



AIRCRAFT MAINTENANCE MANUAL – SYSTEM DESCRIPTION SECTION

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78-10-00-001

EXHAUST

Introduction

The exhaust system contains the hot engine exhaust gas as it moves rearward through the nacelle.

General Description

The exhaust system is made from two assemblies as follows:

- The jet pipe assembly
- The shroud assembly.

The jet pipe assembly is made from three parts; the exhaust nozzle, the forward jet pipe, and the aft jet pipe.

Detailed Description

The exhaust system includes the components that follow:

- Exhaust Nozzle (78-10-21)
- Exhaust Nozzle Shroud (78-10-21)
- Forward Jet Pipe (78-10-06)
- Forward Insulation Blankets (78-10-11)
- Forward Shroud (78-10-06)
- Aft Jet Pipe (78-10-01)

- Aft Insulation Blankets (78-10-11)
- Mid Shroud (78-10-01/06)
- Aft Shroud (78-10-01)
- Trunnion Bearings (78-10-16)
- Aft Exhaust Outlet (78-10-26). [Refer to Figures 1 and 2.](#)

The jet pipe assembly contains the engine exhaust gas as it moves rearward from the engine. The routing of the jet pipe is under the wing box and over the main landing gear stowage bay. The exhaust gas goes through the jet pipe and into the atmosphere at the top rear surface of the nacelle. Heat insulation blankets are installed on the outer surface of the jet pipe. During the engine operation, suction of the eductor air (between the jet pipe and the shrouds) is caused by the exhaust gas as it goes out at the aft exhaust outlet. This secondary airflow helps to keep the accessory temperatures between the approved limits.

The shroud assembly is a housing for the jet pipe assembly along its full length. The top rear structure of the nacelle makes part of the shroud assembly. Heat insulation blankets are installed on the top outer surface of the forward shroud assembly. The exhaust system is cooled by an eductor system which lets ambient air go between the jet pipe and the shroud. The air inlet for the eductor system comes from an air inlet scoop on the nacelle centre side panel.

Exhaust Nozzle

The exhaust nozzle is made from 0.025 in. (0.65 mm) thick Inconel 625. A V-coupling attaches the front of the exhaust nozzle to the rear of the engine.



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Exhaust Nozzle Shroud

The exhaust nozzle shroud is installed around the exhaust nozzle and operates as a firewall between it and the adjacent area. The exhaust nozzle shroud changes in diameter from approximately 25 in. (635 mm) at the forward end to 17.8 in. (452 mm) at the aft end.

A flange, welded to the rear of the exhaust nozzle shroud attaches to the engine firewall.

Forward Jet Pipe

The forward jet pipe is installed in the center of the nacelle, under the wing box. The forward jet pipe is made from three pieces of Inconel 625 welded together. The forward piece of pipe changes in outer diameter from 17.96 to 15.85 in. (456.2 to 402.9 mm). The other pieces have a constant outer diameter of 15.85 in. (402.9 mm).

A P-seal and flange seal configuration holds the front of the forward jet pipe in position against the engine firewall. A mounting pin assembly on each side of the forward jet pipe attaches to the nacelle structure. The rear of the forward jet pipe connects with the aft jet pipe.

Forward Insulation Blankets

Eight insulation blankets are installed around the forward jet pipe. The function of the insulation blankets is to lower the rate of heat release from the jet pipe. The blankets are made from 0.5 in. (12.7 mm) thick Kaowool, between two thin sheets of stainless steel. The inner sheet is 0.004 in. (0.1 mm) thick and the outer sheet is 0.006 in. (0.15 mm) thick. When the insulation blankets are assembled, the Kaowool is compressed to a thickness of

approximately 0.375 in. (9.53 mm). Lockwire holds each pair of insulation blankets in position.

Forward Shroud

The forward shroud is installed around the forward jet pipe. The shroud is also a firewall for the adjacent area. The forward shroud is made from two pieces of titanium welded together. The forward piece of shroud changes in outer diameter from 19.61 to 18.05 in. (498 to 459 mm). The other piece has a constant outer diameter of 18.0 in. (457 mm).

A P-seal and flange seal configuration holds the front of the forward shroud in position against the engine firewall. The forward shroud is attached to the mounting pin assembly on each side of the forward jet pipe. A seal on the rear of the forward shroud engages with the mid shroud.

The top front piece of the forward shroud has two insulation blankets on it. The function of the insulation blankets is to lower the rate of heat release from the jet pipe in the area of the wing and front spar. Lockwire attaches the insulation blankets to lugs on the forward shroud.

Aft Jet Pipe

The aft jet pipe is installed in the aft of the nacelle, above the MLG wheel bay. The aft jet pipe is made from three pieces of Inconel 625 welded together. All the pieces have a constant outer diameter of 15.85 in. (403 mm).

An E-seal and V-coupling configuration connects the aft jet pipe to the forward jet pipe. A mounting pin assembly on each side of the aft jet pipe attaches to the nacelle structure. Each mounting pin



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assembly has a trunnion bearing, which moves longitudinally in the slot of a bracket.

The V-coupling and trunnion bearings let the jet pipe expand and contract with temperature.

Aft Insulation Blankets

Six insulation blankets are installed around the aft jet pipe. The function of the insulation blankets is to lower the rate of heat release from the jet pipe. The blankets are made from 0.5 in. (12.7 mm) thick Kaowool, between two thin sheets of stainless steel. The inner sheet is 0.004 in. (0.1 mm) thick and the outer sheet is 0.006 in. (0.15mm) thick. When the insulation blankets are assembled, the Kaowool is compressed to a thickness of approximately 0.375 in. (9.53 mm). Lockwire holds each pair of insulation blankets in position.

Mid Shroud

The mid shroud is installed around the rear of the forward jet pipe and the front of the aft jet pipe. The mid shroud is also a firewall for the adjacent area. The mid shroud has two pieces of titanium, both of which have a constant outer diameter of 19.55 in. (497 mm).

A V-coupling connects both pieces of the mid shroud together. The front and rear of the mid shroud engages with a seal on the forward and aft shroud. A tie rod assembly on each side of the nacelle structure attaches to the mid shroud.

Aft Shroud

The aft shroud is installed around the aft jet pipe. This shroud is also a firewall for the adjacent area. The aft shroud has two pieces of titanium, both of which have a constant outer diameter of 18.0 in.

(457 mm). A V-coupling connects both pieces of the aft shroud together.

The aft shroud is attached to the mounting pin assembly on each side of the aft jet pipe. A seal on the front of the aft shroud engages with the mid shroud. A V-coupling attaches the rear of the aft shroud to the aft exhaust outlet. A tie rod assembly on each side of the nacelle structure attaches with the aft shroud.

Trunnion Bearings

Each mounting pin assembly on the aft jet pipe has a trunnion bearing. The trunnion bearing moves longitudinally in the slot of a bracket which is installed on the nacelle structure. The trunnion bearings let the jet pipe expand and contract with temperature.

Aft Exhaust Outlet

The aft exhaust outlet is a titanium ejector shroud with a titanium extension shroud around it. Both have an extended cutout at the top rear position to let the engine exhaust gas exit in the air.

A V-coupling attaches the ejector shroud to the aft shroud. The rear end of the extension shroud is attached to the nacelle structure.

Training Information Points

A time of eight to ten hours is necessary to install the exhaust assembly. This time includes the work in the job set-up procedure.

Five persons (maximum), three for the full time, are necessary for the task. It is because the exhaust assembly is large that makes it necessary for the five persons – not the weight of the different components.



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Installation of the exhaust assembly in the small area of the center nacelle is not easy. Personnel must try to prevent damage to the nacelle structure and the other adjacent systems. Access to this area from below is decreased because of the MLG (Main Landing Gear) drag brace. Access to the area aft of Stn 210 is good.

When the forward exhaust assembly is put in position, it is not known if the jet pipe or the shroud is satisfactorily against the engine firewall seals.

The V-coupling which attaches the forward and aft jet pipes is not easy to install, because these two components are large. The MLG decreases the access to the V-coupling from below. As the flap track support structure access panel is small, it prevents better access to the V-coupling from above. It will usually be necessary for more than one try before the installation is correct.

The V-coupling which attaches the aft shroud to the aft upper cowl is easier to install because of good access. Three people are necessary for this operation. The procedure will still not be easy away from the hangar, without the correct steps and staging.

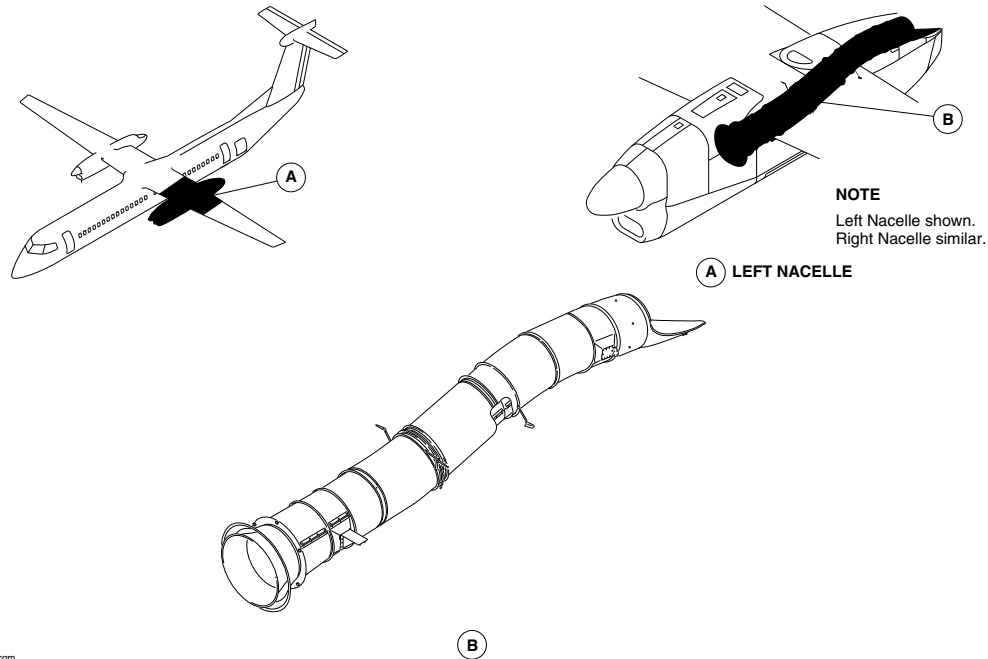
The V-couplings which attach the two pieces of the mid and aft shrouds are easy to install as the shrouds are light and easily aligned.

More time than usual is necessary to attach the forward tie rods, because of the unsatisfactory access. Before the installation of the exhaust assembly, the tie rods must be safetied in a position as near as possible to where they will attach it. The installation of the aft tie rods is easy because of good access.



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Exhaust Assembly – Systems Description Section Page 1
Figure 1

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EFFECTIVITY:
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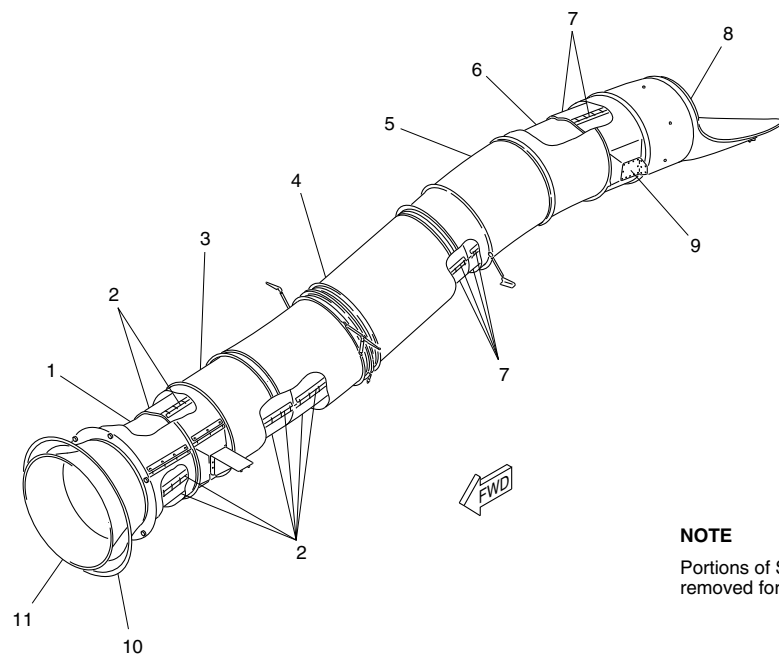
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LEGEND

1. Forward Jet Pipe.
2. Forward Insulation Blankets.
3. Forward Shroud.
4. Mid Shroud.
5. Aft Shroud.
6. Aft Jet Pipe.
7. Aft Insulation Blankets.
8. Aft Exhaust Outlet.
9. Trunnion Bearings.
10. Exhaust Nozzle Shroud.
11. Exhaust Nozzle.

NOTE

Portions of Shroud
removed for clarity.

Exhaust Assembly – Systems Description Section Page 2
Figure 2

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EFFECTIVITY:

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