CHAPTER

05

TIME LIMITS/ MAINTENANCE CHECKS

CHAPTER 5 - LIFE LIMITS

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REVISION NO. 20, DATED JUL 15/99

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5-11-2, LIFE LIMITS	Added stage 3 disk PN 5045T89P01 (item No. 5) and its life limit in table 1	2

CHAPTER 5 - LIFE LIMITS

LIST OF EFFECTIVE PAGES

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LIFE LIMITS OF ENGINE ROTATING PARTS

1. General.

   A. The FAA has approved service life limit cycles for rotating parts installed in the GE Aircraft Engines CF700-2C, -2D, and -2D-2 (Airline Service) turbofan engines.

   B. Rotating parts of all turbine engines have some type of service limits. Critical rotating parts are those parts whose sudden failure could threaten the structural integrity of the engine. These parts, when subjected to large, repeated, and/or alternating stresses, can fail through fatigue. The material properties of a part are depleted by fatigue as a function of the number of stress cycles the part experiences. Stress cycles of turbine engine rotating parts result from the transients of engine speed and temperature occurring during normal engine operation. Therefore, the life limit cycles provide the operator with a means of tracking the useful service life of a part so that the part can be removed from service before possible fatigue failure. These life limits are usually expressed in terms of cycles, and can be related almost directly to the number of stress cycles that occur during engine operation. It is for this reason that the limits are in terms of cycles.

   C. Life limits of the critical rotating parts are established through analysis and testing. Accumulated cycles are compared to the life limits to determine if the affected hardware is still serviceable. No component must be permitted to remain in service beyond its life limit cycles. Refer to paragraph 2 for the definitions of a cycle.

2. Requirements.

   A. Definitions. A cycle is defined as a flight consisting of an acceleration to takeoff power, takeoff, and landing. Use (or non-use) of thrust reverser does not change the cycle count. Other operational procedures that affect the life limit cycles of rotating parts are counted as follows:

      (1) An air start performed for pilot training counts as one cycle for each rotating part.

      (2) Each flight (takeoff and landing) counts as one cycle regardless of whether or not the engines are shut down prior to the next takeoff.

      (3) Deleted.

      (4) Engine starts and shutdowns for operational checks, ground maintenance, and taxiing do not count against cycle limits.

(5) Partial cycles, such as the following, must be counted if such operations either occur on more than 10 percent of total flights or subject the engine to conditions which accelerate LCF usage.

(a) Landing without engine shutdown followed by another flight counts 1/6 cycle for each rotating part.

(b) A touch-and-go landing or go-around counts 1/6 cycle for each rotating part.

(c) Missions under 15 minutes duration (including operating time prior to takeoff) will consume fan shaft life twice that of a longer mission.

(6) When the thrust reverser is used, but the throttle is not advanced beyond 65 percent Ng, no additional cycles are added. When the reverser is used and the throttle is advanced beyond 65 percent Ng, 1/3 cycle is added to the cycle count of each rotating part.

(7) Examples:

(a) During a flight, operator makes an air start on the right-hand engine, lands using the thrust reverser, and shuts down engines. During thrust reverser operation, the throttle is advanced to 70 percent Ng.

Cycle count, right-hand engine:	1	normal mission
	1	air start
	1/3	thrust reverser
	2-1/3	total
Cycle count, left-hand engine:	1	normal mission
	1/3	thrust reverser
	1-1/3	total

(b) More than 10 percent of missions are used for pilot training (10 percent rule applies). Normal flight consists of a takeoff, landing with thrust reverser, and shutdown. During thrust reverser operation, the throttle is not advanced beyond 65 percent Ng. The flight includes three touch-and-go landings.

Cycle count, left and right-hand engines:

1	normal flight
1/2	touch-and-go (1/6 cycle each)
1-1/2	total

NOTE: Thrust reverser operation did not add to cycle count because throttle was not advanced beyond 65 percent Ng.

(c) Flights under 15 minutes occur on more than 10 percent of missions. An operator starts the engines, takes off, and lands using thrust reverser. Engines are not shut down. Operator makes second takeoff and landing using thrust reverser, and does not shut down engines. Operator then makes a third takeoff and landing, without using thrust reverser. Each mission was under 15 minutes and throttle was advanced beyond 65 percent Ng during thrust reverser operation.

Cycle count, left- and right-hand engines:

1	normal takeoff and landing
2/3	thrust reverser
1/3	short mission (1/6 for each)
2	for all rotating parts
2	additional for fan shaft life, which is consumed twice as fast because of the short missions
4	total fan shaft life consumed

B. Affected Components.

CAUTION: LIFE LIMITED PARTS DEFINED BY THIS SECTION MUST NOT BE OPERATED BEYOND THE ESTABLISHED LIMITS.

The engine parts that are life limited by this section are:

- Fan rotor components (refer to 5-11-1)
- Compressor rotor components (refer to 5-11-2)
- Turbine rotor components (refer to 5-11-3)

C. Recording Cycles.

(1) The operator is responsible for maintaining an accurate record of the cycles experienced during engine operation. The operator must also monitor the status of the parts to ensure that none of the parts listed in paragraph B exceed the established life limit cycles.

(2) The CF700 Turbofan Engine Service Record Book provides the forms for recording the engine cycle history.

(3) The operator and/or the Service or Overhaul Facility is responsible for making appropriate engine log book entries to reflect the changes in components.

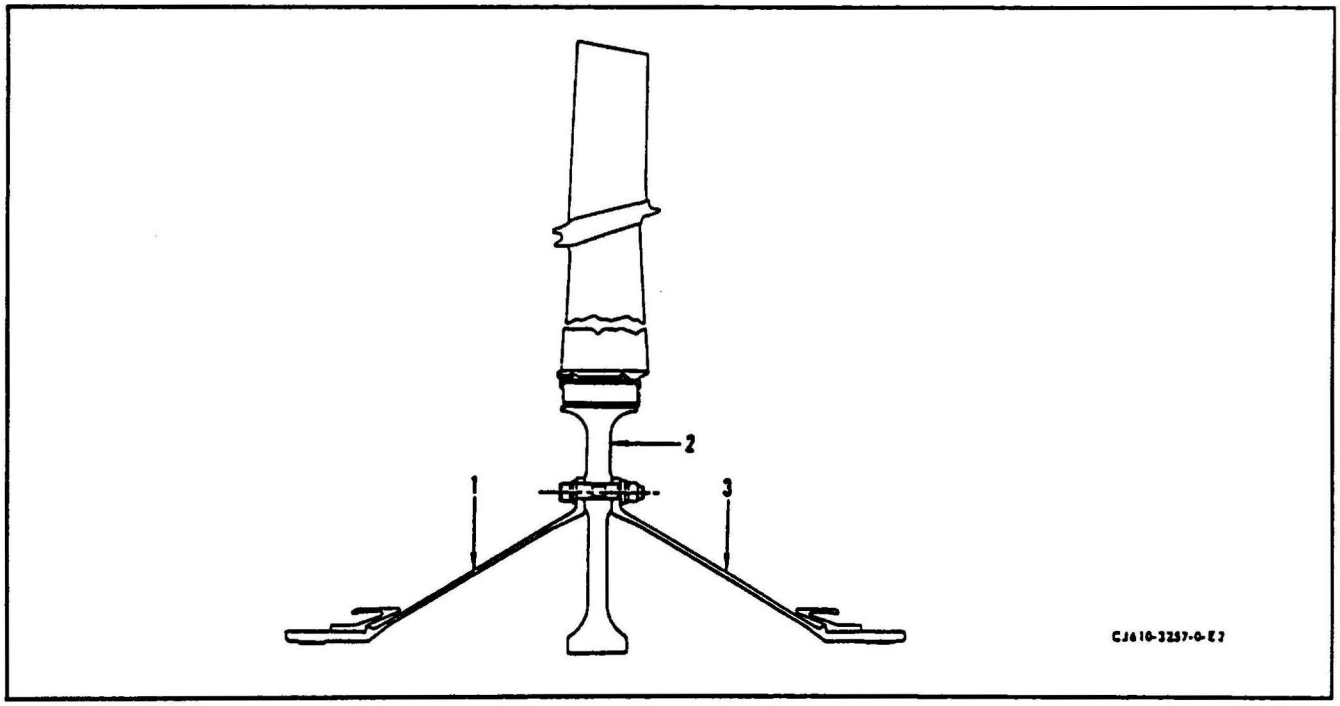
FAN ROTOR – LIFE LIMITS

1. General.

   A. This section contains the FAA-approved life limits for the fan rotor assembly.

   B. The life limit is determined by the total number of flight cycles. Refer to 5-11, paragraph 2, for the requirements. (The operator is responsible to make sure that the cycle-limited parts are not used beyond their cycle-limit.)

2. Life Limits of Components of the Fan Rotor. (Refer to figure 1 and table 1.)



Fan Rotor Components
Figure 1

TABLE 1

FAN ROTOR COMPONENTS – LIFE LIMITS

No.	Part Name and Part Number	Figure 1 Index No.	Life Limits– Cycles
1.	Front Shaft	1	
	37D401342P102 (Non-Center Vent)		10,000
	37D401342P103 (Center Vent)		10,000
2.	Disk	2	
	5002T40P01		10,000
3.	Rear Shaft	3	
	37D401342P102		10,000

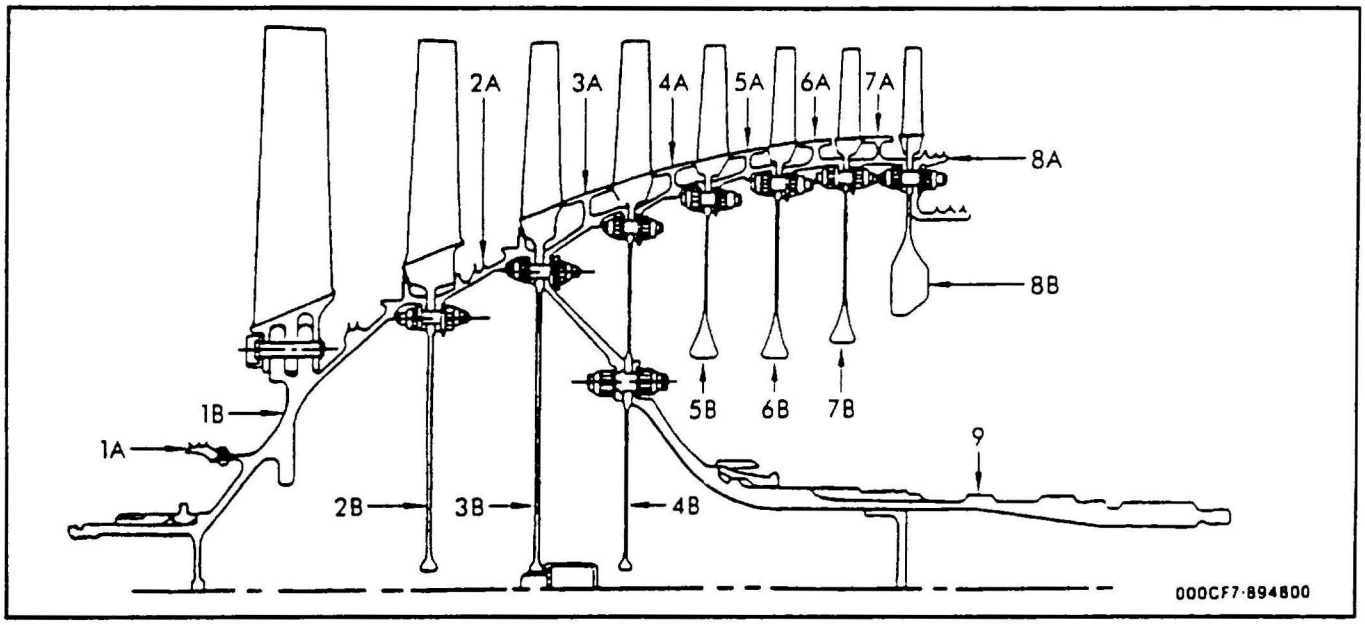
COMPRESSOR ROTOR - LIFE LIMITS

1. General.

   A. This section contains the FAA-approved life limits for the compressor rotor components.

   B. The life limit is determined by the total number of flight cycles. Refer to 5-11, paragraph 2, for the requirements. (The operator is responsible to make sure that the cycle-limited parts are not used beyond their cycle-limit.)

2. Life Limits of Components of the Compressor Rotor. (Refer to figure 1 and table 1.)



Compressor Rotor Components
Figure 1

TABLE 1
COMPRESSOR ROTOR COMPONENTS - LIFE LIMITS

No.	Part Name and Part Number	Figure 1 Index No.	Life Limits-Cycles
1.	Stage 1 Diskshaft	1B	
	37E501428P102		7,000
	37E501428P106		7,000
	5001T26P04		7,000

TABLE 1

COMPRESSOR ROTOR COMPONENTS - LIFE LIMITS (Cont)

No.	Part Name and Part Number	Figure 1 Index No.	Life Limits-Cycles
2.	Stage 2 Disk	2B	
	37D401312P101		7,000
	5045T88P01		7,000
3.	Stage 1 Seal	1A	
	646C638P2		7,000
4.	Stage 2 Spacer	2A	
	37D401302P101		5,000
	37D401302P103		6,600
5.	Stage 3 Disk	3B	
	37D401313P101		7,000
	5045T89P01		7,000
6.	Stage 3 Spacer	3A	
	37D401303P101		5,000
	37D401303P102		5,000
	37D401303P104		6,600
7.	Stage 4 Disk	4B	
	37D401314P101		5,000
	37D401314P102		5,000
	5018T16P01		6,600
8.	Stage 4 Spacer	4A	
	37D401304P103		4,400
	37D401304P104		4,400
	3920T04P02		4,400
	5013T88P01		6,600
9.	Stage 5 Disk	5B	
	37D401315P101		3,900
	4920T32P10		3,900
	5013T79P01		6,600

TABLE 1

COMPRESSOR ROTOR COMPONENTS – LIFE LIMITS (Cont)

No.	Part Name and Part Number	Figure 1 Index No.	Life Limits–Cycles
10.	Stage 5 Spacer	5A	
	37D401305P103		4,000
	37D401305P104		4,000
	3920T05P02		4,000
	5013T89P01		6,600
11.	Stage 6 Disk	6B	
	37D401316P101		4,600
	4920T33P01		4,600
	5013T80P01		6,600
12.	Stage 6 Spacer	6A	
	37D401306P103		5,000
	37D401306P105		6,600
13.	Stage 7 Disk	7B	
	37D401317P101		4,500
	4920T34P01		4,500
	5013T82P01		6,600
14.	Stage 7 Spacer	7A	
	37D401307P103		5,000
	5013T90P01		6,600
15.	Stage 8 Disk	8B	
	37D401709P101		5,000
	4920T35P01		5,000
	5013T83P01		6,600
16.	Stage 8 Seal	8A	
	37D401510P102		6,600
	4010T01P01		6,600

TABLE 1

COMPRESSOR ROTOR COMPONENTS – LIFE LIMITS (Cont)

No.	Part Name and Part Number	Figure 1 Index No.	Life Limits– Cycles
17.	Driveshaft	9	
	37E501234P101		13,200
	5004T73P01		13,200
	5004T73P02*		13,200

*Incorporated in assembly P/N 3007T98G01

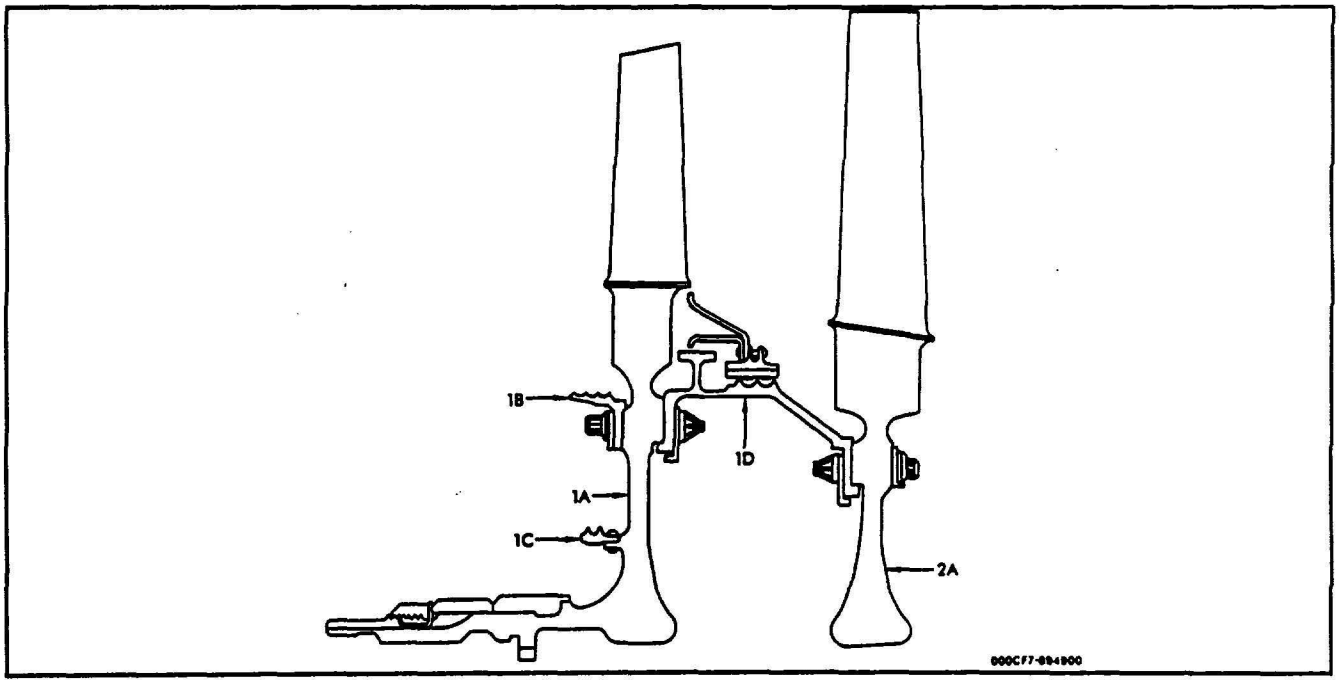
TURBINE ROTOR - LIFE LIMITS

1. General.

   A. This section contains the FAA-approved life limits for the components of the turbine rotor.

   B. The life limit is determined by the total number of flight cycles. Refer to 5-11, paragraph 2, for the requirements. (The operator is responsible to make sure that the cycle-limited parts are not used beyond their cycle-limit.)

2. Life Limits of Components of the Turbine Rotor. (Refer to figure 1 and table 1.)



Turbine Rotor Components
Figure 1

TABLE 1

TURBINE ROTOR COMPONENTS – LIFE LIMITS

No.	Part Name and Part Number	Figure 1 Index No.	Life Limits– Cycles
1.	Stage 1 Wheel	1A	
	634E583P4		3,100
	634E583P4Y		3,100
	634E583P5		5,000
	5011T75P01		10,000
	5011T75P03		10,000
	6028T44P01		7,000
2.	Inner Seal	1C	
	646C501P1		7,000
	3002T74P01		10,000
3.	Outer Seal	1B	
	646C590P2		10,000
4.	Torque Ring	1D	
	37D401014P101		5,000
	37D401014P102		5,000
	5011T74G01/G02		10,000
5.	Stage 2 Wheel	2A	
	646C596P1		3,300
	646C596P1Y		3,300
	646C596P2		5,000
	5011T76P01/P03		10,000
	4036T24P01		5,500

TEMPORARY REVISION 5-002

Filing Instructions: Put this Temporary Revision (TR) in the CF700 Turbofan MAINTENANCE MANUAL SEI-187, adjacent to page 1, dated May 31/98, in Chapter 5-11-4.

Record this TR number in the Record of Temporary Revisions.

Subject: Life Limit of Bearings

Reason: Bearing life analysis substantiated a bearing life higher than 20,000 hours of operation. Bearing failures are near random events and not a wear-out condition and, as such, negate the application of a life limit.

Change: Removed the Life Limits for the bearings of the power takeoff, transfer gearbox, and accessory gearbox in paragraph 2.

FAA APPROVED JANUARY 9, 2003

TEMPORARY REVISION 5-002 (continued)

BEARING - LIFE LIMITS

1. General.

   A. This section contains the FAA-approved life limits for the engine bearings.

   B. The life limit of bearings is measured in hours time-since-new (TSN). Refer to Section 72-02-3 for inspection information.

2. Bearings.

   Cumulative life limits on serviceable bearings are as follows:

Bearing	Part No.	* Life Limit (+30 Hours) CF700
Power Takeoff	Refer to SEI-137	---
Transfer Gearbox	Refer to SEI-137	---
Accessory Gearbox	Refer to SEI-137	---
No. 1	Refer to SEI-137 (Excluding 5020T20P01)	2,100
	5020T20P01	SAME AS ENGINE TBO
No. 2	4003T99P01 or 4003T99P03	SAME AS ENGINE TBO
No. 3	5014T13P02 or 5014T13P06	SAME AS ENGINE TBO
No. 4	4003T99P01 or 4003T99P03, and 4001T22P02	SAME AS ENGINE TBO
No. 5	37B201440P102	SAME AS ENGINE TBO

* Refer to CF700 Service Bulletin 72-39

BEARING - LIFE LIMITS

1. General.

   A. This section contains the FAA-approved life limits for the engine bearings.

   B. The life limit of bearings is measured in hours TSN. Refer to Section 72-02-3 for inspection information.

2. Bearings.

   Cumulative life limits on serviceable bearings are:

Bearing	Part No.	*Life Limit (+30 Hours) CF700
Power Takeoff	Ref. SEI-137	5,000
Transfer Gearbox	Ref. SEI-137	5,000
Accessory Gearbox	Ref. SEI-137	5,000
No. 1	Ref. SEI-137 (Excluding 5020T20P01)	2,100
	5020T20P01	SAME AS ENGINE TBO
No. 2	4003T99P01 or P03	SAME AS ENGINE TBO
No. 3	5014T13P02 or P06	SAME AS ENGINE TBO
No. 4	4003T99P01 or P03, and 4001T22P02	SAME AS ENGINE TBO
No. 5	37B201440P102	SAME AS ENGINE TBO

*Reference CJ610 Service Bulletin 72-43.

MAINTENANCE PRACTICES – INSPECTION/CHECKS

1. General. The maintenance of the engine requires that inspection/checks be made on a periodic, scheduled basis to make certain the engine will function at its most efficient point. In addition to the scheduled inspection/checks, there are those required whenever the engine is subjected to an over-limit operation, e.g. overspeed or overtemperature, etc. This section will describe the requirements for both the scheduled and non-scheduled inspections/checks.

2. Five-Year Corrosion Inspection Requirement.

CAUTION: ENGINES NOT IN COMPLIANCE WITH THE EXTENDED LIFE COMPRESSOR AS DEFINED IN SERVICE BULLETIN (CF700) 72-139 WHICH DO NOT REACH OVERHAUL WITHIN A 5-YEAR PERIOD FROM DATE OF INSTALLATION IN AIRCRAFT, MUST BE SCHEDULED FOR A COMPRESSOR CORROSION INSPECTION.

A. Inspect the engine as follows:

(1) Both compressor casing halves should be removed from the engine. The lower compressor casing half does not require removal if all the vane segments in stage 3 through stage 7 can be removed for inspection with the lower compressor casing half installed. Vanes are to be installed in same positions as removed.

(2) All compressor blades and vane airfoils must be inspected for corrosion.

(3) All vane segments, stage 1 and stage 2, do not require removal for the corrosion inspection.

WARNING: HANDLING BLADED COMPONENTS

WEAR LEATHER PALM GLOVES (WELDER'S TYPE WITH GAUNTLET) WHEN HANDLING COMPONENTS WITH ASSEMBLED BLADES AND VANES. BLADES AND VANES ARE SHARP AND CAN CAUSE SERIOUS INJURY.

(4) All stainless steel vane segments in stage 3 through stage 7 must be removed from compressor casing halves, and the vane segment platforms must be inspected for corrosion. Vanes are to be installed in the same position as removed.

(5) If both casing halves have been removed from the engine and if it is known that the vane segments in stage 3 through stage 7 are made from INCO material, then it is not necessary to remove vane segments from compressor casing halves to inspect the vane segment platforms for corrosion.

(6) Corrosion inspection limits are defined in overhaul manual as follows:

O/H MANUAL	SEI-133
Compressor Casing	Section 72-32-1
Blades	Section 72-33-2
Vane Segments	Section 72-32-2

3. Ten-Year Corrosion Inspection Requirement.

CAUTION: ENGINES IN COMPLIANCE WITH SERVICE BULLETIN (CF700) 72-139 (EXTENDED LIFE COMPRESSOR) MUST BE SCHEDULED FOR A COMPRESSOR CORROSION INSPECTION EVERY 10 YEARS. ALSO, ONLY ENGINES WHICH CONTAIN VANE SEGMENTS MADE FROM INCO MATERIAL QUALIFY FOR A 10-YEAR CORROSION INSPECTION. THIS INSPECTION CAN BE ACCOMPLISHED DURING REPLACEMENT OF CYCLE-LIMITED PARTS, DURING ENGINE OVERHAUL OR 10-YEAR CALENDAR.

A. Inspection of engines in compliance with Service Bulletin (CF700) 72-139. The inspection requirements are as follows:

WARNING: OBSERVE WARNING IN PARAGRAPH 2.

(1) Both compressor casing halves should be removed from the engine. The lower compressor casing half does not require removal if all the vane segments in stage 3 through stage 7 can be removed for inspection with the lower compressor casing half installed. Vanes are to be installed in same positions as removed.

(2) On either of the compressor casing halves that have been removed from the engine, removal of stage 3 through stage 7 vane segments is not required for this inspection.

(3) Corrosion Inspection Limits are defined in overhaul manual as follows:

O/H MANUAL	SEI-133
Compressor Casing	Section 72-32-1
Blades	Section 72-33-2
Vane Segments	Section 72-32-2

NON-SCHEDULED (OVER-LIMITS) INSPECTION/CHECKS

1. Inspection of Engines Subjected to Excessive In-Flight G-Loading.

   A. Inspect the entire engine for evidence of engine contact with the aircraft structure.

   B. Inspect the exterior of the engine for buckling and "oil-canning", loose bolts and clamps, bent brackets and tubes, and evidence of damage to externally mounted equipment.

   C. Inspect the accessory mounting studs and fasteners for looseness or bending.

   D. Inspect the accessory mounting flanges for damage or distortion.

   E. Inspect the gearbox mounting studs, brackets, and bolts for looseness, distortion, and cracks.

   F. Inspect the engine mounts, attaching bolts, and flange areas for bolt damage, hole elongation, and flange distortion.

   G. Perform a functional test on the engine per Adjustment/Test, 72-00.

   H. Record the results of the above inspections/checks. If any of the above conditions exist or if the functional test shows discrepancies, the engine should be replaced.

2. Inspection of Engines Subjected to Overtemperature Operation. If the engine exceeds the maximum temperature of the operating limits, a Hot Section Inspection, Section 5-21-2, paragraph 4, must be performed and turbine rotor given the following additional inspections:

   A. All turbine blades removed and inspected. Refer to Overhaul Manual, SEI-133.

   B. A hardness check made on the turbine wheels in three equally spaced locations adjacent to the dovetail slots on the forward and aft wheel faces. A minimum hardness of 29 R_c must be obtained.

      NOTE: The turbine rotor must be balanced when reassembled.

3. Inspection of Engines Which Show Evidence of Hot-Streaking (Burn-Outs). Engines which show evidence of hot-streaking, denoted by severe damage to turbine nozzles, turbine blades, etc., should be inspected as follows:

   A. Perform hot section distress inspection. Refer to Section 5-21-2, figure 1.

   B. Remove all fuel nozzles so that they can be bench-checked.

4. Inspection of Engines Subjected to Overspeed. If an engine exceeds the maximum speed operating limits for the time specified, return the engine to overhaul for dimensional inspection of the rotors.

5. Inspection of Installed Engines Following Bleed Valve Malfunction or Compressor Deceleration Stall.

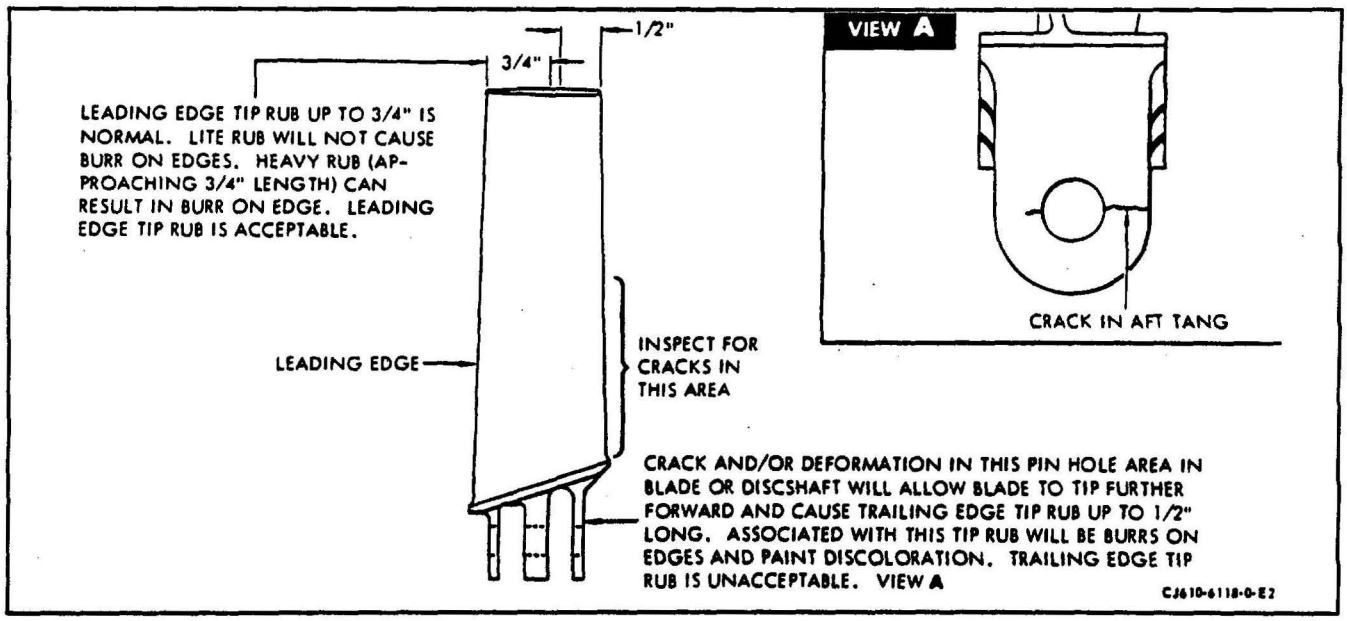
A. Use the following procedural steps to inspect for compressor damage after the following operating conditions are observed:

(1) Compressor air bleed valves jam or hangup between the one-half closed to the fully closed position.

(2) Compressor stalls during deceleration for any cause.

NOTE: A compressor stall is normally associated with a rapid rise in EGT and higher than normal vibration for audible sounds such as a rumble, a woosh, a boom, or a bang.

B. Using a strong light, visually inspect the trailing edges of the first-stage blade tips for rubbing (burrs on tip edges near trailing edge). Rubbing indicates that the retaining pin holes in either the blades or the diskshaft have cracked or deformed. If rubbing is observed, remove the engine from the aircraft and proceed to perform more complete inspection per paragraph D. If leading edge tip rub is acceptable, see figure 1.



Compressor First Stage Blade-Decel Stall Inspection Criteria
Figure 1

C. Visually inspect both concave and convex surfaces using a dental mirror and a strong light for cracking of the first-stage blade airfoil trailing edges between the root and the midsection of the blade. If a crack is found, remove the engine from the aircraft and proceed to paragraph D.

D. Use the following procedure if either blade tip rubbing is observed or if a cracked blade is found:

WARNING: HANDLING BLADED COMPONENTS

WEAR LEATHER PALM GLOVES (WELDER'S TYPE WITH GAUNTLET) WHEN HANDLING COMPONENTS WITH ASSEMBLED BLADES AND VANES. BLADES AND VANES ARE SHARP AND CAN CAUSE SERIOUS INJURY.

(1) Remove all stage 1 compressor blades per Section 72-30.

(2) Thoroughly inspect all blade trailing edges, blade retaining pin holes (see figure 1), and front shaft retaining pin holes for cracks using either of the following two methods:

(a) Visual inspection using a strong light.

(b) Spot method of post emulsification penetrant inspection, per Section 72-03-1.

(3) Replace all stage 1 compressor blades if a cracked blade is found. Scrap removed blades.

(4) Return the engine to overhaul for diskshaft and stage 1 blade replacement if a cracked diskshaft retaining pin hole is found.

E. Return the engine to service if visual inspection does not show blade tip rub or trailing edge cracks.

F. Refer to Troubleshooting Section for correction of cause for compressor stall or bleed valve hangup.

6. Inspection of Engines Operated Above Idle Speed With Nacelle Doors Open or Removed. If an engine is operated above idle speed on the ground or in flight with the nacelle doors open or removed, the fan rotor must be returned to overhaul and fan blades replaced.

CAUTION: ANY ENGINE EXPOSED TO THE ABNORMAL CONDITIONS OF AN ACCIDENT OR INCIDENT REQUIRES SPECIAL INSPECTIONS AND DISPOSITION STANDARDS THAT ARE MORE STRICT THAN THE MANUAL INSPECTION REQUIREMENTS.

7. Accident and Incident Damage - Special Inspection Workscope.

A. Some of the abnormal conditions of operation to which the engine may become exposed during an accident or incident may include one or more of the following:

(1) Shock loading, collision impact, crash damage, or separation from aircraft.

(2) Structural overstress; engine structure supporting weight of aircraft such as failure or separation of landing gear.

(3) Sudden seizure or stoppage.

(4) G-loading during operations, in excess of airframe manual limits.

(5) Extreme ingestion events.

(6) Fire exposure.

(a) Fire consuming all or a part of aircraft.
(b) Post-crash engine exterior fire, engine only.
(c) Engine undercowl fire.

(7) Thermal quench; submersion or partial submersion into water, severe quench in fire fighting.

(8) Severe exposure to corrosives, chemicals, fire extinguisher fluids, or dry powder.

(9) Immersion in brackish/saltwater or sewage.

(10) Post-crash damage during rescue/recovery actions.

(11) Other extreme environments, such as hostile action.

B. When accident or incident damage occurs, engines which have been involved must be subjected to a special workscope. Each event and each engine must have the special workscope completed before return of the engine to service. The owner/operator has the responsibility for continued airworthiness of the engine, which includes replacement of parts. Special workscopes are available through Lynn Product Support Department, please direct your request to:

GE Aircraft Engines
Lynn Product Support Department
ATTN: Manager Commercial Support Programs
1000 Western Avenue
Lynn, MA 01910

8. Inspection of Engines After the Aircraft Has Been Hit by Lightning.

NOTE: If defects or out-of-limits parameters are found while doing steps A, B, or C, get more instructions from your GE Aircraft Engines Representative.

A. Examine both engines installed in the aircraft, including components, for damage caused by arcing (noticeable black discoloration, pitting, burn holes, or heat discoloration). If no defects are found, go to step B.

B. Examine engine and aircraft related wiring, including connectors. *Look for* burn marks, pitting, or broken wires. If no defects are found, go to step C.

C. Do an installed engine run to be sure all parameters are within limits.

D. If no defects are found and engine parameters are within limits, continue to operate.

SCHEDULED INSPECTION/CHECKS

1. General.

   A. The inspection categories of Table 1 are broken down into four inspection intervals: Daily Inspections, Periodic 300-hour and 600-hour inspections, and Hot Section Inspection (HSI). The checks outlined in these intervals indicate minimum inspection requirements for satisfactory inspection compliance.

   B. Visually inspect the items listed in Table 1 under the appropriate Inspection Time Categories.

   C. When the condition of a part is questionable, refer to the maintenance limits and procedures which apply to the individual part.

   D. The following lube system maintenance shall be performed on new engines or whenever the engine has undergone overhaul, Hot Section Inspection, or repair.

   (1) The lube filter shall be inspected for metallic particles per Inspection/Checks, Section 79-00, at 5-10 hours and 50-60 hours.

2. Daily Checks – Preflight/Postflight.

   A. Visually check the engine inlet and exhaust areas, with duct covers removed and using a flashlight for the items listed in Table 1 under item, Daily Checks.

   B. Check the ground surface area and any aircraft surfaces in the immediate vicinity of the engine inlets for foreign debris.

3. Periodic Inspections.

   A. A thorough visual inspection of the engine is required at regular intervals of approximately 300-310 operating hours and 600-610 operating hours.

   B. Clean the compressor section at Categories 3, 4, and 5 of Table 1 by using procedures in Maintenance Practices – Cleaning, Section 72-00. Use either paragraph 2 or paragraph 3, depending upon the nature of the contaminant and the calendar time.

   C. Visually inspect the items listed in Table 1 under the appropriate Inspection Time Categories.

4. Hot Section Inspection. (See Service Bulletin (CF700) 72-39 for time intervals and limiting items.)

A. Inspect items listed in Table 1, Category 4. Disassemble the basic engine to the point where the combustion liner can be removed. Remove only the parts necessary to provide access to the liner. After removing necessary airframe QEC parts, disassemble the engine in the following sequence referring to the applicable section of this manual.

	Removal/Installation Section	Inspection/Check Section
(1) Aft Fan Section.	72-00	72-71-0 through 72-73-0

NOTES: 1. If Service Bulletins (CF700) 72-96 (Replacement of Viton A O-rings with Viton (Fluorel 2160) O-rings) and (CF700) 79-8 (Fan Center Vent System) have not been complied with, it is recommended they be accomplished. This will require a complete disassembly of the aft fan section.

2. If Service Bulletins (CF700) 72-96 and (CF700) 79-8 have been complied with, the aft fan section need only be sufficiently disassembled to perform inspections required in Section 72-70, paragraph 5.

(2) Igniter Plugs. Alternate replacement of top and bottom igniter is recommended. See Table 1, item J.(2), NOTE.

CAUTION: DO NOT MIX HORIZONTAL AND VERTICAL FLANGE BOLTS OF DIFFERENT PART NUMBERS. PART CODE IS NOTED ON TOP SURFACE OF ALL BOLT HEADS.

(3) Turbine Stator Assembly (Casing and Stage 2 Nozzle).	72-50	72-52-0

NOTES: 1. The lower half of the stage 2 nozzle receives more deterioration than the upper half. To increase nozzle life, record position of nozzle halves at disassembly (upper or lower) and reverse position at assembly. Halves are identified by the letter "A" or "B" marked after the serial number on the inner band. If no letter is present, mark one half "A" and the other half "B". Marking to be done with a vibropeen pencil or equivalent.

2. Because the stage 2 turbine nozzle is more susceptible to hot section distress than other engine parts, it is used as an indicator of abnormal distress. Therefore, during Hot Section Inspection (HSI), if the nozzle is abnormally distressed, inspect the engine fuel system as described in figure 1.

	Removal/Installation Section	Inspection/Check Section
(4) Turbine Rotor Assembly.	72-50	72-53-0
(5) First-Stage Turbine Nozzle.	72-40	72-51-0
(6) Combustion Liner.	72-40	72-42-0
(7) No. 3 Bearing.	72-40	72-02-3
(8) Compressor Interstage Bleed Valves.	75-32-0	75-32-0
(9) Any Exposed Carbon Seals and Seal Runners.	72-30/72-40 72-71-0/72-73-0	72-02-2
(10) Fuel Nozzles.	73-18-0	73-18-0

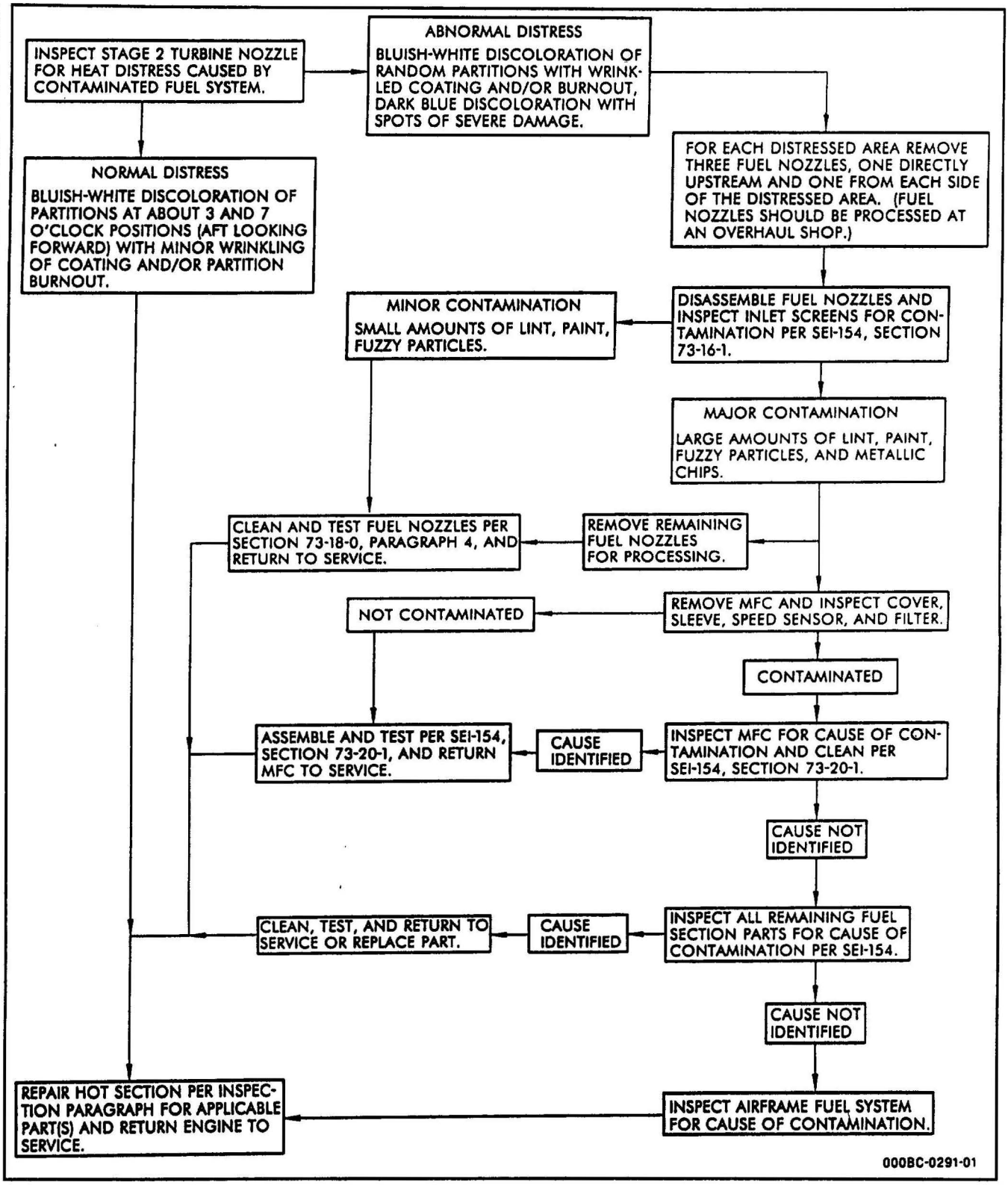
B. Inspect the removed parts per the requirements of the sections referenced under Inspection/Check.

NOTE: It is not necessary to disassemble the subassemblies, such as: turbine rotor, turbine casing, No. 3 bearing and seal, unless condition indicates.

C. Inspect all other items listed in Table 1 and the exposed internal parts (visible areas) per the requirements of individual sections.

D. Clean and repair, or replace defective part (if condition indicates).

E. Reassemble the engine according to the instructions in the Sections referenced under Removal/Installation.



Fuel System Induced Hot Section Distress Inspection Guide
Figure 1

F. Functionally check engine operation per Section 72-00, Adjustment/Test, figure 503. After acceleration check, perform the following seal run-in procedure.

(1) With engine at idle, throttle burst to limiting EGT or RPM (see figure 504, 504A, 504B, 504C, 508, or 509 for limits), stabilize for 1 minute, then chop throttle to idle and stabilize for 1 minute. Repeat five times.

(2) After last chop, stabilize for 2 minutes and shut down engine.

(3) Three minutes after rotation stops, start engine and operate at idle for 2 minutes and shut down.

WARNING: HANDLING BLADED COMPONENTS

WEAR LEATHER PALM GLOVES (WELDER'S TYPE WITH GAUNTLET) WHEN HANDLING COMPONENTS WITH ASSEMBLED BLADES AND VANES. BLADES AND VANES ARE SHARP AND CAN CAUSE SERIOUS INJURY.

(4) For next 30 minutes, periodically check rotor for seizure by turning by hand. If none occurs, repeat take-off power check.

(5) If seizure occurs, repeat steps (1) through (4). If this does not clear seizure, investigate to determine cause of seizure.

Table 1

INSPECTION GUIDE

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
A. Check the engine inlet duct for:				
(1) Deterioration, damage, loose rivets.	x	x	x	x
(2) Integrity of anti-icing boot (if installed).	x	x	x	x
(3) Presence of foreign objects.	x	x	x	x
B. Check the engine external lines, ports, flanges, clamps, and brackets for:				
(1) Security.	x	x	x	x
(2) Damage.	x	x	x	x
(3) Evidence of Leakage.	x	x	x	x
(4) Chafing.	x	x	x	x
C. Evidence of leakage (fuel, oil, air):				
(1) Surface beneath the engine.	x			
(2) Engine surface and accessories.		x	x	x
CAUTION: REPLACE O-RINGS WHENEVER THEY ARE EXPOSED DURING WORK ON THE LUBE SYSTEM.				
D. Check the lube system for contamination as follows:				
NOTE: A leak check must be performed after any part of the lube system is disrupted/disconnected and reassembled as referenced in 72-00, figure 503, step 10.				
(1) Remove and inspect the lube filter for metallic particles per Inspection/Checks, Section 79-00. Clean and reinstall filter.		x	x	x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
NOTES: 1. At 300 hours, the disposable Type "D" filter is to be replaced or may be inspected and rinsed in clean engine oil or rinsed in dry cleaning solvent, P-D-680 (Shell, Chemical Co., Petro Chemical Division, 750 Union Commerce Bldg., Cleveland, Ohio 44115) and dried. Replace filter at 600 hours.				
2. Inspect accessory and transfer gearbox magnetic drain plugs whenever lube filter exhibits metal.				
(2) Remove the magnetic drain plugs from the accessory and transfer gearboxes. Inspect the plugs for metallic particles per Inspection/ Checks, Section 79-00. Clean and reinstall plugs.		x	x	x
(3) Check oil level. Maintain oil level at or slightly below the FULL mark on the oil tank dip stick.	x	x	x	x
NOTE: Oil will seep from the oil tank to the gearbox when the engine is inactive and will give a false indication of a low oil level. Check oil level immediately after engine shutdown.				
(4) Change oil. Refer to Servicing, Section 79-00. Inspect drained oil for presence of particles per Inspection/Checks, Section 79-00.			x	x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
CAUTION: REPLACE O-RINGS WHENEVER THEY ARE EXPOSED DURING WORK ON THE FUEL SYSTEM.				
E. Check the fuel system for contamination: (Refer to Section 73-00.)				
NOTE: A leak check must be performed after any part of the fuel system is disrupted/disconnected and reassembled as referenced in Section 72-00, figure 503, step 11.				
(1) Remove the filters from the fuel pump (Section 73-13) and fuel control (Section 73-21); check for contamination, clean, and reinstall filters.		x	x	x
(2) Clean the overspeed governor servo filter per Section 73-14-0.				x
NOTE: Always check overspeed governor servo filter whenever other fuel filters are found to be contaminated. Source of contamination should be determined.				
F. Check the engine inlet and front frame areas for: (Refer to Section 72-31-0 for serviceable limits.)				
NOTE: A leak check must be performed after any part of the air service system is disrupted/disconnected and reassembled as referenced in Section 72-00, figure 503, step 12.				
(1) Security and cracks at the forward engine mount.		x	x	x
(2) Front frame casing cracks.			x	x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
	Daily	Periodic		HSI (Ref. Para. 4)
		Every 300 HRS	Every 600 HRS	
	1	2	3	4
(3) Bulletnose for:				
(a) Dents.	x	x	x	x
(b) Looseness.		x	x	x
(c) Cracks.		x	x	x
(4) Front frame struts for:				
(a) Nicks and dents.	x	x	x	x
(b) Cracks.			x	x
(5) Variable vanes for:				
(a) Nicks and dents.	x	x	x	x
(b) Cracks.			x	x
(6) Missing pin and clips from visible variable vane levers.		x	x	x
(7) Missing cotterpins from visible variable vane outer shanks.		x	x	x
(8) Rubs between variable vanes and shrouds.			x	x
(9) Distorted variable vane actuator ring.			x	x
(10) Security of anti-icing valve, line, and clamps.			x	x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
(11) Evidence of leaking gaskets at anti-icing valve.			x	x
(12) Variable geometry system looseness. (Check per Section 75-00.)				x
G. Check the compressor rotor and stator assemblies for: (Refer to Sections 72-32-0 and 72-33-0.)				
WARNING: HANDLING BLADED COMPONENTS WEAR LEATHER PALM GLOVES (WELDER'S TYPE WITH GAUNTLET) WHEN HANDLING COMPONENTS WITH ASSEMBLED BLADES AND VANES. BLADES AND VANES ARE SHARP AND CAN CAUSE SERIOUS INJURY.				
(1) Free rotation of the compressor rotor.	x	x	x	x
NOTE: Check by spinning rotor by hand or watching rotor during coast-down.				
(2) Broken rotor studs — Rotate rotor slowly (by hand) and listen for rattling noise, or listen as rotor coasts down during shutdown.	x	x	x	x
(3) Visible compressor rotor blades for nicks, dents, and tip curl.	x	x	x	x
(4) Cracked rotor blades.			x	x
(5) Compressor casings for dents and cracks.				x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
(6) Bleed valve for:				
(a) Security.			x	x
(b) Lubricate. (Refer to Section 75-32-0.)				x
(c) Inspect rollers. (Refer to Section 75-32-0.)				x

WARNING: PENETRANT METHOD OF INSPECTION

PROLONGED OR REPEATED INHALATION OF POWDERS AND VAPORS OF CLEANING SOLVENTS, DEVELOPERS, AND EMULSIFIERS USED IN FLUORESCENT PENETRANT INSPECTION CAN IRRITATE MUCOUS MEMBRANE AREAS OF THE BODY.

CONTINUAL EXPOSURE TO PENETRANT INSPECTION MATERIALS CAN IRRITATE THE SKIN. DIRECT EXPOSURE OF EYES TO BLACK LIGHT AND PROLONGED EXPOSURE OF SKIN TO BLACK LIGHT CAN INFLAME AND DAMAGE EYES AND SKIN.

WEAR NEOPRENE GLOVES WHEN HANDLING PENETRANT INSPECTION MATERIALS. KEEP INSIDES OF GLOVES CLEAN.

STORE ALL PRESSURIZED SPRAY CANS CONTAINING PENETRANTS, DEVELOPERS, AND EMULSIFIERS IN A COOL, DRY AREA PROTECTED FROM DIRECT SUNLIGHT, HEAT, AND OPEN FLAMES. TEMPERATURES HIGHER THAN 120°F (49°C) MAY CAUSE PRESSURIZED CAN TO BURST AND CAUSE INJURY.

IF DIRECT EYE CONTACT WITH BLACK LIGHT CAUSES EYE PROBLEMS, IMMEDIATELY GET MEDICAL HELP.

WHEN USING BLACK LIGHT FOR FLUORESCENT INSPECTIONS, WEAR SAFETY GLASSES.

(d) Fluorescent-penetrant inspect pushrod assembly.				x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
	Daily	Periodic		HSI (Ref. Para. 4)
		Every 300 HRS	Every 600 HRS	
	1	2	3	4
(7) Igniter leads for security and damage.			x	x
(8) Ignition exciter for security and damage.			x	x
(9) Eighth-stage and exit guide vanes.				x
H. Check the mainframe assembly for: (Refer to Section 72-34-0.)				
(1) Fuel manifold for security.		x	x	x
(2) Mainframe casing and struts for damage.				x
(3) Mainframe internal flowpath for corrosion.				x
(4) Fuel nozzles for condition and operation per Section 73-18-0, paragraph 3.A.(2), 3.B.(2), and 3.C. Flow check per Section 73-18-0, paragraph 4.				x
I. Check the accessory drive section for: (Refer to Sections 72-62-0, 72-63-0, and 72-64-0.)				
(1) Security of transfer gearbox on brackets and brackets on mainframe.		x	x	x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
(2) Security of accessory gearbox on brackets and brackets on front frame and/or mainframe.		x	x	x
(3) Security of components mounted on gearboxes.		x	x	x
(4) Spline wear:				
(a) Axis C spline(s) driving generator(s).		x*	x*	x*
(b) All accessory splines: fuel pump, overspeed governor, and hydraulic pump.				x*
J. Check the combustion section for: (Refer to Section 72-40.)	x	x	x	x
(1) Hot spots, bulges, and cracks on the outer casing per Section 72-41-0.	x	x	x	x

*Clean and lubricate mating splines.

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
	Daily	Periodic		HSI (Ref. Para. 4)
		Every 300 HRS	Every 600 HRS	
	1	2	3	4
WARNING: IGNITER PLUGS BEFORE ENERGIZING THE IGNITION CIRCUIT, BE CERTAIN THAT NO FUEL OR OIL IS PRESENT. HAVE FIRE EXTINGUISHER EQUIPMENT PRESENT. HIGH VOLTAGE IS PRESENT. BE CERTAIN THE IGNITION UNIT AND PLUGS ARE GROUNDED BEFORE ENERGIZING THE CIRCUIT. NEVER TOUCH OR MAKE CONTACT WITH THE ELECTRICAL OUTPUT CONNECTOR WHEN OPERATING ANY IGNITION COMPONENT. NEVER HOLD OR MAKE CONTACT WITH THE IGNITER PLUG WHEN ENERGIZING THE IGNITION COMPONENT.				
(2) Replace igniter plugs per Section 80-23-0.		See Note	See Note	x
NOTE: Igniter plug life is a function of engine time, proper immersion depth, ignition cycles, and period of ignition use. The most reliable operation can be obtained by alternatively replacing the top and bottom units at intervals of 100-150 hours, or at intervals consistent with the operators experience and use of ignition in flight.				
(3) The combustion liner shells must be removed permanently and replaced with new shells. The cowl and dome assembly, including the fuel nozzle ferrules and igniter washer, are not to be disassembled nor replaced unless there is an obvious defect. Refer to SEI-133, Section 72-42-0 for limits.				x
(4) Combustion inner casing for hot spots, bulges, and cracks.				x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
(5) Inspect outer combustion casing per Section 72-41-0.				x
K. Check the turbine section for: (Refer to Section 72-51-0, 72-52-0, and 72-53-0 for serviceable limits.)				
(1) Turbine casing cracks.				x
(2) Turbine nozzles for operating defects.				x
(3) Turbine rotor assembly.				x
L. Check the aft fan visible area for: (Refer to Sections 72-70, 72-71-0, 72-72-0, and 72-73-0.)				
(1) Frame cracks and distortion.			x	x
(2) Fan forward and rear frame struts for dents, cracks, and loose or missing rivets or bolts.			x	x
(3) Fan rotor blades for:				
(a) Nicks and dents.	x	x	x	x
(b) Security and cracks.			x	x
(c) Trailing edge cold section missing pieces.		x	x	x
(4) The fan rotor for free rotation.	x	x	x	x
(5) The exit guide vanes for nicks, dents, and cracks.	x	x	x	x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
	Daily	Periodic		HSI (Ref. Para. 4)
		Every 300 HRS	Every 600 HRS	
	1	2	3	4
(6) Forward frame aluminum panels for dents, cracks, missing rivets, and excessive deflection under finger pressure. NOTE: Maximum deflection 0.050 inch		x	x	x
(7) Condition of exhaust thermocouple harness. (Must meet all serviceable requirements of Section 77-21-0.)				x
(8) Exit guide vane outer band abradable coating for missing patches of material. (Refer to Section 72-73-0.)		x	x	x
(9) Dirt buildup inside of No. 4 and 5 oil-in and oil-out tubes. Clean per Section 72-70.				x
(10) Cracks in turbine portion of fan bucket. A defectometer check is to be accomplished at 1,000 hour intervals on the turbine portion of the leading and trailing edges of all fan blades using the instructions in Section 72-72-0, paragraph 2.D. Operators on extended maintenance plans must inspect their blades at 1,000 hour intervals. NOTE: If a defect is found, the entire set of fan blades must be fluorescent-penetrant inspected.				x

Table 1

INSPECTION GUIDE (Cont)

ENGINE COMPONENT AND INSPECTION	INSPECTION TIME CATEGORIES			
		Periodic		HSI (Ref. Para. 4)
	Daily	Every 300 HRS	Every 600 HRS	
	1	2	3	4
M. Check the aircraft tailpipe for:				
(1) Dents, bulges, distortion, or hot-spots. (Refer to Section 78-11-0.)	x	x	x	x
(2) Security of exhaust pressure probes. (Refer to Section 77-11-0.)	x	x	x	x
(3) Inspect and clean exhaust pressure probes. (Refer to Section 77-11-0.)				x
N. Functionally check engine operation per Adjustment/Test, Section 72-00, figure 503.		See Note 1	See Note 1	x
O. Motoring Check.		See Note 2	See Note 2	
P. Clean compressor section per Section 72-00.		See Note 3	See Note 3	See Note 3

NOTES: 1. Functional checks indicated at 300 or 600 hour intervals are recommended if engines have been idle for more than 1 month prior to the check. This check is also recommended if pilot's post flight report indicated there may be an engine operational problem.

2. This check can be accomplished as part of cleaning or igniter plug change. Pilot's normal starting procedure can be used to monitor starter torque capability of 12 percent Ng RPM in 12 seconds or better.

3. A high rate of landings, especially in areas where there is airborne soot or dirt, may require additional cleaning intervals. Generally, 300-350 hours should be sufficient to maintain efficient compressor operation.