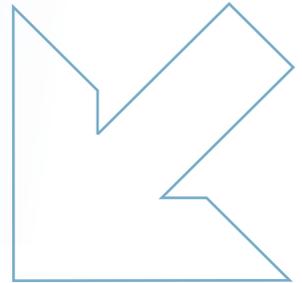




A320 - Dual hydraulic loss



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1 | Introduction

The A320 may experience a series of dual hydraulic loss when, at low altitude, a leak in the green hydraulic system causes the loss of the yellow circuit.

To understand how this may happen, this article will first describe the aircraft's hydraulic system and explain the respective roles of the Power Transfer Unit (PTU) and ECAM caution in case of pressure differential between the green and yellow systems.

The second part of the article will describe how the combination of a major leak in the green circuit and the ECAM inhibition below 1,500 feet may lead to the dual hydraulic loss.

The third and last part will develop on the corrective actions proposed to avoid this type of occurrences.

2 | General overview

The A320 hydraulic system is composed of three different and fully independent circuits: Green, Yellow & Blue. The users are shared between the systems in order to ensure the control of the aircraft, even when one system is inoperative.

On the blue hydraulic system, the normal source of pressure is the electrical pump, and the auxiliary source is the Ram Air Turbine (RAT). The Constant

Speed Motor/ Generator (CSM/G) is used to provide aircraft electrical power in case of emergency.

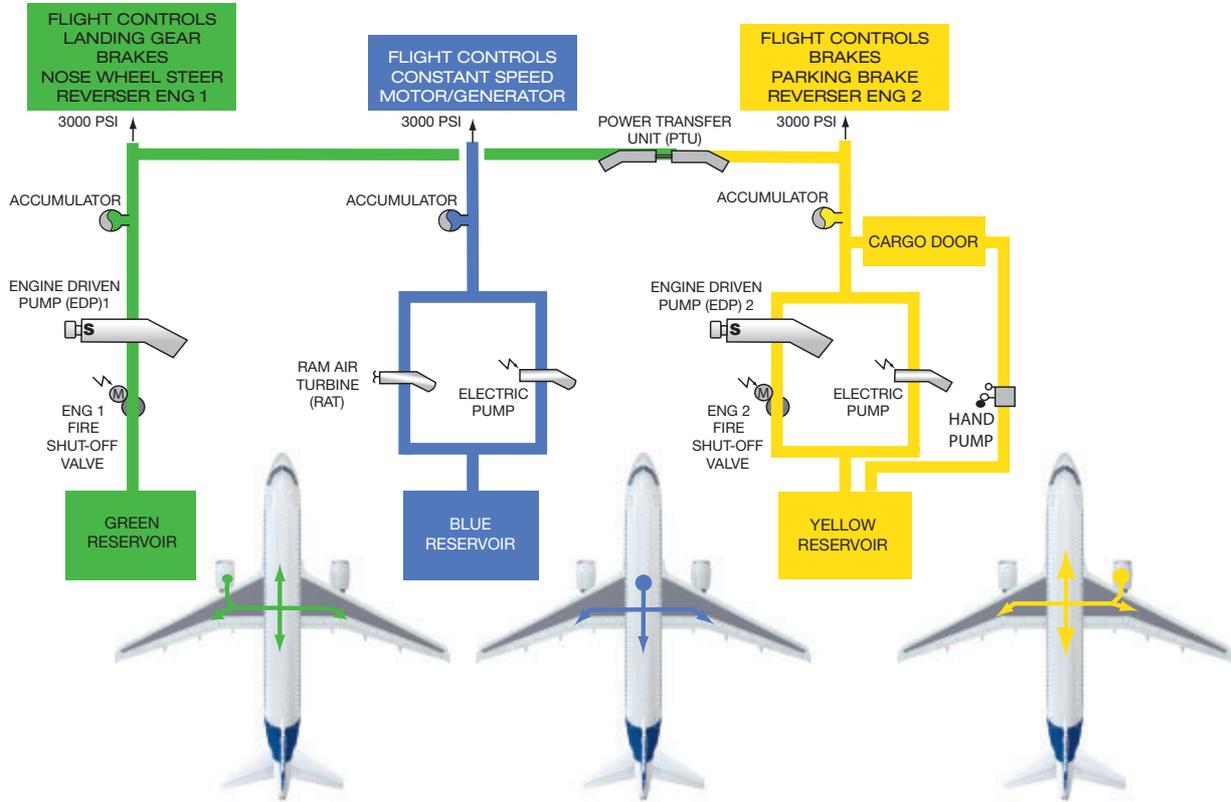
On the green & yellow systems, the normal source of pressure is the Engine Driven Pump (EDP) and the auxiliary source is the Power Transfer Unit (PTU). The PTU is a hydraulic motor pump which transfers hydraulic power between the green and yellow systems without transfer of fluid.

It operates automatically, whenever the pressure differential between the two systems reaches 500 PSI.

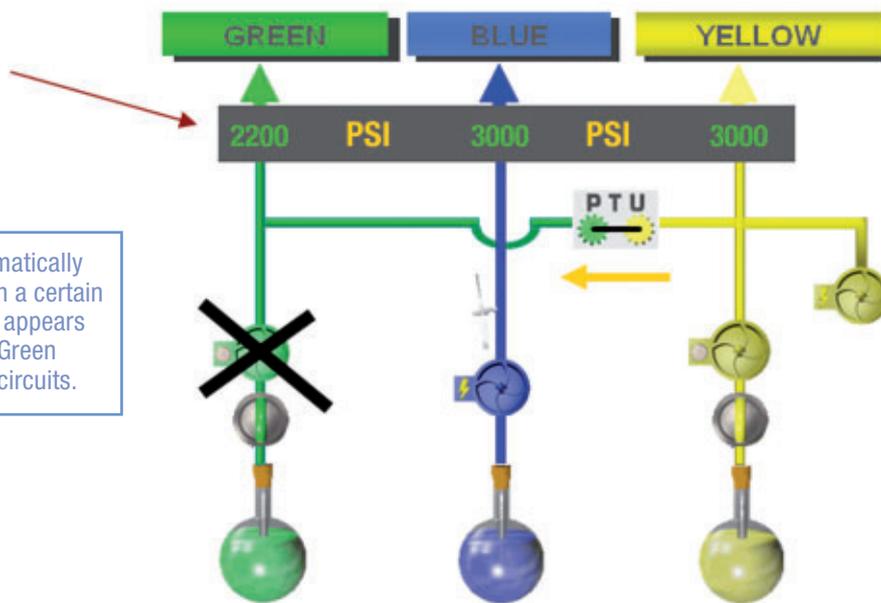
In case of low fluid level in either the green or yellow system, an amber caution is triggered on the ECAM, which requests the pilot to switch off the PTU as well as the EDP. This to avoid having the PTU running at maximum speed and causing the overheating and loss of the properly functioning hydraulic system.

According to the Airbus philosophy of not overloading the flight crew during the critical phases of flight, the above amber caution is inhibited below 1,500 feet.

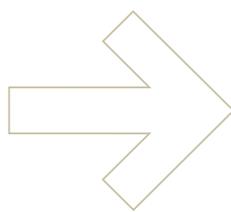
The figure below shows all the systems, which are interconnected to the hydraulic systems:



SYSTEM OVERVIEW / RAT
 Example of architecture.
 Aircraft pre modification 26925.



PTU is automatically operated when a certain ΔP (500PSI) appears between Green and Yellow circuits.

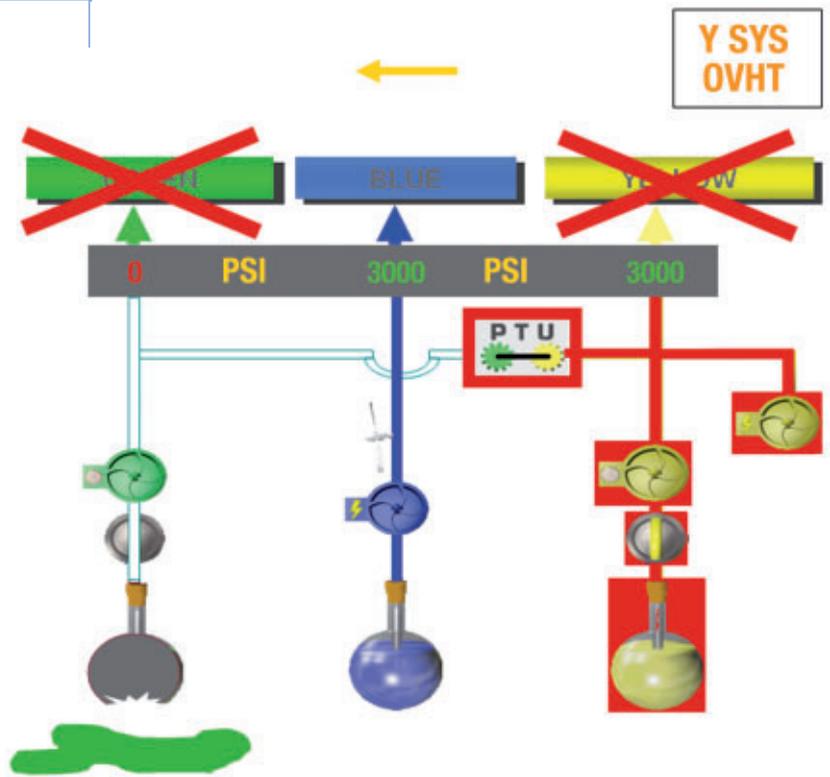




3 | Dual hydraulic loss scenario

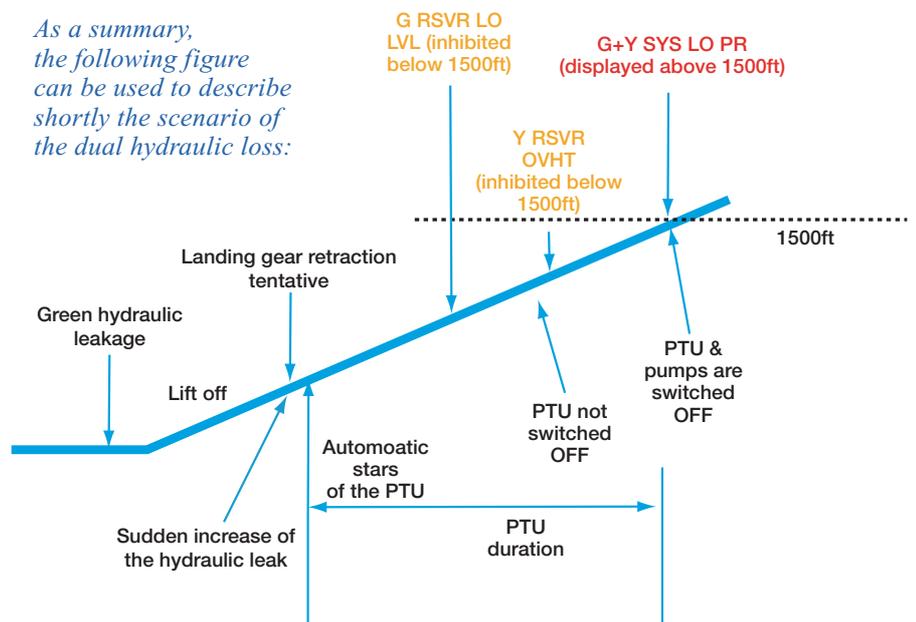
The scenario of the dual hydraulic loss is the following:

- 1) During takeoff, a leak in the gear retraction circuit leads to the loss of the green hydraulic system. This loss stops the retraction of the landing gear.
- 2) The 500 PSI pressure differential between the green and yellow hydraulic pressure is reached and the PTU automatically switches ON.
- 3) The loss of the green system normally triggers the corresponding ECAM caution, which requests the crew to switch off the PTU.
- 4) However, below 1,500 feet, the ECAM caution is inhibited.
- 5) The PTU therefore remains ON, and operates at its maximum speed.
- 6) As a consequence of the non retraction of the landing gear, the crew may be busy communicating with ATC and managing the situation, leaving the aircraft flying below 1,500 feet longer than usual, and thus keeping the ECAM caution inhibited.
- 7) Within less than two minutes, the PTU overheats the yellow hydraulic system and causes its loss.



- In case of green low level, if PTU is not switched off this will lead to
- A Yellow overheat (around 2 minutes later)
- Then to a double G+Y hydraulic failure

As a summary, the following figure can be used to describe shortly the scenario of the dual hydraulic loss:



4 | Corrective actions

This scenario already occurred in-service, leading to the following design change:

Below 1,500 feet the PTU is automatically switched to OFF.

This solution was preferred to the following alternatives:

- Upgrading the ECAM caution to a red warning.
- Cancelling the inhibition of the ECAM warning below 1,500 feet.

Indeed, red warnings require immediate action, which is not justified in this case, and cancelling the inhibition would only overload the crew during a busy flight phase.

The operational consequences of such change are described below:

In case of hyd leak in flight:

- No longer risk of dual hydraulic loss if no rapid crew action.
- Follow "G(Y) SYS LO PR" ECAM caution when triggered.

Note: the ECAM procedure requests a manual confirmation to switch off the PTU.

In case of hyd leak on ground:

- No PTU logic change:
Follow "G(Y) SYS LO PR" ECAM caution

In case of single engine taxi, or hydraulic pump failure or engine failure...:

- **No change : PTU runs** to recover the normal pressure in the affected system.

No ECAM change with new PTU logic:

- **ECAM still requests to switch OFF the PTU**
 - Only Pilot confirmation (in flight) with new logic
 - Common ECAM definition with old logic

5 | Conclusion

The scenario of dual hydraulic loss occurred in-service.

- The green hydraulic system was lost during gear retraction.
- The PTU automatically switched ON.
- The ECAM warning requesting to switch OFF the PTU remained inhibited below 1,500 feet.
- The aircraft remained below that altitude for more than two minutes after the start of the operation of the PTU, which led the yellow system to overheat and caused its loss.

A design change has been developed, which consists in the automatic switching of the PTU to OFF below 1,500 feet.

This change is covered by the following modifications.

MOD 34236 + 35879 / SB 29-1115:
Install provisions for new PTU inhibition logic

MOD 35938 / SB 29-1126:
Activate new PTU inhibition logic

Modifications 34236 & 35879
are now standard on production lines from MSN2740.

Modification 35938 is optional, and must be requested.

We therefore encourage airlines to retrofit these modifications.



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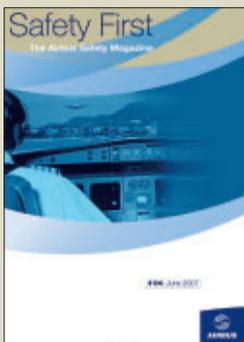
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