

A330/340 EDP Reliability & In Service Issues

A close-up photograph of an aircraft engine component, likely an engine-driven pump (EDP), showing various bolts, wires, and a small red and purple label.

Steve Badenoch

Product Support Manager
Bedhampton FMC Hydraulics



Powering Business Worldwide

Agenda

Current Model Codes and Part Numbers

Historical Background

PV3-300-EA2/A Product Improvements

PV3-300-EA2/A Reliability

Rosan Outlet Fitting Update

Questions

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Rosan Outlet Fitting Update

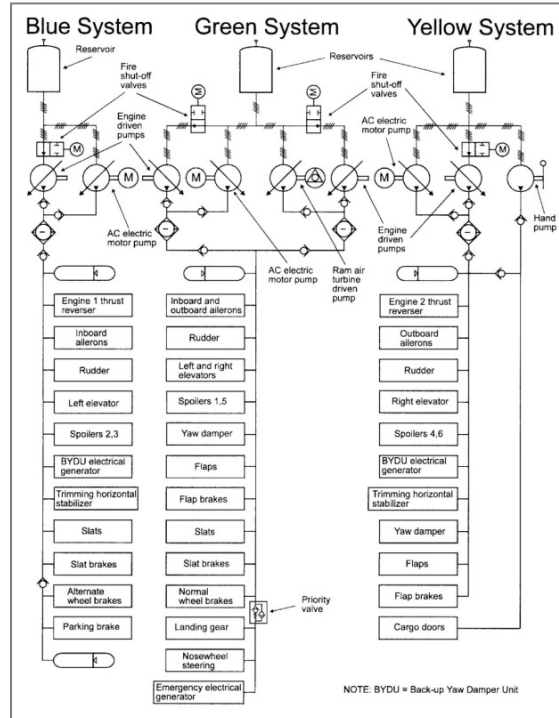
Value proposition

Questions

Current Model Codes and Part Numbers

PV3-300-13K	Part No 974976
PV3-300-13L	Part No 974800
PV3-300-EA2	Part No 3022053-000
PV3-300-EA2A	Part No 3022053-001

Airbus A330/340 Hydraulic System



- There are four EDPs per aircraft
- Blue System 1 x EDP
- Yellow System 1 x EDP
- Green System 2 x EDP
- The Green System is most heavily utilised, both EDPs share a common reservoir.

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Historical Background – PV3-300-13 Series

- The PV3-300-13 Series was first developed in 1991 specifically for the A330/340 platforms
- Many modifications have been introduced throughout its service life and finally evolved into the PV3-300-13L (974800) circa 2000
- It was last supplied as the production standard EDP in Sep 2002
- It is estimated that approximately 1200 -13 Series EDP's may still be in service
- There is still an option to upgrade the PV3-300-13K (974976) to a PV3-300-13L (974800)
- Supplied out of Jackson although a small number were produced by Bedhampton before the introduction of the EA2 Series

Historical Background – PV3-300-EA2 Series

- The PV3-300-EA2 Series was first introduced in 2002 to replace the PV3-300-13L (974800)
- This product is supplied from Bedhampton
- The EA2 Series offers enhanced performance, lighter weight and addresses known issues of the -13 series
- Predicted reliability for the EA2 Series was 33,864 hours MTBF compared to 22,250 hours delivered by the PV3-300-13L (974800)
- A total of 21 new Part No's were introduced on the EA2 Series

Historical Overview - PV3-300-EA2 Series In Service Issues

It became apparent after a few years service that the PV3-300-EA2 (3022053-000) was not performing as predicted

A number of issues were being reported from the Airline Operators

A number of critical modifications were therefore introduced in 2007

A new Model Code / Part No was also introduced

Reported in service issues

- Solenoid valve body/stem joint cracks
- Mounting flange seal assembly (FAL)
- Hydraulic system low pressure
- Hydraulic system overheat
- Parting line leakage (P/N 3022053-000)

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PV3-300-EA2 Series Product Improvements

MODEL No	PART No	SERVICE BULLETIN	SERVICE BULLETIN TITLE	AMENDMENT	DATE OF ISSUE
PV3-300-EA2	3022053-000	3022053-000-29-01	Inspection of Adaptor Block	A - Inspection only. E - New Std Adaptor Block	Sep-07
		3022053-000-29-02	Improved Mounting Flange Seal	B	Nov-07
		3022053-000-29-03	Improved Solenoid Valve	C	Sep-07
		3022053-000-29-04	To prevent Pressure Compensator Seal Failure/Low Hydraulic System Pressure	D	Sep-07
		3022053-000-29-05	Introduction of PV3-300-EA2A P/N 3022053-001	Incorporating Amendments B,C,D,& E.	Sep-07

All product improvements are incorporated into the production configuration PV3-300-EA2A – to help ensure high reliability.

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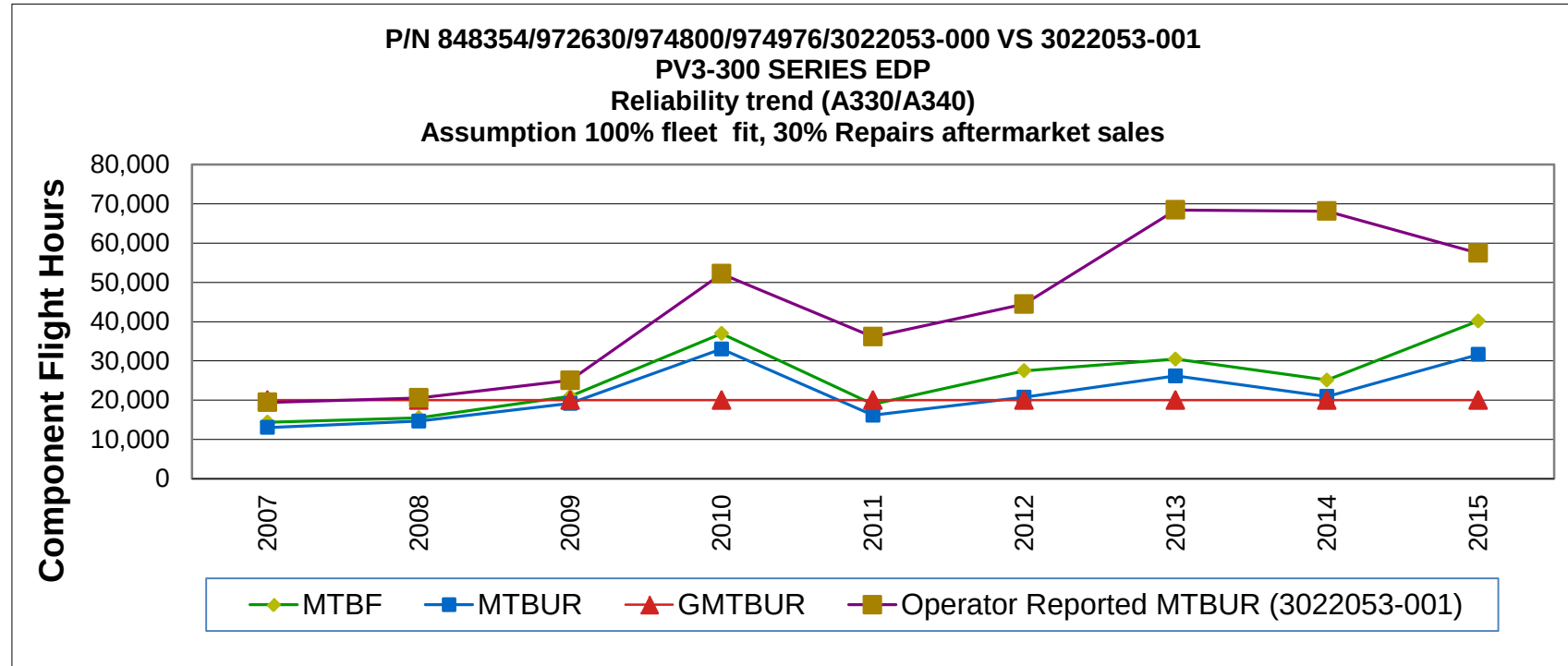
PV3-300-EA2/A Product Improvements

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A330 EDP Reliability Trend



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Rosan Outlet Fitting Update

Questions

Rosan fitting – Problem Description

- Operator disruption due to leakage from outlet port fitting
- It is now the number 1 in service issue
- Recent analysis determined approximately 20% of returns to Bedhampton had a fitting issue
- Reported issues include external leakage and loose outlet fittings



Rosan fitting – Affected Parts

Valve block part no 3022053-200

Material: High grade stainless steel



Outlet union part no SLAS4099-16SP5

Material: Titanium



A330 EDP Valve Block 3022053-200

Background

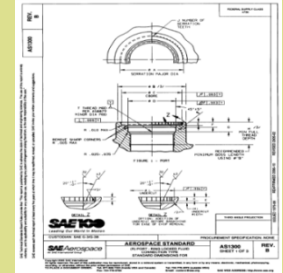
- The valve block is manufactured by a Company based in California USA
- The Company manufacture valve blocks for the PV3-300-13K/L & EA2 series EDP's containing this feature
- Eaton Quality representatives from Eaton L.A have inspected the manufacturing process on Bedhampton's behalf
- Particular interest was in the manufacture and inspection of pump outlet port serrated feature in the valve block
- Material was also inspected

Manufacturing

- The serration feature is cut using a broaching tool
- All broaching tools are certificated and supplied by the tool manufacturer to ensure compliance to specification
- All valve blocks are 100% inspected for hardness
- Heat treatment certificates are supplied for all valve blocks manufactured

Design

- The outlet port is manufactured to Vickers specification VS-1-3-3-46, equivalent to AS1300-16



Findings

- Eaton LA Quality representatives were satisfied that there were no manufacturing issues to report
- All work in progress met requirements
- The in service issue is highly unlikely to be related to the valve block design or manufacture



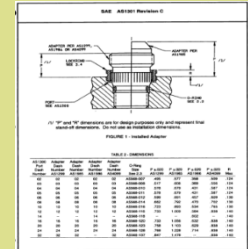
A330 EDP Outlet Adaptor SLAS4099-16SP5

Background

- Supplied by a distributor.
- Installation and manufacturing process reviewed, see next slide

Design

- International standard design standard AS1301



Manufacturing

- Alternative manufacturers can supply fittings to the international standard



Findings

- Samples supplied to manufacturer for investigation
- No manufacturing or material defects were discovered



Assembly Process – Outlet Fitting

1 Lubricate



2 Hand tighten



3 Apply adaptor torque



4 Check serration alignment



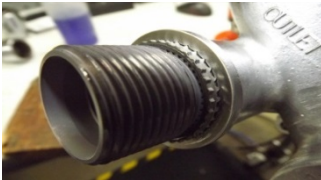
5 Fit locking ring tool



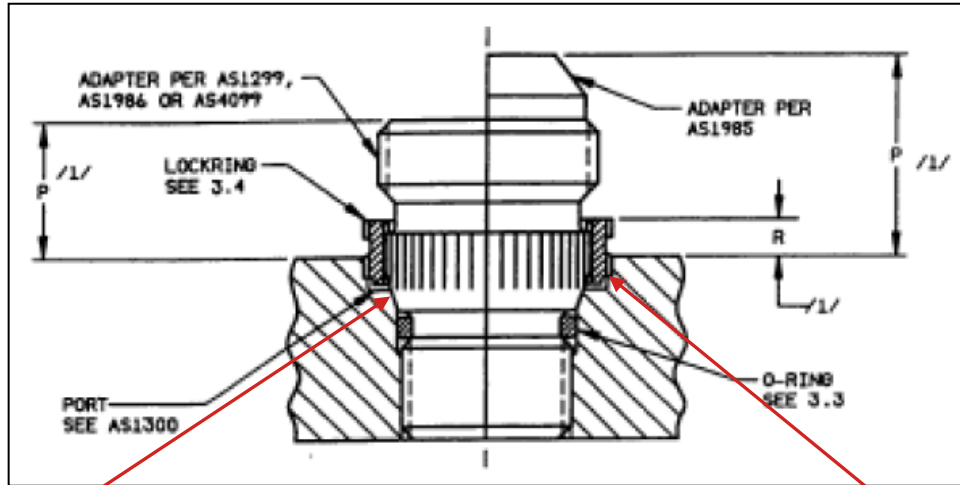
6 Locate locking ring



7 Check installation



Rosan Fitting – Key Features



Metal to metal sealing chamfer

Locking ring & valve block serrations

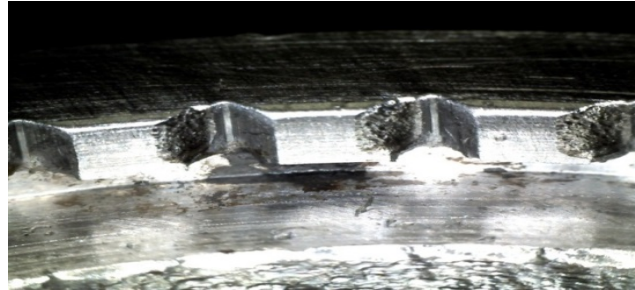
Investigation has found these key features are known areas of wear resulting in external leakage.

A330 EDP Outlet Fitting – Characteristic Regional Wear

External fitting serration wear



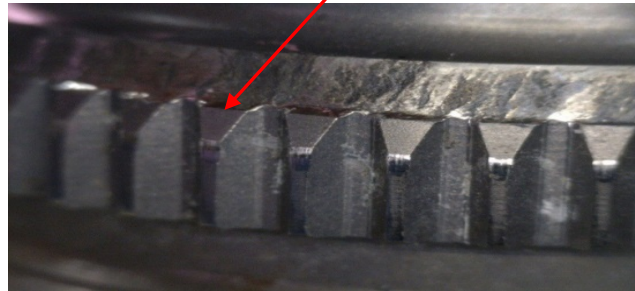
Valve block corresponding serration wear



No chamfer wear or loss of material



Chamfer wear resulting in material loss

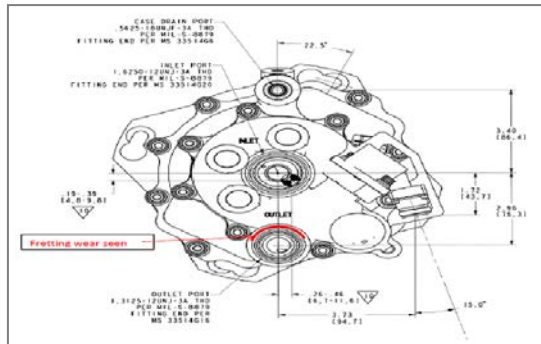


A330 EDP Outlet Fitting – Characteristic Regional Wear

Fitting serration wear



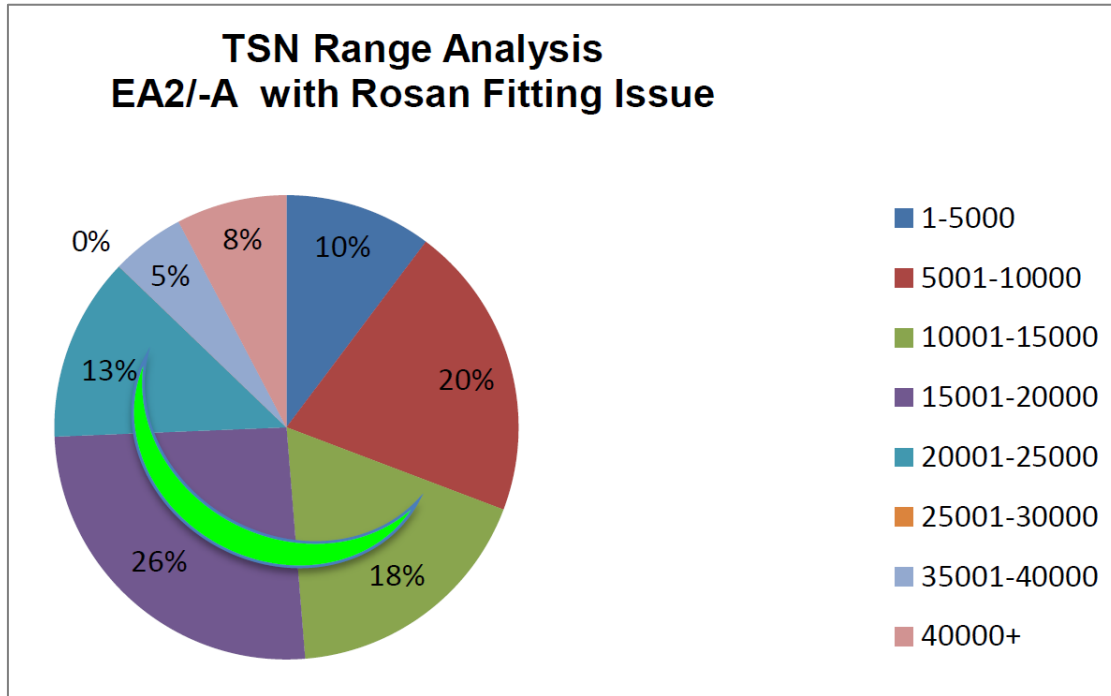
Fitting serration – No wear



Valve block serration wear patterns



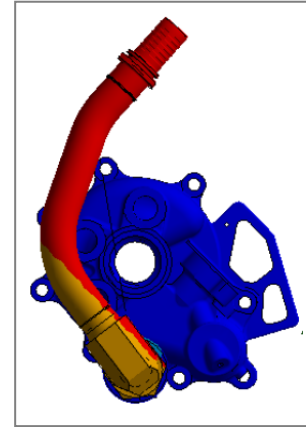
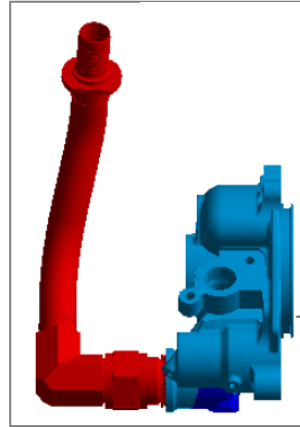
Rosan Fitting Time Related Usage



A330 EDP General Findings

- No EDP material defects or manufacturing issues.
- Removal of material on valve block and fitting results in loss of pre-load torque, fitting movement, seal fretting and leakage.
- Analysis confirms the vast majority of fitting leakage occurring on A330 Rolls Royce engines.
- Analysis also confirms most failures occurring on Green System.
- There is no relationship between flight hours and fitting leakage.

EDP Rolls Royce Trent 700 Installation



Observations

- Very tight installation
- Solid tube with right angled connection at port interface followed by a double kick
- Subsequent FEA has confirmed there is relative motion between the fitting and valve block causing wear to occur, this is caused by a number of factors.

Way forward Airbus MISP – 1507-15

Airbus has raised a Major In Service Problem (MISP) to resolve the Rosan fitting issue.

Airbus has formed and is leading a task force (Eaton, Airbus & Rolls-Royce) and all parties are working together to investigate and develop a viable solution.

Airbus have instrumented an aircraft and performed vibration measurements.

The Task Force are performing extensive analysis based on available vibration data and different scenarios. Dynamic conditions are complex due the effect of operating conditions, amplification of pressure pulsations and hose installation



Questions/Comments



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