



**To:** HOLDERS OF COMPONENT MAINTENANCE MANUAL 24-31-07, 539CH-1 (Saft 024147-000) and 5319CH1 (Saft 025920-000)

**Subject:** CMM Revision No. 17 Dated Sep 2/2022

Replace revised pages by adding and removing pages for pages dated Sep 2/2022.

**NOTE:** The CMM can be downloaded from the internet at [www.saftbatteries.com](http://www.saftbatteries.com)

### HIGHLIGHTS

| <b>CHAPTER/SECTION<br/>PAGE NUMBER</b>     | <b>DESCRIPTION OF CHANGE</b>  |
|--|---|
| Title Page<br>T-1                          | Updated revision number   |
| Record of Revision<br>ROR 1                | Updated revision number and issue information                                       |
| Record of Temporary Revision<br>RTR 1      | Updated table heading   |
| Service Bulletin List<br>SBL 1             | Deleted paragraph   |
| List of Effective Pages<br>LEP 1           | Update revisions to applicable pages  |
| List of Illustrations<br>LOI 1             | Updated IPL figure information  |
| Introduction<br>Intro 2                    | Update CAGE code.   |
| Testing and Fault Isolation<br>1001        | Update IPL Figure link, update CAGE code.   |
| Testing and Fault Isolation<br>1006 - 1007 | Clarifications  |
| Testing and Fault Isolation<br>1008 - 1012 | Clarification and corrections   |
| Testing and Fault Isolation<br>1017        | Add case information  |
| Disassembly<br>3001                        | Update IPL Figure link, update CAGE code.   |
| Cleaning<br>4001                           | Update IPL Figure link  |
| Check<br>5001                              | Update IPL Figure link  |
| Repair<br>6001 - 6003                      | Update IPL Figure link and added information on nut installation, update CAGE code. |
| Assembly<br>7001, 7004                     | Update IPL Figure link, adding lube information                                     |

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| <b>CHAPTER/SECTION<br/>PAGE NUMBER</b>                               | <b>DESCRIPTION OF CHANGE</b>   |
|--|--|
| Special Tool, Fixtures, Equipment,<br>and Consumables<br>9001 - 9002 | Change range by using "to", update CAGE code.                          |
| Illustrated Parts List<br>10002, 10004 – 10006, 10008                | Update figure to include IPL text, update CAGE code.                   |
| Storage (Including Transportation)<br>15003– 15004                   | Corrected environmental parameters. Remove<br>obsolescent information. |

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# **COMPONENT MAINTENANCE MANUAL**

## **WITH**

### **ILLUSTRATED PARTS LIST**

## **Nickel Cadmium Aircraft Battery**

**SAFT Type No. 539CH-1**  
**SAFT Part No. 024147-000**  
**ELDEC Part No. BA35-01**  
**BOEING Part No. S282T003-1**

**SAFT Type No. 5319CH1**  
**SAFT Part No. 025920-000**  
**ELDEC Part No. BA35-02**  
**BOEING Part No. S282T003-4**

Website: [www.saftbatteries.com](http://www.saftbatteries.com)

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**RECORD OF REVISIONS**

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| 3       | 05/01/06    | 05/01/06    | Saft |         |            |             |    |
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**INTRODUCTION**

1. General

- A. This manual is written to the ATA Specification 100 and in ASD Simplified Technical 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](http://www.saftbatteries.com) or at one of the following addresses:

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COMPONENT MAINTENANCE MANUAL  
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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](#)) WITH [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](http://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.

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- (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

Saft batteries are shipped discharged. 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



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You can find the nearest recycling collection point on our website at [www.saftbatteries.com](http://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  |
| ASD   | AeroSpace and Defence Industries Association of Europe |
| 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                 |
| IEC   | International Electrotechnical Commission              |
| IPL   | Illustrated Parts List                                 |
| MTBF  | Mean Time Between Failure                              |
| MTBUR | Mean Time Between Unscheduled Removal                  |
| P/N   | Part Number  |
| RTCA  | Radio Technical Commission for Aeronautics             |
| V     | Volt   |

Verification:

|                           |         |
|---------------------------|---------|
| Testing / Fault Isolation | 6/30/97 |
| Disassembly               | 6/30/97 |
| Assembly                  | 6/30/97 |

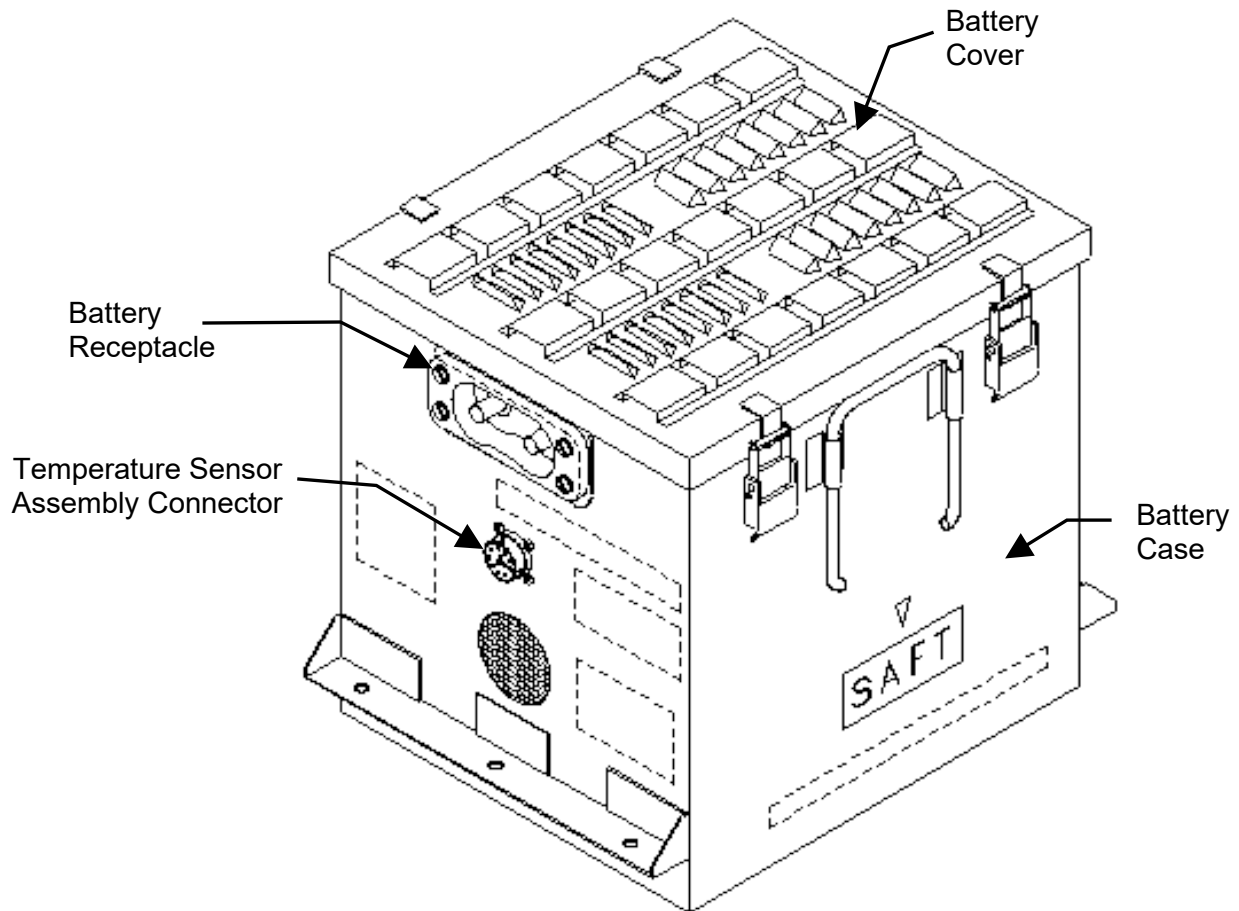
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## DESCRIPTION AND OPERATION

### 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



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| PARAMETER  | VALUES   |
|--|--|
| Voltage:<br>Nominal<br>Open Circuit Voltage (Fully charged)  | 24.0 Volts<br>26.0 Volts   |
| Weight   | 43.54 kg (96 pounds) maximum   |
| Dimensions (Maximum):<br>Height<br>Length (including side brackets)<br>Width (including handles)   | 289.56 mm (11.4 inches)<br>330.20 mm (13.0 inches)<br>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 <sub>1</sub> A Rate<br>0.5 C <sub>1</sub> A Rate<br>0.1 C <sub>1</sub> A Rate<br>Rated Capacity (C <sub>1</sub> )<br>End of Life Capacity | 53.0A<br>26.5A<br>5.3A<br>53 Ampere-hours at 1.0C <sub>1</sub> A<br>48 Ampere-hours at 1.0C <sub>1</sub> A |
| Maximum Consumable Water Reserve<br>per Cell   | 88 cm <sup>3</sup> (5.37 in <sup>3</sup> )   |
| Vent 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.

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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<sup>3</sup> (0.06 in<sup>3</sup>) 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. To determine the electrical performance more readily after aircraft removal, the battery may be floated 31V for 1.5 hours if the aircraft uses a dedicated charger or 28.5V for 1.5 hours if it floats on the aircraft bus before performing the Initial discharge (off-wing capacity) test.



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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.

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**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 1008](#), [Table 1009](#), or [Table 1010](#).

**NOTE:** The ( ) part identification numbers herein are [IPL Figure 1](#) item numbers.

**NOTE:** All voltage readings are DC unless otherwise stated.

2. Required and Materials

A. Equipment

**NOTE:** Equivalent equipment may be used.

| EQUIPMENT                              | MINIMUM EQUIPMENT SPECIFICATION |   | SOURCE OR CAGE CODE    | REPRESENTATIVE TYPE (MFG MODEL/CAGE)                |
|--|---------------------------------|---|------------------------|---|
|  | CHAR.                           | RANGE, ACCURACY, TOLERANCE                    |                        |   |
| Constant current charger               | -                               | 0 to 60A DC<br>40V DC Minimum                 | Commercially Available | Sorenson Power (DCR-40-70B)                         |
| Constant current source with load bank | -                               | 0 to 60A DC<br>1 to 40V DC                    | Commercially Available | Sorenson Power (DCR-40-70B) with Ohmite (L225J5ROE) |
| Megohmmeter                            | -                               | 0 to 50 M $\Omega$ @ 250 V continuous         | Commercially Available | Fluke (1507)  |
| Digital multimeter                     | -                               | 2000 count, accuracy 1% or better             | Commercially Available | Fluke (179)   |
| Climatic chamber                       | -                               | +15°C to +80°C<br>(+59°F to +176°F)           | Commercially Available | Cincinnati Sub-Zero (MCB-1.2-.33-H/AC)              |
| Torque wrench                          | Insulated                       | 0 to 15 N-m<br>(0 to 133 lb <sub>r</sub> -in) | Commercially Available | McMaster-Carr (7936A12)                             |
| Universal vent wrench                  | -                               | -   | 09052<br>F6177         | 093365-000 ( <a href="#">T01</a> )<br>413876        |
| Syringe assembly                       | -                               | -   | 09052<br>F6177         | 020915-004 ( <a href="#">T02</a> )<br>416231        |
| Equalizing resistors                   | -                               | 1 $\Omega$ 3 W                                | F6177                  | 164829 ( <a href="#">T03</a> )                      |
| Cell puller tool                       | -                               | -   | 09052<br>F6177         | 017556-000 ( <a href="#">T04</a> )<br>416159        |
| Vent valve adapter                     | -                               | -   | 09052                  | 025098-000 ( <a href="#">T05</a> )                  |

Equipment (Testing)  
Table 1001



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B. Materials

**NOTE:** Equivalent substitutes are permitted for all items except for those that become part of the configured unit. Equivalent substitutes are not allowed for items marked with a double asterisk (\*\*).

| NAME                           | SPECIFICATION OR PART NUMBER | SOURCE OR CAGE CODE    | USE              |
|--------------------------------|------------------------------|------------------------|------------------|
| Distilled or deionized water** | <a href="#">M01</a>          | Commercially Available | Water addition   |
| Neutral petroleum jelly        | <a href="#">M02</a>          | Commercially Available | Lubrication      |
| Cloth, soft, clean             | -                            | Commercially Available | Protect from FOD |

Materials (Testing)  
Table 1002

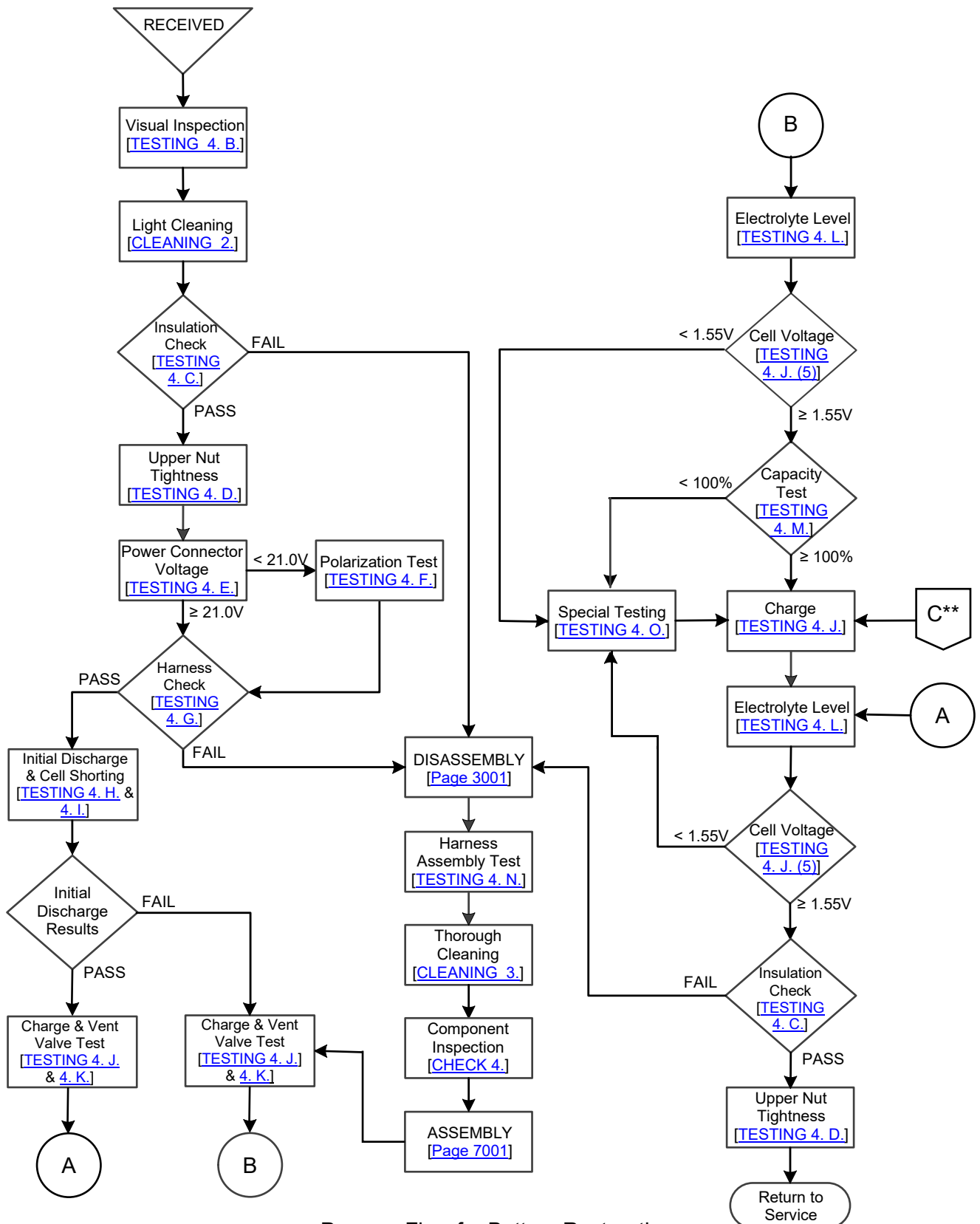
3. Maintenance Procedures

In addition to the checks specified for airborne or ground use, in normal service SAFT 539CH-1 or 5319CH1 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  
Figure 1001

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\*\*From [Table 15001](#)



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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. 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 after the battery has been received its initial discharge.

- (1) Visually inspect battery cover (20) for dents, distortion, or other damage and replace as needed with new Saft component.
- (2) Visually inspect hold-down pad (30) and formed insulator (40) for distortion and other damage, replace with new Saft component as needed.
- (3) Visually inspect battery case (10 or 10A) for dents, distortion, or other damage. If found, identify the component for replacement.
- (4) Visually inspect each cell (260) for any evidence of electrolyte leakage or damage.
  - (a) Damaged cells (260) must be identified 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](#)
- (5) Inspect the upper nuts (120), (340), washers (110), (330), and links (140 through 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.
- (6) Check all ventilation openings to make sure that they are clean and clear.
- (7) Inspect the power connector (90) pins for defects, evidence of arcing or excessive oxidization. If observed, identify the power connector (90) for later replacement with new Saft component.

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C. 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, record the value and 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 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 10M $\Omega$  under a 250V continuous using a megohmmeter.
- (b) If the reading does not meet the above criteria, record the value and the insulation is a "FAIL".

**NOTE:** If, after cleaning the battery and assuring that everything is dry, the resistance is still less than 10M $\Omega$ , one or more cells ([260](#)) is defective, isolate and identify for later replacement.

- (c) If the reading meets the above criteria ( $\geq 10$  M $\Omega$ ), record the value and the insulation test is a "PASS".

D. Upper nut tightness

Check the tightness on each upper terminal nut ([120](#)), ([340](#)) per [Table 8001](#).

E. Battery voltage

Measure and verify the voltage at the battery power connector ([90](#)) is greater than or equal to 21.0V.

F. Polarization test

- (1) Charge the battery at 0.1C<sub>1</sub> (5.3A) 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) Identify for replacement any cell ([260](#)) with zero volts or negative polarity. If any cell ([260](#)) is identified for replacement, the polarization test is a "FAIL".
  - (b) If all cells ([260](#)) are above zero volts, the polarization test is a "PASS".

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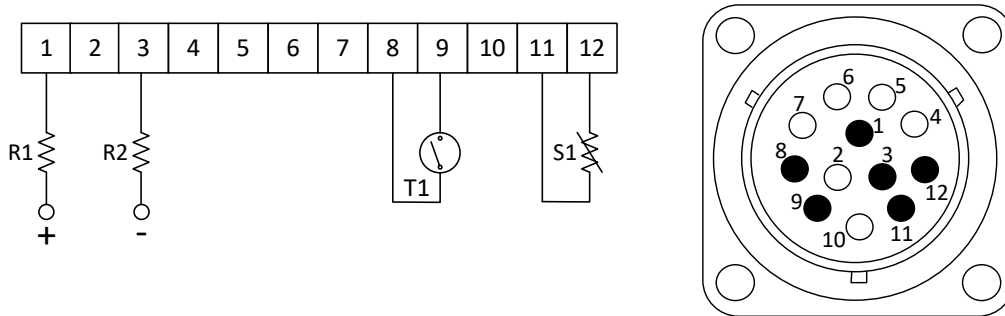
### G. Sensor harness check

**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

- (1) If any part of the sensor harness ([190](#)) is damaged, the entire assembly must be replaced after disassembly with a new Saft component.
- (2) Be sure the internal battery temperature is per [Table 1003](#), and then test with an ohmmeter to sensor connector ([240](#)) connector sensor harness ([190](#)). Any erratic readings represent a failure and the entire sensor harness ([190](#)) must be replaced with new Saft component, refer to [Sensor harness \(190\) replacement](#).

| ITEM                       | PINS  | VALUES<br>@ +22.8 ± 5°C (+73 ± 9°F) |
|----------------------------|---|-------------------------------------|
| R1                         | Positive lug ( <a href="#">230</a> ) to Pin 1 | 29.8KΩ (±10%)                       |
| R2                         | Negative lug ( <a href="#">220</a> ) to pin 3 | 32.4KΩ (±10%)                       |
| S1 ( <a href="#">210</a> ) | pins 11 to 12                                 | 1854Ω to 3116Ω                      |
| T1 ( <a href="#">200</a> ) | pins 8 and 9                                  | ≥ 20MΩ                              |

Sensor Harness Check Values  
Table 1003

### H. 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) Using [T01](#), verify the ¼ turn vent valve ([350](#)) is tightened on each cell ([260](#)).
- (2) Discharge the battery at a rate listed in [Table 1004](#) until the battery reaches 20.0V and record the times the first cell reaches 1.0V and battery reaches 20.0V.





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**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              |                | MINIMUM TIME FOR FIRST CELL TO 1.0V |
|------------------------|----------------|-------------------------------------|
| RATE (C <sub>1</sub> ) | CURRENT (AMPS) |                                     |
| 0.5                    | 26.5           | 122.0 MINUTES                       |
| 1.0                    | 53.0           | 60.0 MINUTES                        |

Initial Discharge (Off-wing Capacity)  
Table 1004

- (3) If defective items were found during the visual inspection or cells (260) identified for replacement, they are to be corrected here.
  - (a) If the case (10 or 10A) was identified for replacement, do [Case replacement](#).
  - (b) For each cell (260) identified for replacement, do [Cell replacement](#).
  - (c) For power connector (90) requiring replacement, do [Power connector replacement](#).
  - (d) Remove and replace as needed nuts (120), (340) and washers (110), (330) with new Saft components. Torque nuts (120), (340) per [Table 8001](#).
  - (e) Replace as needed links (140 to 180) using [Link replacement](#).
  - (f) For each cell (260) which had excessive salts around the terminals during visual inspection, then do [Lower nut tightness](#).
  - (g) If any cell hardware (270), (280), (290), (300) or (310), or (320) was identified as needing replacement, do [Cell hardware replacement](#).

(4) 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 1004](#) 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 1004](#) for the discharged rate, the battery capacity is a "FAIL".

I. Cell shorting

- (1) Using [T01](#), verify the ¼ turn 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 1004](#) 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.



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(b) Method B

- 1 Continue to discharge the battery per [Table 1004](#) 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 cells ([260](#)) are identified for replacement, then return to [Figure 1001](#) utilizing the PASS or FAIL results of the [Initial discharge](#).
- (5) If any cell ([260](#)) was identified for replacement, do [Cell replacement](#).

J. Charge

- (1) Allow the battery to cool to ambient temperature.
- (2) Remove the cover ([20](#)), pad ([30](#)) and formed insulator ([40](#)),
- (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 1005](#).
  - (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<sup>3</sup> (0.61 in<sup>3</sup>) 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](#).

| Charge Table                   |                  |  |                                   |
|--------------------------------|------------------|--|-----------------------------------|
| Main Charge (Step 1)           |                  |  | Final Charge (Step 2) **          |
| Current                        | Minimum* Time    | End of Main Charge Criteria                            | Current and Time                  |
| 0.1C <sub>1</sub> A<br>(5.3A)  | 9.5h<br>(570min) | Every cell >1.5V or 12h***<br>whichever comes first    | 0.1C <sub>1</sub> A (5.3A) for 4h |
| 0.5C <sub>1</sub> A<br>(26.5A) | 1.9h<br>(114min) | Every cell >1.55V or 2.5h***<br>whichever comes first  | 0.1C <sub>1</sub> A (5.3A) for 4h |
| 1.0C <sub>1</sub> A<br>(53.0A) | 0.95h<br>(57min) | Every cell >1.57V or 1.25h***<br>whichever comes first | 0.1C <sub>1</sub> A (5.3A) for 4h |

\* Minimum time applies to a battery previously discharged to at least 20.0V

\*\* During the last 30 minutes do [Electrolyte level](#) and confirm minimum voltage criteria in [Table 1006](#).

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

Charge Table  
Table 1005



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(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 1006](#). Identify each cell that does not comply.

| CELL VOLTAGE<br>(Last 30 minutes at 0.1C <sub>1</sub> A) |
|--|
| ≥ 1.55V  |

Final Charge Voltage Limit  
Table 1006

K. 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) Using [T01](#), install the ¼ turn vent valve (350) that contains O-ring (360) into the [T05](#) fixture.
- (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.

L. Electrolyte level

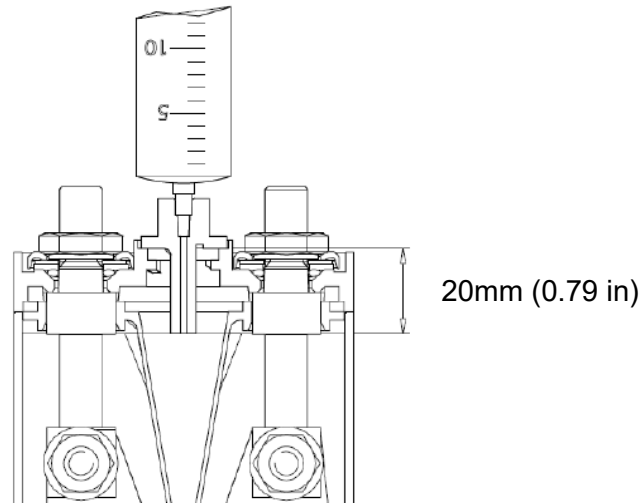
This procedure is to be carried out during the last 30 minutes of the final charge (Step 2) at 0.1C<sub>1</sub>A.

**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](#) IN NICKEL-CADMIUM CELLS WILL CAUSE ELECTROLYTE CONTAMINATION AND DAMAGE. DO NOT RE-USE WATER REMOVED FROM CELLS.

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- (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 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<sup>3</sup> (5.37 in<sup>3</sup>), 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<sup>3</sup> (0.31 in<sup>3</sup>) 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 total number of cm<sup>3</sup> added 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.
- (4) Using T01, tighten ¼ turn vent valve (350) on each cell (260).



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M. 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) Using [T01](#), verify the ¼ turn vent valve ([350](#)) is installed on each cell ([260](#)).
- (3) Discharge the battery at one of the current rates shown in [Table 1007](#) 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              |                | MINIMUM TIME FOR FIRST CELL TO 1.0V |
|------------------------|----------------|-------------------------------------|
| RATE (C <sub>1</sub> ) | CURRENT (AMPS) |                                     |
| 0.5                    | 26.5           | 113.7 MINUTES                       |
| 1.0                    | 53.0           | 56.6 MINUTES                        |

Capacity Check (Second Discharge)  
Table 1007

- (4) If the time the first cell reached 1.0V equals or exceeds the values shown in [Table 1007](#) 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 1007](#) at the discharge rate, then the capacity is < 100%.

N. 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.

- (1) 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.

- (2) Confirm the battery was discharged and disassembled.
- (3) Over Temperature Thermostat ([200](#)) is part of sensor harness ([190](#)). It is attached to the thermostat mounting plate ([60](#)). Disassembly is required in order to test the thermostat (refer to [DISASSEMBLY](#)).
- (4) Test with an ohmmeter the connector sensor harness ([190](#)) per [Table 1003](#). Any erratic readings represent a failure.



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- (5) Thermostat (200) functional testing as follows:
  - (a) Suspend the thermostat mounting plate shown in (60) with thermostat (200) in a beaker of water. Position the thermostat a minimum of 50.8mm (2 inches) from the bottom and 25.4mm (1 inch) 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 ( $\geq 20M\Omega$ ) at temperatures below +66°C (+150°F).
  - (d) Continue raising the water temperature and stabilize at  $71^{\circ}\text{C} \pm 5.0^{\circ}\text{C}$  ( $160^{\circ}\text{F} \pm 9^{\circ}\text{F}$ ), then make sure the thermostat closes ( $< 10\Omega$ ) at a stabilized temperature of  $71^{\circ}\text{C} \pm 5.0^{\circ}\text{C}$  ( $160^{\circ}\text{F} \pm 9^{\circ}\text{F}$ ).
  - (e) Slowly add cool water to the beaker to reduce water temperature to  $65^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$  ( $149^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ). Make sure the thermostat opens ( $\geq 20M\Omega$ ) within  $6.1^{\circ}\text{C}$  ( $11^{\circ}\text{F}$ ) of the closing temperature.
  - (f) If the thermostat fails to meet any of the above criteria, then replace the complete sensor harness (190) with a new Saft component.
- (6) Charge Control Thermistor is permanently mounted on a sensor plate (210). Any erratic reading represents a failure.
  - (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  $7355 \pm 672\Omega$  when the plate temperature is  $0^{\circ}\text{C} \pm 1.7^{\circ}\text{C}$  ( $+32^{\circ}\text{F} \pm 3^{\circ}\text{F}$ ).
  - (d) After the low temperature test, slowly raise the temperature to  $+71^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$  ( $+160^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ).
  - (e) Make sure the ohmmeter indicates  $382 \pm 23\Omega$  when the plate temperature is  $+71 \pm 1.7^{\circ}\text{C}$  ( $+160 \pm 3^{\circ}\text{F}$ ).
  - (f) If the thermistor fails any of the above testing criteria, replace the complete connector sensor harness (190) with a new Saft component.



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O. 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 < 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, do [Low capacity \(Special testing\)](#). Otherwise for a battery with any cell voltage < 1.55V do [Supplementary test](#).

(2) Low capacity (Special testing)

(a) Loosen, but 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 < 1.55V during the final charge, do [Supplementary test](#). Otherwise, do [Capacity test \(Special testing\)](#).

(3) Supplementary test

(a) Charge at 0.1C<sub>1</sub>A for an additional 5 hours and monitor the voltage of the individual cells every 30 minutes.

1 Identify for replacement any cell ([260](#)) with voltage < 1.55V.

2 During the last 30 minutes of this charge, adjust the [Electrolyte level](#).

3 Do [Cell replacement](#) for cells identified for replacement. Otherwise, do [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](#).

(4) Capacity test (Special testing)

(a) Using T01, verify the ¼ turn vent valve ([350](#)) is installed on each cell ([260](#)).

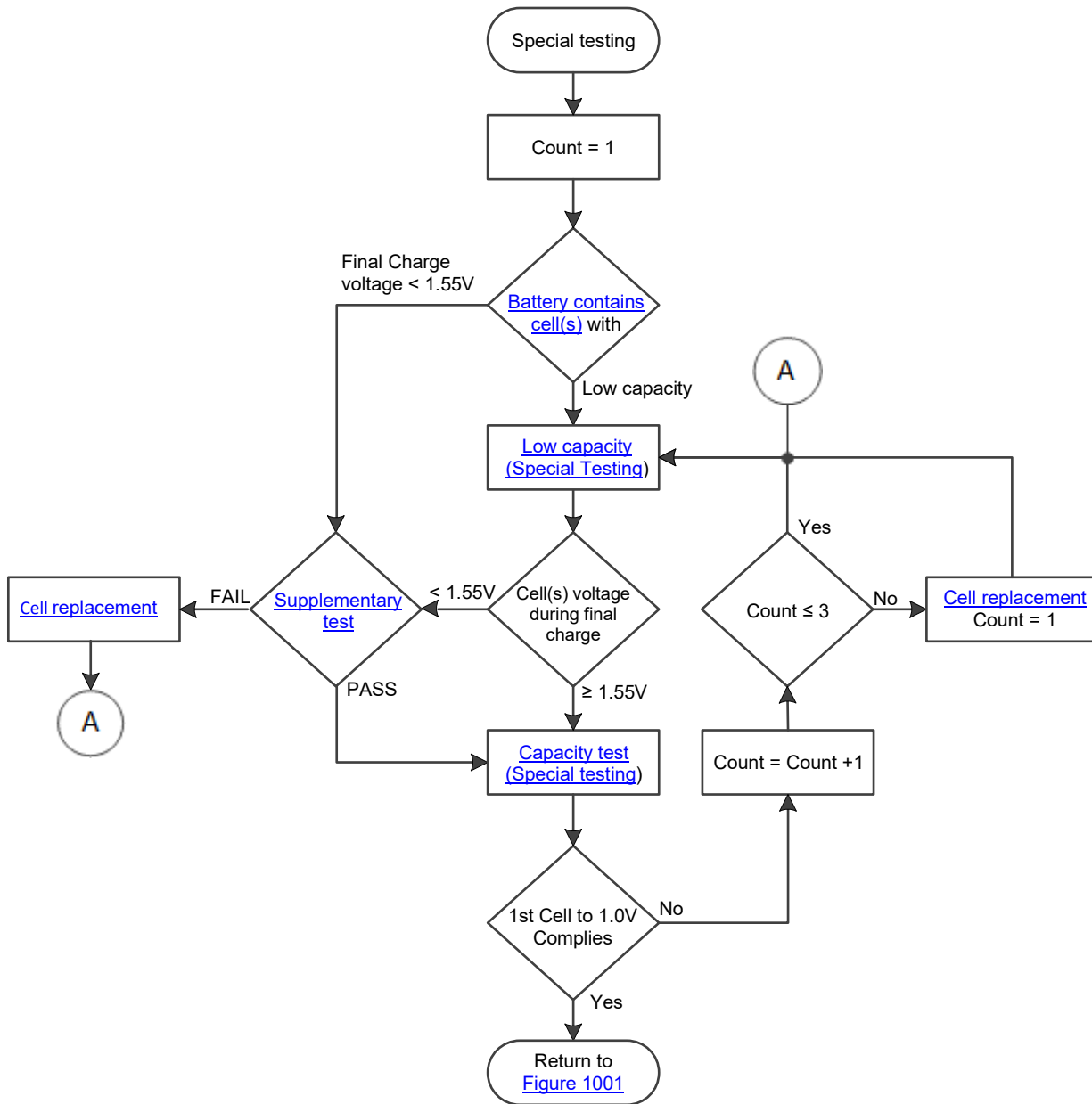
(b) Discharge the battery at a rate shown in [Table 1007](#) until the battery reaches 20.0V. Record the time and current the battery reached 20.0V and identify the noncompliant cells with voltage < 1.0V.

(c) If the time the first cell reached 1.0V equals or exceeds the values shown in [Table 1007](#) 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](#).

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Special Testing Flow Chart  
Figure 1004





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5. Fault Isolation

Fault isolation information is presented in [Table 1008](#), [Table 1009](#), or [Table 1010](#) as a guide to locate the cause of malfunction and isolating the cause to a specific component.

| TROUBLE                      | PROBABLE CAUSE   | REMEDY  |
|------------------------------|--|---|
| (1) No battery voltage       | (a) Defective electrical connector (not making contact). | Check electrical contacts, links<br>Replace if required, <a href="#">Power connector replacement</a> , <a href="#">Cell hardware replacement</a> , <a href="#">Link replacement</a> , or torque <a href="#">Upper nut tightness</a> |
|                              | (b) Broken terminal links                                |   |
| (2) Low Insulation           | (a) Leakage of electrolyte                               | Do <a href="#">Thorough Cleaning</a> , <a href="#">ASSEMBLY</a> , <a href="#">Charge</a> , <a href="#">Electrolyte level</a>  |
|                              | (b) Incorrect adjustment of electrolyte level            |   |
|                              | (c) Reverse cell polarity                                |   |
|                              | (d) Condensation / Contamination                         |   |
|                              | (e) Improper cleaning                                    |   |
|                              | (f) Loose or damaged vent valve                          | Tighten or replace ¼ turn vent valve, do <a href="#">Thorough Cleaning</a> , <a href="#">ASSEMBLY</a> , <a href="#">Charge</a> , <a href="#">Electrolyte level</a>  |
|                              | (g) Damaged cell case                                    | Do <a href="#">Thorough Cleaning</a> , <a href="#">Cell replacement</a> , <a href="#">ASSEMBLY</a> , <a href="#">Charge</a> , <a href="#">Electrolyte level</a>   |
|                              | (h) Charge rate too high                                 | Investigate the cause of the excessive charge. Do <a href="#">Thorough Cleaning</a> , <a href="#">ASSEMBLY</a> , <a href="#">Charge</a> , <a href="#">Electrolyte level</a>   |
| (3) Loss of battery capacity | (a) Normal wear after long service                       | Do <a href="#">Special testing</a>  |
|                              | (b) Exceptionally heavy use                              |   |

Battery Faults  
Table 1008



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

Cell Faults  
Table 1009



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| TROUBLE  | PROBABLE CAUSE                                     | REMEDY  |
|--|--|---|
| (1) Tarnished or burned links  | (a) Loose terminal nuts                            | Clean and torque per <a href="#">Table 8001</a> or do <a href="#">Power connector replacement</a> , <a href="#">Cell hardware replacement</a> , or <a href="#">Link replacement</a> . |
| (2) Exposed copper material on power connector pin   | (a) Mechanical damage                              | Do <a href="#">Power connector replacement</a>  |
|  | (b) Electrical arcing                              |   |
| (3) Melted plastic on power connectors   | (a) Overheat due to contact resistance             | Do <a href="#">Power connector replacement</a>  |
| (4) Corroded links   | (a) Operation in acidic atmosphere                 | Check room eliminate acid source. Do <a href="#">Link replacement</a> and lubricate properly  |
|  | (b) Inadequate greasing                            | Do <a href="#">Link replacement</a> and lubricate properly  |
|  | (c) Mechanical damage to protective nickel-plating | Do <a href="#">Link replacement</a> and lubricate properly  |
| (5) Battery case and cover damage with dents, deformations, and visible cracks which affect fit or impede performance. | (a) Various, transport                             | Replace defective component. Refer to <a href="#">Case replacement</a>  |
|  | (b) Mechanical stress, drop                        |   |

Physical Faults  
Table 1010



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**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. Equipment and Materials

A. Equipment

**NOTE:** Equivalent equipment may be used.

| EQUIPMENT             | MINIMUM EQUIPMENT SPECIFICATION |                            | SOURCE OR CAGE CODE | REPRESENTATIVE TYPE (MFG MODEL/CAGE)         |
|-----------------------|---------------------------------|----------------------------|---------------------|--|
|                       | CHAR.                           | RANGE, ACCURACY, TOLERANCE |                     |  |
| Universal vent wrench | -                               | -                          | 09052<br>F6177      | 093365-000 ( <a href="#">T01</a> )<br>413876 |
| Equalizing resistors  | -                               | 1 $\Omega$ 3 W             | F6177               | 164829 ( <a href="#">T03</a> )               |
| Cell puller tool      | -                               | -                          | 09052<br>F6177      | 017556-000 ( <a href="#">T04</a> )<br>416159 |

Equipment (Disassembly)  
Table 3001

B. Materials

No materials required.

3. 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 1007](#) until each cell reaches 1.0V.
- (2) Remove cover ([20](#)), hold-down pad ([30](#)) and insulator ([40](#)) by opening latches and lifting cover from case ([10](#) or [10A](#)).
- (3) Do [Cell shorting](#)



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- B. Cell (260) Removal
  - (1) Remove nuts (340), (120), and washers (330), (110) from terminals of cells (260) and power connector (90).
  - (2) Remove intercell terminal links (140 through 180) from terminals of cells (260) and power connector (90).
  - (3) Using T04 remove cells (260) from the battery case (10 or 10A) 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 (90) removal
  - (1) Remove screws (100) from the connector.
  - (2) Remove power connector (90) and its gasket (130) from the battery case (10 or 10A).
- E. Sensor harness (190) removal
  - (1) Remove the thermostat mounting nuts (257) from the thermostat plate (60).
  - (2) Remove the thermostat plate (60) and thermostat spacers (57) from the battery case (10 or 10A).
  - (3) Remove the sensor harness connector mounting screws (250 or 250A), nuts (080) and lift the sensor harness (190) out of the battery case (10 or 10A).
- F. Remove all spacers (50) from the battery case (10 or 10A)

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**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.

2. Equipment and Materials

A. Equipment

**NOTE:** Equivalent equipment may be used.

| EQUIPMENT           | MINIMUM EQUIPMENT SPECIFICATION |                            | SOURCE OR CAGE CODE    | REPRESENTATIVE TYPE (MFG MODEL/CAGE) |
|---------------------|---------------------------------|----------------------------|------------------------|--------------------------------------|
|                     | CHAR.                           | RANGE, ACCURACY, TOLERANCE |                        |                                      |
| Stiff bristle brush | Non-metallic                    | -                          | Commercially Available | -                                    |
| Fine wire brush     | -                               | -                          | Commercially Available | -                                    |
| Soft brush          | Non-metallic                    | -                          | Commercially Available | -                                    |

Equipment (Cleaning)  
Table 4001

B. Materials

| NAME                    | SPECIFICATION OR PART NUMBER | SOURCE OR CAGE CODE    | USE              |
|-------------------------|------------------------------|------------------------|------------------|
| Neutral petroleum jelly | <a href="#">M02</a>          | Commercially Available | Lubrication      |
| Mild soap               | <a href="#">M03</a>          | Commercially Available | Cleaning         |
| Cloth, soft, clean      | -                            | Commercially Available | Protect from FOD |

Materials (Cleaning)  
Table 4002

3. Light Cleaning

A. The following procedures are for an assembled battery with battery cover ([20](#)), hold down pad ([30](#)), and formed insulator ([40](#)) removed.

B. Using [T01](#), make sure the ¼ turn 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.



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- 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 ([120](#)), ([340](#)) 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 ([20](#)) and battery case ([10](#) or [10A](#)) using a soft, clean cloth, moistened with water. Dry with compressed air or a dry, clean cloth.

4. 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 ([90](#)) with warm mild 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 ([10](#) or [10A](#)), cover ([20](#)), cover insulator ([40](#)), spacers ([50](#)), ([57](#)), thermostat plate ([60](#)), gasket ([130](#)), nuts ([120](#)), ([257](#)), ([340](#)), washers ([110](#)), ([330](#)), intercell links ([140](#) through [180](#)), and screws ([100](#)), ([250](#) or [250A](#)) in warm mild 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.

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**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. Equipment and Materials

A. Equipment

No equipment required

B. Materials

No materials required

3. 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 ([10](#) or [10A](#)) and cover ([20](#)) for dents, distortion, or other damage. If found, refer to [REPAIR](#) section and replace with new Saft cover ([20](#)) or case ([10](#) or [10A](#)).
- (2) Remove the battery cover ([20](#)), pad ([30](#)) and formed insulator ([40](#)).
- (3) Visually confirm the power connector ([90](#)) 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) Tighten 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 [1008](#) and level electrolyte per [Electrolyte level](#) on page [1009](#).

C. Do successful [Battery insulation](#) test and install battery cover ([20](#)), pad ([30](#)) and formed insulator ([40](#)), then the battery is ready for service.

4. Component Inspection

The following procedures are for a disassembly battery

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.

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- (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 [1009](#) and/or be discarded, if necessary.
- (4) Inspect nuts ([320](#)) and washers ([280](#)), ([290](#)), ([300](#) or [310](#)) 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 with new Saft components.
- D. Spacers ([50](#)), ([57](#))  
Inspect for contamination and free of cracks or holes. Replace any that are defective with new Saft components.
- E. Power connector ([90](#))

**CAUTION:** A DEFECTIVE POWER CONNECTOR CAN CAUSE DANGEROUS OVERHEATING, AS WELL AS IN-SERVICE LOW VOLTAGE.

- (1) Check the power connector ([90](#)) for evidence of arcing, corrosion, cracks, or cross threaded terminals.
  - (2) Using the same methods in [Battery insulation](#) check on page [1005](#), 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 ([90](#)).
- 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. the thermostat plate ([60](#)).
    - (4) Any evidence of the above conditions, however minor, is grounds for rejection. Discard the damaged unit and replace with a new factory component.

**NOTE:** Sensor harness ([190](#)) is a non-repairable item.

- G. Battery cover ([20](#)), case ([10](#) or [10A](#)), thermostat plate ([60](#)),  
Inspect the components for damage, and replace with new Saft components, cover ([20](#)), case ([10](#) or [10A](#)), or thermostat plate ([60](#)) as needed.

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**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. Equipment and Materials

A. Equipment

**NOTE:** Equivalent equipment may be used.

| EQUIPMENT             | MINIMUM EQUIPMENT SPECIFICATION |                            | SOURCE OR CAGE CODE | REPRESENTATIVE TYPE (MFG MODEL/CAGE)         |
|-----------------------|---------------------------------|----------------------------|---------------------|--|
|                       | CHAR.                           | RANGE, ACCURACY, TOLERANCE |                     |  |
| Universal vent wrench | -                               | -                          | 09052<br>F6177      | 093365-000 ( <a href="#">T01</a> )<br>413876 |
| Equalizing resistors  | -                               | 1 $\Omega$ 3 W             | F6177               | 164829 ( <a href="#">T03</a> )               |
| Cell puller tool      | -                               | -                          | 09052<br>F6177      | 017556-000 ( <a href="#">T04</a> )<br>416159 |

Equipment (Repair)  
Table 6001

B. Materials

**NOTE:** Equivalent substitutes are permitted for all items except for those that become part of the configured unit.

| NAME                    | SPECIFICATION OR PART NUMBER | SOURCE OR CAGE CODE    | USE         |
|-------------------------|------------------------------|------------------------|-------------|
| Neutral petroleum jelly | <a href="#">M02</a>          | Commercially Available | Lubrication |

Materials (Repair)  
Table 6002

3. Component Replacement

A. Cell replacement ([260](#))

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



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- (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 (120), (340), washers (110), (330) and intercell connecting links (140 to 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 to 180), washers (110), (330), and upper nuts (120), (340). Torque nuts per [Table 8001](#).

B. Lower nut (320) tightness

- (1) Remove the necessary hardware; upper nuts (120), (340), washers (110), (330), links (140 to 180). Tighten lower nut (320) per [Table 8001](#).
- (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). The components should be new Saft components (120), (320) shoulder side down, or (340). Torque nuts per [Table 8001](#) as required.
- (2) Terminal O-ring (270) replacement
  - (a) Remove the necessary nuts (120), (340), washers (110), (330), and links (140 to 180).

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- (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) as shown in IPL, install washer (280), 2 belleville washers (290), polarity washer (300) or (310), and nut (320) shoulder side down. Torque 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 (110), (330), 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 with Saft new components 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) with new Saft components.
- (3) Using T01, tighten the ¼ turn vent valve (350) onto the cell (260).

F. Sensor harness (190) replacement

- (1) Remove the necessary 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 (90) and gasket (130) from the battery case (10 or 10A) by removing screws (100).
- (3) Remove the thermostat mounting nuts (257) from the thermostat plate (60).
- (4) Remove the sensor harness connector mounting screws (250 or 250A), nuts (257) and lift the sensor harness (190) out of the battery case (10 or 10A).
- (5) Insert the new Saft sensor harness (190) connector into its mounting hole on the case (10 or 10A) and install and torque the connector mounting screws (250 or 250A) and nuts (257) per Table 8001.
- (6) Pass the thermostat-end of sensor harness (190) through the hole in the partition, liner, and spacer assembly.



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- (7) Attach the thermostat to the thermostat plate (60) with thermostat mounting nuts (257). Torque per [Table 8001](#).
- (8) Assemble the power connector gasket (130) to the power connector (90) and insert the terminals of power connector (90) through the oval mounting hole in the front of the battery case (10 or 10A).
- (9) Attach the power connector (90) from the battery case (10 or 10A) 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 necessary 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 (90) replacement.

- (1) Remove nuts (120), (340), washers (110), (330), and links (150).
- (2) Remove the power connector and gasket (130) from the battery case (10 or 10A) by removing screws (100).
- (3) Assemble power connector gasket (130) to new Saft power connector (90).
- (4) Insert terminals of power connector (90) through the oval mounting hole in the front of the battery case (10 or 10A).
- (5) Attach the power connector (90) to the battery case (10 or 10A) 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. Case (10 or 10A) replacement.

- (1) Do [DISASSEMBLY](#)
- (2) Replace case (10 or 10A) with new Saft component and do [ASSEMBLY](#).

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**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. Equipment and Materials

A. Equipment

**NOTE:** Equivalent equipment may be used.

| EQUIPMENT     | MINIMUM EQUIPMENT SPECIFICATION |   | SOURCE OR CAGE CODE    | REPRESENTATIVE TYPE (MFG MODEL/CAGE) |
|---------------|---------------------------------|---|------------------------|--------------------------------------|
|               | CHAR.                           | RANGE, ACCURACY, TOLERANCE                    |                        |                                      |
| Torque wrench | Insulated                       | 0 to 15 N-m<br>(0 to 133 lb <sub>r</sub> -in) | Commercially Available | McMaster-Carr<br>(7936A12)           |

Equipment (Assembly)  
Table 7001

B. Materials

**NOTE:** Equivalent substitutes are permitted for all items except for those that become part of the configured unit.

| NAME                    | SPECIFICATION OR PART NUMBER | SOURCE OR CAGE CODE    | USE         |
|-------------------------|------------------------------|------------------------|-------------|
| Neutral petroleum jelly | <a href="#">M02</a>          | Commercially Available | Lubrication |

Materials (Assembly)  
Table 7002

2. Sensor harness ([190](#))

- A. Insert the sensor harness ([190](#)) connector into its mounting hole on the case ([10](#) or [10A](#)) and reinstall the connector mounting screws ([250](#) or [250A](#)) and nuts ([257](#)) by torquing per [Table 8001](#).
- B. Insert the thermostat liner ([57](#)) 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 ([60](#)) in back of spacer assembly so that the spacer assembly is between the thermostat plate ([60](#)) and the thermostat liner ([57](#)), which is against the partition.
- D. Pass the thermostat-end of sensor harness ([190](#)) through the hole in the partition, liner, and spacer assembly.



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- E. Attach the thermostat to the thermostat plate ([60](#)) with thermostat mounting nuts ([257](#)). Torque per [Table 8001](#).

3. Spacers ([50](#)) and Cells ([260](#))

Install spacers ([50](#)), sensor harness ([190](#)), and cell assemblies ([260](#)) into the battery case ([10](#) or [10A](#)), using the following steps. Refer to [Figure 7001](#) and [Figure 7002](#).

- A. Insert one edge of bottom spacer into battery case ([10](#) or [10A](#)) from the left or right side, then slide the spacer under the cell partition.

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

- B. 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 ([50](#)) into the battery case ([10](#) or [10A](#)) as shown in [Figure 7001](#).

**NOTE:** Spacers ([50](#)) are used as required to ensure the left and right row of cells are retained securely in place to prevent free movement. The maximum quantity to be used is shown in [Figure 7001](#).

- (2) Install seven cell assemblies ([260](#)) in the left and right side of 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.

- C. Install the center row of cells and spacers in accordance with the following steps, and as shown (see [Figure 7001](#)).

- (1) Install side and end spacers ([50](#)) into the center partition of battery case (see [Figure 7001](#)).

**NOTE:** Spacers ([50](#)) are used as required to ensure the center row of cells are retained securely in place to prevent free movement. The maximum quantity to be used is shown in [Figure 7001](#).

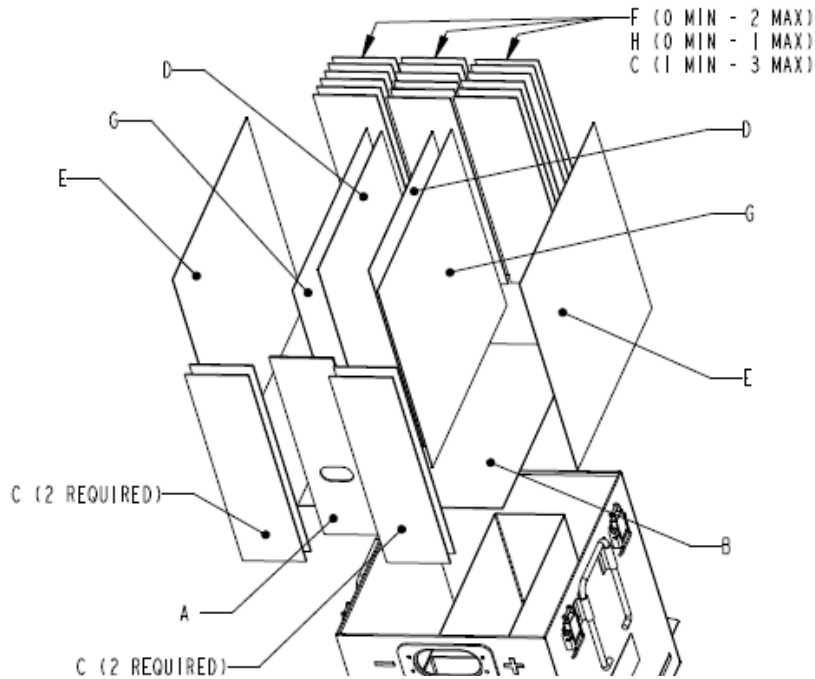
- (2) Install six cell subassemblies ([260](#)) in the center row into case ([10](#) or [10A](#)). Be sure to maintain the proper cell arrangement and polarity orientation (see [Figure 7002](#)). Install the charge control thermistor plate between cells 6 and 9, as shown in [Figure 7002](#). Insertion of the last cell in a row is sometimes difficult and can be assisted by pushing down on the terminals with a small block of soft wood.

- D. Apply a small amount of [M02](#) to the threads of the cell terminals.

- E. Torque the lower terminals nuts ([320](#)) of the cell assemblies ([260](#)) per [Table 8001](#).

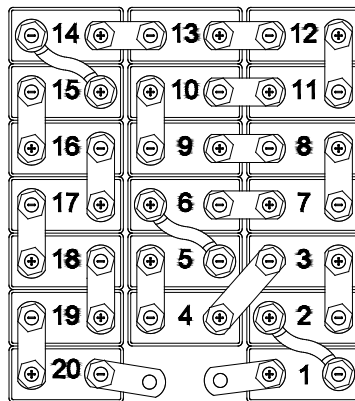


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| ITEM      | DESCRIPTION       | DIMENSION [IN]          | MAX. UNITS PER ASSY |
|-----------|-------------------|-------------------------|---------------------|
| A or (57) | Thermostat spacer | 9.86 x 2.95             | 1                   |
| 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                   |

Battery Spacer Kit (50)  
Figure 7001



Cell Number and Polarity Orientation  
Figure 7002



COMPONENT MAINTENANCE MANUAL  
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4. Power connector (90)

Install power connector (90) into the battery case (10 or 10A) follows:

- A. Assemble power connector gasket (130) to power connector (90).
- B. Insert terminals of power connector (90) through the oval mounting hole in the front of the battery case (10 or 10A).
- C. Attach the power connector (90) to the battery case (10 or 10A) with screws (100). Secure the power connector (90) 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 (90) 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. Lightly lube with [M02](#) the cell terminals, nuts, links, and connector contacts using a nonmetallic brush.  
  
**CAUTION:** DO NOT CRIMP WIRE OF THE SENSOR HARNESS.
- D. Install nuts (120), (340) and washers (110), (330) onto the terminals of the cell assemblies (260) and terminals of the power connector (90). Torque nuts per [Table 8001](#).
- E. Lightly lube with [M02](#) any other components that might be susceptible to atmosphere corrosion.
- F. Install formed insulator (40) on top of the cells as shown in [IPL Figure 1](#).
- G. Install the hold down pad (30) onto the cell assemblies, being sure that each vent hole mates properly with the cell assembly vent valve.
- H. Install the battery cover (20) onto the battery case (10 or 10A) and secure in place by fastening the latches.



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**FITS AND CLEARANCES**

1. Torque Table

| IPL FIGURE | ITEM NUMBER              | TORQUE VALUE |                     | NAME, LOCATION              |
|------------|--------------------------|--------------|---------------------|-----------------------------|
|            |                          | N-m          | lb <sub>f</sub> -in |                             |
| 1          | <a href="#">340, 120</a> | 13.0 ± 1.0   | 115 ± 9             | Nut, Terminal, Upper        |
| 1          | <a href="#">320</a>      | 5.0 ± 0.5    | 44 ± 4              | Nut, Terminal, Lower        |
| 1          | <a href="#">250</a>      | 0.8 ± 0.1    | 7 ± 1               | Screw, Connector Mounting   |
| 1          | <a href="#">100</a>      | 2.3 ± 0.2    | 20 ± 2              | Screw, Sems                 |
| 1          | <a href="#">257</a>      | 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 housed in a polypropylene box.

- (1) [T02](#) (P/N 416232) is assembled using syringe P/N 105112 and nozzle P/N 104184 or [T02](#) (P/N 020916-001) is assembled using syringe P/N 018327-000 and nozzle P/N 020914-001.

| ITEM | DESCRIPTION                                    | 09052 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 $\Omega$ 3 W equalizing resistors            | -          | 164829    |
| T04  | Universal cell extraction tool                 | -          | 416159    |
|      | M10x1.25 tool                                  | 017556-000 | -         |
| T05  | Vent Valve adapter for MS valves               | 024398-000 | -         |

Special Tools  
Table 9001

2. Equipment

**NOTE:** Equivalent equipment may be used

| EQUIPMENT                              | MINIMUM EQUIPMENT SPECIFICATION |   | SOURCE OR CAGE CODE    | REPRESENTATIVE TYPE (MFG MODEL/CAGE)                       |
|--|---------------------------------|---|------------------------|--|
|  | CHAR.                           | RANGE, ACCURACY, TOLERANCE                    |                        |  |
| Constant current charger               | -                               | 0 to 60A DC<br>40V DC Minimum                 | Commercially Available | Sorenson Power (Supply DCR-40-70B)                         |
| Constant current source with load bank | -                               | 0 to 60A DC<br>1 to 40V DC                    | Commercially Available | Sorenson Power (Supply DCR-40-70B) with Ohmite (L225J5ROE) |
| Megohmmeter                            | -                               | 0 to 50 M $\Omega$ @ 250 V continuous         | Commercially Available | Fluke (1507)   |
| Digital multimeter                     | -                               | 2000 count, accuracy 1% or better             | Commercially Available | Fluke (179)  |
| Climatic chamber                       | -                               | +15°C to +80°C<br>(+59°F to +176°F)           | Commercially Available | Cincinnati Sub-Zero (MCB-1.2-.33-H/AC)                     |
| Torque wrench                          | Insulated                       | 0 to 15 N-m<br>(0 to 133 lb <sub>f</sub> -in) | Commercially Available | McMaster-Carr (7936A12)                                    |

Equipment  
Table 9002

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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°F):<br>Clear, colorless, and odorless while boiling<br>Conductivity < 33 µS/cm<br>5 < pH < 7<br>Mn-COD < 30 mg/l (1.7 x 10 <sup>-5</sup> oz/in <sup>3</sup> )<br>(Chemical Oxygen Demand, methodology to evaluate organic or mineral pollution)<br>Chlorines Cl <sup>-</sup> < 5 mg/l (2.9 x 10 <sup>-6</sup> oz/in <sup>3</sup> )<br>Sulfates SO <sub>4</sub> <sup>2-</sup> < 10 mg/l (5.8 x 10 <sup>-6</sup> oz/in <sup>3</sup> )<br>STORAGE: dry and clean container without any corrosion and damage; Temperature: +20°C ± 5°C (+68°F ± 9°F).<br>Over 1 year of storage, do an analysis of the liquid. | Local Vendor  |
| M02  | Neutral petroleum jelly<br>Density @ +60°C (+140°F) Range = 0.840 to 0.866 kg/l (0.486 to 0.501 oz/in <sup>3</sup> )<br>Melting Point Range = +46°C to +52°C (+115°F to +126°F)<br>Acidity/Alkalinity = Neutral to Litmus  | Mineral Vaseline<br>NATO: S 743<br>F: AIR 3565<br>US: VV-P-236A<br>UK: DEF 2333 |
| M03  | Mild soap  | Local Vendor  |

Consumables  
Table 9003

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**ILLUSTRATED PARTS LIST**

1. Introduction

A. Purpose

- (1) This section provides illustrations and parts breakdown of the 539CH-1 and 5319CH1 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 Fig. 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)

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(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:

| CAGE Code    | NAME / ADDRESS  | CAGE Code    | NAME / ADDRESS  |
|--------------|---|--------------|---|
| <b>09052</b> | Saft America Inc.<br>711 Gil Harbin Industrial Boulevard<br>Valdosta, GA 31601<br>USA<br>Phone: +1 (229) 247-2331<br>Fax: +1 (229) 247-8486 | <b>F6177</b> | Saft<br>126 quai Charles Pasqua<br>92300 Levallois-Perret<br>France<br>Phone: +33 1 58 63 16 00<br>Fax: +33 1 58 63 16 18 |

<http://www.saftbatteries.com>

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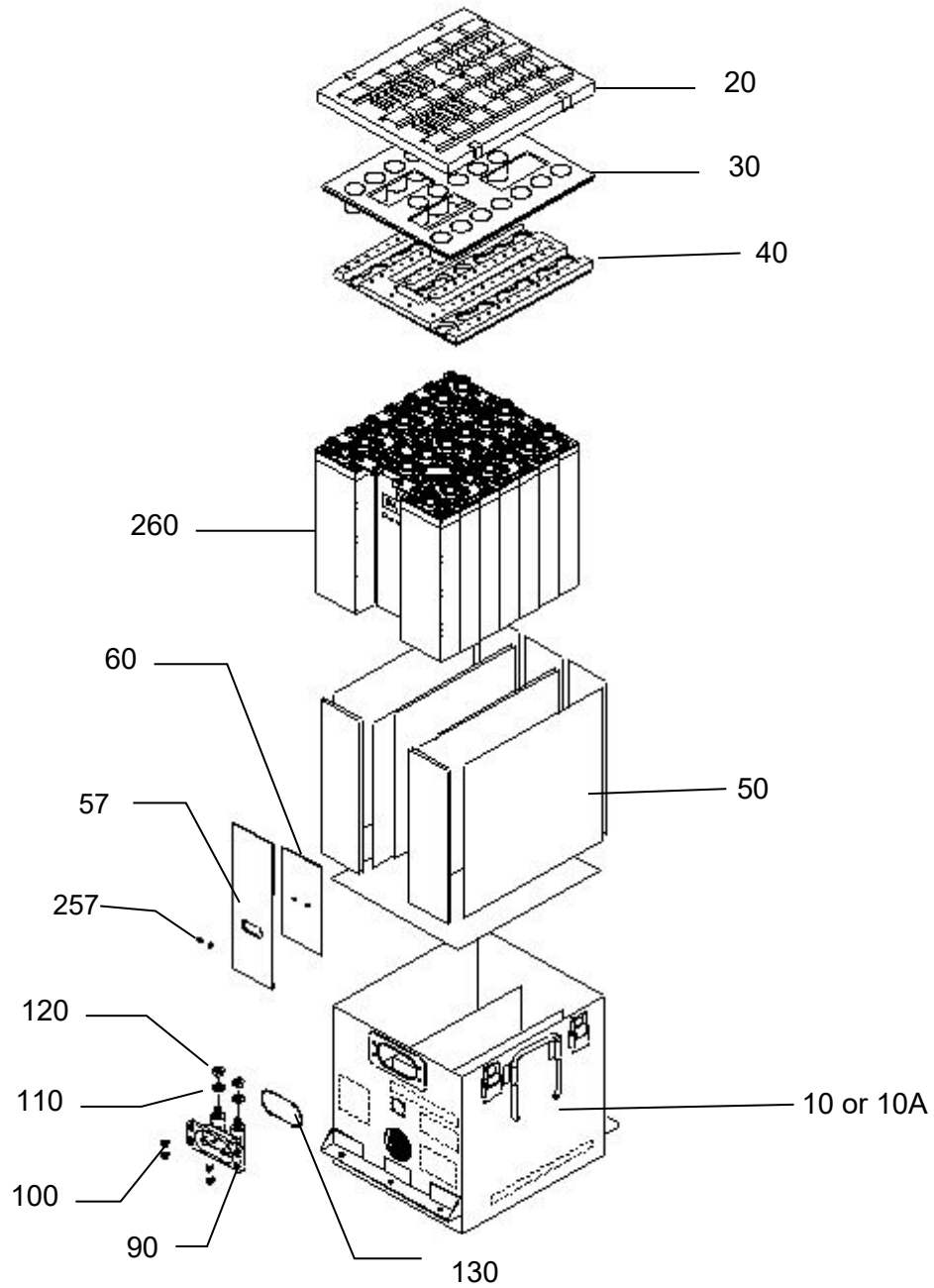
2. Numeric Index

| PART NUMBER                      | AIRLINE STOCK NUMBER | FIGURE NUMBER | ITEM NUMBER   | UNIT | UNITS PER ASSY |
|----------------------------------|----------------------|---------------|---------------|------|----------------|
| MS21083C04<br>(09052 090064-000) |                      |               | 257           | 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                       |                      |               | 57            | EA   | 1              |
| 018737-000                       |                      |               | 60            | 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              |
| 024147-000                       |                      | 1             | 1             |      | RF             |
| 024190-000                       |                      |               | 10            | EA   | 1              |
| 024257-000                       |                      |               | 260           | EA   | 20             |
| 024314-000                       |                      |               | 190           | EA   | 1              |
| 025902-000                       |                      |               | 10A           | EA   | 1              |
| 025920-000                       |                      |               | 1A            |      | RF             |
| 026705-000<br>REPLS 015577-000   |                      |               | 150           | EA   | 2              |
| 091181-002                       |                      |               | 270           | EA   | 40             |
| 092178-008                       |                      |               | 250           | EA   | 4              |
| 092666-005                       |                      |               | 250A          | EA   | 4              |
| 093616-000                       |                      |               | 100           | EA   | 4              |

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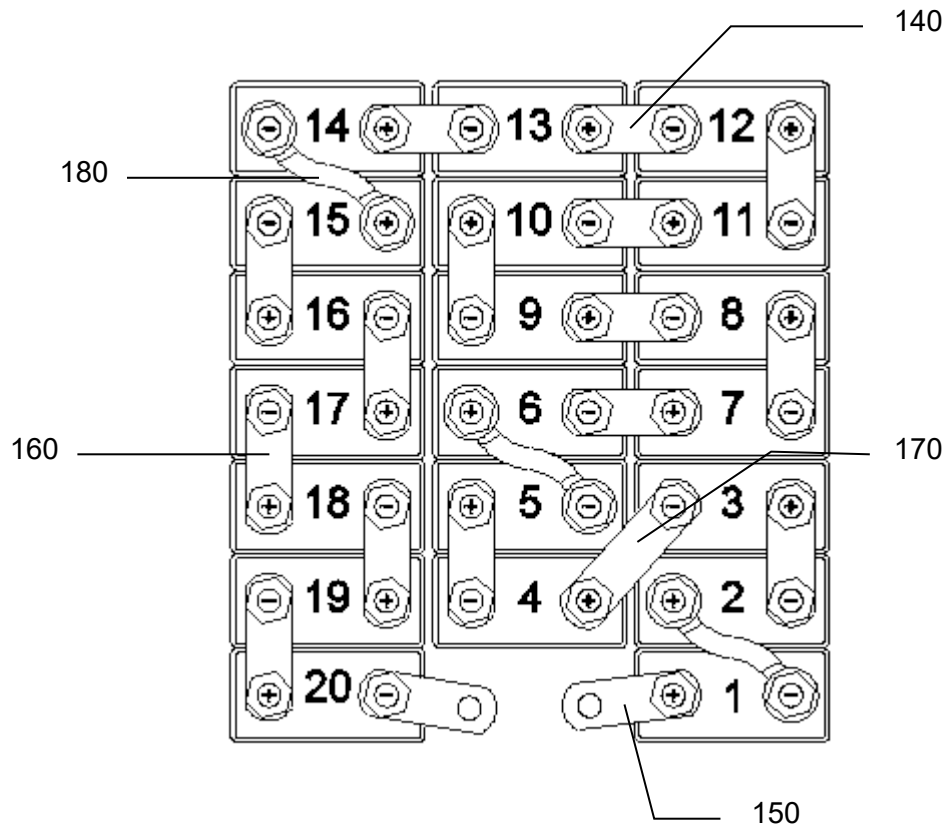
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Battery, Exploded View  
IPL Figure 1 (#1 of 3)



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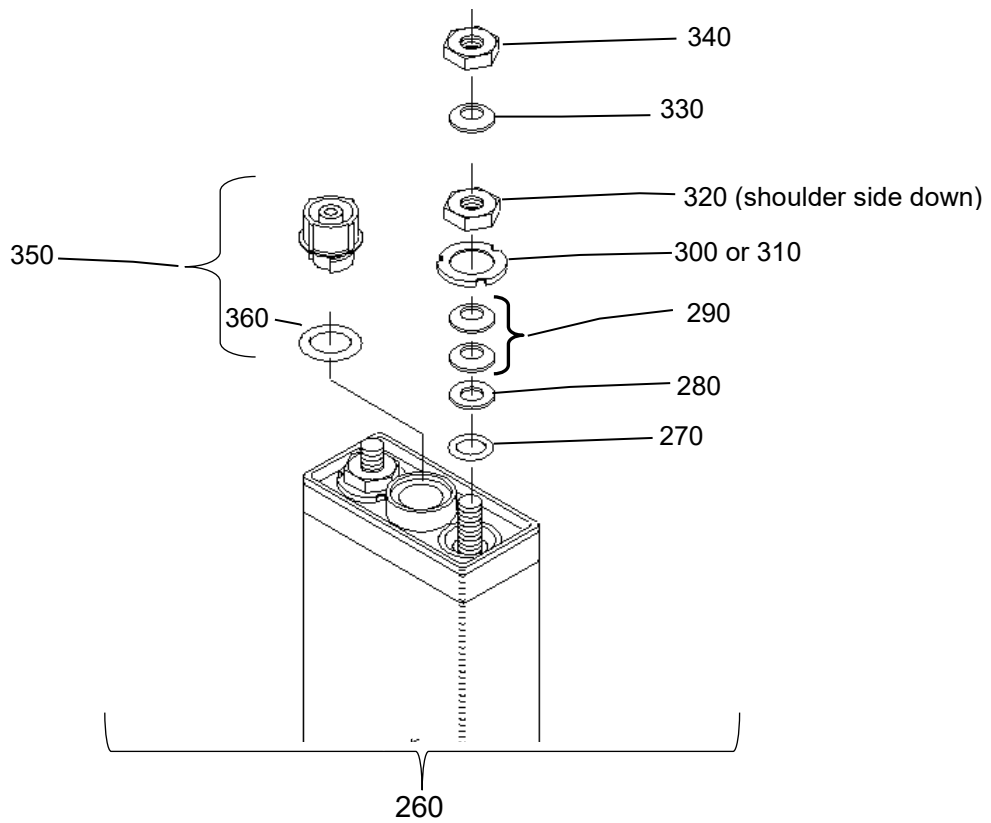
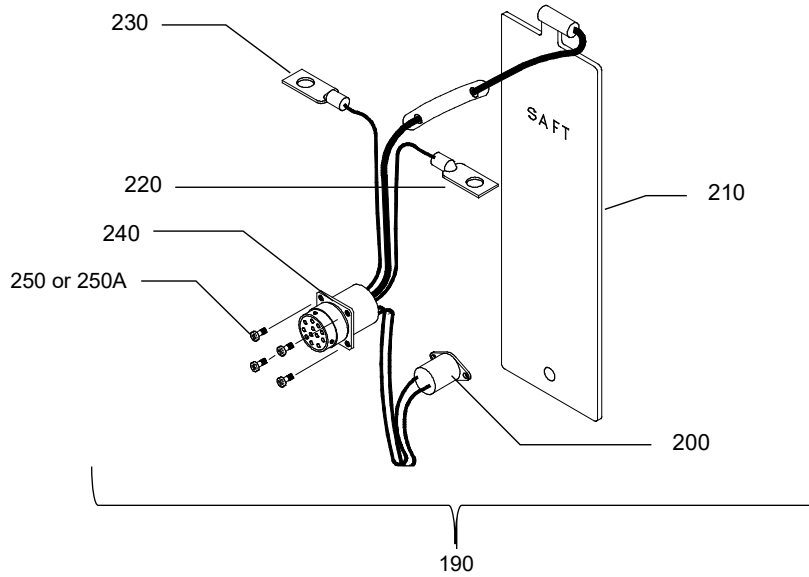
Battery, Exploded View  
IPL Figure 1 (#2 of 3)

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

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3. Detail Parts List

| FIG. & ITEM NUMBER | PART NUMBER | AIRLINE PART NO. | NOMENCLATURE<br>1234567<br>.....                              | EFF CODE | UNITS PER ASSY |
|--------------------|-------------|------------------|---|----------|----------------|
| 1                  | 024147-000  |                  | <b>BATTERY, 539CH-1 (09052)<br/>BA35-01 (V08748)</b>          | A        | RF             |
| 1A                 | 025920-000  |                  | <b>BATTERY, 5319CH1 (09052)<br/>BA35-02 (V08748)</b>          | B        | RF             |
| 10                 | 024190-000  |                  | . Case, Marked  | A        | 1              |
| 10A                | 025902-000  |                  | . Case, Marked  | B        | 1              |
| 20                 | 018552-003  |                  | . Cover   |          | 1              |
| 30                 | 024142-000  |                  | . Pad, Hold Down  |          | 1              |
| 40                 | 018559-000  |                  | . Insulator, Formed Top                                       |          | 1              |
| 50                 | 018951-000  |                  | . Kit, Battery Spacer   |          | 1              |
| 57                 | 018733-000  |                  | . . Liner, Thermostat Mounting                                |          | 1              |
| 60                 | 018737-000  |                  | . Plate, Thermostat Mounting                                  |          | 1              |
| 90                 | 022078-000  |                  | . Connector, Power  |          | 1              |
|                    |             |                  | Attaching Parts   |          |                |
| 100                | 093616-000  |                  | . Screw, Sems   |          | 4              |
|                    |             |                  | * * *   |          |                |
| 110                | 022228-000  |                  | . Washer, Belleville  |          | 2              |
| 120                | 015579-000  |                  | . Nut, Hex, M10x1.25  |          | 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<br>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                | 024314-000  |                  | . Harness, Sensor   |          | 1              |
| 200                | NONPROC1    |                  | . . Thermostat, Temperature Sensing<br>(NONPROCURABLE)        |          |                |
| 210                | NONPROC2    |                  | . . Thermistor/Plate Assy<br>(NONPROCURABLE)                  |          |                |
| 220                | NONPROC3    |                  | . . Terminal Lug, Negative<br>(NONPROCURABLE)                 |          |                |
| 230                | NONPROC4    |                  | . . Terminal Lug, Positive<br>(NONPROCURABLE)                 |          |                |
| 240                | NONPROC5    |                  | . . Connector, Sensor Harness<br>(NONPROCURABLE)              |          |                |

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| FIG. & ITEM NUMBER | PART NUMBER | AIRLINE PART NO. | NOMENCLATURE<br>1234567<br>.....                    | EFF CODE | UNITS PER ASSY |
|--------------------|-------------|------------------|---|----------|----------------|
|                    |             |                  | Attaching Parts                                     |          |                |
| 250                | 092178-008  |                  | . Screw, Binding Head, Connector Mounting           | A        | 4              |
| 250A               | 092666-005  |                  | . Screw, Pan Head, Connector Mounting               | B        | 4              |
| 257                | MS21083C04  |                  | . Nut, Connector Mounting<br>(09052 P/N 090064-000) |          | 6              |
|                    |             |                  | * * *   |          |                |
| 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, Hex, M10x1.25                              |          | 2              |
| 330                | 022228-000  |                  | . . Washer, Belleville                              |          | 2              |
| 340                | 015579-000  |                  | . . Nut, Hex, M10x1.25                              |          | 2              |
| 350                | 023619-000  |                  | . . Valve, Vent                                     |          | 1              |
| 360                | 012536-002  |                  | . . . O-Ring  |          | 1              |

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**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 following must be done to any battery with prior service history.

(a) [Charge](#), [Electrolyte level](#), [Vent valve test](#), and [Capacity test](#).

**NOTE:** 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 | Do <a href="#">Visual Inspection</a> , and return to <a href="#">Figure 1001</a> Entry Point " <a href="#">C</a> " |
| More than 12 months             | <a href="#">Figure 1001</a> Entry Point " <a href="#">Received</a> "   |

Return to Service Following Storage  
Table 15001

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3. Inactive Standby Storage

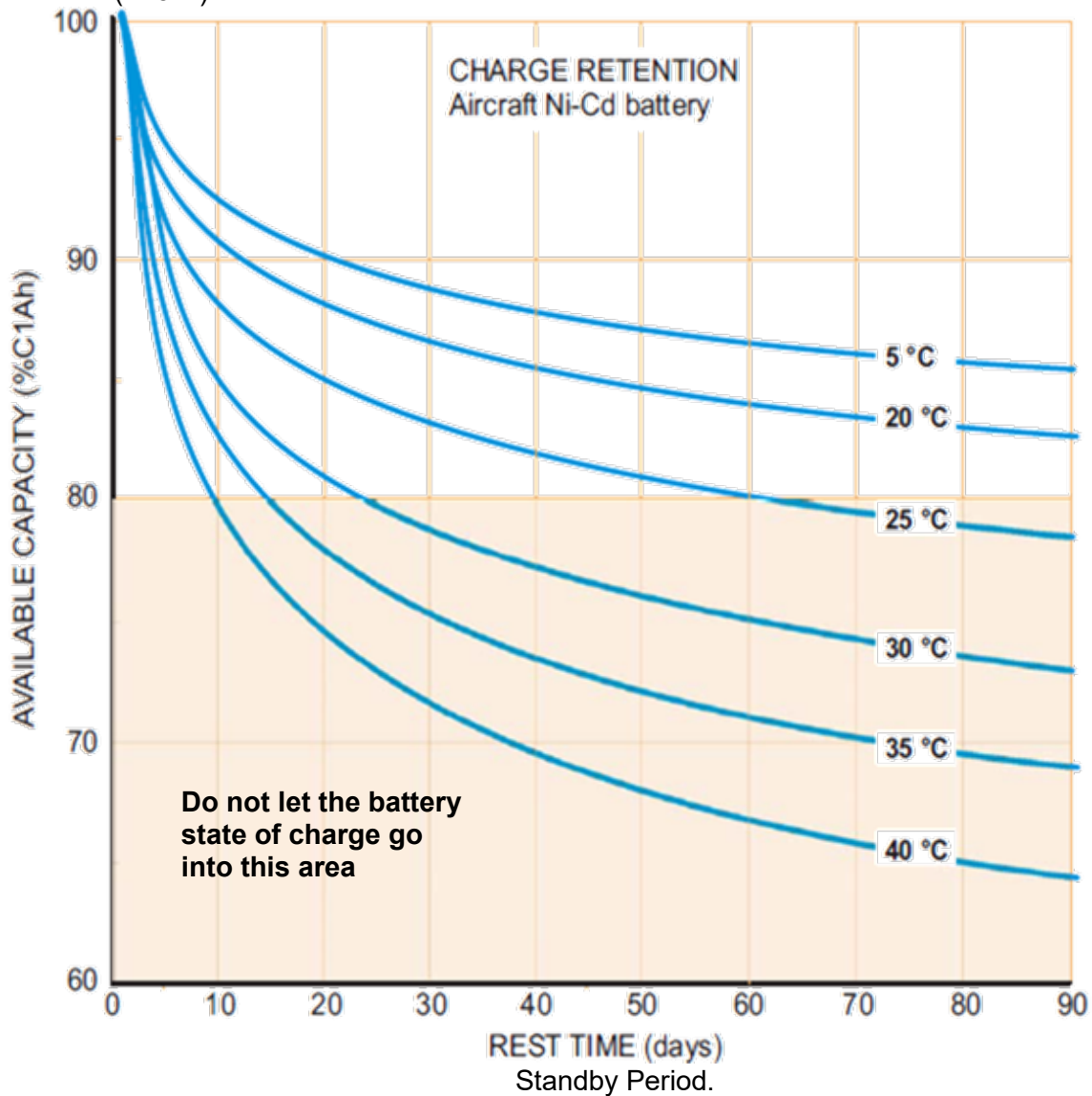
The battery is charged after being serviced then stored fully charged in a dedicated room in such a way that it can be installed in the aircraft without further maintenance except as provided within this section. Refer to [Figure 15002](#).

**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).







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B. Figure 15001 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](#).

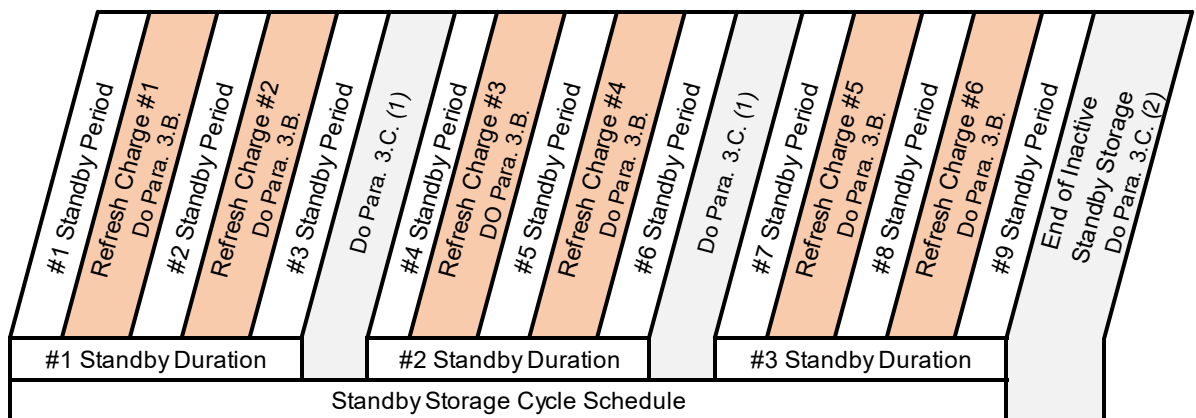
**CAUTION:** DO NOT DO THE 4 HOURS FINAL CHARGE AT 0.1 C<sub>1</sub>A (REFER TO [CHARGE](#)) DURING THIS 'REFRESH' CHARGE OPERATION.

| CHARGE RATE         | VOLTAGE (END OF "REFRESH" CHARGE) |
|---------------------|-----------------------------------|
| 0.1C <sub>1</sub> A | 30.0V for 20 Cells                |
| 0.5C <sub>1</sub> A | 31.0V for 20 Cells                |
| 1.0C <sub>1</sub> A | 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

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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<sup>3</sup>/cell (2.14 in<sup>3</sup>/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).

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