Environmental Control System Decontamination

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Applicability

All Aircraft

References

A319/A320/A321 AMM 21-00-00 P.Block 201

Description

Please explain the reasons, and steps required for aircraft ECS decontamination.

Solution

1. PURPOSE

This article outlines the objectives of the various decontamination steps

and emphasizes the importance of the order in which these steps are performed.

2. BACKGROUND

Due to the air conditioning system being supplied with air from the APU or engine bleed system

there is always the small but constant potential risk of contamination, this being either directly

from the APU/engines or as a result of ingested external contamination. In the event of heavy

contamination the presence of visible smoke may be encountered in the cabin and/or cockpit.

With lower levels of contamination the reports are often only associated with odours in the cabin

although smoke warnings are occasionally reported, usually in conjunction with an air

conditioning pack overheat.*3. DESCRIPTION:*In the case of system contamination, whether mild or heavy, the first step in restoring the aircraft to

a serviceable condition and preventing smoke or odours within the cabin must be to identify the

source of the contamination and eliminate it. In the majority of in-service contamination events the

source is the lubrication oil from the APU, this resulting from either internal leakage or re-ingestion

of oil following external leakage. Cases have however been encountered of contamination by

lubrication oil from the main engines. Once the source has been established and rectified the task of

decontamination can commence. Failure to eliminate the source of the contamination will however

lead to repeated application of the decontamination procedure and significant duplication of effort.

3.1 Contamination source isolation

It is often difficult to immediately identify the exact source of contamination and without

obvious signs such as abnormally high oil consumption it is not uncommon to apply

inappropriate maintenance action. In such cases, not only will it be necessary to repeat the

decontamination procedures but it may lead to very time consuming and costly replacement of

engines or the APU. It is therefore important to have a high level of confidence that the correct

source has been identified.

There are of course already documented trouble shooting procedures although these are again

usually more efficient in the case of heavy oil leakage. In the case of very light oil contamination

it is very difficult to confirm leakage by the defined inspection procedures. It is therefore

necessary to rely on accurate flight crew reports and if possible flight crew co-operation in

trouble shooting.

3.1.1 APU oil leakage

It should first be noted that oil smells or smoke in the cabin resulting from APU oil

contamination can occur at almost any time and not necessarily when the APU is running.

This is due to contamination of the air conditioning packs on ground that can subsequently

generate odours in flight. The most common reports are those of stale odours or oil smells

and occasionally visible smoke or activation of the smoke detection system in conjunction

with a pack overheat. From this information alone however it is not possible to incriminate

leakage are more often reported shortly after take off, disappearing in cruise and reoccurring

late in the descent. The odours may also be noticeable at APU start for some seconds but

would quickly disappear. During operation of the APU with only slight leakage, odours may

not be detectable. The oil will however be gradually deposited within the packs in areas of

cooler temperature. Following engine start and transition to engine bleed air, the odours may

once again be noticeable due to the higher associated airflow rates through the pack. The

odours would however disappear after a short time due to changes in the pack configuration

from cooling to heating mode, reoccurring again late during the descent due to the pack

returning to the cooling mode. Operator experience has also shown that intermittent odour

reports as described above can occur after the source of leakage has been identified and

rectified. This is due to the residual system contamination and emphasizes the importance of

thorough ECS decontamination.

3.1.2 Engine oil leakage

In the case of oil contamination from the engine it is also quite possible that oil smells would

become more apparent under certain pack configurations. It is however expected that reports

of odour would be associated with changes in engine speed or bleed system configuration

(switching from IP to HP bleed or visa-versa).

3.2 System decontamination

Once the source of system contamination is identified and rectified the decontamination

procedure must be applied in accordance with the following steps. It must be noted that the

procedures outlined below and defined in detail within the AMM 21-00-00 must be followed

closely and in the order specified. Failure to do so will lead to ineffective or only partial

decontamination and therefore the risk of future reports of smoke or odours in the cabin.

3.2.1 Step 1

The level of decontamination required will depend upon the source and extent of the

contamination. In the case of oil contamination the first stage is to eliminate contamination

within the pneumatic bleed air ducting thus preventing down stream migration of this

contamination.

In the case where the APU is confirmed to be the source of contamination of the bleed air

ducting, the decontamination procedure must first be applied to the ducting between the

APU and the engine bleed valves. In the case of heavy contamination, this being assumed

when there are visible traces of oil on the internal surface of the ducts, it is necessary to

manually clean the affected ducts using rags and an appropriate degreasing agent.

Particular attention should also be paid the V flanges of the bleed air ducting where oil

accumulation can take place.

In the case where the engine is confirmed to be the source of the contamination, the APU

bleed line can be discounted from the decontamination procedure. The ducting between

the engines and the air conditioning packs must however be inspected to establish the level

of contamination and cleaned manually if necessary.

Assuming that the contamination is light, or that the heavy oil contamination has been

manually removed, it is then necessary to remove the remaining residue with high

temperature airflow. This is generated by the APU with the contaminated air discharging

to the outside environment via disconnected ducting at the level of the engine bleed valves.

3.2.2 Step 2

The second stage of the decontamination procedure concentrates on the air conditioning

packs. The simplest method of removing the contamination is again using high temperature

airflow (from the APU) although additional maintenance maybe necessary in the event of

heavy contamination within the pack. In order to facilitate the pack decontamination whilst

preventing further downstream contamination it is necessary to remove the pack outlet

duct and blank the downstream ducting (see figure 1). This allows the contaminated air to

exit the aircraft via the pack bay and facilitates inspection of the pack condenser to

determine the extent of pack contamination. During initial inspection the presence of thick

oily deposits inside the condenser (visible following outlet duct removal) would indicate

heavy contamination within the pack and therefore necessitate off aircraft maintenance for

certain components. It would also indicate a high probability of downstream

contamination, particularly at the level of the mixer unit, therefore necessitating additional

inspection and cleaning as required.

In the case that the contamination is light, or manual cleaning has already been performed,

any residual contamination must then be removed by running the packs. Due to the varying

flow patterns within the pack (depending upon bypass valve position) the system must be

manipulated in order to simulate both heating and cooling conditions. This involves pack

operation for approximately 15 minutes with cabin temperatures selected full cold and 15

minutes with temperatures selected full hot. In the event of high ambient temperatures

(above 24□C/75□F) it will not be possible to establish a pack heating demand. It will

therefore be necessary to install temperature sensor simulation devices (see figure 2) in

place of the three zone temperature sensors FIN 21HK, 22HK and 23HK.

Note: Failure to perform the decontamination procedure in both the heating and cooling

mode will result in contamination remaining within the air conditioning pack and as such

is likely to lead to further reports and repeated application of the decontamination

procedure.

Following application of the air conditioning pack decontamination procedure there

remains the possibility that certain pack or upstream components will continue to be

affected by contamination. It is therefore necessary to inspect, clean and/or overhaul the

following items:

All aircraft:

Pack water extractor (10HM8, 11HM8)

Pack water injectors (20HM8, 21HM8)

Pack flow control valve (8HB, 11HB)

Post mod 21215 aircraft:

Ozone converters on post mod aircraft (100HM, 101HM)

Post mod 20084 or 22596 or 24486 aircraft:

Aft cargo trim air valve (12HC)

Aft cargo trim air pressure regulating valve (11HC)

Note: Failure to ensure the correct condition of the above items may not lead to smoke or

odours in the cabin but could result in incorrect component behaviour.

3.2.3 Step 3

Following reinstallation of all pack components the final stage of decontamination can be

performed. This will then ensure the removal of oil residue from the downstream air

distribution ducting and trim air ducting. This procedure again involves running of the air

conditioning packs, using APU bleed air, with the cabin temperatures selected to full hot.

Since this procedure also requires the system to be in the heating mode it may again be

necessary to use the temperature simulation devices in high ambient temperature

conditions (above 24□C/75□F). The system should be operated for a period of 15 minutes

with the cabin doors open. Upon completion there should no longer be any evidence of

smoke or odours within the cabin.*

(ref. 21-00-00 P.block 201).*

4. AIRBUS ACTION:

The detailed procedures for aircraft decontamination have recently been reviewed. The revised version has been relocated within the August 1999 revision of the AMM to the ATA chapter 21

5. MODIFICATION INFORMATION:

Not applicable.

6. MATERIAL:

Blanking Caps

Two blanking caps are necessary to perform the pack decontamination procedure, described in
paragraph 3.2.2. They should be locally manufactured in accordance with the sketch given in figure

1 from any light alloy sheet metal.

Temperature Simulating Device

Three temperature simulating devices are required to perform decontamination in high ambient

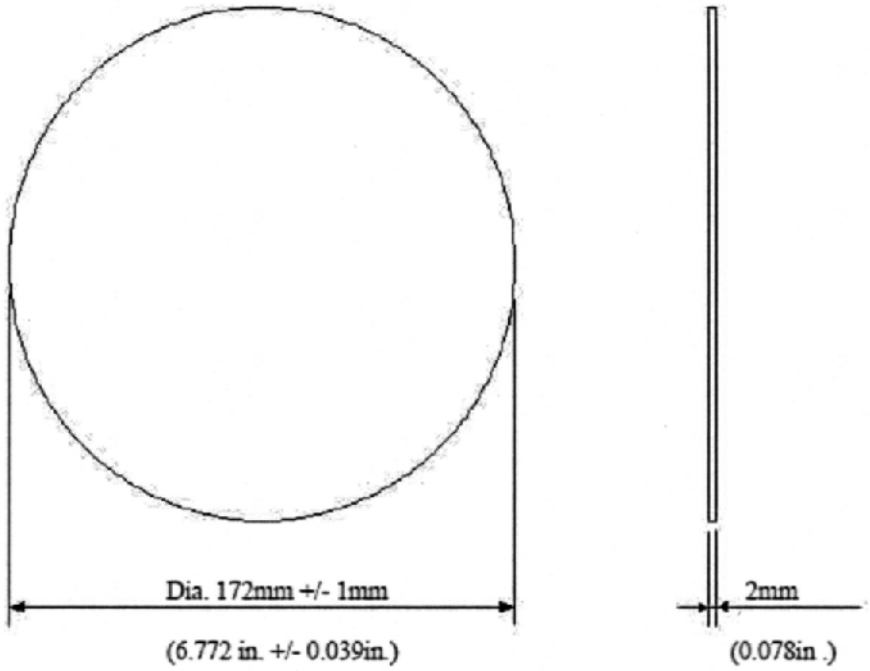
temperatures. These should be locally manufactured in accordance with the schematic given in

figure 2 using readily available industrial standard electrical components.

7. PROCUREMENT:

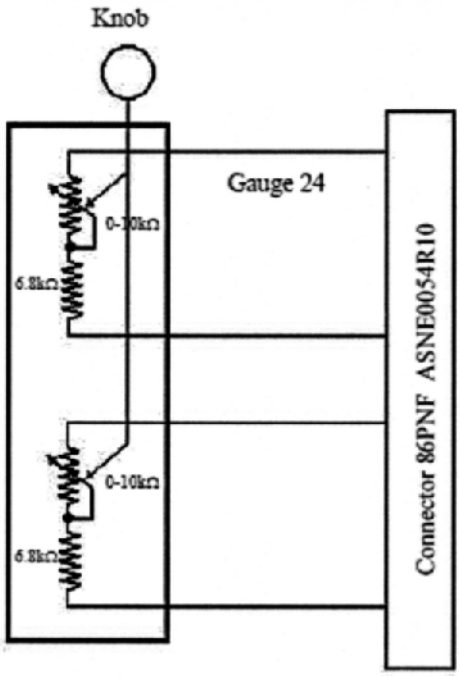
Local manufacture

Figure 1. Blanking plates



Material: Light alloy
Two blanking plates required

Figure 2. Temperature simulating device



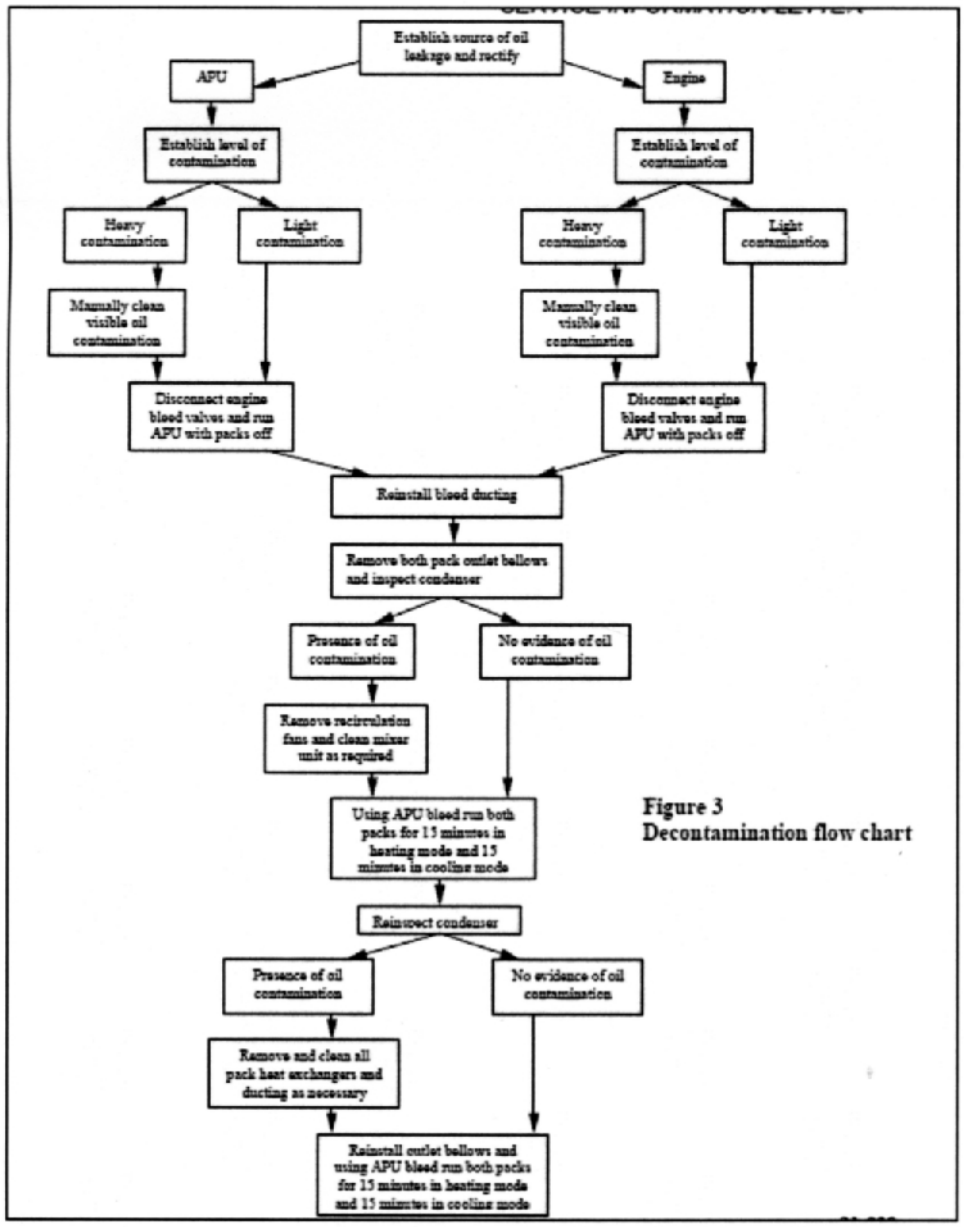


Figure 3
Decontamination flow chart

Additional Note

This article replaces SIL 21-029, and it contains the same information.