सत्यमेव जयते

FINAL INVESTIGATION REPORT

EMERGENCY LANDING INCIDENT OF M/S ASHLEY AVIATION FALCON 2000 AIRCRAFT VT-HGL ON 18/07/2023 AT BHOPAL

DIRECTORATE GENERAL OF CIVIL AVIATION
GOVERNMENT OF INDIA
NEW DELHI-110003

INDEX

FOREWORD

This document has been prepared based upon the evidences collected during the investigation and opinion obtained from the experts. The investigation has been carried out in accordance with Annex 13 to the convention on International Civil Aviation and under Rule 13 (1) of Aircraft (Investigation Accidents and Incidents) Rules, 2017.

The investigation is conducted not to apportion blame or to asses individual or collective responsibility. The sole objective is to draw lessons from this incident which may help to prevent future accident or incident.

ABBREVIATIONS

Abbreviation	Expanded form
ADC	Air Defense Clearance
FIC	Flight Information Center
ARC	Airworthiness Review Certificate
ARP	Aerodrome Reference Point
ATC	Air Traffic Control
HAL	Hindustan Aeronautics Limited
ATPL	Airline Transport Pilot license
C of A	Certificate of Airworthiness
CB	Cumulonimbus
C of R	Certificate of Registration
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DME	Distance Measuring equipment
DVOR	Doppler Very High Frequency Omni Range
FL	Flight Level
ICAO	International Civil Aviation Organization
DGCA	Directorate General of Civil Aviation
IFR	Instrument Flight Rule
VFR	Visual Flying Rule
ILS	Instrument Landing System
IR	Instrument Rating
FRTO	Flight Radio Telephony Operator
PIC	Pilot In Command
NM	Nautical Mile
NOSIG	No Significant
PAPI	Precession Approach Path Indicator
CG	Centre of Gravity
LBS	Pounds
TAF	Terminal Aerodrome Forecast
TEMPO	Temporary
UTC	Universal Coordinated Time
MOD	Modification
ELT	Emergency Locater Transmitter
MPD	Maintenance Planning Document
CZI	Core Zone Inspection
MPI	Mid Point Inspection
FH	Flying Hours
TSO	Time Since Overhaul
PN	Part Number
SN	Serial Number
ROC	Rate of Climb
CAME	Continuous Airworthiness Maintenance Exposition
APU	Auxiliary Power Unit

FINAL INVESTIGATION REPORT ON EMERGENCY LANDING INCIDENT OF M/S ASHLEY AVIATION FALCON 2000 AIRCRAFT VT-HGL ON 18/07/2023 AT BHOPAL

1.	Aircraft	Type	Falcon 2000
		Nationality	Indian
		Registration	VT-HGL
2.	Owner and Operator		M/s Ashley Aviation
3.	Pilot – in –Command		ATPL Holder
	Extent of injuries		Nil
4.	Date & Time of Incident		18.07.2023, 13:28:56 UTC
5.	Place of Incident		En-route (VOBG –VIDP)
6.	Co-ordinates of Incident site		Latitude 20^0 35’ 52.79” N Longitude 77^0 52’ 46.19” E
7.	Last point of Departure		HAL Airport Bangalore (VOBG)
8.	Intended place of landing		Delhi (VIDP)
9.	Number of Passengers on board		07
10.	Type of Operation		Non-schedule (Passenger) Flight
11.	Phase of Operation		Cruise
12.	Type of Incident		Pressurization failure

(All timings in the report are in UTC unless otherwise specified)

SYNOPSIS:

M/s Ashley Aviation, Falcon 2000 aircraft VT-HGL while operating a non-schedule passenger flight from Bangalore (HAL) to Delhi, was involved in emergency landing at Bhopal on 18.07.2023 due pressurization failure. The aircraft took off from Bangalore (HAL) and encountered adverse weather en-route. Aircraft climbed up to FL 400 which was planned cruise level, however flight crew requested for FL 430 to stay clear of thunderstorm activity at lower level near way point HIA, same was approved by ATC.

According to flight crew, after climbing to FL 430, while approaching way point ASIPI, they encountered continuous light turbulence and requested for lower altitude from Nagpur Control. Nagpur Control cleared the aircraft to descent to FL 400. While descending to lower altitude flight crew noticed slight climb in cabin vertical speed on the triple Indicator. The cabin altitude continued to climb with a rate of 700 to 800 ft/min. However, there was no Cabin Master Caution or Master warning in the cockpit. Flight crew carried out Manual pressurization control for improper cabin vertical speed but cabin continued to climb. Keeping in mind the profile, age of passengers and the altitude of aircraft, flight crew initiated emergency descend to safer altitude.

During emergency descent, flight crew donned the oxygen masks and the passenger oxygen masks were deployed manually. All passengers donned the masks and while passing FL360 loss of Cabin Pressure & Master Warning also appeared. Emergency descend was commenced to FL 100 and flight crew requested Nagpur control to divert to Bhopal as most suitable airport to proceed due weather. Aircraft diverted to Bhopal **"PAN PAN"** was declared and safe landing was carried out at Bhopal.

There were no injuries to any of the crew member or passengers on board the aircraft all of them were found in good health.

DGCA instituted the investigation by appointing investigator-in-Charge under Rule 13(1) of the Aircraft (Investigation of Accidents and Incidents) Rule 2017. The investigation revealed that the cause of the incident is attributed to faulty Pneumatic & Electro Pneumatic out Flow Valve.

1. FACTUAL INFORMATION:

1.1 History of flight:

1.1.1 On 18/07/2023, M/s Ashley aviation, Falcon 2000 aircraft VT-HGL was operating a non-schedule passenger flight from Bangalore, HAL to Delhi. The flight was under the command of duly licensed PIC on type along with the duly qualified First Officer. There were 07 passengers and 01 cabin crew on board the aircraft. PIC was the pilot monitoring & first officer was the pilot flying.

1.1.2 Before the flight, both the flight crew had undergone Breath Analyzer examination at Bangalore (HAL) and the test results were found negative. The flight was operating Bangalore (HAL) to Delhi after having proper ADC and FIC obtained. The flight plan revealed that the flight was planned to be conducted under IFR. Before undertaking the

flight, aircraft was declared airworthy after carrying out Pre-flight Inspection by the PIC who is appropriately authorized for pre-flight inspection of the aircraft.

1.1.3 As per flight plan Jaipur was planned destination alternate aerodromes and fuel was uplifted accordingly. There were total 8100 lbs of fuel on board the aircraft; the actual take-off weight of the aircraft was 32910 lbs which was well within the max takeoff weight of 36500 lbs. The CG of the aircraft was well within limits during the entire flight. The flight preparation was done normally and the aircraft was airworthy.

1.1.4 Following a normal pre-flight check and taxi to the runway, aircraft took off from HAL Airport Bangalore at 12:15:46 UTC and flight crew encountered adverse weather en-route. The aircraft was initially cleared for FL 400 to which flight crew requested for FL 430 to stay clear of thunderstorm activity at lower level near way point HIA. The aircraft was cleared to climb FL 430. After climbing to FL 430, while approaching way point ASIPI, flight crew encountered continuous light turbulence and requested for lower altitude from Nagpur Control. While descending to lower altitude flight crew noticed slight climb in cabin vertical speed on the triple Indicator. The cabin altitude continued to climb with a rate of 700 to 800 ft/min.

1.1.5 There was no Cabin Master Caution or Master warning in the cockpit which normally comes when Cabin altitude higher than 10,000 ft ± 500 feet (Mod M1112 & M1707 applicable to VT-HGL, cabin altitude higher than 11,500 ft ± 750 feet). Flight crew carried out Manual pressurization control for improper cabin vertical speed but cabin continued to climb. PIC took over controls from the first officer and stated that keeping in mind the profile, age of passengers and the altitude of aircraft, they turned on heading 330 and started emergency descend to safer altitude.

1.1.6 Flight crew initiated emergency descend around 13:26:58 UTC, they donned the oxygen masks and the passenger oxygen masks were also deployed manually. All passengers donned the masks and while passing FL360 at around 13:28:56 UTC (36301 feet pressure altitude) Loss of Cabin Pressure & Master Warning also appeared and remained ON for 3 minutes 29 seconds. Emergency descend was commenced to FL 100. Flight crew reported that there was thunderstorm activity in the area on reaching FL100, based on the weather images around, it was decided by them that Bhopal was the most suitable airport to land. Flight crew informed that cabin continued to leak at a controlled rate and cabin vertical speed & cabin altitude did not go above 1000 ft/min & 13000 feet respectively on triple Indicator during descent.

1.1.7 Flight crew reported that they advised Nagpur about their intention to divert to Bhopal which was acknowledged by Nagpur. Flight crew contacted Bhopal ATC and **"PAN PAN"** was declared. Flight crew requested ILS RWY 30 and safe landing was carried out around 14:30:20 (UTC) at Bhopal. Post landing aircraft taxied to allocated parking bay 09. There were no injuries to any of the crew member or passengers on board the aircraft all of them were found in good health.

1.2 Injuries to persons:

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor	Nil	Nil	Nil
None	03	07	Nil

1.3 Damage to aircraft: There was no damage to the aircraft.

1.4 Other damages: There were no other damages.

1.5 Personnel Information:

1.5.1 Pilot-in-Command

Age	:	53 Years/ Male
License	:	ATPL
Date of issue	:	13-03-2006
Valid up to	:	12-03-2026
Category	:	ATPL
Date of medical Exam	:	21-10-2022
Exam valid up to	:	28-10-2023
Date of issue of FRTO license	:	24-10-1991
FRTO license valid up to	:	17-06-2026
IR rating	:	04-10-2022 & 04-10-2023
Instructor rating	:	24.03.2023 & 23.03.2025
Total flying experience	:	11200 Hrs
Total flying experience during last 1 year	:	293:24 Hrs
Total flying experience during last 6 months	:	77:18 Hrs
Total flying experience during last 30 days	:	21:44 Hrs
Total flying experience during last 07 days	:	09:05 HRs
Total flying experience during last 24 hours	:	4:59 Hrs
Duty time last 24 hours	:	6:29 Hrs

1.5.2 Co- Pilot

Age	:	25 Years/ Male
License	:	CPL
Date of issue	:	13-07-2018
Valid up to	:	12-07-2028
Category	:	CPL
Date of medical Exam	:	21-10-2022
Medical Exam valid up to	:	14-11-2023
Date of issue of FRTO license	:	13-07-2018

FRTO license valid up to	:	27-01-2078
IR rating and instructor rating	:	30-03-2023 & NA
Total flying experience	:	1200:00 Hrs
Total flying experience during last 1 year	:	263:30 Hrs
Total flying experience during last 6 months	:	88:108 Hrs
Total flying experience during last 30 days	:	19:34 Hrs
Total flying experience during last 07 days	:	09:05 Hrs
Total flying experience during last 24 hours	:	4:59 Hrs
Duty time last 24 hours	:	6.29 Hrs

1.6 Aircraft Information:

1.6.1 Technical Information:

Manufacturer	**Dassault Aviation**	
Type	Falcon2000	
Sr. No.	231	
Year of manufacturer	2006	
Certificate of airworthiness, date of issue and validity	2901/2, 21-03-2012, C of A is valid until ARC Validity (ARC No. 2901/02 valid till 03-07-2024)	
Category	Normal	
Certificate of registration	3492/6	
Owner	Ashok Leyland Limited	
Maximum all up weight authorised	16,556 Kg	
Last major inspection	B & 3B Inspection	
Last inspection	Self-Test of ELT done on 12-07-2023	
Airframe Hrs since new	4080:03H	
Airframe Hrs since last C of A	A/F Hours since last ARC 16:33H	
ENGINE INFORMATION	**No.1**	**No.2**
Manufacturer	Honeywell	Honeywell
Type	CFE738-1-1B	CFE738-1-1B
Serial No.	P-105471	P-105600
Hrs done since new	14355:51Hrs	4004:43Hrs
Hrs done since overhaul	1189:15	--
Last major inspection carried out	CZI & MPI on 05.10.2018	MPI on 26.06.2017
Last inspection	Engine removal inspection and preservation i.a.w. Engine LMM	Borescope Inspection
Average oil consumption	0.0095 L/hr	0.0095 L/hr
Type of fuel used	Jet A-1	Jet A-1

1.6.2 Dassault Falcon 2000 aircraft VT-HGL was manufactured in year 2006 installed with Pneumatic valve PN 2099N031300 & SN 02372 & Electro-pneumatic valve PN 2097M031300 & SN 02420.

1.6.3 Inspection Recommendation by Manufacturer (MPD)

a. Cleaning and Check of Overpressure Tightness of Pneumatic and Electro-pneumatic valves--at 1640 FH.
b. Functional test of both valves---------- at 4840 FH.

1.6.4 Maintence History:

1.6.4.1 <u>Defect dated 18-07- 2023 at Bhopal: at 4081:30 FH</u>

Pilot Defect Report: "PRESSURIZATION FAILURE."

Troubleshooting:

a. Trouble shooting of pressurization system was carried out at Bhopal by AME. Due to lack of facilities at Bhopal airport it was decided to ferry aircraft to Delhi for further trouble shooting.
b. Further Trouble shooting reveled pressure leak from Pneumatic Valve PN 2099N041301 & SN 2099-02933.

Maintenance Performed:

a. Pneumatic outflow valve was replaced with PN 2099N041301 & SN 151 on 02-08-2023 and as a precautionary measure Electro-pneumatic outflow valve PN 2097M041301 & SN 02450 was also replaced with PN 2097M041301 & SN. 02796.
b. Pneumatic & Electro Pneumatic out flow valves were suspected faulty and same were sent for shop investigation.
c. Pneumatic outflow valve S/N: 2099-02933 had completed **49:71 TSO** and Electro-pneumatic valve S/N: 2450 had completed 1124:40 hours till replacement on 02-08-2023.

1.6.4.2 <u>Defect dated 27 -02-2023 at Delhi: at 4031:59 FH</u>

"During 1B inspection, Pneumatic outflow valve found pressure leaking.

Pneumatic outflow valve PN 2099N041301 SN 2099-02773 was found faulty. Same was replaced with PN 2099N041301 & SN 2099-02933 on 03-03-2023.

The Pneumatic outflow valve S/N: 2099-02773 had completed **148:12 TSO** till replacement on 03-03-2023.

1.6.4.3 <u>Defect dated 05-09-2022 at Delhi: at 3883:47FH</u>

Pilot Defect Report: "DURING DESCENT WITH THRUST CHANGES CABIN VS FLUCTUATIONS."

The Pneumatic outflow valve PN 2099N041301 SN 02055 was suspected faulty same was replaced with PN 2099N041301 SN 2099-02773 on 07-09-2022.

The Pneumatic Valve S/N: 2055 had completed **747:16 TSO** till replacement on 07-09-2022.

1.6.4.4 Defect dated 26-09- 2019 at Jaipur: at 3136:31FH

Pilot Defect Report: "IMPROPER CABIN VERTICAL SPEED DURING CLIMB (+1000" ROC)."

Pneumatic outflow valve PN 2099N031300 & S/N 02372 was found faulty same was replaced with PN 2099N041301 & SN 02055 on 30-09-2019.

Pneumatic outflow valve S/N: 2372 had completed **3136:31 hours** till replacement on 30-09-2019.

1.6.4.5 Defect dated 17-12-2018 at DFS, France: at 2956:50 FH

During scheduled 2C Inspection both Pneumatic and Electro pneumatic outflow valves were found out of tolerances. Pneumatic outflow valve PN 2099N031300 & S/N 02372 was repaired and reinstalled. However Electro-pneumatic outflow valve PN 2097M031300 & SN 02420 was replaced with PN 2097M041301 & SN 02450

Electro-pneumatic outflow valve S/N 2420 had completed 2956:50 hours till replacement on 17-12-2018.

Date	Description	Component OFF		Component ON		A/F Hrs. / Landing	Hours Aircraft Flown with removed unit
		P/N	S/N	P/N	S/N		
2006	Pneumatic Valve	---	---	2099N031300	2372	00:00/0	--
17.12.18	Pneumatic Valve	2099N031300	2372	2099N031300	2372	2956:50/1967	--
30.09.19	Pneumatic Valve	2099N031300	2372	2099N041301	2055	3136:31/2118	3136:31
07.09.22	Pneumatic Valve	2099N041301	2055	2099N041301	2099-02773	3883:47/2568	747:16
03.03.23	Pneumatic Valve	2099N041301	2099-02773	2099N041301	2099-02933	4031:59/2649	148:12
02.08.23	**Pneumatic Valve**	**2099N041301**	**2933**	**2099N041301**	**151**	**4081:30/2681**	**49:71**

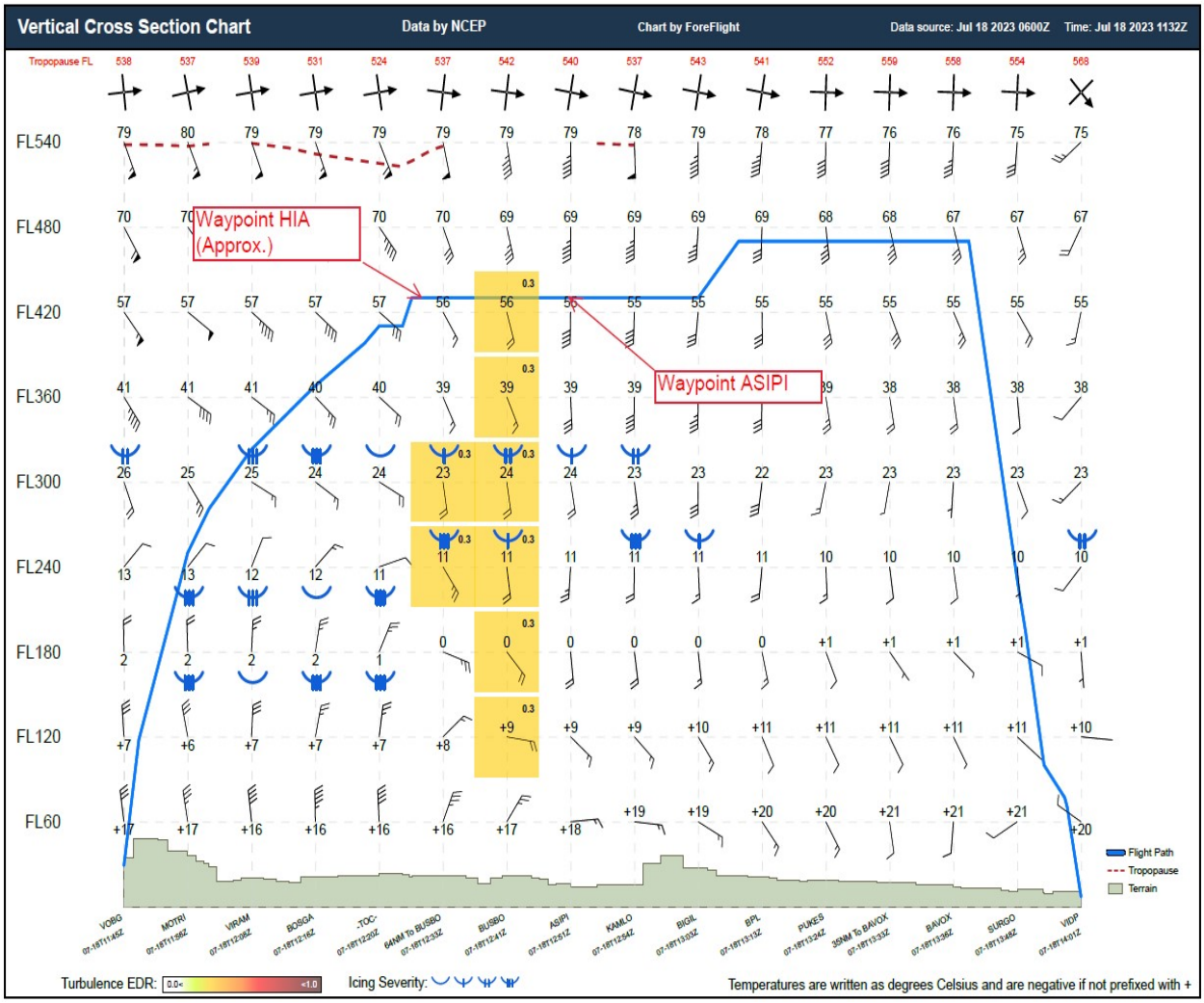
Date	Description	Component OFF		Component ON		A/F Hrs./ Landing	Hours Aircraft Flown with removed unit
		P/N	S/N	P/N	S/N		
2006	Electro pneumatic Valve	--	--	2097M031300	2420	00:00/0	--
17.12.18	Electro pneumatic Valve	2097M031300	2420	2097M041301	2450	2956:50/1967	2956:50
02.08.23	Electro pneumatic Valve	2097M041301	2450	2097M041301	2796	4081:30/2681	1124:40

All the above defects did not fall in the category of repetitive snag as defined in Ashley CAME as repetitive defects are considered if it recurs within 50 hours/3 months of its first occurrence. However, subject depressurization incident on VT-HGL dated 18-07-2023 at Bhopal has been considered as repetitive snag as it had completed **49:71 TSO only.** As a part of preventive maintenance a necessary action has been initiated by the quality department of M/s Ashley Aviation that an additional inspection for operational test of cabin pressurization system will be done in every 12M/800 Hours Inspection.

1.7 Meteorological Information: HAL airport Bangalore, weather dated 18.07.2023 between 1100 UTC to 1130 UTC, was reported visibility 10 KM, winds 240/15 knots, scattered clouds 1200 SCT 1800, QNH 1010 with Trend NOSIG.

TAF VOBG 180800Z 1809/1818 25012KT 6000SCT012 BKN 080

TEMPO 1809/1815 3000 RA DZ SCT010 SCT012 FEW 025 CB BKN 08



At top of climb short of waypoint HIA winds were about 30 knots from east south with temperature -57 degree Celsius at FL 420 at time 1220 UTC. Weather was there between short of waypoint BUSBO and waypoint ASIPI with light to moderate turbulence (turbulence EDR 0.3) at FL 430.

As evident from above weather forecast chart, short of waypoint ASIPI crew initiated descent from FL 430 to FL 400 due weather. Winds speed was 20kts South east in turbulent zone and the temperature was -56 degree Celsius.

Weather during approach and landing at VABP around 1330 UTC, was reported visibility 5000M, wind 010^0/07 knots, weather haze, cloud SCT 2000 FT SCT 2500 FT BKN 10000 FT

FEW 3000 FT CB towards NE and SE temperature 29, dew point 26, QNH1000 trend NO SIG for RWY30.

1.8 Aids to Navigation: Bhopal Airport is equipped with DVOR, DME (ILS) and PAPI. It has also a secondary surveillance RADAR for providing route navigation services. All the equipments were serviceable. Navigational Aids fitted in the aircraft were also serviceable.

1.9 Communication: There was always two ways communication between the ATC and the aircraft. Communication equipment in the aircraft and ATC were serviceable.

1.10 Aerodrome Information:

1.10.1 HAL Airport Bangalore:

Hindustan Aeronautics Limited (HAL) Airport is located 11.6 Km south east of Bangalore City. The Airport is owned and operated by HAL. Airport has got ICAO Code VOBG, ARP coordinates are 12°57'08"N, 77°39'53"E. The elevation is 2912 feet and type of traffic permitted is IFR/VFR. Aerodrome category for firefighting is CAT-7 and limited Rescue equipment's are available. HAL airport has one runway with orientation 27/09.

1.10.2 Bhopal:

Raja Bhoj Airport, Bhopal is a civil aerodrome. The airport is owned and operated by Airports Authority of India. Airport has got ICAO Code VABP, ARP coordinates are 23°17'13"N, 77°20'13"E and is located 15 KM from Bhopal railway station. The elevation is 1711 feet and type of traffic permitted is IFR/VFR. Aerodrome category for firefighting is CAT-7 and equipment's are available as per category. Bhopal airport has two runways with orientation 06/24 and 30/12.

1.11 Flight Recorder:

The Cockpit Voice Recorder (CVR) and the Digital Flight Data Recorder (DFDR) were downloaded and the following information was available from them:

1.11.1 DFDR:

TIME (UTC)	PRESSURE ALTITUDE (FEET)	LOSS OF CABIN PRESSURE	MASTER WARNING	SEQUENCE OF EVENTS
12:08:15	Ground	-	-	Eng#2 startup
12:09:05	Ground	-	-	Eng#1 startup
12:15:08	Ground	-	-	Take off roll initiated
12:15:46	AIR	-	-	Aircraft took off
12:57:50	43008	-	-	Aircraft Leveled off
13:26:58	42,997	-	-	Descend initiated
13:28:56	36,301	ON	ON	Loss of Cabin Pressure & Master warning appeared

13:32:26	13,037	-	-	**Loss of Cabin Pressure & Master Warning disappeared after 03 min 29 sec**
13:34:54	10,016	-	-	Aircraft leveled off
14:02:04	10,000	-	-	Aircraft Initiated descent
14:13:20	Ground	-	-	Aircraft Landed at Bhopal
14:18:36	Ground	-	-	Aircraft Engines OFF

1.11.2 CVR:

TIME	ATC	CAPTAIN	FIRST OFFICER
00:14	VGL tower report DME distance BPL	-	Ma'am we are 72 miles inbound BPL
00:38-00:48	-	Have you deselected the mask?	Yes sir
	-	You went on the mask?	Sir I did
	-	Okay	-
01:10		Bhopal	-
01:17-01:28	VGL tower	We are maintaining heading 030, we'll be unable to come into Bhopal to do a 12 DME arc. Once clear of weather we'll turn left and we can call you straight in ILSRW30	-
	VGL roger, approved	Thank you	-
01:31	-	Sequence the plan	Okay sir. Course intercept 298
02:26	VGL tower, avoid VAD 231A if possible	Roger	Possible?
02:37	-	Yes. Possible, we are avoiding	Roger ma'am, we will avoid VAD VGL
04:12	-	Flight plan is sequenced?	Yes sir, flight plan is sequenced
05:46-06:13	VT-HGL expect ILS approach RW 30 via arrival route 113 radial BPL	Roger	Roger
	VGL tower report DME distance, confirm ready for descend?	Negative ma'am, will call you for descend. We are 62 miles inbound. Will call you when ready	-
	Roger	-	-
08:48	-	Okay FO we are going to establish 298	Okay sir
09:18-09:40	-	-	Bhopal VGL maintaining heading 350, will call you established radial 118
	VGL tower, roger. Can you establish radial 113 BPL?	-	113
	-	Okay. We will establish 113	Roger ma'am, we will establish radial 113 BPL
10:35-10:53	-	-	Bhopal VGL, ma'am we'll like to come on radial 118 BPL. There's some weather north of localiser
	VGL tower roger, report. Confirm established on 118 radial? Report established	-	Call you established radial 118 BPL VGL
11:20		There's a lot of weather that side	-

11:25-11:39	VGL tower confirm you'll be able to establish 113 radial by 20 miles?	Ma'am we can call you on localiser on 118 radial	-
	Roger. Report DME distance	46 miles now	-
	Roger	-	-
11:52-12:11	-	And are you reporting some CB to the east of the airfield?	
	VGL tower, affirm, CB clouds few 3000 feet east-northeast, east-southeast and south	Roger VGL	-
13:23	-	-	Bhopal VGL established radial 118 BPL
13:27-13:45	VGL roger, report for descend	We are ready for descend	Ma'am we are ready for descend VGL
	VGL tower descend FL 80, report 25 miles for further	-	Descend level 80, call you next 25 miles BPL VGL
14:37	-	Cabin Crew tell everybody to remain seated, there will be a little turbulence	-
15:32	VGL tower descend to 3800 feet, QNH 1001, transition level fl 65. Cleared ILS approach RW 30. Report on localiser RW 30	-	Descend 3800 feet QNH 1001. Call you next established localiser RW30. Cleared for the approach VGL
17:18	VT-HGL roger, report established ILSRW30	-	-
21:49	-	-	Bhopal VGL established ILS 30
	VT-HGL tower RW30 cleared to land, winds 350/03	-	Cleared to land RW30, winds copied VGL
22:59	-	-	1000 to minimums
	-	Stabilised	-
23:45	-	-	500 to minimums
	-	Checked	-
24:25	-	-	100 to minimums
	-	Checked	-
24:34	-	Okay auto pilot is off. Visual. Continue	Minimums
25:18	-	Okay request taxi	-
	-	-	Bhopal VGL request taxi instructions
	VGL tower backtrack RW 30 vacate via taxiway G, stand 9	-	Backtrack, vacate via taxiway G, stand 9. VGL
26:20	VGL tower, confirm all ops normal	Affirm	Affirm ma'am VGL
	VGL tower roger, confirm any assistance required	Ma'am, negative. No assistance required. Reason for declaration of emergency was pressurisation failure. All ops normal now	-
	Roger	-	-

Note: CVR data is over written as CVR was running after landing due to APU running. Crew did not switch off APU as DGCA officials were at the aircraft discussing about the incident. Around 33:38 Minutes of recording is available.

1.11.3 ATC tape transcript -Bhopal:

Time	TO	FROM	COMMUNICATION
13:38:47 -13:40:11	Bhopal	VT-HGL	Ma'am maintaining FL100 coming up position UPTAR SQUAWK 7700 PAN PAN PAN PAN PAN PAN due pressurization diverting to Bhopal
	VT-HGL	BHOPAL	Roger, clear to BPL. Report steady radial BPL
	MA'AM	VT-HGL	Blocked say again
	VT-HGL	Tower	Clear to BPL VIA UPTAR. Report steady radial BPL wind 360 degree 05 KTS. Priority landing approved report preference of RWY
	Bhopal	VT-HGL	Ma'am requesting RWY 30 and say again radial you want to maintain
	VT-HGL	Tower	Any steady radial
	Bhopal	VT-HGL	Copied, ma'am current UPTAR we would like RWY30, VGL
13:40:12- 13:41:49	VT-HGL	Tower	Report estimate BPL, POB, and endurance.
	Bhopal	VT-HGL	Ma'am standby one. We are unable to reach Nagpur and now maintaining with you. Maintaining heading 340 due weather. After 20 miles will be turning right due weather and standby_____
	VT-HGL	Tower	Roger, report when released by Nagpur.
	Bhopal	VT-HGL	We are unable to raise Nagpur, if you could please contact them and tell them that we are in contact with you
	VT-HGL	Tower	Roger, will do, report estimate BPL
	Bhopal	VT-HGL	1405
	VT-HGL	Tower	Roger, report total number of person on board and endurance
	Bhopal	VT-HGL	We have 07 passenger on board and we have endurance of 03 hours
	VT-HGL	Tower	Report level passing
	Bhopal	VT-HGL	We are maintaining FL100, we had the pressurization issue
13:42:33- 13:44:10	VT-HGL	TOWER	Report DME distance BPL
	Bhopal	VT-HGL	Ma'am currently 93miles BPL
	VT-HGL	Tower	Roger
	Bhopal	VT-HGL	Ma'am we are unable to get ATIS, could you please get the latest weather for us
	VT-HGL	Tower	Affirm, observation 1330 wind 010/07 visibility 5000M weather haze cloud SCT 2000 FT SCT 2500 FT BKN 10000 FT FEW 3000 FT CB towards NE and SE temperature 29, dew point 26, QNH1000 trend NO SIG RWY30
	Bhopal	VT-HGL	QNH 1000 RWY 30 copied VGL thank you
13:44:21- 13:45:14	Bhopal	VT-HGL	We are now turning right heading 025 due weather
	VT-HGL	Tower	Roger, deviation to right approved. Report 50 M inbound. Report preference for APP RWY30
	Bhopal	VT-HGL	Affirm, ILS RWY30
	VT-HGL	Tower	Roger
	VT-HGL	Tower	Expect ILS approach RWY30 VIA 12 DME ARC RWY30, VGL
	VT-HGL	Tower	Report for further descent
	Bhopal	VT-HGL	Call you for further descent
13:48:27- 13:48:39	VT-HGL	Tower	Report DME distance BPL
	Bhopal	VT-HGL	Ma'am, we are 72 miles BPL VGL
	VT-HGL	Tower	Ma'am, we are maintaining heading 030 we will be unable to come in Bhopal to do 12 DME ARC. Once we are clear of weather we turn left and we will call you straight in ILS RWY30
	VT-HGL	Tower	Roger, approved
13:54:04 - 13:54:35	VGL	Tower	Expect ILS APP RWY30 VIA arrival route 113R BPL
	Bhopal	VT-HGL	Roger ma'am VT-HGL

	VT-HGL	Tower	Report DME distance BPL. Confirm ready for descent
	Bhopal	VT-HGL	Negative, ma'am we will call you for descent. We are 62M inbound. We will call you when ready
13:57:37 - 13:58:03	Bhopal	VT-HGL	Maintaining heading 356 will call you establish R118
	VT-HGL	Tower	Roger. Can you establish R113 radial BPL
	Bhopal	VT-HGL	Roger ma'am. We will establish R113 BPL
13:58:54- 13:59:16	Bhopal	VT-HGL	We would like to come on R118 BPL. There is some weather in north of LLZ
	VT-HGL	Tower	Roger report confirms establish on R118 BPL.
	Bhopal	VT-HGL	Call you establish R118 BPL
13:59:43- 14:00:02	VT-HGL	Tower	Confirm you will be able to establish 113R by 20 miles
	Bhopal	VT-HGL	Ma'am we can call you on LLZ on 118R
	VT-HGL	Tower	Roger report DME distance
	Bhopal	VT-HGL	46 miles ma'am
	VT-HGL	Tower	Roger
14:00:11- 14:00:34	Bhopal	VT-HGL	And are you reporting some CB to the east of the airfield
	VT-HGL	Tower	Affirm, CB cloud FEW 3000FT ENE ESE and south
	Bhopal	VT-HGL	Roger, VT-HGL
14:01:41- 14:02:08	Bhopal	VT-HGL	Establish R118 BPL
	VT-HGL	TOWER	ROGER, REPORT FOR DESCENT
	Bhopal	VT-HGL	Ma'am we are ready for descend VT-HGL
	VT-HGL	Tower	Descend to FL080 report 25M for further
	Bhopal	VT-HGL	Descend to FL080. Call you next 25M BPL VT-HGL
14:03:38- 14:04:08	Bhopal	VT-HGL	Ma'am VT-HGL is 31miles request further descend
	VT-HGL	Tower	Descent to 3800FT QNH 1001 TL FL065. Cleared ILS APP RWY 30. Report on LLZ RWY30
	Bhopal	VT-HGL	Descend 3800FT QNH1001, call you next establish LLZ RWY30. Cleared for the approach VGL
14:05:28- 14:05:44	Bhopal	VT-HGL	Establish LLZ RWY 30
	VT-HGL	Tower	Roger, report established on ILS RWY 30
	Bhopal	VT-HGL	Call you established on ILS RWY **30**
14:10:03- 14:10:19	Bhopal	VT-HGL	Established ILS RWY30
	VT-HGL	Tower	RWY30 cleared to land. wind 350 degree 03 knots
	Bhopal	VT-HGL	Cleared to land RWY30 wind copied, VT-HGL
14:13:39- 14:13:58	Bhopal	VT-HGL	Requesting taxi instruction
	VT-HGL	Tower	Backtrack RWY30 vacated VIA TWY 'G' stand niner
14:14:38- 14:14:59	VT-HGL	Tower	Confirm all ops normal
	Bhopal	VT-HGL	Affirm ma'am, VGL

1.12 Wreckage & Impact Information: Nil

1.13 Medical & Pathological Information: Before the flight, both the flight crew had undergone Breath Analyzer examination at Bangalore, HAL (VOBG) and the test results were found negative.

1.14 Fire: There was no fire

1.15 Survival Aspects: The incident was survivable.

1.16 Tests & Research:

Post incident both Pneumatic & Electro Pneumatic out flow valves were suspected faulty and were sent to M/s Dassault Aviation, France for Shop Examination and following are the Shop Findings:

1.16.1 Visual inspection of Electro Pneumatic out flow valve (P/N 2097M041301, S/N 02450) revealed heavy pollution & bonding strip damaged. Further inspection of Altimetric box revealed valve contamination **(Leakage out of order)**.

1.16.2 Visual inspection of Pneumatic out flow valve (P/N 2099M041301, S/N 2099-02933) revealed internal pollution, sticking clapper & diaphragm cracked. Further inspection of Altimetric & Manometric box revealed valve contamination **(Leakage out of order)**. Drift of altitude limitation setting was also observed in Manometric box.

1.17 Organizational & Management Information: M/s Ashley Aviation Pvt. Ltd. is an Indian non-schedule operator; registered office is in G+5 building, Terminal 1, IGI Airport New Delhi. It has 01 fixed wing FALCON 2000 aircraft VT-HGL on its NSOP. The operator has contract with Indamer Mjet Airport Services Pvt. Ltd. for maintenance of Aircraft.

1.18 Additional Information: Nil

1.19 Useful or Effective Investigation Techniques: Nil

2. ANALYSIS:

2.1Airworthiness & Serviceability of the aircraft:

2.1.1 Falcon 2000 aircraft VT-HGL is a twin turbojet powered aircraft fitted with two Honeywell CFE738-1-1b engines. The aircraft was manufactured by Dassault Aviation Merignac, France in 2006 and is installed with Pneumatic & Electro-pneumatic out flow valve. The aircraft and its engines were being maintained as per the approved maintenance program. The scrutiny of the airframe logbook reveled that as on date of incident the aircraft had completed 4080:03 A/F Hrs /2680 Cycles and No snag was pending for rectification before the incident flight.

2.1.2 Certificate of registration, certificate of airworthiness, aero mobile license & Certificate of release to service in respect of the aircraft were valid. The noise certificate of the aircraft was current. Airworthiness Directives, Service bulletins, mandatory modifications on this aircraft and its engines have been complied with.

2.1.3 During scheduled 2C Inspection on 17.12.2018, both Pneumatic and Electro pneumatic outflow valves were found out of tolerances same were repaired and reinstalled. On 26.09.2019 at Jaipur due pilot report improper cabin vertical speed during climb, pneumatic outflow valve was found faulty same was replaced. On 05.09.2022 at Delhi due pilot report during descent with thrust changes cabin vertical speed fluctuations, pneumatic outflow was suspected faulty same was replaced. Subsequently during 1B inspection on 27.02.2023, pneumatic outflow valve was found pressure leaking same was replaced.

2.1.4 All the above defects as in Para 2.1.3 did not fall in the category of repetitive snag as defined in Ashley CAME. Repetitive defects are considered if it recurs within 50 hours/3 months of its first occurrence. However, subject depressurization incident on VT-HGL dated 18-07-2023 at Bhopal has been considered as repetitive snag i.r.o Pneumatic out flow valve as Pneumatic outflow valve had completed **49:71 TSO** only and Electro-pneumatic valve had completed 1124:40 hours till replacement on 02.08.2023.

2.1.5 Post incident both Pneumatic & Electro Pneumatic out flow valves were suspected faulty and were sent to M/s Dassault Aviation, France for Shop Examination. Shop report of Pneumatic & Electro Pneumatic out flow valves has confirmed that valves were contaminated and leak was found out of order. Inspection recommended by manufacturer (MPD) is, Cleaning and Check of Overpressure Tightness of Pneumatic and Electro-pneumatic valves at every 1640 FH & Functional tests of both valves at every 4840 FH. However, as a part of preventive maintenance considering the repetitive defect in Pneumatic out flow valve, necessary action has been initiated by the quality department of M/s Ashley Aviation that an additional inspection for operational test of cabin pressurization system will be done in every 12Month/800 Hours Inspection. Same has been incorporated in 12Month/800 Hours Inspection schedule.

From the above, it is evident that the aircraft was maintained in airworthy condition and no defect was pending for rectification. Serviceability of the aircraft was not a contributory factor to the incident. However post incident, investigation has reveled that failure of pneumatic and electro-pneumatic out flow valve resulted in pressurization failure

2.2 Pilot handling of the situation:

2.2.1 After departure from HAL Airport Bangalore flight crew encountered adverse weather en-route at FL 400. Flight crew was negotiating with weather and requested for FL 430 to stay clear of thunderstorm activity near way point HIA. After climbing to FL 430, while approaching way point ASIPI, flight crew encountered continuous light turbulence and requested for lower altitude. While descending to lower altitude flight crew noticed slight climb in cabin vertical speed on the triple Indicator. The cabin altitude continued to climb with a rate of 700 to 800 ft/min. However, there was no Cabin Master Caution or Master warning in the cockpit which normally comes when Cabin altitude higher than 10,000 ft ± 500 feet (Mod M1112 & M1707 applicable to VT-HGL, cabin altitude higher than 11,500 ft ± 750 feet).

2.2.2 Flight crew carried out Manual pressurization control for improper cabin vertical speed but cabin continued to climb. PIC took over controls from the first officer and stated that keeping in mind the profile, age of passengers and the altitude of aircraft, flight crew initiated the emergency descend to safer altitude and donned the oxygen masks and the passenger oxygen masks were also deployed manually. All passengers donned the masks and while descend passing FL360, Loss of Cabin Pressure & Master Warning also appeared. There was weather in the area on reaching FL100, it was decided by the flight crew that Bhopal was the most suitable airport to land. Flight crew reported that cabin continued to leak at a controlled rate and cabin vertical speed & cabin altitude did not go above 1000 ft/min & 13000 feet respectively on triple Indicator during descent. Aircraft diverted to Bhopal **"PAN PAN"** was declared and safe landing was carried out at Bhopal.

2.2.3 In a situation where the flight crew in cruise notices a cabin leaking on the triple indicator, evident by the cabin vertical speed climbing at a rate of 700 to 800 ft/min, there is actually no checklist. The improper cabin vertical speed during normal operation, checklist is actually not designed for a cabin leaking in cruise and does not factor a depressurization scenario. It is primarily a checklist in a stage of aircraft climb or descent where the cabin climb or descent rate is out of the green arc on triple indicator. The actual checklist for this situation is in the Cabin Master Caution checklist. However the flight crew will only be lead to that checklist on getting a Master Caution light. In a situation where flight crew notices a cabin climbing in cruise there is

no checklist, flight crew will have to wait many critical minutes in a level flight to then get a Cabin Master Warning and be lead to the correct checklist.

2.2.4 In a situation like this the flight crew assessed the situation and used good judgment to determine the safest course of action. Flight crew did not wait for the Cabin Master Caution light to come ON, keeping in mind the profile, age of passengers and the altitude of aircraft; they declared emergency and initiated the emergency descend to safer altitude. Flight crew donned the oxygen masks and the passengers oxygen masks were also deployed manually and while descend passing FL360, Loss of Cabin Pressure & Master Warning also appeared. Flight crew actions were appropriate in the interest of safety of passengers & aircraft as they did not wait for the cabin Master Caution light to come ON and declared emergency and initiated the emergency descend to safer altitude.

2.3 Weather: On 18.07.2023, M/s Ashley aviation, Falcon 2000 aircraft VT-HGL was operating a non-schedule passenger flight from Bangalore, HAL to Delhi. The prevailing weather at Bangalore was within approved minima of crew and aircraft. Runway in use 09-27, reported visibility was 10 KM, winds 240^0/15 knots, cloud SCT 1200-1800 feet, QNH 1010. Runway surface condition was dry and there were no rain or turbulence. Terminal aerodrome Forecast (TAF) did not show any significant change in trend of the prevailing weather. However TEMPO indicted rain drizzle & Cumulonimbus clouds temporary variations from the prevailing conditions previously given in the TAF.As depicted in weather forecast chart at top of climb short of waypoint HIA winds were about 30 knots from east south with temperature -57 degree Celsius at FL 420 at time 1220 UTC. Weather was there between short of waypoint BUSBO and waypoint ASIPI with light to moderate turbulence (turbulence EDR 0.3) at FL 430. As evident from weather forecast chart, short of waypoint ASIPI flight crew initiated descent from FL 430 to FL 400 due weather. Winds speed was 20 knots South east in turbulent zone and the temperature was -56 degree Celsius.

After departure from HAL Airport Bangalore flight crew encountered adverse weather en-route and till landing at Bhopal. Flight crew was negotiating with weather but weather was not contributory factor to the incident.

3. CONCLUSION:

3.1 Findings:

3.1.1 The flight crew members were appropriately licensed and qualified to operate the flight.

3.1.2 The aircraft was operating within the provision of valid Certificate of Airworthiness and Certificate of Registration before the incident flight.

3.1.3 All the concerned Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engines were found complied with.

3.1.4 The aircraft was maintained in airworthy condition and no defect was pending for rectification. Serviceability of the aircraft was not a contributory factor to the incident.

3.1.5 Flight crew was negotiating with weather but weather was not a contributory factor to the incident.

3.1.6 Flight crew while descending to lower altitude, observed cabin altitude continued to climb with a rate of 700 to 800 ft/min. However, there was no Cabin Master Caution or Master warning.

3.1.7 Flight crew initiated the emergency descend to safer altitude and donned the oxygen masks and the passenger oxygen masks were deployed manually.

3.1.8 During descend passing FL360; Loss of Cabin Pressure & Master Warning also appeared.

3.1.9 Flight crew actions were appropriate as they did not wait for the Cabin Master Caution light to come ON and initiated the emergency descend to safer altitude.

3.1.10 Aircraft diverted to Bhopal **"PAN PAN"** was declared and safe landing was carried out at Bhopal.

3.1.11 Post landing, during troubleshooting Pneumatic & Electro Pneumatic out flow valves were suspected faulty and same were sent for shop investigation.

3.1.12 Shop report of Pneumatic & Electro Pneumatic out flow valves has confirmed that valves were contaminated and leak was found out of order.

3.1.13 Fault in Pneumatic out flow valve is considered as repetitive snag as it had completed 49:71 TSO till replacement on 02.08.2023. However other snags earlier to this did not fall in the category of repetitive snags.

PROBABLE CAUSE OF THE INCIDENT:

Probable Cause of the incident is attributed to faulty Pneumatic & Electro Pneumatic out Flow Valve.

4. <u>SAFETY RECOMMENDATIONS</u>:

M/s Ashley Aviation Pvt. Ltd. has already included operational test of cabin pressurization system at every 12Month/800 Hours inspection schedule as a part of preventive maintenance. In view of the same no further recommendation is made at this stage.

(Mahendra Kumar Meena)
Air Safety Officer- Member

(Vishal Yadav)
Dy. Director Air Safety (NR)
Investigating-in-Charge-VT-HGL

Date: 08.12.2023
Place: New Delhi