To: HOLDERS OF COMPONENT MAINTENANCE MANUAL 24-32-21, 539CH2

Subject: CMM Revision No. 2 Dated May 19/2021

Replace revised pages by adding and removing pages for pages dated May 19/2021

NOTE: The CMM can be downloaded from the internet at www.saftbatteries.com

HIGHLIGHTS

CHAPTER/SECTION PAGE NUMBER	DESCRIPTION OF CHANGE
All Sections	Total restructure and rewrite to conform to other Boeing CMMs

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COMPONENT MAINTENANCE MANUAL

WITH

ILLUSTRATED PARTS LIST

Nickel Cadmium Aircraft Battery

539CH2

Website: www.saftbatteries.com

24-32-21

T-1
REV 2 May 19/2021

RECORD OF REVISIONS

REV NO.	ISSUE DATE	INSERT DATE	BY	REV NO.	ISSUE DATE	INSERT DATE	BY
0	Aug 02/2010	Aug 02/2010	Saft				
1	Jan 29/2018	Jan 29/2018	Saft				
2	May 19/2021	May 19/2021	Saft				

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RECORD OF TEMPORARY REVISIONS

TEMPORARY REV NO	PAGE NUMBER	ISSUE DATE	BY	DATE	BY

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SERVICE BULLETIN LIST

SERVICE BULLETIN NUMBER	REVISION NUMBER	DATE BULLETIN INCORPORATED INTO MANUAL

PRODUCT IMPROVEMENTS

Product Improvements have been incorporated using service bulletins entered in the service bulletin list. Service bulletin highlights are as follows:

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LIST OF EFFECTIVE PAGES

SUBJECT	PAGE	DATE
TITLE PAGE	T-1 T-2	May 19/2021 May 19/2021
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RECORD OF TEMPORARY REVISIONS	RTR 1 RTR 2	May 19/2021 Blank
SERVICE BULLETIN LIST	SBL 1 SBL 2	May 19/2021 Blank
LIST OF EFFECTIVE PAGES	LEP 1 LEP 2	May 19/2021 Blank
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ILLUSTRATED PARTS LIST	10001 10002 10003 10004 10005 10006 10007 10008	May 19/2021 May 19/2021 May 19/2021 May 19/2021 May 19/2021 May 19/2021 May 19/2021 May 19/2021
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INTRODUCTION

1. General

A. This manual is written to the ATA Specification 100 and in AECMA Simplified English. International Standard units of measure are used in this manual, with imperial units in parentheses.

B. This manual describes maintenance on components in a workshop. It does not describe maintenance on components when they are installed in aircraft.

C. Only approved personnel with the necessary skills can do maintenance tasks described in this manual.

D. This manual contains:

(1) Technical data for components

(2) Maintenance and replacement procedures for components

(3) An Illustrated Parts List (IPL) with data for parts of components. Parts are identified in all sections of the manual by IPL figure and item number.

E. We make sure of DISASSEMBLY, TESTING AND FAULT ISOLATION, and ASSEMBLY procedures are correct by doing them.

The manual is divided into separate sections:

(1) Title Page

(2) Record of Revisions

(3) Record of Temporary Revisions

(4) List of Effective Pages

(5) Table of Contents

(6) Introduction

(7) Procedures and IPL Sections

The disassembly and assembly sections contain only specific instructions used on the equipment covered herein. Most standard aerospace practices are not described herein.

This manual provides the information necessary for an experienced shop technician to maintain Saft nickel-cadmium batteries. It describes construction of the battery, as well as techniques used to operate, maintain, and provide care for the battery. Following these instructions will enhance the ability to obtain optimum performance and maximum life from Saft batteries.

All aircraft batteries require checking and maintenance to make sure they are safe when installed and they perform their required functions, especially in emergency conditions on-board the aircraft. Maintenance allows problems to be identified and corrected. The maintenance interval is the period for which correct operation is assured with a low probability of failure and allows high levels of MTBUR and MTBF.

Every effort has been made to provide complete and accurate instructions. If a situation arises that is not adequately described in this manual, please contact Saft via the internet at www.saftbatteries.com or at one of the following addresses:

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2. Definitions

Warnings call attention to use of materials, procedures, or limits which must be followed precisely to avoid injury to persons.

Cautions call attention to procedures which should be followed to avoid damage to equipment.

Notes call attention to procedures which make the job easier.

3. Safety

WARNING: EXCEPT FOR THOSE STEPS THAT REQUIRE THE BATTERY TO BE CHARGED, DO ALL STEPS ON DISCHARGED BATTERIES (REFER TO INITIAL DISCHARGE AND CELL SHORTING) TO AVOID THE POSSIBILITY OF ELECTRIC SHOCK. TIGHTEN ¼ TURN VENT VALVES (350) USING T01 PRIOR TO BEGINNING DISCHARGE. BATTERY CELLS DELIVER VERY HIGH CURRENT WHEN SHORT-CIRCUITED. EXERCISE CAUTION. REMOVE RINGS, WATCHES, NECKLACES, METALLIC BELTS AND OTHER JEWELRY TO AVOID ELECTRIC SHOCK.

WARNING: DO NOT TILT THE BATTERY DURING MAINTENANCE, ANY CONTACT OF SKIN WITH ELECTROLYTE CAN CAUSE SEVERE BURNS.

Safety rules differ from one country to another. Always follow local safety regulations.

There are three types of risks

A. Physical
   (1) Handling: the battery is heavy. When you lift it, bend your legs and not your back.
   (2) Use protective shoes.

B. Electrical
   (1) Do not wear rings, watches, chains, belt buckles, necklaces, or any other metallic objects.
   (2) Use insulated tools.

C. Chemical
   (1) For a complete listing of hazards, refer to the safety information sheet available on Saft's website at www.saftbatteries.com.
   (2) Electrolyte is very corrosive and can damage the skin: use gloves and an apron. If it touches the skin, flush affected part with large quantity of water. Remove contaminated clothing, after flushing begins.

(3) Electrolyte is very dangerous for eyes, use protective goggles. If the electrolyte comes in contact with an eye, flush it with water and get immediate medical attention.

(4) Saft recommends the use of an amphoteric solution (both acidic and basic behavior) and chelator (able to trap cations as a chelate complex) to neutralize electrolyte according to the local regulation.

(5) Electrolyte ingestion can cause damage to the throat and respiratory tract. Do not try to vomit and get immediate medical attention.

(6) Skin contact with nickel can cause chronic eczema.

(7) Inhalation of cadmium oxide can cause dry throat, headaches, vomiting, chest pain. If inhaled, move to fresh air. If the affected person is not breathing, give artificial respiration. If breathing is difficult, give oxygen and get immediate medical attention.

4. New Battery Commissioning

NOTE: Whether or not the battery has been subject to disassembly and reassembly, before going into service and installation, the tightness of all upper nuts / screws must be checked to confirm that torque values correspond with those specified in Table 8001.

Saft batteries are shipped discharged. Refer to Initial New Battery Commissioning.

All new Saft batteries that are receiving the initial commissioning within 12 months of the DOM refer to Initial New Battery Commissioning on page 5001 to place into service.

For all new Saft batteries that have not received an initial commissioning within 12 months of the DOM, then refer to Servicing at end of long-term storage, Table 15001.

5. Battery Ratings

A. Capacity

Nickel-cadmium batteries are rated in terms of capacity in ampere-hours (Ah) (rated capacity).

Other definitions for battery ratings can be found in EN2570, IEC 60952, and RTCA DO 293.

6. Recycling

All batteries eventually lose their ability to perform and are eligible for scrapping and recycling. Saft takes environmental matters seriously and advocates proper recycling of nickel-cadmium batteries and their components. To that end, Saft operates recycling facilities in both Europe and North America.

Nickel-cadmium batteries contain nickel, cadmium, and potassium hydroxide and should be disposed of properly. In all cases, rely on local and national regulations for proper battery disposal and/or shipping to an appropriate recycling location.

Universal Recycling Symbols
Figure Intro 1

You can find the nearest recycling collection point on our website at www.saftbatteries.com.

7. End of Life

EASA and FAA regulations “Part 145” requires end of life cells to be disposed of in a manner prohibiting them to be returned to service. Other authorities may have requirements less explicit, Saft recommends the following procedure to be followed to provide a means of compliance.

A. Make sure the appropriate protective measures (refer to Safety paragraph and Battery Information Sheet (BIS)) are taken.

B. Make sure the cell is fully discharged (See Cell shorting).

C. Break or cut the terminals from the cell. If any electrolyte leakage occurs, make sure the clean-up measures as described in the Battery Information Sheet (BIS).

D. Dispose of the cell in accordance with applicable transport, health and safety, and recycling regulations. (Refer to Recycling paragraph)

All batteries eventually lose their ability to perform and are eligible for scrapping and recycling. Saft takes environmental matters seriously and advocates proper recycling of nickel-cadmium batteries and their components. To that end, Saft operates recycling facilities in both Europe and North America.

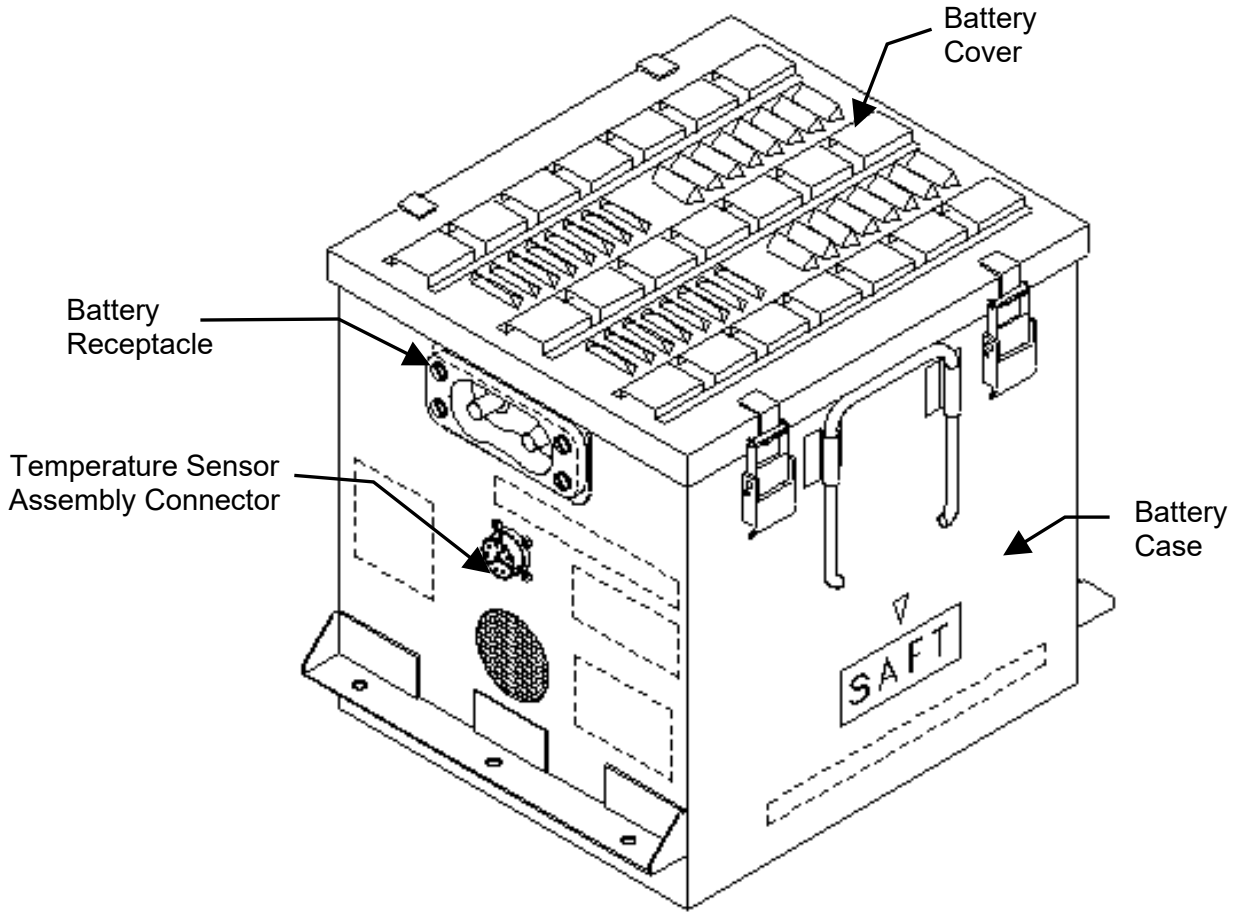
8. Abbreviations

A	Amperes
AECMA	European Association of Aerospace Industries
ATA	Air Transport Association of America
EASA	European Air Safety Authority
FAA	Federal Aviation Authority
IATA	International Transport Air Association
IMDG	International Maritime Dangerous Goods
IPL	Illustrated Parts List
Max.	Maximum
MTBF	Mean Time Between Failure
MTBUR	Mean Time Between Unscheduled Removal
P/N	Part Number
V	Voltage

DESCRIPTION AND OPERATION

1. Description

The Nickel Cadmium Battery provides power either to the standby system or to start the auxiliary power unit. It is a nickel-cadmium type with sintered and plastic bonded electrode plate construction and uses a potassium hydroxide electrolyte. The battery consists of a case and cover, 20 cell assemblies and a sensor harness. The sensor harness includes a thermostat mounted on a plate against the face of the end cell of the center row of cells. A charge control thermistor is located between cells 6 and 9 in the center row of cells.



Nickel Cadmium Battery
Figure 1

PARAMETER	VALUES
Voltage: Nominal	24.0 Volts
Weight	43.54 kg (96 pounds) maximum
Dimensions (Maximum): Height Length (including side brackets) Width (including handles)	 289.56 mm (11.4 inches) 330.20 mm (13.0 inches) 279.40 mm (11.0 inches)
Cell Terminal	M10 X 1.25, externally threaded
Number of Cells	20
Cell Model	Saft-Type CVH531KA
1.0C_1A Rate	53A
0.5 C_1A Rate	26.5A
0.1 C_1A Rate	5.3A
Rated Capacity (C_1)	53 Ampere-hours at 1.0C_1A
End of Life Capacity	48 Ampere-hours at 1.0C_1A
Maximum Consumable Water Reserve	88 cm^3 (5.37 in^3)
Venting valve	MS Style (¼ turn)
Venting Pressure	0.14 to 0.69 bar (2 to 10 psi)
Cell Case Material	Polyamide
Battery Case Material	Stainless Steel
Electrolyte	Potassium Hydroxide
Recommended Storage Temperatures	+5°C to +35°C (+41°F to +95°F)
Ambient Temperature	+15°C to +30°C (+59°F to +86°F)

Leading Particulars
Table 1

2. Operation

A. Flight charging

The battery is charged on the aircraft by an on-board charger. The charge control thermistor provides a signal to the charger to compensate the charge according to the battery temperature. The thermostat will cut off the charger if the battery temperature exceeds a safe operating limit.

B. Maintenance

(1) Maintenance interval basis

The aircraft manufacturer and/or operator is responsible for the definition of maintenance interval based on the use profile of the batteries installed on the aircraft. The maintenance interval has two main factors:

- Energy available for emergency requirements
- Electrolyte consumable reserve.

Both factors depend on the battery charging system, operating temperature, discharge magnitude, charge cycles, flight duration, ground operation, and battery technology.

The higher voltage per cell applied, the higher overcharge current and capacity the battery receives.

The overcharged capacity is directly related to the electrolysis of water from the electrolyte, and hence the consumption of the electrolyte reserve. For every 3 Ah of overcharge, 1 cm^3 (0.06 in^3) of water is consumed via electrolysis. Once the water reserve has been consumed, the result is:

- Dried out cells with a significant risk of permanent damage
- Internal short circuit
- Overheating
- Thermal runaway.

(2) Maintenance interval extensions

To validate maintenance interval extension, the recommendation is to have the Operator and Saft review the maintenance records for a minimum period of 12 months.

The data includes, but is not limited to, the recording of aircraft flight hours accrued while installed, its removal date, inspection date, off-wing capacity, and water consumption as required by this CMM.

As with any maintenance extension, subsequent monitoring of the water addition and electrical performance upon removal from the aircraft must be done to detect any adverse effects and, if necessary, re-adjust the maintenance interval accordingly.

C. Battery data requirements

Maintenance information is required for any Saft battery evaluation to determine its condition and health. Throughout this manual there are multiple steps requiring specific information be recorded to maintain a battery service history. The information provided not will only reflect the batteries airworthiness, but also provide information to assist in any battery issue investigations required at the factory. As a minimum the items identified below are required for each battery maintenance step/action.

(1) Record the date the battery was received, and time testing started.

(2) As required for all discharges, record the duration the first cell reaches 1.0V.

(3) As required during charges,

(a) Record the cell voltages at the start of the charge, at the end of the main charge, and the last 30 minutes of the final charge.

(b) Record the water added to each cell during the last 30 minutes of the overcharge.

(4) As required for special testing, record location and reason for cell replacement either voltage or capacity.

(5) Record the date the battery is returned to service.

TESTING AND FAULT ISOLATION

1. General

   This section contains battery functional tests and fault isolation information. Test procedures are written in step-by-step formats that follow the process flow outlined in Figure 1001. Fault isolation is presented in chart form to identify faults, possible causes, and remedies, refer to Table 1006, Table 1007, or Table 1008.

   NOTE: The ( ) part identification numbers herein are IPL Figure 1 item numbers.

   NOTE: All voltage readings are DC unless otherwise stated.

2. Required Test Equipment

   NOTE: Test equipment with equivalent specifications can be used.

   Refer to Special Tools, Fixtures, Equipment, and Consumables for listing of Standard Tools.

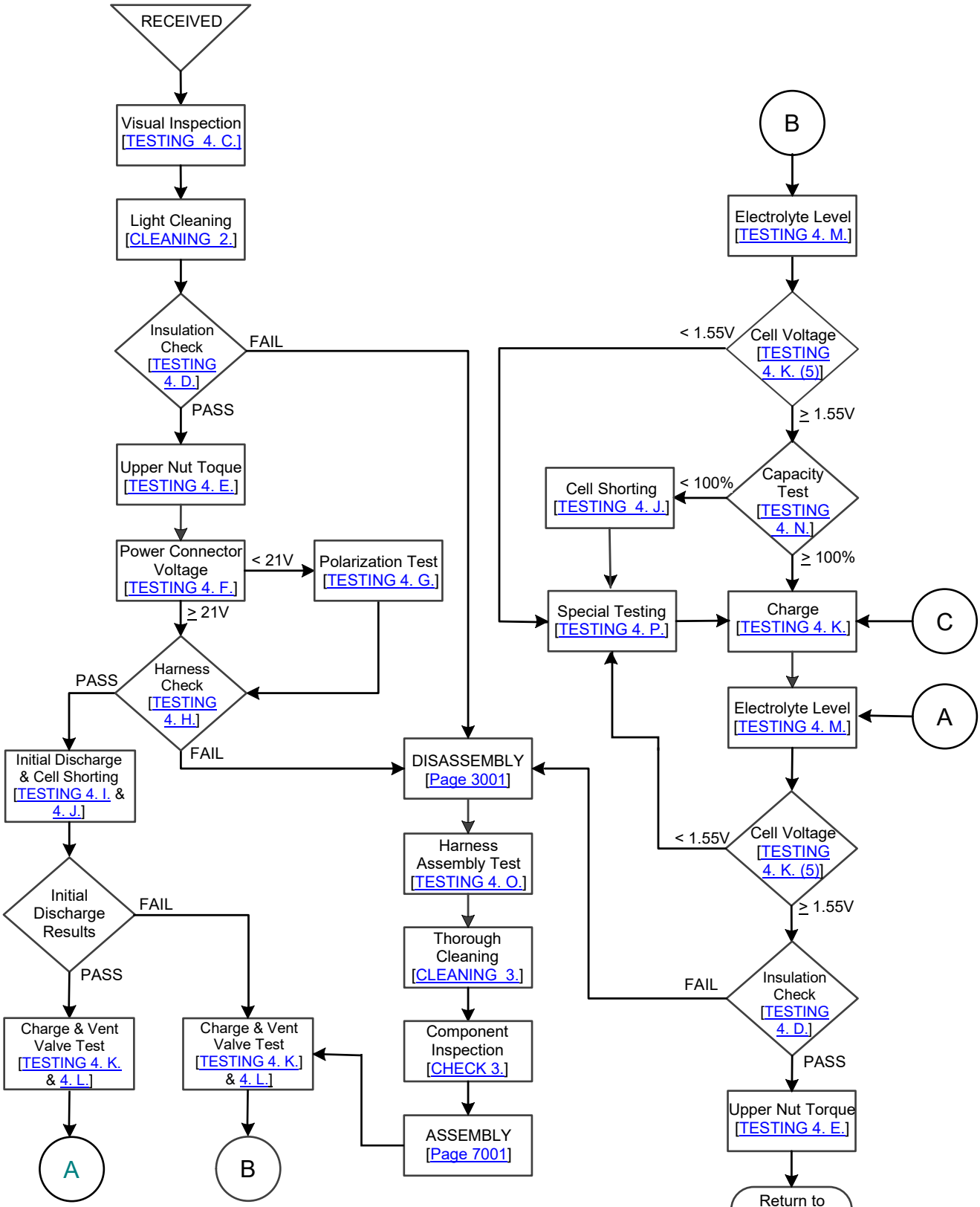
3. Maintenance Procedures

   In addition to the checks specified for airborne or ground use, in normal service SAFT 539CH2 batteries require the following maintenance operations.

   A. Restoration Procedure

      Outlined in Figure 1001 is a step-by-step process flow required. A request for overhaul or restoration should follow this same procedure.

   NOTE: Overhaul by some airworthiness authorities is defined as an item that has been disassembled, cleaned, inspected, repaired as necessary, reassembled, and tested. To identify this process the entire battery must require total disassembly, thorough cleaning, inspection, assembly, and testing.



Process Flow for Battery Restoration Procedures
Figure 1001

4. Testing

A. Test conditions

(1) Facilities and equipment

CAUTION: FUMES FROM LEAD ACID BATTERIES OR SMALL TRACES OF SULFURIC ACID ENTERING A NI-CD BATTERY CAN CAUSE PERMANENT DAMAGE.

(a) Service facilities for Ni-Cd batteries must be entirely separate from those for lead acid batteries.

(b) Equipment used to service lead acid batteries must not be used to maintain Ni-Cd batteries.

(2) For optimum results conduct all tests with the battery temperature at Ambient Temperature, unless otherwise noted in this manual.

B. Test equipment

Refer to Special Tools, Fixtures, and Equipment, and Consumables for test equipment recommendations.

C. Visual Inspection

Items found may require doing immediate disassembly while the majority do not. If a finding does not require going to disassembly procedure, then specific instructions are provided are after the battery has been received its initial discharge.

(1) Visually inspect battery cover (020) for dents, distortion, or other damage and replace as needed.

(2) Visually inspect battery case (010) for dents, distortion, or other damage. Do DISASSEMBLY to replace or repair any defective components.

(3) Remove battery cover (010), hold-down pad (030) and formed insulator (040) removed and visually inspect each cell (260) for any evidence of electrolyte leakage or damage.

(a) Damaged cells (260) must be marked for replacement or further cleaning.

NOTE: Excessive electrolyte leakage will cause the battery to fail the Battery insulation test.

(b) Excessive salts around the terminal posts gives an indication of possible terminal O-ring (270) leakage. Identify any cells with excessive salts for later torquing the lower nut (320).

(c) When inspection reveals electrolyte leakage from the cell at the vent hole opening, replace the defective O-ring (360), do Vent valve O-ring replacement

(4) Inspect the upper nuts (120), (340), washers (110), (330), and links (140 to 180) to ensure it is free of bends, tarnish, corrosion, burns, or loss of plating. Minor tarnish can be polished off with a fine wire brush. Identify defective hardware for later replacement.

(5) Check all ventilation openings to make sure that they are clean and clear.

(6) Inspect the power connector (090) pins for defects, evidence of arcing or excessive oxidization. If observed, identify the power connector (090) for later replacement.

D. Battery insulation

NOTE: A breakdown in electrical insulation between the cells and the battery case will result in a "leakage" current, which, over a period of time, can discharge the battery.

NOTE: Method A or B may be used to check the insulation breakdown.

(1) Method A

(a) Set up the multimeter and meter leads for a measurement of 250mA.

(b) Connect the negative lead from the meter to the battery container then touch the positive lead from the meter to the positive terminal of the battery followed by each positive cell terminal.

(c) If there is a reading other than zero, the insulation test is a “FAIL”.

NOTE: If, after cleaning the battery and assuring that everything is dry, a leakage current is still indicated by a reading other than zero, then one or more cells (260) is defective. Isolate and replace the defective cell(s).

(d) If the reading is equal to zero, the insulation is a “PASS”.

(2) Method B

(a) On a completely assembled battery, measure the insulation resistance between the block of cells and the metal box. The value measured must be at least 10MΩ under a 250V continuous using a megohmmeter.

(b) If the reading does not meet the above criteria, the insulation is a “FAIL”.

NOTE: If, after cleaning the battery and assuring that everything is dry, the resistance is still less than 10MΩ, one or more cells (260) is defective, isolate and identify for later replacement.

(c) If the reading meets the above criteria ($\geq$ 10 MΩ), the insulation test is a “PASS”.

E. Upper nut torque

Check the torque on each upper nut (120), (340) per Table 8001.

F. Battery voltage

Measure and verify the voltage at the battery power connector (090) is greater than or equal to 21V.

G. Polarization test

(1) Charge the battery at $0.1C_1$ for 1.5 hours.

(2) Keep the battery in open circuit for 1 hour.

(3) Measure the open circuit voltage of each cell (260).

(a) Mark for replacement any cell (260) with zero volts or negative polarity. If any cell (260) is marked for replacement, the polarization test is a “FAIL”.

(b) If all cells are above zero volts, the polarization test is a “PASS”.

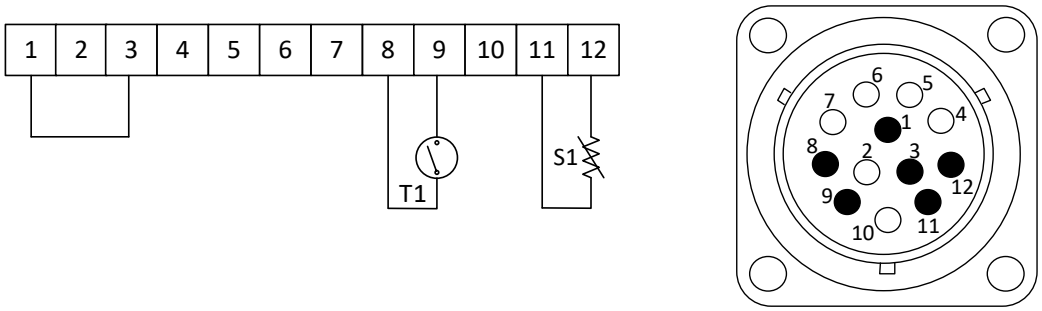
H. Sensor harness check

NOTE: A climate chamber or alternate methods may be used provided the temperatures below are achieved.

NOTE: This check may be substituted with the paragraph Sensor harness test by assuming the check is a “FAIL” and returning to Figure 1001.

The harness should be tested on a biennial basis instead of doing this check (see Sensor harness test)

NOTE: Refer to Figure 1002 for pinout locations.



Connector Pinout
Figure 1002

(2) If any part of the sensor harness (190) is damaged, the entire assembly must be replaced after disassembly.

(3) Be sure the internal battery temperature is at +22.8°C ± 5.0°C (+73°F ± 9°F). Test with an ohmmeter to auxiliary connector (240) per Table 1001 on connector sensor harness (190). Any erratic or incorrect readings represents a failure and the entire assembly (190) must be replaced after disassembly.

ITEM	PINS	VALUES @ +22.8 +/- 5°C (+73 +/- 9°F)
-	Pin 1 - Pin 3	<1MΩ
S1 (210)	pins 11 to 12	1854Ω to 3116Ω
T1 (200)	pins 8 and 9	≥ 20MΩ

Sensor Harness Check Values
Table 1001

I. Initial discharge (off-wing capacity)

The purpose of this procedure is to discharge the battery to a known state of charge and determine the battery capacity from the aircraft.

(1) Discharge the battery at a rate listed in Table 1002 until the battery reaches 20.0V and record the times the first cell reaches 1.0V and battery reaches 20.0V.

NOTE: It is important that the discharge current be continually maintained at the selected value, and that the time of discharge be measured accurately.

NOTE: If a cell goes to zero volts or reverses polarity during the discharge, short out the cell's terminals for the remainder of the discharge.

DISCHARGE RATE (AMPS)	MINIMUM TIME FOR FIRST CELL TO 1.0V
26.5	122.0 MINUTES
53.0	60.0 MINUTES

Initial Discharge (Off-wing Capacity)
Table 1002

(2) If defective items were found during the visual inspection or cells (260) marked for replacement, they are to be corrected here.

(a) For each cell (260) marked for replacement, do Cell replacement.

(b) For power connector (090) requiring replacement, do Power connector replacement.

(c) Remove and replace as needed nuts (120), (340) and washers (110), (330). Torque nuts (120), (340) per Table 8001.

(d) Replace as needed links (140 to 180) using Link replacement.

(e) For each cell (260) which had excessive salts around the terminals during visual inspection, then do Lower nut torque.

(f) If any cell hardware (270), (280), (290), (300) or (310), or (320) was identified as needing replacement, do Cell hardware replacement.

(3) Initial discharge results

NOTE: The results below will be used for a decision point in Figure 1001.

(a) If the discharge time the first cell reaches 1.0V equals or exceeds the value shown in Table 1002 for the discharged rate, the battery capacity is a “PASS”.

(b) If the discharge time the first cell reaches 1.0V is less than the value shown in Table 1002 for the discharged rate, the battery capacity is a “FAIL”.

J. Cell shorting

(1) Confirm the vent valve (350) is tightened on each cell (260).

(2) Discharge each cell in the battery to 0V using one of the two methods below:

NOTE: It is not necessary to have a rest period between a discharge and cell shorting.

(a) Method A

1 Continue to discharge the battery per Table 1002 until each cell is < 1.0V, connect a T03 across its terminals. After all the cells have been shorted, leave the devices in place for 12 to 24 hours.

(b) Method B

1 Continue to discharge the battery per Table 1002 until each cell is < 0.5V, then connect a shorting clip across its terminals. After all the cells have been shorted, leave these clips on for 16 to 24 hours.

(3) At completion of Method A or B, remove the shorting devices

(4) If no cell(s) are marked for replacement, then return to Figure 1001 utilizing the PASS or FAIL results of the Initial discharge.

(5) If any cell (260) was marked for replacement, do Cell replacement.

K. Charge

(1) Allow the battery to cool to ambient temperature.

(2) Remove the cover (020), pad (030) and formed insulator (040),

(3) Prior to charging the battery, loosen (do not remove) all ¼ turn vent valves (350). Ensure that the shorting spring has been removed.

NOTE: If required by Figure 1001, it is recommended to do Vent valve test during the charge.

(4) Charge the battery using one of the methods in Table 1003.

(a) Record the cell voltages at the start and end of the main charge (Step 1), and the last 30 minutes of the final charge (Step 2).

1 If the start cell voltage of the main charge (Step 1) goes above 1.50V, add to the cell about 10 cm^3 (0.61 in^3) of M01.

2 During the last during the last 30 minutes of the final charge (Step 2), adjust the Electrolyte level, and check the Minimum final charge voltage.

NOTE: C_1A designates the rated one–hour capacity (refer to Table 1).

Charge Table				
Main Charge (Step 1)			**Final Charge (Step 2) ***	
Current	Minimum Time	End of Main Charge Criteria	Current	Time
$0.1C_1A$	10h	Every cell >1.5V or 12h** whichever comes first	$0.1C_1A$	4h
$0.5C_1A$	2h	Every cell >1.55V or 2.5h** whichever comes first	$0.1C_1A$	4h
$1.0C_1A$	1h	Every cell >1.57V or 1.25h** whichever comes first	$0.1C_1A$	4h

* During the last 30 minutes do Electrolyte level and confirm minimum voltage criteria in Table 1004.

**New batteries may take 20% longer than the maximum time provided to reach the proper cell voltages.

Charge Table
Table 1003

(5) Minimum final charge voltage

During the last 30 minutes of final charge (Step 2) measure and verify the voltage of each cell (260) meets the value shown in Table 1004. Identify each cell that does not comply.

CELL VOLTAGE (Last 30 minutes at 0.1C_1A)
≥ 1.55V

Final Charge Voltage Limit
Table 1004

L. Vent valve test

NOTE: The vent valve test should be done once a year of battery operation or every maintenance interval, whichever is longer. This test is not necessary if all the vent valves (350) are replaced with new Saft valves each year or maintenance interval, whichever is longer.

NOTE: It is recommended to do this test while the battery is on charge.

CAUTION: THE CELL OPENINGS MUST BE COVERED WITH A CLEAN, DAMP CLOTH TO PREVENT ENTRY OF FOREIGN MATTER.

(1) Check the operation of the vent valve (350) as follows:

(a) Use fixture T05 and affix the vent valve (350) that contains O-ring (360) into the adapter end.

(b) Attach the fixture T05 to a compressed air line through an adjustable pressure reducing valve limited to 1.38 bar (20 psi).

(c) Slowly raise the air pressure to a 1.38 bar (20 psi) maximum to test the functionally below.

(d) Immerse the valve and end of fixture in water, and slowly raise the pressure. Make sure the valve opens between 0.14 to 0.69 bar (2 psi and 10 psi).

(e) Reuse only those vent valves found to open in the 0.14 to 0.69 bar (2 psi and 10 psi) range. Re-soak vent valves that do not open at 0.69 bar (10 psi) until they do open (refer to CLEANING on page 4001). Discard vent valves which are not gas tight at low pressure.

M. Electrolyte level

This procedure is to be carried out during the last 30 minutes of the final charge (Step 2) at 0.1C_1A.

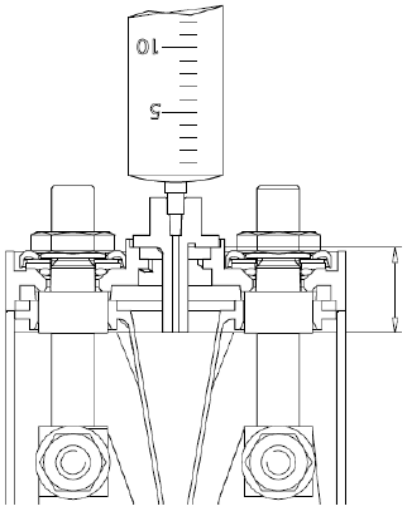
WARNING: USE CARE NOT TO TILT CELLS WHILE VENT VALVES ARE LOOSENED OR REMOVED; CONTACT OF ELECTROLYTE WITH SKIN CAN CAUSE SEVERE BURNS.

CAUTION: USING ANYTHING OTHER THAN M01 (DISTILLED OR DEIONIZED WATER) IN NICKEL-CADMIUM CELLS WILL CAUSE ELECTROLYTE CONTAMINATION AND DAMAGE. DO NOT RE-USE WATER REMOVED FROM CELLS.

(1) Remove the ¼ turn vent valves (350) with T01, taking precautions to prevent foreign substances from entering the cell.

(a) Clean the vent valves (350) by immerse the valves and their O-rings (360) in M01 and let them soak to dissolve any salts.

(2) Inserting T02 into the cell opening until the shoulder of the nozzle rests on the valve seat, see Figure 1003.



Position of T02 in Cell Vent Seat
Figure 1003

(3) Withdraw the plunger and check for any liquid in the T02.

(a) Any excess liquid in the cell will be drawn into the syringe until the electrolyte is level is correct.

(b) If the liquid level is too low, the syringe will remain empty, indicating that the end of the syringe nozzle did not reach the liquid in the cell.

NOTE: If the quantity of water added per cell exceeds 88 cm^3 (5.37 in^3), then check the charging system. If the aircraft charging system is functioning properly, the maintenance period may need be reduced.

1 Draw a measured amount of M01, such as 5 cm^3 (0.31 in^3) into the T02 and inject it into the cell.

2 With the syringe nozzle resting on the valve seat, slowly withdraw the plunger into T02.

3 If T02 remains empty, repeat steps 1 and 2, counting the number of 5 cm^3 injections required to achieve the correct level.

4 At the point in step 2 when some excess liquid is drawn into T02, the correct level for that cell has been reached. Expel the excess liquid into a separate container for proper disposal of hazardous waste.

5 Record the amount of water added/removed from each cell in the battery logbook or battery test sheet.

N. Capacity check (second discharge)

The purpose of this discharge procedure is to verify minimum battery capacity.

(1) Prior to doing the capacity check, do Charge and Electrolyte level.

(2) The vent valve (350) must be installed on top of each cell (260).

(3) Discharge the battery at one of the current rates shown in Table 1005 until the battery reaches 20.0V to determine and record the times the first cell reaches 1.0V and battery reaches 20.0V.

NOTE: It is important that the discharge current be continually maintained at the selected value, and that the time of discharge is measured accurately.

NOTE: If a cell goes to zero volts or reverses polarity during the discharge, short out that cell's terminals with a T03 for the remainder of the discharge.

DISCHARGE RATE (AMPS)	MINIMUM TIME FOR FIRST CELL TO 1.0V
26.5	113.7 MINUTES
53.0	56.6 MINUTES

Capacity Check (Second Discharge)
Table 1005

(4) If the time the first cell reached 1.0V equals or exceeds the values shown in Table 1005 at the discharge rate, then the capacity is ≥ 100%. Allow the battery to rest at least 2 hours.

(5) If the time the first cell reached 1.0V is less than the value shown in Table 1005 at the discharge rate, then the capacity is < 100%.

O. Sensor harness test

This test shall be done for a Battery insulation check failure or disassembly, otherwise the test should be done on a biennial basis by doing DISASSEMBLY to allow the harness to be removed and tested.

WARNING: A FULLY ASSEMBLED BATTERY MUST BE IN A FULLY DISCHARGED CHARGE STATE TO PREVENT INJURY, REFER TO CELL SHORTING.

NOTE: A climate chamber or alternate methods may be used, provided the temperatures below are achieved.

If any part of the sensor harness (190) is damaged or fails any portion of this test, the entire assembly must be replaced with new Saft Sensor harness (190).

NOTE: Refer to Figure 1002 for pinout locations.

(1) Confirm the battery was discharged and disassembled.

(2) Over Temperature Thermostat (200) is part of sensor harness (190). It is attached to the thermostat mounting plate (060). Disassembly is required in order to test the thermostat (refer to DISASSEMBLY).

(3) Test with an ohmmeter the connector sensor harness (190) per Table 1001. Any erratic readings represent a failure.

(4) Thermostat (200) functional testing as follows:

(a) Suspend the thermostat mounting plate shown in (060) with thermostat (200) in a beaker of water. Position the thermostat a minimum of 50.8mm (2 in) from the bottom and 25.4mm (1 in) from the top of the water surface.

(b) Insert a thermometer, or other suitable temperature-measuring device, in the water with the bulb adjacent to the thermostat.

(c) Slowly raise the water temperature to +66°C (+150°F) while observing the ohmmeter. Make sure contacts remain open (≥ 20MΩ) at temperatures below +66°C (+150°F).

(d) Continue raising the water temperature and stabilize at 71°C ± 5.0°C (160°F ± 9°F), then make sure the thermostat closes (< 10Ω) at a stabilized temperature of 71°C ± 5.0°C (160°F ± 9°F).

(e) Slowly add cool water to the beaker to reduce water temperature to 65°C ± 2.8°C (149°F ± 5°F). Make sure the thermostat opens (≥ 20MΩ) within 6.1°C (11°F) of the closing temperature.

(f) If the thermostat fails to meet any of the above criteria, then replace the complete sensor harness (190).

(2) Charge Control Thermistor is permanently mounted on a sensor plate (210). Check the function of the unit as follows:

(a) Immerse the thermistor plate in a beaker containing a mixture of ice and water.

(b) Insert a thermometer, or other suitable temperature-measuring device, in the container, in contact with the plate.

(c) Make sure the ohmmeter indicates 7355 ± 672Ω when the plate temperature is 0°C ±1.7°C (+32°F ± 3°F).

(d) After the low temperature test, slowly raise the temperature to +71°C ± 2.8°C (+160°F ± 5°F).

(e) Make sure the ohmmeter indicates 382 ± 23Ω when the plate temperature is +71 ± 1.7°C (+160 ± 3°F).

(3) If the thermistor fails any of the above testing criteria, replace the complete connector sensor harness (190).

P. Special testing

These procedures are to be followed for a battery that does not meet capacity or if the end of charge cell voltage was less than 1.55V during the final charge. Refer to Figure 1004 flow chart.

NOTE: For a new battery or one removed from the aircraft that has not passed capacity after doing the Special Testing more than 3 times, it is recommended to replace noncompliant cells with new Saft cells (260), refer to All cell replacement recommendation.

NOTE: For battery from long-term storage, several complete charge/discharge cycles may be needed to restore performance.

(1) Special testing decision

For a battery with < 100% capacity, start at Low capacity (Special testing) below. Otherwise, for a battery with any cell voltage less than 1.55V start at Supplementary test below.

(2) Low capacity (Special testing

(a) Loosen (do not remove) all ¼ turn vent valves (350) and fully charge the battery as outlined in Charge section.

(b) For a battery containing any cell voltage less than 1.55V during the final charge do Supplementary test below, otherwise do Capacity test (Special testing) below.

(3) Supplementary test

(a) Charge at 0.1C_1A for an additional 5 hours and monitor the voltage of the individual cells every 30 minutes.

1 Mark any cell that does not comply with Table 1004 for replacement.

2 During the last 30 minutes of this charge, adjust the Electrolyte level and then tighten the vent valves (350) on top of each cell (260).

3 Do Cell replacement for cells marked for replacement otherwise go to Capacity test (Special testing).

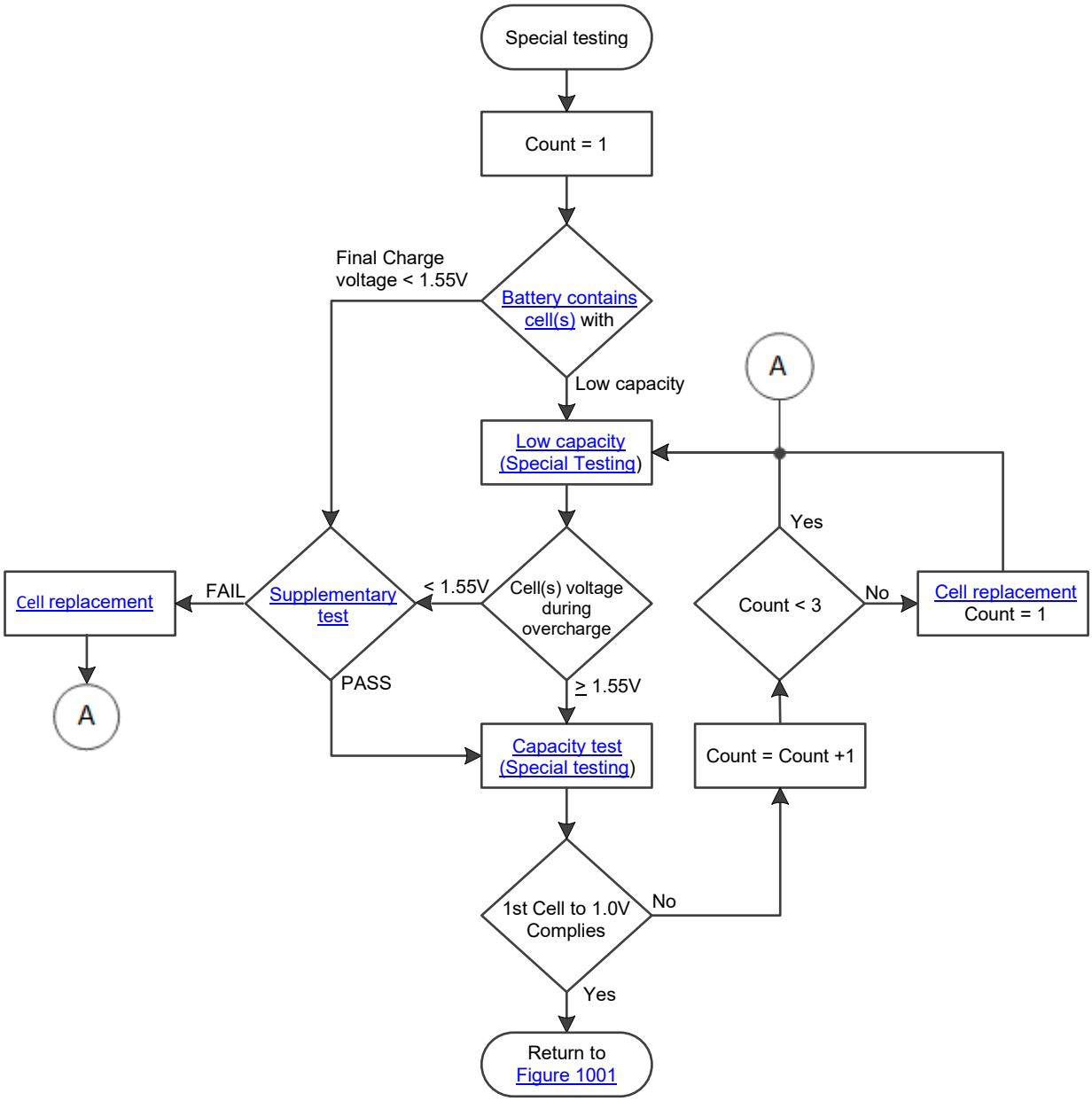
NOTE: If more than one cell (260) was replaced due to low charge voltage during the current maintenance cycle, then the replacement of all cells should be considered. (Refer to Cell replacement on page 6001).

(4) Capacity test (Special testing)

(a) Tighten the vent valve (350) on top of each cell, then discharge the battery at a rate shown in Table 1005 until the battery reaches 20.0V. Record the time and current the battery reached 20.0V and identify the noncompliant cells with voltage less than 1.0V.

(b) If the time the first cell reached 1.0V equals or exceeds the values shown in Table 1005 at the applicable discharge rate, then return to Figure 1001. Otherwise repeat this procedure Low capacity (Special testing) or refer to Fault Isolation.

1 For noncompliant cells that failed this capacity test 3 times, replace with new Saft cells (260), refer to Cell replacement.



Special Testing Flow Chart
Figure 1004

5. Fault Isolation

Fault isolation information is presented in Table 1006 , Table 1007, or Table 1008 as a guide to locate the cause of malfunction and isolating the cause to a specific component.

TROUBLE	PROBABLE CAUSE	REMEDY
(1) Zero volts with battery on “charge"	(a) Defective electrical connector (not making contact). (b) Broken or loose terminal links, upper nuts	Check electrical contacts, links Replace if required, Power connector replacement, Cell hardware replacement, Link replacement, or torque Upper nut torque
(2) Zero volts with battery on "discharge”	(a) Battery completely discharged (b) Battery circuit open or contacts defective (c) Cell(s) completely dry	Do Battery insulation Examine the contacts and links, Visual inspection. Torque per Upper nut torque Do Electrolyte level
(3) Low Insulation	(a) Leakage of electrolyte (b) Damaged cell case (c) Incorrect adjustment of electrolyte level (d) Loose or damage vent valve (e) Cell polarity incorrect during starts (f) Charge rate too high	Do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level Do Thorough Cleaning, Cell replacement, ASSEMBLY, Charge, Electrolyte level Do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level Tighten or replace vent valve, do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level Do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level Investigate the cause of the excessive charge. Do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level
(4) Loss of battery capacity	(a) Normal wear after long service (b) Exceptionally heavy use	Do Special testing

Battery Faults
Table 1006

TROUBLE	PROBABLE CAUSE	REMEDY
(1) All cells have reserve consumed	(a) Charged more than allowed or charged at high temperature. (b) Previous maintenance has not been done (c) Maintenance interval too long	Examine the cause of the excessive charge. Do Charge, and be sure what for the next maintenance interval. If this continues the maintenance interval should be done reduced.
(2) High water consumption in one or more cells	(a) Damaged separator when the water consumption is less than 30% below the average value of added water in all cells. (b) Cell imbalance when water addition is more than 30% above the average value of added water in all cells.	Do Charge, Supplementary test. Do Thorough Cleaning, Cell replacement, ASSEMBLY, Charge, Electrolyte level
(3) Abnormally high cell voltage at beginning of charge	(a) Dry cell	Add 5 to 10 cm^3 (0.31 to 0.61 in^3 of distilled water, do Electrolyte level
(4) Zero Voltage on cell	(a) Short-circuited cell	Do Cell replacement
(5) Low cell voltage at end of charge	(a) Separator damage	Do Cell replacement
(6) Low cell capacity	(a) Normal wear from long service	Do Cell replacement
(7) Cell with a swollen case	(a) Cell operated with low electrolyte level, deterioration of separator and damaged plates	Do Cell replacement

Cell Faults
Table 1007

TROUBLE	PROBABLE CAUSE	REMEDY
(1) Tarnished or burned terminal connectors	(a) Loose terminal nuts and links	Clean and torque per Table 8001 or do Power connector replacement, Cell hardware replacement, or Link replacement.
(2) Exposed copper material on power connector pin	(a) Mechanical damage (b) Electrical arcing	Do Power connector replacement
(3) Melted plastic on connectors	(a) Overheat due to contact resistance	Do Power connector replacement
(4) Corroded links	(a) Operation in acidic atmosphere	Check room eliminate acid source. Do Link replacement and lubricate properly
	(b) Inadequate greasing	Do Link replacement and lubricate properly
	(c) Mechanical damage to protective nickel-plating	Do Link replacement and lubricate properly

Physical Faults
Table 1008

DISASSEMBLY

1. General

This section provides step-by-step instructions on disassembling the complete battery.

NOTE: The ( ) part identification numbers herein are IPL Figure 1 item numbers.

2. Detailed Instructions

WARNING: BATTERY CELLS DELIVER VERY HIGH CURRENTS WHEN SHORT-CIRCUITED. EXERCISE CAUTION. REMOVE RINGS, WATCHES OR OTHER JEWELRY FROM HANDS AND ARMS.

WARNING: BATTERY MUST BE COMPLETELY DISCHARGED BEFORE CELL ASSEMBLIES CAN BE REMOVED DUE TO POSSIBILITY OF ELECTRIC SHOCK.

WARNING: USE CARE NOT TO TILT BATTERY WHILE VENT VALVES ARE LOOSENED; CONTACT OF ELECTROLYTE WITH SKIN CAN CAUSE SEVERE BURNS.

A. Preparation

(1) Discharge the battery at one of the current rates shown in Table 1005 until each cell reaches 1.0V.

(2) Remove cover (020), hold-down pad (030) and insulator (040) by opening latches and lifting cover from case (010).

(3) Do Cell shorting

B. Cell (260) Removal

(1) Remove nuts (340), (120), and washers (330), (110) from terminals of cells (260) and terminals of the terminal adapter connector (090).

(2) Remove intercell terminal links (140 through 180) from terminals of cells (260).

(3) Using T04 remove cell assemblies (260) from the battery case (010) by tightening T04 to cell terminals and removing cell with a steady straight up pull.

C. Disassembly of the cells (260) is restricted to replacing defective O-rings (270) of the cell terminal seals. Refer to Cell hardware replacement.

D. Power connector (090) removal

(1) Remove screws (100) from the connector.

(2) Remove power connector (090) and its gasket (130) from the battery case (010).

E. Sensor harness (190) removal

(1) Remove the thermostat mounting nuts (080) from the thermostat plate (060).

(2) Remove the thermostat plate (060) and thermostat spacers (070) from the battery case (010).

(3) Remove the sensor harness connector mounting screws (250), nuts (080) and lift the sensor harness (190) out of the battery case (010).

F. Remove all spacers (050) from the battery case (010).

CLEANING

1. General

CAUTION: DO NOT USE PETROLEUM SPIRITS, TRICHLOROETHYLENE OR OTHER SOLVENTS FOR CLEANING THE BATTERY. USE OF THESE PRODUCTS MAY DETERIORATE THE INTEGRITY OF METAL PARTS.

NOTE: The ( ) part identification numbers herein are IPL Figure 1 item numbers.

A. The following items are required for cleaning procedures (equivalent substitutes can be used):

- Stiff bristled brush (nonmetallic)
- Dry compressed air source, less than 1.38 bar (20 psi)
- Safety goggles
- Lubricant, non-acid petroleum jelly, M02
- Soft, clean cloth (two required)
- Running water
- Soap, M03
- Distilled or de-ionized water, M01

2. Light Cleaning

A. The following procedures are for an assembled battery with battery cover (020), hold down pad (030), and formed insulator (040) removed.

B. Using T01 make sure the vent valve (350) of each cell (260) is closed and secure. Do not over-tighten.

CAUTION: DO NOT USE A WIRE BRUSH TO CLEAN CELL TOPS. CELLS MAY BE DAMAGED.

C. Remove white deposits (potassium carbonate) from tops of all cell assemblies (260) using a stiff bristled nonmetallic brush.

WARNING: TO PREVENT INJURY WHEN USING COMPRESSED AIR, DIRECT STREAM AWAY FROM BODY. USE SAFETY GOGGLES TO PREVENT EYE INJURIES FROM FINE DUST PARTICLES.

D. Disperse residual dust and particles from the battery with blasts of clean, dry, compressed air not over 1.38 bar (20 psi).

E. Coat all cell nuts (340), (120), and intercell links (140 through 180) with a light film of M02.

CAUTION: SILICONE COATINGS ARE NOT SUITABLE DUE TO THE ALKALINE ELECTROLYTE.

F. Clean the exterior surfaces of the battery cover (020) and battery case (010) using a soft, clean cloth, moistened with water. Dry with compressed air or a dry, clean cloth.

3. Thorough Cleaning

A. The battery must be discharged (refer to Initial discharge and Cell shorting) and disassembled (refer DISASSEMBLY).

B. Remove greasy residue from power connector (090) with warm soapy M03 water.

C. After ensuring that the vent valves (350) are closed, wash each cell (260) in running water. Do not allow any water to enter the cell. Dry with compressed air or a dry, clean cloth.

D. Wash the battery case (010), cover (020), cover insulator (040), spacers (050) & (070), thermostat plate (060), gasket (130), and cell hardware (280) through (340), and (120) in warm soapy M03 water to remove dirt and salt deposits. A plastic scraper or a stiff bristled brush (nonmetallic) may be used to aid in the removal of heavy deposits. Rinse away M03, and thoroughly dry with compressed air or a dry, clean cloth.

CHECK

1. General

This section contains battery inspection information. The procedures are written in step-by-step formats that follow the process flow outlined in Figure 1001.

NOTE: All voltage readings are DC unless otherwise stated.

NOTE: All ( ) part identification numbers herein are IPL Figure 1 item numbers.

2. Initial New Battery Commissioning

A. Before the initial charge, thoroughly inspect the battery assembly to ensure no damage has occurred during shipping or storage as follows:

NOTE: For a new battery not receiving its initial commission within one year of its DOM, then battery must follow Figure 1001

(1) Inspect the battery case (010) and cover (020) for dents, distortion, or other damage. Straighten with a small rubber mallet if necessary.

(2) Remove the battery cover (020), pad (030) and formed insulator (040).

(3) Visually confirm the power connector (090) is present and undamaged.

(4) Visually confirm all cells (260) are positioned for proper polarity per Figure 7002.

(5) Visually confirm all cells (260) are equipped with a vent valve (350).

(6) Torque all upper cell nuts (340) and connector nuts (120) per Table 8001.

(7) Visually confirm the sensor harness (190) is present and undamaged.

B. Charge the battery per Charge on page 1007 and level electrolyte per Electrolyte leveling on page 1008.

C. Do successful Battery insulation test and install battery cover (020), pad (030) and formed insulator (040), then the battery is ready for service.

3. Component Inspection

A. Cell (260)

(1) Visually check for evidence of electrolyte leakage, cracks, corrosion, burns, holes, or cross-threaded terminals. Replace any defect cells with new Saft cells (260).

(2) Excessive salt around a terminal post indicates leakage. Refer to Cell hardware replacement on page 6002 for replacement of lower terminal O-ring (270) if leakage is evident.

(3) Visually check each cell vent valve (350) for defective O-rings (360), cracks, or other physical damage. Replace defective O-rings (360).

(a) Suspect vent valves should be tested in accordance with Vent valve tests on page 1007 and/or be discarded, if necessary.

(4) Inspect the thermostat plate (060), nuts (320), and washers (300 or 310), (290), (280) to ensure it is free of bends, tarnish, corrosion, burns, or loss of plating. Minor tarnish can be polished off with a fine wire brush. Refer to Cell hardware replacement.

B. Inspect the nuts (120), (340) and washers (110), (330) to ensure it is free of bends, tarnish, corrosion, burns, or loss of plating. Minor tarnish can be polished off with a fine wire brush. Defective hardware should be replaced.

C. Intercell terminal links (140 through 180)

Inspect for bends, tarnish, loss of nickel plating, corrosion, or burns. Tarnish can be polished off with a fine wire brush. Replace any defective intercell links.

D. Spacers (050), (070)

Inspect for contamination and free of cracks or holes. Replace any that are defective.

E. Power connector (090)

CAUTION: A DEFECTIVE POWER CONNECTOR CAN CAUSE DANGEROUS OVERHEATING AND IN-SERVICE LOW VOLTAGE DURING DISCHARGE.

(1) Check the power connector (090) for evidence of arching, corrosion, cracks, or cross threaded terminals.

(2) Using the same methods in Battery insulation check on page 1004, check the insulation between the positive pin and the connector shell and the negative pin and connector shell.

(3) Discard any connector that is found to have any damage or fails the insulation test and replace with new Saft battery power connector (090).

F. Sensor harness (190)

(1) Inspect electrical connector for bent or loose pins, corrosion, cracks, faulty wire connections, and evidence of arcing.

(2) Visually check all wiring damage to insulation, cracked or broken wire, and other physical defects

(3) Inspect charge control thermistor and thermostat for damage, loose or broken wire connections, cracks, dents, or other physical defects.

(4) Any evidence of the above conditions, however minor, is grounds for rejection. Discard the damaged unit and replace with factory new.

NOTE: Sensor harness (190) is a non-repairable item and should be replaced if defective.

G. Battery cover (020) and case (010)

Inspect the components for minor for damage. For minor damage refer to Battery cover and case minor dents, otherwise replace with new Saft components, cover (020) and case (010).

REPAIR

1. General

This section contains basic battery component procedures for removing and replacing components.

NOTE: The ( ) part identification numbers herein are IPL Figure 1 item numbers.

NOTE: All voltage readings are DC unless otherwise stated.

2. Required Test Equipment)

NOTE: Test equipment with equivalent specifications can be used.

Refer to Special Tools, Fixtures, Equipment, and Consumables for listing of Standard Tools.

3. Component Replacement

A. Cell replacement (260)

A battery containing cell(s) (260) require replacement. Note the All cell replacement recommendation below.

(1) All cell replacement

(a) For a battery compliant with the following, it is best to assume that all the original cells are or soon will be in unsatisfactory condition. Saft strongly recommends all cells (260) should be replaced with new Saft cells for a battery having:

1 3 or more cells are replaced during the same maintenance interval.

Or

2 1 or more cells are found to be faulty due to low capacity during this maintenance period and 5 of the original cells in the battery have been previously replaced due to low capacity.

NOTE: The recommendation does not apply to the following failures: terminal thread damage, cell leakage, or cell short-circuit

(2) Procedure

(a) Discharge the battery completely by doing a Cell shorting.

(b) Remove the necessary hardware; upper nuts (340), connector nuts (120), washers (330), (110), and intercell connecting links (140 through 180) to remove the defective cell.

(c) Attach T04 to the cell's terminal and remove the cell (260) from the case using a steady upward pull.

(d) Insert a new Saft cell (260) into the case and push it downward on the cell terminals with a small block of soft wood, if necessary (refer All cell replacement)

NOTE: New cell must be discharged before installation.

(e) As needed attach intercell connecting links (140 through 180), washers (330), (110), and upper nuts (340), connector nuts (120), and torque nuts per Table 8001.

B. Lower nut torque

(1) Remove the necessary hardware; upper nuts (120), (340) and washers (110), (330) that attach the links (140 to 180) to confirm the torque per Table 8001 of the lower nut (320).

(2) Install the necessary hardware, links (140 to 180), washers (110), (330), and upper nuts (120), (340). Torque upper nuts (120), (340) per Table 8001.

C. Cell hardware (270) (280), (290), (300) or (310), (320) replacement

WARNING: USE CARE NOT TO TILT CELLS WHILE LOWER HARDWARE ARE LOOSENED OR REMOVED; CONTACT OF ELECTROLYTE WITH CAN CAUSE SEVERE BURNS.

NOTE: The battery should be discharged prior to starting cell hardware replacement.

(1) Replace necessary cell hardware (280), (290), (300) or (310), (320) by removing and replacing the nuts (120), (340), washers (110), (330), links (140 to 180). Torque nuts (120), (320), (340) per Table 8001 as required.

(2) Terminal O-ring (270) replacement

(a) Remove the necessary nuts (120), (340), washers (330), (110), and links (140 to 180).

(b) Remove lower terminal nut (320), the polarity washer (300) or (310), the washers (280), (290) and terminal O-ring (270) being careful to prevent anything from falling into the cell opening.

(c) Replace O-ring (270), install washer (280), 2 belleville washers (290), polarity washer (300) or (310). Torque lower terminal nut (320) per Table 8001.

NOTE: Spring washers (290) should be put in parallel, stacked in same direction with the larger edge downward on the terminal.

(d) Install the necessary links (140 to 180), washers (330), (110), and nuts (120), (340). Torque nuts (120), (340) per Table 8001 as required.

D. Link replacement (140 to 180)

(1) As needed remove the nuts (120), (340), and washers (110), (330) from the link

(2) Replace the link as required and then install the washers (110), (330) and nuts (120), (340). Torque the nuts (120), (340) per Table 8001.

E. Vent valve O-ring (360) replacement

WARNING: USE CARE NOT TO TILT CELLS WHILE VENT VALVES ARE OPEN OR REMOVED; CONTACT OF ELECTROLYTE WITH CAN CAUSE SEVERE BURNS.

(1) Using T01, loosen and remove the ¼ turn vent valve (350) from the cell (260).

(2) Remove and replace defective O-rings (360) from the vent valve (350).

(3) Using T01, tighten the vent valve (350) onto the cell (260)

F. Sensor harness (190) replacement

(1) Remove the applicable hardware; nuts (120), (340) and washers (110), (330) that attach the links (140 to 180) to allow the sensor harness to be removed.

NOTE: Cell 6 or 9 may need to be partially removed to remove the thermistor plate.

(2) Remove the power connector (090) and gasket (130) from the battery case (010) by removing screws (100).

(3) Remove the thermostat mounting nuts (080) from the thermostat plate (060).

(4) Remove the sensor harness connector mounting screws (250), nuts (080) and lift the sensor harness (190) out of the battery case (010).

(5) Insert the sensor harness (190) connector into its mounting hole on the case (010) and install and torque the connector mounting screws (250) and nuts (080) per Table 8001,

(6) Pass the thermostat-end of sensor harness (190) through the hole in the partition, liner, and spacer assembly.

(7) Attach the thermostat to the thermostat plate (060) with thermostat mounting nuts (080). Torque per Table 8001.

(8) Assemble the power connector gasket (130) to the power connector (090) and insert the terminals of power connector (090) through the oval mounting hole in the front of the battery case (010).

(9) Attach the power connector (090) from the battery case (010) by using the screws (100). Secure the power connector by torquing the screws (100) per Table 8001.

NOTE: Cell 6 or 9 may need to be partially removed to install the thermistor plate.

(10) Install the applicable hardware; nuts (120), (340), washers (110), (330), and intercell connecting links (140 to 180) back into the battery. Torque nuts (120), (340) per Table 8001.

G. Power connector (090) replacement.

(1) Remove nuts (120), (340), washers (110), (330), and links (150).

(2) Remove the power connector and gasket (130) from the battery case (010) by removing screws (100).

(3) Assemble power connector gasket (130) to new power connector (090).

(4) Insert terminals of power connector (090) through the oval mounting hole in the front of the battery case (010).

(5) Attach the power connector (090) to the battery case (010) with screws (100). Torque the screws (100) per Table 8001.

(6) Install links (150), washers (110), (330), and nuts (120), (340). Torque the nuts (120), (340) per Table 8001.

H. Battery cover and case (010) minor dents

When necessary, remove minor dents in the battery cover (020) and battery case (010) using a hard rubber mallet. Polish out minor pits or scratches using a fine grain abrasive porous cloth.

ASSEMBLY

1. General

   This section contains assembly instructions necessary after disassembly.

   NOTE: Make sure all components are clean and dry before re-assembly.

   NOTE: All ( ) part identification numbers herein are IPL Figure 1 item numbers.

2. Sensor harness (190)

   A. Insert the sensor harness (190) connector into its mounting hole on the case (010) and reinstall the connector mounting screws (250) and nuts (080) by torquing per Table 8001.

   B. Insert the thermostat liner (070) and thermostat liner assembly on the inside face of the center partition, taking care to align the holes in the liner with the hole in the partition.

   C. Insert the thermostat plate (060) in back of spacer assembly so that the spacer assembly is between the thermostat plate (060) and the thermostat liner (070), which is against the partition.

   D. Pass the thermostat-end of sensor harness (190) through the hole in the partition, liner, and spacer assembly.

   E. Attach the thermostat to the thermostat plate (060) with thermostat mounting nuts (080). Torque per Table 8001.

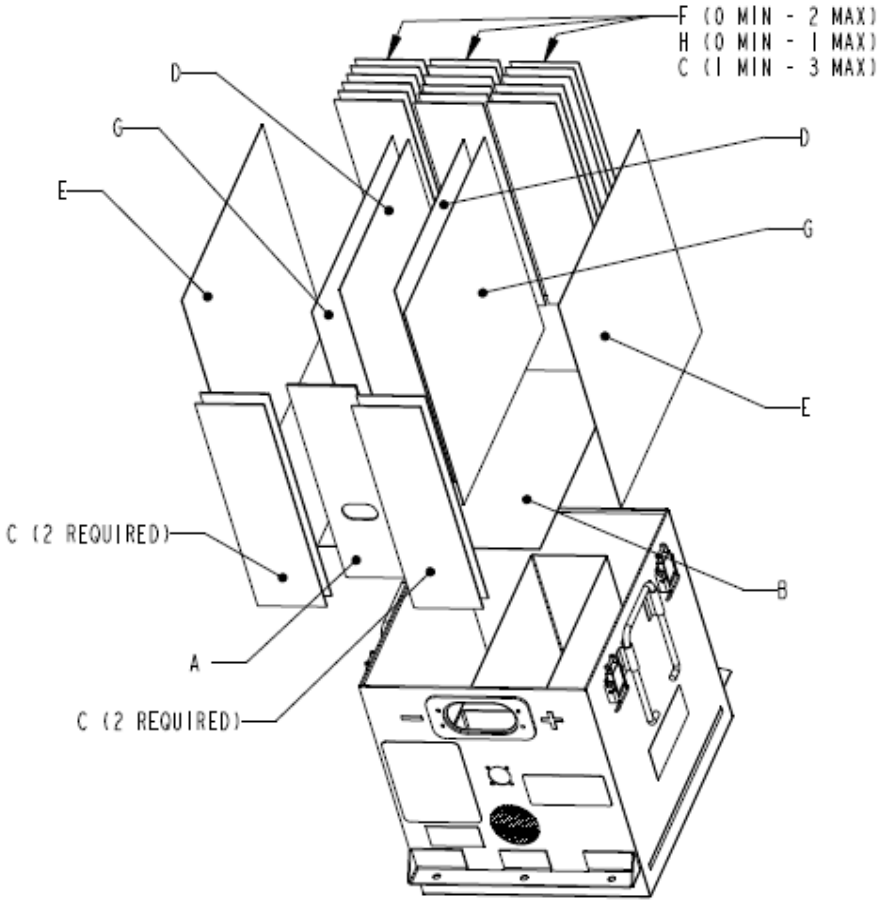
3. Spacers (050) and Cells 260)

   Install spacers (050), sensor harness (190), and cell assemblies (260) into the battery case (010), using the following steps. Refer to Figure 7001 and Figure 7002.

   A. Insert one edge of bottom spacer into battery case (010) from the left or right side, then slide the spacer under the cell partition.

   B. Install the center row spacers and cell subassemblies in accordance with the following steps:

   HINT: It is often easier to install the center cell of a row last.



ITEM	DESCRIPTION	DIMENSION [IN]	MAX. UNIT PER ASSEMBLY
A or (070)	Spacer assembly, Thermostat	9.86 x 2.95	1
B	SPACER	9.52 x 10.72 x 0.032	1
C	SPACER	2.953 x 10.373 x 0.062	13
D	SPACER	9.108 x 9.861 x 0.032	2
E	SPACER	10.629 x 10.373 x 0.032	2
F	SPACER	2.953 x 10.373 x 0.032	6
G	SPACER	10.629 x 9.861 x 0.020	2
H	SPACER	2.953 x 10.373 x 0.020	3

Cell and Spacer Installation
Figure 7001

(1) Install spacers in place on inside of cell partition as shown in Figure 7001.

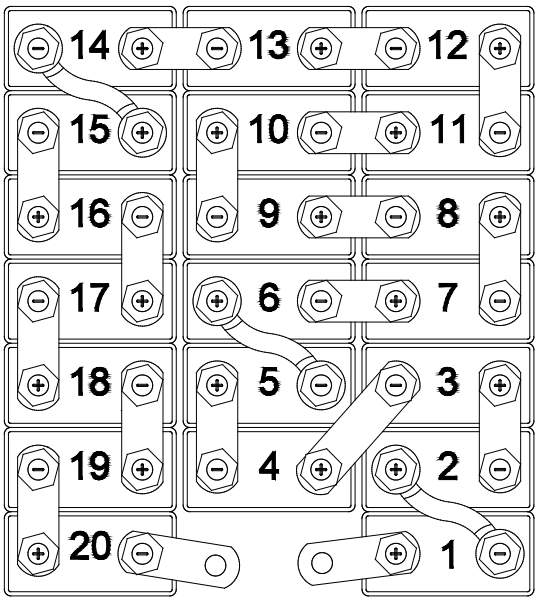
(2) Apply a small amount of M02 to the threads of the cell terminals.

(3) Install side and end spacers into the center partition of battery case as shown in Figure 7001.

(4) Install five cell subassemblies (260) into positions 4, 5, 6, 9, and 10 in the center partition of battery case (010). Be sure to maintain the proper cell arrangement and polarity orientation (see Figure 7002). Install the charge control thermistor plate between cells 6 and 9, as shown in Figure 7002.

(5) Install a cell assembly (260) into position 13 in the center partition of the battery case. Insertion of the last cells is sometimes difficult and can be assisted by pushing down on the terminals with a small block of soft wood.

NOTE: Spacers (050) are used as required to ensure the center row cells are retained securely in place to prevent free movement of the cells. As indicated in Figure 7001, the maximum quantity to be used is as shown.



Cell Number and Polarity Orientation
Figure 7002

C. Install the left and right side row of cells and spacers in accordance with the following steps, and as shown (see Figure 7001).

(1) Install spacers into the battery case (010) as shown in Figure 7001.

(2) Install the left and right end spacers into the battery case (010), as shown in Figure 7001.

(3) Install six cell assemblies (260) in the left hand side of the battery case, be sure to maintain the proper cell arrangement and polarity orientation (see Figure 7002).

(4) Install the remaining row cell assemblies (260) into the battery case. Be sure to maintain the proper cell arrangement and polarity orientation (see Figure 7002). Insertion of the last cell on each side is sometimes difficult and can be assisted by pushing down on the terminals with a small block of soft wood.

NOTE: Spacers are used as required to ensure the left and right hand row of cells are retained securely in place to prevent free movement of the cells. The maximum quantity to be used is shown in Figure 7001.

(5) Torque the lower terminals nuts (320) of the cell assemblies (260) per Table 8001.

4. Power connector (090)

Install power connector (090) into the battery case (010) follows:

A. Assemble power connector gasket (130) to power connector (090).

B. Insert terminals of power connector (090) through the oval mounting hole in the front of the battery case (010).

C. Attach the power connector (090) to the battery case (010) with screws (100). Secure the power connector (090) by torquing the screws (100) per Table 8001.

5. Complete Battery

A. Install intercell terminal links (140 through 180) on the terminals of the cell sub-assemblies (260) and power connector (090) as shown in Figure 7002.

B. Install the two wire lead/lug assemblies of the sensor harness (190) on the terminal posts of the cell sub-assemblies (260) as shown in Figure 7001.

C. Install nuts (340), (120) and washers (330), (110) onto the terminals of the cell assemblies (260) and terminals of the power connector (090). Torque nuts (340), (120) per Table 8001.

D. Lightly lube with M02 the nuts, links, connector contact and all components that might be susceptible to atmospheric corrosion

CAUTION: DO NOT CRIMP WIRE OF THE SENSOR HARNESS.

E. Install formed insulator (040) on top of the cells as shown in IPL Figure 1.

F. Install the hold down pad (030) onto the cell assemblies, being sure that each vent hole mates properly with the cell assembly vent valve.

G. Install the battery cover (020) onto the battery case (010) and secure in place by fastening the latches.

FITS AND CLEARANCES

1. Torque Table

IPL FIGURE	ITEM NUMBER	TORQUE VALUE		NAME, LOCATION
		Nm	lb_f-in	
1	340, 120	13.0 ± 1.0	115 ± 9	Nut, Terminal, Upper
1	320	5.0 ± 0.5	44 ± 4	Nut, Terminal, Lower
1	250	0.8 ± 0.1	7 ± 1	Screw, Connector Mounting
1	100	2.3 ± 0.2	20 ± 2	Screw, Sems
1	80	0.8 ± 0.1	7 ± 1	Nut Aux. Connector Mounting

Torque Values
Table 8001

2. Fits and Clearances Table

No fits and clearances required.

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SPECIAL TOOLS, FIXTURES, EQUIPMENT, AND CONSUMABLES

1. Special Tools

A. Battery maintenance kit

NOTE: Equivalent tools can be used.

NOTE: A special tool kit (P/N 416161) is available from Saft containing special tools T01, T02, T03, and T04. The tools are housed in a polypropylene box and each tool is insulated to ensure optimum safety for the technician.

(1) The T02 (syringe) is used in the electrolyte level adjustment and the T04 (cell puller) is used in cell removal.

ITEM	DESCRIPTION	V09052 P/N	F6177 P/N
T01	Universal vent wrench	093365-000	413876
T02	Syringe assembly (with nozzle 20 mm (0.79 in))	020916-001	416232
T03	1 Ω 3 W equalizing resistors	-	164829
T04	Universal cell extraction tool or M10x1.25 tool	017556-000	416159
T05	Vent Valve adapter for MS valves	024398-000	-

Special Tools
Table 9001

2. Standard Tools

A. The following items are recommended to do the procedures described in this manual. When necessary equivalent substitutes may be used.

- Constant current charger (DC current range 0 – 60A, minimum open DC voltage 40V)
- Constant current load bank (DC current range 0 – 60 A, DC voltage range 1 – 40V)
- Megohmmeter (0 – 50 MΩ @ 250 V DC continuous)
- Precision Multimeter (Volt, Ω, mA) 2000 count, accuracy 1% or better
- Torque Wrench (Fully insulated) 0 – 15 Nm (0 – 133 lb_f-in)
- Thermometer, Immersion
- Standard mechanic's tools.
- Safety gloves.
- Protective goggles.
- Safety shoes.
- Eye wash.
- Protective apron.
- Stiff bristle brush (non-metallic)
- Small paintbrush (non-metallic)
- Dry, compressed air source [less than 1.4 bar (20 psi)]
- Soft, clean cloth (at least two required)

3. Consumables

This paragraph describes the consumables used in the CMM.

NOTE: Equivalent alternatives can be used for list items.

ITEM	DESIGNATION PART NUMBER AND SPECIFICATION DESCRIPTION	MANUFACTURER OR SUPPLIER (NAME, ADDRESS, CODE)
M01	Distilled or deionized water @ +20°C ± 5°C (68°F ± 9°C): Clear, colorless, and odorless while boiling Conductivity < 33 µS/cm 5 < pH < 7 Mn-COD < 30 mg/l (1.7 x 10^{-5} oz/in^3) (Chemical Oxygen Demand, methodology to evaluate organic or mineral pollution) Chlorines Cl^- < 5 mg/l (2.9 x 10^{-6} oz/in^3) Sulfates SO_4^{2-} < 10 mg/l (5.8 x 10^{-6} oz/in^3) STORAGE: dry and clean container without any corrosion and damage; Temperature: 20°C ± 5°C (68°F ± 9°C). Over 1 year of storage, do an analysis of the liquid.	Local Vendor
M02	Neutral petroleum jelly Density @ +60°C (+140°F) Range = 0.840 - 0.866 kg/l (0.486 – 0.501 oz/in^3) Melting Point Range = +46°C to +52°C (+115°F to +126°F) Acidity/Alkalinity = Neutral to Litmus	Mineral Vaseline NATO: S 743 F: AIR 3565 US: VV-P-236/A UK: DEF 2333
M03	Soap	Local Vendor

Consumables
Table 9002

ILLUSTRATED PARTS LIST

1. Introduction

A. Purpose

(1) This section provides illustrations and parts breakdown of the 539CH2 batteries, which can be disassembled, replaced, and reassembled.

B. Explanation and usage of section

(1) Assembly order indenture system

The Indenture System used in the parts list shows the relationship of one part to another. For a given item, the number of indentures depicts the relationship of the item to the associated next higher assembly.

(2) Effectively code

Reference letters (A, B, C, etc.) are assigned in the EFF CODE column to each top assembly. The reference letter of the applicable top assembly is also shown in the EFF CODE column for each detail part and subassembly except that no reference letter is shown for detail parts and subassemblies used on all top assemblies.

(3) Quantity per assembly

The UNITS PER ASSY column shows the total number of units required per assembly, per subassembly, and per sub-subassembly as applicable. The letters REF indicates the item is listed for reference purposes.

(4) Parts replacement data

Interchangeability information will be provided in a future manual revision if it becomes applicable.

(5) Service Bulletin incorporation

Service Bulletin incorporation information applicable to the parts list will be provided in a future manual revision if it becomes applicable.

(6) Items not illustrated

Items not illustrated are indicated by a dash (-) ahead of the item numbers in the Figure and Index column.

(7) Alpha variant item numbers

(a) Alpha variants A - Z (except I and O) are assigned to existing item numbers when necessary to show:

1 Added items

2 Service Bulletin modifications

3 Configuration differences

4 Optional parts

5 Product improvement parts (non-service bulletin)

(b) Alpha variant item numbers are not shown on the exploded view when the appearance and location of the alpha variant item is the same as the basic item.

(8) Vendors

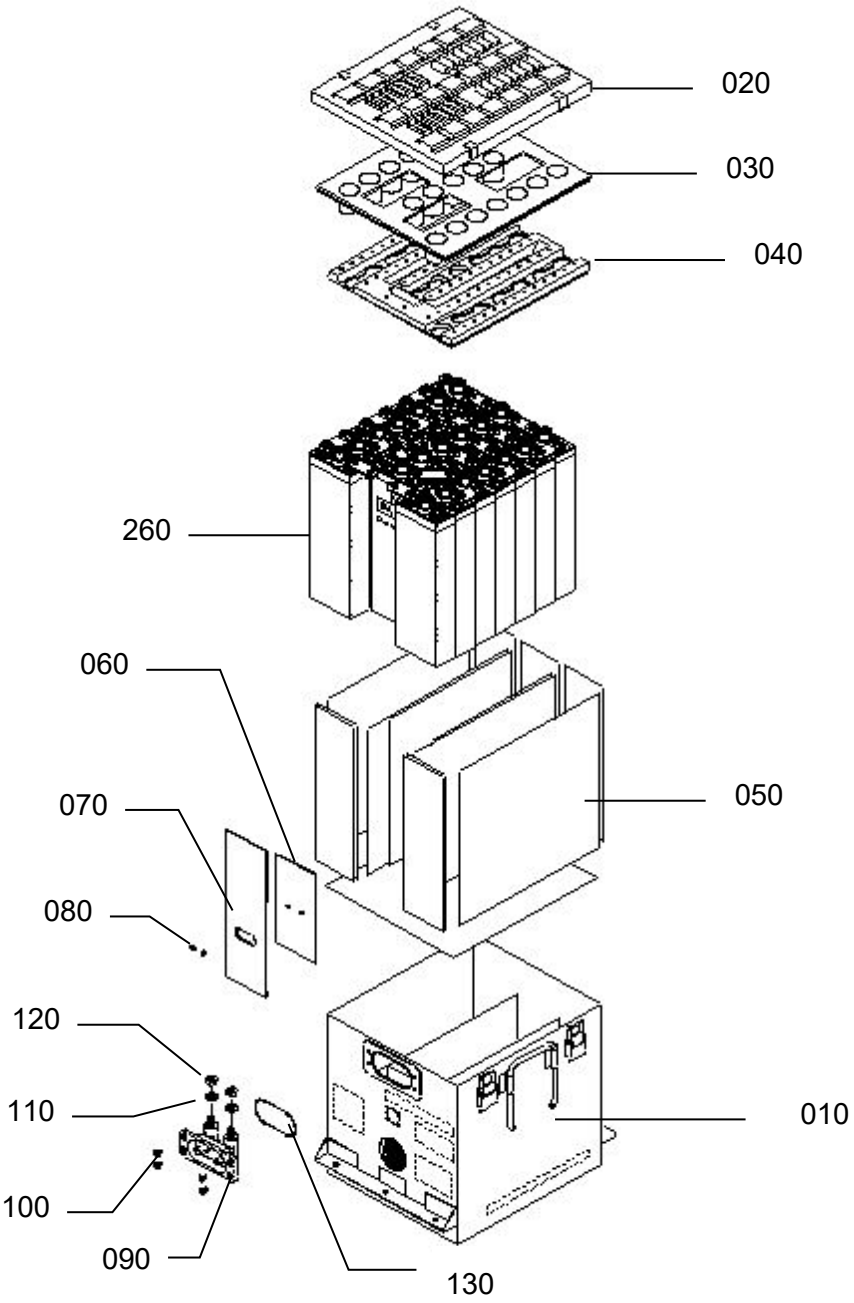
The vendor of all parts shown in the parts list is as follows:

Vendor Code	NAME / ADDRESS	Vendor Code	NAME / ADDRESS
V09052	Saft America Inc. 711 Gil Harbin Industrial Boulevard Valdosta, GA 31601 USA Phone: +1 (229) 247-2331 Fax: +1 (229) 247-8486	**F6177**	Saft 126 quai Charles Pasqua 92300 Levallois-Perret France Phone: +33 1 58 63 16 00 Fax: +33 1 58 63 16 18

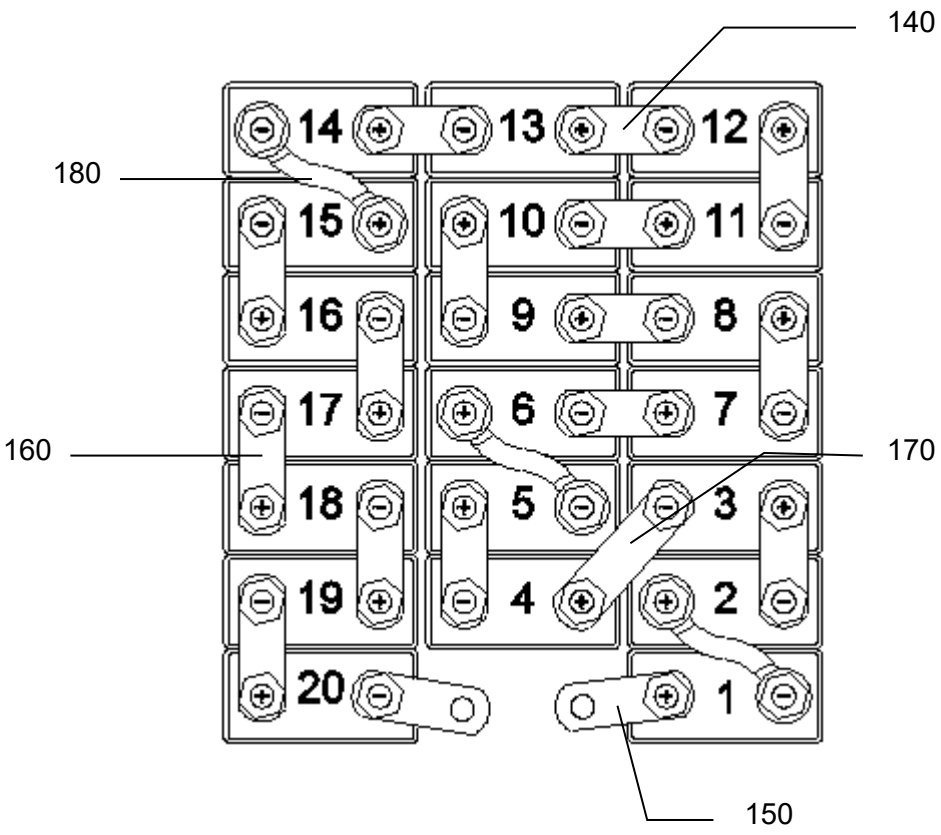
http://www.saftbatteries.com

2. Numeric Index

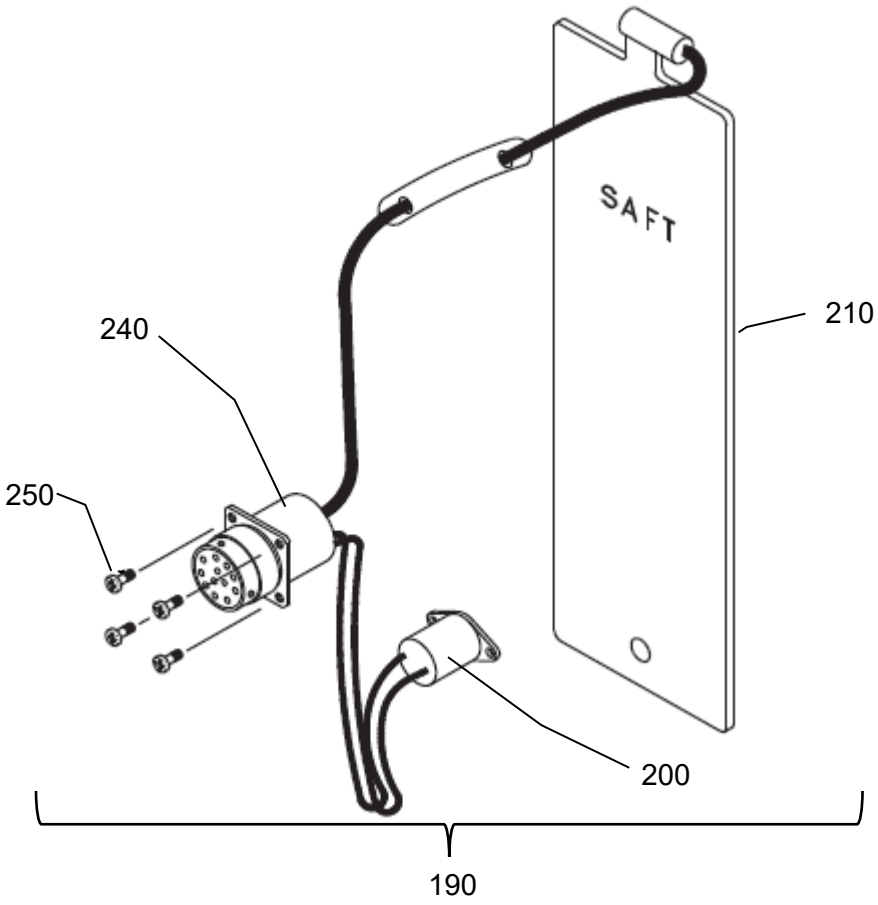
PART NUMBER	AIRLINE STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER	UNIT	UNITS PER ASSY
MS21083-CO4 (V09052 090064-000)			80	EA	6
009384-000			130	EA	1
012536-002			360	EA	20
015575-000			140	EA	5
015579-000			120, 320, 340	EA	82
018552-003			20	EA	1
018559-000			40	EA	1
018567-000			160	EA	10
018568-000			170	EA	1
018569-000			180	EA	3
018733-000			70	EA	1
018737-000			60	EA	1
018740-000			190	EA	1
018951-000			50	EA	1
021870-000			280	EA	40
021871-000			290	EA	80
022078-000			90	EA	1
022228-000			110, 330	EA	42
023388-002			310	EA	20
023388-001			300	EA	20
023619-000			350	EA	20
024142-000			30	EA	1
024190-000			10	EA	1
024257-000			260	EA	20
025902-000			10A	EA	1
025920-000			1A		RF
025962-000		1	1		RF
026705-000 REPLS 015577-000			150	EA	2
091181-002			270	EA	40
092178-008			250	EA	4
093616-000			100	EA	4



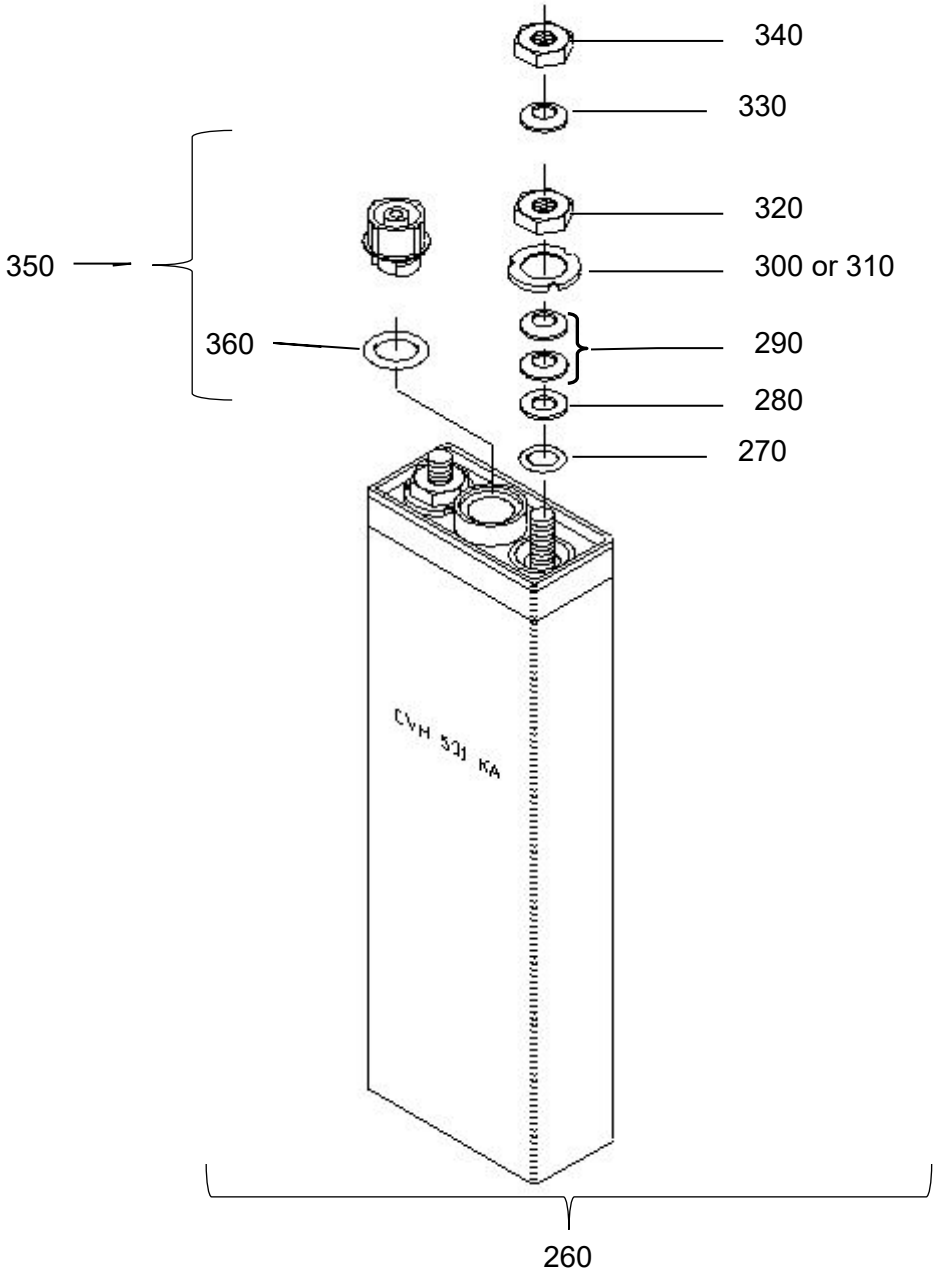
Battery, Exploded View
Figure 1 (#1 of 4)



Battery, Exploded View
Figure 1 (#2 of 4)



Battery, Exploded View
Figure 1 (#3 of 4)



Battery, Exploded View
Figure 1 (#4 of 4)

3. Detail Parts List

FIGURE & ITEM NUMBER	PART NUMBER	AIRLINE PART NO.	NOMENCLATURE 1234567	EFF CODE	UNITS PER ASSY
1 - 1	025962-000		**BATTERY, 539CH2**		RF
010	025963-000		. Case, Marked		1
020	018552-003		. Cover		1
030	024142-000		. Pad, Hold Down		1
040	018559-000		. Insulator, Formed Top		1
050	018951-000		. Kit, Spacer		1
060	018737-000		. Plate, Thermostat		1
070	018733-000		. Spacer, Thermostat		1
080	MS21083-CO4		. Nut, Connector Mounting (V09052 P/N 090064-000)		6
090	022078-000		. Connector, Power		1
100	093616-000		. Screw, Sems		4
110	022228-000		. Washer, Belleville		2
120	015579-000		. Nut, Connector		2
130	009384-000		. Gasket, Connector		1
140	015575-000		. Link, Intercell - 0.125 X 0.750 X 1.334		5
150	026705-000		. Link, Intercell - 0.125 X 0.750 X 1.516 REPLS 015577-000		2
160	018567-000		. Link, Intercell - 0.125 X 0.750 X 1.476		10
170	018568-000		. Link, Intercell - 0.125 X 0.750 X 2.023		1
180	018569-000		. Link, Intercell - 0.118 X 0.668 X 2.331		3
190	018740-000		. Harness, Sensor		1
200	N/A		. . Thermostat, Temperature Sensing NP		
210	N/A		. . Thermistor/Plate Assy NP		
240	N/A		. . Connector, Sensor Harness NP		
250	092178-008		. . Screw, Connector		4
260	024257-000		. Cell, CVH531KA (with hardware)		20
270	091181-002		. . O-Ring		2
280	021870-000		. . Washer, Flat		2
290	021871-000		. . Washer, Belleville		4
300	023388-001		. . Washer, Polarity, Red (+)		1
310	023388-002		. . Washer, Polarity, Blue (-)		1
320	015579-000		. . Nut, Lower		2
330	022228-000		. . Washer, Belleville		2
340	015579-000		. . Nut, Upper		2
350	023619-000		. . Valve, Vent		1
360	012536-002		. . . O-Ring		1

STORAGE (INCLUDING TRANSPORTATION)

1. Introduction

   A. Storage preparation and packaging makes sure that the equipment is protected against any attack by atmospheric agents.

   B. For a battery which has been cleaned and serviced and is not directly put into service on board an aircraft, different methods can be recommended depending on the purpose and the environment conditions of the "storage".

   C. Keep the batteries and spares in a dry and clean room.

2. Inactive Long-Term Storage

   A. Procedure

      (1) The battery should be stored filled and discharged. It is not necessary that it be short circuited. There is no need of maintenance operation during the storage period.

      NOTE: The standard cardboard packaging is considered unsealed and allows 2 years of storage. Storage is allowed for 10 years if the following conditions are met: sealed packaging and isolated from harmful agents (i.e.: dirt, dust, vibrations, or corrosive atmosphere).

      - sealed packaging,
      - temperature: +5°C to +35°C (+41°F to +95°F),
      - humidity < 90 %,
      - normal vertical position,
      - Isolated from detrimental agents: i.e., dirt, dust, dampness, vibration, corrosive atmosphere.

      (2) Saft Ni-Cd batteries may be stored in temperatures ranging from -55°C to +5°C or +35°C to +60°C (-67°F to +41°F or +95°F to +140°F) for an accumulated exposure that does not exceed 30 days.

      (3) Lead batteries must not be stored in the same room.

   B. Servicing at end of long-term storage

STORAGE TIME	SERVICE PROCEDURE
Less than or equal to 12 months	Battery must have passed the capacity criteria of Table 1005 before entering storage Visual Inspection, Figure 1001 Entry Point “C”
More than 12 months	Figure 1001 Entry Point “Received”

Return to Service Following Storage
Table 15001

3. Inactive Standby Storage

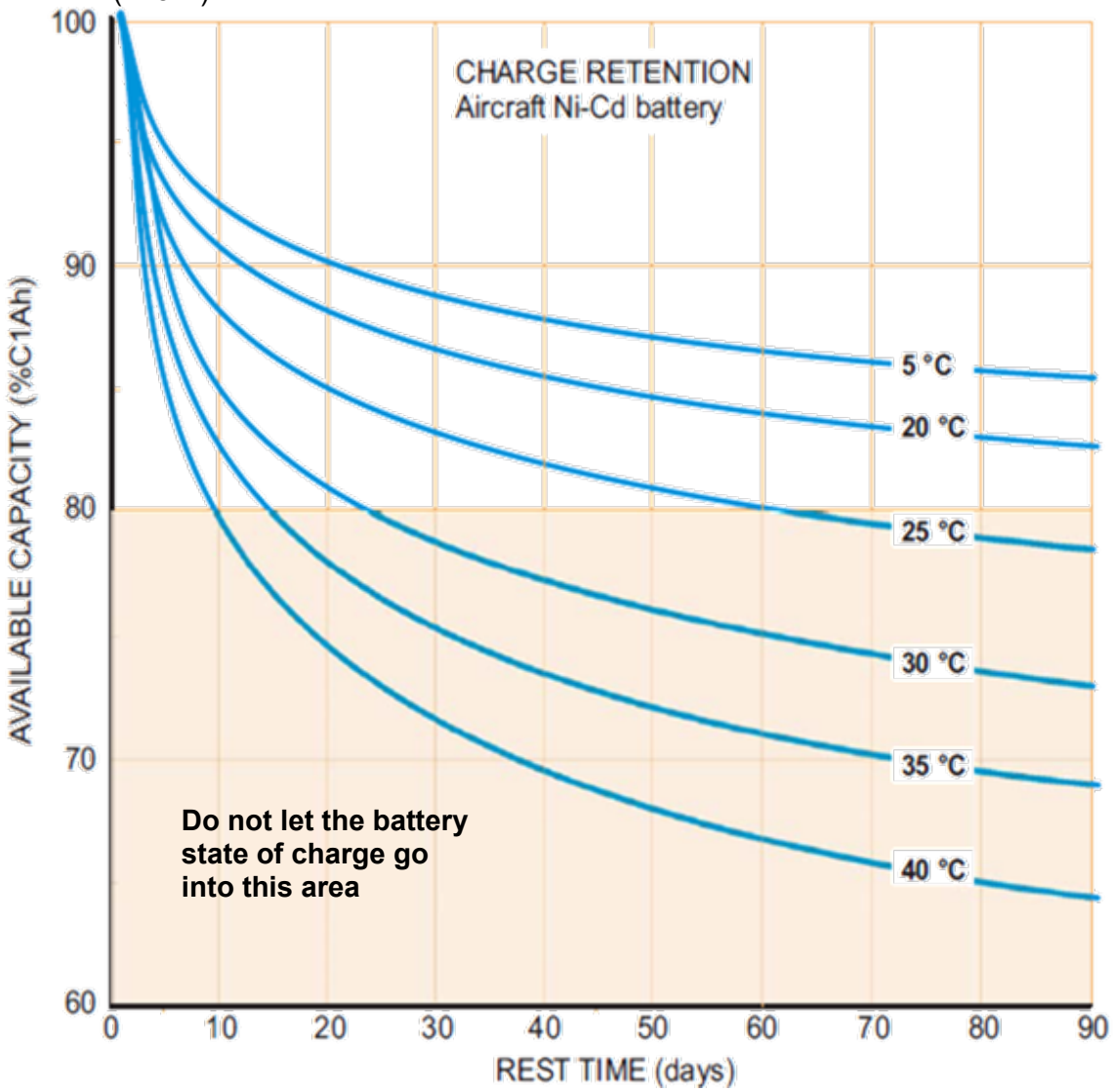
The battery is charged after being serviced then stored fully charged in a dedicated room in such a way that it can be installed in the aircraft without further maintenance except as provided within this section. Refer to Figure 15002.

NOTE: At any time during the inactive standby storage shown in Figure 15002, the battery may be installed on the aircraft or placed into Inactive Long-Term Storage.

NOTE: For a battery previously stored at a temperature below ambient temperature, condensation within the battery may occur, do Battery insulation before installation.

A. Standby period is the rest time that corresponds to 80% available capacity shown in Figure 15001, example, 24 days at +30°C (+86°F).

NOTE: The maximum time for the standby period is 90 days for temperatures ≤ +23°C (+73°F).



Standby Period
Figure 15001

B. Refresh charge is a quick constant current charge that can be done at the end of a Standby period to extend the time the battery is in inactive standby storage. The charge is given in the Table 15002.

CAUTION: DO NOT DO THE 4 HOURS FINAL CHARGE AT 0.1 C_1A (REFER TO CHARGE) DURING THIS 'REFRESH' CHARGE OPERATION.

CHARGE RATE	VOLTAGE (END OF "REFRESH" CHARGE)
0.1C_1A	30.0V for 20 Cells
0.5C_1A	31.0V for 20 Cells
1.0C_1A	31.4V for 20 Cells

Refresh Charge
Table 15002

C. Standby duration consists of a maximum of 3 standby periods with 2 refresh charges. The number of consecutive standby durations is limited to 3. Refer to Figure 15002.

(1) For a battery completing the first or second standby duration and not immediately installed in the aircraft or sent into long-term storage, do the one of the following:

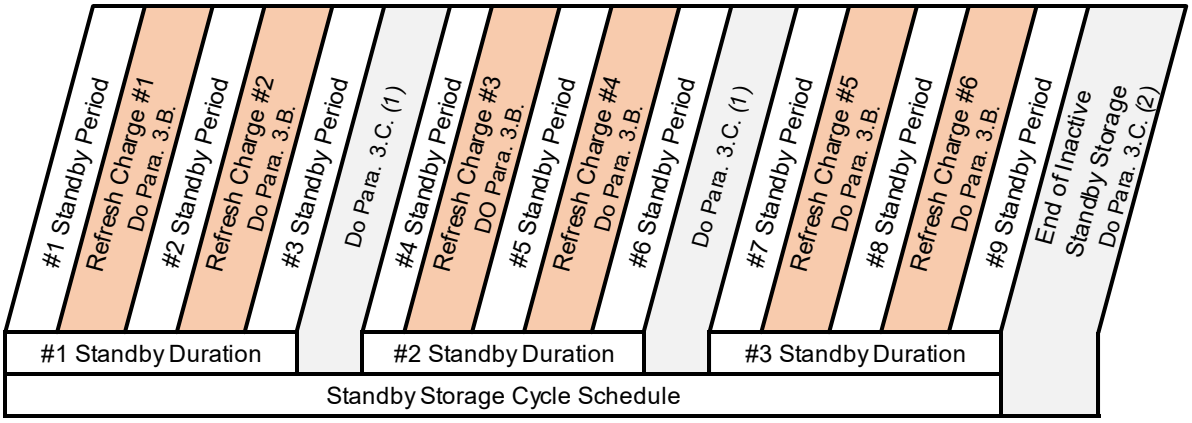
(a) For environments < +30°C (+86°F) do Battery insulation, Initial discharge, Charge, Electrolyte level, and Battery insulation.

(b) For environments > +30°C (+86°F) do Battery insulation, Initial discharge, Cell shorting, Charge, Electrolyte level, and Battery insulation.

(2) For a battery completing the third consecutive standby durations, the battery can go into Inactive Long-Term Storage) or return to Figure 1001.

D. Inactive standby storage schedule is limited to the Standby duration being conducted a maximum of 3 times as shown in Figure 15002.

NOTE: At any time during this inactive standby storage schedule shown in Figure 15002, the battery may be installed on the aircraft or placed into Inactive Long-Term Storage.



Inactive Standby Storage Schedule
Figure 15002

4. Active Standby Mode (Trickle Charge)

CAUTION: WATER CONSUMPTION OCCURS WHEN THE BATTERY IS CONTINUOUSLY CHARGED, IN AN OVERCHARGE CONDITION. SAFT DOES NOT RECOMMEND THIS METHOD, HOWEVER SOME OPERATORS TAKE RESPONSIBILITY FOR ITS USE.

NOTE: This method is not reliable due to quantity and inaccuracy of water consumption.

Example: A 40 Ah battery on a continuous trickle charge of 3 mA/Ah for one month may consume over 35 cm^3/cell (2.14 in^3/cell) of water.

5. Transportation procedure

The battery is normally discharged before packing. If it is necessary to transport a charged battery, make sure that the output terminals are protected against short circuit.

The battery should then be packed vertically in its original container. If the original container is not available, the international and/or local packaging regulations applicable to the mode of transport and destination must be followed.

According to the IATA / IMDG dangerous goods regulations, Saft ships all existing nickel cadmium batteries or cells for aircraft under the classification UN2795 (wet, filled with alkali) according to packaging instruction 800.