ACCIDENT INVESTIGATION COMMISSION

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Safety recommendation: ***AIC 19-R20/18-1002***

Addressed to: Avions de Transport Regional (ATR) Limited

Date issued: 27th July 2019

Investigation link: ***AIC 18-1002***

Action status: Issued

Introduction

On 28th July 2018, at 23:37 UTC[1] (10:37 local time) an Avions de Transport Regional, ATR72-500 registered YJ-AV71 (AV71), operated by Air Vanuatu Operations Limited was on a scheduled flight from Whitegrass Airport, Tanna to Bauerfield Airport, Port Vila. During its landing roll, the aircraft lost directional control and veered off, towards the left of runway 29, and collided with two unoccupied Britten-Norman Islander Aircraft. The ATR had 39 passengers and four crew; two pilots and two Cabin Crew. No injuries were reported.

This occurrence was formally notified to the PNG Accident Investigation Commission (AIC) on 28th July 2018 with the request from the Director Civil Aviation Authority of Vanuatu (CAAV) for the PNG AIC to conduct the investigation. The CAAV delegated the whole of the investigation to the PNG AIC in accordance with *Annex 13 Paragraph 5.1*.

The PNG Minister for Civil Aviation approved the Commission to accept the delegated investigation and dispatch a team of investigators to Vanuatu as soon as possible. Investigators arrived at the accident site on Sunday afternoon 29th July 2018 and immediately commenced the on-site investigation. The investigation was fully supported by AIC staff in Port Moresby including the resources of the AIC's flight recorder laboratory.

Both the States of Manufacture of the Aircraft and the Engine participated as accredited representatives to the investigation. The manufacturer of the aircraft, ATR, and the engine, Pratt & Whitney Canada (P&WC) were involved as advisors to their respective accredited representatives.

In the absence of an independent investigation authority, the Director of the CAAV, represented the State of Operator, Registry and Occurrence undertook to provide guidelines on applicable Republic of Vanuatu Civil Aviation Occurrence Investigation Legislation. However, where possible the conduct of the investigation was to be in accordance with the PNG legislation, the *AIC Policy and Procedures*, and at all times in accordance with *ICAO Annex 13*.

Occurrence

While enroute at 16,000 ft and about 60 nm from Port Vila, the flight crew noticed the No. 2 engine (right engine) *Interstage Turbine Temperature (ITT)* gauge increase rapidly and subsequently exceed its normal operating limits with the Master Caution visual and aural warnings being triggered.

Both the crew and passengers reported hearing loud banging noises from the right side of the aircraft. Some passengers reported seeing white flashes in the cabin. The investigation determined that the noises were as a result of the No. 2 engine compressor stalling.

1 The 24-hour clock, in Coordinated Universal Time (UTC), is used in this report to describe the local time as specific events occurred. Local time in the area of the accident, Vanuatu Time (VUT) is UTC + 11 hours.

At 23:20:54, the Senior Cabin Crew (SCC) was notified of the engine abnormality by the PIC via the crew interphone system. The SCC subsequently notified the flight crew that there was smoke entering the cabin from the right side of the cabin. The PIC broadcasted a *MAYDAY* and notified Vila Air Traffic Control (ATC) of their descent intentions. The pilots commenced the descent and proceeded to complete their checklist.

About 6 minutes after the first abnormal engine event, the No. 2 engine *oil low pressure warning* alert activated on the *Crew Alert Panel*. The pilots referred to the '*QRH*[2] *Engine Oil Low pressure'* checklist and subsequently shut down the No. 2 engine. The rest of the descent and the landing was conducted with the No. 2 engine inoperative.

Recorded data showed that one second after touchdown, both power levers were set to maximum reverse thrust. They were subsequently advanced back to Ground Idle after one second then after a further ground roll of about 200 metres the power levers were returned to reverse thrust.

The aircraft did not have hydraulically powered nosewheel steering and main-wheel brakes. Rudder authority, for ground aerodynamic steering was substantially limited because the switch for manual operation was not set to the appropriate setting. Reverse thrust was applied during the landing roll, which induced a significant left yaw resulting in the subsequent runway excursion.

Safety Deficiency description

'ELECTRICAL SMOKE' checklist

When the electrical smoke warning activated, the flight crew referred to the ATR *Quick Reference Handbook (QRH) 'Electrical Smoke'* checklist (See Attachment 1). The first action item on the checklist required them to refer to the *'Smoke'* checklist (See attachment 2).

The electrical smoke warning had given the crew the impression that the source of the smoke was in the avionics/electrical compartment, leading them to hastily read through the memory action items of the *'SMOKE'* checklist that they had partially completed. With this pre-conception, the crew returned to the Electrical Smoke checklist as soon as they got to the action item, *'SMOKE SOURCE…IDENTIFY'* of the *'SMOKE'* checklist. The '**Note**' contained in the *'SMOKE'* checklist was not consulted. The checklists were carried out in a disjointed and incomplete manner.

The crew continued with the *'Electrical Smoke'* checklist, switching off a number of essential aircraft systems, including both *Alternating Current Wild generators (ACW Gen 1 and 2),* which caused the hydraulic system power loss. They also isolated the *direct current bus tie contactor (DC BTC)* which caused the DC bus 2 network to lose power completely when the No. 2 engine was shutdown.

The investigation determined that under the existing circumstances, the crew actioned the incorrect checklist, due to a confirmation bias induced by the ambiguous electrical smoke warning.

An extra line of defence may have existed if a ***'CAUTION'*** note was ergonomically included in the *'Electrical Smoke'* checklist.

Recommendation number *AIC 19-R20/18-1002* to Avions de Transport Regional (ATR) Limited

'ELECTRICAL SMOKE' checklist

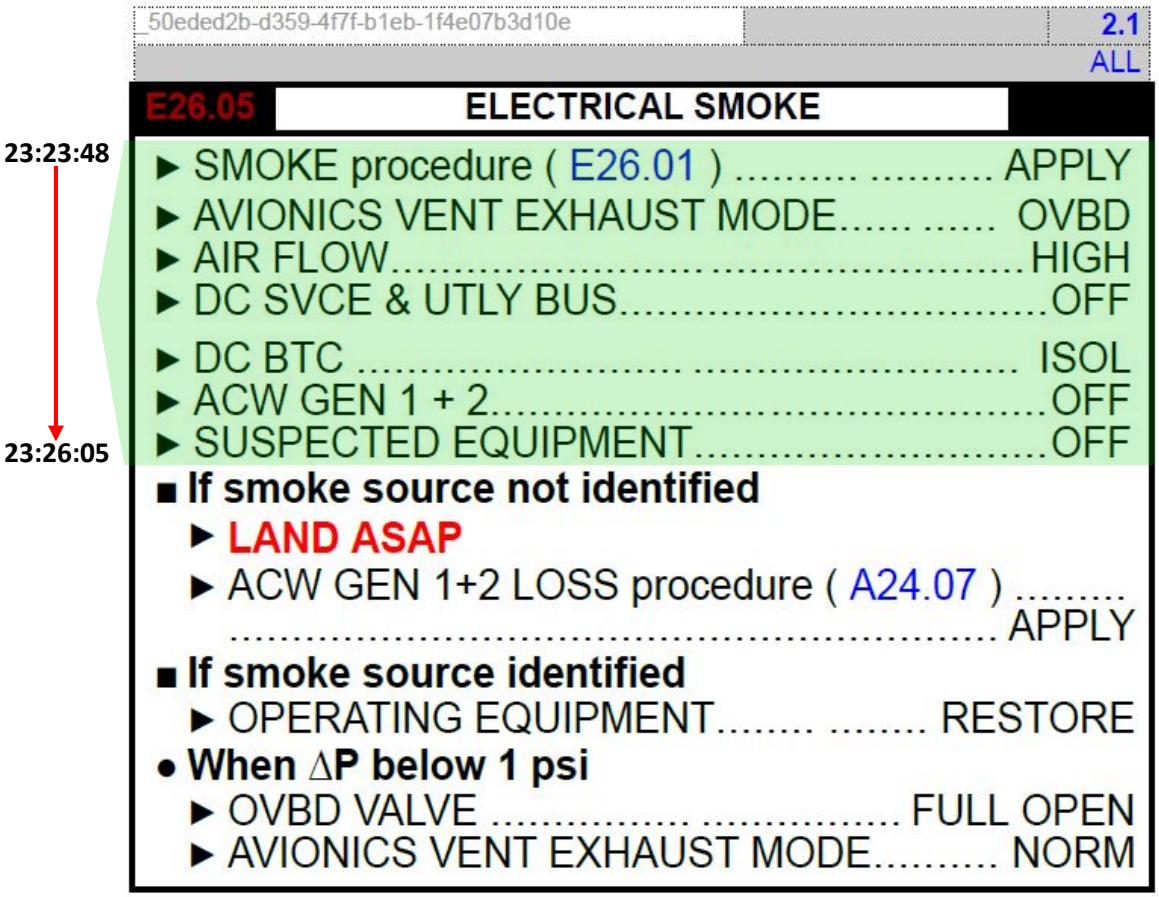
The PNG Accident Investigation Commission (AIC) recommends that ATR should ensure that a ***'CAUTION'*** statement with content similar to the content of the **'Note'** in the *'QRH Smoke'* checklist is included in the *'QRH Electrical Smoke'* checklist.

Action requested

The AIC requests that ATR note recommendation *AIC 19-R20/18-1002*, and provide a response to the AIC within 90 days of the issue date, and explain (including evidence) how ATR has addressed the safety deficiency identified in the safety recommendation. Status **ACTIVE.**

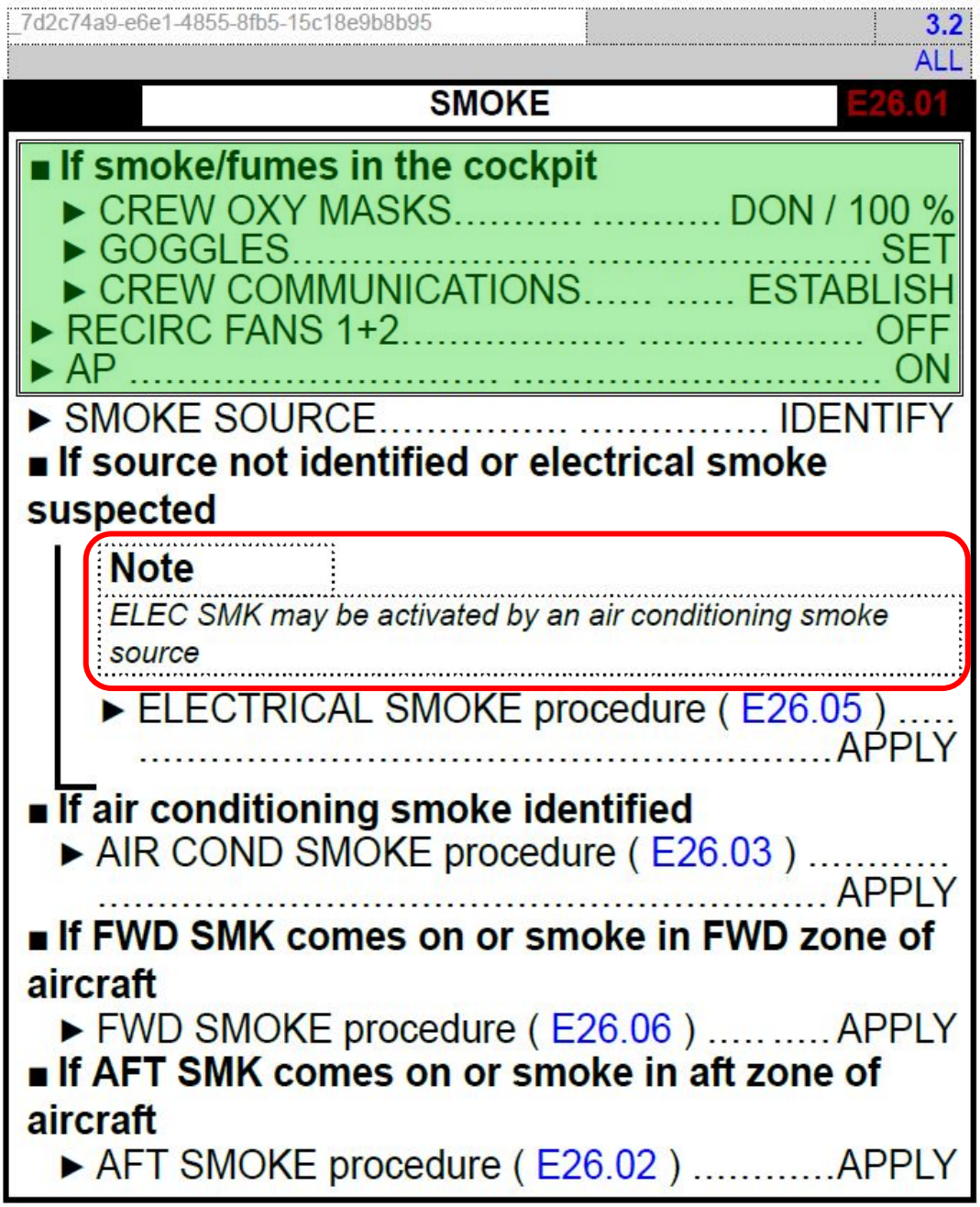
2 QRH: *Quick Reference Handbook* checklist

Attachment 1: Electrical Smoke Checklist



AIC Note: Pale green highlighting added by the AIC to identify the area of checklist completed.

Attachment 2: Smoke Checklist (Emergency)



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ALL

SMOKE E26.01

■ **If smoke/fumes in the cockpit**

▶ CREW OXY MASKS..... ..... DON / 100 %

▶ GOGGLES..... ..... SET

▶ CREW COMMUNICATIONS..... ..... ESTABLISH

▶ RECIRC FANS 1+2..... ..... OFF

▶ AP .... ON

▶ SMOKE SOURCE..... ..... IDENTIFY

■ **If source not identified or electrical smoke suspected**

Note

ELEC SMK may be activated by an air conditioning smoke source

▶ ELECTRICAL SMOKE procedure (E26.05) ....APPLY

■ **If air conditioning smoke identified**

▶ AIR COND SMOKE procedure (E26.03) .... APPLY

■ **If FWD SMK comes on or smoke in FWD zone of aircraft**

▶ FWD SMOKE procedure (E26.06) ....APPLY

■ **If AFT SMK comes on or smoke in aft zone of aircraft**

▶ AFT SMOKE procedure (E26.02) .....APPLY

AIC Notes: Memory items identified by bold border commencing at *'If smoke/fumes in the cockpit'*
Pale green highlighting added by the AIC to identify the areas of checklist completed.
Red border around **Note** added by the AIC to highlight the area of safety deficiency concern.

Hubert Namani, LLB

Chief Commissioner

27th July 2019

AIC assessment of BEA response to *Recommendation AIC 19-R20/18-1002* issued to Avions de Transport Regional (ATR) Limited.

The BEA represented the State of Manufacturer and as such was responsible for coordinating safety action responses from the aircraft manufacturer Avions de Transport Regional (ATR) Limited.

On 9 October 2019 the AIC received a response from BEA which stated in part:

> With regard to the recommendations, they are in line with improving safety. The BEA believes that the problem highlighted by the Investigation Commission in the recommendation for the manufacturer is relevant.

On 14 October 2022, Avions de Transport Regional (ATR) Limited issued a QRH revision package to address the safety deficiencies identified in AIC *Safety Recommendation AIC 19-R20/18-1002.*

The QRH cover page listed *Schedule Revision – Total 14 October 2022.*

The revisions included:

- *EMR.26 Smoke dated 15 June 2022*
- *E 26.01 dated 15 June 2022*
- *Smoke Source Detection dated 17 February 2021*
- *E26.02 dated 23 December 2020*
- *E26.04 dated 15 June 2022*
- *E26.05 dated 30 November 2020*

(See Attachment 1.)

The AIC assessed the Avions de Transport Regional (ATR) Limited corrective action and **assigns response as *fully satisfactory*.**

The AIC has recorded the **Status of the AIC Recommendation: CLOSED**

Capt. Aria Bouraga, MBE
Acting Chief Commissioner

31 October 2022

ATTACHMENT 1:

ATR QUICK REFERENCE HANDBOOK, Scheduled Revision - Total 14 October 2022

The QRH cover page lists Schedule Revision – Total 14 October 2022.

The revisions include:

- *EMR.26 Smoke dated 15 June 2022*
- *E 26.01 dated 15 June 2022*
- *Smoke Source Detection dated 17 February 2021*
- *E26.02 dated 23 December 2020*
- *E26.04 dated 15 June 2022*
- *E26.05 dated 30 November 2020*

FLEET
72-600

Scheduled Revision - TOTAL

14 OCT 2022

Kg

QRH

Quick Reference Handbook

ATR

CG6_QRH_75_L_SI_full_Rev40.0

CAS MESSAGES LIST

Alert	Procedure	Code
DC GEN 1+2	DC GEN 1+2 FAULT	E24.01
	SMOKE or FUMES	E26.01
ELEC SMK	ELECTRICAL SMOKE	E26.02
	AIR COND SMOKE	E26.03
FWD SMK	FWD SMOKE	E26.04
AUX AFT SMK	AUX AFT COMPT SMOKE	E26.05
AFT SMK	AFT SMOKE	E26.06
	PITCH CONTROL JAM AT TAKEOFF OR LANDING	E27.01
ENG 1(2) FIRE	ENG 1(2) FIRE AT TAKEOFF	E70.01
ENG 1(2) FIRE	ENG 1(2) FIRE OR SEVERE MECHANICAL DAMAGE IN FLIGHT	E70.02
ENG 1(2) FIRE	ENG 1(2) FIRE OR SEVERE MECHANICAL DAMAGE ON GROUND	E70.03
ENG 1(2) OUT	ENG 1(2) FLAME OUT AT TAKEOFF	E70.04
ENG 1+2 OUT	ENG 1+2 FLAME OUT	E70.05
	BOMB ON BOARD	E99.01
	COCKPIT DOOR LOCKING SYSTEM	E99.02
	DITCHING	E99.03
	EMERGENCY DESCENT	E99.04
	EMERGENCY EVACUATION (ON GROUND)	E99.05
	FORCED LANDING	E99.06
	SEVERE ICING	E99.08
	STALL	E99.09
	UNRELIABLE AIRSPEED INDICATION	E99.10
AIR DUCT 1(2) OVHT	DUCT 1(2) OVHT	A21.01
AIR PACK	PACK 1(2) VALVE FAULT	A21.02
AIR PACK 1+2	PACK 1+2 VALVES FAULT	A21.03
	RECIRC FAN 1(2) FAULT	A21.06
AIR VENT EXH	AVIONICS VENT EXHAUST MODE FAULT	A21.08
	OVBD VALVE FAULT	A21.09
AIR AUTO PRESS	AUTO PRESS FAULT	A21.10
CAB ALT	CABIN ALTITUDE	A21.11
CAB ΔP	CABIN DELTA P	A21.12
EXCESS CAB ALT	EXCESS CAB ALT	A21.13
EXCESS CAB Δ P	EXCESS CAB DELTA P	A21.14
NEGATIVE CAB Δ P	NEGATIVE CABIN DELTA P	A21.15

EMR.26 SMOKE

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1317-1461

SMOKE OR FUMES E26.01

■ **If smoke/fumes in the cockpit**
- ▶ CREW OXY MASKS..... ..... DON / 100 %
- ▶ GOGGLES.....DON
- ▶ CREW COMMUNICATIONS..... ..... ESTABLISH

▶ RECIRC FANS 1+2..... ..... OFF
▶ AP .... ON
▶ CABIN CREW COMMUNICATIONS.. .. ESTABLISH

CAUTION
ELEC SMK warning may be triggered by an air conditioning smoke source.

▶ SMOKE / FUMES SOURCE .....IDENTIFY

■ **If electrical smoke/fumes identified**
▶ ELECTRICAL SMOKE procedure (E26.02) .... APPLY

■ **If air conditioning smoke/fumes identified**
▶ AIR COND SMOKE procedure (E26.03) .... APPLY

■ **If FWD SMK comes on or smoke/fumes in FWD zone of aircraft**
▶ FWD SMOKE procedure (E26.04) ....APPLY

■ **If AFT SMK comes on or smoke/fumes in aft zone of aircraft**
▶ AFT SMOKE procedure (E26.06) .....APPLY

■ **If smoke/fumes source not identified**

Note
Refer to FCOM - QRH PRO/NNO/EMR/26/SMOKE SOURCE DETECTION provides additional guidance to identify smoke/ fumes source.

▶ ELECTRICAL SMOKE procedure (E26.02) .... APPLY

REV 15 JUN 2022
1287-1301

E26.01 SMOKE OR FUMES

■ **If smoke/fumes in the cockpit**
- ▶ CREW OXY MASKS..... ..... DON / 100 %
- ▶ GOGGLES.....DON
- ▶ CREW COMMUNICATIONS..... ..... ESTABLISH

▶ RECIRC FANS 1 + 2..... ..... OFF
▶ AP .... ON
▶ CABIN CREW COMMUNICATIONS.. .. ESTABLISH

CAUTION
ELEC SMK warning may be triggered by an air conditioning smoke source.

▶ SMOKE / FUMES SOURCE .....IDENTIFY

■ **If electrical smoke/fumes identified**
▶ ELECTRICAL SMOKE procedure (E26.02) .... APPLY

■ **If air conditioning smoke/fumes identified**
▶ AIR COND SMOKE procedure (E26.03) .... APPLY

■ **If FWD SMK comes on or smoke/fumes in FWD zone of aircraft**
▶ FWD SMOKE procedure (E26.04) ....APPLY

■ **If AUX AFT COMPT SMK comes on**
▶ AUX AFT COMPT SMOKE procedure (E26.05) .... APPLY

■ **If AFT SMK comes on or smoke/fumes in aft zone of aircraft**
▶ AFT SMOKE procedure (E26.06) .....APPLY

■ **If smoke/fumes source not identified**

Note
Refer to FCOM - QRH PRO/NNO/EMR/26/SMOKE SOURCE DETECTION provides additional guidance to identify smoke/ fumes source.

▶ ELECTRICAL SMOKE procedure (E26.02) .... APPLY

SMOKE SOURCE DETECTION

SMOKE or FUMES SOURCE DETECTION

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- If smoke/fumes initially comes out of the ventilation outlets, the crew may suspect air conditioning smoke.
- Upon an engine failure or in case of engine abnormal parameters, smoke/ fumes may come from the bleed air system of the engine. In this case, air conditioning smoke can be considered.
- If the smoke/fumes is detected while an equipment is declared faulty or with a C/B tripped off, the crew may suspect that smoke/fumes is coming from this equipment.
- Burning equipment may be smelt or may enter the cockpit before ELEC SMK warning activation.
- Recirculation fans can propagate smoke/fumes in all the pressurized areas. Therefore, several smoke warnings may be triggered.

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ALL

ELECTRICAL SMOKE E26.02

▶ SMOKE or FUMES procedure (E26.01) .. .. APPLY

CAUTION

ELEC SMK warning may be triggered by an air conditioning smoke source

▶ AVIONICS VENT EXHAUST MODE..... ..... OVBD
▶ AIR FLOW.....HIGH
▶ DC SVCE & UTLY BUS.....OFF
▶ DC BTC .... ISOL
▶ ICING CONDITIONS : LEAVE AND AVOID
▶ ACW GEN 1 + 2.....OFF
▶ SUSPECTED EQUIPMENT.....OFF

■ **If smoke source not identified**
▶ **LAND ASAP**
▶ ACW GEN 1+2 LOSS procedure (A24.09) .....
..... APPLY

■ **If smoke source identified**
▶ OPERATING EQUIPMENT..... ..... RESTORE

Note

Restore ACW GEN, DC BTC and/or DC SVCE & UTLY BUS if appropriate

▶ AFFECTED EQUIPMENT FAULT PROCEDURES
.... APPLY

● **When ΔP below 1 psi**
▶ OVBD VALVE .... FULL OPEN
▶ AVIONICS VENT EXHAUST MODE..... NORM

REV 15 JUN 2022
ALL

FWD SMOKE E26.04

- ▶ SMOKE or FUMES procedure (E26.01) .. .. APPLY
- ■ **If passenger configuration**
  - ▶ CABIN CREW (PA)..... ..... ADVISE FOR ACTION
  - ▶ AVIONICS VENT EXHAUST MODE ..... OVBD
  - ▶ AIR FLOW.....HIGH
  - ▶ EXTRACT AIR FLOW lever .....CLOSED
  - ▶ **LAND ASAP**
  - • **When ΔP below 1 psi**
    - ▶ OVBD VALVE .....FULL OPEN
    - ▶ AVIONICS VENT EXHAUST MODE ..... NORM
- ■ **If cargo configuration**

CAUTION

FWD SMK warning may be triggered by an air conditioning smoke source.

- ▶ CAB PRESS MODE SEL .... MAN
- ▶ CAB ALT .... MAX INCREASE
- ▶ CREW OXY MASKS..... ..... AS RQRD
- ■ **If dual bleed operation**
  - ▶ ENG BLEED 2..... .....OFF
- ■ **If dual pack operation**
  - ▶ PACK VALVE 2.....OFF
- ▶ CAB VENT AIR FLOW..... .....OFF
- ▶ FLT COMPT TEMP SEL .... HOT
- ▶ **LAND ASAP**
- ■ **If immediate landing is not possible**
  - ▶ FL : 160/HIGHER (FL 200 is recommended)
  - ■ **When EXCESS CAB ALT warning is triggered**
    - ▶ CAB ALT ..... MAINTAIN MAX INCREASE

Note

Other smoke detection alarms maybe triggered during smoke evacuation process. Disregard them.

30 NOV 2020
1287-1301

AUX AFT COMPT SMOKE E26.05

- ▶ SMOKE or FUMES procedure (E26.01) .. .. APPLY
- ▶ AUX AFT COMPT AGENT.....DISCH
- ▶ RECIRC FANS 1+2..... ..... OFF