



State of Israel



**Ministry of Transport & Road Safety
Aircraft Safety Investigation Authority**

May 5th, 2024

4000-0098-2024-0000189

To: Aaron Sauer - NTSB IIC

Subject: Test Report for Astra 1125 Brake Power Valve

Dear Aaron,

AS part of N39TT ASTRA 1125 accident investigation occurred during landing at KPWK airport, while the pilot has reported loss of braking action during landing on dry runway surface, Runway excursion and collapse of right main landing gear, the suspected Brake Power Valve, P/N D25W714001-503, was sent to the designer and manufacturer of the unit - IAI in Israel.

As the Aircraft safety Investigation Authority Israel (AIAI) ACCREP I was requested by the NTSB to witness the procedures of inspection and testing of the unit at IAI facility, with reference to the following issues:

1. Initial inspection of the packaging.
2. Analysis of manufacturing and/or repair records.
3. Visual examination of unit.
4. Measurements (wear, size of damage, corrosion, etc.)
5. Electrical functional checks, as required.
6. Run the Unit on the test bench, as applicable.
7. Disassembly, as necessary.
8. Further analysis as required.

On April 17th, 2024 I've visited IAI facility to check and test the Brake Power Valve unit, removed from the ASTRA 1125 aircraft S/N: 053 that was involved in the accident.

The unit was inspected for damages and leakages - No damages external were found nor signs for any leakages.

The Brake power Valve (BPV) details:

Assy: 2285

P/N: D25W714001-503

S/N: IL-019

Date of Manufacture: 5/86

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Figure 1 - Brake Power Valve P/N D25W714001-503 S/N IL-019



Figure 2 - BPV FWD side view

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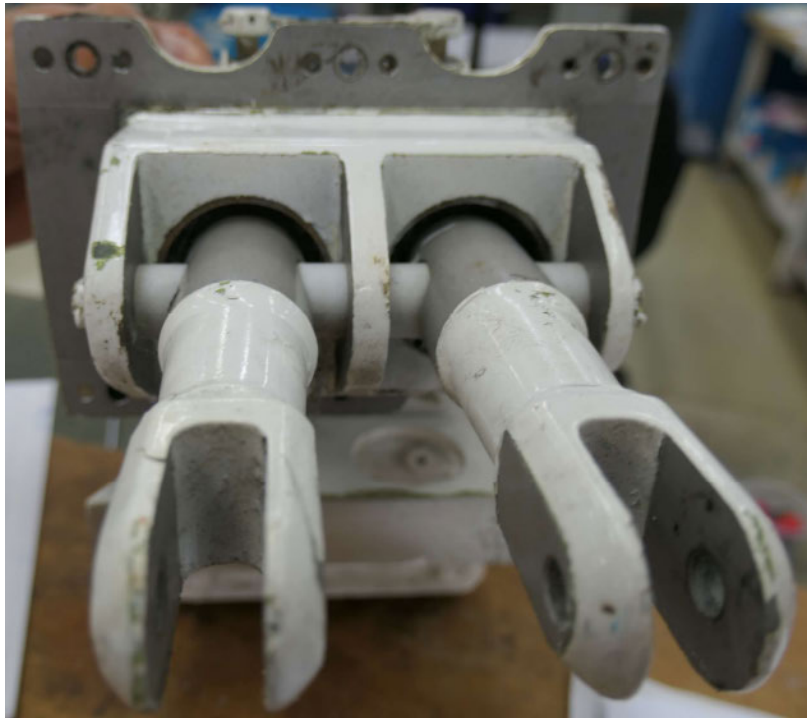


Figure 3 - BPV AFT side view



Figure 4 - BPV Upper side view

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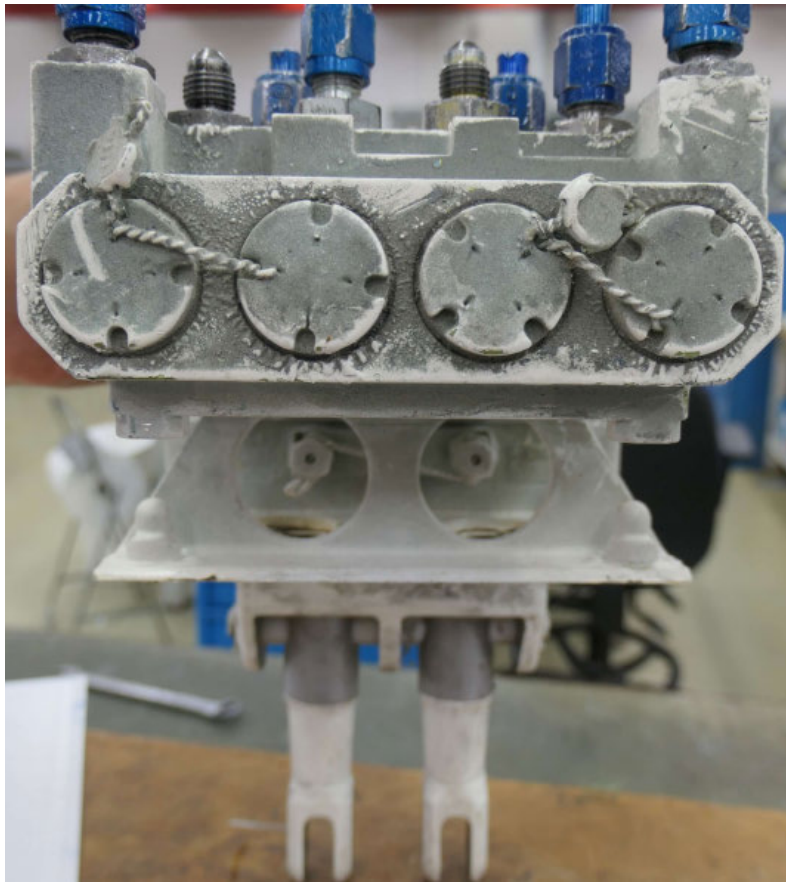


Figure 5 - BPV Lower side view

The maintenance history of the unit was checked - no recorded repair visits at IAI were found nor at Gulfstream facilities in the US.

There are some founding of paint partially removed due to contact with some fluid, probably hydraulic fluid.

The unit does not have any electrical elements; therefore, no electrical inspection was needed.

The fitting does not have security wires and are fitted with torque.

An initial test of the unit was conducted on the Test bench P/N 23806700001 S/N 90 with serviceable tags until May 14th, 2024.

The BPV unit was installed on the test bench and was connected to hydraulic lines, first to the Normal operation fittings and then to the Emergency operation fittings.

First test - Normal operation

Inlet Pressure 3,000Psi

Outlet Pressure Right - 1,720Psi, steady pressure.

Outlet Pressure Left - 1,740Psi, steady pressure.



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Second test - Emergency operation

Inlet Pressure 3,000Psi

Outlet Pressure Right - 1,780Psi, steady pressure.

Outlet Pressure Left - 1,740Psi, steady pressure.

The designed Max. Outlet pressure should be 1,750-1,800Psi.

No leakages or pressure fluctuations were noticed.

The BPV unit was undergoing a full ATP at May 2nd, 2024, as per document ATR2285CMM Rev. D. The Unit passed the test and found fully functional with no leakages (see Annex 1 to this report).

Are there any other requests by the NTSB regarding any additional inspection of this PBV unit?
Would the NTSB like to disassemble the unit for further
that there are no further inspections to be carried out, the IAI asked for shipping address for that
PBV unit.

Sincerely yours,



Boas Grossman

Head of Aviation Accident Investigations



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CMM TEST DATA SHEET No: ATR2285CMM Rev. D

S/N: <u>1L-019</u>	Tracking No. Issuing Date:	P/N: 2285.0000.000	Ref: CMM32-40-95 G100 REV. - E.O: MNT00005037 REV. 1 E.O: 00005107 REV. 2 E.O: 00005156 REV. 3 TESTING - PAGE 101 Dated: 08/2021	Page: 1
W.O: <u>H2670728</u>	Tracking No.	Prep. By: Yaniv Shoshani		Of: 5

SUBJECT: G100 Power Brake Valve Acceptance Test Report

No.	CMM REF.	Description	Requirements	Test Results	Pass	Fail
1	A -C	Test Conditions Per CMM Para A-D				
1.1		HYD. Fluid	Skydrol 500B/LD4	<u>LD4</u>		
		Nominal Pressure	3,000psi	<u>3000</u> psi		
		Ambient Temp:	10°C - 40°C	<u>22</u> °c	☒	☐
		HYD. Fluid Temp	20°C - 50°C	<u>38</u> °c		
		Fluid Pollution Class per SAE-AS-4059	Max 7	<u>7</u>		
2	D	Visual Examination and Adjustment Check				
2.1	D2(a)	Identification name-plate	Para. D(1) (a) thru (h)		☐	☐
	D2 (a)-(b)	Visual inspection in accordance with CMM	Para. D(2) (a) thru (b)		☐	☐
	D2(c)	Mass control (without oil)	3.61-3.99 kg	<u>3.9</u> kg	☐	☐
2.	D3	With foot levers in "OFF" position against backstop screws, valve push rod should be firmly held by their respective return spring, but not binding in either socket.	Firmly and no binding	<u>N/A</u>	☐	☐
2.3	D3	With all controls un-operated, apply means of hand-pump, pressure not exceeding 50 psi at each brake connection (PN, PE, SN, SE) in turn and check that in each case pressure falls away completely to zero when pumping ceases.	Check that in each case pressure falls away completely to zero when pumping ceases.	<u>N/A</u>	☐	☐
2.4	D4 c	Apply 3000 psi to port "N". Measure the pressure at ports "PN" and "SN".	80÷120 psi	<u>N/A</u> psi	☐	☐
2.5	D4 e	Lever Adjusting	42.5 ±0.2 mm	<u>N/A</u> mm	☐	☐



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No.	CMM REF.	Description	Requirements	Test Results	Pass	Fail
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3	D5	Proof Test (Setting according to paragraph 13 on page 704)				
3.1	D5 (a-z)	With all other connections closed and controls un operated, fill valve with fluid so that any leakage will be apparent, and apply 4,500 psi at N. Hold for two minutes.	No leakage or permanent distortion is allowed.		☒	☐
3.2		Reduce pressure to 0 psi			☒	☐
3.3		With all other connections closed and controls un operated, fill valve with fluid so that any leakage will be apparent, and apply 4,500 psi at E. Hold for two minutes.			☒	☐
3.4		Reduce pressure to 0 psi			☒	☐
3.5		Repeat test 3.3 with 5 psi pressure			☒	☐
3.6		Reduce pressure to 0 psi			☒	☐
3.7		Close ports N, E, RN and RE and apply 4,500 psi simultaneously at PN, PE, SN and SE and hold for two minutes.			☒	☐
3.8		Reduce pressure to 0 psi			☒	☐
3.9		Repeat test 3.7 with 5 psi			☒	☐
4	D6	Functional Test				
		Verify that the test setup is in accordance with CMM Figure 103 (Page 114)	Per CMM Fig 103 (Page 114)		☒	☐
5	D6	Normal System (3000 PSI)				
5.1	D6 (1-7) (a)-(b)	Operate the left lever and release.	Pressure rises and drops at port "PN"			
			No fluid should emerge from any port (except Return port).		☒	☐
5.2		Operate the right lever and release.	Pressure rises and drops at port "SN"			
			No fluid should emerge from any port (except Return port).		☒	☐



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No.	CMM REF.	Description	Requirements	Test Results	Pass	Fail
5.3		Smoothness operation	No binding		☒	☐
5.4	D6 (c)1	Applied Force versus Braking Pressure	Results should be with stand limits of the next Table		☒	☐

Braking Pressure [psi]	Increasing Pressure		Decreasing Pressure		Differential Force	
	Maximum Force [lbf]	Actual Force [lbf]	Minimum Force [lbf]	Actual Force [lbf]	Maximum Difference [lbf]	Actual Difference [lbf]
		Port PN Port SN		Port PN Port SN		Port PN Port SN
200	<50	40 40	>20	35 33	<10	5 7
1000	<125	100 101	>85	92 91	<17	8 10
1600	<210	173 176	>150	165 165	<17	8 11

5.5	D6 (c)2	Maximum brake pressure (PN)	1,750 – 1,800 psi	PN: 1720 psi SN: 1740 psi	☐	☒
5.6	D6 (c)3	Brake initial pressure (PN).	<200 psi	PN: 70 psi SN: 70 psi	☐	☒
5.7	D6 (c)4	Force to deliver maximum pressure	190-260 lbf	PN: 230 lbf SN: 240 lbf	☒	☐
5.8	D6 (c)5	Travel	4.5 – 5.5 mm	PN: 5.5 mm SN: 5.45 mm	☒	☐
6	D6(d)	Emergency System (3000 psi)				
6.1	D6(d) 1-7	Operate the left lever and release.	Pressure rises at port "PE"			
			No fluid should emerge from any port (except Return port).		☒	☐
6.2		Operate the right lever and release.	Pressure rises at port "SE"			
			No fluid should emerge from any port (except Return port).		☒	☐
6.3		Smoothness operation	No binding		☒	☐
6.4	D6 (e)1	Applied Force versus Braking Pressure	Results should be with stand limits of the next Table		☒	☐



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No.	CMM REF.	Description	Requirements	Test Results	Pass	Fail
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	Increasing Pressure		Decreasing Pressure			Differential Force			
Braking Pressure	Maximum Force	Actual Force		Minimum Force	Actual Force		Maximum Difference	Actual Difference	
[psi]	[lbf]	[lbf]		[lbf]	[lbf]		[lbf]	[lbf]	
		Port PN	Port SN		Port PN	Port SN		Port PN	Port SN
200	<50	40	40	>20	35	33	<10	5	7
1000	<125	100	101	>85	91	90	<17	9	11
1600	<210	163	171	>150	158	161	<17	10	10

6.5	D6 (e)2	Maximum brake pressure (PN)	1,750 – 1,800 psi	PE: 1750 psi	☒	☐
				SE: 1780 psi	☒	☐
6.6	D6 (e)3	Force to deliver maximum pressure	190-260 lbf	PE: 220 lbf	☒	☐
				SE: 225 lbf	☒	☐
6.7	D6 (e)4	Travel	4.5 – 5.5 mm	PE: 5.5 mm	☒	☐
				SE: 5.5 mm	☒	☐
7	D7	Dynamic Leakage Test (Fig 102 Page 113)				
	D7(b)	Normal Operation				
7.1	D7 (b)3	With brake levers in "OFF" position, apply 3000 psi at N and measure the leakage from RN over the last minute of five minutes.	< 9 cc/min	2.5	☐	☐
7.2	D7 (b)4	Apply maximum brake pressure and check, with 3000 psi at N.	< 150 cc/min	PN: 105 cc/min	☒	☐
				SN: 90 cc/min	☒	☐
	D7(c)	Emergency Operation				
7.3	D7 (c)3	With brake levers in "OFF" position, apply 3000 psi at E and measure the leakage from RE over the last minute of five minutes.	< 6 cc/min	7	☐	☒
7.4	D7 (c)4	Apply maximum brake pressure and check, with 3000 psi at E.	< 150 cc/min	PE: 50 cc/min	☒	☐
				SE: 150 cc/min	☒	☐
8	D8	Flow Test				
	D8(a)	Normal Operation				
8.1	D8(a) 1-9	Pressure Drop @ 1GPM between ports N and PN	<100 psi	28 psi	☒	☐
8.2		Pressure Drop @ 1GPM between ports N and SN	<100 psi	46 psi	☒	☐
8.3		Pressure Drop @ 1GPM between ports PN and RN	<50 psi	15 psi	☒	☐



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No.	CMM REF.	Description	Requirements	Test Results	Pass	Fail
8.4		Pressure Drop @ 1GPM between ports SN and RN	<50 psi	16 psi	☒	☐
	D8(b)	Emergency Operation				
8.1	D8(b) 1-9	Pressure Drop @ 1GPM between ports E and PE	<100 psi	54 psi	☒	☐
8.2		Pressure Drop @ 1GPM between ports E and SE	<100 psi	97 psi	☒	☐
8.3		Pressure Drop @ 1GPM between ports PE and RE	<50 psi	18 psi	☒	☐
8.4		Pressure Drop @ 1GPM between ports SE and RE	<50 psi	22 psi	☒	☐
9	D9	Tests with Pressure at Return Port				
	D9 (a)	Normal Operation				
9.1	D9 (a) 1-6	With brake lever in "OFF" position apply 3000 psi to the normal pressure port and 500 psi to the normal return port. Measure the pressure at the brake port.	>400 psi	500 psi	☒	☐
	D9 (b)	Emergency Operation				
9.2	D9 (b) 1-6	With brake lever in "OFF" position apply 3000 psi to both the emergency pressure port and emergency return port. Measure the pressure at the brake port..	>1,500 psi	2400 psi	☒	☐
10	D10	Air Leakage Test Across Lever Seal				
10.1	D10 (a-e)	Leakage across the lever seal.	< 0.2 SCFM	0 SCFM	☒	☐
11	D11	Cover all hydraulic ports with protective caps.			☒	☐

	Operator	Inspector	Supervisor/Quality
Name:	S.F.		
Signature:	[Redacted]		
Date:	2/5/2024		