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COMPONENT MAINTENANCE MANUAL

WITH

ILLUSTRATED PART LIST

TYPE No.: F20/23XLM

PART No.: 4575126 – ( )

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HIGHLIGHTS

To: Holders of battery Type F20/23XLM ATA Reference 24 – 38 – 51 component maintenance manual (CMM)

Herewith Revision No. 5 dated Jan 26/26

This revision of the component Maintenance Manual has the following modifications:

- Correction of the Commissioning flow chart (Deletion of unnecessary step)
- Correction of Toolbox Description
- Addition of the Minor Modification PN 4575126-01 to the Illustrated Parts List

CHAPTER	PAGES	ACTION
Title	Title Page 1	Updated
Highlights	HLGTS Page 1,2	Updated
Record of revisions	RR – Page 1,2	Updated
List of effective pages	LEP – Page 1,2	Updated
Table of Contents	TC- Page 1,2	Updated
Commissioning	204	Correction
Special tools, fixtures and equipment	901	Correction
Illustrated Parts List	1001-1	Updated

RECORD OF REVISIONS

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		BY	DATE			BY	DATE
01	Nov 30/15						
02	Mar 07/16						
03	Jul 20/18						
04	Oct 03/24						
05	Jan 26/26						

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SERVICE BULLETIN LIST

SERVICE BULLETIN NUMBER	REVISION NUMBER	DATE BULLETIN INCORPORATED INTO MANUAL

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INTRODUCTION

1. GENERAL

This manual describes the processes for trained technicians to maintain the battery type F20/23XLM. It includes the basic design features and details structured tasks for visual inspection, diagnostic, testing, performance reconditioning, repair and the necessary care to maintain best endurance and useful life of these batteries.

These instructions are written in accordance with the ATA No. 100 specification for the manufacturers' technical manual and adopt the following structure.

1 -99	Description and Operation
101 – 199	Testing and fault isolation
201 – 299	Commissioning
301 – 399	Disassembly
401 – 499	Cleaning
501 – 599	Check
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701 – 799	Assembly and Storage
801 – 899	(Not Applicable)
901 – 999	Special tool, fixtures and equipment
1001 – 1099	Illustrated parts lists

Note.

The instructions detailed in the manual are intended for the CHECK, REPAIR and OVERHAUL but not for a release test of a battery which is temporarily unserviceable.

DESCRIPTION AND OPERATION

1. Description

A. General description of the battery.

The F20/23XLM battery is an assembly of twenty 23Ah extra low maintenance cells in a stainless steel container fitted with a connector socket (Type MS3509). These cells are connected in series to the connector socket assembly (100) via rigid, highly conductive nickel-plated copper links (230 to 270).

The battery container is designed with two carrying handles for transportation, two outlet pipes supporting gas ventilation and cooling, and four latches for locking the cover on the container. Inside the battery container the cells are held in place by partitions, liners and spacers and a gasket inside the cover.

The battery is connected to the aircraft systems and is used:

- for APU Start, if necessary
- if a malfunction or failure occurs in the power supply system, in flight
- for powering aircraft systems on ground, (e.g. radio, interior lighting) if the external electrical ground power supply is not connected to the aircraft system

The 24 V battery is recharged in the aircraft via the 28VDC electrical system.

B. Data

(1) Technical data

- Nominal Voltage: 24 volts.
- Rated capacity: 23Ah at 1hour rate current (23A)
- Connector socket: MS 3509
- Electrolyte: Potassium Hydroxide solution with a density of 1.25kg/l to 1.27kg/l at 20°C
- Maximum dimensions at base of battery:

  L = 252 mm (9.92in)
  W = 247 mm (9.72in)
  H = 208 mm (8.19 in)
- Battery weight: 24.5 Kg ± 1 kg (54.01lb ± 2.20Lb)

(2) Operation data

- Operating temperature range
  - For float charge (in service) -15°C to 55°C (5°F to 131°F)
  - For discharge -30°C to 65°C (-22°F to 149°F)

- Maximum instantaneous power:
  - At +23°C (+77°F): 12V 15s 13.4kW
  - At -18°C (+0°F): 12V 15 s 8.9kW

C. Detailed description

The F20/23XLM battery (01) consists of a stainless steel battery container (10) and cover (20) containing twenty FP23XLM cells (40) fitted with a connector socket (100) type MS3509.
The exterior of the battery container (10) is fitted with two vent tubes, four latches, two carrying handles and a connector socket (100) along with the battery identification information, which is etched into the battery container.

The interior of the battery is lined with several pieces of insulating spacers (150 to 200). These are assembled tightly between the cells (40) and the partitions of the battery container (10). Twenty FP23XLM cells (40) are inserted between the partitions. These cells (40) are connected in series to the connector socket assembly (100) via highly conductive rigid nickel-plated copper links. (230 to 270)

The battery cover (20) is fitted with four retainer clips, two handle retainers, a hold down bar and a gasket (30) which is adhered to the underside of the cover (20).

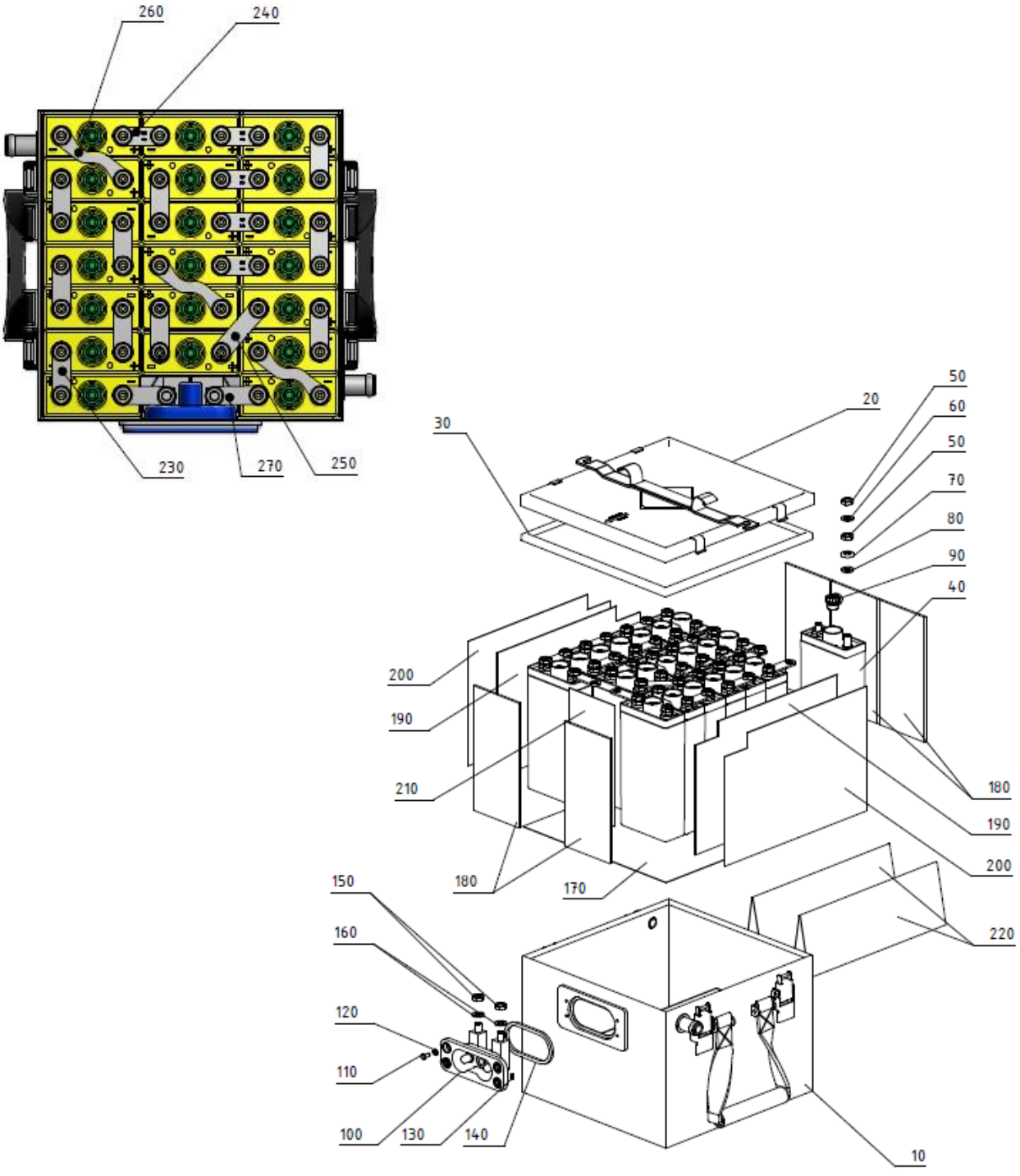


Figure 1 – F20/23XLM Battery

2. Operation and basic requirements for battery's airworthiness.

A. Charge

(1) Flight Charge

It is essential that the aircraft power supply voltage is adjusted and maintained to the operating temperature of the battery, thus ensuring that the battery is charged under optimum conditions preserving the longevity of the battery.

The charge voltage in the battery temperature range from 0°C to 30°C must be: 28.5V + 1V

(2) Maintenance Charge

Note: All battery maintenance shall be carried out in a dedicated battery workshop by trained personnel following the instructions described.

Note: Remove the cover from the battery container prior to any constant current charges, to avoid the accumulation of oxy-hydrogen in the battery box.

1. Constant Current Charge (I- Method)

The constant current charging method shall be used for commissioning and maintaining batteries in the workshop to charge a fully discharged battery with a predefined current and duration. Hawker recommends a maintenance charging rate $0.2*I_1$ for 7 hours, or $0.1*I_1$ for 14 hours. The measurement of top of charge voltage shall be carried out 15 to 10 Minutes prior to the end of charge or after adjustment of the electrolyte level inside cells; refer to para 3). Cells shall indicate a value equal above 1.58 V when measured at electrolyte temperature between 18°C and 30°C. For the commissioning of new batteries, or cells stored fully discharged for more than 3 months, and for reconditioning after service an eight hours charge at $0.2*I_1$ is recommended.

2. Multi stage Charge (IUI-Method)

The IUI multistage charging method is a general method for rapid recharging batteries with cells of an unknown, but balanced state of charge. Hawker recommends a charging rate of I_1 until voltage has increased to 1.55V multiplied by the number of cells followed by a constant current charge of $0.2*I_1$ for 2 hours. The measurement of top of charge voltage shall be carried out 15 to 10 Minutes prior to the end of charge or after adjustment of the electrolyte level inside cells; refer to para 3). Cells shall indicate a value equal above 1.58 V when measured at electrolyte temperature between 18°C and 30°
Note: IUI multi stage charging shall not be applied at battery temperatures below 0°C and on batteries stored for more than 3 month.

3. Electrolyte level adjustments on cells

The adjustment of cell's electrolyte level shall be done in the workshop, 15 to 10 minutes prior to the end of charge processes 1 or 2 always at 4.6 A by adding portions of water until the level touches the electrolyte level indicator.

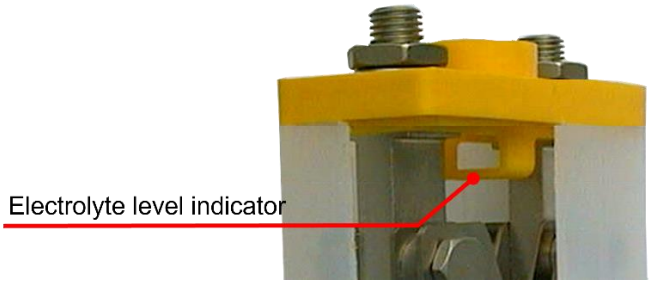


Figure 2 – Electrolyte level

Remove any excessive liquid added prior to the end of charge with the syringe.

Note:

Never adjust electrolyte on battery cells standing idle in any State of Charge (SoC) and during discharge.

1. Requirements for the electrolyte

   The purity of water to adjust the cell's electrolyte is specified in DIN EN 60993.

2. Spillage of electrolyte and insulation resistance

   A spillage of electrolyte into the battery box will affect the insulation resistance of the battery.

3. Avoid drying up of cells electrolyte by maintenance failures, cell defects, excessive charge voltage and exceedance of maintenance intervals.

   Excessive decomposition of water always causes high electrolyte density which stresses the structure of electrodes by swelling. While drying out of electrolyte liquid cells might perform atypical and instable charge and discharge voltage values.

B. Discharges

1. Capacity test at good inwards

The rated capacity is the minimum capacity, expressed in Ah, obtained from a fully charged battery when discharged at the I_1 rate to an EPV of 20V. At good inwards the rated capacity of the battery is required.

2. "Capacity tests" during workshop maintenance

Cells in batteries returned from service should indicate a voltage of ≥ 1.0 V after **48 minutes discharge at I_1.** Batteries with cells, which do not meet this requirement, should be subjected to the scheduled maintenance and / or general overhaul. Cells in batteries being released to service shall indicate a voltage of ≥ 1.0 V after **60 minutes discharge at I_1**.

3. Heavy discharge loads in service and impact.

Supplying high discharge-current peaks and loads above 10 V in service, i.e. for starting, is without any detrimental effects to the battery. A fully charged 24V battery with a nominal rating of 23Ah can supply peak currents in excess of forty times of its nominal rated current.

Note:

Uncontrolled loads due to short circuits on the charged battery can be considered as detrimental, if thermal damage occurs on components.

C. Insulation Resistance requirements for airworthy batteries

The Insulation resistance on a cleaned battery shall be ≥ 10 MΩ.
If the Insulation resistance is lower than 0.5 MΩ battery has to be cleaned and dried (Refer to : "CLEANING" section 2 – "Extensive Cleaning").

D. Precautions and Safety:

	Observe the (local) instructions for battery use and position them visibly near the battery. Trained personnel must only carry out work on batteries Read the Material Safety data sheet
	Use protective glasses and wear safety clothing when working on batteries. Adhere to the current accident prevention rules in the country where the battery is used
	No smoking Do not expose batteries to naked flames, glowing embers or sparks, as it may cause the battery to explode. Avoid sparks from cables or electrical apparatus as well as electrostatic discharges.

	Avoid any contact of electrolyte with the eyes, open wounds / skin and clothing. Avoid ingestion of electrolyte. In case of skin contact with electrolyte and/ or ingestion of electrolyte as well as burns consult a doctor immediately or “First Aid”, flush skin and eyes with plenty of water or a solution of boric acid in water, Remove electrolyte contaminated clothes, immediately wash in excess of acetic water.
	The caustic potash electrolyte solution is highly corrosive. Avoid any spilling of electrolyte Do not disassemble cells since cadmium and cadmium oxide is poisonous and is believed to be carcinogenic. Nickel can cause serious skin allergic reactions and skin irritations to nickel sensitive and exposed persons.
	Batteries are heavy. Use suitable transportation / lifting equipment Battery vent tubes are not intended for use as lifting handles;
	Risks of explosion and fire Remove battery cover from container prior to any charges on ground (in the workshop). Do not use any inflammable organic solvents, CHC’s and mixtures of it for cleaning Do not dismantle cells. Avoid conditions for electrical shocks by using insulated tooling. Electrical short circuits and sparks may injure the operator, damage the battery and ignite gases from charging. Do not wear clothes with static fibres and metallic accessories (rings, watches, belts jewellery) when working on batteries. Use a plastic brush and antistatic cleaning cloth for dry wiping off adhesive dirt from the battery. Never place any conductive parts on metallic parts of the battery. Do not block the battery outlet pipes with the liners.
	Pay attention to the hazards that can be caused by batteries

TESTING AND FAULT ISOLATION on the 24V F20/23XLM

1. Testing refer to “Check”

2. Fault Isolation

No.	Faults	Possible reasons	Identification procedure	Reference to Chapters
1	Zero volt at battery connector socket	Intercell links broken, Connector socket damage,	Voltage measurement	„Check“, either regular maintenance or overhaul “DISASSEMBLY” “REPAIR”: section C “REPAIR”: section G „ASSEMBLY“
2	Zero volt cell	Short circuit	Voltage measurement	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ section D „ASSEMBLY“
3	Minus volt cell	Cell installed and operated in reverse	Voltage measurement	
4	Reduced discharge performance	Low compression of the cells within the battery	Capacity measurement	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ section E „ASSEMBLY“
		Increased resistance due to low torque connection of upper hexagonal nuts	Measurement resistance adjustment of torques	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ section C, if parts are corroded, „CLEANING“ if parts are heavily contaminated „ASSEMBLY“
		cell installed in reverse	Voltage measurement	As described in 3
		corroded nuts, links, washers, and connector socket parts	Visual inspection	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ section C „ASSEMBLY“
		Irreversibly aged cells of capacity and or end of charge voltage underperforming the requirements	Two capacity tests	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ sections A, B, E „ASSEMBLY“

No.	Faults	Possible reason	Identification procedure	Reference to Chapters
4		Imbalanced cells	Two capacity tests	„Check“, either regular maintenance or overhaul, „REPAIR“ section A, B If necessary, „DISASSEMBLY“, „REPAIR“ section E and „ASSEMBLY“
5	Unusual high and instable cell voltage at beginning of charge	Cells dried out	Voltage measurements after 10 minutes at constant current charge on the battery cells residually discharged before	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ section E „ASSEMBLY“
6	Immediately breakdown of discharge voltage	Battery fully discharged in service	Discharge	„Check“, either regular maintenance or overhaul
		cell connector broken or damaged	Voltage measurement	Refer to no. 1 in column 1
		Loose hexagonal nuts, broken spring washers	Visual Inspection	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ section „ASSEMBLY“
		Connector socket defect	Voltage measurement	Refer to no. 1 in column 1
		Cell(s), dried out	Also refer to no. 5	Refer to no 5 in column 1
7	cell top of charge voltage of <1.58V	Separator system inside cell defect cell temperature > 30°C	Top of charge voltage measurement at Constant current charge	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „REPAIR“ section E „ASSEMBLY“

No.	Faults	Possible reasons	Identification procedure	Reference to Chapters
8	Leakage of electrolyte inside the battery container	Any leakage of electrolyte, or conductive liquids and moisture inside the container.	Measurement of Insulation resistance Visual Inspection	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „CLEANING“ Select and carry out repair section according to types of defects „ASSEMBLY“
		Leakage caused by boiling electrolyte due to a cell’ Insulation short circuit or due to a battery external short circuit condition.		
		Leakage due to defective vent plugs.		
		Leakage due to damaged cell cases.		
		Leakage at pole terminals on cell covers.		
9	Visible signs on thermally damaged battery cells and components	Short circuited cells caused a destructive overcharge of the battery	Visual inspection Measurement of Insulation resistance Voltage measurement	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ „CLEANING“ Select and carry out repair section according to types of defects „ASSEMBLY“
10	Battery connector and / or links create excessive heat	Corrosion, poor connection, melting loss due to disconnecting battery under load	Visual inspection, Measurement of surface temperature	„Check“, either regular maintenance or overhaul Tighten the upper hexagonal nuts with 5 Nm. In case of connector socket damage refer to section 1 in this table

No.	Faults	Possible reason	Identification procedure	Reference to Chapters
11	Damaged or distorted battery components	Mechanical impact, transportation damage Battery handles worn out Function of battery latches impaired Venting tubes bended or damaged Battery container distorted Cover distorted Gasket does not adhere inside the cover	Visual Inspection	„Check“, either regular maintenance or overhaul „DISASSEMBLY“ Purchasing of a new battery box Labelling the box „ASSEMBLY“
12	Electrolyte density too low	Repeated cell’s leakages	Electrolyte density measurement on cells	“Check,” overhaul” „DISASSEMBLY“ If necessary, „REPAIR“ section E „ASSEMBLY“

COMMISSIONING

New F20/23XLM are always delivered in a deep discharged (0V) state.
Commissioning (refer to fig 201) shall be applied to set new batteries and spare cells in service.
It shall also be applied to batteries being stored up to 5 years. Refer to “ASSEMBLE AND STORAGE”.

1. Commissioning task

ATTENTION Never charge, discharge or adjust electrolyte on cells connected in series outside the battery case. 1. Remove the cover.
2. Remove the dust cap from the main connector pins.
3. Remove the shorting device from the main connector pins using insulated tools.
4. Torque the upper hexagonal nuts to 5 Nm.
5. Connect the battery to the charge / discharge unit.
6. Undo the vent plugs and keep them aside on the cells mouth. Attention: Do not top up the cells with water at this stage.
7. Check the battery temperature using either option [1] of [2]. Option [1.] - Electrolyte temperature in-side cell • Place an insulated and electrolyte resistive thermometer in the centre most cell of the battery. • Measure the electrolyte temperature, if the temperature is ≤ 31°C continue with step 8. If not, allow the battery to cool until a battery temperature of between +15°C and +30°C has been achieved. Option [2.] Battery Temperature between cells • Place an insulated temperature probe between cells at the centre of the battery

- Measure the battery temperature, if the battery temperature is less than 31°C continue with step 8. If not, allow the battery to cool until a battery temperature of between +15°C and +30°C has been achieved.

8. Charge the battery for 8 hours at I_5 (4.6A).
   If necessary, adjust the electrolyte level of the cells 15 to 10 minutes prior to the end of charge at 4.6A.

ATTENTION

Do not adjust electrolyte level further while battery is standing on open circuit.

9. For degassing cells, stand the battery for one hour on open circuit.

10. Discharge the 24V Battery at 23A to 20 V.

    Measure and record the cell voltages after 60 minutes.

    Requirement: The voltage of each cell after 60 minutes must be ≥ 1.0 V.

    If new battery cells do not meet the requirement, contact the supplier.

11. Soak the battery until a battery temperature of between +15°C and +30°C has been achieved. This might take up to 8 hours.

12. Recharge the battery using either IUI Method [12.1] or I method [12.2].

    Adjust the electrolyte level at a current of 4.6Amps (0.2*I_1A) 15 minutes to 10 minutes prior to end of the charge.

    Afterwards measure the voltage on each cell prior to the end of charge.

    Requirement: cell voltage shall be ≥ 1.58 V

    - Record the values in the log book.
    - If new cells fail this requirement, contact the supplier.

    Attention:
    - Don’t charge the battery with currents higher than 23A.
    - (Apply method 11.2 if battery temperature is low (-5°C to +15°C)).

12.1 IUI method:

Charge the 24V battery at 23 Amps (I_1A) until the voltage has increased to 31 Volts.

After approximately 1 hour charge, check that battery has reached the voltage level to switch to the second current level of 4.6 Amps and charge for two hours at this current.

12.2 I method:

Charge the fully discharged battery for seven hours at 4.6Amps ($0.2*I_1A$).

Requirement: cell voltage shall be ≥ 1.58 V

Record cells end of charge voltages.

13. Allow the battery to stand for 1 hour.

14. Refit and tighten vent plugs.

15. Torque the upper hexagonal nuts to 5 Nm.

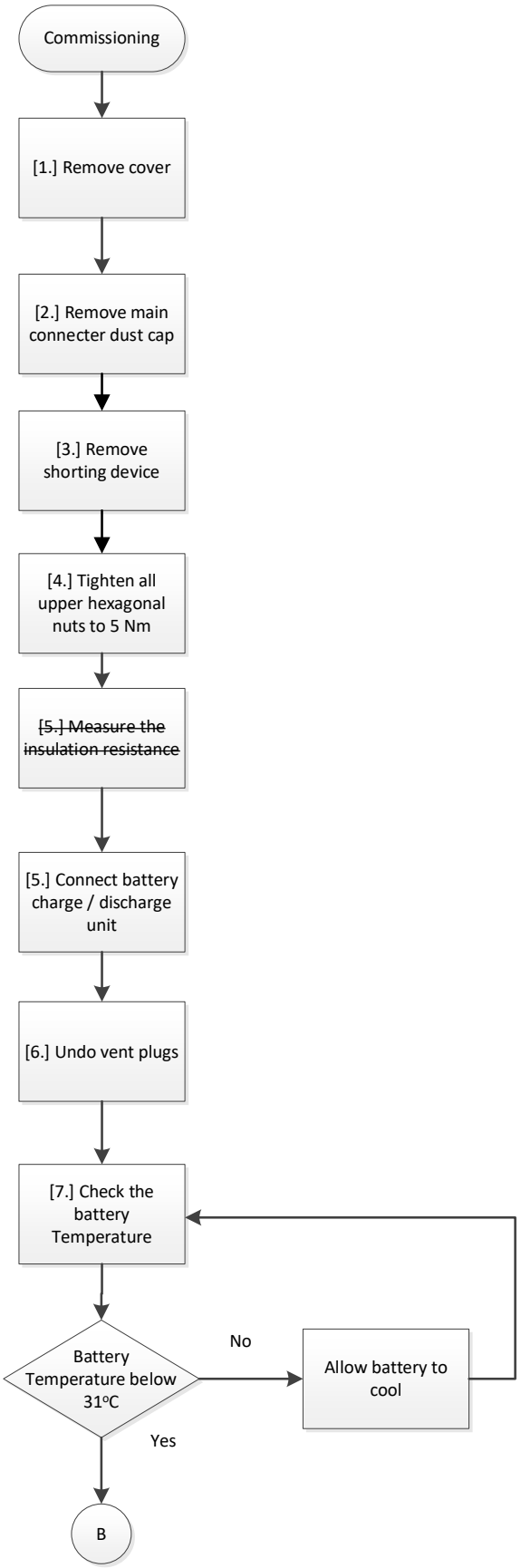
16. Re-fit the cover.

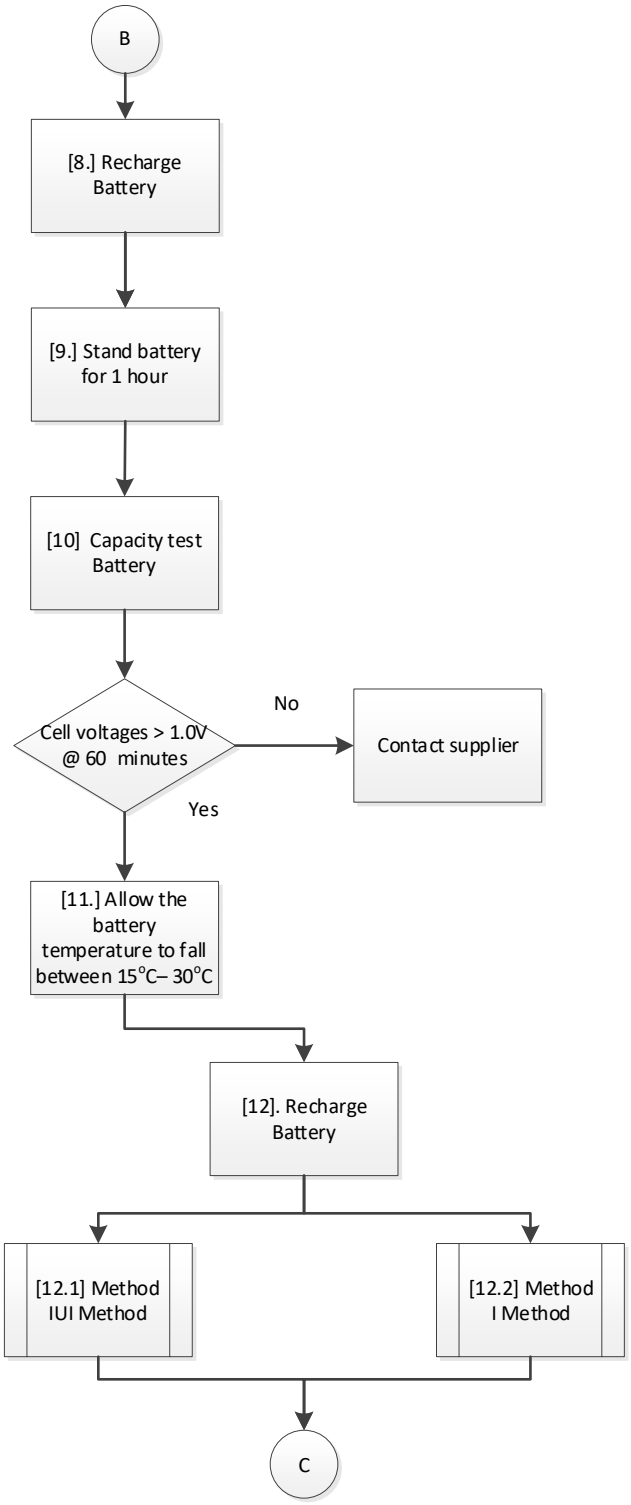
17. Measure the insulation resistance with a MΩ-meter at 250 VDC between the positive+ pin of the battery connector and the battery container.

    Requirement: ≥ 10MΩ

    If the battery is ≤ 10MΩ, stand it for 24 hours in dry atmosphere before repeating test. If battery is still below 10MΩ after the 24 hours stand, investigate cause of insulation failure.

18. Release the charged battery to service.


Commissioning
[1.] Remove cover
[2.] Remove main connecter dust cap
[3.] Remove shorting device
[4.] Tighten all upper hexagonal nuts to 5 Nm
~~[5.] Measure the insulation resistance~~
[5.] Connect battery charge / discharge unit
[6.] Undo vent plugs
[7.] Check the battery Temperature
Battery Temperature below 31°C
No
Allow battery to cool
Yes
B


B
[8.] Recharge Battery
[9.] Stand battery for 1 hour
[10] Capacity test Battery
Cell voltages > 1.0V @ 60 minutes
No
Contact supplier
Yes
[11.] Allow the battery temperature to fall between 15°C– 30°C
[12]. Recharge Battery
[12.1] Method IUI Method
[12.2] Method I Method
C

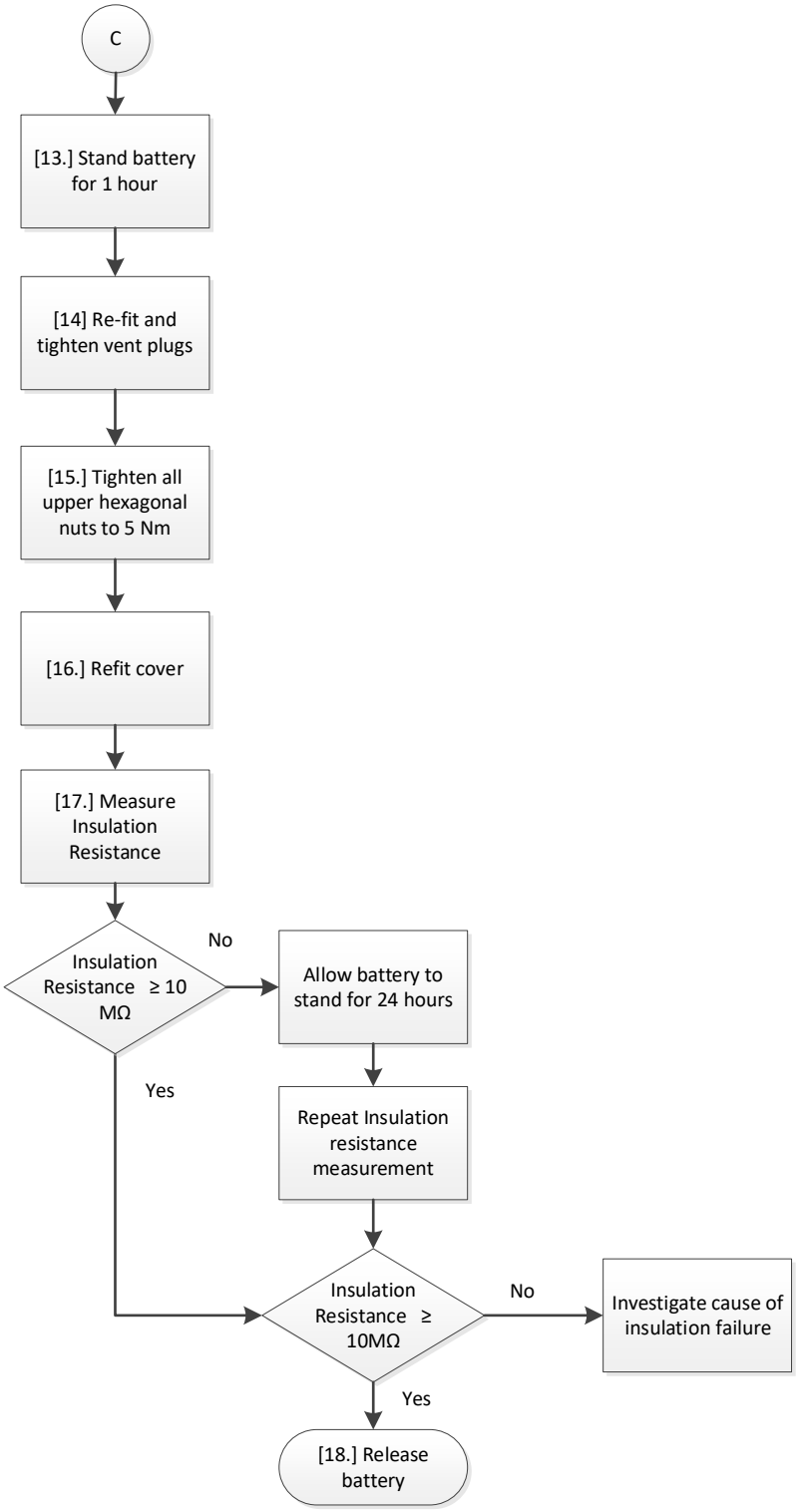


Figure 201 – Commissioning

DISASSEMBLY

1. Disassembly (Refer to figure 1)

Note:

Refer to “TESTING AND FAULT ISOLATION” to find the condition of the component or possible cause of malfunction.
For extensive cleaning full disassembly is required.
For repair only disassemble the battery to the degree necessary.

WARNING:

ENSURE THAT THE BATTERY IS FULLY DISCHARGED PRIOR TO DISASSEMBLY
(Refer to Repair section “I - Deep Discharge”)

A. Removal of cover

1. Disengage the four cover clamps from the battery container (10).
2. Remove the cover (20) from the container (10).

B. Removal of cell(s)

1. Tighten (lock fingertight) the vent plug (90) on each cell using the yellow vent plug spanner(Refer to Figure 901 and “SPECIAL TOOLS, FIXTURES AND EQUIPMENT”).
2. Remove the upper hexagonal nuts (50) and spring washers (60).
3. Remove the intercell links (230 through 270).
4. Identify cell positions within the battery container (10).
5. Remove all the cells (40) from the container (10) starting with the middle cell (40) of each row using the insulated cell puller (refer to figure 903 and “SPECIAL TOOLS, FIXTURES AND EQUIPMENT”, pulling the cell (40) in an upward direction.

C. Removal of vent plugs

1. Untighten the vent plugs (90) with the special vent plug tool spanner (Refer to Figure 901 and “SPECIAL TOOLS, FIXTURES AND EQUIPMENT”).
2. Remove the vent plugs (90).

D. Removal of the liner

1. Identify liners positions (170,180,190,200,210,220) within the battery container.
2. Remove the liners (170,180,190,200,210,220) from the container.

E. Removal of connector socket

Note:

To reduce risk by damage due to short circuit remove an intercell link (240) between two adjacent cells in the middle of the battery or links connecting battery rows.

1. Remove the hexagonal nuts (50) and spring washers (60) that attach the intercell links (270) to the connector socket (100).
2. Remove the two links (270).
3. Remove the four countersunk screws (110), four fan disk washers (120) and four sealing rings (130) from the connector socket (100).
4. Remove the connector socket (100) and its sealing ring (140) from the battery container (10).

CLEANING

ATTENTION: When using compressed air, reduce the pressure to a maximum of 3 bar.

1. Light Cleaning

   - Finger-tighten the vent plug on each cell with the spanner
     (Refer to Figure 901 and “SPECIAL TOOLS, FIXTURES AND EQUIPMENT”).
   - Clean the top of the cells with a plastic brush. Remove any dust, detached residues and salt minerals by an oil-free compressed air source, or preferably an industrial vacuum cleaner.

2. Extensive Cleaning (to be carried out if Insulation resistance of the battery is below 0,5 MΩ)

   - Finger-tighten the vent plug on each cell with the spanner
     (Refer to Figure 901 and “SPECIAL TOOLS, FIXTURES AND EQUIPMENT”).
   - Deep discharge the battery (Refer to Repair section “I - Deep Discharge”).
   - Disassemble the complete battery as detailed in “DISASSEMBLY” section of this CMM, followed by cleaning of the following components:

   A. Battery container and cover

   - Clean the battery container and cover, by washing in a solution of soapy warm water. Afterwards rinse with fresh water.
   - Allow the battery container and cover to dry naturally or supported by an oil free pressurized air supply.
   - Check the battery container and cover for mechanical damage.
   - Check the locks for malfunction.
   - Check whether the gasket is securely fixed to the underside of the cover.

     Note: Replace damaged Battery containers and / or cover; also replace cover if the gasket is damaged or does not adhere to the cover.

   - Coat the metallic surface of the container and cover with silicone spray.

B. Insulating Packing pieces

- Clean the insulating packing pieces/liners, by washing in a solution of soapy warm water. Afterwards rinse with fresh water.
- Allow the parts to dry naturally or supported by an oil free pressurized air supply.
- Check the parts for any mechanical damage.

C. Connector socket, Hexagonal Nuts M8, Spring washers and links

- Clean the connector socket with wet cloth only.
- Clean the cell connecting components by washing in a solution of soapy warm water. Afterwards rinse with fresh water.
- Allow the parts to dry naturally or supported by an oil free pressurized air supply.
- Check the parts for any mechanical and thermal damage and corrosion.

Note: Replace any defective parts

- Coat all replaced and cleaned metallic components with silicone spray (Refer to “SPECIAL TOOLS, FIXTURES AND EQUIPMENT”, Part 2 “MATERIALS”).

D. Cells

Attention:
[1] Prior to cleaning, ensure cells are closed with vents.
[2] Do not submerge cells fully under water.

- Remove any traces of electrolyte and mineral salts from the terminals, cell case and cell cover, by washing in a solution of soapy warm water. Afterwards rinse with fresh water.
- Allow cells to dry naturally or supported by an oil free pressurized air supply.
- Inspect the cells for any damage.
- Inspect the nickel plating of pole terminals for damage.

Note: Replace any defective and damaged cells.

E. Vent plugs (Cleaning to be carried out, before measurement of response pressure)

- Remove the vent plugs from each cell.
- Clean all vent plugs, by washing in a solution of soapy warm water. Afterwards rinse with fresh water.
- Allow the vent plugs to dry naturally or supported by an oil free pressurized air supply.
- Check the integrity of the seal on each vent plug and replace before testing vent plug pressure.
- Check the operation of the vent plugs prior to refitting back into the cells using the following steps:

Testing response pressure of vent plug:

a. Fix the vent plug into the test adapter.
b. Attach the adapter to the adjustable pressure-reducing device.
c. Submerge the adapter and vent plug in a container of water.
d. Increase the pressure slowly.
e. Record the pressure when the vent valve opens (indicated by bubbles).
f. Decrease the pressure slowly.
g. Record the pressure when the vent valve closes (indicated when bubbles stop to appear).
h. Stop the pressure source.
i. Remove the vent plug with its O-ring from the test adapter
j. Identify all vent plugs that do not open or close within 0.35 ± 0.2 bar as defective.
k. Replace defective vent plugs and dispose them.

3. Protection of metallic parts

- Refer to “ASSEMBLY” and carry out A), B), C), D)

Note: Silicone Spray Lubricant is neutral to the polymer parts assembled in the battery and it does not attract dirt.

ATTENTION:
[1] Never use vaseline or other mineral-oil based greases on the battery. It can degrade the rubber components.

[2] Avoid the coating of the black seals, when using any coating agent.

Coat all cleaned metallic components with silicone spray (Refer to “MATERIALS”).

CHECK

1. Maintenance Checks.

In addition to the checks specified for airborne or ground use, in service Hawker F20/23XLM batteries require the following maintenance operations are adhered to:

— Regular Maintenance (refer “CHECK”, section 2)

— General Overhaul (refer to section 3)

2. Regular Maintenance

Regular Maintenance (refer to fig 501) shall be carried out every 12 months or 4000 Operating Hours after the installation of the maintained battery on to the aircraft.
Tasks to be undertaken are listed below:

1. Measure the insulation resistance with a MΩ-meter at 250 VDC between the positive pin of the battery connector and the battery container. Requirement: ≥ 0.5MΩ If R ≤ 0.5 MΩ, continue with General Overhaul
2. Remove the cover and check that the gasket is fully adhered to the cover. If any damage is found, record the defect and replace in accordance with the “REPAIR“ section “H”.
3. Inspect battery container and cover for any damage, signs of dents, cracks, splits, overheating, short circuits, melting, dark spots and tarnish. If any damage is found, record the defect and replace in accordance with the „REPAIR“ section “H”.
4. Inspect the connector socket for any signs of damage caused by arcing, faulty connection, corrosion, loose parts and cracks in the connector socket casing. If any damage is found, record the defect and replace in accordance with the „REPAIR“ section “G”.
5. Tighten any loose vent plug(s) and clean the top of the cells with a plastic brush. Remove any detached deposits with an oil-free compressed air source or an industrial vacuum cleaner.
6. Torque the upper hexagonal nuts to 5 Nm.
7. Measure and record cell voltages.
8. Identify cells with voltages lower than 1.2V
9. Connect the battery to the charge / discharge unit.

10. Check the battery temperature using either option [1] of [2].

    Option [1.] - Electrolyte temperature in-side cell

    - Place an insulated and electrolyte resistive thermometer in the centre most cell of the battery.
    - Measure the electrolyte temperature, if the temperature is less than 31°C continue with step 12. If not, allow the battery to cool until a battery temperature of between +15°C and +30°C has been achieved.

    Option [2.] – Battery Temperature

    - Place an insulated temperature probe between cells at the centre of the battery
    - Measure the battery temperature, if the battery temperature is less than 31°C continue with step 12. If not, allow the battery to cool until a battery temperature of between +15°C and +30°C has been achieved.

11. Discharge the 24 V battery at 23A to 20 V (pay particular attention to previously marked cell(s) in step 8).

    Requirement: after 48 minutes discharge, the voltage of each cell ≥ 1.0V.

    If cells indicate voltage > 0V but < 1 V subject the battery to Reconditioning (Repair section A and B).

    If cells indicate < 0V replace in accordance with Repair section E.

12. Connect 1 Ohm/2-5Watt resistor (Fig. 902) for at least 16 hours .

13. Undo the vent plugs and keep them inside of the cells mouth.

    Attention:
    Do not top up the cells with water at this stage.

14. Recharge the battery using I method
    Charge the fully discharged battery for eight hours at 4.6Amps (0.2*I_1A)**.**

    Adjust the electrolyte level 15 minutes to 10 minutes prior to end of the charge at a current of 4.6A (0.2* I_1) A.

    Afterwards measure the voltage on each cell prior to the end of charge.

    Requirement: Cell voltage shall be ≥ 1.58 V

Record cells end of charge voltages.

Identify cells ≤ 1.58V for replacement. Refer to „REPAIR“ section “E”.

15. Allow the battery to stand for one hour to support the escapes of charging gases from cells.

16. Discharge the 24 V battery at 23 Amps to 20 V

    Requirement:
    The voltage of each cell after 60 minutes must be ≥ 1.0V.

    If cells indicate voltage > 0V but < 1 V subject the battery to Reconditioning (Repair section A and B).

    If cells indicate < 0V replace in accordance with Repair section E.

17. Soak the battery until a battery temperature of between +15°C and +30°C has been achieved. This might take up to 8 hours.

18. Recharge the battery using either IUI Method [18.1] or I method [18.2].

    Adjust the electrolyte level at a current of 4.6Amps (0.2*I1A) 15 minutes to 10 minutes prior to end of the charge.
    Afterwards measure the voltage on each cell prior to the end of charge.

    Requirement: cell voltage shall be ≥ 1.58 V

    Record cells end of charge voltages.
    Mark cells for replacement.

    Attention:
    Don’t charge the battery with currents higher than 23A, when using IUI-method.

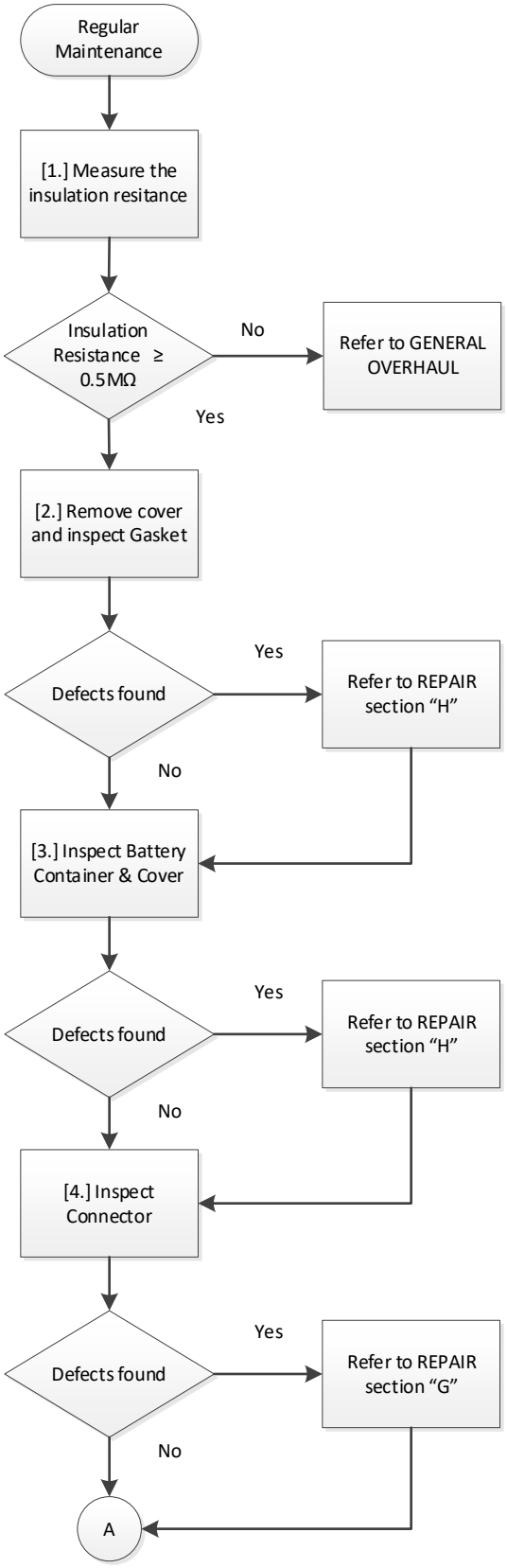
18.1 IUI method:

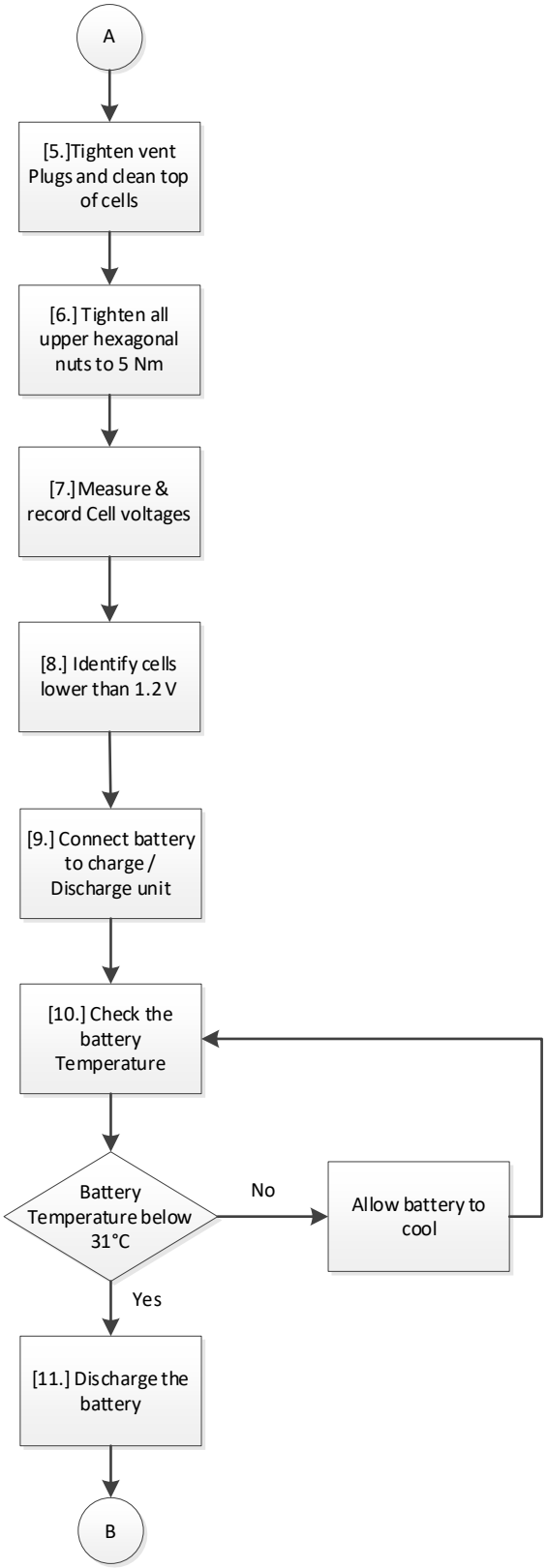
    Charge the 24V battery at 23 Amps (I1A) until the voltage has increased to 31 Volts. After approximately 1 hour charge, check that battery has reached the voltage level to switch to the second current level of 4.6 Amps and charge for two hours at this current.

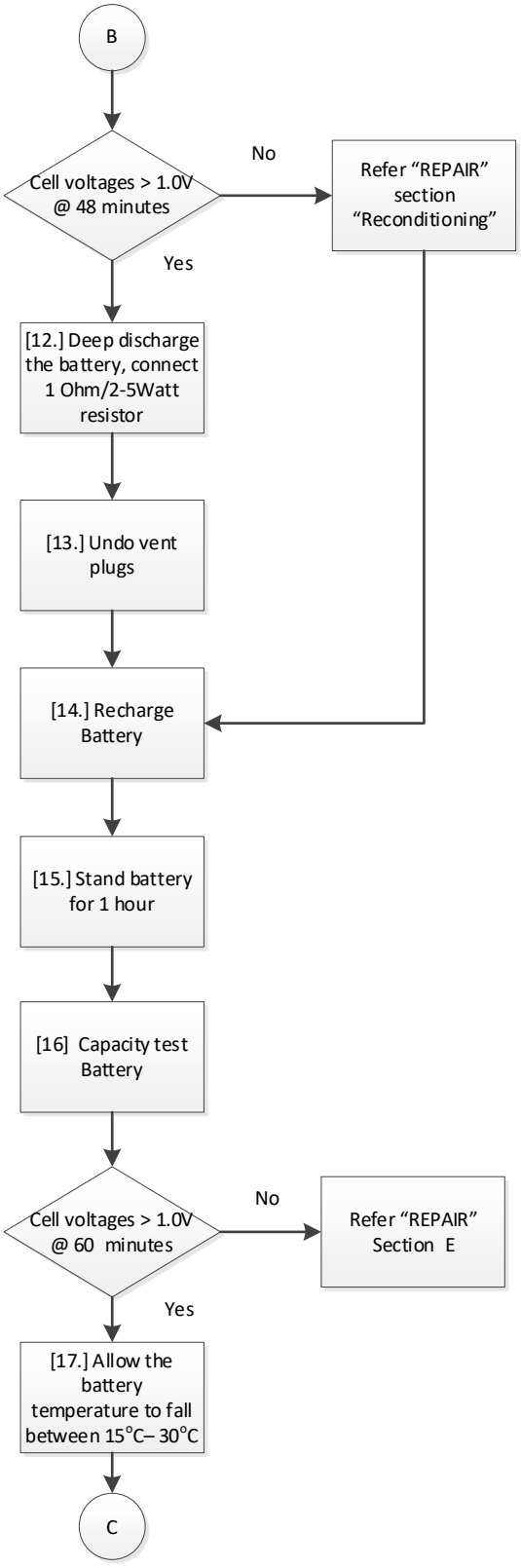
18.2 I method:

    Charge the fully discharged battery for seven hours at 4.6Amps (0.2*I1A).

19. Allow the battery to stand for one hour to support the escapes of charging gases from cells.
20. Re fit and tighten the vent plugs.
21. Re fit the cover.
22. Measure the insulation resistance with a MΩ-meter at 250 VDC between the positive pin of the battery connector and the battery container. Requirement: ≥ 0.5MΩ If R ≤ 0.5 MΩ, continue with General Overhaul, extensive cleaning
23. Release the battery to service.


Regular Maintenance
[1.] Measure the insulation resitance
Insulation Resistance ≥ 0.5MΩ
No
Refer to GENERAL OVERHAUL
Yes
[2.] Remove cover and inspect Gasket
Defects found
Yes
Refer to REPAIR section “H”
No
[3.] Inspect Battery Container & Cover
Defects found
Yes
Refer to REPAIR section “H”
No
[4.] Inspect Connector
Defects found
Yes
Refer to REPAIR section “G”
No
A


A
[5.]Tighten vent Plugs and clean top of cells
[6.] Tighten all upper hexagonal nuts to 5 Nm
[7.]Measure & record Cell voltages
[8.] Identify cells lower than 1.2 V
[9.] Connect battery to charge / Discharge unit
[10.] Check the battery Temperature
Battery Temperature below 31°C
No
Allow battery to cool
Yes
[11.] Discharge the battery
B


B
Cell voltages > 1.0V @ 48 minutes
No
Refer "REPAIR" section "Reconditioning"
Yes
[12.] Deep discharge the battery, connect 1 Ohm/2-5Watt resistor
[13.] Undo vent plugs
[14.] Recharge Battery
[15.] Stand battery for 1 hour
[16] Capacity test Battery
Cell voltages > 1.0V @ 60 minutes
No
Refer "REPAIR" Section E
Yes
[17.] Allow the battery temperature to fall between 15°C– 30°C
C

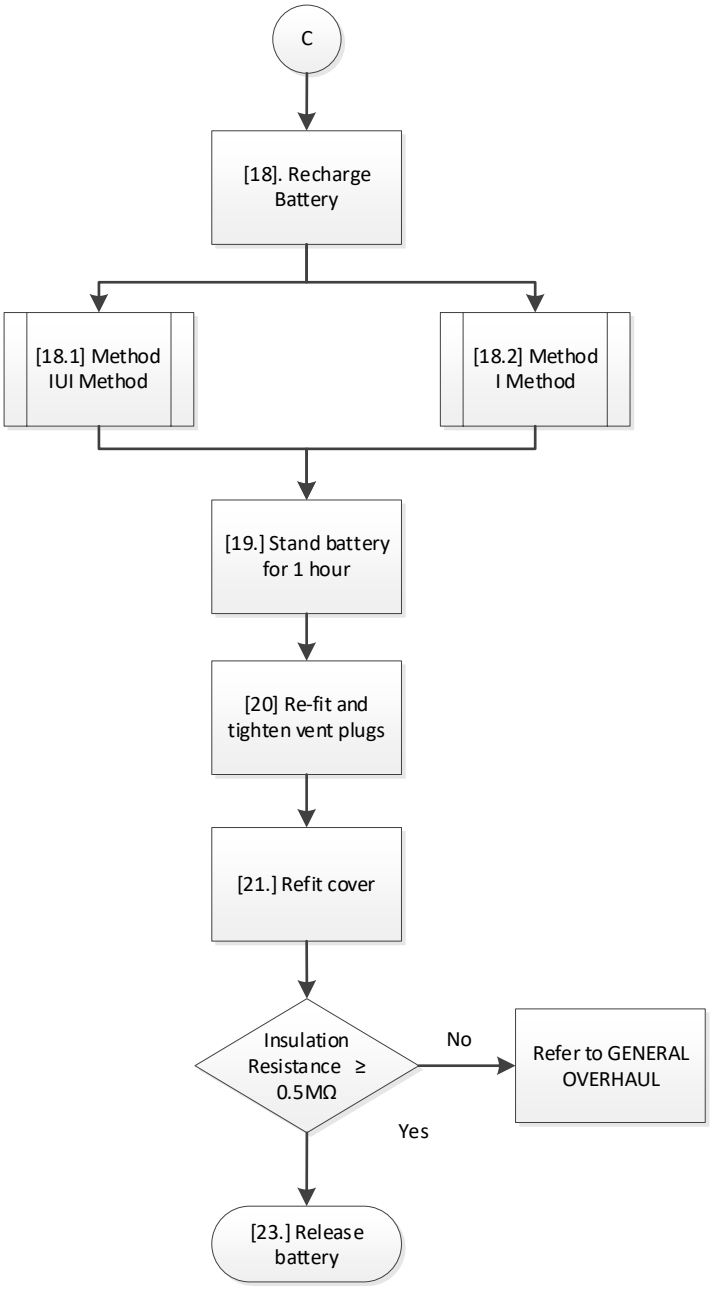


Figure 501 – Regular Maintenance

3. General Overhaul (refer to fig 502) shall be carried out in intervals of 2 year. Tasks to be undertaken are listed below.

1. Remove the cover and check that the gasket is fully adhered to the cover. If any damage is found, record defect and replace in accordance with „REPAIR“ section “H”.
2. Inspect battery container and cover for any damage, signs of dents, cracks, splits, overheating, short circuits, melting, dark spots and tarnish. If any damage is found, record defect and replace in accordance with „REPAIR“ section “H”.
3. Inspect the connector socket for any signs of damage caused by arcing, faulty connection, corrosion, loose parts and cracks in the connector socket casing. If any damage is found, record defect and replace in accordance with „REPAIR“ section “G”
4. Tighten any loose vent plugs and clean the top of the cells with a plastic brush. Remove any detached deposits with an oil-free compressed air source, or an industrial vacuum cleaner.
5. Torque the upper hexagonal nuts to 5 Nm.
6. Measure and record cell voltages.
7. Identify cells with voltages lower than 1.2V.
8. Connect the battery to the charge / discharge unit.
9. Check the battery temperature using either option [1] of [2]. Option [1.] - Electrolyte temperature in-side cell • Place an insulated and electrolyte resistive thermometer in the centre most cell of the battery. • Measure the electrolyte temperature, if the temperature is less than 31°C continue with step 11. If not, allow the battery to cool until a battery temperature of between +15°C and +30°C has been achieved.

Option [2.] - Battery Temperature

- Place an insulated temperature probe between cells at the centre of the battery.
- Measure the battery temperature, if the battery temperature is less than 31°C continue with step 11. If not, allow the battery to cool until a battery temperature of between +15°C and +30°C has been achieved.

10. Discharge the 24 V battery at I_1 to 20V (pay attention to cells previously marked at step 8).

    Requirement: The voltage of each cell after 48 minutes discharge at I1 should be ≥ 1.0 V.

    If cells indicate voltage > 0V but < 1 V subject the battery to Reconditioning (Repair section A and B).

    If cells indicate < 0V replace in accordance with “REPAIR” section “E”.

11. Connect 1 Ohm/2-5 watt resistor (Fig. 902) for at least 16 hours.

12. Disassemble the battery (Refer to “DISASSEMBLY”).

13. Extensively clean the battery components not replaced in step above (Refer to „CLEANING“, section 2, A,B,C,D,E).

14. Inspect all upper hexagonal nuts, washers and intercell links for any signs of damage or corrosion. Dispose and replace any defective components. (Refer to „REPAIR“, section (C)).

15. Inspect all cells for signs of thermal damage and discolouration. Dispose and replace any defective cell(s). (Refer to “REPAIR“ section “E”)

    Note: It is recommended to replace the whole sets of cells if more than 6 cells from the original set were (are to be) replaced.

16. Inspect all insulating packing pieces/liners for any signs of damage.
    Dispose and replace any damaged insulating packing pieces/liners (Refer to „REPAIR“ section “F”).

17. Re-Assembly of the battery (Refer to “ASSEMBLY”).

18. Measure the insulation resistance with a MΩ-meter at 250 VDC between the positive pin of the battery connector and the battery container.

    Requirement: ≥ 10MΩ

    If the battery is ≤ 10MΩ, stand it for 24 hours in dry atmosphere before repeating test.
    If battery is still < 10MΩ after the 24 hours stand, investigate cause of insulation failure.

19. Remove the battery cover.

20. Connect the battery to the charge/discharge unit.

21. Undo the vent plugs.

22. Recharge the battery using the I-Charge method.

    Adjust the electrolyte level at a current of 4.6Amps (0.2*I_1A) 15 minutes to 10 minutes prior to end of the charge.

    Afterwards measure the voltage on each cell prior to the end of charge.
    Requirement: cell voltage shall be ≥ 1.58 V

    I-Charge method:
    Charge the fully discharged battery for 8 hours at 4.6Amps (0.2*I_1A).

    Record cells end of charge voltages.
    Mark cells for replacement at step 26.

23. Allow the battery to stand for 1 hour.

24. Discharge the 24 V battery at I_1 to 20 V.

    Requirement: The voltage of each cell after 60 minutes must be equal / greater than 1.0V.

    If cells indicate voltages > 0V but < 1 V subject the battery to Reconditioning
    (Repair section A and B).

If cells indicate < 0V replace in accordance with “REPAIR” section “E”.

25. Soak the battery until a battery temperature of between +15°C and +30°C has been achieved. This might take up to 8 hours.

26. Recharge the battery using either IUI Method [26.1] or I method [26.2].

Note:

Do no adjust electrolyte level!

Measure the voltage on each cell prior to the end of charge.

Requirement: cell voltage shall be ≥ 1.58 V

Record cells end of charge voltages.
Mark cells for replacement.

Attention:
Don’t charge the battery with currents higher than 23A, when using IUI-method.

26.1 IUI method:

Charge the 24V battery at 23 Amps (I_1A) until the voltage has increased to 31 Volts. After approximately 1 hour charge, check that battery has reached the voltage level to switch to the second current level of 4.6 Amps and charge for two hours at this current.

26.2 I method:

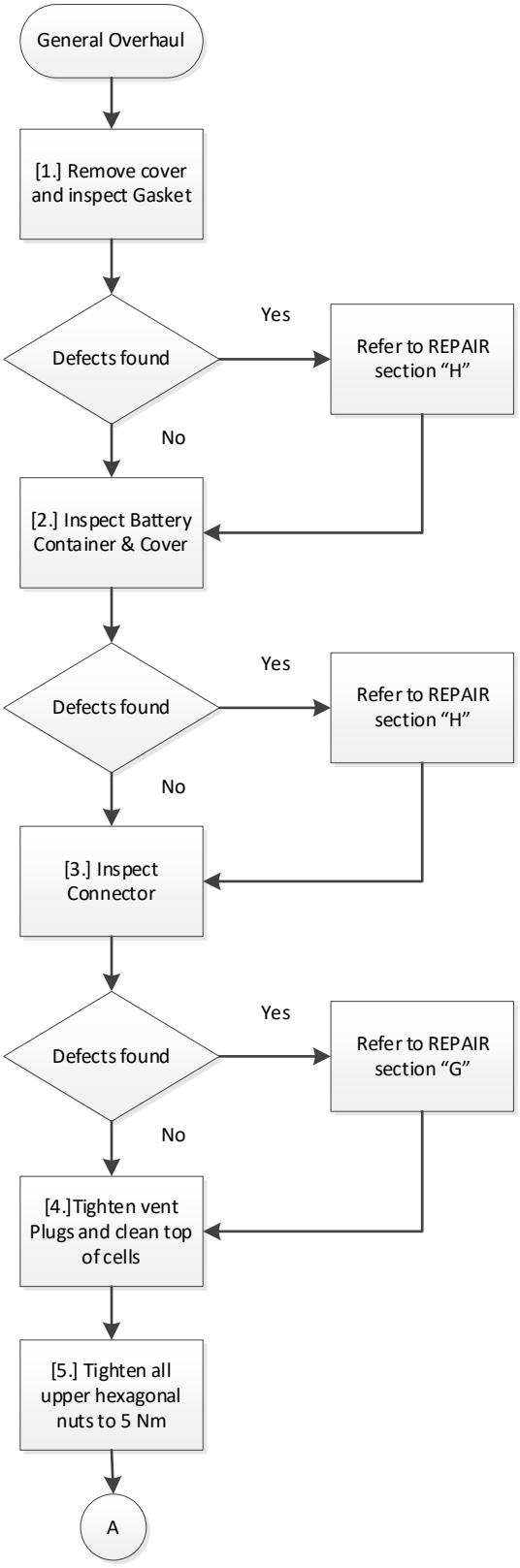
Charge the fully discharged battery for seven hours at 4.6Amps (0.2*I_1A).

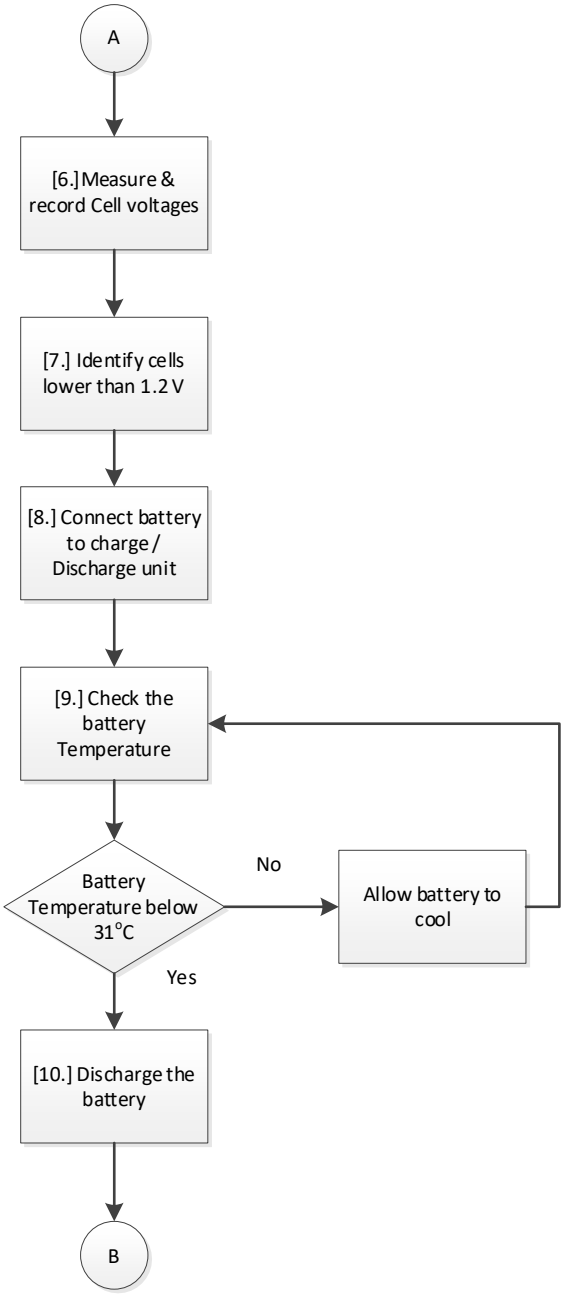
27. Allow the battery to stand for one hour to support the escapes of charging gases from cells.

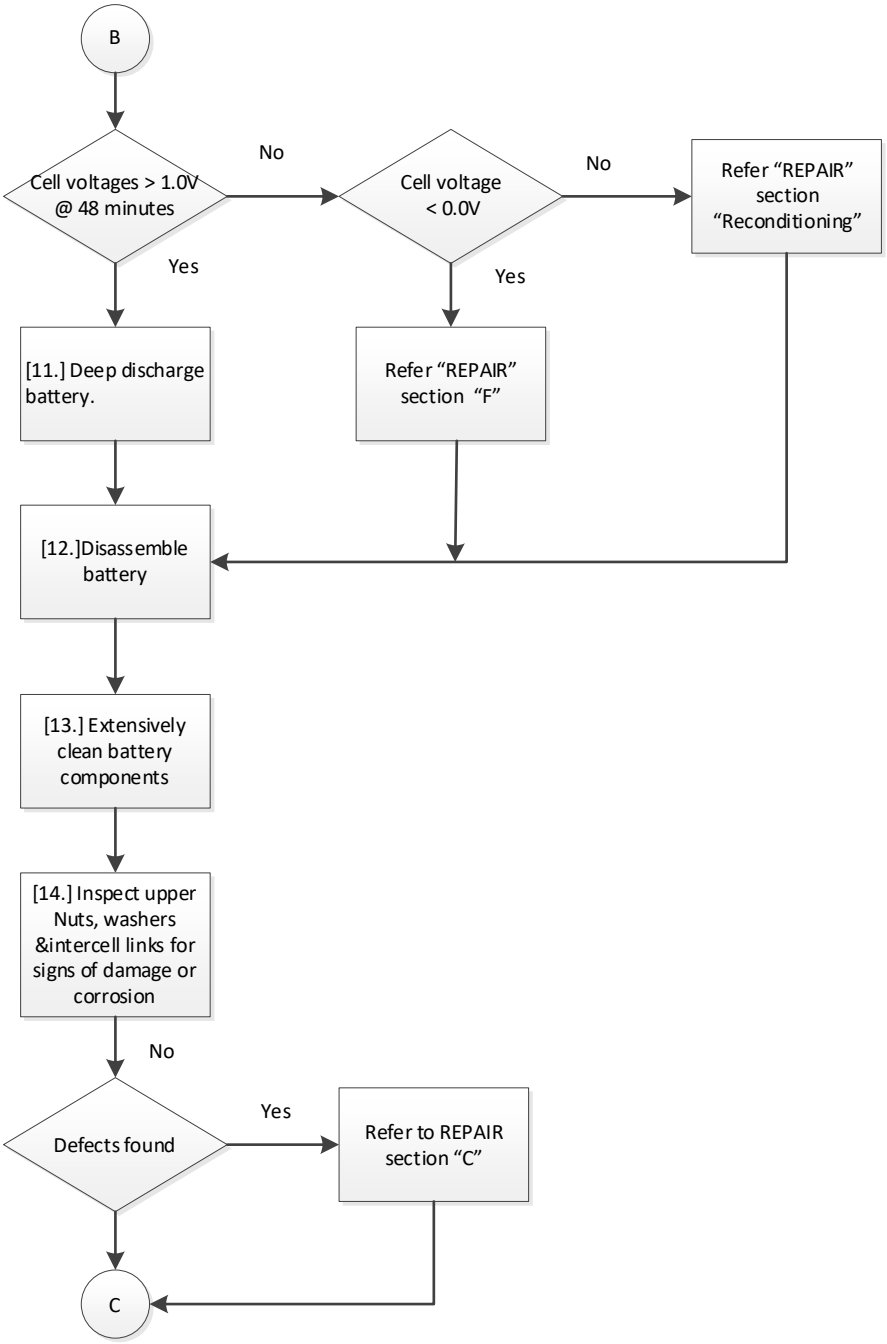
28. Clean and test the vent plugs in accordance with "Cleaning" section “E”.

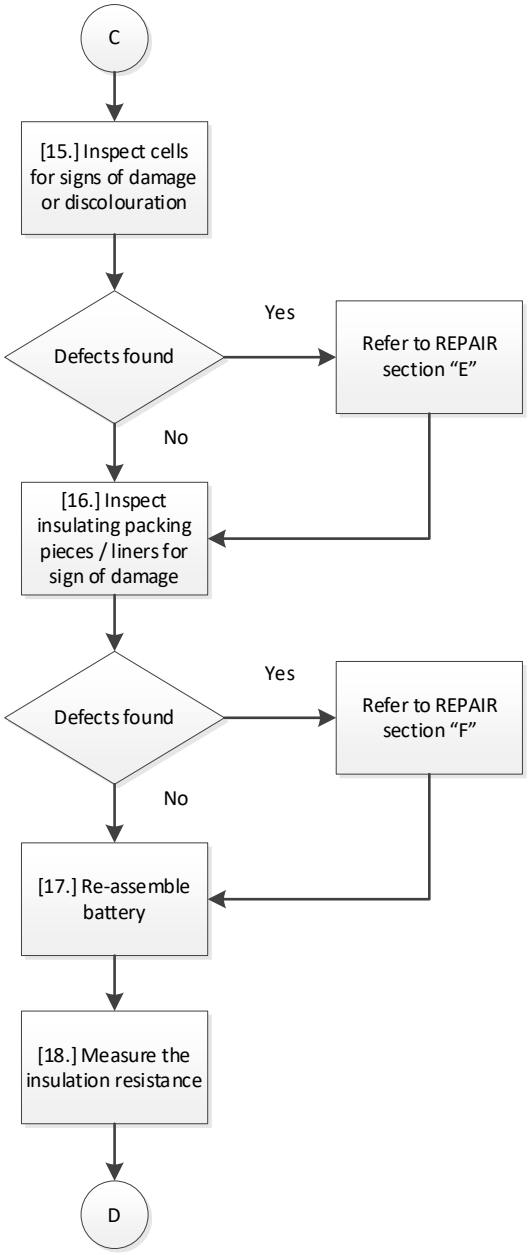
29. Refit and tighten vent plugs.

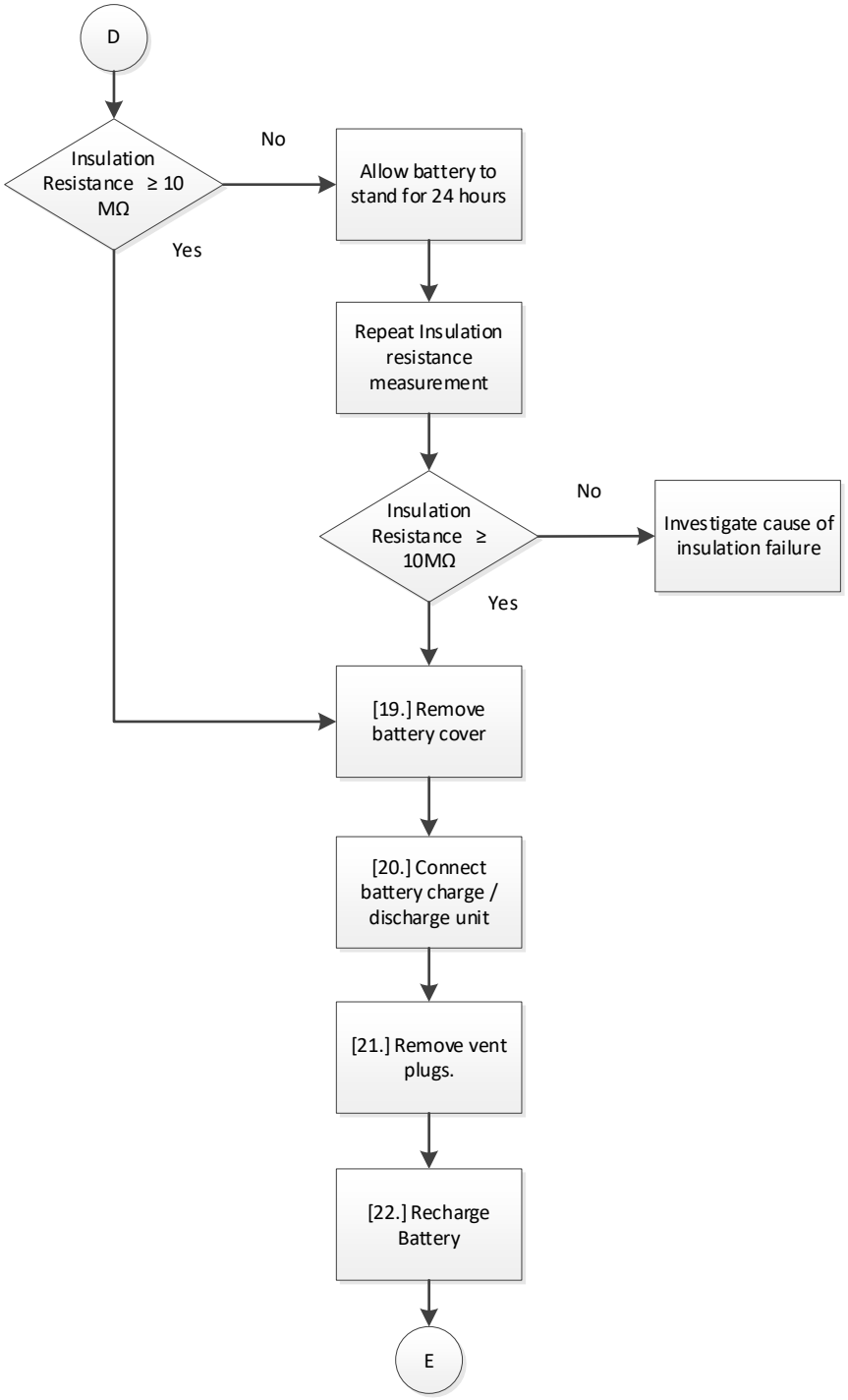
30. Re-fit the cover.
31. Measure the insulation resistance with a MΩ-meter at 250 VDC between the positive pin of the battery connector and the battery container. Requirement: ≥ 10MΩ If the battery is ≤ 10MΩ, stand it for 24 hours in dry atmosphere before repeating test. If battery is still < 10MΩ after the 24hours stand, identify and remove the insulation failure in the wiring system.
32. Release the charged battery to service.

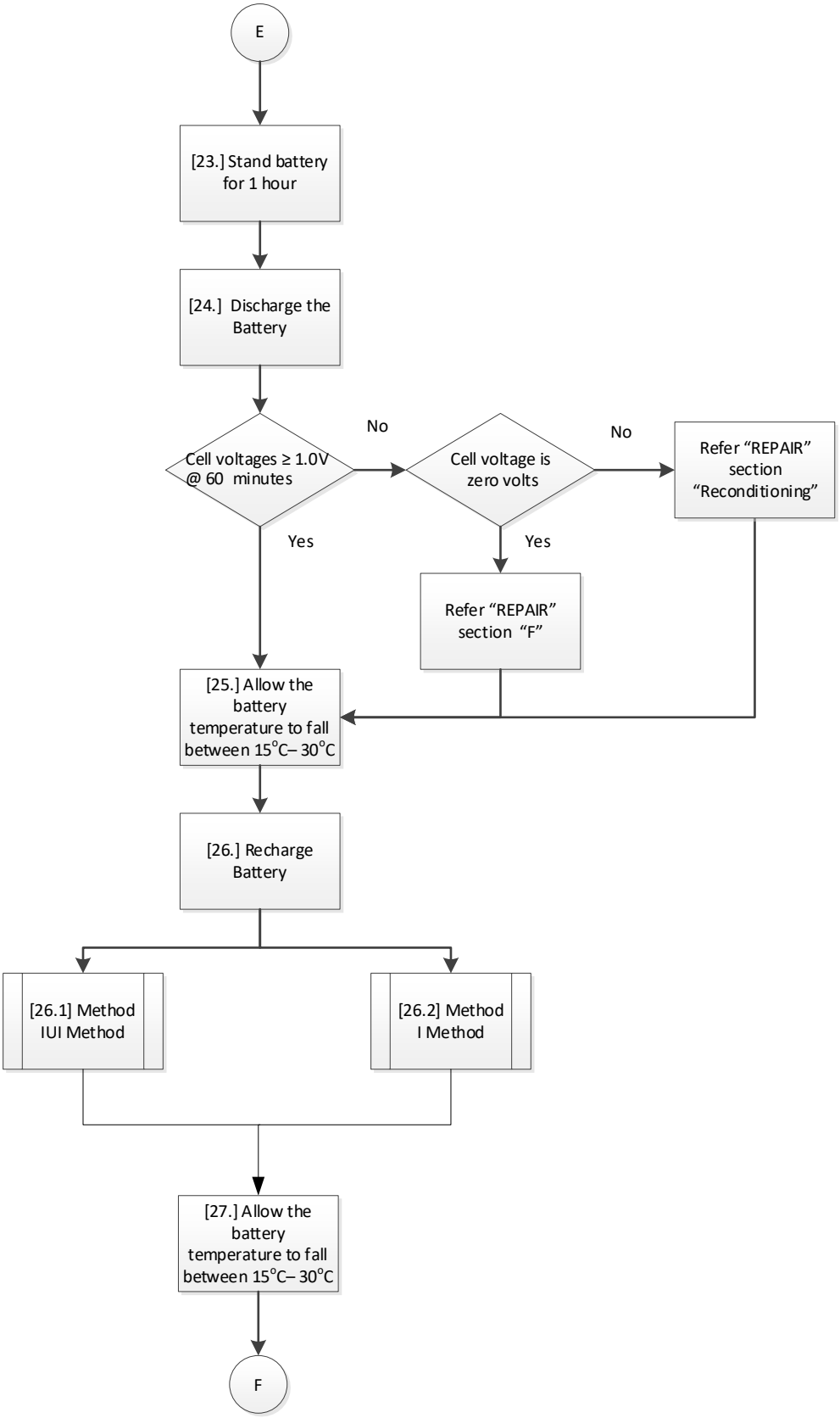

General Overhaul
[1.] Remove cover and inspect Gasket
Defects found
Yes
Refer to REPAIR section “H”
No
[2.] Inspect Battery Container & Cover
Defects found
Yes
Refer to REPAIR section “H”
No
[3.] Inspect Connector
Defects found
Yes
Refer to REPAIR section “G”
No
[4.]Tighten vent Plugs and clean top of cells
[5.] Tighten all upper hexagonal nuts to 5 Nm
A


A
[6.] Measure & record Cell voltages
[7.] Identify cells lower than 1.2 V
[8.] Connect battery to charge / Discharge unit
[9.] Check the battery Temperature
Battery Temperature below 31°C
No
Allow battery to cool
Yes
[10.] Discharge the battery
B


B
Cell voltages > 1.0V @ 48 minutes
No
Cell voltage < 0.0V
No
Refer "REPAIR" section "Reconditioning"
Yes
Yes
[11.] Deep discharge battery.
Refer "REPAIR" section "F"
[12.]Disassemble battery
[13.] Extensively clean battery components
[14.] Inspect upper Nuts, washers &intercell links for signs of damage or corrosion
No
Defects found
Yes
Refer to REPAIR section "C"
C


C
[15.] Inspect cells for signs of damage or discolouration
Defects found
Yes
Refer to REPAIR section “E”
No
[16.] Inspect insulating packing pieces / liners for sign of damage
Defects found
Yes
Refer to REPAIR section “F”
No
[17.] Re-assemble battery
[18.] Measure the insulation resistance
D


D
Insulation Resistance ≥ 10 MΩ
No
Yes
Allow battery to stand for 24 hours
Repeat Insulation resistance measurement
Insulation Resistance ≥ 10MΩ
No
Investigate cause of insulation failure
Yes
[19.] Remove battery cover
[20.] Connect battery charge / discharge unit
[21.] Remove vent plugs.
[22.] Recharge Battery
E


E
[23.] Stand battery for 1 hour
[24.] Discharge the Battery
Cell voltages ≥ 1.0V @ 60 minutes
No
Cell voltage is zero volts
No
Refer "REPAIR" section "Reconditioning"
Yes
Yes
Refer "REPAIR" section "F"
[25.] Allow the battery temperature to fall between 15°C– 30°C
[26.] Recharge Battery
[26.1] Method IUI Method
[26.2] Method I Method
[27.] Allow the battery temperature to fall between 15°C– 30°C
F

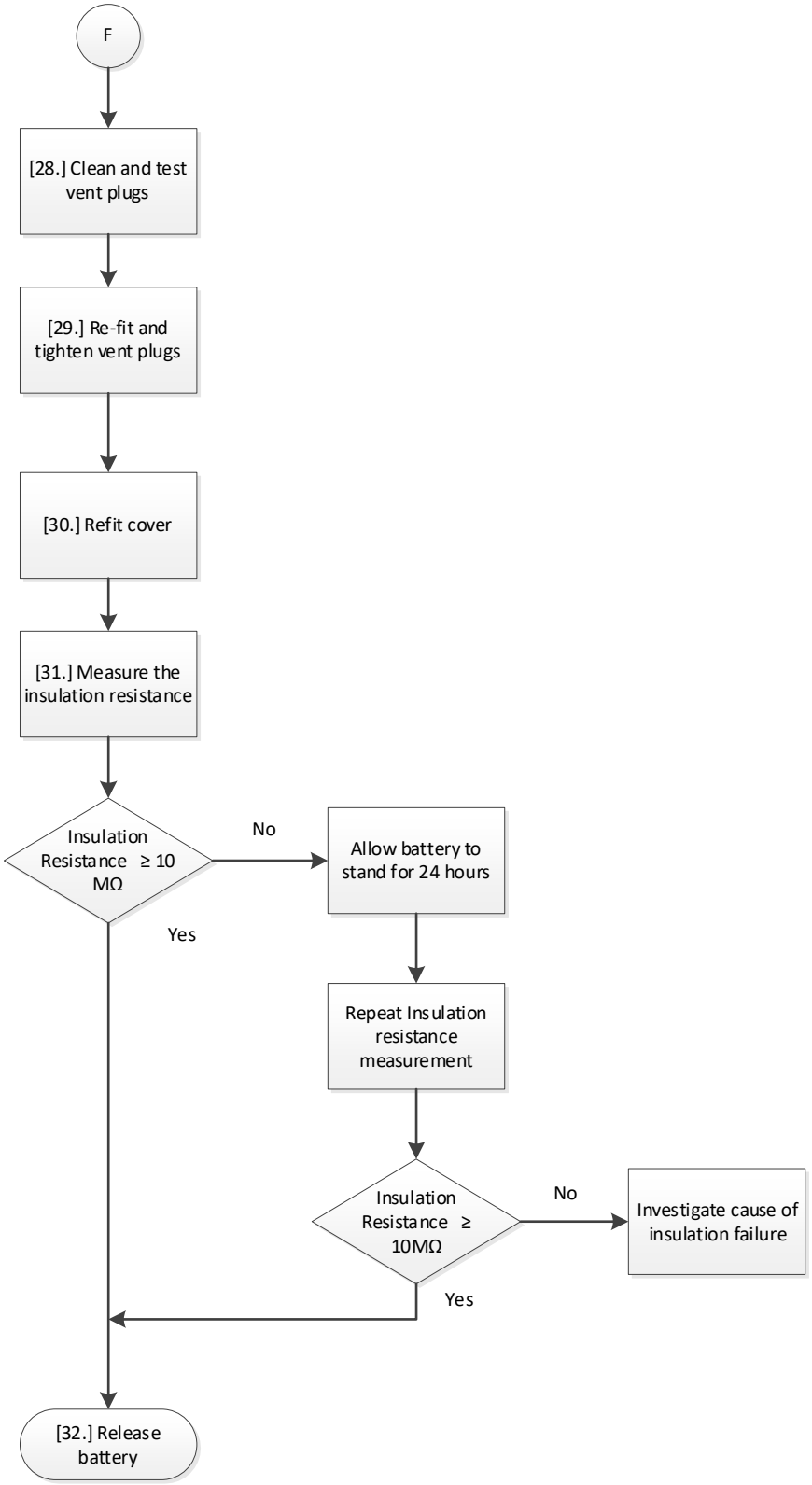


Figure 502 – General Overhaul

A) Reconditioning of imbalanced cells indicating reversible capacity decline

Note:
For charged batteries from service containing cells returning less than 80% of its nominal capacity this reconditioning is advised.
One cycle consisting of deep discharge, recharge and capacity test is sufficient to meet the capacity requirement. Two cycles can be carried out to proof the reproducibility of cell's performance.
If no improvement in capacity output relative to the previous measurement(s) could be achieved the cells are irreversibly aged and shall be replaced.

1. Deep discharge the battery (Refer to Repair section "I - Deep Discharge").

2. Charge the battery for 8 hours at 0.2* I_1.
- If necessary, adjust the electrolyte level of the cells 10 to 15 minutes prior to the end of charge.
- Measure the cell voltages prior to the end of charge.
- Record the data.
- Requirement: The voltage of each cell must be ≥ 1.58V.

3. Stand the battery for 1 hour to support escapes of charge gasses.

4. Discharge the 24V battery at I_1 to 20V.
Requirement: The voltage of each cell after 60 minutes must be equal / greater than 1 Volt.
Identify cells for replacement. (Refer either to „REPAIR" section "E" or test reproducibility of performance in accordance with „REPAIR" section "B").

5. Record the cell voltages
Record whether the battery has passed or failed.

6. (If the requirements were not met, proceed a second reconditioning cycle.
If reconditioning was started from regular maintenance and cells met requirement of section 4 above continue in regular maintenance at step 17. If cells failed in section 4 and have been replaced continue at step 14.

If reconditioning was started from general overhaul and cells met requirement of section 4, or failed and have been replaced always continue at overhaul in step 12.

Optional: For testing reproducibility of data on the reconditioned battery, carry out the process-steps in section B below.)

B) Testing reproducibility of performance

1. Soak the battery discharged in section A until a battery temperature of between +15°C and +30°C has been achieved. This might take up to 8 hours.
2. Charge the 24V battery with 23 A to 31V and charge for 2 hours at 4.6A. Or Charge the battery for 7 hours at I_5. ▪ If necessary, adjust the electrolyte level of the cells 10 to 15 minutes prior to the end of charge. ▪ Measure and record the cell voltages prior to the end of charge. Requirement: ≥1.58 Volt per cell. ▪ Identify cells for replacement after Discharge in section 8.
3. Stand the battery for 1 hour.
4. Discharge the 24V battery at I_1 to 20V. Requirement: The voltage of each cell after 60 minutes must be equal / greater than 1 Volt. Identify cells for replacement. „REPAIR“ Section “E”.
5. Compare discharge time until battery voltage passed 20 V; Time measured in section B shall be >= Time measured in section A. and note results in the log book.
6. Record in the battery log book whether the battery has passed or failed.
7. If the reconditioned battery cells met the requirements, continue in the original start routines of “Check, either “regular maintenance step 11” or in “General overhaul step 11”.

C): Replacement of upper hexagonal nuts, spring washers and links

ATTENTION: • Spare parts used for any repair listed below have to comply with the IPL. • Before disassembly deep discharge the battery (Refer to Repair section “I - Deep Discharge”). 1. Remove any corroded hexagonal nuts (50), spring washers (60) and intercell links (230, 240, 250, 260, 270) from the cells (40) and dispose them.
2. Fit new intercell links (230, 240, 250, 260, 270), spring washers (60) and hexagonal nuts (50).
3. Tighten the upper hexagonal nuts (50) on the pole terminals with the torque value of 5.0 Nm.

D) Replacement of lower hexagonal nuts, caps and seals

Note Only in case of corrosion and or leakage replacement of lower hexagonal nuts, caps and seals can be considered. ATTENTION: • Spare parts used for any repair listed below have to comply with the IPL. • Before disassembly, deep discharge the battery (Refer to Repair section “I - Deep Discharge”). • To avoid potential leakage of electrolyte, replace one lower hexagonal nut and then the other, cap and seal on one pole then the other pole, not both simultaneously. • Lower Hexagonal nuts, sealing caps, and seals should be replaced in pairs. 1. Undo and remove the upper hexagonal nuts (50).
2. Remove the washers (60) and intercell links (230, 240, 250, 260, 270) from the cells (40).
3. Undo one lower hexagonal nut and dispose (50).
4. Undo and dispose the spacer (70) and seal (80).
5. Replace the disposed parts by new parts in accordance with the IPL.
6. Torque the lower hexagonal nut (50) with 4 Nm.
7. Repeat step 3 to 6 to replace the other lower hexagonal nut, sealing cap and seal of the cell.
8. Check the integrity of the seals (80). In case of damage replace the cell in accordance with Repair section.
9. Place the intercell links (230, 240, 250, 260, 270) and spring washers (60) on the terminals.
10. Fix and torque the upper hexagonal nuts (50) with 5 Nm.
11. Record the action.

E) Replacement of cells

ATTENTION: • Spare parts used for any repair listed below have to comply with the IPL. • Before disassembly, deep discharge the battery (Refer to Repair section “I - Deep Discharge”). • If six cells in a 24V battery have been replaced from the original set, it’s recommended to replace all cells and defective battery components and carry out commissioning charge! • Only new cells shall be used for replacement. • Before disassembling cells release any pressure build up in the cells by loosening vent plugs and afterwards tighten the vent plugs with the spanner. • If there is evidence of thermal damage, remove all cells, inspect and contact the manufacturer. 1. Remove upper hexagonal nuts (50), spring washers (60), and links (230, 240, 250, 260, 270) in order to remove defective cell(s).
2. Pull out the defective cell (40) using cell puller, refer to and “SPECIAL TOOLS, FIXTURES AND EQUIPMENT”, Figure 903.
3. Dispose replaced cell(s) (40) in accordance with local regulations.
4. Fit new cell(s) (40) into the block of cells.
5. Refit links (230, 240, 250, 260, 270), washers and upper hexagonal nuts.
6. Fit and torque the upper hexagonal nuts (50) with 5 Nm.
7. Record the action and the serial-no. of the new installed cells (50)

F) Replacement of Insulation liners

ATTENTION • Any spare parts used for repair listed below must comply with the IPL. • Due to tolerances in cell thicknesses the amount of plastic liners can deviate from the drawing in the IPL. • Before disassembling cells release potential pressure build up in the cells by loosening vent plugs and afterwards tightening the vent plugs in the threads. • The cells, reassembled together with new liners and empty containers shall be packed sufficiently to ensure there is no movement of cells within the battery container. • Before disassembly, discharge the battery with 0.2* I_1 to 0.5 V per cell. 1. Undo and remove all upper hexagonal nuts on the cells (50).
2. Remove spring washers (60) and intercell links (230, 240, 250, 260, 270).
3. Note positions of the cells (40) in the container (10) and remove them afterwards.
4. Note positions of insulation liners (170, 180, 190, 200, 210, 220) in the container (10) and remove them afterwards.
5. Install new insulating (170, 180, 190, 200, 210, 220) liners in its correct place. ATTENTION: Be careful not to block the ventilation pipes, when installing the liners.
6. Place cells (40) with correct polarity into their original position in the battery container (10).
7. Retorque the lower pole nuts with 4 Nm.
8. Refit links 230, 240, 250, 260, 270) and spring washers (60) on pole terminals.
9. Tighten and torque the upper nuts (50) with 5 Nm.

G) Replacement of the connector socket

ATTENTION • Any spare parts used for repair listed below must comply with the IPL 1. Remove the hexagonal nuts (150) and spring washers (160) that attaching intercell links (270) from the connector socket (100).
2. Remove the two links (270).
3. Remove the four screws (110) and four fan disk washers (120) from the connector socket (100).
4. Remove the connector socket (100) and four sealing rings (130).
5. Remove the sealing ring (140).
6. Place new sealing ring (140) over the rear of connector socket casing (100).
7. Place the four fan disk washers (120) and four countersunk screws (110) into the fixing holes of the connector socket casing (100).
8. Fix one sealing ring (130) onto each of the four countersunk screws (110).
9. Place the connector socket (100) with attaching parts (110,120,130,140) into the battery container (10) and tighten to 2Nm.
10. Place the links (270), spring washers (160) and tighten the upper hexagonal nuts (150) to 5 Nm.

H) Replacement of Battery container and cover

1. Record the data from the battery label.
2. Send the data together with an order for a new container and cover to the manufacturer.
3. On receipt of new battery container and cover disassemble the battery.
4. For the components to be re-used proceed according to Paragraph “CLEANING” section “2”, “Extensive cleaning”.
5. Reassemble the battery in accordance with “ASSEMBLY AND STORAGE”.

I) Deep Discharge

1. Discharge the battery with I_1 (23A) to 20V.
2. Deep discharge battery by placing a resistor of 1 Ohm / 2-5 Watt between the terminals of each cell for at least 16 hours.

ASSEMBLY AND STORAGE

1. Assembly (refer to IPL, Fig.1)

   Note: Tools and equipment are identified in section “SPECIAL TOOLS AND EQUIPMENT”
   If necessary, clean the parts to be installed, before any re-assembly. Refer to section: „CLEANING“.

   A. In case of battery container , handle, cover replacement always care for correct battery labelling in contact with Hawker (Refer to “REPAIR” section H).

   B. Installation of Connector socket into battery container

      I. Place Sealing ring (140) over rear of the connector socket casing (100).
      II. Place the four fan disk washers (120) and four countersunk screws (110) into the fixing holes of the connector socket casing (100).
      III. Fix one sealing ring (130) onto each of the four countersunk screws (110).
      IV. Place the connector socket (100) with attaching parts (110,120,130,140) into the battery container (10) and tighten to 2Nm.

   C. Installation of insulating liners within battery container

      I. Insert Bottom liner (170) into the base of the battery container.
      II. Insert the remaining liners (180 thru 220) into the battery container (10) noting their position illustrated in the IPL Figure.1.

   D. Installation of cells and metallic surface protection

      I. Place cells (40) FP23XLM with their polarities in correct position into the battery container (10).
      II. Torque the lower hexagonal nuts of each cells to 4 Nm.
      III. Place links (220, 230, 240, 250, 260, 270) and spring washers (60, 160) on cell terminals.
      IV. Place the upper hexagonal nuts (50, 150) on the cell poles and torque them to 5Nm.
      V. Coat the metallic assemblies or parts with Silicone Oil.

      ATTENTION
      Never use Vaseline or other mineral oil based products on Hawker Batteries. They will degrade the rubber components.

      Note: **Silicone Oil** is neutral to any polymer part assembled in the battery and it does not attract dirt, but “excessive” use of the spray, causes coated battery components to look temporarily wet.

E. Installation of the cover

I. Place the cover (20) in correct position on the battery container (10).
II. Fix the cover (20) with the 4 fasteners to the container (10).

F. Full battery assembly

I. Carry out the steps above A, B, C, D, E consecutively.

2. Storage

1. Environmental Storage conditions

Basic requirements recommended for storage rooms:

a) Temperature: Advised average temperature range: 5°C – 35°C.
Temporary deviation in the temperature range of -50°C to +80°C is acceptable during long-term storage.

b) Humidity: 0 – 70% relative humidity.

2. Preparation before storage up to 5 Years in maintained and deep discharged condition

Batteries shall be stored after overhaul and deep discharge

- Carry out either the regular maintenance procedure or the Overhaul.
- Deep discharge the battery (Refer to Repair section “I - Deep Discharge”).
- Fit the shorting device (Fig. 906) on the main connector pins.
- Fit the connector cover (Fig. 907) on the main connector.
- Fix the caution label (Fig. 908) on the battery.
- Check the tightening of the vent plugs on the cells .
- Fit the cover in correct position and lock it with the battery container.
- Always store the battery upright.
- Protect the battery against impact by package, e.g. in the original cardboard box.

Batteries stored up to five years “shall be” recommissioned acc. Page 201

3. Storage of batteries operable for service.

   Maintained and charged batteries can be stored service-operable for “short-time” limited by storage conditions.

   Note: Storage duration of a serviceable battery is directly related to the storage temperature of the battery.

   3.1. Preparation

   a. Maintain the battery, as scheduled (either regular Maintenance or General Overhaul).

   b. Fit and tighten properly the vent plugs on the cells before closing the battery container with the cover.

   c. Coat the metallic parts with silicone spray and protect the main connector pins from any short circuit.

   d. Store the battery upright.

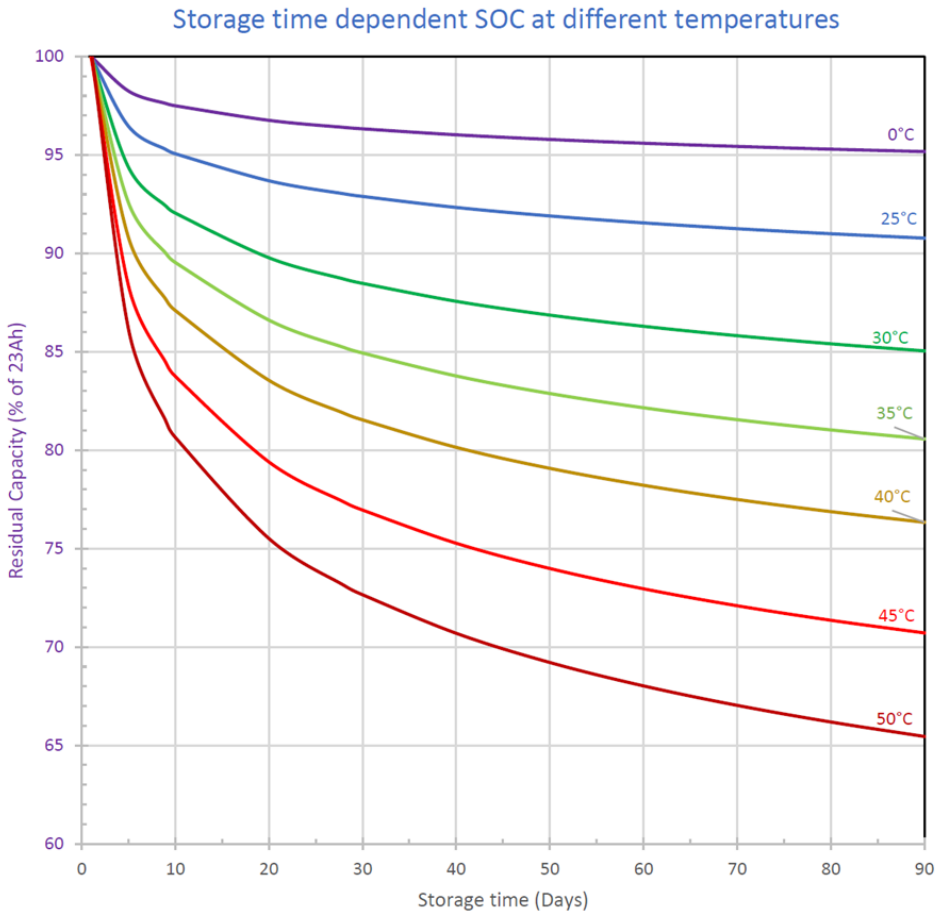
   3.2. Storage Period and intervals for refresh charge

   a. Refer to the Storage diagram.

   b. Subject the battery to refresh charge at the time indicated at the intercept point of storage temperature and 80% SOC in the diagram below.
   We recommend the refresh charge after 90 days.

   c. Two refresh charges after maintenance can be carried out if requirement under 2.3.3 is met, which results in a maximum of 3 storage periods.

   d. If the battery has been subject to three successive periods of short-term storage periods, it must be subjected to regular maintenance.



3.3 Refresh charge parameter are indicated in table below.

Charge current	Charge voltage limitation	Max Charge time	Max charge Current at close of charge
4.6A	30.0 V	1 hours	<4.2A

Limitation for the refresh charged capacity

The recharged capacity during refresh charging must not exceed 4.6 Ah.
If, the recharge capacity exceeds 4.6Ah, then the battery shall be subjected to regular maintenance.

3.4 Refresh charge procedure

Note: Don't carry out any electrolyte level adjustments on cells when applying a Refresh Charge.

a. Remove the cover and protective cap from the battery.
b. Connect the battery to the charge / discharge unit.
c. Adjust on charger the voltage and the current limitations taken from the table above.
d. Do not remove vent plugs from cells.
e. Charge the cells for the corresponding Max time and record the current versus Time (Ampere-hour meter).
f. Prior to cut-off charge read and record the battery voltage and charge current.
g. Fit battery cover and protective cap.

3. Packing

The discharged batteries are to be packed in upright position in accordance with national or global standards for transportation. If available, the undamaged original supplied package of the battery can be re-used.

4. Transportation

Vented batteries packed in accordance with the instructions are to be transported in upright position. The package shall be marked with "TOP" and "BOTTOM" and with any information needed for shipment. CMM, Service bulletins and Log book are to be treated a part of the battery and shall be put into the transportation package or send separately to same destination.

SPECIAL TOOL, FIXTURES AND EQUIPMENT

1. Special Tools

NOTE: Equivalent substitutes may be used for listed items.

The special tools detailed in the table below are required for Testing / Disassembly / Assembly / Cleaning / Check / Overhaul and Repair of the F20/23XLM battery.

Manufacturers Part Number	Designation
2358529	Vent Plug Spanner (Refer to Figure 901)
4607672	Deep Discharge Resistor 1Ω / 2Watt (Refer to Figure 902)
1446355	Cell removal tool (Cell Puller)(Refer to Figure 903)
2359047	Tool Box size 43 Contains: -areometer, -thermometer, -protective gloves, -brush, -funnel, -Cell Puller, - Vent Plug Spanner -spare parts (5 vents, 5 polenuts, 5 sealing caps, 5 sealing rings, 5 spring washers)
4672756	Hawker Charger/Discharger UL10N
4682079	Hawker Cell scan adapter
Commercial available	Syringe (Refer to Figure 904),
Commercial available	Hydrometer: (Refer to Figure 905),

2. Materials

Manufacturers Part Number	Designation	Specification
Commercial Available	Distilled or deionized water	IEC 60993 EN 60993
1430187	Korasilone M	
Commercial Available	Silicon Oil Liqui - Moly 3310	
4682913	Shorting device	1Ω / 2W
4683001	Connector cover	
4681966	Caution label	

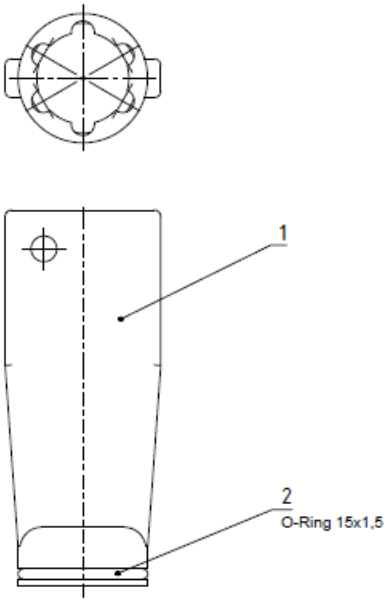


Fig. 901 – Vent Plug spanner

Fig. 902 – Deep Discharge Resistor

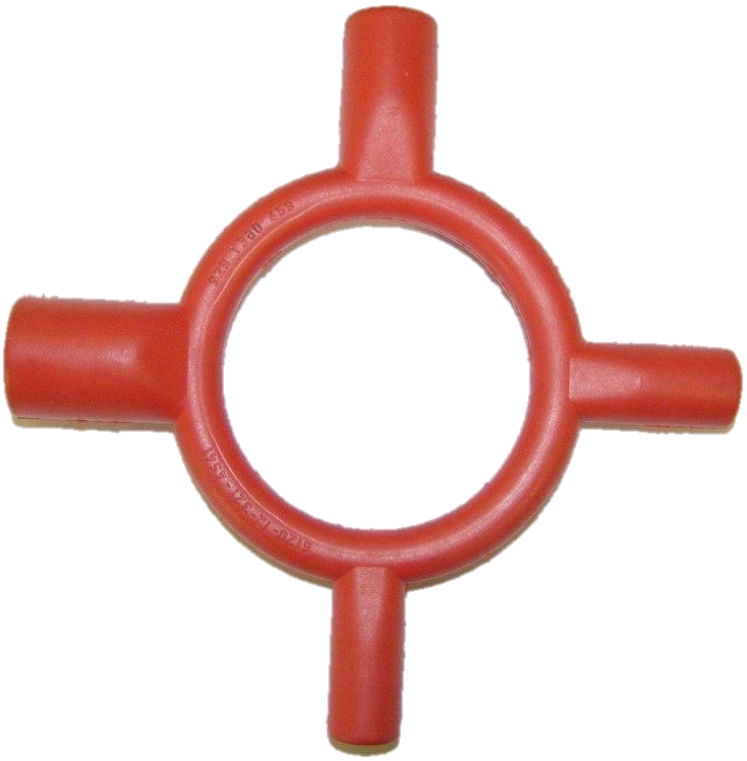


Fig. 903 – Cell removal tool
(Cell puller)

Fig. 904 – Syringe 20ml

Fig. 905 - Hydrometer

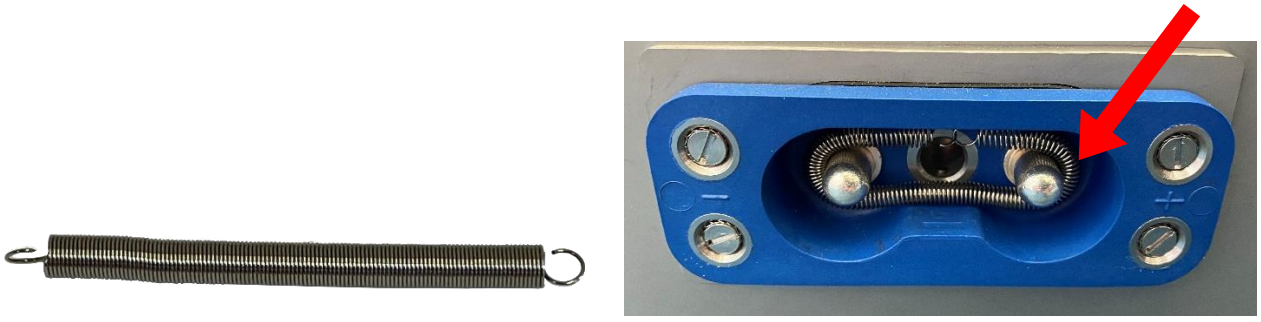


Fig. 906 – Shorting device

Fig. 907 - Connector cover

Fig. 908 - Caution label

ILLUSTRATED PARTS LIST

INTRODUCTION

1. General

This section provides illustrations and parts breakdown of the F20/23XLM battery, which can be disassembled, repaired or replaced and reassembled.

2. How to use the Detailed Parts List

The Detailed Parts Lists includes a complete list and figures of the battery components.

It has the following columns:

1st column: Fig. Item – (Figure and item numbers)
2nd column: Part Number – (Manufacturer's part number)
3rd column: Airline Part Number
4th column: Nomenclature – (List of components)
5th column: Usage Code – (Applicability)
6th column Units per Assembly (Quantity for each immediately higher assembly)

A. Figure and item numbers (Fig. Item)

The figure number for the item given in the list is shown on the first line of each page.

Each assembly, sub-assembly or item with a part number that is given in the parts list has an item number. A letter following the item number identifies the variant. The basic variant is identified with the letter "A".

Assemblies, sub-assemblies and parts that are not illustrated in the figure are identifiable with a dash (-) before their item numbers.

B. Manufacturer's part number (Part Number)

Each assembly, sub-assembly and detail part (that is shown on the figure or not) has a manufacturer's part number.

C. List of Components (Nomenclature)

The list of components is moved to the right to show the relationship between the parts:

Assembly

. Detail parts for assembly
. Sub-assembly
. Attaching parts and/or storage parts for sub-assembly

. . Detail parts for sub-assembly

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

. . . Detail parts for Sub-sub-sub-assembly, etc.

A vendor code is given for all items or articles that are not made by the manufacturer of the assembly.

This vendor code (or the abbreviation “NP”: non procurable) is shown to the right of the 1st line of the nomenclature.

D. Effectively (Usage 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.

E. Quantity Per Assembly

The “Units per Assy.” Column shows the total number of units required per assembly, per sub-assembly as applicable.

This number can be replaced by the letter REF (Reference) or AR (As Required)

3. Changes

When an item is changed, added or removed, the letter “R” is shown in the right margin (the date of issue of the page changes).

The letter “R” is shown opposite the page number (in the right margin) when all the number are changed.

4. Page numbers

The Detailed Parts List is divided into sections. The page numbers are given independently for each section.

Introduction	INTRO 1001	Page 1 to 5
Vendor Code Index	VCI 1001	Page 1
Numerical Index, Numerical	NI/MUN1001	Page 1
Detailed Parts List		Page 1001
Figure, Main	Figure 1	Page 1001-0
Parts List		Page 1001-1

VENDOR CODE INDEX

VENDOR CODE	NAME - ADDRESS
D8034	HAWKER GmbH, Dieckstrasse 42, 58089 Hagen Germany Tel : +49 (0)23 31 372-0 Fax : +49 (0)23 31 372-183

NUMERICAL INDEX

PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	UNITS PER ASSY
1212004		1	50A	80
1212004		1	150A	2
1213933		1	130A	4
1213982		1	80A	40
1214208		1	140A	1
1218186		1	270A	2
1218291		1	240A	5
1218478		1	230A	10
1511219		1	120A	4
1511519		1	60A	40
1511519		1	160A	2
1516396		1	110A	4
2283571		1	70A	40
2287662		1	90A	20
4568996		1	40A	20
4569343		1	30A	1
4572412		1	10A	1
4573547		1	170A	1
4573555		1	220A	2
4573563		1	200A	2
4573571		1	190A	2
4573588		1	180A	5
4573603		1	210A	1
4575134		1	100A	1
4575159		1	260A	3
4575167		1	250A	1
4583794		1	20A	1

DETAILED PARTS LIST

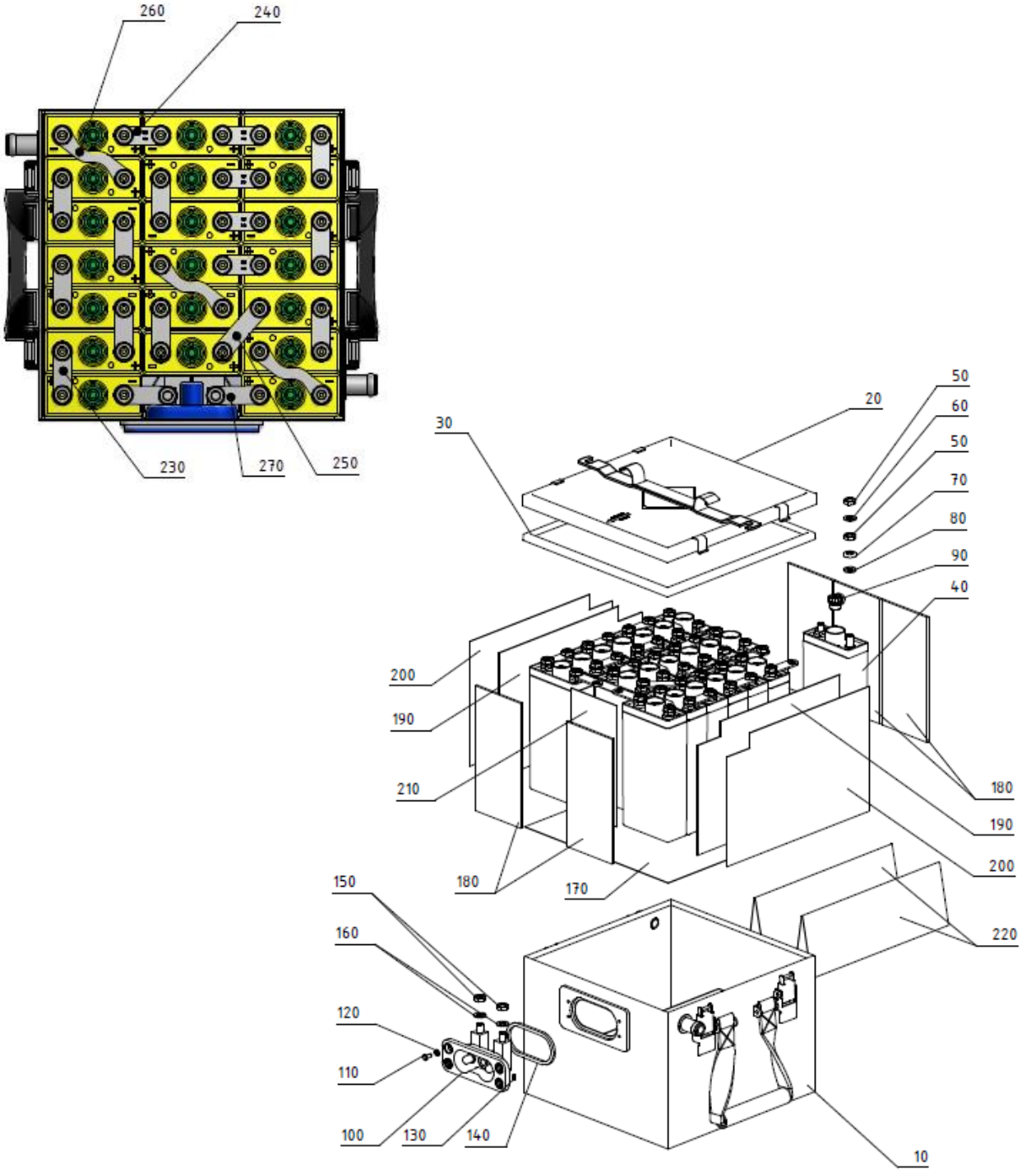


Figure 1 – F20/23XLM Battery, Exploded view

ILLUSTRATED PARTS LIST

FIG.	ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFF. CODE	UNITS PER ASSY
1	-1	4575126-00	Battery Assembly, F20/23XLM	A	1
1	-1	4575126-01	Battery Assembly, F20/23XLM	B	1
	10A	4572412	. Battery container complete		1
	20A	4583794	. Battery cover complete		1
	30A	4569343	. . Gasket, cover		1
	40A	4568996	. Cell, FP23 XLM complete		20
	50A	1212004	. . Hexagonal nut M8		4
	60A	1511519	. . Spring Washer B8		2
	70A	2283571	. . Spacer		2
	80A	1213982	. . Sealing ring		2
	90A	2287662	. . Vent plug		1
	100A	4575134	. Connector socket		1
	110A	1516396	. Countersink Screw AM 4x10		4
	120A	1511219	. Fan disk V4-3		4
	130A	1213933	. Sealing ring 3,3x2,4		4
	140A	1214208	. Sealing ring		1
	150A	1212004	. Hexagonal nut M8		2
	160A	1511519	. Spring Washer B8		2
	170A	4573547	. Insulator, bottom		1
	180A	4573588	. Insulator 3mm		5
	190A	4573571	. Insulator 1 mm		2
	200A	4573563	. Insulator 0,25 mm		2
	210A	4573603	. Insulator		1
	220A	4573555	. Insulator		2
	230A	1218478	. Connector D5		10
	240A	1218291	. Connector D2		5
	250A	4575167	. Connector		1
	260A	4575159	. Z-Connector		3
	270A	1218186	. Connector		2

- DENOTES NOT ILLUSTRATED