaluator:	Office Symbol	Date
Daniel Kerman [redacted]	ANE-171	8/14/96

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U.S. Department of Transportation
Federal Aviation Administration

ACSEP Record of Findings / Observations

ACSEP No:

Project No: PE 13 NE-D

Evaluation Criteria Number:	Controlling Document:	Applicable FAR Section:
15 M 1	PW-SQA 6076AB Volvo Quality Manual, 5/96	21.165 (a)

FINDING [X] System [ ] Safety No. 3

OBSERVATION [ ] System [ ] Isolated [ ] FAR No. ___

Required Condition:

. PW QA 6076 AB, Section II, Paragraph 2.1 states in part, "Supplier shall ensure that adherence to P & W ESA requirements is controlled and monitored on an audit basis once each quarter for each reason. "

Encountered Condition: [X] *Discussed with Fac*

In review of Volvo ESA auditing records, it was found that in 1990 only one quarter was audited (December, 1990). Further review also found that there were no ESA audits conducted during calendar year 1995.

Attached: QA 6076 AB
Volvo Quality Standard 178152

Signature of Evaluator:	Office Symbol	Date
Rich Gidius [redacted]	NE-MIDO-41	8/15/96

FAA Form 8100-6 (12-93)

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15. KORREKTIVA ÅTGÄRDER VID "OVERINSPECTION"

För fel som upptäcks vid "Overinspection" i samband med leveranskontroll av P&W-detaljer skall göra begäran av korrektiva åtgärder. Denna skall vara skriftlig. Se även 17 81 66.

16. P&W MCL-RELEASE AV MATERIAL FÖR HUB OCH DISK

För vitala roterande detaljer skall ämnen till dessa vara godkända av P&W Material Control Laboratory innan de utlämnas från Mottagningskontrollen till Produktion. (Se MCL-F26).

Berörda detaljer:

JT8D
- Hub front
- Disk 1.5
- Disk 3
- Disk 11

JT9D
- Disk 5
- Disk 9
- Disk 11
- Disk 13
- Disk 15

PW 2000
- Hub front HPC

17. HANTERINGS- OCH FÖRORENINGS-SKADOR

17.1 - VAC skall upprätta metoder och skapa möjlighet till identifiering, hantering och förrådsförvaring av detaljer. Detta för att säkerställa att detaljer inte skadas, förstörs eller förväxlas.

17.2 - VAC skall säkerställa att produkter, speciellt detaljer och kompletter som är känsliga för och kan ta skada av främmande föremål, är fria från främmande föremål och ej har skadats till följd av hanteringen på VAC.

Speciell uppmärksamhet skall riktas mot följande:

- hantering av mat och dryck i närheten av detaljer
- lämplig rengöring av invändiga hålrum
- utvändig rengöring som skall utföras efter upptäckt av utvändiga föroreningar
- kontroll på antal verktyg och små detaljer

15. CORRECTIVE ACTION AT "OVERINSPECTION"

For deviations found at "Overinspection" at delivery inspection or P&W parts shall a corrective action request be issued. This shall be in writing. See also 17 81 66.

16. P&W MCL RELEASE OF MATERIAL FOR HUB AND DISK

Material for rotating parts shall be accepted by P&W Material Control Laboratory before they are released by Receiving Inspection to Manufacturing. (See MCL-F26).

Parts concerned:

JT8D
- Hub front
- Disk 1.5
- Disk 3
- Disk 11

JT9D
- Disk 5
- Disk 9
- Disk 11
- Disk 13
- Disk 15

PW 2000
- Hub front HPC

17. FOREIGN OBJECT DAMAGE (FOD)

17.1 - VAC shall establish methods and facilities for identifying, handling and storing parts to ensure against damage, deterioration or substitution.

17.2 - VAC shall ensure that products, particularly parts and assemblies susceptible to FOD, are free from foreign objects and FOD resulting from VAC processing.

Specific attention shall be given to items such as:

- food and beverage control
- proper cleaning of internal cavities
- external cleaning following evidence of external contamination
- tool and small part accountability controls

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8. REVISIONER

Lokaler, produkter, rutiner och arkiv hos VAC och leverantörer till VAC skall göras tillgängliga för myndigheter och kundrepresentanter som auditerar P&W styrning av leverantörer.

Periodiska revisioner utföres enligt QC 04-10. Rappportering av dessa revisionsresultat till P&W skall ske på följande sätt:

- PWA blankett 7382 som är utgiven av P&W Inköpsavdelning skall användas. Denna erhålles från P&W SQPR.

- Den del av blanketten som behandlar VAC:s interna dokumentation skall vara ifylld och överlämnad till P&W SQPR 45 dagar efter blankettens erhållande.

- Den del av blanketten som behandlar VAC's revisionsverksamhet skall vara ifylld senast 1 år efter mottagandet av blanketten. Ifylld blankett skall överlämnas till P&W SQPR.

För att tillmötesgå kraven i PWA Engineering Source Approval enligt 18 97 58 (PWA 370) skall Kvalitetsrevisioner utföra kompletterande revisioner med tidsintervallet max 3 månader. I revisionerna skall ingå en kontroll att operationsbeskrivningar har blivit godkända av P&W, samt att dessa ej har ändrats utan godkännande av P&W.

8. AUDITS

VAC's and VAC's subcontractors facilities, contracted products, procedures and records shall be made available to Government and customer representatives auditing P&W control of suppliers.

Periodic audits are performed in accordance with QC 04-10. VAC shall report these audits to P&W per following:

- P&W form 7382 obtained from P&W Purchase department shall be used. P&W SQPR will distribute this form to VAC.

- The VAC documentation portion of the form shall be completed within 45 days of form receipt and provided to P&W SQPR.

- The VAC Compliance Audit portion of the form shall be completed within one year after reception of the form and furnished to P&W SQPR.

To ensure compliance to Engineering Source approval requirements per 18 97 58 (PWA 370), Quality Audits shall in this aspect perform additional audits at a time interval not exceeded three months. Audit in addition to verify compliance to process sheets requirements, shall include a check to verify that process sheets have been approved (signed) by P&W and have not been revised without prior P&W approval.

9. TYPKONTROLL

- Typkontroll för annat än gjutgods, smiden och valsade eller svetsade ringar.

9.1 Typkontroll, allmänt (Se även QPC 12-50) - VAC skall utföra och dokumentera typkontroll på samtliga ritningskrav på gällande ritning och på samtliga egenskaper på ingående detaljer. Detta skall utföras på en representativ produktionsdetalj för att verifiera att tillverknings- och kontrollunderlag är korrekt. Handelsvaror som muttrar, bult, stift etc och vissa egenskaper som små invändiga gängor, hål, spår vilka kontrolleras med standardverktyg som gängtolk, cylindertolk, skjutmått etc behöver ej undergå typkontroll förutsatt att annan metod att verifiera tillverknings- och kontrollunderlag finns och är godtagbar för P&W SQPR.

9. FIRST PIECE LAYOUT INSPECTION

First Piece Layout for other than Castings, Forgings and Rolled or Welded Rings.

9.1 First Piece Layout, General (Ref. QPC 12-50) - VAC shall perform and document First Piece Layout on all drawing requirements on actual drawing and on all characteristics on subassemblies. This Layout Inspection shall be performed on a representative production article in order to verify that manufacturing and control methods are complete. "Off-the-shelf" items e.g. commercially available nuts, bolts, pins etc and certain article characteristics e.g. small internal threads, holes, slots, etc inspected using standard gages as thread plugs, cylinder plugs, verniers etc do not require Layout Inspection provided some other means of asuring the adequacy of manufacturing and inspection instructions are employed and acceptable to the P&W SQPR.

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U.S. Department of Transportation
Federal Aviation Administration

ACSEP Record of Findings / Observations

ACSEP No:

Project No: PE 13 NE-D

Evaluation Criteria Number:	Controlling Document:	Applicable FAR Section:
4 P 4	P & W 6076 AB, SQA Program Reqts. Volvo Quality Manual, 5/96	21.165 (a)

FINDING ☐ System ☐ Safety No. _____

OBSERVATION ☐ System ☒ Isolated ☐ FAR No. ___

Required Condition:

. Pratt & Whitney Quality Assurance Data (QAD), requires Volvo compliance to Visual Standard (VIS) 454 F.

Reference: QAD number 5000501, Revision D

Encountered Condition: ☒ *Discussed with Fa*

In review of the required condition at the Volvo hub Final Inspection Department, it was found that t 0.007R stylus (TAM 142928) required by VIS-454, Table I, could not be located. The purpose of the 0.007R stylus, is to inspect for excessive spiral tool marks in the I.D. of the tie bolt holes.

Attached: VIS -454 F
Volvo Spec. No. 176512
QAD 5000501, Rev. D
IMS Sheet, Visual Inspection Requirements

Signature of Evaluator:	Office Symbol	Date
Rich Gidius [redacted]	NE-MIDO-41	8/14/96

FAA Form 8100-6 (12-93)

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VOLVO
FLYGMOTOR

KONTROLLFÖRESKRIFT
Fortsättningsblad

Utlåndare	Op.nr/op.rtn.nr	Reg.nr
RV	230	304478

Kod	Kontrollpunkter	Kontr.omf	Mått	Mätverktyg	Mätp ant	Anm
	Visual Inspection	100%				
M 210/250	1991 Surface texture acc. to spec. PWA-398, PWA VIS-155		16/ 44/ 95/ 32/ 3.3/	Surface Comparator		7
M 230/410	2001 Broken edges		.003-.015			
M 310/830	2011 Check vibr. tumbling acc. to spec. PWA VIS-73					Tu
M 1/2 100	2021 Check imperfections acc. to spec. PWA VIS-277, PWA 99-1					Tu
M 230/450	2031 Check handling damages.					
M 230/460	2041 Note the dwg. issue no. on the inspection report and the routing sheet.					
M 410	2051 Pack separate in transport protection TS-8227.					

JT8D 1st STAGE FAN HUB SYSTEM REVIEW AT VOLVO

P&W TEAM:
Paul Bardwell, MCL Supplier Metallurgical Control
Jim Korenkiewicz, MCL Nondestructive Testing
George Martello, Quality Engineering & Review
Mike Palazzi, International Supplier Quality Assurance
Joe Sullivan, Materials Engineering/Engineering Source Approval

PURPOSE:
To review the cause of a localized metallurgical condition found in a .5175-.5195 tie rod hole on part number 5000501-01 s/n R32971.

FINDINGS:

1. ROOT CAUSE: USE OF COOLANT CHANNEL DRILLS

- One step plunge with no chip clearing tool retraction.
- Evidence of localized titanium chip deposits mechanically attached to shank of coolant channel drills corresponding to area of metallurgical damage on failed part.
- Laboratory tests exhibit a microstructure similar to that observed on failed part.
- High incidence of SRON activity, tool burning, and tool breakage occurred during use of coolant channel drills.

2. EFFECTIVENESS OF BLUE ETCH ANODIZE INSPECTION (BEA)

- Holes exhibit numerous BEA indications after *intentional* abusive machining.
- Established metallurgical test plan to evaluate BEA indications for evidence of metallurgical damage to correlate nondestructive inspection techniques.

3. SUSPECT POPULATION

- Team consensus is that the suspect population has been identified (8 additional parts) based on samples above and Volvo review of inspection records of all parts they have produced.

4. CURRENT PRODUCTION: NOT SUSPECT

- Uses modified conventional High Speed Steel drill utilizing a complete tool withdrawal for chip cleaning after each .200 of hole length.
- BEA history shows no rejects.
- Reduction in both SRON activity and tool breakage.

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U.S. Department of Transportation
Federal Aviation Administration

ACSEP Record of Findings / Observations

ACSEP No:

Project No: PE 13 NE-D

Evaluation Criteria Number:	Controlling Document:	Applicable FAR Section:
4 Q 1	PWA SQA 6076 AB Volvo Quality Manual, 5/96	21.165 (a)

FINDING ☐ System ☐ Safety No. ____

OBSERVATION ☐ System ☒ Isolated ☐ FAR No. 2

Required Condition:

Reference: P&W Hub, P/N 5000501

Manufacturing Operation Sheet for operation 113, honing of tie bolt holes, calls for a 0.8 surface finish (32).

Encountered Condition: ☒ *Discussed with Fac*

Review of manufacturing operation 113 revealed that surface finish is not being inspected at this operation. Further review finds surface finish is being inspected at Operation 230, Final Inspection at Inspection Method Sheet (IMS) Sequence No. 1991.

IMS No. 1991 calls out five (5) different surface requirements (1.6, 0.4, 0.5, 32, 0.8). Tiebolt holes are being inspected to 1.6, the engineering drawing requirement. However, there is no distinct IMS sequence specifically called-out for the tie-bolt hole surface finish.

Attached: MOS Operation 113
Operation 230 IMS

Signature of Evaluator:	Office Symbol:	Date
Rich Gidius [redacted]	NE-MIDO-41	8/14/96

FAA Form 8100-6 (12-83)

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EVALUATION SPECIAL EMPHASIS ITEMS

ACSEP NO. _____ **PROJECT NO.** **PE 13 NE-D**

NOTE TO MIO MANAGER AND COGNIZANT PRINCIPAL INSPECTOR

1. In accordance with PWA 370, ESA approval process procedures, P&W provided Volvo with engineering requirements for process approval. For hole processing it was stipulated that Volvo must submit evidence of post machining metallurgical acceptability for samples machined with a sharp tool and samples processed by a tool immediately prior to resharpening.
Review of Volvo process instructions as well as machinist training requirements found no evidence both quantatively or qualitatively which establishes the definition of a "tool immediately prior to resharpening".
It is recommended that due to the airworthiness significance of engine hardware processed within the ESA system and the importance of substantiation being based on tool condition, the definition of tool sharpness should be precisely defined.

2. Approved hub forging suppliers are P&W, Ladish and Cameron Iron Works. Approval status of Cameron was not conclusively established for an order placed in 1988. A review of information available at Volvo, provided a degree of confidence, but it is recommended that the P&W approved supplier list, for that time frame, be reviewed at P & W to assure the status of Cameron when the hub was received at Volvo.

NOTE TO ACO MANAGER AND ASSIGNED PROJECT ENGINEER

Subject: Audit Plan for Volvo Flygmotor, Trollhatten, Sweden, JT8D-200 series engine, Fan Hub Investigation.

From: Richard Gidius, ASI, NE-MIDO-41

To: John Varoli, NE-MIDO 46
Dan Kerman, ANE-142

The following audit plan for the subject company is listed below. The tentative plan now is to depart from the United States on August 11, 1996 and arrive at Trollhatten, Sweden on the afternoon of August 12, 1996.

The audit/investigation at Volvo will begin on August 13, 1996 at approximately 8:00 A.M. The time span for this audit will be from three to six working days to complete.

The audit will be conducted utilizing the Pratt & Whitney quality assurance flow down requirements to Volvo. The methodology of the audit will be in accordance with FAA Order 8100.7, ACSEP evaluation criteria. The main focus of this audit will be to review the controls for the manufacturing and quality control requirements for the P&W, JT8D-200 series engine hub, P/N 5000501-01. Special emphasis will be placed upon the fabrication and inspection of the hub, tie bolt holes.

The audit will consist of the following:

Dan K.

1. Substantiate that P&W, Engineering Source Approval (ESA) per P&W Specification 370, was granted to Volvo by P&W for the manufacture of the subject hub.

a. Verify that any and all significant changes made to the manufacturing process which would require P&W, ESA approval, were submitted to and approved by P&W.

1. Were there any significant changes (approved or unappoved) made to the hub, tie bolt hole machining operation, which could establish a cause for abusive machining?

b. Verify that Volvo is auditing the hub, ESA process per the requirements of P&W Specification 370.

RICH

2. Review the manufacturing operations for the drilling and honing of the hub, tie bolt holes.

15

RICH

a. Adequacy of work instructions.

1. Gage call-outs.
2. Tools and fixtures identified.
3. Dimensional and visual requiremnts listed.
4. On Op. Cert.?

b. Revisions to work instructions in accordance with Item 1(a) above.

1. Are work instructions stamped with or identified as "ESA" approved work sheets?

c. Witness (if possible) the drilling and honing operations of the tie bolt holes, to substantiate compliance to the work instructions.

3. Review the Blue Etch Anodize inspection process per P&W, EIS-13, Code B, Method EIM-3.

a. Ensure hub has no type of plating or coating on surfaces to be inspected, prior to Blue Etch.

b. Ensure hub receives a thorough cleaning prior to the anodize application.

RICH

c. Ensure that the inspection requirements include as a minimum, the requirements of EIS-M and EIS-13.

d. Verify that Volvo, Blue Etch Anodize inspectors are certified to a minimum of a Level II. Reference: P&W, Nondestructive Test Qualification and Certification Specification (NDTQ), dated 8-30-88.

e. Ensure there is a system in place that identifies, segregrates and documents Blue Etch detected nonconformances.

1. That nonconforming parts are submitted to Volvo, Preliminary Reveiew (PR) personnel for subsequent disposition. (submit to P&W MRB, scrap, rework) Reference: PWA-QA-6088.

J.V.

4. Review the Fluorescent Penetrant Inspection (FPI) process per FPM Master, dated 1-15-96. Ensure compliance to the FPM Master.

a. Ensure hub is being processed utilizing FPM-Code 7 (ultra high sensitivity penetrant) and is being inspected to the FPS-M Method.

J.V

b. Inspectors certified to Level II. Reference: P&W, NDTQ, dated 8-30-88.

c. Nonconforming material is processed per Item 3 (e) (1) above.

5. Review the inspection operation which performs the final visual inspection of the hub, tie bolt holes.

a. Ensure P&W Visual Standard, 454 is being utilized by inspection personnel.

b. Perform visual inspection of hub, tie bolt holes utilizing VIS-454. Is inspection standard (VIS-454) adequate?

R.I.M

c. Ensure inspection work instructions include the inspection of hub, tie bolt holes, surface finish requirements as required by the Engineering Drawing.

1. What type of inspection method is used to verify surface finish? Is it adequate?

d. Are visual detected noncoformances being processed to Volvo, Preliminary Review personnel?

J.V.

6. Does Volvo have on file, all of the P&W specifications listed in P&W, Requirement Control Card (RCC) number 016? Note: That are applicable to Volvo.

7. Review material certifications received in with hub forgings, for compliance to the material specifications.

D.K J.V.

a. Are hub forgings being purchased from approved P&W sources? Reference: PWA 300

The above audit plan inspection criteria, represents the minimum that will be reviewed by the FAA, audit team. During the conduct of this audit, other areas of Volvo's quality system may be reviewed based upon results of audit findings.

a. Op. Cert. Program

PLAN

FOR

FAA AUDIT

OF

P & W - VOLVO

JT8 D FAN HUB

AUDIT CONTENT (Cont.)

4. Review FPI process
5. Review final inspection operation
   - disposition of nonconformances
6. File of applicable P&W specifications
7. Review of material certifications
8. Any other areas deemed appropriate

(b)

AUDIT CONTENT

1. Substantiate that P&W ESA (Spec. 370) was granted.

   . verify change approval
   . assess whether any changes to machining operation could have caused abusive machining
   . verify that Volvo audits conducted

2. Review mfg operations re tie bolt holes

   . Work instructions - revisions; ESA approved
   . Witness drilling & honing of tie bolt holes

3. Review Blue Etch anodize inspection process per P&W methods

AUDIT GUIDELINES

- **Product audit as per FAR 21.157 re compliance with FAR 21.165**
- **As a result of LOI issued to P&W**
- **In accordance with ACSEP procedures**

  { Design Data Control; Mfg Processes; Special Processes; Nonconforming Material; Supplier Control; Internal Audit; N D I }

- **Review of Mfg controls & QC Reqmts for hub, as prescribed by P&W flowdown procedures**
- **Special Emphasis on fab & inspection of hub, tie bolt hole**

P&W - VOLVO FAN HUB SPECIAL AUDIT

DAILY JOURNAL
August 13, 1996

ATTENDEES:

P&W	LFV	FAA	VOLVO
George Martello	Staffan Jonsson	Richard Gidius	Gunnar Cegrell
Joe Sullivan	Bo Karlstrom	Daniel Kerman	Bertil Anderson
Mike Palazzi	Karl Olof Thor	John Varoli	Hans Widerberg
Paul Bardwell			Inger Johansson
Jim Korenkiewicz			Sverker Johnson
			Henry Johansson

- McDonnell Douglas representative was asked not to attend, since this was not an accident investigation, but rather an FAA audit of P&W control of its partner/supplier, Volvo.
- In-briefing was presented, outlining the scope and guidelines of the audit (copy attached).
- Team assignments were made as follows:

  R. Gidius: Manufacturing operations; final inspection operations; Blue-etch anodize inspection process.

  D. Kerman: Engineering Source Approval; material certifications.

  J. Varoli: Fluorescent Penetrant Inspection; P&W specification file; material specs.
- Relative to FPI, P&W Spec. No.FPM Master,Revised 1/15/96 and Nondestructive Test Qualification Specification, Chg. K were reviewed. In addition Volvo Quality Manual, QC 01-01, dated 5/96, the Level I document, was reviewed. This document, which contains the Volvo common systems requirements is in English, as is the Document level 2, which contains the division specific systems requirements. However, the Document level 3 which contains the Division specific quality procedures and the Document level 4, which contains work instructions are in Swedish. The latter two documents were "read" with a translator. The Volvo documents that correlate to the P&W FPI Master and NDTQ specification were reviewed for correct flowdown. No discrepancies were noted.
- P&W personnel briefed FAA on the progress of their audit at Volvo during Monday, August 12.
- Three teams were formed, with composition made-up of FAA, P&W and Volvo personnel.
- A review of the Engineering Source Authorization revealed that 12 process and tool changes by Volvo were classed as Insignificant and accepted by P&W field personnel, but should have been categorized as Significant, in accordance with PWA 370 Engineering Source Approval Requirements warranting review by P&W Engineering and Quality personnel. In addition it was noted that there is no definitive criteria for tool resharpening. This is an essential requirement placed on a supplier such as Volvo by P&W engineering for hole drilling and thus should be quantitatively established.
- During the review of the Manufacturing Processes, rough drilling, boring and honing were witnessed. A question whether does the resultant surface finish after honing, satisfy the manufacturing requirements, will be pursued tomorrow.

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- The Fluorescent Penetrant Inspection process at Volvo was reviewed and was found to be in compliance with P&W FPM Master, dated 1/15/96. The computerized FPI process assures that the hub is being processed utilizing FPM-Code 7, as prescribed by the P&W FPM Master. The FPI inspector is certified to Level II, as per the P&W specification.
  The hub forging material certifications were reviewed at Receiving Inspection. The question whether only P&W approved sources are used is to be pursued.
- The ESA review continued. However P&W had not presented the Supplier Report of Non-conformance's (SRON)'s regarding tool-type of problems. Also the report of coolant channel drilling smearing affect had not been presented to FAA.
- The Blue-etch process was reviewed and found to be in compliance.
  The stylus necessary for hole inspection was found not to be in the area.
  The surface finish requirements specified on the drawing and the IMS were different and were found to be confusing.

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- P&W was asked to provide the SRON's for review by FAA engineering personnel and this was accomplished.
- The supplier control audit process at Volvo was reviewed and it was found that all requirements were not being adhered to.
- The approved suppliers for the hub forgings were reviewed and it was found that proper certifications from approved suppliers were filed at Volvo. However the approval status of Cameron Iron Works in 1988 remained to be verified at P&W.
- The close-out briefing was conducted and the team departed for Gothenburg.