To: Holders of component maintenance manual 24-30-05, 23180 / 23186

Subject: CMM Revision No. 5 Dated Mar 8/2023

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 8/2023.

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

Chapter/Section Page Number	Description of Change
Title Page T-1	Add Revision 5 with Date, update website
Record of Revisions ROR 1	Add revision 5
Service Bulletin List SBL 1	Added SB information
List of Effective Pages LEP 1	Corrected/Changed pages
List of Illustrations LOI 1	Corrected figure number
Introduction Intro 1	Correction and website update
Introduction Intro 2	Correction and website update
Introduction Intro 4	Website update
Testing and Fault Isolation 1001	Added tool and corrected resistor value
Testing and Fault Isolation 1006	Relocated vent valve O-ring replacement from Repair section
Testing and Fault Isolation 1007	Modified section to align with TN02
Testing and Fault Isolation 1008 – 1009, 1012 - 1015	Spelling correction and simplified the by utilizing the disassembly and assembly sections to correct findings
Testing and Fault Isolation 1010 - 1011	Clarifications, repaginate
Testing and Fault Isolation 1016, 1018	Relocated lower nut tightness procedure, corrected remedy.
Disassembly 3001 - 3002	Corrected resistance and added clarification
Cleaning 4002	Spelling correction

Chapter/Section Page Number	Description of Change
Check 5001	Clarification
Repair 6001 – 6002	Add tools for torquing, removed repair items that are covered in disassembly and assembly.
Assembly 7001, 7004	Add tool, add procedural step
Special Tools, Fixtures, Equipment, and Consumables 9001 - 9002	Corrected resistance, added tool
Illustrated Parts List 10007 - 10008	Corrections
Storage (Including Transportation) 15004 -15005	Added storage of spare parts and repaginate

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COMPONENT MAINTENANCE MANUAL

WITH
ILLUSTRATED PARTS LIST

Nickel Cadmium Aircraft Batteries

Saft Battery
Model 23180 (P/N 016833-000)

Model 23186 (P/N 016362-000)

Website: www.saft.com

24-30-05
T-1
Rev 5 Mar 8/2023
Original issue date: Sept 01/1979

COMPONENT MAINTENANCE MANUAL
23180 / 23186

RECORD OF REVISIONS

REV NO.	ISSUE DATE	INSERT DATE	BY	REV NO.	ISSUE DATE	INSERT DATE	BY
1	03/01/02	03/01/02	Saft				
2	Jan 25/2022	Jan 25/2022	Saft				
3	Jul 27/2022	Jul 27/2022	Saft				
4	Sep 6/2022	Sep 6/2022	Saft				
5	Mar 8/2023	Mar 8/2023	Saft				

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RECORD OF TEMPORARY REVISIONS

TEMPORARY REV NO	ISSUE DATE	INSERTED DATE / INSERTED BY	DATE REMOVED / REMOVED BY	DATE INCORPORATED

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SERVICE BULLETIN LIST

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

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LIST OF EFFECTIVE PAGES

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RECORD OF TEMPORARY REVISIONS	RTR 1 RTR 2	Jul 27/2022 Blank
SERVICE BULLETIN LIST	SBL-1 SBL-2	Mar 8/2023 Blank
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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 skill 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 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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126 quai Charles Pasqua
92300 Levallois-Perret, France
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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. FINGER TIGHTEN VENT VALVES (240 OR 240A) 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: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 OR 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW ELECTROLYTE LEAKAGE WHILE ON THE AIRCRAFT RESULTING IN UNSCHEDULED REMOVALS

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.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 large quantity of water. Remove contaminated clothing, after flushing begins.

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

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

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

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

(7) Inhalation of cadmium oxide can cause dry throat, headaches, vomiting, chest pain. If inhaled, move to fresh air. If 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

You can find the nearest recycling collection point on our website at www.saft.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. Put one of the terminals from the cell into a bench vice and bend the terminal until it breaks. If any electrolyte leakage occurs, make sure the cleaning procedures are correctly applied (see 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.

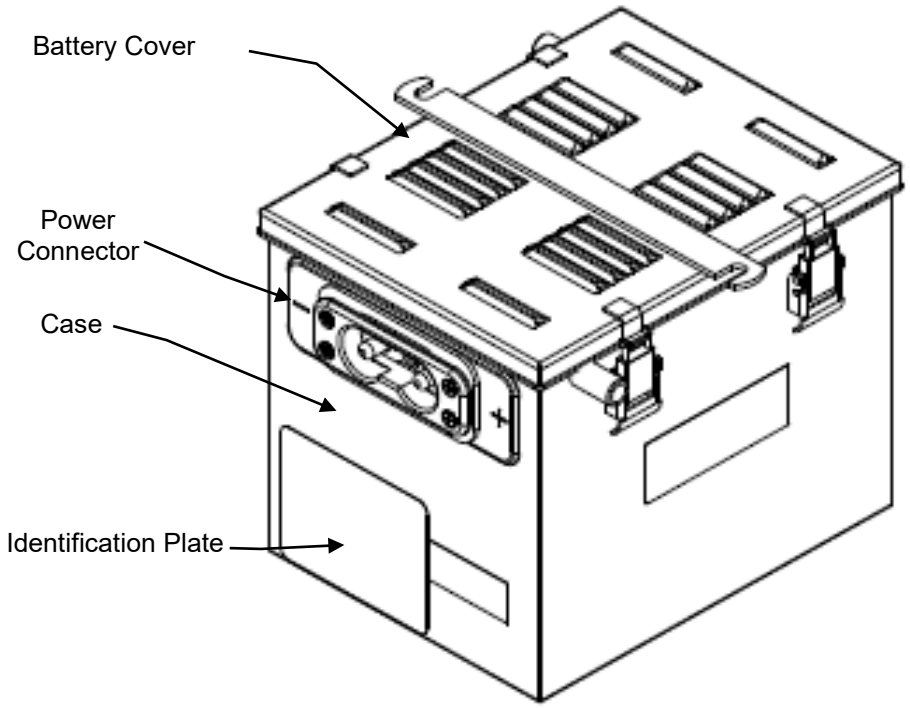
8. Abbreviations

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
IEC	International Electrotechnical Commission
IMDG	International Maritime Dangerous Goods
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	Voltage

DESCRIPTION AND OPERATION

1. Description

The Nickel Cadmium Battery provides power either to the standby system or to start the auxiliary power unit (APU). It is a nickel-cadmium type with sintered plate construction and uses a potassium hydroxide electrolyte. The batteries consist of a case and cover and 20 cell assemblies. The 23180 contains twenty VO23KH cells and for the 23186 contains twenty VP230KH cells.



23180 and 23186 Nickel Cadmium Battery
Figure 1

PARAMETER	VALUES
Voltage: Nominal	 24 Volts
Weight	24.49 kg (54.0 lbs)
Dimensions (Maximum): Height Length Width	 226 mm (8.90 in) 196 mm (7.69 in) 253 mm (9.96 in)
Cell Assembly Terminal	M8 X 1.25, externally threaded
Number of Cell Assemblies	20
Cell Model	VO23KH (23180) VP230KH (23186)
1.0C1A Rate	23.0A (023180) 22.0A (023186)
0.5C_1A Rate	11.5A (23180) 11.0A (23186)
0.1C_1A Rate	2.3A (23180) 2.2A (23186)
Rated Capacity (C_1)	23 Ampere-hours at 1.0C_1A (23180) 22 Ampere-hours at 1.0C_1A (23186)
Vent valve	M8 X 1.00 thread
Venting Pressure	0.14 to 0.69 bar (2 to 10 psi)
Consumable volume of water per cell	21 cm^3 (1.28 in^3)
Cell Assembly 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.

B. Maintenance

(1) Maintenance interval basis

The aircraft manufacturer and/or operator is responsible for the definition of the maintenance interval based on the use profile of the batteries installed on 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, loads provided, number of uses, flight duration, ground operation, and battery technology.

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

The overcharged capacity is directly related to the electrolysis of water from the electrolyte, and hence the consumption of the electrolyte reserve. For every 3 Ah of overcharge, 1 cm^3 (0.061 in^3) of water is consumed via electrolysis. Once the water reserve has been consumed, the result is:

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

(2) Maintenance interval extensions

To validate maintenance interval extension, the recommendation is for 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.

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.

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, Figure 1002, or Figure 1003. Fault isolation Table 1009, Table 1010, or Table 1011 identifies faults, possible causes, and remedies.

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		
Constant current charger	-	0 to 60A DC 40V DC Minimum	Commercially Available	Sorenson Power (DCR-40-70B)
Constant current source with load bank	-	0 to 60A DC 1 to 40V DC	Commercially Available	Sorenson Power (DCR-40-70B) with Ohmite (L225J5ROE)
Megohmmeter	-	0 to 50 MΩ @ 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 (+59°F to +176°F)	Commercially Available	Cincinnati Sub-Zero (MCB-1.2-.33-H/AC)
Torque wrench	Insulated	0 to 15 N-m (0 to 133 lb_f-in)	Commercially Available	McMaster-Carr (7936A12)
Torque screwdriver	-	0 to 3.4 N-m (0 to 30 lb_f-in)	Commercially Available	Utica (TS-30)
Universal vent wrench	-	-	09052 F6177	093365-000 (T01) 413876
Syringe assembly	-	-	09052 F6177	020915-004 (T02) 416231
Equalizing resistors	-	1.2Ω 3W	F6177	164829 (T03)
Cell puller tool	-	-	09052 F6177	017557-000 (T04) 416159
Vent valve adapter M8 valves	-	-	09052	025098-000 (T05)

Equipment (Testing)
Table 1001

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**	M01	Commercially Available	Water addition
Neutral petroleum jelly	M02	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 23180 / 23186 batteries require the following maintenance operations:

NOTE: Unless the maintenance has been previously increased or the air manufacturer states a different value, the following are provided as guidelines.

NOTE: These periods are given as an indication; modify in accordance with operational experience.

NOTE: Periodical and Regular Check may be combined if operating hours do not meet times listed.

A. Periodical check

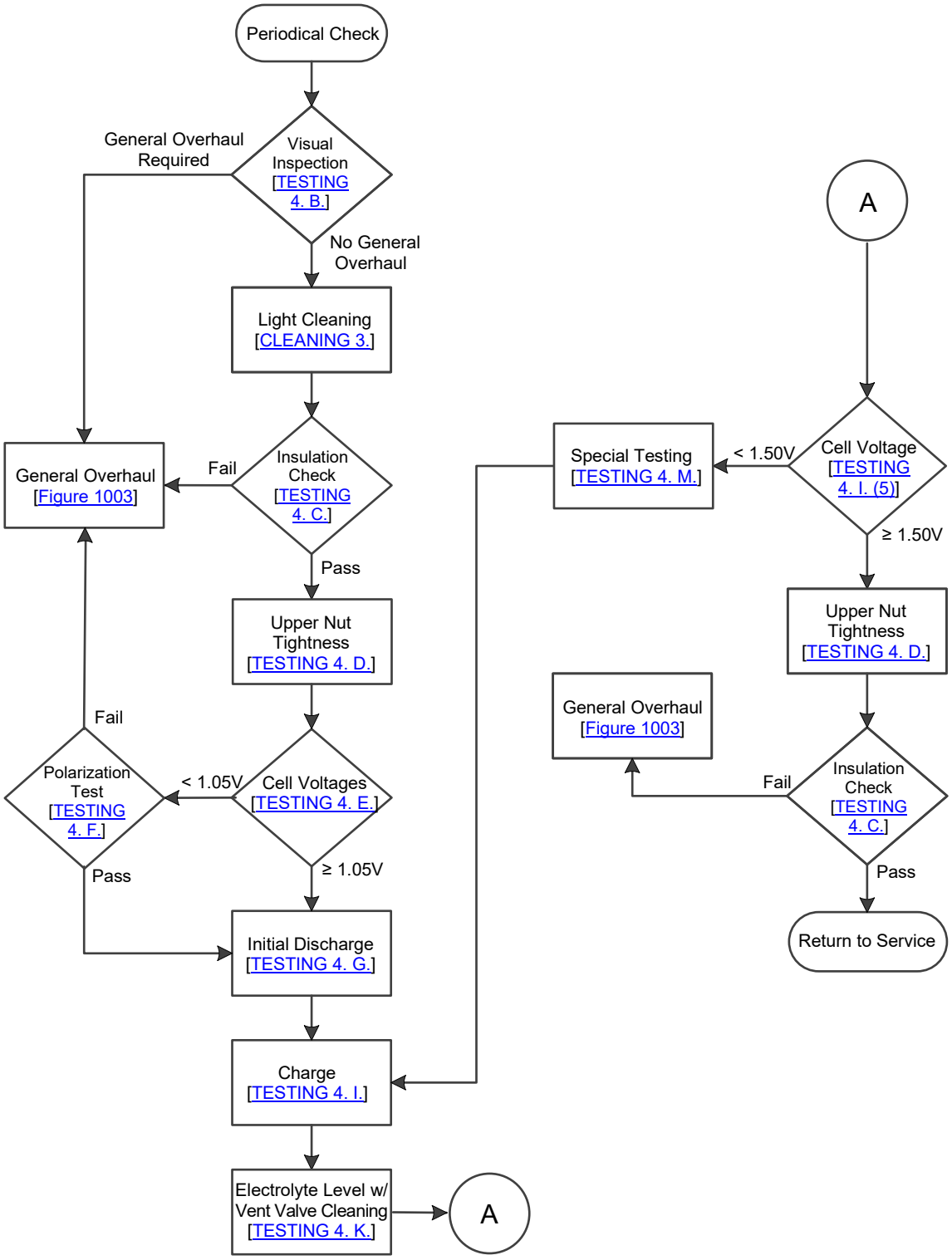
If the electrolyte consumption exceeds the maximum consumable amount between two Regular Checks, this Periodical Check per Figure 1001 may be done to adjust the electrolyte and prevent damage to the cells.

B. Regular check

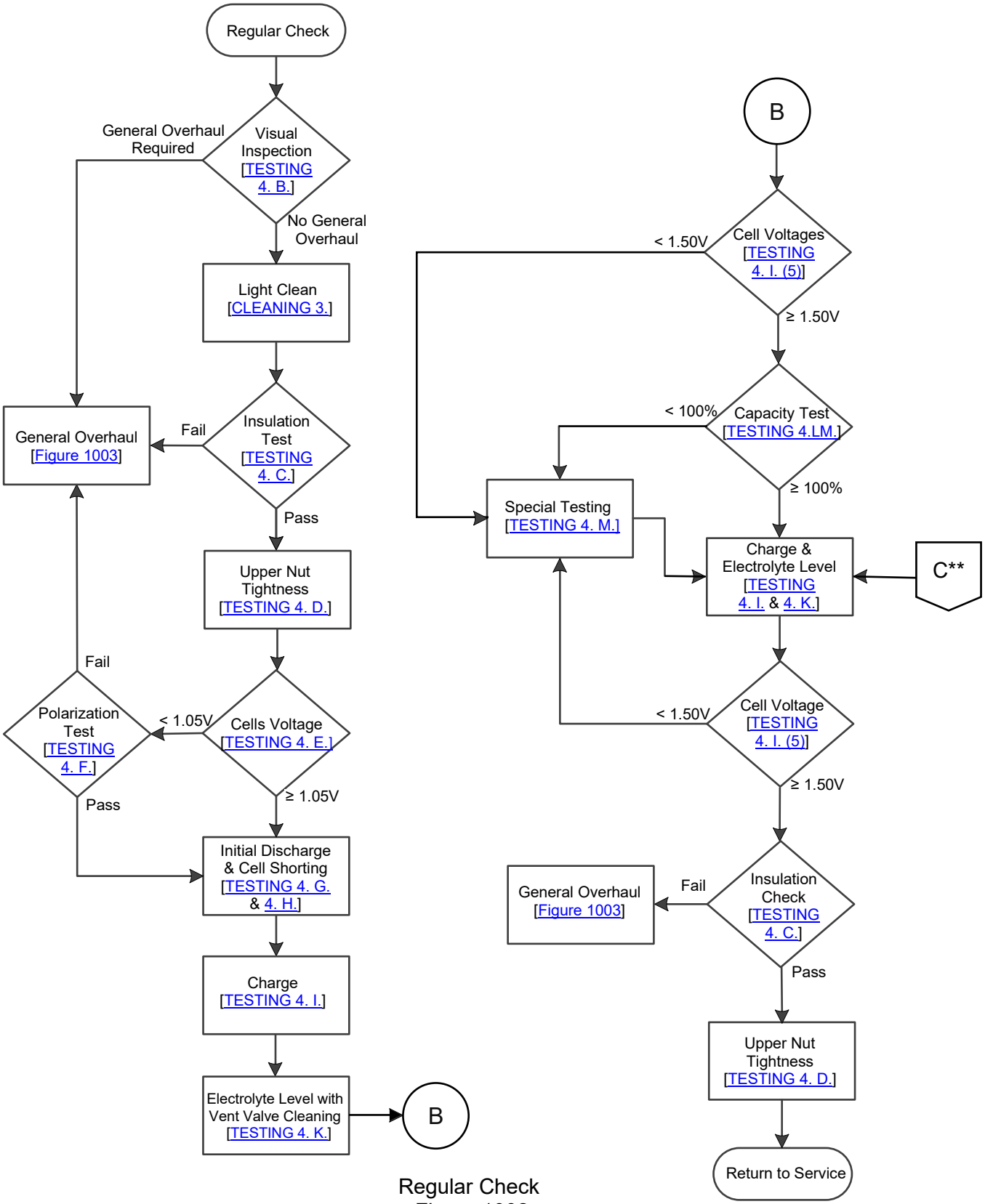
Perform Figure 1002 according to the aircraft manufacture or operator maintenance requirements. If these are not available, then it is recommended to perform this check every six months. To adjust this interval, refer Maintenance interval extensions.

C. General overhaul

Perform Figure 1003 according to the aircraft manufacture or operator maintenance requirements or when required by Figure 1001 or Figure 1002.

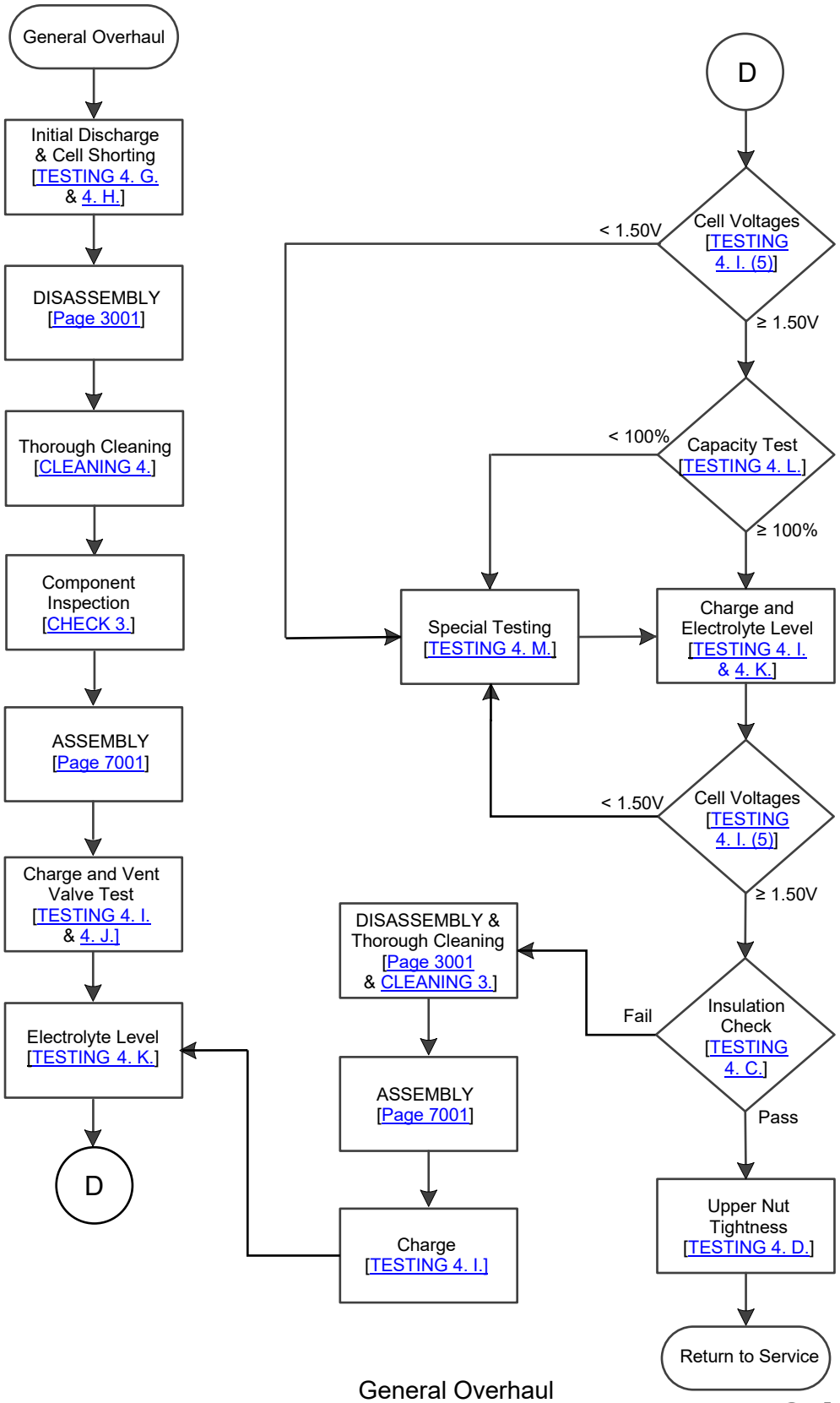


Periodical Check
Figure 1001



Regular Check
Figure 1002

**From Table 15001



General Overhaul
Figure 1003

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 a general overhaul immediately while the majority do not. If a finding does not require going to the general overhaul procedure, then specific instructions are provided on how and when the item will be corrected.

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

(2) Visually inspect battery case (010 or 010A), (012 or 012A) for dents, distortion, or other damage. If found, identify the case for replacement.

(3) Visually inspect visual portions of each cell (150 or 150A) for any evidence of electrolyte leakage.

(a) Damaged cells (150 or 150A) should 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 leakage from terminal O-ring (230 or 230A). Identify any cells with excessive salts for later torquing the lower nut (180).

(c) When inspection reveals electrolyte leakage from the cell at the vent hole opening, replace the defective O-ring (250 or 250A) as follows

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

1. Using the vent valve wrench T01, loosen and remove the vent valve (240 or 240A) from each cell.

2. Remove and replace O-rings (250 or 250A) from the vent valves (240 or 240A).

CAUTION: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 or 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW CONTAINMENTS TO ENTER THE CELL (150 or 150A). ANY STRIPPED THREADS REQUIRE COMPONENT REPLACEMENT.

3. Using T01, finger tighten the vent valve (240 or 240A) securely in place.

(4) Inspect the nuts (130), (160), (180), washers (044), (140), (170), (190 or 190A), (200 or 200A), (210), and (220), screws (040) or (042), and links (060 to 110), and bracket (120) 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 any defective components.

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

(6) Inspect the power connector (030) and its pins for defects, evidence of arching or excessive oxidation. If observed, identify the power connector (030) for later replacement.

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.

(1) On a completely assembled battery using a megohmmeter under a continuous 250V, measure the insulation resistance between the metal box and

(a) the positive terminal of each cell and

(b) the power connector positive pin

(2) The value measured must be ≥ 10MΩ under a continuous 250V.

(a) If the reading meets the above criteria (≥ 10MΩ), 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 insulation resistance is still < 10MΩ, then one or more cells (150 or 150A) are defective. Isolate and identify for replacement or cleaning.

D. Upper nut tightness

Check the tightness on each upper nut (130), (160) per Table 8001.

E. Cell voltage

Measure and verify the voltage of each cell (150 or 150A) is greater than or equal to 1.05V.

F. Polarization test

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

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

(3) Measure the open circuit voltage of each cell (150 or 150A).

(a) Identify for replacement each cell (150 or 150A) with zero volts or negative polarity. If any cell (150 or 150A) is identified for replacement, the polarization test is a “Fail”.

(b) If all cells (150 or 150A) are above zero volts, the polarization test is a “Pass”.

G. 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.

CAUTION: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 OR 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW CONTAINMENTS TO ENTER THE CELL (150 OR 150A). ANY STRIPPED THREADS REQUIRE COMPONENT REPLACEMENT.

(1) Using T01, verify the vent valve (240 or 240A) is finger tight on each cell (150 or 150A).

(2) Discharge the battery at a rate shown in Table 1003 or Table 1004 until the battery reaches 20.0V. 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 rest of the discharge.

DISCHARGE		MINIMUM TIME FOR BATTERY TO 20.0V
RATE (C_1)	CURRENT (AMPS)	
0.5	11.5	60.5 MINUTES
1.0	23.0	30.0 MINUTES

23180 Initial Discharge (Off-wing Capacity)
Table 1003

DISCHARGE		MINIMUM TIME FOR BATTERY TO 20.0V
RATE (C_1)	CURRENT (AMPS)	
0.5	11.0	60.5 MINUTES
1.0	22.0	30.0 MINUTES

23186 Initial Discharge (Off-wing Capacity)
Table 1004

(a) The minimum discharge time to 20.0V at 1.0C_1A should be per Table 1003 or Table 1004. If not, one of the following may be the cause.

1. The battery was discharged since the last aircraft charge.
2. The aircraft charger may not be functioning properly.
3. If the battery was left idle for a time, then self-discharge occurred.
4. The battery cells may be imbalanced and need servicing.

(3) If defective case (010 or 010A) , (012 or 012A), power connector (030), nuts (130), (160), washers (140), (170), or links (060 to 110) items were found during visual inspection, they are to be corrected by performing appropriate DISASSEMBLY and ASSEMBLY.

(a) For each cell (150 or 150A) identified for replacement, do Cell replacement in REPAIR.

(b) For each cell (150 or 150A) which have excessive salts around the terminals during visual inspection, do Lower nut tightness.

(c) For cell hardware (180), (190 or 190A), (200 or 200A), (210), (220), and requiring replacement, do Cell hardware replacement in REPAIR.

(d) For terminal O-ring (230 or 230A) requiring replacement, do Terminal O-ring replacement in REPAIR.

H. Cell shorting

CAUTION: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 OR 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW CONTAINMENTS TO ENTER THE CELL (150 OR 150A). ANY STRIPPED THREADS REQUIRE COMPONENT REPLACEMENT.

(1) Using T01, verify the vent valve (240 or 240A) is finger tight on each cell (150 or 150A).

(2) Discharge each cell to zero volts using one of two methods below:

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

(a) Method A

1. Continue to discharge per Table 1003 or Table 1004 until each cell is < 1.0V, connect a T03 across its terminals. After all the cells have been shorted, then leave the devices in place for 12 to 24 hours.

(b) Method B

1. Continue to discharge the battery per Table 1003 or Table 1004 until each cell is < 0.5V, then connect a shorting clip between its terminals. After all the cells have been shorted, then 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 (150 or 150A) is identified for replacement, return to Figure 1002 or Figure 1003.

(5) If any cell (150 or 150A) was identified for replacement, do Cell replacement in REPAIR.

I. Charge

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

(2) Remove the cover (020).

(3) Prior to charging the battery, loosen (do not remove) all vent valves (240 or 240A). Ensure that the shorting spring has been removed.

NOTE: If the vent valve test is to be done per Figure 1003, do Vent valve test during the charge.

(4) Charge the battery using one of the three methods in Table 1005.

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

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

2. During the last 30 minutes of the final charge (Step 2), adjust the Electrolyte level and check for 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
[23180] 0.1C_1A (2.3A) [23186] 0.1C_1A (2.2A)	10h	Every cell >1.5V or 12h whichever comes first	[23180] 0.1C_1A (2.3A) for 4h [23186] 0.1C_1A (2.2A) for 4h
[23180] 0.5C_1A (11.5A) [23186] 0.5C_1A (11.0A)	2h	Every cell >1.55V or 2.5h whichever comes first	
[23180] 1.0C_1A (23.0A) [23186] 1.0C_1A (22.0A)	1h	Every cell >1.57V or 1.25h whichever comes first	

* Minimum time applies to a battery previously discharged to 20.0V.
** During the last 30 minutes do Electrolyte level and confirm minimum voltage per Table 1006.

Charge Table
Table 1005

(5) Minimum final charge voltage

During the last 30 minutes of final charge (Step 2) measure and verify the voltage of each cell (150 or 150A) meets the value shown in Table 1006. Identify each cell that does not comply.

CELL VOLTAGE (Last 30 minutes at 0.1C_1A)
≥ 1.50V

Final Charge Voltage Limit
Table 1006

J. Vent valve test

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

NOTE: This test is not necessary if all the vent valves are replaced with Saft new valves each year or applicable maintenance interval.

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

(1) Check the operation of the vent valve (240 or 240A) assemblies as follows:

(a) Using T01, finger tighten vent valve (240 or 240A) that contains O-ring (250 or 250A) onto test fixture T05.

(b) Attach the T05 fixture 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 1.38 bar (20 psi) maximum to functionally test below.

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

(e) Reuse only those vent valves found to open in the 0.14 to 0.69 bar (2 psi to 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 relief valves which are not gas tight at low pressure.

K. Electrolyte level

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

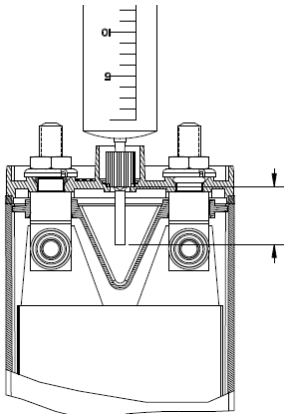
WARNING: USE CARE NOT TO TILT CELLS WHILE VENT VALVES ARE LOOSENED OR REMOVED; CONTACT OF ELECTROLYTE WITH SKIN CAN CAUSE SEVERE BURNS.

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 (240 or 240A) with the T01, taking precautions to prevent entry of foreign matter into the cell (150 or 150A).

(a) Clean vent valves (240 or 240A) by immersing the valves and their O-rings (250 or 250A) 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 as shown in Figure 1004.



Position of Syringe in Cell Vent Seat
Figure 1004

(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 21 cm^3 (1.28 in^3), then check the charging system. If the charger is functioning properly, the maintenance period may need to be reduced.

1. Draw a measured amount of M01, such as 5 cm^3 (0.31 in^3) into 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 1, counting the total number cm^3 required to achieve the correct level.
4. At the point in step 1 when some excess liquid is drawn into the syringe, 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.

WARNING: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 OR 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW MAY ALLOW ELECTROLYTE LEAKAGE WHILE ON THE AIRCRAFT RESULTING IN UNSCHEDULED REMOVALS. ANY STRIPPED THREADS REQUIRE COMPONENT REPLACEMENT.

(4) Using T01, finger tighten vent valves (240 or 240A) on each cell (150 or 150A).

L. Capacity test (second discharge)

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

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

CAUTION: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 OR 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW CONTAINMENTS TO ENTER THE CELL (150 OR 150A). ANY STRIPPED THREADS REQUIRE COMPONENT REPLACEMENT.

(2) Using T01, verify the vent valve (240 or 240A) is installed finger tight on each cell (150 or 150A).

(3) Discharge the battery at one of the current rates shown in Table 1007 or Table 1008 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 T03 for the remainder of the discharge.

DISCHARGE		MINIMUM TIME FOR FIRST CELL TO 1.0V
RATE (C_1)	CURRENT (AMPS)	
0.5	11.5	122.0 MINUTES
1.0	23.0	60.0 MINUTES

23180 Capacity Test (Second Discharge)
Table 1007

DISCHARGE		MINIMUM TIME FOR FIRST CELL TO 1.0V
RATE (C_1)	CURRENT (AMPS)	
0.5	11.0	122.0 MINUTES
1.0	22.0	60.0 MINUTES

23186 Capacity Test (Second Discharge)
Table 1008

(4) If the time until the first cell reached 1.0V equals or exceeds the values shown in Table 1007 or Table 1008 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 is less than the minimum time shown in Table 1007 or Table 1008 at the discharge rate, the capacity is < 100%.

M. 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 < 1.50V during the final charge. Refer to Figure 1005 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, then it is recommended to replace noncompliant cells with new Saft cells (150 or 150A), 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 < 1.50V, do Supplementary test.

(2) Low capacity (Special testing)

(a) Loosen, but do not remove all vent valves (240 or 240A) and fully charge the battery as outlined in Charge section.

(b) For a battery containing any cell voltages < 1.50V during the final charge, do Supplementary test. Otherwise, do Capacity test (Special testing).

(3) Supplementary test

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

NOTE: The additional $0.1C_1A$ 5-hour charge may be stopped once all the cells are ≥ 1.50V.

1. Identify for replacement any cell (150 or 150A) with voltage < 1.50V.
2. During the last 30 minutes of this charge adjust the Electrolyte level.
3. Do Cell replacement in REPAIR for cells identified for replacement. Otherwise do Capacity test (Special testing).

NOTE: If more than one cell (150 or 150A) 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.

(4) Capacity test (Special testing)

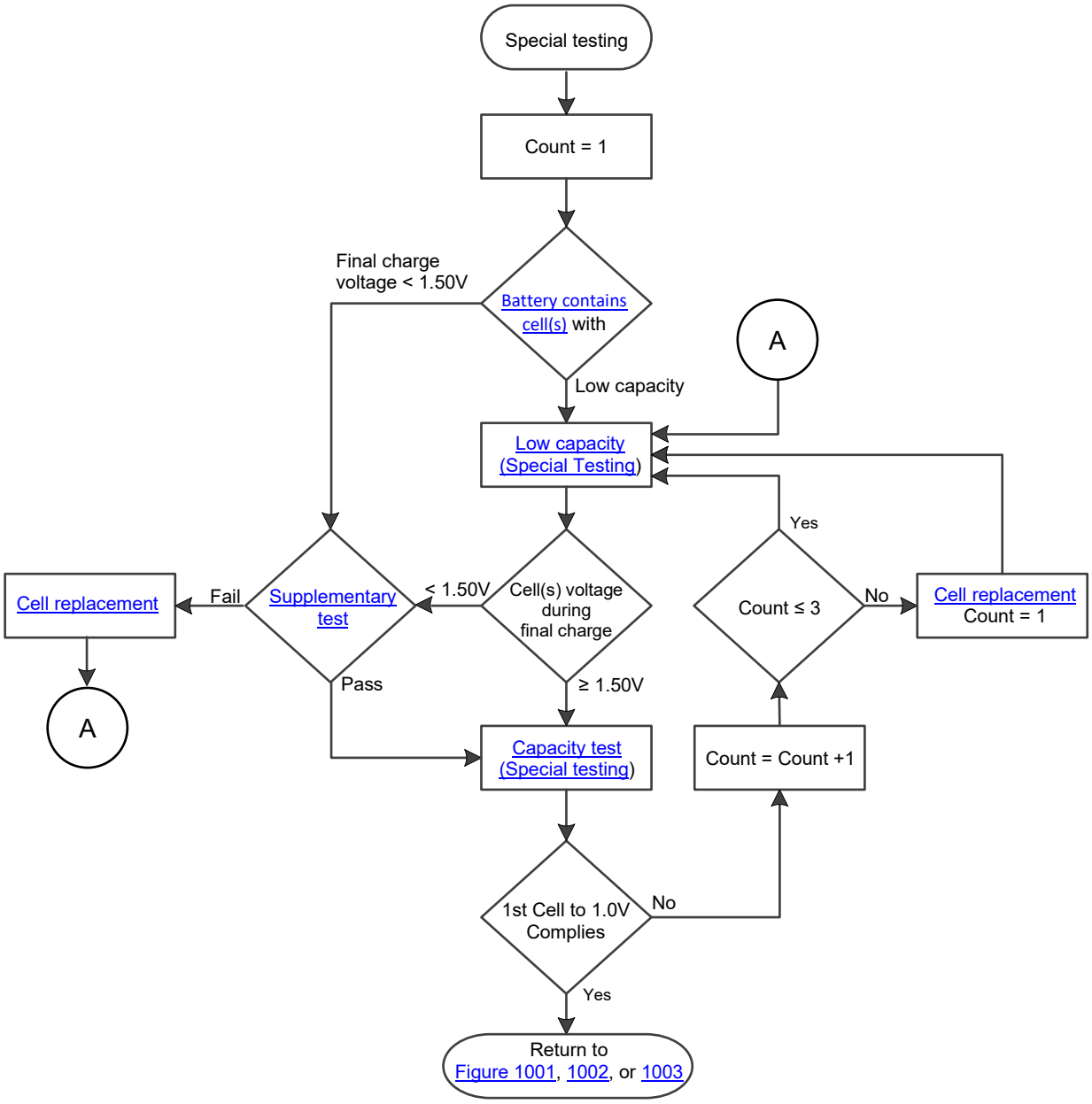
CAUTION: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 or 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW CONTAINMENTS TO ENTER THE CELL (150 or 150A). ANY STRIPPED THREADS REQUIRE COMPONENT REPLACEMENT.

(a) Using T01, verify the vent valve (240 or 240A) is installed finger tight on each cell (150 or 150A).

(b) Discharge the battery at a rate shown in Table 1007 or Table 1008 until the battery reaches 20.0V. Record the time and current the battery reached 20.0V and identify noncompliant cells with voltages < 1.0V.

(c) If the time the first cell reached 1.0V equals or exceeds the values shown in Table 1007 or Table 1008 at the applicable discharge rate, then return to Figure 1001, Figure 1002, or Figure 1003. Otherwise, repeat 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 cells (150 or 150A), refer to Cell replacement in REPAIR.



Special Testing Flow Chart
Figure 1005

N. Lower nut tightness

(1) Remove applicable hardware; nuts (130), (160), washers (140), (170) and links (060 to 110). Torque the lower nut (180) per Table 8001.

(2) Install the applicable hardware; the links (060 to 110), washers (140), (170), and nuts (130), (160). Torque the nuts per Table 8001.

5. Fault Isolation

Fault isolation information is presented in Table 1009, Table 1010, or Table 1011 as a guide in locating a cause of malfunction and isolating the cause to a specific component.

TEST STEP	TROUBLE	PROBABLE CAUSE	REMEDY
4.E.	(1) No battery voltage	(a) Defective electrical connector (not making contact).	Check electrical connections Replace if required using DISASSEMBLY and ASSEMBLY
		(b) Broken or damaged links, upper nuts	
4.C.	(2) Low insulation	(a) Leakage of electrolyte	Do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level
		(b) Incorrect electrolyte level	
		(c) Reverse cell polarity	
		(d) Condensation / Contamination	
		(e) Improper cleaning	
		(f) Loose or damage vent valve	Figure tighten or replace vent valve, do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level
		(g) Damaged cell case	Do Thorough Cleaning, Cell replacement, ASSEMBLY, Charge, Electrolyte level
		(h) Charge rate too high	Investigate the cause of the excessive charge. Do Thorough Cleaning, ASSEMBLY, Charge, Electrolyte level
4.L.	(3) Loss of battery capacity	(a) Normal wear after long service	Do Special testing
		(b) Exceptionally heavy use	

Battery Faults
Table 1009

TEST STEP	TROUBLE	PROBABLE CAUSE	REMEDY
4.K.	(1) All cells have reserve consumed	(a) Charged more than allowed or charged at high temperature. (b) Previous maintenance has not been done (c) Maintenance interval too long	Examine the cause of the excessive charge. Do Charge, Electrolyte level and be sure what for the next maintenance interval. If this continues a periodical check should be done in between the regular checks.
4.K.	(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
4.I.	(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.F.	(4) Zero Voltage on cell	(a) Short-circuited cell	Do Cell replacement
4.I.	(5) Low cell voltage at end of charge	(a) Separator damage	Do Cell replacement
4.L.	(6) Low cell capacity	(a) Normal wear from long service	Do Cell replacement
4.A.	(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 1010

TEST STEP	TROUBLE	PROBABLE CAUSE	REMEDY
4.B.	(1) Tarnished or burned terminal connectors	(a) Loose terminal nuts and links	Clean and torque per Table 8001
4.B.	(2) Exposed copper material on power connector pin	(a) Mechanical damage (b) Electrical arcing	Replace component using DISASSEMBLY and ASSEMBLY
4.B.	(3) Melted plastic on connectors	(a) Overheat due to contact resistance	Replace component using DISASSEMBLY and ASSEMBLY
4.B.	(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
4.B.	(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 1011

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 F6177	093365-000 (T01) 413876
Equalizing resistors	-	1.2Ω 3W	F6177	164829 (T03)
Cell puller tool	-	-	09052 F6177	017557-000 (T04) 416159

Equipment (Disassembly)
Table 3001

B. Materials

No materials required.

3. Instructions

WARNING: BATTERY CELL ASSEMBLIES 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 or Table 1008 until each cell reaches 1.0V.

(2) Remove cover (020) by opening latches and lifting cover from case (010 or 010A) , (012 or 012A).

(3) Do Cell shorting

B. Cell (150 or 150A) removal

(1) Remove the upper nuts (130), (160) and washers (140), (170) from the battery.

(2) Remove intercell terminal links (060 to 110) from terminals of cells (150 or 150A).

(3) Using T04 tighten on the cell terminals as needed to remove cells (150 or 150A) from the battery case (010 or 010A) , (012 or 012A).

C. Disassembly of the cell assemblies (150 or 150A) is restricted to replacing defective cell hardware (180), (190 or 190A), (200 or 200A), (210), (220), or terminal O-rings (230 or 230A) refer to Component replacement in REPAIR.

D. Power connector (030)

Remove power connector (030) and gasket (050) by removing four screws (040) or (042) and washer (044).

E. Remove all spacers (260) from the battery case (010 or 010A) , (012 or 012A).

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	M02	Commercially Available	Lubrication
Mild soap	M03	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 (020) removed.

CAUTION: CARE SHOULD BE TAKEN TO NOT OVER TIGHTEN THE VENT VALVES (240 OR 240A) AS STRIPPED THREADS ON EITHER THE VALVE OR CELL COVER MAY ALLOW CONTAINMENTS TO ENTER THE CELL (150 OR 150A). ANY STRIPPED THREADS REQUIRE COMPONENT REPLACEMENT

B. Using vent valve wrench T01, make sure that the vent valves (240 or 240A) of all cells (150 or 150A) are finger tight, closed and secure. Do not over-tighten.

C. Remove white deposits (potassium carbonate) from tops of all cells (150 or 150A) 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 hex nuts (130), (160), (180), washers (140), (170), (210), and (220), and all intercell terminal links (060 to 110) with M02.

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

F. Clean the exterior surfaces of the battery cover (020) and battery case (010 or 010A) , (012 or 012A) using a soft, clean cloth, moistened with water. Dry with compressed air not over 1.38 bar (20 psi) 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 (030) with warm mild soapy M03 water.

C. After ensuring that the vent valves (240 or 240A) are closed, wash each cell (150 or 150A) in running water. Do not allow any water to enter the cell. Dry with compressed air not over 1.38 bar (20 psi) or a dry, clean cloth.

D. Remove dirt and salt deposits from the battery case (010 or 010A), (012 or 012A), bracket (120), cover (020), spacers (260), links (060 to 110), washers (044), (140), (170), nuts (130), (160), screws (040) or (042), and gasket (050) in warm mild soapy M03 water. 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 not over 1.38 bar (20 psi) or a dry, clean cloth.

CHECK

1. General

   This section contains new battery commissioning and component inspection information.

   NOTE: All voltage readings are DC unless specifically 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 1002

      (1) Inspect the battery case (010 or 010A) and cover (020) for dents, distortion, or other damage. If found, replace with new Saft cover (020) or case (010 or 010A).

      (2) Remove the battery cover (020).

      (3) Visually confirm the power connector (030) is present and undamaged.

      (4) Visually confirm all cells (150 or 150A) are positioned for proper polarity per Figure 7002.

      (5) Visually confirm all cells (150 or 150A) are equipped with a vent valve (240 or 240A).

      (6) Torque all upper nuts (130), (160) per Table 8001.

   B. Charge the battery as shown on page 1010 and level electrolyte per Electrolyte level on page 1011.

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

4. Component Inspection

   A. Cell (150 or 150A).

      (1) Visually check each cell carefully for evidence of electrolyte leakage, cracks, corrosion, burns, holes, or cross-threaded terminals. Replace all damaged cells with new Saft cells (150 or 150A).

      (2) Excessive salt around a terminal post indicates leakage. Refer to Terminal O-ring replacement on page 6002 for replacement of lower terminal O-ring (230 or 230A) if leakage is evident.

(3) Visually check each cell vent valve (240 or 240A) for defective O-rings (250 or 250A), cracks, or other physical damage. Replace if defective.

(4) Suspect vent valves should be tested in accordance with Vent valve test and/or be discarded.

B. Intercell terminal links (060 to 110)

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.

C. Spacers (260)

The components should be clean and free of cracks or defects. Replace any that are defective with new Saft components.

D. Power connector (030)

CAUTION: A DEFECTIVE POWER CONNECTOR (030) CAN CAUSE DANGEROUS OVERHEATING, AS WELL AS IN SERVICE LOW VOLTAGE.

(1) Inspect the power connector (030) for evidence of arching, corrosion, cracks, or cross threaded terminals.

(2) Using the method in Battery insulation check on page 1007, check the insulation between the positive pin and the connector shell and the negative pin and connector shell.

(3) Discard any power connector (030) that is found to have any damage or fails the insulation test. Replace with new Saft power connector (030).

E. Battery cover (20), case (010 or 010A) , (012 or 012A)

Inspect the components for damage, and replace with new Saft components, cover (20), or case (010 or 010A) as needed.

REPAIR

1. General

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

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

NOTE: All voltage readings are DC unless specifically 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 F6177	093365-000 (T01) 413876
Equalizing resistors	-	1.2Ω 3W	F6177	164829 (T03)
Cell puller tool	-	-	09052 F6177	017557-000 (T04) 416159
Torque wrench	Insulated	0 to 15 N-m (0 to 133 lb_f-in)	Commercially Available	McMaster-Carr (7936A12)
Torque screwdriver	-	0 to 3.4 N-m (0 to 30 lb_f-in)	Commercially Available	Utica (TS-30)

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	M02	Commercially Available	Lubrication

Materials (Repair)
Table 6002

3. Component Replacement

A. Cell replacement

Battery containing cell(s) require replacement. Note the All cell replacement recommendation below.

(1) All cell replacement

(a) For a battery compliant with the following then it is best to assume that all the original cells are or soon will be in unsatisfactory condition. Saft strongly recommends all cells (150 or 150A) 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 had been previously replaced due to 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 (180), (190 or 190A), (200 or 200A), (210), (220) by removing and replacing the nuts (130), (160), washers (140), (170), and links (060 to 110). Torque nuts per Table 8001.

C. Terminal O-ring replacement

(1) Remove necessary hardware; nuts (130), (160), washers (140), (170), and links (060 to 110).

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

(2) Remove lower nut (180), the polarity washer (190 or 190A), (200 or 200A), the washers (210), (220), and terminal O-ring (230 or 230A) being careful to prevent anything from falling into the cell opening.

(3) Replace O-ring (230 or 230A), install washers (220), (210), the polarity washer (190 or 190A), (200 or 200A), and torque lower hex nut (180) per Table 8001.

(a) Install the necessary links (060 to 110), washers (140), (170), and nuts (130), (160). Torque nuts per Table 8001 as required.

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 (0 to 133 lb_f-in)	Commercially Available	McMaster-Carr (7936A12)
Torque screwdriver	-	0 to 3.4 N-m (0 to 30 lb_f-in)	Commercially Available	Utica (TS-30)

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	M02	Commercially Available	Lubrication

Materials (Assembly)
Table 7002

3. Power connector (030)

Place the gasket (050) onto the power connector (030) and insert terminals through the oval mounting hole in the front of the battery case (010 or 010A), (012 or 012A) and installing screws (040), or screws (042) and washers (044). Secure the receptacle by torquing the screws (040), (044) per Table 8001.

4. Spacers (260) and cells (150 or 150A)

Install spacers (260) and cell assemblies (150 or 150A) into the battery case (010 or 010A) , (012 or 012A) using the following steps. Refer to Figure 7001 or Figure 7002.

A. Insert one edge of bottom spacer into battery case (010 or 010A) , (012 or 012A) from the left or right side, then slide the spacer under the cell partition.

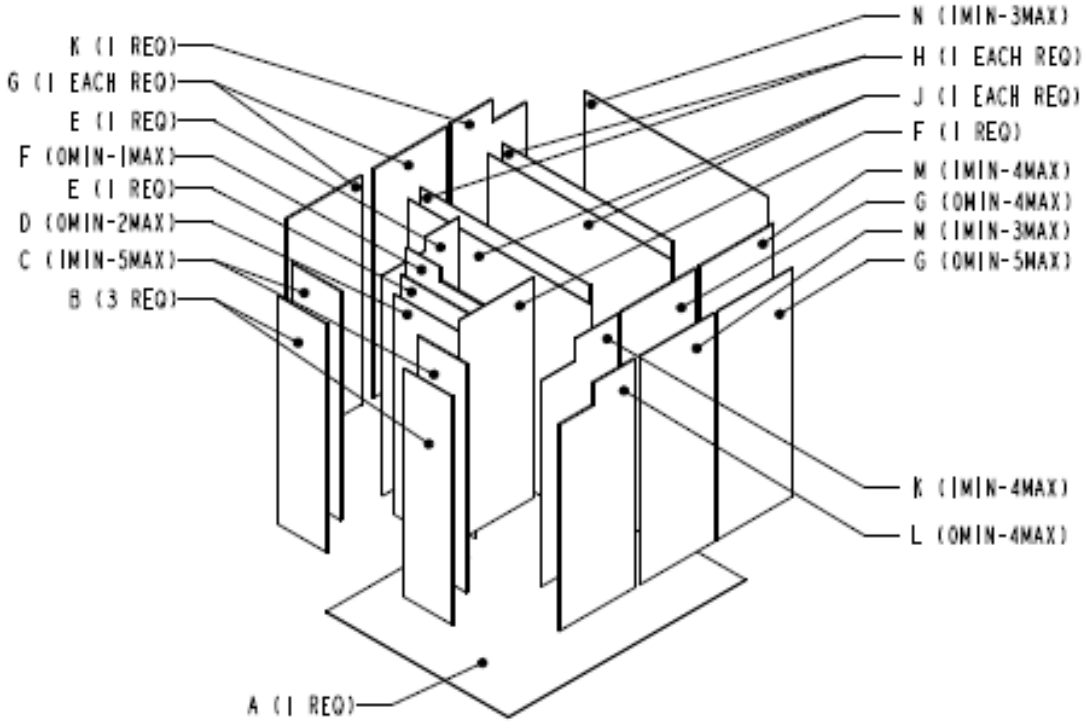
NOTE: Cell insertion is typically easier when a middle cell is the last installed in each row.

B. Install the cells 6, 7, 10, 14, 15, 16, 5, 8, 9, 17,18, 1, 4, 19 cells (150 or 150A) and spacers (260) in accordance to Figure 7001, Table 7003, and Figure 7002. Be sure to maintain the proper cell arrangement and polarity orientation as shown in Figure 7002. Insertion of the last cell of each section (11, 12 ,3, 20, and 2) which is sometimes difficult. The insertion can be assisted by pushing down on the terminals with a small block of soft wood.

NOTE: Spacers are used as required to ensure the cells are retained securely in place. As indicated in Figure 7001, the maximum quantity to be used is as shown.

C. Torque the lower hex nuts (180) of the cell assemblies (150 or 150A) per Table 8001.

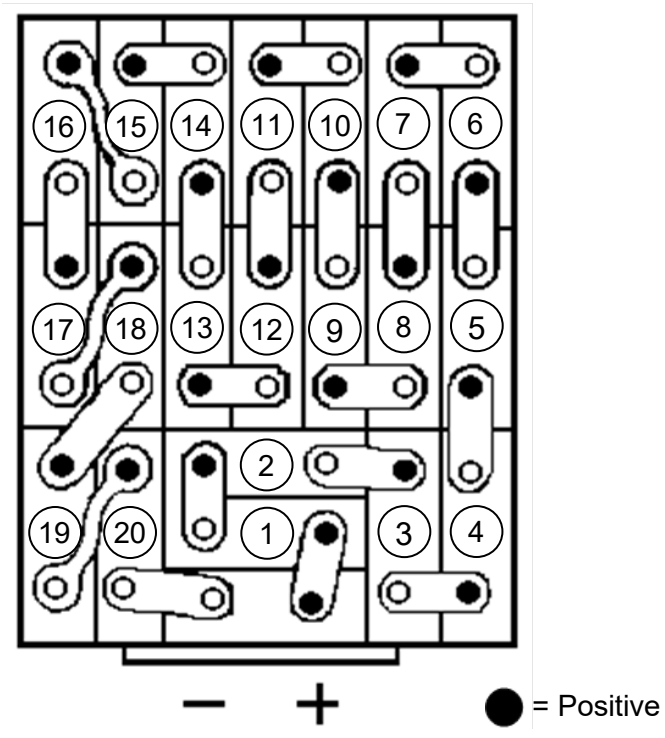
D. Apply a small amount of M02 to the threads of the cell terminals.



Spacer Kit (260) Installation
Figure 7001

ITEM	DESCRIPTION	DIMENSION (IN)	UNIT PER ASSEMBLY
A	Spacer	7.402 x 9.946 x 0.020	1
B	Spacer	2.000 x 8.031 x 0.062	6
C	Spacer	2.000 x 8.030 x 0.020	10
D	Spacer	3.031 x 7.750 x 0.062	2
E	Spacer	8.250 x 3.110 x 0.020, NOTCHED	2
F	Spacer	3.030 x 7.750 x 0.020	2
G	Spacer	3.031 x 8.031 x 0.062	11
H	Spacer	6.940 x 7.750 x 0.020	2
J	Spacer	7.440 x 7.750 x 0.020	7
K	Spacer	8.031 x 3.090 x 0.062, NOTCHED	5
L	Spacer	8.030 x 3.090 x 0.020, NOTCHED	4
M	Spacer	7.438 x 8.031 x 0.032	3
N	Spacer	3.031 x 8.031 x 0.032	7

Spacer Kit (260)
Table 7003



Cell Number and Polarity Orientation
Figure 7002

5. Complete battery

   A. Install intercell terminal links (060 to 110) on the terminals of the cell sub-assemblies (150 or 150A) in Figure 7002.

   B. Lightly lube with M02 the cell terminals, nuts, links, connector contact using nonmetallic brush.

   C. Install the washers (140), (170) and upper hex nuts (130), (160) onto the terminals of the cell assemblies (150 or 150A) and power connector adapter (030). Torque nuts per Table 8001.

   D. Lightly lube with M02 any other components that might be susceptible to atmospheric corrosion.

   E. Install the battery cover (020) onto the battery case (010 or 010A) , (012 or 012A) and secure in place by fastening the latches.

FITS AND CLEARANCES

1. Torque Table

ITEM NUMBER	TORQUE VALUE N-m	TORQUE VALUE lb_f-in	NAME, LOCATION
040 , 042	2.3 ± 0.2	20 ± 2	Screw, Sems
130, 160	8.0 ± 0.8	71 ± 7	Nut, Upper
180	5.0 ± 0.5	44 ± 4	Nut, 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 housed in a polypropylene box.

(1) T02 (P/N 416231) is assembled using syringe P/N 105112 and nozzle P/N 016544. T02 (P/N 020915-004) is assembled using syringe P/N 018327-000 and nozzle P/N 017536-004.

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)	020915-004	416231
T03	1.2Ω 3W equalizing resistors	-	164829
T04	Universal cell extraction tool	-	416159
	M8x1.25 tool	017557-000	-
T05	Vent Valve adapter for M8 valves	025098-000	-

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 40V DC Minimum	Commercially Available	Sorenson Power (Supply DCR-40-70B)
Constant current source with load bank	-	0 to 60A DC 1 to 40V DC	Commercially Available	Sorenson Power (Supply DCR-40-70B) with Ohmite (L225J5ROE)
Megohmmeter	-	0 to 50 MΩ @ 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 (+59°F to +176°F)	Commercially Available	Cincinnati Sub-Zero (MCB-1.2-.33-H/AC)

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 (0 to 133 lb_f-in)	Commercially Available	McMaster-Carr (7936A12)
Torque screwdriver	-	0 to 3.4 N-m (0 to 30 lb_f-in)	Commercially Available	Utica (TS-30)

Equipment
Table 9002

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): 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

Consumables
Table 9003

ILLUSTRATED PARTS LIST

1. Introduction

A. Purpose

This section provides illustrations and parts breakdown of the 23180 / 23186 batteries, which can be disassembled, replaced, and reassembled.

B. Explanation and usage of section

(1) Assembly order indenture system

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

(2) Effectively code

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

(3) Quantity per assembly

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

(4) Parts replacement data

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

(5) Service Bulletin incorporation

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

(6) Items not illustrated

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

(7) Alpha variant item numbers

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

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

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

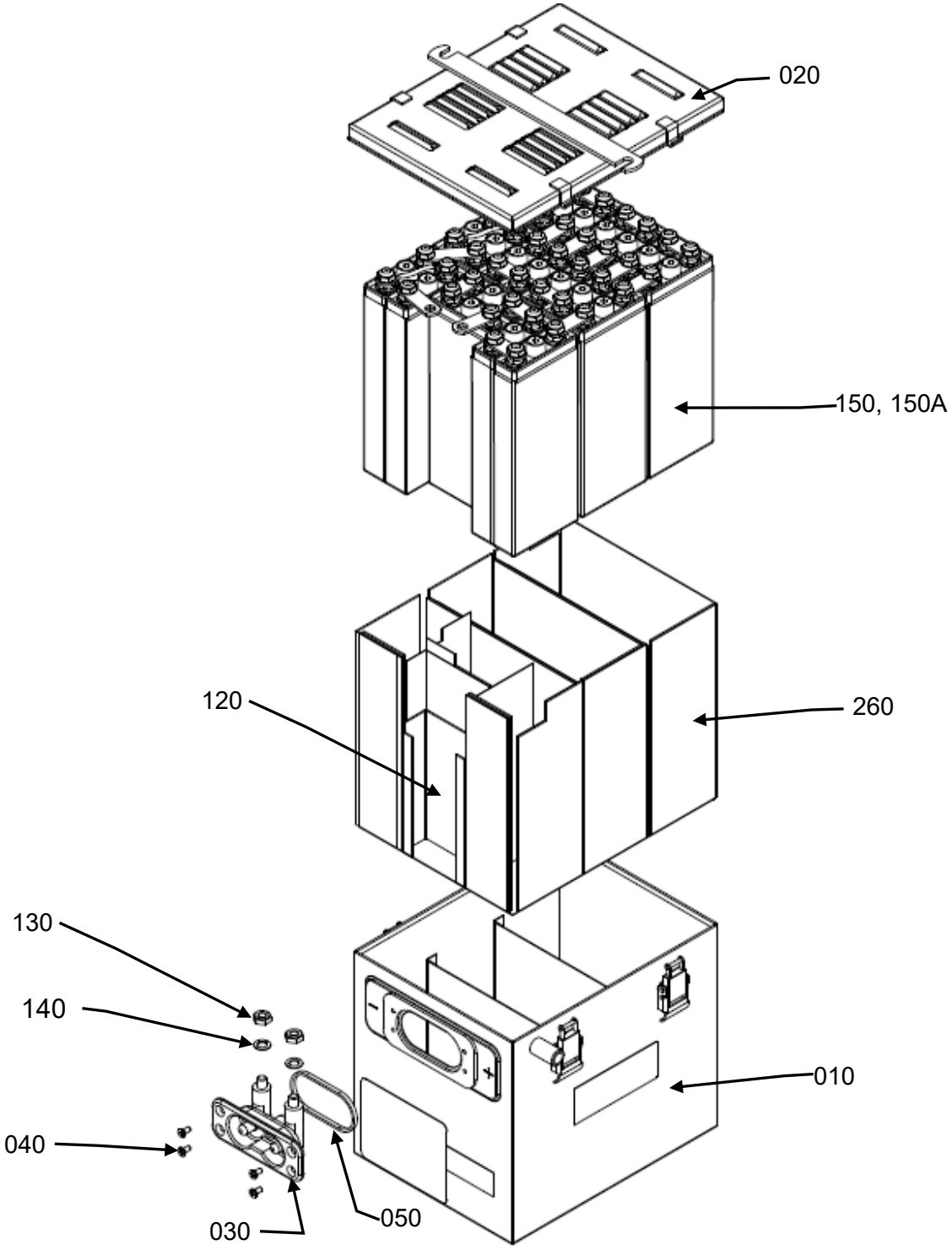
(8) Vendors

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

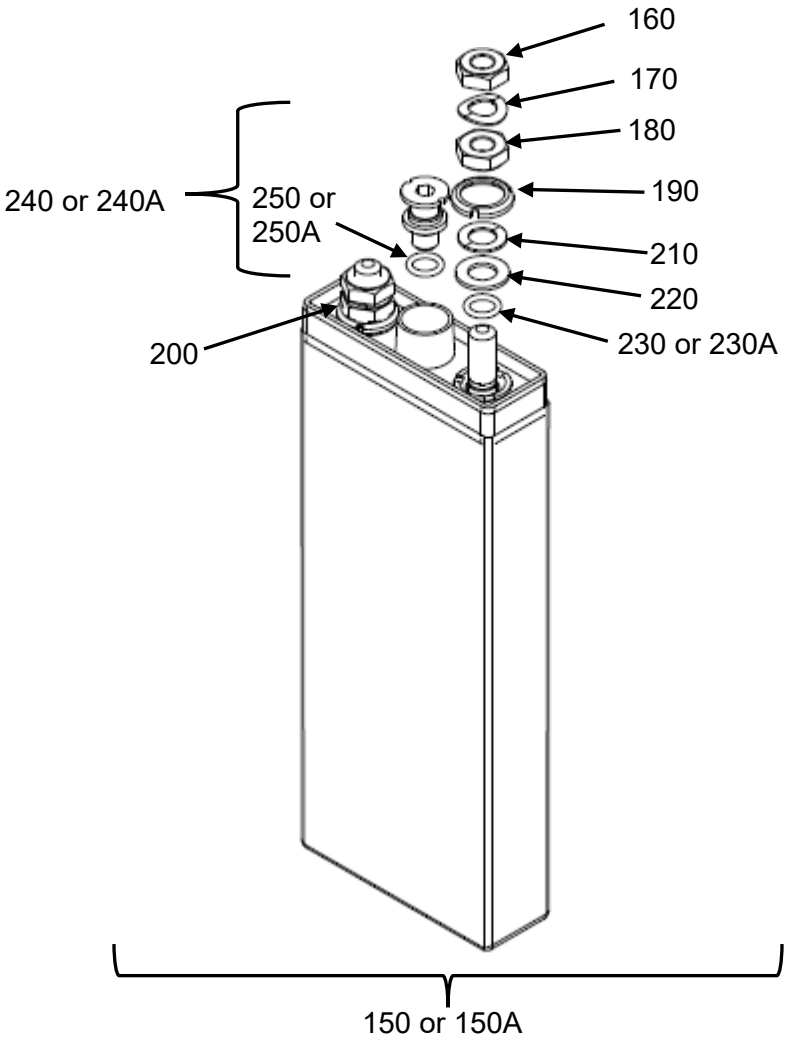
CAGE Code	NAME / ADDRESS	CAGE Code	NAME / ADDRESS
09052	Saft America Inc. 711 Gil Harbin Industrial Boulevard Valdosta, GA 31601 USA Phone: +1 (229) 247-2331 Fax: +1 (229) 247-8486	**F6177**	Saft 126 quai Charles Pasqua 92300 Levallois-Perret France Phone: +33 1 58 63 16 00 Fax: +33 1 58 63 16 18

2. Numeric Index

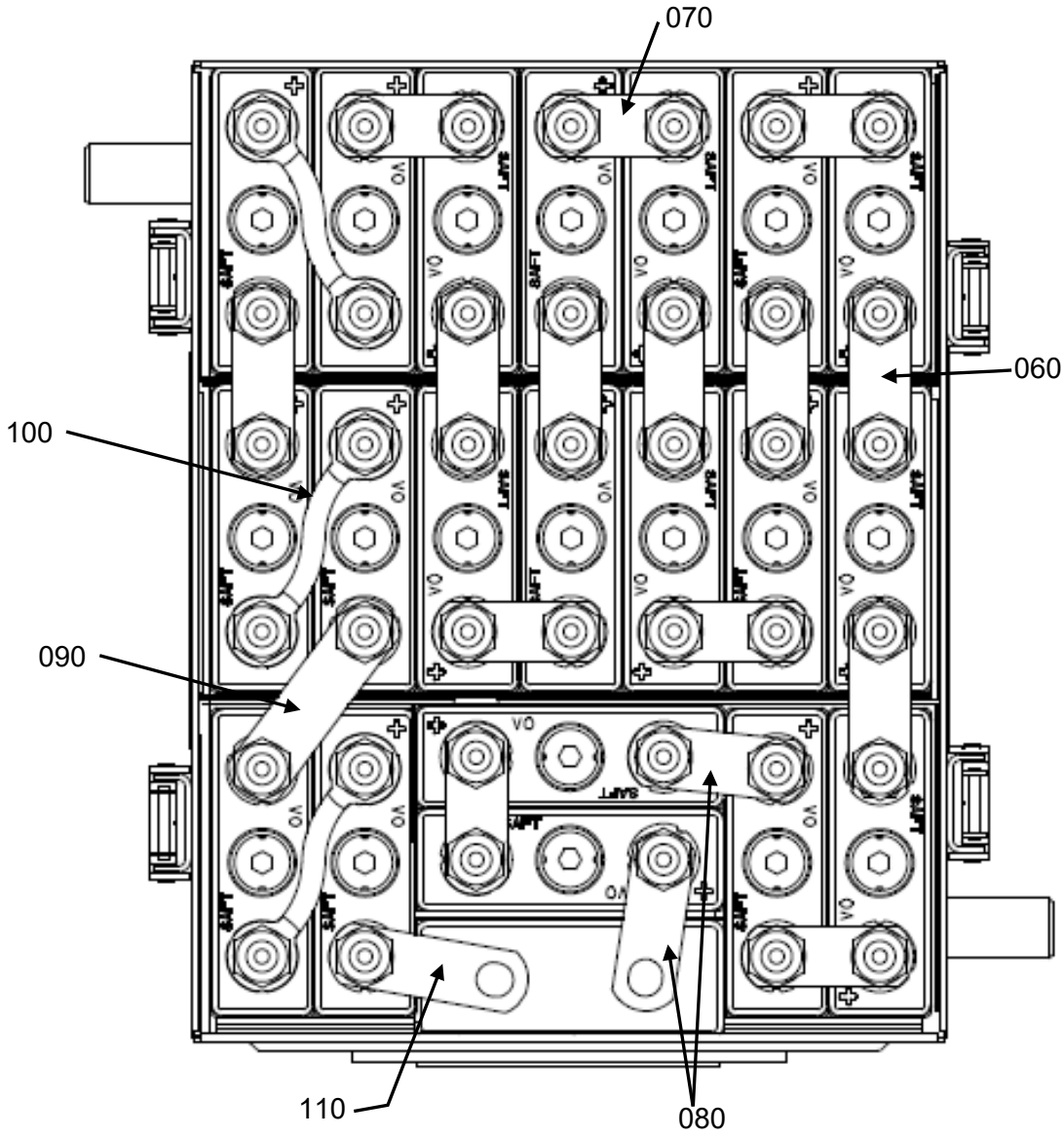
PART NUMBER 09052	AIRLINE STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER	UNIT	UNITS PER ASSY
009384-000			050	EA	1
015679-000			060	EA	7
015681-000			070	EA	7
015682-000			080	EA	2
015683-000			090	EA	1
015684-000			100	EA	3
015685-000			110	EA	1
015689-000			120	EA	1
015698-000			-150A	EA	20
015990-000			240	EA	1
015995-000			130, 160, 180	EA	82
015999-000			220	EA	40
016362-000		1	-1A	EA	RF
016726-000			150	EA	20
016833-000		1	1	EA	RF
017792-000			020	EA	1
018124-000			140, 170, 210	EA	82
020795-000			260	EA	1
021741-000			030	EA	1
021779-000			010	EA	1
021780-000			-010A	EA	1
023935-001			200	EA	20
023935-002			190	EA	20
091180-008			230, 250	EA	60
093616-000			040	EA	4



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



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



Battery, Top View

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

3. Detail Parts List

FIGURE & ITEM	PART NUMBER 09052	PART NUMBER F6177	AIRLINE PART NO.	NOMENCLATURE 1234567	EFF CODE	UNITS PER ASSY
1 -1	016833-000	-		Nickel-Cadmium Battery (09052) Battery Model 23180	A	RF
-1A	016362-000	-		Nickel-Cadmium Battery (09052) Battery Model 23186	B	RF
-1B	-	100408		Nickel-Cadmium Battery (F6177) Battery Model 23180 SUPERSEDED BY ITEM 1	C	RF
-1C	-	106900		Nickel-Cadmium Battery (F6177) Battery Model 23186 SUPERSEDED BY ITEM 1A	D	RF
010	021779-000	-		. Case, Marked, 23180	A	1
-010A	021780-000	-		. Case, Marked, 23186	B	1
-012	-	100419		. Case, Marked, 23180 SUPERSEDED BY ITEM 010	C	1
-012A	-	100419		. Case, Marked, 23186 SUPERSEDED BY ITEM 010A	D	1
020	017792-000	106901		. Cover		1
030	021741-000	102226		. Connector, Power		1
				Attaching Parts		
040	093616-000			. Screw, Sems, 8x32	A, B	4
-042	-	100431		. Screw, M4x10 (Must be used with ITEM 044)	C, D	4
-044	-	100430		. Washer (Must be used with ITEM 042)	C, D	4
				* * *		
050	009384-000	100713		. Gasket, Power Connector		1
060	015679-000	101228		. Link		7
070	015681-000	101229		. Link		7
080	015682-000	-		. Link		2
090	015683-000	101231		. Link		1
100	015684-000	057012		. Link		3
110	015685-000	100880		. Link		1
120	015689-000	161703		. Bracket		1
130	015995-000	-		. Nut, M8x1.25, Upper		2
-130A	-	062000		. Nut, M8x1.25, Upper (ALT TO ITEM 130)		2
140	018124-000	100111		. Washer, Spring		2
150	016726-000	063410		. Cell, VO23KH w/hardware	A	20
-150A	015698-000	063415		. Cell, VP230KH w/hardware	B	20
160	015995-000	-		. . Nut, M8x1.25, Upper		2
-160A	-	062000		. . Nut, M8x1.25, Upper (ALT TO ITEM 160)		2
170	018124-000	100111		. . Washer, Spring		2

DASH (-) ITEM NOT ILLUSTRATED

FIGURE & ITEM	PART NUMBER 09052	PART NUMBER F6177	AIRLINE PART NO.	NOMENCLATURE 1234567	EFF CODE	UNITS PER ASSY
180	015995-000	062023		. . Nut, M8x1.25, Lower		2
190	023935-002	-		. . Washer, Negative Polarity		1
-190A		100695		. . Washer, Negative Polarity (OPT TO ITEM 190)		1
200	023935-001			. . Washer, Positive Polarity		1
-200A	-	100696		. . Washer, Positive Polarity (OPT TO ITEM 200)		1
210	018124-000	100111		. . Washer, Spring		2
220	015999-000	100479		. . Washer, Flat		2
230	091180-008	-		. . O-Ring, Terminal		2
230A	-	416353		. . O-Ring, Terminal (ALT TO ITEM 230)		2
240	015990-000			. . Valve, Vent		1
240A	-	415215		. . Valve, Vent (ALT TO ITEM 240)		1
250	091180-008			. . . O-Ring, Vent-Valve		1
250A	-	411646		. . . O-Ring, Vent-Valve (ALT TO ITEM 250)		1
260	020795-000	-		. Kit, Spacer		1

DASH (-) ITEM NOT ILLUSTRATED

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 previously in service.

         (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 (-67°F to +41°F) or +35°C to +60°C (+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 1002 entry point “C”
More than 12 months	Do Charge and return to Figure 1002 entry point “Regular Check”

Table 15001 Return to Service Following Storage

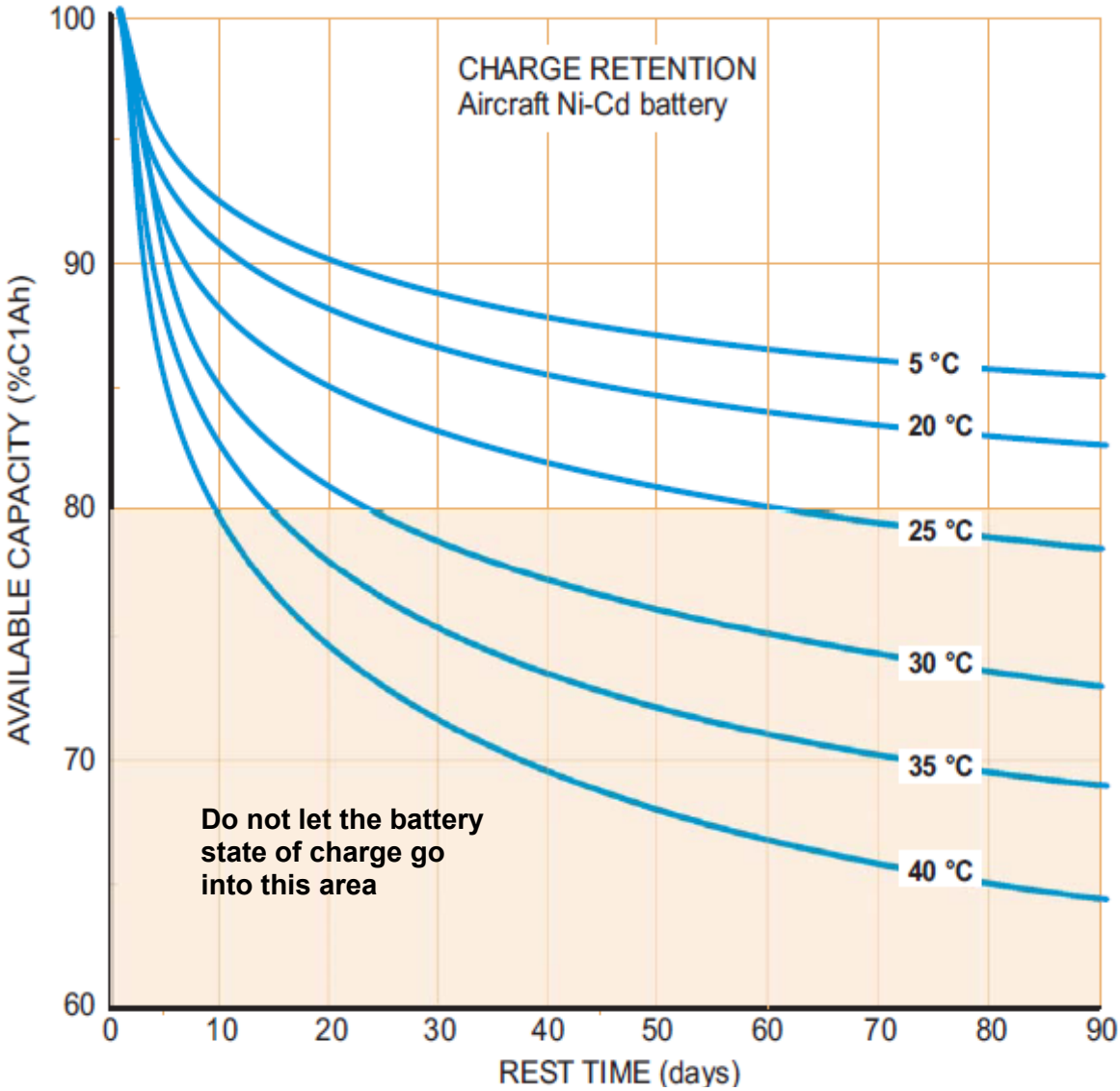
3. Inactive Standby Storage

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 duration that corresponds to 80% available capacity shown in Figure 15001. For example, maximum of 24 days at +30°C (+86°F) or maximum of 90 days for temperatures ≤ +23°C (+73°F).



Inactive Standy Period
Figure 15001

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

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

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

Table 15002 Refresh Charge

C. Standby duration consists of a maximum of 3 standby periods with 2 refresh charges in-between each standby period. 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 one the following below:

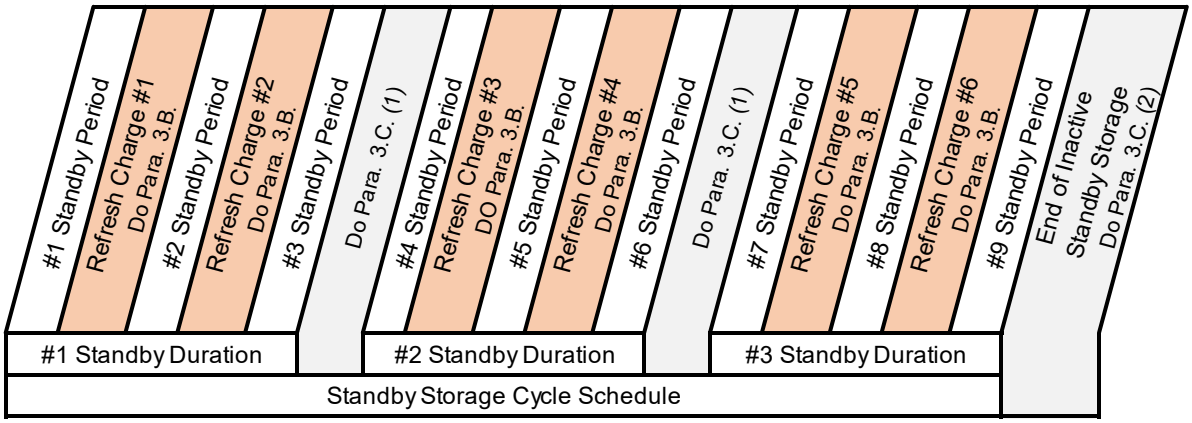
(a) For environments ≤ +30°C (+86°F) do Battery insulation, Initial discharge, Charge, Electrolyte level, and Battery insulation.

(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 duration, the battery can go into long-term storage (refer to Inactive Long-Term Storage) or return to Figure 1002.

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 the Inactive standby storage schedule shown in Figure 15002, the battery may be installed on the aircraft or placed into Inactive Long-Term Storage.



Inactive Standby Storage Schedule
Figure 15002

4. Active Standby Mode (Trickle Charge)

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

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

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

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.

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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