

FINAL INVESTIGATION REPORT



**SERIOUS INCIDENT OF PIAC FLIGHT PK-369 (ISB TO KHI) A320-200
AIRCRAFT REG NO AP-BLV CABIN PRESSURE LOST FOLLOWED
BY OXYGEN MASKS DROPPING : DATED 18 OCTOBER 2017**

SCOPE

Safety Investigation Board (SIB), Pakistan investigations are conducted in accordance with Annex-13 to the ICAO Convention on International Civil Aviation and Civil Aviation Authority (CAA), Pakistan Rules 1994 (CARs 94).

The sole objective of the investigation of an accident or incident under above stated regulations is the prevention of future accidents and incidents of similar nature. It is not the purpose of such an investigation to apportion blame or liability. Accordingly, it is inappropriate that SIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

This report contains facts which have been determined up to the time of publication. This information is published to inform the aviation industry and the public of the general circumstances of civil aviation accidents and incidents.

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THE SIB PAKISTAN ICAO ANNEX 13 SAFETY INVESTIGATION BOARD TEAM

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FINAL REPORT

SERIOUS INCIDENT OF PIAC FLIGHT PK-369 (ISB TO KHI) A320-200 AIRCRAFT REG NO AP-BLV CABIN PRESSURE LOST FOLLOWED BY OXYGEN MASKS DROPPING DATED 18 OCTOBER 2017

Synopsis

On 18 October 2017 PIAC Flight PK-369 (Airbus A-320-200 Reg No AP-BLV) while en-route from BBIAP Islamabad to JIAP Karachi, during cruise encountered loss of cabin pressurization and all passenger oxygen masks dropped. The serious incident was reported to Safety Investigation Board (SIB) Pakistan by the operator through Mandatory Occurrence Report. The incident was notified in accordance with ICAO Annex – 13 and Aviation Division Government of Pakistan issued memorandum vide letter No. HQCAA/1901/399/SIB/657 dated 15 November 2017 authorizing SIB Pakistan to investigate the serious incident.

1 FACTUAL INFORMATION

- 1.1 **History of the flight.** The Flight PK-369 took off from Islamabad at 0808 hrs GMT. At about 0834 hrs GMT during cruise at FL 320 (32,000'), "**Excess Cabin Altitude Warning**" appeared on Electronic Centralized Aircraft Monitor (ECAM). Check list at this stage required a descent below FL 100 (10,000'), but crew continued maintaining same altitude (FL 320) and attempted to reset the Cabin Pressurization System, resulting in dropping of all passenger oxygen masks. The aircraft landed at JIAP Karachi at about 0955 hrs GMT. After landing the defect was reported as "*Excess Cabin Alt Warning came on ECAM, manual pressurization control carried out, cabin pressure became stable & controllable*".
- 1.2 **Injuries to persons.** There were no injuries to any person during the incident.
- 1.3 **Damage to aircraft.** There was no damage to the aircraft.
- 1.4 **Other damage.** None.
- 1.5 **Personnel Information.**

Captain	
Date of Birth	04-08-1973
Type of License held and No	ATPL-1158
Medical Date with status	19-10-2017 till 30-04-2018 (Medically Fit)
Type Rating	Captain A320
Flying Experience	971 hrs (A320) as on 18-10-2017
Total in Command	3076 hrs
Total in command on type Accident / Incident occurred	971 hrs

First Officer	
Date of Birth	04-03-1985
Type of License held and No	CPL-2703 (July 2018)
Medical Date with status	17-04-2017 till 30-04-2018
Type Rating	First Officer A320
Flying Experience	1212 hrs (A320) as on 18-10-2017
Total in Command	148 hrs (SE)
Total in command on type Accident / Incident occurred	--

1.6 **Aircraft information.** The aircraft was being maintained by the operator in accordance with regulations of Pakistan Civil Aviation Authority. Pertinent aircraft and major parts maintenance and life information is as given below:-

1.6.1 **Aircraft**

Aircraft Make & Model	Airbus A320-200
Registration Marking	AP-BLV
Manufacturer Serial No	2758
Year of Manufacture	April 2006
C of A (expiry date)	07 May2018
Total Aircraft Hours / Cycles / Landings	35600 / 17116 / 17113

1.6.2 **Information on the removed / replaced component at KHI on AP-BLV as suspected faulty after the reported incident on 18 October 2017.**

1.6.2.1 Cabin Pressure Controller P/N: 20791-02AB, S/N: 0654796.

1.6.2.2 TSN / TSI (Time Since New/Time Since installation):38162 hrs/ 38162 hrs. Installed since 13/11/06.

1.7 **Meteorological Information.** Not applicable.

1.8 **Aids to Navigation.** Airbus 320 AP-BLV aircraft was equipped with serviceable ADF, VOR / DME, ILS and GPS equipment for the conduct of flight operations. All the ground equipment installed at JIAP Karachi related to ADF, VOR / DME and ILS was found serviceable at the time of occurrence.

1.9 **Communications.** Airbus 320 AP-BLV aircraft was equipped with UHF and VHF sets for radio contact with all concerned / relevant agencies during the conduct of flight.

1.10 **Aerodrome Information.**The JIAP Karachi detailed aerodrome data is appended below:-

INSTRUMENT APPROACH CHART - ICAO
AD ELEV 100'
HEIGHTS RELATED TO AERODROME ELEV

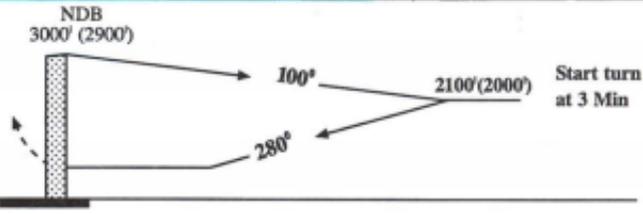
TWR 118.3
APP 125.5
ATIS 126.7

KARACHI/Jinnah Int'l
NDB A RWY 25R/25L



TRANSITION LEVEL FL 50
TRANSITION ALT 3000'

MISSED APPROACH
Turn left and climb to 2000' AMSL on track 220 and contact ATC.



Military airfield with RWY-08/26 exists 2.5 NM SW of AD. Pilots should exercise caution in identification of correct RWY before making approach to land RWY-07L or 07R of Karach International

OCA/H		A	B	C	D
Straight in Approach	NDB	NOT APPLICABLE			
Circling		750'(650')		890'(790')	

OPKC AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

Designations RWY NR	True bearing	Dimensions of RWY (M)	Strength (PCN) and surface of RWY and SWY	THR coordinates	THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
07L	074.29	3200 x 46	54/R/C/X/U CONCRETE ACFT upto A310 are permitted	245416.90N	THR23.50M/77FT
25R	254.29			0670851.02E	
07R	074.29	3400 x 45	87/R/B/W/T CONCRETE SWY bitumen	245402.15N	THR21.62M / 71FT
25L	254.29			0670833.56E	

Designations RWY NR	Slope of RWY/SWY	SWY dimension (M)	CWY dimension (M)	Strip dimension (M)	Obstacle Free Zone
7	8	9	10	11	12
07L	0.168% UP	305 x 46	914	3930 x 300	-
25R		305 x 46	580	3930 x 300	
07R		305 x 45	870x150	4130 x 300	
25L		301 x 45	483X150	4126 x 300	

➔ **Remarks:** RWY07R RESA – 180M X 120M & RESA RWY 25L 150M X 150 M.

OPKC AD 2.13 DECLARED DISTANCES (M)

Designations RWY NR	TORA	ASDA	TODA	LDA	Remarks
1	2	3	4	5	6
07L	3200	3500	4114	3200	-
25R	3200	3505	3780	3200	-
07R	3400	3705	4270	3400	-
25L	3400	3701	3883	3400	-

OPKC AD 2.14 APPROACH AND RUNWAY LIGHTS

Designations RWY NR	APCH LGT type LEN INTST	THR LGT colourW BAR	VASIS (MEH) PAPI	TDZMLGT LEN	RWY Centre line LGT Length, spacing, colour, INTST	RWY EDGE line LGT Length, spacing, colour, INTST	RWY End LGT spacing colourWBAR	SWY LGT LEN (M) colour	Remarks
1	2	3	4	5	6	7	8	9	10
07L	SALS LIH	GREEN	PAPI/ Left 3°	-	-	3200 M, 60 M,	RED	-	Strobe LGT
25R	PALS LIH	GREEN	PAPI/ Left 3°	-	-	WHITE LIH	RED	-	-
07R	SALS LIH 300 M	GREEN	PAPI/ Both sides 2.91°	-	3400M 30 M white LIH	3400 M, 60 M, white LIH	RED	-	-
25L	PALS LIH900M	GREEN	PAPI/ Both sides 2.98°	900 M	Last 900 M alternate white/red	Last 600 M yellow	RED	-	Flashers

Civil Aviation Authority

AMDT 01/17

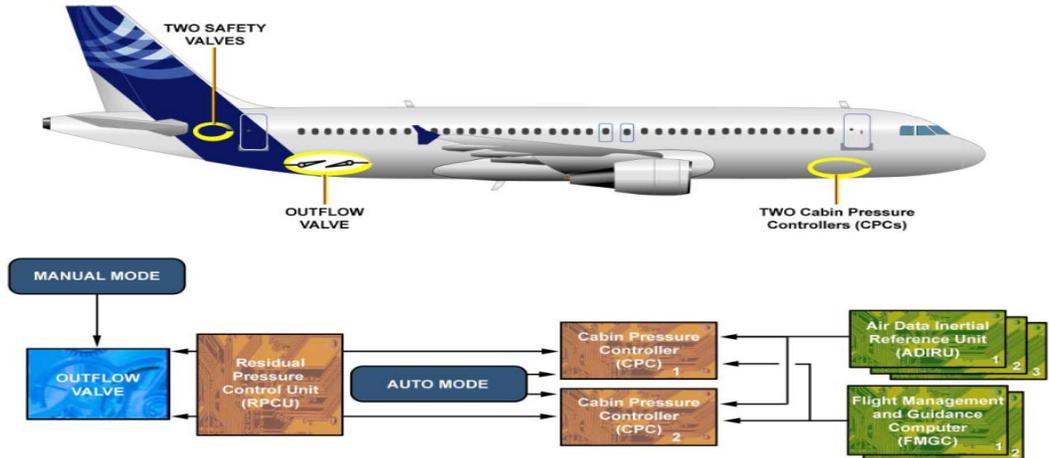
OPKC AD 2.18 ATS COMMUNICATION FACILITIES

Service designation	Call sign	Frequency	Hours of operation	Remarks
TWR	KARACHI Tower	118.3 MHZ 118.8 MHZ 121.5 MHZ	H24 H24 H24	Primary Secondary Emergency
APRON	Karachi Ground	121.6 MHZ 118.4 MHZ 121.8 MHZ 123.0 MHZ	H24 H24 H24 H24	Primary Secondary Vehicle
ATIS APP	ATIS Karachi APP Karachi APP Karachi APP	126.7 MHZ 125.5 MHZ 121.3 MHZ 121.5 MHZ	H24 H24 H24 H24	Primary Secondary Emergency
BS BS	Radio Pakistan	830 KHZ 1450 KHZ	HX HX	0130-1900 HR Variable SKED

OPKC AD 2.19 RADIO NAVIGATION AND LANDING AIDS

Type of aid. CAT of ILS (VAR VOR/ILS)	ID	Frequency	Hours of operation	Site of transmitting antenna coordinates	Elevation of DME transmitting antenna	Remarks
1	2	3	4	5	6	7
GP 25R LLZ 25R ILS CAT I (1°E/1995)	Dots/Dashes IKC	334.4 MHZ 110.1MHZ	H24 H24	245448.11N 0671029.32E 245413.64N0670837.68E	-	-
LOM MM	KO	235 KHZ 75 MHZ	H24 H24	*245547.51N 0671449.66E *245454.06N 0671117.40E	-	3.9 NM FM THRRWY 25R 0.43 NM FM THRRWY 25R
GP/TDME 25L LLZ25L ILS CAT I (1°E/1995)	Dots/Dashes IQA	333.2 MHZ CH34X 109.7 MHZ	H24 H24	245433.50N 0671017.88E 245359.09N0670820.434E	30.90M	2.98° RDH55 FT
NDB	KC	271 KHZ	H24	245523.80N 0670936.28E		Coverage 500NM
VOR / DME	KC	112.1 MHZ CH 58X	H24	245443.06N 0671053.91E	40.84M	Coverage 200NM Radial 300 un-reliable

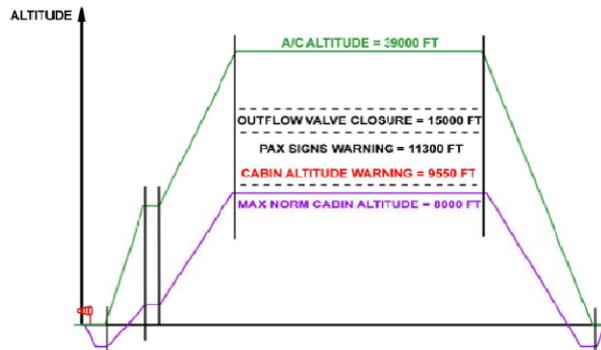
- 1.11 **Flight Recorders.** FDR and CVR were successfully downloaded and fully utilized for the purpose of investigation.
- 1.12 **Wreckage and Runway Marks Information.** Not applicable.
- 1.13 **Medical and Pathological Information.** Not applicable.
- 1.14 **Fire.** Not applicable.
- 1.15 **Survival Aspects.** Not applicable.
- 1.16 **Tests and Research.** The faulty component Cabin Pressure Controller 2 (CPC # 2) was sent to the OEM for a tear down examination which revealed ageing effects on the soldering of its ICs being in hi-life at 38162 hrs.
- 1.17 **Organizational and Management Information.** Not applicable.
- 1.18 **Additional Information.** Not applicable.
- 1.19 **ATC Tape Extracts.** Not applicable.
- 1.20 **Useful and Effective Investigation Techniques.** Standard investigation techniques were used.
- 1.21 **Architecture of A-320 Aircraft Cabin Pressurization System.**
 - 1.21.1 The pressurization control system controls the pressure in the fuselage. It operates automatically (two independent systems) and has a manual (single) backup. There are two electronic "Cabin Pressure Controllers" known as CPC, that control one Out Flow Valve (OFV). During flight, aircraft cabin is being continuously filled in by the air from air-conditioning packs. As per its name: OFV air is released out of the cabin through OFV, being controlled either by CPCs in auto mode or manually through a cockpit switch on overhead panel.
 - 1.21.2 The cabin of aircraft is kept at a comfortable pressure as compared to the outside atmospheric pressure. The difference between these two altitudes is known as ΔP (Differential Pressure). It should be maintained less than 8.5 psi. As from sea level till 31,000 ft, the atmospheric pressure reduces from 14 psi to 4.17 psi, so during climb phase, the pressure inside the cabin is also varied to maintain a desired ΔP . If ΔP reaches 8.6 psi, cabin safety operates & Safety Valve opens to release the excessive cabin pressure in order to ensure structural integrity. In case of excessive cabin altitude of greater than 9550 ft, the active CPC sends a signal to both Flight Warning Computers (FWCs) for the RED (level 3) warning.



Differential pressure - ΔP

Cabin vertical speed - V/S

Cabin altitude - ALT



Cabin pressure altitude

2 ANALYSIS

2.1 Technical Analysis

- 2.1.1 On arrival at KHI, externally both air-conditioning packs were operating normal. The outflow valve and both skin air valves were in open position as expected. Inside the cabin all oxygen masks were found dropped.
- 2.1.2 A debriefing discussion with the Captain revealed that “Excess Cabin Altitude” RED warning along with Continuous Repetitive Chime (CRC) came and they performed “reset” of the system. In response to the query that how reset was done, Captain told that on overhead panel ‘MAN’ push button (Manual) was released and pressed. He further shared that in the meanwhile, the Cabin Purser informed that all oxygen masks inside cabin had dropped.
- 2.1.3 Post Flight Report (PFR) of the incident flight PK-369 was printed on arrival which revealed that :-
 - 2.1.3.1 At GMT 0834hrs, warning of ‘Excess Cabin Altitude’ was recorded. This warning had occurred THRICE during the flight.
 - 2.1.3.2 At GMT 0855hrs, after almost 21 minutes from 1st warning, cabin safety was operated as the Safety Valve was recorded open.
 - 2.1.3.3 At GMT 0955hrs, after touchdown of the aircraft, “Cabin Pressure SYS 2” fault was recorded.

```
-----+-----+
: MAINTENANCE : DB/N
: POST FLIGHT REPORT : A3200NEW010710
:-----+-----+

A/C ID  DATE  GHT  FLTN  CITY PAIR
.AP-BLV  18OCT  0808/1002  PIA369  OPRN OPKC

WARNING/MAINT.STATUS MESSAGES
-----
GHT  PH  ATA
0809 02 23-00 CIDS 2
0809 02 31-00 DAR
0834 06 21-31 CAB PR EXCESS CAB ALT (3)
0855 06 21-31 CAB PR SAFETY VALVE OPEN
0958 07 21-31 CAB PR SYS 2 FAULT
```

Figure 1 : Post Flight Report PK 369

- 2.1.4 On ground, functional test of pressure control & monitoring system for both CPC was performed and found normal. Later on, following salient rectifications were performed for making the aircraft serviceable:-
 - 2.1.4.1 A structural leak check to measure leakage rate was found well within limits, as per recommended differential pressure of 8.12 psi.
 - 2.1.4.2 Operational check of OFV was found satisfactory.

- 2.1.4.3 Despite a satisfactory ground test, considering a previous reporting on 16/10/17 regarding CPC#2 fault, same was replaced with another serviceable one.
- 2.1.5 Both Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) were removed and extensively utilized for the purpose of investigation.
- 2.1.6 Inside the cabin, all 66 emergency oxygen generators were replaced.
- 2.1.7 Aircraft was declared serviceable.
- 2.1.8 A review of the aircraft documents revealed that no defect history existed for “Excess Cabin Altitude Warning”. However fault of CPC # 2 was reported once on 16/10/17 where ground tests were found normal. As per previous Flight Legs (FL) reports retrieved from aircraft, the fault of CPC # 2 also occurred in FL 02/10/17 (during climb), FL 03/10/17 (during cruise) & FL 08/10/16 (during cruise).
- 2.1.9 As per Airbus recommendations, special auto generated reports, known as “A320 Environmental Control System (ECS) Report 19”, were also decoded. These reports unfold the values/positions of the most required parameters and OFV during the entire event which otherwise are not recorded in the FDR.

	GMT	A/C ALTITUDE	CONTROLLER IN COMMAND	PACK FLOW	CABIN V/S(vertical speed)	CABIN DIFF. PRESS	CABIN ALTITUDE	OFV POSITION	REMARKS
1	834	31391 ft	2 in command	50/50	300 ft/min	7.9	5456 ft	9% open	NORMAL Parameters
2	836	33473 ft	2 in command	50/50	250 ft/min	7.9	5296 ft	8% open	NORMAL Parameters
3	838	31963 ft	2 in command	48/45	850 to 4200 ft/min	7.7	5968 ft	11-38% open	ABNORMAL Cabin V/S
4	855	31977 ft	2 in command	48/46	---	---	---	---	ABNORMAL Safety valve operated

- 2.1.10 The three reports were generated due to ‘Excess cabin attitude’ warning which appeared thrice. During first two warnings, all relevant parameters were well within range. But during third warning, an abnormal gradual rise in Cabin Vertical Speed (V/S) was noticed.
- 2.1.11 The fourth report was generated as ΔP had crossed its safety limits of 8.5 psi and as a result, safety valve had opened automatically to avoid aircraft structural damage.
- 2.1.12 During this complete scenario, CPC # 2 was in control of the auto pressurization. Neither CPC # 1 was switched automatically nor manually by crew for auto control. Furthermore, no manual control was obtained by the cockpit crew. The “MAN” push button switch was pushed / exercised 4 to 5 times with a delay of 1 sec.

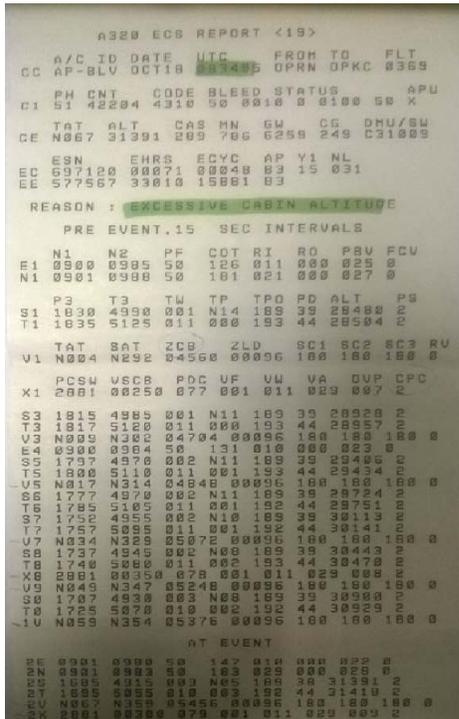


Figure 2 : 1st report - Cabin Excess ALT

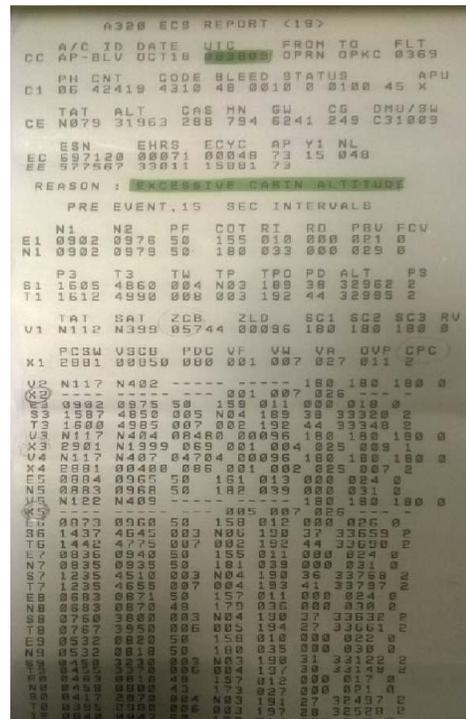


Figure 3 : 2nd Report - Cabin Excess ALT

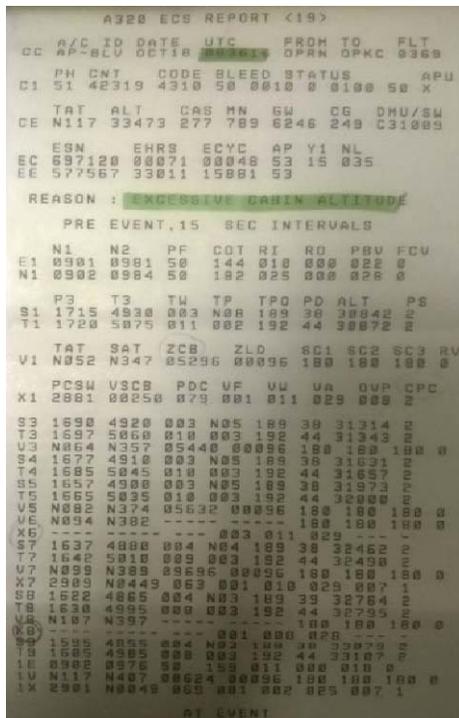


Figure 4 : 3rd Report - Cabin Excess ALT

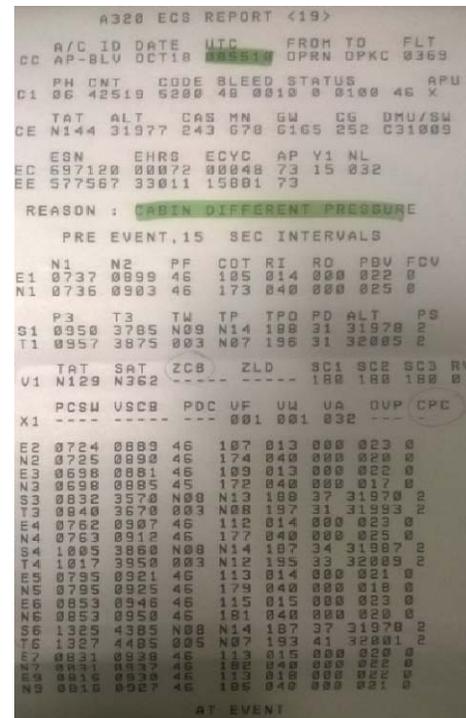


Figure 5 : 4th Report - Cabin DIFF PRESS

2.1.13 The analysis of FDR (refer below pictures) reveals that after 0:30:12 minutes of flight, first warning of cabin pressurization came on at 31448 ft altitude and remained for 91 sec. Again cabin pressure warning appeared after 0:32:23 minutes of flight with the aircraft altitude of 33492 ft and remained for 68 sec with altitude of aircraft at 33048 ft. No descent was initiated. Final warning of cabin pressure system came on at 0:34:16 minutes of time at an altitude of 31948 ft and remained for 143 sec. It then disappeared at an altitude of 31972 ft.

BLV-DL 10/1/2017 Parameter Map: A320PIA22-1-0 (v1.04) Format: Basic Acquired Parameters (v1.00) Parameters: 1198													
Flight: 0-0 ISB-KHI T/O Frm: 21988 12:11:04 AM Lnd Frm: 23555 1:55:32 AM													
User comment: FDM													
Frame-Sf	SfCount	Time	Aircraft	Standard	M30a04	D04a02	D04a03	D04a04	D04a0508	D04a05	D04a06	D04a07	D04a08
_AC_TY	_ALT	_STD	_CABIN_P	_WARN	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR_TO3	CITY_PAIR_TO4	
22274-2	89097	00:30:05			31300								
22274-3	89098	00:30:06			31328								
22274-4	89099	00:30:07			31344								
22275-1	89100	00:30:08	A320		31360								
22275-2	89101	00:30:09			31376								
22275-3	89102	00:30:10			31412								
22275-4	89103	00:30:11			31428								
22276-1	89104	00:30:12	A320		31448								
WARNING First WARNING of 'EXCESS CABIN ALTITUDE' Came after 30 Minutes post take off & REMAINED for 91 sec													
22276-2	89105	00:30:13			31460								
22276-3	89106	00:30:14			31492								
22276-4	89107	00:30:15			31508								
22277-1	89108	00:30:16	A320		31528								
22277-2	89109	00:30:17			31544								
22277-3	89110	00:30:18			31580								
22277-4	89111	00:30:19			31596								
22278-1	89112	00:30:20	A320		31616								
22278-2	89113	00:30:21			31632								P

BLV-DL 10/1/2017 Parameter Map: A320PIA22-1-0 (v1.04) Format: Basic Acquired Parameters (v1.00) Parameters: 1198													
Flight: 0-0 ISB-KHI T/O Frm: 21988 12:11:04 AM Lnd Frm: 23555 1:55:32 AM													
User comment: FDM													
Frame-Sf	SfCount	Time	Aircraft	Standard	M30a04	D04a02	D04a03	D04a04	D04a0508	D04a05	D04a06	D04a07	D04a08
_AC_TY	_ALT	_STD	_CABIN_P	_WARN	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR_TO3	CITY_PAIR_TO4	
22306-4	89227	00:32:15			33432								
22307-1	89228	00:32:16	A320		33440								
22307-2	89229	00:32:17			33444								
22307-3	89230	00:32:18			33456								
22307-4	89231	00:32:19			33460								
22308-1	89232	00:32:20	A320		33472								
22308-2	89233	00:32:21			33472								
22308-3	89234	00:32:22			33488								
22308-4	89235	00:32:23			33492								
WARNING After 40 seconds of first warning, SECOND WARNING came ON and REMAINED for 68 sec													
22309-1	89236	00:32:24	A320		33496								
22309-2	89237	00:32:25			33504								
22309-3	89238	00:32:26			33516								
22309-4	89239	00:32:27			33524								
22310-1	89240	00:32:28	A320		33532								
22310-2	89241	00:32:29			33536								P
22310-3	89242	00:32:30			33548								
22310-4	89243	00:32:31			33556								
22311-1	89244	00:32:32	A320		33560								
22311-2	89245	00:32:33			33568								R
22311-3	89246	00:32:34			33576								
22311-4	89247	00:32:35			33584								

BLV-DL 10/1/2017 Parameter Map: A320PIA22-1-0 (v1.04) Format: Basic Acquired Parameters (v1.00) Parameters: 1198													
Flight: 0-0 ISB-KHI T/O Frm: 21988 12:11:04 AM Lnd Frm: 23555 1:55:32 AM													
User comment: FDM													
Frame-Sf	SfCount	Time	Aircraft	Standard	M30a04	D04a02	D04a03	D04a04	D04a0508	D04a05	D04a06	D04a07	D04a08
_AC_TY	_ALT	_STD	_CABIN_P	_WARN	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR	CITY_PAIR_TO3	CITY_PAIR_TO4	
22335-2	89341	00:34:09			32016								
22335-3	89342	00:34:10			31996								
22335-4	89343	00:34:11			31988								
22336-1	89344	00:34:12	A320		31980								
22336-2	89345	00:34:13			31972								
22336-3	89346	00:34:14			31964								
22336-4	89347	00:34:15			31956								
22337-1	89348	00:34:16	A320		31948								
WARNING After 45 seconds of Second warning, THIRD WARNING came ON and REMAINED for 143 sec													
22337-2	89349	00:34:17			31944								
22337-3	89350	00:34:18			31932								
22337-4	89351	00:34:19			31932								
22338-1	89352	00:34:20	A320		31928								
22338-2	89353	00:34:21			31924								
22338-3	89354	00:34:22			31920								
22338-4	89355	00:34:23			31916								
22339-1	89356	00:34:24	A320		31920								
22339-2	89357	00:34:25			31916								
22339-3	89358	00:34:26			31920								

- 2.1.14 First 30 minutes of the flight were uneventful. The cabin pressurization was being controlled by CPC # 2. Later on, in total three successive warnings of excess cabin altitude appeared within a period of 04 minutes, each followed by a gap of few seconds. As per design, warnings were triggered by CPC # 2.
- 2.1.15 As per available reports, during first two warnings parameters of both the cabin altitude and cabin vertical speed were within normal range. But during, third warning an abnormal gradual rise in “Cabin Vertical Speed (V/S)” was noticed, from 850 ft/sec till 4200 ft/sec.
- 2.1.16 During these three warnings, CPC # 2 was in control of the auto pressurization. Neither CPC # 1 was switched over automatically nor manually by crew for auto control. Furthermore, no manual control was obtained by crew.
- 2.1.17 During third warning, after approx 4 minutes since first warning, purser informed the crew that Oxygen masks had dropped.
- 2.1.18 17 minutes since crew took manual control of pressurization, the ΔP (Cabin differential pressure) had crossed its safety limits of 8.5 psi and a cabin altitude increased more than 14,000 ft, consequentially as per design, the safety valve was operated on auto to avoid damage of aircraft structure. A more detailed analysis on Pilots’ actions has been covered in the operational analysis.
- 2.1.19 Based on the recorded faults of CPC # 2 during recent flights and being a Hi-Life unit (38162 hrs), CPC # 2 was isolated as a suspected contributor to the reported problem.
- 2.1.20 The suspected CPC # 2 was sent to the OEM for a tear down examination which revealed ageing effects on the soldering of its ICs due Hi-Life 38162 hrs.
- 2.2 Operational Analysis**
- 2.2.1 First 55 minutes of CVR for the cockpit indications of the events and the crew actions were analyzed thoroughly. Initially around 30 minutes of flight was smooth without any indication of failure or abnormally. The mentioned below analysis is as per CVR recorded time (starting from 30 minutes till completion of 53 minutes of flight time):-

Time	Voice Heard / Action / Event	Remarks
30:20	1 st CRC warning for cabin pressurization system sounded, and “Excess Cabin Alt” Warning appeared.	
31:21	After elapse of one minute the crew decided to change it to system # 2.	Crew was confused about the Warning indication and was not aware which CPC System was in operation / control.
32:00	2 nd CRC warning sounded. The crew requested for descend, ATC verified the request, however the crew maintained FL320.	Check list calls out for a descent but crew maintained FL320. Refer ‘ CHK 1 ’, mentioned below.

33:28	The crew attempted to reset the system.	Illegitimate “reset” attempt – No such action was required. Refer ‘ CHK 2 ’, mentioned below.
34:15	Cabin crew informed that Oxygen masks had dropped.	
34:40	Captain asked to Check advisory for the manual pressurization.	
35:00	Crew realized mistake of resetting of system.	
36:46	<p>The crew discussed to discontinue flight and land at Lahore, and decided to seek advice from the situation room.</p> <p>The crew provided incomplete information to the situation room stating that the cabin alt warning appeared without any warning of pressurization system, and oxygen masks dropped.</p> <p>The situation room verified the state and the crew confirmed that the cabin pressurization was being maintained manually, and that the oxygen masks had dropped.</p> <p>The crew reiterated to land at Lahore.</p>	The crew did not mention of incorrect manual resetting of the system.
49:50	Situation room recommended to continue to Karachi	Incorrect decision
51:25	Captain reconfirmed from the situation room to continue flight to Karachi.	Flight continued
52:04	Captain informed situation room that cabin pressurization warning and safety valve open warning had appeared, and that the crew had tried to control that.	17 minutes after referring to manual control check list, crew was unable to control the cabin altitude which led to operation of safety valve.
	Remaining part of flight was uneventful.	

CHK 1

 PAKISTAN International Airlines <small>www.pia.com.pk</small>	PROCEDURES ABNORMAL AND EMERGENCY PROCEDURES CAB PR	
A318/A319/A320/A321 FLIGHT CREW OPERATING MANUAL	CAB PR EXCESS CAB ALT	
Applicable to: ALL Ident: PRO-ABN-CAB_PR-T-00017318.0005001 / 21 MAR 16		
ANNUNCIATIONS		
Triggering Conditions: This alert triggers when: - In climb or descent, the cabin altitude is above the higher of: • 9 550 ft, or • 1 000 ft above the airfield pressure altitude. - In cruise, the cabin altitude is above 9 550 ft.		
Flight Phase Inhibition: 		

 PAKISTAN International Airlines <small>www.pia.com.pk</small>	PROCEDURES ABNORMAL AND EMERGENCY PROCEDURES CAB PR	
A318/A319/A320/A321 FLIGHT CREW OPERATING MANUAL	CAB PR EXCESS CAB ALT (Cont'd)	
Ident: PRO-ABN-CAB_PR-T-00018096.0004001 / 20 DEC 16		
Rely on the CAB PR EXCESS CAB ALT warning even if not confirmed on the CAB PRESS SD page. The warning can be triggered by a cabin pressure sensor different from the one used to control the pressure and display the cabin altitude on the SD.		
<ul style="list-style-type: none"> ● If above FL 100: CREW OXY MASK.....USE ■ If below FL 160: DESCENT.....INITIATE MAX FL.....100MEA ■ If above FL 160: SIGNS.....ON EMER DESCENT.....INITIATE DESCENT.....INITIATE ● If A/THR is not active: THR LEVERS.....IDLE <p style="font-size: x-small;">If the A/THR is active, check A/THR is at IDLE on the ED.</p>		

CHK 2

 PAKISTAN International Airlines <small>www.pia.com.pk</small>	AIRCRAFT SYSTEMS AIR CONDITIONING / PRESSURIZATION / VENTILATION PRESSURIZATION - CONTROLS AND INDICATORS	
A318/A319/A320/A321 FLIGHT CREW OPERATING MANUAL	OVERHEAD PANEL	
Ident: DDC-21-20-40-00000334.0003001 / 07 MAY 13 Applicable to: ALL		
CABIN PRESS		
<p>(1) LDG ELEV knob</p> <p>AUTO : The pressurization system uses the FMGS data to construct an optimized pressure schedule. To exit the AUTO position, pull out and turn the selector.</p> <p>Other positions : The pressurization schedule does not use the landing elevation from the FMGS, but instead uses the landing elevation selected with this knob (from -2 000 to +14 000 ft) as its reference.</p> <p><i>Note:</i> The LDG ELEV knob scale is only given as an indication; refer to the ECAM information for accurate adjustment.</p>		
<p>(2) MODE SEL pb</p> <p>AUTO : Automatic mode is operating. One of the two systems controls the outflow valve.</p> <p>MAN : This legend appears in white, and FAULT does not come on. The flight crew then uses the MAN V/S CTL selector to control the outflow valve.</p> <p><i>Note:</i> Switching the MODE SEL pb to MAN, for at least 10 s, then returning it to AUTO will select the other system.</p>		

Correct procedure to select Other SYS – wait 10 sec

3 CONCLUSIONS

3.1 Technical Findings

- 3.1.1 On PK-369, a problem in auto pressurization control started 30 minutes after flight, at around FL310. Three 'Excess cabin altitude' warnings came within a period of 4 minutes and finally all emergency cabin oxygen masks were dropped. The cabin altitude had actually reached, more than 14,000 ft limit, where these masks deploy automatically. 17 minutes later, the safety valve also operated to avoid structural collapse, as cabin ΔP (differential pressure) had crossed the upper limit of 8.5 psi.
- 3.1.2 During this time CPC # 2 was in control of auto pressurization. This CPC had faulted during previous (most recent) flight legs. It is believed that this CPC malfunctioned in controlling the required cabin vertical speed, as a result cabin altitude kept climbing and crossed its limits. It is also evident, that unlike previous flight legs where after fault, CPC #2 declared itself 'faulty' and switched over the system to CPC #1 automatically, but for this flight the faulty CPC #2 remained in control even after its failure to control the cabin pressure.

3.2 Operational Findings

- 3.2.1 The crew was unable to promptly monitor and correctly analyse the situation. The crew made a resetting attempt contrary to the laid procedure given in Quick Reference Handbook (QRH), didn't reduce the altitude below FL 100 and didn't discontinue the flight especially after dropping of the oxygen masks (by landing at Lahore). Instead the crew initiated wrong selection, opted to maintain altitude and conveyed incorrect / incomplete situation to the situation room. Had the cockpit crew reacted promptly as per their laid down procedures, the incident of dropping of the masks was avoidable and pressurization was controllable either by the CPC #1 or manually by crew.
- 3.2.2 **Cause of the Occurrence.** Cabin Pressure Controller No 2 (CPC #2) failed to regulate the cabin pressure at the desired value and failed to automatically switch over the system to CPC #1. However, Cockpit Crews' delayed recognition of the situation as well as wrong actions aggravated the situation till automatic dropping of Oxygen masks (as designed).

4 SAFETY RECOMMENDATIONS

- 4.1 The fault of CPC#2 was reported in Post Flight Report (PFR) in some previous flight legs. Although operational tests were satisfactory on ground, however internal failure of CPC#2 was suspected to be the cause behind those reported events. It is therefore recommended that for future purposes, a procedure should be instituted for handling and monitoring of Post Flight Reports (PFRs) especially when recorded faults are related to critical systems like Cabin Pressurization System etc.
- 4.2 PCAA Flight Standards Directorate is to issue instructions to all operators for following the OEM recommended emergency procedures in the light of relevant flight crew training manual (FCTM).

- 4.3 The involved Captain and First Officer are to undergo one day ground schooling with special focus on aircraft pressurization system and related emergency situations.
- 4.4 The involved Captain and First Officer are to undergo CRM refresher training.
- 4.5 The involved Captain and First Officer are to undergo one CAA Inspector monitored route check as a pair for verification of CRM procedures.