



TELEDYNE BATTERY PRODUCTS

MAINTENANCE MANUAL FOR 7638-38HT

PROPOSITION 65 WARNING

BATTERY POSTS, TERMINALS AND RELATED ACCESSORIES CONTAIN LEAD AND LEAD COMPOUNDS, CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND REPRODUCTIVE HARM. **WASH HANDS AFTER HANDLING.**

Receipt and use of this technical document by any receiving party is subject to compliance with all decrees, statutes, rules and regulations of the United States Government and of the Governments of the countries in which Teledyne Battery Products and the receiving party are doing business at the time of receipt by the receiving party in effect, or which may be in effect hereafter, which govern exports or otherwise pertains to export controls, including without limitation, the Export Administration Regulations and the International Traffic in Arms Regulations.

WARNING

THE SAFETY INSTRUCTIONS/PRECAUTIONS POSTED IN VARIOUS SECTIONS WITHIN THIS MANUAL MUST BE STRICTLY FOLLOWED.

ALWAYS WEAR SAFETY GLASSES AND ACID-RESISTANT GLOVES WHENEVER HANDLING BATTERIES ELECTROLYTE CONTAINS SULFURIC ACID, WHICH CAN PERMANENTLY DAMAGE EYES AND CAUSE SEVERE BURNS TO EXPOSED SKIN.

FOR LIMITATIONS, PROCEDURES AND PERFORMANCE INFORMATION NOT CONTAINED IN THIS SUPPLEMENT CONSULT THE BASIC PILOTS OPERATING HANDBOOK, AIRPLANE FLIGHT MANUAL, THE SPECIFIC STC OR THE BATTERY CONTINUOUS AIRWORTHINESS INSTRUCTIONS FOR THE APPLICATION. THIS SERVICE MANUAL SHOULD NOT BE CONSTRUED AS THE FINAL AUTHORITY IN MAINTAINING YOUR SPECIFIC BATTERY. PLEASE CONSULT WITH TELEDYNE TECHNICAL SUPPORT FOR FURTHER INFORMATION.



MAINTENANCE MANUAL

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REVISIONS

Revision	Description of Change	Approved By	Date
NC	New document	JMR	9-30-09
A	Revised Table 1 to support recharging severely discharged batteries	JMR	4-7-10
B	Revised Table 1 to add capacity test statement	JMR	5-4-10
C	Revised performance requirement in section 6.2.4 from 80% to 85%; revised conditioning during capacity testing, section 6	JMR	3-4-12
D	Revised section 6.2	JMR	9-4-12
E	Revised section 6.4	JMR	12-21-14
F	Revised section	JMR	1-20-17

SCOPE

This manual provides Maintenance Procedures for Teledyne Battery Products' (TBP) 7000 Series LT Valve-Regulated Lead-Acid (LT VRLA) Aircraft Batteries manufactured part number 7638-38HT

This manual has been written for the purpose of guidance only; consult Teledyne Battery Products Technical Support for further information.

VALVE-REGULATED LEAD-ACID BATTERIES

3.1 DESCRIPTION

- 3.1.1. The 7000 series LT valve-regulated lead-acid (VRLA) batteries are designed with an optimum lead alloy with tin to provide the best possible electrode characteristics necessary for performance. These VRLA batteries contain electrolyte absorbed in glass-mat separators, with no free electrolyte and are sometimes referred to as “sealed” or “recombinant-gas” batteries.

WARNING

ALL VRLA batteries contain sulfuric acid, which is highly corrosive and which can cause serious physical injury if it comes in contact with skin or if inhaled. It can also cause serious eye injury or blindness if it comes into contact with the eyes.

Caution must be exercised to avoid damage to the exterior case which could allow the contents to escape or come in physical contact with external materials or personnel.

If a battery case is found to be damaged, handle the battery with care and avoid contact with the skin. Inspect all areas adjacent to the battery for evidence of corrosion.

- 3.1.2. TBP valve-regulated lead-acid batteries have vent caps (with valves enclosed) that are sealed in place and cannot be accessed for maintenance. At no time must these vent caps be removed.

WARNING

During normal operation, the batteries will vent very small amounts of gases that must be vented away from the battery and aircraft. The venting mechanisms consist of nozzles (in the battery cover) and vent tubes that are designed to exhaust the battery compartment. Ensure that the vent tubes are not restricted or disabled in any way.

- 3.1.3. The electrolyte is contained in an absorptive glass-mat (AGM) separator that retains and immobilizes the electrolyte. These batteries can be operated in any orientation without spilling electrolyte.
- 3.1.4. The battery consists of twelve cells connected in series internally, making up a 24V battery. These cells are not replaceable.

- 3.1.5. Each cell is constructed of premium grade LT electrodes (plates) that are electrically isolated by AGM separators.

3.2 SPECIFICATIONS

- 3.2.1 TBP battery ratings are defined by a series of specifications:

3.2.1.1 The One-Hour Rate

This is the rate of discharge a battery can endure for one hour with the battery voltage at or above 1.67 volts per cell, or 20 volts for a 24 volt lead-acid battery, or 10 volts for a 12 volt lead-acid battery.

The One-Hour Capacity, measured in Ampere Hours or Ah, is the product of the discharge rate and time (in hours) to the specified end voltage.

3.2.1.2 The Emergency Rate

This is the rate of discharge a battery can endure for thirty minutes with the battery voltage at or above 1.67 volts per cell, or 20 volts for a 24 volt lead-acid battery, or 10 volts for a 12 volt lead-acid battery.

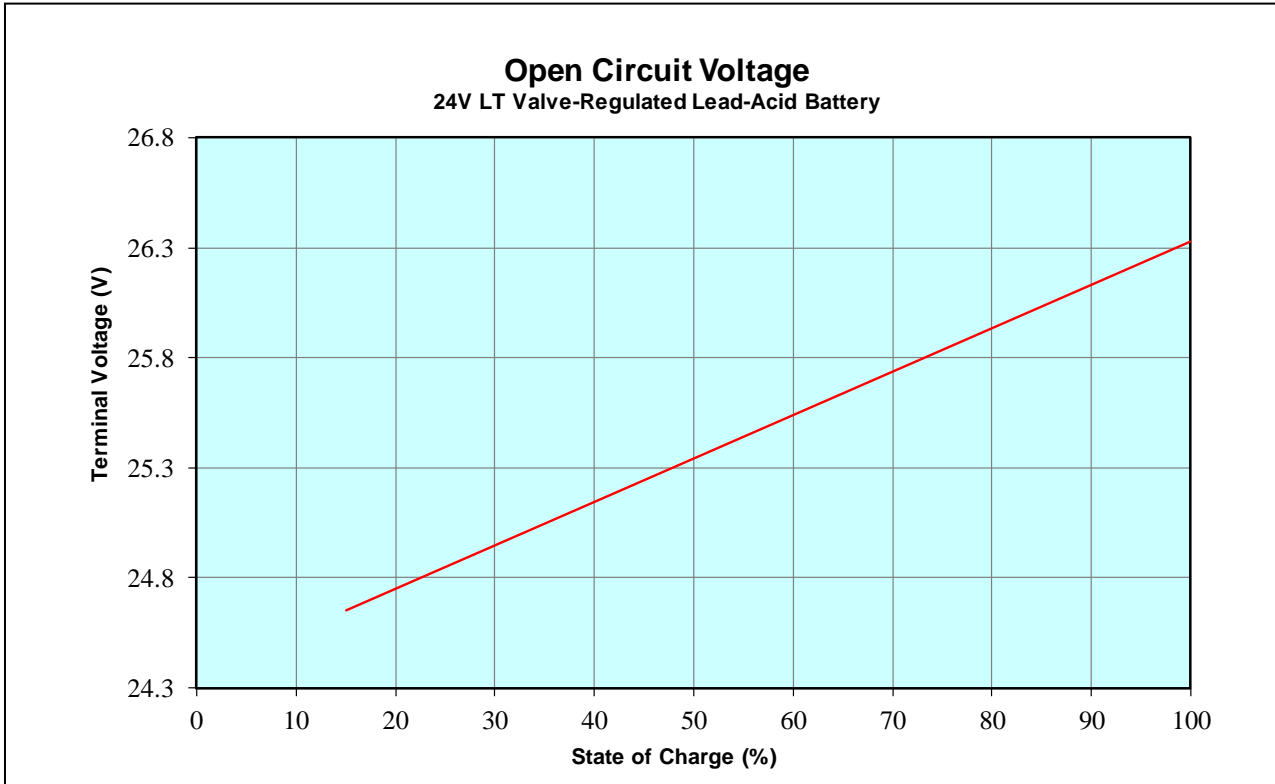
The Emergency Rate is the total essential load, measured in amperes, required to support the essential bus for thirty minutes.

- 3.2.1.3 I_{pp} : This is the peak current delivered at 0.3 seconds into a 15 second controlled discharge at a constant terminal voltage of half the nominal battery voltage.

I_{pr} : This is the discharge current at the conclusion of a 15 second controlled discharge at a constant terminal voltage of half the nominal battery voltage.

- 3.2.2 State of charge using voltage measurements should be used as a guide only. Figure 1 indicates the relationship between Battery Open-Circuit Voltage (OCV) and % State-of-Charge (SOC). Please note that state-of-charge is not the same as available capacity (see GLOSSARY).

FIGURE 1



Premium LT Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS

3.2.3. All valve-regulated batteries operate best in controlled temperatures. Excessive excursions above 100°F can shorten the life of lead-acid batteries. The optimum operating temperature is around 80°F.

Available capacity declines as the temperature drops. This decline is primarily related to the state of the electrolyte and easily recoverable once the battery has warmed up sufficiently.

SERVICE INSTRUCTIONS

4.1 SHIPMENT OF BATTERIES

- 4.1.1 The batteries are shipped conditioned and fully charged.
- 4.1.2 Each battery is identified with a unique serial number label and manufacturing date marked with indelible ink on the right side of the battery (side adjacent to the positive terminal, with the terminals facing forward). Please use this manufacturing date for future reference.

4.2 INSPECTION FOR SHIPPING DAMAGE

- 4.2.1 Upon receipt, the packages must be examined for any shipping damage before they are placed in storage or use. If any damage is noted, contact the shipping company immediately.
- 4.2.2 Type verification can be performed by checking the serial number label on the packaging against the accompanying Certificate of Compliance.

4.3 STORAGE REQUIREMENTS

- 4.3.1 Teledyne's 7000 series LT valve-regulated lead-acid batteries can be stored between -20°F and +110°F (store ideally at 80°F). Storage at temperatures other than these, can lead to permanent damage.

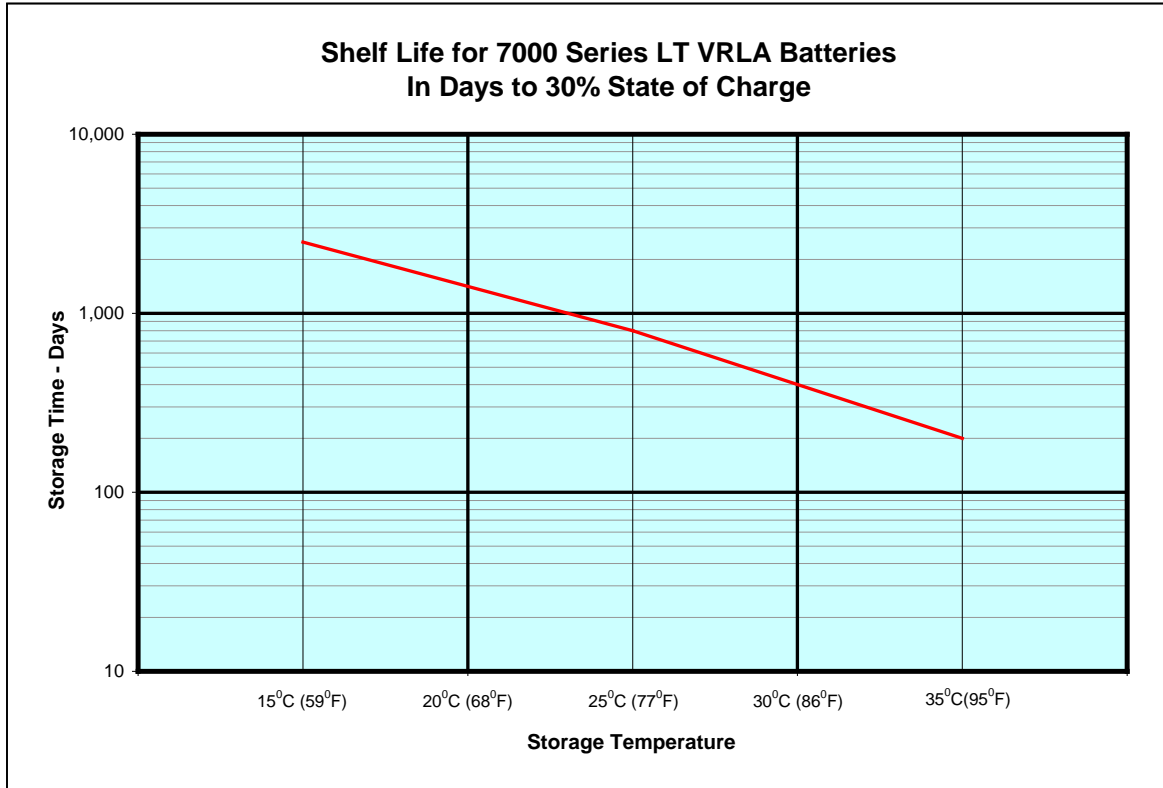
Storage temperatures will determine inspection requirements.

- 4.3.2 Teledyne's 7000 series valve-regulated lead-acid batteries have a maximum of 24 months of inspection-free storage life, IF stored at temperatures between 40°F to 80°F.

Batteries maintained at lower temperatures should be reviewed in this category as well.

- 4.3.3 Review figure 2 to determine the shelf life at various temperatures indicated. The 7000 series batteries can be stored for the number of days at the temperature indicated in Figure 2 without any damage.

FIGURE 2



- 4.3.4 If stored between 95°F (35°C) to 110°F (43°C), the battery must be inspected on a monthly basis. It is not recommended to store any VRLA batteries at these temperatures for excessive periods of time (maximum 3 months storage). Prolonged storage at high temperatures (over 110°F) will reduce battery life.
- 4.3.5 All batteries returned from service after initial use must be stored fully charged. The storage start date and battery voltage must be logged on the outer package or marked on the battery.
- 4.3.6 Long term storage at low temperatures (around 0°F) will not detrimentally affect the life of the battery, provided the battery is at a reasonably high state of charge (over 80%) before placing in storage.
- 4.3.7 Please call TBP technical support if there are any questions regarding shelf life and recharge periods.

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4.4 INITIAL INSPECTION

- 4.4.1 Visually inspect the battery to ensure there is no damage. Remove the protective cap over the terminal pins and ensure that the pins are clean and there is no corrosion. The pins have been installed with the correct torque at the factory and do not require any re-seating. Call TBP Technical Support if you find any discrepancy.
- 4.4.2 DO NOT remove the lid. The vents are sealed in the cover and cannot be removed for maintenance.
- 4.4.3 Inspect the open circuit voltage. Typical practice should be to recharge the battery at constant potential before placing into service. Review section 5 for all charging instructions.

For basic charging, constant-potential is the preferred charging method. Deep-discharge recovery will usually require application of Constant-Current and/or Constant-Potential charging (see 6.4). Please consult with technical support at Teledyne before attempting recovery from prolonged deep-discharge.

WARNING

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Caution must be exercised to avoid damage to the exterior case which could allow the contents to escape or come in physical contact with external materials or personnel.

If a battery case is found to be damaged, handle the battery with care and avoid contact with the skin. Inspect all areas adjacent to the battery for evidence of corrosion.

- 4.4.4 Charging should be terminated when the charge current drops to less than 0.5 ampere (may takes up to 15 hours depending on the state-of-charge of the battery).

CHARGING

RECOMMENDATION

Charging should be conducted in a well-ventilated area at ambient conditions ranging from 65°F to 80°F.

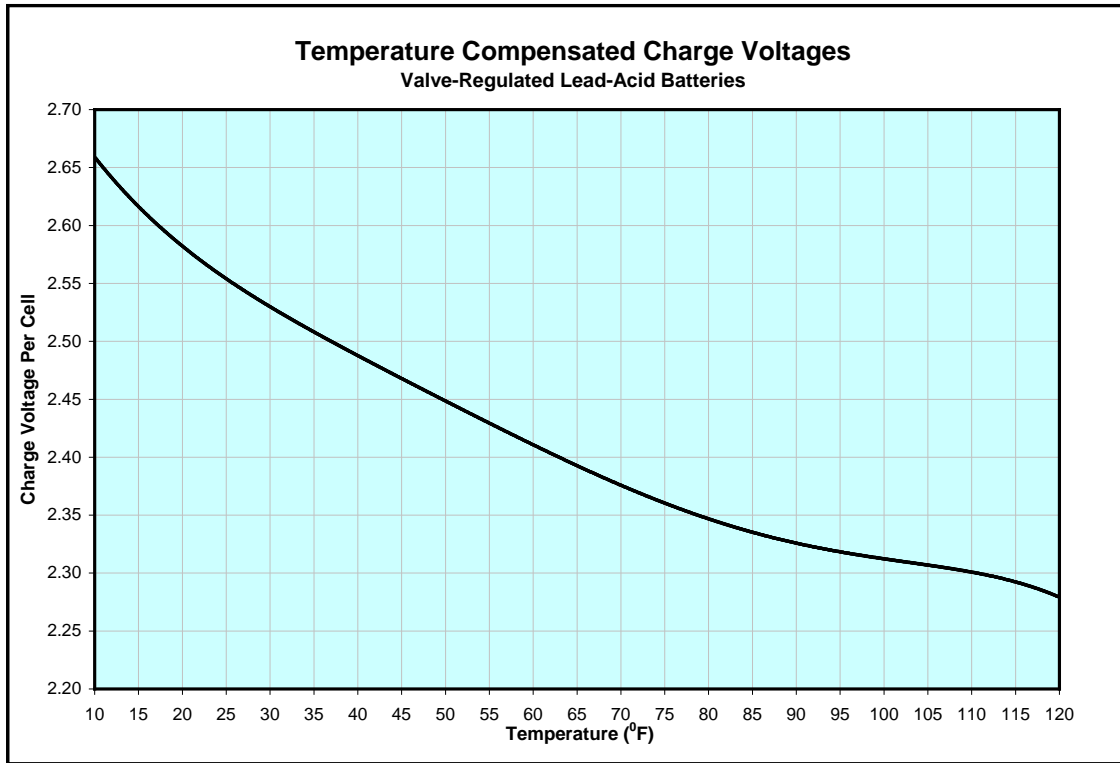
5.1 OVERVIEW

- 5.1.1 Please review the charging method (constant-current or constant-voltage) before commencing. The preferred method is constant-voltage.
- 5.1.2 Correct charging is very important and will affect the overall life of the battery. The charging process is not 100% efficient due to losses resulting from internal resistance and will typically require 2% to 6% more recharge than the amount of capacity removed during discharge.
- 5.1.3 Overcharging generally occurs when either constant-current charging is used without adequate control of total time on-charge or the voltage limit in constant-voltage charge is higher than the recommended range (see 5.2.4). Overcharging a battery will corrode the positive grids and break-down the water component in the electrolyte to hydrogen and oxygen (electrolysis). This is quite detrimental to the life of VRLA batteries since the water cannot be replaced.

5.2 STANDARD CONSTANT-POTENTIAL (VOLTAGE; CP/CV)

- 5.2.1 These chargers are generally designed to provide a constant voltage source, with selectable initial current rates. Model variants provide selectable charge voltage and initial charge rates. Higher output current will reduce recharge time.
- 5.2.2 Because the current in any circuit is directly proportional to the voltage gradient across that circuit, CV charging will result in a high initial charging current which will start dropping off when the voltage gradient between the charger and battery begins to decrease.
- 5.2.3 Typically, the charger will regulate to around 28.6 volts (24 volt batteries) or 14.3 volts (12 volt batteries). As the battery approaches the charger output voltage, charge current will drop below 0.5 ampere.

FIGURE 3



5.2.4 The battery must be connected to the charger with output voltage set between 28.2V up to 29.0V for 24V batteries and left on until the charge rate drops below 0.5 ampere. At this point, disconnect the charger from its power source first before disconnecting the battery from the charger. Disconnecting the charger first will eliminate any sparks, since the battery could still be accepting a low rate of charge.

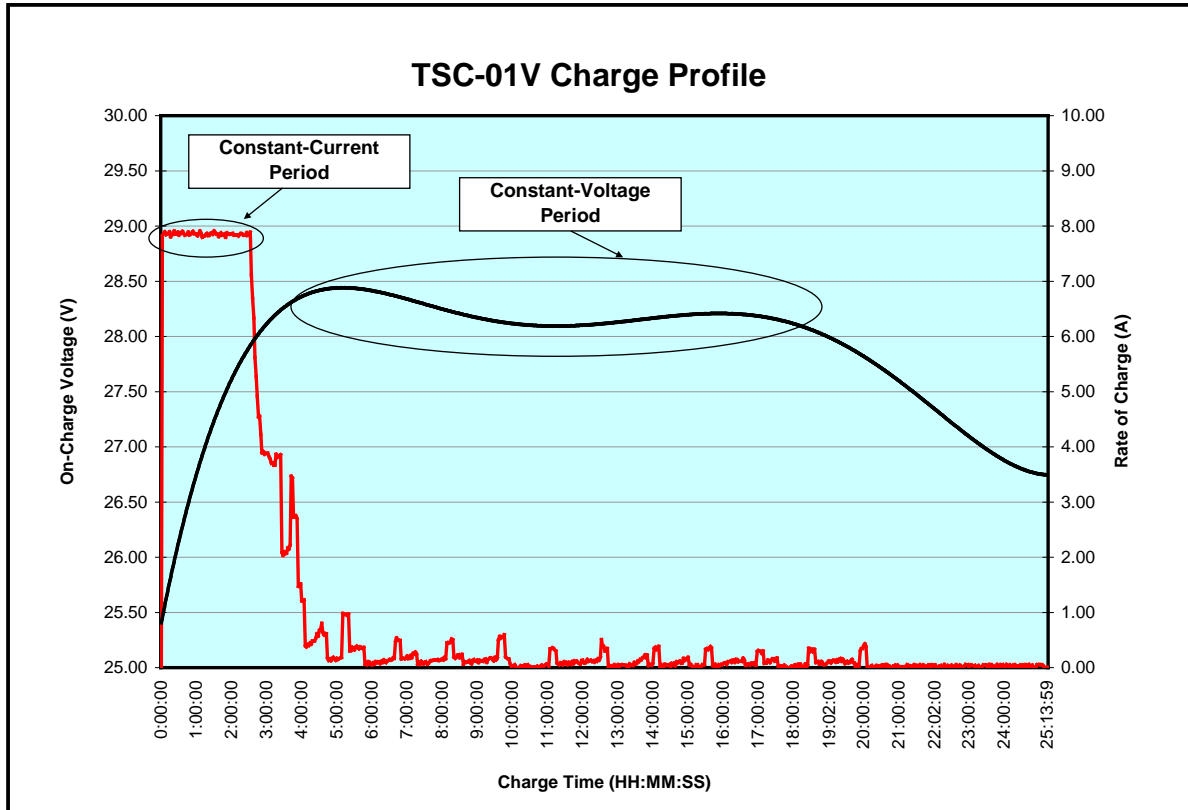
Note: Unless the charger is of a type that turns off automatically, you must disconnect the charger and battery once the charge rate drops below 0.5 ampere.

5.2.5 Alternatively, constant-voltage charging can be temperature-compensated for better control. Note Figure 3 for Temperature Compensated Charge Voltages.

5.2.6 Figure 4 represents Teledyne Battery Products' TSC-O1V Charger profile. This is a specialized charger that provides a constant-current charge initially; thereafter, it switches to constant-voltage charge to the battery.

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FIGURE 4



Premium LT Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS

5.3 STANDARD CONSTANT CURRENT (CI)

- 5.3.1 Constant current charging is accomplished using a specific charger designed to deliver a constant rate of charge for a programmable length of time.
- 5.3.2 If the battery has been subjected to a severe/deep discharge, please call tech support at TBP to provide specific support for charging.

5.4 INITIAL CHARGING

- 5.4.1 All general charging will be accomplished using the Constant Potential charge regime. Based on voltage, the battery should be charged as shown in Table 1.

Table 1

Battery Voltage	Process
<24V	Call Tech Support at Teledyne Battery Products. [The battery will need to be charged at constant current (1A) followed by the discharge and recharge as shown below].
24V–25.8V	Charge the battery at constant potential of 28.2 to 29 volts; Discharge at one-hour rate to 20V – then recharge at constant potential of 28.2 volts to 29 volts until charge current drops <0.7A. If after 12 hours of charge, the charge rate does not drop below required value, repeat for up to 6 discharge–charge cycles until charge current drops below 0.7A. If the batteries have been stored for extended periods of time (> 120 days), a capacity check will be essential to ensure the batteries are properly conditioned – as monitored during the cycling process. Verify that the battery provides design capacity. The battery should be conditioned within 6 cycles.
25.9V–26.2V	Charge at constant potential of 28.2 volts to 29 volts until current drops <0.7A

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5.5 OVERCHARGING

- 5.5.1 Overcharging will occur when using uncontrolled constant-current charging or if the voltage limit on a constant-voltage charger is higher than the manufacturer’s recommended value (see 5.2.4).
- 5.5.2 Prolonged overcharging will lead to loss of water from the electrolyte – in the form of gassing and grid corrosion.

Please call TBP Technical Support for any additional concerns with charging.

ROUTINE MAINTENANCE

6.1 INSPECTION/SERVICE PERIOD

After initial installation, TBP requires a capacity check of the battery to be performed at $1,200 \pm 50$ hours or 11 ± 1 months, whichever comes first, with subsequent capacity checks performed every 600 ± 50 hours or 6 ± 1 months. Please refer to aircraft manufacturer's guidelines for further clarification.

WARNING

The battery must be removed from the installation and serviced in a well-ventilated designated area. During servicing, the battery will generate oxygen and hydrogen gases, which can be explosive under the right conditions.

6.1.1 Battery Integrity

Visually inspect the battery for any signs of cracks, corrosion, unusual terminal pin wear or discoloration on the pins.

WARNING

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Caution must be exercised to avoid damage to the exterior case which could allow the contents to escape or come in physical contact with external materials or personnel.

If a battery case is found to be damaged, handle the battery with care and avoid contact with the skin. Inspect all areas adjacent to the battery for evidence of corrosion.

6.2 CONTINUED AIRWORTHINESS REQUIREMENT - CAPACITY TESTING

During this inspection process please follow the steps indicated in the following page. Before beginning the inspection, remove the battery from the aircraft to an inspection area.

This inspection process applies to batteries that are in service.

STEP	TASK
1	Measure the battery voltage and record it in the Battery Log Book, Q01-2002-01
2	Charge the battery using Constant Potential charging per section 5.2
3	Allow the battery to rest for 1 hour before conducting the discharge test.
4	<p>The battery should be discharged at the one hour rate (see Table 2, Appendix A) to an end voltage of 20V (1.67 volts per cell; per IEC60952-1). At the end of the first year, the battery should achieve at least 95% of the rated capacity (or 57minutes) at the one-hour rate.</p> <p>For each subsequent year, the battery life should be an additional 2.5% less, every 6 months, than the rated capacity. If the discharge time is less than the specified time, repeat the test once, starting from charging per Step 5.</p> <p>If the battery capacity loss exceeds the stated 2.5% every 6 months, but overall capacity is above the minimum requirements of 85%, capacity checks will be conducted every 3 months, using 1.25% capacity drop per this time period; until the capacity is measured to be less than 85%, at which point, the battery is rejected.</p>
5	Charge the battery using Constant Potential charging of $28.5 \pm 0.3V$ for 2 hours, followed by a 1A constant current charge for 18 hours. During the 1A charge, the battery will reach 32-32.5Volts. This is normal. Make sure the charger timer is set correctly.
6	Allow the battery to rest for 1 hour before conducting the discharge test.
7	Discharge the battery at the one hour rate - see step 4. If the battery passes, proceed to step 9, otherwise proceed to step 5 for one more cycle.
8	If the battery does not provide more than 85% of its rated capacity , reject the battery.
9	If the battery provides 85% of its rated capacity , recharge the battery at constant potential per section 5.2 and prepare for final inspection before installation in aircraft.
10	The battery must be inspected for components shown in sections 6.3 and 6.4 before installation.

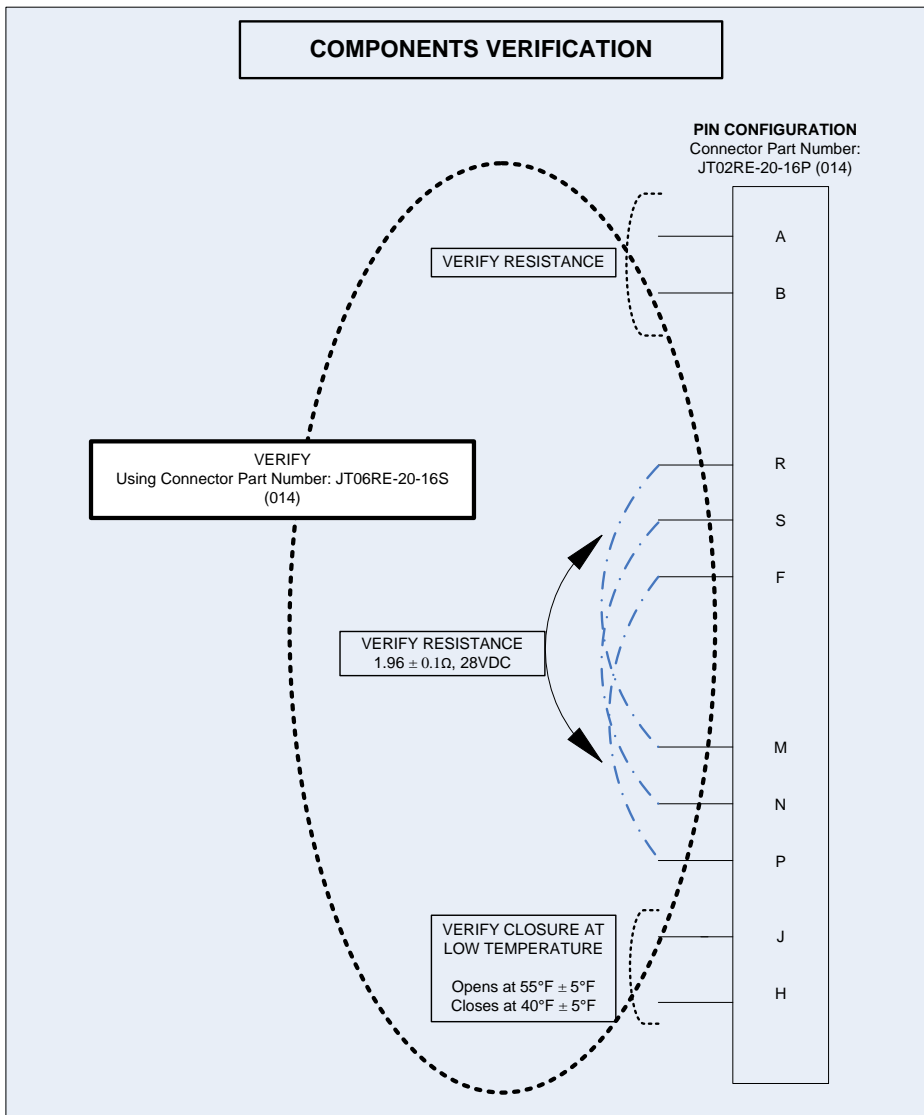
6.3 INSPECTION OF CONNECTORS

- 6.3.1 Before reconnecting to the aircraft, ensure that the connector sockets have not worn or become loose. This inspection can be performed with a go-no-go gauge, part number 3600-51, obtained from TBP.

6.4 INSPECTION OF HEATER CIRCUIT

- 6.4.1 The heater circuit and fuse can be verified by checking the resistance of the heater blanket and inline fuse across pins R-M, S-N and F-P at ambient temperatures of around 25°C (77°F). This check also verifies wiring connections to these pins. See Figure 5 for pin configuration.
- 6.4.2 Heater components can also be checked through pins MNP-RSF using the female connector wired for testing specific pins, or alternatively, one could use leads with alligator clips. See Figure 6.

Figure 5: Connector Pin Configuration



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Figure 6: Verification of Heater Blanket Connection – Pins MNP–RSF



- 6.4.3 To verify operation of thermostat, use recommended spray (see Appendix B) to provide the required cooling. The spray should be applied to the thermostat as shown in figure 7.
- 6.4.4 BEFORE APPLYING THE SPRAY, place a dry cloth to cover the space below the thermostat and to the right of the thermostat around the fuse.
- 6.4.5 In humid areas, the spray will introduce additional condensation – after the test – care must be taken to ensure the moisture does not soak back in spaces between the external casing and heater blanket underneath.
- 6.4.6 After the spray is applied for about 15–20 seconds, the thermostat will close and continuity will be observed across pins J–H as measured by a milli-ohmmeter or similar meter connected to these pins. If not, apply the spray for an additional 10–15 seconds and observe the meter.
- 6.4.7 After the test, wipe off any condensate carefully, using a clean dry cloth. Make sure the wiring and fuse are not damaged during this process.

Figure 7: Location of Thermostat



6.4.8 After these tests are successfully completed, the battery is ready for installation.

6.5 DEEP-DISCHARGE RECOVERY

6.5.1 Deep discharge is usually indicated by a battery voltage of less than 24 volts. A battery which has been deeply discharged can be recharged using constant-current charging techniques for best recovery.

6.5.2 Discharge the battery at the one hour rate (38A) until the battery drops to 20V.

- 6.5.3 Recharge the battery at a constant current charge rate of 1.0A for a total input (in ampere-hours) of 120% of the one-hour capacity, which is determined as follows:

For the 7638-38HT, the charge time is determined as follows:

$$1.2 (120\% \text{ input}) \times 38\text{Ah} = 45.6 \text{ Ah (Ampere-hours) needed.}$$

At the charge rate of 1.0 amperes, the total charge time would be:
 $45.6\text{Ah}/1.0\text{A} = 45.6 \text{ hours.}$ To reduce time, one can also use charge rates up to 2.5A

- 6.5.4 After a pause of about 1 hour, discharge the battery at the one hour rate (see Appendix A) until the battery drops to 20V under load. Record the time to 20V. If it is greater than 85% of specification (see Appendix A), recharge per Section 5.2 and return to use. If not, continue to Section 6.5.5.
- 6.5.5 Charge the battery at constant potential of $28.6\text{V} \pm 0.4\text{V}$ until the charge rate drops to 1A, followed by a constant current charge at 1A for 12 hours.
- 6.5.6 Discharge the battery at the one hour rate (see Appendix A) until the battery drops to 20V. The battery should be at least 85% of capacity. If the battery is lower than 85%, recharge per step 6.5.5 followed by discharge per step 6.5.4, one more time. If the battery does not provide more than 80% of the rated specification, it should be rejected.
- 6.5.7 Recharge the battery per 5.2 (Constant Potential Charge) before returning the battery to service.
- 6.5.8 Avoid subjecting a battery to frequent deep discharges as this can reduce the useful life of the battery.

UNSCHEDULED REMOVALS

Unscheduled removals may be required when the battery has been inadvertently discharged or has a premature failure. The battery should be charged and tested before making the final disposition.

- 7.1 Recharge the battery using Constant Potential method described in 5.2. Perform a capacity check as outlined in 6.2.3 through 6.2.6. If the battery fails to provide at least 85% of specified capacity as noted in the battery performance table, Appendix A, it should be replaced.
- 7.2 Alternatively, measure battery open circuit voltage and review approximate state of charge as shown in Figure 1. If the voltage is below 75% state-of-charge, the battery should be pulled out for servicing as outlined in Section 6.

TRANSPORTATION

- 8.1 TBP LT VRLA batteries are classified as “Nonspillable” and are exempted from all other requirements of 49 CFR, Chapter 1, Subchapter C, Parts 106 – 180, as determined in:
- a) US Department of Transportation’s 49CFR, Chapter 1, Part 173.159, paragraph “d”
 - b) IATA/ICAO Packing Instructions 806, Provision A67

RECYCLING

9.1 MATERIAL SAFETY DATA SHEETS

9.1.1 They can be downloaded as needed from the TBP website:

www.gillbatteries.com

9.2 RECYCLER LOCATIONS

9.2.1 All parts of spent lead-acid batteries are recyclable. Generally, batteries are collected by retailers and wholesalers who send large quantities to battery recyclers for reclamation. Battery recyclers are permitted hazardous waste treatment recycling facilities. If you have just a few batteries you should contact your local battery retailers or wholesalers.

9.2.2 Recycler in Southern California:

RSR Quemetco, Inc.
720 South 7th Avenue
City of Industry, CA 91745
(800)527-9452

9.2.3 The California Department of Toxic Substances Control publishes an annual listing of commercial hazardous waste recyclers, which also includes facilities outside of California. A copy of this publication, the "Directory of Industrial Recyclers" may be obtained by calling (916) 324-2423, or writing to the:

California Waste Exchange Resource Recovery Unit
Hazardous Waste Management Program
Department of Toxic Substances Control
P.O. Box 806
Sacramento, CA 95812-0806

9.2.4 **Nation-wide Recycling:**

Most retailers, auto parts stores or service outlets that sell new lead-acid batteries will accept a small number (one or two) of spent lead-acid batteries for recycling. If you have a larger quantity to be recycled, call to verify that your chosen outlet can handle a larger quantity of old batteries.

Even if you live in a state where there is no lead-acid battery recycling law, it's common for battery retailers everywhere in the U.S. to accept used lead-acid batteries from customers. The spent batteries collected by retailers are shipped to EPA licensed and regulated facilities for recycling.

For additional information, please use the following web address to locate nation-wide recycling facilities: www.batterycouncil.org

9.3 INTERNATIONAL RECYCLING RESOURCES

9.3.1 British Battery Manufacturers Association
26 Grosvenor Gardens
London SW1W 0GT
Direct Tel: +44 (0) 207 838 4800
Direct Fax: +44 (0) 207 838 4801

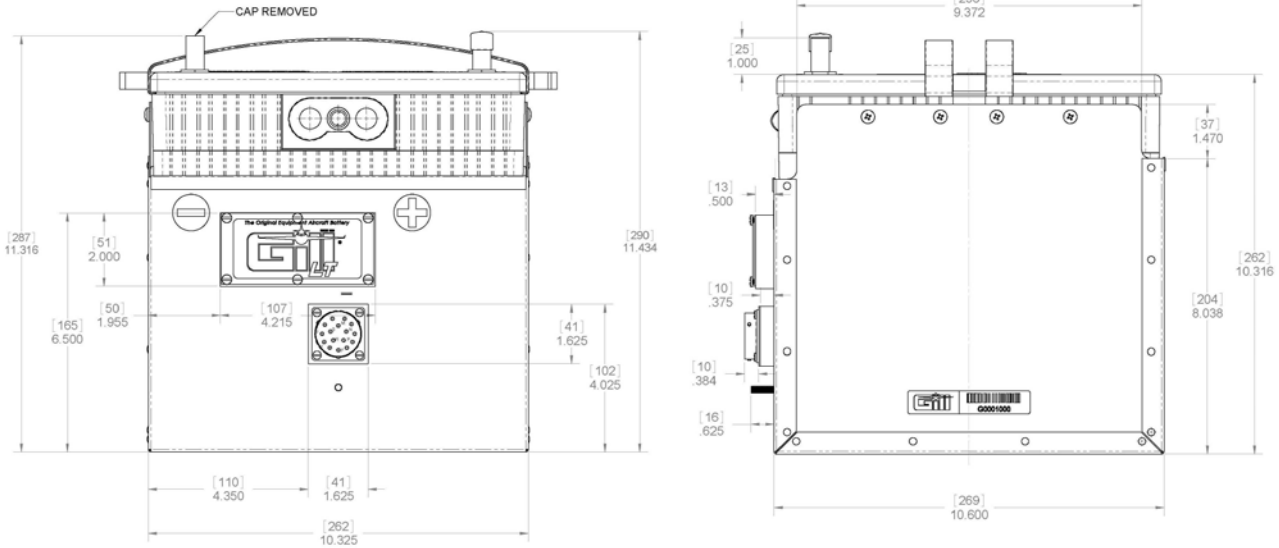
9.3.2 SNAM (Societe Nouvelle d'Affinage des Metaux)
Rue de la Garenne
St Quentin Sallavier
38297 La Verpilliere Cedex
France
Telephone: 00 33 74 945 985
Battery re-processing.

9.3.3 For smaller batteries, you may also contact the Rechargeable Battery Recycling Corporation (RBRC) at www.rbrc.com for directions.

GLOSSARY

Active material	The formed (charged) material on the positive and negative electrodes (plates).
AGM	Absorptive Glass Mat, a non-woven fiberglass separator that holds the electrolyte.
Ah	Ampere-hour; the standard designation of capacity units for batteries.
CFR	Code of Federal Regulations.
Electrolyte	The liquid added to a battery that is capable of conducting ions between the two electrodes.
Electrolysis	Decomposition of an electrolyte by the action of an electric current flowing through the electrodes (positive and negative plates) placed in the electrolyte.
IATA	International Air Transport Association.
ICAO	International Civil Aviation Organization.
IEC	International Electrotechnical Commission.
I_{pp}	Peak current delivered at 0.3 seconds into a 15 second controlled discharge at a constant terminal voltage of half the nominal battery voltage.
I_{pr}	Discharge current at the conclusion of a 15 second controlled discharge at a constant terminal voltage of half the nominal battery voltage
Nonspillable	Refers to the ability of the battery to retain the electrolyte when subjected to tests identified under US DOT Reg. 49 CFR, Part 173.159 (d).
OCV	Open Circuit Voltage; measured with no loads connected to the battery.
Passivation	Refers to the oxidation of the negative electrode.
Recombination	The process by which oxygen combines (reacts) with the negative active material.
Sponge lead	Fully charged negative plates convert to a very porous pure lead material, often referred as sponge lead since it resembles a sponge under high magnification.
Sulfation	The product of discharge, lead sulfate, formed on both positive and negative plates.
Venting	Means for a battery to release the gases it generates during charging.

APPENDIX A



DIMENSIONS IN [] ARE IN MILLIMETERS

Premium LT Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS

7638-38HT Specifications

TABLE 2

Type	Nominal Battery Voltage	One- Hour Rate (A)
7638-38HT	24	38

APPENDIX B

Freeze Spray Specification

Premium LT Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



TECHSPRAY®

Product Information

Freezer
 Diagnostic Freeze Spray
 1672

Introduction

An HFC-134a based, rapidly evaporating liquid that can chill to -62°F (-52°C). Because HFCs do not harm the ozone, this product has a zero ozone depletion factor. Used as a troubleshooting aid for intermittently faulting capacitors, resistors, semi-conductors, and other defective components. It also detects cold solder joints, cracks in printed circuit boards, and oxidized junctions.

Features / Benefits
 Non-Flammable
 Non-Ozone Depleting
 Chills to -62°F (-52°C)
 Zero Residue

Chemical Components

1,1,1,2-Tetrafluoroethane.....(811-97-2)	100%
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Environmental Policy

Techspray® is committed to developing products to ensure a safer and cleaner environment. We will continue to meet and sustain the regulations of all federal, state and local government agencies.

Packaging and Availability

Freezer is available in the following sizes:

1672-10S	10 Ounce Aerosol	
1672-15S	15 Ounce Aerosol	

Resources

Techspray® products are supported by global sales, technical and customer services resources.

For additional technical information on this product or other Techspray® products in the United States, call the technical sales department at 800-858-4043, email tsales@techspray.com or visit our web site at: www.techspray.com



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Countries Outside US

Call to locate a distributor
 in your country.

Important Notice to Purchaser/User: The information in this publication is based on tests that we believe are reliable. The results may vary due to differences in tests type and conditions. We recommend that each user evaluate the product to determine its suitability for the intended application. Conditions of use are outside our control and vary widely. Techspray's only obligation and your only solution is replacement of product that is shown to be defective when you receive it. In no case will Techspray® be liable for any special, incidental, or consequential damages based on breach of warranty, negligence or any other theory.



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