



INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

COMPONENT MAINTENANCE MANUAL

CONCORDE VALVE REGULATED LEAD-ACID

RG-441 BATTERY

AUTHORISED UNDER TSO-C173

The data/information contained herein has been reviewed and approved for general release on the basis that this document contains no export-controlled information

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RECORD OF REVISIONS

Rev. No.	Description	Date	Appd.
A	Add additional Airworthiness Limitations regarding cold weather operations in the Bombardier BD-100-1A-10.	4/27/09	JBT

TITLE Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO. 5-0173	REV A
CAGE CODE 63017	SHEET 2 OF 11	

SERVICE BULLETIN LIST

Number	Brief Description	Type Affected

TITLE Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO. 5-0173	REV A
CAGE CODE 63017		SHEET 3 OF 11

Contents

1. Scope: 5

2. Purpose: 5

3. Application: 5

4. Definitions: 5

5. Precautions: 5

6. Airworthiness Limitations: 6

7. Deviations: 7

8. Inspection Requirements and Overhaul Schedule: 7

9. Troubleshooting: 9

10. Servicing discharged batteries: 9

11. Replacement / Repair: 9

12. Facilities: 9

13. Storage Limitations: 9

14. Disposal: 10

TITLE Component Maintenance Manual, Concorde RG-441 Battery		DWG. NO. 5-0173	REV A
CAGE CODE 63017		SHEET 4 OF 11	

1. Scope: This Maintenance Manual Supplement provides the additional data required to insure satisfactory operation, maintenance, and repair of the Concorde valve regulated lead-acid battery installation. The battery is not repairable and there are no replaceable components.
2. Purpose: This manual sets forth the instructions for determining continued airworthiness of a Concorde valve regulated lead-acid main battery.
3. Application: Engine starting applications and emergency power supply.
4. Definitions:
 - a. Valve regulated battery - A lead-acid battery in which there is no free electrolyte. This battery requires no maintenance of the liquid level and recombines the gases formed on charge within the battery to reform water. The battery may be used in any attitude without danger of leakage or spilling of electrolyte.
 - b. Rated capacity C1 - Quantity of electricity in Ampere-hours (Ah) which the cell or battery is capable of delivering in 1 h, throughout its normal service life, after full charge, under conditions defined with regard to temperature and end discharge voltage.
 - c. End Point Voltage (EPV) - Unless otherwise stated, during discharge the battery voltage corresponding to a mean voltage per cell of 1.67 Volts for lead-acid batteries.
5. Precautions:
 - a. **CAUTION:** Aircraft batteries are certified to have certain minimum capacity for emergency operations in the event of a electrical generator system failure. Never "jump start" an aircraft that has a discharged or 'dead' battery.
 - b. **WARNING: ELECTRIC SHOCK HAZARD.** Do not touch uninsulated portion of the connector or the battery terminals. A possibility of serious electrical shock exists.
 - c. **WARNING: ELECTRIC SHOCK HAZARD.** Do not lay tools or other metal objects on the battery as arcing or explosion could occur. Remove conductive jewelry before working around battery, charger, or test equipment.
 - d. **CAUTION: ELECTRIC BURN HAZARD.** Do not wear conductive rings, belt buckles, or other jewelry when working with batteries, chargers, or test equipment. Do not lay tools or other metal objects on the battery as arcing and severe burns could occur.
 - e. **WARNING:** Batteries on charge or discharge produce hydrogen gas, which can explode if ignited. Do not smoke, use an open flame, or cause sparking near a battery. Charge, service or test a battery only in a well ventilated area. The use of exhaust fans may reduce the risk of explosion.
 - f. **WARNING:** Batteries contain sulfuric acid which will cause burns. **DO**

TITLE	Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO. 5-0173	REV A
CAGE CODE	63017	SHEET 5 OF 11	

NOT TOUCH EYES AFTER TOUCHING BATTERY. Do not get acid in your eyes, or on your skin, or clothing. In the event of acid in the eyes, flush thoroughly with clean cool water for several minutes. Get professional medical attention. Refer to battery MSDS for additional information.

- g. **WARNING:** Wear proper eye, face and hand protection at all times when working with batteries. Know the location and use of emergency eyewash and shower nearest the battery charging area.
- h. **CAUTION:** To prevent damage to the connector, arc burns, or explosion, batteries should never be connected or disconnected while being charged or discharged. Batteries must be connected or disconnected only when the circuit is open. Ensure the aircraft battery switch, external power source, or the charger/analyzer is in the "OFF" position before connecting or disconnecting the battery. Battery terminal protectors should be installed whenever the battery is not connected in the aircraft or to the test equipment.
- i. **CAUTION:** Batteries contain hazardous materials. Know the location and proper use of emergency response materials. Refer to battery Material Safety Data Sheet (MSDS) for additional information.
- j. **Caution / Warning:** Only constant potential charging may be done on the aircraft. DO NOT constant current charge a battery on the aircraft. There may be a serious risk of injury to personnel and / or damage to the aircraft or aircraft systems due to high voltage and generation of explosive gases when charging constant current.

6. Airworthiness Limitations:

- a. For batteries covered by TSO-C173 the following limitation applies:
Note: The conditions and tests for this TSO approval of this battery are minimum performance standards. Those installing this battery, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14CFR part 43 or the applicable airworthiness requirements. Nickel-cadmium and lead-acid battery safety concerns include the possibility of fire and venting violently.
- b. There are no airworthiness limitations associated with the installation of a Concorde valve-regulated lead-acid battery in an aircraft.
- c. The Bombardier BD-100-1A10 (Challenger 300) has a special emergency capacity and cold temperature requirement.
 - i. The Emergency load profile of the Challenger 300 is based on a battery that is derated to 90% capacity due to deterioration of the battery and 90% State of Charge (SOC). Therefore, the battery must be removed and replaced when the capacity falls to 90% in order to ensure a full 60 minutes of flight in the event of a double generator failure. For other applications, this limitation may not

TITLE Component Maintenance Manual, Concorde RG-441 Battery		DWG. NO. 5-0173	REV A
CAGE CODE 63017		SHEET 6 OF 11	

- apply.
 - ii. In extreme cold weather operations when the aircraft cannot be hangered in a temperature controlled environment, the battery should be removed from the aircraft and stored in a warm place when the aircraft is not in use.
 - iii. If cold soaked at -31°F (-35°C), the batteries may provide only 24 minutes of emergency operation and may not start the APU.
 - d. The battery is equipped with a temperature sensor when installed in certain applications. If a temperature sensor is required, this is indicated in the Aircraft Illustrated Parts Catalog if approved under the Type Certificate (TC) or on the Master Drawing List if approved under a Supplemental type Certificate (STC).

7. Deviations:

- a. All items qualified to TSO-C173 were tested in accordance with Change 1 to DO-293.

8. Inspection Requirements and Overhaul Schedule:

a. Inspection Requirements:

i. Scheduled inspections:

(1) Engine starting batteries:

- (a) An initial check of the emergency capacity is required 12 months after installation or after 600 hours of operation, whichever occurs first.
- (b) After the initial check, a check of emergency capacity is required after 4 months or after every additional 200 hours of operation.

(2) Emergency power batteries: Batteries that are used for both applications must be inspected in accordance with the engine starting schedule.

- (a) An initial check of the emergency capacity is required 12 months after installation or after 2000 hours of operation, whichever occurs first.
- (b) After the initial check, a check of emergency capacity is required after 12 months or after every additional 1000 hours of operation.

NOTE: The inspection schedule may be adjusted after the useful battery life is established in a particular operation. After the useful life of a battery is established for a particular aircraft or operating mode, the actual useful life period in months or hours may be substituted for the above schedule.

b. Inspection Procedure:

i. Charge the battery:

(1) Special tools:

- (a) Advanced Power Products Beta D-50 Aircraft Battery Analyzer P/N 4126, or equal.

TITLE	Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO.	5-0173	REV	A
CAGE CODE	63017	SHEET		7 OF 11	

- (b) Advanced Power Products Alpha C-25 Battery Charger P/N 4142, or equal.
- (c) Advanced Power Products CA15-50 Charger/analyzer P/N 4159, or equal.

Warning: Contact Concorde for determination of equal test equipment. Some types of battery chargers may destroy the battery.

- (2) Depending on the type of charger available, charge the battery Constant Potential (CP). Charge at 2.35 volts/cell or 14.1 volts for 12 volt batteries, or 28.2 volts for 24 volt batteries until the charge current stabilizes for 1 hour.
- ii. Capacity test:
 - (1) Stabilize the battery at 15°C (59°F) or higher. The battery must be at the temperature for at least 24 hours.
 - (2) Discharge the battery at the rate specified to the end point voltage specified by the airframe or equipment manufacturer. If no rate or end point voltage is specified, discharge at the C1 rate on the label to an end point voltage of 1.67 volts/cell, 20 volts for 24 volt batteries.
 - (3) Record the time to EPV.
 - (4) The battery is acceptable for continued use if the ampere hour capacity (actual time of discharge x ampere rate of discharge) is greater than 85% of the nominal rated capacity (C1) shown on the label. If the battery passes the capacity test return it to service. If the battery fails the capacity test perform a conditioning procedure. After the battery has been conditioned perform a second capacity test. If the battery passes return it to service. If the battery fails replace it.

WARNING: When installed in the Bombardier BD-100-1A10 (Challenger300), the capacity requirement for removal is 90%. The recommended removal capacity is any test with a capacity below 93% of the nominal rated capacity (C1).

NOTE: Airframe or accessory equipment manufacturers may specify a different capacity requirement.

- iii. Return to service: Charge the battery as above. If the battery gets very hot (external case temperature greater than 55°C (130°F) during charging, it should be replaced.

c. Conditioning procedure:

Warning: The battery must be removed from the aircraft prior to performing a conditioning charge.

i. Special tools:

- (1) Advanced Power Products Beta D-50 Aircraft Battery

TITLE	Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO.	5-0173	REV	A
CAGE CODE	63017	SHEET	8 OF 11		

- Analyzer P/N 4146 or 4159, or equal.
- (2) Advanced Power Products Alpha C-25 Battery Charger P/N 4142 or 4159, or equal.
- Warning:** Contact Concorde for determination of equal test equipment. Some brands of battery chargers will destroy the battery.
- ii. Procedure:
- (1) Discharge the battery at the C1 rate to an end point voltage of 9 volts for 12 volt batteries and 18 volts for 24 volt batteries.
- (2) Constant current charge at the C1 /10 rate for 16 hours or until the battery voltage on charge is 31 volts or higher for 4 hours. **WARNING: This procedure may damage the battery if performed on a repetitive basis.**
- (3) Allow the battery to cool for 8 hours.
- (4) Retest the battery following the inspection procedure.
- d. Component Overhaul Schedule: No component overhaul required for this type product.

9. Troubleshooting:

Symptom	Probable Cause	Corrective Action
Low voltage / no voltage	Battery partially or fully discharged.	Charge in accordance with Section 10.
	Battery fuse blown or circuit breaker tripped.	Inspect and replace fuse. Reset circuit breaker.
Battery does not hold charge	Battery beyond serviceable life.	Replace battery.
Battery gets hot while recharging.	Battery beyond serviceable life.	Replace battery.

10. Servicing discharged batteries:
- a. Uninstalled recharging:
- i. Remove the battery from the aircraft.
- ii. Special tools:
- (1) Advanced Power Products Alpha C-25 Battery Charger, P/N 4142; Advanced Power Products CA15-50 Charger/analyzer P/N 4159; or equal.
- Warning:** Contact Concorde for determination of equal test equipment. Some brands of battery chargers will destroy the battery.
- iii. Depending on the type of charger available, charge the battery Constant Potential (CP). Charge at 14.1 volts for 12 volt batteries

TITLE	Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO. 5-0173	REV A
CAGE CODE	63017	SHEET 9 OF 11	

or 28.2 volts for 24 volt batteries until the charge current stabilizes for 1 hour.

NOTE: Batteries that have been allowed to stand in a deeply discharged state may not accept a CP recharge. See conditioning procedure in paragraph 13.c for handling those batteries.

11. Replacement / Repair:
 - a. Repairs should be performed only by a Concorde approved battery shop.
 - b. Replacement may be made by removing and installing a new battery in accordance with the instructions of this supplement.
 - c. Recommended replacement interval - The battery should be replaced after 5 years or 5000 hours of operation or whichever occurs first.

12. Facilities:
 - a. Valve regulated batteries may be serviced in any battery facility, including nickel-cadmium service facilities. The battery is sealed to prevent cross contamination of the electrolyte.

13. Storage Limitations:
 - a. Batteries are serviced and charged at the factory prior to shipment.
 - i. For maximum battery life, boost charge when open circuit voltage is below 25.0 volts for 24 volt batteries and 12.5 volts for 12 volt batteries. The normal voltage for a fully charged battery is approximately 26 volts for 24 volt batteries and 13 volts for 12 volt batteries.
 - ii. Batteries that have not been recharged when stored for long periods are to be conditioned (13.c) and tested (8.b) before being placed in service.
 - b. Boost charging procedure:
 - i. Special tools:
 - (1) Advanced Power Products Alpha C-25 Battery Charger, P/N 4142; Advanced Power Products CA15-50 charger/analyzer, P/N 4159; or equal.
 - ii. Depending on the type of charger available, charge the battery Constant Potential (CP). Charge at 14.1 volts for 12 volt batteries or 28.2 volts for 24 volt batteries until the charge current stabilizes for 1 hour.

14. Disposal:
 - a. Batteries contain lead, sulfuric acid, and other hazardous materials.
 - b. Lead acid batteries are recyclable.

CAUTION: This aircraft battery is encased in an aluminum container. This container must be removed prior to recycling.
 - c. Dispose of all spent batteries in accordance local laws and regulations. See battery Material Safety Data Sheet (MSDS) for additional information.

TITLE	Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO.	5-0173	REV	A
CAGE CODE	63017	SHEET	10 OF 11		

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TITLE	Component Maintenance Manual, Concorde RG-441 Battery	DWG. NO. 5-0173	REV A
CAGE CODE	63017	SHEET 11 OF 11	