

REV DATE: Feb 01/2025

AIRBUS

Tail Number - MSN - FSN: ALL

72-31-00-290-002-A - Inspection of the High Pressure Compressor Rotor Assembly

** ON A/C FSN 201-250, 351-400

TASK 72-31-00-290-002-A

Inspection of the High Pressure Compressor Rotor Assembly

FIN: 1000EM1 1000EM2

WARNING: BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER ENGINE SHUTDOWN.

USE APPLICABLE THERMAL GLOVES. THE ENGINE PARTS AND THE ENGINE OIL CAN

STAY HOT FOR ONE HOUR AFTER SHUTDOWN AND CAN BURN YOU.

WARNING: BE CAREFUL WHEN YOU USE CONSUMABLE MATERIALS. OBEY THE MATERIAL

MANUFACTURER'S INSTRUCTIONS AND YOUR LOCAL REGULATIONS.

1. Reason for the Job

Inspection of a High Pressure Compressor Rotor (HPCR) with the stator case installed is limited to those areas that can be seen with a rigid borescope. There are nine borescope ports (S1 through S9) in the compressor stator case, between the 4 and 5 o'clock position, aft looking forward.

2. Job Set-up Information

A. Fixtures, Tools, Test and Support Equipment

REFERENCE	QT Y	DESIGNATION	
No specific	AR	BAR LENGTH 60 CM (2 FT) BREAKER	
No specific	1	CONTAINER 20 L - SHALLOW	
No specific	AR	SPEED BRACE 3/4 IN - SQUARE DRIVE	
No specific	AR	WARNING NOTICE(S)	
No specific		Torque wrench: range to between 15 and 20 lbf.in (0.17 and 0.23 m.daN)	
No specific		Torque wrench: range to between 57 and 63 lbf.in (0.64 and 0.71 m.daN)	
No specific		Torque wrench: range to between 75 and 85 lbf.in (0.85 and 0.96 m.daN)	
No specific		Torque wrench: range to between 270 and 300 lbf.in (3.05 and 3.39 m.daN)	
No specific		Torque wrench: range to between 450 and 550 lbf.in (5.09 and 6.22 m.daN)	
856A1084	1	CART-STATOR ACTUATOR	
856A1320	1	BORESCOPE-KIT	
856A1321	1	FIBERSCOPE SET	

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-1	Assembly		

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AMM - LLM - A318/A319/A320/A321	REV DATE: Feb 01/2025
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856A1322	1	BORESCOPE-LIGHT SOURCE SET
856A1323	1	MONITOR, RESOLUTION BORESCOPE
856A1488	1	MOTOR, DRIVE - CORE ENGINE ROTATION

B. Consumable Materials

REFERENCE	DESIGNATION
<u>CP1064</u>	milk of magnesia
<u>CP2101</u>	Graphite mineral vaseline
<u>CP2619</u>	Never Seez-Pure Nickel, Special
<u>CP8001</u>	lockwire 0.032 in. (0.8 mm) dia.
<u>CP8002</u>	lockwire 0.032 in. (0.8 mm) dia
<u>CP8006</u>	safety cable 0.032 in. (0.8 mm) dia.

C. Work Zones and Access Panels

ZONE/ACCESS	ZONE DESCRIPTION
400	POWER PLANT, NACELLES AND PYLONS
FOR <u>1000EM1(ENGINE-1)</u>	
437AL, 438AR, 451AL, 452AR	
	FOR <u>1000EM2(ENGINE-2)</u>
447AL, 448AR, 461AL, 462AR	

D. Referenced Information

REFERENCE	DESIGNATION	
Ref. 71-00-00-710-001-B	Dry Motoring Check	
Ref. 71-00-00-710-006-B	Minimum Idle Check	
Ref. 71-13-00-010-040-B	Opening of the Fan Cowl Doors	
Ref. 71-13-00-410-040-B	Closing of the Fan Cowl Doors	
Ref. 72-00-00-200-025-A	Over-Serviceable-Limit Extensions	
Ref. 72-00-00-200-025-A01	Over-Serviceable-Limit Extensions	
Ref. 72-21-00-290-003-A	Borescope Inspection of the Booster Rotor Blades, Stages 2, 3, 4 and 5 through the Booster Inlet and Borescope Ports SO3 and SO5	
Ref. 72-31-00-300-002-A	Repair of Broken Borescope Plug	
Ref. 72-31-00-300-004-A		

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	Blend Repair of the High Pressure Compressor (HPC) Rotor Blades Stages 1-9	
Ref. 72-63-00-000-002-A Removal of the Handcranking Drive Cover		
Ref. 72-63-00-400-002-A	Installation of the Handcranking Drive Cover	
Ref. 78-30-00-081-041-B	Make the Thrust Reverser System Serviceable after Maintenance	
Ref. 78-30-00-481-041-B	Make the Thrust Reverser System Unserviceable for Maintenance	
Ref. 78-36-00-010-040-B	Opening of the Thrust Reverser Doors	
Ref. 78-36-00-410-040-B	Closing of the Thrust Reverser Doors	
Ref. 80-11-10-000-002-A	Removal of the Pneumatic Starter	
Ref. 80-11-10-400-002-A	Installation of the Pneumatic Starter	
Ref. NTM 72-00-00		
Ref. Fig. Core Rotation Drive Motor Installation		
Ref. Fig. VSV System Connections at the HMU		
Ref. Fig. Borescope Ports of the High-Pressure Compressor		
Ref. Fig. HPC Rotor Indexing to Zero		
Ref. Fig. Locally Manufactured Alignment Rod		
Ref. Fig. Locally Manufactured Deep Socket Wrench		
Ref. Fig. Removal of IGV Borescope Plug (S1)		
Ref. Fig. Compressor Blades Inspection		
Ref. Fig. Stator Vane ID to Rotor Contact		
Ref. Fig. Stage 1-3 VSV Shroud Rubbing		

3. Job Set-up

SUBTASK 72-31-00-941-052-A

- A. Safety Precautions
 - (1) On the center pedestal, on the ENG panel 115VU:
 - (a) Put a WARNING NOTICE(S) to tell persons not to start the engine.
 - (2) Make sure that the engine shutdown occurred five minutes or more before you do this procedure.
 - (3) On the overhead maintenance panel 50VU:
 - (a) Make sure that the ON legend of the ENG/FADEC GND PWR/1(2) pushbutton switch is off.
 - (b) Put a WARNING NOTICE(S) to tell persons not to energize the FADEC 1(2).

SUBTASK 72-31-00-010-055-A

B. Open the fan cowl doors: Ref. AMM TASK 71-13-00-010-040

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- (1) FOR <u>1000EM1 (ENGINE-1)</u> 437AL, 438AR
- (2) FOR <u>1000EM2 (ENGINE-2)</u> 447AL, 448AR.

SUBTASK 72-31-00-040-052-A

C. Make the thrust reverser unserviceable Ref. AMM TASK 78-30-00-481-041.

SUBTASK 72-31-00-010-056-A

- D. Open the thrust reverser doors Ref. AMM TASK 78-36-00-010-040:
 - (1) FOR <u>1000EM1 (ENGINE-1)</u> 451AL, 452AR
 - (2) FOR <u>1000EM2 (ENGINE-2)</u> 461AL, 462AR.

4. Procedure

Ref. Fig. Core Rotation Drive Motor Installation

Ref. Fig. VSV System Connections at the HMU

Ref. Fig. Borescope Ports of the High-Pressure Compressor

Ref. Fig. HPC Rotor Indexing to Zero

Ref. Fig. Locally Manufactured Alignment Rod

Ref. Fig. Locally Manufactured Deep Socket Wrench

Ref. Fig. Removal of IGV Borescope Plug (S1)

Ref. Fig. Compressor Blades Inspection

Ref. Fig. Stator Vane ID to Rotor Contact

SUBTASK 72-31-00-410-055-A

- A. Do a borescope installation:
 - (1) Use the MONITOR, RESOLUTION BORESCOPE (856A1323) (856A1323G01) to make sure that the borescope or fiberscope and light source are serviceable. See the Non-Destructive Test Manual for this procedure Ref. NTM 72-00-00 (58828).
 - (2) Install the tools to turn the core engine.

NOTE: The core engine may be turned using a breaker bar (see step (a)) or with a drive motor (see step (b)).

- (a) To turn the core manually with a breaker bar, do the steps that follow:
 - Remove the handcranking drive cover from the core rotation pad on the left side of the accessory gearbox (AGB), opposite the starter. Ref. AMM TASK 72-63-00-000-002
 - Install a SPEED BRACE 3/4 IN SQUARE DRIVE with a BAR LENGTH 60 CM (2 FT) BREAKER into the handcranking drive pad. When you do the borescope inspection, turn the core engine clockwise (CW, aft looking forward).

NOTE: To turn the core engine CW, the handcranking drive must be turned counterclockwise (CCW).

(b) To turn the core with a drive motor, do the steps that follow:

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- 1 Remove the starter Ref. AMM TASK 80-11-10-000-002.
- Install the MOTOR, DRIVE CORE ENGINE ROTATION (856A1488) (856A1488P0 /P02) into the accessory gearbox (AGB) starter drive pad. Align the drive shaft of the drive motor with the starter drive pad drive shaft and engage the splines.

NOTE: The tool must be installed in the horizontal position with the air hoses to the rear.

- 3 Turn the tool until the captive bolts align with the gearbox bolt holes.
- 4 Tighten the two captive bolts by hand.
- 5 Install the clamp to secure the drive motor.
- 6 Attach the foot or hand control air hoses to the quick disconnects on the tool.
- Connect the air supply to the drive motor. The air supply must be capable of 100 psi (6.9 bar). The air supply must be lubricated and filtered at 6 SCFM (170 L/minute).

WARNING: BE CAREFUL NOT TO GET AIRCRAFT FUEL IN YOUR MOUTH OR IN YOUR EYES.

IF YOU GET FUEL ON YOUR SKIN OR ON YOUR CLOTHES, FLUSH IT

IMMEDIATELY WITH WATER.

IF NECESSARY, GET MEDICAL HELP.
AIRCRAFT FUEL IS POISONOUS.

CAUTION: USE A SECOND WRENCH TO APPLY COUNTERTORQUE TO THE NIPPLE WHEN YOU DISCONNECT/CONNECT FUEL LINES ON NIPPLES.

(3) Actuate the VSV system to the full open position as follows:

NOTE: Put a CONTAINER 20 L - SHALLOW under the HMU to catch fuel released when fuel

lines are disconnected.

NOTE: If the CART-STATOR ACTUATOR (856A1084) (856A1084G02 or 856A1084G04) is

not available, the VSV system may be actuated to the full open position by dry

motoring the engine Ref. AMM TASK 71-00-00-710-001.

- (a) Disconnect the VSV rod-end and head-end flex-hoses from the hydromechanical unit (HMU).
- (b) Remove the caps from the CART-STATOR ACTUATOR (<u>856A1084</u>) (<u>856A1084G02 or 856A1084G04</u>).
- (c) Attach the rod-end and head-end hoses from the cart to rod-end and head-end connectors of the rod-end and head-end hoses you disconnected from the HMU.
- (d) Actuate the variable stator system

CAUTION: DO NOT LET THE PRESSURE BE MORE THAN 300PSI (20.68BAR) OR YOU WILL CAUSE DAMAGE TO ENGINE PARTS.

- Pump the actuator until the VSV system is at the open position (actuator rod retracted).
- (e) Disconnect the CART-STATOR ACTUATOR (<u>856A1084</u>) (<u>856A1084G02 or 856A1084G04</u>).

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WARNING: PRESSURE OF UP TO 300 PSI. (20.68 BAR) EXISTS IN THE SUPPLY LINES. RELIEVE PRESSURE TO PREVENT INJURY WHEN DISCONNECTING FITTINGS.

- Follow the instructions for use of the CART-STATOR ACTUATOR (856A1084)

 (856A1084G02 or 856A1084G04) to relieve any static pressure existing in the supply hoses. Gages on the CART-STATOR ACTUATOR (856A1084)

 (856A1084G02 or 856A1084G04) should read zero and the selector valve should be in the OFF position.
- 2 Disconnect the hoses of the cart from the rod-end and head-end hoses.
- 3 Install the caps on the cart hoses.
- (f) Connect the rod-end and head-end hoses to the HMU.

CAUTION: USE A SECOND WRENCH TO APPLY COUNTERTORQUE TO THE NIPPLE WHEN YOU DISCONNECT/CONNECT FUEL LINES ON NIPPLES.

- TORQUE the head-end hose to between 450 and 550 lbf.in (5.09 and 6.22 m. daN).
- TORQUE the rod-end hose to between 270 and 300 lbf.in (3.05 and 3.39 m.daN).
- (4) Remove the borescope plugs from the stages to be inspected as follows. Tag each borescope plug to identify the stage from which it was removed:

NOTE: The borescope plugs are located along the compressor case between the 4 and 5 o'clock positions, aft looking forward.

(a) Remove the lockwire:

WARNING: USE PROTECTIVE GOGGLES AND GLOVES EACH TIME YOU CUT LOCKWIRE. DISCARD LOOSE OR USED LOCKWIRE IMMEDIATELY. LOOSE OR USED LOCKWIRE CAN CUT YOU OR MAKE YOU BLIND.

- 1 Cut and remove the lockwire from the borescope plugs to be removed.
- (b) Remove the IGV borescope plug (S1), if necessary, as follows:
 - Remove the two screws (20) that attach the borescope access blanking plate (10) at 5 o'clock, aft looking forward, on the fan frame inner flange.
 - 2 Remove the borescope access blanking plate (10).
 - 3 Remove the IGV borescope plug (S1).
 - 4 Tag the plug to ensure it will be reinstalled in the correct port.
- (c) Remove the stage 1 through stage 5 borescope plugs (S2 through S6), as necessary. Tag each plug to ensure it will be reinstalled in the correct port.
- (d) Remove the stage 6, 7 and 8 borescope plugs (S7 through S9), as necessary, as follows:

CAUTION:

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DO NOT APPLY A TORQUE OF MORE THAN 280 lbf.in. (3.164 m.daN) TO THE 6TH, 7TH AND 8TH STAGE BOROSCOPE PLUGS WHEN YOU REMOVE THEM. IF YOU DO NOT OBEY THIS INSTRUCTION, THE INNER PLUG SHAFT CAN BREAK.

- 1 Loosen the outer borescope plug.
- Pull the outer borescope plug straight out as far as possible to engage the internal shaft spline.
- 3 Remove the borescope plug.
- 4 Tag each plug to ensure it will be reinstalled in the correct port.
- If the borescope plug is broken or if the inner plug does not come out with the outer plug, remove the broken inner plug with a deep socket wrench Ref. AMM TASK 72-31-00-300-002.
- (5) Connect the fiber light cable to the fiberscope (green or blue band) from the BORESCOPE-KIT (
 856A1320) (856A1320P04 or P05) and to the port on the BORESCOPE-LIGHT SOURCE SET (
 856A1322) (856A1322P01 through P07). Turn the light source on.
- (6) If you use the MOTOR, DRIVE CORE ENGINE ROTATION (856A1488) (856A1488P01 or P02) to turn the core engine, do an inspection of the compressor blades as follows. If you use the breaker bar to turn the core, go to step (7).
 - (a) Index the core engine to zero as follows:
 - 1 Put the fiberscope into the stage 3 borescope port (S4) and look aft to the stage 4 compressor blade platform.
 - While you look in the fiberscope turn the core clockwise (CW), as seen from the front of the engine, using the MOTOR, DRIVE CORE ENGINE ROTATION (856A1488) (856A1488P01 or P02).
 - 3 Turn the core until you see the first blade slot locking lug.
 - 4 Continue to turn the core until you see the second locking lug. The second locking lug is 2 blades past the first locking lug.
 - Align the leading edge of the first blade past the second locking lug with the leading edge of the nearest stage 4 vane. This is the zero index point and blade number 1.
 - Set the pointer on the protractor to the zero degree mark. The core engine is now set to the zero index point for inspection of all stages of the compressor rotor.
 - (b) Do an inspection of stage 4 compressor blades while you turn the core engine using the MOTOR, DRIVE CORE ENGINE ROTATION (856A1488) (856A1488P01 or P02).
 - (c) Use the limits found in step 4.B.
 - (d) Remove the fiberscope.
 - (e) Insert the fiberscope in the borescope plug of the next stage to be inspected and repeat step (b) thru (d) for the other stages to be inspected.
 - (f) If the vane segments in stages 6, 7 and 8 have moved to partially cover the borescope port, do step (8).

(7)

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If you use the breaker bar to turn the core engine, do an inspection of the compressor blades as follows:

- (a) Insert the fiberscope in the borescope port of the stage you want to inspect.
- (b) Do an inspection of the compressor blade you see. Use the limits found in the inspection table.
- (c) Rotate the core engine so that you can see the next blade. Use the breaker bar to turn the core engine clockwise (CW).

NOTE: To turn the core engine CW, the handcranking drive must be turned counterclockwise (CCW).

- (d) Repeat steps (b) and (c) until you have inspected all of the blades in that stage. Count the blades as you inspect them to make sure all of the compressor blades are inspected. The number of blades in each stage is:
 - 1 Stage 1:38 blades
 - 2 Stage 2:53 blades
 - <u>3</u> Stage 3 : 60 blades
 - 4 Stage 4: 68 blades
 - <u>5</u> Stage 5 : 75 blades
 - 6 Stage 6:82 blades
 - 7 Stage 7:82 blades
 - <u>8</u> Stage 8 : 80 blades
 - 9 Stage 9 : 76 blades
- (e) Repeat steps (a) thru (d) for the other stages to be inspected.
- (f) If the vane segments in stages 6, 7 and 8 have moved to partially cover the borescope holes (S7 through S9), do step (8).
- (8) To inspect the stages 6, 7, 8 and 9 blades when the vane segments have moved to partially cover the borescope holes, use the alternatives that follow:

CAUTION: MAKE SURE THE FLEXIBLE BORESCOPE DOES NOT GET CAUGHT IN THE BLADES WHILE YOU TURN THE CORE.

- (a) If the diameter of the borescope holes are larger than 0.24 in. (6.01 mm), do the borescope inspection using the FIBERSCOPE SET (856A1321) (856A1321P01 through P03).
- (b) If the diameter of the borescope holes are less than 0.24 in. (6.01 mm), do the following steps:
 - Put a tapered rod in the borescope hole. The rod must be made from 0.37 in. (9.40 mm) diameter aluminum, 18 in. (0.46 m) long, with a 4 in. (101.60 mm) taper at one end. The tapered end must be rounded to 0.062 in. (1.57 mm) radius, accurate radius not necessary.

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- Apply a light downward force on the end of the tapered rod to move the vane segments.
- (c) If the stage 7 borescope hole (S8) is not fully open, inspect the aft part of the compressor through the stage 8 borescope hole (S9). If the stage 8 borescope hole (S9) is not fully open, try to do the inspection through the stage 6 borescope port (S7).

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B. Inspect the blades to the limits that follow:

Ref. Fig. Compressor Blades Inspection

Ref. Fig. Stage 1-3 VSV Shroud Rubbing

Ref. Fig. Stator Vane ID to Rotor Contact

NOTE: If you find airfoil damage, we recommend that you do a borescope inspection of the stage 5

booster blades and the abradable (refer to CFM SB 72-0391) Ref. AMM TASK 72-21-00-290-

003.

NOTE: The depth of a defect such as a nick is measured along the axis of the damage unless

otherwise noted.

NOTE: Unless otherwise identified, all damage limits for high pressure compressor blades are the

same for the different blade configurations.

NOTE: HPC blades with PN P33xPxx (3D Aero) have a 'C' marked on the aft platform. HPC blades

with PN P39xPxx (TI) have a 'H' marked on the platform.

MAXIMUM SERVICEABLE LIMITS	REMARKS
Any number of radial cracks within 0.30 in. (7.6 mm) of the leading or trailing edge, up to 0.25 in. (6.3 mm) in length are serviceable	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
Any number of radial cracks more than 0.30 in. (7.6 mm) from the leading or trailing edge, up to 0.10 in. (2.5 mm) in length are serviceable	See Repair Ref. AMM TASK 72- 31-00-300-004.
Any number of chord-wise cracks, up to 0.30 in. (7.6 mm) from the tip, up to 0.2 in. (5.1 mm) in length are serviceable	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
Any amount	
Not serviceable	See repair Ref. AMM TASK 72- 31-00-300-004.
	Any number of radial cracks within 0.30 in. (7.6 mm) of the leading or trailing edge, up to 0.25 in. (6.3 mm) in length are serviceable Any number of radial cracks more than 0.30 in. (7.6 mm) from the leading or trailing edge, up to 0.10 in. (2.5 mm) in length are serviceable Any number of chord-wise cracks, up to 0.30 in. (7.6 mm) from the tip, up to 0.2 in. (5.1 mm) in length are serviceable Any amount

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D.Nicks, missing material and erosion on the leading and trailing edge found in Dim. B, if the HPC blade is not a Tech Insertion Stage 4 blade (PN P394PXX)	Any number if the damage is less than 0.04 in. (1.0 mm) in depth	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
E.Nicks, missing material and erosion on the leading and trailing edge found in Dim. B, if the HPC blade is a Tech Insertion Stage 4 blade (PN P394PXX)	Any number, if the damage is less than 0.030 in. (0.8 mm) in depth	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004
F.Dents on the leading or trailing edge found in Dim. B	Any amount if the damage is less than 0.04 in. (1.0 mm) in depth and up to 0.06 in. (1.5 mm) deflection from the original contour	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
G.Nicks, dents and tears on the leading and trailing edge tip corners in Dim. A	Any number if less than 0.25 in. (6.3 mm) in depth	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
H.Missing material and erosion at the leading and trailing edge tip corners in Dim. A and tip	a) Individual blades with missing material more than 0.30 in. (7.6 mm) x 0.30 in. (7.6 mm) on both leading and trailing edges are not permitted. b) Any number of blades for each stage 1 thru 4, up to 0.30 in. (7.6 mm) x 0.30 in. (7.6 mm) if the downstream damage is serviceable. c) For stage 2, a maximum of 4 blades up to 0.40 in. (10.2 mm) x 0.40 in. (10.2 mm), and 46 blades up to 0.30 in. (7.6 mm) x 0.30 in. (7.6 mm) for total of 50 blades with missing tip corners. d) For stage 3, a maximum of 5 blades up to 0.40 in. (10.2 mm) x 0.40 in. (10.2 mm) and 51 blades up to 0.30 in. (7.6 mm) x 0.30 in. (7.6 mm) for a total of total of 56 blades with missing tip corners. e) For stage 4, maximum of 6 blades up to 0.40 in. (10.2 mm)	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.

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	x 0.40 in. (10.2 mm) and 57 blades up to 0.30 in. (7.6 mm) x 0.30 in. (7.6 mm) for a total of total of 63 blades with missing tip corners	
J.Curl on the end of the airfoil	Up to 25% of chord, maximum radial length of 0.30 in. (7.6 mm) when it does not engage the stationary parts during operation	
K.Nicks, dents and scratches of the airfoil root radius (does not include the trailing edge root radius of stage 2 and stage 3).	Any number if the damage is 0.005 in. (0.13 mm) maximum in depth. Alternatively, any number of elliptical, smooth, and round bottom dents having no sharp edges with a maximum diameter of 0.030 in. (0.76 mm). Dents must not connect or overlap. Scratches parallel to the platform are not serviceable.	
L.Nicks, dents and scratches of the trailing edge root radius of stage 2 and stage 3.	Any amount, if less than 0.03 in. (0.8 mm) in depth.	See limit extensions Ref. AMM TASK 72-00-00-200-025.
M.Tears on the leading and trailing edge found in the lower 25% of the airfoil (but not the root radius)	Not serviceable	See repair Ref. AMM TASK 72- 31-00-300-004.
N.Nicks, dents and missing material on the leading and trailing edge of the lower 25% of the airfoil (but not the root radius)	Any amount if the damage is less than 0.03 in. (0.8 mm) in depth.	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
Wear or scratches on trailing edge platform of stages 2 and 3	Any amount, if less than 0.03 in. (0.8 mm) in depth.	See limit extensions Ref. AMM TASK 72-00-00-200-025.
2.Stages 5-9 compressor blades:		
A.Cracks in Dim. A and tip	Up to 25% of the blades across stages 5 through 9 can have radial cracks that are within 0.20 in. (5.1 mm) from the leading or trailing edge. These	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.

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	cracks can be up to 0.15 in. (3.8 mm) in length.	
	Radial cracks more than 0.20 in. (5.1 mm) from the leading or trailing edge are not serviceable	
	Up to 25% of the blades across stages 5 through 9 can have chord-wise cracks that are no more than 0.20 in. (5.1 mm) from the tip. These cracks can be up to 0.15 in. (3.8 mm) in length	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
B.Missing or chipped erosion coating	Any amount	
C.Nicks, tears, missing material and erosion on the leading and trailing edge found in Dim. B	Any number if the damage is less than 0.04 in. (1.0 mm) in depth	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
D.Dents on the leading and trailing edge found in Dim. B	Any number if the damage is less than 0.04 in. (1.0 mm) in depth and 0.06 in. (1.5 mm) deflection from the original contour	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
E.Nicks, dents and tears on the leading and trailing edge found in Dim. A	Any number is serviceable if the damage is less than 0.15 in. (3.8 mm) in depth	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
F.Missing material and erosion at the leading and trailing edge tip corners	All blades, up to 0.15 in. (3.8 mm) x 0.15 in. (3.8 mm), if downstream damage is serviceable. A maximum of 25 blades across stages 5 through 9 up to 0.2 in. (5.1 mm) x 0.2 in. (5.1 mm).	See limit extensions Ref. AMM TASK 72-00-00-200-025.
G.Curl on the end of the airfoil	Up to 50% of chord maximum radial length 0.30 in. (7.6 mm) when it does not engage the stationary parts during operation	See limit extensions Ref. AMM TASK 72-00-00-200-025.
H.Dents, nicks and scratches on the airfoil root radius	Any number if the damage is 0.005 in. (0.13 mm) maximum in depth.	

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	Alternatively, any number of elliptical, smooth, and round bottom dents having no sharp edges with a maximum diameter of 0.030 in. (0.76 mm). Dents must not connect or overlap. Scratches parallel to the platform are not serviceable.	
J.Tears on the leading and trailing edge found in the lower 25% of the airfoil (but not the root radius)	Not serviceable	See repair Ref. AMM TASK 72- 31-00-300-004.
K.Nicks, dents and missing material on the leading and trailing edge of the lower 25% of the airfoil (but not the root radius)	Any amount if the damage is less than 0.03 in. (0.76 mm) in depth.	See limit extensions Ref. AMM TASK 72-00-00-200-025 or repair Ref. AMM TASK 72-31-00-300- 004.
3.Stages 1-9 compressor blade:		
A.Tears, nicks, dents, missing material, erosion, bending and burrs in the tip	Any number or amount is serviceable	
NOTE: The blade tip is the top 0.10 in. (2.5 mm) of the blade.		
B.Nick and dents on the airfoil center panel	Any number if the damage is not cracked on the opposite side of the airfoil	
C.Erosion and scratches on the airfoil center panel	Any amount	
D.Material on the blade	Any amount	
E.Through holes	Not serviceable	
4.Platform of stages 4-9 locking blades.		
A.Clearance between the blade platforms	Serviceable	
B.Distortion on the blades	Any amount	
C.Cracks	Not serviceable	

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D.Shingling	Not serviceable	
5.Blade locks for stages 4-9 blades:		
A.Cracks	Any number of cracks on one lock is permitted per stage.	See limit extensions Ref. AMM TASK 72-00-00-200-025
B.Looseness NOTE: To check for looseness, use a bent length of heavy gage wire to move the blade lock. Monitor the movement through the borescope.	Not serviceable	See limit extensions Ref. AMM TASK 72-00-00-200-025 lock.
6.Stator flow path:		
A.Missing rub coating	Any amount	
B.Cracks which are crazed	Any amount NOTE: The area adjacent to the borescope ports is the only rub coat you can examine.	
7.Stages 1 through 3 compressor stator variable vane shrouds		
A.Wear caused by rubbing on vanes	Any amount	
8.HPC Inner Shroud Lip for:		
A.Wear from rotor-stator contact	Any amount	

SUBTASK 72-31-00-010-057-A

- C. Remove the borescope equipment
 - (1) When inspection is complete, turn the lamp switch off. Keep the main light source blower on until the lamp and housing cools down.
 - (2) Before you install the borescope plugs, put the 0.37 in. (9.40 mm) diameter tapered rod into the borescope hole. This will make sure the hole is open.
 - (3) Install the IGV borescope plug (S1) as follows:
 - (a) Apply Graphite mineral vaseline (Material Ref. <u>CP2101</u>) or <u>Never Seez-Pure Nickel</u>, <u>Special (Material Ref. CP2619)</u> or milk of magnesia (Material Ref. <u>CP1064</u>) to the threads and pressure face of the borescope plug.

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- (b) Put the borescope plug in the correct borescope port. Tighten the plug by hand.
- (c) TORQUE the plug to between 57 and 63 lbf.in (0.64 and 0.71 m.daN).

WARNING: USE PROTECTIVE GOGGLES AND GLOVES EACH TIME YOU CUT LOCKWIRE. DISCARD LOOSE OR USED LOCKWIRE IMMEDIATELY. LOOSE OR USED LOCKWIRE CAN CUT YOU OR MAKE YOU BLIND.

- (d) Wirelock the plugs with lockwire 0.032 in. (0.8 mm) dia. (Material Ref. CP8001) or lockwire 0.032 in. (0.8 mm) dia (Material Ref. CP8002) or safety cable 0.032 in. (0.8 mm) dia. (Material Ref. CP8006).
- (e) Install the borescope access blanking plate (10) using the two screws (20).
- (4) Install the stage 1 through 5 borescope plugs (S2 through S6) as follows:
 - (a) Apply Graphite mineral vaseline (Material Ref. <u>CP2101</u>) or <u>Never Seez-Pure Nickel</u>, <u>Special (Material Ref. CP2619)</u> or <u>milk of magnesia (Material Ref. CP1064)</u> to the threads and pressure face of the borescope plugs.
 - (b) Install the borescope plug in the borescope port. Tighten the borescope plug by hand.
 - (c) TORQUE the borescope plugs to between 57 and 63 lbf.in (0.64 and 0.71 m.daN).

WARNING: USE PROTECTIVE GOGGLES AND GLOVES EACH TIME YOU CUT LOCKWIRE. DISCARD LOOSE OR USED LOCKWIRE IMMEDIATELY. LOOSE OR USED LOCKWIRE CAN CUT YOU OR MAKE YOU BLIND.

- (d) Wirelock the borescope plugs. Use lockwire 0.032 in. (0.8 mm) dia. (Material Ref. CP8001) or lockwire 0.032 in. (0.8 mm) dia (Material Ref. CP8002) or safety cable 0.032 in. (0.8 mm) dia. (Material Ref. CP8006).
- (5) Install the stage 6, 7 and 8 borescope plugs (S7, S8 and S9) as follows:

CAUTION:

MAKE SURE YOU FULLY SCREW THE INNER CAP IN. IF NOT FULLY
SCREWED IN, THE INNER CAP OF THE BORESCOPE PLUG WILL DEFLECT
THE COMPRESSOR REAR CASE AS THE OUTER CAP IS TIGHTENED. THIS
WILL CAUSE BINDING OF THE COMPRESSOR ROTOR.

- (a) Make sure the borescope port is open. Insert the 0.37 in. (9.40 mm) diameter tapered rod in the borescope port.
- (b) Apply Graphite mineral vaseline (Material Ref. CP2101) or Never Seez-Pure Nickel,
 Special (Material Ref. CP2619) or milk of magnesia (Material Ref. CP1064) to the threads
 and pressure face of the borescope plugs.
- (c) Put the plug in the correct borescope port and tighten the inner plug by hand. Use the outer plug to turn the inner plug.
- (d) TORQUE the inner plug to between 75 and 85 lbf.in (0.85 and 0.96 m.daN). Loosen half a turn and RETORQUE to between 15 and 20 lbf.in (0.17 and 0.23 m.daN) more than the running torque.
- (e) Compress the plug spring and tighten the outer plug by hand.

NOTE: If the inner plug is correctly installed and the threads are not damaged, you can install the outer plug by hand. If the outer plug cannot be fully installed by hand,

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the inner plug is not correctly installed. Remove the plug and repeat steps (c), (d) and (e).

(f) TORQUE the outer plug to between 57 and 63 lbf.in (0.64 and 0.71 m.daN).

WARNING: USE PROTECTIVE GOGGLES AND GLOVES EACH TIME YOU CUT LOCKWIRE. DISCARD LOOSE OR USED LOCKWIRE IMMEDIATELY. LOOSE OR USED LOCKWIRE CAN CUT YOU OR MAKE YOU BLIND.

- (g) Wirelock all 3 outer plugs together with lockwire 0.032 in. (0.8 mm) dia. (Material Ref. CP8001) or lockwire 0.032 in. (0.8 mm) dia (Material Ref. CP8002) or safety cable 0.032 in. (0.8 mm) dia. (Material Ref. CP8006).
- (6) Remove the tools used to rotate the core as follows:

NOTE: If the breaker bar is installed, see steps (a) and (b). If the drive motor is installed, see steps (c) and (d).

- (a) Remove the SPEED BRACE 3/4 IN SQUARE DRIVE and BAR LENGTH 60 CM (2 FT) BREAKER from the handcranking drive pad.
- (b) Install the handcranking drive pad cover Ref. AMM TASK 72-63-00-400-002.
- (c) Remove the MOTOR, DRIVE CORE ENGINE ROTATION (856A1488) (856A1488P01 or P02) from the starter pad of the AGB.
- (d) Install the starter Ref. AMM TASK 80-11-10-400-002.

5. Close-up

SUBTASK 72-31-00-410-057-A

- A. Close Access
 - (1) Make sure that the work area is clean and clear of tools and other items.
 - (2) Close the thrust reverser doors Ref. AMM TASK 78-36-00-410-040:
 - (a) FOR <u>1000EM1 (ENGINE-1)</u> 451AL, 452AR
 - (b) FOR <u>1000EM2 (ENGINE-2)</u> 461AL. 462AR

SUBTASK 72-31-00-710-054-A

B. If fuel or oil lines were disconnected, do a minimum idle leak check Ref. AMM TASK 71-00-00-710-006 and check for leaks.

SUBTASK 72-31-00-440-052-A

C. Make the thrust reverser serviceable Ref. AMM TASK 78-30-00-081-041.

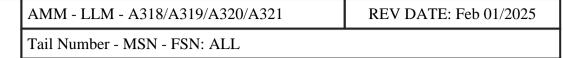
SUBTASK 72-31-00-410-058-A

- D. Close Access
 - (1) Close the fan cowl doors Ref. AMM TASK 71-13-00-410-040:
 - (a) FOR <u>1000EM1 (ENGINE-1)</u> 437AL, 438AR
 - (b) FOR 1000EM2 (ENGINE-2)

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447AL, 448AR.
(2) Remove the WARNING NOTICE(S).

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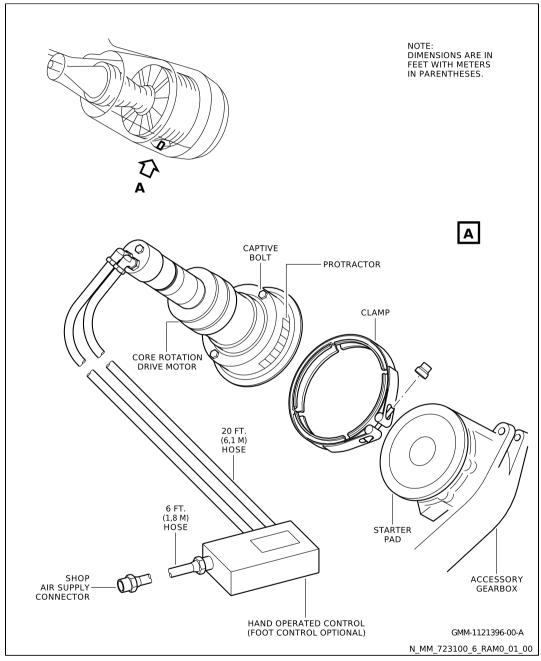


Figure 72-31-00-991-30000-06-A (SHEET 1) - Core Rotation Drive Motor Installation
** ON A/C FSN 201-250, 351-400

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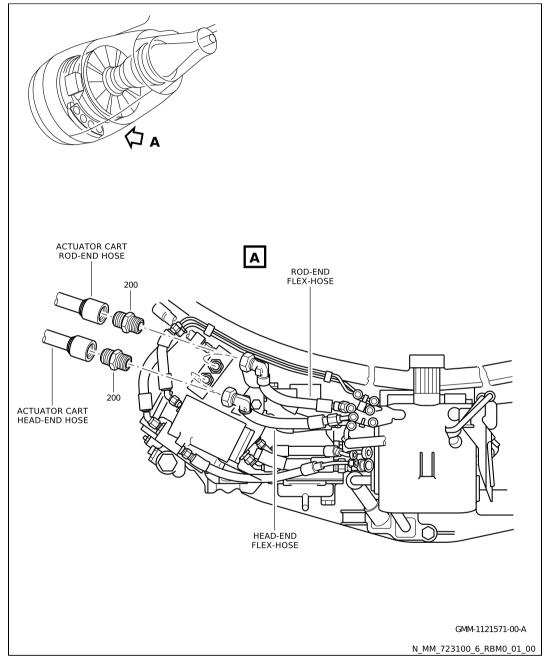


Figure 72-31-00-991-30100-06-A (SHEET 1) - VSV System Connections at the HMU ** ON A/C FSN 201-250, 351-400

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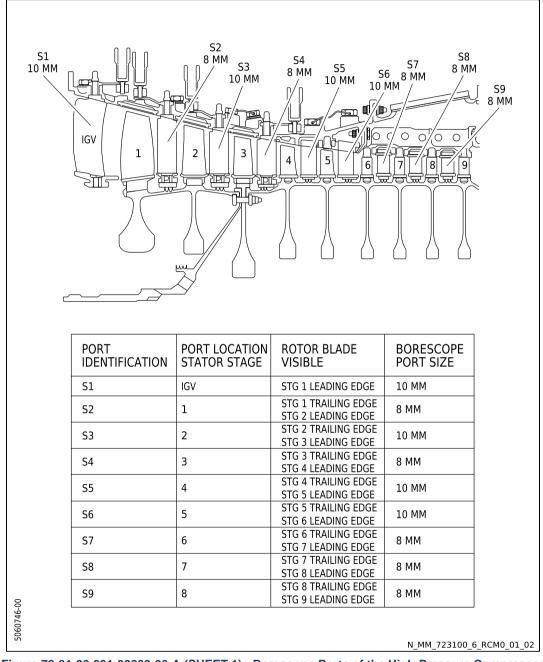


Figure 72-31-00-991-30200-06-A (SHEET 1) - Borescope Ports of the High-Pressure Compressor

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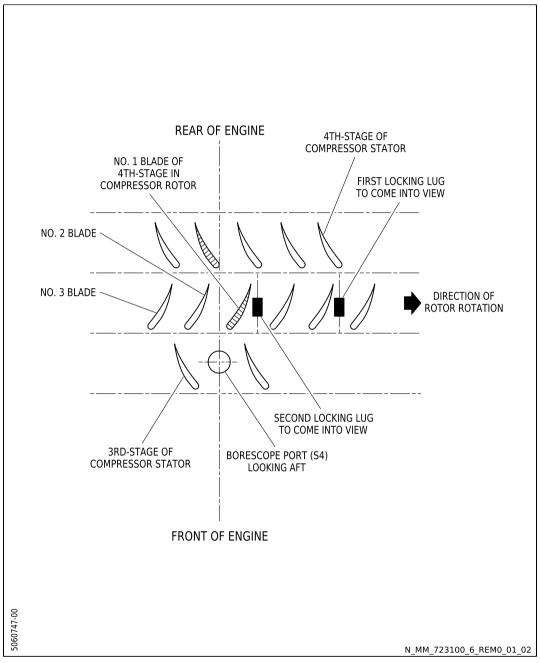


Figure 72-31-00-991-30600-06-A (SHEET 1) - HPC Rotor Indexing to Zero
** ON A/C FSN 201-250, 351-400

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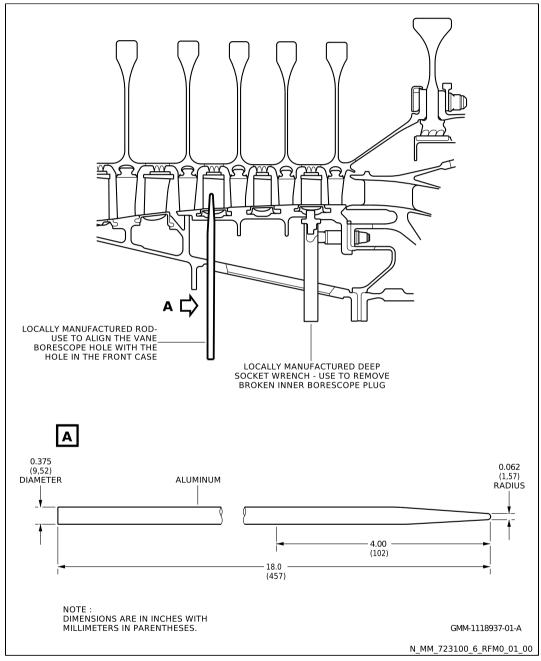


Figure 72-31-00-991-30700-06-A (SHEET 1) - Locally Manufactured Alignment Rod
** ON A/C FSN 201-250, 351-400

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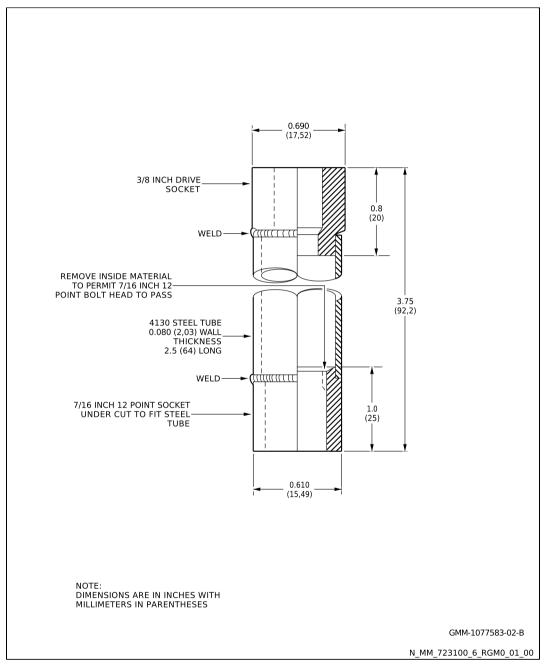


Figure 72-31-00-991-30800-06-A (SHEET 1) - Locally Manufactured Deep Socket Wrench
** ON A/C FSN 201-250, 351-400

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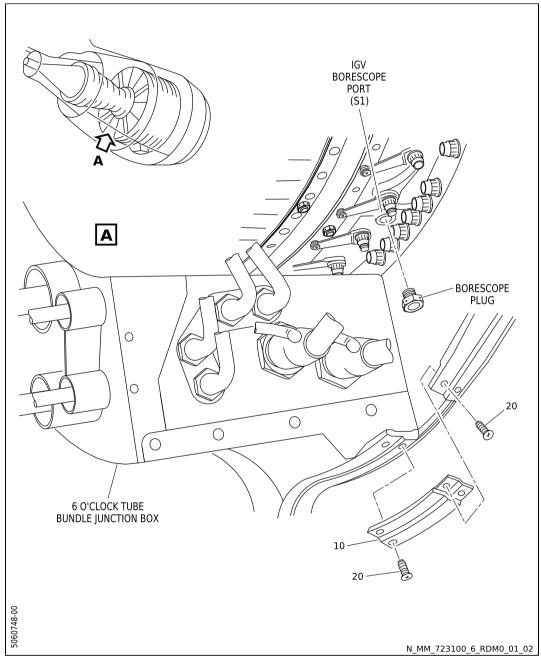


Figure 72-31-00-991-30900-06-A (SHEET 1) - Removal of IGV Borescope Plug (S1) ** ON A/C FSN 201-250, 351-400

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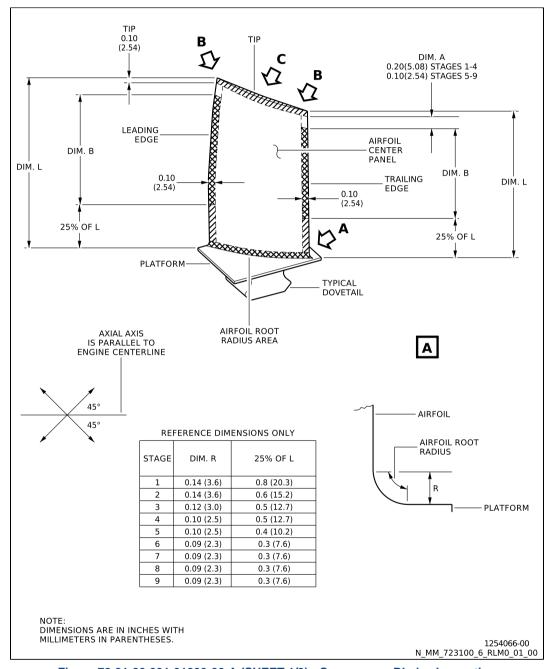


Figure 72-31-00-991-31000-06-A (SHEET 1/3) - Compressor Blades Inspection ** ON A/C FSN 201-250, 351-400

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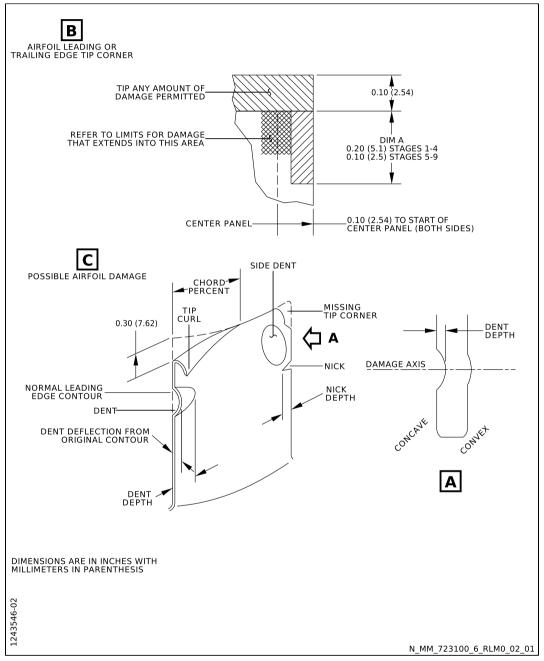


Figure 72-31-00-991-31000-06-A (SHEET 2/3) - Compressor Blades Inspection
** ON A/C FSN 201-250, 351-400

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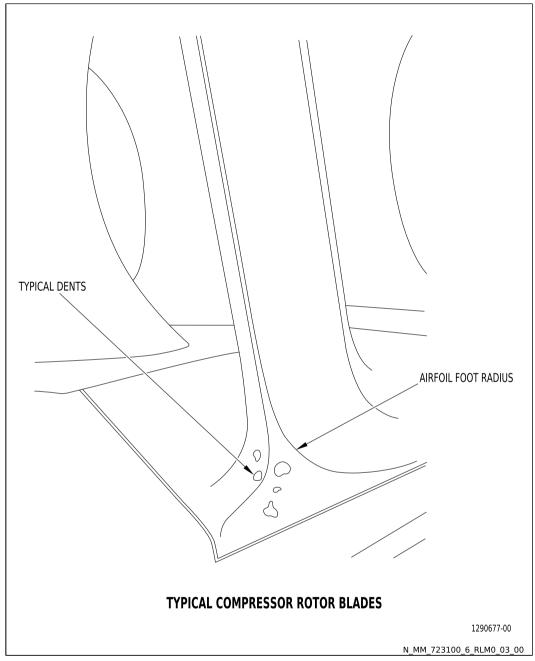


Figure 72-31-00-991-31000-06-A (SHEET 3/3) - Compressor Blades Inspection ** ON A/C FSN 201-250, 351-400

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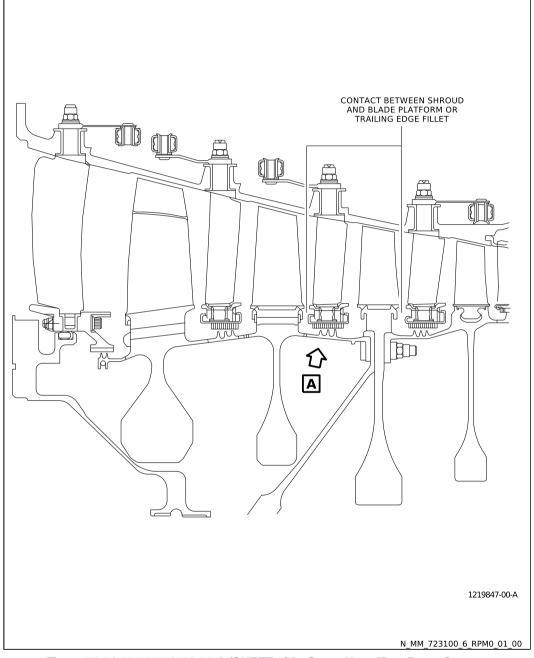


Figure 72-31-00-991-31600-06-A (SHEET 1/2) - Stator Vane ID to Rotor Contact
** ON A/C FSN 201-250, 351-400

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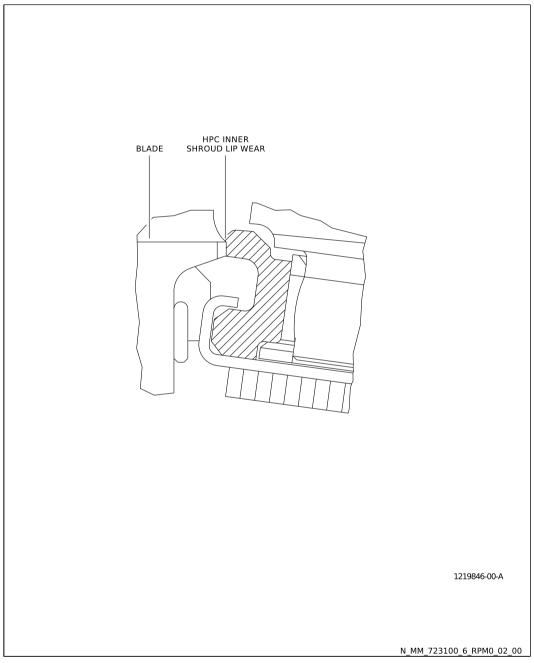


Figure 72-31-00-991-31600-06-A (SHEET 2/2) - Stator Vane ID to Rotor Contact
** ON A/C FSN 201-250, 351-400

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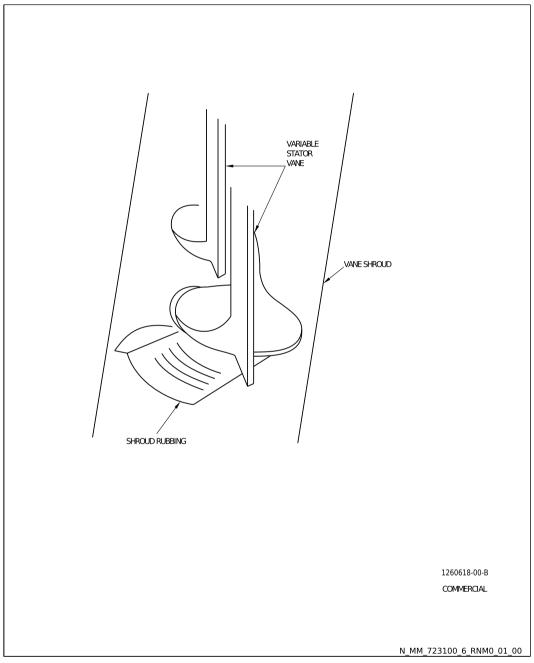


Figure 72-31-00-991-31500-06-A (SHEET 1) - Stage 1-3 VSV Shroud Rubbing
** ON A/C FSN 201-250, 351-400

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