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MAINTENANCE MANUAL WITH ILLUSTRATED PARTS LIST

AIRCRAFT BATTERY

1656-6

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INTRODUCTION

1. General

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, repair, overhaul, and generally 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 in order to make sure they are safe when installed and they perform their required functions especially in emergency conditions on board the aircraft. Maintenance checks also permit any problems to be identified and corrected. The maintenance interval is the period for which correct operation is assured with a low probability of failure and allows high levels of MTBUR and MTBF to be achieved. Apart from the question of safety, the avoidance of failure on board the aircraft, with consequent costly impact on delays, reduces operational costs.

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.saftbatteries.com/cmm or at one of the following addresses:

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Website All Saft technical documentation, distributors and repair shops can be found at www.saftbatteries.com/cmm.

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

Caution: Except for those steps that require the battery to be charged, do all steps on discharged batteries (refer to Residual discharge paragraph) to avoid the possibility of electric shock. Tighten vent-valves (180) 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.

Caution: Do not tilt the battery while doing maintenance, any contact of skin with 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.

3-1. Physical

- Handling: the battery is heavy. When you lift it, bend your legs and not your back.
- Use protective shoes.

3-2. Electrical

- Do not wear rings, watches, chains, belt buckles, necklaces or any other metallic objects.
- Use insulated tools.

3-3. Chemical

- For a complete listing of hazards, refer to the safety information sheet available on Saft's website at www.saftbatteries.com/cmm.
- Electrolyte is very corrosive and can damage the skin: use gloves and an apron. If it touches the skin, flush affected part with water and neutralize with an acetic solution, vinegar or lemon juice, or with a boric acid solution at 10% concentration.
- Electrolyte is very dangerous for eyes, use protective goggles. If the electrolyte comes in contact with the eyes, flush them with water for at least 15 minutes and immediately call a doctor.
- Electrolyte ingestion can cause damage to the throat and the respiratory tract. Do not try to vomit. Call a doctor immediately.
- Skin contact with nickel can cause chronic eczema.

- 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. Get medical attention immediately.
- Potassium hydroxide in the electrolyte can cause eczema.

4. Aircraft Conversions

Saft aircraft batteries come in a wide variety of configurations that are approved for installation on selected aircraft. When replacing a lead-acid battery with a Saft nickel-cadmium aircraft battery, it is vitally important to clean all mounting and holding fixtures in the aircraft prior to installation. All traces of acid and salt should be removed by washing with a neutralizing agent such as sodium bicarbonate (baking soda) in water. Once the area has been fully cleaned and prepared, the surface should be painted with an alkaline resistant paint. This preparation should ensure that your new Saft battery will not be harmed by sulfuric acid residue.

5. Ground Applications

Your Saft battery can be used in such ground applications as starting gas turbine generators, ground mobile equipment, or in shop testing equipment. The same principles used in flight operations apply when the battery is used in ground applications. Ventilation of the battery during ground use can be accomplished through a ventilation system or by simply removing the cover (only in a well-ventilated area). Check with your local authorities for regulations in effect for your area.

6. Placing a new battery in service - initial commissioning

NOTE: Whether or not the battery has been subject to disassembly and reassembly, before its issue to service and installation, the tightness of all upper nuts / screws must be checked to verify that torque values correspond with those specified (refer to the Nut tightness chapter).

Saft batteries are shipped discharged. A visual inspection, torque check, charge procedure, electrolyte check, and insulation test should be done prior to the battery being placed into the aircraft for service. Refer to the Inspection/check chapter.
If the battery has been stored for longer than 3 months, refer to Servicing after discharged storage.

7. Battery Ratings

7-1. Capacity

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

American Standard AS8033 defines capacity as "the dischargeable ampere-hours (Ah) available from a fully charged cell/battery at any specified discharge rate/temperature condition".

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

A battery rated for $1C_1$ Ah indicates that the battery is rated at a value based upon a discharge time of 1 hour at 23°C ± 3°C (73.4°F ± 5.4°F).

8. Recycling

All batteries eventually lose their ability to perform and are eligible for scrap 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.

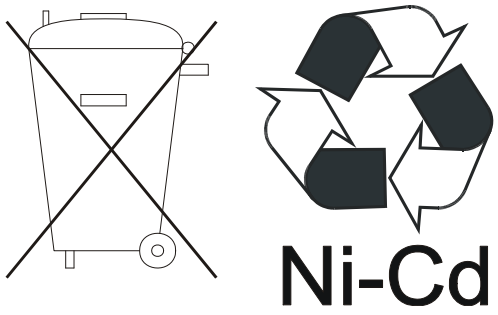

Figure INTRO-1 Universal Recycling Symbols

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

9. End of life cells

EASA regulations 'Part 145', require that end of life cells must be disposed of in a manner that does not allow them to be returned to service. The following procedure provides a means of complying with these regulations.

While other authority requirements (such as FAA) may be less explicit, Saft recommends that the following procedures be adopted in order to ensure that end of life cells cannot be re-used:

- Ensure that appropriate protective measures (refer to Safety paragraph and the Battery Information Sheet (BIS)) are taken..
- Ensure that the cell is fully discharged (refer to Cell shorting paragraph)
- Put one of the terminals from the cell between the two sides of a bench vice and bend until the terminal breaks. In the event of electrolyte leakage, ensure that appropriate clean up measures as described in the Battery Information Sheet (BIS) are observed.
- Dispose of the cell in accordance with applicable transport, health and safety and recycling regulations (Refer to Recycling paragraph).

10. Measurements

The measurements which are given in this manual come from the original manufacturer drawings.

This CMM uses the "Systeme International" (S.I.) units for quantities and values. It also gives the imperial units in parentheses.

10-1. Units of Measure

10-1-1. I.S. Units

A	Ampere
Ah	Ampere hours
C_1A	Rated current
C_1Ah	Rated capacity for an hour
g	Gram
m	Meter
min	Minute
N	Newton
N.m	Newton meter
Pa	Pascal
V_{DC}	Volt direct current
°C	Degree Celsius
%	Per cent
W	Ohm

10-1-2. U.S. Units

ft	Foot
in	Inch
inHg	Inch of mercury
lb	Pound
lbf.in	Pound force inch
°F	Degree Fahrenheit

10-1-3. Multiplying Prefixes

µ	Micro
m	Milli
da	Deca
k	Kilo
M	Mega

10-2. Measurement Conversion Table

10-2-1. From U.S. Standard System to I.S. Measurement

1 kPa	0.1450 psi
1 cm	0.3937 in
1 cm²	0.1550 in²
1 N	0.2248 lbf
1 g	0.0353 oz
1 kg	2.2046 lb
1 mm	0.0394 in
1 N.m	8.8507 lbf/in

10-2-2. From U.S. Standard System to I.S. Measurement

1 psi	6,8948 kPa
1 in	2,54 cm
1 in	25,4 mm
1 in²	6,4516 cm²
1 lbf	4,4482 N
1 oz	28,3495 g
1 inHg	3,3864 kPa
1 lb	0,4536 kg
1 gal (U.S.)	3,7854 l/min
1 lbf.in	0,1130 N.m
1 lbf.ft	1,3558 N.m

10-3. Temperature Conversion Table

10-3-1. SI MEASUREMENT Degrees Celsius (°C)

Celsius = (Fahrenheit - 32) x 0.5555

10-3-2. U.S. STANDARD SYSTEM Degrees Fahrenheit (°F)

Fahrenheit = (Celsius x 1.8) + 32

10-4. Abbreviations

The abbreviations given below are used in this manual:

AECMA	European Association of Aerospace Industries
ATA	Air Transport Association of America
dia.	diameter
EASA	European Air Safety Authority
FAA	Federal Aviation Authority
fig.	figure
IATA	International Transport Air Association
IMDG	International Maritime Dangerous Goods
ipl	illustrated parts list
max.	maximum
mfr	manufacturer
min.	minimum
MTBF	Mean time between failure
MTBUR	Mean time between unscheduled removal
n°	number
p/n	part number
para.	paragraph
ref.	refer to

s/a	subassembly
TBD	to be defined
V	Voltage

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DESCRIPTION AND OPERATION

1. Description

1-1. General

The batteries are connected to the aircraft system:

- According to the aircraft manufacturer, to start the engine or the APU.
- On the ground, to provide power before electrical power is supplied to the aircraft systems.
- In flight, if a malfunction or a failure occurs in the power supply system.

2. Technical data

2-1. Characteristics

The most important characteristics are indicated in the table below.

Technical data	Values
Type of cells	VP160KH
Number of cells	20
Nominal voltage	24 V
Rated capacity C_1Ah (Ah)	15 Ah
Charge or discharge current 1 C_1A	15 A
Charge current 0.5 C_1A	7.5 A
Charge current 0.1 C_1A	1.5 A
Electrolyte	Solution of KOH
Electrolyte level (mm)	20 mm (0.78 in)
Consumable volume of electrolyte per cell	20 cm^3 (0.79 in^3)
End of charge voltage	1.50 V / per cell
End of life criterion in %	85%
End of life criteria in hour or minutes	51 min
Battery maximum weight	17.8 kg (39.2 lbs)
Battery connector	Connector according to ISO5064/11 or MS3509

3. Description

NOTE: The item numbers are those of the detailed parts list chapter (Refer to Detailed part list).

The 1656-6 Saft nickel-cadmium battery consists of a box (045), containing 20 individual cells VP160KH. These cells are connected in series to obtain 24 V nominal. Individual cells are enclosed in a polyamide container that provides insulation, allowing them to be fitted side-by-side in the battery box. Interconnection of cells is via rigid, highly conductive, nickel-plated copper links (070 to 120). Each link is held in place by nickel-plated copper nuts (050) on the cells' terminals. Inside the battery box, individual cells are held in place by partitions, liners and spacers (190), and a cover (020).

The connector (220) connects the battery to the aircraft DC power.

The cover (020), which can be removed, is attached to the box (045) by 2 latches.

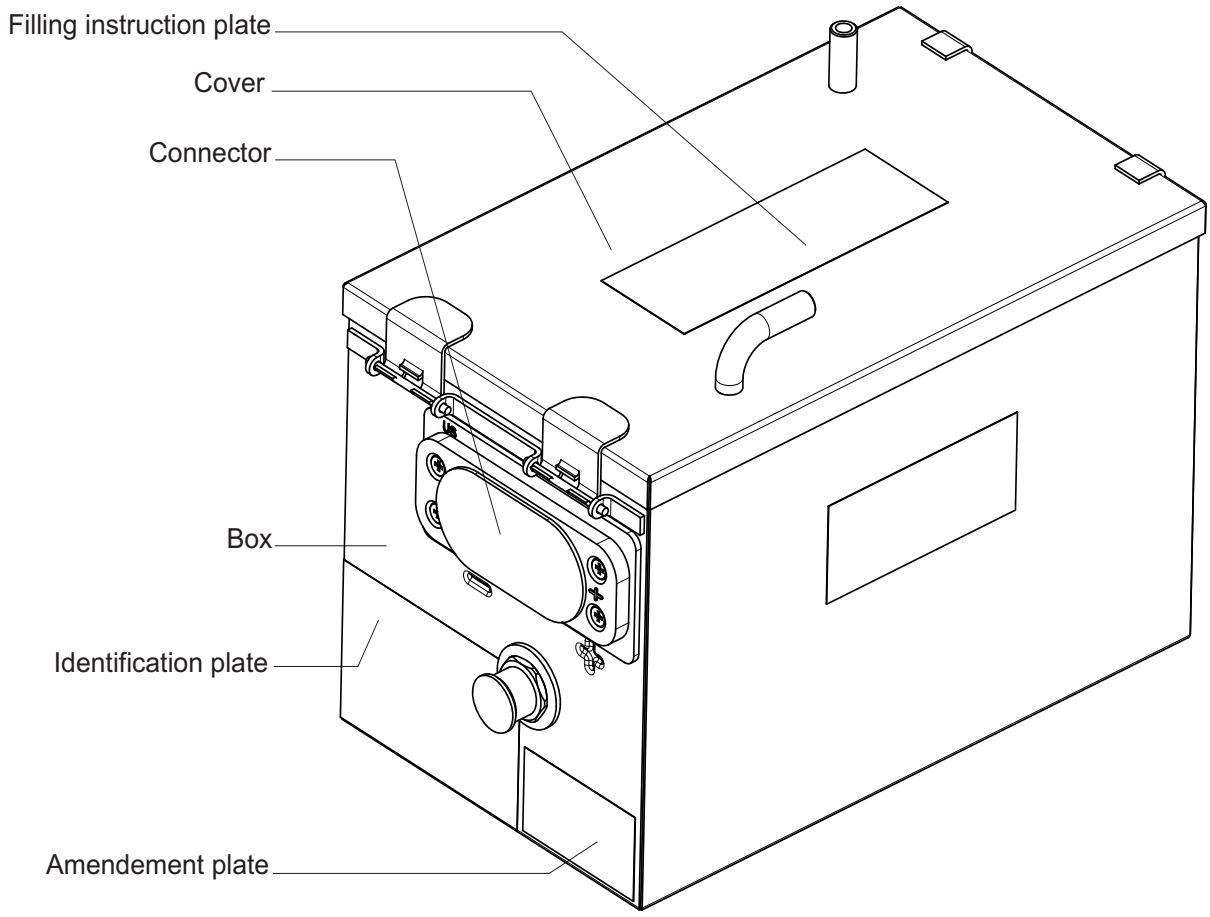

Figure 2 Nickel-Cadmium Aircraft Battery

4. Operation

4-1. climatic requirement

Unless otherwise stated, charge and discharge testing should be done when the battery temperature is between + 15 °C and + 30 °C.

4-2. Maintenance

All maintenance, including charging, discharging, should be done specifically in accordance with the instructions contained in this manual.

5. Charge

5-1. Constant Current Charge

Starting with a discharged battery:

- Remove the cover complete (020).
- Loosen, but do not remove, all vent-valves (180).

- Charge using one of the methods shown in the table below.

NOTE: Check cell voltage at the beginning of the charge. If any cell indicates an immediate voltage rise above 1.5 V, add 5 cm^3 of distilled or deionized water to that cell.

- During the last 15-30 minutes of the overcharge cycle, Adjust electrolyte level.

Main charge				Final charge (overcharge)	
Current and duration			Minimum voltage	Current and duration	Minimum voltage
1.5 A	time	mini 10 h maxi 12 h	1.5 V / per cell	1.5 A for 4 h	1.50 V / per cell
7.5 A	time	mini 2 h maxi 2 h 30 min.	1.55 V / per cell	1.5 A for 4 h	1.50 V / per cell
15 A	time	mini 1 h maxi 1 h 15 min.	1.57 V / per cell	1.5 A for 4 h	1.50 V / per cell

Table 1 - Charge Rates

5-2. Rapid Partial Charge

One of the following two procedures can be used in an emergency situation to charge the battery to approximately 80% of its capacity. ***Do not use these procedures for charging the battery during normal maintenance.***

- Charge the battery at 7.5 A until the battery reaches an average of 1.55 V/cell. Do not charge for more than 2 hours and 30 minutes

or

- Charge the battery at 15 A until the battery reaches an average voltage of 1.57 V/cell. Do not charge for more than 1 hour and 15 minutes.

5-3. Constant Potential Charge

Caution: Constant potential charging should not be attempted if the open circuit battery voltage is below 1.0 V per cell.

In an emergency, a partially discharged battery may be recharged using a constant potential charging system such as exists on the aircraft. Do not use this procedure for charging the battery during normal maintenance:

With the use of a constant potential system, it is imperative that the charge rate be checked periodically for accuracy, and that the charger be set according to the average ambient operating temperature.

NOTE: A maintenance check of the battery should be done at the earliest opportunity to verify battery performance.

Connect the battery to the constant potential power source. Charge for a minimum of 1 hour at 1.425 V/cell to obtain approximately 90% of the rated capacity of the battery.

NOTE: A maintenance check of the battery should be done at the earliest opportunity to verify battery performance.

5-4. Other methods of charging

In addition to the constant current method of charging, other methods that fully charge the battery can be used. However, in any case, individualcell voltage checks (U ≥1.50 V / per cell) and electrolyte adjustments must be carried out using a final overcharge sequence at constant current 1.5 A during 4 hours. If specific instructions are not given in the charger operating manual, you must first contact Saft.

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TESTING AND FAULT ISOLATION

1. Introduction

This chapter gives the tests and inspections required to find the cause of faulty condition of the unit either removed for unscheduled maintenance or during scheduled maintenance. The test procedure is given in the tables below. For each test refer to the indicated procedures which specify all necessary information.

1-1. Battery electrical faults

Problem	Probable cause	Correction
(1) Zero battery open-circuit voltage	(a) Defective electrical connector (no contact made) (b) Link broken	Check electrical contacts, links and tightness of nuts (refer to Inspection/check).
(2) Zero volt with the battery set to "discharge"	(a) Battery fully discharged (b) Battery circuit open or contacts defective (c) Cell completely dry	Do an insulation check (refer to Inspection/check) Examine the contacts and links. Make sure the terminal nuts are tight (refer to Inspection/check). Refer to related subsequent steps. Replace the cell.
(3) Low insulation	(a) Leakage of electrolyte	Disassemble and clean the battery (refer to Disassembly and Cleaning). Do an electrolyte level check (refer to Inspection/check).

Table 1 - Battery electrical faults

1-2. Cell faults

Problem	Probable cause	Correction
(1) Too much water decrease for all battery cells.	(a) Charge much more than the limit or too much charge at high temperature.	Examine the cause of excessive charge. If necessary, adjust to normal operating temperature (refer to Description and operation).
	(b) Previous maintenance has not been done.	Note the cell location and check the level of water consumption versus other cells at the next maintenance.
(2) High water dispersion: water consumption in one or more cell(s) is very different from the other cells in the battery.	(a) more than 30% above the average value of added water in all cells: leaking cell(s).	Dissassemble the battery (refer to Disassembly). Clean the battery (refer to Cleaning).. Replace the cell(s). Charge and do an electrolyte level check (refer to Inspection/check).
	(b) less than 30% below the average value of added water in all cells: cell(s) with damaged separator(s).	Do the Supplementary test (refer to Inspection/check). If necessary, replace the cell(s).
(3) A cell has a higher voltage at the start of charge than is defined in para. Charge chapter Description and operation.	(a) Dry cell.	When the defect occurs, add 5 cm^3 (5 ml) of distilled water to the cell. Do not adjust more accurately until the end of the charge.
NOTE: If you charge a cell with a quantity of electrolyte which is not sufficient, this can cause the temperature to increase too much.		
(4) A cell has a lower voltage at the end of charge than is defined in para. Charge chapter Description and operation.	(a) The cell was operated at temperatures and charge rates outside the limits, and the separator is damaged.	Replace the cell (refer to Disassembly, Assembly AND Storage (including transportation)).
	(b) Usual wear after long operation	
(5) Low capacity cell.	(a) insufficient balancing	Repeat Charge, discharge at 15 A and Cell shorting up to three times
	(b) Usual wear after long operation.	Replace the cell (refer to Disassembly, Assembly AND Storage (including transportation)).
	(c) Unusual operation, operation at high temperature or operation with low electrolyte.	Do the applicable procedure (refer to Inspection/check).
(6) Cell with a swollen case.	(a) Cell operated with low electrolyte level ; deterioration of separators and damaged plates.	Replace the cell (refer to Disassembly).
(7) Cell with zero voltage when the battery circuit is open.	(a) Short-circuited cell.	Replace the cell (refer to Disassembly).

Table 2 - Cell faults

1-3. Physical faults

Problem	Probable cause	Correction
(1) Leakage of electrolyte.	(a) Incorrect adjustment of electrolyte level.	Disassemble and clean the battery (refer to Disassembly and Cleaning chapters). Do an electrolyte level check (refer to Inspection/check).
	(b) Cell polarity incorrect during high-rate discharge (for example, during the engine start).	Disassemble and clean the battery (refer to Disassembly and Cleaning). Do an electrolyte level check (refer to Inspection/check).
	(c) Too much charge at high temperature or too much current.	Investigate the cause of excessive charge. If necessary, adjust to normal operating temperature (refer to Description and operation). Disassemble and clean the battery (refer to Disassembly and Cleaning).
	(d) The lower nut is not correctly tightened.	Do an electrolyte level check (refer to Inspection/check). Torque the lower nut (refer to Assembly chapter)
(2) Electrolyte found in the battery box.	(a) Damaged cell case.	Replace the cell if necessary and refer to related subsequent steps.
	(b) Leakage of electrolyte.	Disassemble and clean the battery (refer to Inspection/check and Cleaning). Do an electrolyte level check (refer to Inspection/check).
(3) Corrosion on the links.	(a) Operation in acidic air.	Make sure the battery test bench and the storage areas have no materials which can give off acid fumes.
	(b) Mechanical damage to nickel plating.	Replace the damaged links (refer to Disassembly, Assembly AND Storage (including transportation)).
(4) The links are too hot.	(a) Loose terminals nuts.	Make sure the nuts are torqued (refer to Inspection/check).

Table 3 - Physical faults

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DISASSEMBLY

1. Introduction

NOTE: Refer to the Testing and fault isolation chapter to identify the possible cause of a malfunction. This will give the necessary level of disassembly.

The instructions found in this section are designed to allow the maintenance person to completely disassemble the battery for the purpose of General Overhaul. However, some maintenance operations do not require complete disassembly. Disassemble only to the extent necessary to effect appropriate repair or replacement.

2. Safety

Refer to chapter Safety.

3. Equipment

3-1. Standard tools

Refer to chapter Standard tools in Special tools, fixtures, equipment and consumables.

3-2. Special tools

When special tools are used in this chapter, they are identified by a code number listed in Special tools, fixtures, equipment and consumables chapter.

4. Disassembly procedures

NOTE: All ( ) part identification numbers herein are IPL Fig. 1 item numbers and are using hypertext facility.

4-1. Removing the cover (020)

Undo the retaining latches. Remove the cover taking care to avoid contact between the cover and the cell terminals or links.

4-2. Removing the cells (160)

**NOTE: Make note of the proper placement of the links (070 to 120) prior to removal.
To facilitate ease of removal, remove the center cell in each row first.**

Remove the nuts (050) that attach links to the cells.

Remove all links (070 to 120).

Fully screw the extractor tool (T04) onto a cell terminal then pull up to remove the cells (130).

4-3. Removing the vent valves (180)

Unscrew the vent valve with the special tool (T01).

Remove the vent valve (180) with its O-ring.

4-4. Removing the connector (220)

Remove the screws (200) and the washer (210).

Remove the connector (220).

4-5. Removing the sensor (240)

Remove the nut that attaches the sensor (240) to the box.

Remove the sensor (240)

4-6. Disassembly of the battery

Remove the cover (020) according to para. Removing the cover (020).

Remove the connector (220) according to para. Removing the connector (220).

NOTE: Note placement prior to removal to ensure proper placement during re-assembly.

Remove the liner spacer kit (190).

Remove the sensor (240) according to para. Removing the sensor (240).

CLEANING

1. Introduction

The instructions in this chapter are for the general cleaning of your Saft aircraft battery. The instructions under “Light Cleaning” are to be done each time the battery is removed from the aircraft, and can be accomplished with no disassembly of the battery. The section “Thorough Cleaning” includes the instructions for the cleaning of a disassembled battery for the purpose of a General Overhaul.

2. Safety

Refer to chapter Safety.

3. Equipment

3-1. Standard tools

Refer to chapter Standard tools in Special tools, fixtures, equipment and consumables.

3-2. Special tools

When special tools are used in this chapter, they are identified by a code number listed in Special tools, fixtures, equipment and consumables chapter.

3-3. Consumables

When consumables are used in this chapter, they are identified by a code number listed in Special tools, fixtures, equipment and consumables chapter.

4. Light Cleaning

On an assembled battery.

Caution: Do not use solvent, petroleum spirits, trichloroethylene or other products containing chloride for cleaning the battery. The use of solvents may degrade the integrity of metal and plastic parts.

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

4-1. Procedure

Caution: To prevent injury when using compressed air, direct air stream away from the body. Use safety goggles to prevent eye injury from airborne particles.

- Remove the battery cover complete (020).
- Check the battery vent tubes to ensure that they are clean and clear.
- Hand tighten the vent valves (180) with the Universal vent wrench (T01)
- Remove potassium carbonates (white deposits) from the top of all cells (130) using a stiff bristle, non-metallic brush.
- Disperse residual salts and dust particles from the battery using blasts of clean, dry compressed air.
- Coat all nuts (050) and links (070 to 120) with M02.

5. Thorough Cleaning

On a disassembled battery.

5-1. Procedure

Fully disassemble the battery (refer to Disassembly chapter).

5-1-1. Cells (130)

Make sure that the vent valve (180) is tight.

Caution: Do not soak the cells in water.

To easily remove all the electrolyte and mineral salts from the terminals, the cover and the sides of the cell cases: clean in warm water with a soft brush.

Rub the cell with a cloth and let dry.

5-1-2. Box and cover (010)

Clean with lightly soapy water, rub with a cloth and let dry.

5-1-3. Nuts, spring washers and links

Clean in lightly soapy water with a brush, rinse well with clean water and let dry.

5-1-4. Liner spacer kit (190)

Clean in warm water and let dry.

5-1-5. Vent valve (180)

Caution: The cleaning of the vent valve (180) must be done when the cells are assembled in the box.

Remove the vent valve (180) (Refer to Disassembly chapter).

Cover the cell holes to keep out unwanted material.

Soak the vent valve for some time (during the night, for example) in a container of distilled water to remove all salts from the vent hole.

6. Lubrication

When the battery is clean (and after installation of the vent valve), coat all upper nuts (050), and links (070 to 120) with M02.

INSPECTION/CHECK

1. Introduction

1-1. General

This chapter includes the checks, the maintenance procedures and the functional tests that must be done to use Saft batteries in flight and on the ground.

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

2. Maintenance intervals

The aircraft manufacturer is responsible for defining the usage and function, including maintenance intervals, for aircraft batteries installed in its aircraft. Saft only provides recommendations that require the agreement of the aircraft manufacturer.

NOTE: Maintenance steps must be completed in a battery shop.

Saft distinguishes between three types of maintenance

2-1. Periodical check

The periodical check consists essentially of voltage and insulation checks, discharge of residual capacity and charge with electrolyte level adjustment. The main purpose of this periodical check is to replace water which is consumed by electrolysis during battery overcharge. It is normally applied between regular checks but can be omitted if the water consumption measured at the regular check is within allowable limits.

2-2. Regular check

The regular check is the same as the periodical check except that the battery is also deep discharged ('balancing'), followed by a capacity check cycle.

2-3. General overhaul

The general overhaul is the same as the regular check except that the battery is also disassembled and thoroughly cleaned and inspected.

3. Recording

It is very important to record the battery check values (capacity, end of charge voltage, water consumption) for each cells as required in the battery logbook for each maintenance. It is recommended that an operator tracks these maintenance data in order to verify the interval is correct relative to that particular operation. This may also allow the interval to be extended if the data justifies it.

4. Safety

Refer to chapter Safety.

5. Equipment

5-1. Standard tools

Refer to chapter Standard tools in Special tools, fixtures, equipment and consumables.

5-2. Special tools

When special tools are used in this chapter, they are identified by a code number listed in Special tools, fixtures, equipment and consumables chapter.

6. Periodical check

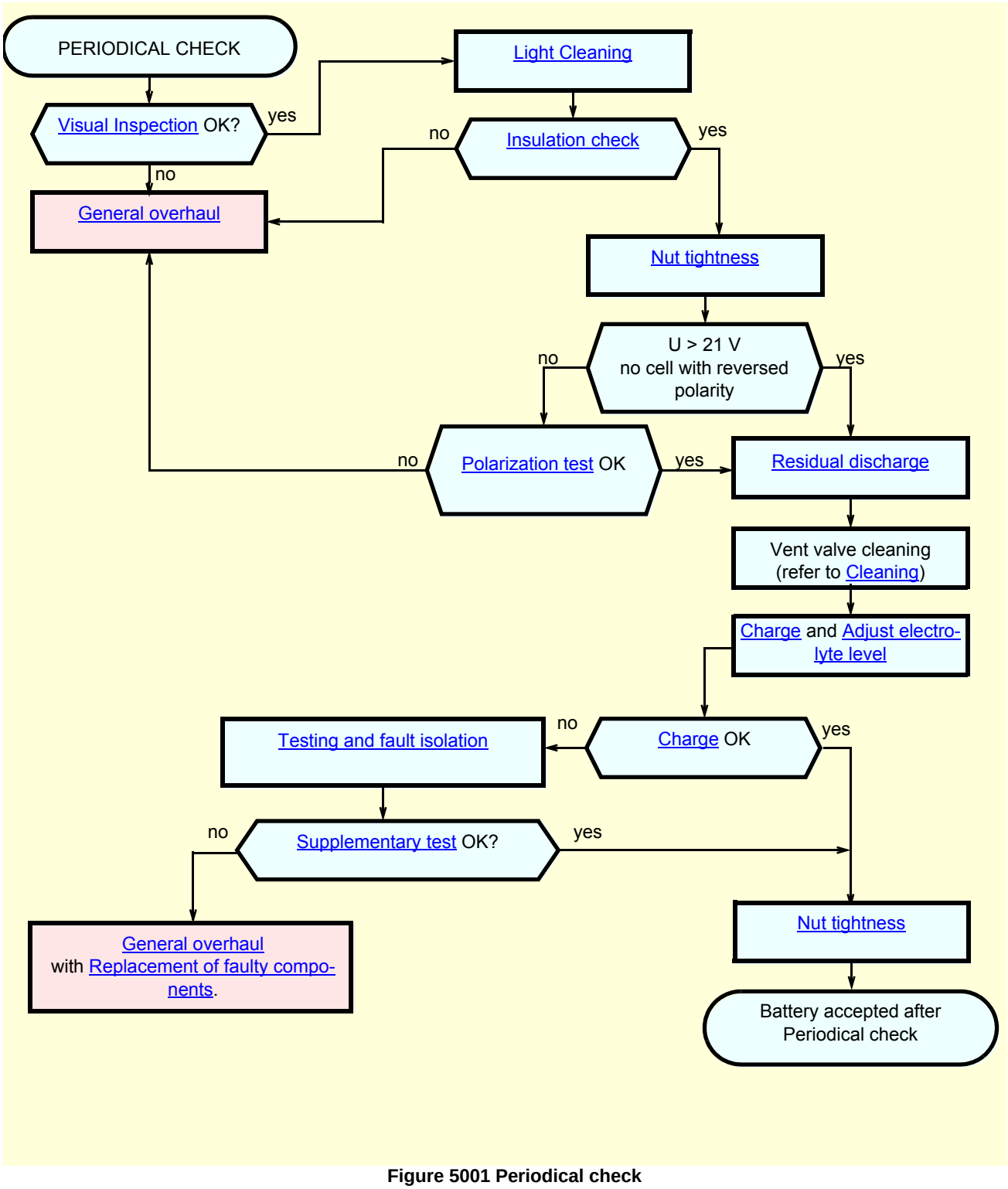


Figure 5001 Periodical check

Consult the airframe manufacturer for specific maintenance intervals or special procedures to be followed. Otherwise, at specific intervals according to aircraft use, or if electrolyte consumption exceeds the approved consumption levels between 2 regular checks, do this periodical check according to the above figure.

NOTE: Time periods are given as a guideline. Modify in accordance with operational experience. Periodic and Regular maintenance checks may be combined if operating hours permit.

6-1. Visual Inspection

Visual inspection should be done each time the battery is removed for maintenance.

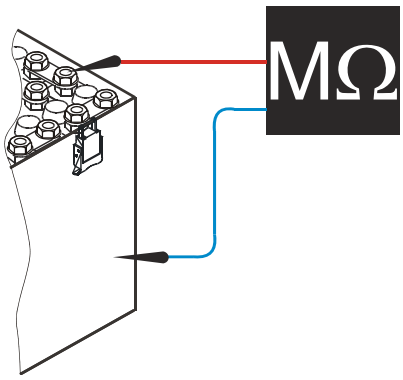
- Remove the cover complete (020).
- Visually check each cell (130) for any evidence of electrolyte leakage. If there is salt or electrolyte traces do a General overhaul. Excessive salts around a terminal post indicates possible leakage from the terminal O-ring. Verify the torque of the lower nut (refer to chapter Assembly).
- Inspect the links (070 to 120) and all upper nuts (050), and washers (060). The hardware should be free of bends, tarnish, corrosion, burns, or any loss of nickel plating. Minor tarnish can be polished off with a fine wire brush. Defective hardware should be replaced.
- Check the connector (220) for evidence of arcing, corrosion, cracks, or cross-threaded terminals. Replace the defective connector.

Caution: Worn aircraft connector and/or loose connections can greatly affect the performance of the battery. A defective conector (220) can cause battery self-discharge as well as low voltage in service.

- Inspect the electrical connector for bent or loose pins, corrosion, cracks, faulty wire connections, evidence of arcing, or cracked or loose potting material.
- Inspect the battery box (045) and cover assembly (030) for any damage. Minor dents may be repaired with a small rubber mallet. Ensure the cover gasket, if applicable, is undamaged and fully secured to the cover assembly (020).

6-2. Insulation check

A breakdown in electrical insulation between the cells (130) and the battery box (045) will result in a “leakage” current, which over time will discharge the battery. The most common cause for the loss of insulation is the leakage of electrolyte from the cells (130) that acts as a conductor between the cells and the battery box (045). Because leakage current can affect battery performance, it is necessary that it be kept to a minimum.

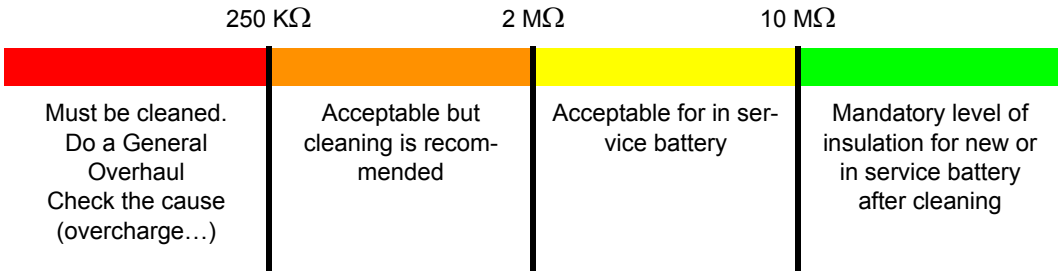


On a completely assembled battery, use a megohmmeter, set to 250 V DC, to measure the insulation resistance between the positive terminal of each cell (130) and the battery box (045).

Measure the insulation between pin A, B, C, D of the connector of the sensor (240) and the box(045).

Measure the insulation between pin A, B, C, D of the connector of the sensor (240) and the positive terminal of the connector (220).

Refer to the table below for the acceptance criteria.



6-3. Nut tightness

Tighten and check the torque of all upper cell nuts (050) (refer to Fits and clearances)

6-4. Polarization test

Charge the battery at 1.5 A for 1.5 hours.

Leave the battery on open circuit for 1 hour.

Measure the open circuit voltage of each cell. If any cell is zero (0) V or negative polarity, do a General overhaul. If all cells are above zero (0) V, continue with maintenance as specified.

6-5. Residual discharge

Discharge the battery at the 15 A or 7.5 A rate until each cell in the battery is discharged to 1.0 volt or below.

6-6. Adjust electrolyte level

Caution: Using anything other than distilled or deionized water in nickel-cadmium cells will cause electrolyte contamination and damage.

Always take appropriate precautions to prevent any foreign substances from entering the cell. Anything other than distilled or deionized water that enters the cells will cause electrolyte contamination and will affect overall performance.

The amount of time that the vent-valves are removed from the cell for maintenance should be limited to prevent as much air as possible from entering the cell. Carbon dioxide in the air will combine with the electrolyte to form potassium carbonate. Potassium carbonate will increase the internal resistance of the cells and thus decrease the performance at low temperatures and during high rate discharges. Always ensure that the vent-valves are properly secured while the battery is in use.

Electrolyte level adjustment must be done during the last 15-30 minutes of the 4 hours overcharge at 1.5 A rate of charge.

Caution: Take care not to tilt cells while vent-valves are loosened or removed. Contact of electrolyte with skin can cause burns. If contact occurs, flush area with large amounts of water. Electrolyte in the eyes is very serious. Flush with water and contact a doctor immediately.

Caution: The battery must be fully charged before adjusting the electrolyte level.
Use only distilled or deionized water (see chapter Special tools, fixtures, equipment and consumables).
Do not re-use water removed from cells.
The quantity (in cm^3) required to level the first cell will serve as a guide for requirements of the remaining cells but the amount of water required for each cell can vary, so carry out this check on a cell by cell basis. Each cell must be leveled individually. If the quantity of water added per cell is above 80% of the electrolyte water volume shown in the specification tables (refer to chapter Technical data), check the charging system. If it is functioning properly, shorten the time period between servicing.

Caution: The maximum amount of added water is 20 cm^3 (0.79 in^3) per cell.

Adjust the level of electrolyte, one cell at a time, using the following instructions:

- 1. Remove the vent-valves (180) with the vent-valve wrench (T01)
- 2. Check the nozzle length before fitting it to the syringe
- 3. Insert the syringe (T02) into the cell opening until the shoulder of the nozzle rests on the vent-valve seat .

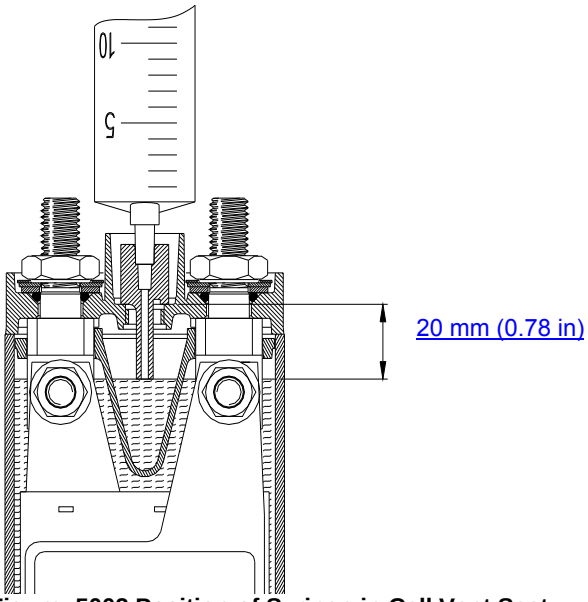


Figure 5002 Position of Syringe in Cell Vent Seat

- 4. Withdraw the plunger and check for any liquid in the syringe.
  Any excess liquid in the cell will be drawn into the syringe until the electrolyte is level with the end of the nozzle. This is the correct level for the electrolyte.
  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. In this case, replenish low electrolyte:.
- 5. Draw 5 cm^3 of the distilled water (M01) into the syringe and inject it into the cell.
- 6. With the syringe nozzle remaining on the vent-valve (180) seat, slowly withdraw the plunger in the syringe.
- 7. If the syringe remains empty, repeat steps 5 and 6, counting the number of 5 cm^3 injections required to achieve the correct level. Record the amount of water added to each cell on the maintenance record.
- 8. At the point in step 6 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 disposal. Do not re-use the liquid removed from cells. Check with local authorities for proper disposal of hazardous waste.

6-7. Supplementary test

At the end of complete charge, continue to charge for 5 h at 1.5 A (refer to PARA Charge)

Measure the voltage of the individual cell voltages every 30 min. The individual cell voltages:

- must not decrease by more than 0.03 V during the 5 h test
- must be more than 1.50 V / per cell
- Adjust the electrolyte level (refer to Adjust electrolyte level).

7. Regular check

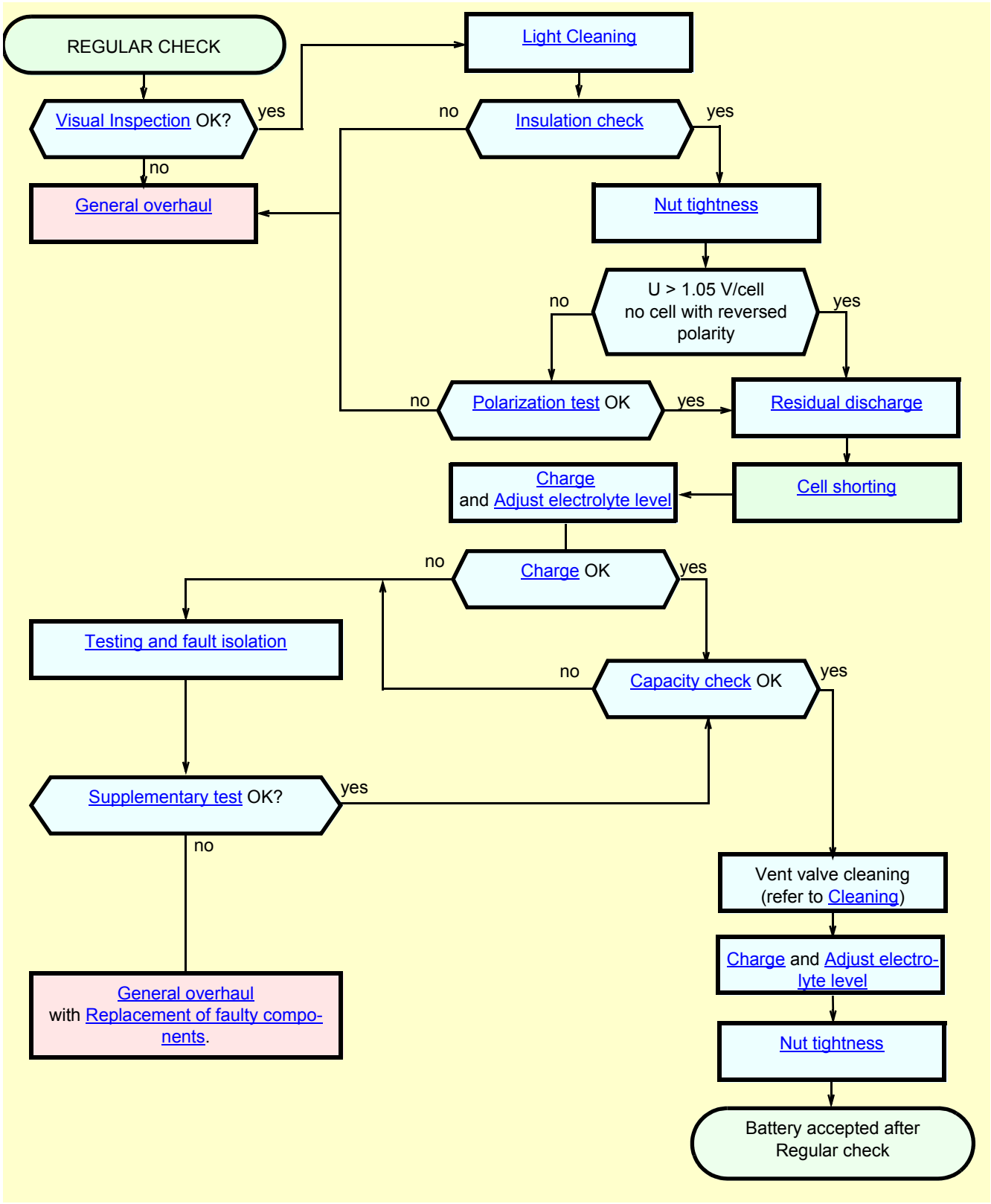


Figure 5003 Regular check

Consult the airframe manufacturer for specific maintenance intervals or special procedures to be followed. Otherwise, at specific intervals according to aircraft use, or AFTER A MAXIMUM OF ONE YEAR, test the battery according to the above figure.

NOTE: Time periods are given as a guideline. Modify in accordance with operational experience. Periodic and Regular maintenance checks may be combined if operating hours permit.

7-1. Cell shorting

As each cell's voltage drops below 1.0 V, connect an equalizing resistor (T03) across each cell's terminals. Leave the resistors in place for 12 to 16 hours to allow each cell to completely discharge and the battery to cool.

NOTE: As an alternative to the resistor a shorting clip can be applied when the voltage has dropped to 0.5 V.

7-2. Capacity check

Discharge the battery at 15 A. until all cell individual voltages fall below 1.0 V. Record the time when each cell falls below 1.0 V and the battery voltage falls below 20 V.

Note all the cells reaching 1 V before 51 min of discharge. For all theses cells, refer to page 1002 para (5)(a).

8. General overhaul

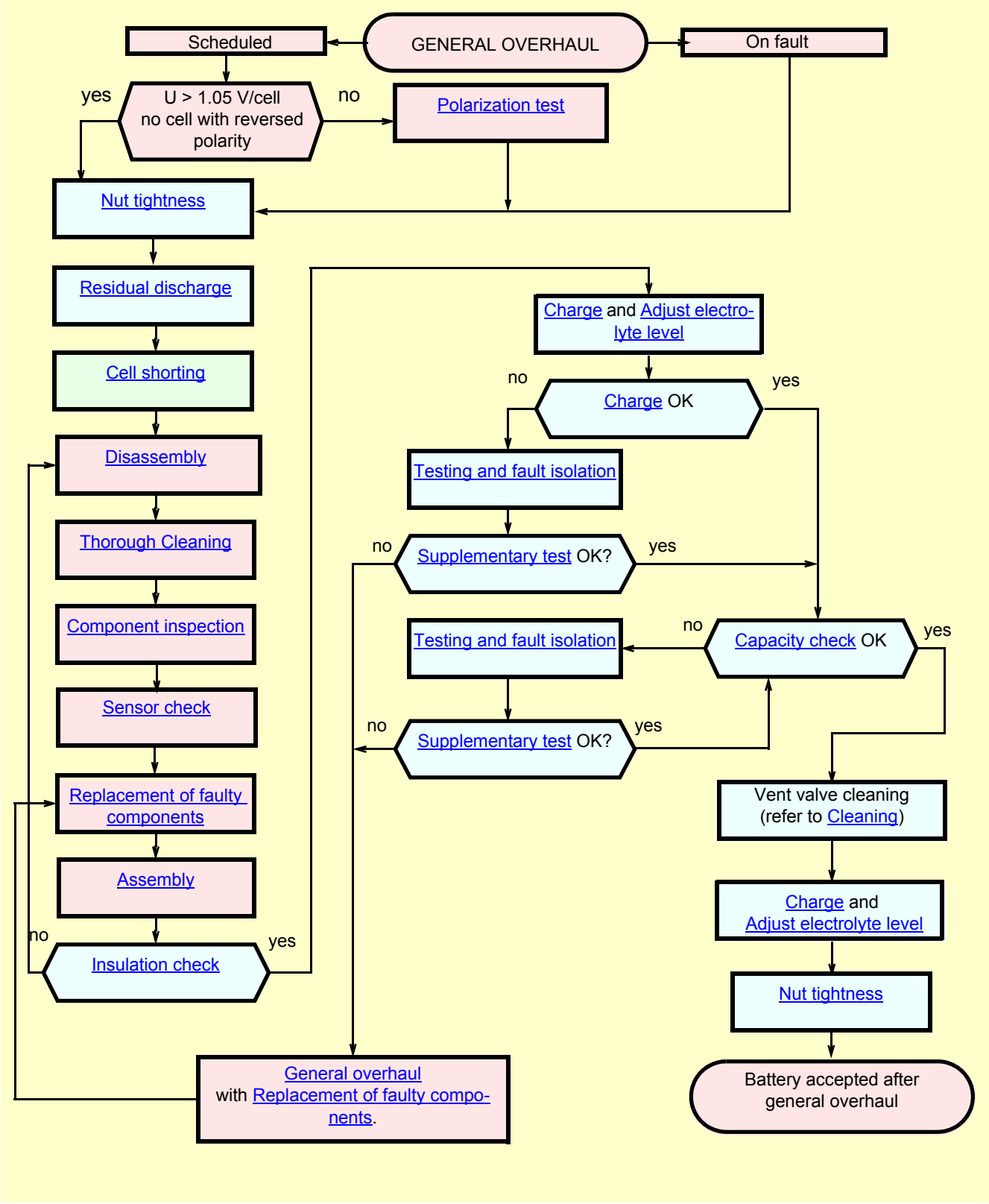


Figure 5004 General overhaul

Consult the airframe manufacturer for specific maintenance intervals or special procedures to be followed. Otherwise, at specific intervals according to aircraft use, or AFTER A MAXIMUM OF ONE YEAR, test the battery according to the above figure.

8-1. Component inspection

8-1-1. Cells

Make sure that the lower terminal nuts are tight (refer to Fits and clearances chapter).

Verify that cell boxes show no leakage.

8-1-2. Box

Make the sides of the box straight and remove dents.

8-1-3. Nuts, links and spring washers

Discard the components that show signs of corrosion or damage.

8-1-4. Packing parts

Discard all defective components.

8-1-5. Connector

Check the connector (220) for evidence of arcing, corrosion, cracks, or cross-threaded terminals. Replace the defective connector.

8-2. Replacement of faulty components

8-2-1. Cells - 3/5 cells rule

Saft strongly recommends to change all the cells or replace the complete battery if:

one or more cells are found to be faulty and 5 of the original cells in the battery had previously been changed,

or

3 or more cells are found to be faulty during the same maintenance.

The 3/5 cells rule does not apply to the following failures:

- mecanical failure such as terminal thread damage,
- cell leakage,
- cell short-circuit.

NOTE: All cells that are changed must be replaced by a new Saft cell..

8-2-2. Other components

Any other components that are to be changed must be replaced by a new Saft component.

8-3. Sensor check

Do this test in a climatic chamber with the sensor dissassembled from the battery. Check the sensor, according to the table below:

Check of	Between	Value
Thermostat	C-D	close on rise @ 71 °C ± 5 °C (160 °F ± 9 °F)
Thermistor	A-B	300 kΩ ± 15 kΩ @ 25 °C (77 °F)
Insulation	Each pin of the connector and all metal parts of the sensor	> 10 MΩ @ 250V DC

8-4. Vent valve test

NOTE: The Vent Valve Test is not necessary if the full set of used vent valves is replaced by a brand new one each year during the General Overhaul.

- This test should be done while the battery is on charge, just following the electrolyte leveling procedure. Check the operation of the vent-valve assembly as follows: Place the vent valve (180) with its O-ring into the vent valve adapter (T05) of the pressure test fixture.
- Immerse the vent-valve in water and slowly raise the air pressure.

- Test according to the table below, and change all vent valves that do not pass the test.

test	Check
O-ring	No distortion, split or cracks
air pressure < 0.14 bar (2 psi)	Vent valve is closed
0.14 bar (2 psi) < air pressure < 0.7 bar (10 psi)	Vent valve opens

Table 1 - Vent valve test

9. Return to Service After Storage

When a battery is to be returned to service after storage, procedures should be followed as given in chapter Storage (including transportation).

ASSEMBLY

1. Introduction

This section covers basic battery assembly procedures. In all cases, when reassembling a battery, all components should be clean and dry.

2. Safety

Refer to chapter Safety..

3. Equipment

3-1. Standard tools

Refer to chapter Standard tools in Special tools, fixtures, equipment and consumables..

3-2. Special tools

When special tools are used in this chapter, they are identified by a code number listed in Special tools, fixtures, equipment and consumables. chapter.

4. Battery Assembly

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

4-1. Installation of the liner spacer kit (190)

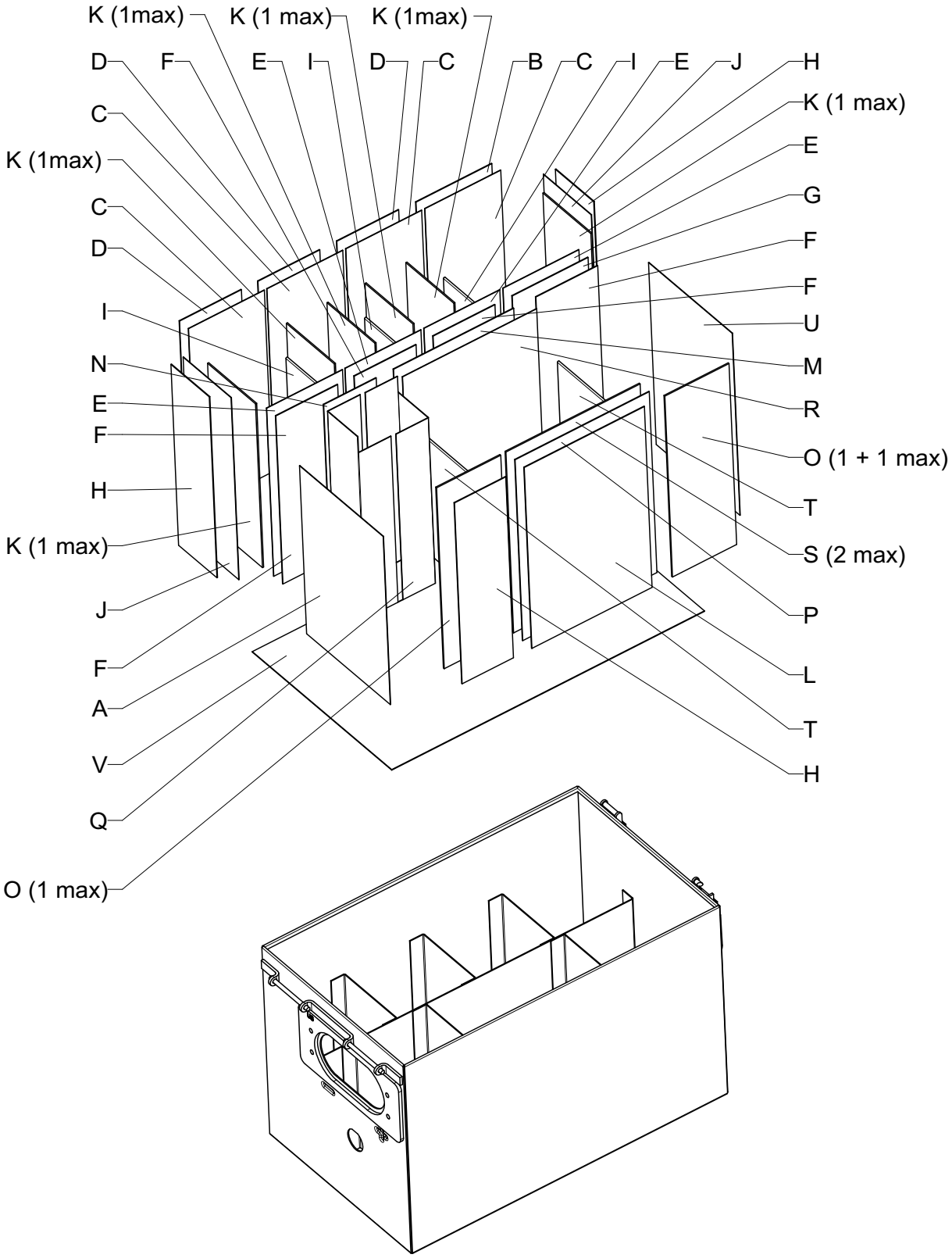


Figure 7001 Liner spacer kit installation

- Put the differents spacers in position (Ref. fig. 7001).
- Install the cells

Item	Description	Dimension (mm)	Unit per assembly
A	Spacer	0,3x157x96	1
B	Spacer	0,5x169x65	1
C	Spacer	0,3x170x65	4
D	Spacer	0,5x170x53	3
E	Spacer	0,3x157x65	4
F	Spacer	0,5x157x53	4
G	Spacer	0,5x157x65	1
H	Spacer	0,5x169x44	3
I	Spacer	0,3x220x55	3
J	Spacer	0,3x170x55	2
K	Spacer	1X153X55	6
L	Spacer	0,5X169X103	1
M	Spacer	0,5X157X103	1
N	Spacer	0,5X157X45	1
O	Spacer	1x169x55	3
P	Spacer	0,5x169x115	1
Q	Spacer	0,3x400x90	1
R	Spacer	0,3x157x115	1
S	Spacer	1x169x115	2
T	Spacer	0,3x110x96	2
U	Spacer	0,3x170x96	1
V	Spacer	0.5x268x160	1

4-2. Installation of the cells (130)

Put cells (130) in the compartments. Carefully position the cell (130) and push onto terminals with a piece of soft wood. (if it is difficult to put in the last cell, remove one or two spacers).

Verify the polarity of each cell accordingt to the figure 10001 1656-6 Nickel-Cadmium Aircraft Battery.

Tighten and check the torque of all lower nuts (140) (refer to Fits and clearances)

Install the links (070 thru 120).

Install the washers (060).

Install the upper nuts (050) and torque them according to Fits and clearances chapter.

Lightly lubricate the terminals and the links with M02 (use a non-metallic paintbrush).

Install the cover complete (020) and attach it.

4-3. Installation of the vent valve (180)

Make sure the vent valves (180) are in good condition. Replace the vent valves (180) if they are worn.

Install the vent valve (180) with the universal vent wrench (T01).

4-4. Installation of the sensor (240)

Install the sensor (240) in the box (045).

Install the washer

install the nut.)

4-5. Installation of the connector (220)

Screw the connector (220) with the washer (210) and the screw (200).

4-6. Recording

Fill out the log book.

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FITS AND CLEARANCES

1. Introduction

The torque values below are “lube torque” values. The thread of the terminals and attaching nuts (or screws) should be lightly greased with (M02) prior to assembly and applying torque.

2. Torque table

IPL FIG ITEM N°	NAME	TORQUE VALUE	
		N.m	lbf.in
upper nut 050	Nut	7 to 9	62 to 80
lower nut 140	Nut	4.5 to 5.5	39.2 to 47.8

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SPECIAL TOOLS, FIXTURES, EQUIPMENT AND CONSUMABLES

1. Introduction

This chapter is divided into two parts:

- The first part provides the list of special tools, fixtures and equipments needed to do the steps listed in the other chapters.
- The second part provides the listing of consumable materials used in this manual.

All listed items are identified in this manual by a standard code number:

- Txx for tools, fixtures and equipment,
- Mxx for consumable materials.

2. Standard tools

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 points 1% or better
- Climatic chamber
- Torque Wrench (Fully insulated) 0-15 N.m (0-133 lbf.in)
- Standard mechanic's tools.
- Safety gloves.
- Protective goggles.
- Safety shoes.
- Eye wash.
- Protective apron.
- Stiff bristle brush (non-metallic)
- Small paintbrush (non-metallic)
- Dry, compressed air source [less than 1.4 bar (20 psi)]
- Soft, clean cloth (at least two required)

3. Special tools

NOTE: Equivalent tools can be used.

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

CODE	DESCRIPTION	F6177 P/N	V09052 P/N
T01	Universal vent wrench	413876	093365-000
T02	Syringe assembly (with nozzle 20 mm (0.78 in))	416231	020915-004
T03	1 Ω 3 W equalizing resistors	164829	-
T04	Universal cell extraction tool	416159	-
T05	Vent valve adapter for M8 valve	-	025098-000

4. Consumables

NOTE: Equivalent alternatives can be used for list items.

This paragraph describes the consumables used in the OMM.

CODE	DESIGNATION PARTNUMBER AND SPECIFICATION	MANUFACTURER OR SUPPLIER (NAME, ADDRESS, CODE)
M01	Distilled or deionized water clear, colorless, odorless while boiling, resistivity > 30 kΩ.cm 5 < pH < 7 Absence of organic and reducing substances. Reducing agent content (expressed in weight of oxygen) < 30 mg/l (test with permanganate). Total of ions SO_4^{2+} Cl^- < 10 mg/l Dry abstract < 15 mg/l Silicium in SiO_2 < 15 mg/l	Local vendor
M02	Neutral petroleum jelly Density @ 60°C (140°F) Range = 0.840 - 0.866 Kg/L Melting Point Range = 46°C - 52°C (115°F - 126°F) Acidity/Alkalinity = Neutral to Litmus	Mineral vaseline NATO: S 743 F: AIR 3565 US: VV-P-236/A UK: DEF 2333
M03	Soap	Local vendor

Table 1 - List of consumables

ILLUSTRATED PARTS LIST

1. Introduction

1-1. General

The Illustrated Parts List (IPL) contains a list and illustrations of the assemblies and detailed parts of the unit in disassembly sequence.

To find the illustration for a part if the part number is known, refer to the Alpha numerical index and look for the part number and the corresponding figure and item number. Refer to the Detailed part list and look for the first figure and item number found in the Alpha numerical index for that part. If this figure shows the part in a section or system of the equipment other than the one necessary, refer to the other figure numbers listed in the Numerical Index.

To determine the part number of a given part, refer to the illustration showing the assembly including this part. Note the item number of the illustrated part and refer to the Detailed part list which indicates its part number and identification.

1-2. Numerical Index

In this index, part numbers are classified from left to right, each character (letter, number, hyphen) being considered separately.

The part number column contains all part numbers included in the Detailed part list.

1-3. Detailed Parts List

1-3-1. Figure and Item Number

Each assembly, sub-assembly and part holding a part number and included in the parts list is given as an item number.

The figure number linked to the item number is shown on the first line at the top of each page.

Assemblies, sub-assemblies numbered parts included in the list but not illustrated are identified by a hyphen (-) preceding the item number.

An index letter shown before the item number refers to the figure showing the modified portion of the applicable part.

Manufacturer's Part Number: a manufacturer's part number is given to each assembly and detail part, whether illustrated or not.

Nomenclature: the nomenclature is given with an indenture, to show how the parts and the assemblies and related to their next higher assemblies. These are the details:

1 2 3 4 5 6 7

Assembly

. Detailed parts for assembly,

. Sub-assembly

. Attaching parts and/or storage parts for sub-assembly,

* * *

. . Detailed parts for sub-assembly

. . Sub-sub-assembly,

. . Attaching parts and/or storage parts for sub-sub-assembly,

* * *

. . . Detailed parts for sub-sub-assembly.

The attaching parts are shown directly after the assembly of the part thereof. They are listed under the same indent number as the item they are attached to, and are identified by the words "Attaching Parts" and are followed by three asterisks.

The manufacturer's code or the abbreviation NP (not procurable) are placed at the extreme right- hand side of the first line of the parts list column.

1-3-2. Effectivity code

An alphanumerical index indicates the effectivity of sub-assemblies and detailed parts lists in relation to the next higher assembly (ies) or sub-assembly (ies).

When the effectivity is fully applicable, the usage code column remains blank.

The use code for assemblies and detailed parts refers to the figure/item number of the next higher assembly (ies) or sub-assembly (ies). Example: Effectivity 1A, 1B, 1C is written 1ABC.

1-3-3. Units per Assembly

The units per assembly column shows the quantity of units required for one next higher assembly.

In some cases, the information is replaced by the abbreviation RF (for reference) or AR

2. Alpha numerical index

Part Number	Airline Stock Number	Figure Number	Item Number	Total required
1656-6			-001	RF
012943			090	8
012944			100	1
013633			110	1
013678			070	9
014703			080	1
031282			320	2
034031			340	1
062000			050	42
062023			140	2
063417			130	19
100111			060	42
100430			210	4
100479			170	2
100523			200	4
100695			150	1
100696			160	1
102226			220	1
105405			280	1
106316			030	1
106319			040	1
114724			260	1
114735			120	1
115737			045	1
115763			250	1
115764			270	1
117026			300	1
166925			230	1
280068			350	1
410218			240	1
410630			020	1
410996			190	1
411108			310	1
411736			010	1
413609			330	2
415215			180	1

3. Detailed part list

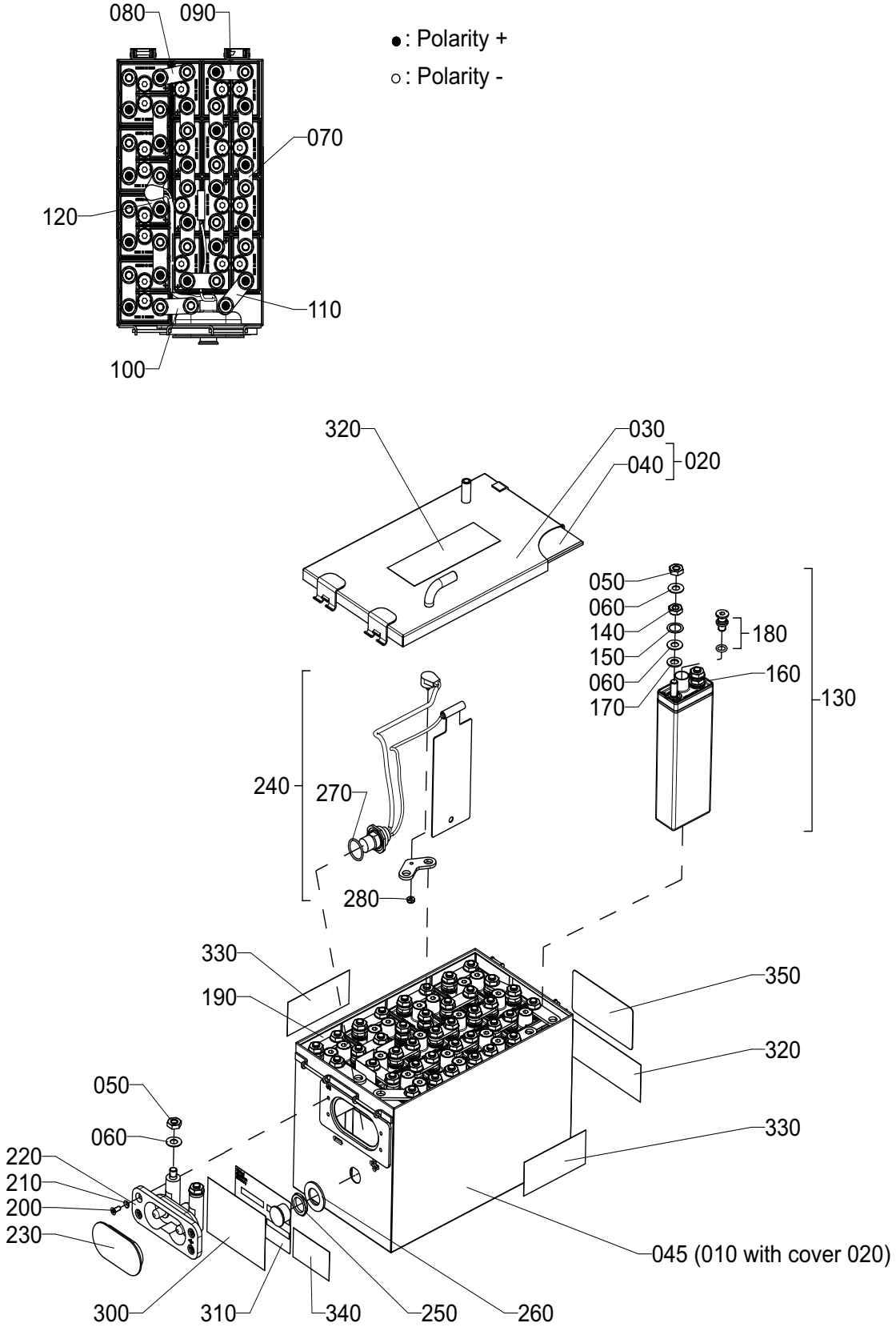

Figure 10001 1656-6 Nickel-Cadmium Aircraft Battery

Figure Number	Item Number	Part Number / VP6177	Airline Stock Number	Nomenclature 1 2 3 4 5 6 7	Quantity per Battery
1	-001	1656-6		BATTERY 1656-6, 410627	RF
	010	411736		. Box and cover, complete	1
	020	410630		. . Cover, complete	1
	030	106316		. . . Cover, assembly NP	1
	040	106319		. . . Cover gasket NP	1
	045	115737		. . Box, assembly	1
	050	062000		. . Nut, M8x1.25	42
	060	100111		. Washer, spring	42
	070	013678		. Link, Intercell, E24	9
	080	014703		. Link, Intercell, E28.5	1
	090	012943		. Link, Intercell, E33	8
	100	012944		. Link, Intercell, E34.5	1
	110	013633		. Link, Intercell, E36	1
	120	114735		. Link, Intercell, curved	1
	130	063417		. Cell, VP160KH, complete	19
	140	062023		. . Nut, M8x1.25	2
	150	100695		. . Washer, Polarity, Red (+)	1
	160	100696		. . Washer, Polarity, Blue (-)	1
	170	100479		. . Washer, Flat	2
	180	415215		. . Vent valve, complete	1
	190	410996		. Liner-spacer kit	1
	200	100523		. Screw F/90 M4-10	4
	210	100430		. Washer; lock	4
	220	102226		. Connector, complete	1
	230	166925		. Protector	1
	240	410218		. Sensor, complete	1
	250	115763		. . Nut, sensor	1
	260	114724		. Washer, plate	1
	270	115764		. O-ring, 56.75	1
	280	105405		. Nut, 6/32"	1
	300	117026		. Film, protector	1
	310	411108		. Plate, identification	1
	320	031282		. Plate, filling intruction	2
	330	413609		. Plate, Saft label	2

Figure Number	Item Number	Part Number	Airline Stock Number	Nomenclature 1 2 3 4 5 6 7	Quantity per Battery
		VP6177			
	340	034031		. Plate, amendment	1
	350	280068		. Plate, recycling	1

- : item non illustrated

STORAGE (INCLUDING TRANSPORTATION)

1. Introduction

1-1. General

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

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".

The figure and item numbers are those of the Illustrated parts list chapter.

1-2. Storage room

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

1-3. Temperature conditions

The recommended temperature range is + 20 °C ±15 °C (68 °F ±27 °F). However, occasional excursion into the range of -55 °C to +60 °C (-67 °F to +140 °F) is permitted.

2. Inactive long term storage

NOTE: There is no need of maintenance operation during the storage period.

The battery should be stored filled and discharged. It is not necessary that it be short circuited. No revalidation is required during storage.

The storage life is 10 years, if using the following conditions:

- sealed packaging,
- temperature: +20 °C (68 °F) ±15 °C (±27 °F),
- humidity < 70 %,
- normal vertical position,
- Isolated from detrimental agents: i.e. dirt, dust, dampness, vibration, corrosive atmosphere.

Lead batteries must not be stored in the same room.

Saft Ni-Cd batteries may be stored in temperatures ranging from -55 °C to +60 °C (-67 °F to +140 °F) for short periods of time without harming the battery.

The standard cardboard packaging is considered unsealed and allows 2 years of storage under the above conditions.

3. Inactive stand-by storage

3-1. Definition

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 check. The battery may be kept in stand-by for the period corresponding to 80% available capacity on figure 15001 (for example 24 days at 30 °C) with a maximum of 90 days.

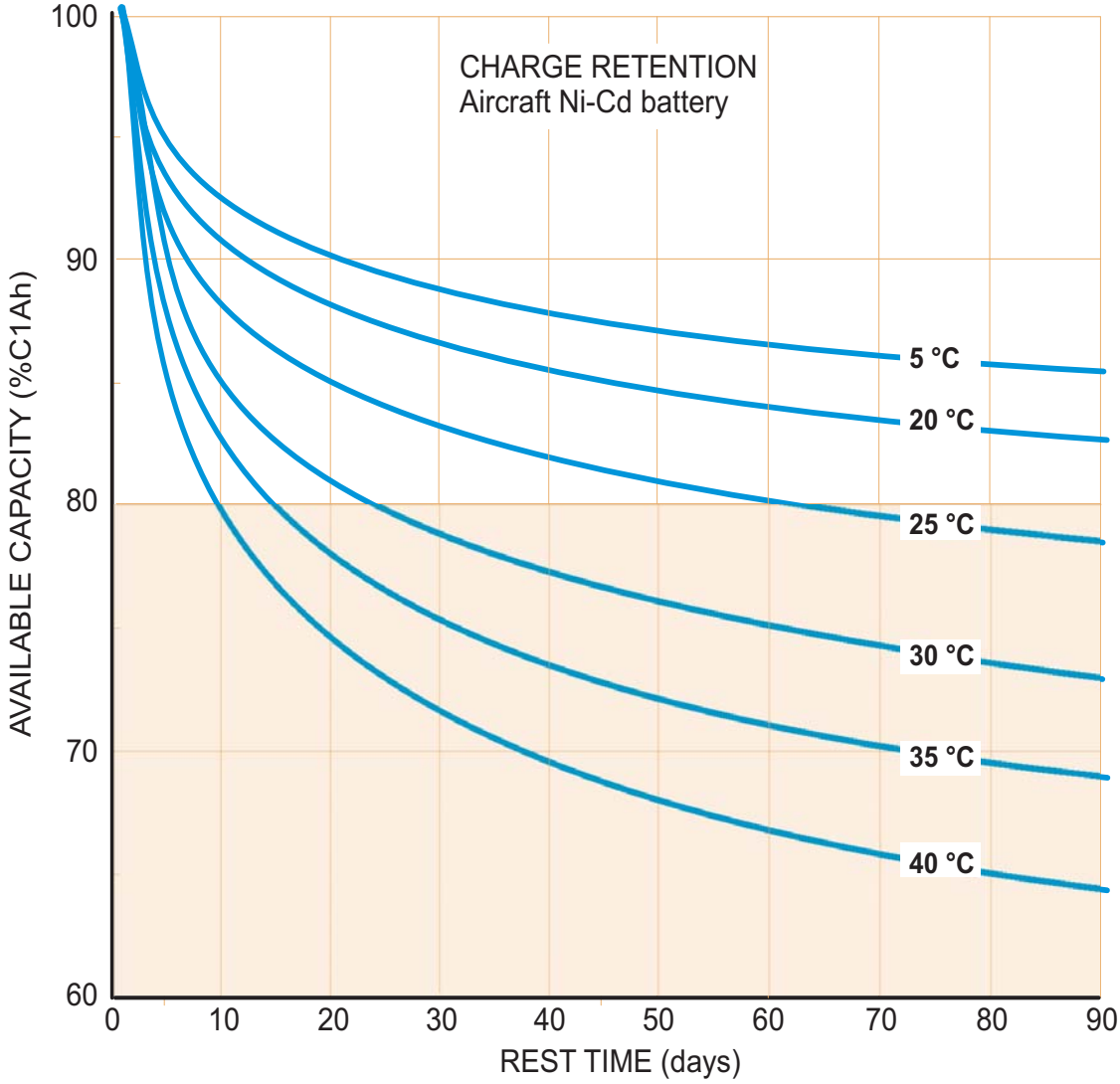

Figure 15001 inactive stand by storage

3-2. Ambient temperature with 'topping' or 'refresh charge'

The stand-by period defined in para. Inactive stand-by storage can be prolonged by applying a 'topping' or 'refresh' charge, at the end of the period. The charge is defined as a short charge at 0.1 C1A, 0.5 C1A or 1 C1A until the voltage reaches the values given in the table below:

CHARGE rate	VOLTAGE (end of " refresh " charge)
0.1 C_1A	30 V for 20 cells
0.5 C_1A	31 V for 20 cells
1 C_1A	31.4 V for 20 cells

The battery can be 'refreshed' up to two (2) times (for example 24 days at +30°C can be prolonged to 72 days at +30°C).

CAUTION: The time necessary to reach the required voltage should be very short.
Do not do the the 4 hours overcharge at 0.1 C1A (refer to PARA Charge) during this 'refresh' charge operation.

3-3. Action at the end of the standby period

At the end of the stand-by period, if the battery is not immediately installed in the aircraft, do one of the following procedures:

If the battery has been subject to one period, or two successive periods of stand-by, it must be discharged and recharged (refer to Periodical check) after which it can be subject to another period of up to 3 months stand-by. If it is to be put into long term storage to para. Inactive long term storage

If the battery has been subject to three successive periods of stand-by, it must undergo electrical treatment (refer to Regular check) after which it can be subject to another sequence of three stand-by periods of up to 3 months it is to be put into long term storage refer to para. Inactive long term storage.

CAUTION: If the above conditions are not met, there is a risk of placing a battery on board the aircraft that does not meet the emergency requirements.
If the battery has previously been stored at a temperature below that of the ambient, condensation may occur. Before installing, verify the insulation resistance.

4. Active stand-by mode (= use of a trickle charge)

CAUTION: water consumption.

Principle: the battery is continuously charged, in an overcharge condition. Saft does not recommend this method, however some operators take responsibility for its use.

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

Example: if a 40 Ah battery remains on a continuous trickle charge of 3 mA/Ah for one month, the total consumption of water is 35 cm3/cell.

The operator must adjust the electrolyte level before placing the battery onboard the aircraft. Otherwise the risk of a battery inci-dent exists (cells dried out before the normal end of the interval maintenance). This creates the conditions for a thermal runaway with all its consequences (unscheduled removal with the possibility of the total loss of the battery and a delayed if not cancelled flight).

5. Spares

5-1. Spare Cells

Spare cells must be stored filled and discharged (in a discharged cell, the electrolyte level is not visible). It is not necessary that they be short circuited. The vent valves must not be removed. The storage conditions are the same as those given in para. 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 cleaned and repaired as necessary in accordance with the battery maintenance documentation.

5-2. Spare O-rings, gaskets and vent valves

5-2-1. O-rings and gaskets

6 years of storage with storage conditions from date of manufacture unless otherwise specified on the packaging. They must be protected from exposure of air, light and high humidity (< 70%). Storage life depends on temperature so it is recommended to store in a cool area (<25 °C / 77 °F). At +35 °C / 95 °F, storage life is reduced to 5 years. Before use, O-rings must be inspected and any showing visible signs of damage, distortion or deterioration must be discarded.

5-2-2. Vent valves with O-rings

6 years of storage with storage conditions from date of manufacture unless otherwise specified on the packaging (the limitation is due to the O-ring). Protected from exposure of air, light and high humidity (< 70%). Storage life depends on temperature so it is recommended to store in a sealed container (non-PVC) in a cool area (<25°C / 77 °F). At +35 °C / 95 °F, storage life is reduced to 5 years. Before use, O-rings must be inspected and any showing visible signs of damage, distortion or deterioration must be discarded.

5-3. Other spares

Other spares, protected from external contamination (i.e. dirt, dust, dampness, vibration, corrosive atmosphere) and high humidity (>70 %), 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. Servicing after discharged storage

Storage time	Servicing procedure
Less than 3 months	Visual Inspection Insulation check Nut tightness Charge Adjust electrolyte level
3 months to 1 year	Charge followed by Periodical check
More than 1 year	Charge followed by Regular check.

7. Transportation procedure

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

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

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