



TELEDYNE BATTERY PRODUCTS

VALVE-REGULATED LEAD-ACID AIRCRAFT BATTERY SERVICE MANUAL

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.



**COMPONENT MAINTENANCE
MANUAL**

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REVISIONS

Revision	Description of Change	Approved By	Date
NC	New document	J. Rajpara	1-24-03
A	Revised Appendix; Added Warranty and Prop 65 notification.	J. Rajpara	5-7-03
B	Added App. C, Battery Specs., App. D, MSDS's, and App. E, Eligibility List	J. Rajpara	6-23-03
C	Reviewed and revised; added appropriate warnings.	J. Rajpara	8-19-04
D	Added G-230S and G-242S	J. Rajpara	5-10-05
E	Added G-250S	J. Rajpara	12-8-06

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



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SCOPE

This manual provides Maintenance Procedures for Gill Valve-Regulated Lead-Acid Aircraft Batteries manufactured under FAA Parts Manufacturer Approvals (PMA's).

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

The latest list of our PMA's can be obtained on our website at: www.gillbatteries.com or by calling our Customer Support at (800) 456 0070.

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VALVE-REGULATED LEAD-ACID BATTERIES

3.1 DESCRIPTION

- 3.1.1 Valve-regulated lead-acid (VRLA) batteries contain all electrolyte absorbed in glass-mat separators, with no free electrolyte and are sometimes referred to as “sealed” or recombinant-gas batteries. The electrochemical reactions for VRLA batteries are the same as flooded batteries, except for the gas recombination mechanism that is predominant in VRLA batteries.

WARNING

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 Gill 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 position without spilling electrolyte.
- 3.1.4 The battery consists of twelve cells connected in series internally, making up a 24V battery, or six cells for 12V batteries. These cells are not replaceable.



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3.1.5 Each cell is constructed of premium grade electrodes (plates) that are isolated by AGM separators. These cells are inserted in the battery case under compression that helps to provide consistent availability of electrolyte with the tight pack providing good resistance to vibration.

3.2 SPECIFICATIONS

3.2.1 Gill 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.

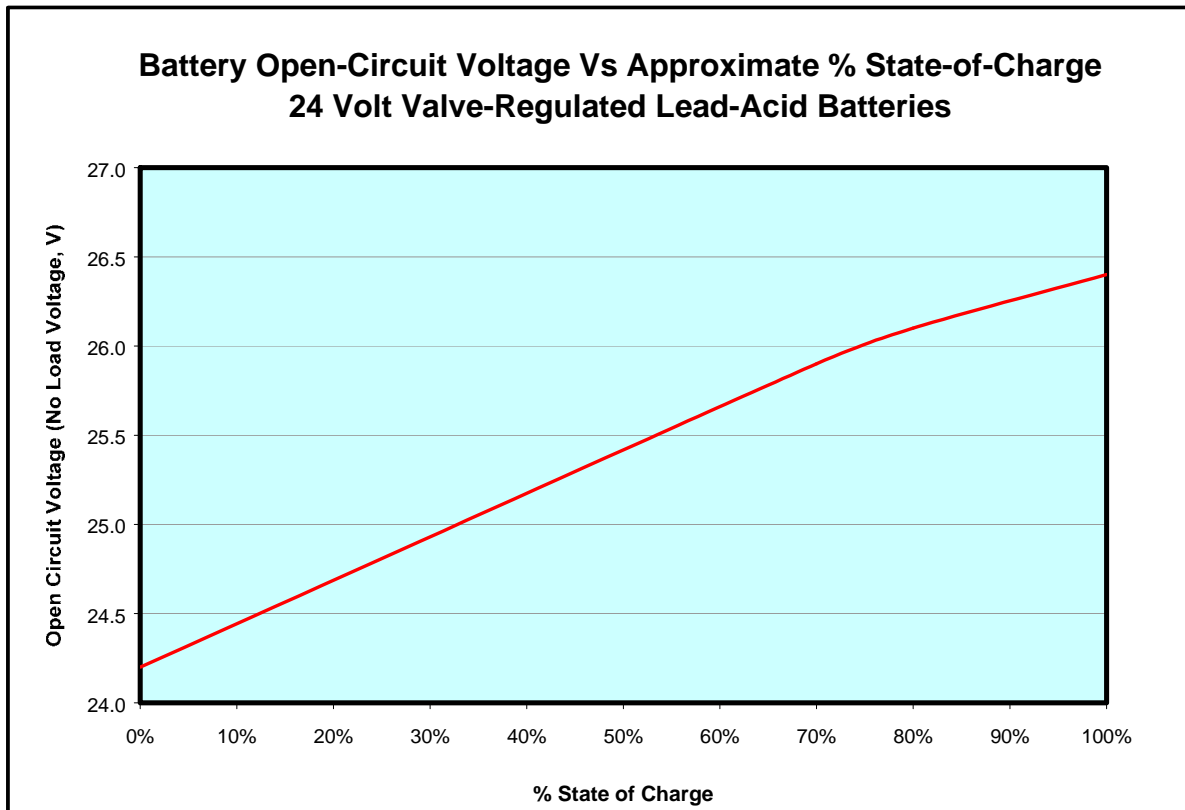
3.2.1.3 I_{pp} : This is the peak current delivered at 0.3 seconds into a 15 second controlled discharge at a constant terminal voltage of half the nominal battery voltage.

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



3.2.3. 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.

3.3 STC KIT PURCHASE

3.3.1 GILL STC KITS have been manufactured pursuant to FAA-Parts Manufacturer Approval (FAA-PMA) and are designed for use only with specified GILL batteries and parts. Teledyne Continental Motors Battery Products accepts no

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responsibility for any failure caused by any battery or part used with these kits which it does not manufacture, supply or specify.

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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 FAA Form 8130-3 or Certificate of Compliance.

4.3 STORAGE REQUIREMENTS

- 4.3.1 Valve-regulated lead-acid batteries can be stored between -20°F and $+110^{\circ}\text{F}$ (store ideally at 80°F). Storage at temperatures other than these, can lead to permanent damage.

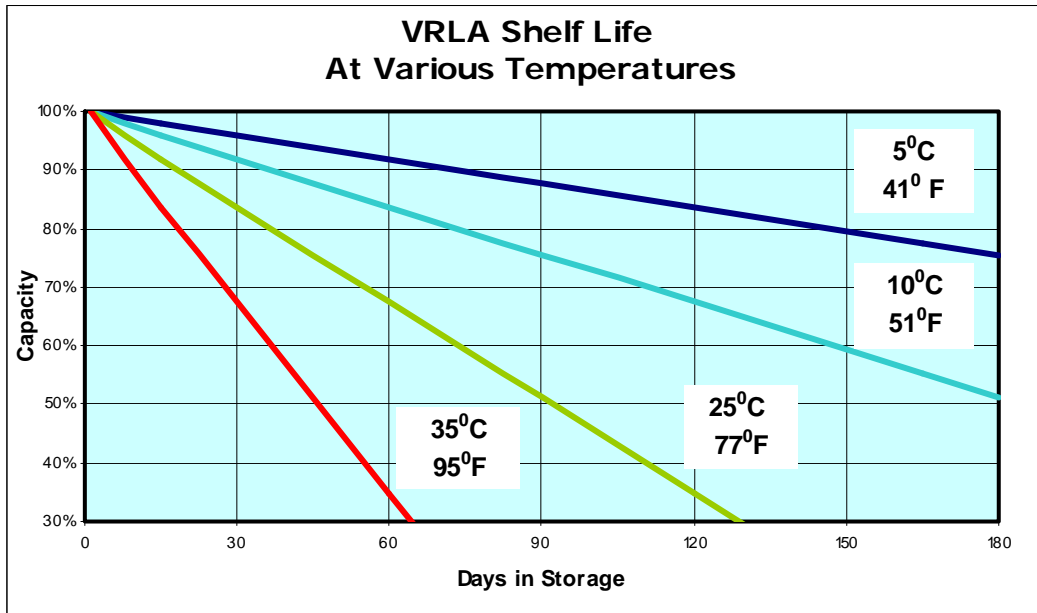
Storage temperatures will determine inspection requirements.

- 4.3.2 Gill VRLA batteries have a maximum of 12 months of inspection-free storage life, IF stored at temperatures between 40°F to 50°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. Typically, the batteries should be recharged around 50% state of charge.

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 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 Gill technical support if there are any questions regarding shelf life and recharge periods.

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

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the factory and do not require any re-seating. Call Gill Technical Support if you find any discrepancy.

- 4.4.2 DO NOT remove the lid. This is a “sealed” battery and does not need any other maintenance.
- 4.4.3 Inspect the open circuit voltage. If the OCV of the battery is between 25.5 to 26.0 volts, use Constant-Potential charging as described in 5.3; if the battery is below 25.5V call Gill Technical Support for guidance.

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

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.

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



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CHARGING

RECOMMENDATION

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

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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 10% to 20% more recharge than the amount of capacity removed during discharge.
- 5.1.3 Undercharging a battery occurs when the required 110% to 120% of the removed capacity is not returned during recharge. If this occurs repeatedly, residual lead sulfate will eventually increase in the plates, making it difficult to fully recharge the battery. In this case the battery will suffer a permanent loss of capacity.
- 5.1.4 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 5.3.4). 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 CONSTANT-CURRENT (CI)

- 5.2.1 These chargers must be capable of providing an output of ~ 35 volts and ~ 8 amperes (with selector switch) and provide a timer that can terminate charging when the required charge input is provided.
- 5.2.2 The ampere hours of energy restored is the product of rate of charge (in amperes) and the time (in hours).



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5.2.3 Since these chargers are designed to provide a constant current throughout the charging period, this method can lead to overcharging if not controlled. In order to control the charge input, these chargers must have a shut-off timer.

5.2.4 In order to reduce heat and minimize corrosion, it is preferred to use low rates (0.5amps to 5 amps) when charging batteries using this technique. Note explanation in 6.4 “Deep Discharge Recovery” for general outline on using constant current recharge.

The battery will get slightly warm during charge. Measured at the surface of the case, the battery temperature should not exceed 100°F.

5.2.5 For a complete list of all battery types and the charging rates, please use Table 1.

**TABLE 1
CONSTANT-CURRENT CHARGING RATES**

24 VOLT BATTERIES								
Battery No Load Voltage	One-Hour Capacity (Ah)							Charge Time (Hr)
	6.5	10	13	15	20	24	44	
	Charge Rates (Amps)							
>26.3	Charging Not Required							0
26.1 to 26.3	0.5	0.5	0.5	0.5	1	1	2	5
25.8 to 26.0	0.5	0.5	0.5	0.5	1	1	2	9
25.5 to 25.7	0.5	0.5	1	1.5	1	1	2	13

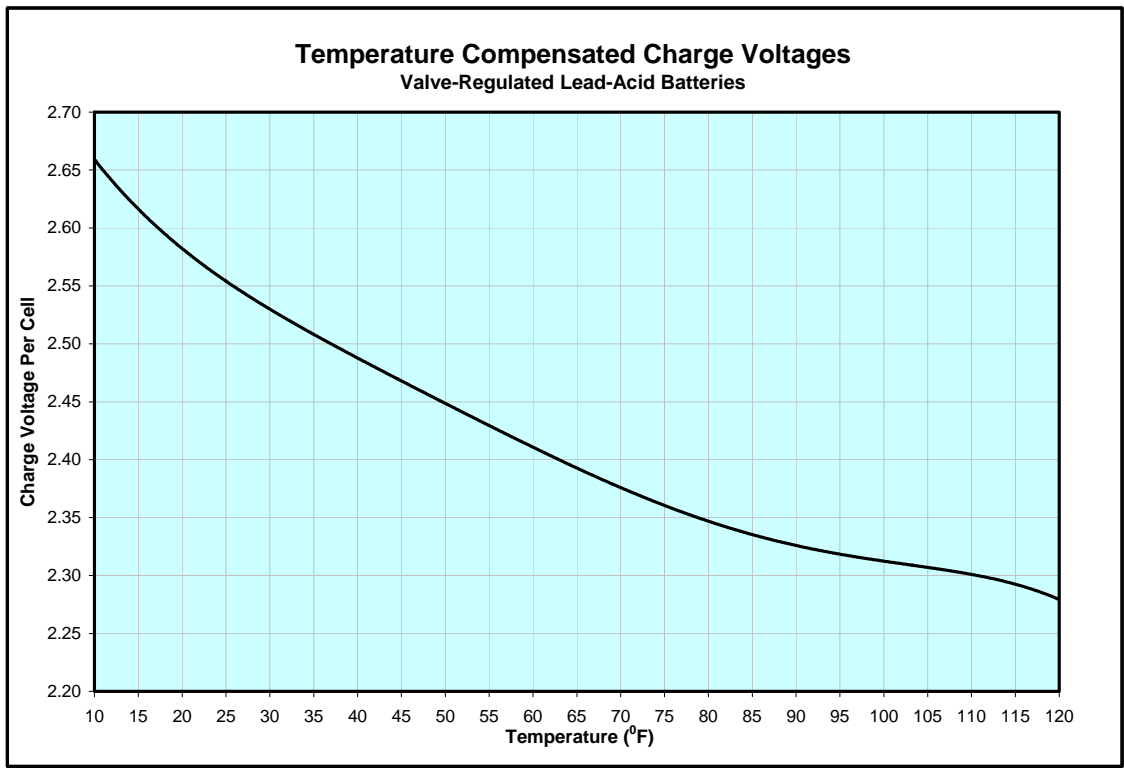
12 VOLT BATTERIES			
Battery No Load Voltage	One-Hour Capacity (Ah)		Charge Time (Hr)
	18	23	
	Charge Rate (Amps)		
>13.2	Charging Not Required		0
13 to 13.2	1	1	5
12.8 to 12.9	1	1	9
12.6 to 12.7	1	1	13

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5.3 CONSTANT-VOLTAGE (CV)

- 5.3.1 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.
- 5.3.2 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.
- 5.3.3 Typically, the charger will regulate to 28.4 volts (24 volt batteries) or 14.2 volts (12 volt batteries). As the battery approaches the charger output voltage, charge current will drop below 0.5 ampere.

FIGURE 3



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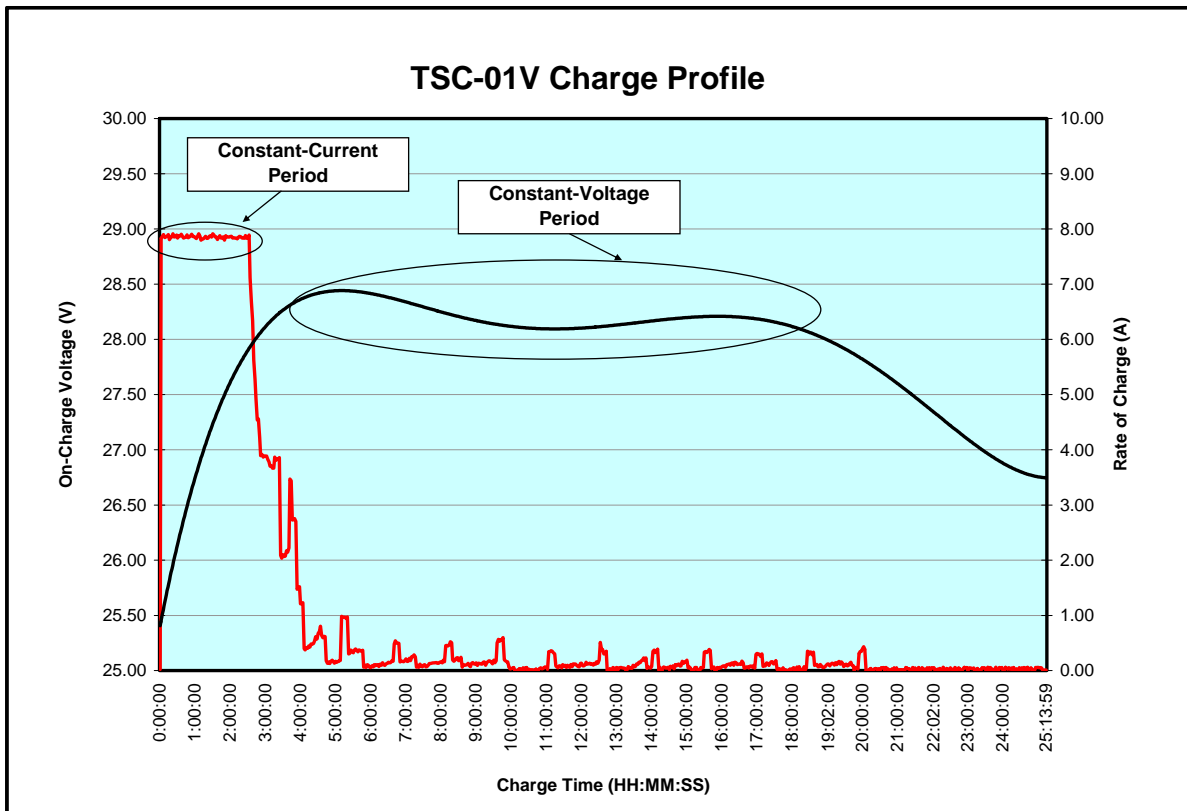
5.3.4 The battery must be connected to the charger with output voltage set between 28.2V and 28.6V for 24V batteries (14.1V to 14.3V for 12V batteries) and left on until the charge rate drops below 1 ampere. At this point, disconnect the charger from its power source first before disconnecting the battery 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.

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

5.3.6 Figure 4 represents Teledyne Battery Products' TSC-01V Charger profile. This is a specialized charger that provides a constant-current charge initially; thereafter, it switches to constant-voltage charge to the battery.

FIGURE 4





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5.4 OVERCHARGING

- 5.4.1 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 5.3.4).
- 5.4.2 Prolonged overcharging will lead to loss of water from the electrolyte - in the form of gassing and grid corrosion.

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

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ROUTINE MAINTENANCE

6.1 INSPECTION/SERVICE PERIOD

After initial installation, Gill requires a capacity check of the battery to be performed at 800 hours or 11 ± 1 months, whichever comes first, with subsequent capacity checks performed every 400 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

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.

6.2 CONTINUED AIRWORTHINESS REQUIREMENT – CAPACITY TESTING

During this inspection process the following components must be reviewed:

6.2.1 Measure and record the battery voltage.

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- 6.2.2 Charge the battery using Constant-Current or Constant-Voltage methods described in Section 5.
- 6.2.3 Allow the battery to rest for 4 hours before commencing the discharge test.
- 6.2.4 The battery should be discharged at the 1 hour rate (see Table 2, Appendix A) to an end voltage of 1.67 volts per cell or 20 volts (per IEC 60952-1). Measure the time. The battery must achieve at least 80% of the rated time (or 48 minutes at the 1 hour rate). If the first discharge time is less than 48 minutes, repeat the cycle one more time.
- 6.2.5 If the second discharge fails to deliver at least 48 minutes, the battery should be rejected. Call Gill Technical Support for further details.
- 6.2.6 If the discharge cannot be conducted according to the rates required, Teledyne Gill can provide the appropriate discharge curve for that battery and suggest alternative rates. These performance curves are also in Appendix C. Call Gill Technical Support for additional instructions.
- 6.2.7 Once the battery has passed all required inspections and after it is fully recharged using constant-voltage charging methods, the battery is ready for 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 Teledyne Gill.

6.4 DEEP-DISCHARGE RECOVERY

- 6.4.1 Deep discharge is usually indicated by a battery voltage of less than 21 volts. A battery which has been deeply discharged can be recharged using constant-current charging techniques. Constant-voltage method is not recommended.
- 6.4.2 The battery should be charged at a rate of 1.0A for a total input (in ampere-hours) of 200% of the one-hour capacity, which is determined as follows:



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For example, for a one-hour capacity of 44 Ah, the charge time is determined as follows:

$$2 \times 44\text{Ah} = 88 \text{ Ah (Ampere-hours) needed.}$$

At the charge rate of 1.0 amperes, the total charge time would be:

$$88 \text{ Ah} / 1.0\text{A} = 88 \text{ hours}$$

- 6.4.3 Stable voltage, measured 2 hours after charge termination, should be between 26.3V to 26.5V for 24V batteries and 13.1V to 13.3V for 12V batteries. If the voltage falls below the range specified, charging should be resumed using guidelines in 5.3.

Charging the battery to voltages higher than specified can shorten battery life.

- 6.4.4 Avoid subjecting a battery to frequent deep discharges as this can reduce the useful life of the battery.

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UNSCHEDULED REMOVALS

- 7.1 Unscheduled removals may be required when the battery has been inadvertently discharged or has a premature failure. Recharging the battery using Constant Current method described in 5.2 should be attempted. . Perform a capacity check as outlined in 6.2.3 through 6.2.6. If the battery fails to provide specified capacity as noted in Table 2, Appendix A, it should be rejected.
- 7.2 In lieu of the capacity test set forth above, testing on an installed battery may be performed during the 400-hour maintenance check, or the periodic maintenance interval performed by the service center. This test entails a battery OCV check which is compared to the graph 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.



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TRANSPORTATION

- 8.1 Gill 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

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RECYCLING

9.1 MATERIAL SAFETY DATA SHEETS

9.1.1 These have been included in Appendix C. They can be downloaded as needed from the Gill 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 The following is a listing of recyclers in California:

GNB, Inc. Resource Recycling Division
2700 South Indiana Street
Los Angeles, CA 90023
(213) 262-1101

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



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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.



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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).
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, paragraph "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.
State of Charge	The measure of charge level of a battery. This measure is not the same as available capacity. A "spent" battery could indicate a full state of charge (voltage) but has lower capacity than the battery started out with.
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.



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APPENDIX A

TABLE 2
VRLA Battery Capacities

Type	Battery Voltage	1 Hour Rate (A)	30 Minute Rate (Amps)
G-25S	12	18	30
G-35S	12	23	40
G-230S	24	6.5	9
G-242S	24	10	17
G-243S	24	13	20
G-250S	24	15	23
G-641S	24	20	35
G-639ES	24	24	40
G-6381ES	24	44	70

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APPENDIX B

VRLA Battery Specifications and Performance Curves

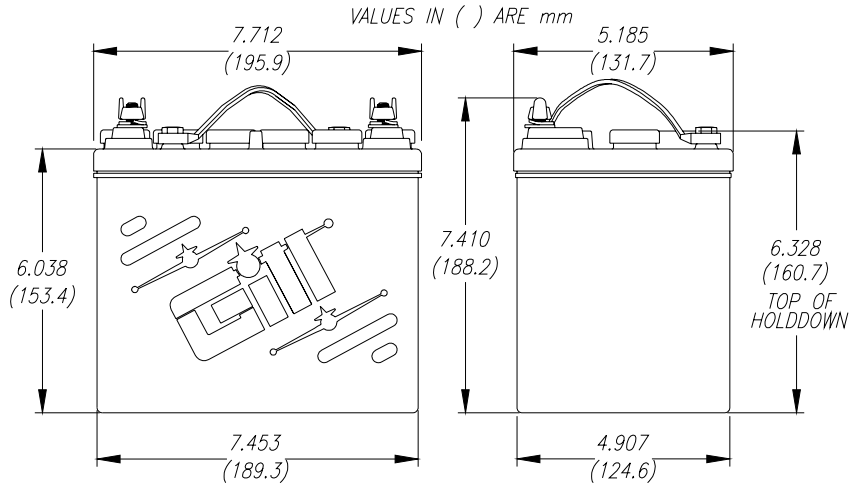
- 1) G-25S
- 2) G-35S
- 3) G-230S
- 4) G-242S
- 5) G-243S
- 6) G-250S
- 7) G-639ES
- 8) G-641S
- 9) G-6381ES

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



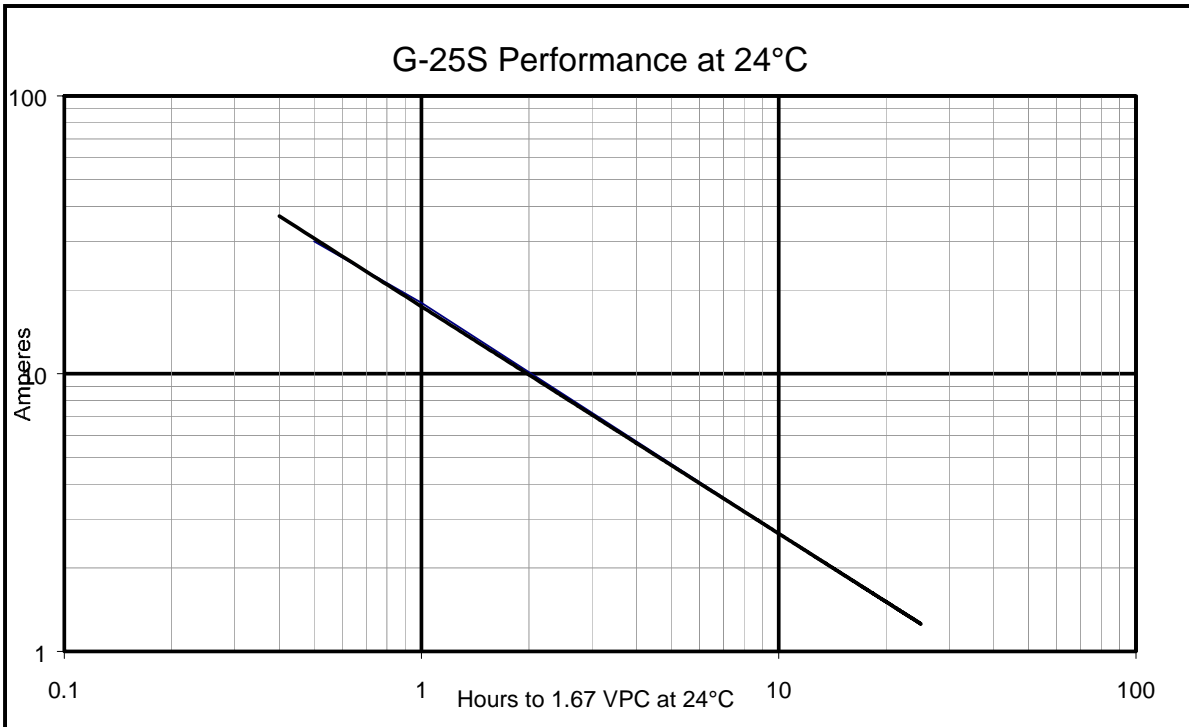
G-25S

**COMPONENT MAINTENANCE
MANUAL**



G-25S Performance

Power Rating, Current, at Various Temperatures							Battery Weight (lb)			
Run time	60 sec. (@ -18°C to 1.2 Volts per cell)	30 min. (@ 24°C to 1.67 Volts per cell)	1 hr (@ 24°C to 1.67 Volts per cell)	I _{pp} @ 24°C (A)	I _{pr} @ 24°C (A)	I _{pp} @ -18°C (A)		I _{pr} @ -18°C (A)	I _{pp} @ -30°C (A)	I _{pr} @ -30°C (A)
Watts	2,614	358	217	1,059	779	733	531	634	398	25
Amps	300	30	18							
Capacity (Ah)	5	15	18							
Energy (Wh)	44	179	217							

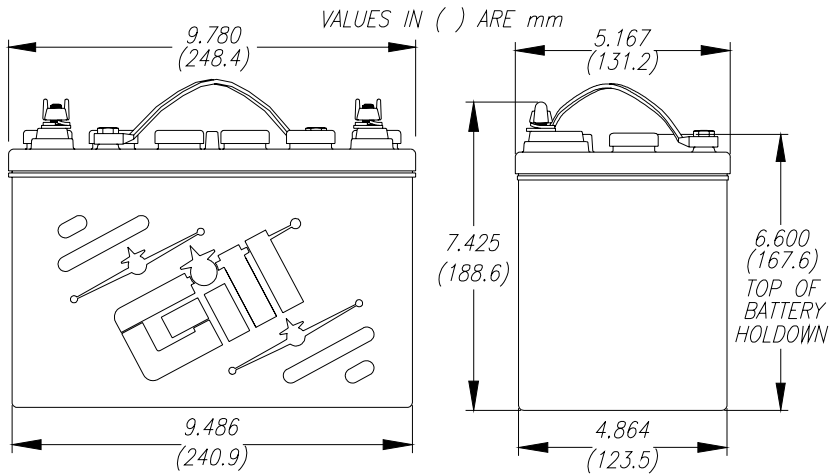


Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



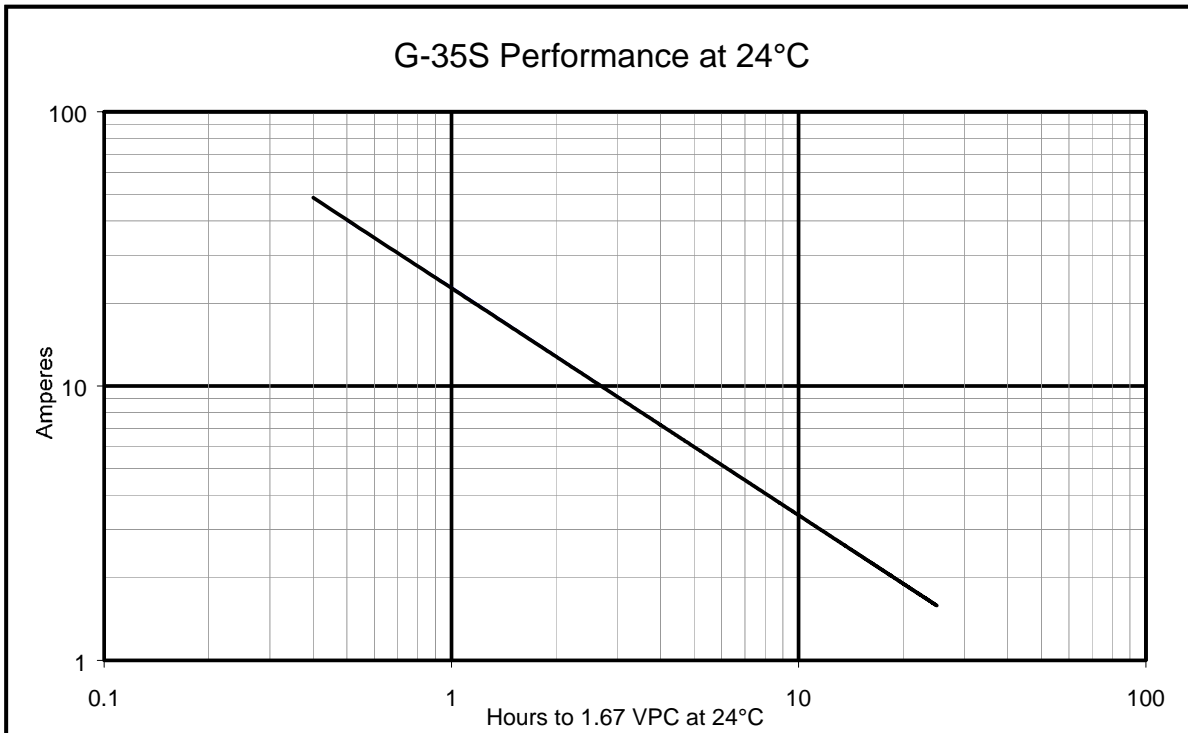
G-35S

**COMPONENT MAINTENANCE
MANUAL**



G-35S Performance

Power Rating, Current, at Various Temperatures							Battery Weight (lb)			
Run time	60 sec. (@ -18°C to 1.2 Volts per cell)	30 min. (@ 24°C to 1.67 Volts per cell)	1 hr (@ 24°C to 1.67 Volts per cell)	Ipp @ 24°C (A)	Ipr @ 24°C (A)	Ipp @ -18°C (A)		Ipr @ -18°C (A)	Ipp @ -30°C (A)	Ipr @ -30°C (A)
Watts	4,200	480	279	1,071	948	834	563	784	504	28.3
Amps	350	40	23							
Capacity (Ah)	6	20	23							
Energy (Wh)	70	240	279							

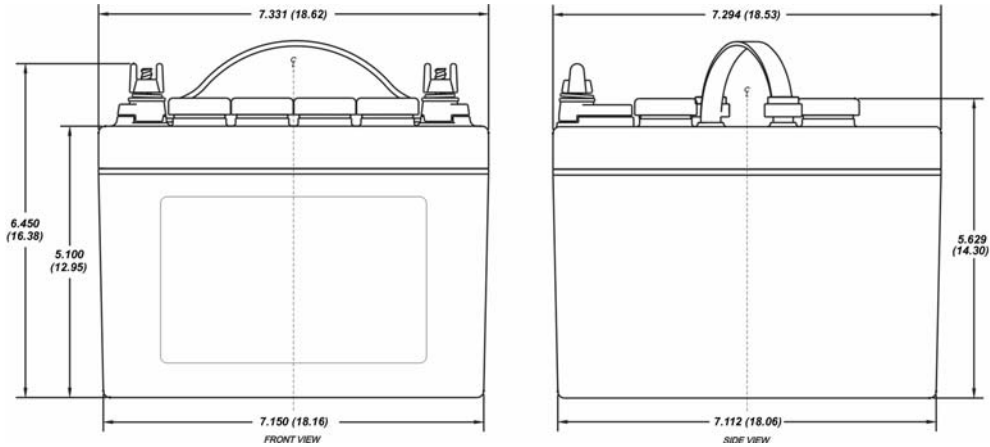


Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



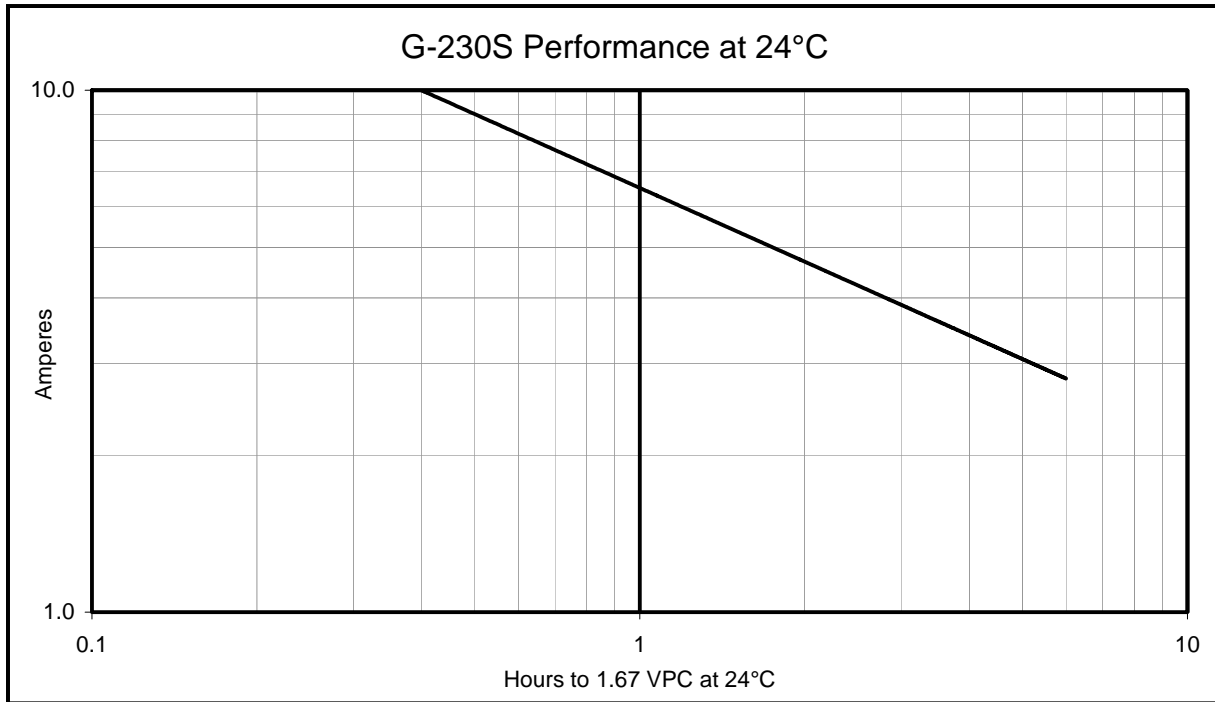
G-230S

**COMPONENT MAINTENANCE
MANUAL**



G-230S Performance

Power Rating, Current, at Various Temperatures											Battery Weight (lb)
Discharge	60 sec. (@ -18°C to 1.2 Volts per cell)	30 min. (@ 24°C to 1.67 Volts per cell)	1 hr (@ 24°C to 1.67 Volts per cell)	Ipp @ 24°C (A)	Ipr @ 24°C (A)	Ipp @ -18°C (A)	Ipr @ -18°C (A)	Ipp @ -30°C (A)	Ipr @ -30°C (A)		
Watts	1,162	216	156							18	
Amps	70	9.0	6.5	239	145						
Capacity (Ah)	1	4.5	6.5								
Energy (Wh)	19	108	156								

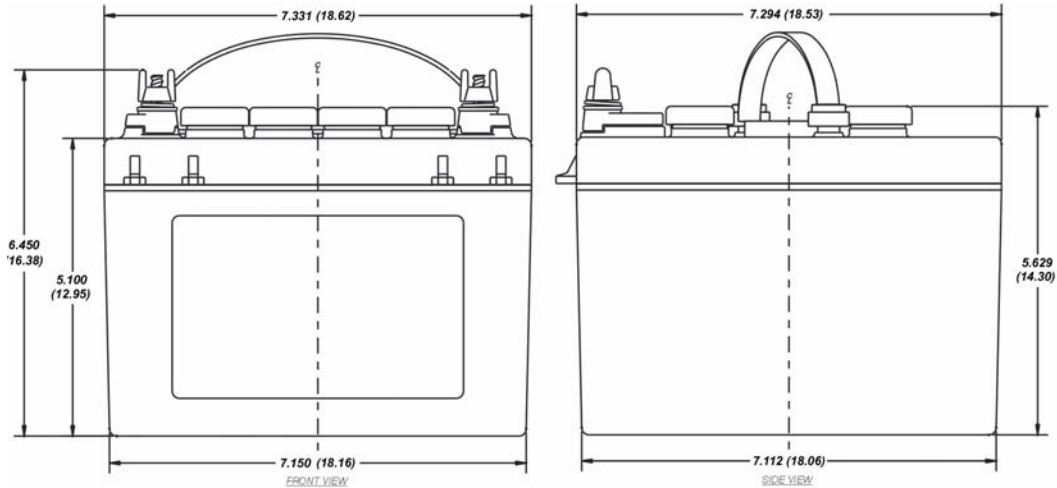


Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



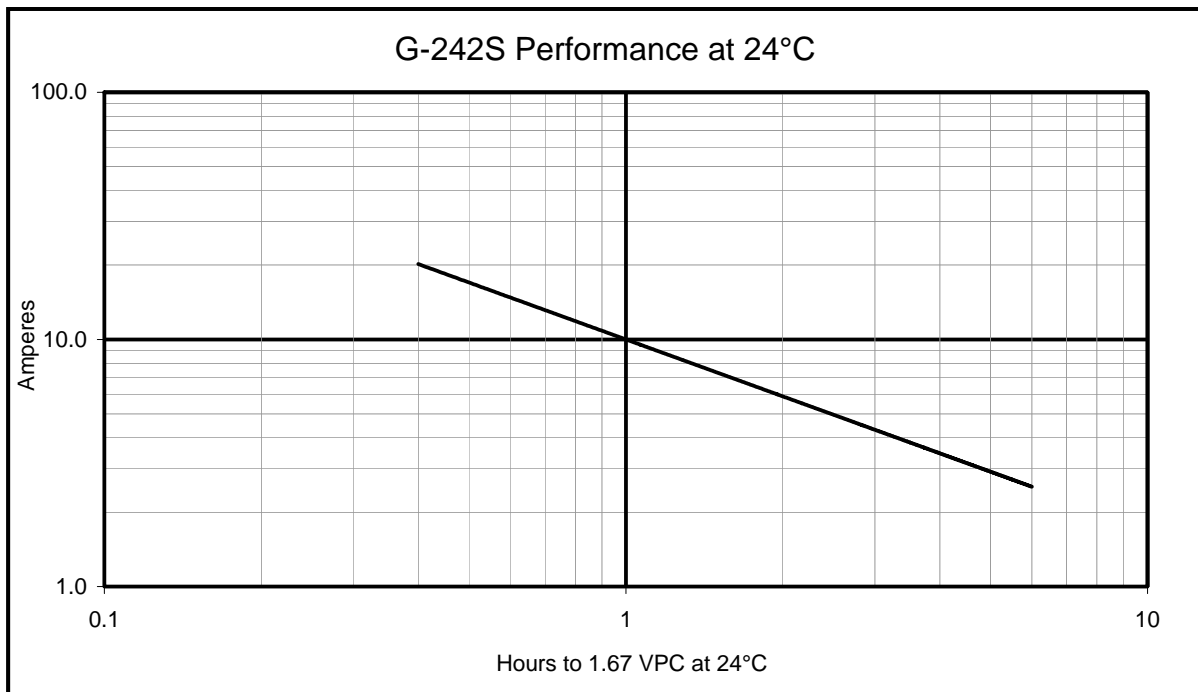
G-242S

**COMPONENT MAINTENANCE
MANUAL**



G-242S Performance

Power Rating, Current, at Various Temperatures									Battery Weight (lb)	
Discharge	60 sec. (@ -18°C to 1.2 Volts per cell)	30 min. (@ 24°C to 1.67 Volts per cell)	1 hr (@ 24°C to 1.67 Volts per cell)	Ipp @ 24°C (A)	Ipr @ 24°C (A)	Ipp @ -18°C (A)	Ipr @ -18°C (A)	Ipp @ -30°C (A)		Ipr @ -30°C (A)
Watts	2,490	408	240							27
Amps	150	17.0	10.0	856	366	476	366			
Capacity (Ah)	3	8.5	10.0							
Energy (Wh)	42	204	240							

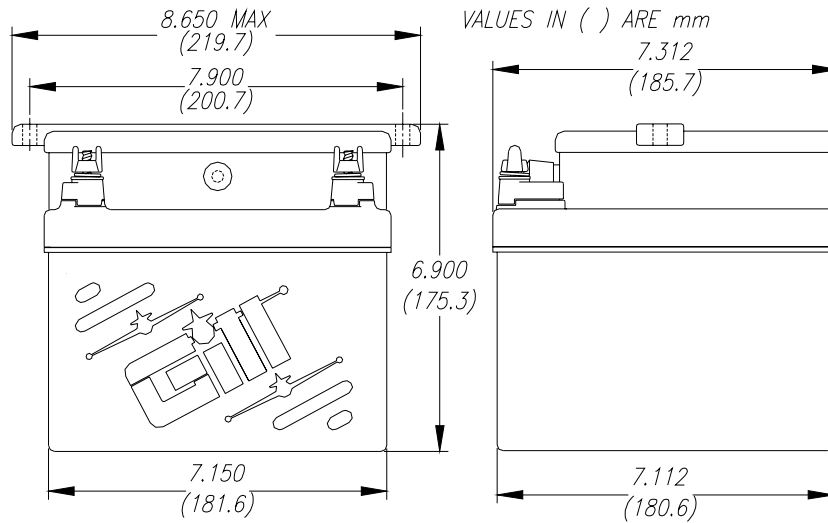


Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



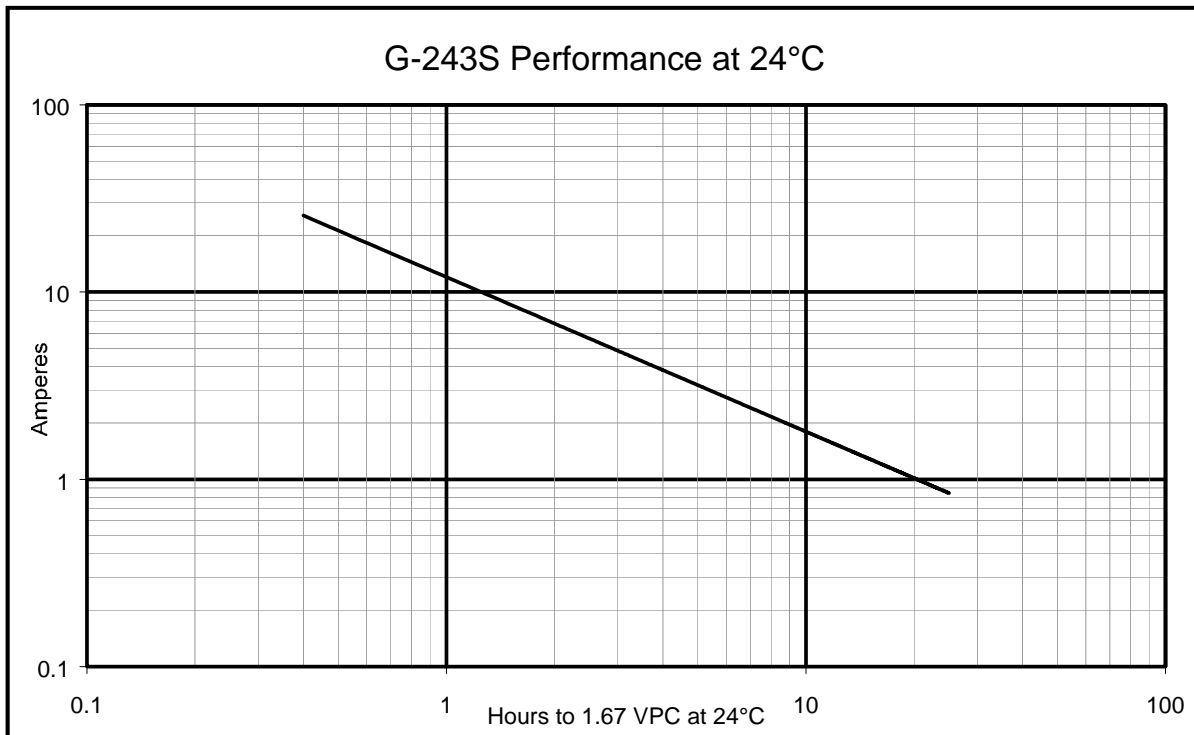
G-243S

**COMPONENT MAINTENANCE
MANUAL**



G-243S Performance

Power Rating, Current, at Various Temperatures							Battery Weight (lb)			
Discharge	60 sec. (@ -18°C to 1.2 Volts per cell)	30 min. (@ 24°C to 1.67 Volts per cell)	1 hr (@ 24°C to 1.67 Volts per cell)	Ipp @ 24°C (A)	Ipr @ 24°C (A)	Ipp @ -18°C (A)		Ipr @ -18°C (A)	Ipp @ -30°C (A)	Ipr @ -30°C (A)
Watts	3,154	480	312	1,278	402	803	346	627	224	29.8
Amps	190	20	13							
Capacity (Ah)	3	10	13							
Energy (Wh)	53	240	312							

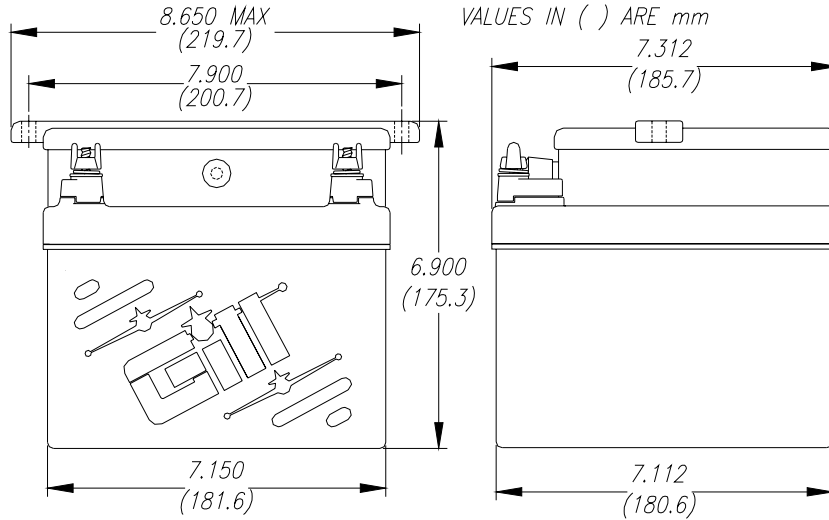


Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



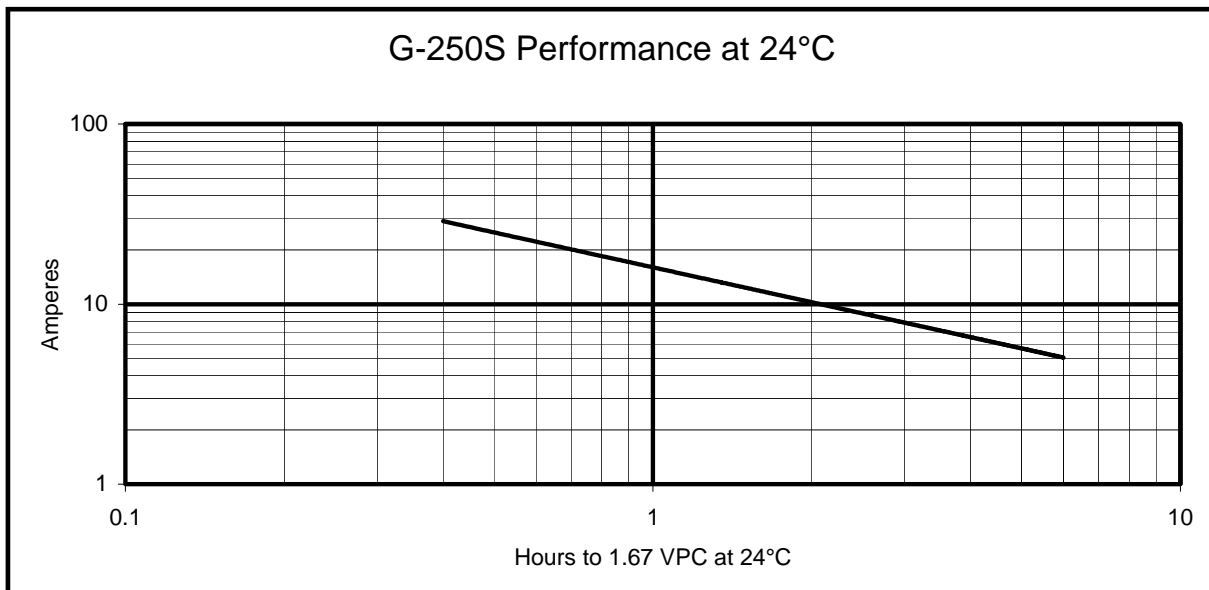
G-250S

**COMPONENT MAINTENANCE
MANUAL**



G-250S Performance Data

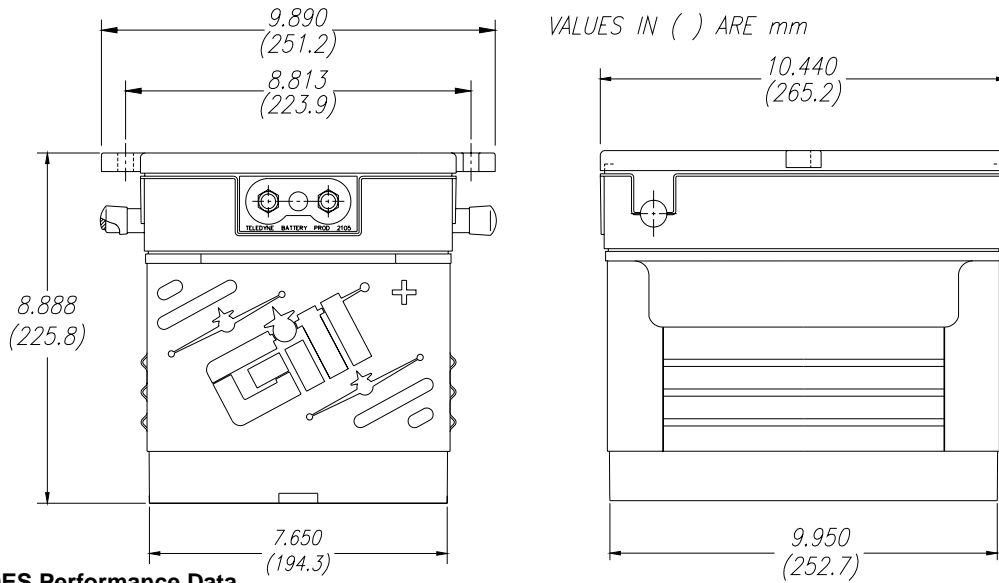
Power Rating Current at Various Temperatures										
Run time	60 sec. (@ -18°C 1.2 Volts per cell)	30 min. (@ 24°C 1.67 Volts per cell)	1 hr (@ 24°C 1.67 Volts per cell)	Ipp @ 24°C (A)	Ipr @ 24°C (A)	Ipp @ -18°C (A)	Ipr @ -18°C (A)	Ipp @ -30°C (A)	Ipr @ -30°C (A)	Battery Weight (lb)
Watts	0	600	360							31.5
Amps	0	25	15			719	261			
Capacity (Ah)	0	13	15							
Energy (Wh)	0	300	360							



Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS

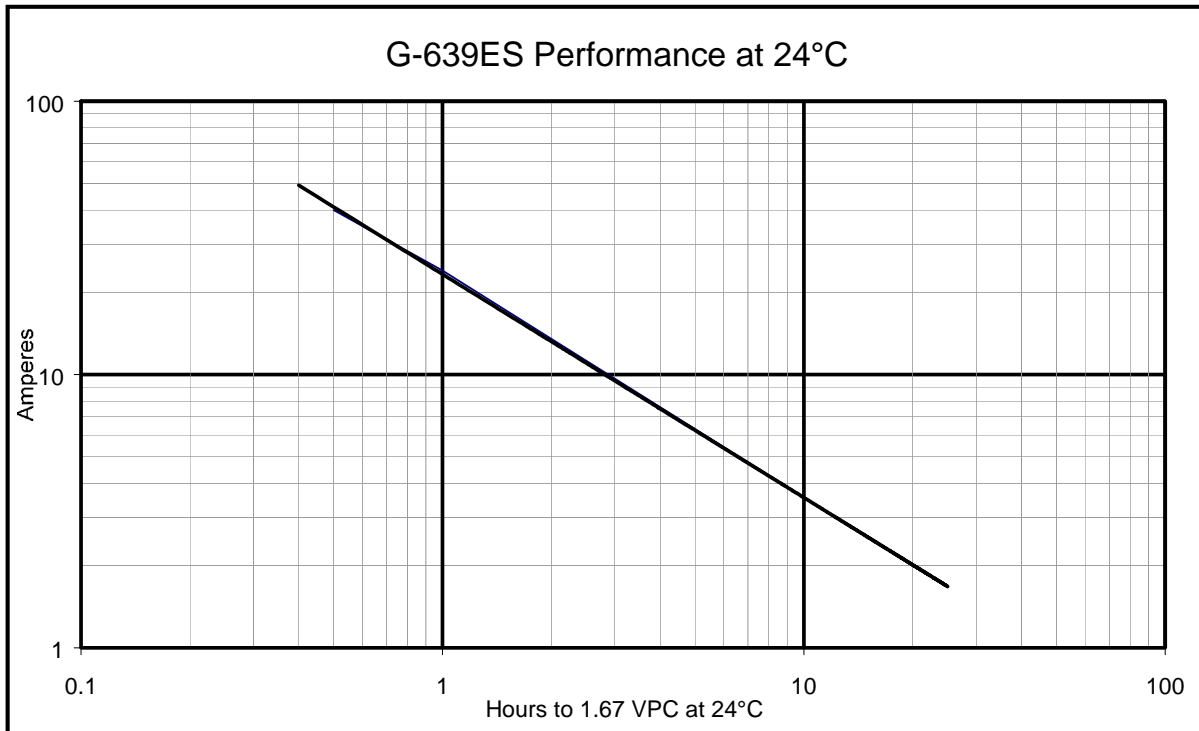


**COMPONENT MAINTENANCE
MANUAL**



G-639ES Performance Data

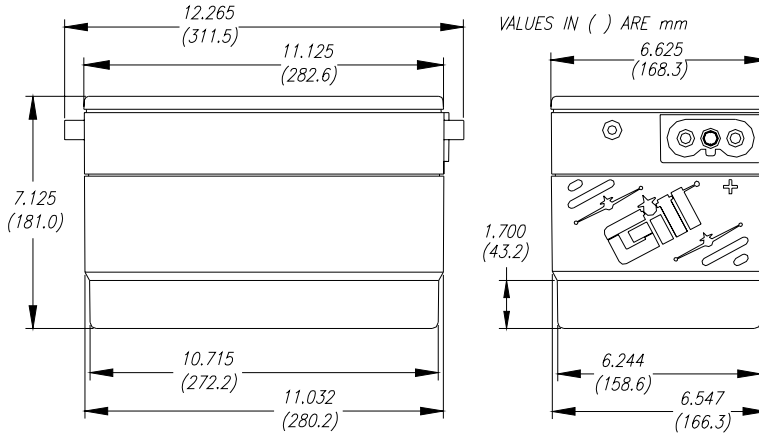
Power Rating, Current, at Various Temperatures							Battery Weight (lb)			
Run time	60 sec. (@ -18°C 1.2 Volts per cell)	30 min. (@ 24°C 1.67 Volts per cell)	1 hr (@ 24°C 1.67 Volts per cell)	Ipp @ 24°C (A)	Ipr @ 24°C (A)	Ipp @ -18°C (A)		Ipr @ -18°C (A)	Ipp @ -30°C (A)	Ipr @ -30°C (A)
Watts	5,727	970	581	1,503	1,002	1,104	734	866	596	60
Amps	400	40	24							
Capacity (Ah)	7	20	24							
Energy (Wh)	95	485	581							



Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS

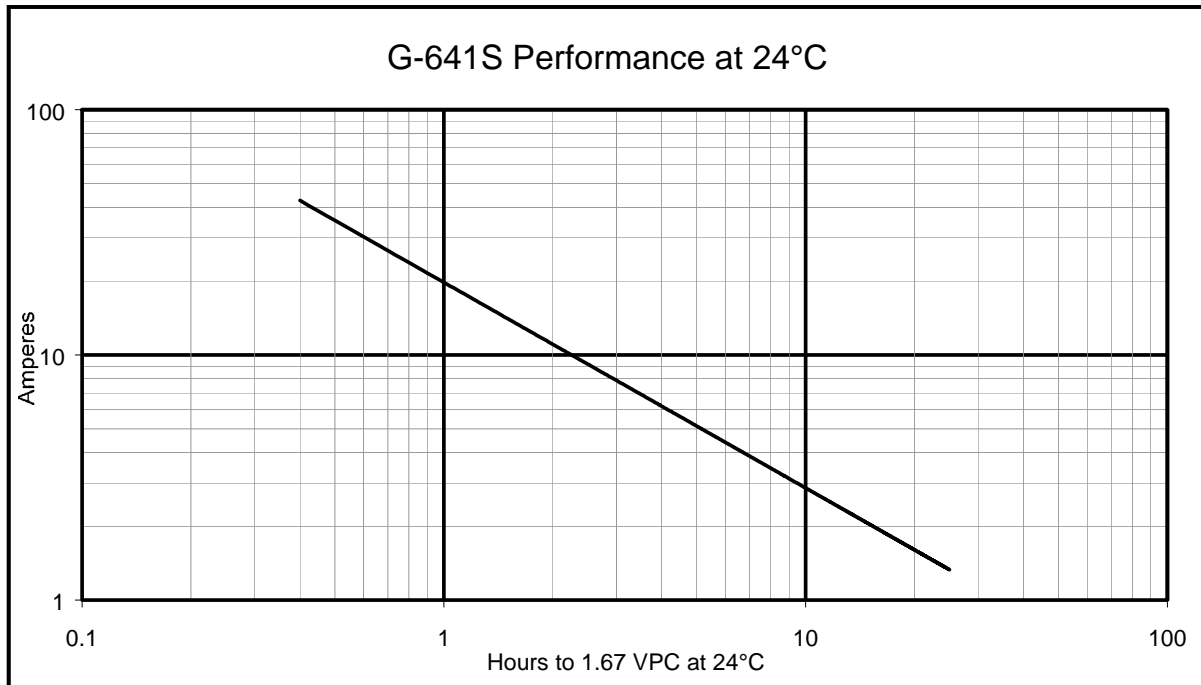


**COMPONENT MAINTENANCE
MANUAL**



G-641S Performance Data

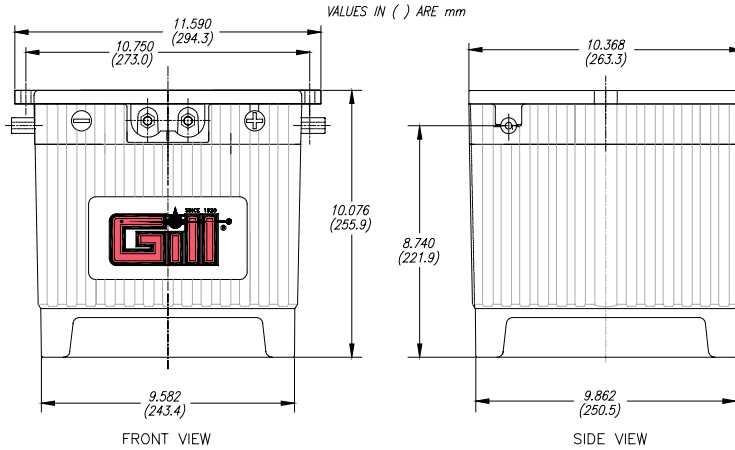
Power Rating, Current, at Various Temperatures							lpp @ 24°C (A)	lpr @ 24°C (A)	lpp @ -18°C (A)	lpr @ -18°C (A)	lpp @ -30°C (A)	lpr @ -30°C (A)	Battery Weight (lb)
Run time	60 sec. (@ -18°C 1.2 Volts per cell)	30 min. (@ 24°C 1.67 Volts per cell)	1 hr (@ 24°C 1.67 Volts per cell)										
Watts	4,466	860	488										44
Amps	290	35	20	1,685	385	1,453	563	1,047	554				
Capacity (Ah)	5	18	20										
Energy (Wh)	74	430	488										



Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS

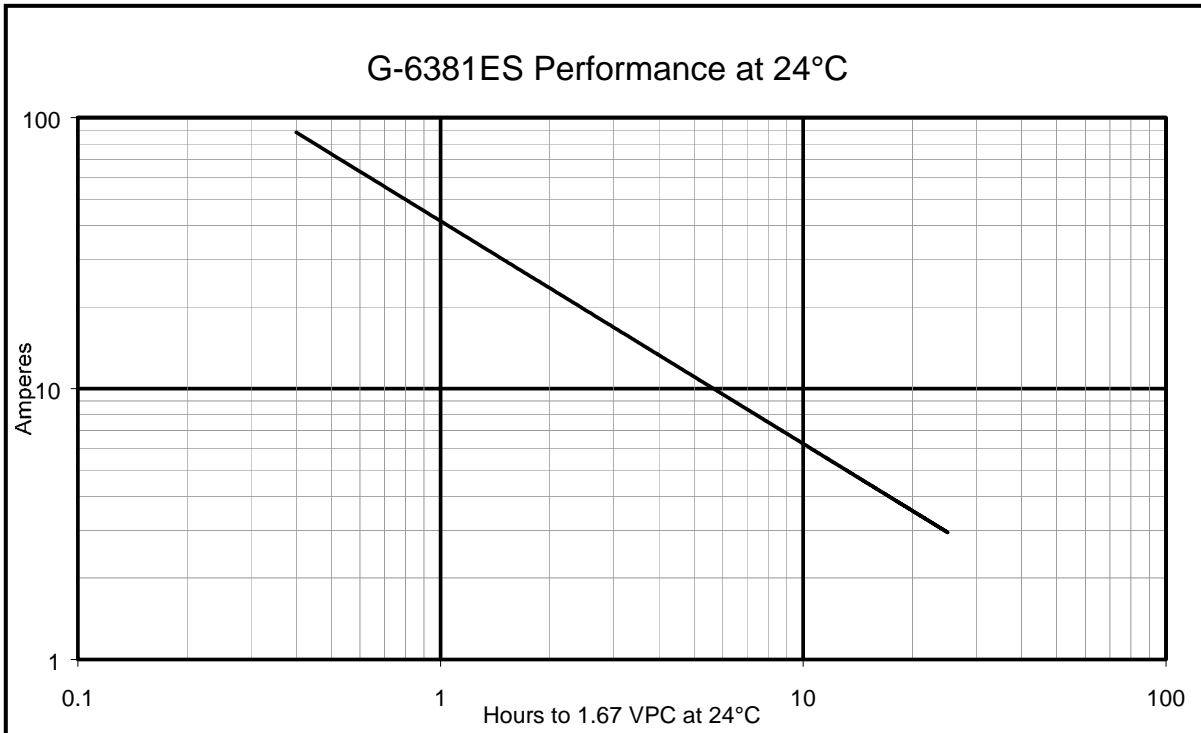


**COMPONENT MAINTENANCE
MANUAL**



G-6381ES Performance

Power Rating, Current, at Various Temperatures							Battery Weight (lb)		
Discharge	60 sec. (@ -18°C to 1.2 Volts per cell)	30 min. (@ 24°C to 1.67 Volts per cell)	1 hr (@ 24°C to 1.67 Volts per cell)	I _{pp} @ 24°C (A)	I _{pr} @ 24°C (A)	I _{pp} @ -18°C (A)		I _{pr} @ -18°C (A)	I _{pp} @ -30°C (A)
Watts	9,438	1,714	1,058	1,857	1,247	1,677	1,051	1,411	948
Amps	600	70	44						
Capacity (Ah)	10	35	44						
Energy (Wh)	157	857	1,058						
87									



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**COMPONENT MAINTENANCE
MANUAL**

APPENDIX C

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS

**TELEDYNE BATTERY PRODUCTS MATERIAL SAFETY DATA SHEET
LEAD-ACID NON-SPILLABLE BATTERY**

HAZARD RATING



**TELEDYNE BATTERY PRODUCTS
MATERIAL SAFETY DATA SHEET
LEAD-ACID NON-SPILLABLE BATTERY**

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

VENDOR ASSUMES NO RESPONSIBILITY FOR INJURY TO VENDEE OR THIRD PERSON PROXIMATELY CAUSED BY ABNORMAL USE OF THE MATERIAL EVEN IF REASONABLE SAFETY PROCEDURES ARE FOLLOWED. FURTHERMORE, VENDEE ASSUMES THE RISK IN THIS USE OF THE MATERIAL.

CONTRACT/ORDER NO.:-----
 NATIONAL STOCK NO.:-----
 SPECIFICATION REFERENCE NO.:-----
 DATE PREPARED: March 2003

SECTION I: PRODUCT IDENTIFICATION

MANUFACTURER'S NAME: TELEDYNE BATTERY PRODUCTS

ADDRESS: 840 WEST BROCKTON AVENUE
REDLANDS, CA 92374

TELEPHONE: 909-793-3131

24-HOUR EMERGENCY CONTACT: INFOTRAC 1-800-535-5053

PRODUCT NAME: VALVE-REGULATED LEAD ACID, NON-SPILLABLE BATTERY

TRADE NAME: TELEDYNE BATTERY, GILL AIRCRAFT BATTERY, CENTURION AND SILTRON

SYNONYMS: 12B90R, 690R, 691R, G-25S, G-30S, G-35S, G-243S, G-6381ES, G-630ES AND G641S

CHEMICAL FAMILY: LEAD AND LEAD COMPONENTS

FORMULA: NOT APPLICABLE

DOT DESCRIPTION: NON-SPILLABLE BATTERY

INTENDED USE: VALVE REGULATED/LEAD-ACID BATTERIES FOR AIRCRAFT, EMERGENCY LIGHTING, GROUND SUPPORT, ENGINE STARTING EQUIPMENT AND CABLE TV/TELECOMMUNICATIONS.



The Original Equipment Aircraft Battery

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SECTION II: HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	CAS #	WEIGHT %	OSHA PEL	ACGIH TLV	OSHA ACTION LEVEL
Lead and lead compounds	7439-92-1	<95	50 µg/m ³	0.15 mg/m ³	30 µg/m ³
Sulfuric acid (Electrolyte)	7664-93-9	<22	1 mg/m ³	1 mg/m ³	Not Applicable
Antimony	7440-36-0	<0.4	0.5 mg/m ³	0.5 mg/m ³	Not Applicable
Arsenic	7440-38-2	<0.1	10 µg/m ³	0.2 mg/m ³	5 µ/m ³
Barium sulfate	7727-43-7	<0.4	5 mg/m ³ **	10 mg/m ³	Not Applicable
Calcium compounds	7440-70-2	<0.1	5 mg/m ³ *	2 mg/m ³ *	Not Applicable
Carbon black extracts	1333-86-4	<0.1	3.5 mg/m ³	3.5 mg/m ³	Not Applicable
Magnesium sulfate	10034-99-8	<0.3	Not Applicable	Not Applicable	Not Applicable
Nickel Sulfate	7786-81-4	<0.1	0.1 mg/m ³	0.1 mg/m ³	Not Applicable
Sodium sulfate	7757-82-6	<0.3	10 mg/m ³ ^A	10 mg/m ³ ^A	Not Applicable
Selenium	7782-49-2	<0.1	0.2 mg/m ³	0.2 mg/m ³	Not Applicable
Tin compounds	7440-31-5	<0.5	2 mg/m ³	2 mg/m ³	Not Applicable

* As CaO ** Respirable ^ Total nuisance dust

SECTION III: PHYSICAL DATA

BOILING POINT: @ 760 mm Hg	LEAD 3164 °F (1740 °C)	MELTING POINT:	LEAD 621 °F (327.43 °C)
	ELECTROLYTE 203 °F (95 °C)		ELECTROLYTE N/A
SPECIFIC GRAVITY:	LEAD 11.34	VAPOR PRESSURE:	LEAD NEGLIGIBLE
	ELECTROLYTE 1.285		ELECTROLYTE 10 @ 18 °F
VAPOR DENSITY:	LEAD N/A	SOLUBILITY:	LEAD N/A
	ELECTROLYTE >1		ELECTROLYTE 100%
% VOLATILES BY VOL.:	NEGLIGIBLE	EVAPORATION RATE:	LEAD N/A
			ELECTROLYTE <1

APPEARANCE AND ODOR: NO ODOR. BATTERY CASE IS PINK, WHITE, OFF-WHITE, OR BLACK. ELECTROLYTE IS A CLEAR AND ODORLESS LIQUID.

SECTION IV: HEALTH HAZARD INFORMATION

ROUTES OF EXPOSURE	
INHALATION:	INHALATION OF ELECTROLYTE CAN CAUSE BURNS IN THE UPPER RESPIRATORY TRACT. LUNG IRRITATION AND PULMONARY EDEMA MAY OCCUR. LEAD DUST, VAPOR OR FUME MAY BE ABSORBED BY THE RESPIRATORY SYSTEM AND CAN RESULT IN BOTH ACUTE AND CHRONIC OVEREXPOSURE AS WELL AS RESPIRATORY IRRITATION.
SKIN CONTACT:	ELECTROLYTE MAY CAUSE BURNS OR LOCALIZED IRRITATION. LEAD IS NOT READILY ABSORBED THROUGH THE SKIN.
EYE CONTACT:	ELECTROLYTE MAY CAUSE IRRITATION, CORNEAL BURNS AND CONJUNCTIVITIS. BLINDNESS OR SEVERE OR PERMANENT INJURY MAY RESULT. LEAD DUST, VAPOR OR FUME MAY CAUSE IRRITATION.
INGESTION:	ELECTROLYTE MAY CAUSE BURNS TO THE MOUTH, ESOPHAGUS AND STOMACH. LEAD DUST, VAPOR OR FUME MAY BE ABSORBED BY THE RESPIRATORY SYSTEM AND CAN RESULT IN BOTH ACUTE AND CHRONIC OVEREXPOSURE.

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EFFECTS OF OVEREXPOSURE

ACUTE

OVEREXPOSURE: SULFURIC ACID MAY CAUSE IRRITATION TO THE EYES, NOSE AND THROAT. DIFFICULTY IN BREATHING MAY BE EXPERIENCED. ACID SPLASHED IN THE EYES OR ON THE SKIN MAY CAUSE BURNS OR IRRITATION. ACUTE UNTREATED OVEREXPOSURE TO LEAD MAY LEAD TO WEAKNESS, VOMITING, LOSS OF APPETITE, UN-COORDINATED BODY MOVEMENTS, CONVULSIONS, STUPOR AND POSSIBLY COMA.

CHRONIC

OVEREXPOSURE: REPEATED PROLONGED EXPOSURE TO DILUTE SULFURIC ACID MAY CAUSE IRRITATION OF THE SKIN. REPEATED OR PROLONGED EXPOSURE TO MIST OR VAPORS OF SULFURIC ACID MAY CAUSE EROSION OF THE TEETH, CHRONIC IRRITATION OF THE EYES OR CHRONIC INFLAMMATION TO THE NOSE, THROAT AND BRONCHIAL TUBES. UNDER NORMAL CONDITIONS OF USE, EXPOSURE TO LEAD OR LEAD CONTAINING COMPOUNDS DOES NOT OCCUR. CHRONIC UNTREATED EXPOSURE TO LEAD MAY CAUSE WEAKNESS, INSOMNIA, HYPERTENSION, SLIGHT IRRITATION TO SKIN AND EYES, METALLIC TASTE IN MOUTH, ANEMIA, CONSTIPATION, HEADACHE, MUSCLE AND JOINT PAINS, NEUROMUSCULAR DYSFUNCTION, POSSIBLE PARALYSIS, ENCEPHALOPATHY AND PNEUMOCONIOSIS. LEAD EXPOSURE CAN POSE RISK TO DEVELOPING FETUSES AND MAY ALSO IMPAIR THE REPRODUCTIVE SYSTEMS IN BOTH MEN AND WOMEN. DAMAGE TO THE KIDNEYS, HEMATOPOIETIC AND/OR CENTRAL NERVOUS SYSTEM MAY OCCUR.

CARCINOGENICITY

	IARC	NTP	OSHA
Lead	X		X
Arsenic	X	X	X
Sulfuric acid	X		

EMERGENCY AND FIRST AID PROCEDURES

EYES: (DRY OXIDE OR ACID) WASH IMMEDIATELY WITH LARGE AMOUNTS OF WATER, LIFTING THE LOWER AND UPPER LIDS CONTINUOUSLY. GET MEDICAL ATTENTION.

SKIN: NOT A DIRECT ROUTE OF ENTRY FOR LEAD AND LEAD COMPOUNDS. FOR ACID EXPOSURE, IMMEDIATELY FLUSH THE EXPOSED AREA OF THE SKIN WITH LARGE AMOUNTS OF WATER. REMOVE ANY CONTAMINATED CLOTHING AND SHOES (THIS CAN BE DONE WHILE UNDER SHOWER). GET MEDICAL ATTENTION FOR ACID EXPOSURE.

INHALATION: FOR LEAD AND LEAD COMPOUNDS EXPOSURE, REMOVE EMPLOYEE FROM AREA OF EXPOSURE AND GET MEDICAL ATTENTION. FOR ACID EXPOSURE, REMOVE EMPLOYEE TO FRESH AIR. IF PERSON IS NOT BREATHING AND HAS NO PULSE, PERFORM CPR. KEEP VICTIM WARM AND AT REST. IF BREATHING IS DIFFICULT, GIVE OXYGEN. GET IMMEDIATE MEDICAL ATTENTION.

INGESTION: FOR LEAD EXPOSURE, GET MEDICAL ATTENTION. FOR SULFURIC ACID, GIVE EMPLOYEE LARGE AMOUNTS OF WATER IF CONSCIOUS. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION. FOR LEAD, GET IMMEDIATE MEDICAL ATTENTION.

SECTION V: FIRE AND EXPLOSION DATA

FLASH POINT: N/A FOR LEAD 675 °F FOR POLYPROPYLENE CASE

AUTO IGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS IN AIR (% BY VOL): N/A

EXTINGUISHING MEDIA: USE HALON, DRY CHEMICAL EXTINGUISHER. BATTERY CASE WILL BURN.

SPECIAL FIRE FIGHTING PROCEDURES: USE OF WATER IN EXTINGUISHING BURNING BATTERIES MAY CAUSE SPATTERING DUE TO THE PRESENCE OF MOLTEN LEAD.

UNUSUAL FIRE AND EXPLOSION HAZARD: WHILE BATTERY IS BEING CHARGED, HYDROGEN GAS IS PRODUCED.

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BATTERY MAY EXPLODE IF HYDROGEN GAS IS TRAPPED INSIDE THE BATTERY CASE. KEEP IGNITION SOURCES AWAY.

SECTION VI: REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: NONE

INCOMPATIBILITY: CONTACT OF ELECTROLYTE WITH ORGANIC MATERIAL. ALSO CONTACT OF LEAD WITH STRONG OXIDIZERS MAY LIBERATE HYDROGEN GAS.

HAZARDOUS DECOMPOSITION PRODUCTS: SULFURIC ACID MIST, SULFUR DIOXIDE AND CARBON MONOXIDE MAY BE RELEASED WHEN ELECTROLYTE DECOMPOSES. NO DECOMPOSITION FOR LEAD AND LEAD COMPOUNDS.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: WILL NOT OCCUR.

SECTION VII: SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED: SHOULD A BATTERY BREAK OPEN, ISOLATE THE AREA. PICK UP AND CONTAINERIZE ALL BATTERY PARTS AND MATERIALS. LIMIT PERSONAL EXPOSURE WITH GLOVES, EYE AND FACE PROTECTION. ELECTROLYTE SHOULD BE ABSORBED WITH A NON-ORGANIC TYPE ABSORBENT SUCH AS DRY SAND OR EARTH. AVOID DILUTION WITH WATER. LEAD SPILLED FROM THE BATTERY SHOULD BE HEPA VACUUMED OR WET MOPPED, DO NOT DRY SWEEP OR USE COMPRESSED AIR.

NEUTRALIZING CHEMICALS: USE SODA ASH OR BAKING SODA TO NEUTRALIZE THE ELECTROLYTE.

WASTE DISPOSAL METHODS: BATTERY PARTS MAY BE RECYCLED BY AN EPA-PERMITTED SECONDARY LEAD SMELTING FACILITY OR DISPOSED OF AS HAZARDOUS WASTE PURSUANT TO RCRA REQUIREMENTS.

SECTION VIII: SPECIAL PROTECTION INFORMATION

HANDLING AND STORAGE: EXERCISE CAUTION IN HANDLING AND STORAGE DUE TO WEIGHT OF UNITS.

OTHER PRECAUTIONS: DO NOT ALLOW METAL OR OTHER CONDUCTIVE MATERIAL TO SHORT CIRCUIT TERMINALS. HEAT, SPARK, DAMAGE TO ELECTRICAL CIRCUITS, AND FIRE MAY RESULT FROM SHORT CIRCUITING. PRACTICE GOOD HYGIENE TO MINIMIZE PERSONAL EXPOSURE. BATTERY MAY RELEASE HYDROGEN DURING CHARGING OR IF EXPOSED TO HIGH TEMPERATURES. DO NOT STORE IN AIR TIGHT CONTAINER.

VENTILATION REQUIREMENTS: BATTERY CHARGING AREAS MUST BE ADEQUATELY VENTILATED TO PREVENT HAZARDOUS CONCENTRATIONS OF FLAMMABLE GAS OR ACID MIST. DESIGN CRITERIA FOR VENTILATION SYSTEMS ARE CONTAINED IN THE INDUSTRIAL VENTILATION MANUAL PUBLISHED BY THE ACGIH.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY: UNDER NORMAL CONDITIONS OF USE RESPIRATORY PROTECTION IS NOT REQUIRED. HOWEVER, SHOULD CONDITIONS ARISE WHERE RESPIRATORS ARE NEEDED, USE ONLY NIOSH/MSHA RESPIRATORS APPROVED FOR DUST, FUME AND MIST.

EYE: CHEMICAL GOGGLES, FULL FACE SHIELD.

SKIN: GLOVES APPROVED FOR SULFURIC ACID.

MSDS 1002

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Updated: March 2003

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OTHER: ACID RESISTANT APRON.

SECTION IX: SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS:

SHOULD A BATTERY BREAK OPEN AND A LEAD SPILL OCCURS, PRECAUTIONS SHOULD BE TAKEN TO PREVENT LEAD DUST FROM BECOMING AIR BORNE. INDIVIDUALS SHOULD WEAR RESPIRATORY PROTECTION, PROTECTIVE CLOTHING, RUBBER GLOVES AND EYE PROTECTION IF CONDUCTING A LEAD SPILL CLEAN UP.

AVOID THE USE OF NON-INSULATED TOOLS. IF THEY ARE REQUIRED, TAKE CARE NOT TO MAKE A CONNECTION BETWEEN THE TWO BATTERY TERMINALS AS SEVERE SPARKING MAY OCCUR WHICH COULD RESULT IN AN EXPLOSION. RINGS, METAL WATCH BANDS, NECKLACES AND OTHER JEWELRY SHOULD BE REMOVED WHILE SERVICING BATTERIES.

SUFFICIENT VENTILATION SHOULD BE PROVIDED IN ALL WORK AREAS TO PREVENT A BUILD UP OF DANGEROUS GASES. IF THE BATTERY ROOM'S AIR IS CONDITIONED AS PART OF AN OVERALL BUILDING SYSTEM, THE EXHAUST AIR FROM THE BATTERY ROOM SHOULD NOT BE RETURNED TO THE AIR DISTRIBUTION SYSTEM. THE ROOM SHOULD HAVE ITS OWN EXHAUST SYSTEM CONNECTED DIRECTLY TO OUTSIDE AIR. HYDROGEN AND OXYGEN GASES ARE PRODUCED DURING NORMAL BATTERY OPERATION, ESPECIALLY DURING CHARGING. HYDROGEN GAS IS LIGHTER THAN AIR, COLORLESS, ODORLESS AND TASTELESS, THEREFORE IT IS DIFFICULT TO DETECT WITHOUT SPECIAL EQUIPMENT. ALWAYS ASSUME THAT SMALL AMOUNTS OF GASES ARE PRESENT AND TAKE ALL NECESSARY PRECAUTIONS.

SECTION X: OTHER WARNINGS

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.**

SARA TITLE III

THE CHEMICALS LISTED BELOW ARE TOXIC CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 AND 40 CFR PART 372.

MATERIAL OR COMPONENT	CAS #	WEIGHT %
Lead and lead compounds	7439-92-1	<95
Sulfuric acid	7664-93-9	<22
Antimony	7440-36-0	<0.4
Arsenic	7440-38-2	<0.1
Selenium	7782-49-2	<0.1

THIS LEAD-ACID BATTERY IS CLASSIFIED AS A MANUFACTURED ARTICLE (40 CFR 372.3) AND THE HAZARDOUS MATERIALS (LEAD, ANTIMONY, ARSENIC AND NICKEL COMPOUNDS) CONTAINED WITHIN ARE NOT RELEASED UNDER NORMAL CONDITIONS OF USE. SINCE THESE CHEMICALS ARE NOT RELEASED DURING NORMAL USE THEY ARE EXEMPT FROM THE REPORTING REQUIREMENTS CONTAINED IN 40 CFR PART 372 SUBPART B. HOWEVER, SULFURIC ACID MAY BE RELEASED INTO THE ENVIRONMENT IF A BATTERY BREAKS AND THEREFORE MAY NOT BE EXEMPT FROM THE REPORTING REQUIREMENTS OF SARA TITLE III. SEE EXEMPTIONS, 40 CFR 372.38 (b).

THIS INFORMATION SHOULD BE INCLUDED IN ALL MSDS'S THAT ARE COPIED AND DISTRIBUTED FOR THIS MATERIAL.

UPDATED BY: JESUS BUENO LUNA, ENVIRONMENTAL / HEALTH AND SAFETY COORDINATOR
DATE: MARCH 2003

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



**COMPONENT MAINTENANCE
MANUAL**

**TELEDYNE BATTERY PRODUCTS MATERIAL SAFETY DATA SHEET
BATTERY ELECTROLYTE**

**TELEDYNE BATTERY PRODUCTS
MATERIAL SAFETY DATA SHEET
BATTERY FLUID (ELECTROLYTE)**

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

VENDOR ASSUMES NO RESPONSIBILITY FOR INJURY TO VENDEE OR THIRD PERSON PROXIMATELY CAUSED BY ABNORMAL USE OF THE MATERIAL EVEN IF REASONABLE SAFETY PROCEDURES ARE FOLLOWED. FURTHERMORE, VENDEE ASSUMES THE RISK IN THIS USE OF THE MATERIAL.

CONTRACT/ORDER NO.: _____
 NATIONAL STOCK NO.: _____
 SPECIFICATION REFERENCE NO.: _____
 DATE PREPARED: March 2003

HAZARD RATING:
 HEALTH _____3
 FLAMMABILITY _____0
 REACTIVITY _____2
 PERSONAL PROTECTION _____D

SECTION I: PRODUCT IDENTIFICATION

MANUFACTURER'S NAME: TELEDYNE BATTERY PRODUCTS

ADDRESS: 840 WEST BROCKTON AVENUE
 REDLANDS, CA 92374

TELEPHONE: 909-793-3131

24-HOUR EMERGENCY CONTACT: INFOTRAC 1-800-535-5053

TRADE NAME: BATTERY ELECTROLYTE, VARIOUS GRADES

SYNONYMS: SULFURIC ACID

FORMULA: H₂SO₄

DOT DESCRIPTION: CONSUMER COMMODITY ORM-D

INTENDED USE: ELECTROLYTE FOR LEAD-ACID BATTERIES

SECTION II: HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	CAS #	WEIGHT %	OSHA PEL	ACGIH TLV	OSHA ACTION LEVEL
Sulfuric acid	7664-93-9	<50	1 mg/m ³	1 mg/m ³	Not Applicable

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



The Original Equipment Aircraft Battery

COMPONENT MAINTENANCE MANUAL

TELEDYNE BATTERY PRODUCTS MATERIAL SAFETY DATA SHEET BATTERY ELECTROLYTE

SECTION III: PHYSICAL DATA

BOILING POINT:	203 °F (95 °C)	MELTING POINT:	N/A
@ 760 mmHg			
SPECIFIC GRAVITY:	1.22 to 1.40	VAPOR PRESSURE:	< 1 mmHg @ 70 °F
VAPOR DENSITY:	>1	SOLUBILITY (in Water):	100%
% VOLATILES BY VOL.:	N/A	EVAPORATION RATE:	<1
APPEARANCE AND ODOR: CLEAR LIQUID, NO ODOR.			

SECTION IV: HEALTH HAZARD INFORMATION

ROUTES OF EXPOSURE

INHALATION: INHALATION OF ELECTROLYTE CAN CAUSE BURNS IN THE UPPER RESPIRATORY TRACT. LUNG IRRITATION AND PULMONARY EDEMA MAY OCCUR.

SKIN CONTACT: ELECTROLYTE MAY CAUSE BURNS OR LOCALIZED IRRITATION.

EYE CONTACT: ELECTROLYTE MAY CAUSE IRRITATION, CORNEAL BURNS AND CONJUNCTIVITIS. BLINDNESS OR SEVERE OR PERMANENT INJURY MAY RESULT.

INGESTION: ELECTROLYTE MAY CAUSE BURNS TO THE MOUTH, ESOPHAGUS AND STOMACH.

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE: SULFURIC ACID MAY CAUSE IRRITATION TO THE EYES, NOSE AND THROAT. DIFFICULTY IN BREATHING MAY BE EXPERIENCED. ACID SPLASHED IN THE EYES OR ON THE SKIN MAY CAUSE BURNS OR IRRITATION.

CHRONIC OVEREXPOSURE: REPEATED PROLONGED EXPOSURE TO DILUTE SULFURIC ACID MAY CAUSE IRRITATION OF THE SKIN. REPEATED OR PROLONGED EXPOSURE TO MIST OR VAPORS OF SULFURIC ACID MAY CAUSE EROSION OF THE TEETH, CHRONIC IRRITATION OF THE EYES OR CHRONIC INFLAMMATION TO THE NOSE, THROAT AND BRONCHIAL TUBES.

CARCINOGENICITY	IARC	NTP	OSHA
Sulfuric acid	X		

EMERGENCY AND FIRST AID PROCEDURES

EYES: WASH IMMEDIATELY WITH LARGE AMOUNTS OF WATER, LIFTING THE LOWER AND UPPER LIDS CONTINUOUSLY. GET MEDICAL ATTENTION.

SKIN: IMMEDIATELY FLUSH THE EXPOSED AREA OF THE SKIN WITH LARGE AMOUNTS OF WATER. REMOVE ANY CONTAMINATED CLOTHING AND SHOES (THIS CAN BE DONE WHILE UNDER SHOWER). GET MEDICAL ATTENTION.

INHALATION: REMOVE EMPLOYEE FROM AREA OF EXPOSURE TO FRESH AIR. IF PERSON IS NOT BREATHING AND HAS NO PULSE, PERFORM CPR. KEEP VICTIM WARM AND AT REST. IF BREATHING IS DIFFICULT, GIVE OXYGEN. GET IMMEDIATE MEDICAL ATTENTION.

INGESTION: GIVE EMPLOYEE LARGE AMOUNTS OF WATER IF CONSCIOUS. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION.

MSDS 1003

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Updated: March 2003

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



COMPONENT MAINTENANCE MANUAL

TELEDYNE BATTERY PRODUCTS MATERIAL SAFETY DATA SHEET BATTERY ELECTROLYTE

SECTION V: FIRE AND EXPLOSION DATA

FLASH POINT: N/A
AUTO IGNITION TEMPERATURE: N/A
FLAMMABLE LIMITS IN AIR (% BY VOL): N/A
EXTINGUISHING MEDIA: USE DRY CHEMICAL OR CO2 EXTINGUISHER FOR SMALL FIRES. WATER FOG FOR LARGE FIRES.
SPECIAL FIRE FIGHTING PROCEDURES: N/A

SECTION VI: REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: NONE
INCOMPATIBILITY: CONTACT OF ELECTROLYTE WITH ORGANIC MATERIAL...
HAZARDOUS DECOMPOSITION PRODUCTS: SULFURIC ACID MIST, SULFUR DIOXIDE AND CARBON MONOXIDE MAY BE RELEASED WHEN ELECTROLYTE DECOMPOSES.
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION VII: SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED: ELECTROLYTE SHOULD BE ABSORBED WITH A NON-ORGANIC TYPE ABSORBENT SUCH AS DRY SAND OR EARTH. AVOID DILUTION WITH WATER.
NEUTRALIZING CHEMICALS: USE SODA ASH OR BAKING SODA TO NEUTRALIZE ELECTROLYTE.
WASTE DISPOSAL METHODS: ELECTROLYTE SHOULD BE HAULED TO A PERMITTED TREATMENT FACILITY.

SECTION VIII: SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS: BATTERY CHARGING AREAS MUST BE ADEQUATELY VENTILATED TO KEEP VAPOR AND MIST CONCENTRATIONS BELOW EXPOSURE LIMITS. DESIGN CRITERIA FOR VENTILATION SYSTEMS ARE CONTAINED IN THE INDUSTRIAL VENTILATION MANUAL PUBLISHED BY THE ACGIH.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY: UNDER NORMAL CONDITIONS OF USE RESPIRATORY PROTECTION IS NOT REQUIRED. HOWEVER, SHOULD CONDITIONS ARISE WHERE RESPIRATORS ARE NEEDED, USE ONLY NIOSH/MSHA RESPIRATORS APPROVED FOR DUST, FUME AND MIST.
EYE: CHEMICAL GOGGLES, FULL FACE SHIELD.
SKIN: GLOVES APPROVED FOR SULFURIC ACID.
OTHER: ACID RESISTANT APRON.

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



COMPONENT MAINTENANCE MANUAL

TELEDYNE BATTERY PRODUCTS MATERIAL SAFETY DATA SHEET BATTERY ELECTROLYTE

SECTION IX: SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS:

AVOID THE USE OF NON-INSULATED TOOLS. IF THEY ARE REQUIRED, TAKE CARE NOT TO MAKE A CONNECTION BETWEEN THE TWO BATTERY TERMINALS AS SEVERE SPARKING MAY OCCUR WHICH COULD RESULT IN AN EXPLOSION. RINGS, METAL WATCH BANDS, NECKLACES AND OTHER JEWELRY SHOULD BE REMOVED WHILE SERVICING BATTERIES.

SUFFICIENT VENTILATION SHOULD BE PROVIDED IN ALL WORK AREAS TO PREVENT A BUILD UP OF DANGEROUS GASES. IF THE BATTERY ROOM IS AIR CONDITIONED AS PART OF AN OVERALL BUILDING SYSTEM, THE EXHAUST AIR FROM THE BATTERY ROOM SHOULD NOT BE RETURNED TO THE AIR DISTRIBUTION SYSTEM. THE ROOM SHOULD HAVE ITS OWN EXHAUST SYSTEM CONNECTED DIRECTLY TO OUTSIDE AIR. HYDROGEN AND OXYGEN GASES ARE PRODUCED DURING NORMAL BATTERY OPERATION, ESPECIALLY DURING CHARGING. HYDROGEN GAS IS LIGHTER THAN AIR, COLORLESS, ODORLESS AND TASTELESS, THEREFORE IT IS DIFFICULT TO DETECT WITHOUT SPECIAL EQUIPMENT. ALWAYS ASSUME THAT SMALL AMOUNTS OF GASES ARE PRESENT AND TAKE ALL NECESSARY PRECAUTIONS.

SECTION X: OTHER WARNINGS

PROPOSITION 65

N/A

SARA TITLE III

THE CHEMICALS LISTED BELOW ARE TOXIC CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 AND 40 CFR PART 372.

MATERIAL OR COMPONENT	CAS #	WEIGHT %
Sulfuric acid	7664-93-9	<50

THIS INFORMATION SHOULD BE INCLUDED IN ALL MSDS THAT ARE COPIED AND DISTRIBUTED FOR THIS MATERIAL.

UPDATED BY: JESUS BUENO LUNA, ENVIRONMENTAL / HEALTH AND SAFETY COORDINATOR
DATE: MARCH 2003

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



COMPONENT MAINTENANCE MANUAL

APPENDIX D

FAA-PMA ELIGIBLE INSTALLATION LIST AND SUPPLEMENT DATA

Drawing 1516 Revised: 8-18-04

NUMBER:	ELIGIBLE FOR INSTALLATION ON:	PMA-SUP
G-240	Cessna models: 152, 172, 182	4
G-241	Cessna models: 152, 172, 182, 172R, 172S	4, 42
G-242	Cessna models: 152, 172, 177, 182, 207, 210, 336, 337	4
G-242	Piper models: PA-23, PA-31, PA-36	4
G-243	Cessna models: 152, 182, A152, 172, 172R, 172RG, 172S, T182, R182, TR182, T303, 210 (S/N 21059503 & ON), T210M, T210N, T210R,	4, 38, 42
G-243	188, 188A, 188B, A188, A188A, A188B AND T188C	38
G-243	Cirrus Design models: SR20, SR22	41
G-243	Slingsby Aviation, Ltd., models: T67M260, T67M260-T3A	38
G-243S	Cessna models: 152, 182, A152, 172, 172R, 172RG, 172S, T182, R182, TR182, T303, 210 (S/N 21059503 & ON), T210M, T210N, T210R,	26, 40, 43
G-243S	188, 188A, 188B, A188, A188A, A188B AND T188C	43
G-243S	Cirrus Design models: SR20, SR22	40
G-243S	Mooney models: M20M, M20R	26
G-243S	Slingsby Aviation, Ltd., models: T67M260, T67M260-T3A	43
G-244	Beech model: A60	4
G-244	Cessna models: 310, 335, 340, 402, 404, 414, 421	4
G-244	Piper model: PA-31	4
G-246	Airtractor models: AT-300, AT-400	4
G-246	Piper models: PA-23, PA-31	4
G-246AT	Air Tractor models: AT-300, -302, -400, -400A, -402, -402A, -402B, -502, -502A, -502B, -503A, -602, -802, -802A	19
G-247	Piper model: PA-31P-350	6
G-25	Aerostar models: 600, 601, 601P	4, 11
G-25	Beech models: 19, 23, 24, 55, 58, 77	4, 11
G-25	Cessna models: 120, 140, 150, 170, 172, 175, 177, 310, 320, 340	4, 11
G-25	Piper models: PA-11, PA-36, PA-38,	4, 11
G-25M	Piper Aerostar: 600, 601, 601P, 602P	2
Starpower 25	Aero-Star models: 600, 601, 601P	7
Starpower 25	Beech models: 19, 23, 24, 55, 58, 77	7
Starpower 25	Cessna models: 120, 140, 150, 170, 172, 175, 177, 310, 320, 340	7
Starpower 25	Piper models: PA-11, PA-36, PA-38	7
G-25S	Cessna models: 120, 140, 150, 150A, 150B, 150C, 150D, 150E, 150F, 150G, 150H, 150J, 150K, 150L, 150M, 170, 170A, 170B, 172,	34
G-25S	172A, 172B, 172C, 172D, 172E, 172G, 172F (USAF T-41A), 172H (USAF T-41A), 172I, 172K, 172L, 172M, 172N, 172P, 172Q, 172R,	34
G-25S	172S, 175, 175A, 175B, 175C, 177, 177A, 177B, 310, 310A (USAF U-3A), 310B, 310C, 310D, 310E (USAF-U-3B), 320, 320-1, 320A,	34
G-25S	320B, 320C, 320D, 320E, 320F, 340	34
G-25S	Piper models: PA-11, PA-36-285, PA-36-300, PA-36-375, PA-38-112	34
G-25S	Aerostar models: PA-60-600 (Aerostar 600), PA-60-601 (Aerostar 601), PA-60-601P (Aerostar 601P), PA-60-602P (Aerostar 602P)	34
G-25S	Raytheon models: 19A, 23, A24, D55, E55, E55A, 58, 58A, 77	34
G-25S	Sky International models: A-1, S-1S, S-1T, S-2, S-2A, S-2S, S-2B	38
G-35	Beech models: 17, 18, 19, 23, 24, 33, 35, 36, 50, 76	9, 11
G-35	Bell model: 47G-5	11
G-35	Cessna models: 180, 182, 185, 188, 195, 206, 207, 210	11
G-35	Mooney models: M20, M20B, M20D, M20G, M20J, M20K	11
G-35	Piper models: PA-11, PA-12, PA-14, PA-16, PA-18, PA-22, PA-23, PA-24, PA-25, PA-28, PA-30, PA-32, PA-34, PA-39, PA-44	11
G-35M	Maule models: M-4-210, -4-210C, -4-230C, -4-180C, -5-210C, -5-220C, -5-200, -5-235C, -5-180C, -6-235, -6-180, M-7-235, MX-7-180,	1
G-35M	MX-7-235	1
G-35S	Beechcraft models: 23, 35, 36, 50, 76	18
G-35S	Bell model: 47G-5	18
G-35S	Cessna models: 180, 182, 185, 188, 195, 206, 207, 210	18
G-35S	Maule models: M-4-210, -220, -180, M-5-180, -210, -220, -235, -200, -210TC, M-6-180, -235, M-7-235, MX-7-180,	16
G-35S	MX-7-235, MXT-7-180, MT-7-235, MX-7-160, MXT-7-160, MX-7-180A, MXT-7-180A, MX-7-180B, M-8-235	16
G-35S	Mooney models: M20, M20B, M20D, M20G, M20J, M20K	18
G-35S	Piper models: PA-12, PA-14, PA-16, PA-18, PA-22, PA-23, PA-24, PA-25, PA-28, PA-30, PA-32, PA-34, PA-39, PA-44	18
Starpower 35	Beech models: 17, 18, 19, 23, 24, 33, 35, 36, 50, 76	8
Starpower 35	Bell model: 47G-5	8
Starpower 35	Cessna models: 180, 182, 185, 188, 195, 206, 207, 210	8
Starpower 35	Mooney models: M20, M20B, M20D, M20G, M20J, M20K	8
Starpower 35	Piper models: PA-11, PA-12, PA-14, PA-16, PA-18, PA-22, PA-23, PA-24, PA-25, PA-28, PA-30, PA-32, PA-34, PA-39, PA-44	8
G-6381C	Avions Marcel Dassault models: Fan Jet Falcon Series C, D, E, F	13
G-6381C	Beech models: 65-90, 65-A90, B90, C90, E90, 99, 99A, 100, A99, A99A, A100, A100A	13
G-6381C	Embraer models: EMB-110P1, EMB-110P2	13
G-6381C	Gates Learjet models: 23, 24 series, 25 series, 28 series, 29 series, 35 series, 36 series	13

Premium Valve Regulated Lead Acid Aircraft Batteries By TELEDYNE BATTERY PRODUCTS



COMPONENT MAINTENANCE MANUAL

FAA-PMA ELIGIBLE INSTALLATION LIST AND SUPPLEMENT DATA

Drawing 1516 Revised: 8-18-04

NUMBER:	ELIGIBLE FOR INSTALLATION ON:	PMA-SUP
G-6381C	Gulfstream Aerospace model: G-159	13
G-6381C	Israel Aircraft Industries models: 1121, 1121A, 1121B, 1123, 1124	13
G-6381C	Lockheed-Georgia: 1329-23 series	13
G-6381C	Mitsubishi models: MU-2B, MU-2B-10, -15, -20, -25, -26, 26A, -30, -35, -36, -36A, -40, -60	13
G-6381C	Rockwell International models: NA-265 series; Aero Commander models 680T, 680V, 680W	13
G-6381E	Avions Marcel Dassault models: Fan Jet Falcon Series C, D, E, F	13
G-6381E	Raytheon (Beechcraft) models: 65-90, 65-A90, 65-A90-1(JU-21A, U-21A, RU-21A, RU-21D, U-21G, RU-21H),	13, 23
G-6381E	65-A90-4(RU-21E, RU-21H), B90, C90, E90, F90, 99, 99A, 100, A99, A99A, A100, A100A, B100, 200, 200(A100-1(U-21J), 200C,	13, 23
G-6381E	200CT, 200T, A200(C-12A) OR (C-12C), A200CT(C-12D), OR (FWC-12D) OR (RC-12D), OR (C-12F) OR (RC-12G) OR (RG-12H) OR	30
G-6381E	(RC-12K) OR (RC-12P), B200, B200C OR B200(C-12F) OR (UC-12F) OR (UC-12M) OR (C-12R), B200CT, B200T, 300, B300, 300LW,	30
G-6381E	B300C, MU-300-10, 400, 400T, Hawker 1000	30, 38
G-6381E	Bell models: 204B, 205A, 205B, 205A-1, 212, 222U, 412	13, 38
G-6381E	Cessna models: 208, 208B, 425, 441, 500, 501, 550, 551, S550, 560, 560XL	13, 23, 26, 28, 38
G-6381E	Embraer models: EMB-110P1, EMB-110P2	13
G-6381E	Gates Learjet models: 23, 24 series, 25 series, 28 series, 29 series, 35 series, 36 series, 31, 31A, 55, 55B, 55C series	13, 27
G-6381E	Gulfstream Aerospace model: G-159	13
G-6381E	Israel Aircraft Industries models: 1121, 1121A, 1121B, 1123, 1124	13
G-6381E	Lockheed-Georgia: 1329-23 series	13
G-6381E	Mitsubishi models: MU-2B, MU-2B-10, -15, -20, -25, -26, 26A, -30, -35, -36, -36A, -40, -60	13
G-6381E	Pilatus model: Pilatus-PC-12	38
G-6381E	Piper Aircraft Corporation models: PA-31T, -31T1, -31T2, PA-42 and PA-42-720	13
G-6381E	Rockwell International: NA-265 series; Aero Commander models 680T, 680V, 680W, 690, 690A	13
G-6381E	Sikorsky models: S-76A, S-76B, S-76C	38
G-6381E	Socata Group Aerospatiale model: TBM-700	38
G-6381ES	Raytheon (Beechcraft) models: 65-90, 65-A90, 65-A90-1(JU-21A, U-21A, RU-21A, RU-21D, U-21G, RU-21H),	20, 22, 23, 30, 35
G-6381ES	65-A90-4(RU-21E, RU-21H), B90, B99, C90, E90, F90, 99, 99A, 100, A99, A99A, A100, A100(U-21F), A100A, B100, 200(A100-1(U-21J),	20, 22, 23, 30, 35
G-6381ES	300, 200, 200C, 200CT, 200T, A200(C-12A) OR (C-12C), A200CT(C-12D), OR (FWC-12D) OR(RC-12D), OR (C-12F) OR (RC-12G)	20, 22, 23, 30, 35
G-6381ES	OR (RG-12H) OR (RC-12K) OR (RC-12P), B200, B200C, (C-12F) OR (UC-12F) OR (UC-12M) OR (C-12R), B200CT, B200T, B300,	20, 22, 23, 30, 35
G-6381ES	300LW, B300C, 400A serial number RK-98 and after, MU-300-10, 400, 400T, Hawker 1000	20, 22, 23, 30, 35, 43
G-6381ES	Bell Helicopter models: 204B, 205A, 205A-1, 205B, 212, 222U, 412	22, 43
G-6381ES	Cessna models: 208, 208A, 208B, 425, 441, 500, 501, 525/525A Series, 550, S550, 551, 560, 560XL, 650 Series	22, 26, 28, 29, 32, 33, 43
G-6381ES	Dassault Aviation models: Fan Jet Falcon Series C, D, E, F	20, 22
G-6381ES	Empresa Brasileira de Aeronautica S/A models: EMB-110P1, EMB-110P2	20, 22
G-6381ES	Gulfstream Aerospace models: G-159, G-1159	23, 25
G-6381ES	Israel Aircraft Industries models: 1121, 1121A, 1121B, 1123, 1124	20, 22
G-6381ES	Learjet models: 23, 24, 24A, 24B, 24B-A, 24C, 24D, 24D-A, 24E, 24F, 24F-A, 25, 25A, 25B, 25C, 25D, 25F, 28, 29, 35, 35A, 36A,	20, 22, 27
G-6381ES	31, 31A, 55, 55B, 55C, 60	20, 22, 27, 45
G-6381ES	Lockheed-Georgia models: 1329-23A, -23D, -23E	20, 22
G-6381ES	Mitsubishi Heavy Industries models: MU-2B, MU-2B-10, -15, -20, -25, -26, 26A, -30, 35, 36, -36A, -40, -60	20, 22
G-6381ES	Piper models: PA-31T, -31T1, -31T2, PA-42 and PA-42-720 Series	31
G-6381ES	Sabreliner models: NA-265, NA-265-20, -30, -40, -60, -65, -70, -80	20, 22
G-6381ES	Twin Commander Aircraft models: 680T, 680V, 680W, 690, 690A	20, 22
G-6381ES	Pilatus model: Pilatus-PC-12	43
G-6381ES	Socata Group Aerospatiale model: TBM-700	43
G-6381ES	Sikorsky models: S-76A, S-76B, S-76C	43, 46
G-638C	Avions Marcel Dassault models: Fan Jet Falcon Series C, D, E, F	13
G-638C	Beech models: 65-90, 65-A90, B90, C90, E90, 99, 99A, 100, A99, A99A, A100, A100A	13
G-638C	Embraer models: EMB-110P1, EMB-110P2	13
G-638C	Gates Learjet models: 23, 24 series, 25 series, 28 series, 29 series, 35 series, 36 series	13
G-638C	Gulfstream Aerospace model: G-159	13
G-638C	Israel Aircraft Industries models: 1121, 1121A, 1121B, 1123, 1124	13
G-638C	Lockheed-Georgia: 1329-23 series	13
G-638C	Mitsubishi models: MU-2B, MU-2B-10, -15, -20, -25, -26, 26A, -30, -35, -36, -36A, -40, -60	13
G-638C	Rockwell International: NA-265 series; Aero Commander models 680T, 680V, 680W	13
G-638E	Avions Marcel Dassault models: Fan Jet Falcon Series C, D, E, F	13
G-638E	Beech models: 65-90, 65-A90, B90, B100, C90, E90, 99, 99A, 100, A99, A99A, A100, A100A, F90	13
G-638E	Embraer models: EMB-110P1, EMB-110P2	13
G-638E	Gates Learjet models: 23, 24 series, 25 series, 28 series, 29 series, 31, 31A, 35 series, 36 series, 55, 55C	13, 27
G-638E	Gulfstream Aerospace model: G-159	13
G-638E	Israel Aircraft Industries models: 1121, 1121A, 1121B, 1123, 1124	13
G-638E	Lockheed-Georgia models: 1329-23 series, 23A, 23D, 23E	13, 20, 22
G-638E	Mitsubishi models: MU-2B, MU-2B-10, -15, -20, -25, -26, -26A, -30, -35, -36, -36A, -40, -60	13
G-638E	Rockwell International: NA-265 series; Aero Commander models 680T, 680V, 680W	13

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COMPONENT MAINTENANCE MANUAL

FAA-PMA ELIGIBLE INSTALLATION LIST AND SUPPLEMENT DATA

Drawing 1516 Revised: 8-18-04

NUMBER:	ELIGIBLE FOR INSTALLATION ON:	PMA-SUP
G-639C	Hawker Siddeley Beechcraft Hawker models: DH-125, HS-125, BH-125	3
G-639C	Messerschmitt-Bolkow-Blohm GMBH model: BO-105S	23
G-639E	British Aerospace models: DH.125-400A, HS.125-600A, HS.125-700A, BH.125-600A, BAE.125-800A, Jetstream series 3101	12, 24
G-639E	Hawker Siddeley, Beechcraft Hawker models: DH.125, HS.125, BH.125	3
G-639E	Messerschmitt-Bolkow-Blohm GMBH model: BO-105S	12
G-639ES	Beech (Raytheon) models: DH.125 series 400, HS.125 series 600, HS.125 series 700, BH.125 series 600, Bae.125 Series 800	24
G-639ES	British Aerospace Operations Ltd: Jetstream series 3101	24
G-639ES	Dassault-Breguet model: Falcon 10	38
G-639ES	Eurocopter Deutschland models: BO-105A, BO-105C, BO-105S, MBB-BK 117 A-1, MBB-BK 117 A-3, MBB-BK 117 A-4,	24, 38
G-639ES	MBB-BK 117 B-1, MBB-BK 117 B-2, MBB-BK 117 C-1	38
G-639ES	Mitsubishi Heavy Industries models: YS-11A-200, YS-11A-300, YS-11A-500, YS-11A-600	38
G-639ES	SIAI MARCHETTI Srl model: F.260	17
G-640E	Beech models: 65, A65, 65-80, 65-A80, 65-B80, 65-88, 70	4, 23
G-641S	Bell models: 206A, 206B, 206L, 206L-1, 206L-3 with STC SR01406LA	36
G-641S	McDonnell Douglas (Hughes) models: 369, 369A, 369H, 369HM, 369HS, 369HE, 369D, 369E, 369F, 369FF, 500N, 600N, with STC kit	39
G-641S	SR01427LA installed	39
G-641S	Schweizer Aircraft Corporation model: 269D (333)	44
G-641	Bell models: 206, 206A, 206B, 206B-1, 206L, 206L-1, 206L-3	5, 21, 23
G-641	McDonnell Douglas (Hughes) models: 369, 369A, 369H, 369HM, 369HS, 369HE, 369D, 369E, 369F, 369FF, 500N, 600N with STC kit	39
G-641	SR01427LA installed	39
G-641	Schweizer Aircraft Corporation model: 269D (333)	44
G-88	Ayres Corp. model: S-2R	6
GE-50C	Gulfstream Commander models: 500, 520, 560, 560A, 560E, 680, 680E, 720	14
GE-50C	North American models: AT6-C, AT6-D, AT6-F, T-6G, SNJ-5, SNJ-6, SNJ-7 or any BC-1A, AT6, AT6-A, AT6-B, SNJ-2, SNJ-3,	14
GE-50C	SNJ-4 converted to 24 volts per North American Drg 121-954004, P51	14
GE-51C	Airtractor models: AT-301, AT-301A	4
SA5525NM	Gulfstream model: G-159	23
SA1017SO	Beech models: 65-90, 65-A90, 65-A90-1(JU-21A, U-21A, RU-21A, RU-21D, U-21G, RU-21H), 65-A90-4(RU-21E, RU-21H),	23
SA1017SO	B90, C90, E90, 99, A100	23
SA1018SO	Beech model: B100	23
SA1213SO	Israel Aircraft Industries models: 1121, 1121A, 1121B	23
SA1214SO	Israel Aircraft Industries, models: 1123, 1124	23
SA1215SO	Dassault models: Fan Jet Falcon series: C, D, E, F	23
SH1186SO	Bell models: 212, 412	23
SH2186SO	Bell models: 204B, 205A, 205A-1	23
SA2245SO	Cessna model: 425	23
ST1030SO	British Aerospace models: DH.125-400A, HS.125-600A, HS.125-700A, BH.125-600A, BAE.125-800A	23
SH1410SO	Messerschmitt-Bolkow-Blohm GMBH model: BO-105S	23
SA2948SO	British Aerospace, model: Jetstream 3101	23
SA1183SO	Beech models: 65, A65, 65-80, 65-A80, 65-B80, 65-88, 70	23
SA887SO	Aero Commander, models: 680T, 680V, 680W	23
SA894SO	Beech models: 99, 99A, A99, 100, A100, A100A	23
SA1013SO	Beech models: C90 (S/N's LJ590 & after), E90 (S/N's LW58 & after) F90 (S/N's LA-2 & after), B99 (S/N's U146, U148 through U164)	23
SH2240SO	McDonnell Douglas (Hughes) models: 369 series, 500N	23
ST1031SO	Rockwell International: NA-265 series	23
ST1032SO	Lockheed-Georgia, model: 1329-23 series	23
ST1033SO	Learjet models: 23, 24, 25, 28, 29, 35, 36 series	23
SA1042SO	Mitsubishi models: MU-2B, -10, -15, -20, -25, -26, -26A, -30, -35, -36, -36A, -40, -60	23
SA1050SO	Gulfstream, model: G-159	23
SA1051SO	Cessna models: 500, 501, 550, S-550, 551, 560	23
SA1058SO	Beech model: A100	23
SA1059SO	Rockwell Commander models: 690, 690A	23
SA1167SO	Embraer models: EMB-110P1, EMB-110P2	23
SA01203LA	Cessna: 525 and 525A series	33
SA1016SO	Raytheon (Beechcraft) models: 200(A100-1(U-21J), 200C, 200CT, 200T, A200(C-12A) OR (C-12C), A200CT(C-12D), OR (FWC-12D)	23, 30
SA1016SO	OR (RC-12D), OR (C-12F) OR (RC-12G) OR (RG-12H) OR (RC-12K) OR (RC-12P), B200, B200C, (C-12F) OR (UC-12F) OR	23, 30
SA1016SO	(UC-12M) OR (C-12R), B200CT, B200T, 300, B300, 300LW, B300C	23, 30
SA1728SO	Piper models: PA-31T, -31T1, -31T2, PA-42 and PA-42-720 Series	31
SH297NM	Bell Helicopter models: 206, 206A, 206B, 206B-1, 206B-3, 206L, 206L-1, 206L-3	23
ST01117LA	Cessna models: 208, 208A, and 208B	29
ST01185LA	Cessna models: 650 series	32
SR01406LA	Bell models: 206A, 206B, 206L, 206L-1, 206L-3	36
SR01427LA	MD Helicopters, Inc. (MDHI) models: 369, 369A, 369H, 369HM, 369HS, 369HE, 369D, 369E, 369F, 369FF, 500N, 600N	39
SR01601NY-D	Sikorsky models: S-76A and S-76C	46

REFER TO STC/PMA FOR COMPLETE QUALIFIED SERIAL NUMBER LIST

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