



To: Holders of component maintenance manual 24-32-20, 4318CH24

Subject: CMM Revision No. 6 Dated Mar 21/2023

Effectivity: All Models

HIGHLIGHTS

Replace revised pages by adding or removing the previous CMM pages and using the ones from the current revision dated Mar 21/2023.

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

Chapter/Section Page Number	Description of Change
Title Page T-1	Add Revision 6 with Date, rearranged, updated website
Record of Revisions ROR 1	Add revision 6
Service Bulletin List SBL 1	Updated information
List of Effective Pages LEP 1	Corrected/Changed pages
Introduction Intro 1 – Intro 2	Clarification and updated website
Introduction Intro 3	Updated website
Introduction Intro 4	Added abbreviations
Testing and Fault Isolation 1002, 1009	Correction
Testing and Fault Isolation 1003 - 1004	Clarification and added vent value O-ring from repair section, updated insulation resistance format.
Testing and Fault Isolation 1005	Updated to reflect disassembly and assembly sections
Testing and Fault Isolation 1006 – 1007, 1010, 1011	Clarification
Testing and Fault Isolation 1008, 1014	Repaginate
Testing and Fault Isolation 1012	Relocated lower nut tightness from repair section
Testing and Fault Isolation 1013, 1015	Updated remedy
Disassembly 3001	Clarifications
Check 5001 - 5002	Clarifications

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Chapter/Section Page Number	Description of Change
Repair 6001 – 6002	Clarifications, removed instructions covered in disassembly and assembly
Special Tools, Fixtures, Equipment, and Consumables 9001	Corrected value and added tool
Storage (Including Transportation) 15004 – 15005	Added storage of spare parts



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COMPONENT MAINTENANCE MANUAL

WITH

ILLUSTRATED PARTS LIST

Nickel Cadmium Aircraft Battery

Saft Model

4318CH24

Website: www.saft.com

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SERVICE BULLETIN LIST

SERVICE BULLETIN		DATE	TITLE
NUMBER / REV	DATE	INCORPORATION OR NO EFFECT	
SB0516 / D	Jan 30/2023	No Effect	Inspection of latch clearances

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INTRODUCTION

1. General

- A. This manual is written to the ATA Specification 100 and in AECMA Simplified English. International Standard units of measure are used in this manual, with imperial units in parentheses.
- B. This manual describes maintenance on components in a workshop. It does not describe maintenance on components when they are installed in aircraft.
- C. Only approved personnel with the necessary skill can do maintenance tasks described in this manual.
- D. This manual contains:
 - (1) Technical data for components
 - (2) Maintenance 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. The manual verifies DISASSEMBLY, TESTING AND FAULT ISOLATION, and ASSEMBLY procedures.

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 to be 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 elevated levels of MTBUR and MTBF.

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

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2. Definitions

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

Cautions call attention to procedures which must 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 ([230](#)) WITH [T01](#) PRIOR TO BEGINNING DISCHARGE. BATTERY CELLS DELIVER VERY HIGH CURRENT WHEN SHORT-CIRCUITED. EXERCISE CAUTION. REMOVE RINGS, WATCHES, NECKLACES, METALLIC BELTS OR OTHER JEWELRY TO AVOID ELECTRIC SHOCK.

WARNING: DO NOT TILT THE BATTERY WHILE DOING MAINTENANCE, ANY CONTACT OF ELECTROLYTE CAN CAUSE SEVERE BURNS.

Safety rules are different 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.saft.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 a 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 them 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 the respiratory tract. Do not try to vomit and get immediate medical.
- (6) Skin contact with nickel can cause chronic eczema.
- (7) Inhalation of cadmium oxide can cause dry throat, headaches, vomiting, chest pain. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen and get immediate medical attention.

4. Initial Commissioning New Battery

All new 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

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



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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

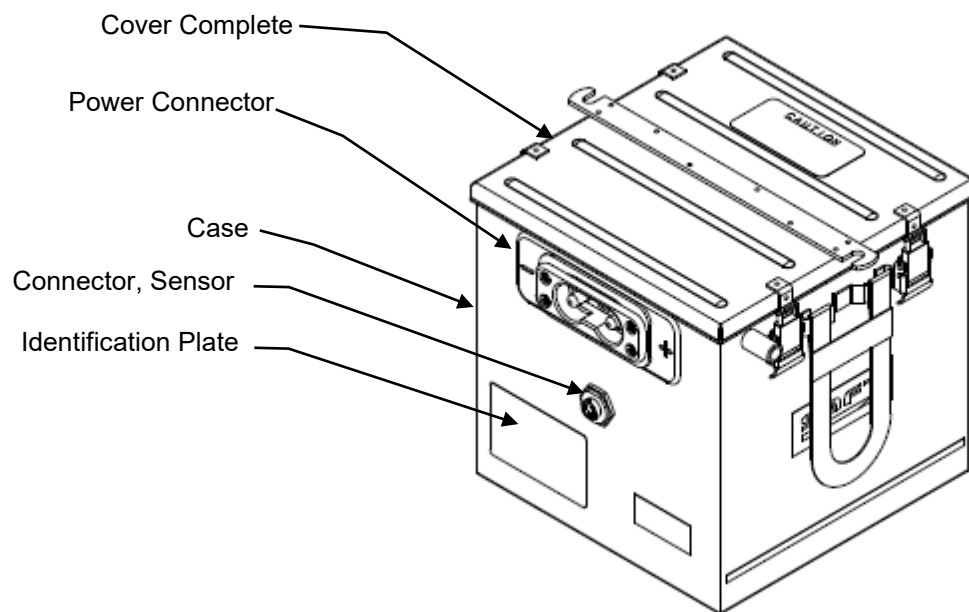


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DESCRIPTION AND OPERATION

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 with potassium hydroxide electrolyte. The battery consists of a case and cover, 20 cells and a sensor harness. The sensor harness includes a thermal resistor and center tap voltage. A charge control thermistor is in the lug attached between cells 10 and 11. A resistor (R1) is connected in series with the center tap lead.



Nickel Cadmium Battery
Figure 1



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PARAMETER	VALUES
Voltage: Nominal	24.0 Volts
Weight	38.4 kg (84.7pounds) maximum
Dimensions (Maximum): Height Length Width	260.4 mm (10.25 inches) 252.5mm (9.94 inches) 246.9m (9.72 inches)
Number of Cells	20
Cell Assembly Terminal	M10 X 1.25 externally threaded
Cell Model	Saft Type CVH430KA
1.0C ₁ A Rate	43.0A
0.5C ₁ A Rate	21.5A
0.1C ₁ A Rate	4.3A
Rated Capacity (C ₁)	43 Ampere-hours at 1.0C ₁ A
Vent valve	MS Style (¼ turn)
Venting Pressure	0.14 to 0.69 bar (2 to 10 psi)
Consumable volume of water per cell	70 cm ³ (4.27 in ³)
Cell Assembly Case Material	Polyamide
Battery Case Material	Stainless Steel
Electrolyte	Potassium Hydroxide
Operation temperature:	-40°C to +70°C (-40°F to +158°F)
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.



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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 cc (0.061 in³) 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 final charge.
- (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 provided in chart form to identify faults, possible causes, and remedies, refer to [Table 1006](#), [Table 1007](#), or [Table 1008](#).

NOTE: The () part identification numbers herein are IPL numbers and are shown in the Battery, Exploded View [IPL Figure 1](#).

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

2. Required Test Equipment

NOTE: Test equipment having equivalent specifications can be used.

Refer to [Special Tools, Fixtures, Equipment, and Consumables](#) for listing of Standard Tools.

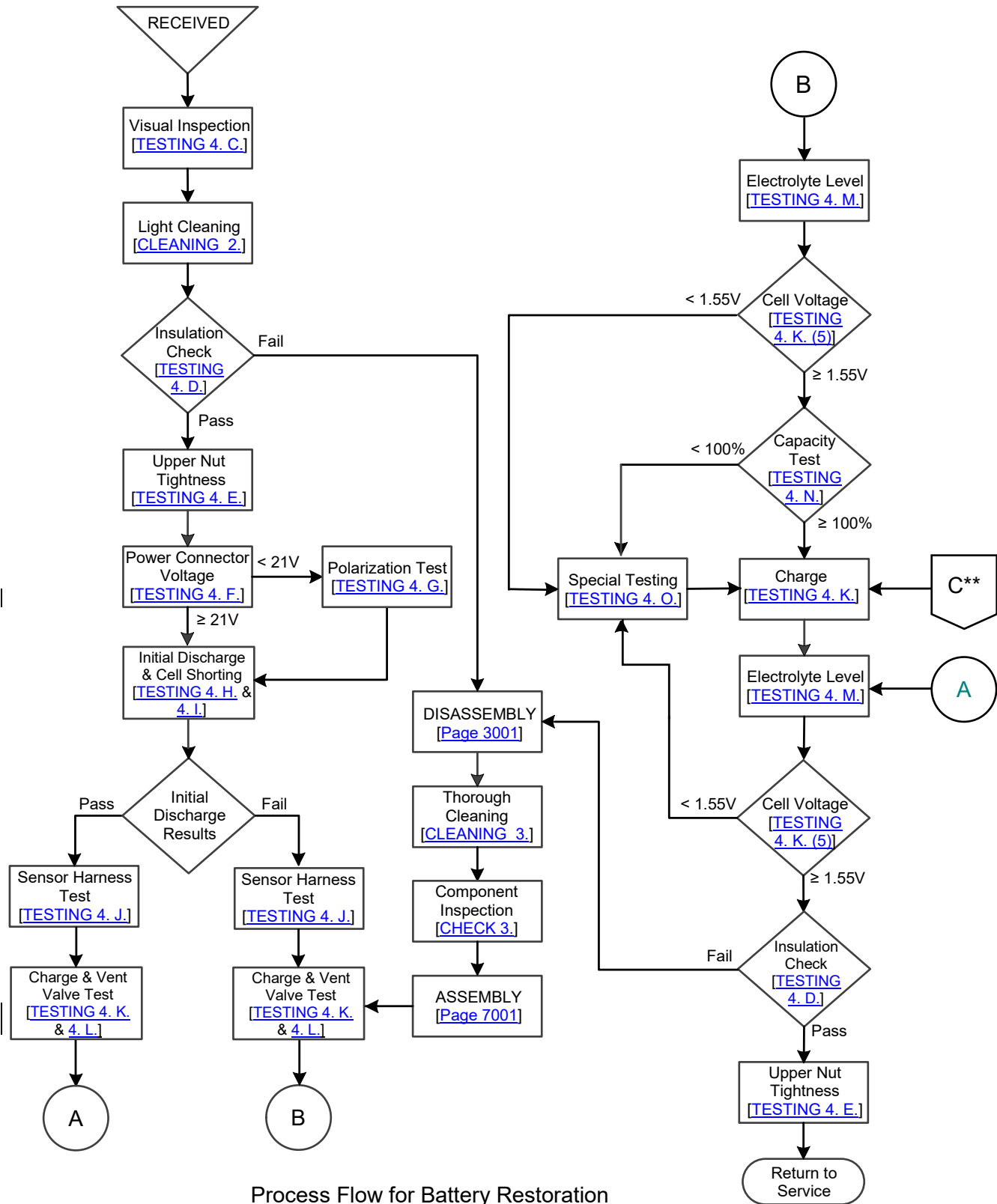
3. Maintenance Procedures

In addition to the checks specified for airborne or ground use, in normal service SAFT 4318CH24 batteries require the following maintenance operations.

A. Restoration Procedure

Outlined in [Figure 1001](#) is a step-by-step process flow. 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, assembly, and testing.



Process Flow for Battery Restoration
Figure 1001

**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. Test equipment

Refer to [Special Tools, Fixtures, Equipment, and Consumables](#) for test equipment recommendations.

C. Visually 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 ([030](#)) for dents, distortion, or other damage and replace as needed with new Saft component.
 - (2) Visually inspect battery case ([010](#)) for dents, distortion, or other damage. If found, identify the component for replacement.
 - (3) Visually inspect handles ([300](#)) for defects, frays, and other damage. Replace as needed.
 - (4) Visually inspect visible portions of each cell ([220](#)) for any evidence of electrolyte leakage and damage.
 - (a) Damaged cells ([220](#)) must be marked for replacement or further cleaning.
- (b) Excessive salts around the terminal posts gives an indication of possible leakage from terminal O-ring ([290](#)). Identify any cells with excessive salts for later torquing the lower nut ([250](#)).
- (c) When inspection reveals electrolyte leakage from the cell at the vent hole opening, replace the defective O-ring ([240](#)), replace defective O-ring.

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 vent valve ([230](#)) from the cell ([220](#)).

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- 2 Remove and replace defective O-rings (240) from the vent valve (230).
 - 3 Using T01, tighten the ¼ turn vent valve (230) onto the cell (220).
- (5) Inspect the upper nuts (070), (225), washers (080), (228), and links (090 to 130) 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) Check the power connector (040) pins for defects, evidence of arcing, or excessive oxidization. If observed, identify the power connector (040) for later replacement.

D. Battery insulation

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

- (1) On a completely reassembling the battery using a megohmmeter under a continuous 250V, measure the insulation resistance between the metal box and
 - (a) the positive terminal of each cell,
- (2) The value measured must be $\geq 10M\Omega$ under a continuous 250V.
- (3) If the reading meets the above criteria ($\geq 10M\Omega$), the insulation is a “Pass”; otherwise, the insulation test is a “Fail”.

NOTE: If, after cleaning the battery and assuring that everything is dry, the resistance is still $< 10M\Omega$, then one or more cells (220) is defective, isolate and identify for later replacement.

E. Upper nut tightness

Check that the tightness on each upper terminal nut (070), (225) per to [Table 8001](#).

F. Battery voltage

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

G. Polarization test

- (1) Charge the battery at 0.1C₁A for 1.5 hours.
- (2) Keep the battery in open circuit for 1 hour.
- (3) Measure the open circuit voltage of each cell.
 - (a) Mark for replacement any cell (220) with zero volts or negative polarity. If any cell (220) is marked for replacement, the polarization test is a “Fail”.
 - (b) If all cells are greater than 0V, the polarization test is a “Pass”.



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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 ([230](#)) is installed on each cell ([220](#)).
- (2) Discharge the battery at a rate listed in [Table 1001](#) until the battery reaches 20.0V and record the times the first cell reaches 1.0V and battery reaches 20.0V.

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

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

DISCHARGE RATE (C ₁)	CURRENT (AMPS)	MINIMUM TIME FOR FIRST CELL TO 1.0V
0.5	21.5	121.2 MINUTES
1.0	43.0	60.0 MINUTES

Initial Discharge (Off-wing Capacity)
Table 1001

- (3) If defective case ([010](#)), power connector ([040](#)), nuts ([070](#)), ([225](#)) and washers ([080](#)), ([228](#)), or links ([090](#) to [130](#)) were found during the visual inspection, they are to be corrected by performing appropriate [DISASSEMBLY](#) and [ASSEMBLY](#).
- (4) For each cell ([220](#)) marked for replacement, do [Cell replacement](#) in [REPAIR](#).
- (5) For each cell ([220](#)) which had excessive salts around the terminals during visual inspection, do [Lower nut tightness](#).
- (6) If any cell hardware ([250](#)), ([260](#)) or ([260A](#)), ([270](#)), ([280](#)) was identified as needing replacement, do [Cell hardware replacement](#) in [REPAIR](#).
- (7) If terminal O-ring ([290](#)) requires replacement, do [Terminal O-ring replacement](#) in [REPAIR](#).
- (8) Initial discharge results

NOTE: The results below will be used for a decision point in [Figure 1001](#).

- (a) If the discharge time of the first cell reaching 1.0V equals or exceeds the value shown in [Table 1001](#) for the discharged rate, the battery capacity is a "Pass".
- (b) If the discharge time of the first cell reaching 1.0V is less than the value shown in [Table 1001](#) for the discharged rate, the battery capacity is a "Fail".

I. Cell shorting

- (1) Using [T01](#), verify the ¼ turn vent valve ([230](#)) is tightened on each cell ([220](#)).
- (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 discharge and cell shorting.

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- (a) Method A
 - 1 Continue to discharge the battery per [Table 1001](#) until each cell is < 1.0V, then connect a [T03](#) across its terminals. After all the cells have been shorted, leave the devices in place for 12 to 24 hours.
- (b) Method B
 - 1 Continue to discharge the battery per [Table 1001](#) until each cell is < 0.5V, then connect a shorting clip across its terminals. After all the cells have been shorted, leave these clips on for 16 to 24 hours.
- (3) At completion of Method A or B, remove the shorting devices.
- (4) If no cell(s) are marked for replacement, then return to [Figure 1001](#) utilizing the Pass or Fail results of the [Initial discharge](#).
- (5) If any cell ([220](#)) were marked for replacement, do [Cell replacement](#) in [REPAIR](#).

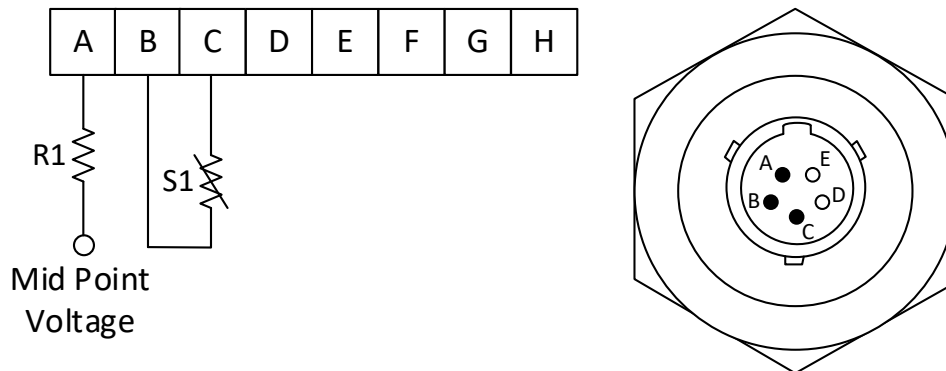
J. Sensor harness test

WARNING: A FULLY ASSEMBLED BATTERY MUST BE IN A FULLY DISCHARGE CHARGE STATE TO PREVENT INJURY, REFER TO [CELL SHORTING](#).

- (1) If any part of the sensor harness ([160](#)) is damaged, the entire assembly must be replaced, refer [DISASSEMBLY](#) and [ASSEMBLY](#).

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

NOTE: Refer to [Figure 1002](#) for pinout locations.



Connector Pinout
Figure 1002



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- (2) Verify the sensor values at the temperature range per [Table 1002](#) using an ohmmeter. Any erratic readings represent a failure of the sensor harness ([160](#)), refer [DISASSEMBLY](#) and [ASSEMBLY](#).

PINS	VALUES @ +25 ± 10°C (+77 ± 18°F)
Lug and Pin A	430Ω ± 1%
pins B and C	3000Ω ± 180Ω

Sensor Values
Table 1002

K. Charge

- (1) Allow the battery to cool to ambient temperature.
- (2) Remove the cover ([030](#)).
- (3) Prior to charging the battery, loosen (do not remove) all ¼ turn vent valves ([230](#)). 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 procedures in [Table 1003](#).
 - (a) Record the cell voltages at the start and end of the main charge (Step 1), and the last 30 minutes of the final charge (Step 2).
 - 1 If the start cell voltage of the main charge (Step 1) goes above 1.50V, add to the cell about 10 cm³ (0.61 in³) of [M01](#).
 - 2 During the last 30 minutes of the final charge (Step 2), adjust the [Electrolyte level](#) and check for [Minimum final charge voltage](#).

Main Charge (Step1)			Final Charge (Step 2)**
Current	Minimum Time*	End of Main Charge Criteria	Current and Time
0.1C ₁ A (4.3A)	10h	Every cell >1.5V or 12h whichever comes first	0.1C ₁ A (4.3A) for 4h
0.5C ₁ A (21.5A)	2h	Every cell >1.55V or 2.5h whichever comes first	0.1C ₁ A (4.3A) for 4h
1.0C ₁ A (43.0A)	1h	Every cell >1.57V or 1.25h whichever comes first	0.1C ₁ A (4.3A) for 4h

* Minimum time applies to a battery previously discharged to 20.0V.

** During the last 30 minutes do [Electrolyte level](#) and confirm minimum voltage criteria in [Table 1004](#).

Charge Table
Table 1003



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(5) Minimum final charge voltage

During the last 30 minutes of final charge, measure and verify the voltage of each cell (220) meets the value shown in [Table 1004](#). Identify each cell that does not comply and do [Special testing](#) per [Figure 1001](#).

CELL VOLTAGE
Last 30 minutes at 0.1C₁A
≥ 1.55V

Final Charge Voltage Limit
Table 1004

L. Vent valve test

NOTE: The vent valve test should be done once a year of battery operation. This test is not necessary for all vent valves replaced with Saft new valves (230) each year.

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 (230) as follows:
 - (a) Using [T01](#), tighten the ¼ turn vent valve (230) than contains O-ring (240) onto test fixture [T05](#).
 - (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 to 10 psi).
 - (e) Reuse only those vent valves found to open in the 0.14 to 0.69 bar (2 to 10 psi) range. Re-soak vent valves that do not open at 0.69 bar (10 psi). Discard vent relief valves which are not gas tight at low pressure.

M. Electrolyte level

This procedure is to be carried out during the last 30 minutes of the final charge at 0.1C₁A.

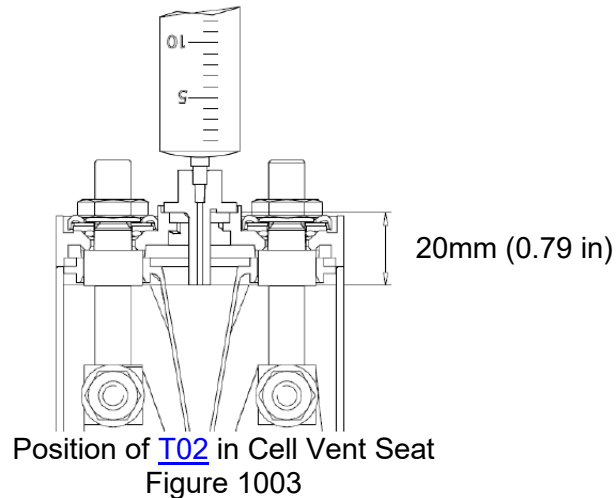
WARNING USE CARE NOT TO TILT CELLS WHILE VENT VALVES ARE LOOSENED OR REMOVED; CONTACT OF ELECTROLYTE WITH SKIN CAN CAUSE SEVERE BURNS.

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

- (1) Remove the vent valves (230) with the [T01](#), take precautions to prevent foreign substances from entering the cell (220).

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- (a) Clean the by Immersing the valves (230) and their O-rings (240) in M01 and let them soak to dissolve any salts.
- (2) Insert T02 into the cell opening until the shoulder of the nozzle rests on the valve seat (refer Figure 1003).



- (3) Withdraw the plunger and check for any liquid in 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 70 cm³ (4.27 in³), then check the charging system. If the aircraft charging system is functioning properly, the maintenance period may need to be reduced.
- 1 Draw a measured amount of M01, such as 5 cm³ (0.31 in³) 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 cm³ 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 the ¼ turn vent valve (230) on each cell (220).



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N. Capacity test (second discharge)

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

- (1) Prior to doing this capacity check, do [Charge](#) and [Electrolyte level](#).
- (2) Using [T01](#), verify the ¼ turn vent valve ([230](#)) is installed on each cell ([220](#)).
- (3) Discharge the battery at one of the current rates shown in [Table 1005](#) until the battery reaches 20.0V to determine and record the times the first cell reaches 1.0V and battery reaches 20.0V.

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

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

DISCHARGE		MINIMUM TIME FOR FIRST CELL TO 1.0 VOLT
RATE (C ₁)	CURRENT (AMPS)	
0.5	21.5	112.0 MINUTES
1.0	43.0	56.0 MINUTES

Capacity Check (Second Discharge)
Table 1005

- (4) If the time until the first cell reaches 1.0V equals or exceeds the values shown in [Table 1005](#) at the discharge rate the capacity is $\geq 100\%$, allow the battery to rest at least 2 hours.
- (5) If the time the first cell reaches is less than the value shown in [Table 1005](#) at the discharge rate the capacity is $< 100\%$.

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 $< 1.55V$ 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 ([220](#)), refer to [All cell replacement](#) recommendation in [REPAIR](#).

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

- (1) Special testing decision

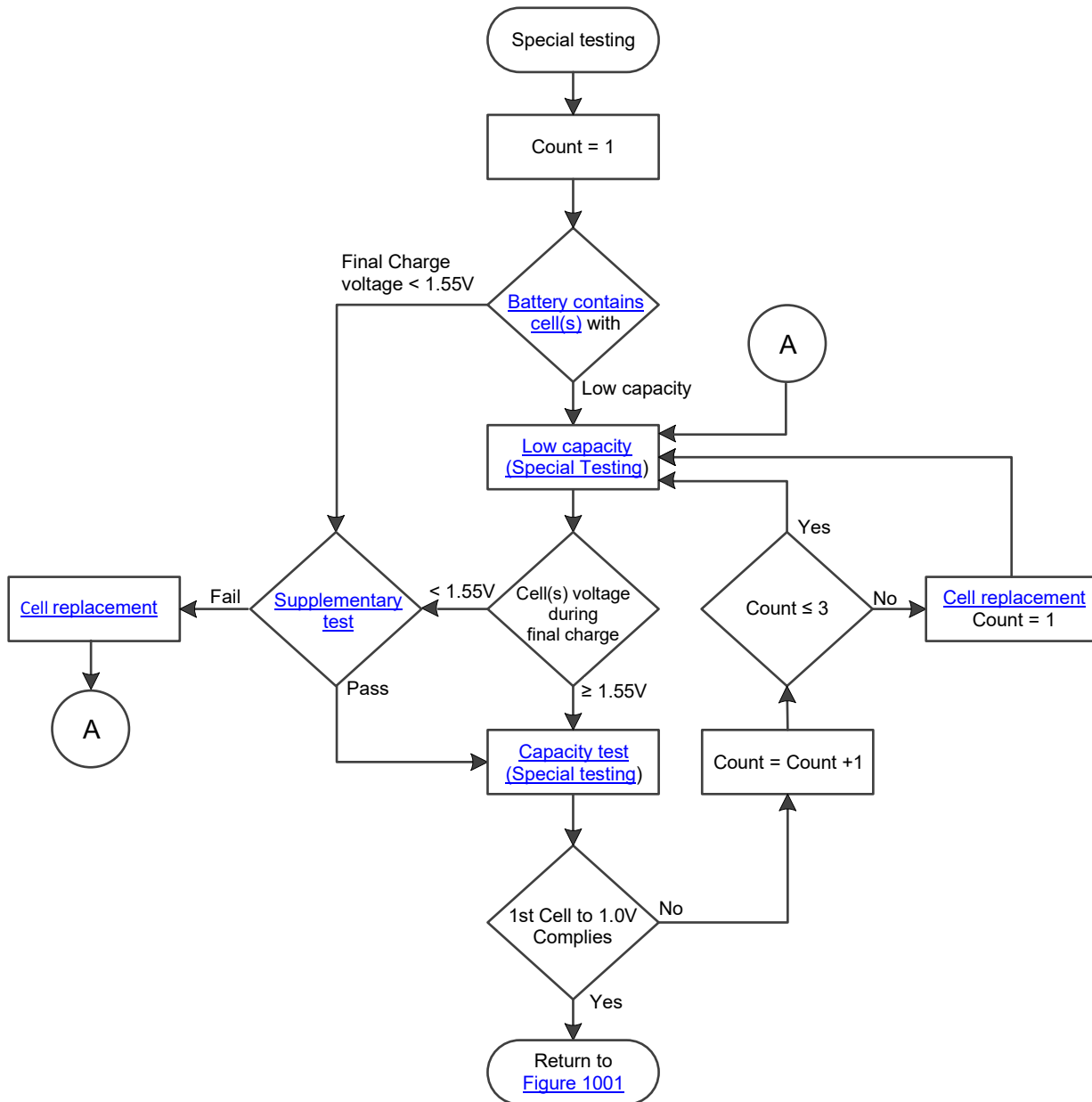
For a battery with $< 100\%$ capacity, do [Low capacity \(Special testing\)](#). Otherwise for a battery with any cell voltage $< 1.55V$, do [Supplementary test](#).



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- (3) Low capacity (Special testing)
- (a) Loosen, but do not remove all vent valves ([230](#)) 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 testing \(Special testing\)](#).
- (4) Supplementary test
- (a) Charge at 0.1C₁A for an additional 5 hours and monitor the voltage of the individual cells every 30 minutes.
NOTE: The additional 0.1C₁A 5-hour charge may be stopped once all the cells ≥ 1.55V.
 - 1 Identify for replacement any cell ([220](#)) with voltage < 1.55V.
 - 2 During the last 30 minutes of this charge, adjust the [Electrolyte level](#).
 - 3 Do [Cell replacement](#) in [REPAIR](#) for cells marked for replacement. Otherwise, do [Capacity test \(Special testing\)](#).**NOTE:** If more than one cell ([220](#)) 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](#) in [REPAIR](#).
- (5) Capacity test (Special testing)
- (a) Using [T01](#), verify the ¼ turn vent valve ([230](#)) is installed on each cell ([220](#)).
 - (b) Discharge the battery at a rate shown in [Table 1005](#) until the battery reaches 20.0V. Record the time and current the battery reached 20.0V and identify noncompliant cells with voltage < 1.0V.
 - (c) If the time the first cell reached 1.0V equals or exceeds the values shown in [Table 1005](#) at the applicable discharge rate, return to [Figure 1001](#). Otherwise, repeat this procedure [Low capacity \(Special testing\)](#) or refer to [Fault Isolation](#).
 - 1 For noncompliant cells that have failed this capacity test 3 times, replace with new Saft cell ([220](#)), refer to [Cell replacement](#) in [REPAIR](#).

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Special Testing Flow Chart
Figure 1004

P. Lower nut tightness

- (1) Remove the necessary hardware; remove nuts (070), (225), washers (080), (228), and intercell connecting links (090 to 130). Torque the lower nut (250) per Table 8001.
- (2) Install applicable hardware; intercell connecting links (090 to 130), washers (080), (228), upper nuts (070), (225). Torque upper nuts per Table 8001.



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5. Fault Isolation

Fault isolation information is presented in [Table 1006](#), [Table 1007](#), or [Table 1008](#) as a guide in locating a 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). (b) Broken or loose terminal links, upper nuts	Check electrical connections Replace if required using DISASSEMBLY and ASSEMBLY
(2) Low Insulation	(a) Leakage of electrolyte (b) Incorrect electrolyte level (c) Reverse cell polarity (d) Condensation / Contamination (e) Improper cleaning (f) Loose or damage vent valve (g) Damaged cell case (h) Charge rate too high	Do Thorough Cleaning , ASSEMBLY , Charge , Electrolyte level Tighten or replace ¼ turn vent valve, do Thorough Cleaning , ASSEMBLY , Charge , Electrolyte level Do Thorough Cleaning , Cell replacement , ASSEMBLY , Charge , Electrolyte level Investigate the cause of the excessive charge. Do Thorough Cleaning , ASSEMBLY , Charge , Electrolyte level
(3) Loss of battery capacity	(a) Normal wear after long service (b) Exceptionally heavy use	Do Special testing

Battery Faults
Table 1006



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

Cell Faults
Table 1007



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TROUBLE	PROBABLE CAUSE	REMEDY
(1) Tarnished or burned terminal connectors	(a) Loose terminal nuts and links	Clean and torque per Table 8001
(2) Exposed copper material on power connector pin	(a) Mechanical damage (b) Electrical arcing	Replace component using DISASSEMBLY and ASSEMBLY
(3) Melted plastic on connectors	(c) Overheat due to contact resistance	Replace component using DISASSEMBLY and ASSEMBLY
(4) Corroded links	(a) Operation in acidic atmosphere (b) Inadequate greasing (c) Mechanical damage to protective nickel-plating	Check room eliminate acid source, replace component using DISASSEMBLY and ASSEMBLY Replace component using DISASSEMBLY and ASSEMBLY Replace component using DISASSEMBLY and ASSEMBLY
(5) Battery case and cover damage with dents, deformations, and visible cracks which affect fit or impede performance.	(a) Various, transport (b) Mechanical stress, drop	Replace component using DISASSEMBLY and ASSEMBLY

Physical Faults
Table 1008



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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 numbers and are shown in the Battery, Exploded View [IPL Figure 1](#).

2. Detailed Instructions

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

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

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

A. Preparation

- (1) Discharge the battery at one of the current rates shown in [Table 1005](#) until each cell reaches 1.0V.
- (2) Remove cover ([030](#)) by opening latches and lifting cover from case ([010](#)).
- (3) Do [Cell shorting](#)

B. Cell ([220](#)) removal

- (1) Remove nuts ([070](#)), ([225](#)) and washers ([080](#)), ([228](#)) from cell ([220](#)) terminals and power connector ([040](#)).
- (2) Remove intercell terminal links ([090](#) through [130](#)) from cell ([220](#)) terminals.
- (3) Using [T04](#) on the cell terminals as needed to remove cells ([220](#)) from the battery case ([010](#)).

C. Disassembly of the cells ([220](#)) is restricted to replacing defective cell hardware ([250](#)), ([260](#)) or ([260A](#)), ([270](#)), ([280](#)) or terminal O-rings ([290](#)), refer to [Component replacement](#) in [REPAIR](#).

D. Power connector ([040](#)) removal

- (1) Remove the four screws ([060](#)) from the connector.
- (2) Remove the power connector ([040](#)) with its gasket ([050](#)) from the case ([010](#)).

E. Sensor harness ([160](#)) removal

- (1) Remove the nut ([170](#)), washer ([180](#)), and screw ([190](#)) that attach to link ([130](#)).
- (2) Remove the nut ([200](#)), gasket ([210](#)), and sensor harness ([160](#)) from the case ([010](#)).

F. Remove all spacers ([020](#)) from the battery case ([010](#)).

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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 numbers and are shown in the Battery, Exploded View [IPL Figure 1](#).

- A. The following items are required to do the cleaning procedures (equivalent substitutes can be used):
- (1) Stiff bristled brush (nonmetallic)
 - (2) Dry compressed air source, less than 1.38 bar (20 psi)
 - (3) Safety goggles
 - (4) Lubricant (non-acid petroleum jelly), [M02](#)
 - (5) Soft, clean cloth (two required)
 - (6) Running water
 - (7) Mild Soap, [M03](#)
 - (8) Distilled or de-ionized water, [M01](#)

2. Light Cleaning

- A. The following procedures are for an assembled battery with battery cover ([030](#)).
- B. Using [T01](#) make sure that the ¼ turn vent valve ([230](#)) of each cell ([220](#)) are closed and secure. Do not over-tighten.
- C. Remove white deposits (potassium carbonate) from tops of all cells ([220](#)) using a stiff bristled nonmetallic brush.

WARNING: TO PREVENT INJURY WHEN USING COMPRESSED AIR, DIRECT AIRFLOW AWAY FROM BODY AND 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 nuts ([070](#)), ([225](#)), washers ([080](#)), ([228](#)), and links ([090](#) through [130](#)) 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 ([030](#)) and battery case ([010](#)) using a soft, clean cloth, moistened with water. Dry with compressed air or a dry, clean cloth.

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3. Thorough Cleaning

- A. The battery must be discharged (refer to [Initial discharge](#) and [Cell shorting](#)) and disassembled (refer [DISASSEMBLY](#)).
- B. Remove greasy residue from power connector ([040](#)) with warm mild soapy [M03](#) water.
- C. After ensuring that the vent valves ([230](#)) are installed and locked into place, wash each cell ([220](#)) in running water. Do not allow any water to enter the cell. Dry with compressed air or a dry, clean cloth.
- D. Without submerging the connector of sensor harness ([160](#)), wipe clean with damp cloth and let dry.
- E. Wash the battery case ([010](#)), handles ([300](#)), cover ([030](#)), spacers ([020](#)), gasket ([050](#)), cell links ([090](#) through [130](#)), cell hardware ([070](#)), ([080](#), ([130](#)), ([225](#)), and connector hardware ([170](#)), ([180](#)), ([190](#)), and ([200](#)) 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 all [M03](#) and 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 specifically otherwise stated.

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

2. Initial New Battery Commissioning

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

NOTE: For a new battery not receiving its initial commission within one year of its DOM, then battery must follow [Figure 1001](#).

- (1) Inspect the battery case ([010](#)) and cover ([030](#)) for dents, distortion, or other damage. If found, replace with new Saft case ([010](#)) or cover ([030](#)).
- (2) Remove the battery cover ([030](#)).
- (3) Visually verify the power connector ([040](#)) is present and undamaged.
- (4) Visually verify all cells ([220](#)) are positioned for proper polarity per [Figure 7002](#).
- (5) Visually verify all cells ([220](#)) are equipped with a vent valve ([230](#)).
- (6) Tighten all upper cell nuts ([070](#)), ([225](#)) and locking nut ([170](#)) and connector nut ([200](#)) per [Table 8001](#).
- (7) Visually verify the sensor harness ([190](#)) is present and undamaged.

B. Charge the battery per [Charge](#) on page [1007](#) and level electrolyte per [Electrolyte level](#) on page [1008](#).

C. Perform successful [Battery insulation](#) test and install battery cover ([030](#)), then the battery is ready for service.

3. Component inspection

A. Cell ([220](#))

- (1) Visually inspect for evidence of electrolyte leakage, cracks, corrosion, burns, holes, or cross-threaded terminals. Replace any defect cells with new Saft cells ([220](#)).
- (2) Excessive salt around a terminal post indicates leakage. Refer to [Terminal O-ring replacement](#) on page [6001](#) for replacement of lower terminal O-ring ([290](#)) if leakage is evident.
- (3) Visually check each cell vent valve ([230](#)) for defective O-rings ([240](#)), cracks, or other physical damage. Replace defective O-rings ([240](#)).
 - (a) Suspect vent valves ([230](#)) should be tested in accordance with [Vent valve test](#) and/or be discarded.

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- (4) Inspect the nuts ([250](#)) and washers ([260](#)) or ([260A](#)), ([270](#)), ([280](#)) to ensure it is free of bends, tarnish, corrosion, burns, or loss of plating. Minor tarnish can be polished off with a fine wire brush. Refer to [Cell hardware replacement in REPAIR](#).
- B. Inspect upper nuts ([070](#)), ([225](#)) and washers ([080](#)), ([228](#)) 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 ([090](#) through [130](#))
Inspect for bends, tarnish, loss of nickel plating, corrosion, or burns. Tarnish can be polished off with a fine wire brush. Replace any defective intercell links.
- D. Spacers ([020](#))
The spacers ([020](#)) should be clean and free of cracks or holes. Replace any that are defective.
- E. Power connector ([040](#))
CAUTION: A DEFECTIVE POWER CONNECTOR CAN CAUSE DANGEROUS OVERHEATING AND IN-SERVICE LOW VOLTAGE DURING DISCHARGE.
- (1) Check the power connector ([040](#)) for evidence of arching, corrosion, cracks, or cross threaded terminals.
 - (2) Using the [Battery insulation](#) method on page [1004](#), check the insulation between the positive pin and the connector shell and the negative pin and connector shell.
 - (3) Discard any connector found to be defective or fails the insulation test. Replace with factory new power connector ([040](#)).
- F. Sensor harness ([160](#))
- (1) Inspect electrical connector for bent or loose pins, corrosion, cracks, faulty wire connections, and evidence of arcing.
 - (2) Inspect charge control thermistor and resistor lug for damage, loose or broken wire connections, cracks, dents, or other physical defects.
 - (3) Visually check all wiring damage to insulation, cracked or broken wire, and other physical defects.
 - (4) Any evidence of the above conditions the component should be discarded and replaced with new Saft harness ([160](#)).
- NOTE:** Sensor harness ([160](#)) is a non-repairable item and should be discarded if defective.
- G. Battery cover ([030](#)), case ([010](#)), and handle ([300](#))
Inspect the components for damage. If found, replace with new Saft cover ([030](#)), case ([010](#)), or handle ([300](#)) as needed.



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REPAIR

1. General

This section contains basic battery component procedures.

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

NOTE: All voltage readings are DC unless otherwise stated.

2. Required Test Equipment

NOTE: Test equipment with equivalent specifications can be used.

Refer to [Special Tools, Fixtures, Equipment, and Consumables](#) for listing of Standard Tools.

3. Component Replacement

A. Cell replacement

A battery containing cell(s) (220) require replacement. Note the [All cell replacement](#) recommendation below.

(1) All cell replacement

(a) For a battery compliant with the following, it is best to assume that all the original cells are or soon will be in unsatisfactory condition. Saft strongly recommends all cells (220) should be replaced with new Saft cells for a battery having:

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

Or

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

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

(2) Do [DISASSEMBLY](#) and [ASSEMBLY](#) to replace cells.

B. Cell hardware 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 (250), (260) or (260A), (270), (280) by removing and replacing the nuts (070), (225), washers (080), (228), links (090 to 130). Torque nuts (070), (225), (250) per [Table 8001](#) as required.

C. Terminal O-ring replacement

(1) Remove necessary nuts (070), (225), washers (080), (228), and links (090 to 130).

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

- (2) Remove lower terminal nut ([250](#)), polarity washer ([260](#)) or ([260A](#)), washers ([270](#)), ([280](#)), and terminal O-ring ([290](#)) being careful to prevent anything from falling into the cell opening.
- (3) Replace O-ring ([290](#)), install washer ([280](#)), 2 belleville washers ([270](#)), polarity washer ([260](#)) or ([260A](#)) and torque lower terminal nut ([250](#)) per [Table 8001](#).

NOTE: Spring washers ([270](#)) should be put in parallel, stacked in same direction with the larger edge downward on the terminal.

- (4) Install the necessary links ([090](#) to [130](#)), washers ([080](#)), ([228](#)), and torque nuts ([070](#)), ([225](#)) per [Table 8001](#) as required.



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ASSEMBLY

1. General

This section contains assembly instructions necessary after disassembly and test.

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

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

2. Sensor harness (160)

- A. Position the sensor harness (160) connector through the opening of the case divider in the central row of the case (010) and install O-ring (210) and torque nut (200) per [Table 8001](#).
- B. Secure and torque the sensor lug in place on link (130) with nut (170), washer (180), and screw (190), refer to [Table 8001](#).

3. Power Connector (040)

- A. Apply a small amount [M04](#) to the power connector gasket (050)
- B. Install the power connector (040) with its gasket (050) and torque the four Sems screws (060). (Refer to [Table 8001](#)).
- C. Remove excess [M04](#), if any.

4. Spacers (020) and Cells (220)

- A. Install spacers (020), sensor harness (160), and cells (220) into the battery case (010), using the following steps. Refer to [Figure 7001](#) and [7002](#).

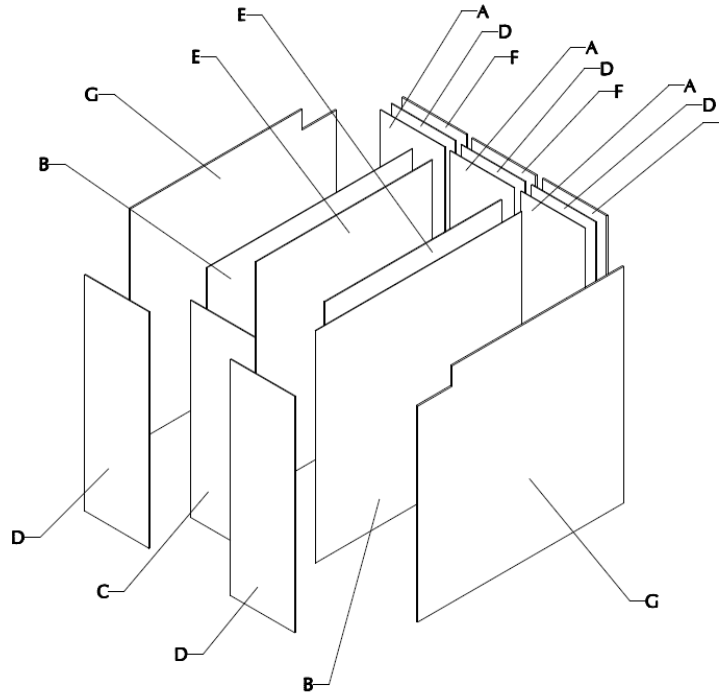
HINT: It is often easier to install the center cell of a row last. Observe polarity.

- (1) Install the left and right side row of cells and spacers in accordance with the following steps in battery case (010), as shown in [Figure 7001](#) and [Figure 7002](#).

NOTE: Spacers are used as required to ensure the row cells are retained securely in place. When installed it shall be necessary to exert approximately 17.8 daN (40 lbf) of upward force to remove a cell from the assembly.

- (a) Install on each side and at each end spacers into the in the left and right side of battery case (010), as shown in [Figure 7001](#).
- (b) Install seven cell subassemblies (220) into the left side of the case (010). Be sure to maintain the proper cell arrangement and polarity orientation see [Figure 7002](#). Insertion of the last cell can sometimes be difficult, to assist insertions press down on the terminals with a small block of soft wood.
- (c) Install seven cell subassemblies (220) into the right side of the battery case (010). Be sure to maintain the proper cell arrangement and polarity orientation per [Figure 7002](#). Insertion of the last cell can sometimes be difficult, to assist insertions press down on the terminals with a small block of soft wood.

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ITEM	DESCRIPTION	DIMENSION (IN)	UNITS PER ASSY
A	Spacer	2.953 x 9.370 x 0.020	20
B	Spacer	9.450 x 9.200 x 0.020	2
C	Spacer	2.953 x 8.610 x 0.032	1
D	Spacer	2.953 x 9.370 x 0.032	12
E	Spacer	8.100 x 9.200 x 0.032	2
F	Spacer	2.953 x 9.370 x 0.062	7
G	Spacer	9.453 x 9.375 NOTCHED x 0.062	2

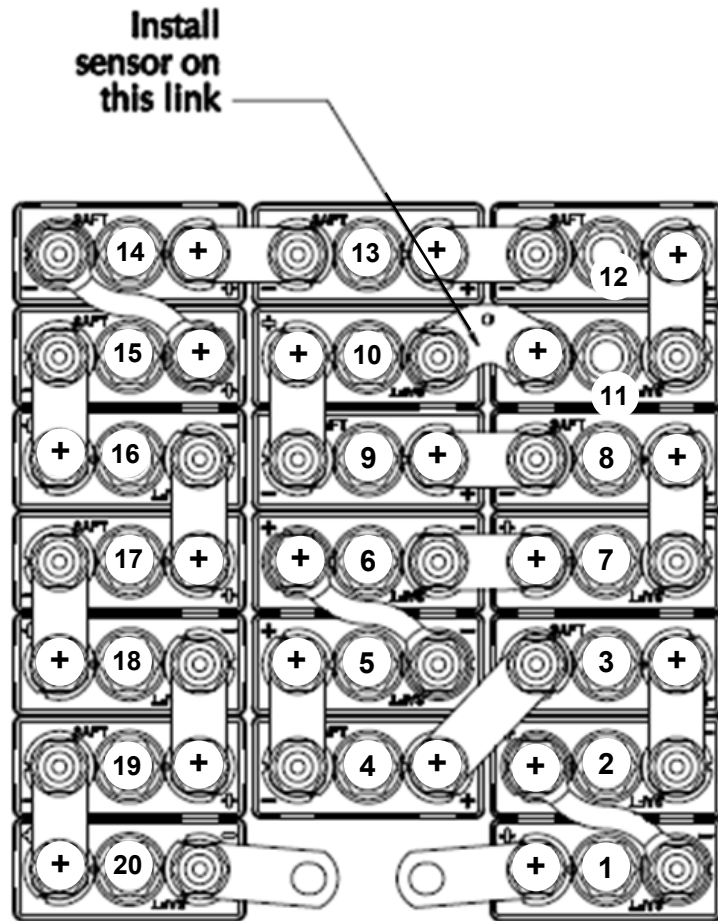
Spacer Kit Installation

Figure 7001

- (2) Install center row of cells and spacers in accordance with the following steps in battery case (010), as shown in [Figure 7001](#) and [Figure 7002](#).

NOTE: Spacers are used as required to ensure the center row cells are retained securely in place. When installed it shall be necessary to exert approximately 17.8 daN (40 lb_f) of upward force to remove a cell from the assembly.

- (a) Install side and end spacers into the center partition of battery case (see [Figure 7001](#)).
- (b) Install six cell subassemblies (220) into the center partition of battery case (010). Be sure to maintain the proper cell arrangement and polarity orientation (see [Figure 7002](#)). Insertion of the last cells is sometimes difficult and may be assisted by pushing down on the terminals with a small block of soft wood.



Cell Number and Polarity Orientation
Figure 7002

5. Complete Battery

- A. Install intercell terminal links ([090](#) through [130](#)) on the terminals of the cell sub-assemblies ([220](#)) and battery power connector ([040](#)).
- B. Lightly lube with [M02](#) the cell terminals, nuts, links, and power connector pins using a nonmetallic brush.
- C. Install washers ([080](#)), ([130](#)), and nuts ([070](#)), ([225](#)) onto terminals of cells ([220](#)) and power connector ([040](#)). Torque nuts ([070](#)), ([225](#)), refer to [Table 8001](#).
CAUTION: DO NOT CRIMP WIRE LEAD/LUG ASSEMBLIES OF THE SENSOR HARNESS.
- D. Lightly lube with [M02](#) any other components that might be susceptible to atmospheric corrosion.
- E. Install battery cover ([030](#)) onto the battery case ([010](#)) and secure in place by fastening the latches.



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FITS AND CLEARANCES

1. Torque Table

IPL SECTION FIGURE	ITEM NUMBER	TORQUE VALUE		NAME, LOCATION
		Nm	lb _f -in	
1 (Sheet 1 of 4) 1 (Sheet 4 of 4)	070, 225	13.0 ± 1.0	115 ± 9	Nut, Terminal, Upper
1 (Sheet 1 of 4)	060	2.3 ± 0.2	20 ± 2	Screw, Sems
1 (Sheet 3 of 4)	170	1.1 ± 0.1	10 ± 1	Nut, Locking
1 (Sheet 3 of 4)	190	1.1 ± 0.1	10 ± 1	Screw, Pan Head
1 (Sheet 3 of 4)	200	5.93 ± 0.28	52.5 ± 2.5	Nut, Aux. Connector
1 (Sheet 4 of 4)	250	5.0 ± 0.5	44 ± 4	Nut, Terminal, Lower

Torque Values
Table 8001

2. Fits and Clearances Table

No fits and clearances required.



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SPECIAL TOOLS, FIXTURES, EQUIPMENT, AND CONSUMABLES

1. Special Tools

A. Battery maintenance kit

NOTE: Equivalent tools can be used.

NOTE: A special tool kit (P/N 416161) is available from Saft containing special tools T01, T02, T03, and T04. The tools are housed in a polypropylene box. Refer to [Table 9001](#)

- (1) [T02](#) (P/N 416232) is assembled using syringe P/N 105112 and nozzle P/N 104184. [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	1.2Ω 3W 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. Standard Tools

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

- Constant current charger (DC current range 0 – 60A, minimum open DC voltage 40V)
- Constant current load bank (DC current range 0 – 60 A, DC voltage range 1 – 40V)
- Megohmmeter (0 – 50 MΩ @ 250 V continuous)
- Precision Multimeter (Volt, Ω, mA) 2000 count, accuracy 1% or better
- Torque Wrench (Insulated) 0 to 15 N-m (0 to 133 lb_f-in)
- Torque Screwdriver 0 to 3.4 N-m (0 to 30 lb_f-in)
- Thermometer, Immersion
- Standard mechanic's tools.
- Safety gloves.
- Protective goggles.
- Safety shoes.
- Eye wash.
- Climatic Chamber
- Protective apron
- Stiff bristle brush (non-metallic)



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- Small paintbrush (non-metallic)
- Dry, compressed air source [less than 1.38 bar (20 psi)]
- Soft, clean cloth (at least two required)

3. Consumables

NOTE: Equivalent alternatives can be used for list items.

This paragraph describes the consumables used in the CMM.

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): Clear, colorless, and odorless while boiling Conductivity < 33 µS/cm 5 < pH < 7 Mn-COD < 30 mg/l (1.7 x 10 ⁻⁵ oz/in ³) (Chemical Oxygen Demand, methodology to evaluate organic or mineral pollution) Chlorines Cl ⁻ < 5 mg/l (2.9 x 10 ⁻⁶ oz/in ³) Sulfates SO ₄ ²⁻ < 10 mg/l (5.8 x 10 ⁻⁶ oz/in ³) STORAGE: dry and clean container without any corrosion and damage; Temperature: +20°C ± 5°C (+68°F ± 9°F). Over 1 year of storage, do an analysis of the liquid.	Local Vendor
M02	Neutral petroleum jelly Density @ +60°C (+140°F) Range = 0.840 to 0.866 kg/l (0.486 to 0.501 oz/in ³) Melting Point Range = +46°C to +52°C (+115°F to +126°F) Acidity/Alkalinity = Neutral to Litmus	Mineral Vaseline NATO: S 743 F: AIR 3565 US: VV-P-236A UK: DEF 2333
M03	Mild Soap	Local Vendor
M04	Silicone sealant	Dow Corning 737 or equivalent neutral cure RTV

Consumables
Table 9002

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ILLUSTRATED PARTS LIST

1. Introduction

A. Purpose

This section provides illustrations and parts breakdown of the battery, 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) Effectivity code

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

(3) Quantity per assembly

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

(4) Parts replacement data

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

(5) Service Bulletin incorporation

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

(6) Items not illustrated

Items not illustrated are indicated by a dash (-) ahead of the item numbers in the FIGURE and ITEM NO. column.

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(7) Alpha variant item numbers

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

- 1 Added items
- 2 Service Bulletin modifications
- 3 Configuration differences
- 4 Optional parts
- 5 Product improvement parts (non-service bulletin)

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

(8) Vendors

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

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



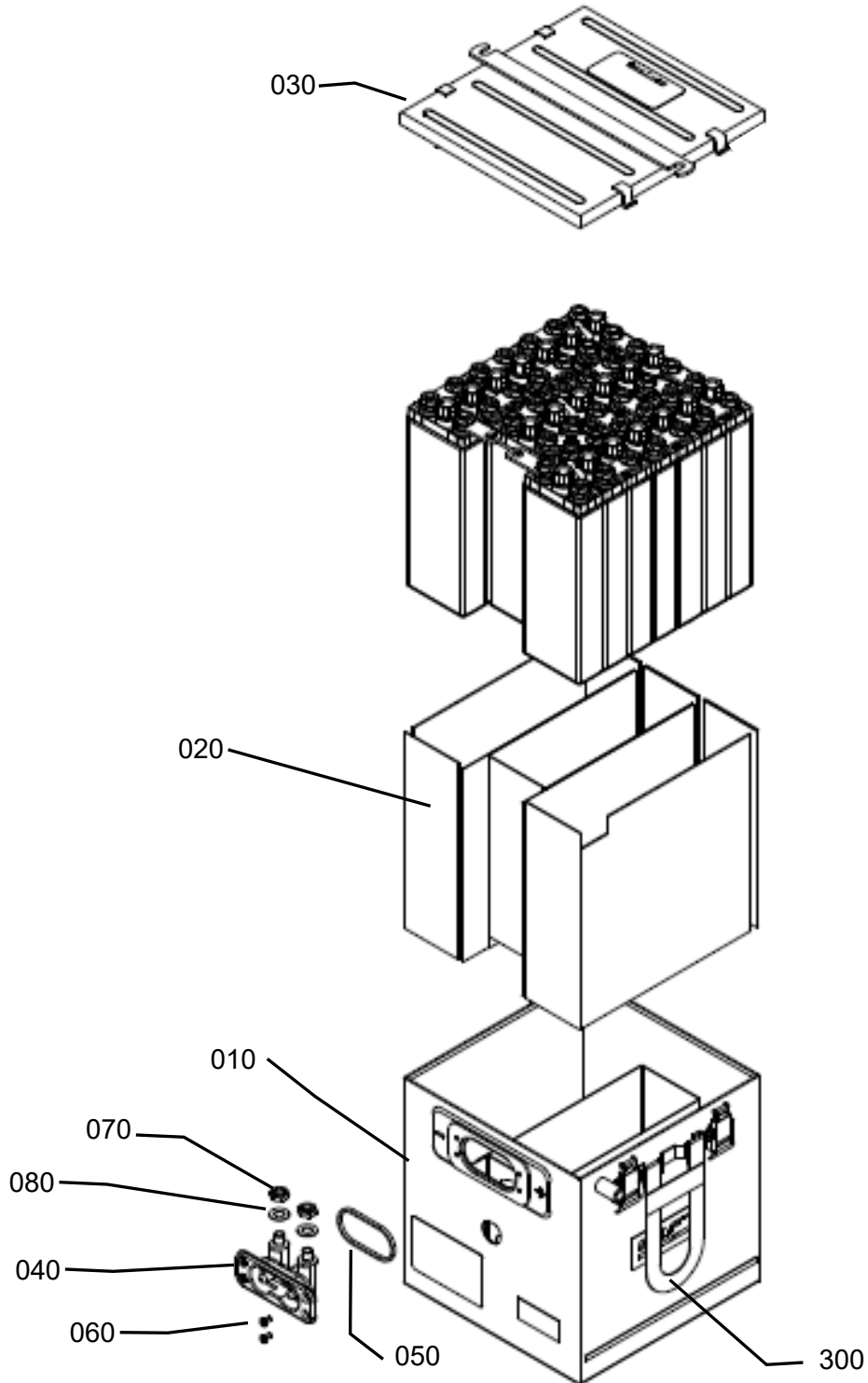
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2. Numeric Index

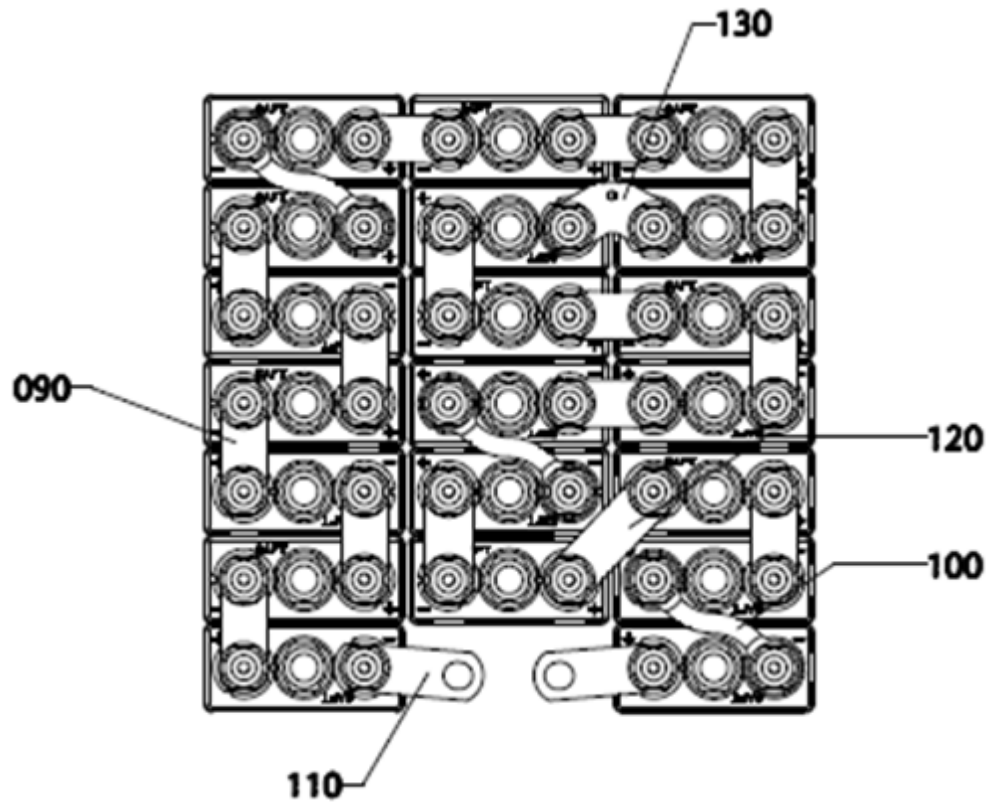
PART NUMBER	AIRLINE STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER	UNIT	UNITS PER BATTERY
MS3186A111P			200	EA	1
M25988/3-024			210	EA	1
009384-000			050	EA	1
012536-002			240	EA	20
015575-000			090	EA	14
015576-000			100	EA	3
015577-000			110	EA	2
015578-000			120	EA	1
015579-000			070, 225, 250	EA	82
015926-000			130	EA	1
021740-000			040	EA	1
021870-000			280	EA	40
021871-000			270	EA	80
022228-000			080, 228	EA	42
023388-002			260A	EA	20
023388-001			260	EA	20
023619-000			230	EA	20
023707-001			300	EA	2
025009-000			160A	EA	1
025271-000		1	1		RF
025272-000			010	EA	1
025396-000			030	EA	1
025853-000			220	EA	20
026647-000			020	EA	1
090061-000			180	EA	1
091181-002			290	EA	40
093015-005			190	EA	1
093169-000			170	EA	1
093616-000			060	EA	4

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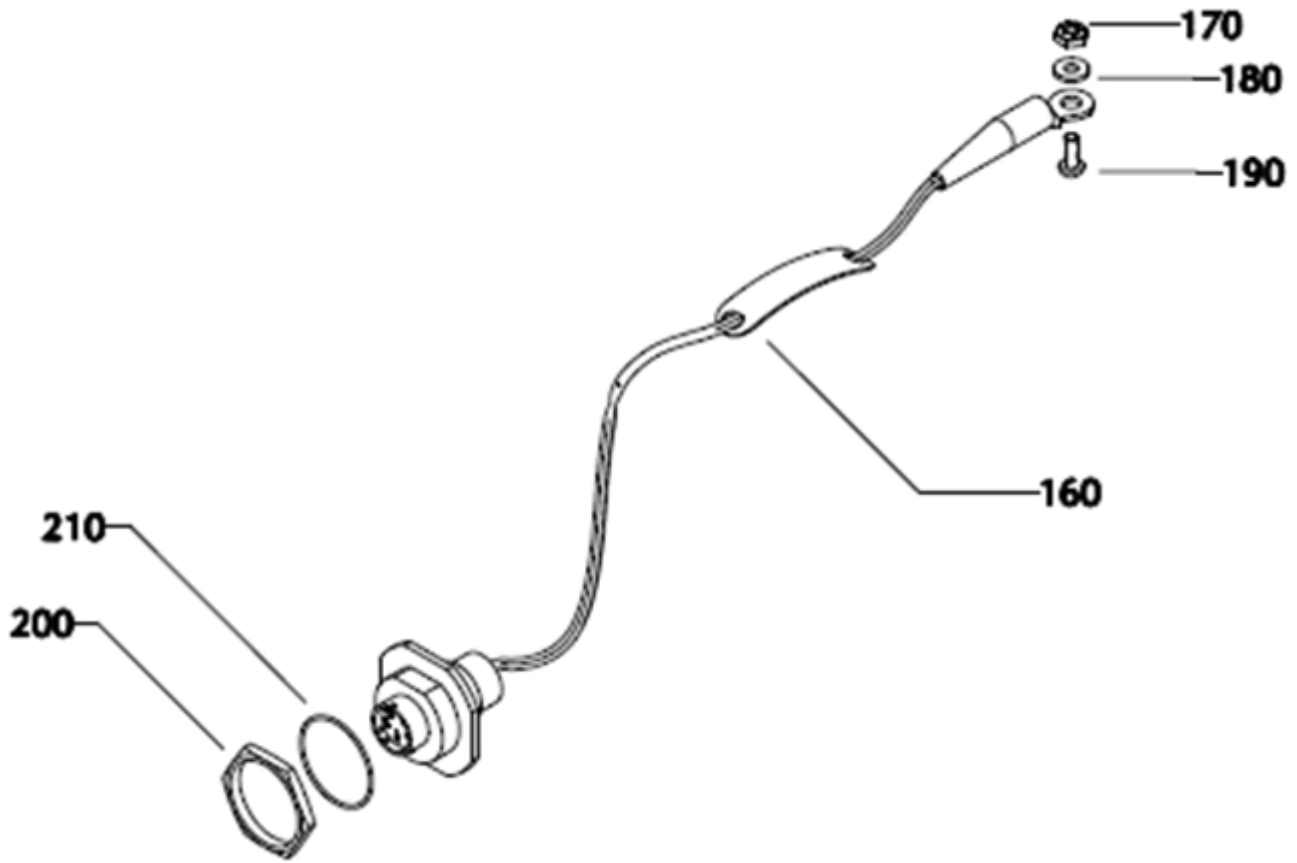
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Battery, Exploded View
IPL Figure 1 (Sheet 1 of 4)

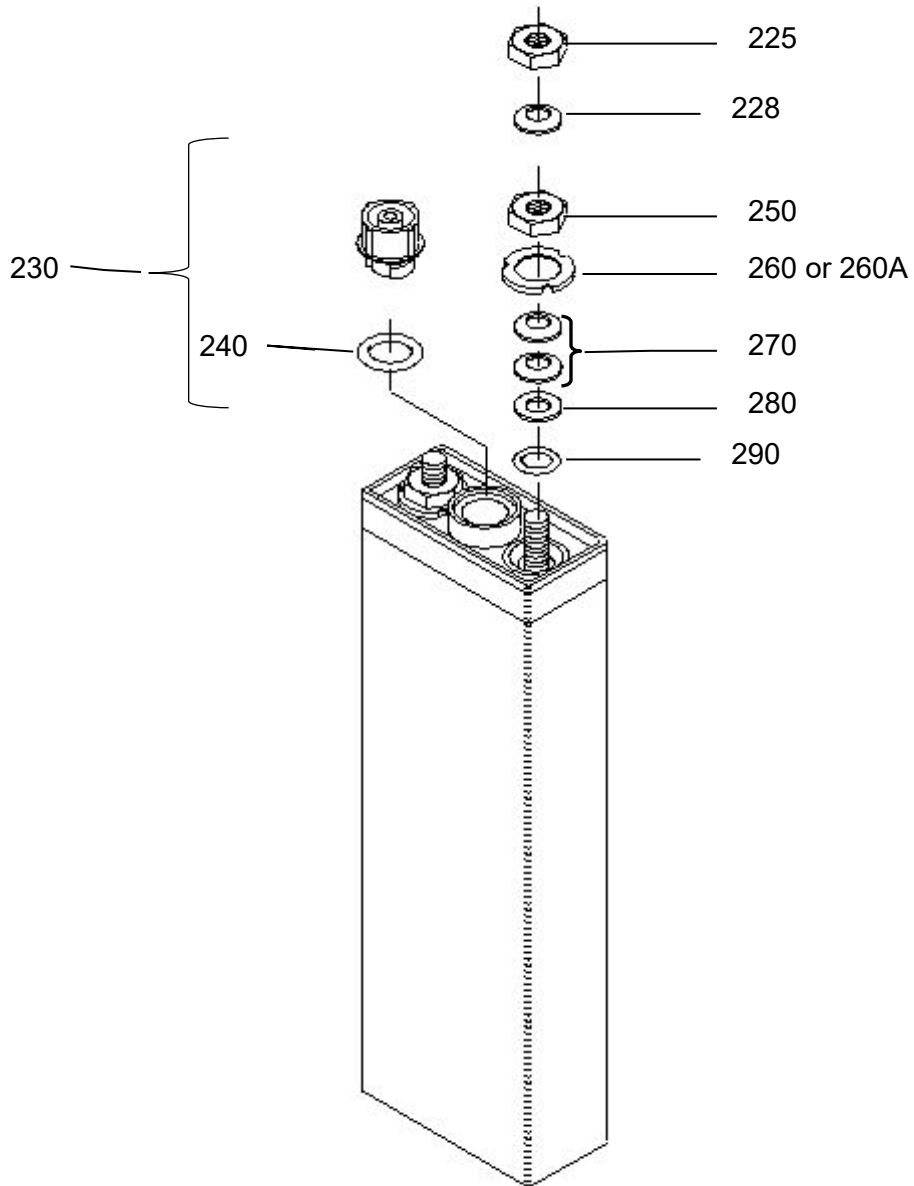


Battery, Exploded View
IPL Figure 1 (Sheet 2 of 4)



Battery, Exploded View
IPL Figure 1 (Sheet 3 of 4)

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Battery, Exploded View
IPL Figure 1 (Sheet 4 of 4)



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3. Details Parts List

FIG	ITEM	PART NUMBER	AIRLINE STOCK NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	QTY
1	-1	025271-000		4318CH24		RF
	010	025272-000		. Case, Marked		1
	020	026647-000		. Kit, Spacer		1
	030	025396-000		. Cover Assembly		1
	040	021740-000		. Connector, Power		1
	050	009384-000		. Gasket		1
				Attaching parts		
	060	093616-000		. Screws, Sems		4
				* * *		
	070	015579-000		. Nut		2
	080	022228-000		. Washer, Belleville		2
	090	015575-000		. Link		14
	100	015576-000		. Link		3
	110	015577-000		. Link		2
	120	015578-000		. Link		1
	130	015926-000		. Link		1
	160	024634-000		. Sensor, Harness SUPSD BY ITEM 160A		1
	-160A	025009-000		. Sensor, Harness SUPSDS ITEM 160		1
				Attaching parts		
	170	093169-000		. Nut Hex Locking		1
	180	090061-000		. Washer Flat		1
	190	093015-005		. Screw Pan Head		1
	200	MS3186C111P		. Nut		1
				* * *		
	210	M25988-3-024		. O-Ring, M25988/3-024		1
	220	025853-000		. Cell, CVH430KA w/hardware		20
	225	015579-000		. . Nut Upper		2
	228	022228-000		. . Washer, Belleville		2
	230	023619-000		. . Valve, Vent		1
	240	012536-002		. . . O-Ring		1
	250	015579-000		. . Nut Lower		2
	260	023388-001		. . Polarity Washer, Red		1
	260A	023388-002		. . Polarity Washer, Blue		1
	270	021871-000		. . Washer, Belleville		4

DASH (-) ITEM NOT ILLUSTRATED

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FIG	ITEM	PART NUMBER	AIRLINE STOCK NUMBER	NOMENCLATURE							USAGE CODE	QTY
				1	2	3	4	5	6	7		
	280	021870-000		.	.	Washer, Flat						2
	290	091181-002		.	.	O-Ring						2
	300	023707-001		.		Handle						2

DASH (-) ITEM NOT ILLUSTRATED



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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](#), [Sensor harness test](#), [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: If climatic conditions are met and the packaging protects the battery from mechanical damages, environmental contaminants (i.e.: dirt, dust, vibrations, or corrosive atmosphere), and is airtight, then a 10-year storage period is allowed (if not airtight, a 2 year storage period is allowed).

- 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 Visual inspection and return to Figure 1001 entry point " C "
More than 12 months	Do Charge and return to Figure 1001 entry point " Received "

Return to Service Following Storage
Table 15001

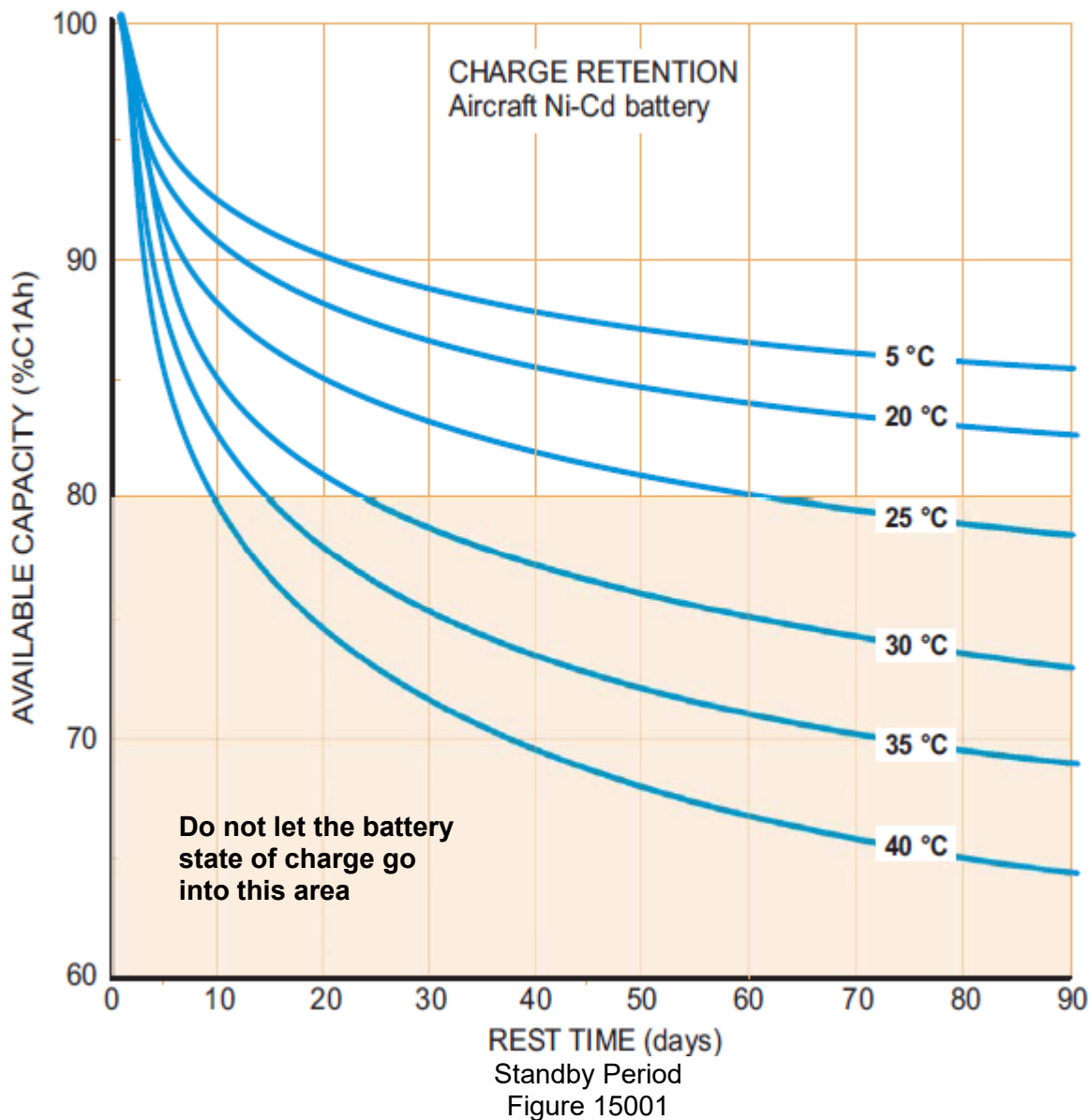
3. Inactive Stand-by Storage

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 duration that corresponds to 80% available capacity shown in [Figure 15001](#). For example, maximum 24 days at +30°C (+86°F) or maximum of 90 days for temperatures $\leq +23^\circ\text{C}$ (+73°F),





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

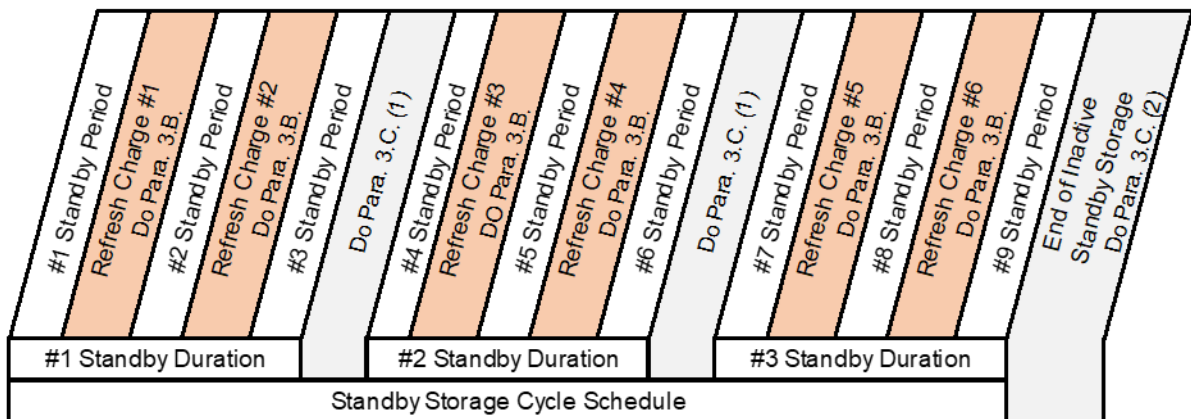
CAUTION: DO NOT DO THE 4 HOURS FINAL CHARGE AT 0.1 C₁A (REFER TO [CHARGE](#)) DURING THIS 'REFRESH' CHARGE OPERATION.

Charge Rate	Voltage (End of "Refresh" Charge)
0.1C ₁ A	30.0V for 20 Cells
0.5C ₁ A	31.0V for 20 Cells
1.0C ₁ 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: Anytime during this inactive standby storage schedule shown in [Figure 15002](#), 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 150 mA for one month may consume over 35 cm³/cell (2.14 in³/cell) of water.

5. Storage of spare parts

A. Spare Cells

Spare cells must be stored in a vertical upright position, filled, and discharged condition (electrolyte levels are not visible in discharged cells). It is not necessary to short circuit the cells. The vent valves must be installed. The storage conditions are the same as those given in paragraph Inactive long-term storage. No maintenance operation is needed during storage. Before installation in a battery, cells must be visually inspected for damage or leakage and repaired as necessary in accordance with this CMM.

B. Spare O-rings, gaskets, and vent valves

(1) O-rings and gaskets

Six (6) years of storage period starts from the date of manufacture unless otherwise specified on the packaging. The O-rings and gaskets should be protected from exposure to the air, light, and high humidity < 85%. Storage life depends on temperature. It is recommended to store the parts in a cool area < +25°C (+77°F). Above +35°C (+95°F), storage life is reduced to 5 years. Before use the O-rings or gaskets it must be inspected. In case of visible signs of damage, distortion, or deterioration, the part must be discarded.

O-rings must be inspected before use and must be disregarded if there are visible signs of damage, distortion, or deterioration.

(2) Vent valves with O-rings

Six (6) years of storage period starts from the date of manufacture unless otherwise specified on the packaging. The vent valves and O-rings should be protected from exposure of air, light and high humidity (< 85%). Storage life depends on temperature. It is recommended to store the parts in a sealed container (non-PVC) in a cool area < +25°C (+77°F). Above +35°C (+95°F), storage life is reduced to 5 years. Before use the vent valves and O-rings it must be inspected. In case of visible signs of damage, deformation, or deterioration, the vent valve and O-ring must be discarded.

C. Other spares

Other spares, protected from external contamination (i.e. dirt, dust, dampness, vibration, corrosive atmosphere) and high humidity (> 85%), may be stored for unlimited periods. Before use, they must be inspected and any showing visible signs of damage, distortion or deterioration must be discarded.



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6. 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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