
RTW 2021

Airbus

A220

Liebherr Saline

LIEBHERR

Liebherr-Aerospace



Presenters

Mark Sobol	Technical Support Manager	Liebherr Saline, US
Audrey Loubiere	Technical Support Engineer	Liebherr Toulouse, France
Claire Duchaigne	Technical Support Engineer	Liebherr Toulouse, France
Luize Bartelega	Customer Support Engineer	Liebherr Lindenberg, Germany

Agenda

- 1** Welcome speech
- 2** Fleet data
- 3** **ATA 36 - LTS**
 - 3.1** PRSOV Failed Open
 - 3.2** HPV Failed Closed
 - 3.3** PCE leakage
 - 3.4** Kidde loop quality issue
 - 3.5** BALODS / Nuisance messages
- 4** **ATA 21/30 - LTS**
 - 4.1** WAIV premature removals
 - 4.2** ACM fan modification retrofit status
 - 4.3** TAPRV removals
 - 4.4** Mid Ground Valve water ingress
 - 4.5** Soft IASC 6.0 implementation status
 - 4.6** LPGC Cover hard to Open/Close

Agenda

- 5 Health Monitoring overview**
 - 5.1 PRSOV HM**
 - 5.2 General presentation of Liebherr services**
- 6 Quizz time**
- 7 ATA 32 - LLI**
- 8 New Training Solutions**
- 9 Liebherr Initiatives and Support Packages**

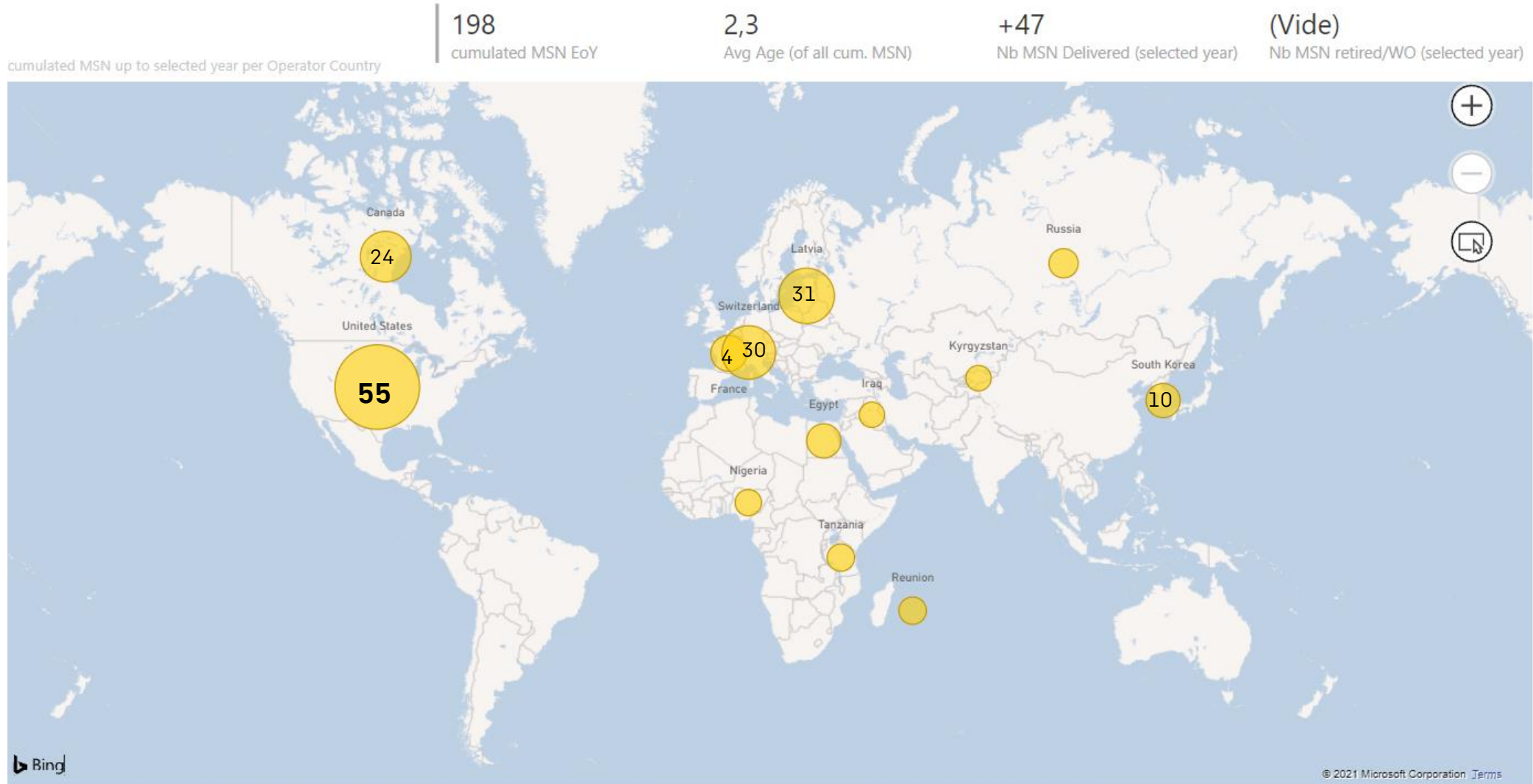
Introduction

- Welcome speech
- Safety rules
- Raise Hand Function

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OVERVIEW – 2021 Fleet data –



OVERVIEW – Fleet data / America

Operator: Region > Co... Operator Name Manufacturer > Family > Type Engine Type Status

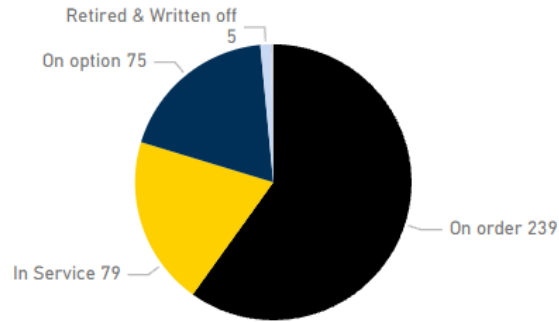
America Tout Airbus (Manufacturer) + A22... Tout Tout

399
Total Nb MSN

80
In Service + Stored
(99 % In service)

1,5
Average Age

Nb aircraft (MSNs) per Status



Nb aircraft (MSNs) per Operator Region



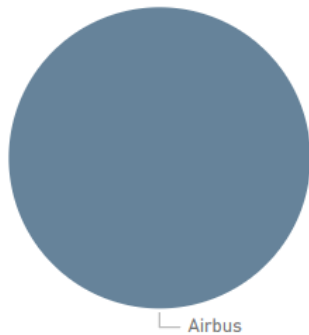
Total nb of MSNs with Delivery date this Year

Année	2021												Total
	1	2	3	4	5	6	7	8	10	11	12	Total	
AER Region	3	2	4	2	3	4	1	2	3	2	4	30	30
Total	3	2	4	2	3	4	1	2	3	2	4	30	30

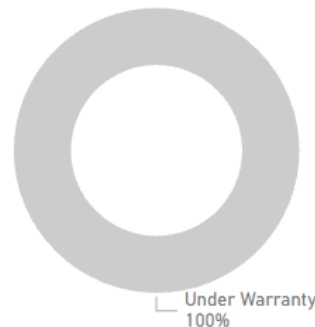
Focus "In Service" aircraft

79

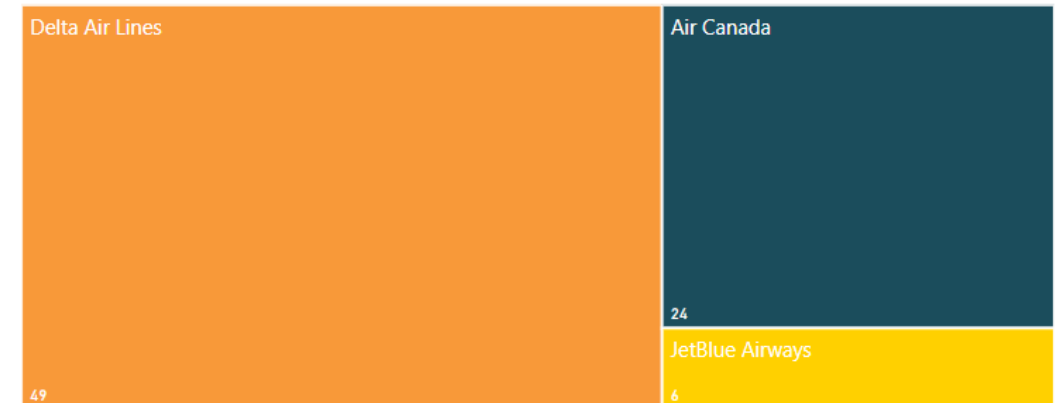
Number of aircraft in service per Manufacturer



Nb aircraft (MSNs) per Warranty status



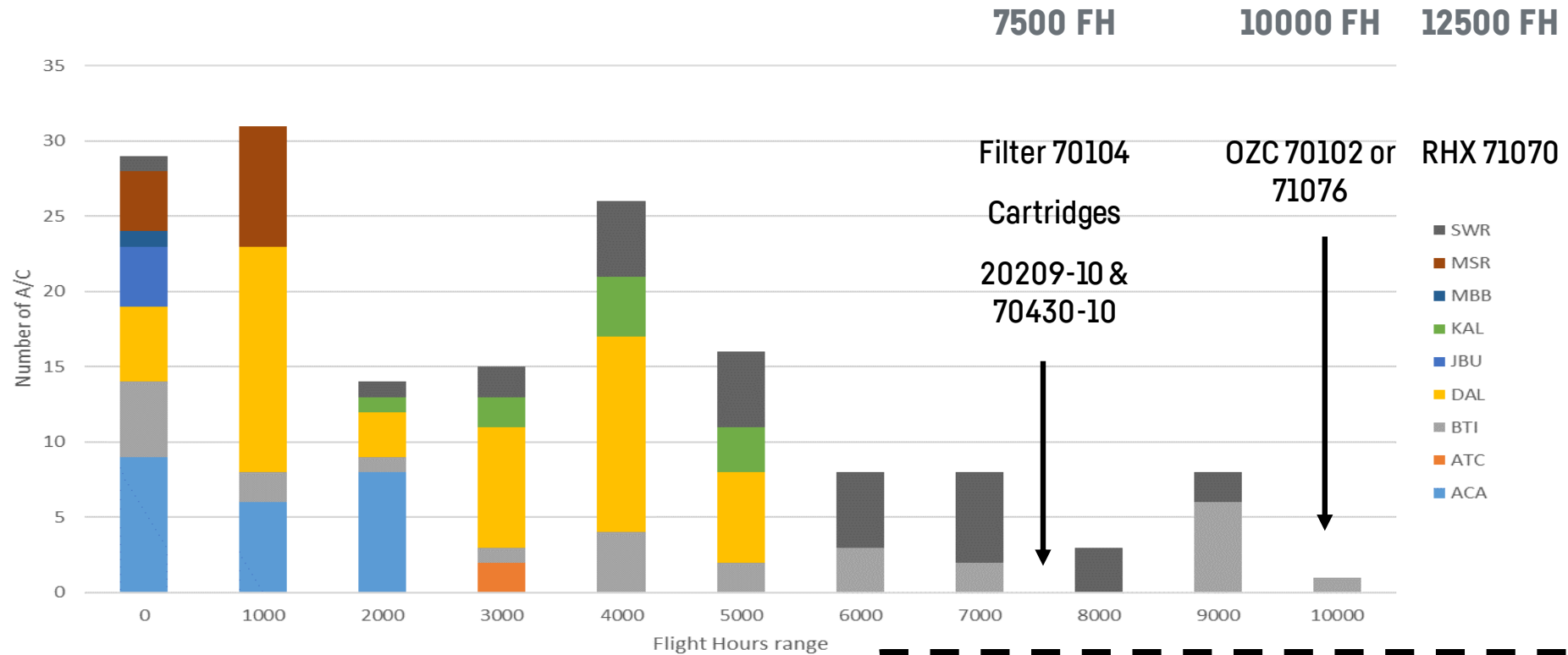
Number of aircraft in service per Operator (Top 20)



OVERVIEW – Fleet recovery



Scheduled maintenance (MPD tasks)



- A220 Fleet FH current repartition**
- ✓ Anticipate Maintenance check planning
 - ✓ If possible provide dates and spares needed
 - ✓ Optimization of fleet support

Airbus A220

ATA 36

LIEBHERR

Liebherr-Aerospace Toulouse



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PRSOV FAILED OPEN

Description:

High rate of PRSOV removals due to the following messages :

L/R BLEED FAIL, 36 L/R BLEED FAIL – L/R PRESS REG SOV
INOP

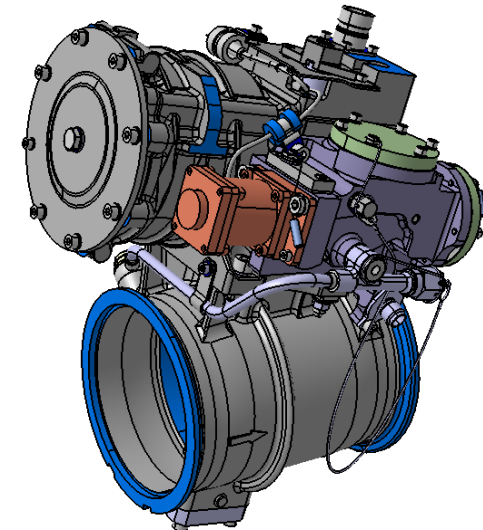
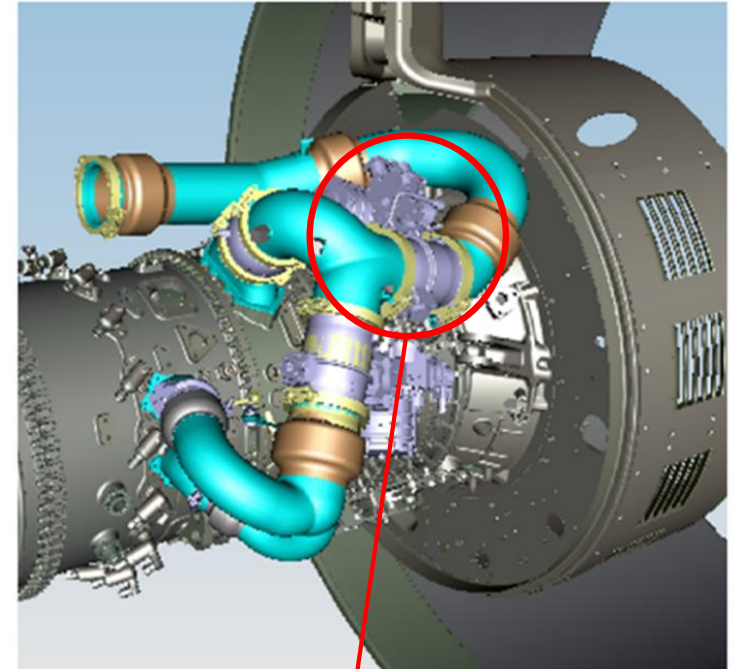
- PRSOV pressure regulation drift high

L/R BLEED FAIL, 36 L/R BLEED FAIL – L/R PRESS REG SOV
FAIL OPEN

- Full Closed switch in not contacted 15 sec after PRSOV
close command

A/C Level:

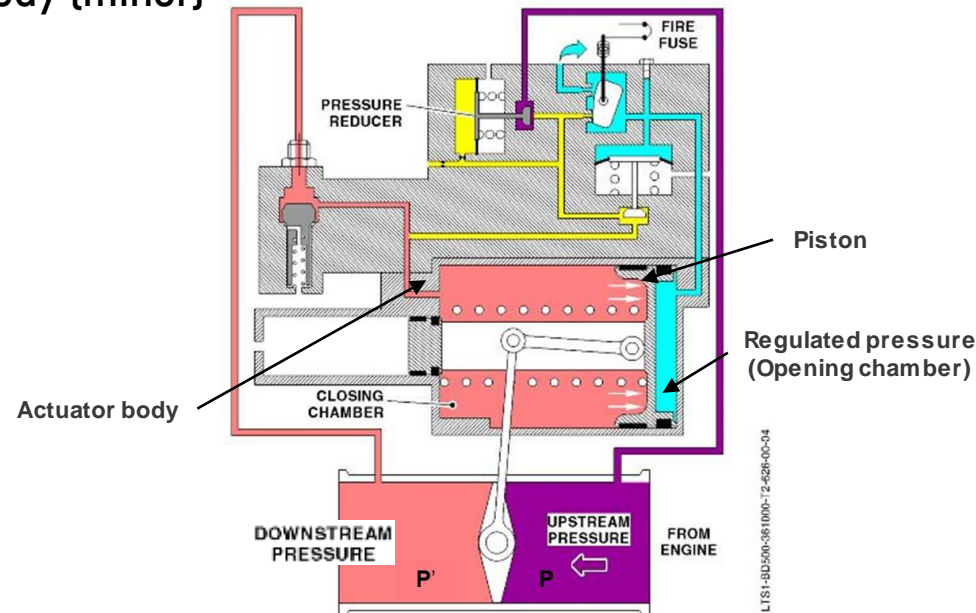
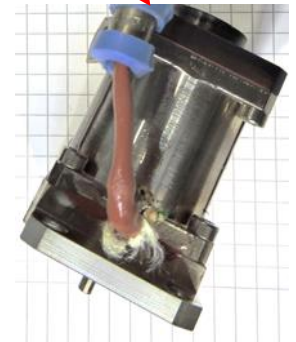
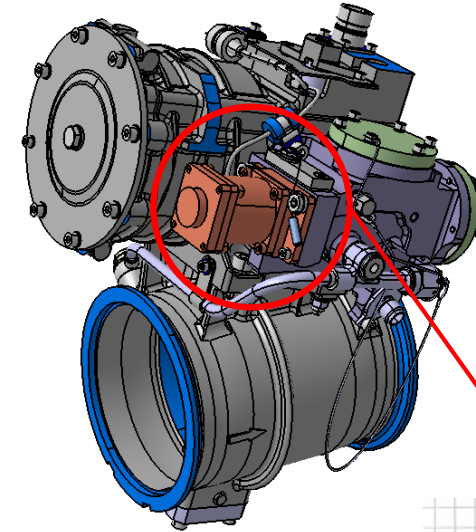
- MEL maintenance task and component replacement
- Operational restriction to operate in single bleed
configuration (31,000ft, no icing takeoff)



PRSOV FAILED OPEN

Root Cause Analysis:

1. Vibration environment has been identified as main root cause for premature torque motor and seals wear
2. PRSOV failed open during APU switching due to insufficient upstream/downstream pressure
3. Friction between piston and actuator body (minor)

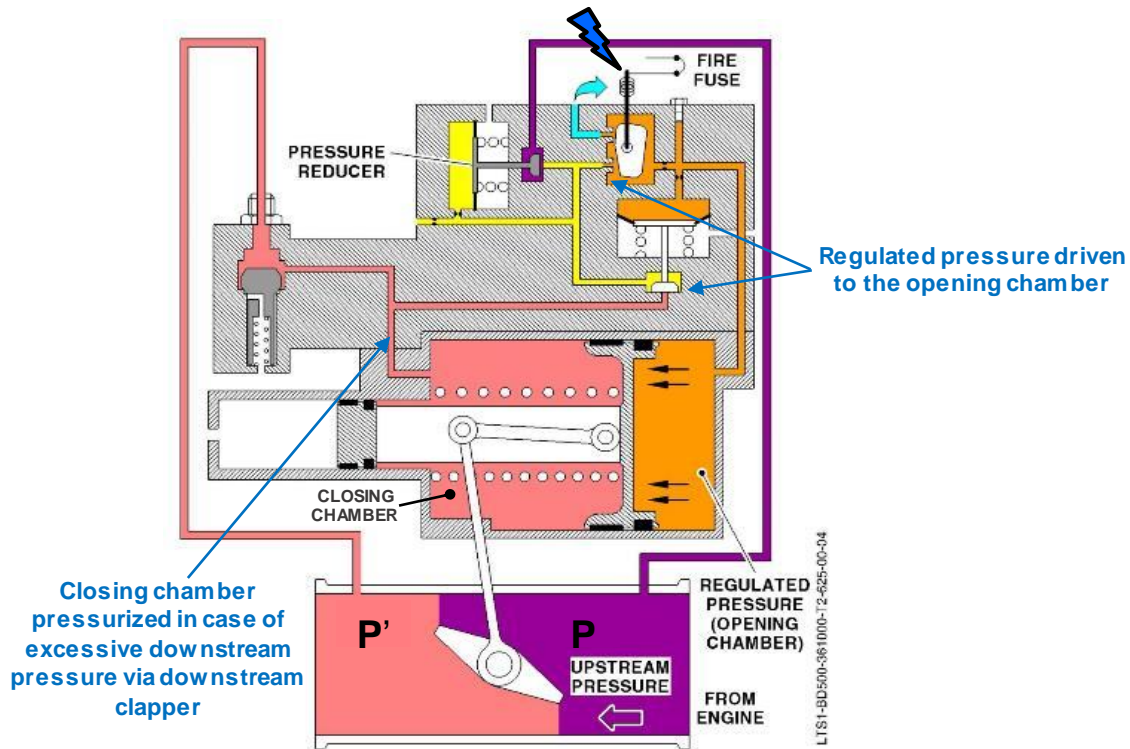


PRSOV FAILED OPEN

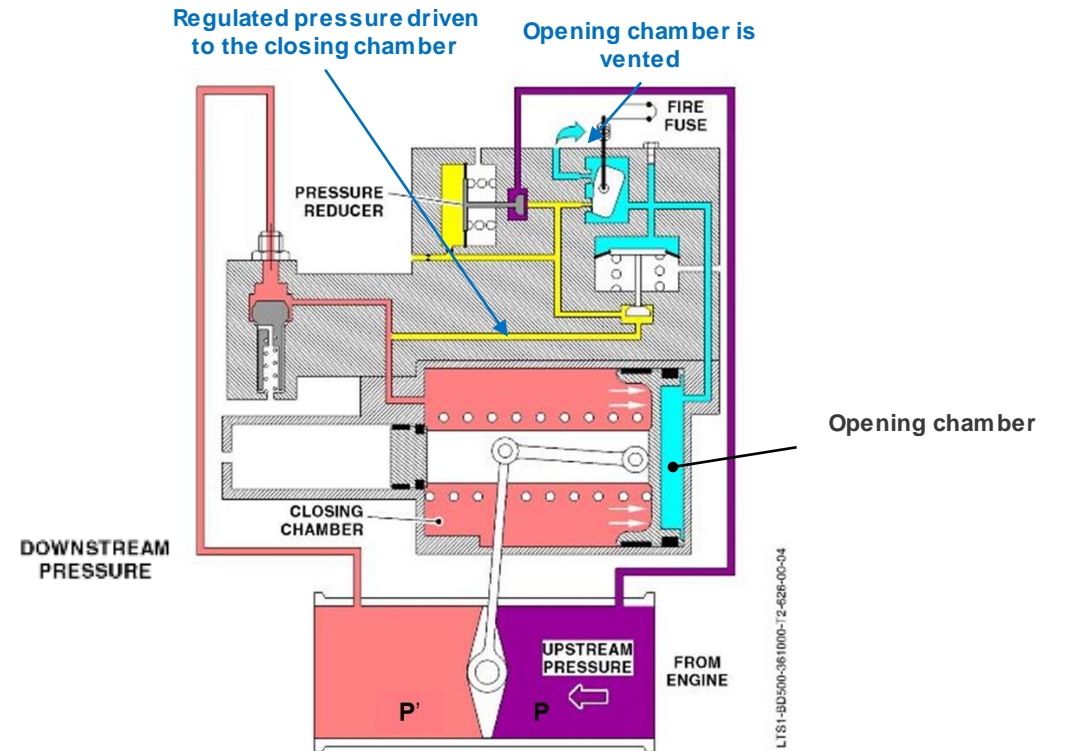
Valve Operation :

PRSOV regulating

Conditions :
 $I > 150 \text{ mA}$
 $P(\text{upstream}) > 15 \text{ psig}$



PRSOV closed



PRSOV FAILED OPEN

Valve degradation impact:

Torque motor wear

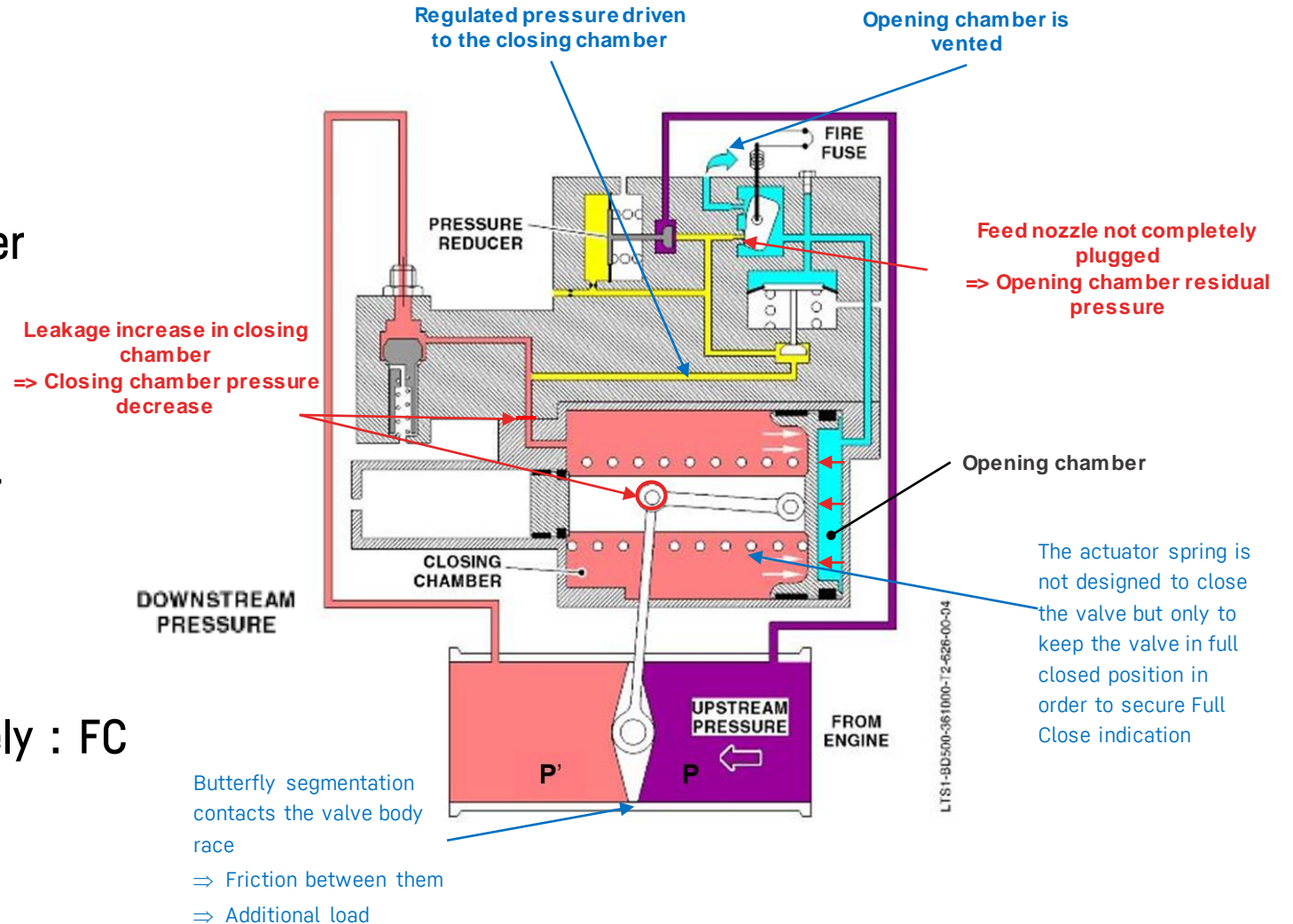
- Hysteresis increase
- Residual pressure in opening chamber

Seals wear

- Leakage increase in closing chamber
- Closing chamber pressure decrease

- PRSOV almost closed but not completely : FC switch not contacted

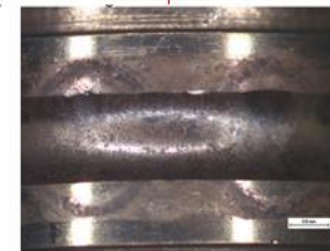
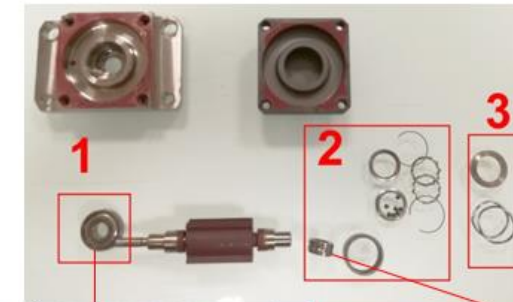
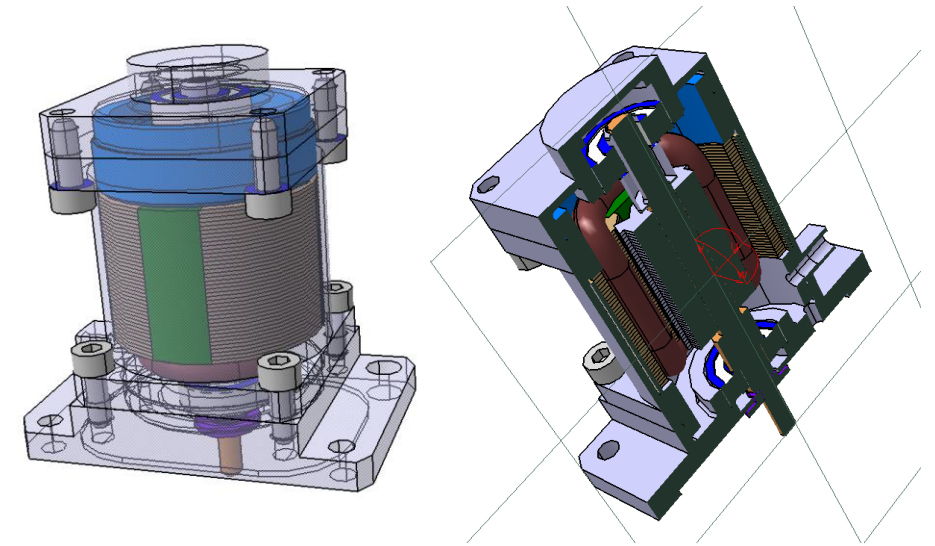
PRSOV closed



PRSOV FAILED OPEN

Vibration environment as main root cause for premature torque motor and seals wear

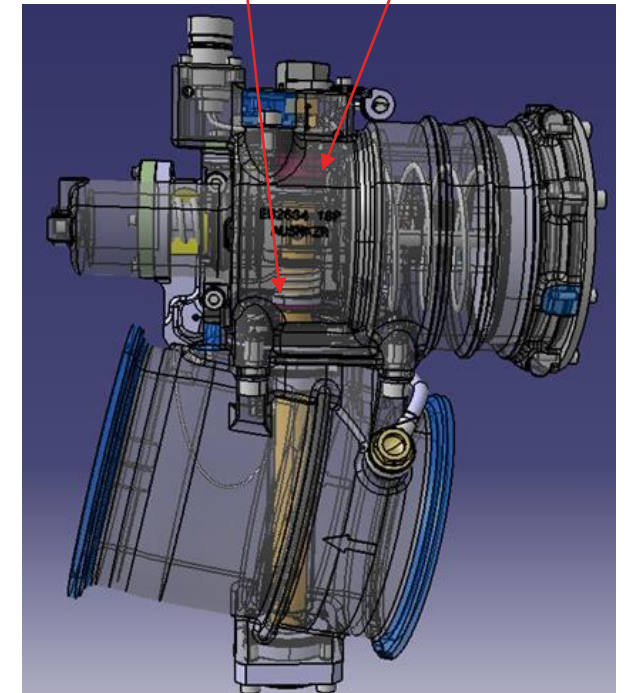
- Severe vibration environment leads to
 - Torque motor bearing damage :
 - Cage degradation : Particles due to cage wear prevent ball bearings motion.
 - Vibrations levels high enough to counter torque motor bearing pre-load (reversible phenomenon which is acceptable during a limited time of exposure).
 - Impact : Residual pressure in opening chamber
 - pressure regulation drift and/or failed open events



PRSOV FAILED OPEN

Vibration environment as main root cause for premature torque motor and seals wear

- Seals wear : excessive external leakage
 - Wear is observed on graphite seals located along butterfly axis leading to leakage from closing chamber and from valve body.
- Impact : Pressure decrease inside closing chamber
 - pressure regulation drift and/or failed open events



PRSOV FAILED OPEN

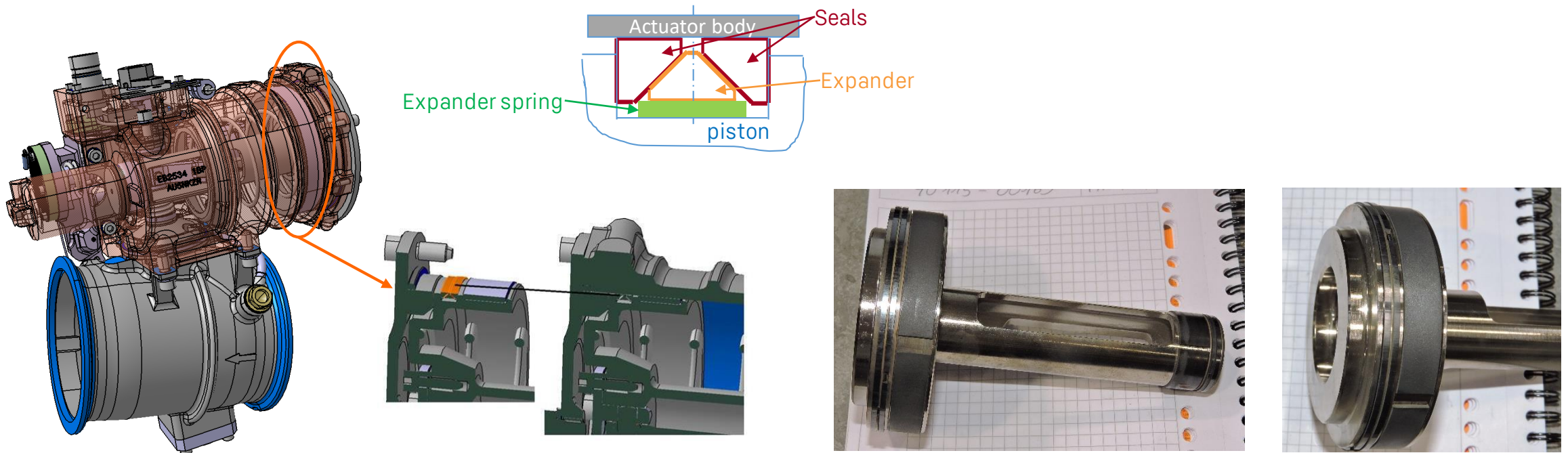
Vibration environment as main root cause for premature torque motor and seals wear

- Mitigation actions
 - Systematic replacement of torque motor and seals at each valve's return (since 2018)
 - Health monitoring : PRSOV failed open algorithm (since January 2021)
 - PRSOV Amendment A :
 - Since July 2020, VSB 70115-36-01 is recommended and is implemented on attrition systematically

PRSOV FAILED OPEN

Mitigation : PRSOV Amendement A / Excessive friction between piston and actuator body

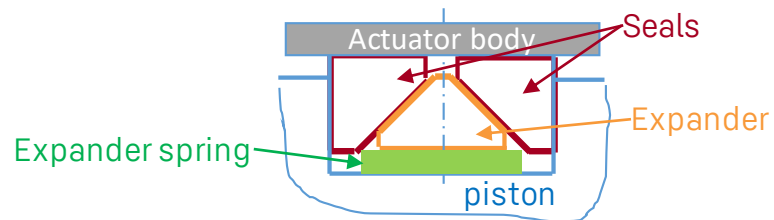
- Expander spring apply load on segmentation to minimize leakage between actuator chambers
 - Combined with thermal dilatation effect, this load could increase
 - Not sufficient to block the valve but leads to additional load against valve closing



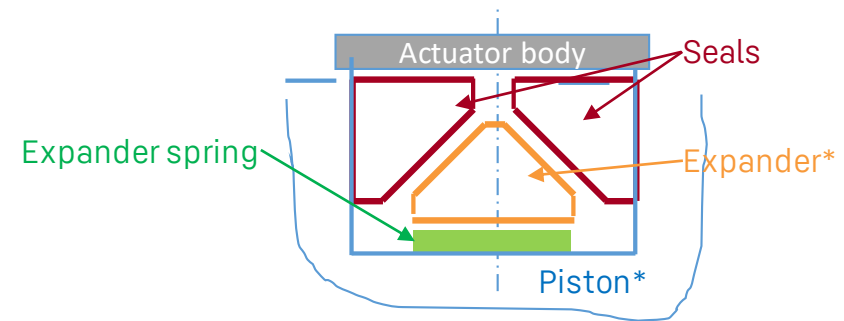
PRSOV FAILED OPEN

Mitigation : PRSOV Amendment A / Excessive friction between piston and actuator body

- Amendment A objective
 - Decrease piston friction to minimize contact load
- Modification
 - Piston groove diameter reduction
 - Expander outer diameter reduction



previous

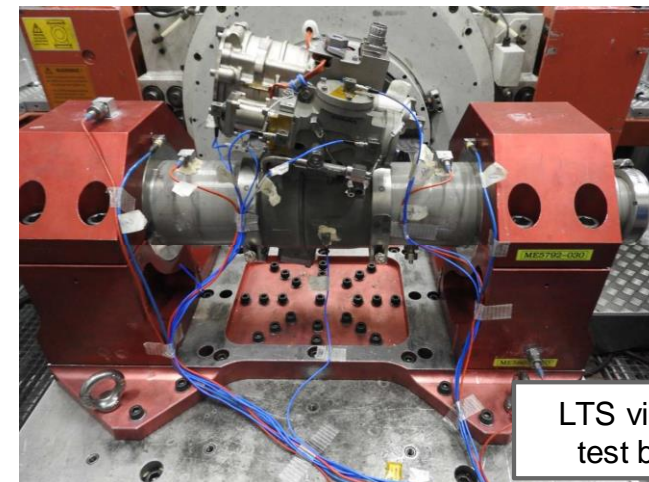
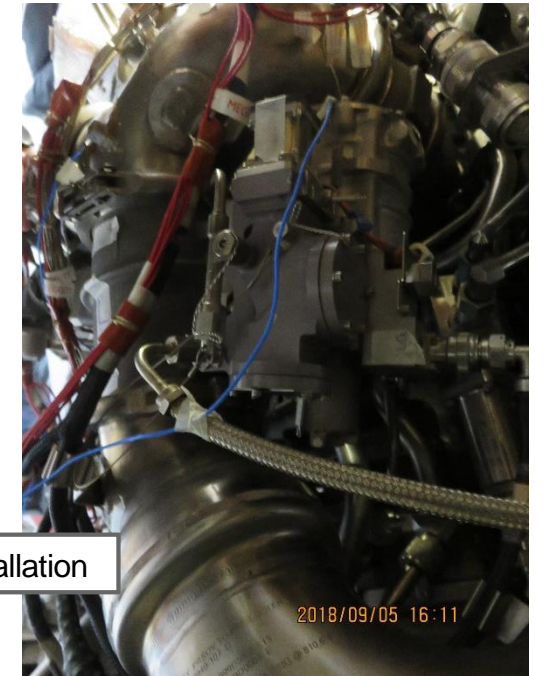
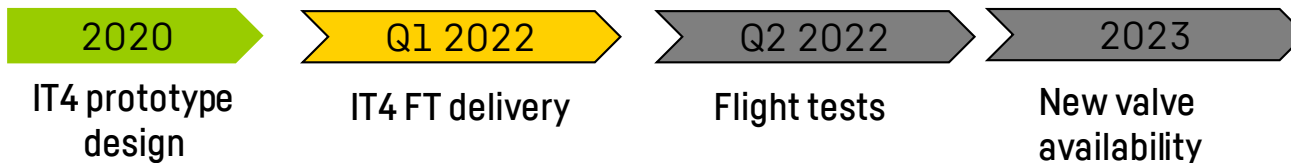


current

PRSOV FAILED OPEN

Final fix

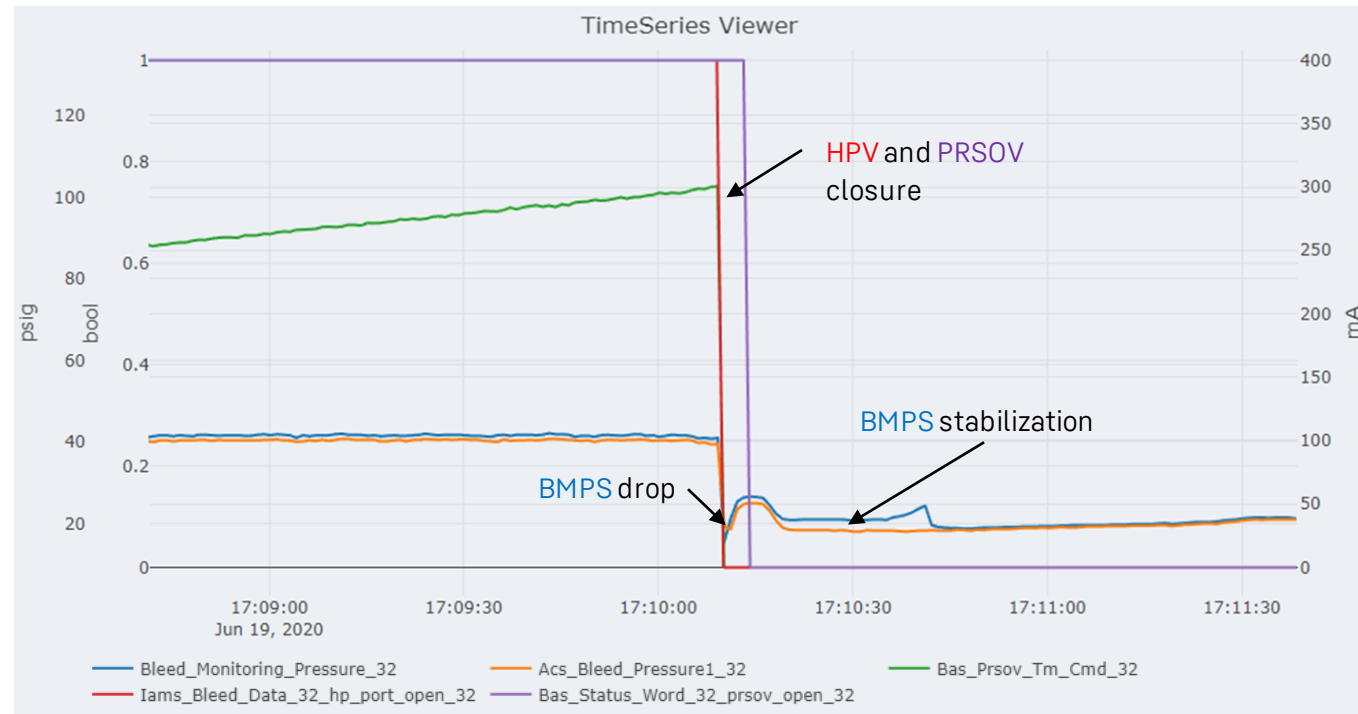
- PRSOV redesign
 - Less sensitive to vibration
 - ECS HP bleed ducting installation improvement
 - Decrease vibration levels injected at valve interface
 - Plateau phase (Airbus Canada, P&W and LTS) in progress to define solution
 - Flight test campaign to validate this solution planned for Q2 2022
 - IT4 prototype valve available on Q1 2022



PRSOV FAILED OPEN

PRSOV failed open during APU switching due to insufficient upstream/downstream pressure:

- However, PRSOV upstream pressure (BMPS) drops during this switching, before stabilization at APU pressure
- In addition to unexpected leakage or Torque Motor hysteresis increase, PRSOV could stop just before contacting FC switch (potential insufficient load)



PRSOV FAILED OPEN

PRSOV failed open during APU switching due to insufficient upstream/downstream pressure:

- Final fix :
 - IASC SW7.0 logic modification : The HPV closure command will be delayed in order to maintain enough upstream pressure feeding the PRSOV actuator while the PRSOV butterfly closes.
 - IASC SW7.0 deployment ECD : Q4 2023

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HPV FAILED CLOSED

Description:

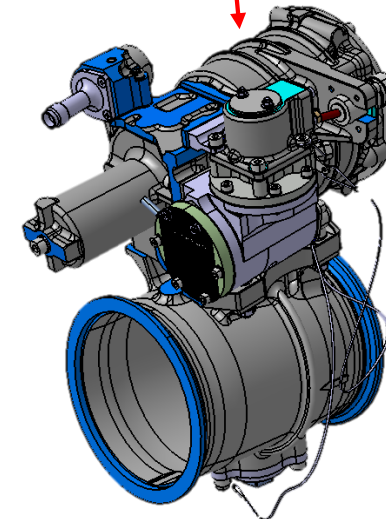
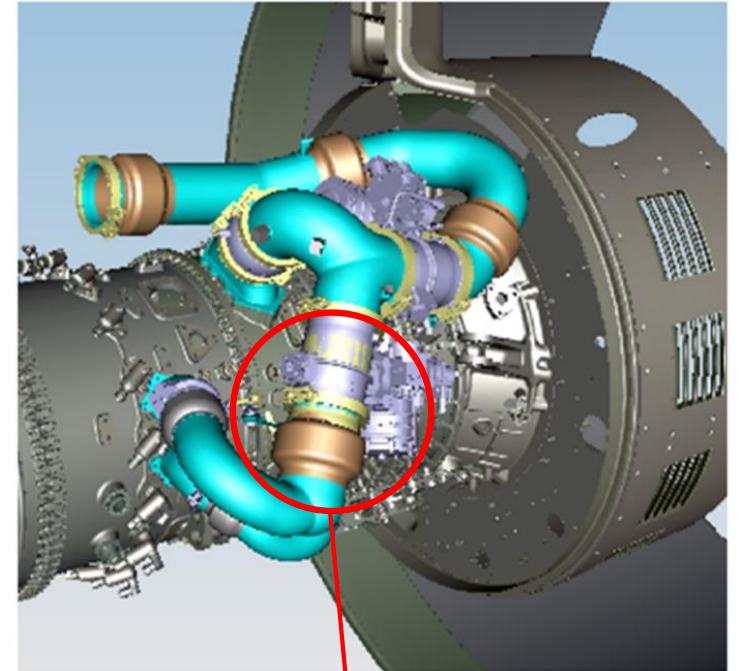
High rate of HPV removals due to the following messages :

L/R BLEED FAIL, 36 L/R BLEED FAIL – L/R HPV FAIL CLSD

- HPV is commanded open and confirmed closed (BMPS – IPPS < 20psig).
 - This monitoring should only be active when low pressure or low temperature conditions are detected

A/C Level:

- MEL maintenance task and component replacement
- Operational restriction to operate in single bleed configuration (31,000ft, no icing takeoff)



HPV FAILED CLOSED

Valve functional diagram :



Reducer diaphragm



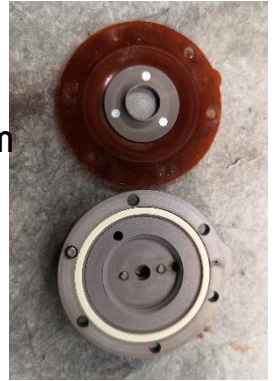
Solenoid plunger



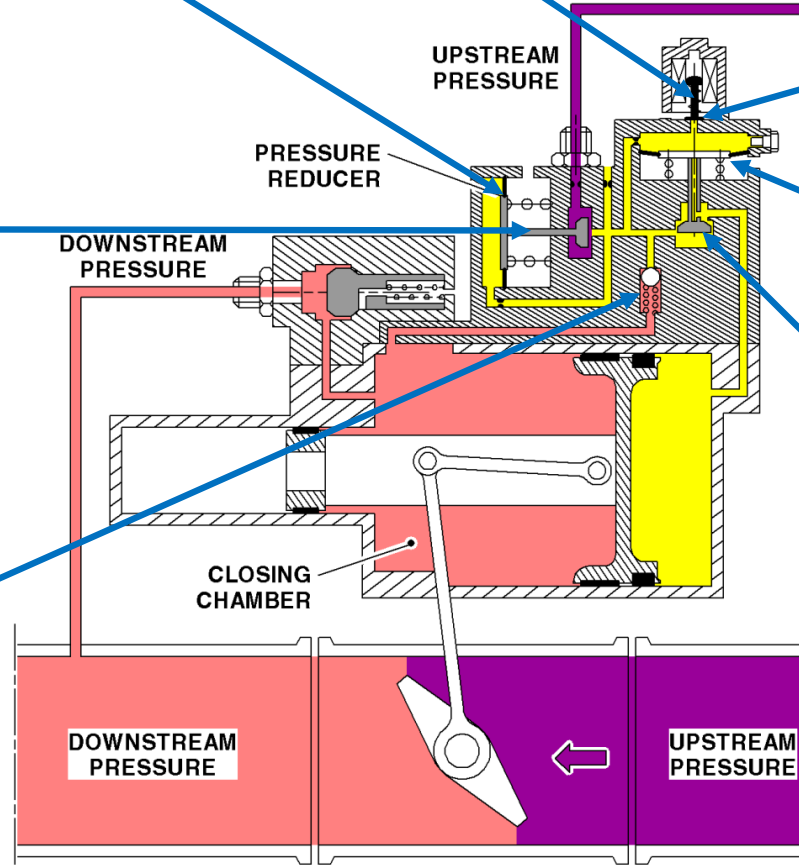
Blade clapper



Reducer clapper



On/off diaphragm



Overpressure clapper



On/off clapper

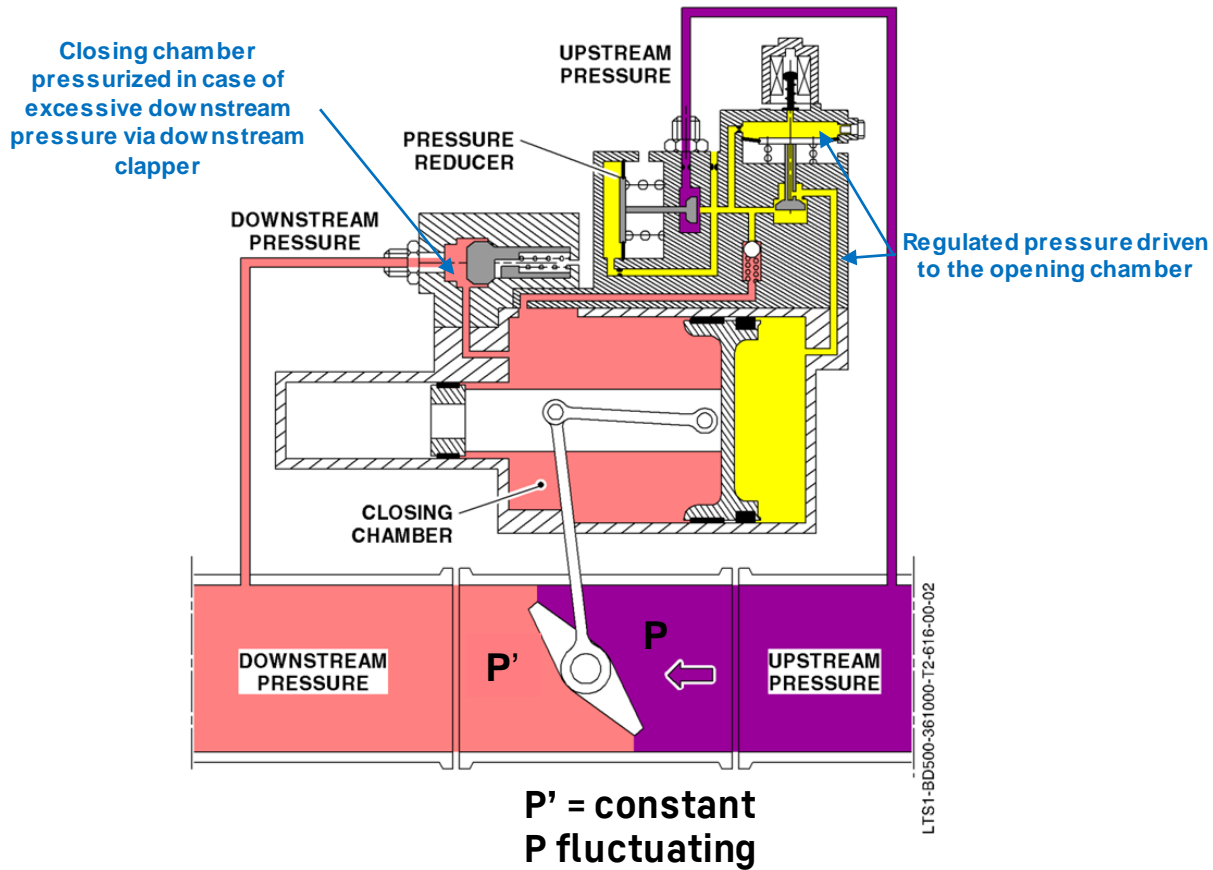
LTS1-BD500-361000-T2-616-00-02

HPV FAILED CLOSED

Valve Operation :

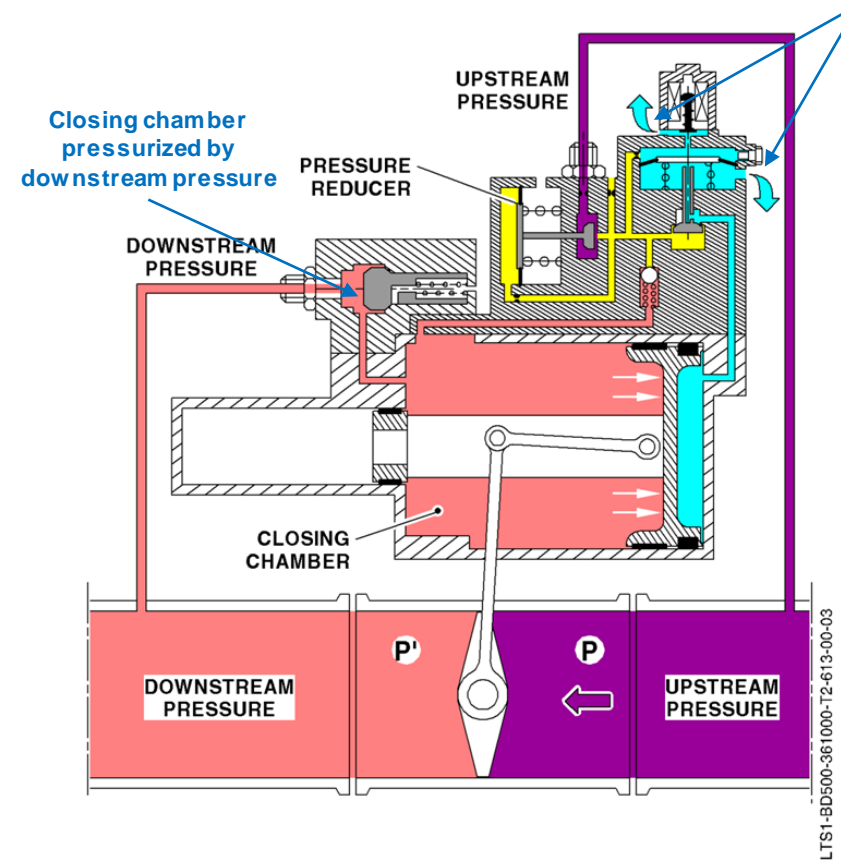
HPV regulating

Conditions :
Solenoid energized
 $P(\text{upstream}) > 20 \text{ psig}$



HPV closed

Opening chamber is vented



HPV FAILED CLOSED

RCA / Findings

1. Thermal

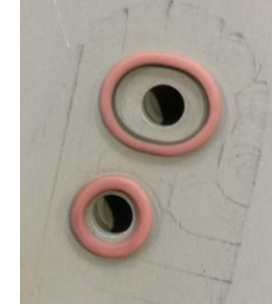
Regulator components overheat

- Failed closed event

Overheated



Good condition



Regulator seals



Spring guide



Diaphragm and cover seal

HPV FAILED CLOSED

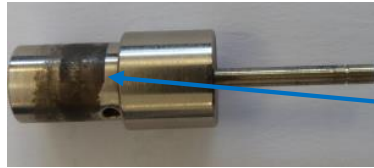
RCA / Findings

1. 2. Vibration

Solenoid plunger fretting

- Failed closed

Worn



Solenoid plunger
with fretting
traces

Good condition



Blade clapper failure

- Failed closed



Broken blade
clapper



HPV FAILED CLOSED

Valve degradation impact:

Regulator components overheat

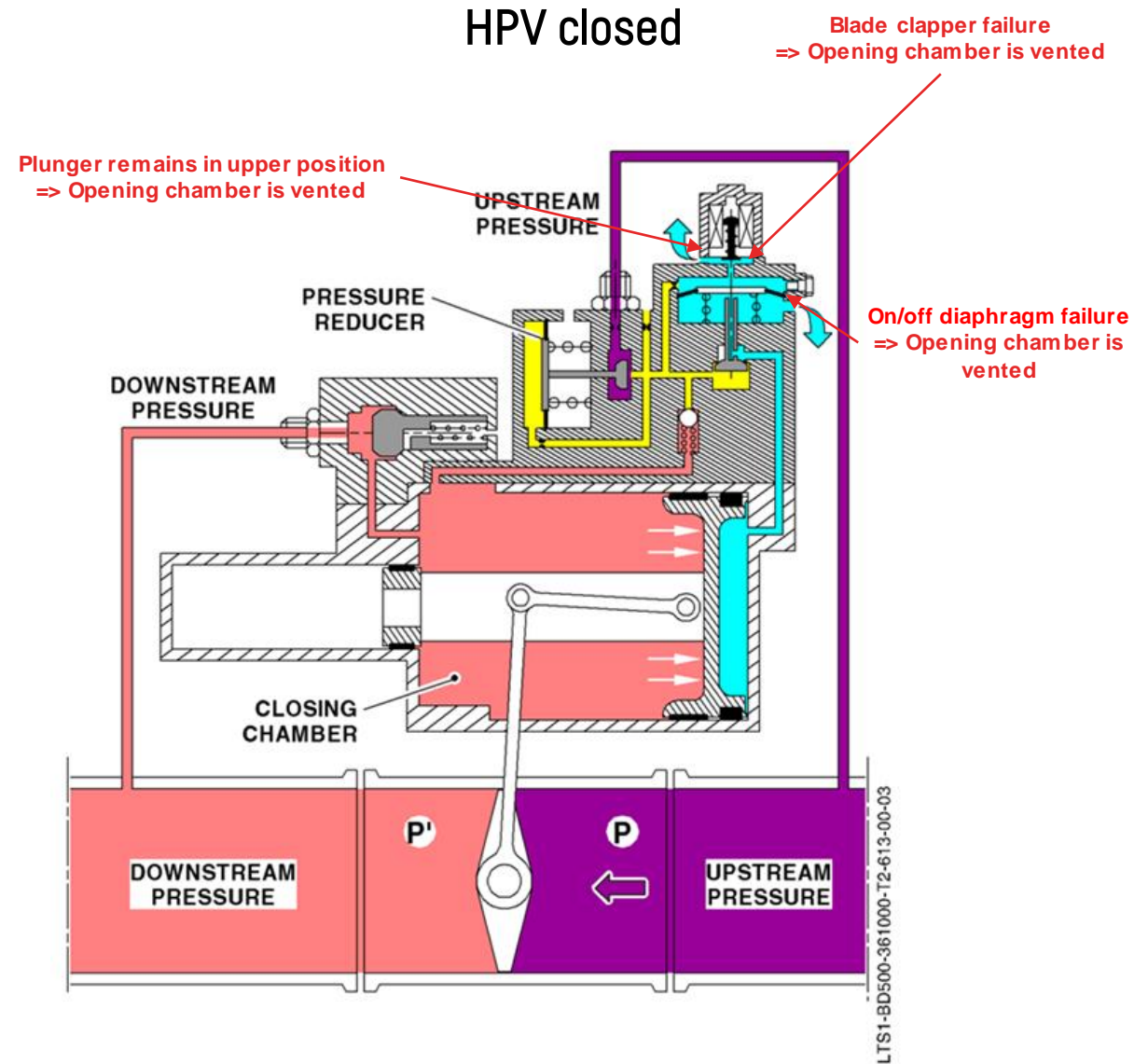
- On/off diaphragm drilled
- On/off clapper does not trigger
- Opening chamber vented

Solenoid plunger fretting

- Plunger blocked inside the solenoid body
- Opening chamber is vented

Blade clapper failure

- Opening chamber is vented



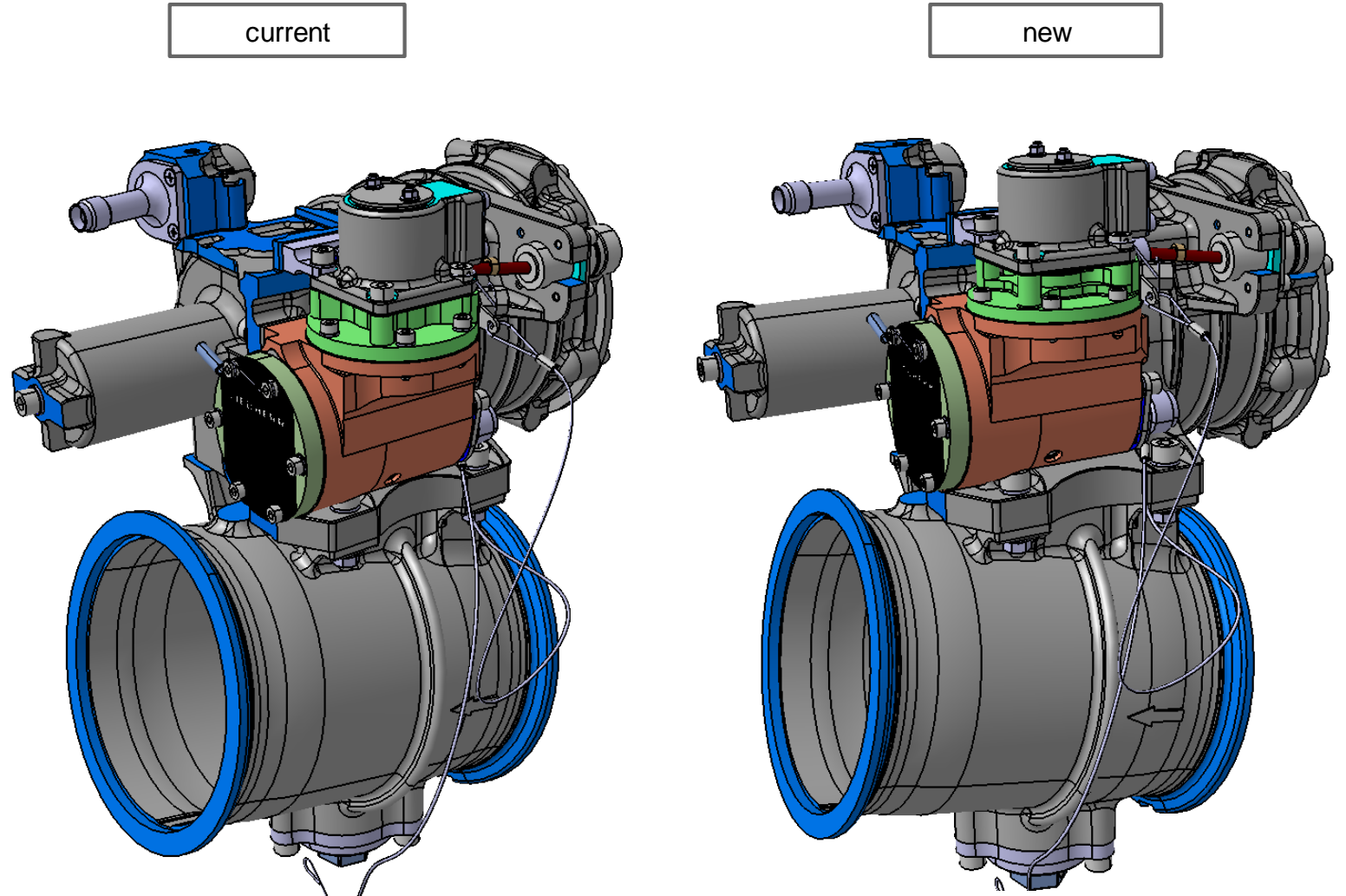
HPV FAILED CLOSED

Mitigation actions

- Systematic replacement of solenoid plunger and regulator seals (70114B010001)
- HPV redesign 70114B020001
 - VSB released in October 2021

In service strategy :

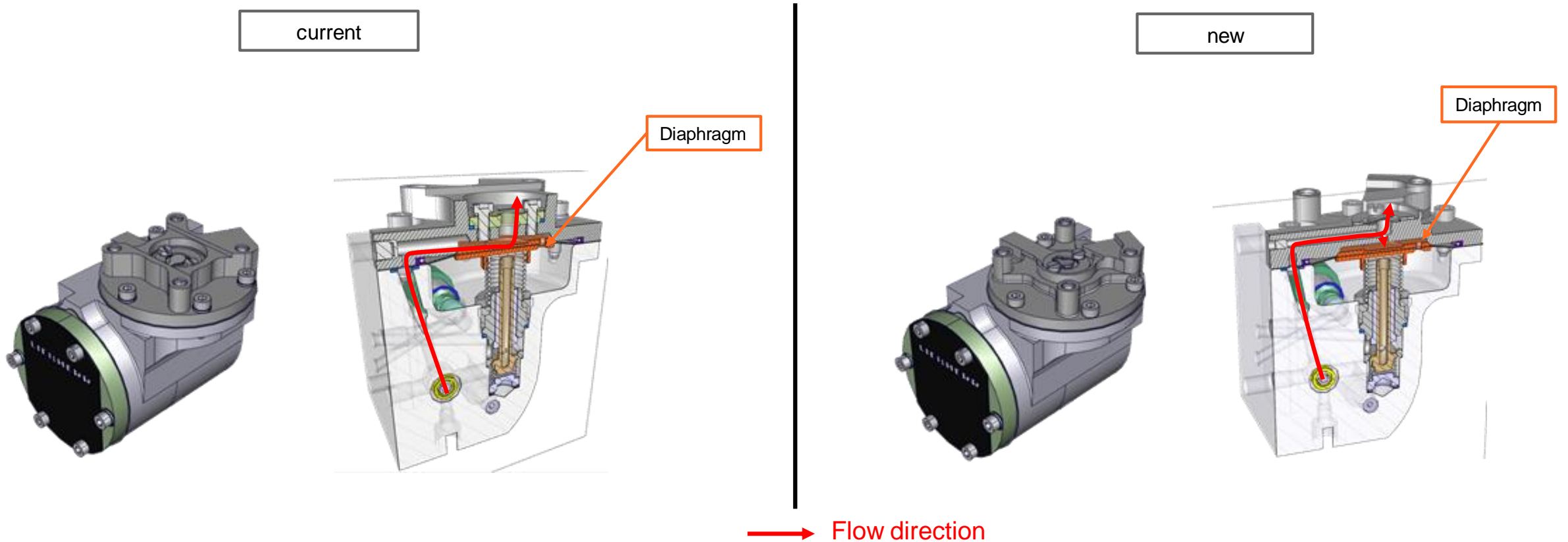
- VSB 70114-36-01 is desirable and will be implemented on attrition systematically



HPV FAILED CLOSED

HPV redesign

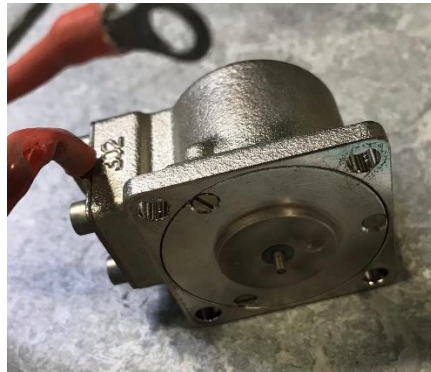
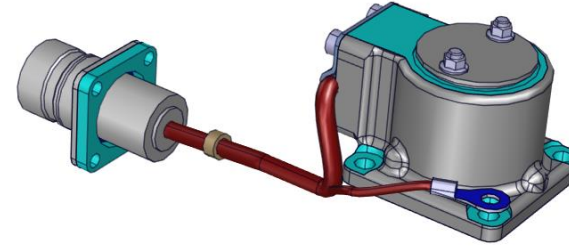
- Regulator cover improvement
 - Limit hot air flow near the diaphragm and decrease temperature inside the regulator



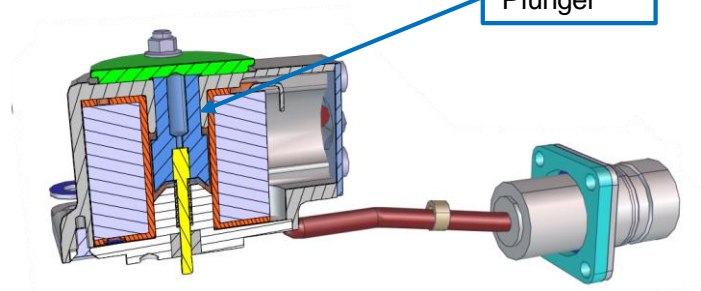
HPV FAILED CLOSED

HPV redesign

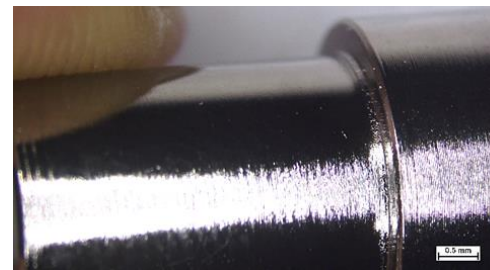
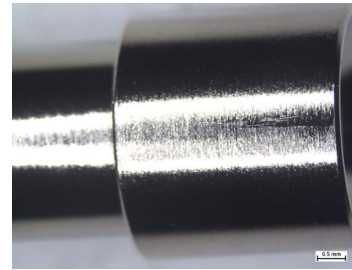
- Teflon coating on plunger
- Limit fretting phenomenon between plunger and solenoid body due to vibration



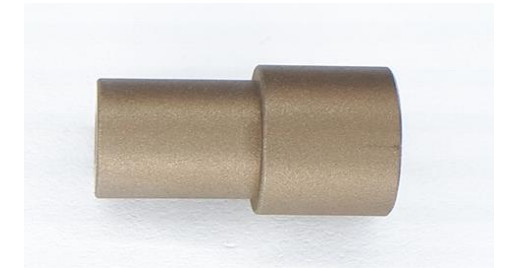
Plunger



current



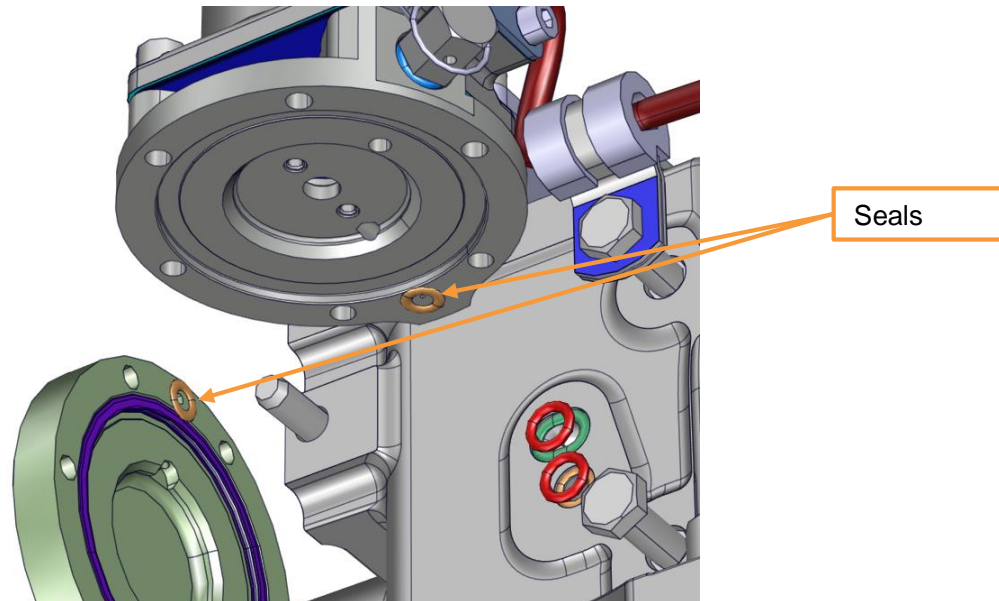
new



HPV FAILED CLOSED

HPV redesign

- Regulator seals material change
 - Increase temperature resistance

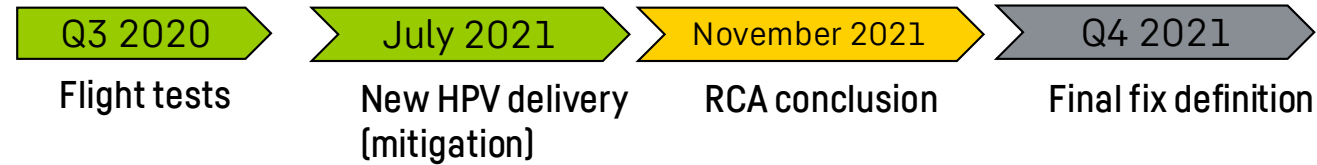


HPV FAILED CLOSED

Final fix

➤ Thermal

- Simulation in progress as per flight test data to identify overheat contributor (external and internal)
- Potential ventilation improvement under analysis
- ECD : Q4 2021



➤ Vibration

- Analysis done in parallel with PRSOV and ECS bleed duct improvement
 - Potential impact on dynamic environment
- ECD : Q3 2022 (pending PRSOV IT4 flight test)

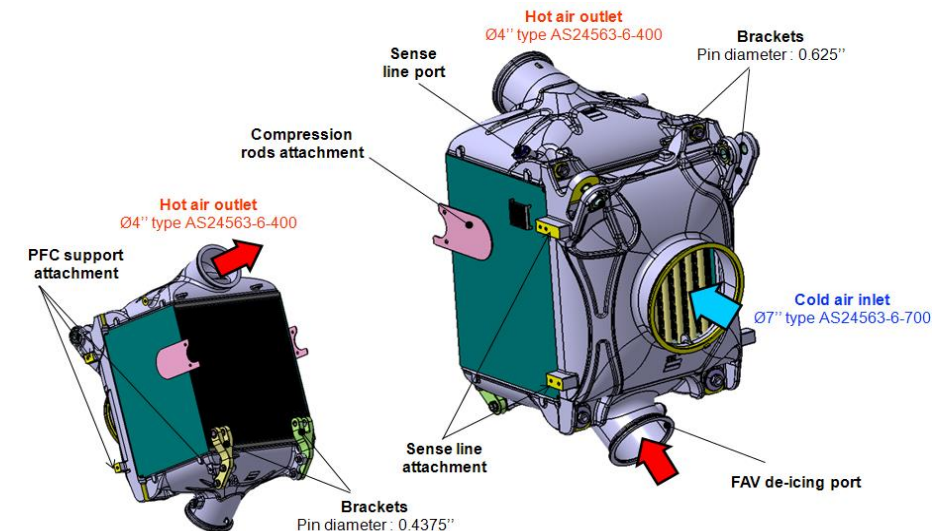
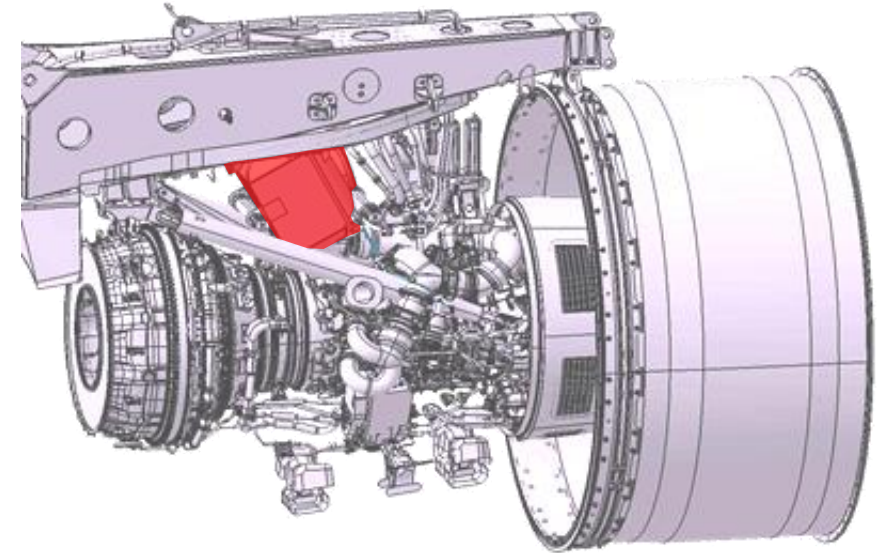
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Precooler P/N 70263A Leakage

Description:

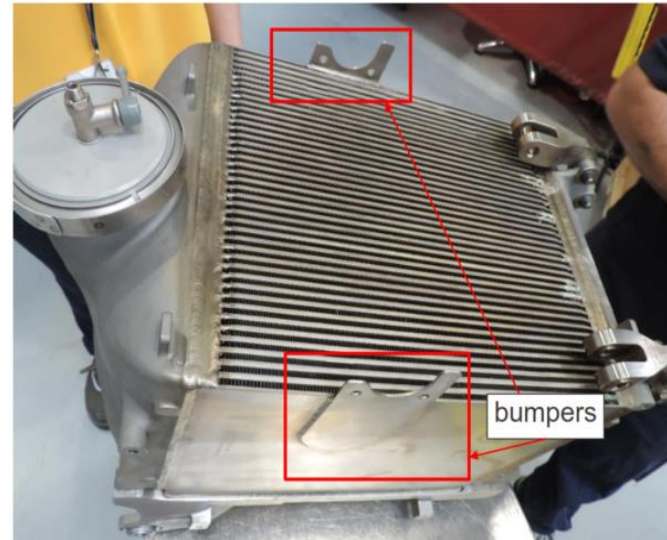
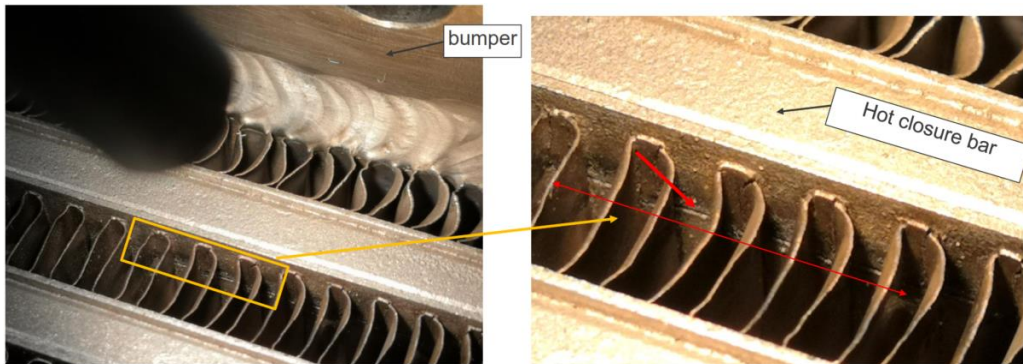
- To day, 3 PCE removed during troubleshooting or maintenance actions on the bleed system and confirmed leaking out of CMM tolerance.
 - The leakage didn't generate a failure message at bleed system or engine level during operation.
-
- RIL CS-RIL-36-10-0010 issued in coordination with Airbus Canada [July 20] for PCE inspection guidance on the cold outlet :
 1. Precooler should be considered serviceable if no associated Caution or Warning message was reported prior to.
 2. PCE to be replaced only if the hot closure bar is starting to move outside of its position (see next slide for picture details)



Precooler P/N 70263A leakage

Shop findings:

- Main leakage is located under the bumpers (ID plate side), on the cold outlet side.
- The two first parting sheets are cracked on several centimeters and in one case the first hot closure bar was starting to detach and slide outside.
- No brazing defect (manufacturing parameter) was observed on the different removals analyzed by our material laboratory.



Leakage test performed at Liebherr shop during incoming inspection

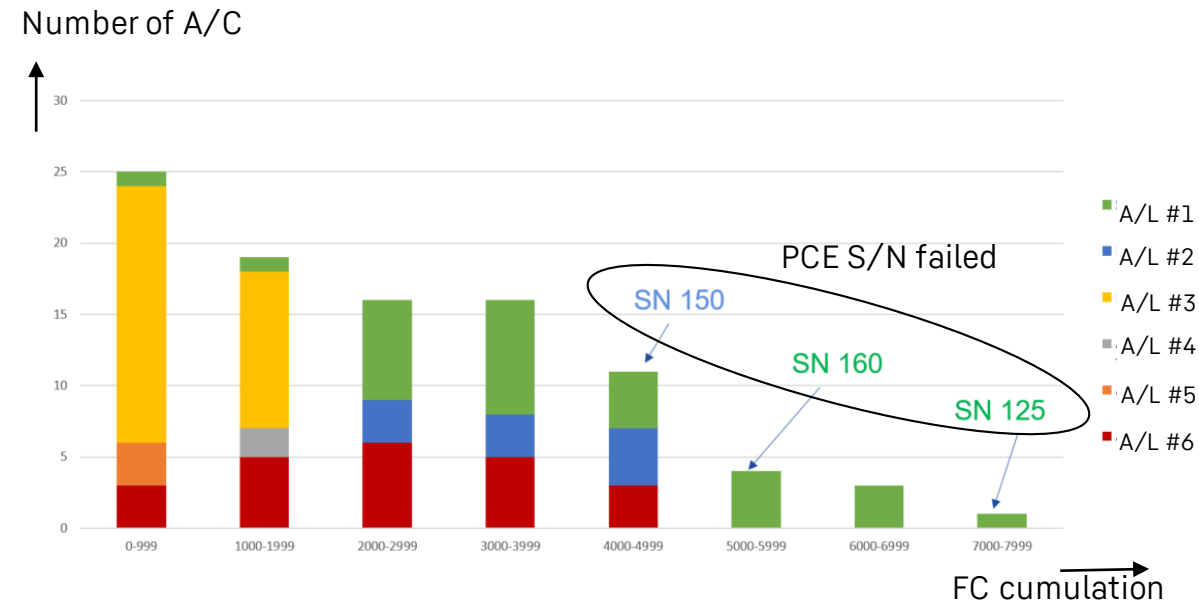
Precooler P/N 70263A leakage

Root Cause status :

- Thermal constraints was identified as major contributor leading to local overstress on cold outlet end sides hot parting sheets. Damage reproduced by calculation on another PCE P/N that has similar failure findings in service.
- Excessive vibrations (second order) FT data used for analysis (PRSOV) : conclusion shows solicitations (around 357 Hz on Y and Z) above what was tested during the qualification test.
- Still open branch : A220 duty cycle with in service data to be analyzed and check if abnormal values (out of development specifications) could cause a premature failure of the PCE not seen during qualification/endurance tests.

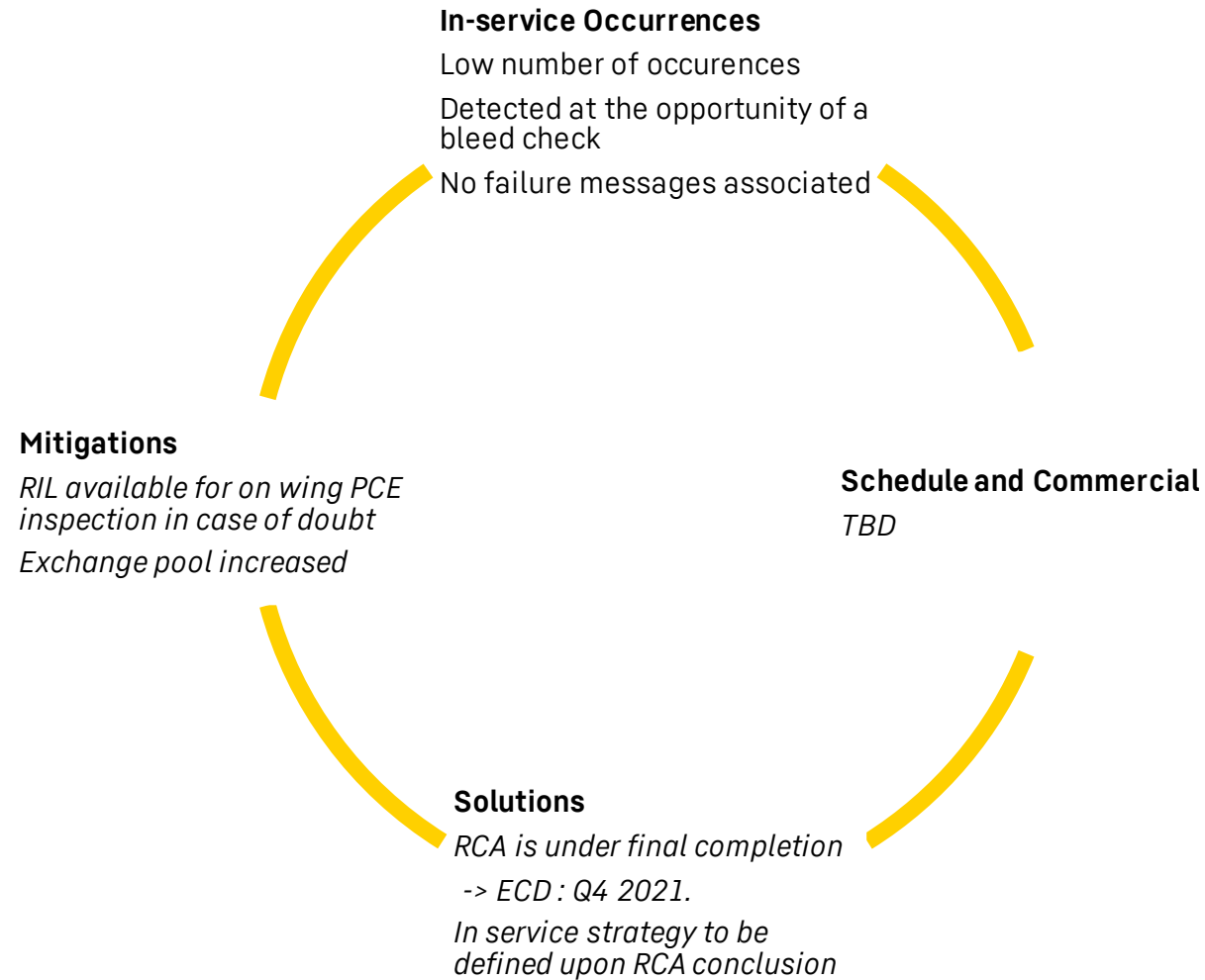
Root cause analysis completion :

1st issue shared with Airbus Canada. RCA update to be done once duty cycle analysis completed (Q4 2021)



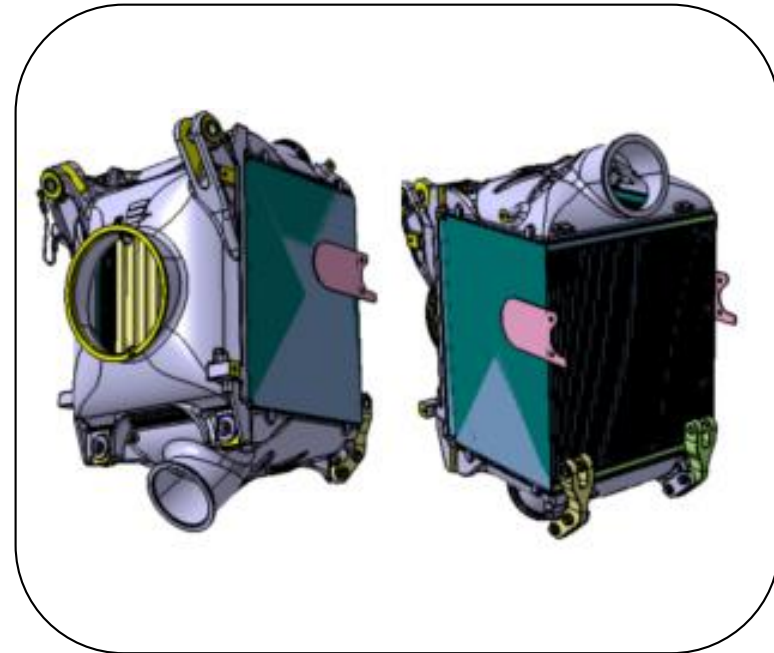
FC are more impacting the PCE than FH cumulation as it creates a thermal stress at each bleed start up or bleed source switching (temperature difference)

PCE leakages – SUM UP



Available documentation:

- Airbus TFU – PCE leakage
- Liebherr RCP A220-36-0383
- Airbus RIL-36-10-0010



Agenda

- 1 Welcome speech
- 2 Fleet data
- 3 **ATA 36 - LTS**
 - 3.1 PRSOV Failed Open
 - 3.2 HPV Failed Closed
 - 3.3 PCE leakage
 - 3.4 **Kidde loop quality issue**
 - 3.5 BALODS / Nuisance messages
- 4 **ATA 21/30 - LTS**
 - 4.1 WAIV premature removals
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 - 4.3 TAPRV removals
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 - 4.5 Soft IASC 6.0 implementation status
 - 4.6 LPGC Cover hard to Open/Close

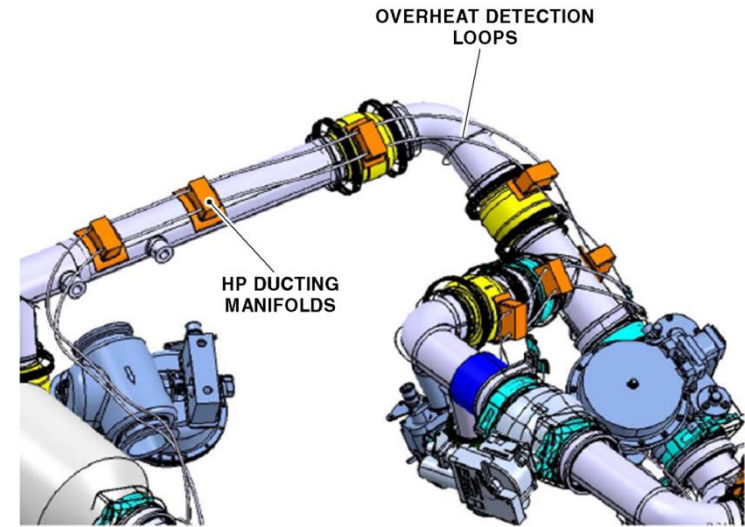
Kidde / Bleed air Leak detection loops inspection

Description:

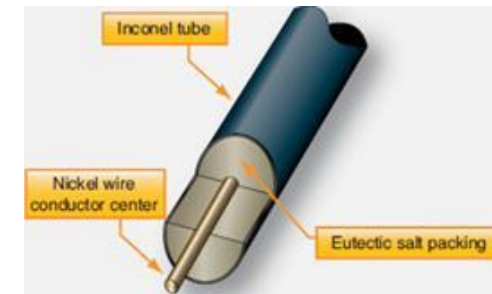
- A bleed air leak and overheat detection system (BALODS) quality issue has been identified by Liebherr following a disclosure letter provided by Kidde Aerospace and Defense (the manufacturer).
- All installed sensing elements on the A220 are potentially impacted.
- The sensing elements may not be able to properly detect leakage in a timely manner

• Operational Impact

- A bleed leak may be undetected or not isolated
- 2 Mandatory service bulletins and one Airworthiness Directive will be released with instructions for inspection/test



TYPICAL BLEED LEAK INSTALLATION



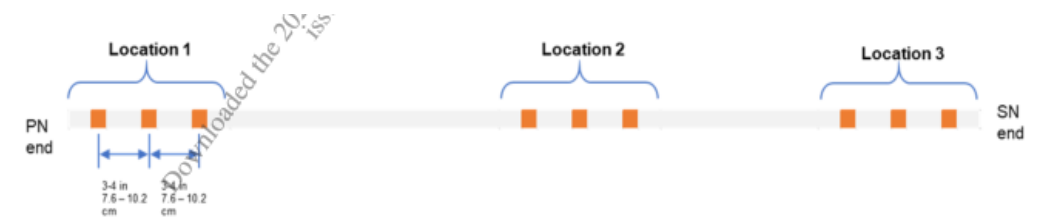
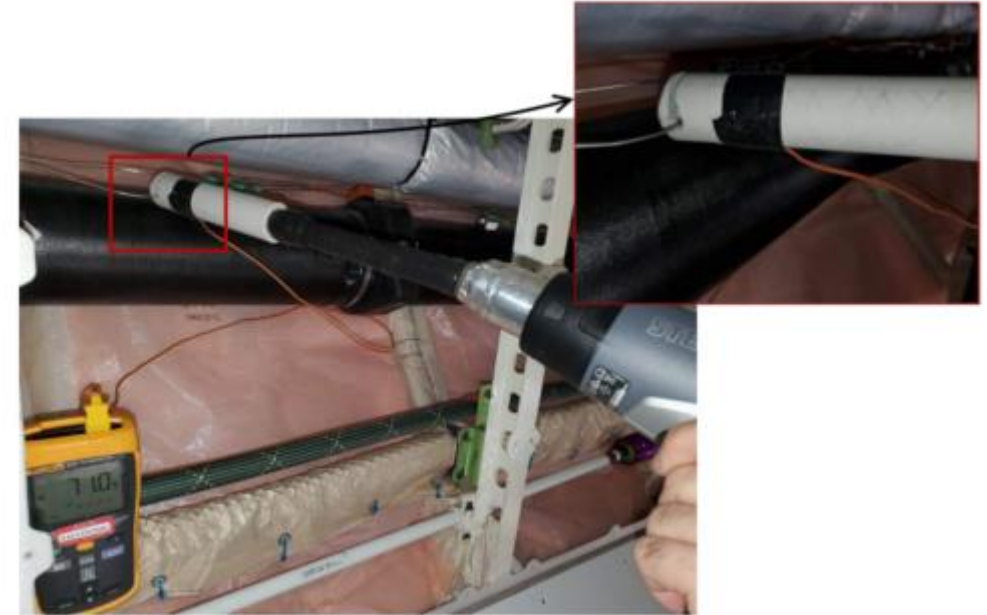
Kidde / Bleed air Leak detection loops inspection

Root cause:

Incompletely filled eutectic salt in sensing elements due to manufacturing equipment issues, combined with deficiencies in their manufacturing process (immersion testing processes) and ATP procedures which were intended to detect the non-conformance.

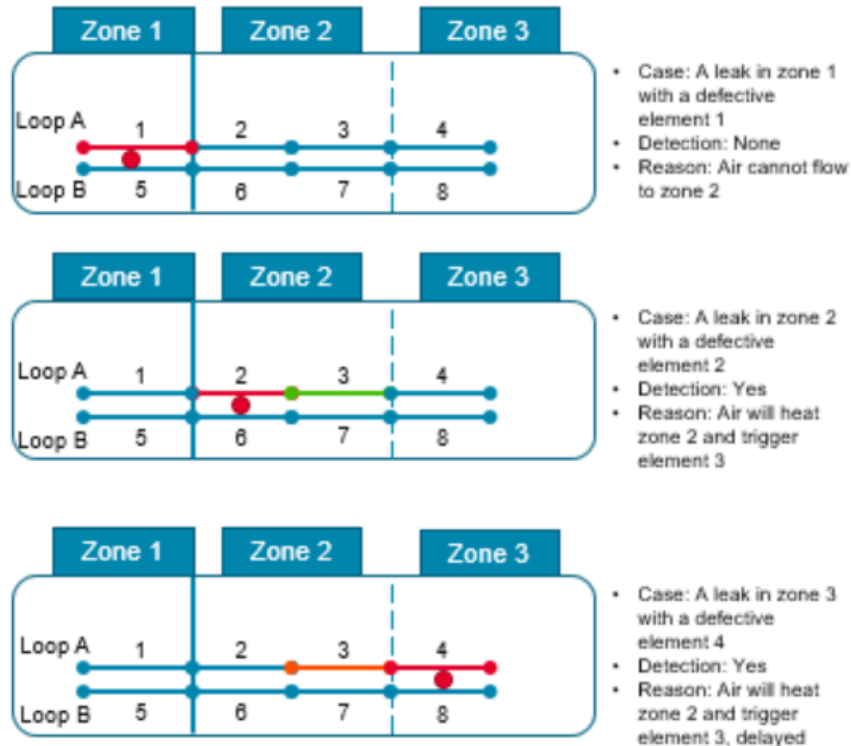
Inspection test :

- Quantity of sensing elements including Loop A & B :
 - 56 sensing elements on A220-100
 - 58 sensing elements on A220-300
- Each sensing element needs to be tested at 3 different locations.
- Required tool : Regulated heat gun equipped with a shielded nozzle
- **Compliance** : Airbus recommends that SB 1 needs to be done at no more than **2450** flight hours, and SB 2 at no more than **8500** FH from the release date.

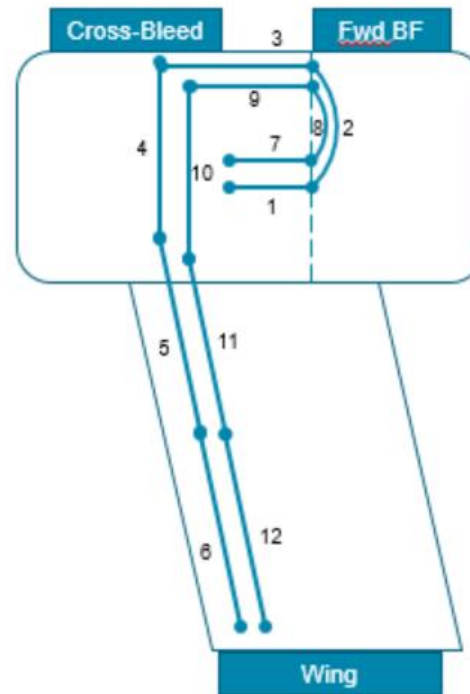


Kidde / Bleed air Leak detection loops inspection

Difference between SB1 and SB2 is regarding the safety risk of non detection of a leak in the associated zone and so, the need for a quick test of the loops in that area.



Existing scenario with a defective element



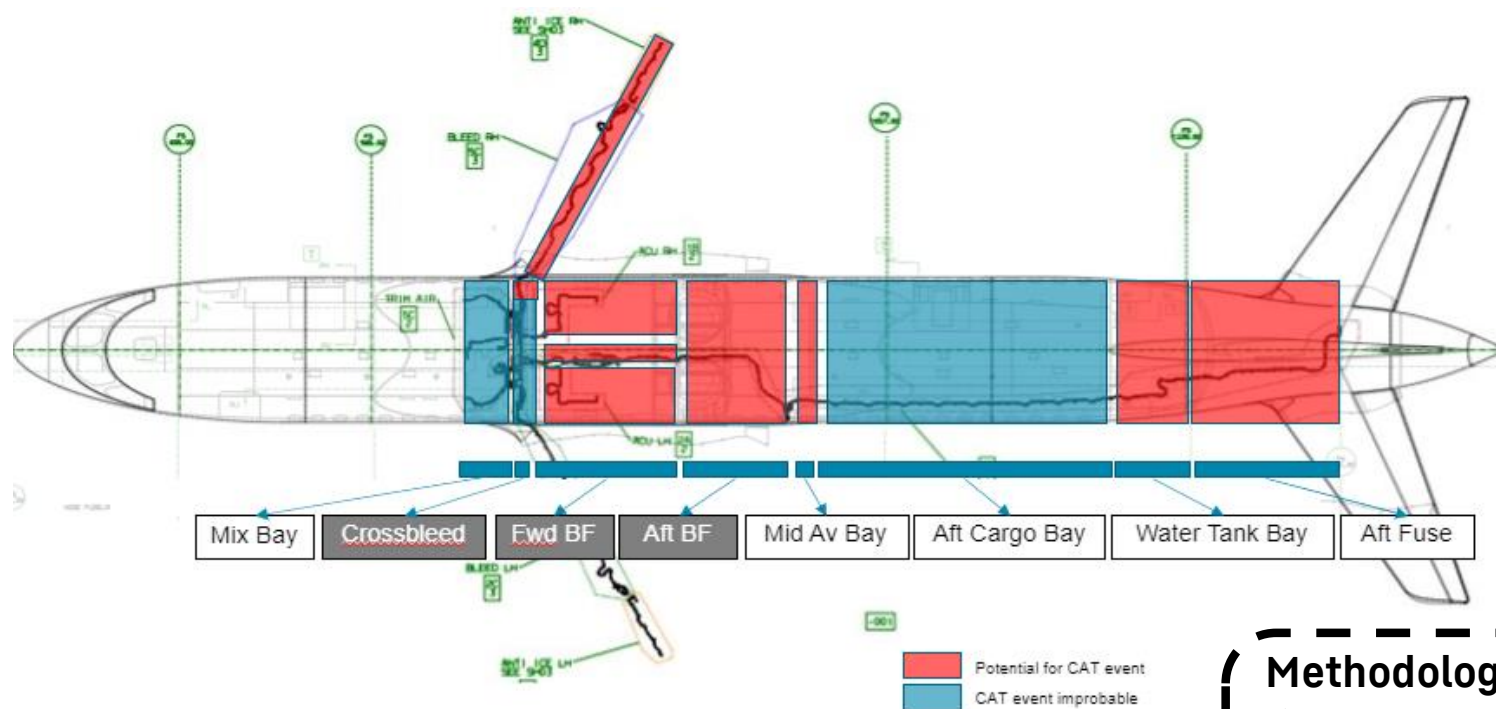
Loop name	Aircraft zone	Loop Chanel	Ref connector	Sensing element item ref.	Recommended Inspection Delay
LHS BLEED LOOP	FWD Fuse	Ch A	MT530	2	2450h
		Ch B	MT540	8	2450h
	Cross-Bleed	Ch A	MT557	1	Possible extension
			MT531	3	Possible extension
			MT532	4	Possible extension
		Ch B	MT558	7	Possible extension
			MT541	9	Possible extension
			MT542	10	Possible extension
	Wing	Ch A	MT533	5	2450h
			MT534	6	2450h
		Ch B	MT543	11	2450h
			MT544	12	2450h

SB2

SB1

Illustration of the analysis for LHS Bleed loop

Aircraft was divided in 8 separate zones in the fuselage and 1 zone in the wings



Methodology :

- ✓ Zones definition : according to air volumes and existing thermo models.
- ✓ For each zone, all critical equipment and structure components were identified.
- ✓ For each critical component or structure, thermal case conditions were set (with bleed leak flow and temperature) and secondary detection, if possible.

Kidde / Bleed air Leak detection loops inspection

Mitigation :

- Airbus Canada completed testing of sensing elements installed on production aircraft and in FAL stock. Non-conformant sensing elements were returned to Kidde (= 1.26%)
- FAL Cut In for test prior delivery: **50060/55110**

Status:

- A Continuing Airworthiness case has been raised to assess the situation. Required action is to test (on wing) all affected sensing elements and replace non-conforming sensing elements.
- Kidde's assessment of the number of sensing elements impacted (after testing) is <2% of the total population – all will need to be tested . SB CFD-26-1 released in May for off wing test

Terminating Action :

- Service Bulletin 1 and 2 to be released with different PN to be tested and different reaction times for implementation (respectively 2450 FH and 8500 FH)
- Kidde will make available some spare parts (loops/HW, consumables) to backstop inspection findings, ETA from SB release, allocation based on operators' feedback (inspection plan).
- Inspection tools-instruments to support in-service inspection can be ordered at SATAIR.

**Service Bulletin 1 is in validation with TCCA.
Expected in November
2021. TCCA AD expected to follow**

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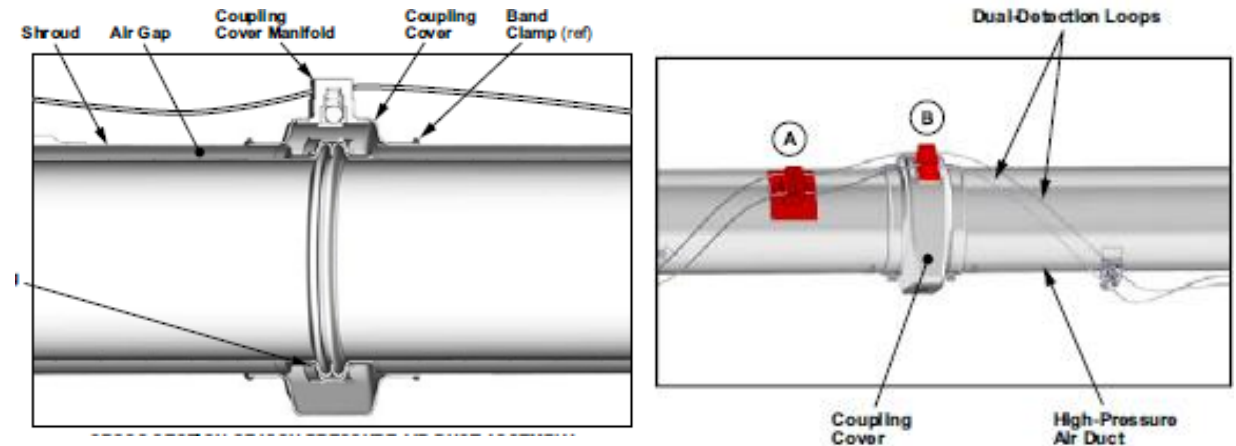
LEAK DET FAULT (A) with 36 LEAK DET FAULT LOOP REDUND LOSS (INFO)

Description:

- Multiple events of:
LEAK DET FAULT (A) with 36 LEAK DET FAULT LOOP REDUND LOSS (INFO) are being reported on ground or during engine start (most common), in cruise
- This failure message occurs when one of the loops is seen faulty (no leak detection)
 - Could be due to broken loop, connector failures (short/open), installation

Operational Impact

- Troubleshooting to confirm faulty loop or nuisance



LEAK DET FAULT (A) with 36 LEAK DET FAULT LOOP REDUND LOSS (INFO)

Root Cause Investigation

- Hardware level :
 - On-going with Kidde
 - Need to have feedback from operators on loops conditions when the failure is confirmed
 - Pictures of installation prior to removal and pictures of removed loops and connectors
 - Confirmation that installation meets AMP requirements (clearances, routing, bend radius)
- Software level :
 - HMU report #446 created to :
 - Assist in troubleshooting (provides % location on sensing element length when OMS cannot provide)
 - Required to collect data for root cause identification and corrective action of nuisances

Terminating action

- Corrective action will only be possible by performing intermittent nuisance messages analysis with sufficient data from HMU report #446 provided to Airbus Canada/Liebherr.

Airbus A220

ATA 21/30

LIEBHERR

Liebherr-Aerospace Toulouse



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WAIV 60097B02 – Premature removals

Description:

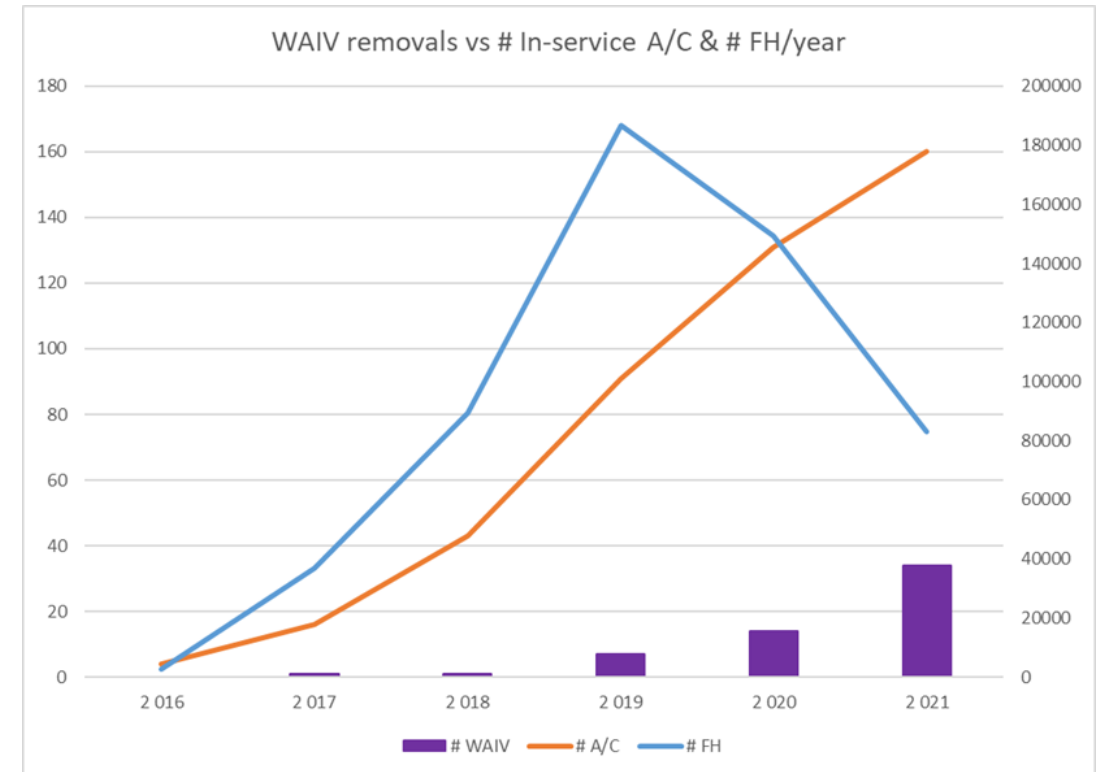
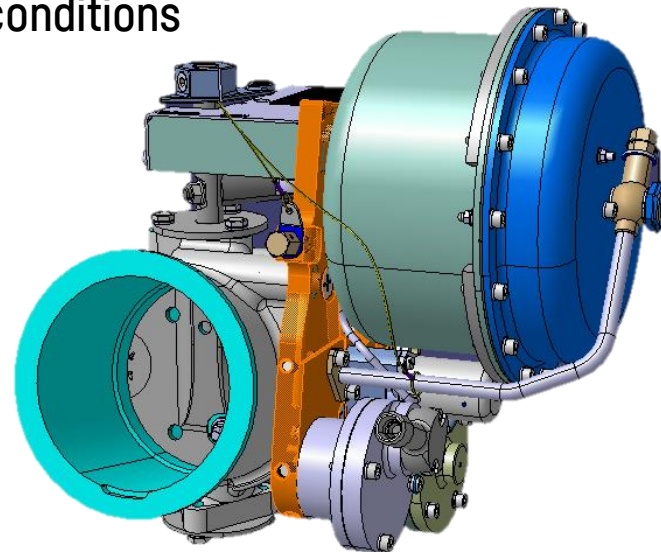
Removals are increasing since 2020, with the same trend than the number of operating A/C, but faster than the total flight hours performed per year.

A/C Level:

Events occur both in flight or in ground

Operational impact: MMEL application

=> no flight in icing conditions

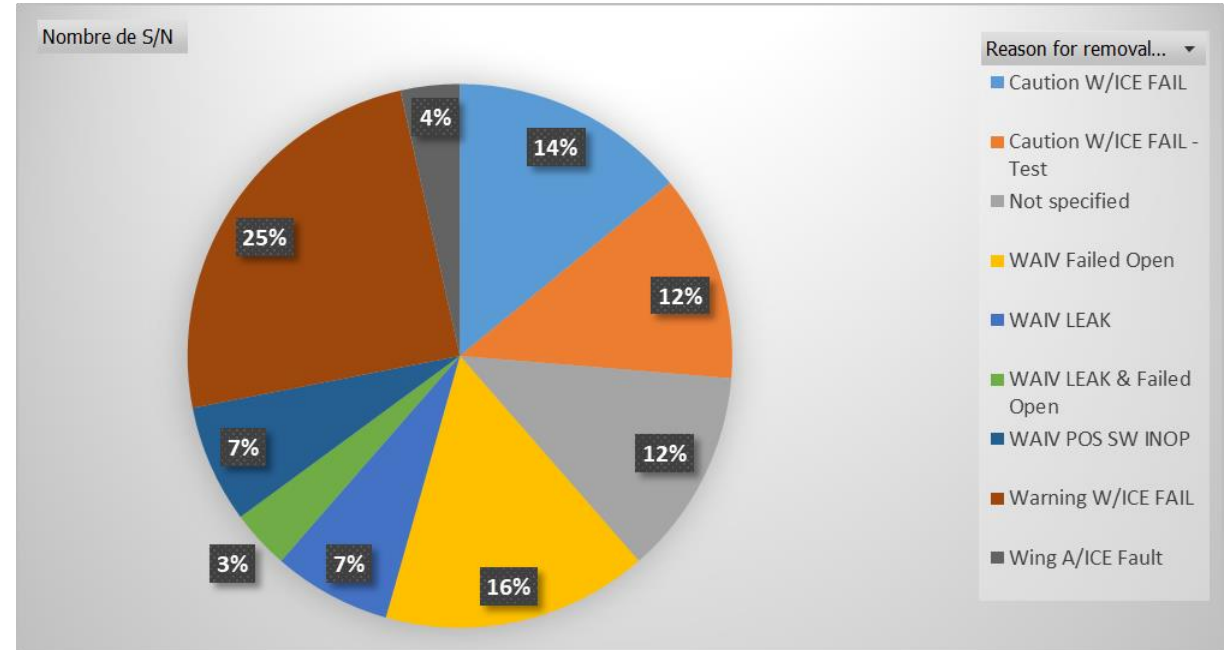


WAIV 60097B02 – Premature removals

Description:

Main reasons for removal, as per repair order data, are :

- L/R WING A/ICE FAIL [301W01/02]
- WING A/ICE FAIL [301C07]
- L/R WING A/ICE VLV FAIL OPEN [301N21/22]

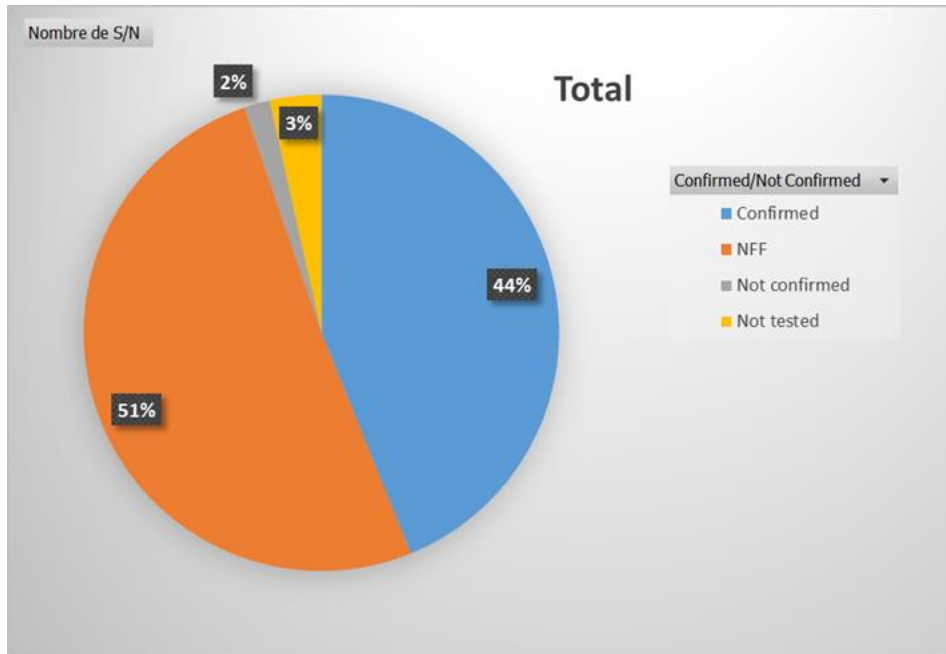


WAIV 60097B02 – Premature removals

Shop findings :

More than half of the removals are NFF or not confirmed

For the confirmed removals, main findings are pollution [14%] and solenoid failure [9%]



Root Cause Analysis

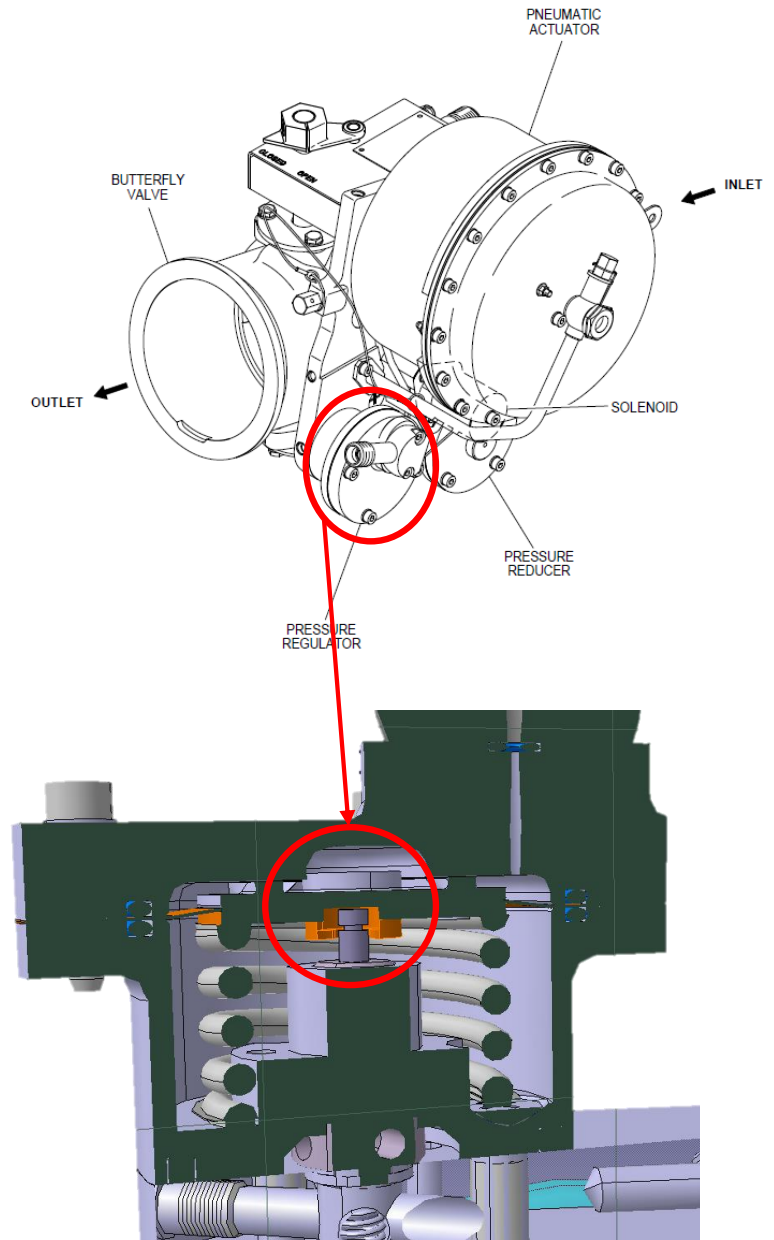
High NFF rate could be due to :

1. Failure mode not detected during incoming test
2. Nuisance messages

WAIV 60097B02 – Premature removals

1. Regulator diaphragm issue

- Few cases of unexpected contact between regulator diaphragm and regulator clapper were reported
- This phenomenon can only be detected during hot temperature tests and lead to pressure regulation drift
- Previously not performed on repaired valves
- Associated failure messages
 - 30 L WING A/ICE FAIL - L WING PRESS FAIL or 30 R WING A/ICE FAIL - R WING PRESS FAIL (Info) associated to L/R WING A/ICE FAIL(Warning)

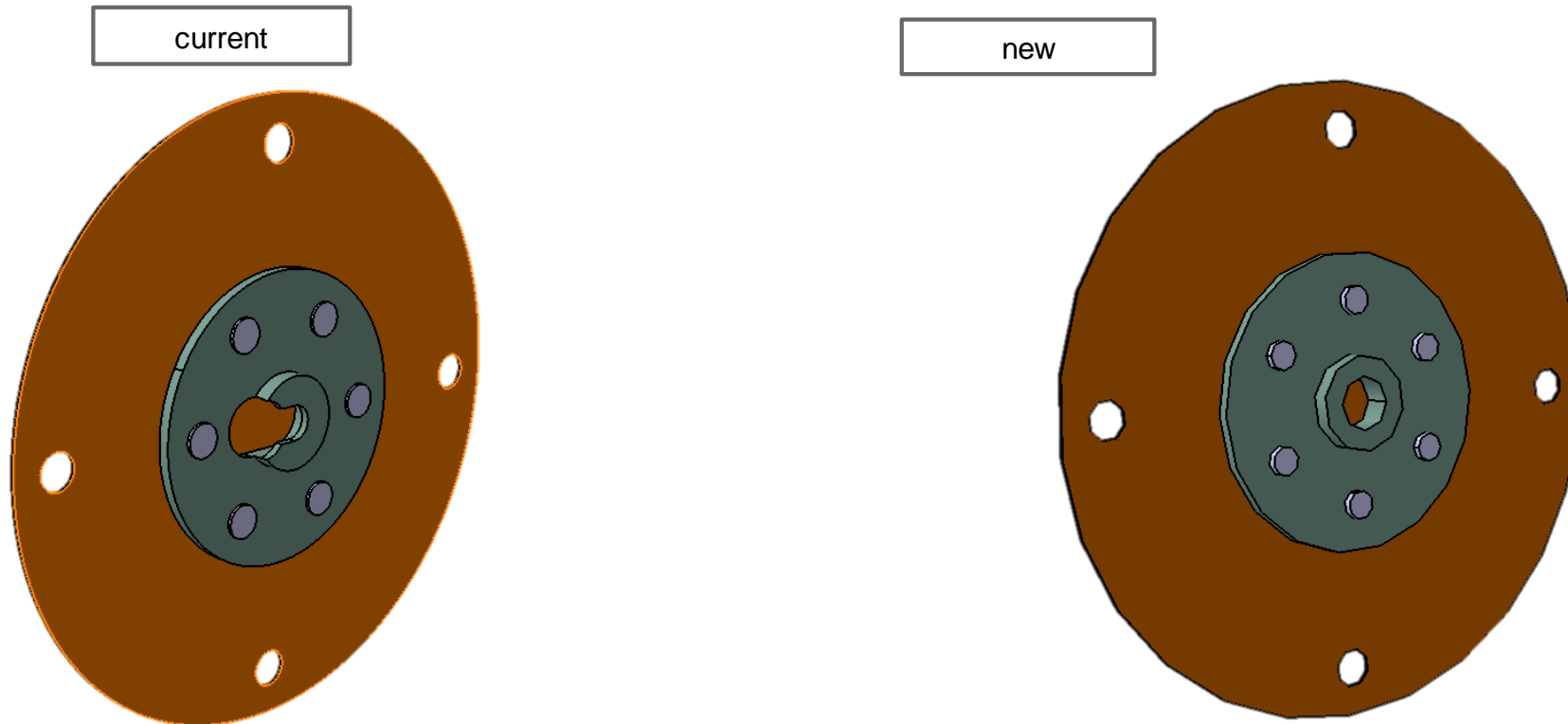


WAIV 60097B02 – Premature removals

Diaphragm issue :

Mitigation : Hot temperature tests systematically done since April 2021

Solution : diaphragm design improvement to avoid contact with clapper



WAIV 60097B02 – Premature removals

2 nuisance messages has been detected for WAIV

a) at A220 EIS, on WAI AUTO mode, L and R WING A/ICE FAIL (W) messages posted when the aircraft exiting icing conditions or after WAIS daily test

Mitigation : SL CS-SL-30-10-0004 (released on December 2017)

1st solution : inhibition of the message implemented in Avionic Built 8A2 (deployed at the same than IASC SW6.0)

WAIV 60097B02 – Premature removals

2 nuisance messages has been detected for WAIV

b) IASC SW6.0 leads to following nuisance messages :

At IASC SW6.0 EIS, several occurrences of WAIV Leakage and WAIV Failed Open OMS messages

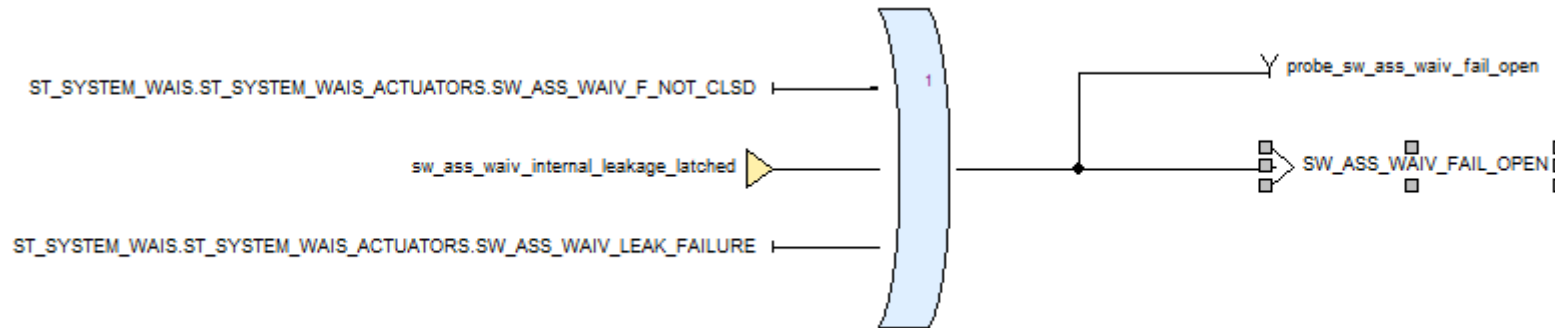
- Messages not systematic
- On ground only

WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

WAIV Fail Open occurred when one of those 3 events is true :

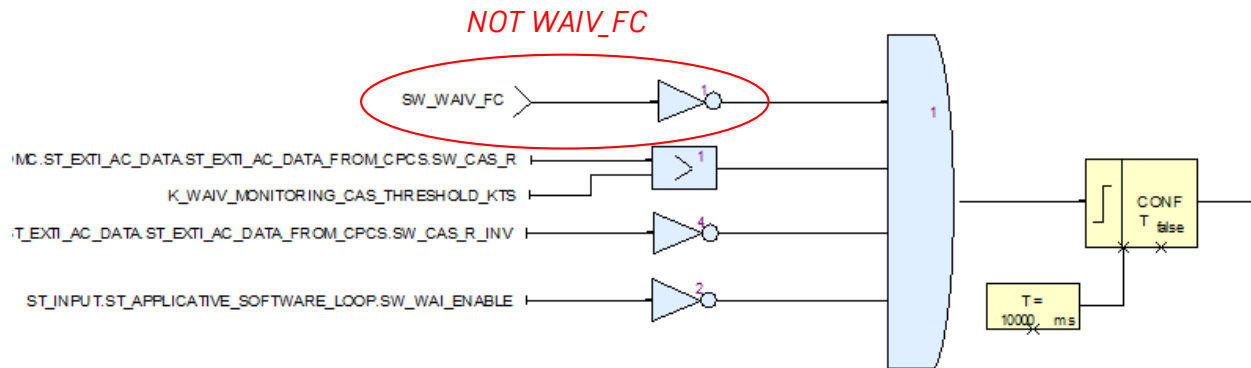
- WAIV Fail Not Closed : WAIV_F_NOT_CLSD
- WAIV internal leakage
- WAIV Leak Failure



WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

- WAIV Fail Not Closed : WAIV_F_NOT_CLSD logic



```

-----
RIGHT WING ANTI ICE VALVE 2 (HP10) Occurences:1 /ACTIVE      3012F0015
FAILED OPEN / REPORTED BY IASC1B  Recurences:0             02DEC2020 16:31:10
OR IASC2B                                                  Flight Phase:TAXI IN
    
```

Parameter Snapshot

```

-----
Integrated Air Sys / 274      / 13      WAI_ON                0
Integrated Air Sys / 355      / 12      OPP_WAIV_FAIL_OPEN     1
Integrated Air Sys / 371      / 23      R_WAIV_Full_Closed     1
Integrated Air Sys / 233      / 17-29   SFY_Opposite_WAI_Temp  148
Integrated Air Sys / 245      / 18-29   SFY_Opposite_WAIS_Outboard_Press 0
Integrated Air Sys / 220      / 17-29   ACS_Bleed_Pressure1    19
Integrated Air Sys / 221      / 17-29   ACS_Bleed_Pressure2    19
Integrated Air Sys / 220      / 17-29   ACS_Bleed_Pressure1    19
Integrated Air Sys / 221      / 17-29   ACS_Bleed_Pressure2    20
Integrated Air Sys / 355      / 11      WATV_FATI_OPEN         0
Integrated Air Sys / 371      / 23      R_WAIV_Full_Closed     1
Integrated Air Sys / 234      / 17-29   SFY_Associated_WAI_Temp 148
Integrated Air Sys / 244      / 18-29   SFY_Associated_WAIS_Outboard_Pre 0
    
```

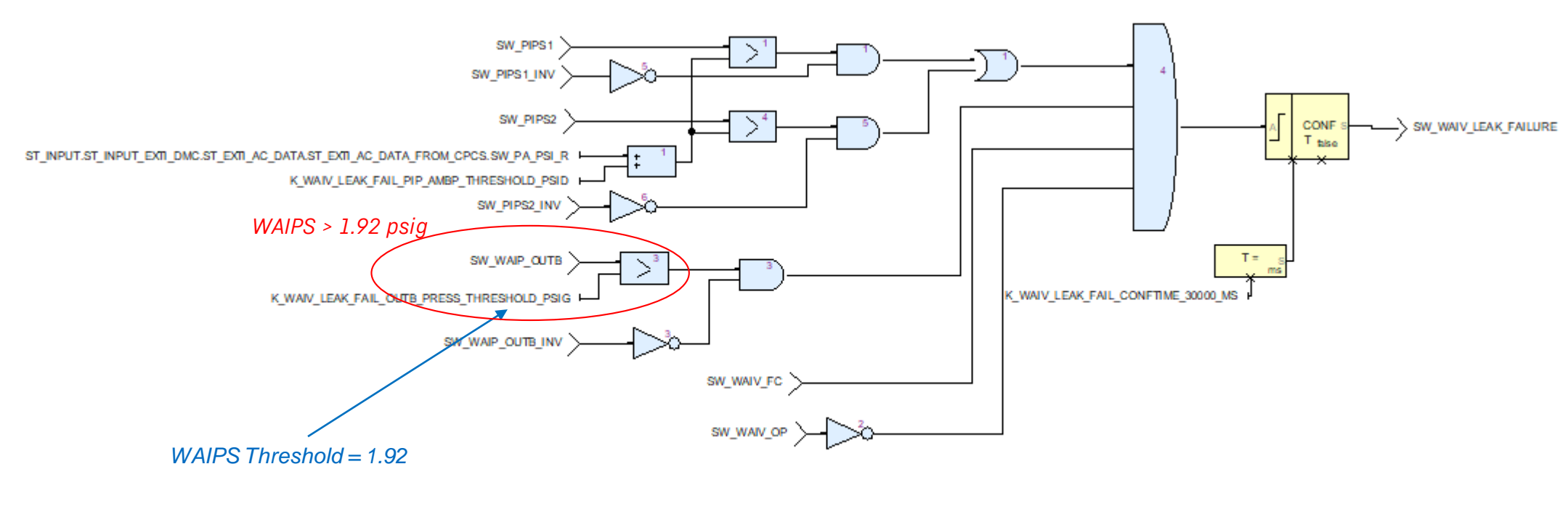
WAIV FC = 1
 ⇒ WAIV_F_NOT_CLSD = 0

⇒ WAIV Fail Open is not due to this failure

WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

- WAIV Leak Failure logic



WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

- WAIV Leak Failure logic

```
-----  
RIGHT WING ANTI ICE VALVE 2 (HP10) Occurrences:1 /ACTIVE      3012F0015  
FAILED OPEN / REPORTED BY IASC1B Recurrences:0              02DEC2020 16:31:10  
OR IASC2B                                                    Flight Phase:TAXI IN
```

Parameter Snapshot

```
Integrated Air Sys / 274      / 13      WAI_ON                      0  
Integrated Air Sys / 355      / 12      OPP_WAIV_FAIL_OPEN         1  
Integrated Air Sys / 371      / 23      R WAIV Full Closed         1  
Integrated Air Sys / 235      / 17-29   SFY Opposite WAI Temperature 148  
Integrated Air Sys / 245      / 18-29   SFY Opposite_WAIS_Outboard_Press 0  
Integrated Air Sys / 220      / 17-29   ACS_Bleed_Pressure1        19  
Integrated Air Sys / 221      / 17-29   ACS_Bleed_Pressure2        19  
Integrated Air Sys / 220      / 17-29   ACS_Bleed_Pressure1        19  
Integrated Air Sys / 221      / 17-29   ACS_Bleed_Pressure2        20  
Integrated Air Sys / 355      / 11      WAIV_FAIL_OPEN             0  
Integrated Air Sys / 371      / 23      R WAIV Full Closed         1  
Integrated Air Sys / 234      / 17-29   SFY Associated WAI Temp     148  
Integrated Air Sys / 244      / 18-29   SFY_Associated_WAIS_Outboard_Pre 0
```

WAIPS = 0 < 1.92

⇒ WAIV_Leak_Failure = 0

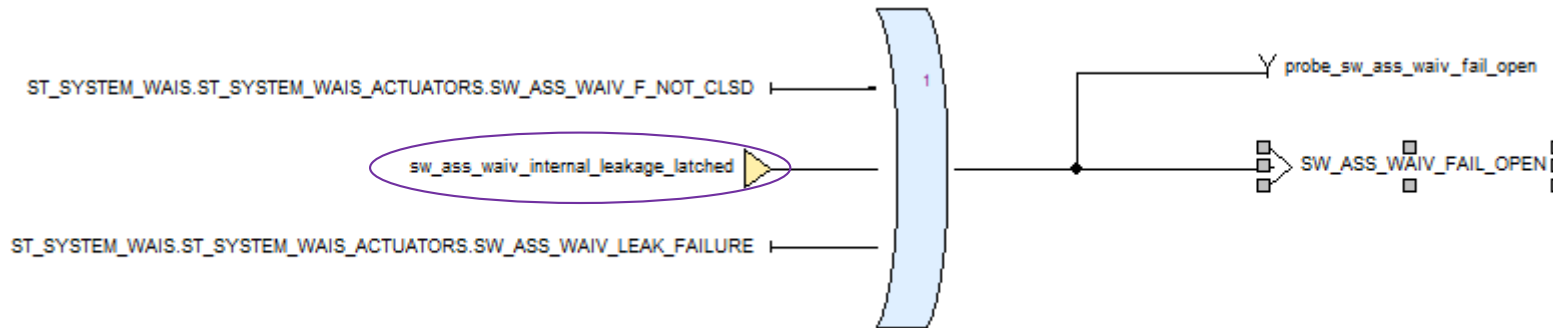
⇒ WAIV Fail Open is not due to this failure

WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

WAIV Fail Open occurred when one of those 3 events is true :

- ➔ ~~WAIV Fail Not Closed : WAIV_F_NOT_CLSD~~
- **WAIV internal leakage**
- ➔ ~~WAIV Leak Failure~~



WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

- WAIV internal leakage logic

Set threshold :

if OAT < 25°C => 157°C

if OAT >=25°C => 170°C

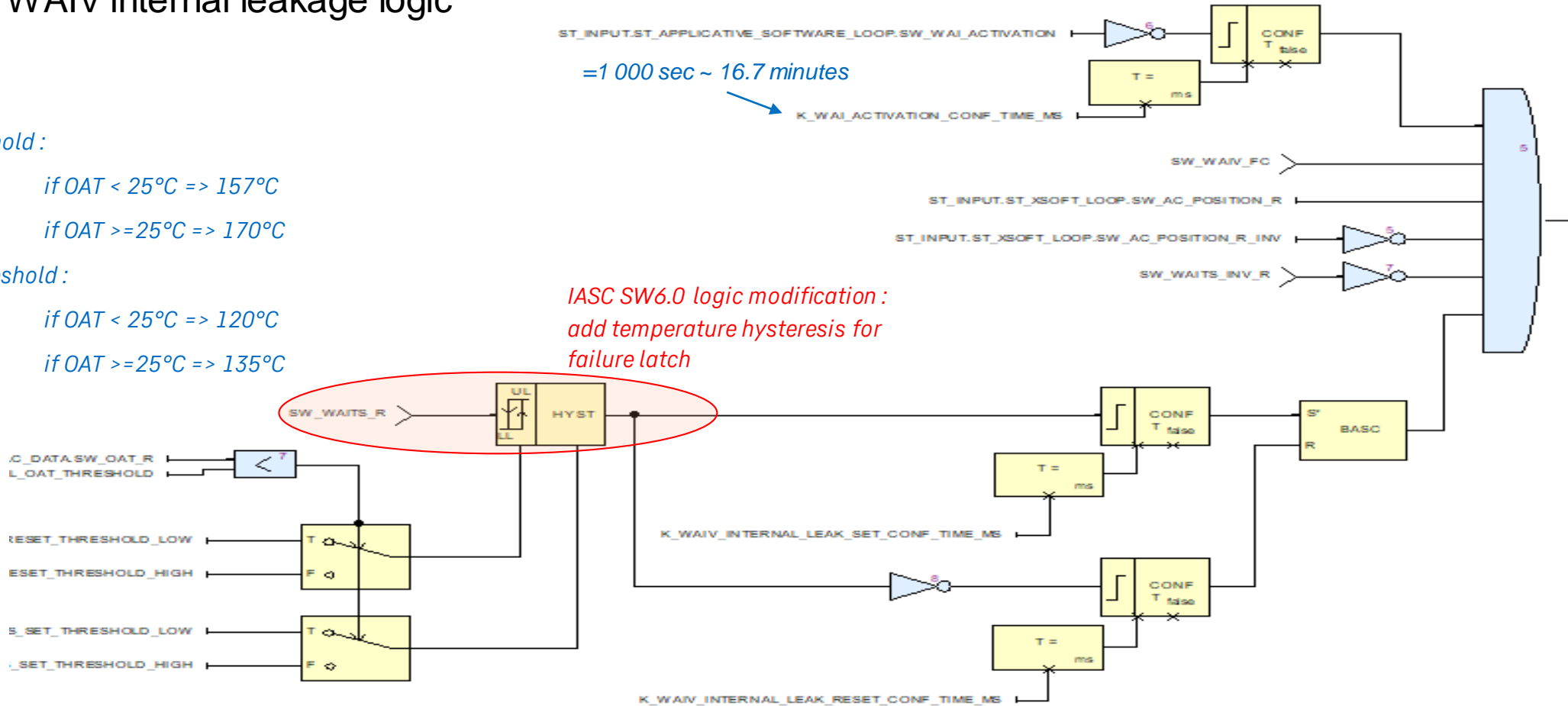
Reset threshold :

if OAT < 25°C => 120°C

if OAT >=25°C => 135°C

=1 000 sec ~ 16.7 minutes

*IASC SW6.0 logic modification :
add temperature hysteresis for
failure latch*



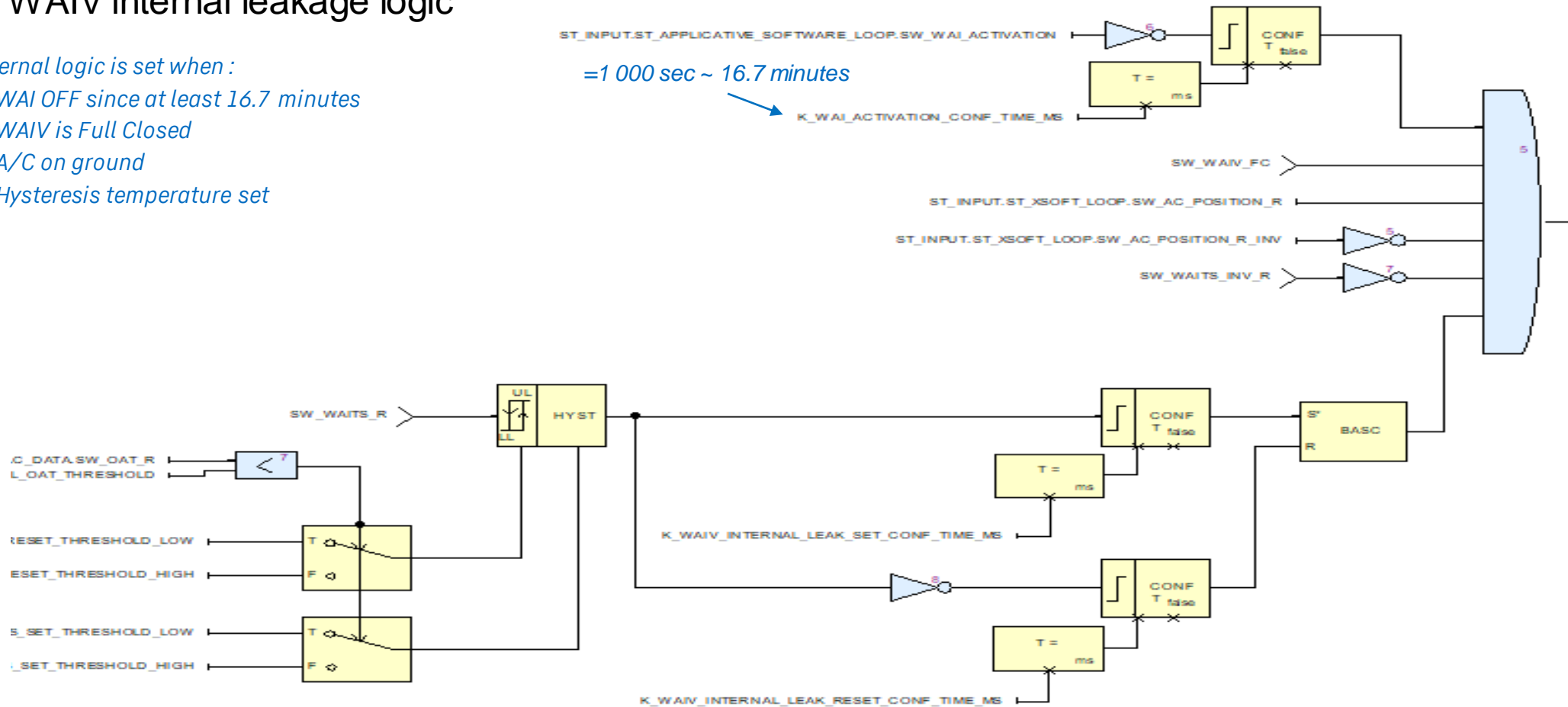
WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

➤ WAIV internal leakage logic

WAIV internal logic is set when :

- WAI OFF since at least 16.7 minutes
- WAIV is Full Closed
- A/C on ground
- Hysteresis temperature set



WAIV 60097B02 – Premature removals

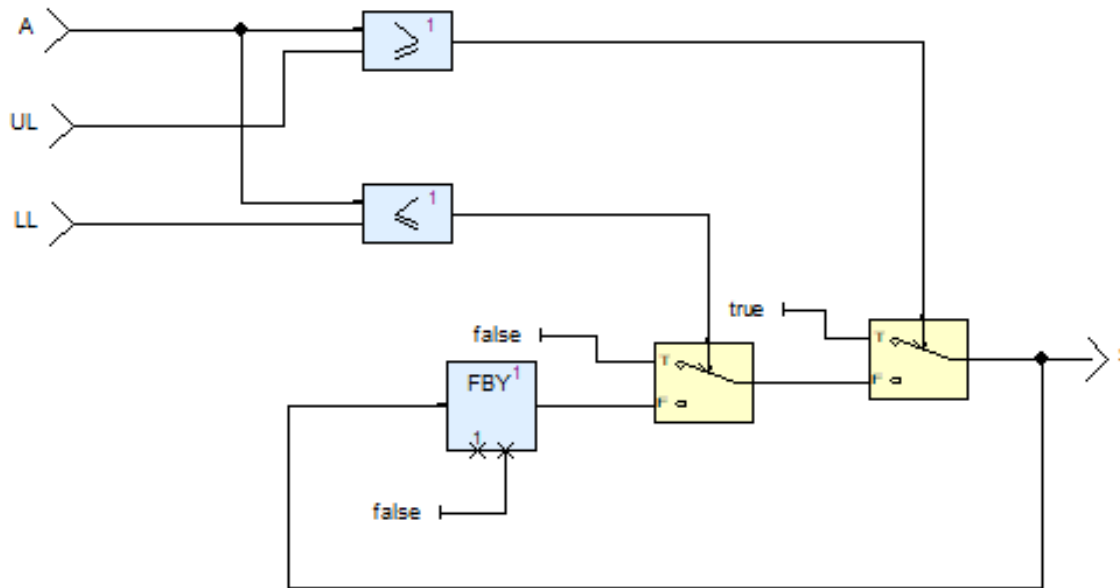
IASC SW6.0 leads to following nuisance messages :

- Temperature hysteresis logic

*A : measured value
= WAITS*

*UL : Upper Level
= set threshold*

*LL : Lower Level
= reset threshold*



*Output S is set at TRUE if WAITS ≥ (157 or 170 °C)
depending of SW_OAT_R value*

*Output S is set at FALSE if WAITS ≤ (120 or 135°C)
depending of SW_OAT_R value*

In other case, previous value remains :

- *if (120 or 135°C) ≤ WAITS ≤ (157 or 170 °C) and
S = 1 because WAITS was higher than 157 or
170 °C before, therefore S remains at 1.*

WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

- WAIV internal leakage logic

```
-----  
RIGHT WING ANTI ICE VALVE 2 (HP10) Occurrences:1 /ACTIVE      3012F0015  
FAILED OPEN / REPORTED BY IASC1B Recurrences:0              02DEC2020 16:31:10  
OR IASC2B                                                    Flight Phase:TAXI IN
```

Parameter Snapshot

```
Integrated Air Sys / 274      / 13      WAI_ON                0  
Integrated Air Sys / 355      / 12      OPP_WAIV_FAIL_OPEN   1  
Integrated Air Sys / 371      / 23      R_WAIV_Full_Closed   1  
Integrated Air Sys / 235      / 17-29   SFY_Opposite_WAI_Temperature 148  
Integrated Air Sys / 245      / 18-29   SFY_Opposite_WAIS_Outboard_Press 0  
Integrated Air Sys / 220      / 17-29   ACS_Bleed_Pressure1  19  
Integrated Air Sys / 221      / 17-29   ACS_Bleed_Pressure2  19  
Integrated Air Sys / 220      / 17-29   ACS_Bleed_Pressure1  19  
Integrated Air Sys / 221      / 17-29   ACS_Bleed_Pressure2  20  
Integrated Air Sys / 355      / 11      WAIV_FAIL_OPEN       0  
Integrated Air Sys / 371      / 23      R_WAIV_Full_Closed   1  
Integrated Air Sys / 234      / 17-29   SFY_Associated_WAI_Temp 148  
Integrated Air Sys / 244      / 18-29   SFY_Associated_WAIS_Outboard_Pre 0
```

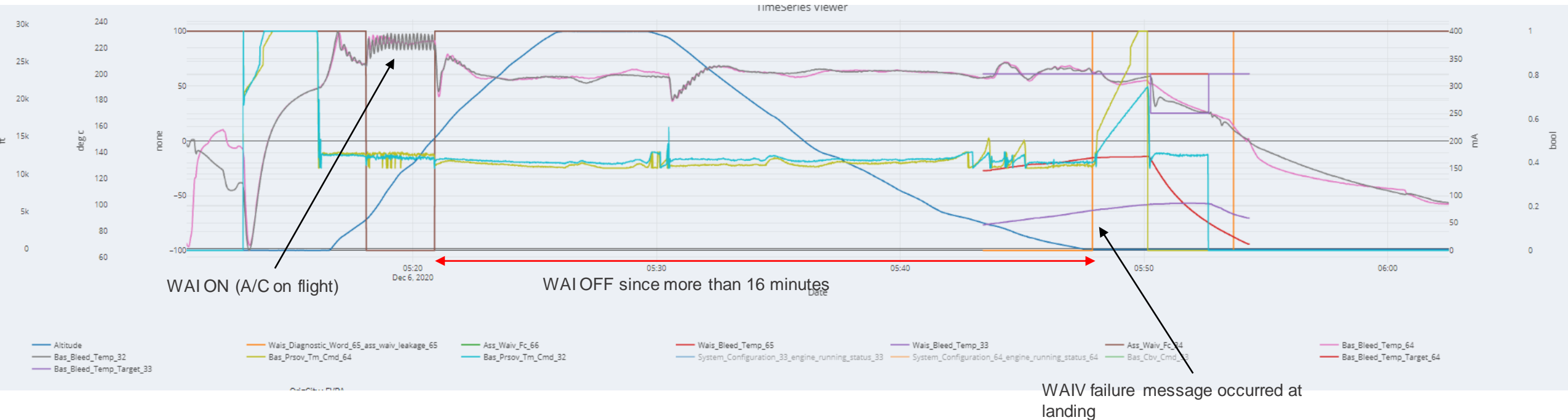
120°C < WAITS < 157°C
⇒ WAIV_internal_leakage = 1

⇒ Leading to WAIV Fail Open

WAIV 60097B02 – Premature removals

IASC SW6.0 leads to following nuisance messages :

- WAIV internal leakage logic



WAIV 60097B02 – Premature removals

2 nuisance messages has been detected for WAIV

b) IASC SW6.0 leads to following nuisance messages :

L/R WING ANTI ICE VALVE FAILED OPEN (maint. message) [3012F0008/3012F0015] and L/R WING ANTI ICE VALVE LEAKAGE (maint. message) [3012F0019/3012F0020] and WING A/ICE FAIL (C) [307C07] nuisance messages on ground with/without 30L/R WING A/ICE FAULT – L/R WING A/ICE VLV LEAK (info) [301N19/301N20]

Mitigation : SL CS-SL-30-10-0007 (released on January 18th 2021)

Final fix : IASC SW7.0 (ECD 2023Q4)

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ACM 70067A – Fan wheel failure

Description:

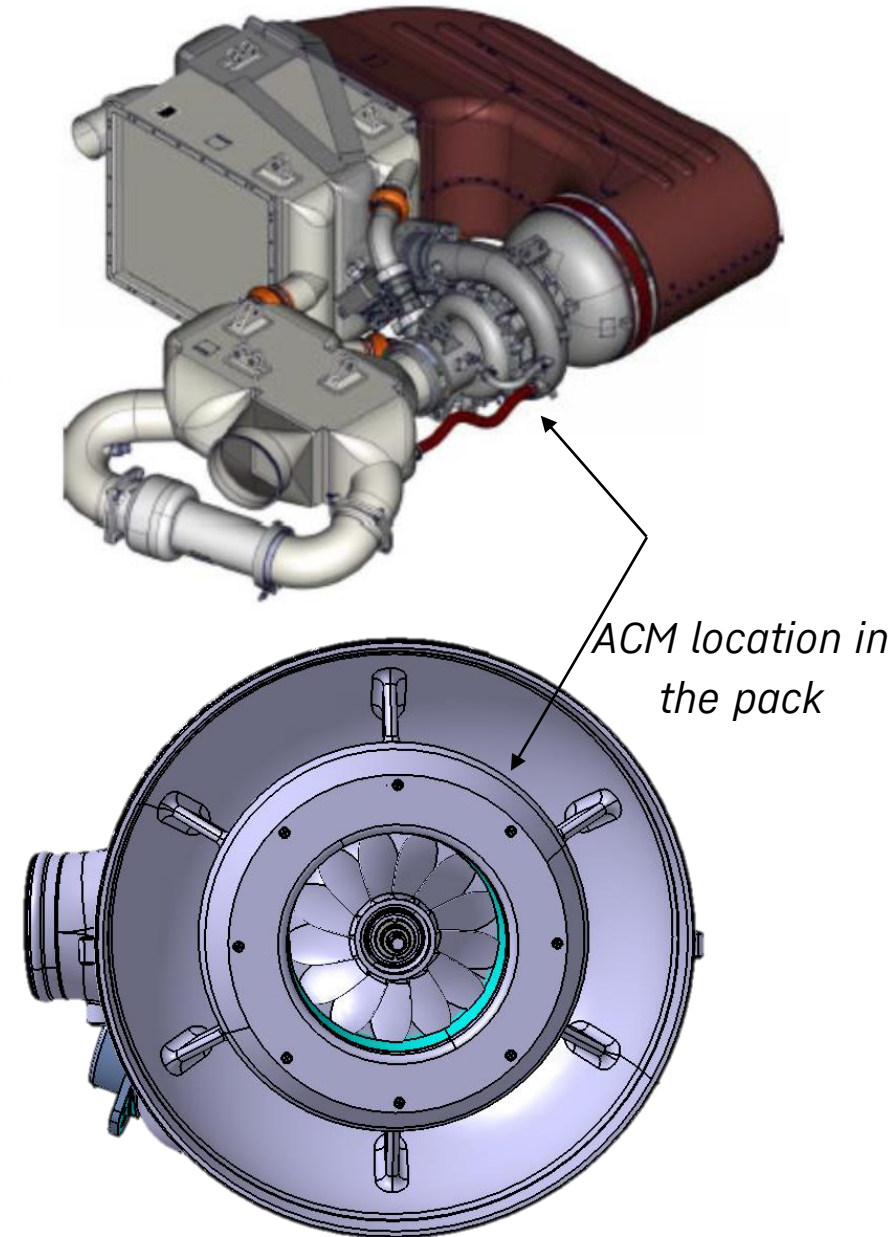
Following one event of ACM fan seizure (3393FH) in 2017, twelve events of ACM fan blade rupture (1700-5400FH, one at 387FH) occurred in 2019-2020 + 4 in 2021.

- A/C level:

Almost all events are identified by :

- loud/strange sound,
- 21 PACK FAULT – L/R BYPASS VLV INOP,
- 21 L/R PACK OVHT – L/R PACK INOP, and pack auto shutdown

In conjunction, failed bypass valves (TCV) were confirmed due the vibrations generated during the ACM failure that caused the TCV motor internal magnet failure.



ACM 70067A – Fan wheel failure

Shop finding :

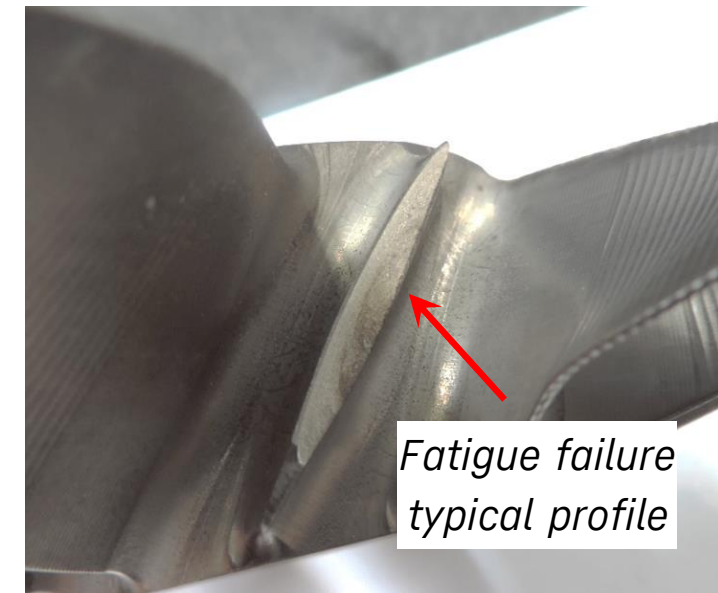
All the failed ACM were found with one or several blades broken.

All observed failures have a typical fatigue fracture cross section with a crack initiation from blade surface

Root cause:

After extensive investigations, the combination of the following causes originates the failure :

- The residual stresses after machining
- The frequency mistuning phenomenon of blades
- The bending stresses induced by the variable aerodynamic flow



ACM 70067A – Fan wheel failure

Solution :

The fan wheel blade design is improved by adding surface treatment process : Shot peening on blade surface.

Improved fan blades were introduced at Airbus Canada production in **Sept 2020**.

To ease the follow up the new ACM you will find here after the S/N point of embodiment (POE): all new parts delivered since mid Aug 2020

- ACM PN 70067A010001 **amdt A** : SN POE : **70067-0500**
- Pack PN 70065B010101 : SN POE : 70065-00428
- Pack PN 70065B010201 : SN POE : 70065-00431

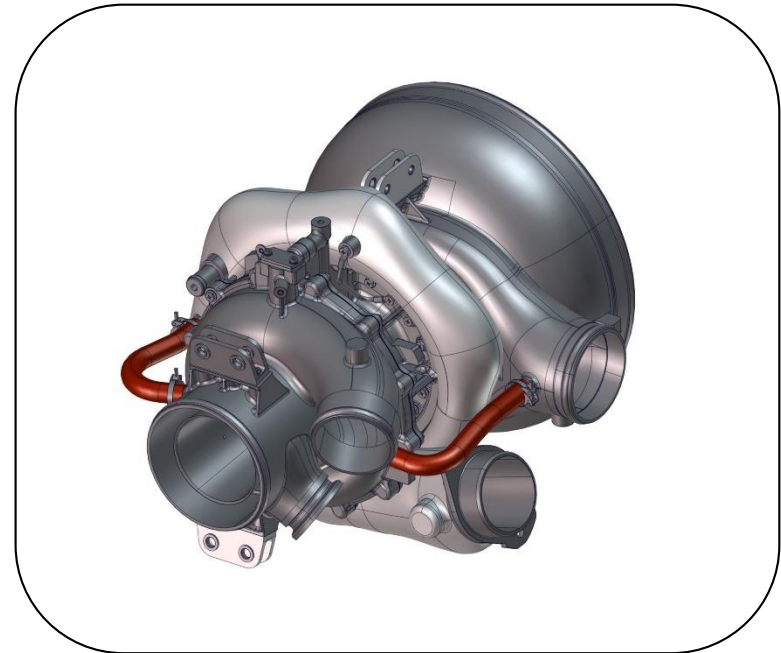
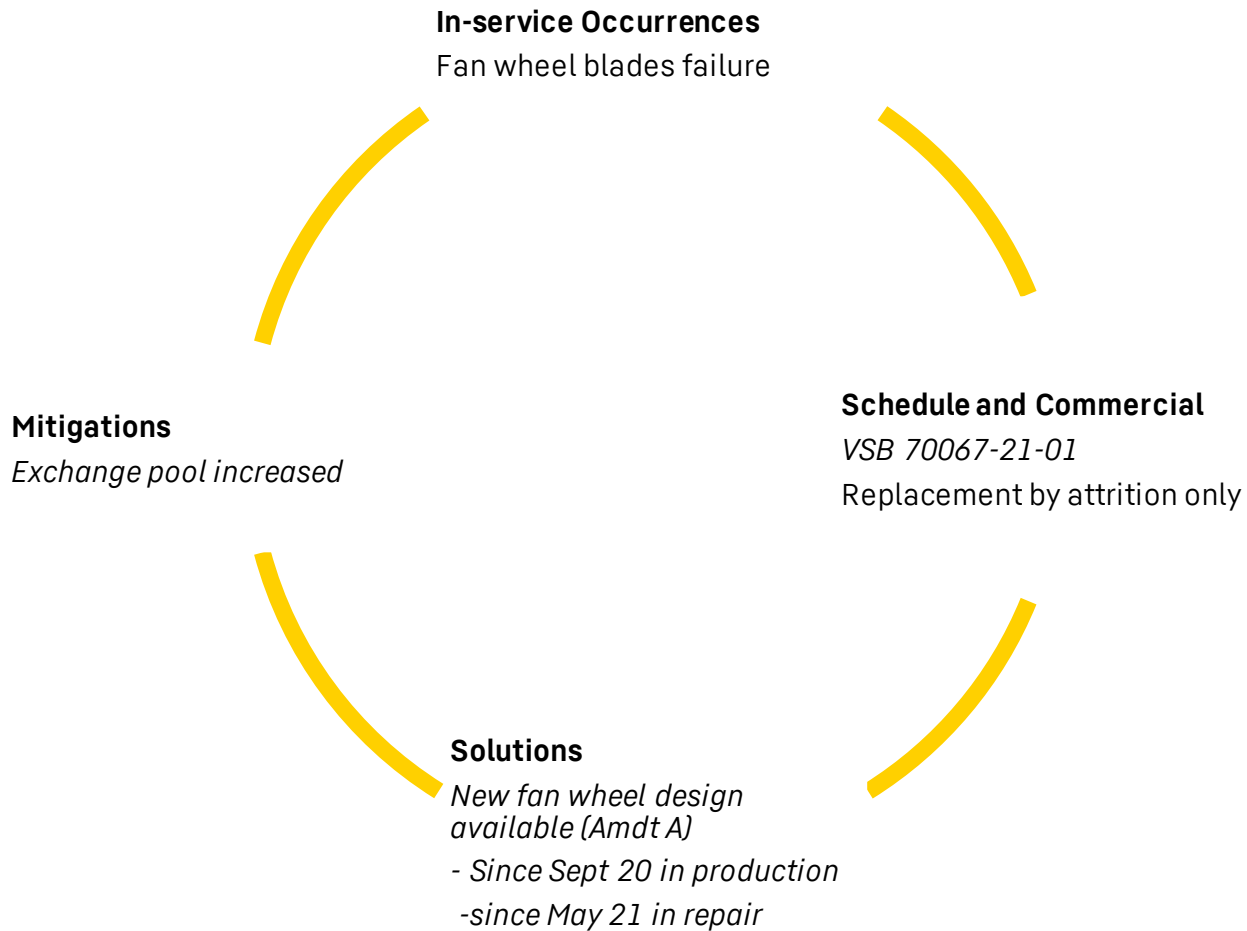
In service strategy :

VSB 70067-21-01 is optional and is implemented on attrition

ACM failure– SUM UP

Available documentation:

- Airbus TFU – ACM failure
- Liebherr RCP A220-21-0368



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 - 4.6 LPGC Cover hard to Open/Close

TAPRV P/N 70121A020001 removals

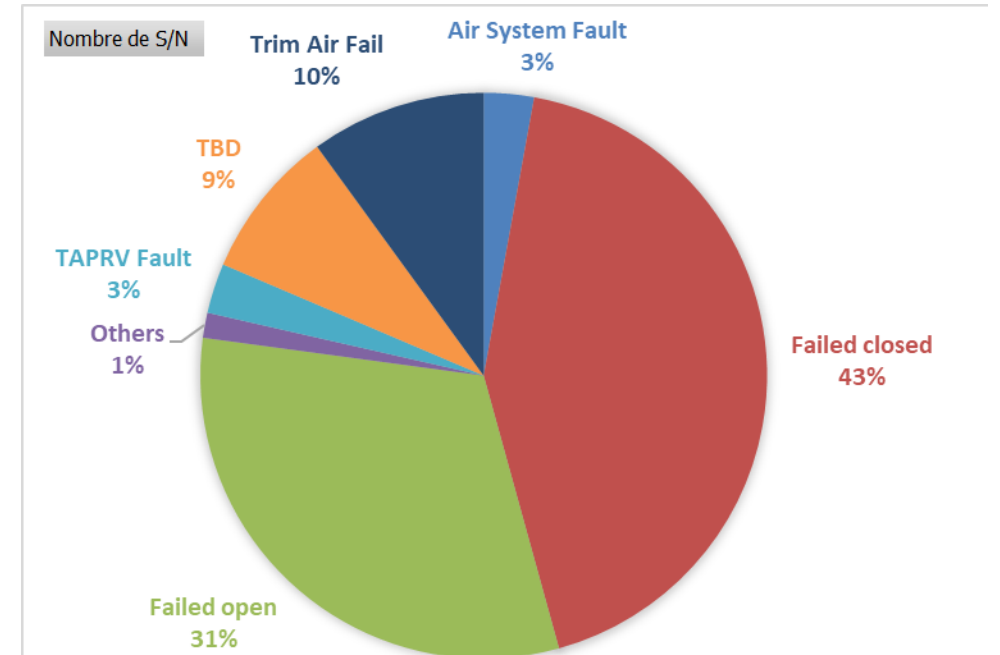
Description:

The failure is reported at **EICAS level** with the following messages :

- AIR SYSTEM FAULT (A) –21 AIR SYSTEM FAULT -TRIM AIR PRV FAIL CLSD (INFO)
- AIR SYSTEM FAULT (A) –21 AIR SYSTEM FAULT -TRIM AIR PRV FAIL OPEN (INFO)

Associated **MDC report** : TRIM AIR PRESSURE REGULATING VALVE FAILED CLOSED (or OPEN) / REPORTED BY IASC2A

- **Operational Impact**
- Unscheduled maintenance for troubleshooting and reset of the trim air system
- Operational impact/ delays for securing the valve in closed position
- No MMEL operational restrictions associated

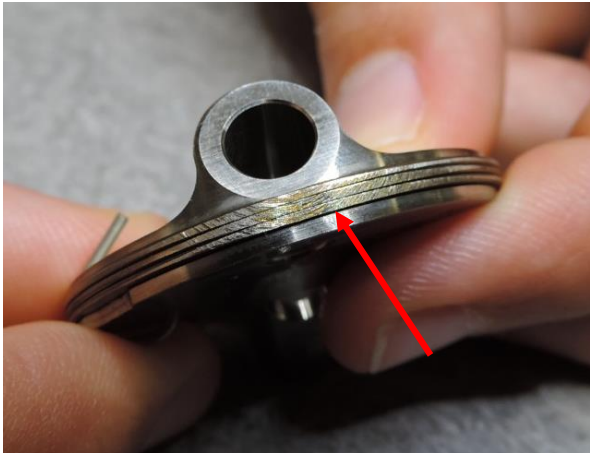


TAPRV reasons for removal since EIS (70 valves)

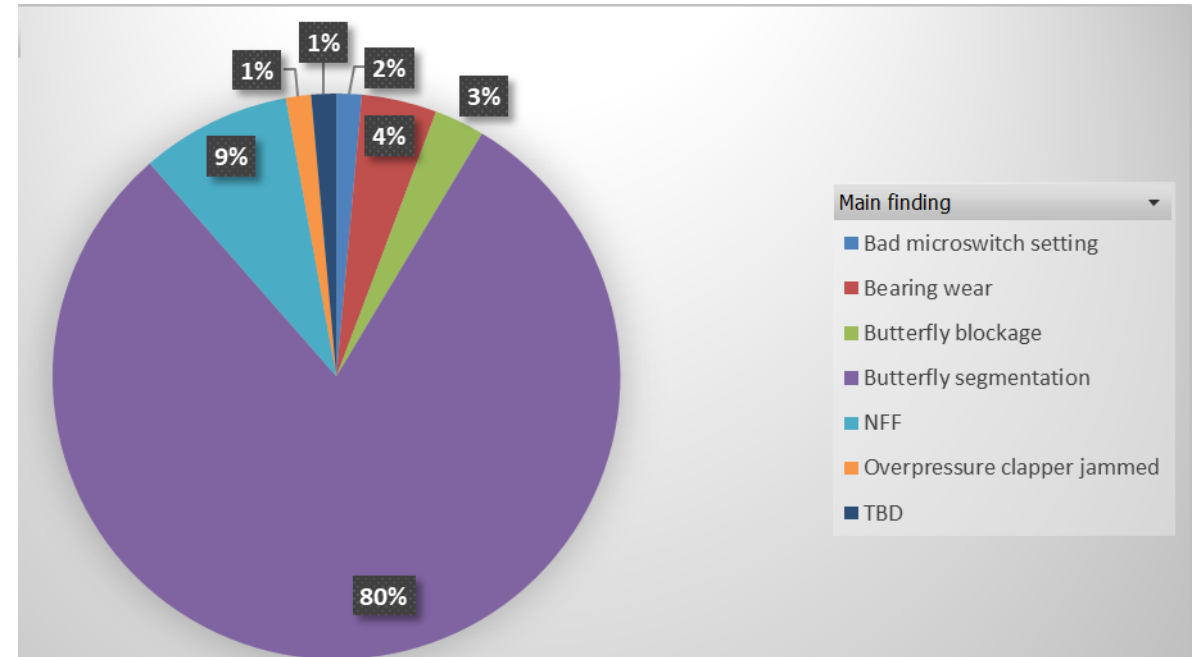
TAPRV P/N 70121A020001 removals

Shop finding :

- Internal leakages above the CMM tolerances and/or valve hard to open
- Internal leakage is a consequence of butterfly segmentation wear, which leads to clearance increase with valve body.
- Worn butterfly segmentation on the bottom and top sides.



Friction marks (seals wear) + excessive clearance



TAPRV main findings since EIS (70 valves)

TAPRV P/N 70121A020001 removals

Root cause :

Root causes identified :

- Software spurious messages (due to SW 4 and 5)
- Hardware level : Butterfly segmentation friction with valve's body.

Mitigation plan :

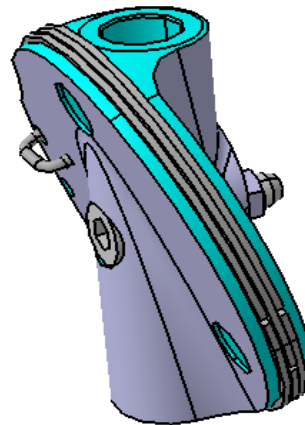
1. Software level :
 - SIL ref CS-SL-21-60-0002 has been released to reset spurious messages (applicable for both IASC SW4.0 and SW5.0)
 - SW5.0 modification
2. HW level : spare increase, systematic butterfly replacement in addition to segmentation

Solution :

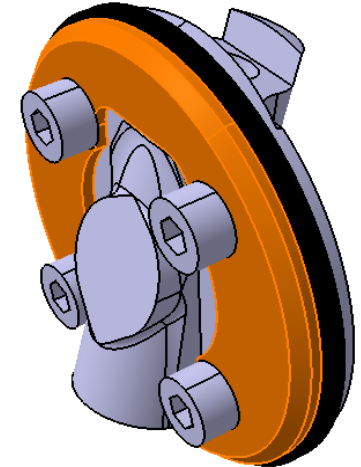
1. SW level : software 6 confirmation time correction (Failed Closed logic)

2. At valve level :

- In order to reduce the valve sensitivity to excessive friction a change proposal has been identified at butterfly, butterfly segmentation and shaft.
- P/N change is proposed, P/N will be **70121A030001**.



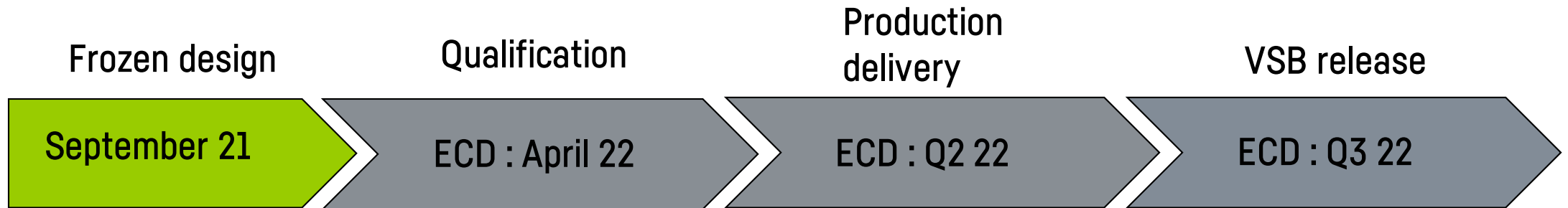
Alloy triple segment



Single graphite segment **LIEBHERR**

TAPRV P/N 70121A020001 removals

Scheduled planning for new TAPRV 70121A03:



In service strategy : still in discussion between Airbus
Canada and LTS

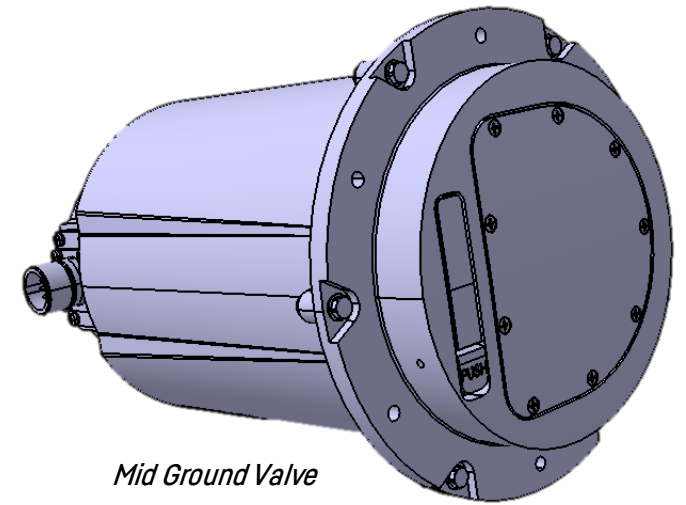
Agenda

- 1 Welcome speech
- 2 Fleet data
- 3 **ATA 36 - LTS**
 - 3.1 PRSOV Failed Open
 - 3.2 HPV Failed Closed
 - 3.3 PCE leakage
 - 3.4 Kidde loop quality issue
 - 3.5 BALODS / Nuisance messages
- 4 **ATA 21/30 - LTS**
 - 4.1 WAIV premature removals
 - 4.2 ACM fan modification retrofit status
 - 4.3 TAPRV removals
 - 4.4 **Mid Ground Valve water ingress**
 - 4.5 Soft IASC 6.0 implementation status
 - 4.6 LPGC Cover hard to Open/Close

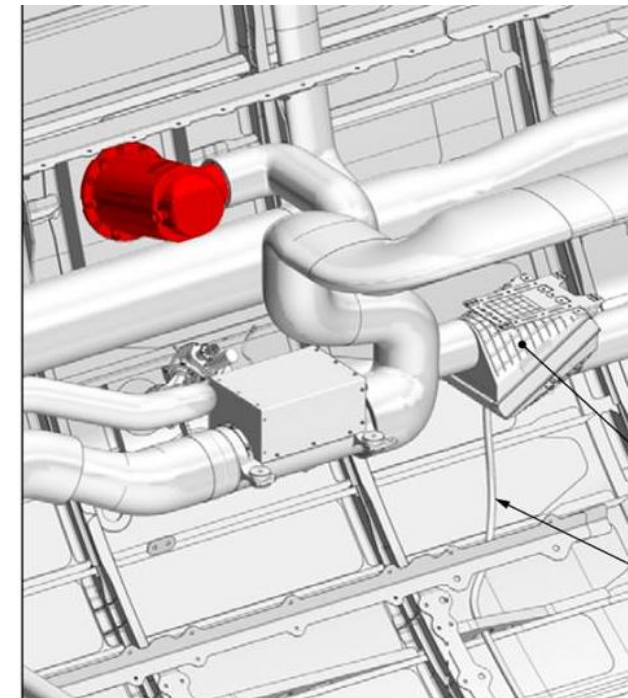
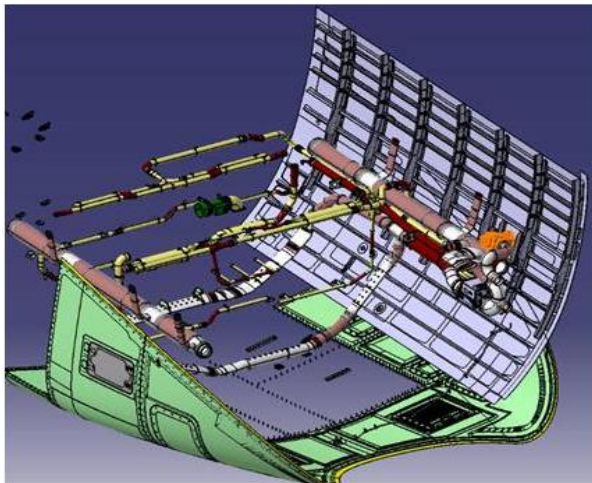
Mid Ground valve PN 70493A01– Water Ingress

Description:

- A/C level: The following info message is frequently being reported on ground
 - EQUIP BAY COOL FAULT (A) EICAS
 - MID GND VLV FAILED CLOSED, or
 - MID GND VLV FAILED OPEN
- Delays due to maintenance actions to de-activate the valve in the closed position to apply MMEL;
- Difficulties to deactivate valve in closed position due to seized / corroded valve pushbutton and lever



Mid Ground Valve



Avionics filter

Filter drain

Mid Ground valve – Water Ingress

Root cause :

- Water ingress confirmed on returned valves
- Valve fails due to short circuit generated by water presence
- Corrosion of the push button retaining pin preventing deactivation of the valve



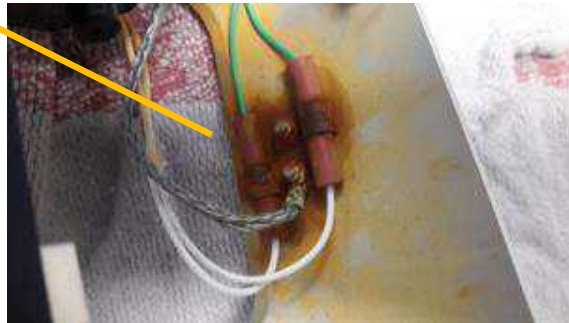
Picture 1

water: 86 grams



Picture 2

Water found inside the valve



Corrosion on connector adaptor



traces of corrosion on the pin of the manual handle



push button : corrosion marks on both sides

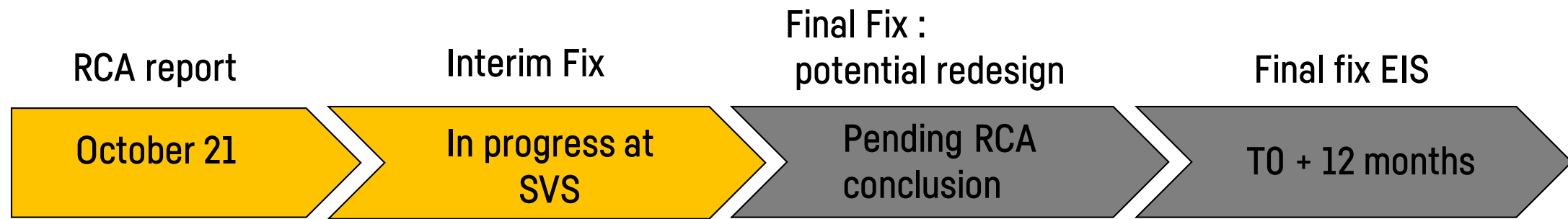
Mid ground valve– Water ingress

Mitigation actions in progress :

- Pin corrosion : waterproofness product application on A/C by operator
- Electrical connector corrosion : varnish application by operator (to be discussed if possible on A/C or in repair shop)
- MMEL 21 ITEM 24-24 Valve Inoperative:
Initiate Category change from “Category C”, 10 days time-interval to “Category D”, 120 days time-interval (in work @ Airbus Canada + ECD Q2 22).

Action plan & solution :

- RCA report sent to Airbus Canada
- Final fix definition pending RCA conclusion



Agenda

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 - 4.6 LPGC Cover hard to Open/Close

Integrated Air System Controller (IASC) SW6.0

Description:

46 Problem Reports incorporated in the revised software addressing several in service issues

As of today, IASC SW6.0 is deployed on ~96% of the fleet

Integrated Air System Controller (IASC) SW6.0

Description:

46 Problem Reports incorporated in the revised software addressing the following in service issues:

- Ground Valve messages
- Trim Air Pressure Regulating Valve (TAPRV) Failed Closed
- Trim Air Pressure Shut Off Valve (TASOV) Failed open
- FWD/AFT Galley Fan & Heater messages
- Cargo Shut Off Valve (CSOV) during ground sequence
- Pack Discharge Temp Sensor (PDTS) out of range
- Cross Bleed Valve (CBV) in close position in case of BLEED FAIL (Engine bleed leak suspect) SW delivery not in line with TCCA expectation [Q4 2019]
- RFAN inhibition on ground in normal flow mode

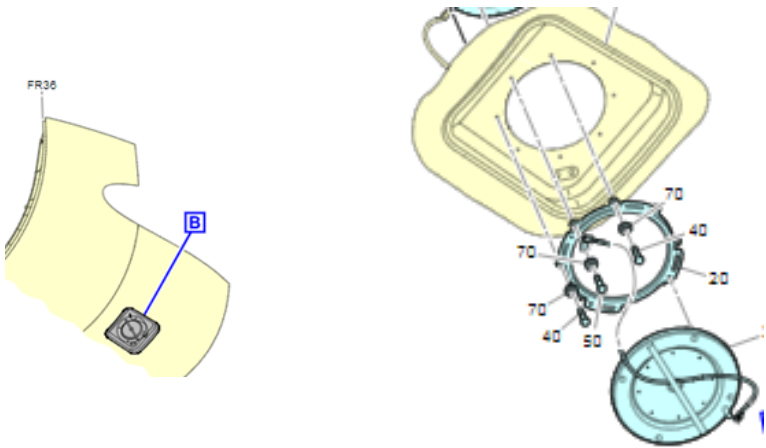
Agenda

- 1 Welcome speech
- 2 Fleet data
- 3 **ATA 36 - LTS**
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 - 4.3 TAPRV removals
 - 4.4 Mid Ground Valve water ingress
 - 4.5 Soft IASC 6.0 implementation status
 - 4.6 **LPGC Cover hard to Open/Close**

Low Pressure Ground Connector (LPGC) Cover Hard to Open/Close

Description:

- On several aircraft the cover of the Low Pressure Ground Connector is very hard to close/open.
- In certain cases, maintenance has found the tangs (close and lock tabs) missing or broken.
- The cover is usually operated by ground handling staff. When the cover is found to be hard to close/open, in some cases it is not properly closed which may lead to damage and delays



Low Pressure Ground Connector (LPGC) Cover Hard to Open/Close

Mitigation actions

- CS-SL-12-10-0001: install/remove & lubrication of tangs.
- CS-RIL-21-20-0007: Install tang/nut
- SNIEO (limited trial) for operational placard
- LTS tool to help cover manipulation
- REO 500-21-21-001: continue a/c operation with one tang missing and/or cover installation adapter fitting loop damaged
- MMEL relief is under consideration to allow operation of the a/c with one tang and one adapter loop damaged

PUSH THEN TURN
◀ **INSTALL (CW)**
▶ **REMOVE (CCW)**



Terminating action

- To be confirmed following root cause analysis (in progress)
 - Need to have operators feedback

Airbus A220

Health
Management

LIEBHERR

Liebherr-Aerospace Toulouse



Agenda

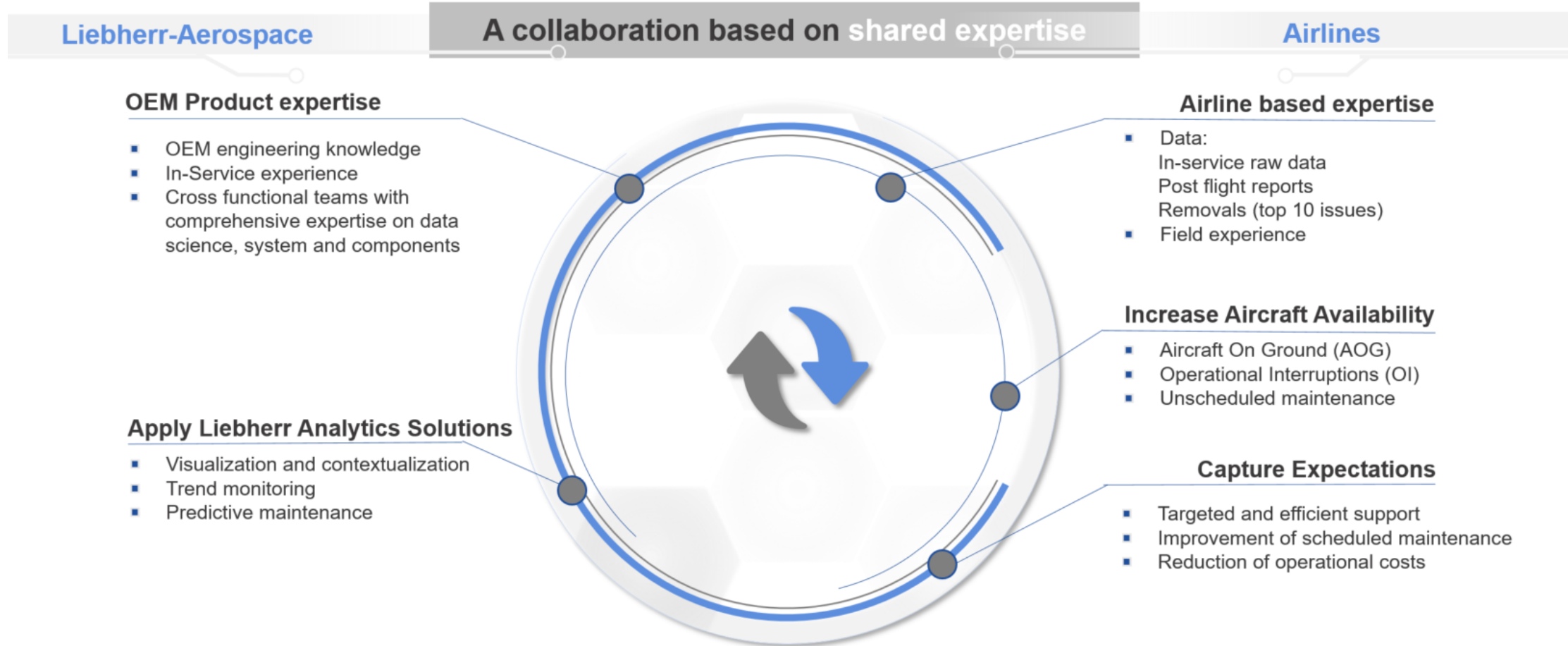
- 5 Health Monitoring overview**
 - 5.1 General presentation of Liebherr HM services**
 - 5.2 PRSOV HM
- 6 Quizz time
- 7 ATA 32 - LLI
- 8 New Training Solutions
- 9 Liebherr Initiatives and Support Packages

The range of Liebherr Support Solutions



Liebherr Analytics Solutions are extending our portfolio with great added value

Health Management vision



ASK ABOUT OUR EARLY ADOPTER PROGRAM FOR ANALYTICS SOLUTIONS

Liebherr Analytics Solutions is our fast-growing portfolio of Health Management tools, including:

- **Visualizers** and troubleshooting applications,
- **Trend monitoring** dashboard,
- **Predictive maintenance algorithms**,

Our **Early Adopter Program** is a great opportunity for our preferred customers to

- Have us focus on the products most important to you
- Benefit from our solutions at no cost for the first year
- Get reassurance on data exchange, security and storage
- Maximize HM integration in your maintenance operations

A few EAP seats remain available for A320 and A220 operators

Ask your FSR or Sales Manager how to join our EAP



Press Release: HM contract with Swiss and Air Baltic

Agenda

5 Health Monitoring overview

5.1 General presentation of Liebherr services

5.2 PRSOV HM

6 Quizz time

7 ATA 32 - LLI

8 New Training Solutions

9 Liebherr Initiatives and Support Packages

PRSOV Failed Open predictor

RTW LSL 21

LIEBHERR

Liebherr Aerospace Toulouse SAS



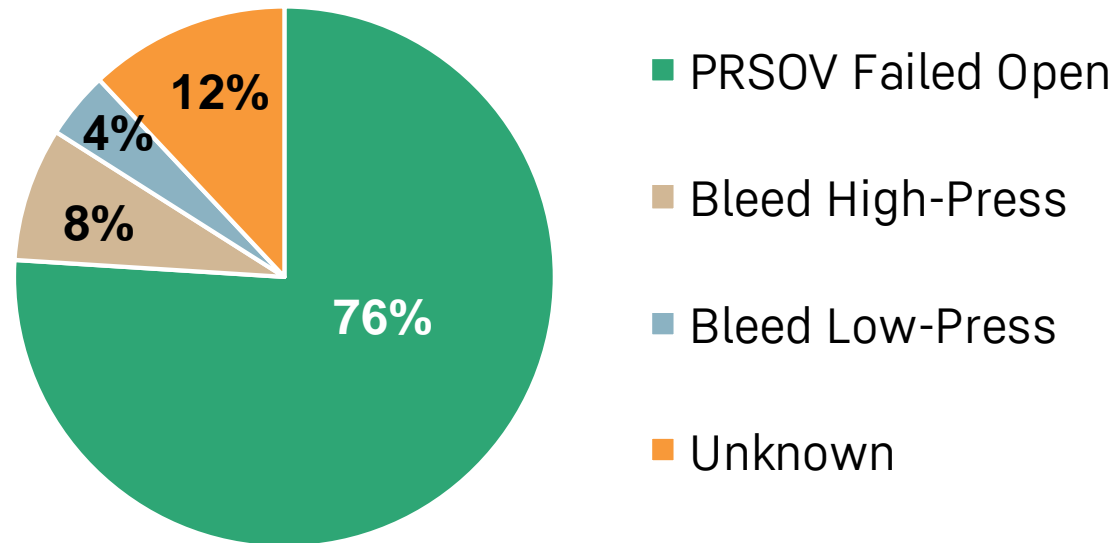
Agenda

1. PRSOV Failed Open predictor design
2. Performance status
3. Next steps

01 - PRSOV Failed Open predictor design

Intent of PRSOV Failed Open predictor

Removals under SW 5.0



Predictor is designed to anticipate PRSOV Failed Open which represented 76% of reason for removals (capture of the degradation from 4 days to 20 days before failure shall occur)

02 - Performance status



PRSOV Failed Closed

Liebherr Analytics

Recommendation monitoring					
ICAO	Registration	SN	PN	Side	Recommendation id
GEQ	T89NF	70115-00389	70115B010001	2	A220-36-70115-26
EXN	ES-LCW		70115B010001	2	A220-36-70115-25
GEQ	T80NF	70115-00161	70115B010001	2	A220-36-70115-24
EXN	ES-LCW	70115-00255	70115B010001	1	A220-36-70115-23
VAW	NI-SLS	70115-00158	70115B010001	2	A220-36-70115-22
NEQ	N56993	70115-00253	70115B010001	1	A220-36-70115-21
VAW	NI-SLM	70115-00187	70115B010001	1	A220-36-70115-20
EXN	ES-JKZ	70115-00352	70115B010001	1	A220-36-70115-19
EXN	ES-LCY	70115-00138	70115B010001	1	A220-36-70115-18
EXN	ES-JKG	70115-00414	70115B010001	2	A220-36-70115-17
VAW	NI-SMX	70115-00268	70115B010001	1	A220-36-70115-16
EXN	ES-LCR	70115-00430	70115B010001	1	A220-36-70115-15
EXN	ES-LCV	70115-00198	70115B010001	1	A220-36-70115-14
GEQ	T80NF	70115-00377	70115B010001	1	A220-36-70115-13
VAW	NI-SLN	70115-00252	70115B010001	1	A220-36-70115-12
GEQ	T89XR	70115-00315	70115B010001	1	A220-36-70115-11
EXN	ES-JKC	70115-00342	70115B010001	1	A220-36-70115-10

Liebherr Analytics platform with PRSOV details
flagged by the algorithm

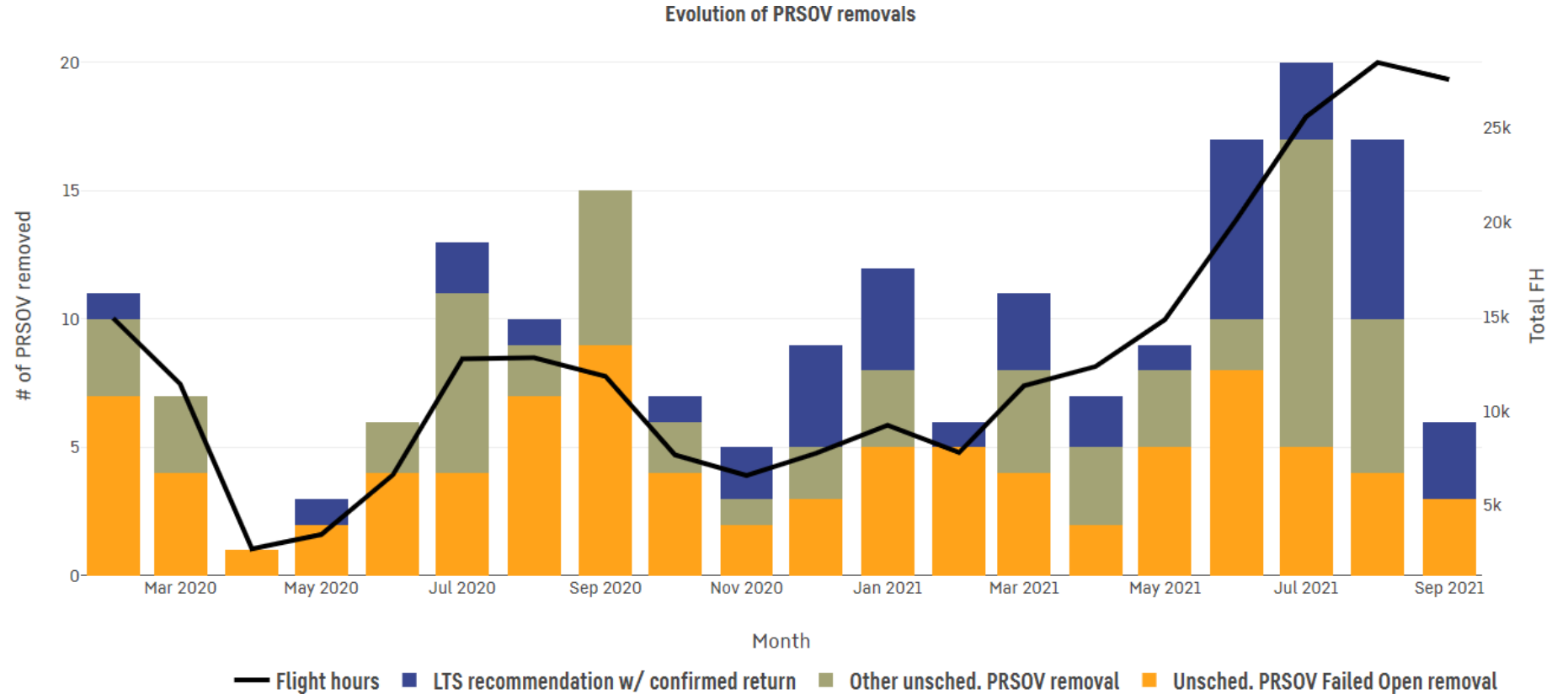
LIEBHERR Customer Services	Engineering [PREDICTIVE] Liebherr Recommendation for PRSOV removal	Reference: A220-36-70115-62	
		Initial Issue Date: 11/10/2021	
Creator:	Liebherr-Aerospace Toulouse S.A.S	A/C Type:	A220
P/N:	70115B010001	ATA:	36
		Topic:	PRSOV removal recommendation
MESSAGE: Dear Team, In the scope of the Predictive Maintenance Service, please find here after a recommendation aiming to secure your coming operations:			
DESCRIPTION: Please be informed that the algorithm, developed to identify PRSOV failure, has detected a performance degradation on the Pressure Regulating Shut-Off Valve (PRSOV) 70115B010001 on the following A/C:			

Recommendation form generated via Liebherr
Analytics platform and sent to airline
engineering



Performance status

Global PRSOV removals numbers consistent with current fleet activity (unscheduled removals reduced with the introduction of the predictor)



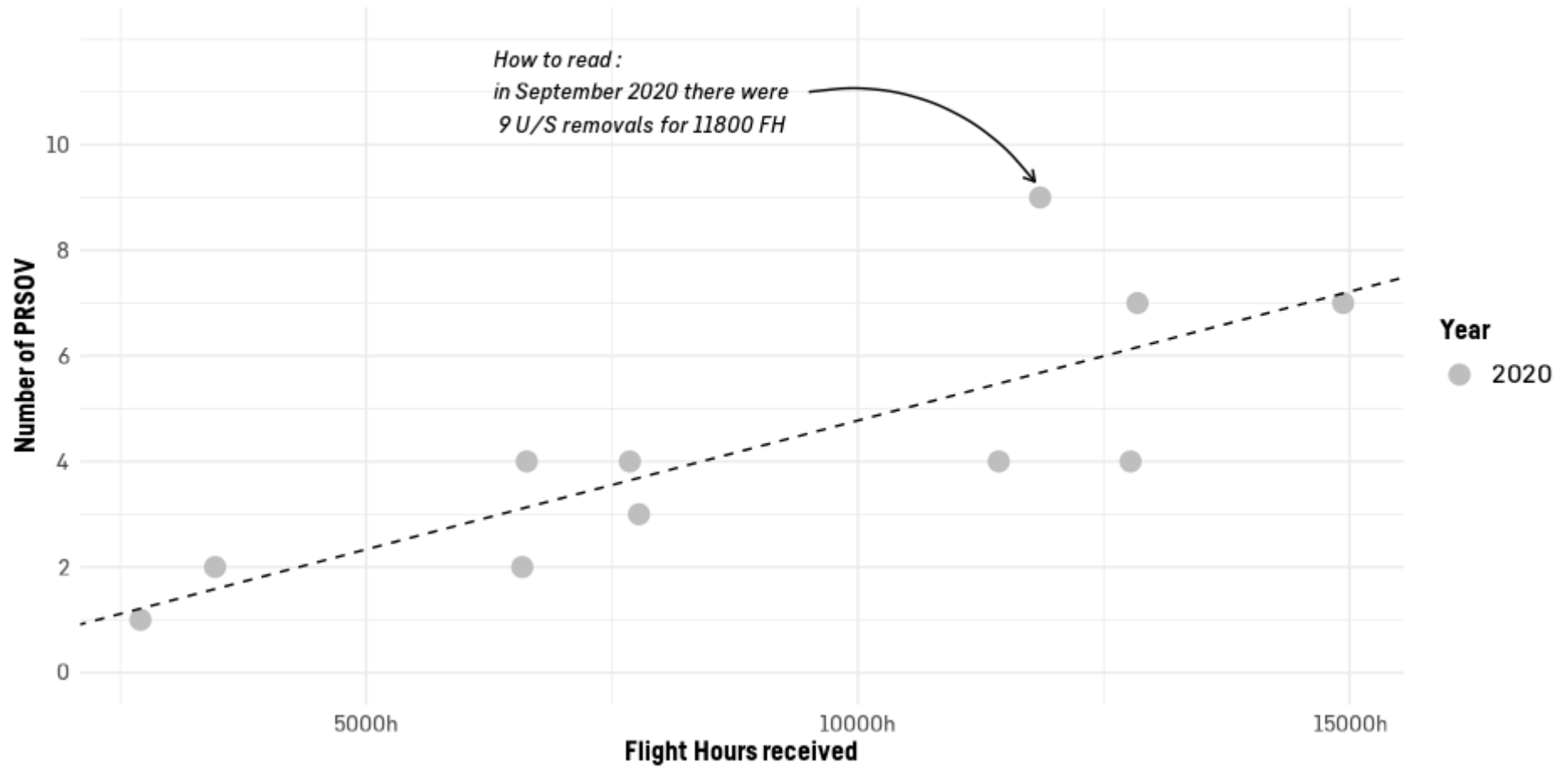
Since January 2021, achieved performance on PRSOV Failed Open removals : (6 months rolling March to August): **45 %**

Performance status – another view

Number of unscheduled PRSOV removals (for a Failed Open message) per monthly FH
Each point is representing a month of 2020

To better gauge the impact of the algorithm, we can try to compare 2020 when it was in development and 2021 when it is deployed.

In 2020 we see a clear relationship between the fleet activity and the number of removals.



Data from 2020-02-01 to 2020-12-31

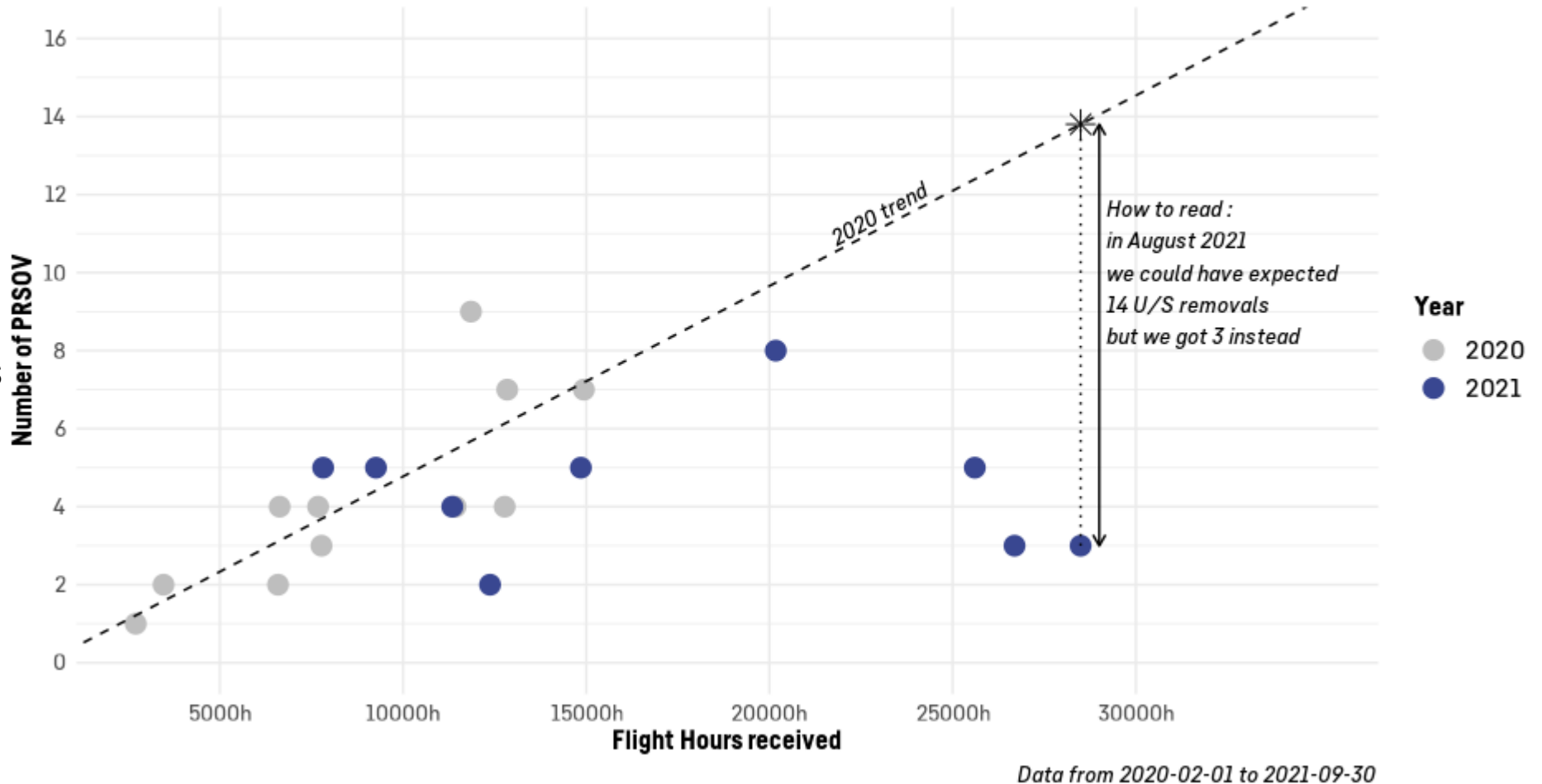
Performance status – another view

In 2021, we see that the actual number of unscheduled removals is way lower than expected with the 2020 trend.

In total in 2021 we could have expected 75 removals for a PRSOV Failed Open but the actual number of removals is 40.

*Meaning that the algorithm avoided **35** unscheduled removals since January.*

Number of unscheduled PRSOV removals (for a Failed Open message) per monthly FH
Each point is representing a month



Performance status – Missed failures analysis

Which PRSOV Failed open were missed by predictor?

In 2021 we missed to anticipate 40 PRSOV Failed Open removals, 4 of them were at the very beginning of the year before the algorithm was deployed, therefore only 36 removals are analyzed.

The following distribution is achieved:

- Failure soon after the valve installation (11 cases, 30% of missed failures)
- No policy to handle ignored past PRSOV Failed Open failures (*see p. 7*) (3 cases, 8%)
- Unusual PRSOV Failed Open message context (2 cases, 5%)
- Issue with the data, either no data transmitted or data format change (2 cases, 5%)
- Engineering decision from Liebherr (2 cases, 5%)

Performance status – Missed failures analysis

Which PRSOV Failed open were missed by predictor? (continued.)

Still 16 missed removals have to be distributed :

- 5 in a first group with similar failure types
- 5 in another group with signs of degradation before the failure
- 6 that are harder to classify and that would need further analysis

These are the removals that Liebherr will continue to analyze to try to improve the PRSOV failed open predictor

Performance status – Missed failures analysis

How to address the most common missed cases ?

- Failure soon after the valve installation : up-to-date removal information for us to quickly identify those cases (note: rapid and up-to date removal information is required from the operator when an engine replacement and/or a PRSOV replacement/swap occurs. This information is required for the algorithm to rapidly identify an installation condition or configuration change)
- No policy to handle ignored past PRSOV Failed Open failures : corrected with policy on p.7
- Unusual PRSOV Failed Open message context : one off, not sufficient information to determine cause
- Issue with the data, either no data transmitted or data format change : communication between Airbus Canada, Liebherr and the operator to identify data issues and HMU report updates
- Engineering decision from Liebherr : Algorithm maturity, decision process and alert automation are addressing this cause

Performance status – Missed failures analysis

Delay between algorithm alarm and failure

In the missed failures, we have 7 cases where there is an algorithm alarm before the failure (from 1 day to 4 days).

These could be avoidable if we try to move towards more automation of the recommendation process and operators can react quickly.

Regarding operator reaction time : we observe an average of **8 days** between the removal recommendation notification and the actual removal of the PRSOV.

A third of recommendations are treated in less than 48h but 16% are treated in more than 15 days, the maximum delay observed being 28 days.

04 - Next steps

Next steps

Improvement of predictor

LTS is continuously monitoring the PRSOV Failed Open predictor

Any missed failure is analyzed by development team.

LTS is running its degradation model to identify new potential signatures.

LTS is willing to improve the performance of its predictor.

Different options are possible:

- Either improving the PRSOV Failed Open predictor design (use case to define predictor modification design process)
- Or covering the failures not addressed by the current predictor

NEW TRAINING SOLUTIONS

Liebherr-Aerospace
Training Center

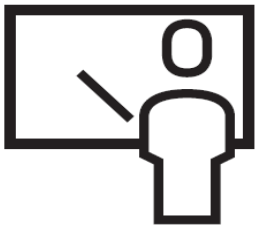
LIEBHERR

Training Center



New Training Solutions

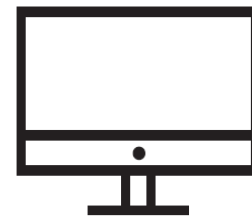
**STANDARD
CLASSROOM**



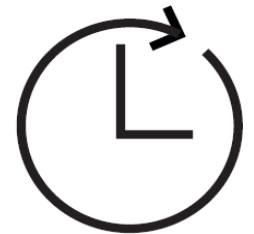
**VIRTUAL
CLASSROOM**



eLEARNING



**POCKET
TRAINING**





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 conducted at Liebherr Lindenberg, Liebherr Toulouse or Customer facilities.
- **Major advantage: contact with real components and systems**



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.**

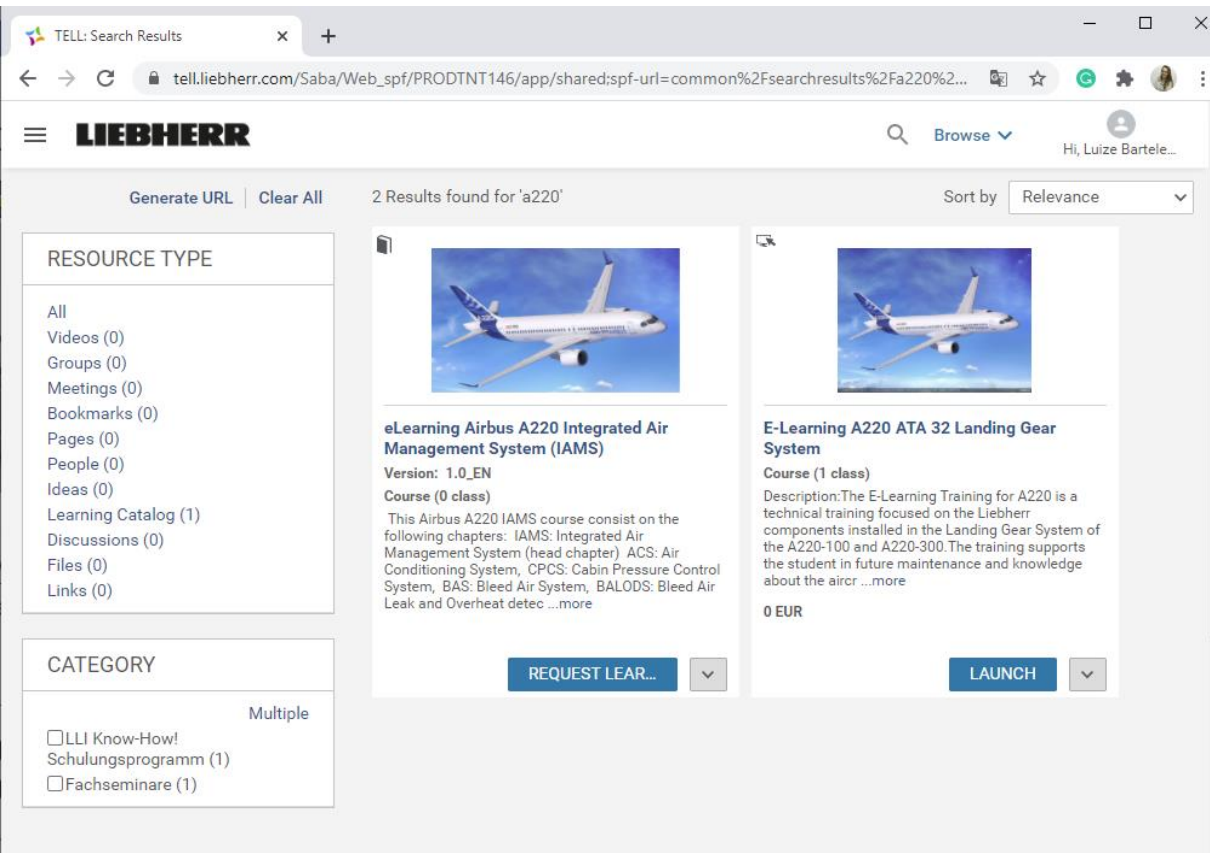


The screenshot shows a Cisco Webex Meeting interface. At the top, there's a meeting title "Cisco Webex Meetings" and a "Meeting Info" section. Below that is a participant list with names like "Luize Bartelega Me", "John", "WuXiao", "Jake YU", and a phone number. The main content area shows a technical diagram titled "Retraction and Extension System NLG & Door Uplock". The diagram includes labels for "Micro Switch", "Connector", "Electrical Motor", "Can Disk", and "Defined Gap, where Micro Switch is off". The diagram is presented in a window titled "COMAC Training.pdf - Adobe Acrobat Reader DC (32-bit)". On the right side, there's a "Participants (10)" list with names and icons. At the bottom, there's a "Q & A" section and a "Connect audio" button.

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.**



The screenshot shows a web browser window displaying search results for 'a220' on the TELL platform. The page features a navigation menu on the left with categories like 'RESOURCE TYPE' and 'CATEGORY'. The main content area displays two search results, each with an image of an Airbus A220 aircraft and a brief description of the eLearning course. The first result is 'eLearning Airbus A220 Integrated Air Management System (IAMS)' and the second is 'E-Learning A220 ATA 32 Landing Gear System'. Both results include a 'REQUEST LEAR...' or 'LAUNCH' button.

TELL: Search Results

tell.liebherr.com/Saba/Web_spf/PRODTNT146/app/shared:spf-url=common%2Fsearchresults%2Fa220%2...

LIEBHERR

Generate URL | Clear All | 2 Results found for 'a220' | Sort by Relevance

RESOURCE TYPE

- All
- Videos (0)
- Groups (0)
- Meetings (0)
- Bookmarks (0)
- Pages (0)
- People (0)
- Ideas (0)
- Learning Catalog (1)
- Discussions (0)
- Files (0)
- Links (0)

CATEGORY Multiple

- LLI Know-How! Schulungsprogramm (1)
- Fachseminare (1)

eLearning Airbus A220 Integrated Air Management System (IAMS)
Version: 1.0_EN
Course (0 class)
This Airbus A220 IAMS course consist on the following chapters: IAMS: Integrated Air Management System (head chapter) ACS: Air Conditioning System, CPSC: Cabin Pressure Control System, BAS: Bleed Air System, BALODS: Bleed Air Leak and Overheat detec...more

E-Learning A220 ATA 32 Landing Gear System
Course (1 class)
Description:The E-Learning Training for A220 is a technical training focused on the Liebherr components installed in the Landing Gear System of the A220-100 and A220-300.The training supports the student in future maintenance and knowledge about the aircr...more

0 EUR

REQUEST LEAR... | LAUNCH


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.**

☰ Liebherr Pocket Training - A220 Throttle Plate Mod RESOURCES


(5) ASSEMBLY OF THE CYLINDER TUBE ASSEMBLY **LIEBHERR**

(I) Install the **locking washers** and the **screws** to the **cover disc**. Make sure that the lower tab of the locking washers is properly positioned in the hole. Torque the screws in accordance with following procedure:
1 - Torque the screws in a criss-cross pattern to 24 +1 Nm (212 +8 lbf.in) for three times.




Screws:
PN NAS6706U9
Locking Washers:
PN MS9582-12

Illustration



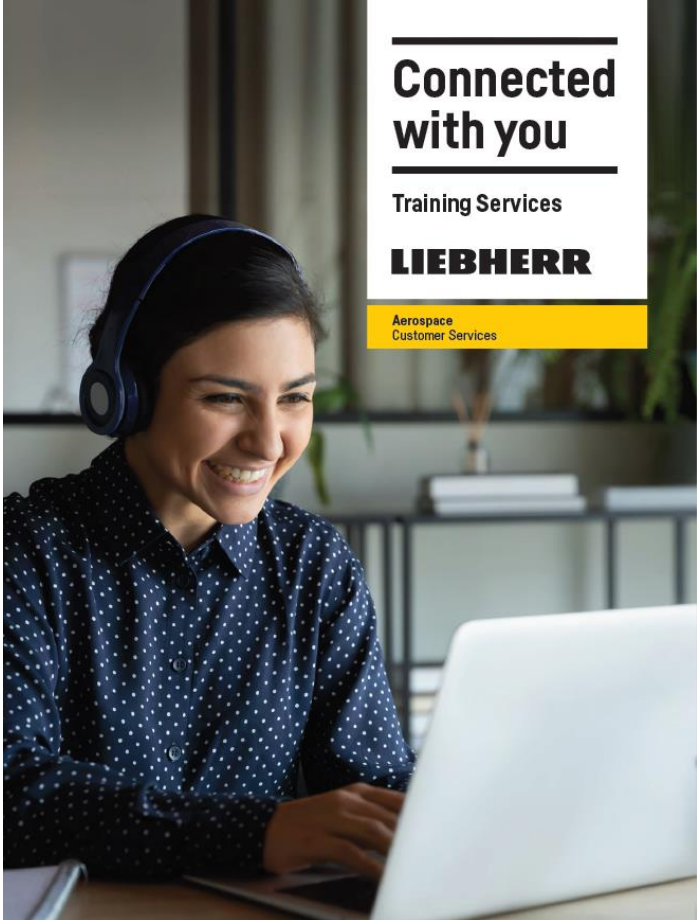
Photos



🔊 || ————— ↻ < PREV NEXT >

New Training Solutions

NEW ADVERTISING PACKAGE



New Training Solutions

MEET THE TEAM

Liebherr-Aerospace Lindenberg GmbH



LUIZE BARTELEGA

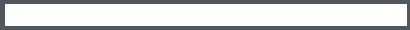
Customer Training
Instructor and Developer

Liebherr-Aerospace Toulouse SAS



OLIVIER LE GUENNEC

Customer Training
Instructor and Developer



THROTTLE MOUNT A220 ATA 32

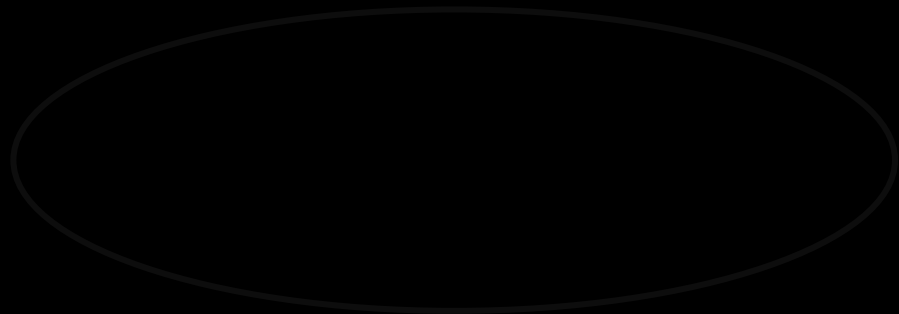
RTW 2021

LIEBHERR

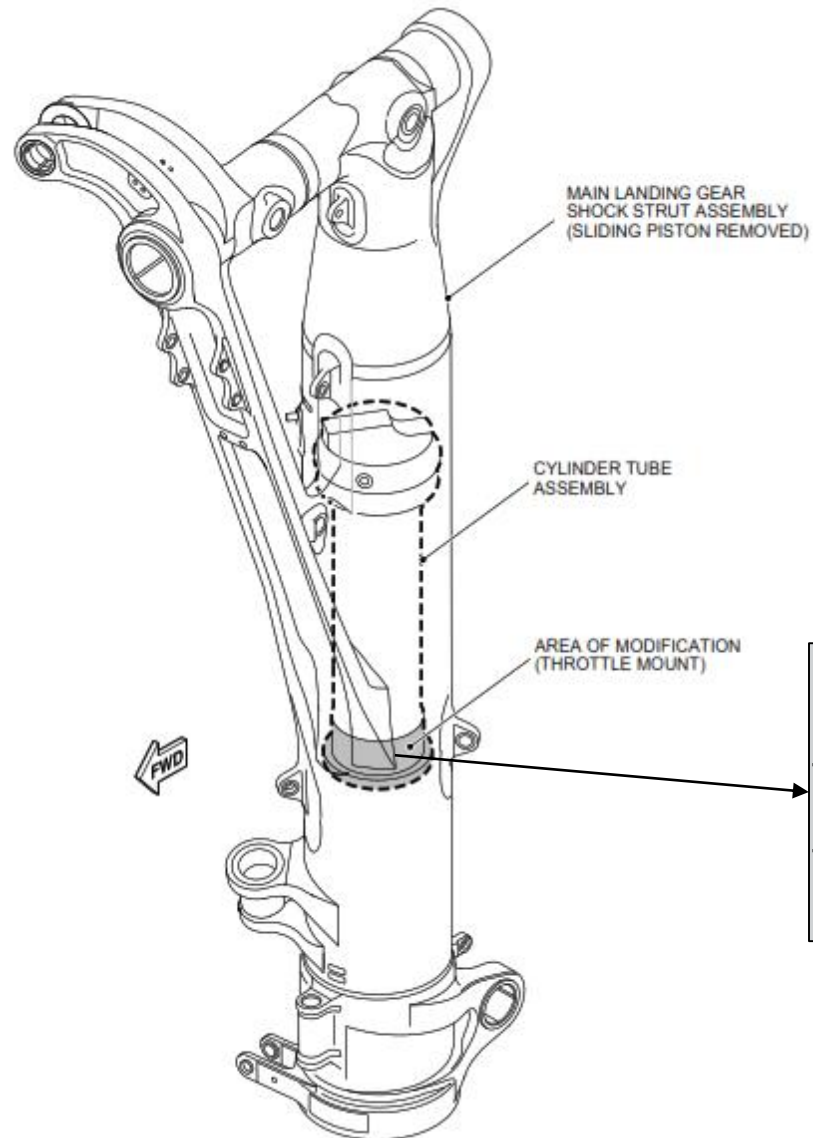
Liebherr-Aerospace

Agenda

- Throttle Mount Modification
- Description
- Solution
- Support Information
- Timeline



Throttle Mount – Installation

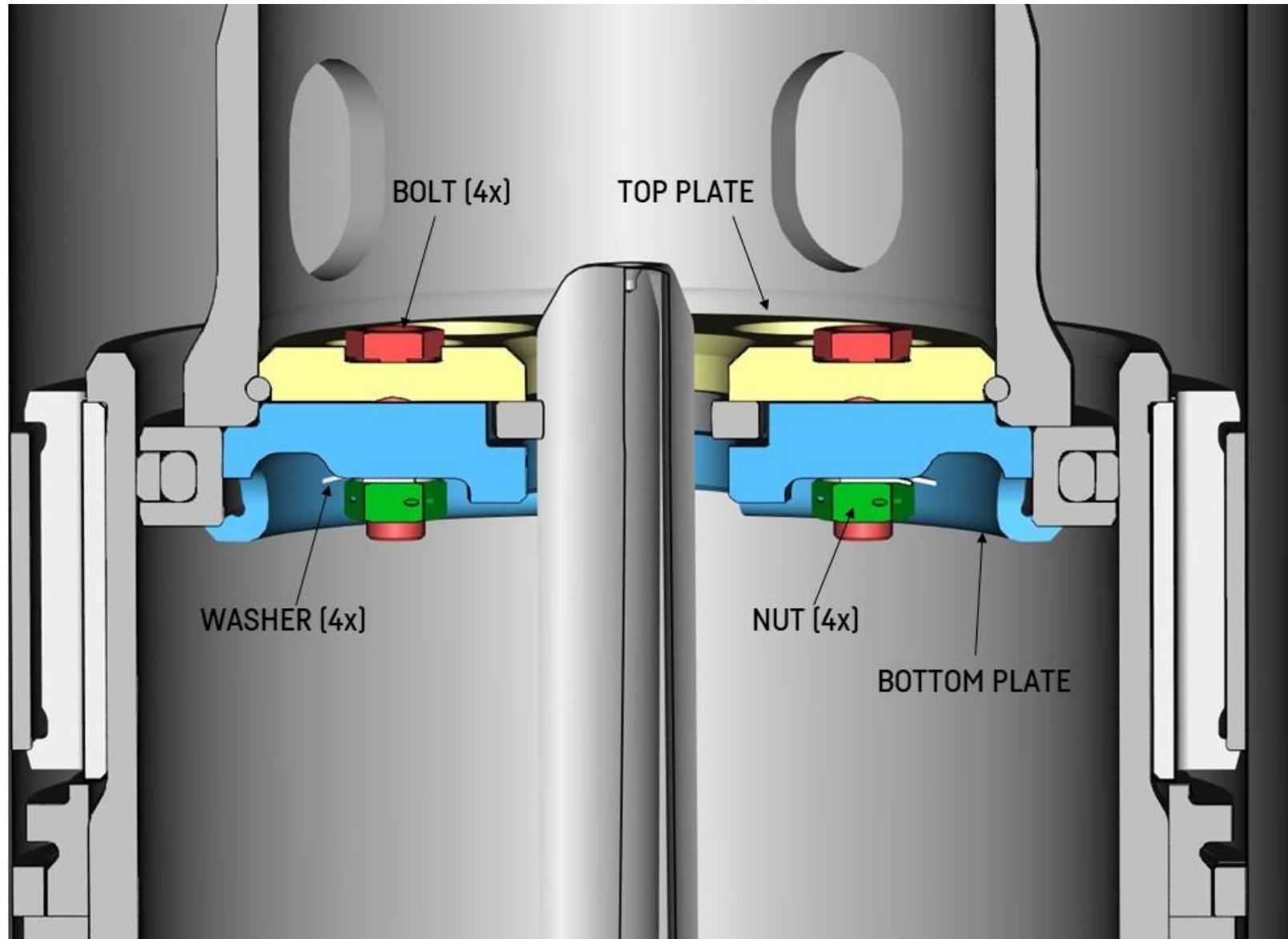


The Throttle Mount is:

- installed in the MLG Main Fitting
- attached to the cylinder tube

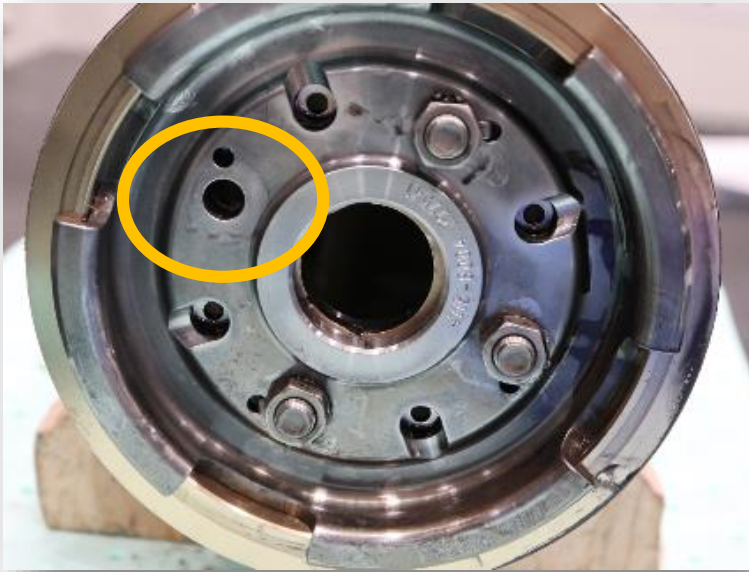
Description

The Throttle Mount, currently installed in the A220 MLG, has the following components:



Description

Disassembly of the MLG:



Throttle Mount with lost screw



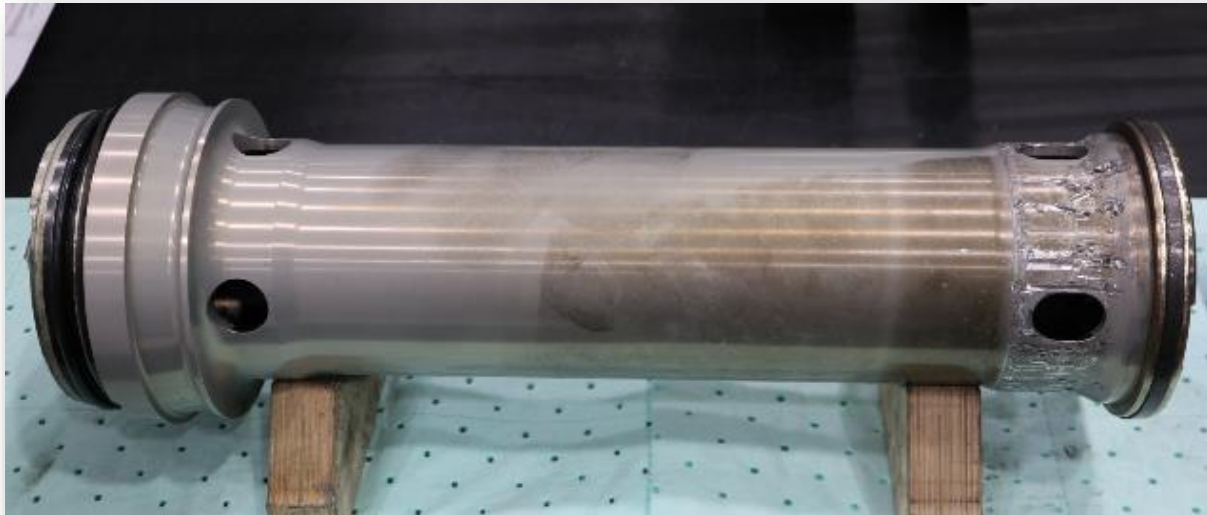
Parts found in Shock Strut



Metering Pin damaged

Description

Lost screws create damage on inner surfaces and parts



Cylinder Tube Assembly



Upper Bearing Ring

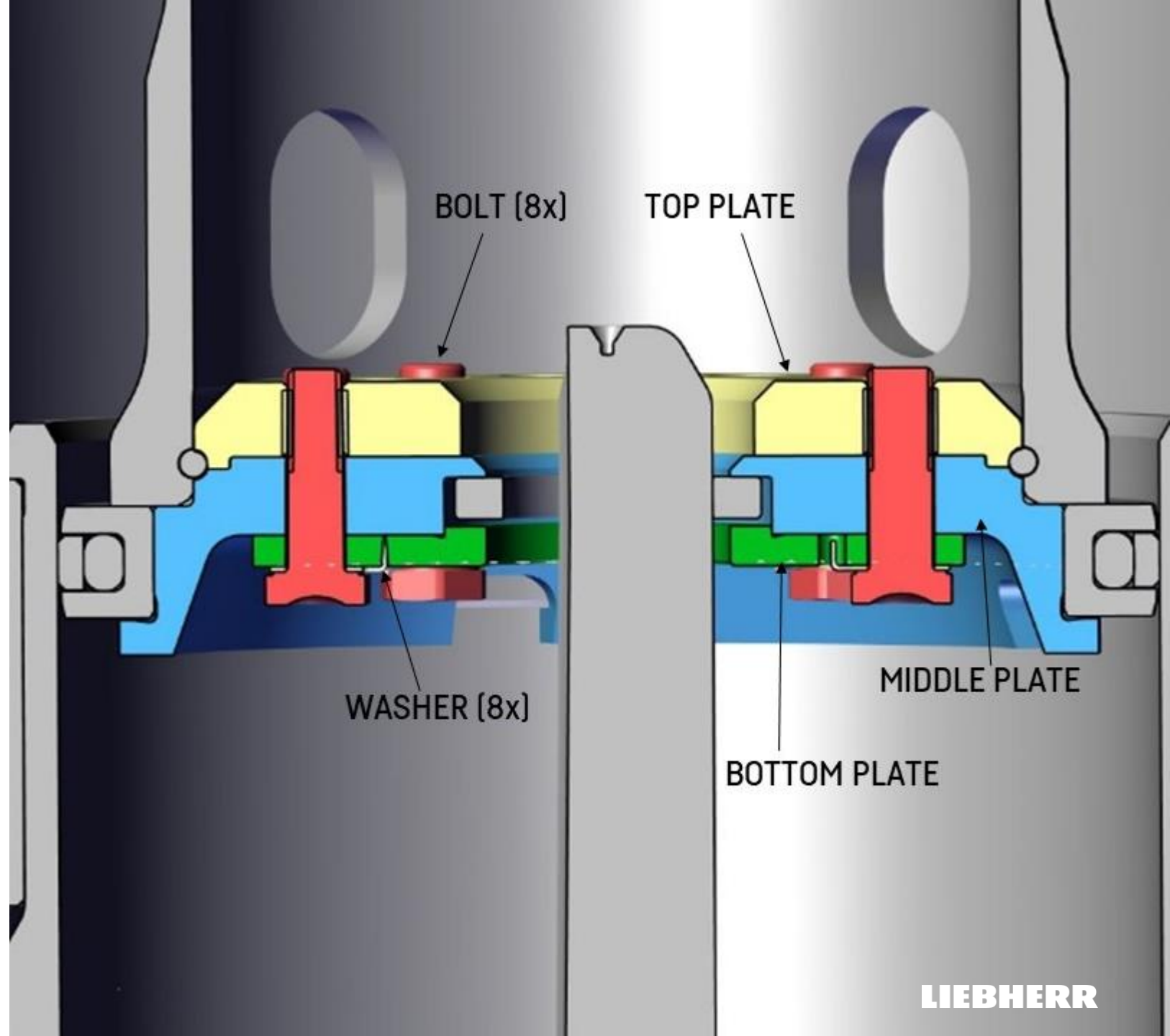


Metal Chips in COV

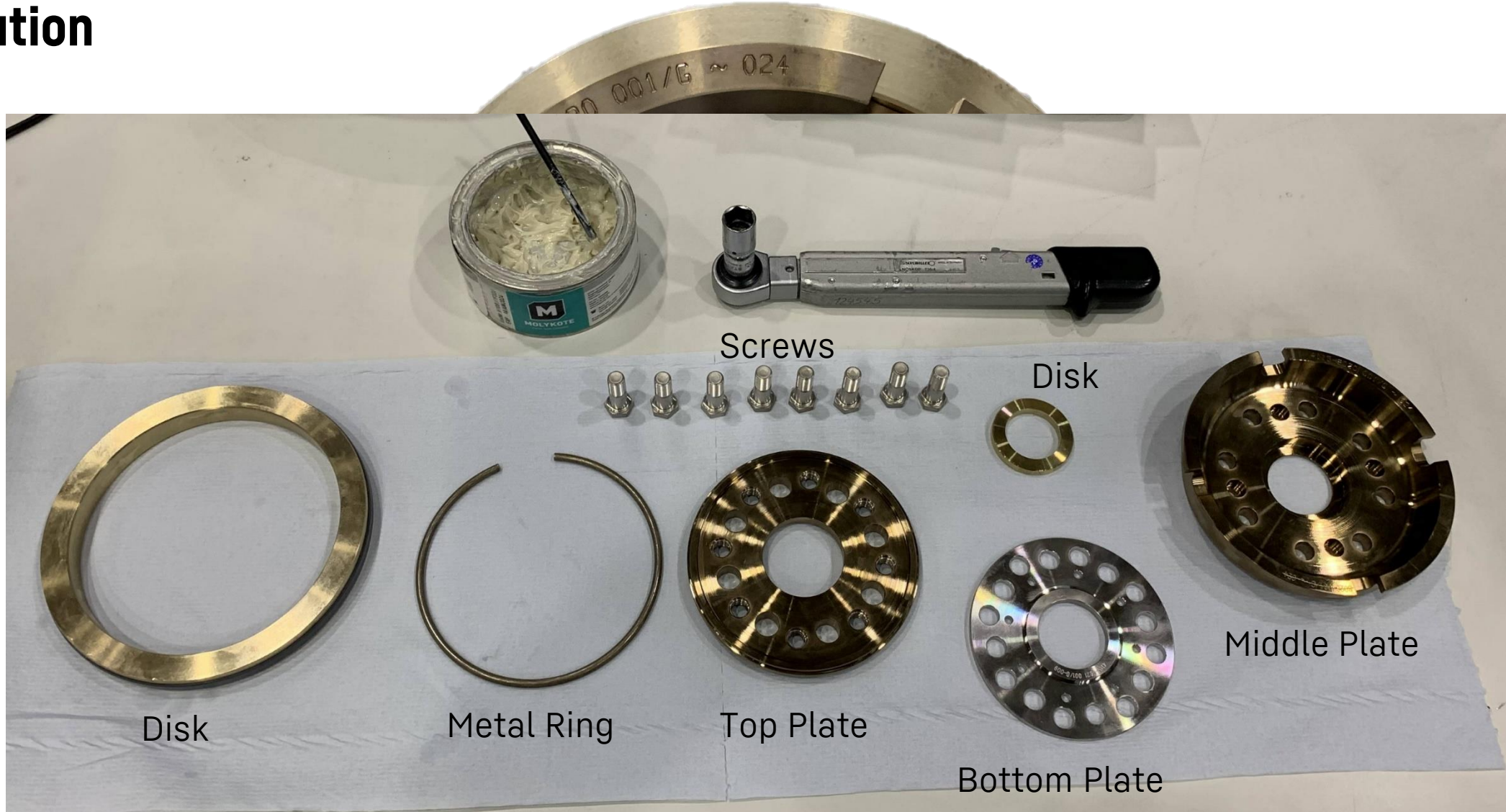
Solution

New design of the Throttle Mount:

- torque increased from 5 Nm to 27 Nm
- use of self-locking helicoils doubly secured with locking washers
- improved tightening procedure



Solution



THROTTLE MOUNT A220 ATA 32 - RTW 2021

Operator Support Information

LIEBHERR
SERVICE BULLETIN

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Fax: +49 (0)3631 46-4103
E-Mail: techpub.lindenberg@liebherr.com
or contact us on our website:
http://www.liebherr.aero

SERVICE BULLETIN
STANDARD

**LANDING GEAR - MAIN LANDING GEAR SHOCK
STRUT ASSY - MODIFICATION OF THROTTLE MOUNT**

1. **PLANNING INFORMATION**

A. **EFFECTIVITY**

(1) Unit affected:
Main Landing Gear Shock Strut Assembly

(2) Part numbers affected:
4115A0000-03, 4115A0000-03, 4115A0000-04, 4115A0000-04, 4115B0000-01, 4116B0000-01

B. **CONCURRENT REQUIREMENTS**

(1) Liebherr-Aerospace Service Bulletin 4110A-32-03 "Inspection of Cylinder Tube Assy PN 4115A0700-02" shall be performed together with this Service Bulletin.

C. **REASON**

The A220 main landing gear shock strut is oil dampened by a metering pin sliding through a throttle mount assembly. The throttle mount assembly is an integral part of the cylinder tube assembly inside the shock strut and consists of an upper and a lower plate held together by four bolts and nuts secured by lock washers.

During main landing gear sampling inspection and during shock strut seal replacement in service loose or missing bolts of the throttle mount assembly have been found. The root cause analysis revealed the possibility of a loss of torque of the nuts by setting of parts and a too low torque value as per design, combined with an unfavourable assembly procedure. After a loss of tightening torque, the locking washer loses effectivity and may separate from the bolt.

Initial Issue : Jul 02/21 **4110A-32-02**
Page 1 of 36

SB_4110A-32-02_00
A220-100

LIEBHERR
SERVICE BULLETIN

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or contact us on our website:
http://www.liebherr.aero

SERVICE BULLETIN
STANDARD

**LANDING GEAR - MAIN LANDING GEAR SHOCK
STRUT ASSY - MODIFICATION OF THROTTLE MOUNT**

1. **PLANNING INFORMATION**

A. **EFFECTIVITY**

(1) Unit affected:
Main Landing Gear Shock Strut Assembly

(2) Part numbers affected:
5965A0000-02, 5965A0000-02, 5965B0000-01, 5966B0000-01

B. **CONCURRENT REQUIREMENTS**

(1) Liebherr-Aerospace Service Bulletin 5969A-32-03 "Inspection of Cylinder Tube Assy PN 4115A0700-02" shall be performed together with this Service Bulletin.


C. **REASON**

The A220 main landing gear shock strut is oil dampened by a metering pin sliding through a throttle mount assembly. The throttle mount assembly is an integral part of the cylinder tube assembly inside the shock strut and consists of an upper and a lower plate held together by four bolts and nuts secured by lock washers.

During main landing gear sampling inspection and during shock strut seal replacement in service loose or missing bolts of the throttle mount assembly have been found. The root cause analysis revealed the possibility of a loss of torque of the nuts by setting of parts and a too low torque value as per design, combined with an unfavourable assembly procedure. After a loss of tightening torque, the locking washer loses effectivity and may separate from the bolt.

Initial Issue : Jul 02/21 **5969A-32-02**
Page 1 of 36

SB_5969A-32-02_00
A220-300

 Luize Bartelge

**A220 MLG SHOCK STRUT ASSY -
MODIFICATION OF THROTTLE
MOUNT**

START COURSE DETAILS

LIEBHERR

Course duration: approx. 20 minutes.
This Pocket Training covers VSB 4110A-32-02 and VSB 5969-32-02.

- INTRODUCTION
- TOOLS AND MATERIALS
- REMOVAL OF THE CYLINDER TUBE ASSEMBLY
- DISASSEMBLY OF THE CYLINDER TUBE ASSEMBLY
- INSPECTION OF THE CYLINDER TUBE ASSEMBLY
- ASSEMBLY OF THE CYLINDER TUBE ASSEMBLY
- INSTALLATION OF THE CYLINDER TUBE ASSEMBLY

Pocket Training

A220 BD500-321004

**Landing Gear - Main Gear and Doors - Main
Landing Gear (MLG) Shock Strut Assembly,
Throttle Mount Replacement - Service Bulletin**

BD500-321004
Issue No. 001.00

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Publication No.:
Manufacturer: **AIRBUS** Airbus Canada Limited Partnership
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13100 Haven-Fabre Blvd.
Mirabel, Quebec J7H 3C8

Page 1
2021/09/14

BD500-321004
(Airbus VSB)



Luiza Barthelega

A220 MLG SHOCK STRUT ASSY - MODIFICATION OF THROTTLE MOUNT

START COURSE

DETAILS ▾

LIEBHERR

Course duration: approx. 20 minutes.

This Pocket Training covers VSB 4110A-32-02 and VSB 5969-32-02.

- ☰ INTRODUCTION ○
- ☰ TOOLS AND MATERIALS ○
- ☰ (4) REMOVAL OF THE CYLINDER TUBE ASSEMBLY ○
- ☰ (5) DISASSEMBLY OF THE CYLINDER TUBE ASSEMBLY ○
- ☰ (6) INSPECTION OF THE CYLINDER TUBE ASSEMBLY ○
- ☰ (7) ASSEMBLY OF THE CYLINDER TUBE ASSEMBLY ○
- ☰ (8) INSTALLATION OF THE CYLINDER TUBE ASSEMBLY ○



LIEBHERR

Timeline



In-service Occurrences

Loss of torque on the Throttle Mount. Damage of components in the Shock Strut.

Solution

Design change.

Schedule and Commercial

VSB available in Q3 2021.

VSB application planned for Q1 2022.

CYLINDER TUBE A220 ATA 32

RTW 2021

LIEBHERR

Liebherr-Aerospace

Agenda

- Installation
- Description
- Inspection
- Repair
- Support Information
- Timeline

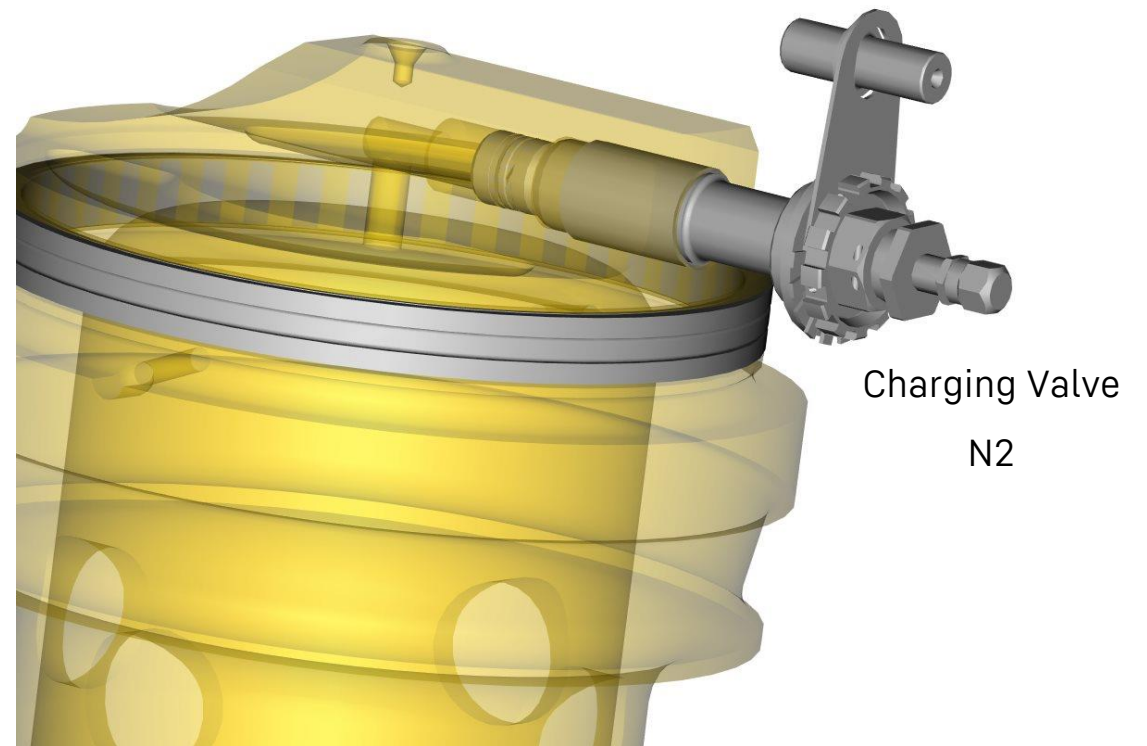
CYLINDER TUBE A220 ATA 32 - RTW 2021

Installation



Description

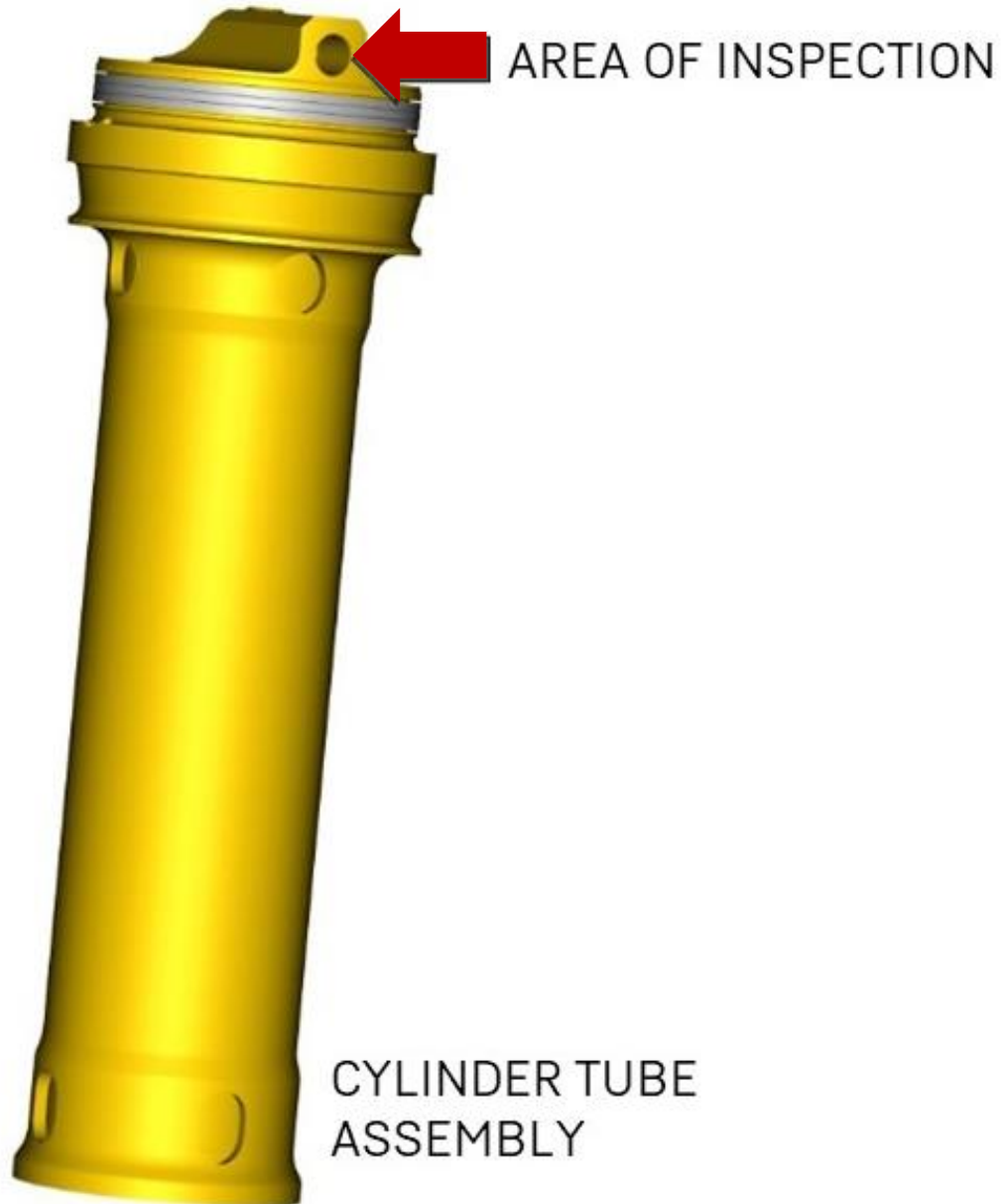
At disassembly of the cylinder tube in the main fitting there is a risk of cross bore surface damage!



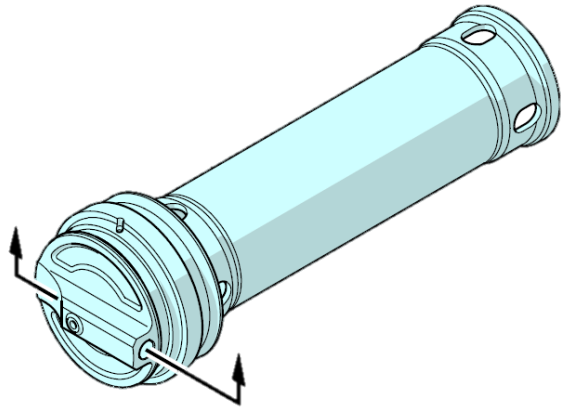
RTW 2021

Description

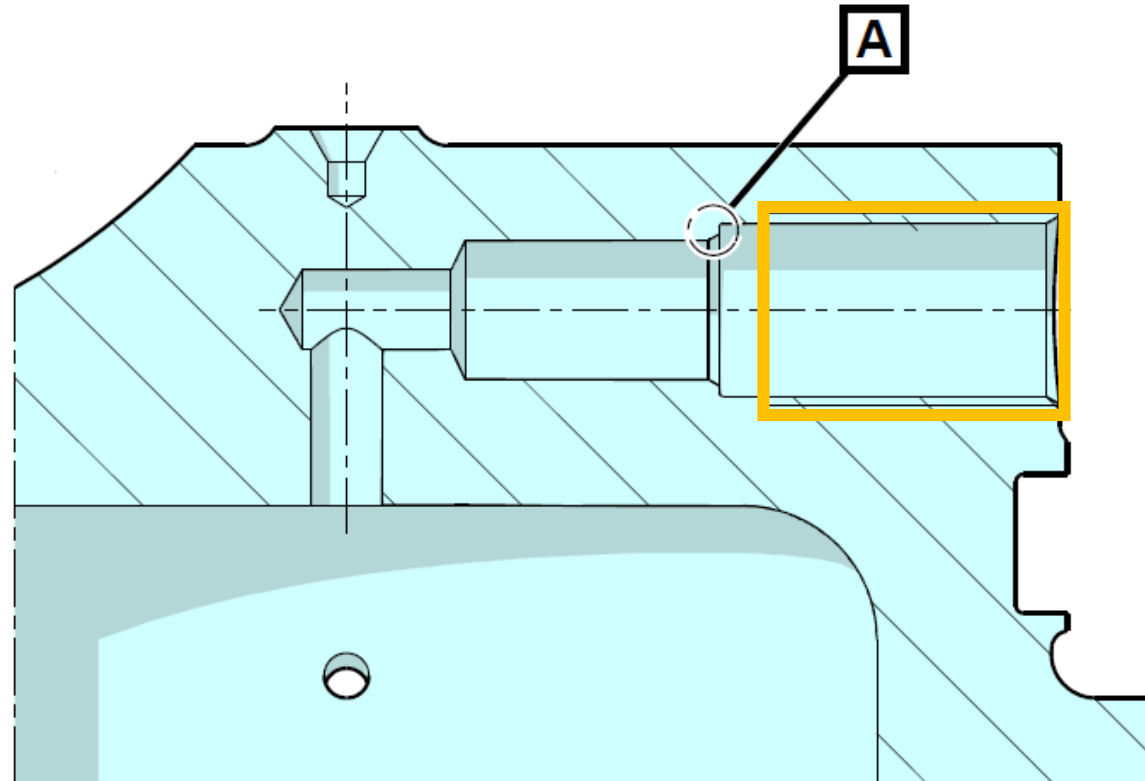
The inspection is recommended after any removal.



Inspection



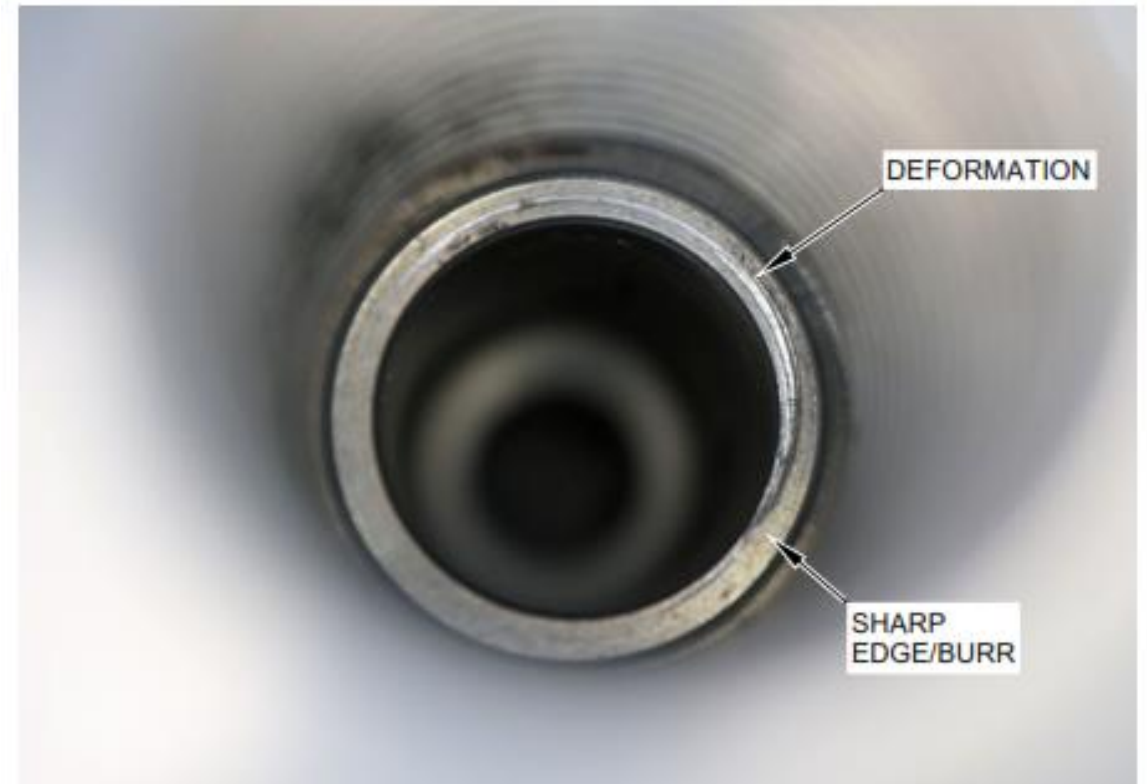
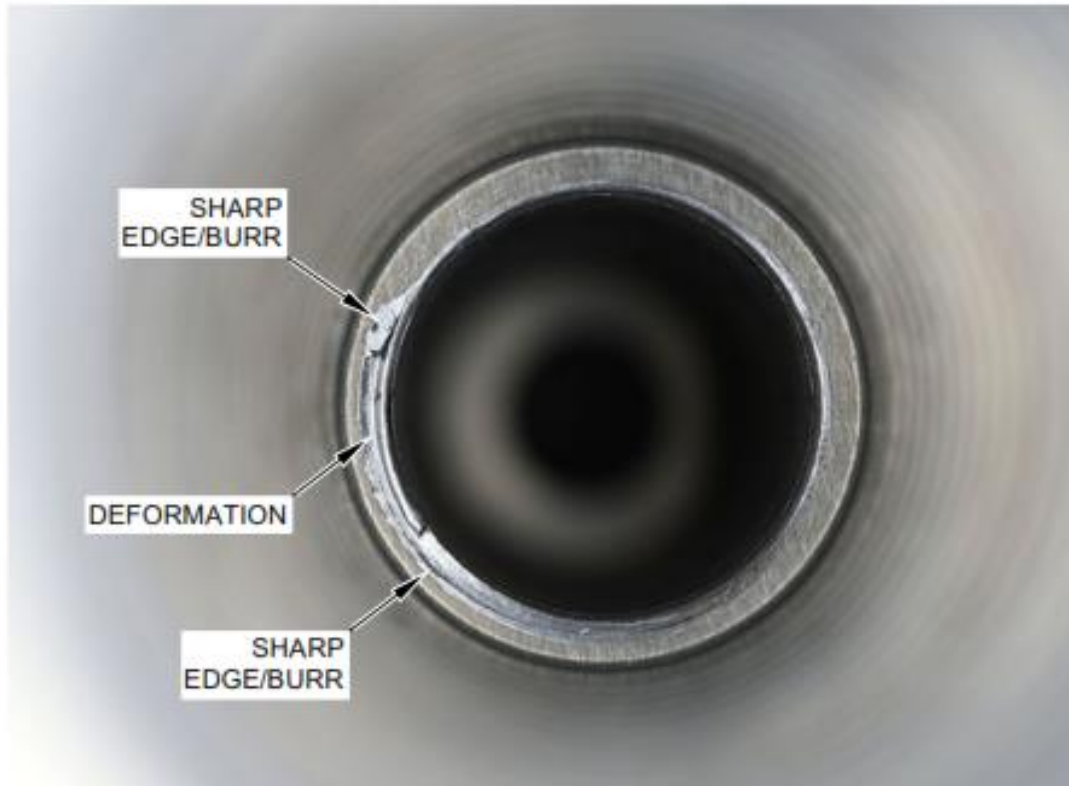
INSPECTION ZONE 1
POTENTIAL DAMAGE AT THE INNER
SHOULDER OF THE BORE



A-A

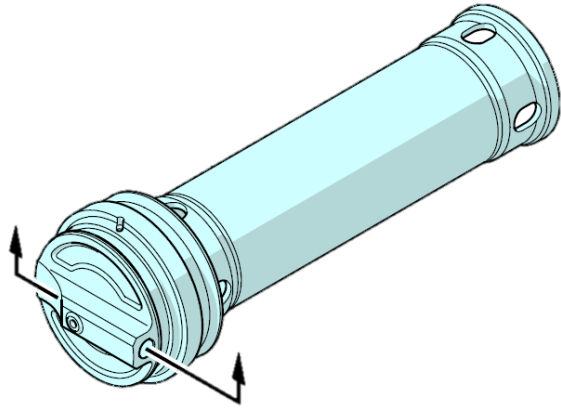
Inspection Zone 1 - Potential damage at the Inner Shoulder of the Bore

Inspection

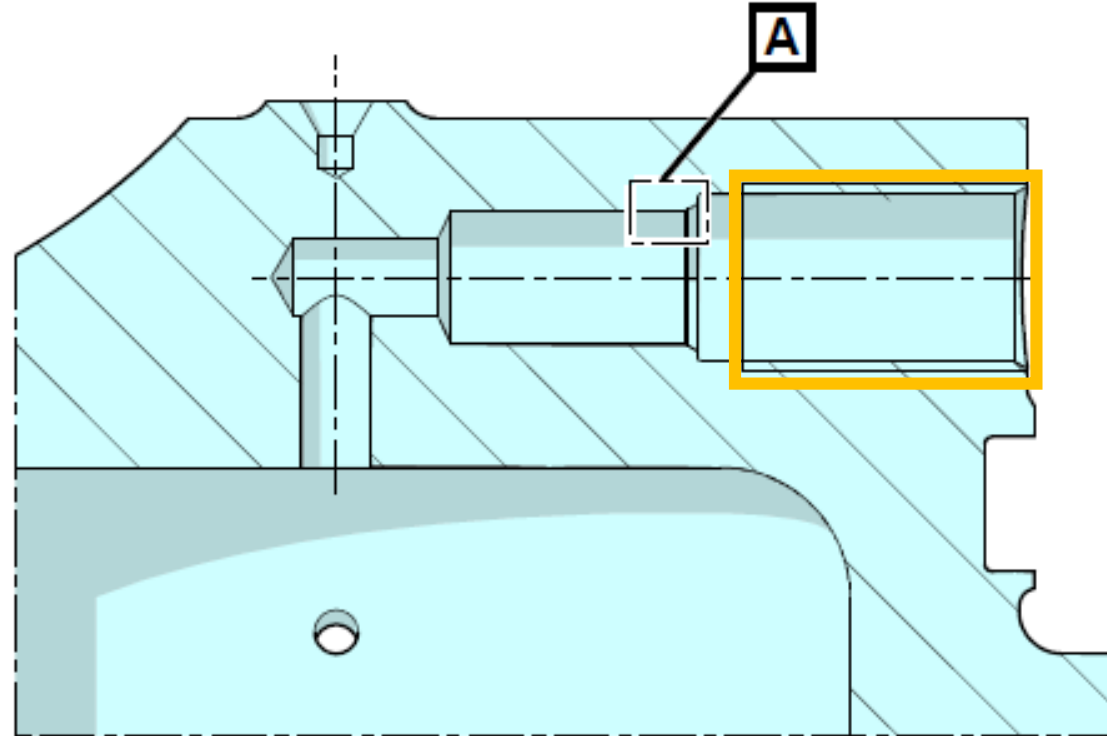


Inspection Zone 1 - Potential damage at the Inner Shoulder of the Bore

Inspection



INSPECTION ZONE 2
POTENTIAL DAMAGE AT THE INNER
DIAMETER OF THE BORE
(O-RING GLIDE SURFACE)

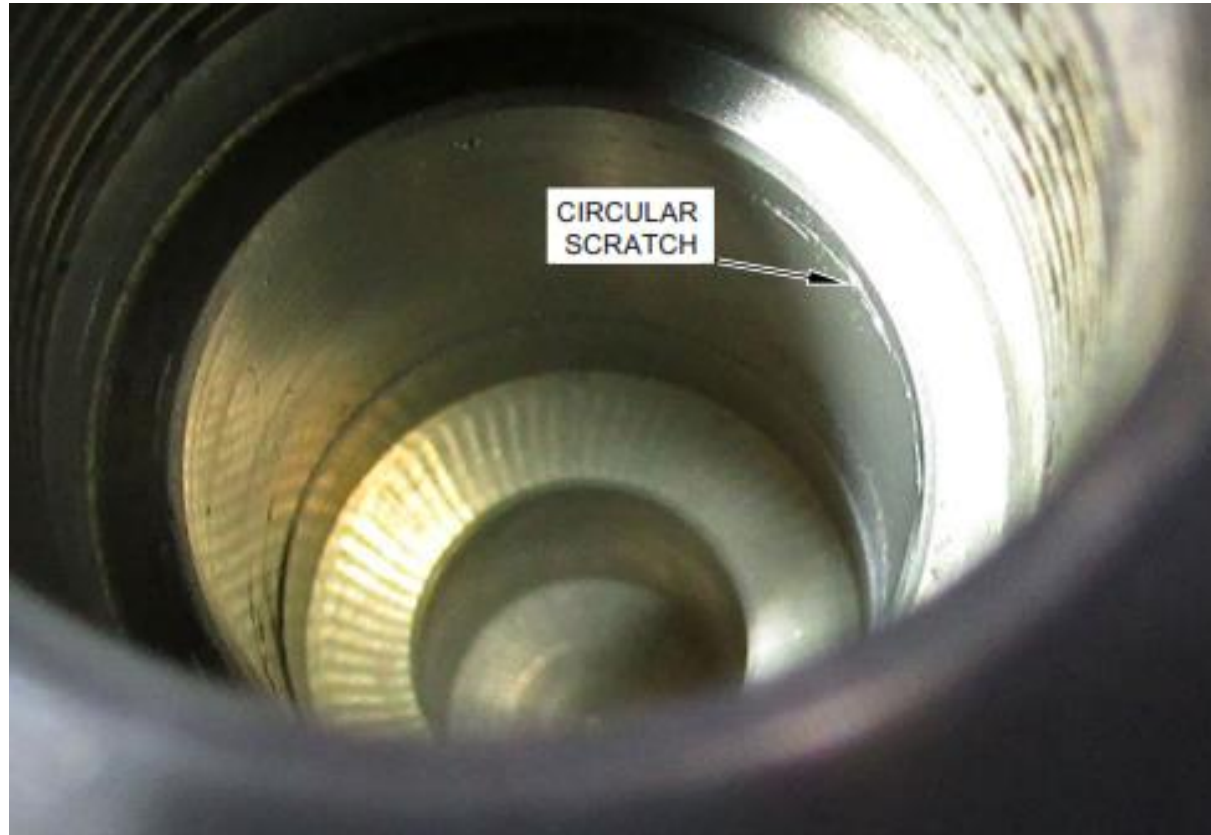


A-A

Inspection Zone 2 - Potential damage at the Inner Diameter of the Bore

CYLINDER TUBE A220 ATA 32 - RTW 2021

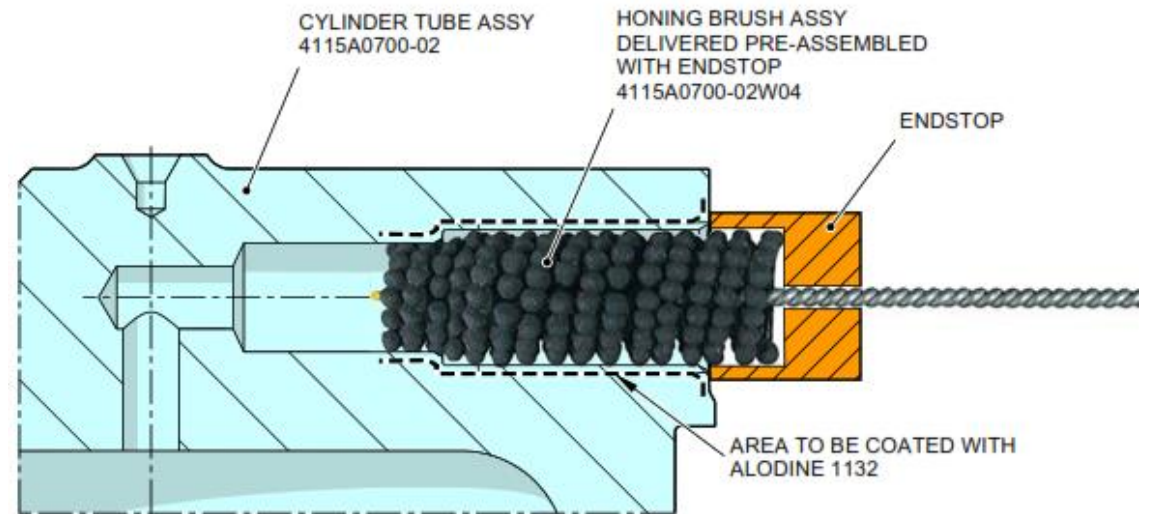
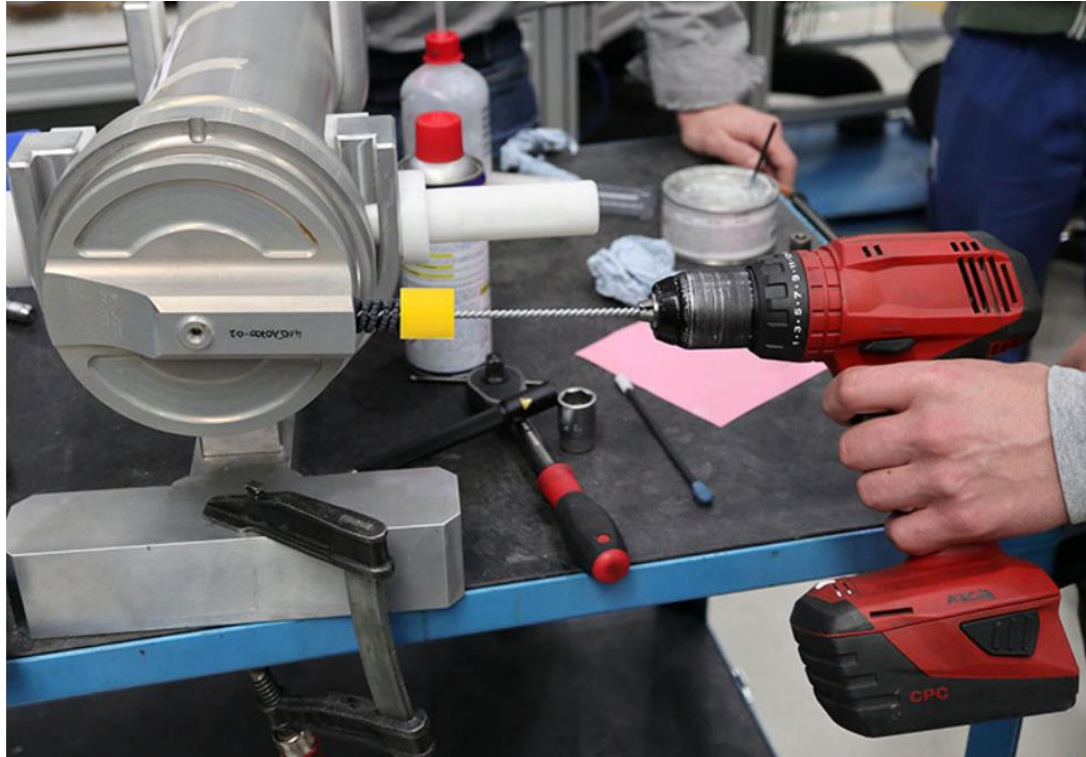
Inspection



Inspection Zone 2 - Potential damage at the Inner Diameter of the Bore

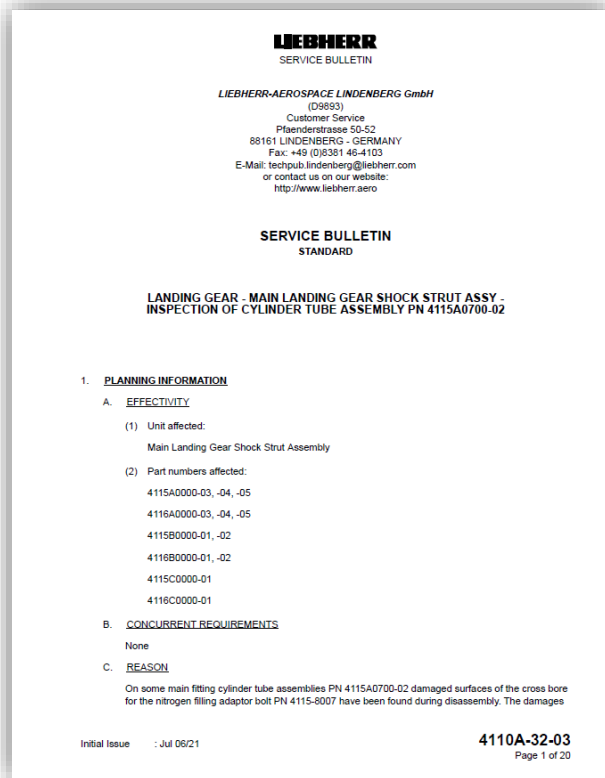
CYLINDER TUBE A220 ATA 32 - RTW 2021

Repair

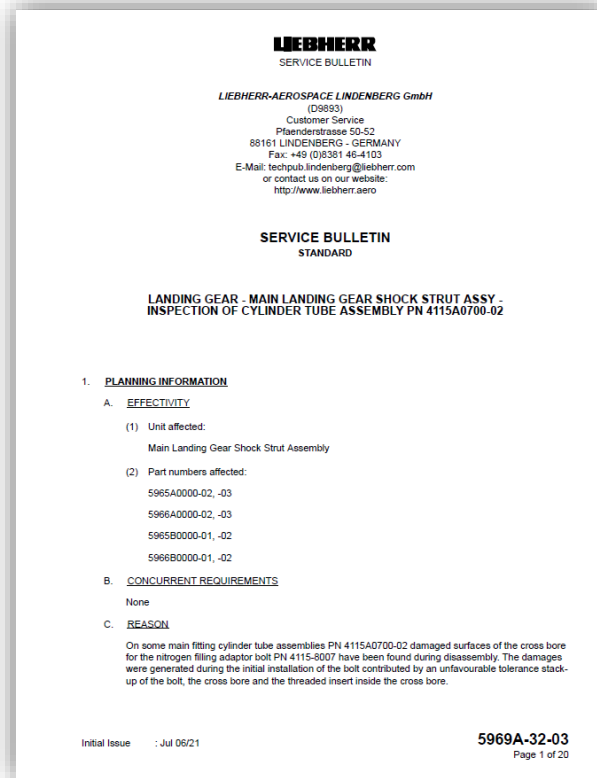


Repair with Honing Brush Assembly PN 4115A0700-02W04

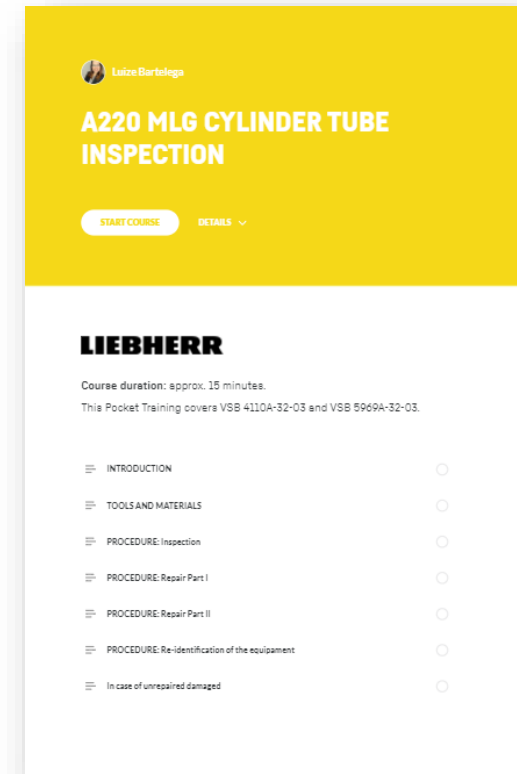
Operator Support Information



SB_4110A-32-03_00
A220-100



SB_5969A-32-03_00
A220-300



Pocket Training

A220 MLG CYLINDER TUBE INSPECTION

98% COMPLETE

INTRODUCTION

TOOLS AND MATERIALS

PROCEDURE: Inspection

PROCEDURE: Repair Part I

PROCEDURE: Repair Part II

PROCEDURE: Re-identification
of the equipment

In case of unrepaired damaged

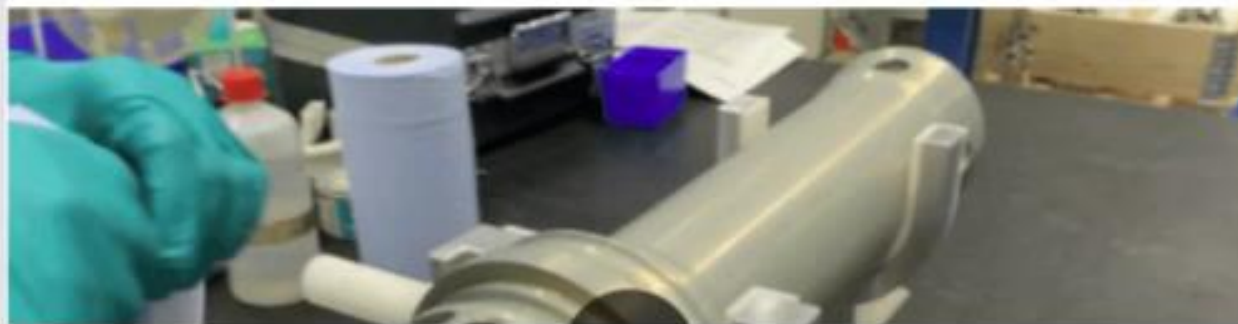
Lesson 2 - TOOLS AND MATERIALS

Lesson 3 of 7

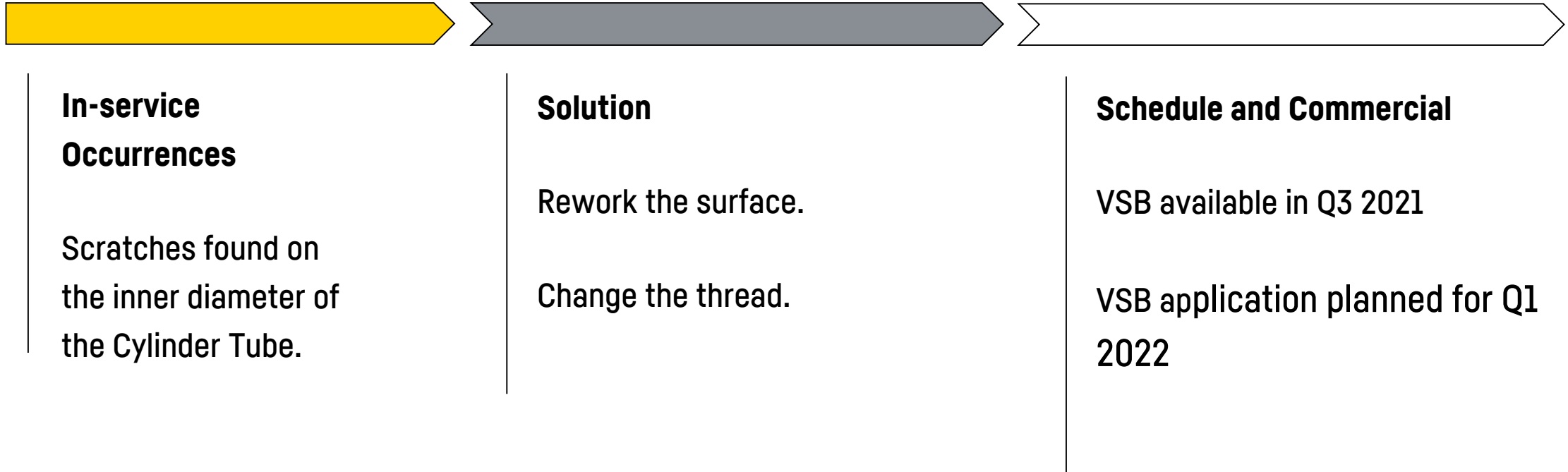
PROCEDURE: Inspection

 Luize Bartelega

(a) Clean the cross bore of the cylinder tube assembly PN 4115A0700-02 with a lint-free cloth(M204) and ethyl alcohol (M202).



Timeline



SPINDLE INSPECTION A220 ATA 32

RTW 2021

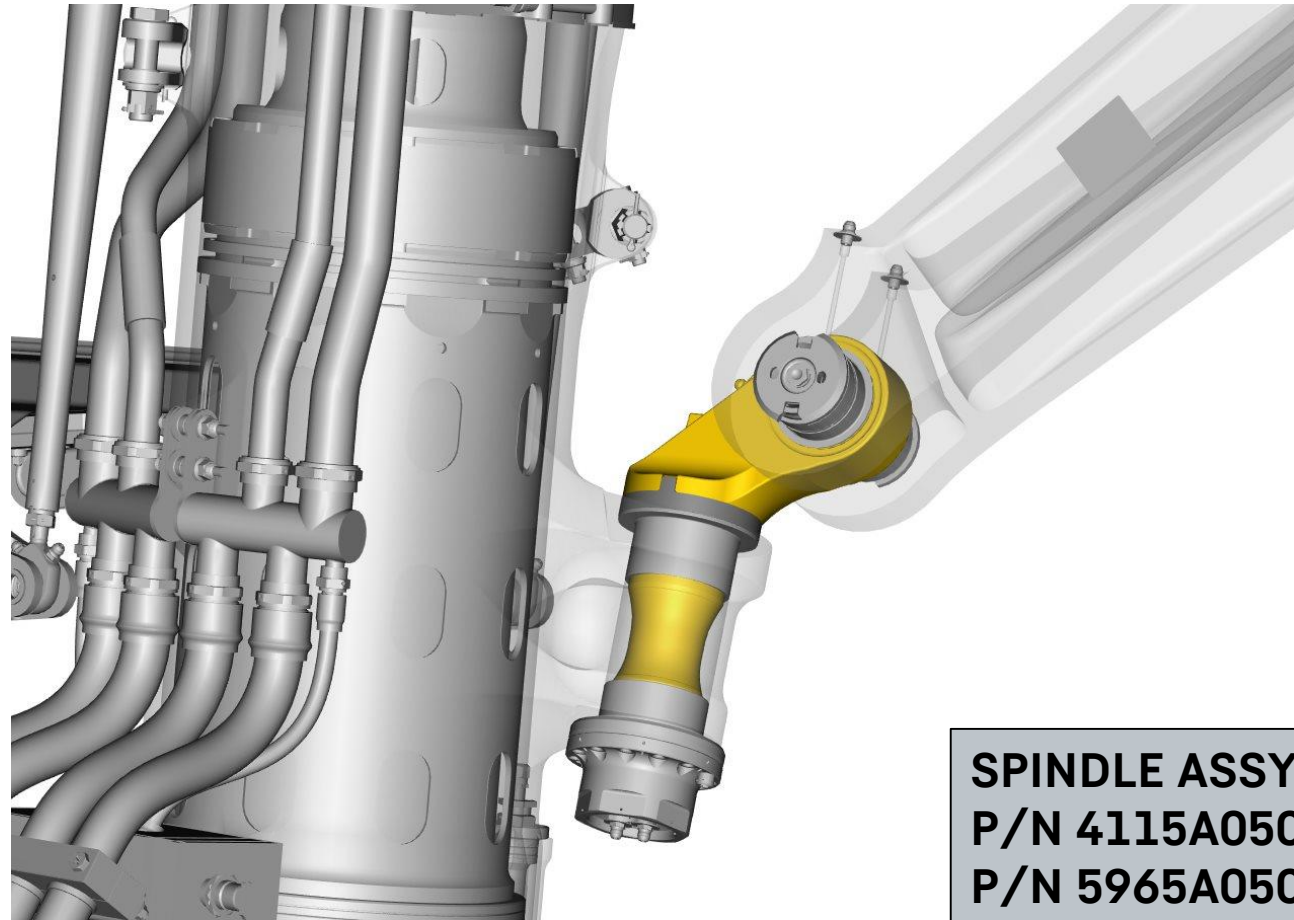
LIEBHERR

Liebherr-Aerospace

Agenda

- Spindle Location
- Description
- Inspection
- Repair
- Operator Support Information
- Timeline

Location



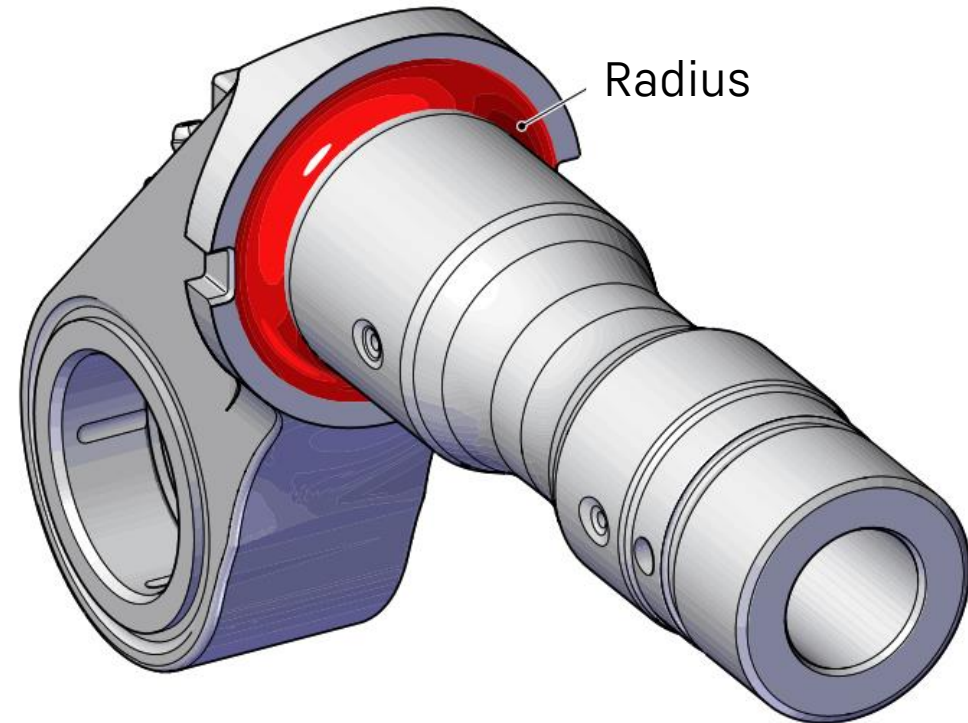
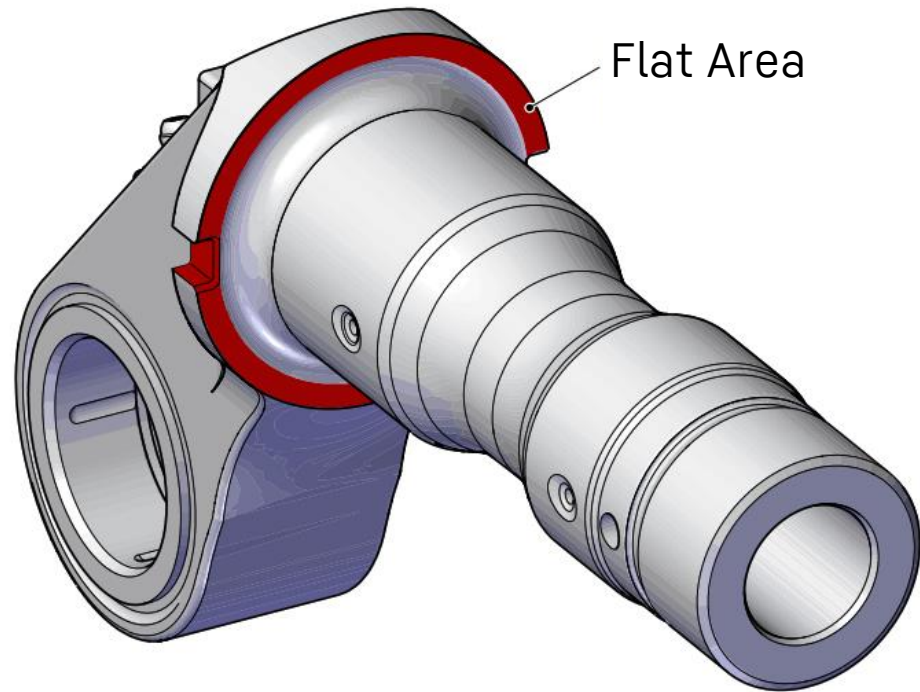
SPINDLE ASSY
P/N 4115A0500-01/-02 for -100
P/N 5965A0500-01 for -300

Description

Corrosion on Lower Spindle was detected.

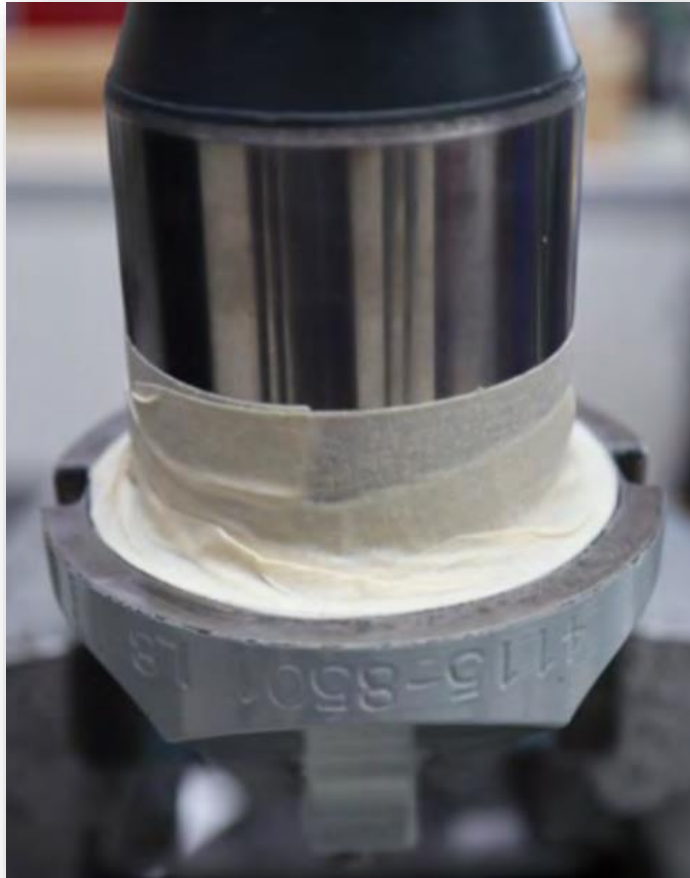


Inspection



Definition of Inspection Areas – Spindle removed

Repair



Masking of Flange F prior to repair



Removal of Corrosion and Xylan

Repair: Coating Flat Area

PN repaired according to VSB

Cadmium LHE 5070

Molykote D-321R

**Rework: 3000 flight cycles or
2 years**

PN repaired at Liebherr

Cadmium LHE 5070

Xylan Coating

**Rework: 3000 flight cycles or
2 years**

New PN Design (future)

Cadmium LHE 5070

HVOF

SPINDLE INSPECTION A220 ATA 32 – RTW 2021

Operator Support Information

Document Validation Record

LIEBHERR

REF. NO. L-4115-SB-001_4115A-32-01 ISSUE 03

Technical Publications / MRO

Vendor Service Bulletin

MAIN LANDING GEAR - SHOCK STRUT - INSPECTION OF SPINDLE ASSY

PLATFORM : A220-100
 SYSTEM : MAIN LANDING GEAR SUB SYSTEM
 EQUIPMENT : SHOCK STRUT ASSY
 PARTNUMBER : 4115A050-02, 4115A050-01 -
 DOCUMENT REF. NO. :
 FILE NAME : SB_4115A-32-01_03.02_merged_SMT_15081739_587.pdf
 CUSTOMER : AIRBUS CANADA LIMITED PARTNERSHIP
 EXTERNAL ID : 4115A-32-01
 EXTERNAL REVISION : 03
 CONFIDENTIAL LEVEL : CONFIDENTIAL SECRET

SIGNATURE TYPE	ROLE	NAME	DATE	SIGNATURE
Prepare	Creator	Jörg Henkel	26.03.2021	<i>J. Henkel</i>
Check	Technical Service Engineer	Volker Busmann	26.03.21	<i>V. Busmann</i>
Approve	Airworthiness Engineer	Alberto Vidotto	26.03.21	<i>A. Vidotto</i>
Authorize	Product Support Manager	Martin Gsch	26.03.2021	<i>M. Gsch</i>
Accept	Customer	Maurice Gravel	26.03.2021	<i>M. Gravel</i>

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SB4115A_32-01_rev03
A220-100

Document Validation Record

LIEBHERR

REF. NO. L-5965-SB-001_5965A-32-01 ISSUE 01

Technical Publications / MRO

Vendor Service Bulletin

Main Landing Gear - Shock Strut - Inspection of Spindle Assy

PLATFORM : A220-300
 SYSTEM : MAIN LANDING GEAR SUB SYSTEM
 EQUIPMENT : SHOCK STRUT ASSY
 PARTNUMBER : 5965A050-01 -
 DOCUMENT REF. NO. :
 FILE NAME : SB_5965A-32-01_01.02_merged_SMT_15081739_587.pdf
 CUSTOMER : AIRBUS CANADA LIMITED PARTNERSHIP
 EXTERNAL ID : 5965A-32-01
 EXTERNAL REVISION : 01
 CONFIDENTIAL LEVEL : CONFIDENTIAL SECRET

SIGNATURE TYPE	ROLE	NAME	DATE	SIGNATURE
Prepare	Creator	Jörg Henkel	26.03.2021	<i>J. Henkel</i>
Check	Technical Service Engineer	Volker Busmann	26.3.2021	<i>V. Busmann</i>
Approve	Airworthiness Engineer	Alberto Vidotto	26.03.21	<i>A. Vidotto</i>
Authorize	Product Support Manager	Martin Gsch	26.03.21	<i>M. Gsch</i>
Accept	Customer	Maurice Gravel	26.03.2021	<i>M. Gravel</i>

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SB5965A-32-01_rev01
A220-300

A220

BD500-321003

**Landing Gear - Main Landing Gear and Doors
- Inspection of the Lower Spindle of the Shock
Strut - Service Bulletin**

BD500-321003
Issue No. 001.00

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Customer Services
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Page 1
2021/04/13

BD500-321003
(Airbus VSB)

AIRBUS

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A220@airbus.ca

CS-AOM-32-10-0002
Rev. NC, 6 July 2021

ALL OPERATOR MESSAGE

Airbus Canada Limited Partnership
A220 Customer Services

- ◆ SUBJECT: Transport Canada (TCCA) Airworthiness Directive (AD) CF-2021-22 - Landing Gear - Main Landing Gear (MLG) Lower Spindle Pin Corrosion
- ◆ SNS: 32-10
- ◆ DATE: 6 July 2021
- ◆ MODEL: BD-500-1A10/BD-500-1A11 (A220-100-300)
- ◆ APPLICABILITY: ALL
- ◆ REFERENCE: N/A
 - AFFECTED #B: BD500-321003

PURPOSE

Transport Canada has recently issued Airworthiness Directive CF-2021-22. A copy of the AD follows, and is provided to all A220 Operators, as advisory information only.

BACKGROUND

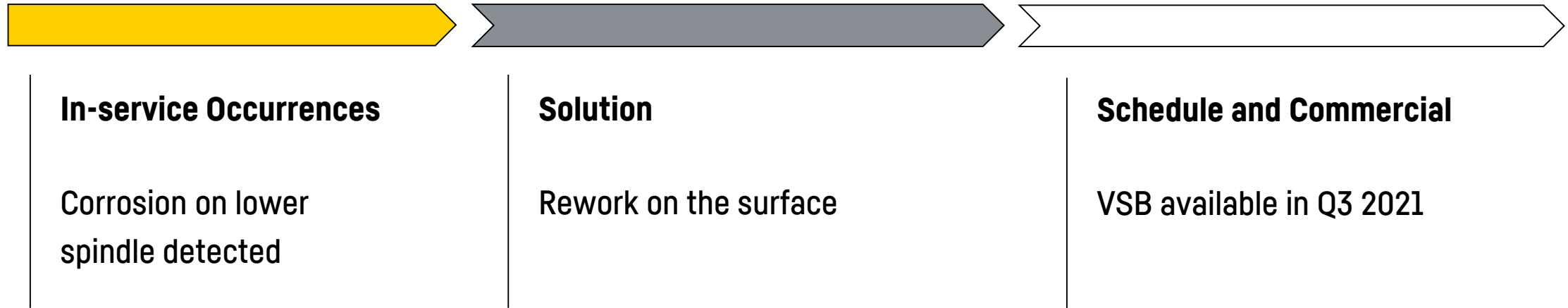
This ACM is released to inform A220 operators that Transport Canada issued AD CF-2021-22 to correct an error previously mentioned in AD CF-2021-18, issued 6 May 2021. (CS-AOM-32-10-0001)
This AD was prompted following in-service findings of corrosion on the flange of the MLG lower spindle pin. This AD requires initial and repetitive inspection of the left and right MLG lower spindle pin to detect damage, and to repair or replace the MLG lower spindle pin if damage is found.

Page 1 of 2

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Form: CS-AOM Rev 07

AD CS-AOM-32-10-0002 (Airbus AD)

Timeline



GSE A220 ATA 32

RTW 2021

LIEBHERR

Liebherr-Aerospace

Agenda

- Overview GSE A220 Landing Gear System
- GSE – All Operators Needs
- GSE NLG
- GSE MLG

GSE – Introduction - Overview

Pos.	Part Number	Tool Name
1	6263A5000-01	MOUNTING DEVICE
2	6263-6101	CALIBRATING ARBOR
	4115-0801W03	CALIBRATING SLEEVE
3	6263A2600-01	DISMANTLING TOOL
4	6416A0000-01	MOUNTING SLEEVE
5	4115-0801W05	MOUNTING DEVICE
6	4115A0000-02W03	MOUNTING DEVICE
7	6569A0000-01	CARRYING DEVICE
8	6263A2800-01	DISMANTLING TOOL
9	6263A0300-01	ASSEMBLY TOOL
10	6263A6200-01	MOUNTING DEVICE
11	6263A2500-01	ASSEMBLY TOOL
12	6263-6104	PROTECTING CAP
13	6263A6600-01	PROTECTING COVER, ASSY
14	6417-0002	CALIBRATING SLEEVE
15	2000A5611K01	SOCKET
16	6263-6102	WRENCH
17	4115-0081W01	SOCKET WRENCH
18	4115-0801W04	PROTECTING COVER
19	4115-0089W01	MOUNTING DEVICE
20	6263A2200-01	CALIBRATION TOOL
21	6263-0004	SOCKET HEAD
22	2000A4210K01	SOCKET

Pos.	Part Number	Tool Name
23	6263A2900-01	DISMANTLING TOOL
24	6263-6103	SOCKET HEAD
25	2000A5609K01	SOCKET
26	6263A6400-01	MOUNTING DEVICE
27	4115-0010W02	MOUNTING DEVICE
28	6263A6700-01	MOUNTING DEVICE
29	4115-8007W01	WRENCH
30	4115-0701W01	MOUNTING DEVICE
31	5035-0025W01	MOUNTING DEVICE
32	5035-0025W02	CALIBRATING SLEEVE
33	6418-0002	CALIBRATING SLEEVE
34	4115A0700-01W02	MOUNTING DEVICE
35	4115A0700-02W02	CARRYING DEVICE
36	53714A2200-01	FIXING DEVICE
37	6263A2700-01	ASSEMBLY PIN
38	4124-0023W02	CALIBRATING ARBOR
39	6263A0500-01	MOUNTING DEVICE
40	6263A0400-01	DISMANTLING TOOL
41	4124-0026W01	SPECIAL SPANNER FOR ADJUSTING
42	4124-0201W28	PROTECTING CAP
43	6263A0800-01	SPACE BRACKET
44	2000A5629K01	SOCKET
45	6263A0200-01	SOCKET WRENCH

Pos.	Part Number	Tool Name
46	6263A6300-01	SEAL INSTALLATION TOOL
47	4124A0800-01W01	SEAL MOUNTING TOOL
48	6263A6500-01	MOUNTING DEVICE
49	4124-0001W02	MOUNTING DEVICE
50	4124-0802W01	MOUNTING DEVICE
51	53714A1200-01	MOUNTING DEVICE
52	53714A1300-01	DISMANTLING DEVICE
53	53714-1101	HALF SHELLS
54	53714-1102	HALF SHELLS
55	53714-1107	GUIDE STRIP
56	53714-1108	MOUNTING SLEEVE
57	4124A1000-03W04	MOUNTING DEVICE
58	4124-0004W02	DISMANTLING TOOL
59	4124-0007W01	SEAL MOUNTING TOOL
60	4124A1400-01W01	SEAL MOUNTING TOOL
61	6263A3000-01	CLAMPING DEVICE
62	6263A0100-01	LOCKING PIN
63	3368A8000-02	EVALUATION UNIT
64	6263A4000-01	TARGET
65	4124A0200-01W08	MOUNTING DEVICE



GSE for MLG



GSE for NLG



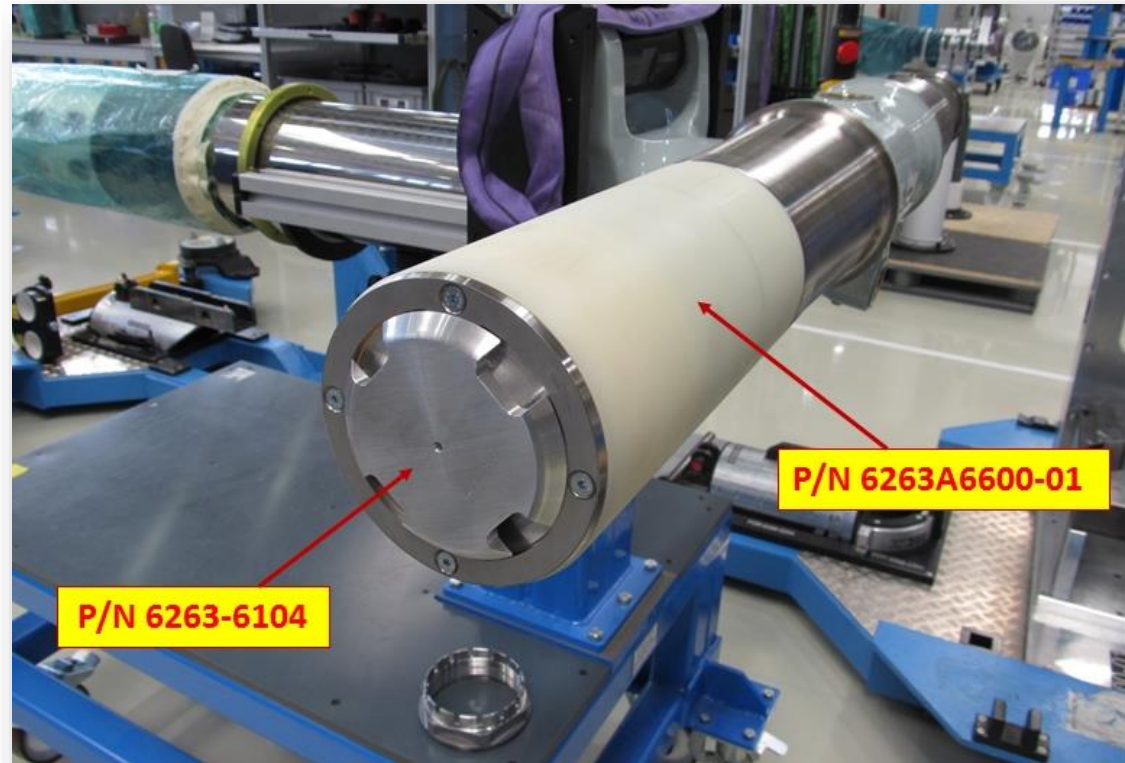
GSE for MLG and NLG

GSE – Usage Example – MLG – Wheels and Brakes Support Tools

- Tool P/N 4115-0081W01, 6263-6104 and 6263A6600-01
- Function: Used to remove and install the wheels and brakes of the MLG to avoid damage of the wheel axle

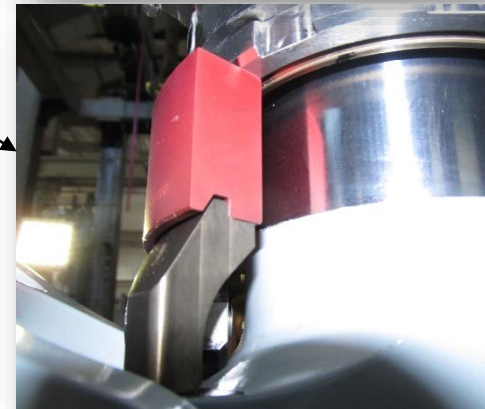


4115-0081W01
to open and tighten
the Wheel Axle Nut



GSE – Usage Example – NLG Hydraulic Fluid Servicing

- Tool P/N 6263A0800-01
- Function: to fill in the correct quantity of hydraulic fluid depending on the temperature



GSE – Usage Example – NLG Removal & Installation Piston Axle

- Tool P/N 6263A0500-01
- Function: for removal and installation of the Piston Axle
to push the Lower Cam into the Main Fitting to gain access to the Split Ring and the
Anti Rotation Pins



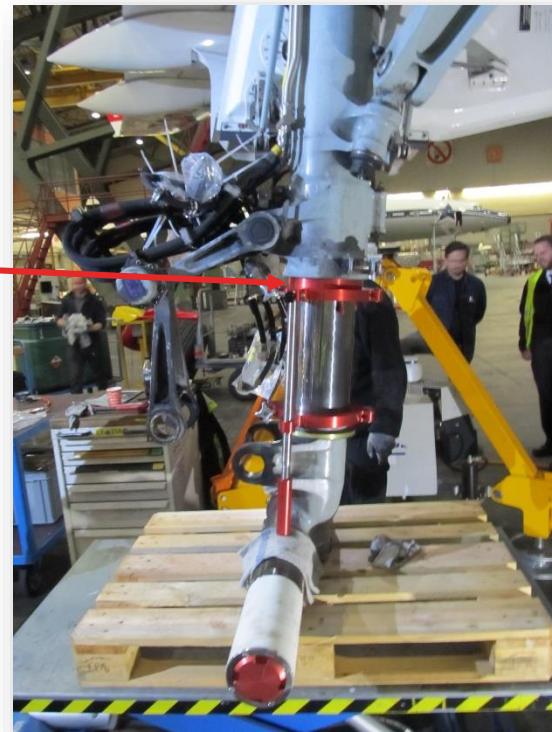
6263A0500-01

GSE – Usage Example – MLG Removal & Installation Piston Axle

- Tool P/N 6263A0300-01
- Function: for removal and installation of the Piston Axle
to push the Lower Bearing Support into the Main Fitting to gain access to the Split Ring
and the Anti-Rotation-Pin

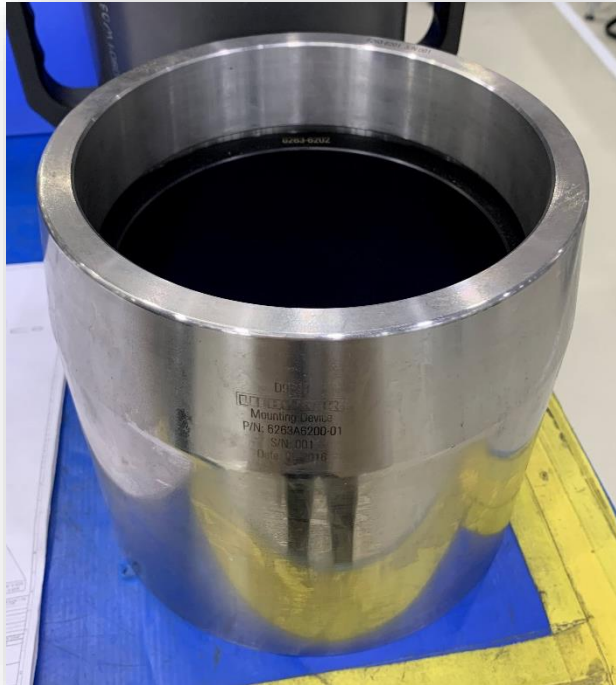


6263A0300-01



GSE – Usage Example – MLG Seals Installation

- Tool P/N 6263A6200-01
- Function: used to install the Static Seals in the Lower Bearing.



GSE – Usage Example – MLG Static Seal Calibration

- Tool P/N 6263A2200-01
- Function: to install and remove the Calibration Sleeve for the Static Seals



Calibration Sleeve

