RTW 2022
Airbus
SA Family

GERMANY, EUROPE

19 September 2022

LIEBHERR

Liebherr-Aerospace Toulouse

Airbus SAceo

ATA 36

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Agenda

1 Introduction and presentation
2 SAceo - Fleet Performance - Airbus data
3 SAceo - ATA36 - Available solutions and mitigations
4 SA - ATA21 - AIR PACK REGUL FAULT
5 SAneo - ATA36 - High Pressure Valve
6 SAneo - ATA36 - Fan Air Valve Body
7 Liebherr Initiatives and Digital Services

Your Liebherr Aerospace Toulouse Technical Support Team – Airbus fleet

Damien Pinet / Commercial Aircraft Team Leader

Nicolas Perles / SAneo ATA36 focal

Elisabeth Dahan / SAceo ATA6 focal

BTS & GSE Focal

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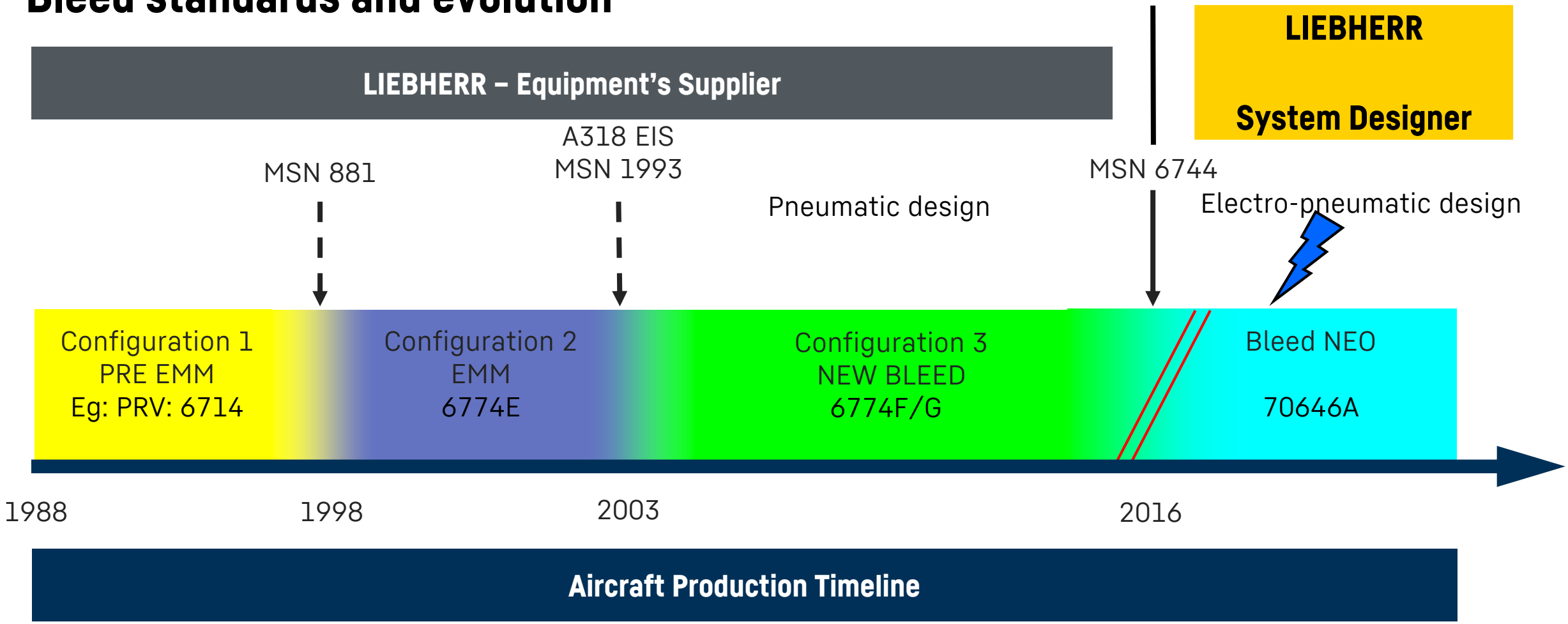
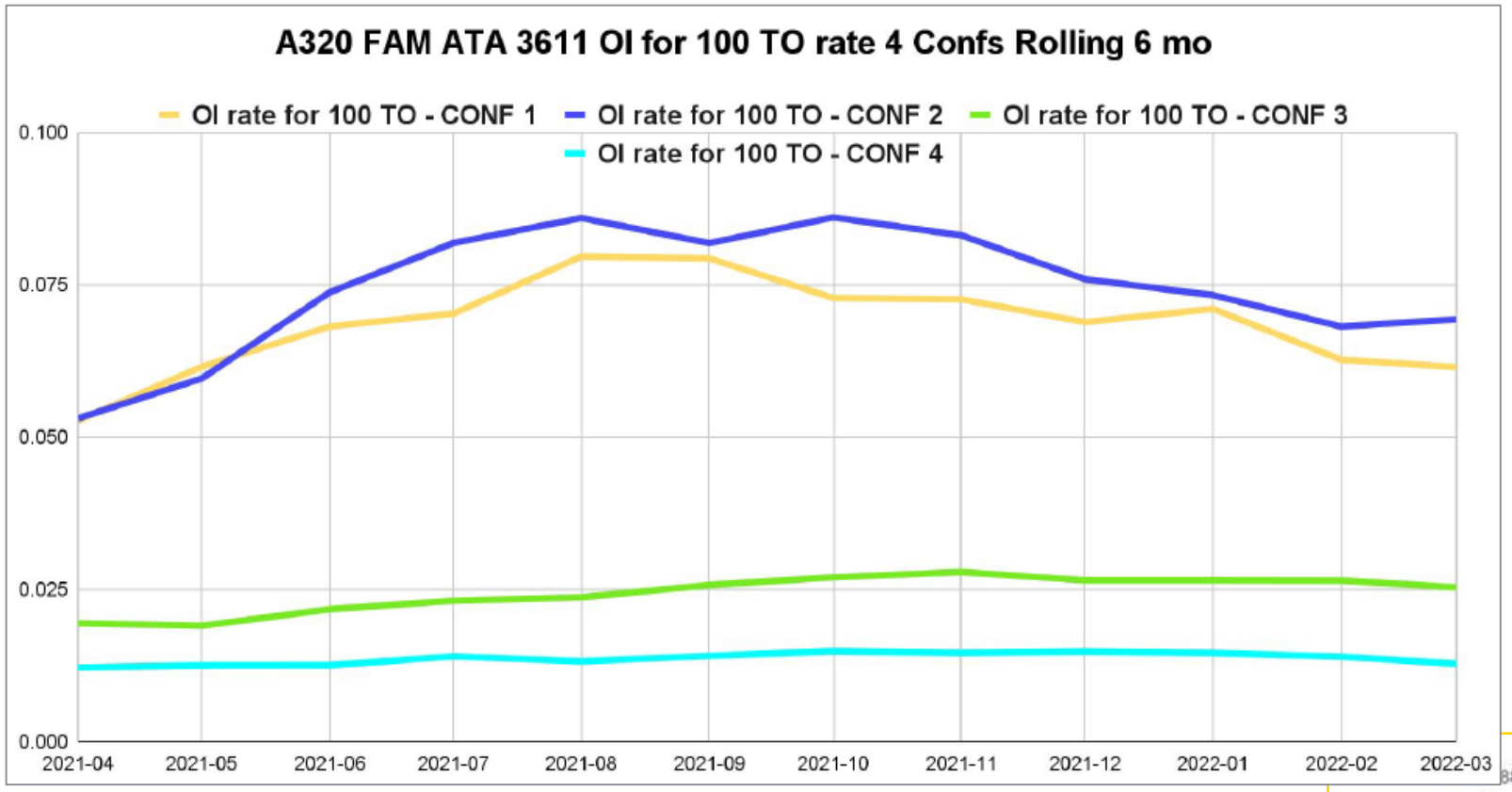
A320ceo

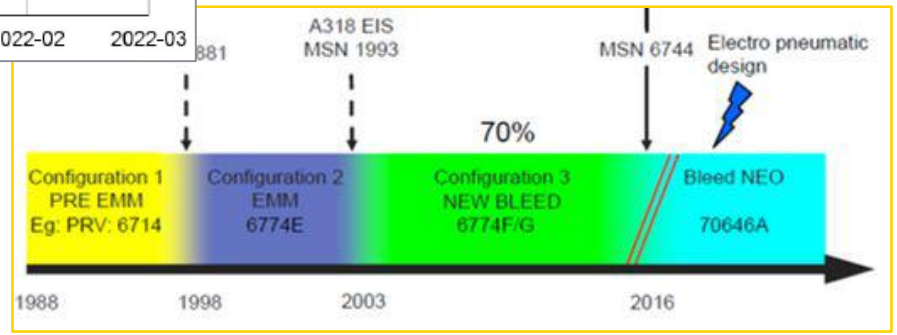
Bleed standards and evolution



A320ceo ATA36-11 – WW Fleet OI rate trend vs Bleed configurations



**Airbus data as of March 2022*



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A320 Family ceo

Targeted solutions to optimize aircraft operation

		AIR ENG HP VALVE FAULT	AIR ENG BLEED NOT CLSD - PRV	TLT Misbehavior - 34D01*, 341E*, 341F01	Bleed Low Temperature - TCT	Bleed Overpressure at Take-Off	AIR ENG BLEED ABNORM PR - OPV 6740F01* & 6740G01*	AIR ENG BLEED FAULT - Over Temperature	AIR ENG BLEED FAULT - OTHERS	AIR ENG BLEED ABNORM PR - OTHERS
Mitigation/ solution	BMC STD12 + OPV G + Wiring	●	●	●		●				
	BMC STD12		●		●	●				
	TLT PN 341F020000			●						
	TCT PN 342B050000				●			●		
	FAV PN 6730F010000							●		
	EEC SCN 22					●				
	AMM/TSM improvement	●		●	●	●	●	●		
AIRBUS complementary solutions	AIRBUS bleed heath check	●	●		●	●		●	●	●
	Skywise predictive maintenance	●	●	●	●			●	●	●
LIEBHERR complementary solutions	LIEBHERR bleed health check	●	●		●	●		●	●	●
	Data Driven Engineering Solutions (DDES)	●	●		●	●				
	Pack off/take-off SP	●	●	●		●				
	Bleed pressure regulation SP					●	●			
	Bleed temperature regulation SP				●			●		
	Overhaul solutions SP	●	●	●	●			●		
	Modernisation	●	●	●				●		

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Agenda

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Take-Off / Packs OFF - Solution and Mitigations

Take-Off / Packs OFF System

Overview

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Take-off pack off

Preventive maintenance based on scheduled and recommended removals of the key involved equipment.

TOPO_SP

Airbus

ISI 36.11.00109

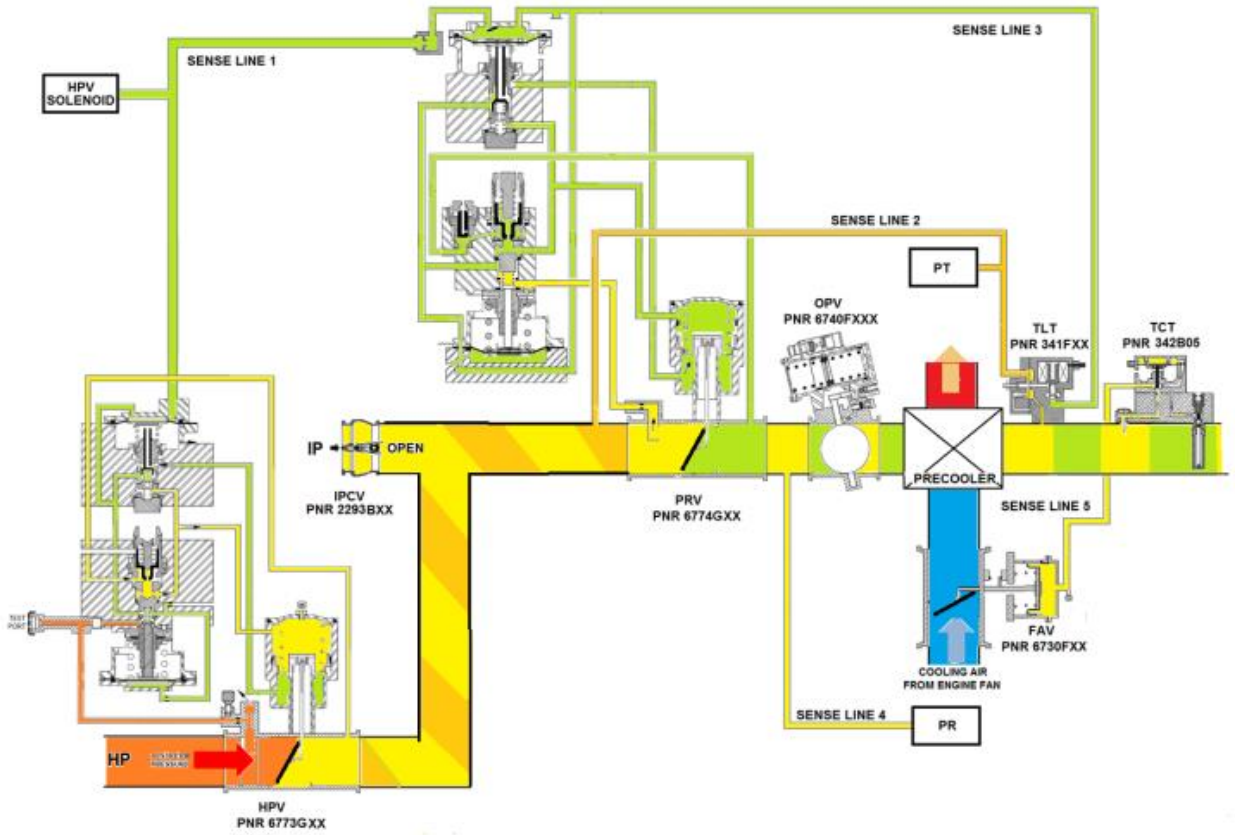
BMC STD12

BMC Full Kit

Airbus and Liebherr solutions act as complementary means to maximize system performance over time

Agenda

Engine Bleed Abnormal Press – Support Solutions & Maintenance



Liebherr

System performance

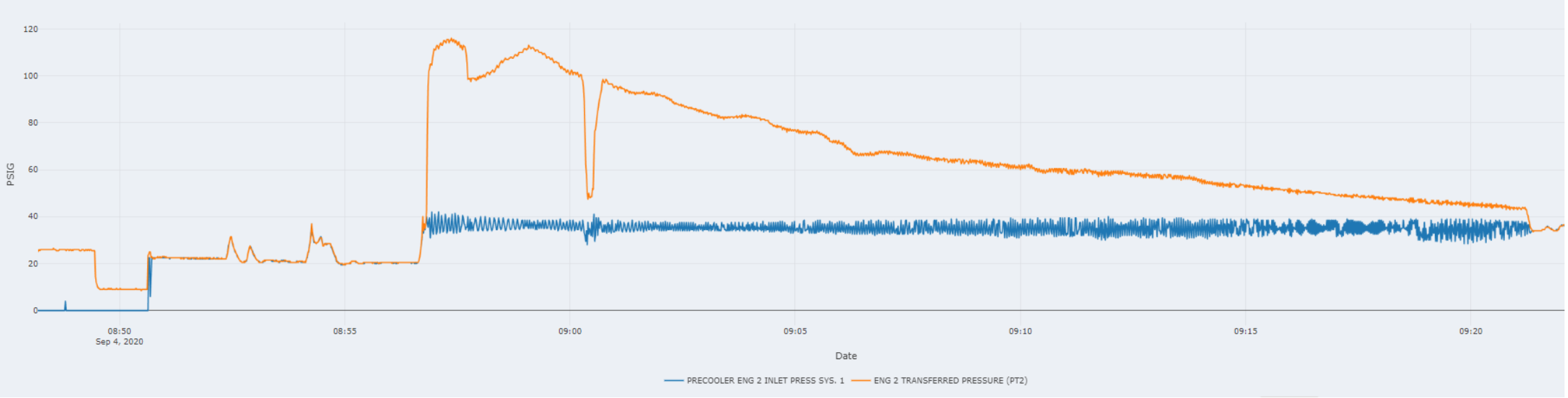
Addressing the key system performance drivers to prevent and avoid the in-service occurrences due to Abnormal press.

Abnorm_Press

Liebherr Support Package to mitigate ABNORMAL PRESS + OVPRESS Faults in Take-Off with Packs ON

Engine Bleed Abnormal Press – PRV Functional Test

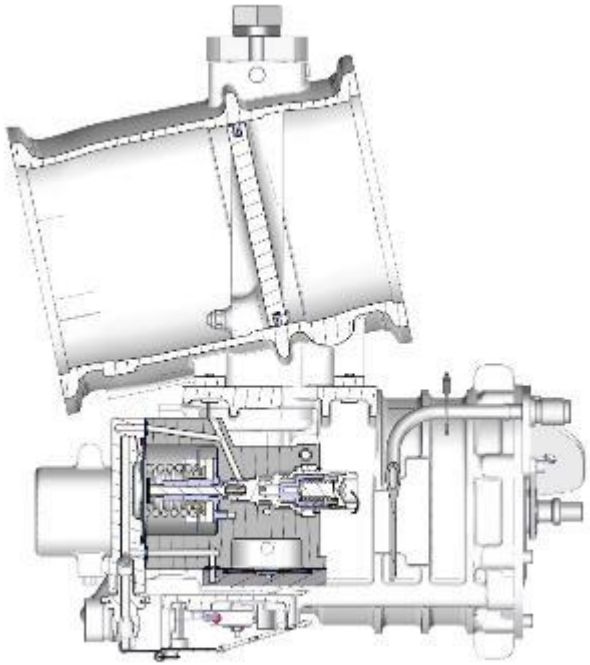
– Liebherr identified a correlation between Aircraft extended storage and increase of ENG BLEED FAULT + ABNORMAL PRESS FAULT during Take-Off, shortly after A/C Return To Service.



In addition, refer to Airbus **OIT 999.0037/20** for Return To Service maintenance recommendations

Engine Bleed Abnormal Press – PRV functional test

The test can be performed using **Liebherr BTS PNR 99127B03** or **99127B04** and **kit 99127-231**, with no additional tools necessary.



This test procedure is available through SIL **LS6774-36-01** since November 2020

FAQ on storage recommendations & Return to Service

– Liebherr FAQ page still available and updated to provide a list of Q&A about our ATA21, 36, 27 & 32 products in regards to storage/parking conditions and provide you with recommendations proposed with AIB for RTS.

https://www.liebherr.com/en/deu/specials/aer-webforms/webform-fleet-support-for-takeoff-2020/faq.html

Liebherr still continues to analyse removals of equipment's after storage/parking period

Engine Bleed Abnormal Press – Sense-lines leak check

A rigorous periodic inspection and maintenance of the sense-lines on the SA CEO Bleed pneumatic system is key to ensure an optimal system performance.

E.g.: AMM TASK 36-11-00-720-008-A: Functional Test of the Sense Line Connected between the HP Bleed Valve and the Bleed-Pressure Regulator Valve with the Bleed Test Set

5.On the test set: - Do a check of the pressure valu e shown on the LCD (5).	On the test set: - The pressure is more or equal to 5.8 psi (0.40 bar).

Scenario 1: no leak in HPV/PRV sense-line

Scenario 2: leak in HPV/PRV sense-line

Sense-Line Tester kit SBE2213 applicable with Liebherr and Airbus Bleed Test Set

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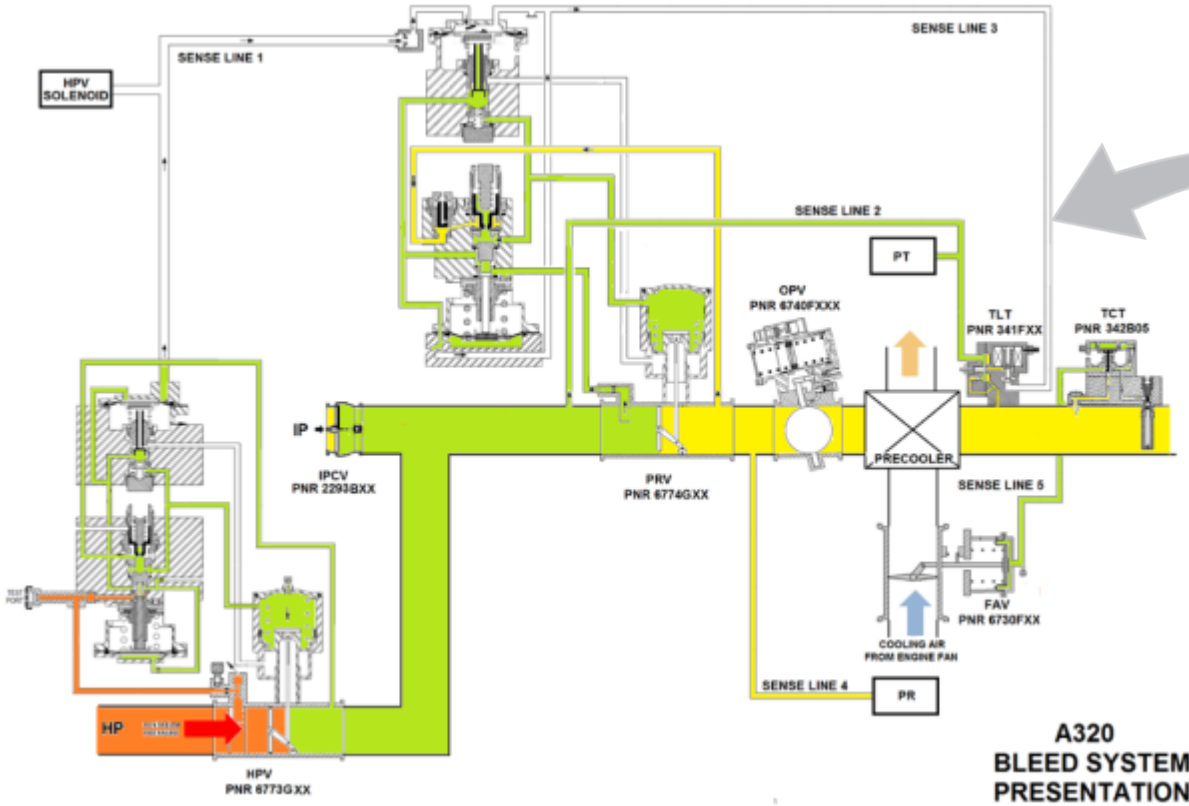
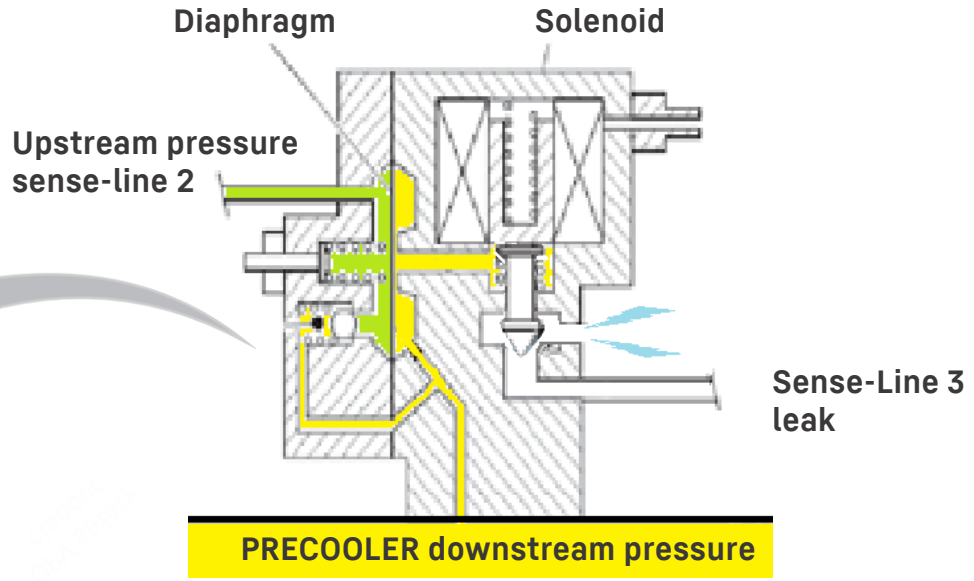
Engine Reverse Flow at start sequence – TLT function

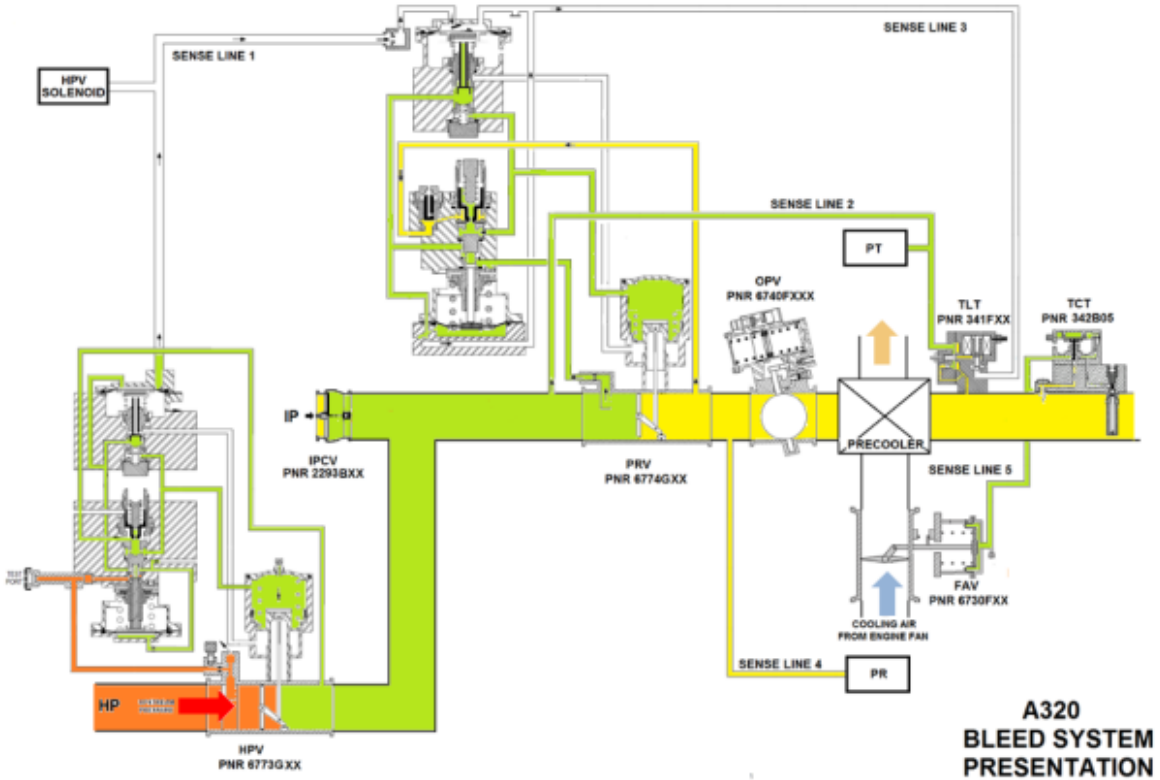




/// Behaviour of the TLT Non-Return function

Engine Reverse Flow at start sequence – TLT function

- **Only during Engine starting sequence using APU Bleed, both Bleeds are still interconnected for a 10s time period**
- The TLT Non-Return Function is alone to protect the engine
- In this particular 10s timeframe, the failure of TLT reverse flow protection may lead to engine stall.

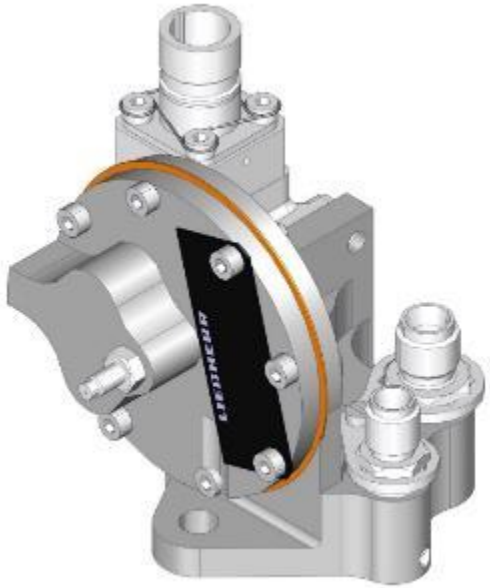


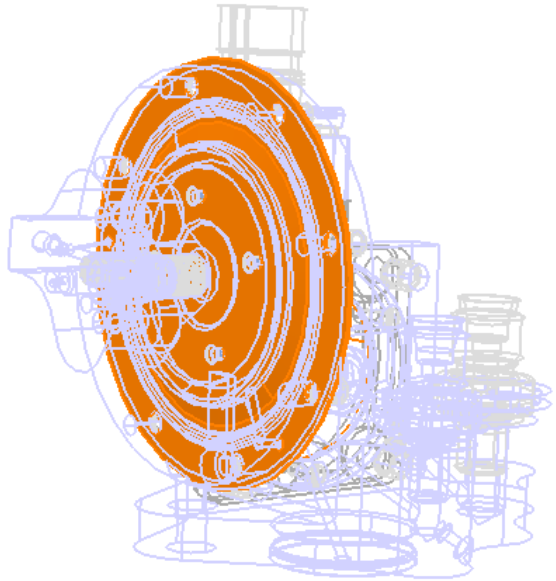
/// Complete failure of TLT reverse flow function just after the engine start sequence with APU Bleed (10s) may lead to engine stall.

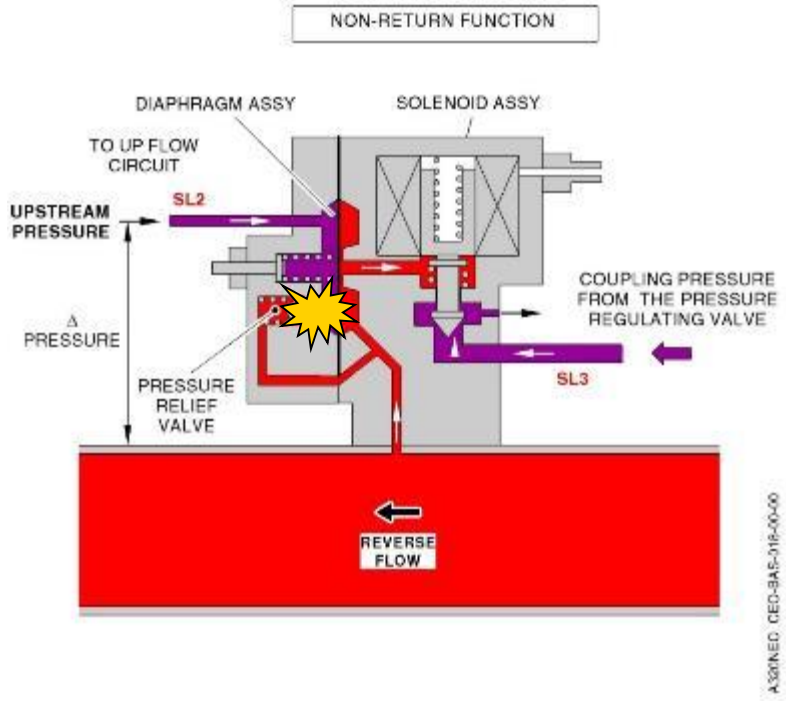
Engine Reverse Flow - TLT 341F010000 manufacturing evolution

After engine stall events, some TLT (341F010000) were investigated and found with pollution in the Non-return function and the solenoid.

After analysis, some RTV was found as part of the pollution and RTV is used in the manufacturing of TLT diaphragm

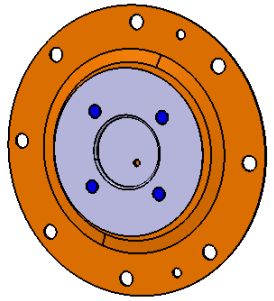






Engine Reverse Flow - TLT 341F01 manufacturing evolution

The modification will consists in removing RTV during diaphragm manufacturing only.



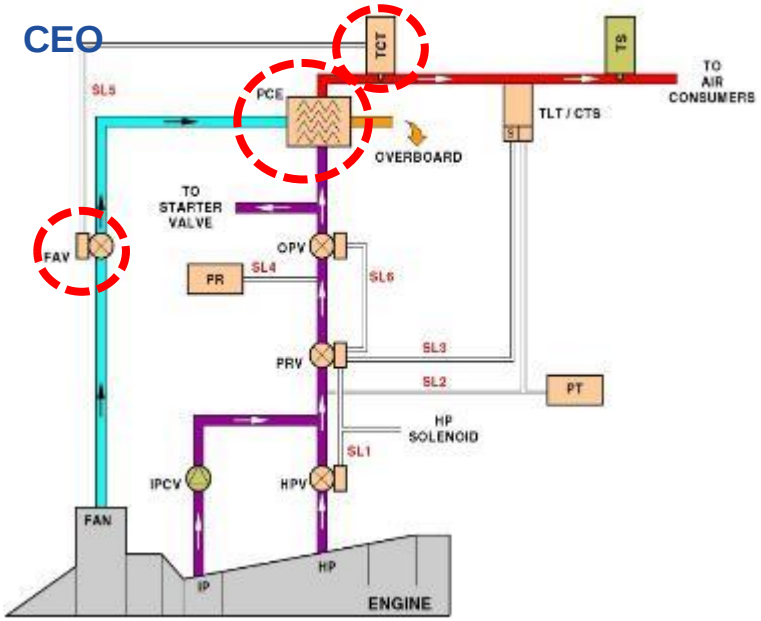
VSB 341F-36-01 to be applied on attrition basis. At opportunity of a Major repair, systematic embodiment at no additional costs.

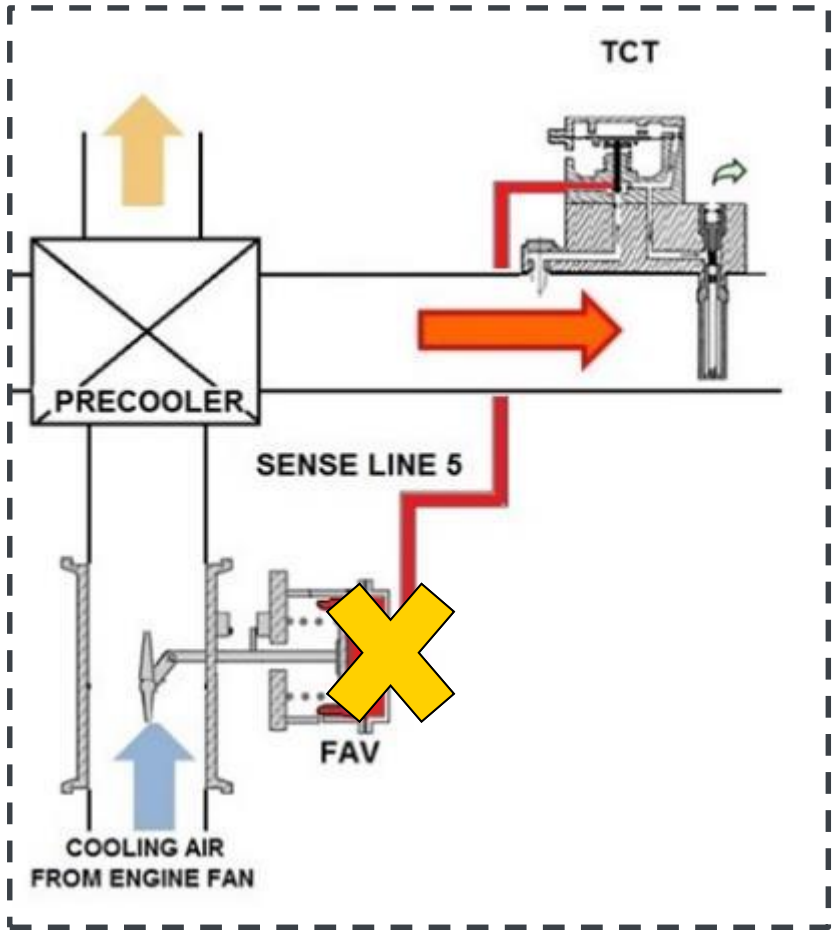
Year 2021	Available
New design Qualification validation completion	New P/N **341F020000**

/// **VSB 341F-36-01** available since July 2022

Agenda

Engine Bleed Low Temp





Bleed Low Temp is detected when Precooler Outlet temperature drops below 150°C for more than 5secs

Engine Bleed Low Temp – Support Solutions & Maintenance

A periodic cleaning of the FAV banjo hole can efficiently prevent the majority of low temp events

Refer to Airbus AMM TASK 36-11-00-720-012-A

(applicable on FAV 6730F010000 only)

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System performance

Addressing the key system performance drivers to prevent and avoid the in-service occurrences due to temperature regulation.

Temp_Regul

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AIR PACK REGUL FAULT E/W ORPHAN INVESTIGATION

– Previous investigations:

➢ 2014 : AIR PACK REGUL FAULT E/W without associated FM

✓ **Solution 1 : Correction of « AIR PACK X REGUL FAULT » logic in Software 1803B0000-03**

➢ 2017 : CDS high removal rate investigation

✓ **Solution 2 : CDS disparity monitoring change logic in new hardware & software 71103A010001**

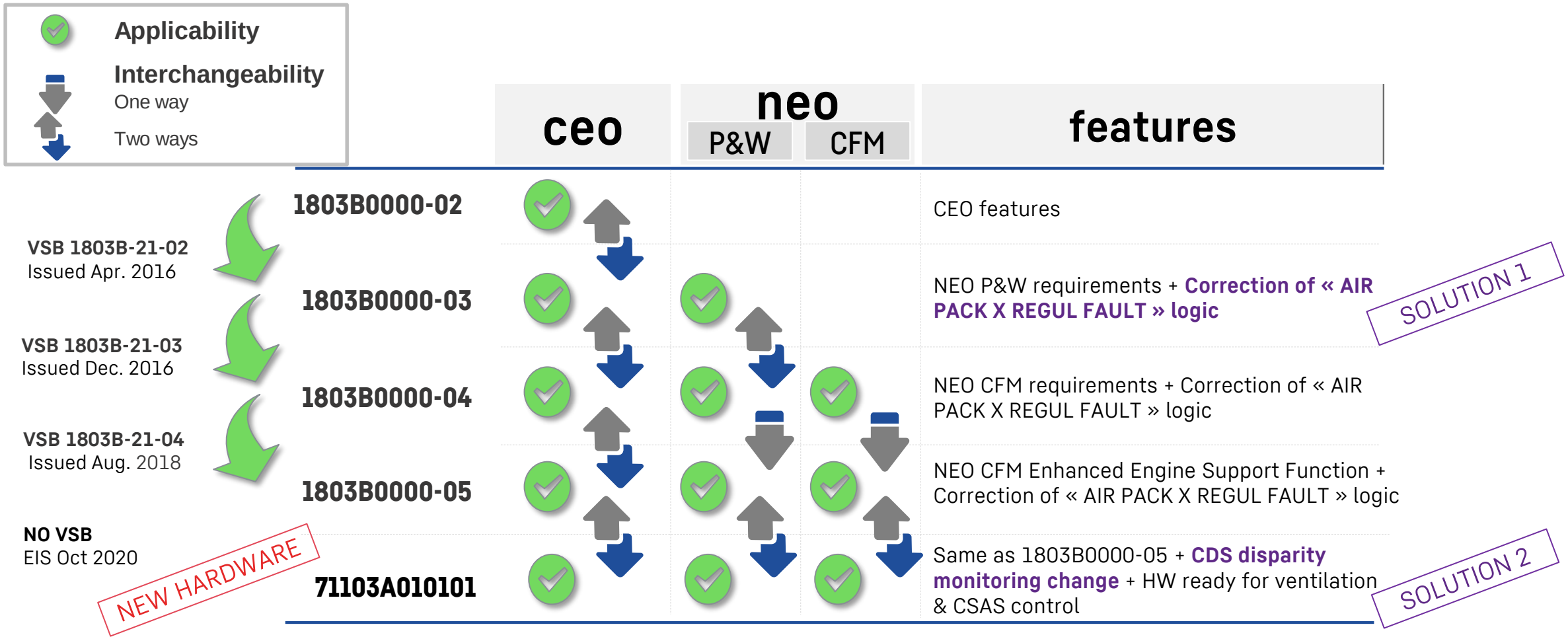
– 2020 : AIR PACK REGUL FAULT E/W ORPHAN new investigation

Investigation results :

- One CDS intermittent failure leading to Orphan E/W ➔ reporting logic correction is planned for next software batch (expected target date not before 2023)
- TSM 21-61-810-820/821-A called by Orphan E/W AIR PACK X REGUL FAULT has been reviewed.
- New troubleshooting tips in case of E/W Orphan ➔ AIRBUS PRESENTATION

– Investigation progress

AIR PACK REGUL FAULT E/W ORPHAN INVESTIGATION

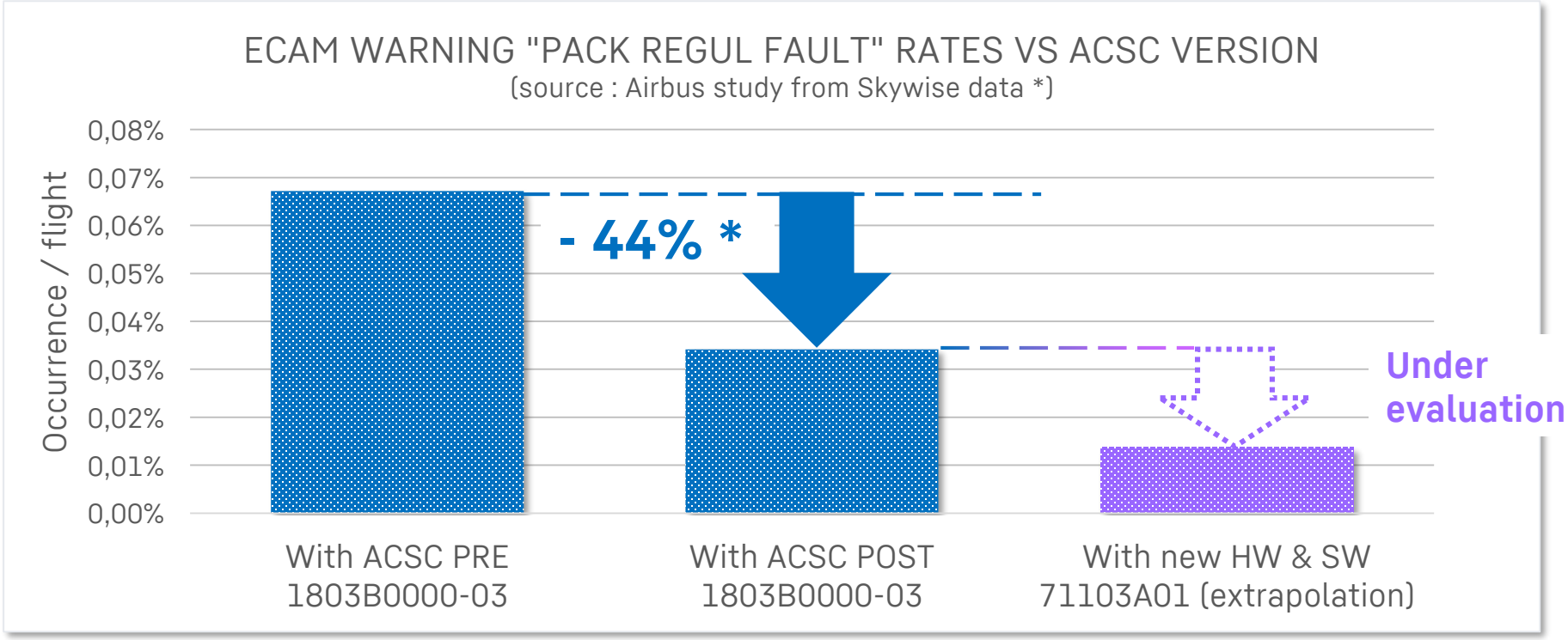


/// Software modification of 1803 hardware not available, pending on 71103 results

AIR PACK REGUL FAULT E/W ORPHAN INVESTIGATION

– ACSC software modification improvement measure

In June 2021, Airbus performed a comparative study in ECAMs “AIR PACK# REGUL FAULT” occurrence rate per flight between pre and post mod 1803B0000-03 software. The result is very positive, with a reduction of :



(*) : Based on A319-A320-A321 aircraft delivered from 2010 to 2019, on a total of nearly 3,500,000 flights.

/// Operator encouraged to install post 1803B0000-03 standard to ease T/S of this E/W

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HPV In-service occurrences

High Pressure Valve (HPV)
70645A020001

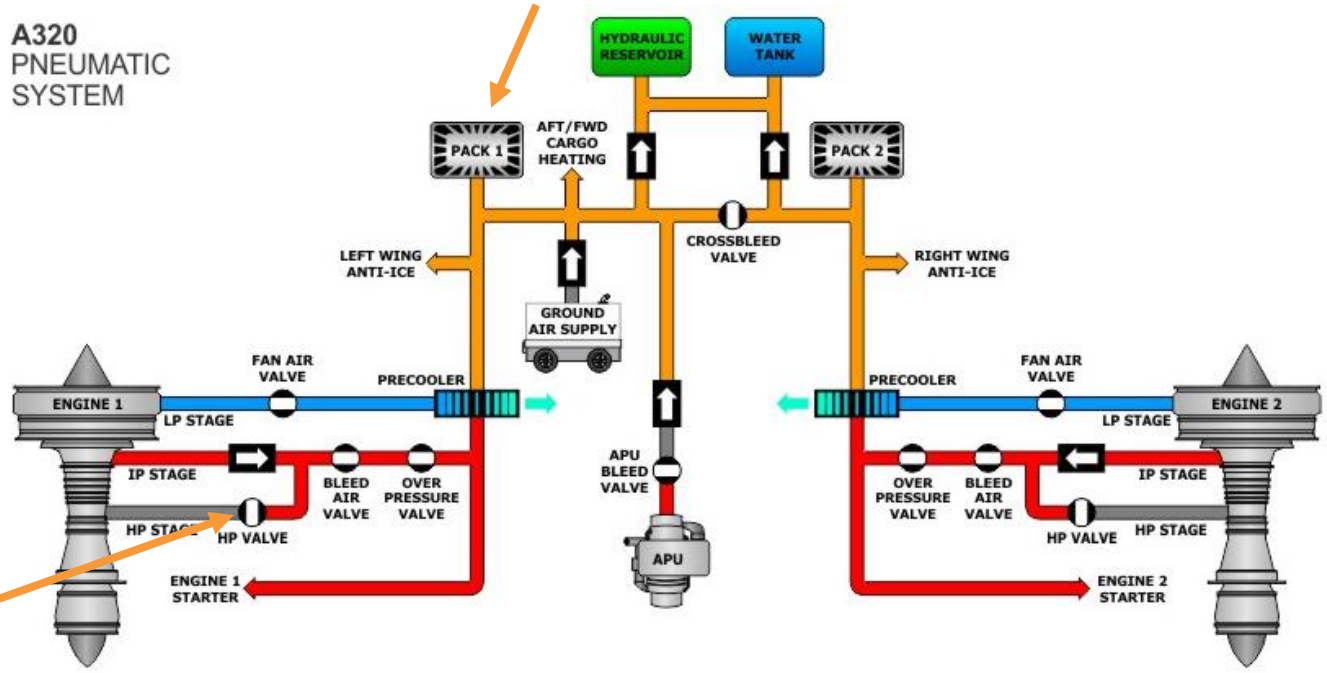
- HPV Failed Closed
  - **RCP-Saneo-36-0339**
  - **TFU 36.11.00115**
- HPV Failed Open
  - **RCP-Saneo-36-0380**
  - **TFU 36.11.00106**

HPV Fault - Failed closed (FC) system effect

Context

- **Cruise, bleed** on **I**ntermediate **P**ressure port
- **Top of descent** leads to engine **thrust reduction**

Pack Inlet Pressure is detected **below 18 psig**



HPV is detected closed while commanded to open

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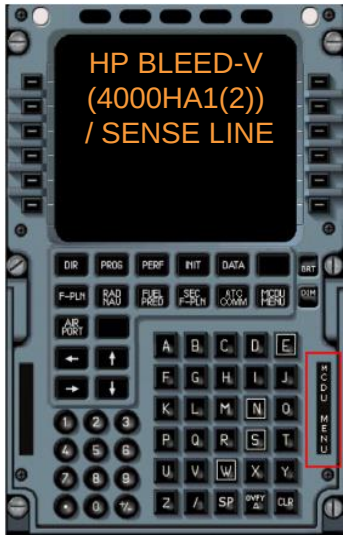
HPV Fault - Failed open (FO) system effect



In-service occurrence

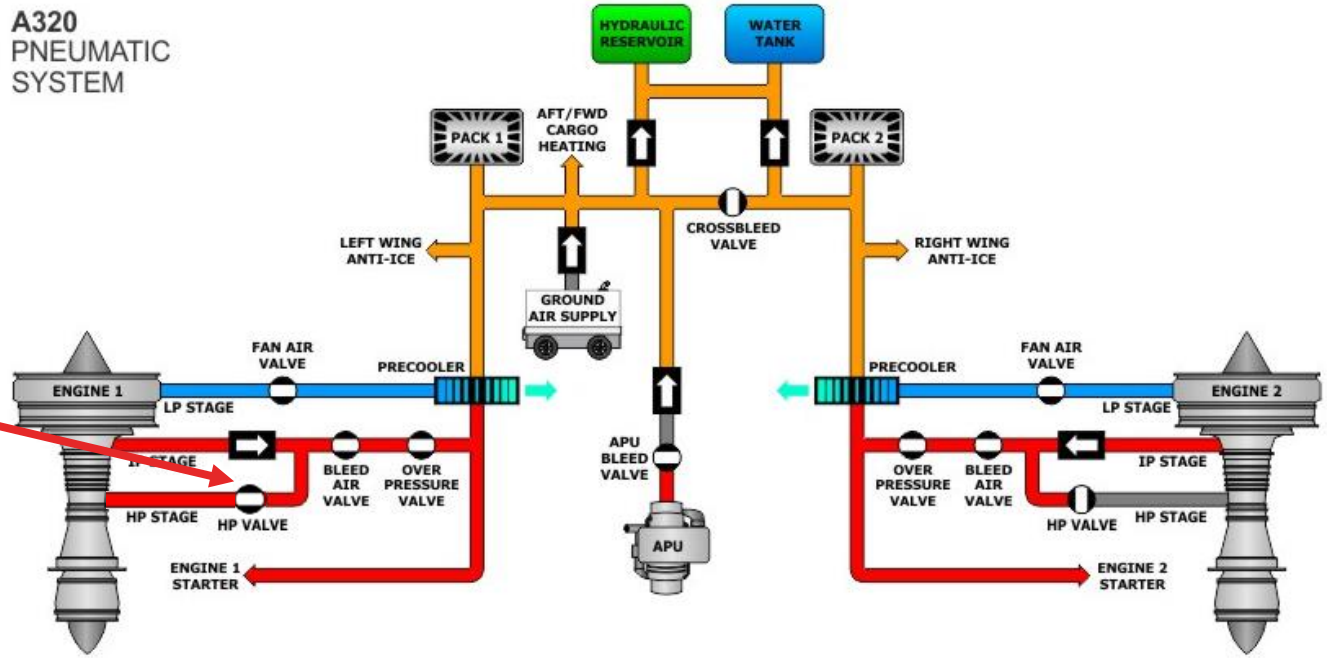
Most cases occur on ground at Take-off during engine thrust increase to Take-off level

BMC detects **HPV is open** also

it is commanded to close

BMC isolates the bleed and

closes corresponding PRV



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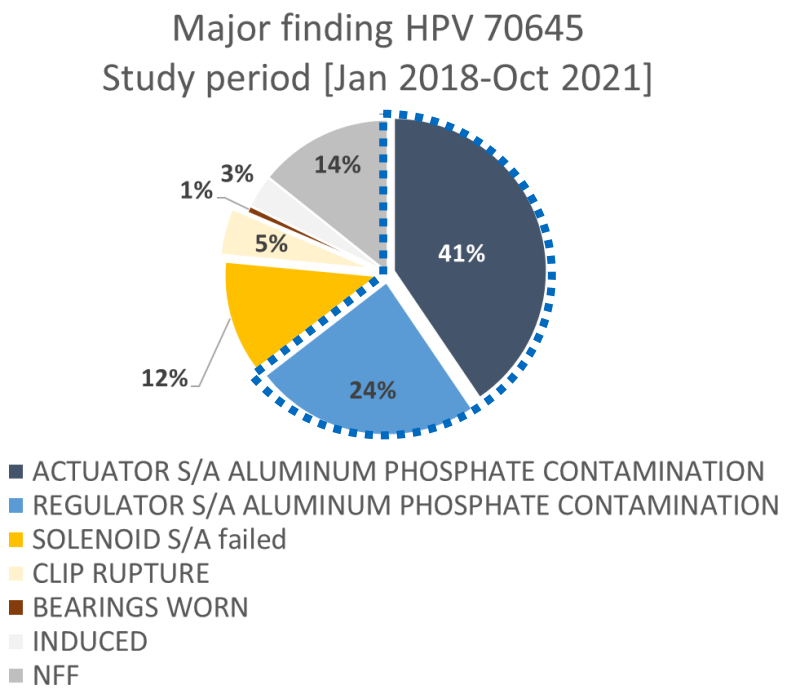
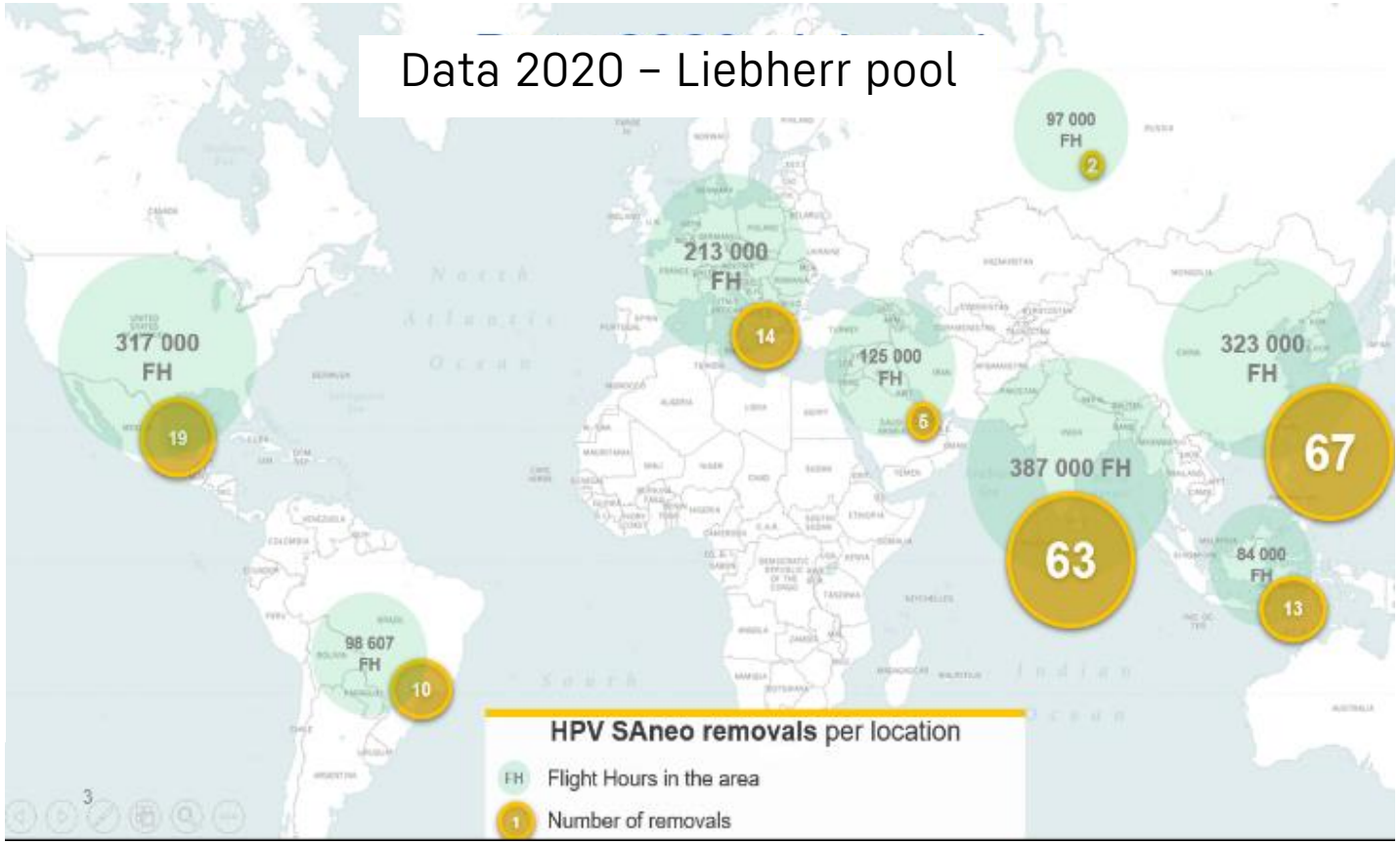
A320neo

HPV Faults in-service findings

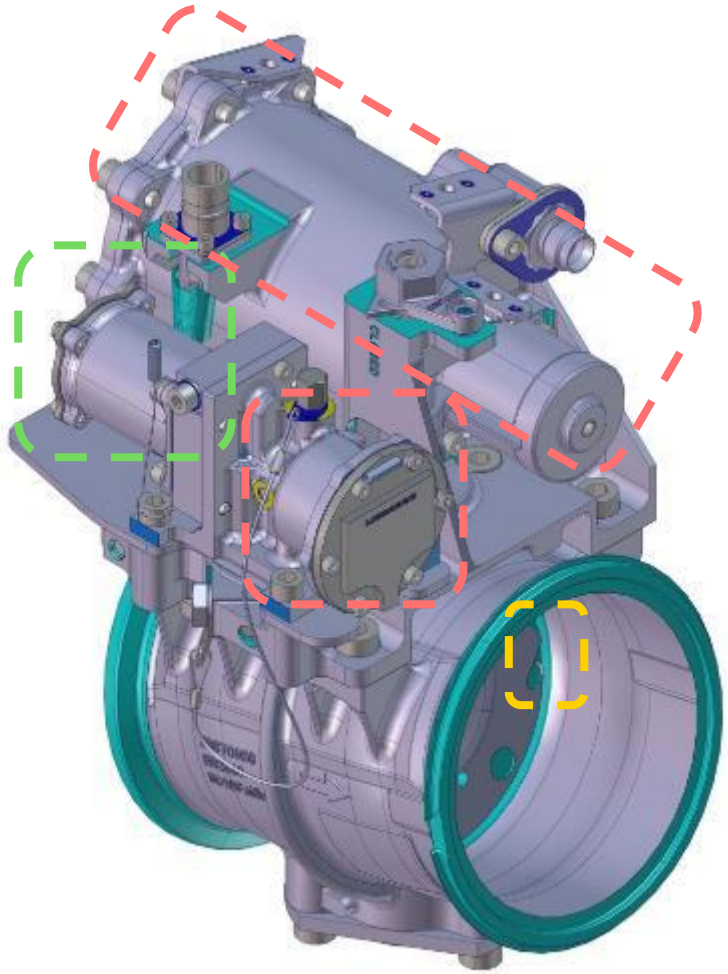




*NFF rate drastically reduced starting from CMM update

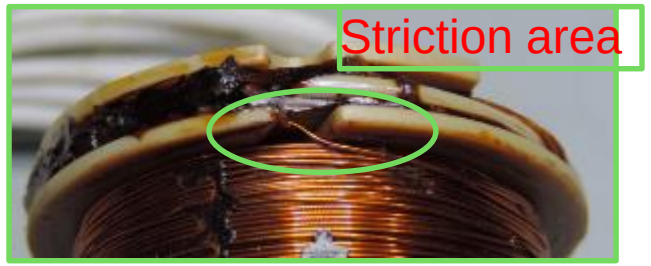
/// Asia more affected than the rest of the world

HPV Faults in-service findings

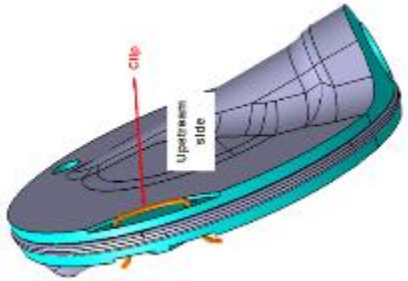


✓ *Aluminium phosphate exudation from JPXX32 graphite on actuator seals and regulation clapper*

✓ *Solenoid winding weakness*



✓ *Butterfly clip rupture*



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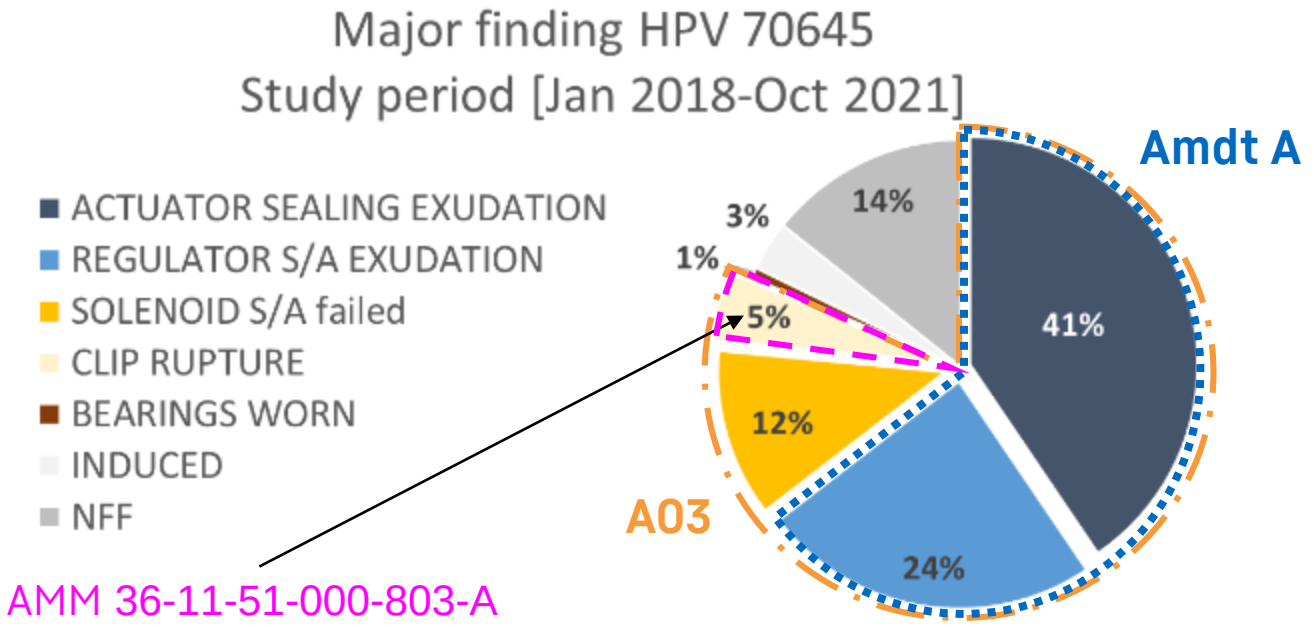
HPV faults & solution+mitigation generalization timeline

Design solutions	Failure Mode		Amdt A	clip replt	HPV A03
	FC	FO			
Graphite piston seals	X	X	✓		✓
Graphite regul. clapper	X		✓		✓
Butterfly clip		X		✓	✓
Solenoid sleeve	X				✓

RCA	Solution validation	Solution selection	VSB 70645-36-01 Amdt A
RCA	Solution validation	Solution selection	AMM 36-11-51-000-803-A
RCA	Solution validation	Solution selection	VSB Q4 2022 A03



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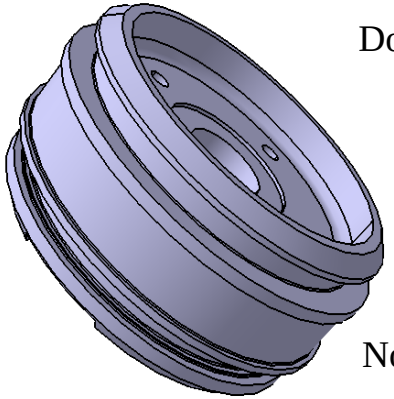
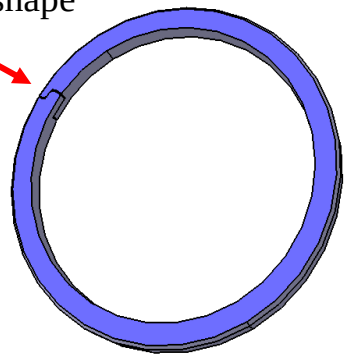
HPV A03 modifications

✓ Actuator

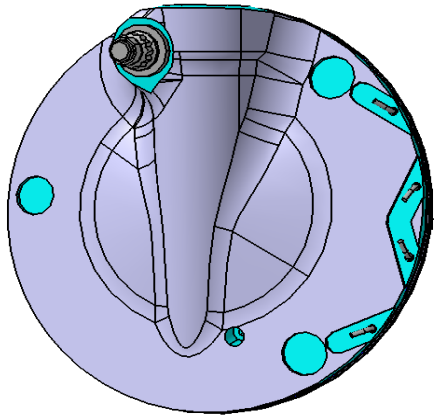


Double split shape

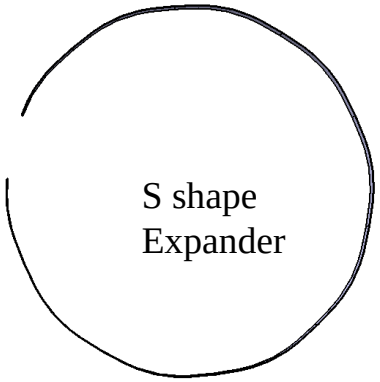


No index

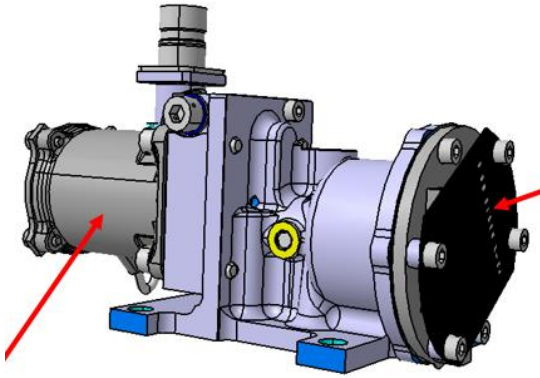
Butterfly

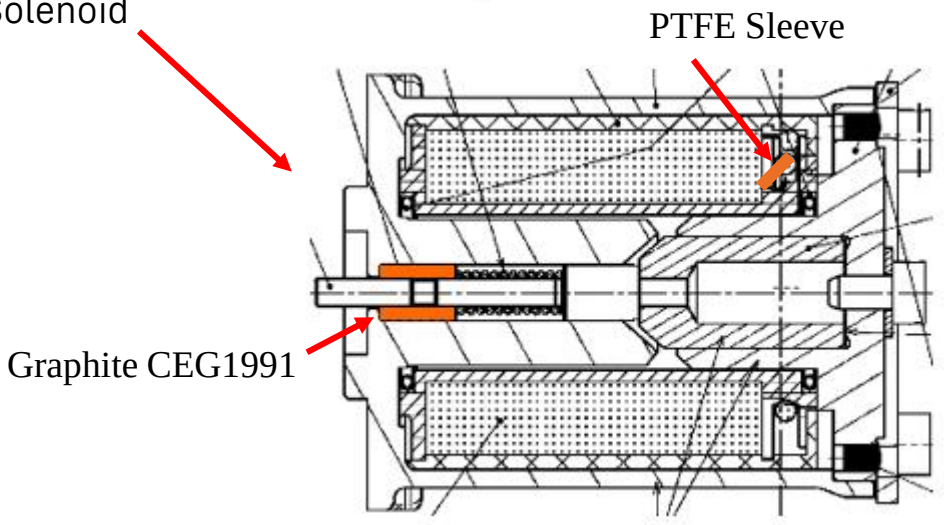


2 Clip of 1.2mm diameter



✓ Solenoid & ID plate





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HPV Faults - In-service mitigation

– After investigation of the different events, Airbus and Liebherr confirm the troubleshooting is very efficient to detect the HPV faults on wing. In the majority of cases, a HPV faults is linked to a **hard failure of the valve**.

– Pending HPV 70645**A030001** introduction, Airbus and Liebherr recommend to strictly follow Airbus TSM and remove HPV when an HPV Maintenance Message (CMS) is triggered.

/// Recommendation: per TSM, replace the HPV when a HPV Maintenance Message is posted

A320neo

HPV/PRV – Liebherr Support Solutions

HPV 70645A020001		
VSB 70645-36-01 (Amdt A) Jul2022	Butterfly clip Preventive Replacement in Airbus AMM May 2022	Butterfly clip and Solenoid fix 70645A03 Q1 2023

PRV 70646A010001	
Preventive Maintenance Support Package	Design benefits from HPV Q1 2023

/// Continuous embodiment and proven efficiency of VSB 70645-36-01 on HPV
Butterfly clip replacement applied by several major airlines with success

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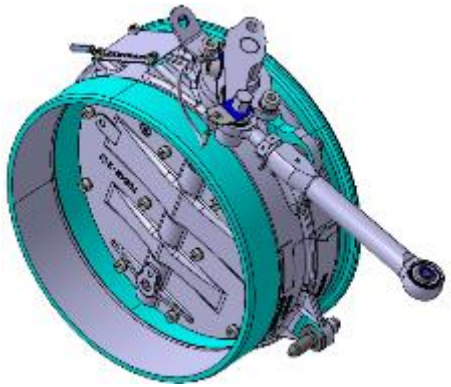
FAV In-service occurrences

Fan Air Valve (FAV)
70649A01000x (body)
70654A0x0001 (actuator)

- FAV Investigation
  - **RCP-Saneo-36-0318**
  - **TFU 54.51.00.0104 (CFM)**
  - **TFU 54.51.00.018 (PW)**

FAV body



FAV valve body overview

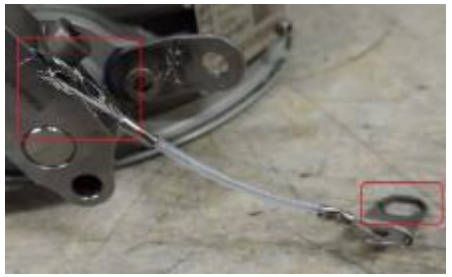
Root cause for FAV valve body observed damages

From 2018, reports of FAV (body & rod) damage on AC with reinforced brackets i.e:

- Airbus POST SB 54-1045 or POST MOD 164147 for PW engines
- Airbus POST SB 54-1044 or POST MOD 163328 for CFM engines

Typical finding described here:

Retaining cable damaged



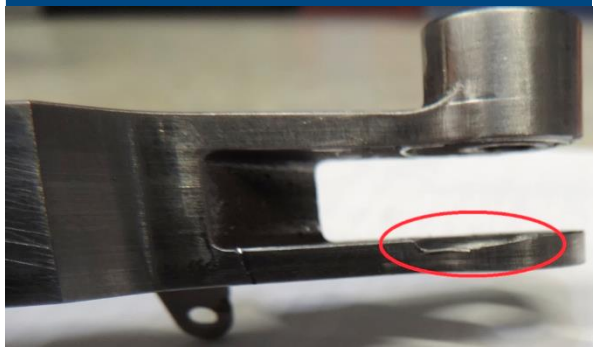
Retaining cable missing

Lock wire or seal damaged

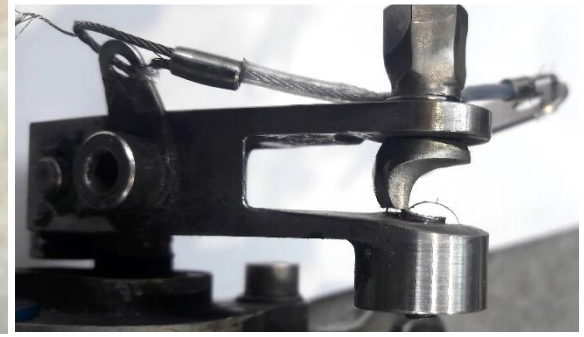
Pins damaged

Valve body damaged

Lever assy damaged



Special screw damaged



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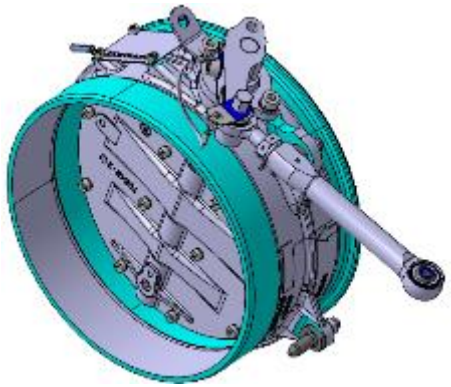
FAV body

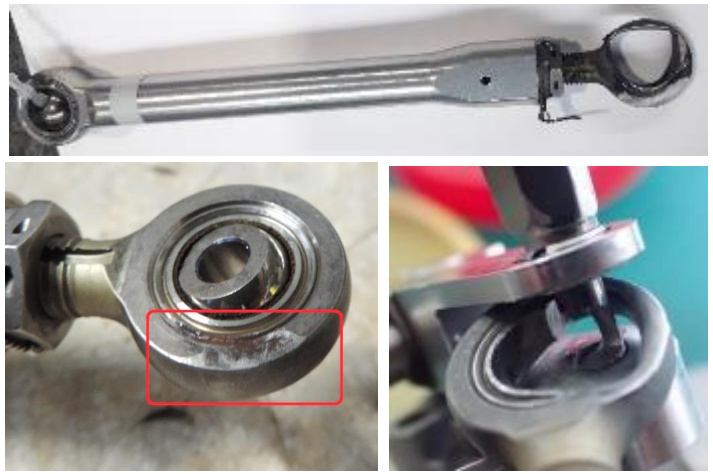


FAV valve body overview

Recommendation in case of FAV body damage

AMM does not provide instructions to replace only the FAV rod on the wing. Airbus and Liebherr absolutely do not recommend replacing only the rod because other parts integrity cannot be ensured.

Rod assy damaged



Rod assy broken

FAV FIN 7120HM1/7120HM2
PN 70649A010001 (PW)
PN 70649A010002 (CFM)

AIRBUS

During aircraft inspection, if any of these damages are observed, the complete FAV Body + ROD needs to be replaced

Thank you for your participation

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A320 PCU MODELS

RTW 2022

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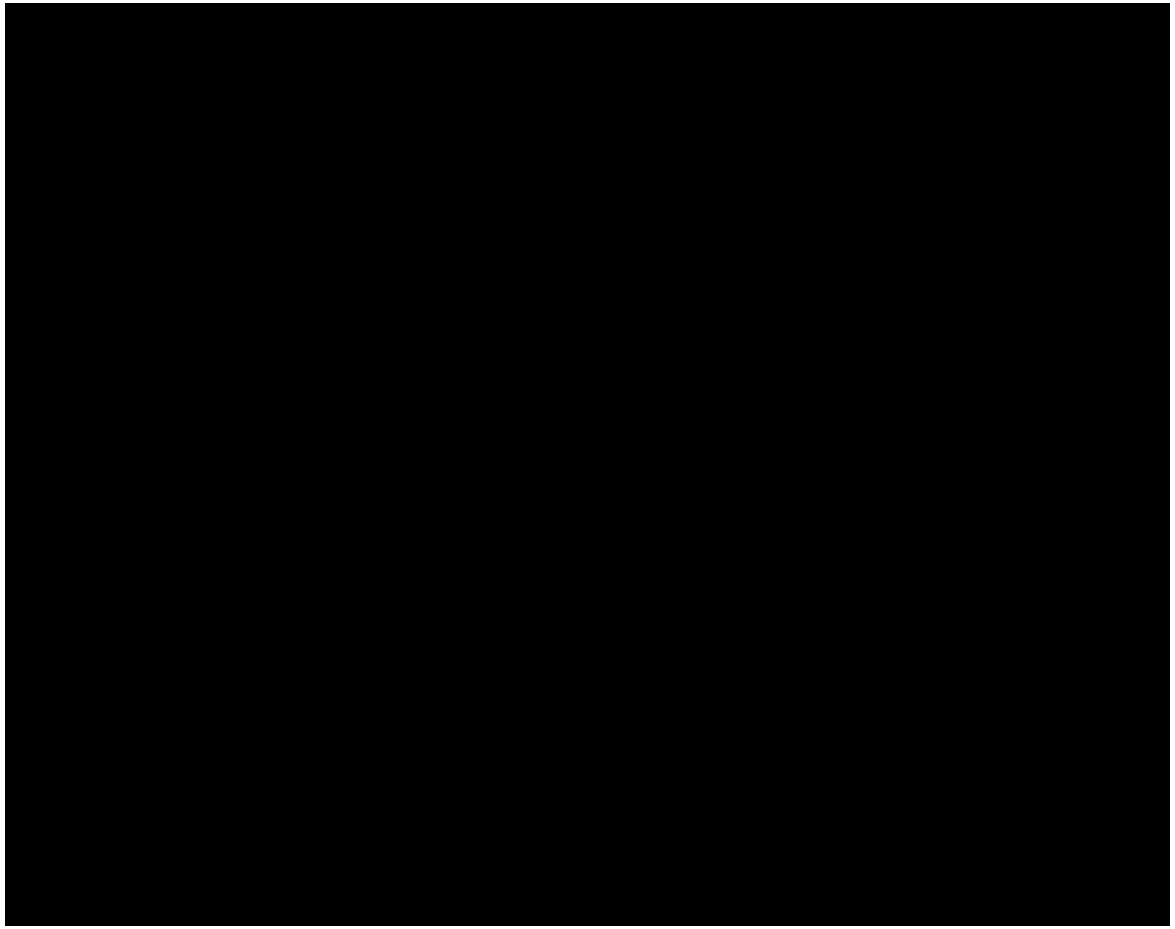
Liebherr-Aerospce

AGENDA

- Overview
- PN – Original Equipped
- PN - Options
- Operator Support Information

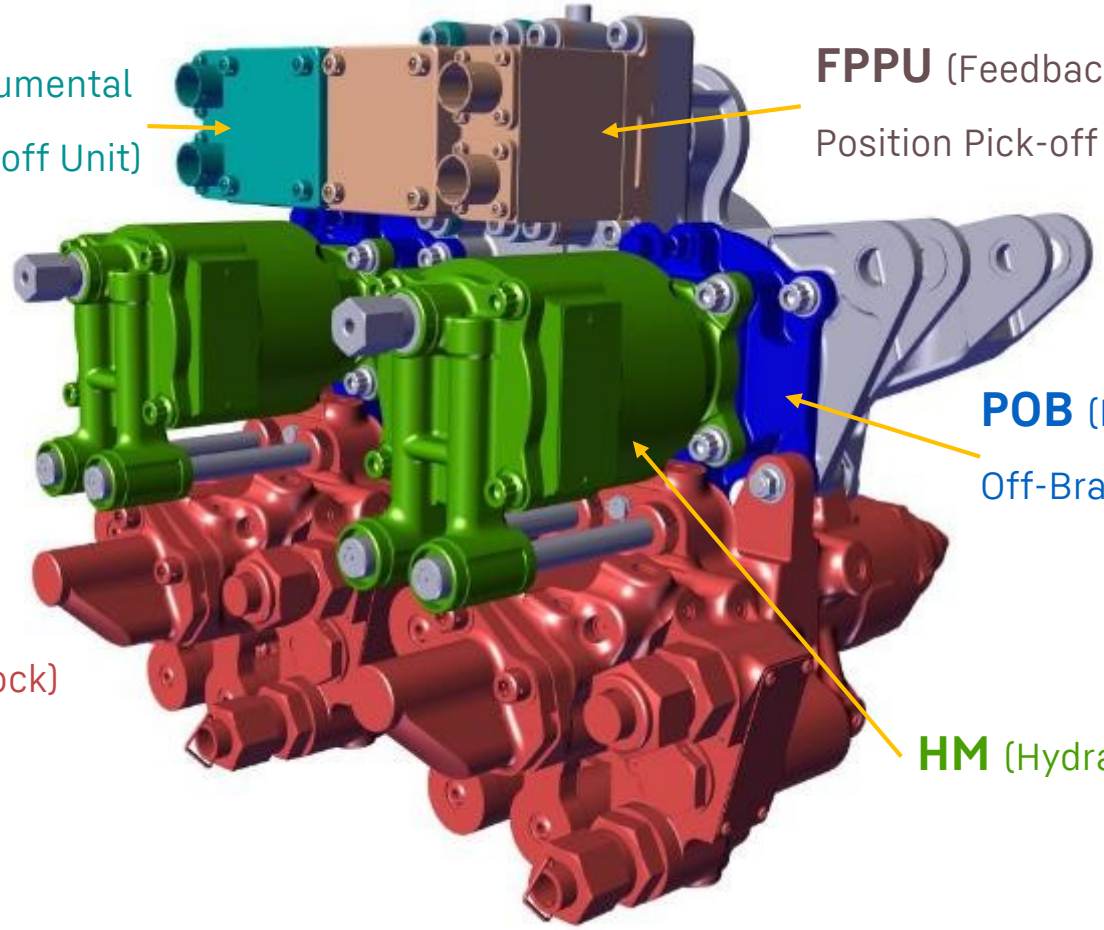
OVERVIEW



OVERVIEW

PN 9028A0004-01 | **IPPU** (Instrumental Position Pick-off Unit)

FPPU (Feedback Position Pick-off Unit) | PN 9028A0004-01



PN 787A0000-04
PN 787A0000-06
PN 787A0000-07
PN 787A0000-08
PN 787A0000-09
PN 787A0000-10
PN 787A0000-11

VB (Valve Block)

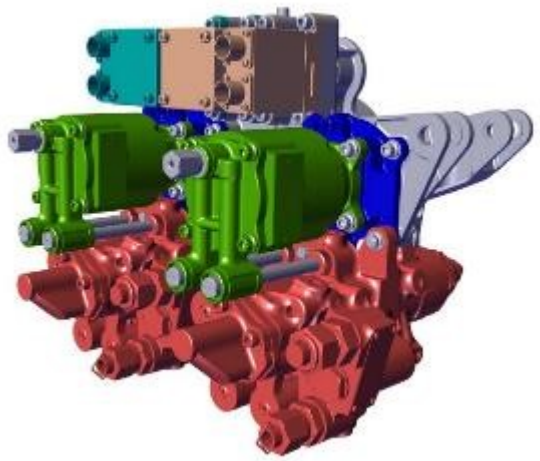
POB (Pressure Off-Brake) | PN 786A0100-01 | PN 786A0100-02 | PN 786A2000-03

HM (Hydraulic Motor) | PN 2000A1391K01

PNs – ORIGINAL EQUIPPED

PCU	POB	VB	IPPU	FPPU	HM
786A0000-06	786A0100-01	787A0000-04	9028A0004-01	9028A0004-01	2000A1391K01
786A0000-08	786A0100-01	787A0000-06			
786A0000-09	786A0100-02	787A0000-06			
786A0000-10	786A0100-02	787A0000-07			
786A0000-11	786A2000-01	787A0000-07			
786A0000-12	786A2000-01	787A0000-07			
786A0000-13	786A2000-01	787A0000-08			
	786A2000-02	787A0000-07			
786A0000-14	786A2000-03	787A0000-09			
		787A0000-10			
		787A0000-11			

PNs – OPTIONS



PCU	POB	VB	IPPU	FPPU	HM
786A0000-06	786A2000-01 786A2000-02 786A2000-03	787A0000-07 787A0000-08 787A0000-09 787A0000-10 787A0000-11	9028A0004-01	9028A0004-01	2000A1391K01
786A0000-08					
786A0000-09					
786A0000-10					
786A0000-11					
786A0000-12					
786A0000-13					
786A0000-14					

PCU 786A0000-06

Installation of improved Pressure Off Brake

PCU 786A0000-07

Installation of Re-Design Solenoid Valves

PCU 786A0000-08

Installation of Re-Design Solenoid Valves

PCU 786A0000-09

Installation of Re-Design Solenoid Valves

PCU 786A0000-10

Pressure-off brakes fitted with alternative Friction disk packages

PCU 786A0000-11

Hydraulic motor, abex

PCU 786A0000-12

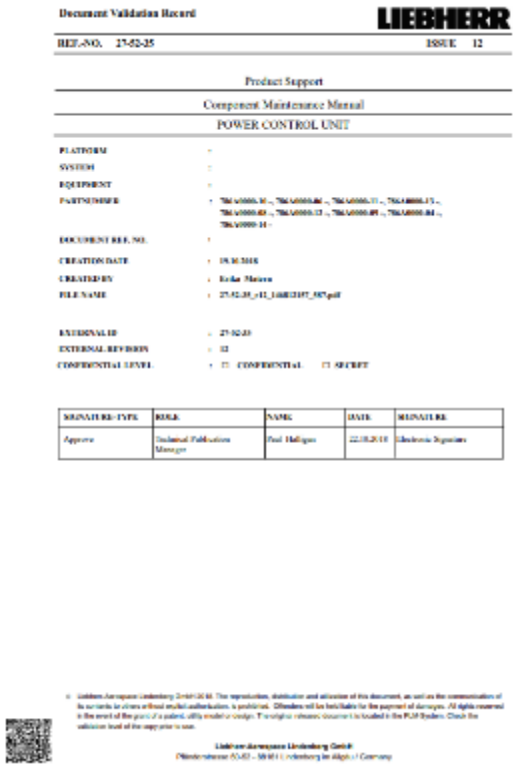
Product Evolution Spring, Solenoid Valve, Hydraulic Motor, Slp Bracket

PCU 786A0000-13

New POB Config

PCU 786A0000-14

OPERATOR SUPPORT INFORMATION


Document Validation Record

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REF.-NO. 27-52-35 ISSUE 12

Product Support

Component Maintenance Manual

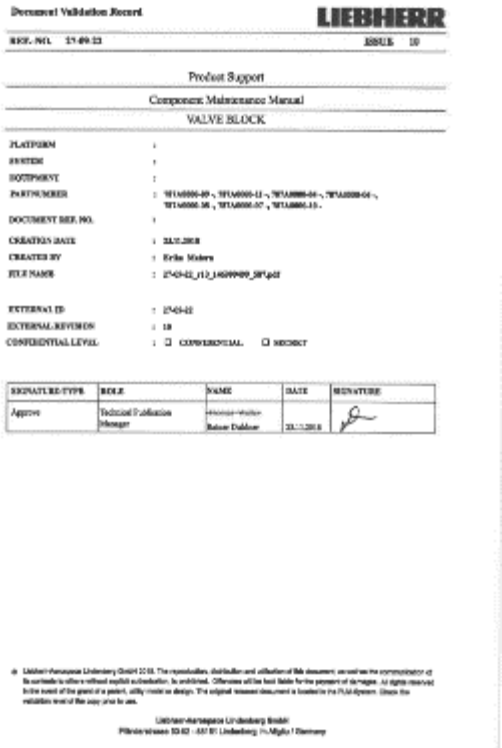
POWER CONTROL UNIT

PLATFORM :
SYSTEM :
EQUIPMENT :
PARTNUMBER :
DOCUMENT REF. NO. :
CREATION DATE : 19.10.2018
CREATED BY : Erika Meiers
FILE NAME :
EXTERNAL ID : 27-52-35
EXTERNAL REVISION : 12
CONFIDENTIAL LEVEL : ☒ CONFIDENTIAL ☐ SECRET

SIGNATURE-TYPE	ROLE	NAME	DATE	SIGNATURE
Approve	Technical Publication Manager	Paul Hallgate	22.10.2018	Electronic Signature

CMM 27-52-35

PCU (all PNs)


Document Validation Record

LIEBHERR

REF.-NO. 27-09-22 ISSUE 10

Product Support

Component Maintenance Manual

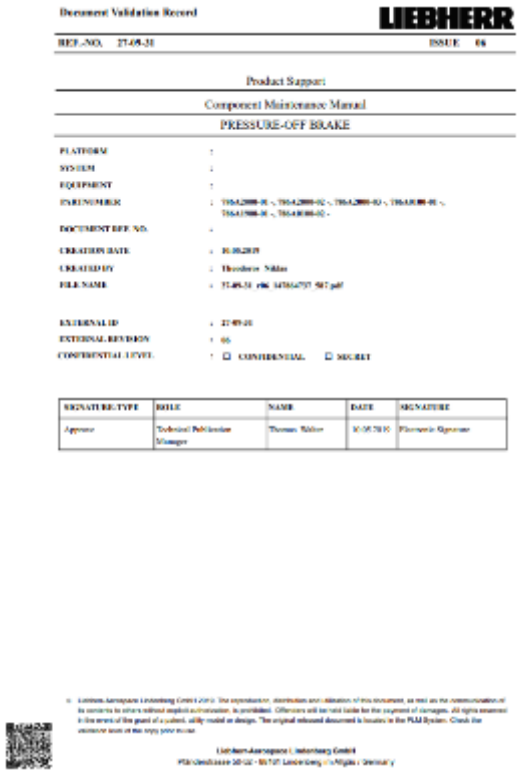
VALVE BLOCK

PLATFORM :
SYSTEM :
EQUIPMENT :
PARTNUMBER :
DOCUMENT REF. NO. :
CREATION DATE : 22.07.2018
CREATED BY : Erika Meiers
FILE NAME :
EXTERNAL ID : 27-09-22
EXTERNAL REVISION : 10
CONFIDENTIAL LEVEL : ☐ CONFIDENTIAL ☐ SECRET

SIGNATURE-TYPE	ROLE	NAME	DATE	SIGNATURE
Approve	Technical Publication Manager	Meister-Walter Rainer Dahlmer	23.7.2018	

CMM 27-09-22

VB (all PNs)


Document Validation Record

LIEBHERR

REF.-NO. 27-09-31 ISSUE 06

Product Support

Component Maintenance Manual

PRESSURE-OFF BRAKE

PLATFORM :
SYSTEM :
EQUIPMENT :
PARTNUMBER :
DOCUMENT REF. NO. :
CREATION DATE : 10.10.2019
CREATED BY : Theodosios Niklas
FILE NAME :
EXTERNAL ID : 27-09-31
EXTERNAL REVISION : 06
CONFIDENTIAL LEVEL : ☒ CONFIDENTIAL ☐ SECRET

SIGNATURE-TYPE	ROLE	NAME	DATE	SIGNATURE
Approve	Technical Publication Manager	Thomas Walter	10.10.2019	Electronic Signature

CMM 27-09-31

POB (all PNs)

A320
SLAT GRA
ATA 27

RTW 2022

[redacted]

Liebherr - Aerospce

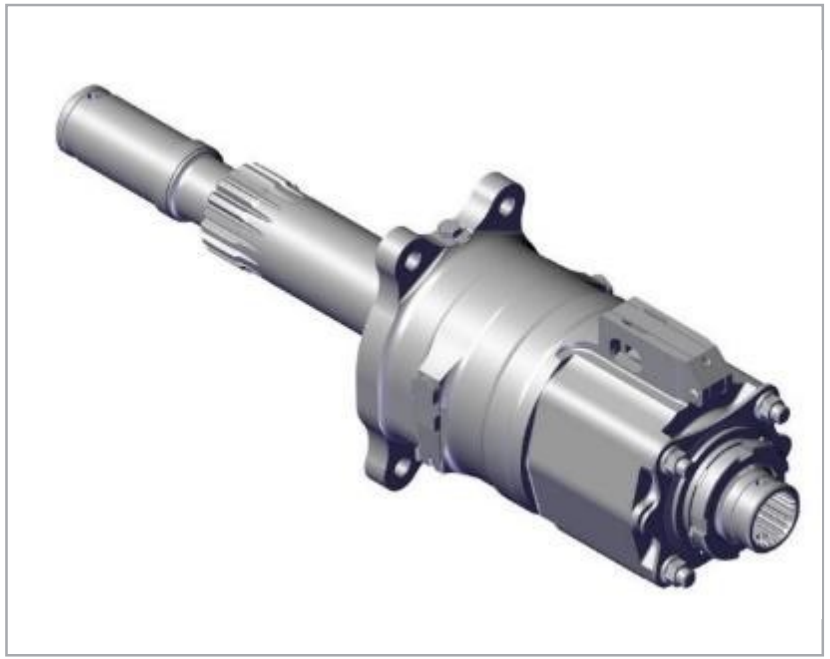
AGENDA

- Overview
- Component Description
- Investigation and Root Cause
- Way-forward
- Timeline

OVERVIEW

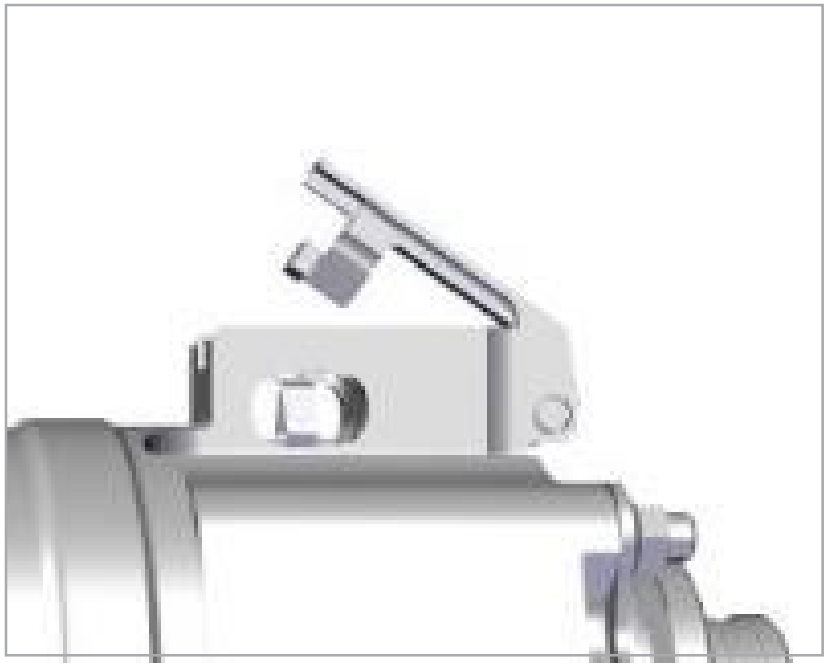
COMPONENT

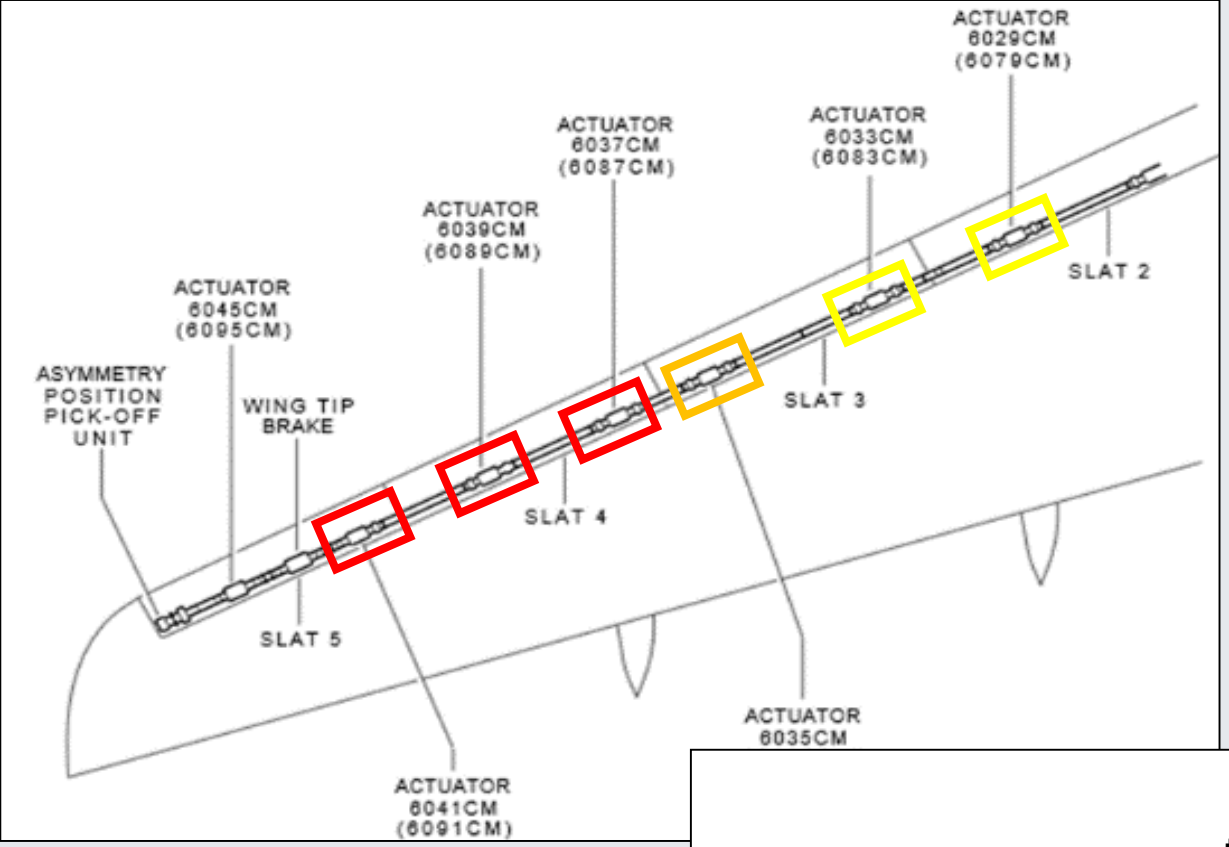
A320 GEAR ROTARY ACTUATOR
830D0000-01/-02



SLAT JAM

LOCKOUT INDICATOR ACTIVATED
MOSTLY ON A321 TRACKs 9, 10, 11:



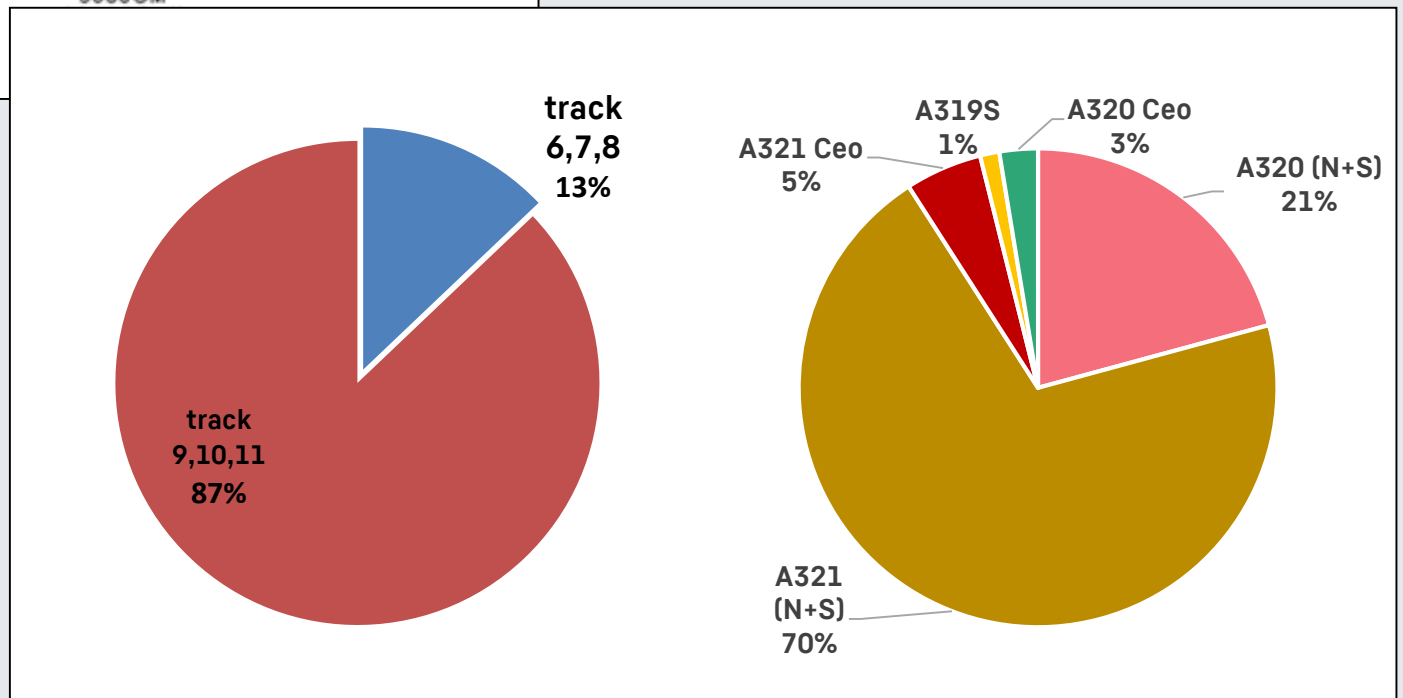


A320 SLAT GRA ATA 27 – RTW 2022

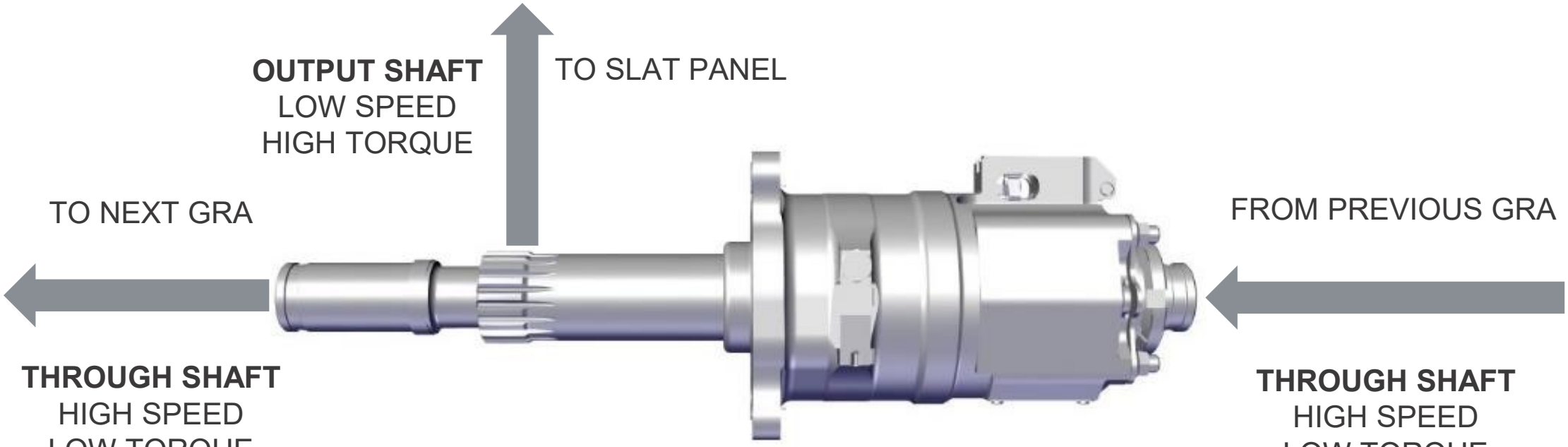
OVERVIEW

- Mainly slat track 9/10/11

- 77 reported slat Jam cases from 2014 to 2021

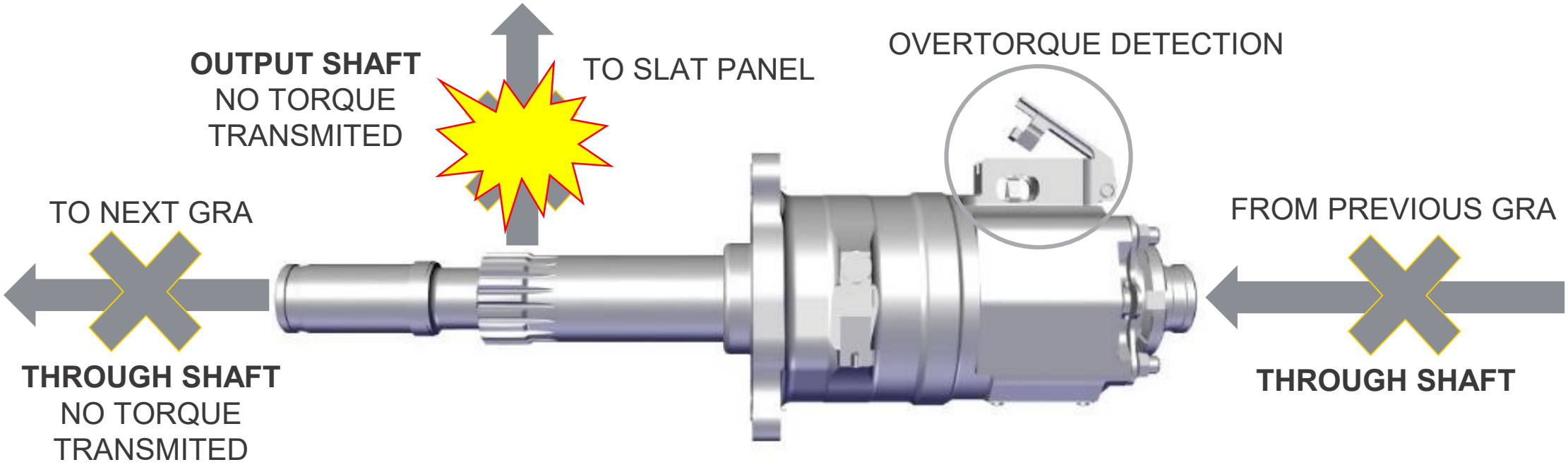


DESCRIPTION: A320 GRA



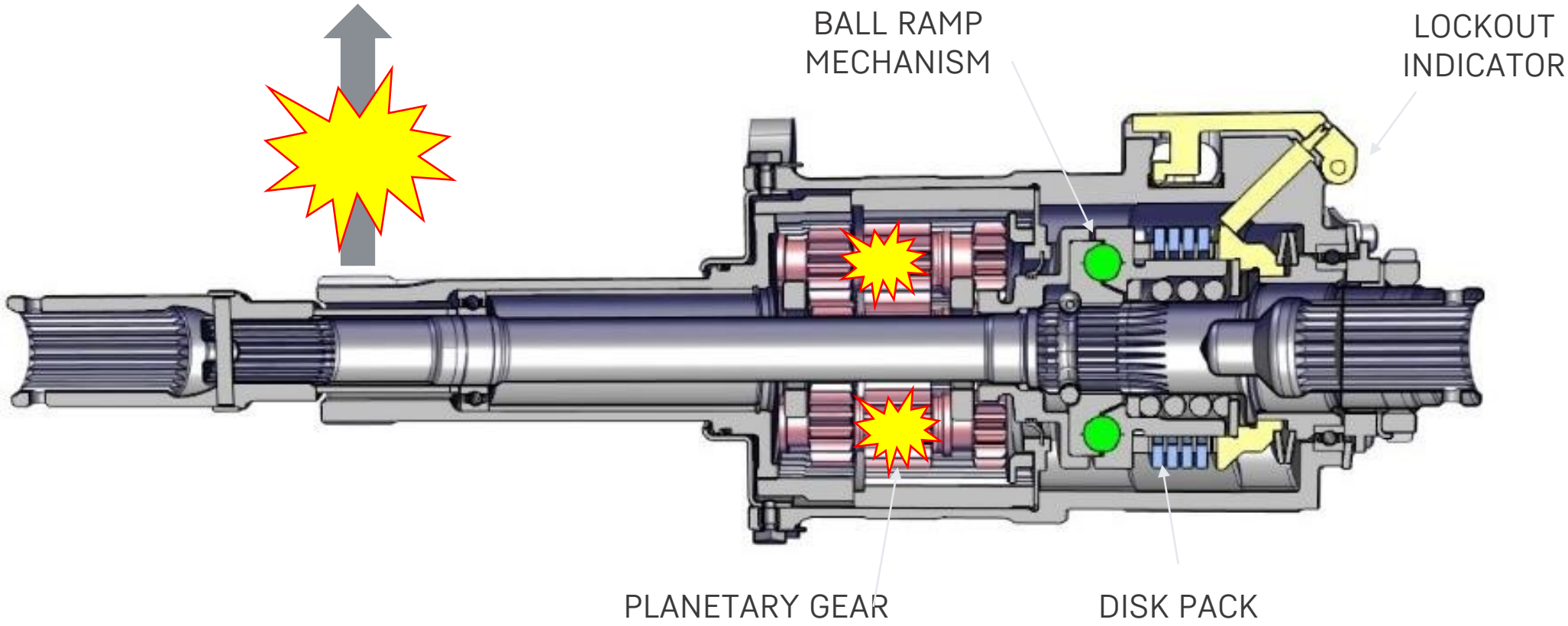
NORMAL OPERATION

DESCRIPTION: A320 GRA



ABNORMAL OPERATION

DESCRIPTION: A320 GRA



INVESTIGATIONS & ROOT CAUSE

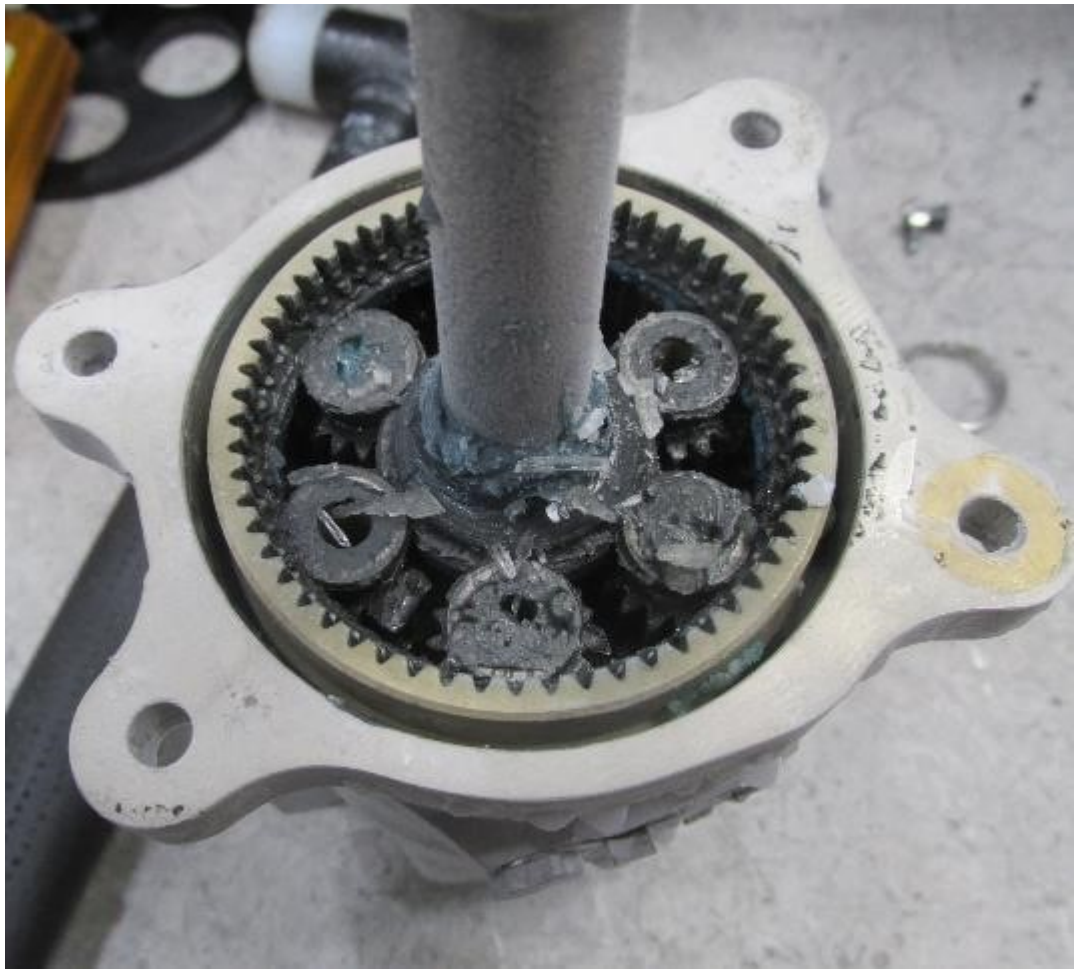
- 43% of returned GRAs jammed @ -40°C test *
- Moisture found on 45% GRAs during disassembly.*

– Recommendation: ship affected units in sealed plastic bags to avoid water evaporation
– Reminder: Report every slat jam event to Airbus

*: data based on returned GRAs due to slat jam (total units:55)

INVESTIGATIONS & ROOT CAUSE

- Root cause on GRA level: Frozen water
- Root Cause contributor on A/C level: Increased wing bending (sharklets) - Refer to Airbus TFU 27.80.00023 for more information

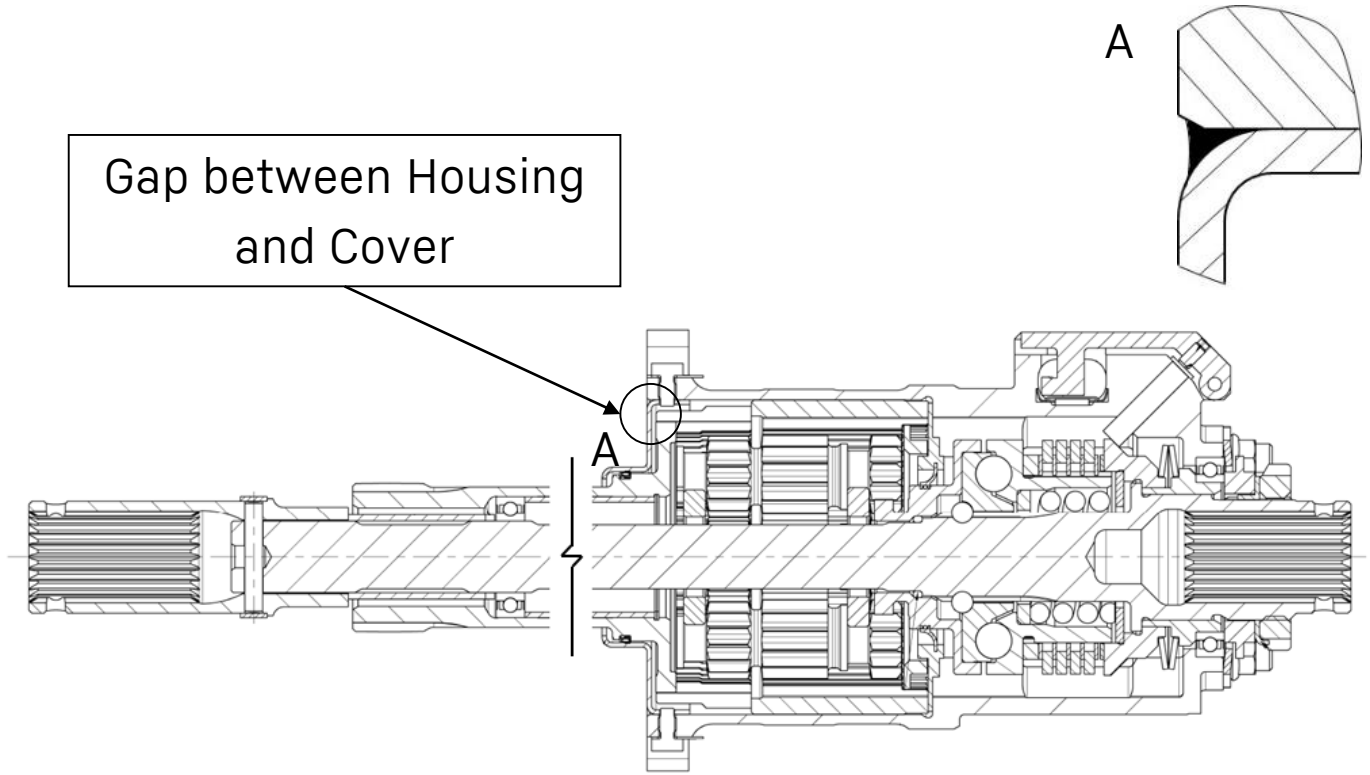


WAY-FORWARD

Solution:

- Change the grease from AeroShell 33 back to Nyco GN22

- Sealing the gap between the Housing and the Cover.



PNR 830E0000-01: Planetary gear filled with lubricating grease NYCO GN22

TIMELINE

In-service Occurrences

Slat jam during approach.

Mitigations

Cold test

Health Monitoring.

Solutions

Grease change

Qualification Tests complete.

Schedule and Commercial

VSB 830E-27-01 available in Jan 2023

VSB application on attrition

CASES UPDATE A320 ATA 27

RTW 2022

[redacted]

Liebherr-Aerospace

Agenda

- Valve Block LVDT
- Rudder Servo Actuator Eye-end
- E-Rudder Servo Control

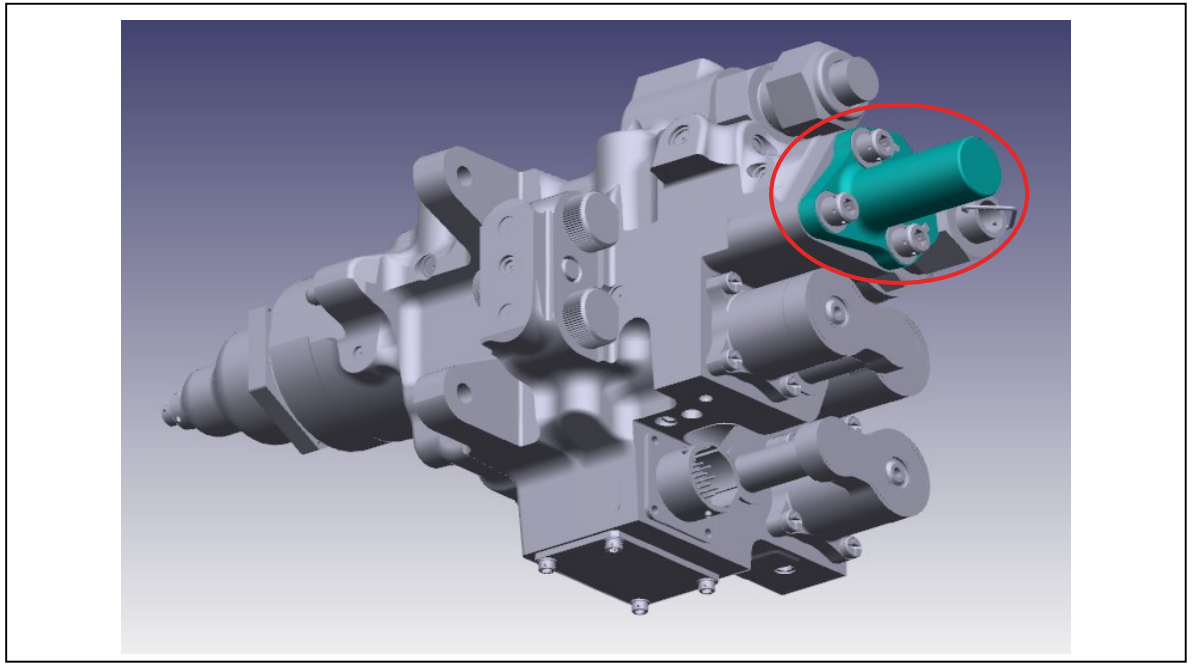
Valve Block LVDT

SCHEDULE AND COMMERCIAL
Liebherr SB: 787A-27-05 Since 24.03.2016.

SOLUTIONS
LVDT PN: 9070A0008-03 since 24.03.2016.

IN-SERVICE OCCURRENCES
FLAP (SLAT) SYS 1 (2) Fault with failure message VALVE BLOCK - VALVE SENSOR

MITIGATIONS
Low Temperature Test
High Temp Test



- New LVDT shows good reliability.
- No more removals of new LVDT 9070A0008-03

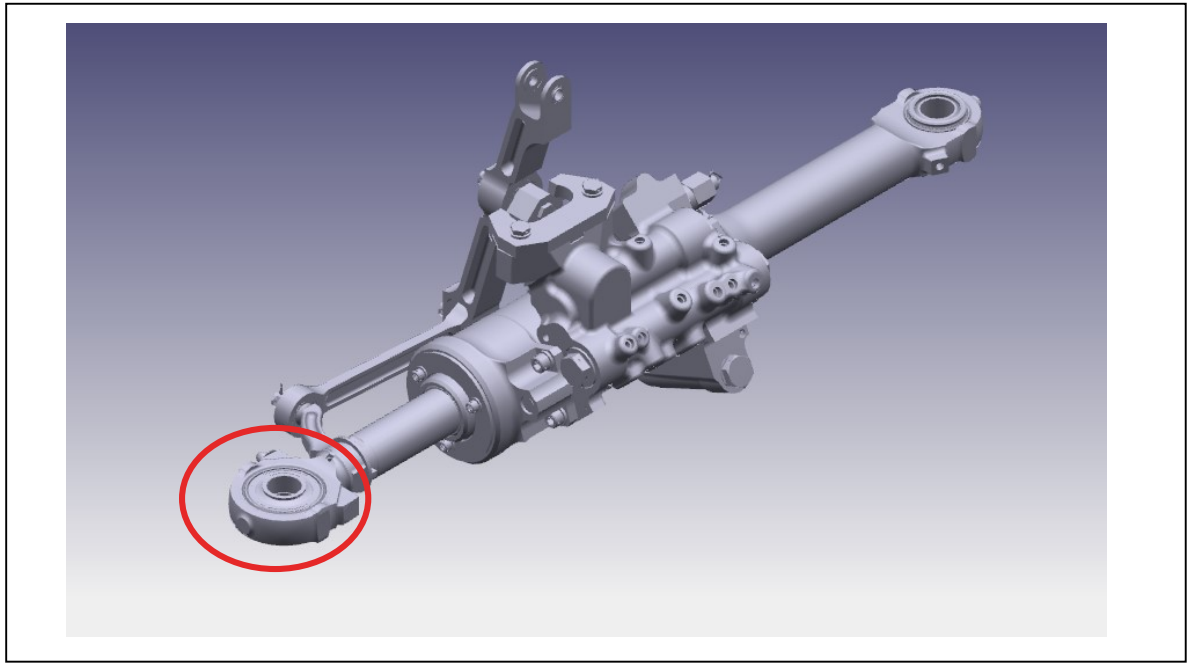
Rudder Servo Actuator Eye-end

SCHEDULE AND COMMERCIAL
VSB 810A-27-06 introduced 24 Jun. 2013. (Airbus SB 27-1224)

SOLUTIONS
Introduction of new roller bearing.

IN-SERVICE OCCURRENCES
Excessive play in contributes to aircraft vibration.

MITIGATIONS
Change of liner eye-end bearing on-wing via in-situ tool.



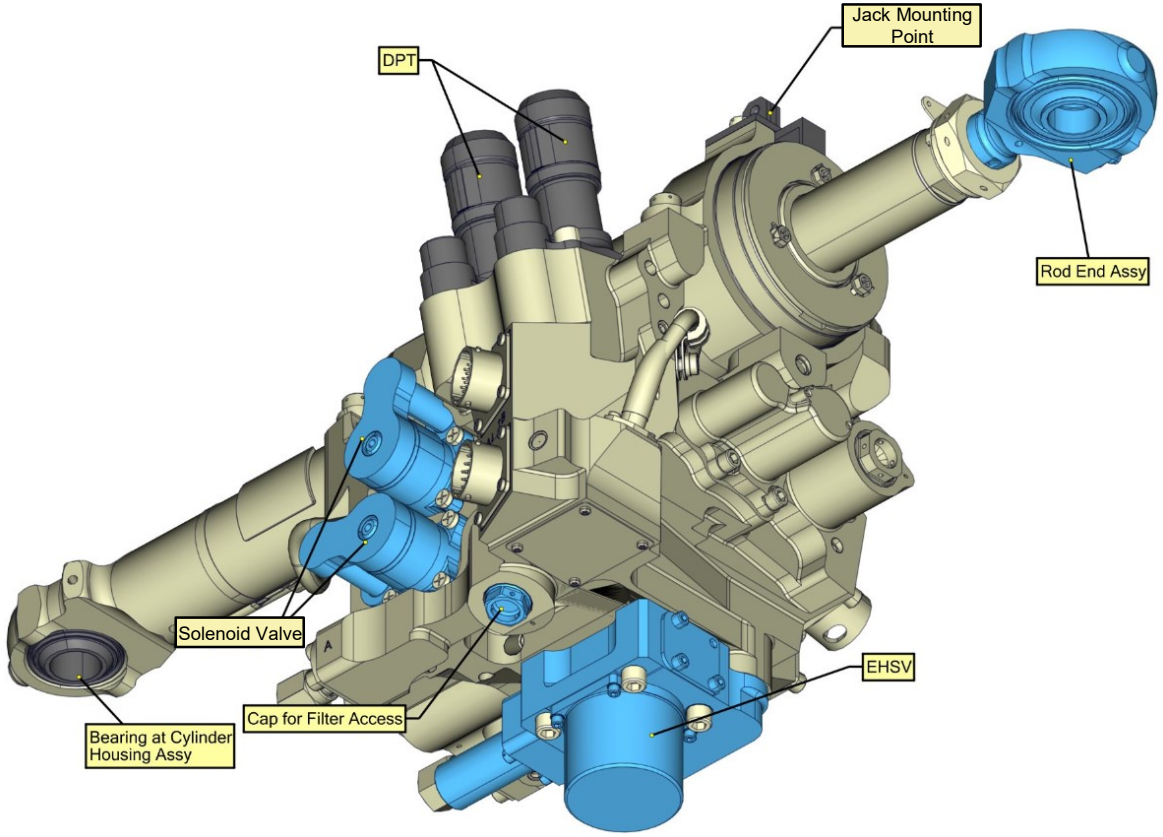
- New Eye-end shows good reliability
- No new complaints
- About 5,200 A/Cs flying with roller bearing as of end of 2021*

*data from Airbus

E-Rudder Servo Control

E-Rudder Servo Control PN 812A0000-02 for future A320Neo E-Rudder system. Modification not possible from current build standard.

Component Name	Replacement Level
Rudder servo control	AMM level On AC
Rod End Assy	AMM level Off AC
EHSV	AMM level On AC
DPT	CMM level
Solenoid Valve	AMM level On AC
Bearing at Cylinder Housing Assy	CMM level
Jack Mounting point	CMM level
Filter	AMM level On AC



NEW TRAINING SOLUTIONS

RTW 2022

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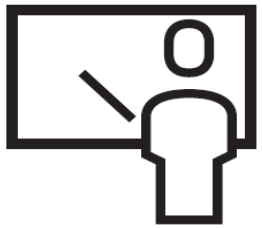
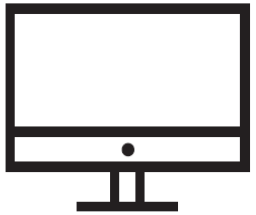
New Training Solutions

STANDARD CLASSROOM

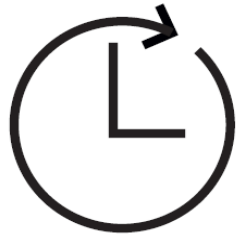


VIRTUAL CLASSROOM

eLEARNING



POCKET TRAINING



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New Training Solutions

STANDARD CLASSROOM

- Students and Trainer in a Classroom
- The training content can be theoretical or “Hands on” Training (at workshop)
- Trainings can be conduted at Liebherr Lindenberg, Liebherr Tolouse or Customer facilities.
- **Major advantage: contact with real components and systems**

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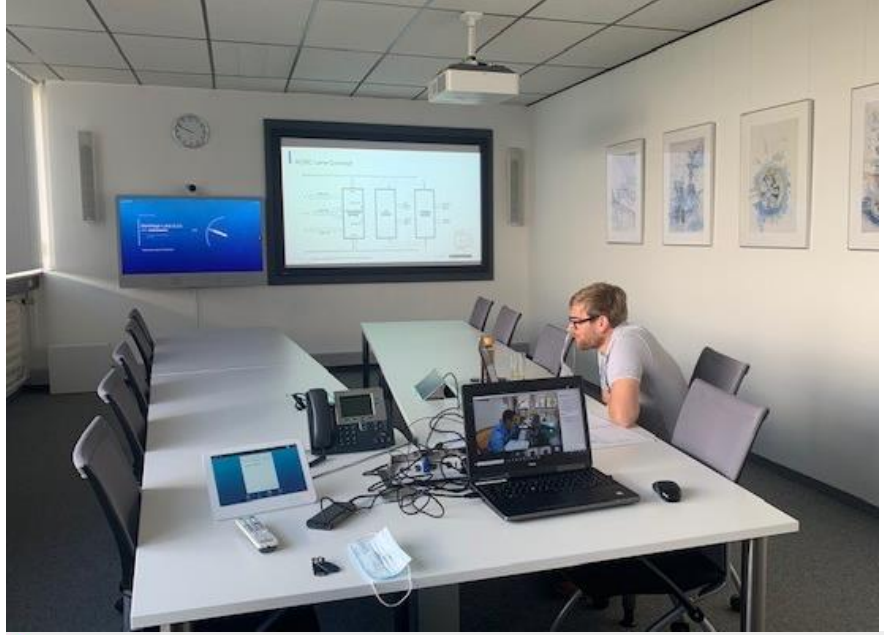
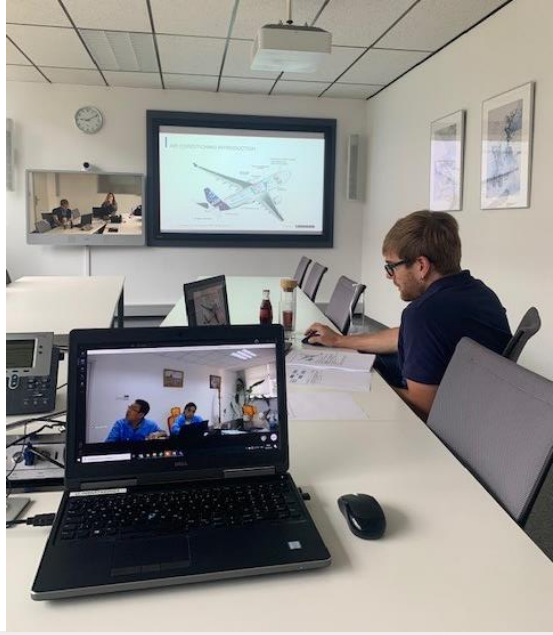
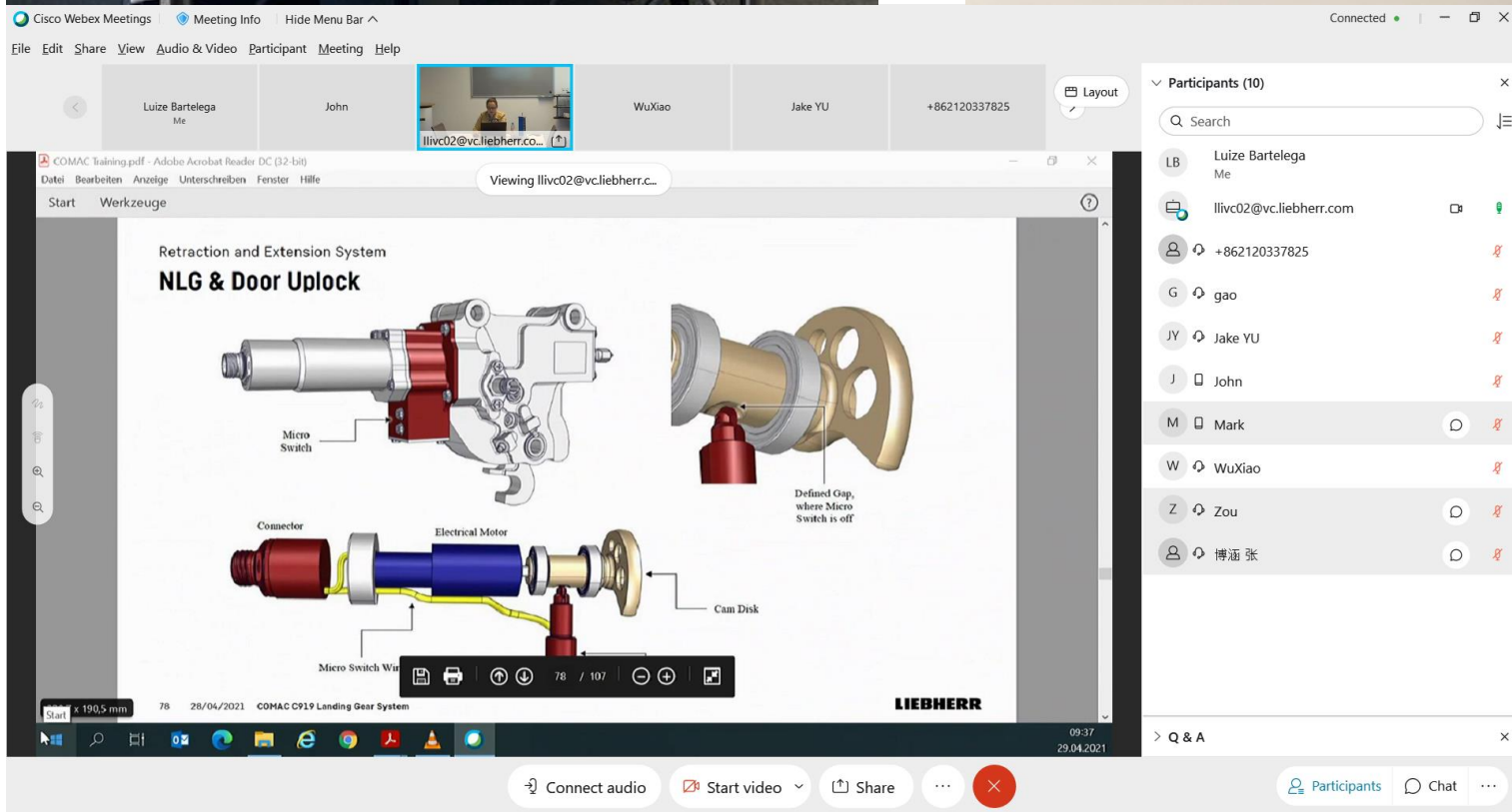
New Training Solutions

VIRTUAL CLASSROOM

- Trainer and students sharing an Online Classroom.
- Same training content as theory Standard Classroom.
- **Major advantage: no travel is necessary.**

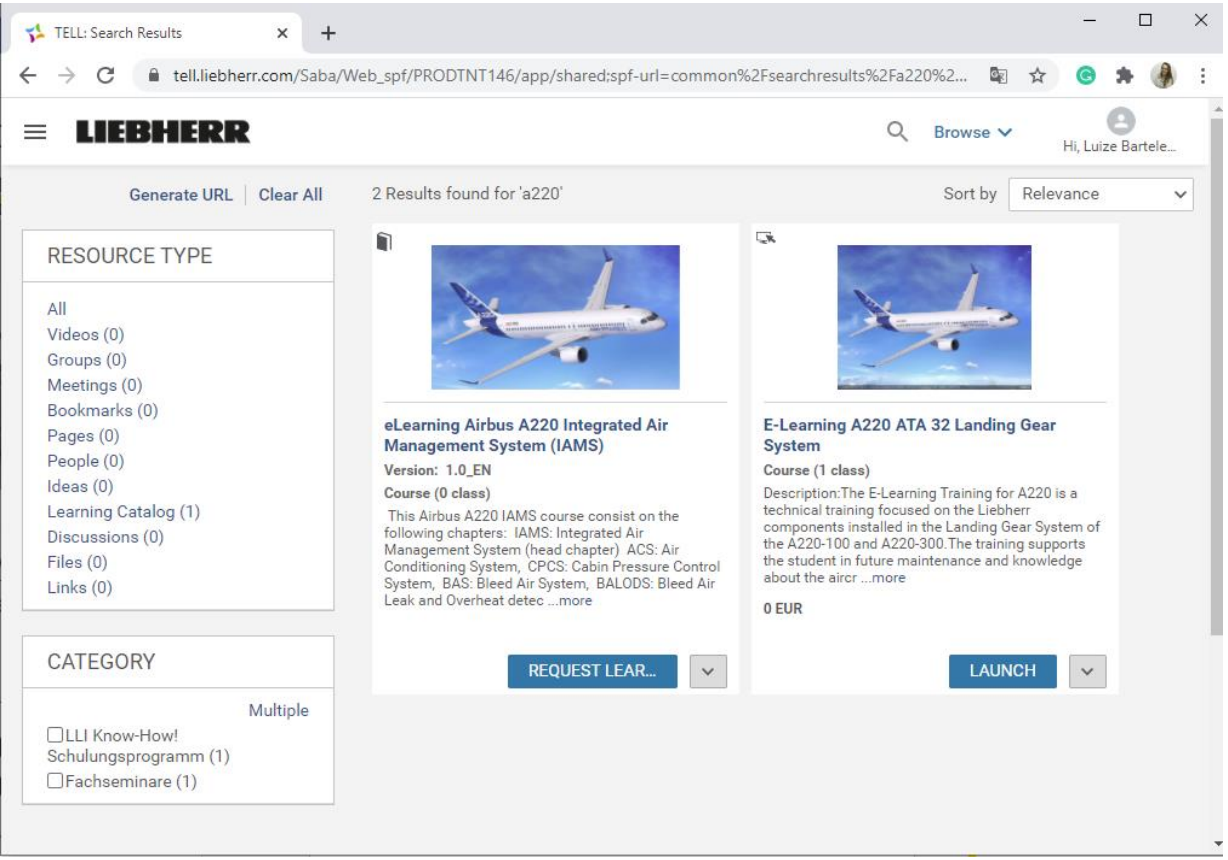






New Training Solutions

eLEARNING



- Training delivered in TELL. Students learn by themselves, at any time, at any place.
- Same Training Content as theory Standard Classroom.
- After completion of the eLearning, an optional Q&A Online Meeting can also be provided.
- **Major advantage: flexibility in learning process.**

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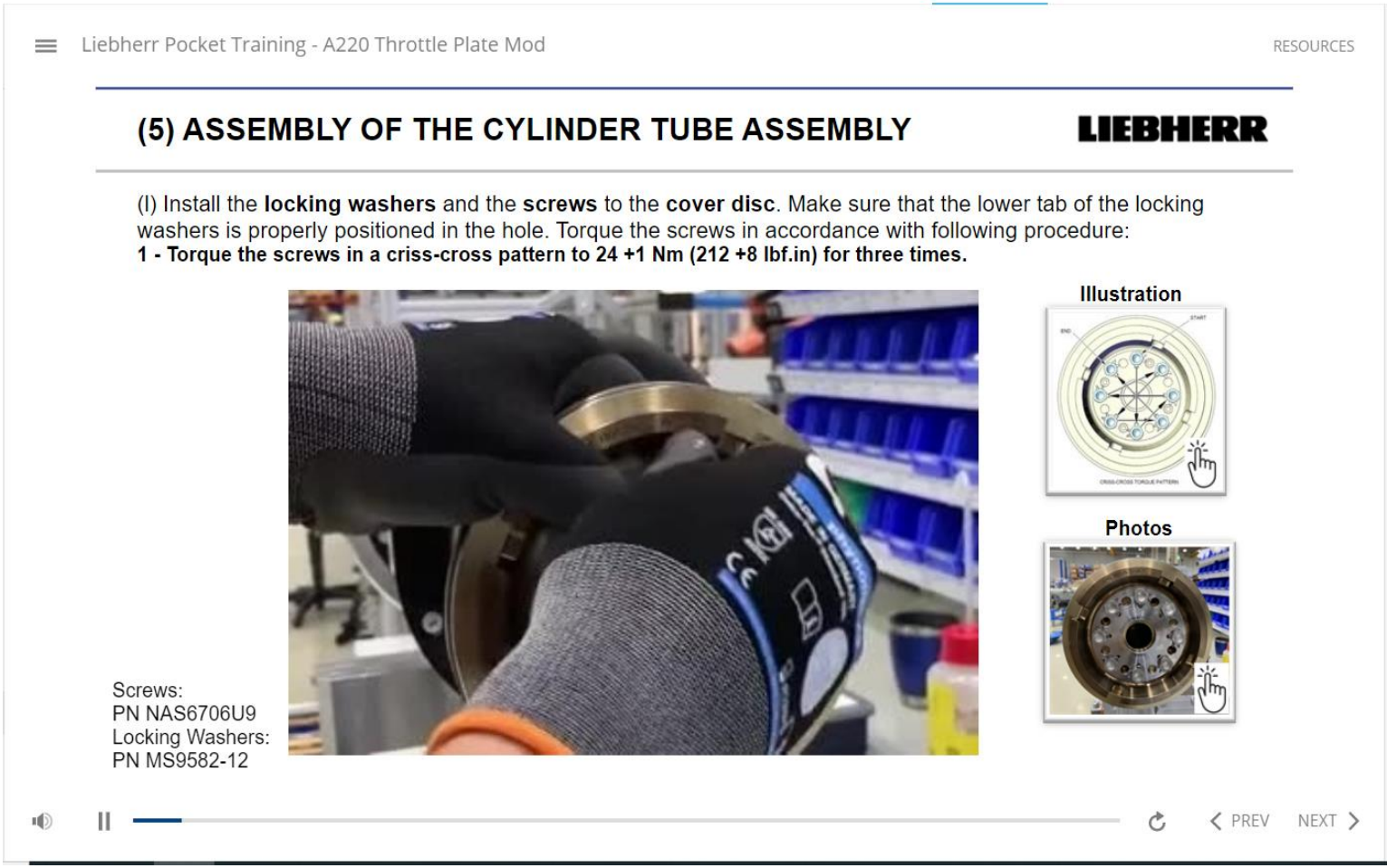
New Training Solutions

POCKET TRAINING

- Short and condensed Training sessions, of maximum one hour. Only one specific topic is covered.
- Pocket Trainings explains maintenance tasks like Seal Changing, Servicing Procedures and VSBs.
- **Major advantages: fast and effective way to receive Technical Support. Travel expenses are avoided.**



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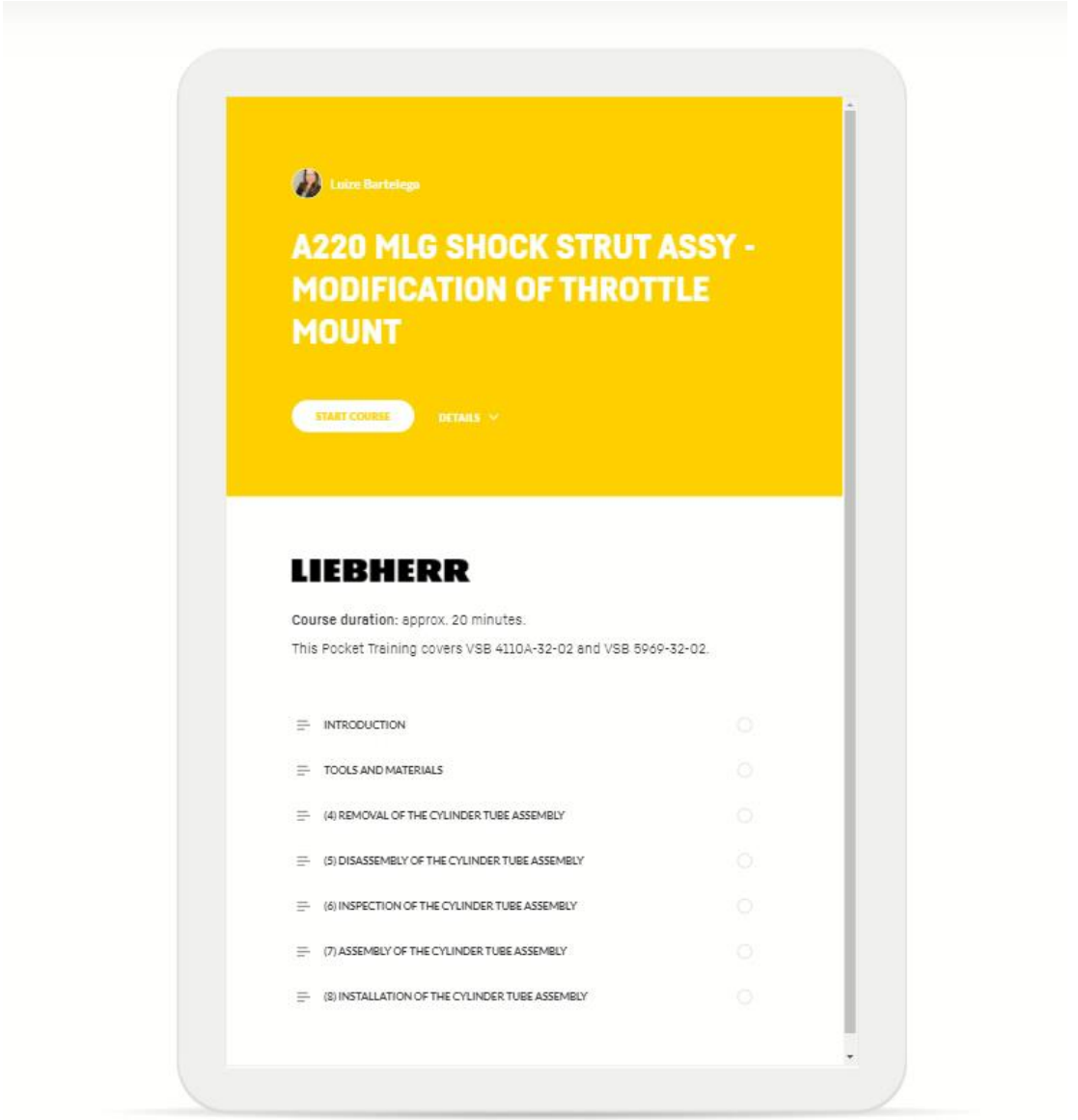
New Training Solutions

POCKET TRAINING



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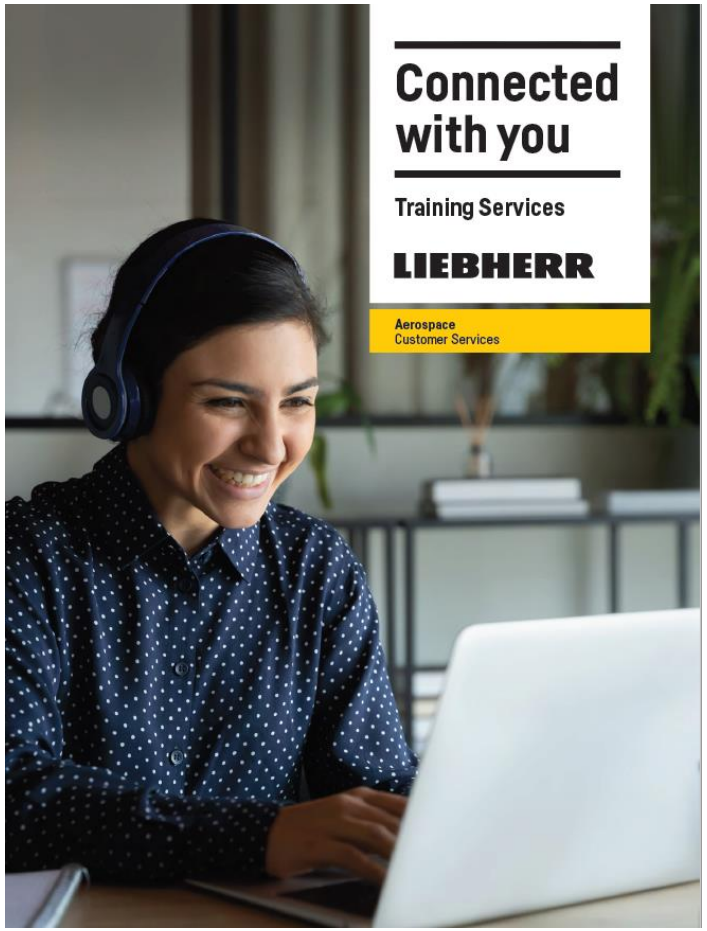
NEW ADVERTISING PACKAGE



MEET THE TEAM

Liebherr-Aerospace Lindenberg GmbH

LUIZE BARTELEGA

Customer Training
Instructor and Developer

Liebherr-Aerospace Toulouse SAS

OLIVIER LE GUENNEC

Customer Training
Instructor and Developer