

FINAL INVESTIGATION REPORT



SERIOUS INCIDENT OF M/S PIAC FLIGHT PK-785 (ISB-LHR), B777-200ER
AP-BGJ FIRE / SMOKE IN FWD GALLEY OVEN # 3 DATED 05TH APRIL, 2017

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SERIOUS INCIDENT OF M/S PIAC FLIGHT PK-353 (PEW – KHI), B777-200ER
AP-BGK HEAVY SMOKE / FIRE INSIDE OVEN AT POS: FW D#2
DATED 23RD MAY, 2017

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Synopsis

There were two incidents of Fire / Smoke in Oven during flight. Investigation into both the incidents have been combined into this single for being identical in nature from all aspects like same Operator (M/s PIAC), same type but different S Nos of the aircraft (B777-200ER) and similar location of both the Ovens (forward galley). The details of both the occurrences are as under:

On 05th April, 2017, M/s PIAC Flight No. PK-785 (Sector ISB – LHR) B777-200ER, Reg. No. AP-BGJ forward galley oven number 3 caught fire after 3.5 hours of flight. The fire was extinguished by cabin crew by discharging two fire extinguishers. The serious incident was reported to Safety Investigation Board (SIB), Pakistan by the operator through Mandatory Occurrence Report (**Appendix 'A'**). The incident was notified in accordance with ICAO Annex – 13 (**Appendix 'B'**) and Aviation Division, Government of Pakistan issued memorandum vide letter No. HQCAA/1901/391/SIB/295 dated 11th April, 2017 (**Appendix 'C'**) authorizing SIB, Pakistan to investigate the incident.

In the second incident, on 23rd May, 2017 M/s PIAC Flight PK-353 (PEW-KHI) B777-200ER Reg. No. AP-BGK, Flight diverted to Multan due to Heavy Smoke / Fire inside Oven at Pos: FW D#2 (F-106), two Halon Fire Extinguishers were used by the cabin crew. The serious incident was reported to Safety Investigation Board in Daily IOU Report Period 230500LT to 240500LT May, 2017 (**Appendix 'D'**) and by operator through Mandatory Occurrence Report (**Appendix 'E'**). The incident was notified in accordance with ICAO Annex – 13 (**Appendix 'F'**). Aviation Division, Government of Pakistan issued memorandum vide letter No. HQCAA/1901/393/SIB dated 29th May, 2017 (**Appendix 'G'**) authorizing SIB, Pakistan to investigate the incident.

1. FACTUAL INFORMATION

- 1.1. **History of the Flights.** In Case-I, the PIA PK-785 was operating on a routine flight from ISB-LHR on 05th April, 2017. Oven No. 3 in forward galley caught fire after 3.5 hrs of flight. Two fire extinguishers were utilized to extinguish the fire by the cabin crew. Similarly, in Case-II, PK-353 was also on routine flight from PEW-KHI on 23rd May, 2017. Oven No 2 in the forward galley caught fire which was extinguished using two fire extinguishers by the cabin crew, however, the flight was diverted to MUX and a safe landing was made. The aircraft was switched off on the runway. In both the cases, the affected ovens were secured and services from the forward galley were restored as normal.
- 1.2. **Injuries to persons.** Nil.
- 1.3. **Damage to aircraft.** Nil.
- 1.4. **Other damage.** Nil.
- 1.5. **Personnel Information.** Not applicable.
- 1.6. **Aircraft information.** The mishap aircrafts were maintained by the operator in accordance with the regulations of Pakistan Civil Aviation Authority. Pertinent aircraft and major parts maintenance and life information is as follows:

1.6.1. Aircraft

Aircraft Make & Model	B777-200ER
Registration Marking	AP-BGJ
Manufacturer Serial No	33775
Year of Manufacture	JAN 2004
C of A (S No. , expiry date)	640/2 , 30/01/2018 EXPIRY DATE
Maint review prior to 05-04-2017 (date, hrs, cycles, expiry date)	03/04/2017, 54484 : 10HRS,12240C, 30/09/2017 EXPIRY DATE
Daily inspection prior to 05-04-2017 occurrence (date, location)	D/C DATE 05/05/17 AT ISB
Transit check prior to 05-04-2017 occurrence (date, location)	T/C DATE 05/05/17 AT PEK
Total Aircraft Hours as on 05-04-2017 (prior to occurrence)	59948:9
Total aircraft cycles as on 05-04-2017 (prior to occurrence)	12328
Total Landings as on 05-04-2017 (prior to occurrence)	12314
Last Check-C (type, date, hrs, cycles, agency performed & location) prior to occurrence	Chk-C6, 20/05/16,200515h,11315L,PIAC,KHI
Last Check-A (type, date, hrs, cycles, agency performed & location) prior to Occurrence	CHK-1A+3a, 11/04/17, 54589 : 31H, 12259C PIAC,KHI

Aircraft Make & Model	B777-200ER
Registration Marking	AP-BGK
Manufacturer Serial No	33776
Year of Manufacture	Feb-04
C of A (S No. , expiry date)	641/2, exp dt: 14-02-2018.
Maint review prior to 23-05-2017 (date, hrs, cycles, expiry date)	30/01/2017 , 54239 : 54hrs,12228c, 29/07/2017 expiry date
Daily inspection prior to 23-05-2017 occurrence (date, location)	D/C DATE 21/05/17 AT ISB

Transit check prior to 23-05-2017 occurrence (date, location)	T/C DATE 22/05/17 AT LHE T/C DATE 23/05/17 AT MUX
Total Aircraft Hours as on 23-05-2017 (prior to occurrence)	55809:41
Total aircraft cycles as on 23-05-2017 (prior to occurrence)	12536
Total Landings as on 23-05-2017 (prior to occurrence)	12517
Last Check-C (type, date, hrs, cycles, agency performed & location) prior to occurrence	Chk-C6, 08/06/16 ,51493h,11496,PIAC,KHI
Last Check-A (type, date, hrs, cycles, agency performed & location) prior to Occurrence	CHk-1A+2a, 09/05/17,55586h,12496c,PIAC,KHI

1.6.2. The Information related to Oven installed on Aircraft AP-BGJ and AP-BGK is as below:

Oven on AP-BGJ	
Part No.	8202-16-0000-01
S No. / Identification	06-02-0897
Manufacturer's Details	OEM: SELL / ZODIAC AEROSPACE TYPE CERT.NO.: LBA.11.133/1NTS POWER VOLTS : 115/200 V PHASE:3ø CONTROL VOLTS:115V WATTS : 3960 W,400HZ CAPACITY MAX. : 49.6 LBS / 22.5 KG GROSS WEIGHT : 98.1 LBS / 44.5 KG
Time Since New (TSN)	15906
Time Since Installed	15433
Details of last 05 scheduled or un-scheduled maintenance performed on the Oven along with dates	i. D/R:13.08.13, BGK,TSO/TSI:473/473 Hrs, R/Snag: Oven Over Heat, Shop Findings: NFF(Test Performed), ii. D/R 29.12.12,BGZ,TSO/TSI:AF Hrs:31222, R/Snag: Heating Un-Serviceable, Shop Findings: Seal Broken(Repair)

Oven on AP-BGK	
Part No	8202-16-0000-01
S No. / Identification	03-11-0258
Manufacturer's Details	OEM: SELL / ZODIAC AEROSPACE POWER VOLTS : 115/200 V PHASE:3□ CONTROL VOLTS:115V WATTS : 3960 W,400HZ CAPACITY MAX. : 49.6 LBS /22.5 KG GROSS WEIGHT : 98.1 LBS /44.5 KG
Time Since New (TSN)	55809
Time Since Installed	22763
Details of last 05 scheduled or un-scheduled maintenance performed on the Oven along with dates	FIRST VISIT IN SHOP

- 1.7. **Flight Recorders.** Not applicable.
- 1.8. **Medical and Pathological Information.** No injury reported to any person.
- 1.9. **Fire.** In both the cases, Fire/Smoke observed during flight and fire extinguishers were used.
- 1.10. **Useful and Effective Investigation Techniques.** Standard investigation techniques were used.

2. TECHNICAL ANALYSIS

- 2.1. **Case-I (AP-BGJ, Oven S No. 06-02-0897 dated 05/04/2017).** Physical condition of the oven was found to be very dirty. On opening the door, the unit was found blackish with burnt edible oil. The Overheat protector was found not tripped and after powering it ON, heavy grinding noise was observed. Once its fan cover was removed, the fins of the Impeller fan were found broken and melted. No signs of rubbing found on the fan cover and the fan was rotating freely by hand.
- 2.2. Based on the damaged impeller blades, the oven was sent to Zodiac Aerospace, Germany (OEM) to provide their expert opinion about this failure. OEM report is attached as **Appendix 'H'**. Salient findings of this report are as mentioned below :
 - 2.2.1. The safety equipment, over heat cut off switch and blower thermal switch worked correctly despite malfunction of the oven.
 - 2.2.2. An unsafe condition due to technical problems of the Oven could not be confirmed.
 - 2.2.3. All the faults which were seen during the investigation make this oven Beyond Economical Repair (BER).
 - 2.2.4. The OEM concluded that the root cause for this occurrence was burnt food / grease inside the oven cavity caused by irregular cleaning and maintenance. The cleaning and maintenance intervals are given in the corresponding component maintenance manual CMM25-36-83 Rev.4.



A good quantity of remains of Edible Oil at bottom of removed Oven



Damaged Fins of the Impeller

- 2.3. **Case-II (AP-BGK, Oven S No. 03-11-0258 dated 23/05/17).** The oven was taken to the Electrical Shop at M/s PIAC. Following are the details of technical investigation into this case:
- 2.3.1. The Overheat Protector (OHEA) light indicator was showing **"Over Heat"** on the Oven Control Module (OCM). After resetting the Overheat protector, the (OHEA) message disappeared.
 - 2.3.2. Door was opened for visual inspection. During visual inspection, clear signs of overheat / burnt marks observed inside the oven cavity.
 - 2.3.3. Then unit was operated on SELL (OEM) test bench where it was found operational with slight noise. All 03-modes of the operation were checked and found satisfactory.
 - 2.3.4. The Oven was then disassembled & inspected. The baffle plate was opened and oil deposits were found behind the baffle plate at 3'O & 9'O clock positions (as shown in the pictures

below). The Impeller was removed from the motor & oil deposits were found even on the fins of impeller. With Impeller removed, motor was found moving freely.

- 2.3.5. The fins of impeller were intact. There were no rubbing signs found in between impeller & the baffle plate.



Baffle plate with clear sign of oil



Impeller



Motor Serviceable



Connector with no abnormality



Roti (Naan) with burnt plastic

- 2.4. During investigation, few ovens lying in the shop as well as aboard the aircraft were found to have deteriorated seal between the Oven door and body. This seal is meant to retain the steam / smoke inside the oven during heating process.
- 2.5. Owing to the discovered common factor of Oil found in both the cases, the OEM's maintenance manual, the maintenance procedure being followed by PIAC Engineering and the operating procedure being followed by the cabin crew was studied which revealed the following :
 - 2.5.1. The Maintenance Manual (CMM25-36-83, Rev.4) lays down lot of emphasis on the cleaning of the Oven including daily and at every stage of the maintenance along with its specific cleaning procedure.
 - 2.5.2. The Engineering Procedures Manual of Cabin Maintenance Division (M/s PIAC) clearly defines cleaning of the Oven with oven cleaner. On the other hand, the Flight Services – Procedures Manual which is meant for the users of this Oven i.e. cabin crew, doesn't mention this cleaning of the Oven at any of the stages like during acceptance from the Engineering Staff or as Pre-use etc. Consequently, the cabin crew is neither trained nor educated on this aspect of the Oven. The awareness of cabin on cleaning is not only important during acceptance but also during long flights where the Ovens are used number of times and there is no engineering staff to clean it.

3. CONCLUSIONS

3.1 Findings.

- 3.1.1 The Oven pertaining to the Case-I was declared beyond economical repair by the OEM.
- 3.1.2 The OEM concluded that Oil splashes lead to the fire inside the oven which ultimately damaged the impeller fan.
- 3.1.3 The OEM declared that the greasy material and oil splashes found inside the oven were due to non-adherence to the cleaning procedures mentioned in the maintenance manual.
- 3.1.4 In the Case-II, again heavy traces of oil were found inside the oven as well as behind its baffle plate. This indicated that the oven was never subjected to prescribed cleaning procedure for quite some time.
- 3.1.5 The safety equipment, overheat cutoff switch and blower thermal switch have worked correctly despite the fire inside the oven.
- 3.1.6 In both the cases, the root cause was burnt food / edible oil inside the oven cavity.
- 3.1.7 The Engineering Procedures Manual of Cabin Maintenance Division (M/s PIAC) clearly defines cleaning of the Oven with oven cleaner while preparing the aircraft for next flight.
- 3.1.8 During review of training manuals of cabin crew, it was revealed that there exists no details pertaining to cleaning of the residuals of oil inside the ovens and handling of such cases both at the time of aircraft / cabin acceptance and in-flight, especially while on long hauls.
- 3.1.9 It was also noted with concern that no such WARNING / CAUTION exists on the Oven to warn / caution about implications of accumulated Oil contents inside the oven cavity while operating.

3.2 Cause of the Occurrence.

- 3.2.1 Deficiency / non-availability of the OEM's defined cleaning procedure with the cabin crew and Non-adherence by engineering staff at M/s PIAC lead to accumulation of edible oil which resulted in heavy smoke / fire once ovens were operated for normal use by the cabin crew.

4. SAFETY RECOMMENDATIONS

- 4.1 Engineering Staff of all operators to be briefed to ensure that all onboard Ovens are adequately cleaned as per already laid down procedures in true letter and spirit.
- 4.2 The Engineering department of M/s PIAC should devise a one-time campaign for the cleaning of ovens cavity & inspection / installation of damaged door seals. As a long term preventive plan, the Engineering department to plan & implement a schedule program for an overhaul cleaning of the ovens cavities in accordance with recommendations of OEM.
- 4.3 The 'Flight Services' department of M/s PIAC to define and implement procedures, both in their training & Standard procedures manuals, regarding monitoring / cleaning of ovens cavities at the time of cabin acceptance prior to departures and during flight as well. In the same context, appropriate DECAL may be placed outside all Ovens to Warn / Caution the cabin crew for its cleanliness prior to normal use.