Airplane Flight Manual Supplement
to the
Textron Model 400A
Airplane Flight Manual
for the installation of
TB40 Lithium-Ion Airplane Battery

Serial No._____ Registration No._____

This supplement must be attached to the Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM) when the airplane is modified for the installation of the TrueBlue Power Single/Dual TB40 Lithium-Ion Airplane Batteries in accordance with Supplemental Type Certificate STC ST01999WI.

The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA Approved KENT S LUND Digitally signed by KENT S LUND Date: 2023.01.05 12:00:00 -06'00'

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IR	i-iii, Section 1 Section 2 Section 3 Section 4 Section 5 Section 6	01/05/2023	Installation of the TrueBlue Power TB40 Lithium Ion Battery	KENT S LUND Digitally signed by KENT S LUND Date: 2023.01.05 12:00:25 -06'00' Kent S. Lund, Manager Central Flight Test Section, AIR-714 Federal Aviation Administration Wichita, KS

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SECTION 1 - GENERAL

Introduction

This FAA Approved Airplane Flight Manual Supplement presents changes to the basic Airplane Flight Manual (AFM) associated with the installation of replacement TrueBlue Power Lithium Ion batteries, for the lead-acid main ship battery. The True Blue Power TB40 is approved for installation on the Textron Model 400A. See full system description in Section 7.

Definitions

LAND AS SOON AS POSSIBLE

Land at the nearest suitable airport. Unless otherwise specified, use Normal Procedures for Approach, Before Landing, and Landing. Extreme situations can require an off-airport landing. Primary consideration is safety of occupants.

LAND AS SOON AS PRACTICAL

Land at a suitable airport. Unless otherwise specified, use Normal Procedures for Approach, Before Landing, and Landing. The primary consideration is the urgency of the emergency or abnormal situation. Continuing to the destination or an alternate with appropriate service facilities can be an option.

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SECTION 2 - LIMITATIONS

Cold Weather Limitation

If cold soaked in temperatures below -40°C for over one hour without power applied, an external power cart must be connected to supply power for all pre-flight operations.

Engine Start Prohibited

Use of the battery for engine start is prohibited if the MD23 battery monitor indicates a NO STRT status

Note: Engine start is prevented by battery management system when NO STRT is displayed.

Takeoff Prohibited

Takeoff is prohibited if the FAULT or SERVICE message(s) are present on the battery status annunciator(s).

-- or --

Type of Operations Equipment List

The MD23 battery monitor is required for all VFR, IFR day / night, and icing operations.

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SECTION 3 - EMERGENCY PROCEDURES

SERVICE BATTERY

Red SERVICE on the MD23 battery 

monitor.

1. Monitor battery health and temperature.
2. LAND AS SOON AS PRACTICAL.
3. Battery service required prior to next flight.

BATTERY OVERHEAT

Red Temperature on the MD23 battery monitor. 

This annunciation indicates the internal battery temperature has exceeded 95°C. The battery has entered a protected state and has shutdown output.

1. Battery Switch – OFF.
2. Generator Switch - VERIFY ON.
3. Monitor battery health and temperature.
4. LAND AS SOON AS PRACTICAL.

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SECTION 3A - ABNORMAL PROCEDURES

BATTERY FAULT

Amber FAULT on the MD23 battery monitor.

1. Battery Switch – OFF.
2. Generator Switch - VERIFY ON.
3. LAND AS SOON AS PRACTICAL.
4. Monitor battery health and temperature.
5. Condition MUST be corrected prior to next flight.

Note: Fault may be due to short circuit, overcurrent, overvoltage, overtemperature, or a heater fault. Fault descriptions are provided on page 2 of the display. See Annunciations on page 8.

BATTERY STATE OF CHARGE - START

Amber NO START on the MD23 battery monitor.

1. Notify maintenance for ground power start or battery service.

Note: Battery capacity insufficient for battery-powered engine start (at or below 30%). Use ground power for start.

BATTERY STATE OF CHARGE –TAXI

Amber CHARGE indication on the MD23 battery monitor.

1. Allow generator to charge battery to above 72% prior to dispatch.

Note: Battery capacity insufficient to provide required electrical power reserves (at or below 72%). Allow battery to charge battery to above 72% prior to dispatch.

BATTERY STATE OF CHARGE –IN FLIGHT

Amber CHARGE indication on the MD23 battery monitor.

1. Generator Switch - VERIFY ON.
2. Verify Generator Output (Voltmeter and Ammeter) are normal.
3. Reduce Electrical Loads.
4. Monitor battery health and temperature.
5. LAND AS SOON AS PRACTICAL.

Note: This annunciation, if illuminated in flight, indicates that the battery charge has dropped to or below 72%.

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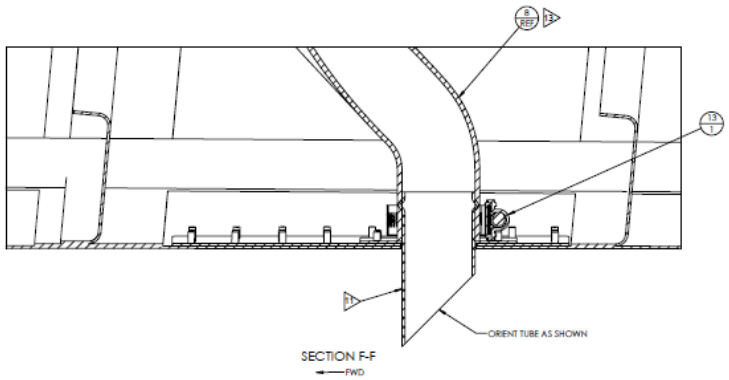
SECTION 4 - NORMAL OPERATING PROCEDURES

Preflight Inspection

1. Confirm that the battery ventilation tube is undamaged and secured to the battery and the aircraft skin.
2. Examine the battery ventilation duct for obstructions or blockage.



Engine Start

(Below 0° C OAT – Initiate Pre-Heat)

1. Battery Switch – ON
2. Battery Switch – OFF
3. Allow 15 minutes for battery to warm.

(Above 0° C OAT)

No change to basic AFM.

Before Takeoff

4. MD23 Battery Monitor – VERIFY ACTIVE and CHARGE > 72%

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SECTION 5 - PERFORMANCE

No Change

SECTION 6 - WEIGHT AND BALANCE

See revised weight and balance in basic Airplane Flight Manual.

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SECTION 7 - SYSTEM DESCRIPTION

Battery

The True Blue Power TB40 Lithium Ion Airplane Battery is a replacement for the original Lead-Acid main ship battery. It is installed in the same location as the original battery in the aft tail cone compartment.

The TB40 provides a nominal capacity of 40 Ah at 26.5 volts DC. Battery capacity will decrease slightly over the life of the battery.

In the case of a loss of generator power, the TB40 battery can supply essential electrical systems for 20 minutes if the load is reduced below 60 Amps or 30 minutes if the load is reduced below 50 Amps.

The TB40 is capable of supplying electrical power for normal ground operations, engine starting, and emergency backup power in the event of primary and/or optional standby power generation loss.

The battery is capable of supplying up to 1500 amperes for the purpose of battery only, engine starts.

After engine start, the battery recharges and maintains its internal charge by accepting current from the airplane's power generation system. A typical engine start will not significantly deplete the battery, thus minimizing the time to recharge.

When the airplane's power generation systems are offline or fail, the battery will provide back-up power to the airplane. As the battery capacity decreases, the voltage will begin to drop until the battery is fully depleted. A fully charged battery will initially indicate approximately 27 volts. When the battery voltage reaches 24.5 volts, approximately 10 minutes of battery capacity remain. When the battery's voltage drops to approximately 19 volts, the battery's internal, under-voltage protection, will shut off the battery's output to prevent any potential cell damage due to the deep discharge.

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Battery Operating Modes

The battery has three basic modes of operation: Sleep Mode, Control Mode, and Active Mode. These modes, and associated functionality, are explained below.

Sleep Mode

Sleep Mode disables the power output of the battery and reduce internal energy consumption to preserve resting state of charge. When the battery is in Sleep Mode, the battery is not charging or discharging, the internal battery heaters are inactive, all active communications are disabled, and internal energy consumption is reduced to a minimum.

In Sleep Mode, low power devices, such as clocks, may still operate without causing the battery to transition to Active Mode. The battery is also capable of monitoring the terminals for an external load or charge.

The battery will automatically enter Sleep Mode when the airplane battery master switch is off and the one-hour pre-heat cycle has timed out. The battery can be manually put into sleep mode by pressing the STATUS/SOC button for 3 seconds.

Control Mode

Control Mode is reserved exclusively for maintenance activities. Control Mode is not available or accessible in flight.

Active Mode

In Active Mode, the battery is fully functional and available to provide power barring no protections are being enforced and the battery is operating properly. During this mode, the battery is available to provide engine start, provide aircraft power, and to maintain charge.

Annunciations

The TB40 installation utilizes the following system control and annunciation on the MD23 battery monitor in the left-hand instrument panel.

The Control Knob located at the bottom-center of the unit bezel allows for selection of the battery status pages. The knob scrolls between pages, the push function allows for selection of a highlighted item.

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MD23 Battery Monitor Indications

Label	Status	Color	Indication / Crew Action
STATUS	ACTIVE	Green	Displays battery status: Active, no crew action required. Battery start permitted.
	NO STRT	Amber	Notify maintenance. Battery capacity insufficient for start. Use ground power.
	FAULT	Amber	Monitor battery health and temperature. Fault maybe due to short circuit, overcurrent, overvoltage, overtemperature, or a heater fault. Maintenance required prior to next flight.
	SERVICE	Red	Monitor battery health and temperature. Land as soon as practical. Maintenance required prior to next flight.
CHARGE%	> 72%	White	Dispatch permitted.
	≤ 72 %	Amber	Charge battery to level above 72% prior to dispatch.
VOLTS	≤ 30.6 VDC ≥ 16 VDC	White	Current voltage of the battery is within range.
	> 30.6 VDC < 16 VDC	Amber	Battery Overvoltage (charging disabled) Battery Undervoltage (discharging disabled)
AMPS		White	Discharge or charge current (discharge current denoted as negative (-)
TEMP (°C)	≤ 72 °C (charging) ≤ 95 °C (discharging)	White	Internal temperature of the battery, in degrees Celsius
	> 72 °C (charging) > 95 °C (discharging) > 110 °C (any cell temp)	Red	
	Heater Icon (left of temp)	 Gray	Heater is inactive / offline
		 Gray	Heater is active / available
		 White	Heater is on / heating
LIFE		White	Remaining percentage between original max and end of life capacity. 0-100%
CAPACITY		White	Current maximum capacity of the battery. (Ah)
FAULT		White	Reported battery faults. "None", if none.

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Battery Status Indicator

The on-board status indicator on the face of the TB40 provides on-demand health status and state of charge. It can also be used to manually transition the battery from Sleep Mode to Active Mode by pressing the STATUS button. This can be used to check status, state of charge, or to initiate the heaters to pre-heat the battery (if the battery is cold).

When the battery is in Active Mode, status is continuously displayed. Status is listed as one or more of four states as listed below. For each state, a lighted chevron will appear under the associated label on the Status Indicator.

- **Active:** Solid Green indicator: Battery is Active.
  Flashing Green indicator: Battery is in Pre-Heat Cycle.
- **Fault:** Solid Yellow indicator: Battery has an internal fault.
- **Heat:** Flashing White indicator: Battery heaters are currently heating.
  Solid Yellow indicator: Heater is disabled.
- **Service:** Solid Red indicator: Battery has a permanent fault.

The Status Indicator can also provide on-demand state of charge. By temporarily pressing the STATUS/SOC button, the chevrons will quickly cycle in blue, indicating a change to state of charge indication. The Status Indicator will display a visual depiction of state of charge by illuminating the chevrons from left to right to the approximate level of charge.

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Internal Heaters

The True Blue TB40 battery can be operated at temperatures as low as -40°C utilizing internal heaters. If cold soaked in temperatures below -40°C for over one hour without power applied, an external power cart must be connected to supply power for all pre-flight operations.

Battery Preheat

The battery internal heaters are enabled when the battery is in Active Mode (aircraft power cycled on) or if the pre-heat cycle has been enabled with the STATUS/SOC switch during pre-flight while aircraft power is off. The heaters will only activate when the battery temperature is sensed below 0°C. The heaters will stop operating when the internal battery temperature is above 5°C.

Manual initiation of the pre-heat cycle can be prompted prior to operations by toggling the battery master switch from OFF to ON to OFF. The battery can be fully warmed in 15 minutes or less after the heaters turn on.

Pre-heat time will vary depending on temperature but can be fully warmed in 15 minutes or less after turning the heaters on.

The Pre-Heat Cycle will continue to maintain the battery temperature for one hour, and then enter Sleep or Active Mode. To manually exit the pre-heat cycle:

Press and hold the STATUS/SOC button for 3 seconds. Battery will immediately transition to Sleep Mode if the battery is not charging or discharging.

Engine Starting

Battery output is limited at temperatures below 0°C and may not be sufficient for engine starting without pre-heat. If attempting an engine start using battery power only, the battery internal heaters should be allowed adequate time to heat the battery prior to the start attempt. It is recommended that the start attempt be postponed until the green ACTIVE message on the MD23 is illuminated. Pre-heat time will vary depending on temperature.

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SECTION 8 - HANDLING, SERVICE, AND MAINTENANCE

Handling

No special considerations are required while the TB40 battery is installed in the airplane. If the battery is to be removed from the airplane, first touch any local airframe structure with one hand and the battery case with the other hand to statically discharge yourself before physically removing it.

If the airplane will be out of service for 5 days or more, disconnect the battery plug to prevent discharge due to parasitic current draw.

CAUTION: *Do not short circuit the battery pins.*

Servicing

The TB40 contains NO USER SERVICEABLE COMPONENTS.

Maintenance

All maintenance shall be performed in accordance with the Instructions for Continued Airworthiness (ICA) for this Supplemental Type Certificate (STC).