

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR24LA109

INVESTIGATIVE SUPPLEMENTAL MATERIAL

ACCIDENT

Location: Billings, Montana
Date: 04.12.2024
Time: 0805 mountain daylight time
Airplane: Beech King Air B200

INVESTIGATIVE SUPPLEMENTAL MATERIAL

IIC Zoë Keliher
National Transportation Safety Board
Portland, Oregon

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Wichita, KS

HISTORY OF FLIGHT

On March 12, 2024, at 0805 mountain daylight time, Raytheon Aircraft Company B200 King Air, N299AV, was substantially damaged when it was involved in an accident in Billings, Montana. The pilot-in-command and safety pilot were not injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 repositioning flight.

The pilot-in-command stated that he flew the airplane for 5.8 hours the day before the accident. On the morning of the accident, he planned for a short, 17-minute trip to pick up passengers at 0800 in Colstrip, Montana. The pilot recalled that he did not feel hurried and had plenty of time.

When asked numerous times to explain the start-up procedures, he stated that he started the left engine first and waited about 7-8 seconds for N1 to stabilize before he brought the condition lever up to high idle (about 52%). He recalled that he then positioned the three-setting switch down to change from "starter to generator." He verified that both volt meters indicated loads below 50% and then started the right engine with a cross-generator start. After start, he verified that the battery indicated 23 volts. He could not provide specifics of the positions of the "Ignition and Engine Start" switches or the generator switches, but stated that it was a normal start. He did not perform an engine run-up, as it is not part of his procedures.

After departure from Billings, he received a "RA Fail" message followed by "PT Fail" amber light on the primary and multi-function displays and the electrical panels began to shut down. The pilot and safety pilot both recognized the airplane had a total loss of electrical power.

As the airplane was descending and heading back to the airport, the safety pilot was searching for an electrical failure checklist. They could not find such a checklist and the safety pilot started reading out the checklist for manually extending the landing gear. The air traffic control tower controller cleared the pilot to land by using a green light. The pilot opted to enter the airport traffic pattern on an extended base leg and land on runway 28R. He pulled the landing gear circuit breaker on the base leg and unstowed the emergency landing extension bar. After pumping it for about 30 pumps (he estimated about a minute), he turned the airplane from the base leg to final approach and felt pressure on the handle. Both pilots observed the landing gear extended from looking outside the windows but were unable to verify the landing gear were in the down and locked position because there was no electrical power to illuminate the landing gear lights.

With the flaps retracted, the airplane touched down on the runway 28R. The pilot stated that the main landing gear buckled, followed by the nose gear. The propellers contacted the runway as the belly slid across the surface, damaging both engines.



Figure 1: Airplane landing with the gear retracted

When asked if he reset the generators while in flight, the pilot could not remember. Additionally, when asked to describe the switch that he would use to perform a generator reset, he stated they were the silver switches (without a gang-bar) that are pressed down to reset the generators. He further stated that switches under the gang-bar were only used for starting the engines.

Investigators reviewed the Federal Aviation Administration (FAA) provided Automatic Dependent Surveillance-Broadcast (ADS-B) data for the accident flight (see Figure 1 below). The data disclosed that the airplane departed from runway 28R about 0742 and made a gradual, right-climbing turn to the east. The track ended about 0747.

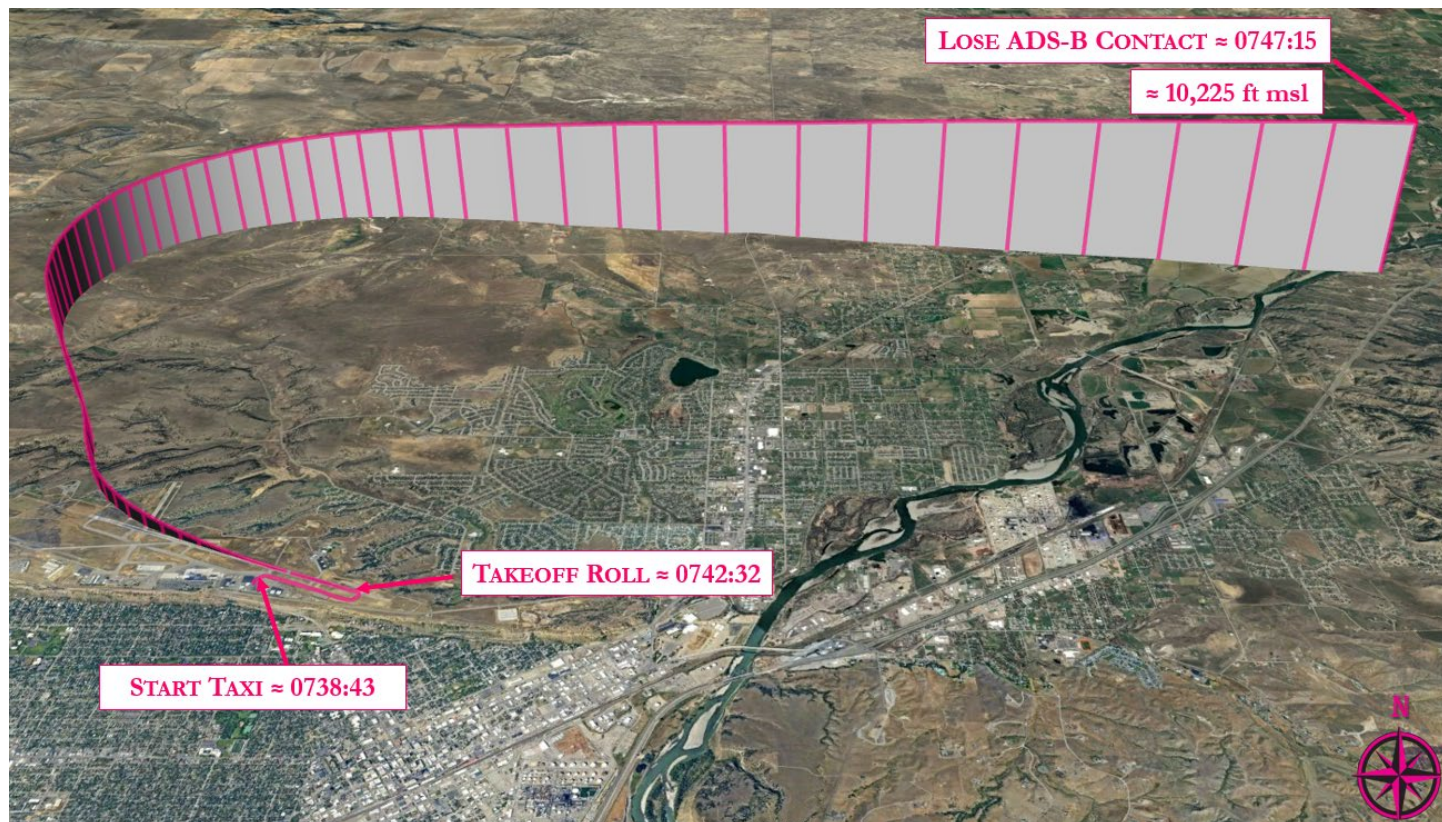


Figure 2: ADSB data showing the flight path until the loss of electrical power

AIRPLANE INFORMATION

The Raytheon Aircraft Company B200 King Air airplane, serial number BB1680, was manufactured in 1999 and was powered by two Pratt and Whitney PT6A-61 engines. The airplane was equipped with a Garmin G1000 and GFC-700 Automatic Flight Control System.



Figure 3: Data plate from the airplane

ELECTRICAL SYSTEM

The airplane electrical system operates on a 28-volt direct current (VDC) basis, with the negative lead of each power source grounded to the main airplane structure. DC electrical power is generated by a 42-ampere-hour sealed lead-acid battery, along with two 250-ampere starter/generators connected in parallel.

This system can supply power to all necessary subsystems for the airplane's normal operation. An emergency hot battery bus is also available for essential equipment and the cabin entry threshold light circuit. Power from the battery to the main bus goes through a battery relay, controlled by a switch labeled BAT - ON - OFF on the pilot's subpanel. Power from the generators to the bus system passes through reverse-current-protection circuitry, preventing the generators from drawing power from the bus when their voltage is lower than that of the bus. The generator switches, labeled GEN 1 and GEN 2, are also on the pilot's subpanel.

Starter power to each individual starter/generator is provided from the main bus through a starter relay. The start cycle is controlled by a three-position switch for each engine, placarded IGNITION AND ENGINE START - ON - OFF STARTER ONLY, on the pilot's subpanel. The starter/generator drives the compressor section of the engine through the accessory gearing. The starter/generator initially draws approximately 1100 amperes, then drops rapidly to about 300 amperes as the engine reaches 20% N1.

Power is supplied from three sources: the battery, the right generator, and the left generator. The generator buses are interconnected by two 325-ampere current limiters. The entire bus system operates as a single bus, with power being supplied by the battery and both generators. There are four dual-fed sub-buses. Each sub-bus is supplied power from either generator main bus through a 60-amp limiter, a 70-amp diode, and a 50-amp circuit breaker. Among the loads on the generator buses are the number 1 and number 2 inverters. Through relay circuitry, the INVERTER selector switch activates the selected inverter, which provides 400-hertz, 115-volt alternating current to the avionic equipment and 400-hertz, 26-volt AC power to the torquemeters. The volt/frequency meter indicates the voltage and frequency of the alternating current being supplied to the avionic equipment.

The generator control units (GCU) are self-contained units mounted below the center aisle floor forward of the main spar. Each starter-generator has its own GCU to provide line contactor relay control, voltage regulation, generator paralleling, differential voltage sensing and control, reverse current sensing, control, and overvoltage and overexcitation protection. The generators are controlled by individual voltage regulators which maintain a constant voltage during variations in engine speed and electrical load requirements. The voltage regulating circuit will automatically disable or enable a generator's output to the bus. The load on each generator is indicated by the respective left and right volt/loadmeter located in the overhead panel.



Figure 4: Generator load gauges in overhead panel

The generators are connected to the voltage regulating circuits by means of control switches located under the MASTER SWITCH gang bar on the pilot's outboard subpanel to provide the crew with control over the starter-generators. The generator switches has three positions: GEN RESET; ON; OFF. Placing the switch momentarily in GEN RESET and then releasing to the ON position brings the generators online. In the spring-loaded GEN RESET position, the generator voltage builds up to 28 volts and the line contactor is open. When the generator switch is released to ON, the line contactor closes. After either engine has been started and its generator switch has been moved to RESET, the GCU brings the generator up to normal system voltage. Releasing the spring-loaded GEN switch to the center ON position closes the generator line contactor.

Whenever the generator control switch is in the OFF position, battery voltage is routed from the generator control circuit breaker through the generator control switch and the normally closed contacts of the field disconnect relay to the coil of the field grounding relay. This energizes the field grounding relay which shorts the shunt field of the respective starter-generator to the airframe structure. Regulator power is interrupted and, consequently, generator operation is disabled whenever the generator control switch is OFF or when the respective engine is being started. During engine start, the field disconnect relay is energized, thus interrupting the coil circuit of the field grounding relay.

If the L DC GEN or R DC GEN amber caution annunciator illuminates during flight, verify with the associated loadmeter. Then push the corresponding generator switch to RESET and after one second to ON. If the generator does not reset, turn it off and rely on the other generator. Monitor the loadmeter so the load on the remaining generator does not exceed generator load limits. Turn off all nonessential electrical equipment as necessary.

The aircraft battery will continue to power the G1000 equipment for at least 30 minutes following complete loss of normal electrical power generation. Once the aircraft battery can no longer power the G1000, the standby battery will automatically power the standby attitude indicator, altimeter vibrator, and the internal lighting of the three standby instruments for an additional 30 minutes. The standby battery will also power the internal lighting of the magnetic compass on certain aircraft for an additional 30 minutes. To conserve battery power, consider not moving the flaps from their present position and performing a manual landing gear extension.

ENGINE STARTING (BATTERY)

1. Right Ignition and Engine Start.....ON
[R IGNITION ON]—ILLUMINATED
[R FUEL PRESS]—EXTINGUISHED
2. Right Condition Lever (12% N₁ or above)LOW IDLE
3. Right ITT and N₁ MONITOR (1000°C maximum)
4. Right Oil Pressure CHECK
5. Right Ignition and Engine Start (50% N₁ or above)OFF
6. Right Condition LeverHIGH IDLE
7. Right GeneratorRESET, THEN ON
8. BatteryCHARGE
(until loadmeter reads approximately 50% or less)
9. Left Ignition and Engine StartON
[L IGNITION ON]—ILLUMINATED
[L FUEL PRESS]—EXTINGUISHED
10. Left Condition Lever (12% N₁ or above)LOW IDLE
11. Left ITT and N₁ MONITOR (1000°C maximum)
12. Left Oil Pressure CHECK
13. Left Ignition and Engine Start (50% N₁ or above)OFF
14. D.C. Volt/Loadmeters PRESS TO CHECK VOLTAGE
(27.5–29.0 volts)
15. Left Generator.....RESET, THEN ON
16. Right Condition Lever REDUCE TO LOW IDLE

Figure 5: Engine start checklist

The hot battery bus is an electrical distribution bus that remains continuously energized from the aircraft's main battery regardless of the position of the battery or generator switches. It supplies power to components that must remain operational at all times for safety, protection, or memory retention purposes. Items powered by the hot battery bus include the battery relay, clock light, left and right engine fire extinguishers, entry light, external power sense circuit, left and right firewall shutoff valves, and navigation memory. These components receive continuous power to ensure the availability of essential systems and retained settings even when the main electrical system is not energized.

The mechanic who performed the recovery stated that they disconnected the battery prior to moving the airplane. After relocating the airplane into a hangar, he temporarily reconnected the battery (without turning the switch to "on"). He was able to illuminate the panel lights (normal brightness), which was an indication that the hot bus was powered. He disconnected the battery and the airplane was not touched until the investigation team performed the examination at the facilities of Edwards Jet Center in Billings, Montana on March 21, 2024.

The master battery switch was in the "OFF" position. The left and right generator switches were in the "ON" position. The switches were all located under a "guard" which consisted of a thin piece of aluminum on a piano hinge covering the three toggle switches. A manufacturer's representative stated that the purpose was to turn all three switches off by pressing down on the sheet metal. The standby power switch was in the off position.

The 28-volt Concord led acid main battery part RG-380E/44k (s/n 70008004), was found disconnected from the power supply. Using a multimeter, investigators determined that there were 24 volts. The caution-advisory annunciator panel was documented without power applied. The L DC GEN light was removed and found to have a small white piece of debris in between the light housing and the metal rack. The debris was consistent in shape and color with that of a piece of thin wire casing with a single strand of wire embedded within it. Removal of the lights revealed that one had its filament broken and the other filament condition could not be determined. The housing was reinserted with the debris removed. The R DC GEN light was removed and the lights were found to have their filaments broken.

The battery was then connected to the airplane and the battery switch was selected "on." The annunciator panel test switches were activated revealing that the lights on the warning annunciator panel illuminated.



Figure 6: The annunciator panel test switches

The test for the caution-advisory annunciation panel revealed that all the lights illuminated with the exception of the left and right generator lights (L DC GEN and R DC GEN). When the left light was reset, the light was dimly illuminated, consistent with one bulb not working. An illuminated light was removed and placed into the receptacle for the generator lights. It illuminated in both slots, indicating that the contacts were not faulty.



Figure 7: Test for the caution-advisory annunciation panel

The gauges (overhead) activated and showed the % load.

BATTERY

The battery, Concorde RG380E/44K, was installed new in June 2020 and according to the records, had been removed on four occasions for servicing. It was last serviced on October 18, 2023 at an airplane total time of 13,741.1 hours, at which point it was recorded as being reconditioned and had a capacity of 93.90%.

Battery P/N	Battery S/N	Initial Install	1st removal	A/C Total Hours @Install	A/C Total Hours @Removal	A/C	Capacity %	Cap. ✓	Date	Battery Recondition
RG380E/44K	70008004	6/10/2020	5/12/2021	13622.7	14036.4	N155AV	New	New		New
Battery P/N	Battery S/N	Reinstall	2nd removal	A/C Total Hours @Install	A/C Total Hours @Removal	A/C	Capacity %	Cap. ✓	Date	Battery Recondition
RG380E/44K	70008004	5/12/2021	11/5/2021	14036.4	14412.9	N155AV	97.40%		5/12/2021	No
Battery P/N	Battery S/N	Reinstall	3rd removal	A/C Total Hours @Install	A/C Total Hours @Removal	A/C	Capacity %	Cap. ✓	Date	Battery Recondition
RG380E/44K	70008004	5/28/2022	4/3/2023	12950.4	13354.8	N299AV	105.70%		5/5/2022	No
Battery P/N	Battery S/N	Reinstall	4th removal	A/C Total Hours @Install	A/C Total Hours @Removal	A/C	Capacity %	Cap. ✓	Date	Battery Recondition
RG380E/44K	70008004	4/10/2023	10/18/2023	13354.8	13741.1	N299AV	97.00%		4/3/2023	No
Battery P/N	Battery S/N	Reinstall	5th removal	A/C Total Hours @Install	A/C Total Hours @Removal	A/C	Capacity %	Cap. ✓	Date	Battery Recondition
RG380E/44K	70008004	10/18/2023		13741.1		N299AV	93.90%		10/18/2023	Yes

Figure 8: Battery information and record

Ship battery	a. NiCad storage only	90 days	N/A not equipped						
	b. Lead Acid	See next section (Concorde RG-380E)							
Concorde RG-380 E	Initial	365 days							
All checks + or -	Recurring (Cap. + 90%)	183 days	Oct-23		Apr-24				
1 month	Recurring (Cap. 85%-90%)	90 days							

The battery was capacity tested. A 42-amp was applied to the battery and the load dropped to 22.2 volts after 30 secs; to 21.3 volts after 6 minutes; and it failed at 19.99 volts after 8.2 mins. The mechanic testing the battery stated normal batteries will be 23.8-24.2 after 30 secs.

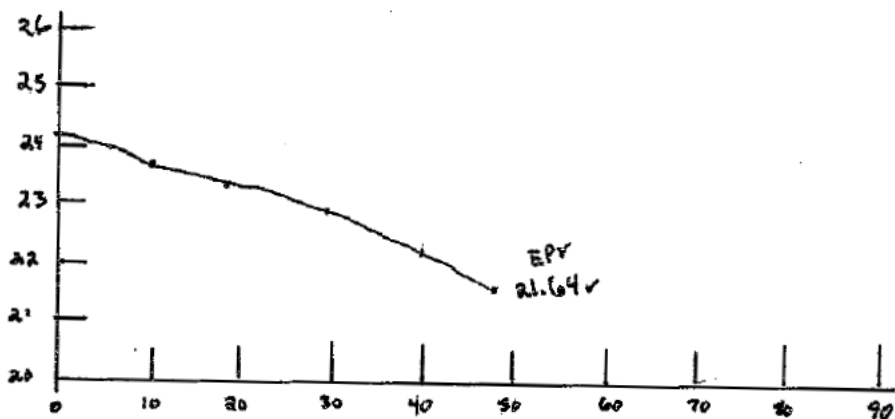


Figure 9: Test results for the battery

The PS835D (serial number 2005) standby power supply that powers the standby attitude indicator was tested.
Relay: 6041H189

The tail beacon has been replaced with a manufacturer-approved replacement LED beacon PN:01-0790852-06.

The starter generators and generator control units (GCUs) were removed and sent for functional testing. All components tested within the required operational parameters. The No. 2 engine starter generator was identified as part number 101389007-1, serial number 14288. The No. 1 engine starter generator was part number 10189007-1, serial number 12573. The GCUs tested included the right-position unit, part number 31435/55138-001A, serial number 93217, and the left-position unit, part number 31435-51538-001A, serial number 369.

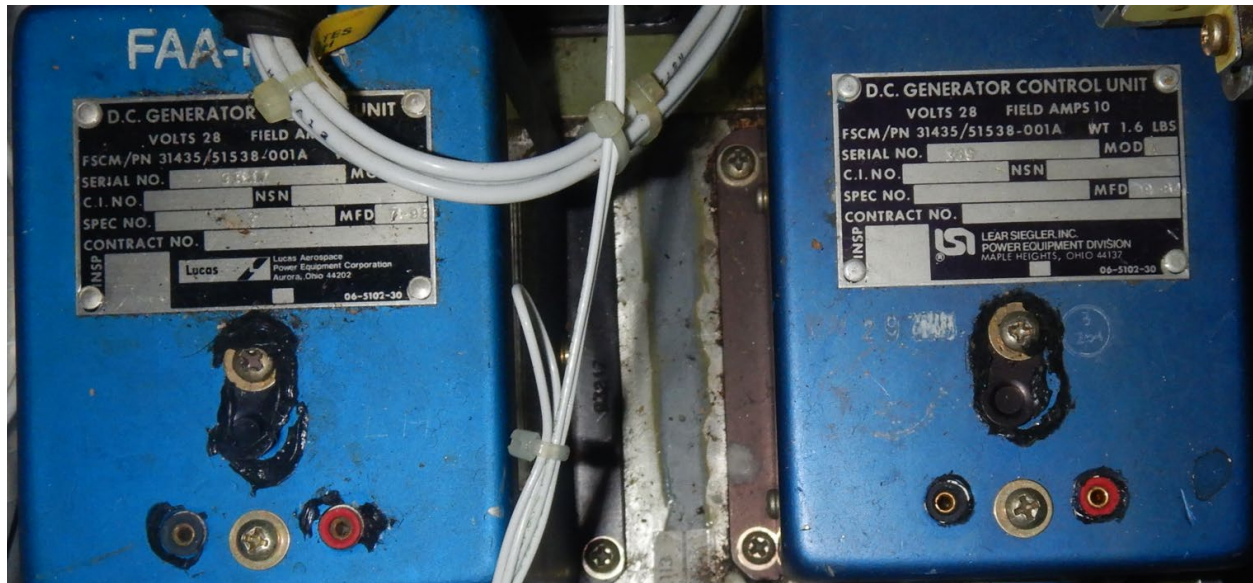


Figure 10: Starter-Generators

AMETEK B&S AIRCRAFT PARTS & ACCESSORIES

FAA CERTIFICATE NO. NE2R028L

TEST RECORD

MODEL NO.	MOD STATUS	SERIAL NO.	TEST STAND NO.	WORK ORDER NO.	DATE	MANUAL REVISION
23048-016		14288	5-2	BGN/114996	5/16/24	#22 10/30/19

FOR MODELS 23048, 026, 027, 028

SECTION	RPM	OUTPUT VOLTS	LOAD AMPS	FIELD CURRENT	COMMUTATION	VOLTS B-A	RESIST B-A	VOLTS D-E	TEMPERATURE INLET	TEMPERATURE FRAME
5										
A	13,000	30.0	0	1.7	---	---	---	---	---	85°
* C	12,000	30.0	250	2.8	Blk	---	---	1.9	90°	150°
** E	6,900	30.0	250	7.4	---	12.6	1.7	---	---	165°
***F	6,200	26.0	250	6.8	---	7.7	1.1	---	---	170°
****I	14,000	0	0	OVERSPEED:	PASS	FAIL				
I	12,000	30.0	250	2.8	Blk	---	---	---	---	175°

* STABILIZATION REQUIRED

** NO AIR, 15 MINUTE RUN

*** NO AIR

**** 5 MINUTE RUN

(L) DIELECTRIC TEST: _____ PASS _____ FAIL

(M) START TEST: OPEN SHUNT FIELD

15.0 VDC C-E, 8933 (RPM) (4800 MINIMUM)

(N) LOCKED ROTOR TEST: OPEN SHUNT FIELD, 20 FT. LBS. TORQUE

C-E VDC 94 (VOLTS) (13.0 MAX) 420 (AMPS) (500 MAX)

(O) COMMUTATOR CHECKS:

FINISH _____ (MICRO IN.) BAR TO BAR RUNOUT _____ (IN.) (.0002 MAX) TOTAL RUNOUT _____ (IN.) (.0008 MAX)

DRIVE SHAFT OUTPUT DIMENSION

_____ (3.105" - 3.160")

INSPECTED BY: _____

SHAFT PART NUMBER 02-6100-02

Figure 11: Test results for starter-generator serial number 14288

AMETEK B&S AIRCRAFT PARTS & ACCESSORIES
FAA CERTIFICATE NO. NE2R028L
TEST RECORD

MODEL NO.	MOD STATUS	SERIAL NO.	TEST STAND NO.	WORK ORDER NO.	DATE	MANUAL REVISION
23048-010		12753	5-1	BGN/14995	5/16/24	#22 10/30/19

FOR MODELS 23048-010, 027, 028

SECTION	RPM	OUTPUT VOLTS	LOAD AMPS	FIELD CURRENT	COMMUTATION	VOLTS B-A	RESIST B-A	VOLTS D-E	TEMPERATURE INLET	TEMPERATURE FRAME
A	13,000	30.0	0	1.4	---	---	---	---	---	85°
* C	12,000	30.0	250	2.3	BLK	---	---	1.9	90°	172°
** E	6,900	30.0	250	6.4	---	11.4	1.8	---	---	180°
*** F	6,200	26.0	250	6.0	---	10.0	1.7	---	---	185°
**** I	14,000	0	0	OVERSPEED	PASS	FAIL	---	---	---	---
I	12,000	30.0	250	2.2	BLK	---	---	---	---	182°

* STABILIZATION REQUIRED
 ** NO AIR, 15 MINUTE RUN
 *** NO AIR
 **** 5 MINUTE RUN

(L) DIELECTRIC TEST: ☐ PASS ☐ FAIL

(M) START TEST: OPEN SHUNT FIELD
 15.0 VDC C-E, 9466 (RPM) (4800 MINIMUM)

(N) LOCKED ROTOR TEST: OPEN SHUNT FIELD, 20 FT. LBS. TORQUE
 C-E VDC 9.9 (VOLTS) (13.0 MAX) 4.18 (AMPS) (500 MAX)

(O) COMMUTATOR CHECKS:

FINISH (MICRO IN.) BAR TO BAR RUNOUT (IN.) (.0002 MAX) TOTAL RUNOUT (IN.) (.0008 MAX)

DRIVE SHAFT OUTPUT DIMENSION
 _____ (3.105" - 3.160")
 INSPECTED BY: _____
 SHAFT PART NUMBER 02-6100-02

Figure 12: Test results for starter-generator serial number 12753

LANDING GEAR SYSTEM

The pilot pumped the landing gear down. They both thought they were down and could see the gear down. He did not stow the handle because he knew that the pressure would bleed off if he stowed the handle.

The landing gear handle was in the down position with the silver hook over the lever. The manual handle was in the stowed position. The landing gear was manually extended. The landing gear were cycled both manually and electrically; they operated without mishap. The landing gear took about 1-1.5 minutes to pump down. According to a Textron representative, 30 pumps would bring the landing gear out of the wheel wells but not to the full down and locked position.

According to a King Air training expert, manual landing gear extension with one pilot requires substantial effort and time. Standard procedure involves stabilizing the aircraft (without autopilot), performing several pump strokes, visually reassessing the flight path, and repeating until a distinct change in handle pressure confirms full extension. During a total electrical failure, the pilot would not see the three green indicator lights and would need to rely solely on the tactile feedback from the pump handle. There is no harm in under-pumping during the procedure.

RECORDED DATA

A review of the data related to battery condition over the past six months of flights. Due to the dataset's size, analysis was limited to that timeframe.

Review of the last 199 Garmin G1000 log files revealed no "RED" exceedances and only a small number of "YELLOW" alerts, primarily associated with torque readings above 2,230 rpm. Most of these were minor, though on the 11th two notable over-torque events occurred with 2,298 on engine No. 2 for 16 seconds and 2250 on engine No. 1 for 13 seconds. On analog gauges, a range of 2230 ±10-20 would have been difficult to discern, whereas the G1000 records all

parameters precisely. The exception is voltage, which appeared to be missing; N299AV has never recorded voltage data in any examined logs.

The G1000 system operates for only a limited duration on battery power before voltage drops too low to sustain the avionics, leading to loss of ADS-B and communications. The duration of this period depends on both battery health and electrical load. On the morning of the 12th (G1000 times minus one hour), the sequence showed:

06:17:58 – power on, no start

06:25:03 – power off (likely during flight plan entry)

Total: 7 minutes 1 second

06:29:03 – power on with two engine starts

06:47:05 – loss of ADS-B, comms, etc.

Total: 18 minutes 1 second

AIRMEN INFORMATION

Pilot in command (left seat):

According to Federal Aviation Administration (FAA) airman records, the pilot held an airline transport pilot certificate. At the time of the accident, the pilot had accrued a total flight experience of 10,559 hours, of which 186 hours were as pilot-in-command of the same make and model. According to operator records, between October 1, 2023, and the date of the accident, the pilot had accumulated a total of 146 flight hours, of which 32.7 hours were in the accident airplane. The pilot's most recent second-class medical certificate was issued on October 25, 2023, with the limitation that he must use corrective.

The pilot completed his most recent Part 135 recurrent training at FlightSafety International in a Beechcraft King Air 200 equipped with a G1000 avionics suite on October 19, 2023. The training, conducted over three days, included a satisfactory completion of the 14 CFR 135.293(a)(2-3) and 135.297 checks. The pilot completed 6 hours of simulator flight, during which he performed 10 takeoffs and 7 landings. Emergency procedures included a simulated landing-gear and flap-system malfunction. The curriculum also included 11 hours of ground training and 4.5 hours of briefing and debriefing. The pilot had previously completed his initial FlightSafety International training on November 1, 2022, which included 40.5 hours of ground instruction and 11.5 hours of flight training.

Date	Duration	Registration
10/01/2023	1.9	N499AV
10/03/2023	1.8	N499AV
10/04/2023	7.1	N499AV
10/09/2023	2.2	N299AV
10/12/2023	1.7	N299AV
10/21/2023	1	N208AV
10/27/2023	0.3	N155AV
10/27/2023	0.3	N299AV
10/28/2023	3.6	N299AV
11/02/2023	4	N499AV
11/03/2023	2.4	N499AV
11/06/2023	3	N499AV
11/06/2023	3.1	N499AV
11/14/2023	2.9	N299AV
11/18/2023	2.6	N299AV
11/19/2023	3.5	N299AV
11/30/2023	1.9	N208AV
12/02/2023	6	N208AV
12/04/2023	2	N208AV
12/06/2023	7.8	N499AV
12/12/2023	7	N299AV
12/16/2023	1.6	N299AV
12/17/2023	1.5	N299AV
12/22/2023	2	N499AV
12/22/2023	2.7	N499AV
01/03/2024	3.1	N208AV
01/08/2024	4	N208AV
01/11/2024	2.3	N208AV
01/12/2024	1.6	N208AV
01/14/2024	4.1	N208AV
01/21/2024	2.3	N208AV
01/30/2024	5.4	N208AV
01/31/2024	0.6	N208AV
02/04/2024	2.1	N499AV
02/15/2024	2.9	N499AV
02/23/2024	2.6	N499AV
02/23/2024	2.9	N499AV
02/24/2024	3.5	N499AV
02/25/2024	2	N499AV
02/25/2024	5	N499AV
02/28/2024	4	N208AV
02/29/2024	2.3	N208AV
03/03/2024	2.5	N208AV
03/11/2024	5.8	N299AV
03/17/2024	1.5	N499AV
03/26/2024	4.8	N499AV
03/29/2024	6.8	N499AV

Figure 13: Recent pilot hours with registration

RECORDS

Date	Customer Name	CFI / Charter Crew	Flight Time	Hobbs Out	Hobbs In	Invoice Number	Ground	Total Landings
3/6	[REDACTED]	Dave/Tom	1.3	8704.9	8706.2			2
3/7	[REDACTED]	Dave/Ben	1.7	8706.2	8707.9			2
3/8	[REDACTED]	Dave/Ben	3.7	8707.9	8711.6			3
3/11	[REDACTED]	Ken/Ben	5.8	8711.6	8717.4			4
3/12	[REDACTED]	Ken/Ben		8717.4	8717.4			0

PAST SIMILAR MISHAPS

There were several Aviation Safety Reporting System (ASRS) reports of similar failures:

ACN: 1975037 - February 2023: During the initial climb, the Beechcraft Super King Air 200 experienced a total electrical failure that resulted in the loss of communications, GPS navigation, and primary flight instruments. The flight crew descended into visual meteorological conditions, manually extended the landing gear, and completed a light-gun assisted landing without damage or injury. Post-flight examination determined that both engine starter switches had remained in the ON position. The pilot stated that the cause of the event was confirmed that the starter system supersedes the generators and remains active after 50 percent N1 even if turned back on, acknowledging that the switches were likely re-engaged inadvertently after hot start procedures and noting that the event could have been prevented by slowing cockpit flow, verifying switch positions, performing checklists as a crew, and maintaining composure during abnormal situations.

ACN: 1943789 - October 2022: During the initial climb, the Beechcraft Super King Air 200 experienced a total electrical failure resulting in the loss of all powered systems. The pilot descended while remaining clear of controlled airspace, executed the alternate landing gear extension procedure, and returned for a light-gun-assisted landing without damage or injury. Post-flight examination confirmed a complete electrical power loss, but the cause was not noted.

ACN: 1855685 – November 2021: During initial climb following takeoff, the Beechcraft Super King Air 200 experienced an electrical malfunction immediately after landing gear retraction, resulting in the loss of both generators, avionics power, and all communications and transponder functions. The pilot maintained altitude within the local airspace, returned for a light-gun-assisted landing, and taxied to the ramp without further incident. Post-flight inspection found no faults with the landing gear or hydraulic system, and subsequent test flights were completed uneventfully after system checks and verification of normal electrical operation.

ACN: 1615125 – January 2019: Approximately 20 minutes into cruise, a Beechcraft Super King Air 200 experienced progressive electrical anomalies: MFD error messages, fluctuating engine indications, and an autopilot disconnect, followed by a total electrical power loss. The crew conducted a spiraling descent using the standby attitude indicator, magnetic compass, and a ForeFlight iPad, manually extended the landing gear, and were cleared to land at an alternate airport. A post flight examination confirmed a complete electrical failure; the cause was not determined.

ACN: 1590539 – October 2018: After takeoff, a Beechcraft Super King Air 200 experienced a progressive electrical failure resulting in loss of communications and subsequent total electrical power loss. The pilot continued toward the destination, circled while performing the emergency gear extension procedure, and landed using light-gun signals without further incident. Post-flight diagnostic testing found no system malfunctions other than a discharged battery, which was replaced, and a subsequent maintenance ferry flight was completed without recurrence.

ACN: 1120983 – September 2013: During climb, a Beechcraft Super King Air 200 equipped with a Garmin G1000 system experienced a complete loss of both primary flight displays, the multifunction display, and autopilot following multiple intermittent avionics and cooling fan alerts. The pilot used standby instruments and a magnetic compass to return to the departure airport, manually extended the landing gear, and discovered a total electrical loss when the gear lights were

inoperative. The pilot then identified that both generator switches had not been turned on after a ground power start, restored electrical power by resetting the generators, and landed without further incident.

ACN: 1119624 – September 2013: During a maintenance flight to evaluate a pressurization system, a Beechcraft Super King Air 200 experienced a total electrical power loss after the pilot inadvertently activated the starter-generator switches instead of the auto-ignition switches during climb. Both generator lights illuminated, and subsequent attempts to reset the generators were unsuccessful, prompting a precautionary return and landing without further incident. The pilot later determined the error occurred due to distraction from concurrent maintenance discussions and procedural interruptions, resulting in battery depletion and loss of radio communication after landing.

ACN: 979495 – November 2011: Shortly after takeoff during a training flight, a Beechcraft Super King Air 200 experienced a dual generator failure that resulted in loss of communications, navigation equipment, and primary flight instruments. The flight crew observed low battery voltage, manually extended the landing gear, and continued VFR to their destination airport, which had firefighting capability. The airplane landed without further incident, and maintenance initiated an investigation into the cause of the dual generator failure.

ACN: 713207 – October 2006: During initial climb in instrument meteorological conditions, a Beechcraft Super King Air 200 experienced a total electrical failure after both generator switches were left off following a ground power start. The flight crew lost communications and autopilot function, declared an emergency, and coordinated with ATC using transponder signals before restoring electrical power by reactivating the generators. The flight continued without further incident, and post-event review identified that the external power start checklist had not been used, resulting in both generators remaining off.

MANUAL/CHECK LIST EXCERPTS

NOTE

The following step will cause the autopilot, yaw damper, and electric trim to become inoperative.

s. Avionics Master PWR.....OFF

t. Flaps.....DO NOT LOWER

7. The following equipment will be functional while the G1000 is powered from the aircraft battery power, Avionics Master Power Switch is OFF, and the [L DC GEN] and [R DC GEN] annunciators are illuminated:

- Pilot's Attitude, Heading, Air Data, and Nav CDI
- Copilot's Attitude, Heading, Air Data, and Nav CDI
- MFD, Engine Gages
- Com 1, Pilot's Audio Panel, GPS 1, GPS 2, VHF Nav 1, VHF Nav 2, Transponder 1
- Flight Director

NOTE

The aircraft battery will continue to power the G1000 equipment for at least 30 minutes following complete loss of normal electrical power generation.

8. Consider a Landing Gear Manual Extension to conserve battery power.

ELECTRICAL SYSTEM

DUAL GENERATOR FAILURE

L DC GEN AND R DC GEN

This procedure supersedes the AFM procedure in its entirety.

1. Gen 1 and Gen 2 Generator Switches.....RESET, THEN ON

If Either Generator Will Reset:

2. Operating Generator Loadmeter DO NOT EXCEED 100% LOAD (88% above 31,000 ft)

3. Inoperative Generator Switch.....OFF

If Neither Generator Will Reset:

4. Avoid IFR conditions if possible and LAND AT THE NEAREST SUITABLE AIRPORT.

5. Standby Battery Switch.....INDICATES ARM or ON

6. Non-Essential Equipment:

- a. Auto-Ignition.....OFF
- b. Engine Anti-Ice.....LEAVE IN CURRENT POSITION
- c. Prop Sync.....OFF
- d. All Exterior LightsOFF
- e. All Ice Protection Except Left Pitot Heat.....OFF
 - Surface Deice.....ACTIVATE WHEN REQUIRED
- f. COM1.....SELECTED and ACTIVE
- g. Transponder.....SELECT XPDR 1
- h. Cabin Furnishings, Lights, No Smoke/FSB.....OFF
- i. Vent Blower.....AUTO
- j. Aft Blower (if installed).....OFF
- k. Cabin Temp Mode ControlOFF
- l. Electric Heat.....OFF
- m. Cigar Lighter/Accessories.....UNPLUG
- n. Overhead Flood Lights.....ON (if required)
- o. Instrument Indirect LightsOFF
- p. Master Panel Lights.....OFF
- q. Left and Right Fuel Control Heat CBs (right panel).....PULL
- r. Reading Light CB (right panel).....PULL

SELECT NO. 2

j. Transponder.....OFF

k. Radar.....OFF

l. ADF.....OFF

m. Cabin Furnishings, Lights, No Smoke/FSB.....OFF

n. Vent Blower.....AUTO

o. Right Bleed Air Valve.....ENVIR OFF

p. Aft Blower (if installed).....OFF

q. Cabin Temp Mode Control.....OFF

r. EFIS Power.....OFF

s. FMS (if installed).....OFF

t. Electric Trim.....OFF

u. Overhead Flood Lights (if required).....ON

v. Instrument Indirect Lights.....OFF

w. Master Panel Lights.....OFF

x. Left and Right Fuel Control Heat CB's (right panel).....PULL

y. Avionics No. 1 Circuit Breaker (right panel).....PULL

z. EFIS Aux Battery CB (right panel).....PULL

7. Verify that only the following equipment is on and all other optional equipment not mentioned above is off.

a. Battery

b. Avionics Master

c. L Pitot Heat (if required)

d. Comm 2 and NAV 2

e. Flood Lights (if required)

8. Battery Ammeter (if installed).....MONITOR
(should be 28 amps or less)

9. Avoid icing conditons, if possible.

10. Land.....NEAREST SUITABLE AIRPORT

11. Flaps.....DO NOT LOWER

12. Landing Gear.....EXTEND MANUALLY

13. Restrict use of Landing/Taxi Lights to one light for 5 minutes or less.

PILOT CHECKLIST-MODEL B200/B200C

DUAL GENERATOR FAILURE

L DC GEN AND R DC GEN

WARNING

The following procedure is intended to provide 30 minutes of battery life for a typical airplane. This battery life is based on specific assumptions which may not occur in every instance such as the generator loads at the time of failure, battery condition, the time required to load shed non-essential equipment, and the electrical equipment installed on the airplane.

1. Generators.....RESET, THEN ON

If Either Generator Will Reset:

2. Operating Generator Loadmeter.....DO NOT EXCEED 100%
(88% above 31,000 feet)

3. Inoperative Generator.....OFF

If Neither Generator Will Reset:

4. Generators.....OFF

5. Maintain airplane control using the following instruments:

a. Pilot's and Copilot's Airspeed

b. Copilot's Attitude Indicator

c. Copilot's Altimeter

d. Copilot's EHSI/HSI or Standby Compass

6. Non-essential Equipment:

WARNING

The following step will cause the pilot's attitude indicator and the autopilot to become inoperative.

a. Inverter.....OFF

b. Auto-Ignition.....OFF

c. Engine Anti-Ice.....LEAVE IN EXISTING POSITION

d. Traffic Advisory System (if installed).....OFF

e. All Exterior Lights.....OFF

• Beacon on when required

f. All Ice Protection Except L Pitot Heat.....OFF

• Surface Deice.....ACTIVATE WHEN REQUIRED

g. Landing Gear Relay CB.....PULL
(to prevent inadvertent gear extension)

h. Comm 1.....OFF

i. NAV 1.....OFF

DUAL GENERATOR FAILURE

L DC GEN AND R DC GEN

1. Gen1 and Gen2 Generator Switches.....RESET, THEN ON

If Either Generator Will Reset:

2. Operating Generator Loadmeter.....DO NOT EXCEED 100%
(88% above 31,000 feet)

NOTE

Ensure the IGNITION AND ENGINE START switches are selected OFF, otherwise it will not be possible to reset the generators.

WARNING/CAUTION/ADVISORY ANNUNCIATORS

L ENG FIRE	INVERTER	DOOR UNLOCKED	ALT WARN	R ENG FIRE
L FUEL PRESS	—	—	—	R FUEL PRESS
*L OIL PRESS	*L GEN OVHT	*A/P TRIM FAIL	*R GEN OVHT	*R OIL PRESS
—	L BL AIR FAIL	*A/P FAIL	R BL AIR FAIL	—



AUXILIARY FUEL
TRANSFER FAILURE

*Optional Equipment

WARNING ANNUNCIATOR PANEL

4 L DC GEN	—	5 HYD FLUID LOW	RVS NOT READY	—	4 R DC GEN
3 L CHIP DETECT	—	—	6 DUCT OVERTEMP	—	3 R CHIP DETECT
6 L ENG ICE FAIL	—	4 BATTERY CHG	EXT PWR	—	6 R ENG ICE FAIL
*L AUTOFEATHER	—	*ELEC TRIM OFF	AIR COND N, LOW	—	*R AUTOFEATHER
L ENG ANTI-ICE	*BRAKE DEICE ON	LDG/TAXI LIGHT	PASS OXY ON	*ELEC HEAT ON	R ENG ANTI-ICE
L IGNITION ON	L BL AIR OFF	—	FUEL CROSSFEED	R BL AIR OFF	R IGNITION ON

CAUTION-ADVISORY ANNUNCIATOR PANEL

*Optional Equipment

WARNING/CAUTION/ADVISORY ANNUNCIATORS

1 L ENG FIRE	4 INVERTER	3 DOOR UNLOCKED	8 ALT WARN	1 R ENG FIRE
2 L FUEL PRESS	—	—	—	2 R FUEL PRESS
*L OIL PRESS	*L GEN OVHT	*A/P TRIM FAIL	*R GEN OVHT	*R OIL PRESS
—	8 L BL AIR FAIL	*A/P FAIL	8 R BL AIR FAIL	—



AUXILIARY FUEL
TRANSFER FAILURE

*Optional Equipment

WARNING ANNUNCIATOR PANEL

5/4 L DC GEN	—	5 HYD FLUID LOW	RVS NOT READY	—	5/4 R DC GEN
3 L CHIP DETECT	—	—	6 DUCT OVERTEMP	—	3 R CHIP DETECT
6 L ENG ICE FAIL	—	4 BATTERY CHG	EXT PWR	—	6 R ENG ICE FAIL
*L AUTOFEATHER	—	*ELEC TRIM OFF	AIR COND N, LOW	—	*R AUTOFEATHER
L ENG ANTI-ICE	*BRAKE DEICE ON	LDG/TAXI LIGHT	8 PASS OXY ON	*ELEC HEAT ON	R ENG ANTI-ICE
L IGNITION ON	L BL AIR OFF	—	FUEL CROSSFEED	R BL AIR OFF	R IGNITION ON

CAUTION-ADVISORY ANNUNCIATOR PANEL

*Optional Equipment

LANDING GEAR SYSTEM

HYDRAULIC FLUID LOW

HYD FLUID LOW

If The [HYD FLUID LOW] Illuminates During Flight:

1. Landing Gear ATTEMPT TO EXTEND NORMALLY UPON REACHING DESTINATION

If Landing Gear Fails To Extend:

2. Follow LANDING GEAR MANUAL EXTENSION procedures.

LANDING GEAR MANUAL EXTENSION

If One Or More Of The Landing Gear Fails To Extend After Placing The Landing Gear Control Down, Perform The Following:

1. Landing Gear Relay Circuit Breaker (pilot's right subpanel) PULL
2. Landing Gear Control CONFIRM DN
3. Alternate Extension Handle UNSTOW AND PUMP
 - a. Pump handle up and down until the three green gear-down annunciators are illuminated.
 - b. While pumping, do not lower handle to the level of the securing clip as this will result in loss of pressure.

If All Three Green Gear-Down Annunciators Are Illuminated:

4. Alternate Extension Handle STOW
5. Landing Gear Controls DO NOT ACTIVATE
 - a. The Landing Gear Control and the Landing Gear Relay Circuit Breaker MUST NOT BE ACTIVATED.
 - b. The landing gear should be considered UNSAFE until the airplane is on jacks and the system has been cycled and checked.

If One Or More Green Gear-Down Annunciators Do Not Illuminate For Any Reason And A Decision Is Made To Land In This Condition:

6. Alternate Extension Handle CONTINUE PUMPING
 - a. Continue to pump the handle until maximum resistance is felt.
 - b. When pumping is complete, leave handle at the top of the stroke. DO NOT LOWER AND STOW.

Prior To Landing:

7. Alternate Extension Handle PUMP AGAIN
 - a. Pump the handle again until maximum resistance is felt.
 - b. When pumping is complete, leave handle at the top of the stroke. DO NOT LOWER AND STOW.

After Landing:

8. Alternate Extension Handle PUMP AGAIN WHEN CONDITIONS PERMIT
 - a. Pump the handle again, when conditions permit, to maintain hydraulic pressure until the gear can be mechanically secured.
 - b. DO NOT STOW HANDLE.
 - c. DO NOT ACTIVATE THE LANDING GEAR CONTROL OR THE LANDING GEAR RELAY CIRCUIT BREAKER.
 - d. The landing gear should be considered UNLOCKED until the airplane is on jacks and the system has been cycled and checked.

Table 206. Cautionary/Advisory Annunciators(BB-1439, BB-1444 and After Except BB-1463; BL-139 and After; BT-35 and After; BN-5 and After; BY-1 and After; BZ-1 and After)

Nomenclature	Color	Cause For Illumination
L DC GEN	Yellow	Left generator off the line.
HYD FLUID LOW	Yellow	Hydraulic fluid in the landing gear system is low.
L CHIP DETECT	Yellow	Metal contamination in left engine oil is detected.
RVS NOT READY	Yellow	Propeller levers are not in the high rpm, low pitch position with landing gear extended.
R DC GEN	Yellow	Right generator off the line.
DUCT OVERTEMP	Yellow	Duct air too hot.
R CHIP DETECT	Yellow	Metal contamination in right engine oil is detected.
L ENG ICE FAIL	Yellow	Left engine selected anti-ice system inoperative.
** L PITOT HEAT	Yellow	Left pitot probe heater malfunction.
BATTERY CHG	Yellow	Excessive charge rate on battery.
EXT PWR	Yellow	External power connector is plugged in.
** R PITOT HEAT	Yellow	Right pitot probe heater malfunction.
R ENG ICE FAIL	Yellow	Right engine selected anti-ice system inoperative.
* L AUTOFEATHER	Green	Autofeather armed with power levers advanced above 90% N ₁ .
* ELEC TRIM OFF	Green	Electric trim de-energized by a trim disconnect switch on the control wheel with the system power switch on the pedestal turned on.
AIR CND N ₁ LOW	Green	Right engine rpm too low for air-conditioning load and AC system disconnected.
* R AUTOFEATHER	Green	Autofeather armed with power levers advanced above 90% N ₁ .
L ENG ANTI-ICE	Green	Left engine anti-ice vanes in position for icing conditions.
* BRAKE DEICE ON	Green	Brake deice system in operation.
LND/TAXI LIGHT	Green	Landing or taxi lights on with landing gear up.
PASS OXY ON	Green	Passenger oxygen system charged.
ELEC HEAT ON	Green	The cabin electric heat is on.
R ENG ANTI-ICE	Green	Right engine anti-ice vanes in position for icing conditions.
L IGNITION ON	Green	Left starter/ignition switch is in the engine/ignition mode or left autoignition system is armed and left engine torque is below approximately 410 foot-pounds.
L BL AIR OFF	Green	Left environmental bleed air valve closed.
FUEL CROSSFEED	Green	Crossfeed valve is open.
R BL AIR OFF	Green	Right environmental bleed air valve is closed.
R IGNITION ON	Green	Right starter/ignition switch is in the engine/ignition mode or right autoignition system is armed and right engine torque is below approximately 410 foot-pounds.

NOTE:

* Optional Equipment

** On airplanes BB-1680 and After; BT-40 and After; BL-141 and After; BN-5 and After; BY-1 and After; BZ-1 and After and prior airplanes incorporating Kit No. 101-3238-1.

AVCENTER N299AV Normal Checklist
Effective: 03/1/2024

Before Start

C Preflight.....Complete
C* Documentation.....Checked
C* Knife Valve.....Open
C* Emergency Exit.....Checked
C Pressurization.....() Set
C Switches & CBs.....Checked
C Stall Warning.....Checked
C Engine Controls.....Set
C Landing Gear.....Down/3 Green
C* Alt Gear Handle.....Stowed
B Fuel Panel/Fuel Required.....Checked
C Battery.....Checked
C Annunciator Panel.....Checked
C* Gear Handle Light.....Checked
C* Hydraulic Flow Light.....Checked
C Bleed Air.....Env/Off
C O2 Mask.....Checked
C Battery.....On
C Stby Battery Sw.....Push
C Stby Att Gyro Fail Flag....Not Displayed
C* G1000 Database.....Valid
C AUX-Weight Planning.....Input Data
PF Departure Brief (WARTS).....Complete

Engine Starting (Battery)

C Parking Brake.....Set
B Belts & Harness.....Checked
C Passenger Briefing.....Complete
C Avionics.....Off
C Beacon.....On
C Cabin Door.....Closed
C Ice Vanes.....Open
C Engine.....Start ()

Before Taxi

PF Engine Instruments.....Checked
PF Current Limiters.....Checked
C Generators.....On
C Avionics.....On
PF Autopilot Preflight Test.....Complete
C Nav Lights.....As Required
F Bleed Air.....As Required
F Temp Control.....Auto
F Vac/Pneumatics.....Checked
C Stby Att Indicator.....Checked
B Route.....Verified
B Altimeters.....Set/Xckd

Taxi

PF Brakes.....Checked
PM/PF Flight Controls.....Top/Bottom
PM Trim.....Checked/Set
PM Generator Load.....Checked
PF Manual Feather.....Checked
C Auto-Feather.....Armed
F Bleeds.....Open
B Flight/Nav Inst.....Set

Before Takeoff (Run-Up)

C* Auto Feather.....Checked
C* Prop Gvs/Rudder Boost..Checked
C* Ice Protec Equip.....Checked
C Autopilot/YD/Trim.....Checked
C Vac/Pneumatic Press.....Checked
C Flight Director.....Checked
C* Pressurization.....Checked

Before Takeoff (Final Items)

B Flaps.....()
PM Cabin.....Secure
PF Takeoff Brief.....Complete
C Ice Vanes.....As Required
C Auto Ignition.....Armed
C Lights.....Set
C Hot Five.....On
C Autofeather.....Armed
PM Transponder.....GND
PM Radar.....()
PM Annunciator Panel.....Checked
PM PFD Alt & Heading.....Normal
PM GPS Position.....Valid

After Takeoff

PF Climb Power.....Set
Sterile Cockpit Until 10,000ft

PM Landing Gear.....Up
PM Landing Lights.....Set to Recce
PM Flaps.....Up
PM Pressurization...Set & Checked

PF Yaw Damp.....On

Climb

B Altimeters.....Set 29.92
C Lights.....Set
PF Monitor Guard
C Passenger Safety.....As req

Cruise

PF Cruise Power.....Set
C Fuel.....Monitor
C Auto-Feather.....Off
PM Pressurization.....Monitor
B Altimeter.....Set/Xckd

B Both Pilots Responsible/Respond/Perform
PF Pilot Flying Performs, Responsible, and/or Responds
PM Pilot Monitoring Performs, Responsible, and/or Responds
C Captain (Pilot in Command) Performs, Responsible/Responds
F First Officer Performs, Responsible and/or Responds

BOXED Items Accomplished Silently then Checklist Reported Complete

Bold Items – Accomplish on all legs * Non Bold Items – First Flight of Day