

## OPERATIONS

Preventing Violent Door Opening due to Residual Cabin Pressure



# Preventing Violent Door Opening due to Residual Cabin Pressure

Thousands of aircraft doors are opened daily, usually without incident. However, several events are reported to Airbus each year where residual cabin pressure caused a door to open violently, leading to serious injuries or aircraft damage.

This article describes the available residual cabin pressure warnings, with their limitations. It recalls the recommendations for flight crew, cabin crew, and ground staff to take before opening an aircraft door and provides the safety precautions to take to avoid unintentional pressurization of the aircraft on ground.

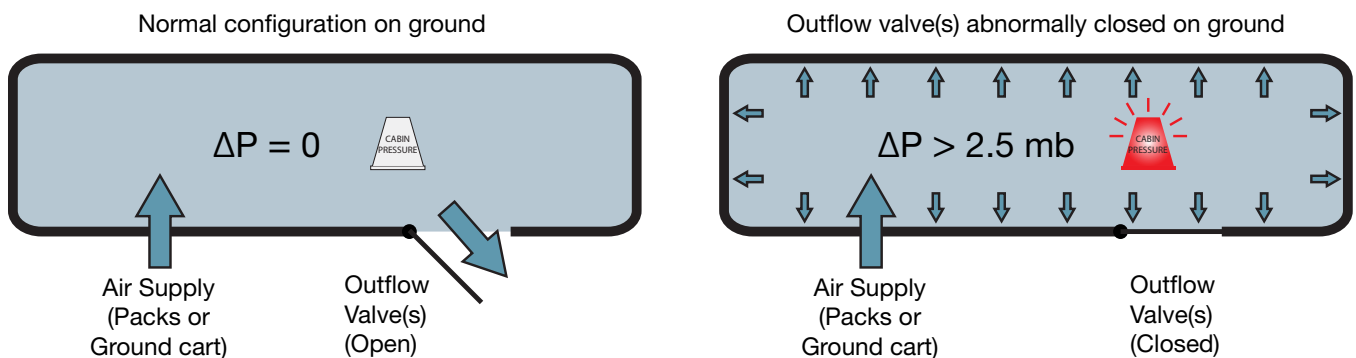


This article supersedes the “Residual Cabin Pressure” article published in the Safety first issue #3.

After landing, the cabin pressure equalizes with the external air pressure when the outflow valves are fully open (fig.1). There is one outflow valve on the A320 family, two on A300/A300-600/A310/A330/A340 and A350 aircraft, and four on A380 aircraft.

In some abnormal cases, outflow valves can remain closed, when the aircraft is on the ground, causing the air pressure in the cabin to be higher than the ambient air pressure outside the aircraft. In this case, there is a risk that an aircraft door could violently open and injure the operator or damage the aircraft.

**(fig.1)**  
Normal and abnormal configuration of the outflow valves on ground



## THE RESIDUAL PRESSURE WARNING LIGHT

The Residual Pressure Warning Light **(fig.2)**, part of the residual pressure warning function, warns anyone who wants to open a door if the aircraft is pressurized. This device is installed on all Airbus aircraft except for some A300, A310 and A300-600 where it was offered as an option. On these aircraft not fitted with the warning light, a caution placard located on the door reminds the operator of the risk that residual pressure may cause violent door opening.

### INFORMATION

The Residual Pressure Warning Light can be installed on cabin doors by the SB A300-52-0148, A310-52-2039, A300-52-6024.



**(fig.2)**  
Cabin door with the residual pressure warning light

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### A320 AIRCRAFT FAMILY CARGO DOOR EXCEPTION

There is no residual pressure indicator on forward and aft cargo doors of A320 aircraft due to the presence of a vent door that equalizes the air pressure inside the cargo compartment with the outside when the operator opens the cargo door.

Depending on aircraft type, the Residual Pressure Warning Light is fitted on:

- Passenger doors,
- Emergency exits,
- FWD and AFT cargo-compartments doors,
- Main Deck Cargo Door on Freighter aircraft

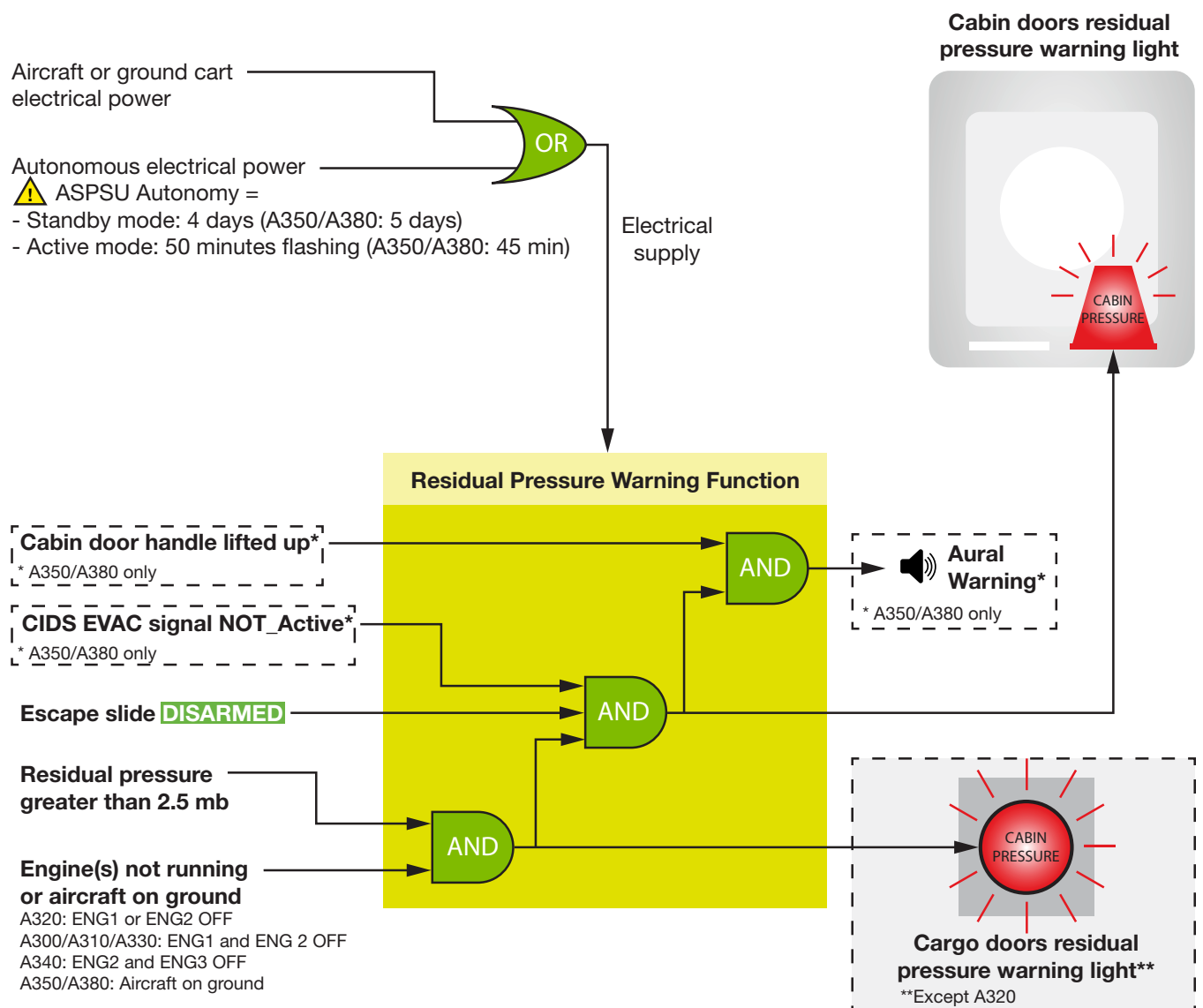
Refer to the FCOM, CCOM and AMM for Residual Pressure Warning Light locations on your aircraft.

The Residual Pressure Warning Light flashes if the following conditions are met at the same time **(fig.3)**:

1. The slide of the door is disarmed (for passenger doors and emergency exits only)
2. Engines are off or the aircraft is on ground (depending on the aircraft type)
3. The residual cabin pressure exceeds a defined threshold

**(fig.3)**

Residual pressure warning function activation logic



On A350 and A380 aircraft, there is an aural warning in addition to the Residual Pressure Warning Light. It will sound, together with the flashing warning light, when the 3 triggering conditions mentioned above are met and the operator begins to lift the door handle a few degrees.

## General Recommendations to avoid violent door opening

In several events reported to Airbus, an operator tried to open a door even though the warning light was flashing. Due to the overpressure, the door violently opened, causing damage to the aircraft and injury to the operator.

### Recommendations

Anyone operating an aircraft door must be trained to the associated procedures.

If the operator (flight crew, cabin crew or ground staff) observes that the Residual Pressure Warning Light is flashing, they must not attempt to open the door. If the cabin crew sees the light flashing from inside the cabin, they must immediately alert the flight crew (as per CCOM SOP). The flight crew should check the differential pressure and outflow valves position on the ECAM and take the necessary actions. Then, the cabin crew must wait for flight crew authorization to open the doors.

If the Residual Pressure Warning Light is seen flashing from the outside of an aircraft, the position of the outflow valves should be checked (**fig.4**). If outflow valves are observed closed, the ground staff should remove any connected external air source and check if an inward opening door, such as the forward avionics compartment door (**fig.5**) can be opened. If the avionics door cannot be opened, residual pressure still remains. The operator should then wait until the pressure dissipates by leakage.

## Residual Pressure Warning function specificities and limitations

### Emergency evacuation

In the case of an emergency evacuation, due to the logic of the system, the residual pressure warning light will not flash as long as the slides are **ARMED** (**fig.3**).

The CCOM “EMERGENCY PASSENGER DOOR OPERATION” procedure provides guidance to identify residual cabin pressure such as a higher resistance of the door’s control handle when lifted, or a “hissing noise” around the immediate door area. In this situation, immediate communication must be established with the flight crew.

### Limitation of the autonomous power supply of the residual pressure warning function

When there is no aircraft power supply and its main batteries are switched off, the residual pressure warning function is powered by the battery of the Autonomous Standby Power Supply Unit (ASPSU).

The ASPSU battery autonomy is (**fig.3**):

- 4 days (5 days for A380 and A350) in “stand-by” mode
- 50 minutes (45 minutes for A380 and A350) in “active” mode with the warning light flashing.

“ If the operator observes that the Residual Pressure Warning Light is flashing, they must not attempt to open the door. ”



(fig.4)

A350 Outflow valve in the open position



(fig.5)

A330 FWD avionics compartment access door (inward opening)

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“ If the aircraft is unpowered for more than 4 days (5 days for A380 and A350), its residual pressure warning function is not available until the aircraft is re-energized. ”

Therefore, if the aircraft is unpowered for more than 4 days (5 days for A380 and A350), its residual pressure warning function is not available until the aircraft is re-energized. ■



### BEST PRACTICE

Check outflow valves are open before opening a cabin or a cargo door from outside to ensure there is no residual pressure in the fuselage, especially if the aircraft does not have power connected to it. The avionics compartment access door (**fig.5**) can be used to check for residual pressure and release it safely because it is an inward opening door.



### INFORMATION

On A330/A340 aircraft delivered before June 2013, an “engine running” signal is incorrectly sent to the residual pressure warning function when the aircraft is de-energized, causing the warning function to be inactive. A modification to correct this issue is available in the following Service Bulletins:

- A330-52-3094
- A340-52-4102
- A330-52-3096
- A340-52-5024

## ALERTING THE FLIGHT CREW: THE EXCESS RESIDUAL PRESSURE ECAM WARNING

In addition to the residual pressure warning function, the **CAB PR EXCES RESIDUAL PR** ECAM warning (**fig.6**) triggers if residual pressure is detected in the cabin after landing and the engines are switched off. The flight crew must follow the ECAM procedure, alert cabin crew and ground crew about the situation, and advise them not to operate the aircraft doors. ■

(fig.6)

A320 **CAB PR EXCES RESIDUAL PR** ECAM Warning



### INFORMATION

This ECAM alert is basic on all A350 and A380 aircraft and on A320/A330/A340 built since 2004. The alert can also be implemented on aircraft built prior to 2004 and on A300-600/A310 aircraft with the following Service Bulletins:

- A300-31-6135
- A310-31-2135
- A320-21-1164
- A330-21-3112
- A340-21-4121
- A340-21-5020



## NOTE

On A350 and A380 aircraft, the ECAM alert is **CAB PRESS EXCESS RESIDUAL DIFF PRESS**

This alert is not available for the A300 aircraft, however standard operating procedures at parking instruct the flight crew to check zero  $\Delta P$  prior to informing the cabin crew that aircraft doors can be opened.

## AVOIDING UNINTENTIONAL PRESSURIZATION OF THE AIRCRAFT ON GROUND

Several reported incidents of violent door opening occurred after an unintentional pressurization of the aircraft on the ground.

### Event Description

Due to winter conditions, an A320 aircraft was secured for cold soak. As per procedure, the outflow valve was closed using the DITCHING pushbutton. The next day, a ground cart was connected to the aircraft for pre-conditioning while the aircraft doors and the outflow valve were still closed. This resulted in a cabin pressure build-up. An operator did not rely on the residual pressure warning light flashing and tried to open a passenger door. The door violently opened and the operator was injured.

### Recommendations

When connecting a ground cart to the LP or HP ground air connectors, the maintenance personnel must ensure that the outflow valves are open and stay open, or one or more passenger doors are open and stay open, or the forward avionics compartment access door is open and stays open. ■

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## INFORMATION

Improved warning placards (**fig. 7**) with additional recommendations for ground personnel are installed on the LP/HP ground connection area or maintenance doors of A320 family aircraft delivered since March 2015, on A330/A340 aircraft delivered since February 2014 and A380 aircraft delivered since October 2010 and on all A350 aircraft. The placards can be installed on the remaining aircraft by the following Service Bulletins:

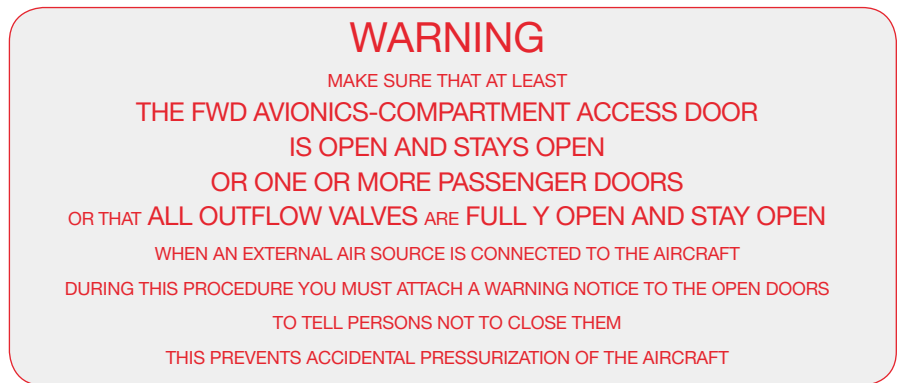
- SB A320-11-1097
- SB A330-21-3171
- SB A340-21-4158
- SB A340-21-5050
- SB A380-21-8040

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**(fig.7)**

Example of an improved placard on A330



On A310 aircraft delivered after May 1994 and A300-600 aircraft delivered after December 1994, a modification introduces a mechanical fool-proof device which prevents connection of the ground supply to the aircraft LP ground connector until the service door 136AR has been removed. This avoids build-up of cabin pressure and subsequent risks of violent door opening when a LP ground source is connected to the aircraft. On aircraft not fitted with this modification from production this can be embodied by application of recommended SB A300-21-0119, A310-21-2045 or A300-21-6029.

## RESIDUAL CABIN PRESSURE FOLLOWING THE USE OF THE MANUAL PRESSURE CONTROL MODE

If all cabin pressure controllers fail, the ECAM procedure requires the flight crew to manually control the cabin pressure.

Incorrect manual pressure control by the flight crew following landing can lead to the outflow valves to remain closed when the aircraft taxis to the gate.

On A320/A330/A340 aircraft, Airbus developed a solution to this issue: the Residual Pressure Control Unit (RPCU). The RPCU automatically opens the outflow valves on the ground when the aircraft is operated in manual pressure control mode. ■



### INFORMATION

The RPCU is installed in production on A320 family aircraft delivered after August 2005 and on A330/A340 aircraft delivered after October 2005.

The RPCU can be installed on A320 family aircraft delivered before August 2005 through the SB A320-21-1154.

On A380 and A350 aircraft, the RPCU functionality is integrated into the Cabin Pressure Controllers that prevent closure of the outflow valves when residual cabin pressure is detected on ground.

The RPCU is not available on A300/A300-600/A310 aircraft.

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Opening an aircraft door is done thousands of times a day without incident, however particular care should be taken to do this task. Any personnel opening aircraft doors must be trained to the associated procedures.

Relying on the Residual Pressure Warning Light is the key to prevent violent door opening events due to residual cabin pressure: if the Residual Pressure Warning Light is flashing, the door **MUST NOT** be opened. If the light is seen flashing from the inside, the cabin crew must contact the flight crew who will take the necessary actions to remove the residual pressure. Good communication between the flight crew and the cabin crew is essential.

Checking outflow valves are open is a fast way to confirm that an aircraft is not pressurized. If an inward avionics compartment door is difficult to open, this is another indication that the aircraft is pressurized.

It is also important to remember that the residual pressure warning function is only available for 4 days (5 days on A350/A380) when the electrical power is removed from an aircraft.

To avoid unintentional pressurization of an aircraft when connecting a ground air supply, the maintenance personnel must ensure:

- The outflow valves are open and stay open, or
- One aircraft passenger door is open and stays open, or
- The forward avionics compartment door is open and stays open.



**Safety first, #27** October, 2018. Safety first is published by Airbus S.A.S. - 1, rond point Maurice Bellonte - 31707 Blagnac Cedex/France. Publisher and Editor: Yannick Malinge, Chief Product Safety Officer. Concept Design by Airbus Multi Media Support 20182427. Reference: X00D16031905 Issue 27. Photos by Airbus, Eurodoc Sonovision ITEP GmbH, C. Koshorst.

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