



**CONCORDE BATTERY
CORPORATION**
2009 San Bernardino Road
West Covina, CA 91790
Phone: 626-813-1234
www.concordebattery.com

COMPONENT MAINTENANCE MANUAL

HCU-6 HEATER CONTROL UNIT (AND ASSOCIATED BATTERY HEATING ELEMENT)

THIS DOCUMENT SUPPLEMENTS THE APPLICABLE AIRCRAFT
MAINTENANCE MANUAL (AMM) AND THE APPLICABLE COMPONENT
MAINTENANCE MANUAL (CMM) FOR THE BATTERY.

*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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1. Scope and Purpose: This Maintenance Manual Supplement provides instructions to insure satisfactory operation, maintenance, and repair of the Concorde HCU-6 Heater Control Unit (HCU) and the associated heating element within the battery.
2. Application: The HCU-6 Heater Control Unit is designed for use with RG[®] Series batteries containing internal heating elements.
3. Safety Precautions:
 - a. **WARNING: LOW CAPACITY HAZARD.** Aircraft batteries are certified to have a certain minimum capacity for emergency operations in the event of an electrical generator system failure. Never use a battery that has less than 80% of rated capacity.
 - b. **WARNING: ELECTRIC BURN HAZARD.** Lead-acid batteries are capable of delivering high currents if the terminals are shorted. The resulting heat can cause severe burns and is a potential fire hazard. Take the following precautions:
 - Do not place tools or metal objects across battery terminals.
 - Do not wear conductive rings, belt buckles, watches or other jewelry when servicing batteries.
 - Wear insulated gloves and use insulated tools when servicing batteries.
 - Install battery terminal protectors whenever the battery is not connected in the aircraft or to the test equipment.
 - c. **WARNING: DANGER OF EXPLODING BATTERIES.** Lead-acid batteries can produce explosive mixtures of hydrogen and oxygen while on charge or discharge, which can explode if ignited. Take the following precautions:
 - Do not smoke, use an open flame, or cause sparking near a battery.
 - Wear proper eye and face protection when servicing batteries.
 - Make sure work area is well ventilated.
 - Do not constant current charge a battery when installed in an aircraft.
 - Connect cables securely to the battery terminals to avoid arcing.
 - d. **WARNING: DANGER OF CHEMICAL BURNS.** Lead-acid batteries contain sulfuric acid which can cause severe burns to body tissue. Take the following precautions:
 - Never remove or damage vent valves.
 - Avoid contact of the electrolyte with skin, eyes or clothing.
 - Do not touch eyes after touching battery.
 - In the event of acid in the eyes, flush thoroughly with clean cool water for several minutes and get professional medical attention immediately.
 - Refer to battery Safety Data Sheet (SDS) for additional information.

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- e. **CAUTION: DANGER OF EQUIPMENT DAMAGE.** 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.
4. Airworthiness Limitations: There are no airworthiness limitations associated with the installation of Concorde HCUs in an aircraft.
5. Personnel: Only personnel authorized by the cognizant aviation authority are permitted to service Concorde HCUs. For aircraft registered in the USA, 14CFR Part 43.3 applies.
6. Installation Procedure:
- Install HCU on battery per Concorde Drawing 5-0313.
 - Install battery in accordance with the instructions for the battery installation.
 - Connect HCU to the aircraft using the mating connector in the aircraft.
 - Annotate log book with HCU serial number and date of installation.
7. Testing and Fault Isolation:
- Test the HCU every 12 months (± 1 month) or whenever:
 - HCU operation appears to be faulty.
 - HCU is mated to a different battery assembly.
 - Refer to Figure 1 for electrical schematic of HCU and Table 1 for a list of test equipment.
 - With the HCU installed on the battery, test the battery DC heating element as follows:
 - Calculate the nominal resistance of the DC heating element based on the voltage and current rating using the following formula:

$$R\text{-calculated} = \text{Heater Voltage}/\text{Heater Amperage}$$

NOTE: Refer to the envelope drawing of the battery to obtain the rated Heater Voltage and Heater Amperage for the DC heater.

- Multiply the calculated resistance by 1.20 to get the maximum allowable resistance and multiply the calculated resistance by 0.80 to get the minimum allowable resistance:

$$R\text{-maximum} = R\text{-calculated} \times 1.20$$

$$R\text{-minimum} = R\text{-calculated} \times 0.80$$

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3. Measure the resistance between J2 pins R and M. If the measured resistance is more than R-maximum or less than R-minimum, reject the battery.

Example: Heater rating from battery envelope drawing is 10.62 Amps at 28.25 VDC.

R-calculated = $28.25/10.62 = 2.66$ ohms.

R-maximum = R-calculated x 1.20 = $2.66 \text{ ohms} \times 1.20 = 3.19$ ohms

R-minimum = R-calculated x 0.80 = $2.66 \text{ ohms} \times 0.80 = 2.13$ ohms.

If the measured resistance is more than 3.19 ohms or less than 2.13 ohms, reject the battery.

4. Measure the resistance between J2 pin R and battery case, and between J2 pin M and battery case. If either resistance is less than 1 megohm, reject the battery.

NOTE: To get a true reading from the battery case, probe one of the HCU mounting screws.

- d. To access the HCU components that require testing, remove the HCU from the battery.
- e. Test the thermistor (RTD1) as follows:
 1. Place the digital thermometer probe in thermal contact with the thermistor and wait at least 5 minutes for the temperatures to stabilize.
 2. Record the temperature reading from the digital thermometer.
 3. Using a DMM, record the resistance between J2 pins A and B.
 4. Check the resistance reading against the range shown in Table 2 for the temperature recorded in step 2.
 5. If the resistance of the thermistor is outside the specified range, reject the HCU.
- f. Test the heater thermostat (TS1) as follows:
 1. Place digital thermometer probe in thermal contact with thermostat TS1.
 2. Use freeze spray to decrease the temperature of TS1 below 18.3°C (65°F).
 3. Measure the resistance between J2 pins H and K.
 4. If the measured resistance is greater than 1 ohm, reject the HCU.
 5. Use a heat gun to increase the temperature of TS1 above 29.4°C (85°F).
 6. Measure resistance between J2 pins H and K.
 7. If the measured resistance is less than 1 megohm, reject the HCU.

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- g. Test the heater thermostat (TS2) as follows:
 1. Place digital thermometer probe in thermal contact with thermostat TS2.
 2. Use freeze spray to decrease the temperature of TS2 below 1.7°C (35°F).
 3. Measure the resistance between J2 pins J and K.
 4. If the measured resistance is greater than 1 ohm, reject the HCU.
 5. Use a heat gun to increase the temperature of TS2 above 18.3°C (65°F).
 6. Measure resistance between J2 pins J and K.
 7. If the measured resistance is less than 1 megohm, reject the HCU.

- h. Install the HCU on the battery and re-check the battery DC heating element per paragraph 7(c).

- i. Troubleshooting Summary:

Symptom	Probable Cause	Corrective Action
Resistance of DC heater element out of range	Heater failure	Replace battery
Resistance of DC heater to battery case is less than 1 megohm	Heater failure	Replace battery
RTD1 out of range	RTD1 failure	Replace HCU
TS1 out of range	TS1 failure	Replace HCU
TS2 out of range	TS2 failure	Replace HCU

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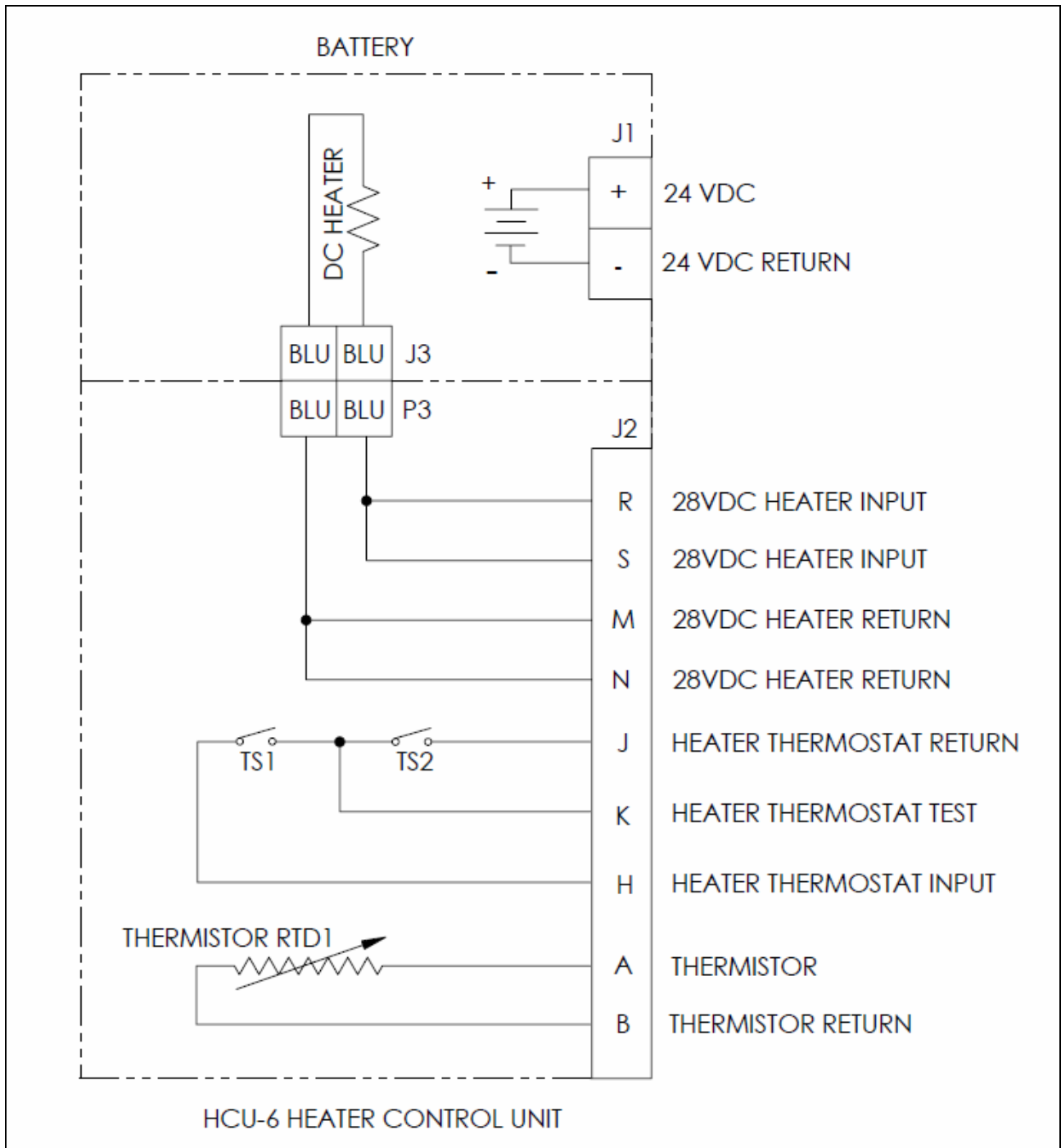


Figure 1. Schematic Diagram for HCU-6

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Table 1. List of Test Equipment

Description	Source	Part Number	Purpose
Digital Multimeter (DMM), with a resistance range of at least 0.1 ohms to 1 Megohm with accuracy of 0.1% or better.	Commercially Available	N/A	Measuring resistance of heater element and thermostats
Digital Thermometer	Commercially Available	Fluke Model 51 or equivalent	Measuring temperature of thermostats
Mating Connector P2	Various	MS27473E20B16S or equivalent	Connect HCU J2 to DMM
No. 16 Gauge Socket Probes	Commercially Available	N/A	Connect HCU J2 pins to DMM (as an alternative to using mating connector).

Table 2. Thermistor Resistance versus Temperature

Temp °C	Temp °F	Min. ohms	Max. ohms		Temp °C	Temp °F	Min. ohms	Max. ohms
0	32.0	322.4	363.6		21	69.8	157.4	161.5
1	33.8	310.8	348.9		22	71.6	152.4	155.9
2	35.6	299.8	335.0		23	73.4	147.8	150.7
3	37.4	289.1	321.6		24	75.2	143.1	145.8
4	39.2	278.9	308.8		25	77.0	138.6	141.4
5	41.0	269.1	296.5		26	78.8	134.1	137.2
6	42.8	259.7	284.9		27	80.6	129.5	133.3
7	44.6	250.7	273.7		28	82.4	125.1	129.6
8	46.4	242.2	263.2		29	84.2	120.8	126.0
9	48.2	234.0	253.2		30	86.0	116.7	122.4
10	50.0	226.5	243.9		31	87.8	112.8	119.0
11	51.8	219.5	235.3		32	89.6	109.2	115.5
12	53.6	212.6	227.0		33	91.4	105.7	112.2
13	55.4	206.2	219.1		34	93.2	102.3	109.0
14	57.2	200.0	211.6		35	95.0	99.1	105.9
15	59.0	193.6	204.0		36	96.8	95.9	102.8
16	60.8	187.2	196.4		37	98.6	92.9	99.9
17	62.6	180.8	188.8		38	100.4	89.9	97.1
18	64.4	174.5	181.4		39	102.2	87.0	94.3
19	66.2	168.4	174.3		40	104.0	84.2	91.6
20	68.0	162.7	167.7		41	105.8	81.5	88.9

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8. Replacement / Repair:
 - a. The HCU is non-repairable and must be replaced if it has a fault.
 - b. Replace HCU by removing failed HCU and installing a new HCU in accordance with paragraph 6 of this supplement.
9. Storage Limitations: None.
10. Disposal: Dispose spent batteries and HCU's in accordance with local ordinances and regulations.