AIR CYCLE MACHINE - INSPECTION/CHECK

EFFECTIVITY: ALL

1. General

A. This section gives the procedure to do the on-wing inspection of the air cycle machines.

B. There are two possible options to do the the on-wing inspection of the air cycle machine rotor:

- Through the removal of the dual heat exchanger.
- Through a borescope inspection.

C. These procedures are applicable to the LH and RH air conditioning packs.

D. The procedures in this section are given in the sequence below. The tasks identified with (♦) are part of the Scheduled Maintenance Requirements Document (SMRD).

TASK NUMBER	*DESCRIPTION*	*EFFECTIVITY*
21-51-03-210-801-A ♦	AIR CYCLE MACHINE - ROTOR VISUAL INSPECTION	ALL
21-51-03-290-801-A	AIR CYCLE MACHINES - ROTOR BORE-SCOPE INSPECTION	ALL

TASK 21-51-03-210-801-A
EFFECTIVITY: ALL

2. AIR CYCLE MACHINE - ROTOR VISUAL INSPECTION

A. General

(1) This task gives the procedure to the general visual inspection of the air cycle machine rotor.

(2) This procedure is applicable to the LH and RH air conditioning packs.

(3) The air cycle machines are installed in the forward wing-to-fuselage fairing, zone 191.

B. References

REFERENCE	*DESIGNATION*
(AMM 21-51-03-04)	-
(AMM 21-51-04-03)	-
AMM MPP 06-41-01/100	-
AMM TASK 21-51-00-700-802-A/500	-
AMM TASK 21-51-02-000-801-A/400	DUAL HEAT EXCHANGER - REMOVAL
AMM TASK 21-51-02-400-801-A/400	DUAL HEAT EXCHANGER - INSTALLATION

C. Zones and Accesses

ZONE	*PANEL/DOOR*	*LOCATION*
191	191ZB	Forward wing-to-fuselage fairing

D. Tools and Equipment

ITEM	*DESCRIPTION*	*PURPOSE*	*QTY*
Commercially available	Torque wrench (Range: 0-50 lb.in)	To tighten the bolt	

E. Auxiliary Items

ITEM	*DESCRIPTION*	*PURPOSE*	*QTY*
Commercially available	Caliper - Vernier, 0 - 6 in (0 - 152mm), Readable to 1/1000 (0.0254/ 25.4 mm)	To measure the erosion	1
Commercially available	Hand - Held 10X Minimum Magnifying Lens	To help the ACM blades inspection	1
Commercially available	Flashlight - Explosion Proof	To help the ACM blades inspection	1
Commercially available	Mirror - Inspection	To help the ACM blades inspection	1

F. Consumable Materials

Not Applicable

G. Expandable Parts

Not Applicable

H. Persons Recommended

QTY	*FUNCTION*	*PLACE*
1	Does the task	LH or RH side of the forward wing-to-fuselage fairing
1	Helps the other technician	LH or RH side of the forward wing-to-fuselage fairing

I. Preparation (Figure 601)

SUBTASK 841-002-A

WARNING: MAKE SURE THAT THE AIRCRAFT IS IN A SAFE CONDITION BEFORE YOU DO THE MAINTENANCE PROCEDURES. THIS IS TO PREVENT INJURY TO PERSONS AND/OR DAMAGE TO THE EQUIPMENT.

WARNING: DO NOT TOUCH THE BLEED-AIR SYSTEM DUCTS OR COMPONENTS IMMEDIATELY AFTER THE ENGINE OR APU STOPS. THE HIGH TEMPERATURE OF THE BLEED-AIR CAN CAUSE INJURIES TO PERSONS.

(1) On the Circuit Breaker Panel, open the PACK 1 and PACK 2 circuit breakers and attach a DO-NOT-CLOSE tag to them.

(2) Remove the wing-to-fuselage fairing, access panel 191ZB.

SUBTASK 841-003-A

(3) To get access to the ACM turbine rotor, do as follows:

(a) Remove the bolt (3). Refer to Figure 601.

(b) Disconnect the wire rope (4). Refer to Figure 601.

(c) Disconnect the turbine outlet duct (1) and slide it into the condenser/mixer (REF.). Refer to Figure 601.

(d) Remove and discard the old O-ring (2). Refer to Figure 601.

CAUTION: Do not spin the fan blades nor turbine. Rotation in the wrong direction can damage the air bearings.

(4) To get access to the ACM fan rotor, remove the heat exchanger. Refer to AMM TASK 21-51-02-000-801-A/400.

J. Air Cycle Machine - Rotor Visual Inspection (Figure 602) (Figure 603)

SUBTASK 212-002-A

(1) Do a general visual inspection of the ACM rotors as follows (Figure 602):

NOTE: You can use a flashlight, a mirror, and a 10X magnifying lens as aids to do the inspection of the turbine rotor.

(a) Examine the turbine rotor to make sure that:

1 There are no missing or cracked blades. Replace the ACM as necessary (AMM 21-51-04-03).

2 There are no signs of rotor contact or rubbing between the outside diameter of the blade and the mating shroud. Replace the ACM as necessary (AMM 21-51-03-04).

(b) Examine the fan rotor to make sure that:

1 There are no missing or cracked blades. Replace the ACM as necessary (AMM 21-51-04-03).

2 There are no signs of rotor contact or rubbing between the outside diameter of the blade and the mating shroud. Replace the ACM as necessary (AMM 21-51-03-04).

(c) Examine the fan rotor for signs of tip erosion (Figure 603):

NOTE: Tip erosion is always located on the leading edge corner area of the blade.

1 If you find erosion on the fan rotor blades, do the measurement and check if the value is under the limits given in Figure 603.

2 If the measurement exceeds the limits given in Figure 603, replace the ACM. Refer to (AMM 21-51-03-04).

3 If the measurement is under the limits given in Figure 603, no maintenance action is required.

K. Follow-on

SUBTASK 842-002-A

CAUTION: EXAMINE ALL THE WORK AREAS TO MAKE SURE THAT YOU REMOVED ALL TOOLS AND EQUIPMENT AFTER YOU COMPLETED THE WORK. IF YOU DO NOT OBEY THIS PROCEDURE, DAMAGE TO THE AIRCRAFT CAN OCCUR.

(1) Install the turbine outlet duct (1). Refer to Figure 601.

(a) Install the new O-ring (2).

(b) Connect the the turbine outlet duct (1) back to its position.

(c) Install the bolt (3) to attach the wire bolt (4) and turbine outlet duct (1) to the air cycle machine. Tighten the bolt (3).

(d) With a torque wrench, apply a torque of 1.69 - 2.82 N.m (15 - 25 lb.in) to the bolt (3) more than running torque.

(2) Install the dual heat exchanger. Refer to AMM TASK 21-51-02-400-801-A/400.

SUBTASK 842-003-A

CAUTION: EXAMINE ALL THE WORK AREAS TO MAKE SURE THAT YOU REMOVED ALL TOOLS AND EQUIPMENT AFTER YOU COMPLETED THE WORK. IF YOU DO NOT OBEY THIS PROCEDURE, DAMAGE TO THE AIRCRAFT CAN OCCUR.

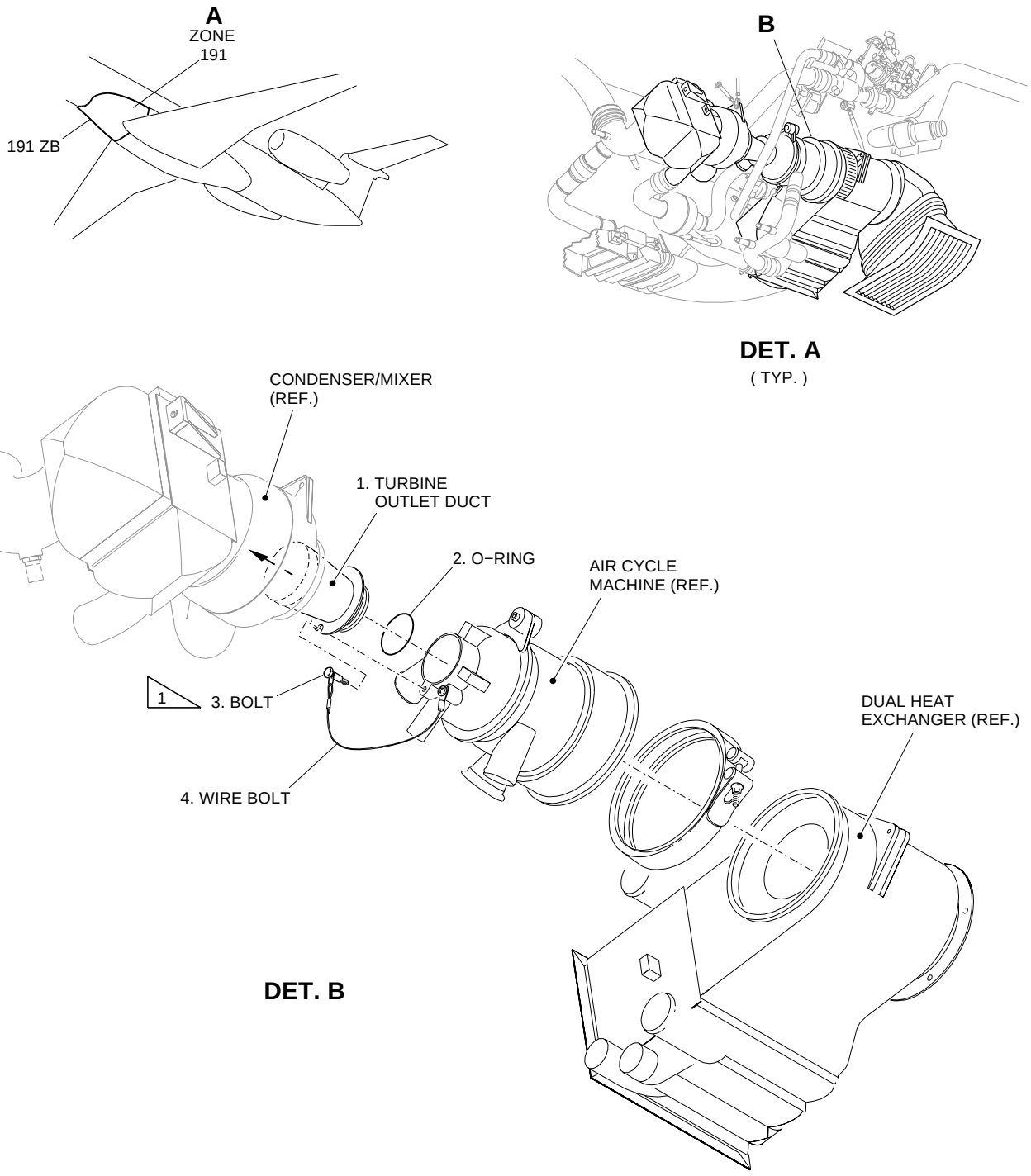
(3) Install the wing-to-fuselage fairing, access panel 191 ZB (AMM MPP 06-41-01/100).

(4) On the Circuit Breaker Panel, close the PACK 1 and PACK 2 circuit breakers and remove the DO-NOT-CLOSE tag from them.

(5) Do an operational check of the cooling pack system AMM TASK 21-51-00-700-802-A/500.

EFFECTIVITY: ALL

Air Cycle Machines - Access to the Turbine and Fan Rotor
Figure 601



1 TORQUE: 1.69 − 2.82 N.m (15 − 25 lb.in) MORE THAN RUNNING TORQUE.

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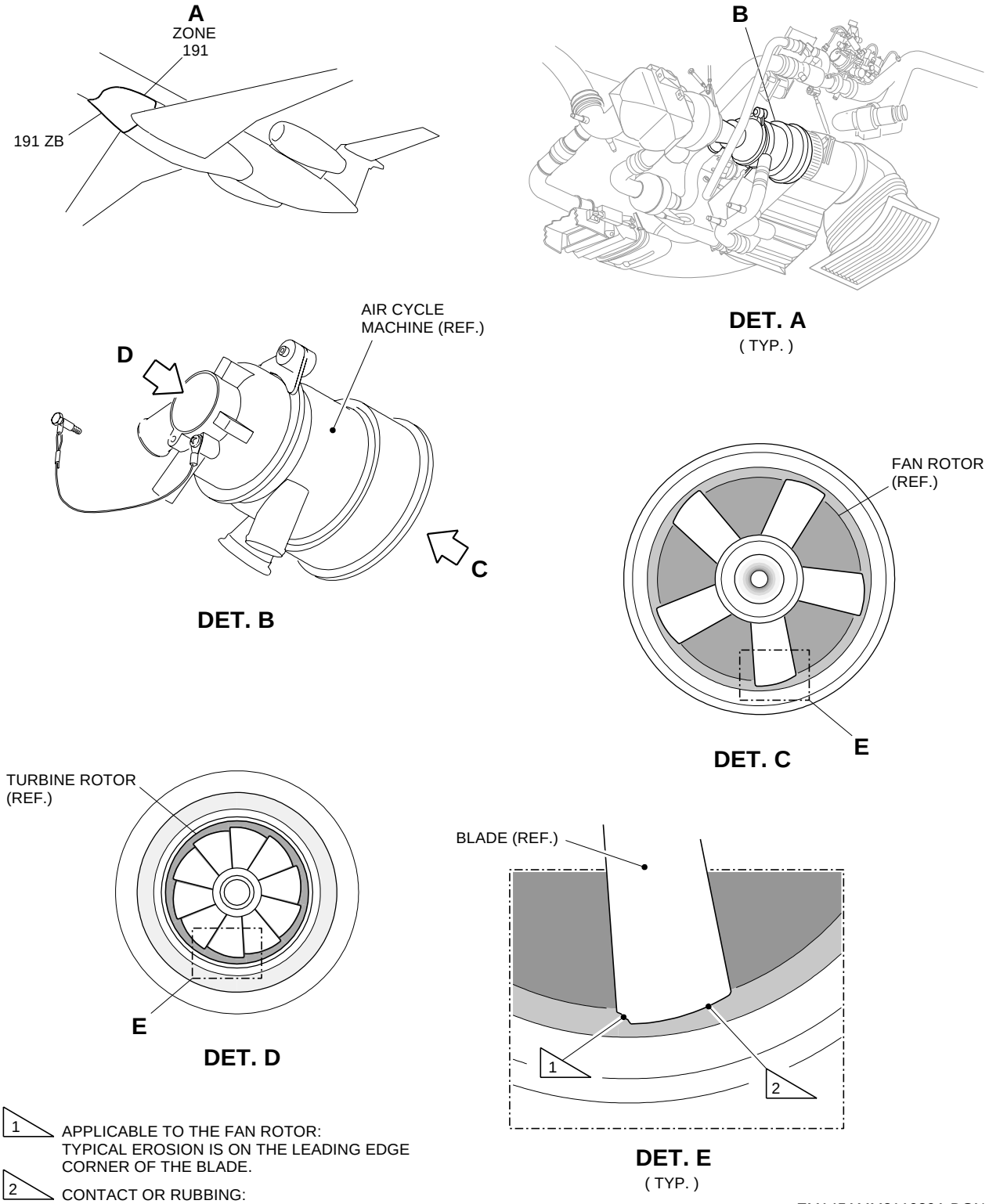
EFFECTIVITY: ALL

Air Cycle Machines - Rotor Visual Inspection
Figure 602



1 APPLICABLE TO THE FAN ROTOR:
TYPICAL EROSION IS ON THE LEADING EDGE CORNER OF THE BLADE.

2 CONTACT OR RUBBING:
IS ON THE OUTSIDE DIAMETER OF THE BLADE.

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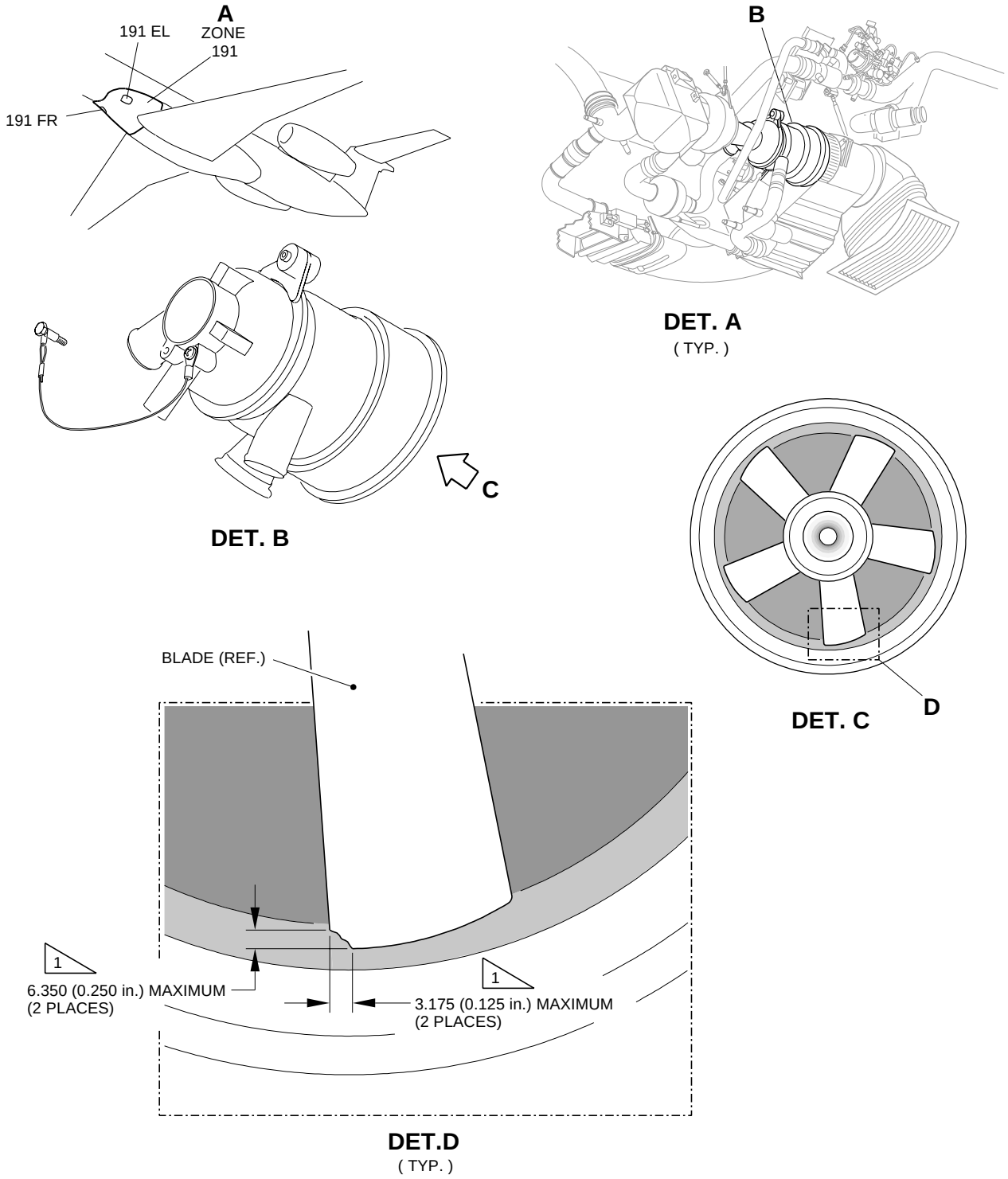
EFFECTIVITY: ALL

Air Cycle Machines - Fan Rotor Erosion Limits
Figure 603



1 EROSION: MATERIAL MAY BE ERODED FROM LEADING AND/OR TRAILING EDGE OF THE FAN BLADE TIP AS SHOWN.

EM145AMM211028A.DGN

TASK 21-51-03-290-801-A
EFFECTIVITY: ALL

3. AIR CYCLE MACHINES - ROTOR BORESCOPE INSPECTION

A. General

(1) This task gives the procedure to do an on-wing borescope inspection of the air cycle machine rotor.

(2) The procedure to inspect the RH and LH air cycle machine rotor are the same.

(3) The air cycle machines are installed in the forward wing-to-fuselage fairing, zone 191.

B. References

REFERENCE	*DESIGNATION*
(AMM 21-51-03-04)	-
(AMM 21-51-03-04))	-
(AMM 21-51-04-03)	-
AMM MPP 06-41-01/100	-
AMM TASK 21-51-00-700-802-A/500	-
SUBTASK 841-002-A00	-

C. Zones and Accesses

ZONE	*PANEL/DOOR*	*LOCATION*
191	191EL	LH side of the forward wing-to-fuselage fairing
191	191FR	RH side of the forward wing-to-fuselage fairing

D. Tools and Equipment

Not Applicable

E. Auxiliary Items

ITEM	*DESCRIPTION*	*PURPOSE*	*QTY*
Commercially available	Fiberscope with light source	To help the ACM blades inspection	ACM
Commercially available	Hand - Held 10X Minimum Magnifying Lens	To help the ACM blades inspection	ACM
Commercially available	Flashlight - Explosion Proof	To help the ACM blades inspection	ACM
Commercially available	Mirror - Inspection	To help the ACM blades inspection	ACM

F. Consumable Materials

Not Applicable

G. Expandable Parts

Not Applicable

H. Persons Recommended

QTY	*FUNCTION*	*PLACE*
1	Does the task	LH or RH side of the forward wing-to-fuselage fairing
1	Helps the other technician	LH or RH side of the forward wing-to-fuselage fairing

I. Preparation (Figure 604)

SUBTASK 841-004-A

WARNING: MAKE SURE THAT THE AIRCRAFT IS IN A SAFE CONDITION BEFORE YOU DO THE MAINTENANCE PROCEDURES. THIS IS TO PREVENT INJURY TO PERSONS AND/OR DAMAGE TO THE EQUIPMENT.

WARNING: DO NOT TOUCH THE BLEED-AIR SYSTEM DUCTS OR COMPONENTS IMMEDIATELY AFTER THE ENGINE OR APU STOPS. THE HIGH TEMPERATURE OF THE BLEED-AIR CAN CAUSE INJURIES TO PERSONS.

(1) On the Circuit Breaker Panel, open the PACK 1 and PACK 2 circuit breakers and attach a DO-NOT-CLOSE tag to them.

(2) Remove these access panels, as applicable:

- 191EL for the LH ACM
- 191FR for the RH ACM

SUBTASK 841-005-A

(3) To get access to the ACM turbine rotor, do as follows:

(a) Remove the bolt (3). Refer to Figure 604.

(b) Disconnect the wire rope (4). Refer to Figure 604.

(c) Disconnect the turbine outlet duct (1) and slide it into the condenser/mixer (REF.). Refer to Figure 604.

(d) Remove and discard the old O-ring (2). Refer to Figure 604.

CAUTION: Do not spin the fan blades nor turbine. Rotation in the wrong direction can damage the air bearings.

(4) To get access to the ACM fan rotor, do as follows:

(a) Remove the clamp (5) to disconnect the outlet grate (6) from the duct (REF.). Refer to Figure 604.

(b) Remove the screws (7) and remove the outlet grate (6). Refer to Figure 604.

(c) Use a borescope to inspect the fan blades (SUBTASK 841-002-A00

SUBTASK 841-005-B

(5) Prepare the Fiberscope as follows:

(a) Connect the light source to the Fiberscope probe as follows:

1 Carefully remove the light source and all borescope equipment from their cases.

2 Remove the protective cover from the light source.

3 Set the light source ON/OFF switch to the OFF position.

4 Turn the light source brightness switch to the L (Low) position.

5 Connect the light source to an applicable power source.

WARNING: DO NOT BREATHE ISOPROPYL ALCOHOL VAPORS. ALWAYS PUT ON GOGGLES, GLOVES AND A RESPIRATOR WHEN YOU USE ISOPROPYL ALCOHOL. DO THE WORK IN AN AREA THAT HAS A GOOD AIRFLOW, FAR FROM SPARKS, FLAMES, AND HOT SURFACES. ISOPROPYL ALCOHOL IS TOXIC AND FLAMMABLE AND CAN CAUSE EYE, SKIN OR RESPIRATORY PROBLEMS. IF IT GETS ON YOUR SKIN, FLUSH IT WITH SOAP AND WATER. IF IT GETS IN YOUR EYES, FLUSH THEM WITH WATER AND GET MEDICAL AID IMMEDIATELY.

(6) Use alcohol TT-I-735 and lint free wipe 7348LE to clean the eyepiece, lens, and two ends of the flexible fiber-optic cable, if necessary

(7) Connect one end of the flexible fiber-optic cable to the light source.

CAUTION: ONLY AUTHORIZED INSPECTION PERSONNEL ARE PERMITTED TO DO THE BORESCOPE INSPECTION PROCEDURES. OTHERWISE, UNNECESSARY MAINTENANCE COULD BE DONE CAUSED BY AN INCORRECT INSPECTION.

(8) Connect the opposite end of the flexible fiber-optic cable to the borescope probe.

(9) To do the inspection, you must do as follows:

(a) Set the light source ON/OFF switch to the ON position.

(b) Turn the brightness switch from the L to the H position.

(c) Carefully push the Fiberscope probe into the outlet duct , through the heat exchanger, and do the inspection of the rotor fan blades.

NOTE: If necessary, adjust the depth and turn the borescope probe.

J. Air Cycle Machine - Rotor Borescope Inspection (Figure 605) (Figure 606)

SUBTASK 212-003-A

(1) Do a general visual inspection of the ACM rotors as follows:(Figure 605)

NOTE: You can use a flashlight, a mirror, and a 10X magnifying lens as aids to do the inspection of the turbine rotor.

(a) Examine the turbine rotor to make sure that:

1 There are no missing or cracked blades. Replace the ACM as necessary (AMM 21-51-04-03).

2 There are no signs of rotor contact or rubbing between the outside diameter of the blade and the mating shroud. Replace the ACM as necessary (AMM 21-51-03-04).

(b) Examine the fan rotor to make sure that:

1 There are no missing or cracked blades. Replace the ACM as necessary (AMM 21-51-04-03).

2 There are no signs of rotor contact or rubbing between the outside diameter of the blade and the mating shroud. Replace the ACM as necessary (AMM 21-51-03-04)).

(c) Examine the fan rotor for signs of tip erosion:(Figure 606)

NOTE: Tip erosion is always located on the leading edge corner area of the blade.

1 If you find erosion on the fan rotor blades, do the measurement and check if the value is under the limits given in Figure 606.

2 If the measurement exceeds the limits given in Figure 606, replace the ACM. Refer to (AMM 21-51-03-04)).

3 If the measurement is under the limits given in Figure 606, no maintenance action is required.

K. Follow-on

SUBTASK 842-004-A

CAUTION: EXAMINE ALL THE WORK AREAS TO MAKE SURE THAT YOU REMOVED ALL TOOLS AND EQUIPMENT AFTER YOU COMPLETED THE WORK. IF YOU DO NOT OBEY THIS PROCEDURE, DAMAGE TO THE AIRCRAFT CAN OCCUR.

(1) Install the turbine outlet duct (1). Refer to Figure 604.

(a) Install the new O-ring (2).

(b) Connect the the turbine outlet duct (1) back to its position.

(c) Install the the bolt (3) that attaches the wire rope (4).

(d) Apply torque to the bolt (3) of 15 to 25 lb.in (1.69 to 2.82 N.m) more than running torque.

(2) Install the outlet grate (6) as follows:

(a) Put the outlet grate (6) in position on the forward lower fairing.

(b) Connect the sleeve of the outlet grate (6) to the duct (REF.) and attach it with the clamp (7).

(c) Install the screws (7) to connect the outlet grate (6) to the forward lower fairing.

SUBTASK 842-004-B

(3) Set the light source ON/OFF switch to the OFF position.

(4) Disconnect the flexible fiber-optic cable from the light source and from the borescope probe.

(5) Install the protective cover on the light source.

(6) Put the light source and all borescope equipment in their cases.

SUBTASK 842-005-A

CAUTION: EXAMINE ALL THE WORK AREAS TO MAKE SURE THAT YOU REMOVED ALL TOOLS AND EQUIPMENT AFTER YOU COMPLETED THE WORK. IF YOU DO NOT OBEY THIS PROCEDURE, DAMAGE TO THE AIRCRAFT CAN OCCUR.

(7) Install these access panels, as aplicable: Refer to AMM MPP 06-41-01/100.

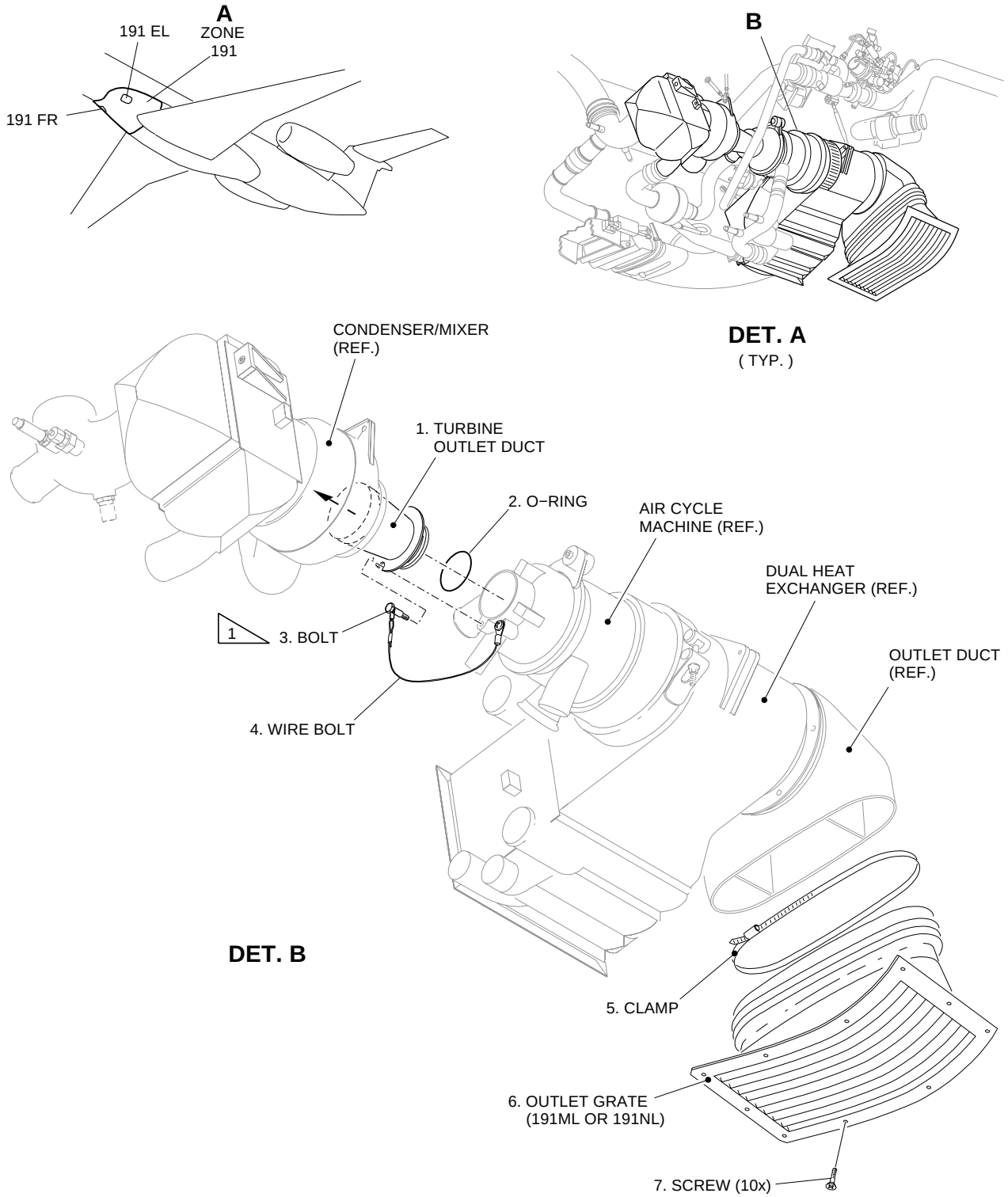
- 191EL for the LH ACM
- 191AR for the RH ACM

(8) On the Circuit Breaker Panel, close the PACK 1 and PACK 2 circuit breakers and remove the DO-NOT-CLOSE tag from them.

(9) Do an operational check of the cooling pack system AMM TASK 21-51-00-700-802-A/500.

EFFECTIVITY: ALL

Air Cycle Machines - Access to the Turbine and Fan Rotor
Figure 604



1 TORQUE: 1.69 − 2.82 N.m (15 − 25 lb.in) MORE THAN RUNNING TORQUE.

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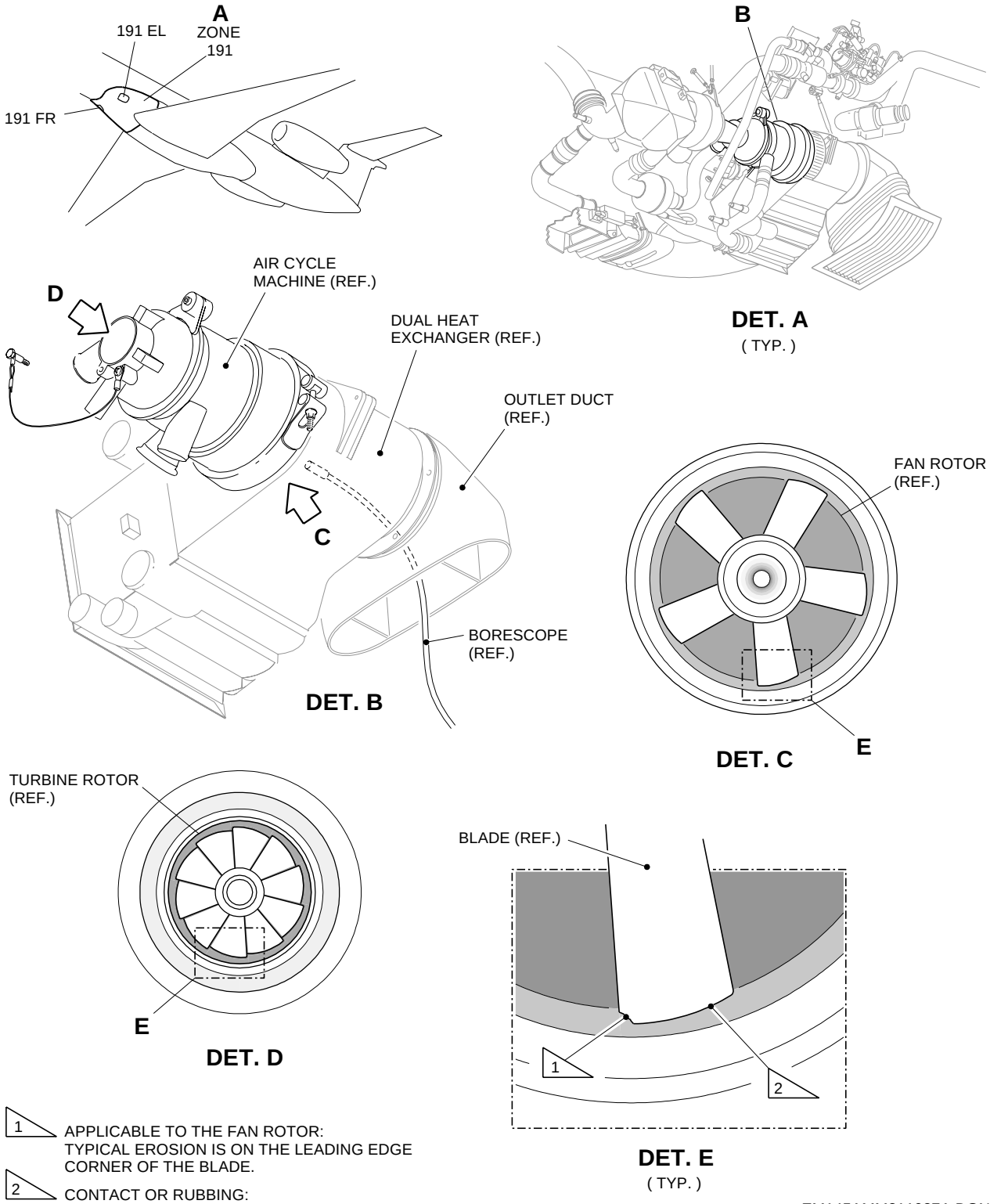
EFFECTIVITY: ALL

Air Cycle Machines - Rotor Visual Inspection
Figure 605



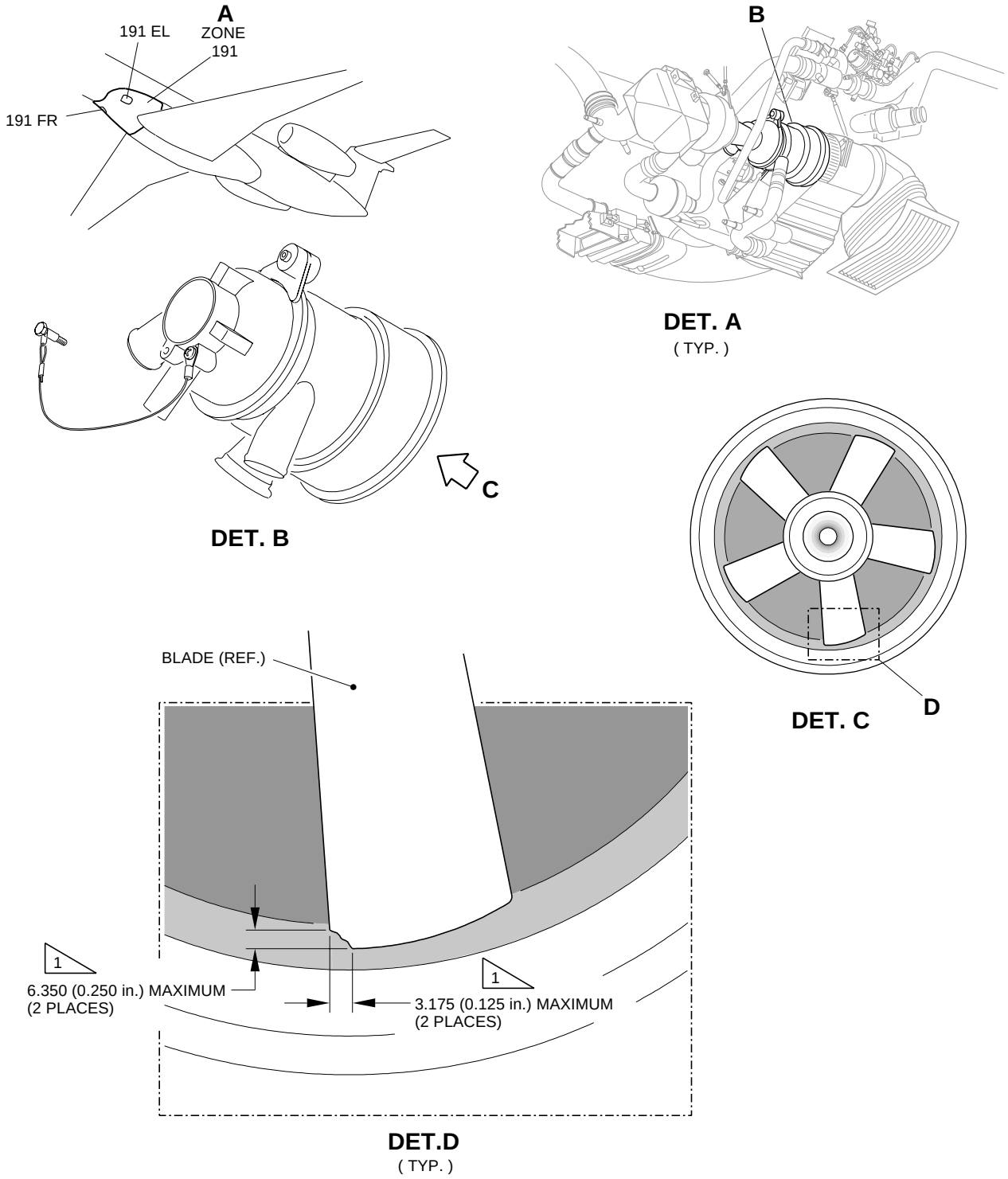
1 APPLICABLE TO THE FAN ROTOR:
TYPICAL EROSION IS ON THE LEADING EDGE
CORNER OF THE BLADE.

2 CONTACT OR RUBBING:
IS ON THE OUTSIDE DIAMETER OF THE BLADE.

EM145AMM211027A.DGN

EFFECTIVITY: ALL

Air Cycle Machines - Fan Rotor Erosion Limits
Figure 606



1 EROSION: MATERIAL MAY BE ERODED FROM LEADING AND/OR TRAILING EDGE OF THE FAN BLADE TIP AS SHOWN.

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