



Air Accident Investigation Sector

Incident

- Summary Report -

AAIS Case N° AIFN/0007/2023

Brake Fire

Operator:	Etihad Airways
Make and Model:	Boeing B777-3FXER
Nationality and Registration:	United Arab Emirates, A6-ETP
Place of Occurrence:	Abu Dhabi International Airport
State of Occurrence:	The United Arab Emirates
Date of Occurrence:	19 May 2023



This Investigation was conducted by the Air Accident Investigation Sector of the United Arab Emirates pursuant to Civil Aviation Law No. 20 of 1991, in compliance with Air Accident and Incident Investigation Regulations, and in conformance with the provisions of Annex 13 to the Convention on International Civil Aviation.

This Investigation was conducted independently and without prejudice. The sole objective of the investigation is to prevent future aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

The Air Accident Investigation Sector issued this Summary Report in accordance with national and international standards and best practice. Consultation with applicable stakeholders, and consideration of their comments, took place prior to the publication of this Report.

The Summary Report is publicly available at:

<https://www.gcaa.gov.ae/en/departments/airaccidentinvestigation/Pages/InvestigationReports.aspx>

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Investigation Process

The occurrence involved a Boeing B777-300ER, registration marks A6-ETP, operated by Etihad Airways. The occurrence was reported to the Air Accident Investigation Sector (AAIS) Duty Investigator by phone call to the Hotline Number +971 50 641 4667.

After the initial investigation phase, the occurrence was classified as an 'incident'.

The AAIS opened an investigation in line with the State's obligations in accordance with Annex 13 to the Chicago convention as the United Arab Emirates being the State of Occurrence, Registry, and the Operator.

The AAIS notified the National Transportation Safety Board (NTSB) of the United States as of being the State of Manufacture and Design.

The scope of this investigation is limited to the events leading up to the occurrence and no in-depth analysis of non-contributing factors was undertaken.

Notes:

1. Whenever the following words are mentioned in this Report with the first capital letter, they shall mean the following:
 - (Aircraft) – the aircraft involved in this incident
 - (Commander) – the commander of the incident flight
 - (Copilot) – the copilot of the incident flight
 - (Incident) – this investigated incident
 - (Investigation) – the investigation into this incident
 - (Operator) – Etihad Airways
 - (Report) – this incident investigation Summary Report.

2. Unless otherwise mentioned, all times in this Report are given in 24-hour clock in Coordinated Universal Time (UTC), (UAE local time minus 4).
3. The structure of this Summary Report is an adaptation of the Final Report format incorporated in Annex 13 to the Chicago Convention.

Factual Information

History of the Flight

On 18 May 2023, at 1054 UTC, an Etihad Airways Boeing 777-300ER, registration marks A6-ETP, departed for a scheduled passenger flight number EY455, from Sydney Kingsford Smith Airport (YSSY¹), Australia, to Abu Dhabi International Airport (OMAA²), the United Arab Emirates. There were 366 people on-board comprising 348 passengers, 4 flight crewmembers, and 14 cabin crewmembers.

The Commander was the pilot monitoring (PM) and the Copilot was the pilot flying (PF).

The Aircraft landed at OMAA runway 13R at 0139 on 19 May 2023. After vacating the runway via taxiway Echo 10, the Aircraft proceeded on taxiway Echo and exited via Echo 13. The Aircraft continued taxiing on taxiway Foxtrot (Attachments A).

During the taxi on taxiway Foxtrot, the flight crew shut down the right engine for single-engine taxi as per the taxi procedure. Sometime thereafter, the flight crew noticed flames coming from the left main landing gear via the ground maneuver camera system (GMCS) display on the multifunction display (MFD) for a short period, which subsequently self-extinguished. However, smoke continued emanating from the same area.

The flight crew stopped the Aircraft on taxiway Foxtrot between taxiways Echo 6 and Echo 9. The flight crew then took precautionary measures by making a MAYDAY call to air traffic control (ATC) using very high frequency (VHF) radio communication due to their suspicion of a fire on the main landing gear. Additionally, the flight crew requested the assistance of the airport's rescue and

¹ YSSY is the ICAO four letter airport code for Sydney Kingsford Smith Airport

² OMAA is the ICAO four letter airport code for Abu Dhabi International Airport

firefighting services. The flight crew made an alert call using the passenger address (PA) system.

At 0145, ATC declared the ground incident by notifying the airport's rescue and firefighting services.

At 0146, the fire trucks reached the location of the Aircraft. The firefighting team noticed smoke and hydraulic oil leakage from the left main gear. Following firefighting procedures, the fire commander requested the flight crew to shut down the left engine.

At 0147, the airport ground operations team, as instructed by ATC, began inspecting the taxiways that the Aircraft had gone through after vacating the runway. During the inspection, they found small fragments of broken metal pieces on taxiway Echo 13. They promptly notified ATC about their findings.

At 0158, ATC directed the ground operations team leader to perform an inspection on runway 13R. During the inspection, the team found additional fragments of broken metal and carbon fiber pieces on the runway centerline abeam taxiway Echo 10. At 0204, they informed ATC that the south runway (runway 13R/31L) was not suitable for safe operations. At the same time, a separate ground operations team was inspecting the north runway (runway 13L/31R) to make it ready for accommodating takeoffs and landings while the operation of the south runway was being restored.

The firefighters remained vigilant and kept a close watch on the situation. At 0207, an Operator's maintenance engineer arrived at the Incident site. As a precautionary measure, the engineer used convection fan cooling on the left main landing gear brakes. After inspecting the area and confirming that the wheels could rotate, the engineer, in consultation with the Operator's Engineering Department, decided to tow the Aircraft to the nearest parking stand.

At 0300, the process of towing the Aircraft commenced, and a fire truck was assigned to accompany it until it safely reached parking stand 301 at 0305. All passengers and crewmembers disembarked from the Aircraft uneventfully.

After the Aircraft arrived at the designated parking stand, and based on the results of the inspections carried out on runway 13R and the connecting taxiways, the airport emergency status was concluded at 0323.

Damage to Aircraft

After the Aircraft was parked at the stand, a *high-energy brake damage* inspection was conducted in accordance with the *aircraft*

maintenance manual (AMM) 05-51-14. It was found that brake assembly number 2 had sustained damage with observed hydraulic fluid leakage from one of the pistons (figures 1 and 2). The brake assembly was replaced as per *AMM 32-45-07*.



Figure 1. Hydraulic fluid leakage



Figure 2. Damaged piston

The in-depth inspection found signs of overheating damage on the axle sleeve (figure 3), and therefore, it was replaced in accordance with *AMM 32-11-28*.



Figure 3. Overheat damage on axle sleeve

The main landing gear wheels number 1 and 2 were subsequently replaced. An operational test on the replaced brake assembly was performed and no leak was observed and all indications showed normal.

Personnel Information

Two sets of flight crew (Crew A and Crew B) were assigned for long-range variations (LRV) flight operations as per the Operator's *operations manual - part A*. Each set of the Incident flight consisted of one commander and one copilot. All flight crewmembers held a valid air transport pilot license (ATPL-A) and Class 1 medical certificate issued by the General Civil Aviation Authority (GCAA) of the United Arab Emirates. All flight crewmembers were type rated for the Boeing 777.



Aircraft Information

The Aircraft was a Boeing 777-3FXER, which was fitted with two General Electric GE90-115BG03 engines.

The Aircraft was manufactured in May 2013 under manufacturer serial number 41669, and delivered to the Operator on 25 June 2013.

At the time of the Incident, the Aircraft had accumulated 46,745 flight hours and 6,567 cycles. The last inspection (A-Check) was carried out on 4 May 2023, at 46,256.9 hours, and 6,501 cycles. The last inspection was the transit check on 18 May 2023 when the Aircraft had accumulated 46,468.5 flight hours, and 6,524 cycles, prior to departure from YSSY.

The maximum take-off weight of the Aircraft was 351,534 kg, and the maximum landing weight was 251,290 kg.

The brake assembly (part number 2-1693) was manufactured by Collins and had accumulated 1,188 cycles since installation and 9,250 cycles since new. There had been 78 cycles since the most recent tire change of the mating wheel assembly.

On the day before departure from YSSY, the Aircraft's technical logbook indicated a single cabin defect regarding a non-functioning seat recline. There were no recorded technical defects or deferred items. The flight crew did not report any technical anomalies before or during the flight until the Incident occurred during taxiing after landing at OMAA. Furthermore, there were no post-flight fault maintenance messages displayed on the engine indicating and crew alerting system (EICAS) for the duration of the flight.

The manufacturer's fleet team digest (FTD) information and service bulletins (SBs) did not indicate any documented known issues or similar occurrences.

Brake temperature indication

Wheel brake temperatures are displayed on the GEAR synoptic display on the MFD. Numerical values related to wheel brake temperature are displayed adjacent to each wheel/brake symbol, which has a range from 0.0 to 9.9 in increments of 0.1.

The values have a tendency to rise after the brakes are used. The normal range values, depicted in white, span from 0 to 4.9. When values fall between 3.0 and 4.9, the brake symbol for the hottest brake appears as a solid white. Values of 5.0 and above are represented in amber,

accompanied by the display of the EICAS advisory message 'BRAKE TEMP' indication.

Tire pressure indication

Individual tire pressures, from 0 to 400 PSI, are displayed inside the individual wheel symbols on the GEAR synoptic display.

The EICAS advisory message 'TIRE PRESS' is displayed if any tire pressure is above or below the normal range, or there is an excessive pressure difference between two tires on the same axle.

Meteorological Information

The meteorological conditions of the OMAA around the time of the Incident were: at 0200 UTC, wind from 260 degrees with a speed of 3 knots and variable from 190 to 320 degrees, visibility 10 kilometers or more, temperature 29 degrees Celsius, dewpoint 19 degrees Celsius, QNH barometer setting 1008, no significant clouds, and no significant anticipated changes.

The sunrise at OMAA on 19 May 2023 was at 0538 local time (0138 UTC).

The meteorological conditions of OMAA on the day of the Incident did not contribute to the circumstances of the Incident.

Aerodrome Information

Abu Dhabi International Airport (OMAA), coordinates 24°25'59"N 54°39'04"E, are designated at the mid-point of runway 13R/31L on the centerline, and is located 16.5 kilometers east of Abu Dhabi city. The airport elevation is 83 feet.

OMAA is equipped with two asphalt runways: 13R/31L; and 13L/31R. Runway 13R has a landing distance available of 4,106 meters. The distance between both runways' centerlines is 2,000 meters.

Runway 13R is equipped with a CAT I Instrument Landing System International Civil Aviation Organization Category (ILS ICAO) precision approach lighting system, centerline strobe, flashing runway threshold identifier light, and precision approach path indicator (PAPI) on both sides for a 3.0 degrees glide path.

Flight Recorders

The quick access recorder (QAR) data and the transcript of the ATC communications were provided for the Investigation.

Based on the data, when the Aircraft was on final with fully stable on the ILS approach profile,



the autopilot was disengaged at 0139:07 when the Aircraft was descending through 650 feet indicated altitude (530 feet radio height) with an airspeed of 148 knots.

The Aircraft touched down at 0139:48 on runway 13R within the normal touchdown zone (about 2,300 feet (701 meters) from the threshold) with a normal rate of descent of about 200 feet per minute, about zero lateral acceleration, and 142 knots indicated airspeed. The landing weight was about 225,950 kg.

Approximately one second later, the spoilers began to extend to UP positions and remained active for about 19 seconds, while the auto speed brakes were engaged until 0141:06.

At 0139:52, the thrust levers were manually selected to reverse and stowed at 0140:15.

At 0140:13, during the landing roll, while the ground speed was 43 knots, the Aircraft commenced turning right to vacate the runway.

When the Aircraft vacated the runway through taxiway Echo 10, the ground speed was about 30 knots. After Echo 10, the Aircraft continued taxiing through taxiway Echo 13 and then turned right to taxiway Foxtrot.

At 0143:56, while taxiing on taxiway Foxtrot with a ground speed of 18 knots, the right engine was shut down as per the *Reduced Engine Taxi-In (RETI)* procedure³ as per the Operator's flight crew operating manual (FCOM).

The Aircraft stopped at 0144:23 on taxiway Foxtrot and the parking brake was set. At this time, the brake temperatures were indicated on the EICAS as shown in table 1.

Table 1. Brakes temperatures at the stop point	
Brake position	Temperature (Degrees Celsius)
Brake 1	220
Brake 2	110
Brake 3	170
Brake 4	130
Brake 5	170
Brake 6	150
Brake 7	110
Brake 8	110

Brake 9	120
Brake 10	170
Brake 11	120
Brake 12	100

When the left engine was shut down at 0147:50, the brake temperatures reached the levels indicated in table 2.

Table 2. Brakes temperatures after left engine shutdown	
Brake position	Temperature (Degrees Celsius)
Brake 1	310
Brake 2	200
Brake 3	250
Brake 4	210
Brake 5	270
Brake 6	260
Brake 7	200
Brake 8	190
Brake 9	210
Brake 10	250
Brake 11	210
Brake 12	180

The tires' pressures are shown in table 3.

Table 3. Tires pressure	
Tire position	Pressure (Psi)
Tire 1	230
Tire 2	238
Tire 3	224
Tire 4	231
Tire 5	223
Tire 6	226
Tire 7	224
Tire 8	224
Tire 9	226
Tire 10	229
Tire 11	227
Tire 12	223

The Operator carried out an independent analysis of the landing performance which confirmed that the calculated brake energy and brake temperatures were within the normal ranges. This was further confirmed by the Aircraft's brake temperature monitoring system (BTMS) values, which indicated a maximum value of 3.1 units, 9 minutes after landing (at the point of left engine

³ Reduced Engine Taxi-In (RETI) is an Operator's procedure of one engine operating for taxiing in after the landing and vacating the runway.

shutdown). This equates to a normal cooling regime requirement (42 minutes of cooling time).

Test and Research

The involved brake assembly was sent to the manufacturer (Collins) for further investigation.

The manufacturer issued an engineering report after the brake examination. According to the report, damages were identified in multiple areas within the brake assembly. The initial inspection revealed that the pressure plate assembly and piston housing assembly were the most affected components. (The brake assembly is illustrated in Attachment B).

The lugs on the pressure plate had sheared (figure 4), resulting in unrestricted spinning with the rotors. This unrestricted motion led to subsequent damage at the point of contact between the pistons and the pressure plate, carving a noticeable groove into the surface of the pressure plate.



Figure 4. Damaged pressure plate and piston [Source: Collins Aerospace]

Due to the failure of the 7 o'clock piston, a clearance check was not possible, however, all other pistons in the housing were able to retract with no issue, implying the other pistons were not dragging prior to the failure.

Prior to the brake fire Incident, the lugs on both stator 1 and stator 2 experienced failure. The stator clips became trapped between the heat sink and the torque plate. Damage was found on the inner diameter of the rotor assemblies (figure 5), as a consequence of contact with the dislodged stator clips. This contact-induced damage hindered the uniform distribution of clamp force through the heat sink.



Figure 5. Damaged rotor due to contact with stator clips [Source: Collins Aerospace]

This uneven loading resulted in an unusual wear pattern, wearing entirely through part of the outboard half of stator 2. The remaining section of stator 2 is shown in figure 6.



Figure 6. The remaining section of stator 2 [Source: Collins Aerospace]

Nevertheless, despite these issues, at the onset of the fire, stator 3 was still intact, and the brake retained its capability to generate torque.

The damage caused during the operation following the stator lug failure destroyed evidence of the cause of the initial stator failure. However, on both the pressure plate and stator 1, traces of the original lug slots were observable, and these surfaces appeared devoid of catalysts or excessive oxidation. The consideration of these potential factors could not be abandoned, given that a significant portion of the surfaces where evidence of such damage might exist has been removed.



The report stated that the damage present on the pressure plate, and the depth of wear present on stators 1 and 2 indicate that the brake had continued operating for a significant amount of time following the stator lug failure, and at a minimum would have been present during the previous wheel removal at 78 cycles earlier. The damage to the pressure plate lugs and face would have been visible without removing the wheel assembly. In addition, the failure of the other stators would have been noticeable both due to the appearance of the outer surface of the stators, and due to the lack of alignment of the broken lug indicators.

The examination concluded that the brake fire resulted from the failure of the pressure plate lugs, permitting unrestricted rotation of the pressure plate with the wheel assembly underneath the pistons. This condition, combined with the interaction between the heat sink assembly and dislodged stator clips, created uneven wear.

The brake assembly had operated with failed stators for a significant number of cycles, exacerbating damage to the pressure plate and heat sink assemblies. This prolonged operation ultimately led to the failure of the piston, triggering a hydraulic leak into the heat sink, and subsequently igniting a brake fire.

Organizational and Management Information

The Operator

The Operator commenced operations in November 2003 in compliance with an air operator certificate (AOC) issued by the GCAA.

Operator's *Operations Manual Part A, (OM-A, sub-section 12.12.2*, described a 'distress' condition, as follows:

"12.12.2 Distress

A condition of being threatened by serious and/or imminent danger and requiring immediate assistance. The appropriate phraseology to use in such circumstances is the word 'MAYDAY', repeated three times."

Standard abnormal emergency calls/communication when the aircraft is on the ground was stated in the *OM-A, sub-section 8.3.15.19.1*, which outlines circumstances where an abnormal event has arisen, or an emergency evacuation may soon be required, to initiate an alert call to the cabin.

The *B777 quick reference handbook (QRH) Back Cover 3* outlines conditions and procedures of rapid deplaning that may be required.

Exterior inspection is described in the *FCOM*, as follows:

"Exterior Inspection

Before each flight the Captain, First Officer must verify that the airplane is satisfactory for flight.

...

Tires, brakes and wheels
Check

Verify that the wheel chocks are in place as needed.

If the parking brake is set, the brake wear indicator pins must extend out of the guides."

In addition, the *EY B777 Transit Check* describes the specific inspection for the brake assembly for condition and brake wear indicator pins, as follows:

"Ref: AMC to CAR M.301 – 1

LH/RH Main Landing Gear and Wheel Well Area

- 1) General visual inspection of left/right main landing gears and wheel well area for hydraulic leakage and obvious damage (as far as visible from ground with doors closed).
- 2) Check area under left/right main landing gear door for hydraulic leakage.
- 3) Visually check left/right main landing gear shock strut for normal extension and no evidence of damage and leakage.
- 4) General visual inspection of wheels for damage.
- 5) General visual inspection of tires for condition and obvious damage (cuts, wear and under inflation, etc.).
- 6) Inspect main landing gear brake assembly for condition and brake wearing indication pins and evidence of leaks.
- 7) Clean and coat the exposed chrome surface of L/R MLG inner cylinder using lint-free cloth dampened with shock strut fluid or one of the following Royco SSF/LGF, AEROSHELL 4 or 41 (MIL-H-5606).
- 8) Visually inspect the LH and RH MLG Junction Box and Band Clamps for obvious damage."

Prior to each flight, the transit check is performed by maintenance personnel of the



Operator at the base, as well as by contracted maintenance organizations at out-stations. The check includes a specific inspection of the brake assembly for condition and brake wear indicator pins.

Analysis

The Touchdown

The landing went smoothly, with about 200 feet per minute rate of descent, and a negligible amount of lateral load factor. The Aircraft touched down within the designated zone, and the indicated airspeed was 142 knots. The Aircraft vacated the runway via taxiways Echo 10, Echo 13, and Foxtrot, with normal ground speed.

The brakes were applied normally, and there were no indications of excessive heat.

Accordingly, the Investigation concludes that the landing roll and taxi operations did not contribute to the damage to the brake number 2 assembly.

Brake Number 2 Damage

Based on the brakes' manufacturer engineering (examination) report, the lugs of stators 1 and 2 initially failed, and their clips became trapped between the heat sink and the torque plate. Due to the contact with dislodged stator clips, the rotor assemblies suffered damage to their inner diameters. This contact-induced damage prevented the even distribution of clamp force through the heat sink. Continued operations and cycles of the brake assembly further increased damage to the pressure plate and heat sink assembly. The uneven loading distribution led to an unusual wear pattern, causing complete wear through part of the outboard half of stator 2. The cumulative damage resulted in the shear of the pressure plate lugs, which made the pressure plate freely rotate with the wheel assembly underneath the pistons, and broke the brake wear indicator pin.

The combination of the pressure plate free rotation and the increased damage to the heat sink assembly caused more uneven wear. The damage on the outboard half of stator 2 probably occurred during the last cycle after landing. This additional uneven wear condition caused one of the pistons (7 o'clock position) to fail.

The piston failure caused a hydraulic leak into the heat sink, leading to the oil heating up and reaching its flashpoint, consequently triggering the brief brake fire.

Stator 3 was found intact, which indicates that the brake was partially capable of generating torque at the time it was applied.

The Investigation could not determine the primary cause of the stators' lug damage.

Exterior Inspections

Prior to a flight, it's essential for both the flight and maintenance personnel to perform exterior inspections in line with procedural guidelines to confirm the aircraft's airworthiness. This involves checking the brakes, confirming the extension of brake wear indicator pins from their guides, and thoroughly examining the brake assembly for any indications of leaks or wear.

In a normal brake assembly condition, the brake wear indicator pin is securely attached to the pressure plate and aligned to its guide (Attachment B).

If the pressure plate had been rotating for several cycles before the piston failure, it would have caused the wear indicator pin to disintegrate from its position. This disintegration would have been noticeable during the exterior inspection by the flight crews and transit checks by the maintenance personnel. It is most probable that the brake wear indicator pin was intact during the pre-flight check at the departure airport, assuming that the checks have been performed properly. Therefore, it is probable that the indicator pin disintegrated from the brake assembly unit sometime after landing. However, the pin could not be located during inspections of the runway and taxiways.

The brake manufacturer's examination report stated that the pressure plate lugs and face damage would have been identified by visual inspection even without removing the wheel assembly, and would most likely have been present during the previous wheel removal (78 cycles prior to the Incident). The existing transit checks and exterior inspection procedures would have enabled the maintenance personnel and flight crews, who carried out the required checks and inspections in the last 78 cycles (from the last tire replacement), to observe the brake assembly, particularly the brake wear. Transit checks and exterior inspections (preflight walkaround inspections) provide an opportunity to view the state of the brake wear pin, and to make a general assessment of the state of the brake assembly without having access to all pressure plate grooves and lugs. However, there were no indications in the technical logbooks of any brake assembly damage since the last wheel removal.



Given the nature of visual checks and inspections and the construction of the wheel assembly, the condition of the outer surface of the stators and the alignment of the lug indicators was not possible to be determined. Therefore, the Investigation believes that it was not possible for both the maintenance personnel and the flight crew to observe visually the failure of the stators. Identifying such a failure would have required wheel assembly removal.

In addition, Boeing's *Aircraft Maintenance Manual* Task 32-45-01-400-801 – *Main Landing Gear Wheel and Tire Assembly – Installation*, includes instructions during the wheel installation task to check the exposed brake for “cracks, broken parts, distortion, parts that show a large amount of wear, and index marks on the pressure plate and stator disks (12 o'clock position) that do not align”, among other conditions, noting “Index marks that do not align indicate the stator has broken loose from the torque tube and is rotating with the rotor disks. Bent wear pin will also indicate excessive slot wear on the pressure plate. This will cause loss of brake effectiveness.” The brake inspection steps associated with this task would have enabled maintenance personnel to observe the brake assembly in detail, with specific steps to check for conditions related to the mentioned failures. However, there were no indications of any such findings on the brake assembly in the technical logbooks during the last wheel/tire replacement.

Crew Distress Declaration

After noticing flames from the left main landing gear, which went out quickly, the flight crew stopped the Aircraft on taxiway Foxtrot and broadcasted a MAYDAY call to air traffic control as a precautionary measure, following the Operator's standard procedures.

Conclusions

Based on the evidence available, the following findings, causes, and contributing factors were made with respect to this Incident. These shall not be read as apportioning blame or liability to any particular organization or individual.

Findings

- (a) The Aircraft was certificated, equipped, and maintained in accordance with the requirements of the *Civil Aviation Regulations* of the United Arab Emirates.
- (b) The Aircraft was airworthy when dispatched for the flight, and there was no indication of brake-relevant defects. Additionally, the exterior inspections and transit checks did not identify brake mechanical anomalies.
- (c) The flight crewmembers were licensed and qualified for the flight in accordance with the requirements of the *Civil Aviation Regulations* of the United Arab Emirates.
- (d) The Commander was the pilot monitoring and the Copilot was the pilot flying.
- (e) The deterioration of brake number 2 initially started with the stators' failure and continued during operations, leading to the shearing of pressure plate lugs.
- (f) The damaged pressure plate lugs allowed the pressure plate to rotate freely, leading to the damage of the piston at the 7 o'clock position.
- (g) The piston damage caused hydraulic oil to be released into the heat sink, resulting in the oil heating up to reach the flashpoint and creating a brief flame followed by smoke.
- (h) The Investigation could not definitely determine the cause of the initial damage to the stators' lugs due to compromised evidence from the continuous operations.
- (i) The transit checks and exterior inspection procedures would have enabled the maintenance personnel and flight crews, who carried out the required checks and inspections in the last 78 cycles (from the last tire replacement), to observe the brake wear pin and the brake for signs of leak. However, it was not possible to visually observe the stators with the wheel/tire assembly installed, and thus both the maintenance personnel and the flight crew performing the transit checks and exterior inspection would be unable to observe visually the failure of the stators.
- (j) During the last wheel/tire replacement, maintenance personnel had an additional opportunity to observe the brake damage when performing *Aircraft Maintenance Manual (AMM)* Task 32-45-01-400-801 – *Main Landing Gear Wheel and Tire Assembly – Installation*. The brake inspection steps associated with this task would have enabled maintenance personnel to observe the brake assembly in detail, but no findings were reported relevant to brake damage.



Causes

The Air Accident Investigation Sector determines that the brake number 2 fire resulted from the damage of one of its pistons causing hydraulic oil to be released into the heat sink, resulting in the oil heating up to reach the flashpoint and creating a brief flame followed by smoke.

The damage to the piston was caused by unrestricted continuous rotation of the pressure plate with the wheel assembly underneath the pistons.

The cause of the initial stators' lug damage could not be determined by the Investigation.

Contributing Factors

The Air Accident Investigation Sector determines that a contributing factor to the brake fire Incident was that the brake defect could not be noticed during the exterior inspections and transit checks.

Safety Recommendation

Identifying the condition of the pressure plate grooves and lugs is not possible by the routine visual inspections carried out during transit checks and exterior inspections (walkaround inspections). However, the brake inspection steps associated with the *Main Landing Gear Wheel and Tire Assembly – Installation* task would have allowed maintenance personnel to closely examine the brake assembly. After reviewing the records, no evidence of brake damage was found.

Having the visual inspection limitations, the Investigation does not find a need for a safety recommendation that can articulate further practical steps for identifying barely visible brake parts during the transit checks and exterior inspections.

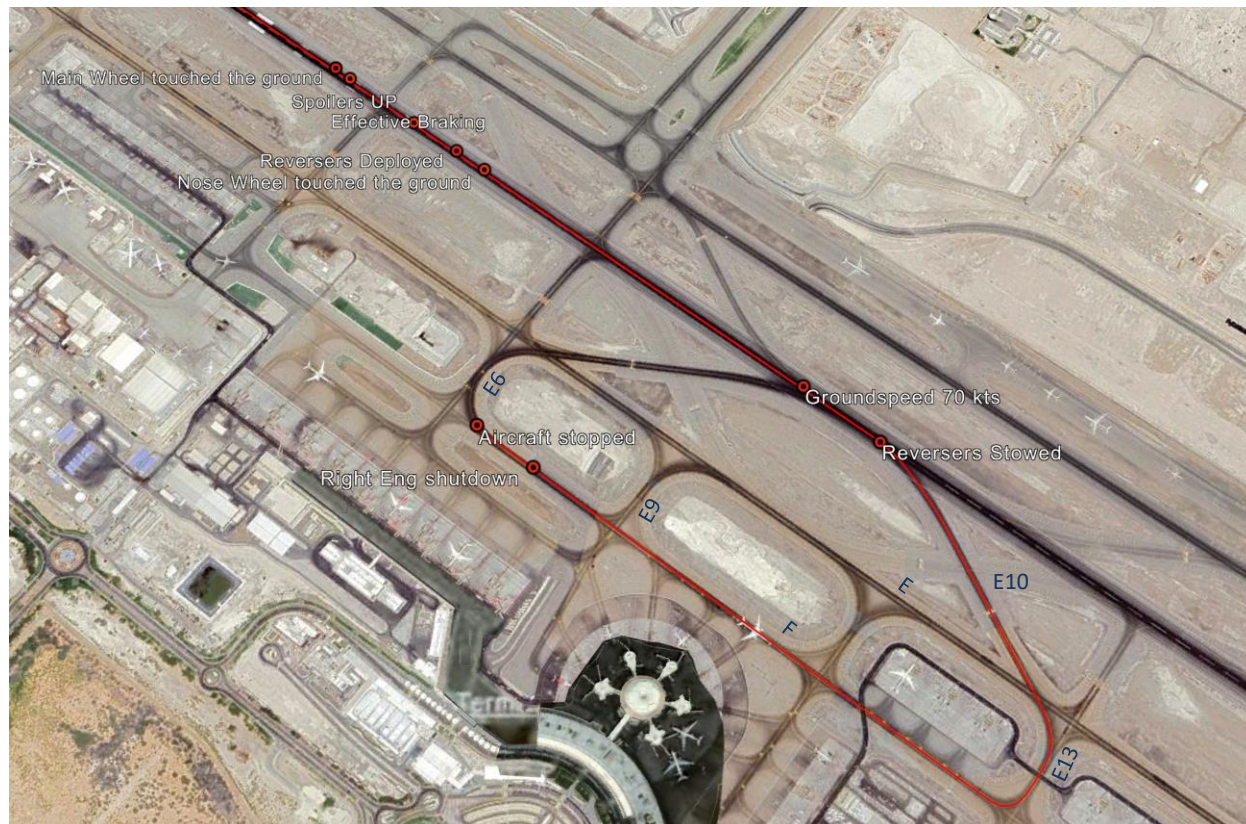
Therefore, the Air Accident Investigation Sector concludes that if the *Main Landing Gear Wheel and Tire Assembly – Installation* task is carried out diligently, maintenance personnel will be able to identify such defects before installing the wheel onto the aircraft.

This Summary Report is issued by the:
Air Accident Investigation Sector
The United Arab Emirates

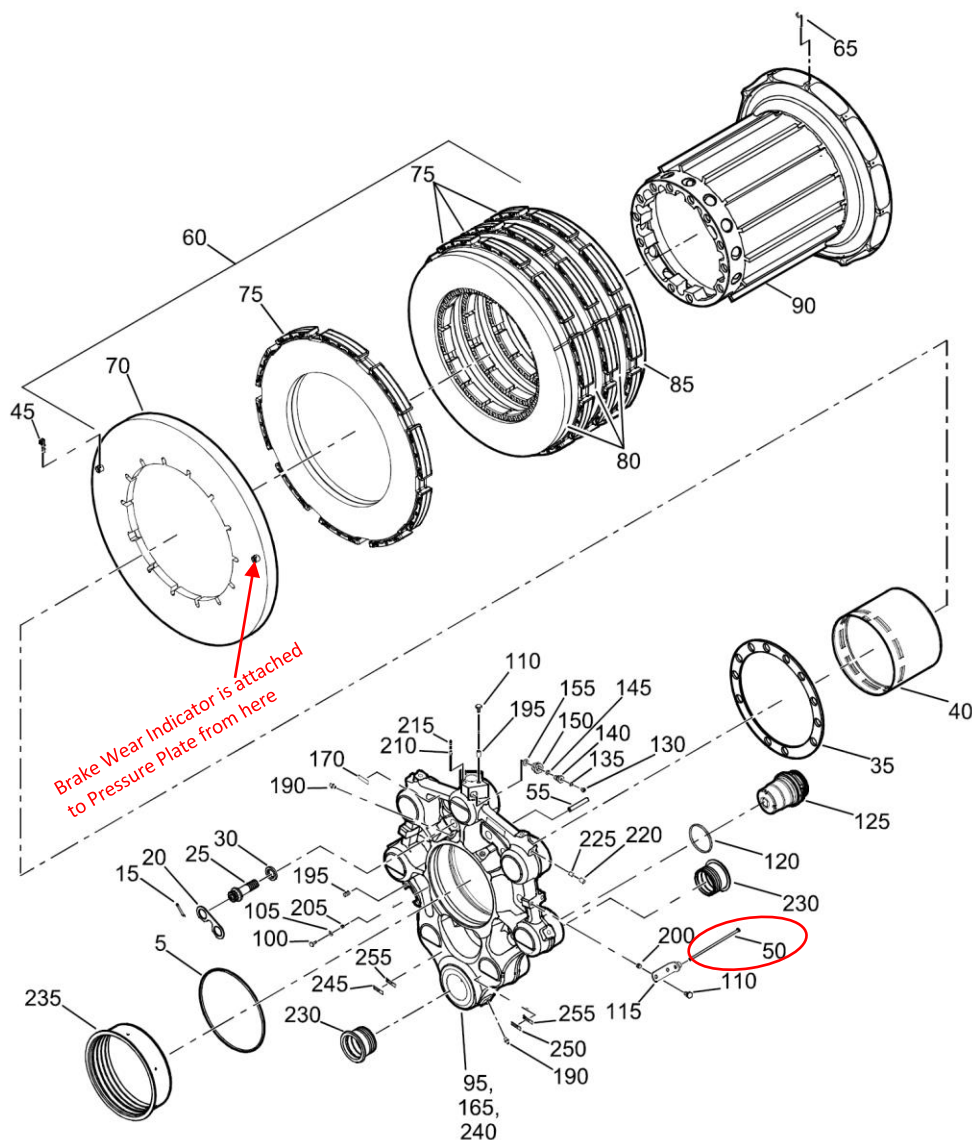
Email: aai@gcaa.gov.ae
www.gcaa.gov.ae



Attachment A: Aircraft Ground Track after Landing



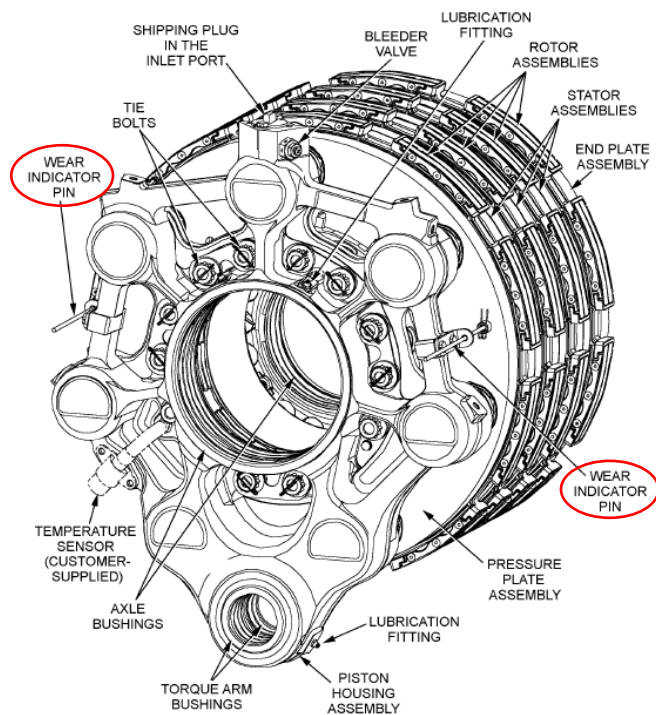
Attachment B: Brake Assembly



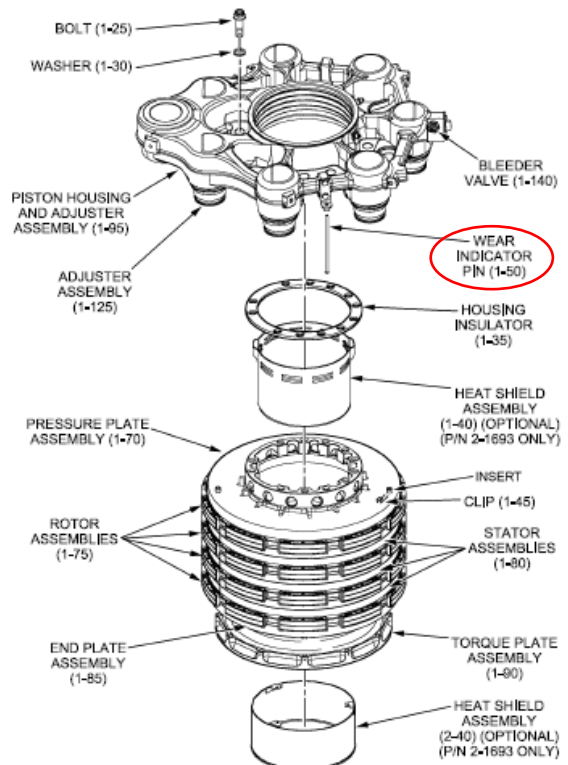
Notes:

35:	Insulator, Housing		
40:	Shield Assembly, Heat		
45:	Clip		
50:	Pin, Wear Indicator		
60:	Heat Sink Assembly		
65:	Clip		
70:	Pressure Plate Assembly		
75:	Rotor Assembly		
80:	Stator Assembly		
85:	End Plate Assembly		
90:	Torque Plate Assembly		
95:	Piston Housing and Adjuster Assembly		
165:	Piston Housing Assembly		
240:	Housing, Piston		

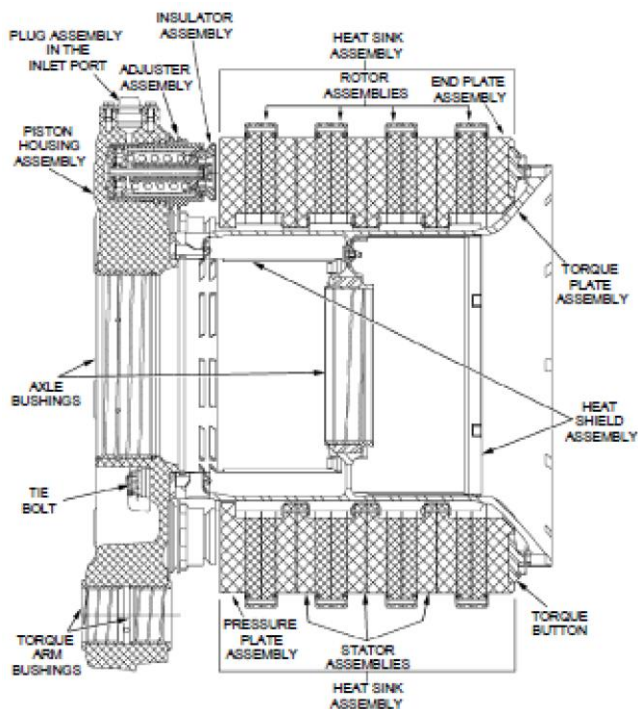
Attachment B: Brake Assembly (cont.)



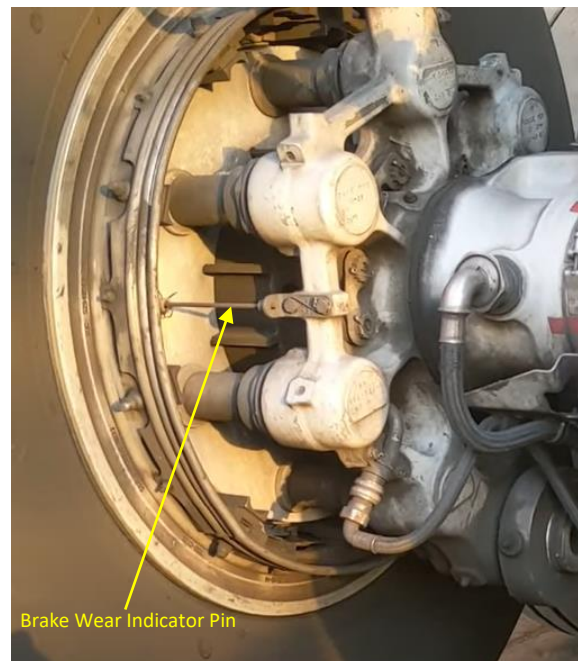
Brake Assembly Description



Exploded View of Main Brake Assembly



Cross Section of the Brake Assembly



Brake Assembly