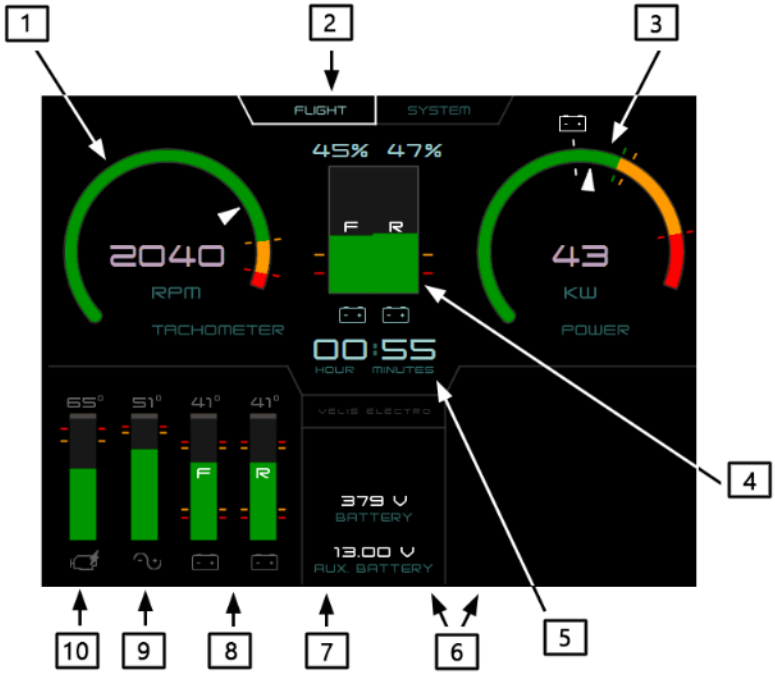
Display Modes

EPSI570C has three different display modes/pages: Flight mode and System mode are used in flight, Charge mode is used on the ground during battery recharge. The transition from a mode to another is done by the selection knob rotation.

NOTE: Values shown in the following pictures are for demonstrative purposes only and do not apply to any specific real operational situation.

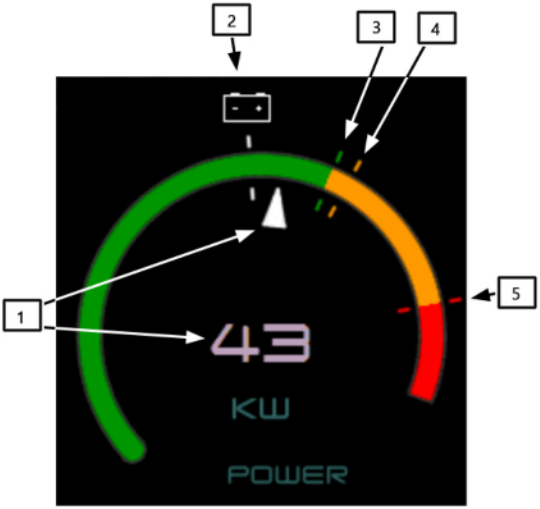
FLIGHT page

FLIGHT page mode is the mode used most during flight. It displays the actual operational parameters like RPM and power kW (battery output power). This screen allows the monitoring of component status and temperatures, battery voltage and warning messages as well. See the picture below for a description of FLIGHT mode page.



1	RPM indication	6	Warning and Caution sections (when messages are present)
2	Actual menu page	7	HV Battery and aux batt voltage
3	Power indication kW	8	Battery temperatures
4	Battery state of charge (F-R)	9	Power controller temperature
5	Remaining flight time (For information only)	10	motor temperature

EPSI570C Power indication - presentation details (two battery connected):

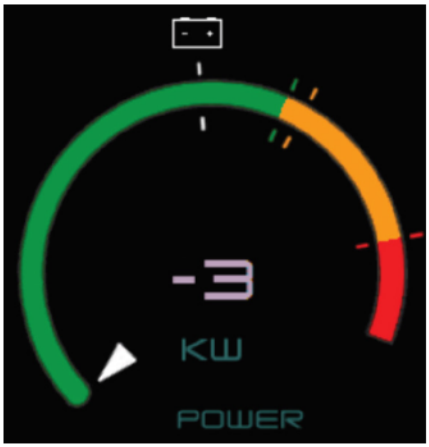


1	Actual power setting
2	Maximum power setting for single battery operation
3	Maximum Continuous Power (MCP)
4	Minimum Performance Take Off Power (MPTOP)
5	Maximum Take off Power (MTOP)

NOTE: MCP, MPTOP and MTOP are defined in section 1.7.3.

NOTE: with software package 13.0 or subsequent installed, in case of disconnection of one HV battery, the EPSI570C power indication changes as shown in the example in the section "EPSI570C display in case of system malfunctions".

EPSI Power indication - recuperation mode:



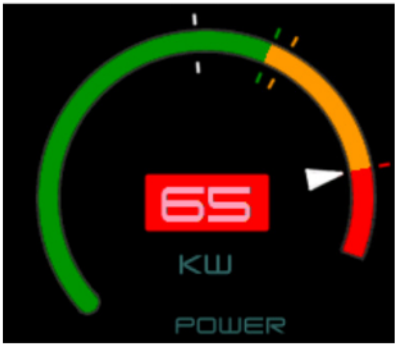
When in recuperation mode, the EPSI power indicator displays negative values, indicating the amount of energy being recuperated or returned to the battery. The power needle drops to zero and stays at zero, despite the actual power setting being negative.

The recuperation power level is a function of the propeller RPM, the higher the RPM the higher the recuperation. At high speed and high RPM condition maximum recuperation setting on the power lever results in approximately 7,5 kW of recharging power (displaying negative values) and drops to zero at flare speeds upon landing.

Examples of parameters in caution or warning range - FLIGHT page:

- Example 1) Temperature in caution or warning range (battery temperature)

- Example 2) RPM and Power indication in caution and warning range



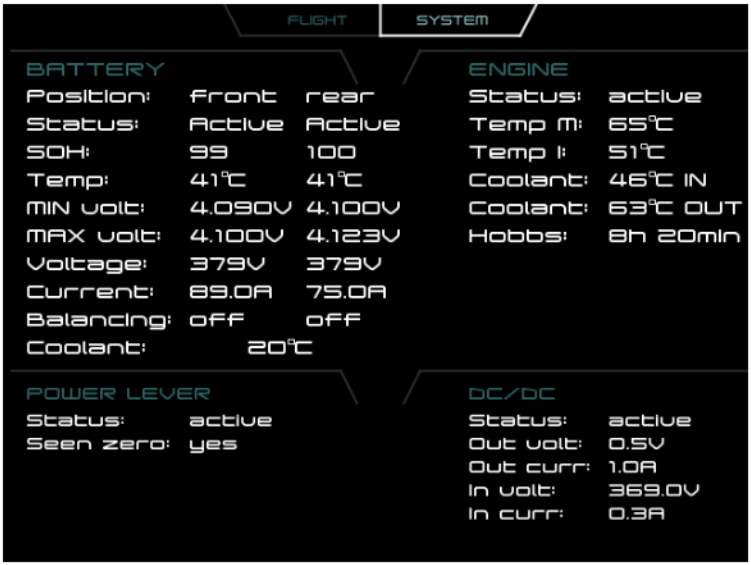
- Example 3) Battery SOC indication in caution range (SOC <30%)

SYSTEM page

SYSTEM page mode shows several diagnostic values of the system components. This mode is selected by rotating the knob.

Some parameters will be displayed on an amber or red background when in caution or warning range (Battery: SOH, Temp, Min volt, Current; Engine: temp m, Temp I).

Refer to the following table for a short description of the parameters.



BATTERY section	
One column for each battery	
Parameter	**Description**
Status:	Battery status ("-" = not connected/not present; ready = connected ; active = connected and power relays closed ; error)
SOH:	State Of Health of the batteries (SOH) (if this parameter is lost due to malfunction, mission can be completed. Contact manufacturer after the flight)
Temp:	Shows the max temp inside the battery pack, detected by the temperature sensors

MIN Volt: MAX Volt:	Minimum and Maximum voltage value of the cells in each battery pack.
Voltage: Current:	Battery boxes voltage and current. Negative values possible during charging.
Balancing:	Indicates if cell balancing is active
Coolant:	Temperature of the battery coolant sensor in battery cooling system diagram - Section 7.6.3.

ENGINE section	
Power controller and motor	
Parameter	**Description**
Status:	Status of the power controller
Temp m:	Motor temperature
Temp I	Power controller temperature
Coolant - IN:	Engine coolant temperature - Sensor "coolant cold" in engine cooling system diagram - Section 7.6.3.
Coolant - OUT:	Engine coolant temperature - Sensor "coolant hot" in engine cooling system diagram - Section 7.6.3.
Hobbs:	Hobbs meter of the power controller (Counts the cumulated power controller time - when PWR EN switch is ON and RPM > 100).

NOTE: If power controller or motor temperature sensor failure occurs, the mission has to be aborted. In this case, Coolant IN and Coolant OUT temperature values (EPSI570C – SYSTEM page) can help the pilot identify engine cooling malfunction if temperatures rise abnormally.

POWER LEVER section	
Power lever	
Parameter	**Description**
Status:	Status of the component.
Seen zero:	yes/no: shows if the power lever has been moved to cut off after battery activation. This is a safety feature. The motor can only be started once power lever has been moved to cut off position.

DC/DC section	
DC/DC converter	
Parameter	**Description**
Status:	Status of the component
Out volt: Out curr:	Voltage and current output of the converter
In volt: In curr:	Voltage and current input to the converter

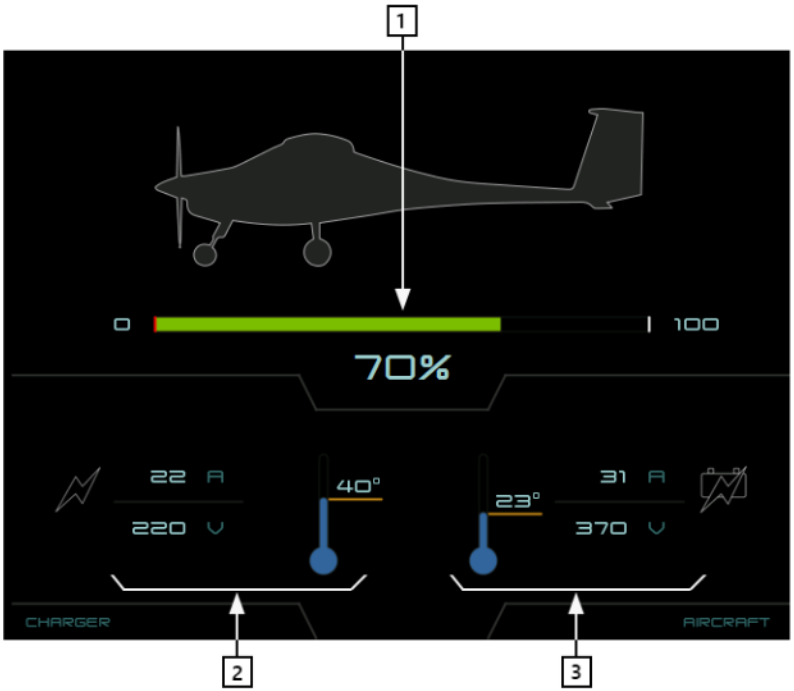
Examples of parameters in caution or warning range - SYSTEM page:

- Example 1) Motor temperature in caution range, Power controller temperature in warning range:

- Example 2) Front Battery parameters (SOH, temperature, min cell voltage) in caution range:

CHARGE page

CHARGE page mode is active during battery recharge process. It displays the actual charging process parameters in the form of a progress bar (100% is charge completed), temperature of the charger and of the batteries, and charger input/output voltage and current values.



1	Charging phase - progress bar %,
2	Charger - input parameters: AC current (mains), voltage (mains), charger power module temperature
3	Aircraft - battery system parameters: DC input current, charging voltage, battery temperature (highest value measured among all battery temperature sensors).

NOTE: Values in the picture are for illustrative purposes only.

Warning and Caution messages

EPSI570C is used in conjunction with the annunciator panel to display warnings and cautions related to the electric motor, power controller, batteries or other systems. The warning and caution messages are “descriptive”, and provide a basic details of the problem and/or system affected. When a message appears, it is accompanied by an aural warning emitted by the beeper integrated into the annunciator, and is also heard in the headsets. Two areas of the EPSI570C display are used to show the messages.

Central display area

The central display area is used to show the first un-acknowledged warning or caution, in chronological order. Only one single message, is visible at a given time. Warnings have priority over Cautions and override them: a warning message will be displayed even if it happened before a caution. The central area is the most important to check, as it shows the latest and the most important/urgent message. After a message has been acknowledged by pressing the MASTER CAUTION /MASTER WARNING button, this area of the screen will return to the normal status (battery and aux battery voltage), or it will display the next message, if any.

This area of the display is functionally connected to the MASTER CAUTION /MASTER WARNING buttons on the annunciator. The annunciator buttons will be illuminated according to the message category shown on the display.

NOTE: if the pilot is in SYSTEM page, the caution/warning message will appear also in the central area of this page. The pilot has to return to FLIGHT page an continue the message-associated procedure.

The pilot has to perform the corrective action required by the caution or warning. After this action, the pilot can push the button on the annunciator panel to reset and acknowledge the message. If it was the only message present, the MASTER CAUTION or MASTER WARNING light will turn off, and the central display area will be empty. If other messages are present in the background, the display will show the second most recent message (warnings have priority), and annunciator buttons will illuminate accordingly. This sequence will continue until the last message has been acknowledged.

Bottom-right display area

After a message has been acknowledged by pushing the button on the annunciator panel, the message remains visible in the list on the bottom-right area of the EPSI570C display. A colored square will show the message category (red for warnings, orange for cautions). Messages are presented in chronological order, the latest at the bottom. Warning messages have priority over cautions, and are displayed on top of the list, regardless of the chronological order in respect to cautions.

The list can show up to seven messages, and is functionally connected to the right part of the annunciator panel. System icons will illuminate according to the cautions or warnings which are listed on the EPSI570C display, and give the pilot an overview of systems that are affected by unresolved issues. When the cause which triggered the caution or the warning disappears or is solved (e.g. high temperature), the message will disappear also from the list (only after being acknowledged by the pilot by pressing the buttons on the annunciator) and the related system icon on the annunciator will turn off.

CAUTION: Do not take off in case any Caution/Warning messages appear on EPSI570C display or annunciator.

CAUTION: Do not take off in case of any missing indication/information field on EPSI570C display or in case any lights/icons fail to illuminate during the system selftest that activated when MASTER switch is turned ON. Contact manufacturer for support.

EPSI570C Warning and Caution messages

NOTE: See Section 3 - Emergency procedures - for the list of EPSI570C warning and caution messages and related emergency procedures.

EPSI570C display in case of system malfunctions

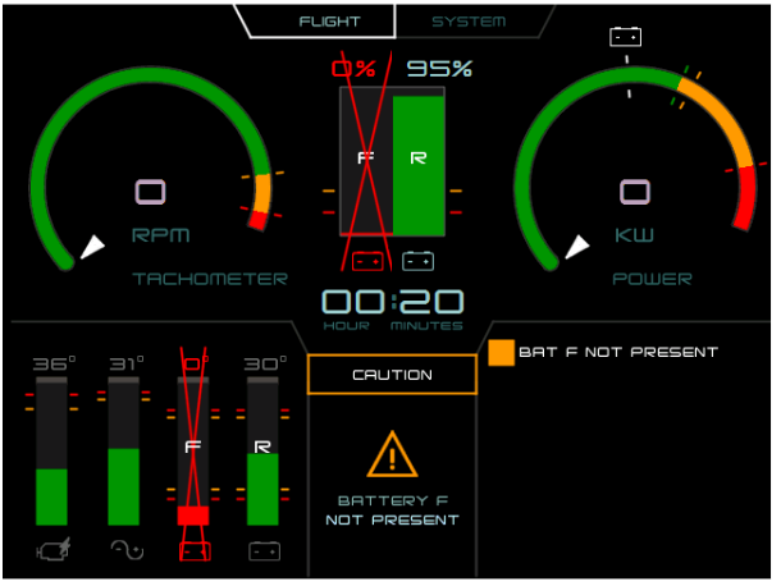
In case of malfunction or disconnection of a system (e.g. one of the high voltage batteries), its parameters may not be available. Unavailable data will be covered by a red cross, or replaced by "0" value.

EXAMPLE: BATTERY NOT PRESENT (battery loss of communication)

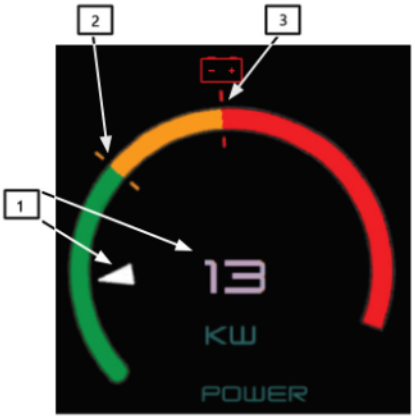
Some emergency procedures may require front (F) or rear (R) high voltage battery manual disconnection. This is accomplished by disengaging its circuit breaker. Beside power transfer interruption (open relay), also data connection with the battery is lost and all its parameters will no longer be available.

The following pictures show EPSI570C display when the communication with the front (F) battery is lost.

Flight page: SOC and temperature of the front battery are not available and covered by a red cross.

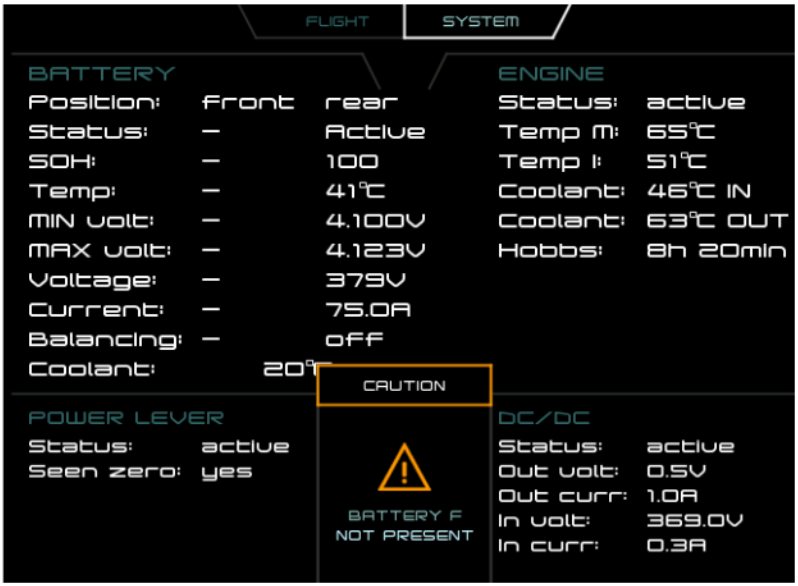


When EPSI570C software version 3.00 or subsequent is installed, power indicator on flight page changes automatically to the following layout in case of disconnection of one battery:



1	Actual power setting
2	Maximum continuous power for single battery operation (25 kW)
3	Maximum power setting for single battery operation (40 kW)

System page: all the parameters of "front" battery are not available.

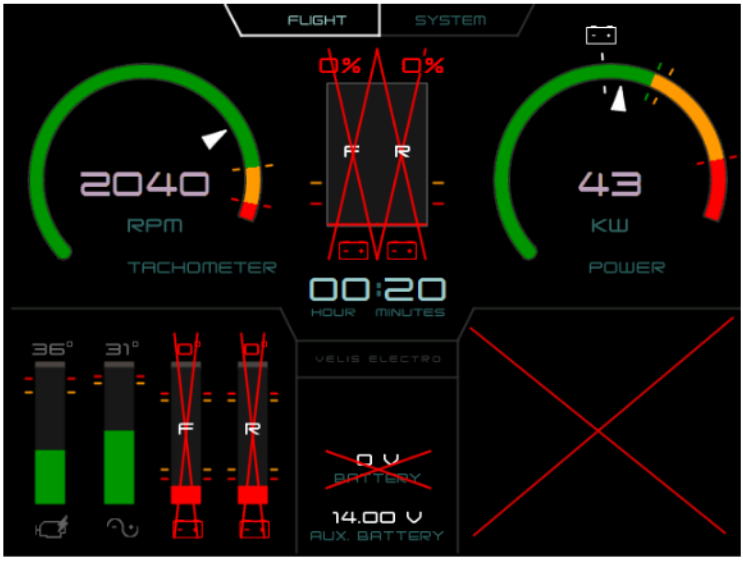


NOTE: Caution message in the central display area will disappear from FLIGHT and SYSTEM page after acknowledgment.

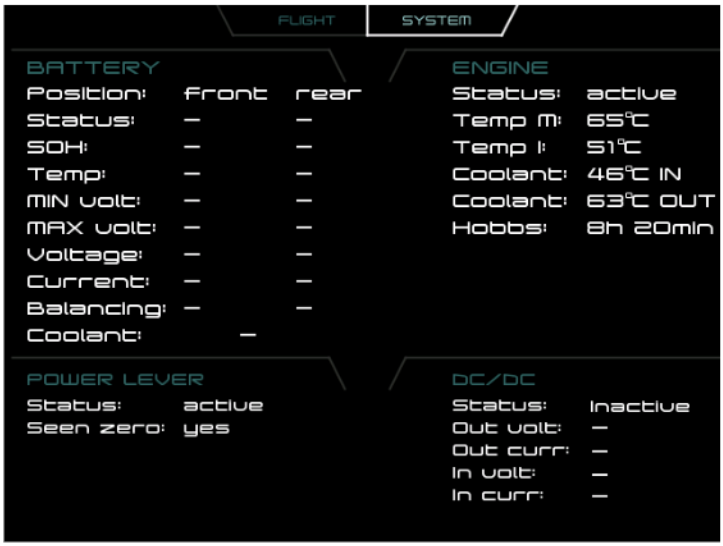
EXAMPLE: EPSI LOSS OF COMMUNICATION

The data displayed in the EPSI pages are either lost (battery SOC and temperature) or frozen to the last recorded value (motor and power controller parameters). In addition, the loss of communication EPSI-system controller implies that the EPSI does not display any caution or warning message, with the caution and warning list replaced by a red cross. This behavior is nominal, as cautions and warnings are generated by system controller and only in a subsequent phase sent to the EPSI.
The lack of caution and warning message on the EPSI is balanced by the correct functioning of the annunciator. As additional deficiency, the power indication on the Kanardia instrument shows constantly 0kW, because its signal is managed by the system controller (See also Section 3.10 - EPSI570C display failure emergency procedures).

Flight page: Battery parameters not available, caution/warning messages not available, other parameters frozen to the last recorded value.



System page: Battery parameters not available, other parameters frozen.



SECTION

10

SECTION 10 – SUPPLEMENTS

LIST OF SUPPLEMENTS

APPENDIX NO.	APPENDIX
10-3A	EMERGENCY PROCEDURES - PB345V124E-L
10-5A	PERFORMANCE - PB345V124E-L
10-3B	EMERGENCY PROCEDURES - PB345V119E-L
10-5B	PERFORMANCE - PB345V119E-L

SUPPLEMENT
10-3A

SECTION 10 – SUPPLEMENT 10-3A

B345V124E-L battery type - EMERGENCY PROCEDURES

When the aircraft is equipped with the PB345V124E-L battery type, this POH Supplement is applicable and entirely replaces the content of *Section 3 - Emergency procedures* - of the POH. This document must be carried in the airplane at all times. Information in this supplement adds to or replaces information in the basic POH.

POH SECTIONS	STATUS
SECTION 1: GENERAL	NO CHANGE
SECTION 2: LIMITATIONS	NO CHANGE
SECTION 3: EMERGENCY PROCEDURES	REPLACE
SECTION 4: NORMAL PROCEDURES	NO CHANGE
SECTION 5: PERFORMANCE	NO CHANGE
SECTION 6: WEIGHT AND BALANCE	NO CHANGE
SECTION 7: SYSTEM DESCRIPTION	NO CHANGE
SECTION 8: HANDLING, SERVICING AND MAINTENANCE	NO CHANGE

SECTION 10
SUPPLEMENT 10-3A

BATTERY TYPE PB345V124E-L
EMERGENCY PROCEDURES

Signature: _____

Stamp: _____

Date of Approval: _____

SECTION 3 – EMERGENCY PROCEDURES

TABLE OF CONTENTS

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3.1 INTRODUCTION

3.1.1 GENERAL NOTES AND DEFINITIONS

This section provides procedures for handling emergencies and critical flight situations. Although emergencies caused by airplane, systems, or engine malfunctions are extremely rare, the guidelines described in this section should be considered and applied as necessary should an emergency arise.

En-route emergencies caused by weather can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered.

In-flight mechanical problems will be extremely rare if proper preflight inspections and maintenance are practiced. Always perform a thorough walk-around preflight inspection before any flight to ensure that no damage occurred during the previous flight or while the airplane was on the ground.

Aircraft emergencies are very dynamic events. Because of this, it is impossible to address every action a pilot might take to handle a situation. However, four basic actions can be applied to any emergency:

Maintain Aircraft Control

Many minor aircraft emergencies turn into major ones when the pilot fails to maintain aircraft control. Remember, do not panic and do not fixate on a particular problem. To avoid this, even in an emergency: aviate, navigate, and communicate, in this order. Never let anything interfere with your control of the airplane. Never stop flying.

Analyze the Situation

Once you are able to maintain control of the aircraft, assess the situation. Look at the propulsion system parameters. Determine what the airplane is telling you.

Take Appropriate Action

In most situations, the procedures listed in this section will either correct the aircraft problem or allow safe recovery of the aircraft. Follow them and use good pilot judgment.

Land immediately

Continuation of the flight may be more hazardous than ditching or landing in terrain normally considered unsuitable.

Land as soon as possible

Find the nearest suitable area, such as an open field, at which a safe approach and landing is assured, and land without delay.

Land as soon as practical

The continuation of the flight and the landing site, such as the nearest available runway, is at the discretion of the pilot. It is not recommended to continue the flight beyond the nearest suitable landing area.

3.1.2 MEMORY ITEMS

Memory items are emergency procedures which require immediate reaction by the pilot.

The emergency procedures classified as memory items are identified in the POH by the following symbol beside the procedure name:

NOTE: it is recommended to get acquainted with memory items by means of dedicated ground training and accurate study of the procedures and required action sequence.

MEMORY ITEM PROCEDURES	
Procedure name	Section
BATTERY DISCONNECTED	3.5.5
ENGINE COOLANT PUMP FAILURE	3.5.18
POWER LEVER COMMUNICATION FAILURE	3.5.21

3.2 WARNING/CAUTION INDICATION SYSTEM

The aircraft is equipped with two main independent failure indication systems. The first is composed of the EPSI570C display and annunciator panel, which are software governed. This system informs the pilot about propulsion system component malfunctions and failures by means of warning/caution messages and aural warnings.

The second system is specifically designed to warn the pilot about battery overtemperature. It is analog and consists of battery temperature sensors and two warning LED lights, one for each battery pack, installed on the instrument panel. The overtemperature warning lights are activated when the analog sensors detect a battery temperature above 58 °C (warning range).

The 58 °C threshold coincides also with the temperature at which automatic disconnection of the battery is triggered by the digital system. This is accompanied by a warning message on EPSI570C and annunciator.

Example: front (F) battery overtemp warning light active

The digital and the analog systems are both operative at the same time (normal condition) and, in the event of battery overtemperature, the warning is signaled by both. In the case of EPSI570C display/software malfunction, the analog system remains operative.

NOTE: Battery overtemperature requires emergency procedures described in section Battery Overtemperature (3.5.7).

See section (3.2.1) for the list of warning and caution messages and appendix 9-A1 and section (7.6.5) for more information about the use of the EPSI570C, annunciator panel and battery overtemperature warning lights.

WARNING: Do not take off if any warning or caution appears on the EPSI570C display, annunciator panel or battery overtemperature warning lights.

Additionally, a third warning system is installed. It is a aural and haptic stall warning system in the control stick handles that are activated when the angle of attack becomes critical.

WARNING: Do not operate the engine in recuperation mode (see appendix 9-A1), when dealing with an EMERGENCY or parameter abnormalities, especially when dealing with engine or battery problems. Try to keep engine power setting at zero (0) or in positive range.

3.2.1 EPSI570C WARNING AND CAUTION MESSAGES

The following table presents the possible warning and caution messages that appear on the EPSI570C display.

WARNING: Do not take off if any warning or caution appears on the EPSI570C display, annunciator panel or battery overtemperature warning lights.

WARNINGS		
BATTERY WARNINGS		
Warning Message	**Description**	**Section**
BATTERY F/R DISCONNECTED DUE TO: OVERVOLTAGE / UNDERVOLTAGE / INTERLOCK ERROR / INTERNAL HW FAILURE	This message indicates that the system has automatically disconnected a battery pack due to one of the reasons listed.	3.4.9 3.5.5
BATTERY F/R DISCONNECTED DUE TO: OVERTEMPERATURE	This message indicates an automatic battery disconnection due to overtemperature.	3.5.7
ENGINE WARNINGS		
Warning Message	**Description**	**Section**
ENGINE OVERTEMPERATURE	Power controller temperature or motor temperature in warning range. Power controller derating is active.	3.5.10

CAUTIONS

BATTERY CAUTIONS

Caution Message	Description	Section
BATTERY F/R HIGH TEMPERATURE	The system has detected a battery temperature in the caution range.	3.4.9 3.5.6
BATTERY F/R ABOUT TO DISCONNECT	Battery temperature is rising into the warning range and system will disconnect the battery soon.	3.4.9 3.5.6
BATTERY F/R NOT PRESENT	The system is unable to communicate with the battery. (via CAN-bus communication system)	3.4.7 3.4.9 3.5.5 3.5.8
ONLY ONE BATTERY PACK IS ACTIVE	This caution appears when the power controller is ON and when motor RPM >300. Only one battery can delivery power. This message is meant to avoid the possibility of taking off with only one pack active and providing power.	3.4.7 3.4.9 3.5.5
BATTERY F/R OVERCURRENT	The system has detected an overcurrent from the battery.	3.4.9 3.5.11
BATTERY VOLTAGES NOT EQUAL	Difference between battery voltages is >5V.	3.4.5
SOC <30%	State of charge is less than 30%.	3.4.9 3.5.12
NO GO-AROUND AVAILABLE	Appears when SOC<15%. Batteries are almost discharged. Only few minutes of power left.	3.5.13
BATTERY F/R STARTUP FAILED	This message appears after turning the power enable switch on during ground operation.	3.4.5
BATTERY F/R SOC ADJUSTED	This message informs the pilot that SOC has been recalculated and updated.	3.5.14
BATTERY F/R LOW CELL VOLTAGE	The system has detected a low voltage in the battery cells.	3.5.15
BATTERY COOLANT PUMP 1/2 FAILURE	Battery coolant pump 1 or 2 malfunction.	3.5.16

BATTERY COOLANT FAN FAILURE	Battery coolant fan malfunction. This caution appears during recharging.	3.4.6
BATTERY F/R SELFTEST FAILED PBIT	The system has detected battery parameter anomalies during system startup.	3.4.5
BATTERY F/R SELFTEST FAILED LOW TEMP	The system has detected battery temperatures below the limit for startup (<0°C)	3.4.5
ENGINE CAUTIONS		
Caution Message	**Description**	**Section**
ENGINE HIGH TEMPERATURE	Power controller temperature or motor temperature in caution range. If temperatures keep increasing expect "Engine Overtemperature" warning message.	3.4.9 3.5.9
ENGINE COMMUNICATION FAILURE	Power setting can't be changed and remains at the last valid setting.	3.4.10 3.5.17
ENGINE COOLANT PUMP FAILURE	Engine coolant pump malfunction. Expect rise of power controller and motor temperatures, power derating and power cut off.	3.4.9 3.5.18
SYSTEM CAUTIONS		
Caution Message	**Description - Action**	
SYSTEM ISOLATION FAILURE	The system has detected a failure in the electrical insulation between high voltage and low voltage systems/lines.	3.5.19
DC/DC COMMUNICATION FAILURE	DC/DC system malfunction. Auxiliary battery might not be recharged.	3.4.8 3.5.20
DC/DC NOT WORKING	DC/DC system malfunction. Auxiliary battery might not be recharged.	3.4.8 3.5.20
POWER LEVER COMMUNICATION FAILURE	Power lever malfunction. Power setting can't be changed and remains at the last valid setting.	3.4.10 3.5.21

BATTERY CURRENT NOT EQUAL	Max permissible difference in electrical current between batteries is out of tolerance. This message also appears when one battery is disconnected (current is 0).	3.5.22
AUXILIARY BATTERY FAILURE	Auxiliary battery malfunction. No backup available in case of DC/DC converter failure.	3.14

3.3 AIRSPEEDS FOR EMERGENCY OPERATIONS

Maneuvering Speed:	100 KIAS
Best Glide Speed (flaps 0):	70 KIAS

Emergency Landing (Engine-out) - Final approach speeds:

Flaps 0	63 KIAS
Flaps +1	60 KIAS
Flaps +2	58 KIAS

3.4 GROUND EMERGENCIES

3.4.1 ENGINE SYSTEM FIRE ON GROUND

Should you encounter firewall-forward fire on the ground, react as follows:

1	Come to a complete standstill	-
2	MASTER switch	OFF
3	BATT EN switch	OFF
4	PWR EN switch	OFF
5	BATT REAR & BATT FRONT circuit breakers	DISENGAGE
6	PWR CTRL circuit breaker	DISENGAGE
7	Emergency ground egress procedure (3.4.4)	PERFORM

WARNING: A waterless agent fire extinguisher should be used in case of engine system fire.

WARNING: DO NOT attempt to restart the motor after an engine system fire.

3.4.2 BATTERY FIRE ON GROUND

A clear indication of battery fire is dense smoke and a distinctive chemical smell. Fire can develop quickly and aggressively. Should you encounter battery fire on the ground, react as follows:

1	Come to a complete standstill	-
2	MASTER switch	OFF
3	BATT EN switch	OFF
4	BATT REAR & BATT FRONT circuit breakers	DISENGAGE
5	Emergency ground egress procedure (3.4.4)	PERFORM

WARNING: Be aware that lithium battery fires are extremely dangerous because they are self-sustaining! They are a result of a chemical reactions and are impossible to extinguish. You can only prevent or delay fire propagation by continually cooling down the batteries and surrounding items with copious amount of water.

NOTE: expect battery overtemperature analog warning lights ON in case of battery fire/overtemperature.

WARNING: DO NOT attempt to restart the motor or to reconnect the batteries after a battery system fire. Aircraft should be under surveillance for at least 24h in a safe place where potential fire, caused by possible latent battery thermal runaway or late cell ignition, can not cause further damage to the surroundings.

3.4.3 EMERGENCY ENGINE SHUTDOWN ON GROUND

1	Power Lever	CUT OFF
2	MASTER Switch	OFF
3	BATT EN Switch	OFF
4	PWR EN Switch	OFF
5	PWR CTRL Circuit breaker	DISENGAGE

3.4.4 EMERGENCY GROUND EGRESS

1	Engine	SHUTDOWN
2	Parking brake	ENGAGE
3	Seat belts	RELEASE
4	Airplane	EXIT
5	Vicinity of airplane	EVACUATE

While exiting the airplane, make sure the evacuation path is clear of other aircraft, spinning propellers and/or other hazards.

3.4.5 BATTERY FAILURE AT SYSTEM START-UP

The system performs a self test on electrical components during the start-up phase. Batteries are included in the checks.

In case of battery malfunction during system test (or temperatures below 0°C) the following caution messages can appear:

EPSI570C message	Annunciator
BATTERY F/R SELFTEST PBIT/LOW TEMP FAILED *(amber)*	 or
BATTERY F/R STARTUP FAILED *(amber)*	 or 

CAUTION: If these messages appear, do not continue start up. If reason is low battery temperature, try to start up when battery temperature is >0°C. If failure persists, or in case of other messages contact manufacturer.

EPSI570C message	Annunciator
BATTERY VOLTAGES NOT EQUAL *(amber)*	

1	DO NOT TAKE OFF	-

CAUTION: If this message appears, do not take off. Try to fully recharge batteries. If the message persists, contact manufacturer.

3.4.6 BATTERY COOLANT FAN FAILURE

The battery coolant fan is used during the recharging phase. If the battery coolant fan fails, charging power is derated to 0 kW (see also Section 8 for additional information about charging procedure) and the following caution message appears:

EPSI570C message	Annunciator
BATTERY COOLANT FAN FAILURE *(amber)*	

1	Recharging procedure	ABORT

NOTE: Contact manufacturer.

3.4.7 ONLY ONE BATTERY CONNECTED

If a battery is not detected in the CAN-bus communication line (also consequent to battery circuit breaker disengagement) there is no communication between the system controller and the battery. When this occurs the following message appears:

EPSI570C message	Annunciator
BATTERY F/R NOT PRESENT *(amber)*	

1	DO NOT TAKE OFF	-

Additionally, on EPSI570C the parameters of the battery that is not communicating are not available and are covered by a red cross (See section 9-A1 for details).

If communication with the battery is still possible, but the disconnection happens at the power line interface of the battery, the following message appears on the EPSI570C as soon as RPM reaches 300 RPM, to avoid take off with a single battery delivering power.

EPSI570C message	Annunciator
ONLY ONE BATTERY PACK IS ACTIVE *(amber)* (if RPM>300)	

1	DO NOT TAKE OFF	-

CAUTION: If these messages appear, do not take off. Check battery connectors. If the problem is not solved, contact manufacturer. If they appear in flight see Single battery disconnection emergency procedures (3.5.5).

3.4.8 DC/DC CONVERTER FAILURES

When the system detects a DC/DC converter failure, the auxiliary battery is not being recharged. This means the engine, several instruments and systems, required according to the MLE, will soon become inoperative. Expect one of the following caution messages to appear:

EPSI570C message	Annunciator
DC/DC COMMUNICATION FAILURE *(amber)*	
DC/DC NOT WORKING *(amber)* (if RPM>300)	

1	DO NOT TAKE OFF	-

CAUTION: If these messages appear, do not take off and contact manufacturer.

3.4.9 PROPULSION SYSTEM COMPONENT FAILURES

CAUTION: If any warning or caution messages related to propulsion system components appear while on the ground (engine or battery high temperature, engine overtemperature, battery overcurrent, coolant pumps, battery disconnection etc), do not take off.

If any warning or caution message appears while on the ground:

- If take off run is not initiated yet:

1	DO NOT TAKE OFF	-

CAUTION: Contact manufacturer.

- If the take off run is initiated and conditions (speed, available runway) permit safe aircraft stoppage:

1	Come to a complete standstill	PERFORM
2	MASTER switch	OFF

NOTE: If the warning/caution message is battery related, disengage affected battery circuit breaker. Expect additional caution messages caused by battery disconnection/single battery operation to appear.

3	MASTER switch	ON
4	Taxi off the runway (using low power setting)	PERFORM
5	Shutdown procedure (4.12)	PERFORM

- If conditions do not permit safe aircraft stoppage:

3	Take off	CONTINUE
4	Land	AS SOON AS PRACTICAL

CAUTION: Contact manufacturer.

3.4.10 POWER LEVER / ENGINE COMMUNICATION FAILURE

If a power lever or engine communication failure occurs, the power setting can't be adjusted by the pilot and remains at the last valid value before the communication loss. Expect one of the following caution messages to appear:

EPSI570C message	Annunciator
POWER LEVER COMMUNICATION FAILURE *(amber)*	
EPSI570C message	**Annunciator**
ENGINE COMMUNICATION FAILURE *(amber)*	

- If the take off run is not initiated yet:

1	PWR CTRL circuit breaker	DISENGAGE
2	Power lever	CUT OFF
3	Shutdown procedure (4.12)	PERFORM
4	Parking procedure (4.13)	PERFORM

- If take off run is initiated and there is enough runway to stop the aicraft or power/speed is not sufficient for lift off and climb:

1	PWR CTRL circuit breaker	DISENGAGE
2	Power lever	CUT OFF
3	Come to a complete standstill	PERFORM
4	Shutdown procedure	PERFORM
5	Push the aircraft off the runway	PERFORM
6	Parking procedure (4.13)	PERFORM

- If there is not enough runway available to stop, and power/speed is sufficient for lift off and climb: perform Engine / power lever communication failure (in flight) procedures (3.5.17 / 3.5.21).

NOTE: In the case of an engine communication failure, all parameters related to motor and power controller, including the parameters (RPM, kW) displayed on Kanardia instrument installed in front of the left seat, are covered with a red cross. The values displayed represent the last valid output.

CAUTION: Contact manufacturer.

3.5 IN-FLIGHT EMERGENCIES

3.5.1 COMPLETE POWER LOSS AFTER TAKE OFF

If complete power loss occurs immediately after becoming airborne and a runway landing is possible, abort with a runway landing. If, however, altitude attained precludes a runway stop, but is not sufficient to restart the motor, lower the nose to maintain airspeed and establish a glide attitude. In most cases, the landing should be made straight ahead, turning only to avoid obstructions. After establishing a glide for landing, perform as many of the checklist items as time permits.

1	Best Glide or Landing Speed (as appropriate)	ESTABLISH
2	BATT FRONT & BATT REAR Circuit breakers	DISENGAGE
3	PWR CTRL Circuit breaker	DISENGAGE
4	Flaps	AS REQUIRED
5	Land (emergency landing)	PREPARE TO LAND

WARNING: Do not change course or make turns if this is not of vital necessity! After having landed safely, ensure protection of the aircraft and vacate the runway to keep the runway clear for arriving and departing traffic. Do this calmly and carefully, so as to avoid injury and equipment damage.

WARNING: If a turn back to the runway is elected, be very careful not to stall the airplane.

Minimum recommended altitude for attempting a turn back to the runway:

Power loss in upwind leg	at least 700 ft AAL
Power loss in crosswind leg	at least 500 ft AAL

CAUTION: This maneuver is influenced by many factors like pilot skills, experience, reaction time, wind, presence of obstacles etc. Good situational awareness and pilot judgment is essential.

3.5.2 COMPLETE IN-FLIGHT POWER LOSS

If the power is lost at altitude, pitch down as necessary to establish best glide speed. While gliding toward a suitable landing area, attempt to identify the cause of the failure and correct it.

1	Best Glide Speed (flaps 0)	ESTABLISH 70 KIAS

- If time permits:

2	Motor restart in flight procedure (3.5.3)	ATTEMPT

- If restart is not effective:

3	Emergency landing procedure (3.9.1)	PERFORM

WARNING: High motor or power controller temperature may be indicative of an imminent complete propulsion system failure.

BEST GLIDE SPEED AND RATIO CONDITIONS:

Weight:	600 kg
Best Glide Speed - V_G (flaps 0):	70 KIAS
Max. Glide Ratio:	15:1

3.5.3 MOTOR RESTART IN FLIGHT

NOTE: The minimum height, at which a motor restart attempt can be made safely, is 1000 ft AAL.

Attempt to restart the motor in flight following these steps:

1	Power lever	CUT OFF
2	PWR EN Switch	OFF
3	MASTER Switch	OFF
4	PWR CTRL Circuit breaker	DISENGAGE
	After 3 seconds:	
5	PWR CTRL Circuit breaker	ENGAGE
6	MASTER SWITCH	ON
7	PWR EN Switch	ON
8	Power lever	SLOWLY INCREASE
	- If restart is not effective:	
9	Emergency landing procedure (3.9.1)	PERFORM

3.5.4 PARTIAL POWER LOSS

Possible causes for a partial loss of power include power controller, system controller or power lever malfunctions, fluctuating RPM or power derating intervention due to engine overtemperature. Check EPSI570C/annunciator for indication of malfunctions or abnormalities, or presence of caution or warning messages.

NOTE: If partial power loss is accompanied by engine overtemperature caution messages, the power loss is due to power derating activation. Perform Engine overtemperature procedures (3.5.10).

NOTE: A damaged propeller may cause extremely rough operation. If an out-of-balance propeller is suspected, immediately shut down engine and perform Emergency landing procedure (3.9.1).

Partial power loss at take off

Partial power loss is most critical during take off. The time available to assess the situation is limited and the pilot has to react quickly.

If partial power loss happens during take off run, and conditions permit a safe stoppage, the pilot has to abort the take off.

If the take off can't be aborted, perform the following:

1	Power available	ASSESS

NOTE: 35 kW is considered as minimum power that should be available for safe initial climb.

2	Airspeed	ESTABLISH Vx (57 KIAS)
3	Climb over the obstacles to safe altitude	PERFORM
4	Propulsion system parameters	CHECK/MONITOR
5	Land	AS SOON AS PRACTICAL

Partial power loss in flight

If a partial engine failure permits level flight, keep monitoring EPSI570C display/annunciator and instruments, and try to determine the cause of the power loss. Land at a suitable airfield as soon as practical.

If conditions do not permit safe level flight, move the power lever through the complete range to obtain the best operation possible and check the amount of available power. Use partial power as necessary to set up a forced landing pattern over a suitable landing field. Always be prepared for a complete power loss.

3.5.5 BATTERY DISCONNECTED

M

Single Battery Disconnection

Battery disconnection can be either manual, by disengaging the battery circuit breaker, or automatic, triggered by the system.

In case of automatic battery disconnection, the EPSI570C will display a warning message identifying which battery has been disconnected (F=Front or R=Rear) and the reason for disconnection.

NOTE: In case of automatic "battery f/r disconnected due to: overtemperature" see specific Battery overtemperature procedures (3.5.7).

EPSI570C message	Annunciator
BATTERY F/R DISCONNECTED DUE TO: OVERVOLTAGE / UNDERVOLTAGE / INTERLOCK ERROR / INTERNAL HW FAILURE *(red)*	

General procedure in case of single battery disconnection:

1	Affected battery circuit breaker	DISENGAGE
2	Reduce power	AS MUCH AS POSSIBLE
3	SOC, RFT, Battery temperature	MONITOR
4	Land	AS SOON AS PRACTICAL

Subsequent to automatic battery disconnection, the following caution messages will also appear (the second caution will be visible after the acknowledgment of the first):

EPSI570C message	Annunciator
ONLY ONE BATTERY PACK IS ACTIVE *(amber)*	
BATTERY CURRENT NOT EQUAL *(amber)*	

Subsequent, and consequently, to battery circuit breaker disengagement (this action will cause loss of communication with the battery and parameters such as battery temperature and voltage will no longer be available - see Appendix 9-A1 for details), also the following caution message will appear:

EPSI570C message	Annunciator
BATTERY F/R NOT PRESENT *(amber)*	 or

WARNING: Battery disconnection will reduce the aircraft endurance drastically. Monitor the remaining SOC and the RFT, and react accordingly. If the SOC does not permit reaching an airfield, set up a forced landing pattern over a suitable landing field and perform Emergency landing procedure (3.9.1).

WARNING: Max 40 kW of power with one battery operative. However, in exceptional cases (i.e. traffic/obstacle avoidance), full power can be applied for a recommended maximum duration of 30 seconds. If possible, use power settings below 30 kW to avoid battery temperature increase or risk of disconnection due to undervoltage of the functional battery.

WARNING: Do not operate the engine in recuperation mode (see appendix 9-A1). Try to keep engine power setting at zero (0) or in positive range.

WARNING: Do not attempt to reconnect a battery that has been automatically or manually (by disengaging the circuit breaker) disconnected. After one battery is disconnected, the equal voltage between the two battery boxes it's not guaranteed anymore. Reconnecting one battery may lead to high very dangerous balancing current between the two batteries.

Double Battery Disconnection

Double battery disconnection shall be considered a Complete in-flight power loss, and requires Emergency landing procedure (3.9.1), without motor power:

1	Emergency landing procedure (3.9.1)	PERFORM

WARNING: Do not attempt to reconnect a battery that has been automatically or manually (by disengaging the circuit breaker) disconnected.

3.5.6 BATTERY HIGH TEMPERATURE

If battery temperature enters the caution range (between 51°C and 57 °C), EPSI570C and annunciator will display the following caution message:

EPSI570C message	Annunciator
BATTERY F/R HIGH TEMPERATURE *(amber)*	 or

Perform the following:

1	Power Lever	Reduce < 30 kW
2	Battery temperature	MONITOR

- If battery temperature remains in the caution range:

3	Land	AS SOON AS PRACTICAL

- If battery temperature continues to increase, exceeding 55°C, also the following message appears:

EPSI570C message	Annunciator
BATTERY F/R ABOUT TO DISCONNECT *(amber)*	 or 

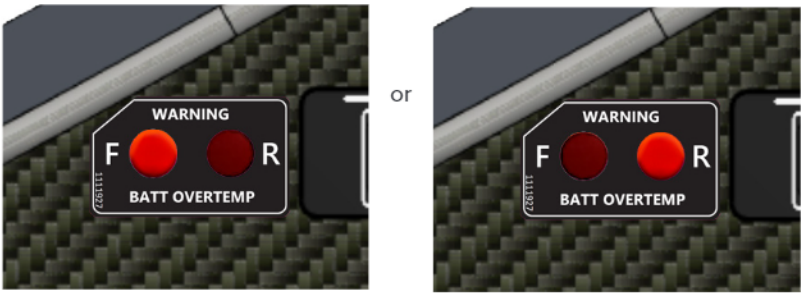
NOTE: The procedure remains the same as for the previous caution message "BATTERY F/R HIGH TEMPERATURE".

3.5.7 BATTERY OVERTEMPERATURE

If battery temperatures continue to rise, entering the warning range (≥ 58 °C), the battery is automatically disconnected by the system. Expect the following message to appear:

EPSI570C message	Annunciator
BATTERY F/R DISCONNECTED DUE TO OVERTEMPERATURE *(red)*	

Also expect the battery overtemperature warning light of the affected battery to illuminate (independent analog system):



Perform the following:

1	Reduce power	AS MUCH AS POSSIBLE
2	Affected battery circuit breaker	DISENGAGE *
3	Caution messages on EPSI570C following battery disconnection/circuit breaker disengagement	ACKNOWLEDGE
4	SOC and RFT	MONITOR
5	Other battery temperature and parameters	MONITOR

- If warning is signalled by both alert systems (battery overtemperature warning lights AND EPSI warning message):

6	Land	IMMEDIATELY
7	Airplane	EVACUATE

- If warning is signalled by only one of the alert systems (battery overtemperature warning lights only OR EPSI warning only):

6	Land	AS SOON AS POSSIBLE

* **NOTE**: After battery circuit breaker disengagement, communication with the battery is lost. The battery overtemp warning light will go off and battery parameters (such as temperature) will not be available (see Appendix 9-A1 for details). This does not mean that the overtemperature issue is solved.

CAUTION: Max 40 kW of power with one battery operative.

NOTE: High power settings or prolonged full power applications may cause overtemperature or "disconnection due to undervoltage" of the remaining battery.

WARNING: Battery overtemperature may induce battery thermal runaway. An indication of possible ongoing thermal runaway is dense smoke or chemical smell from battery compartments. This situation is extremely dangerous and can lead to battery fire. **Any warning light activation or presence of chemical smell/smoke requires immediate attention**.

WARNING: In presence of smoke or chemical smell, **land immediately.**

NOTE: See also Battery system fire procedure (3.6.2) for additional information about lithium battery fires and related procedures.

WARNING: Do not operate the engine in recuperation mode (see appendix 9-A1). Try to keep engine power setting at zero (0) or in positive range.

WARNING: Do not attempt to reconnect a battery that has been automatically or manually (by disengaging the circuit breaker) disconnected. After one battery is disconnected, equal voltage between the two battery boxes is not guaranteed anymore. Reconnecting one battery may cause a high and very dangerous current surge between the two batteries

CAUTION: Do not re-connect or use the overheated battery after landing. Contact manufacturer.

PB345V124E-L battery type

3.5.8 BATTERY NOT PRESENT

Single battery loss of communication

EPSI570C message	Annunciator
BATTERY F/R NOT PRESENT *(amber)*	 or

1	Single battery disconnection procedure (3.5.5)	PERFORM

Communication loss with one battery is indicated by a single caution message. Affected battery information (SOC, temperature) is not available and EPSI battery parameters are covered by a red cross as shown in Section 9-A1. The battery can supply power, but can't be monitored. A precautionary manual disconnection is required (HV BATT F/R circuit breaker disengagement), applying Single battery disconnection procedure (3.5.5).

Double battery loss of communication

EPSI570C message	Annunciator
BATTERY F NOT PRESENT *(amber)* **BATTERY R NOT PRESENT** *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Annunciator/ Batt warning lights	MONITOR
3	Land	AS SOON AS PRACTICAL *

A total communication loss with both batteries is signalled by two caution messages. Red crosses appear over the parameters of both batteries.

* **CAUTION:** SOC and RFT values are not available and residual endurance is difficult to assess, so excessive energy consumption could occur without the pilot realizing it. A power-off precautionary landing is recommended. Additionally, if batteries are below 15%SOC, the power for a go-around is not guaranteed.

3.5.9 ENGINE HIGH TEMPERATURE

If engine (motor or power controller) temperature enters the caution range (65 °C - 69 °C for power controller or 100 °C - 109 °C for the motor) the following caution message will be displayed on EPSI570C:

EPSI570C message	Annunciator
ENGINE HIGH TEMPERATURE *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Engine (motor or power controller) temperature	MONITOR
3	Engine coolant pump status	CHECK EPSI for failure messages

CAUTION: Engine temperature may increase due to engine coolant pump malfunction. Engine coolant pump malfunction is usually detected and signaled by a caution message (see 3.5.18). If the engine high temperature is caused by coolant pump failure expect temperatures to increase rapidly as soon as power is applied.

- If engine temperature remains in caution range:

4	Land	AS SOON AS PRACTICAL

WARNING: High power settings when the engine temperature is inside caution range will lead to the temperature entering the warning range, followed by engine overtemperature warning message.

NOTE: If power controller or motor temperature sensor failure occurs, the mission has to be aborted. In this case, Coolant IN and Coolant OUT temperature values (EPSI570C – SYSTEM page) can help the pilot identify engine cooling malfunction if temperatures rise abnormally.

3.5.10 ENGINE OVERTEMPERATURE

If engine temperature continues to increase and enters the warning range (70 °C for power controller and 110 °C for the motor), expect the following warning message to appear:

EPSI570C message	Annunciator
ENGINE OVERTEMPERATURE *(red)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Engine (motor or power controller) temperature	MONITOR

CAUTION: If engine temperature reaches the warning range **power derating** is activated (see 7.6.4 for power derating description). Full power will be available again only after the temperatures have dropped out of the warning range. Expect imminent power cut to zero in case of high power usage!

- If partial power is still available and the engine coolant pump is functional, perform the following:

3	Land	AS SOON AS POSSIBLE

- if engine overtemperature is associated with "engine coolant pump failure" message (3.5.18), power will very likely be derated to zero in a few seconds after power application. The recommended procedure is the following:

3	Power lever	CUT OFF
4	Best glide speed (flaps 0)	70 KIAS
5	Land (emergency landing)	PREPARE TO LAND

NOTE: Avoid unnecessary power application or recuperation mode. Residual power before final derating to 0 kW can be carefully used to adjust final approach path during the emergency landing final phase, or traffic/obstacle avoidance.

- if power is derated to zero:

3	Emergency landing procedure (3.9.1)	PERFORM

3.5.11 BATTERY OVERCURRENT

This message is usually associated with single battery operation and if the system detects excessive current drain from the functional battery.

The following caution message will appear on EPSI570C:

EPSI570C message	Annunciator
BATTERY F/R OVERCURRENT *(amber)*	 or

1	Reduce power	AS MUCH AS POSSIBLE
2	Battery status/current (of both batteries)	CHECK

- if both batteries are still connected (current of both batteries ≠ 0 A):

3	Battery temperatures and currents	MONITOR
4	Land	AS SOON AS PRACTICAL

- if one battery is disconnected (current = 0 A) and has caused overcurrent of the other:

3	Circuit breaker of battery delivering 0 A	DISENGAGE
4	Single Battery disconnection procedure (3.5.5)	PERFORM

CAUTION: Abort mission if the message appears while on the ground.

3.5.12 LOW STATE OF CHARGE (LOW SOC)

Battery SOC is indicated on the EPSI570C with two bars showing SOC percentage for each battery pack.

SOC bars are green when SOC % is between 100% and 30%, and turn amber below 30%.

When SOC % is lower than 30%, expect the following caution message to appear:

EPSI570C message	Annunciator
SOC<30% *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Remaining SOC and RFT	MONITOR
3	Land	PREPARE TO LAND

NOTE: A normal mission must terminate with SOC ≥ 30% at landing!

3.5.13 NO GO-AROUND AVAILABLE

If the flight continues and SOC% decreases to 15%, the following caution message appears:

EPSI570C message	Annunciator
NO GO-AROUND AVAILABLE *(amber)*	

CAUTION: The message above indicates that batteries are almost discharged and the remaining energy is only sufficient for a few minutes of flight. There is not enough energy left to perform a go-around safely.

1	Land	PREPARE TO LAND

WARNING: If SOC < 15%, applying full power may cause battery voltage to drop and eventual battery disconnection.

3.5.14 BATTERY SOC ADJUSTED

Battery malfunction may cause the system to recalculate the battery SOC. The updated values might be different from the previous. Remaining Flight Time (RFT) may change as well.

NOTE: This is not the case for normal SOC decrease during flight.

After SOC% is recalculated, expect the following caution message:

EPSI570C message	Annunciator
BATTERY F/R SOC ADJUSTED *(amber)*	 or

1	Updated SOC value	CHECK
2	SOC and RFT	MONITOR

CAUTION: The mission has to be re-planned according to new SOC and RFT values!

3.5.15 BATTERY CELL LOW VOLTAGE

When the system detects a low cell voltage in either of the battery boxes, expect the following caution message to appear:

EPSI570C message	Annunciator
BATTERY F/R LOW CELL VOLTAGE *(amber)*	 or

1	Reduce power	AS MUCH AS POSSIBLE
2	SOC and RFT	MONITOR

CAUTION: If power is not adequately reduced, expect the affected battery to be disconnected automatically due to undervoltage.

NOTE: The caution message is triggered when the system detects a minimum cell voltage below 3100 mV in either of the battery boxes. Displayed SOC is linked to cell voltage. Expect also low SOC caution message (3.5.12) to appear with the message above. Battery voltage decreases rapidly, especially when high power is applied at low SOC.

- If the battery disconnects:

3	Single battery disconnection procedure (3.5.5)	PERFORM

CAUTION: In the case of battery undervoltage/overvoltage do not re-charge the battery. The battery has to be sent to an authorized maintenance organization for inspection. Contact manufacturer after the flight.

3.5.16 BATTERY COOLANT PUMP FAILURE

When the system detects a failure of one or both battery coolant pumps, expect the following caution messages to appear:

EPSI570C message	Annunciator
BATTERY COOLANT PUMP 1/2 FAILURE *(amber)*	

<u>Single battery coolant pump failure</u>

- If a single coolant pump fails (one caution message, for pump 1 OR 2):

1	Battery temperatures	MONITOR
2	Flight	Continue normally

Double battery coolant pump failure

- If both coolant pumps fail (two caution messages, one for pump 1 AND one for pump 2:

1	Reduce power	AS MUCH AS POSSIBLE
2	Battery temperatures	MONITOR
3	Land	AS SOON AS PRACTICAL

NOTE: Contact manufacturer after the flight.

CAUTION: High power settings with both pumps inoperative will cause a rapid increase of battery temperatures. It is recommended to avoid excessive use of power unless absolutely necessary (traffic or obstacle avoidance).

3.5.17 ENGINE COMMUNICATION FAILURE

In the case of engine communication failure, the power setting can't be adjusted by the pilot and will stay the same as it was before the communication loss. The pilot has to evaluate the situation and assess whether there's enough power available to sustain level flight or return to base.

Expect the following caution message to appear:

EPSI570C message	Annunciator
ENGINE COMMUNICATION FAILURE *(amber)*	

1	Power Available	ASSESS

CAUTION: if communication is lost at high power settings and power can't be reduced, this may result in high power system component temperatures.

Assess the power available to determine if it is possible to return to base or to reach an alternate airfield or a suitable landing area. When at gliding

distance from the elected landing site and when ready for a power-out approach, switch the motor off:

2	PWR CTRL circuit breaker	DISENGAGE
3	Emergency landing procedure (3.9.1)	PERFORM

NOTE: In the case of engine communication failure, all parameters related to the motor and power controller, including the parameters (RPM, kW) displayed on the Kanardia instrument installed in front of the left seat, are covered by a red cross (see Section 9-A1 for more details). The values displayed represent the last valid output. Engine temperatures and other parameters will not be available and can't be monitored. Be prepared to the possibility of engine temperature rising, if communication was lost at high power settings. Power derating and propeller overspeed protection will remain active.

3.5.18 ENGINE COOLANT PUMP FAILURE

Engine coolant pump failure causes engine temperatures to rise immediately as power is applied. Power controller temperature will rise faster than motor temperature, and in a few seconds will cause power controller shut down and total loss of power at most useful power settings.

When the system detects a engine coolant pump failure, expect the following caution message to appear:

EPSI570C message	Annunciator
ENGINE COOLANT PUMP FAILURE *(amber)*	

React as follows:

1	Power lever	CUT OFF
2	Best glide speed (flaps 0)	70 KIAS
3	Engine (power controller and motor) temperatures	CHECK
4	Land (emergency landing)	PREPARE TO LAND

NOTE: Avoid unnecessary power application or recuperation mode. Residual

power before final derating to 0 kW can be carefully used to adjust final approach path during the emergency landing final phase, or for traffic/obstacle avoidance.

NOTE: See also Engine high temperature/overtemperature procedures (3.5.9 and 3.5.10) for caution and warning messages associated with engine high temperature and overtemperature.

3.5.19 ELECTRICAL SYSTEM INSULATION FAILURE

When the system detects an electrical insulation failure between high voltage and low voltage systems/wirings, expect the following caution message to appear:

EPSI570C message	Annunciator
SYSTEM ISOLATION FAILURE *(amber)*	

1	Land	AS SOON AS PRACTICAL

CAUTION: Contact manufacturer after the flight. Any inspection/troubleshooting by the pilot shall be avoided as it could lead to lethal electrical shock.

3.5.20 DC/DC CONVERTER FAILURES (IN FLIGHT)

When the system detects an DC/DC converter failure, expect one of the following caution messages to appear:

EPSI570C message	Annunciator
DC/DC COMMUNICATION FAILURE *(amber)*	
DC/DC NOT WORKING *(amber)* (if RPM>300)	

The DC/DC converter is the system that recharges the auxiliary battery. If the auxiliary battery is not being recharged, it will discharge during flight and aircraft instruments and essential systems will eventually become inoperative.

CAUTION: The system controller is powered by a DC/DC converter/aux battery. Also motor power will eventually be lost when aux battery is discharged.

1	AUX BATTERY Voltage	MONITOR
2	Land	AS SOON AS PRACTICAL

NOTE: aux battery guarantees at least 30 minutes of power.

3.5.21 POWER LEVER COMMUNICATION FAILURE

In the case of power lever communication failure, the power setting can't be changed by the pilot and it will stay the same as it was before the communication loss. The pilot has to evaluate the situation and assess whether there's enough power available to sustain level flight or return to base.

Expect the following caution message to appear:

EPSI570C message	Annunciator
POWER LEVER COMMUNICATION FAILURE *(amber)*	

1	Power Available	ASSESS
2	Engine and Battery temperatures	MONITOR

Assess the power available to determine if it is possible to return to base or to reach an alternate airfield or a suitable landing area.

When at gliding distance from elected landing site and when ready for a power-out approach, switch the motor off:

3	PWR CTRL circuit breaker	DISENGAGE
4	Emergency Landing (3.9.1)	PERFORM

3.5.22 BATTERY CURRENT NOT EQUAL

If the system detects disproportionate current drain between the two batteries, the following caution message will appear on EPSI570C:

EPSI570C message	Annunciator
BATTERY CURRENT NOT EQUAL *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Land	AS SOON AS PRACTICAL

NOTE: Contact manufacturer after the flight

3.6 FIRE IN FLIGHT

3.6.1 ENGINE FIRE IN FLIGHT

1	PWR EN switch	OFF
2	MASTER switch	OFF
3	BATT EN switch	OFF
4	BATT REAR & BATT FRONT circuit breakers	DISENGAGE
5	Door windows	OPEN
6	Side-slip maneuver in direction opposite to the fire.	IF POSSIBLE
7	Land (emergency landing without motor power)	AS SOON AS POSSIBLE
8	Airplane	EVACUATE

3.6.2 BATTERY SYSTEM FIRE

Indication of battery fire is dense smoke and a distinctive chemical smell. Fire can develop quickly and aggressively. A battery system fire will trigger warning and cautions similar to those in a battery high temperature emergencies (see section 3.5.6). Expect battery high/overtemperature cautions and warnings to appear on the EPSI570C display and annunciator. Also expect BATT OVERTEMP WARNING light/s to illuminate. Should you encounter battery fire during flight, react as follows:

1	Affected battery circuit breaker	DISENGAGE
2	Land	IMMEDIATELY
3	Airplane	EVACUATE
4	Long range water type fire extinguisher (if available)	ACTIVATE

CAUTION: After battery circuit breaker disengagement the battery overtemp warning light will go off. This does not mean that the overtemperature issue is solved.

WARNING: Be aware that lithium battery fires are extremely dangerous because they are self-sustaining! They are a result of a chemical reactions

and are impossible to extinguish. You can only prevent or delay fire propagation by continually cooling down the batteries and surrounding items with a copious amount of water.

WARNING: The aircraft should be under surveillance for at least 24h due to possible latent battery thermal runaway or late cell ignition.

3.6.3 COCKPIT FIRE IN FLIGHT

If the cause of the fire is apparent and accessible, try first to locate the source of the fire and isolate it by disengaging the affected system or circuit breaker. If this is not effective, use a fire extinguisher (if available) or any other means to extinguish flames and land as soon as possible. Opening the vents may feed the fire, but to avoid incapacitating the crew from smoke inhalation, it may be necessary to rid cabin of smoke or fire extinguishing.

1	PWR EN switch	OFF
2	BATT EN switch	OFF
3	AVIONICS switch	OFF
4	MASTER Switch	OFF
5	Fire Extinguisher (if available)	ACTIVATE

WARNING: Should the fire extinguisher contain Halon gas, its operation can be toxic, especially in a closed area. After extinguishing fire, ventilate cabin by opening air vents and unlatching door (if required).

If airflow is not sufficient to clear smoke or fumes from cabin:

3	Door vents	OPEN

CAUTION: The door structure/hinge is not designed for intentional open-door operations. Be advised that the chance of door failure occurring is higher, as the airspeed at which the door is opened at increases.

4	Land (emergency)	IMMEDIATELY

3.7 SPINS

The airplane is not approved for intentional spins.

While the stall characteristics of the airplane make accidental entry into a spin extremely unlikely, spinning is possible. Spin entry can be avoided by using good airmanship: coordinated use of controls in turns, proper airspeed control and never abusing the flight controls with accelerated inputs when close to the stall.

If the controls are misapplied at the stall or abused accelerated inputs are made to the elevator, rudder and/or ailerons, an abrupt wing drop may be felt and a spiral or spin may be entered. In some cases it may be difficult to determine if the aircraft has entered a spiral or the beginning of a spin.

In any case, spin recovery technique is classic:

1	Power lever	CUT OFF
2	Roll input	Neutral
3	Rudder	Full deflection - opposite to the spin

As rotation is about to stop, or fully stopped:

4	Rudder	Neutralize
5	Control stick	Release control force towards neutral elevator position, roll input neutral
6	Horizontal flight	Resume (do not exceed g-load and airspeed limitations)

NOTE: the aircraft is equipped with an aural and haptic stall warning system in the control stick handles, that are automatically activated when critical AOA is approached.

3.8 EXCEEDING V_{NE}

Should the VNE be exceeded, reduce airspeed slowly and continue flying using gentle control deflections. Land safely as soon as possible and have the aircraft verified for airworthiness by authorized service personnel.

3.9 LANDING EMERGENCIES

If all attempts to restart the motor failed and an emergency landing is imminent, select a suitable field and prepare for landing.

A suitable field should be chosen as early as possible so that maximum time will be available to plan and execute the emergency landing. For emergency landings on unprepared surfaces, use full flaps if possible. Land on the main gear and hold the nose wheel off the ground as long as possible. If motor power is available, before attempting an "off airport" landing, fly over the landing area at a low but safe altitude to inspect the terrain for obstructions and surface conditions.

NOTE: Use of full (+2) flaps will reduce glide distance. Full flaps should not be selected until landing is assured.

3.9.1 EMERGENCY LANDING

1	Best Glide Speed	70 KIAS (flaps 0)
2	PWR CTRL circuit breaker	DISENGAGE
3	BATT FRONT & BATT REAR circuit breakers	DISENGAGE
4	Seat Belts	SECURED

Select a suitable field and prepare for the landing.

5	Flaps (when landing is assured)	+2

If time permits:

6	Radio	Transmit (121.5 MHz) MAYDAY, giving location and intentions
7	Transponder	SQUAWK 7700
8	ELT Switch	ON (if necessary)

NOTE: ELT transmission can be deactivated by resetting either the remote switch or the ELT control switch to ARM/OFF position. Please see [2] for additional details.

3.9.2 DITCHING

1	Best Glide Speed	70 KIAS (flaps 0)
2	Power lever	CUT OFF
3	BATT FRONT circuit breaker	DISENGAGE
4	BATT REAR circuit breaker	DISENGAGE
5	Life vests	CHECK
6	Loose items in cabin	SECURE
7	Seat belts	CHECK SECURED AND TIGHTEN
8	Radio	Transmit (121.5 MHz) MAYDAY
9	Transponder	SQUAWK 7700
10	ELT switch	ON
11	Approach	High seas, high wind: into the wind. Light wind, heavy swells: parallel to the swells
12	Doors	OPEN
13	AUX BATT circuit breaker	DISENGAGE
14	Flaps	+2
15	Landing at the lowest possible speed	PERFORM
16	Seat belts	Release immediately
17	Airplane	EVACUATE
18	Life vest and raft	Inflate when outside the cabin
19	Flotation Devices	INFLATE WHEN CLEAR OF AIRPLANE

NOTE: If available, life preservers should be donned and life raft should be prepared for immediate evacuation upon touchdown. Consider OPENING a door prior to assuming the emergency landing body position in order to provide a ready escape path.

It may be necessary to allow some cabin flooding to equalize pressure on the doors. If the doors cannot be opened, break out the windows and crawl through the opening.

3.9.3 LANDING WITH A DEFECTIVE MAIN LANDING GEAR TIRE

1	Land the airplane at the edge of the runway that is located on the side of the intact tire, so that changes in direction during roll-out due to the braking action of the defective tire can be corrected on the runway.
2	Land with the wing low on the side of the intact tire.
3	Direction should be maintained using the rudder. This should be supported by use of the brake. It is possible that the brake must be applied strongly - if necessary to the point where the wheel locks.

CAUTION: A defective tire is not easy to detect. The damage normally occurs during take off or landing and is hardly noticeable during fast taxiing. It is only during the lower taxiing speeds that a tendency to swerve occurs.

3.9.4 LANDING WITH DEFECTIVE BRAKES

Brake system deficiency is usually detected only after touch down, during ground roll deceleration phase. If brakes are inefficient:

1	Seat belts	CHECK FASTENED AND TIGHTENED
2	Master Switch	OFF
3	PWR CTRL circuit breaker	DISENGAGE

In case of single brake failure, release immediately brake pressure to avoid swerve due to asymmetric braking. Only if necessary apply very light pressure on the brakes, using nose wheel steering to compensate asymmetric braking.

Steer the aircraft gently during deceleration. Once the aircraft has stopped, restart the power and vacate the runway at low speed and using low power settings.

3.10 EPSI570C DISPLAY FAILURE

NOTE: All propulsion system protection features will remain operative in the case of EPSI570C failure. Propulsion system temperatures and other system parameters can't be monitored. Precautionary use of low power settings is recommended.

Total EPSI570C display failure (hardware failure)

- In the event of EPSI570C display failure (i.e. black or malfunctioning screen):

1	Reduce power	AS MUCH AS POSSIBLE
2	EPSI Circuit Breaker	DISENGAGE
3	Annunciator/ batt warning lights	MONITOR
4	Land	AS SOON AS PRACTICAL *

CAUTION: In case of EPSI hardware failure, stall warning system might be inoperative.

NOTE: If the failure only affects the EPSI display, the Kanardia instrument serves as backup for kW and RPM indication, and can be used together with other remaining instruments for the continuation of the flight (ASI, ALT, Compass, VSI, Horis).

Partial EPSI570C display failure (loss of communication)

- In the event of EPSI570C communication failure (see also page 9-A1-15):

1	Reduce power	AS MUCH AS POSSIBLE
2	Annunciator/ batt warning lights	MONITOR
3	Land	AS SOON AS PRACTICAL *

NOTE: In case of EPSI570C communication failure, the Kanardia instrument serves as backup for kW and RPM indication, and can be used together with other remaining instruments for the continuation of the flight (ASI, ALT, Compass, VSI, Horis).

* **CAUTION:** SOC and RFT values are not available and residual endurance is difficult to asses, so excessive energy consumption could occur without the pilot realizing it. A power-off precautionary landing is recommended. Additionally, if batteries are below 15%SOC, the power for a go-around is not guaranteed.

3.11 RADIO COMMUNICATION FAILURE

1	Switches, Controls	CHECK
2	Frequency	CHANGE
3	COM Circuit Breaker	CHECK
4	Headset	CHANGE
5	Transmission	ATTEMPT
if unsuccessful:		
6	transponder	SQUAWK 7600

3.12 PITOT STATIC SYSTEM MALFUNCTION

Static Source Blocked

If erroneous readings of the static source instruments (airspeed, altimeter and vertical speed) are suspected, the information from the GPS system should be used for situational awareness.

NOTE: Referring to the GPS for flying, adjust indicated airspeed during climb or approach. Use +10 KTS on top of standard procedure as guidance and observe the wind situation.

Pitot Tube Blocked

If only the airspeed indicator is providing erroneous information, and in icing conditions, the most probable cause is pitot ice. Descend into warmer air. If an approach must be made with a blocked pitot tube, use known pitch and power settings and the GPS ground speed indicator, taking surface winds into account.

1	Ground speed indicator	+10 KTS for procedures, observe winds

3.13 ELECTRIC TRIM FAILURE

Any failure or malfunction of the electric trim can be overridden by use of the control stick. If runaway trim servo is the problem, cut the circuit by disengaging the TRIM circuit breaker and land as soon as practical.

1	Airplane Control	GRASP STICK, MAINTAIN MANUALLY
	If problem is not corrected:	
2	TRIM Circuit Breaker	DISENGAGE
3	Power Lever	AS REQUIRED
4	Control Stick	MANUALLY HOLD PRESSURE
5	Land	AS SOON AS PRACTICAL

3.14 AUXILIARY BATTERY FAILURE

The auxiliary (aux) battery disconnects automatically in the case of malfunction, overvoltage and/or undervoltage. The low voltage systems are still powered by the DC/DC converter.

Expect the following caution message to appear:

EPSI570C message	Annunciator
AUXILIARY BATTERY FAILURE *(amber)*	

1	Land	AS SOON AS PRACTICAL

CAUTION: Do not take off if AUX BATT has low voltage (< 12.8V).

3.15 ICE BUILD-UP

Turn back or change altitude to exit icing conditions. Consider lateral or vertical path reversal to return to last "known good" flight conditions. Maintain VFR flight! Watch for signs of icing on the pitot tube. In case of pneumatic instrument failures, use the GPS information to reference to approximate ground speed. Plan the landing at the nearest airport, or a suitable off airport landing site in case of an extremely rapid ice build-up. Increase the speed to avoid stall.

Maneuver the airplane gently and leave the flaps retracted. When ice is built-up at the horizontal stabilizer, the change of pitching moment due to flaps extension may result of loss of elevator control. Approach at elevated speeds (+15 KTS, also if using the GPS as a reference).

WARNING: Failure to act quickly may result in an unrecoverable icing encounter.

CHECKLISTS

EMERGENCY PROCEDURES

NOTE: Memory items are emergency procedures which require immediate reaction by the pilot and are identified in the emergency checklist by the following symbol next to the procedure name:

It is recommended to get acquainted with memory items by means of dedicated ground training and accurate study of the procedures and required action sequence.

NOTE: Use of the following checklists is not obligatory and at the discretion of the owner/operator.

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GROUND EMERGENCIES

ENGINE SYSTEM FIRE ON THE GROUND	
Come to a complete standstill	-
MASTER switch	OFF
BATT EN switch	OFF
PWR EN switch	OFF
BATT REAR/BATT FRONT circuit breakers	DISENGAGE
PWR CTRL circuit breaker	DISENGAGE
Emergency ground egress procedure	PERFORM

BATTERY FIRE ON THE GROUND	
Come to a complete standstill	-
MASTER switch	OFF
BATT EN switch	OFF
BATT REAR/BATT FRONT circuit breakers	DISENGAGE
Emergency ground egress procedure	PERFORM

EMERGENCY ENGINE SHUTDOWN ON GROUND	
Power Lever	CUT OFF
MASTER Switch	OFF
BATT EN Switch	OFF
PWR EN Switch	OFF
PWR CTRL Circuit breaker	DISENGAGE

PB345V124E-L battery type

PB345V124E-L *battery type*

EMERGENCY GROUND EGRESS

Engine	SHUTDOWN
Parking brake	ENGAGE
Seat belts	RELEASE
Airplane	EXIT
Vicinity of airplane	EVACUATE

MASTER CAUTION / MASTER WARNING — ANY CAUTION / WARNING MESSAGE AT TAKE OFF

If take off run is not initiated yet:

DO NOT TAKE OFF	-

If the take off run is initiated and conditions (speed, available runway) permit safe aircraft stoppage:

Come to a complete standstill	PERFORM
MASTER switch	OFF
Affected battery circuit breaker (if message is battery-related)	DISENGAGE
Taxi off the runway (using low power setting)	PERFORM
Emergency shutdown procedure	PERFORM

If conditions do not permit safe aircraft stoppage:

Take off	CONTINUE
Land	AS SOON AS PRACTICAL

POWER LEVER / ENGINE COMMUNICATION FAILURE

CAUTION:

POWER LEVER COMMUNICATION FAILURE (amber)

or

ENGINE COMMUNICATION FAILURE (amber)

If take off run is not initiated yet:

PWR CTRL circuit breaker	DISENGAGE
Power lever	CUT OFF
Shutdown procedure	PERFORM
Parking procedure	PERFORM

If take off run is initiated and there is enough runway to stop the aircraft
or power/speed is not sufficient for lift off and climb

PWR CTRL circuit breaker	DISENGAGE
Power lever	CUT OFF
Come to a complete standstill	PERFORM
Shutdown procedure	PERFORM
Push the aircraft off the runway	PERFORM
Parking procedure	PERFORM

If there is not enough runway available to stop, and power/speed is sufficient for lift off and climb:

perform Engine / power lever communication failure (in flight) procedures

PB345V124E-L battery type

IN FLIGHT EMERGENCIES

COMPLETE POWER LOSS AFTER TAKE OFF	
Best Glide or Landing Speed (as appropriate)	ESTABLISH (70 - 60 KIAS)
BATT REAR/BATT FRONT circuit breakers	DISENGAGE
PWR CTRL Circuit breaker	DISENGAGE
Flaps	AS REQUIRED
Land (emergency landing)	PREPARE TO LAND

COMPLETE IN-FLIGHT POWER LOSS	
Best Glide speed (flaps 0)	70 KIAS
If time/altitude permits:	
Motor restart in flight procedure	ATTEMPT
If restart is not effective:	
Emergency landing procedure	PERFORM

PB345V124E-L *battery type*

MOTOR RESTART IN FLIGHT	
Power lever	CUT OFF
PWR EN Switch	OFF
MASTER Switch	OFF
PWR CTRL Circuit breaker	DISENGAGE
After 3 seconds:	
PWR CTRL Circuit breaker	ENGAGE
MASTER switch	ON
PWR EN switch	ON
Power lever	Slowly increase
If restart is not effective:	
Emergency landing procedure	PERFORM

PB345V124E-L battery type

PB345V124E-L battery type

PARTIAL POWER LOSS (at take off)	
If it is not possible to stop the aircraft before the end of the runway, lift off and:	
Power available	ASSESS (at least 35 kW for safe climb)
Airspeed	Vx (57 KIAS)
Climb over obstacles	PERFORM
Propulsion system parameters (EPSI)	CHECK/MONITOR
Land	AS SOON AS PRACTICAL

PARTIAL POWER LOSS (in flight)	
EPSI570C/annunciator	CHECK for Caution/ Warning messages
If conditions do not permit safe level flight:	
Emergency landing procedure (use partial power as necessary)	PERFORM
If conditions permit safe level flight:	
EPSI570C and instruments	MONITOR
Land	AS SOON AS PRACTICAL

BATTERY DISCONNECTED (single battery)

WARNING:

BATTERY F/R DISCONNECTED DUE TO:
OVERVOLTAGE / UNDERVOLTAGE
/ INTERLOCK ERROR
/ INTERNAL HARDWARE FAILURE (red)

Affected battery circuit breaker	DISENGAGE
Other EPSI messages sub-sequent to disconnection	ACKNOWLEDGE
SOC, RFT, battery temperature	MONITOR
Reduce power	AS MUCH AS POSSIBLE
Land	AS SOON AS PRACTICAL

DOUBLE BATTERY DISCONNECTION

Emergency landing procedure	PERFORM

PB345V124E-L battery type

PB345V124E-L battery type

BATTERY HIGH TEMPERATURE (temperature in caution range)

CAUTION:

BATTERY F/R HIGH TEMPERATURE (amber)

followed by (if temperature increases more):

BATTERY F/R ABOUT TO DISCONNECT (amber)

Power lever	Reduce <30 kW
Battery temperature	MONITOR

If battery temperature remains in the caution range:

Land	AS SOON AS PRACTICAL

BATTERY OVERTEMPERATURE (temperature in warning range)

WARNING:

BATTERY F/R DISCONNECTED DUE TO: OVERTEMPERATURE (red)

Reduce power	AS MUCH AS POSSIBLE
Affected battery circuit breaker	DISENGAGE
Other EPSI messages sub-sequent to disconnection	ACKNOWLEDGE
SOC and RFT	MONITOR

*If battery overtemperature is signalled by Warning light **AND** EPSI caution message:*

Land	IMMEDIATELY
Airplane	EVACUATE

*If battery overtemperature is signalled by on system only (Warning light **OR** EPSI caution message):*

Land	AS SOON AS POSSIBLE

BATTERY NOT PRESENT (single batt)

CAUTION:

BATTERY F/R NOT PRESENT (amber)

Affected battery circuit breaker	DISENGAGE
Other EPSI messages sub-sequent to disconnection	ACKNOWLEDGE
SOC, RFT, battery temperature	MONITOR
Reduce power	AS MUCH AS POSSIBLE
Land	AS SOON AS PRACTICAL

BATTERY NOT PRESENT (double batt)

CAUTION:

BATTERY F NOT PRESENT (amber)

and

BATTERY R NOT PRESENT (amber)

Reduce power	AS MUCH AS POSSIBLE
Annunciator/ batt warning lights	MONITOR
Land	AS SOON AS PRACTICAL

A power-off precautionary landing is recommended (SOC not available)

PB345V124E-L battery type

PB345V124E-L battery type

ENGINE HIGH TEMPERATURE (temperature in caution range)

CAUTION:

ENGINE HIGH TEMPERATURE (amber)

Reduce power	AS MUCH AS POSSIBLE
Engine temperature	MONITOR
Engine cooling pump status (EPSI messages)	CHECK EPSI for failure messages

If engine temperature remains in caution range:

Land	AS SOON AS PRACTICAL

ENGINE OVERTEMPERATURE (temperature in warning range, continues from Engine High Temperature)

WARNING:

ENGINE OVERTEMPERATURE (red)

CAUTION: POWER DERATING ACTIVE
If partial power is still available and the engine coolant pump is functional, perform the following:

Land	AS SOON AS POSSIBLE

If also coolant pump is not functional (caution message - engine coolant pump failure):

Power lever	CUT OFF (use residual power on final)
Best Glide Speed	70 KIAS (flaps 0)
Land (emergency landing)	PREPARE TO LAND

If power is derated to zero:

Emergency landing procedure	PERFORM

BATTERY OVERCURRENT

OR


CAUTION:

BATTERY F/R OVERCURRENT (amber)

Reduce power	AS MUCH AS POSSIBLE
Battery status/current (of both batteries)	CHECK
if both batteries are still connected (current of both batteries ≠ 0 A):	
Battery temperatures and currents	MONITOR
Land	AS SOON AS PRACTICAL
if one battery is disconnected (current = 0A), and caused overcurrent to the other:	
Circuit breaker of battery delivering 0 A	DISENGAGE
Single Battery disconnection procedure	PERFORM

LOW STATE OF CHARGE (SOC)

+


CAUTION:

SOC < 30% (amber)

Reduce power	AS MUCH AS POSSIBLE
Remaining SOC and RFT	MONITOR
Land	PREPARE TO LAND

PB345V124E-L battery type

PB345V124E-L *battery type*

NO GO-AROUND AVAILABLE

MASTER CAUTION	***CAUTION:***
NO GO-AROUND AVAILABLE (amber)	
Land	PREPARE TO LAND

WARNING: If SOC < 15%, applying full power may cause battery voltage to drop and eventual battery disconnection

BATTERY SOC ADJUSTED

MASTER CAUTION	F OR R	***CAUTION:***
BATTERY F/R SOC ADJUSTED (amber)		
Updated SOC value	CHECK	
SOC and RFT	MONITOR	

BATTERY CELL LOW VOLTAGE

MASTER CAUTION	F OR R	***CAUTION:***
BATTERY F/R LOW CELL VOLTAGE (amber)		
Reduce power	AS MUCH AS POSSIBLE	
SOC and RFT	MONITOR	
If affected battery is disconnected due to undervoltage:		
Battery disconnected (single batt) procedure	PERFORM	

BATTERY COOLANT PUMP FAILURE

MASTER CAUTION

CAUTION:

BATTERY COOLANT PUMP 1/2 FAILURE (amber)

If a single coolant pump fails (pump 1 or pump 2):

Battery temperatures	MONITOR
Flight	Continue normally

If both coolant pumps fail (two caution messages):

Reduce power	AS MUCH AS POSSIBLE
Battery temperatures	MONITOR
Land	AS SOON AS PRACTICAL

ENGINE COMMUNICATION FAILURE

MASTER CAUTION

CAUTION:

ENGINE COMMUNICATION FAILURE (amber)

Power available	ASSESS

When at gliding distance from the elected landing site and when ready for a power-out approach:

PWR CTRL circuit breaker (motor will quit)	DISENGAGE
Emergency landing procedure	PERFORM

PB345V124E-L battery type

PB345V124E-L *battery type*

ENGINE COOLANT PUMP FAILURE

CAUTION:

ENGINE COOLANT PUMP FAILURE (amber)

Power lever	CUT OFF
Best glide speed	70 KIAS (flaps 0)
Engine temperatures	CHECK
Land (emergency)	PREPARE TO LAND (use residual power for obstacle avoidance only)

ELECTRICAL SYSTEM INSULATION FAILURE

CAUTION:

SYSTEM ISOLATION FAILURE (amber)

Land	AS SOON AS PRACTICAL

CAUTION: Any inspection/troubleshooting by the pilot shall be avoided as it could lead to lethal electrical shock.

DC/DC CONVERTER FAILURES

CAUTION:

DC/DC COMMUNICATION FAILURE (amber)

or, if RPM >300:

DC/DC NOT WORKING (amber)

AUX BATTERY Voltage	MONITOR
Land	AS SOON AS PRACTICAL

POWER LEVER COMMUNICATION FAILURE

MASTER CAUTION

CAUTION:

POWER LEVER COMMUNICATION FAILURE (amber)

Power available	ASSESS
Engine and Battery temperatures	MONITOR

When at gliding distance from the elected landing site and when ready for a power-out approach:

PWR CTRL circuit breaker (motor will quit)	DISENGAGE
Emergency landing procedure	PERFORM

BATTERY CURRENT NOT EQUAL

MASTER CAUTION

CAUTION:

BATTERY CURRENT NOT EQUAL (amber)

Reduce power	AS MUCH AS POSSIBLE
Land	AS SOON AS PRACTICAL

AUXILIARY BATTERY FAILURE

MASTER CAUTION

CAUTION:

AUXILIARY BATTERY FAILURE (amber)

Land	AS SOON AS PRACTICAL

PB345V124E-L battery type

FIRE IN FLIGHT

ENGINE FIRE IN FLIGHT	
PWR EN switch	OFF
MASTER switch	OFF
BATT EN switch	OFF
BATT REAR & BATT FRONT circuit breakers	DISENGAGE
Door windows	OPEN
Side-slip - direction opposite to the fire	IF POSSIBLE
Land (emergency)	AS SOON AS POSSIBLE
Airplane	EVACUATE

BATTERY SYSTEM FIRE	
Affected battery circuit breaker	DISENGAGE
Land	IMMEDIATELY
Airplane	EVACUATE
Long range water type fire extinguisher (if available)	ACTIVATE

COCKPIT FIRE	
ALL Switches	OFF
Fire Extinguisher (if available)	ACTIVATE
Door vents	OPEN
Land (emergency)	IMMEDIATELY

PB345V124E-L *battery type*

SPIN	
Power lever	CUT OFF
Roll input	Neutral
Rudder	Full deflection, direction opposite to the spin
As rotation is about to stop, or fully stopped:	
Rudder	Neutralize
Control stick	Release force towards neutral elevator position, roll input neutral
Horizontal flight	Resume, do not exceed airspeed/g limits

PB345V124E-L battery type

PB345V124E-L *battery type*

EMERGENCY LANDING	
Best Glide Speed	70 KIAS (flaps 0)
PWR CTRL circuit breaker	DISENGAGE
BATT FRONT & BATT REAR circuit breakers	DISENGAGE
Seat Belts	SECURED
Flaps (when landing is assured)	+2
If time permits:	
Radio	Transmit (121.5 MHz) MAYDAY
Transponder	SQUAWK 7700
ELT Switch	ON (if necessary)

DITCHING	
Best Glide Speed	70 KIAS (flaps 0)
Power lever	CUT OFF
BATT FRONT & BATT REAR circuit breakers	DISENGAGE
Life vests	CHECK
Loose items in cabin	Secure
Seat belts	CHECK SECURED AND TIGHTEN
Radio	Transmit (121.5 MHz) MAYDAY
Transponder	SQUAWK 7700

Continue ➔

DITCHING (continue)	
ELT switch	ON
Approach direction	High seas, high wind: into the wind. Light wind, heavy swells: parallel to the swells
Doors	OPEN
AUX BATT circuit breaker	DISENGAGE
Flaps	+2
Landing at the lowest possible speed	PERFORM
Seat belts	Release immediately
Airplane	EVACUATE
Life vest and raft	Inflate when outside the cabin
Flotation Devices	INFLATE WHEN CLEAR OF AIRPLANE
LANDING WITH DEFECTIVE BRAKES	
Seat belts	CHECK FASTENED AND TIGHTENED
Master Switch	OFF
PWR CTRL circuit breaker	DISENGAGE
Steer gently	-
Once the aircraft has stopped:	
Engine	Re-start
Vacate runway at low speed/low power setting	PERFORM

PB345V124E-L battery type

EPSI570C DISPLAY FAILURE

Display failure (black screen, hardware malfunction):

Reduce power	AS MUCH AS POSSIBLE
EPSI Circuit Breaker	DISENGAGE
Annunciator/ Batt Overtemp warning lights	MONITOR
Land	AS SOON AS PRACTICAL

EPSI570C communication failure:

Reduce power	AS MUCH AS POSSIBLE
Annunciator/ Batt Overtemp warning lights	MONITOR
Land	AS SOON AS PRACTICAL

RADIO COMMUNICATION FAILURE

Switches, Controls	CHECK
Frequency	CHANGE
COM Circuit Breaker	CHECK
Headset	CHANGE
Transmission	ATTEMPT

If unsuccessful:

Transponder	SQUAWK 7600

PITOT STATIC MALFUNCTION

Refer to GPS for flying:

Ground speed indicator	+10 KTS for procedures, observe winds

PB345V124E-L *battery type*

ELECTRIC TRIM FAILURE	
Airplane Control	GRASP STICK, MAINTAIN MANUALLY
TRIM Circuit Breaker	DISENGAGE
Power Lever	AS REQUIRED
Control Stick	Manually hold pressure
Land	AS SOON AS PRACTICAL

PB345V124E-L battery type

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SUPPLEMENT
10-5A

SECTION 10 – SUPPLEMENT 10-5A

B345V124E-L battery type - PERFORMANCE DATA

When the aircraft is equipped with the PB345V124E-L battery type, this POH Supplement is applicable and entirely replaces the content of *Section 5 - Performance Data* - of the POH. This document must be carried in the airplane at all times. Information in this supplement adds to or replaces information in the basic POH.

POH SECTIONS	STATUS
SECTION 1: GENERAL	NO CHANGE
SECTION 2: LIMITATIONS	NO CHANGE
SECTION 3: EMERGENCY PROCEDURES	NO CHANGE
SECTION 4: NORMAL PROCEDURES	NO CHANGE
SECTION 5: PERFORMANCE DATA	REPLACE
SECTION 6: WEIGHT AND BALANCE	NO CHANGE
SECTION 7: SYSTEM DESCRIPTION	NO CHANGE
SECTION 8: HANDLING, SERVICING AND MAINTENANCE	NO CHANGE

SECTION 10
SUPPLEMENT 10-5A

BATTERY TYPE PB345V124E-L
PERFORMANCE DATA

Signature: _____

Stamp: _____

Date of Approval: _____

SECTION 5 – PERFORMANCE DATA

TABLE OF CONTENTS

5.1 INTRODUCTION

The performance tables and diagrams on the following pages show the performance of the airplane. The data presented in these tables and diagrams has been derived from test–flights using an airplane, motor and batteries in good operating condition, and was corrected to standard atmospheric conditions 15° C and 1013.25 mb at sea level.

The performance tables do not take into account the expertise of the pilot or the maintenance condition of the airplane. The performance illustrated in the tables can be achieved if the indicated normal procedures are followed and the airplane is maintained properly.

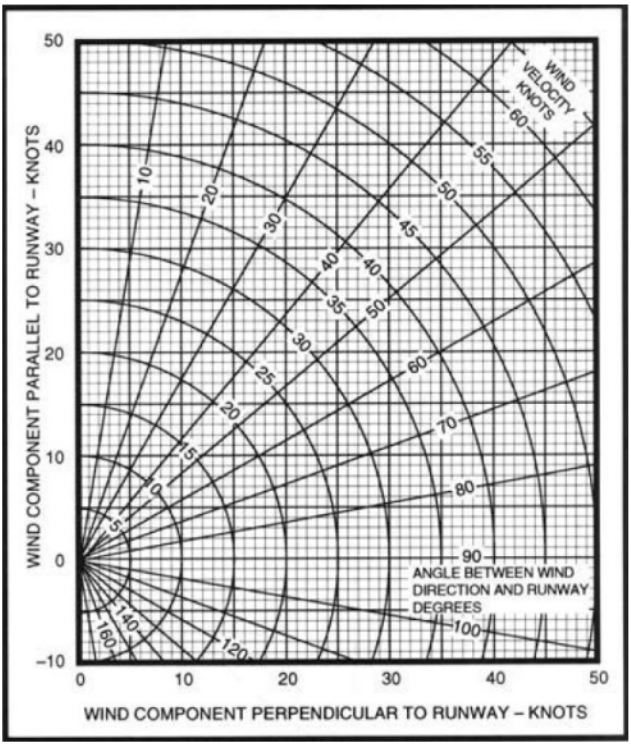
The energy consumption during cruise is based on propeller RPM and power settings. Some undefined variables such as the batteries state of health, contamination of the aircrafts surface, or turbulence could influence flight distance and flight duration. For this reason, it is of utmost importance that all available data is used when calculating the range and endurance.

5.2 OUTSIDE AIR TEMPERATURE FOR ISA-CONDITION

Pressure Altitude [ft]	ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
SL	0	10	15	20	30
1000	-2	8	13	18	28
2000	-4	6	11	16	26
3000	-6	4	9	14	24
4000	-8	2	7	12	22
5000	-10	0	5	10	20
6000	-12	-2	3	8	18
7000	-14	-4	1	6	16
8000	-16	-6	-1	4	14
9000	-18	-8	-3	2	12
10000	-20	-10	-5	0	10
11000	-22	-12	-7	-2	8
12000	-24	-14	-9	-4	6
13000	-26	-16	-11	-6	4
14000	-28	-18	-13	-8	2

PB345V124E-L battery type

5.3 WIND COMPONENT



EXAMPLE:

Runway Heading:	10°
Wind Direction:	60°
Angle between wind and runway:	50°
Wind Velocity:	15 Knots
Component parallel:	~9,6 Knots
Component perpendicular:	~11,5 Knots

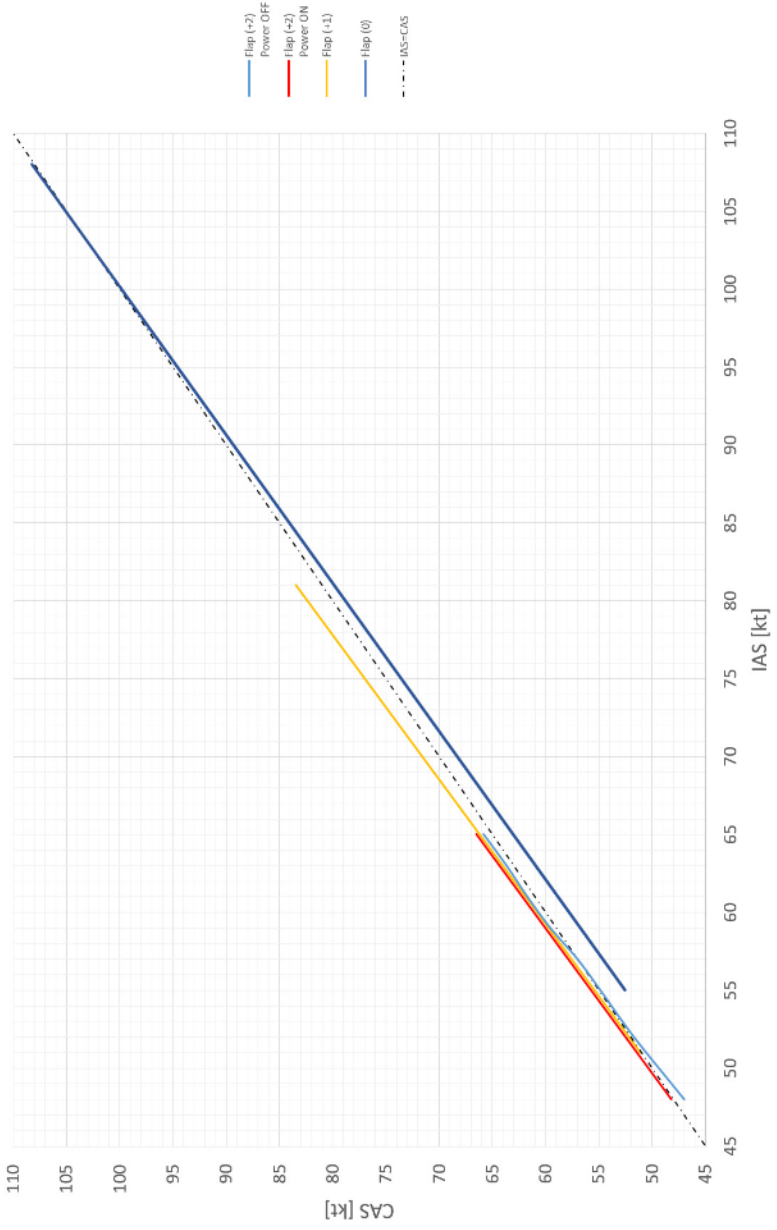
5.4 AIRSPEED CALIBRATION

Conditions
Power: power level for level flight, or idle when indicated.

NOTE: Indicated airspeed values assume zero instrument error.

KIAS	KCAS			
	Flaps (0) level flight	Flaps (+1) level flight	Flaps (+2) level flight	Flaps (+2) idle
50	---	50	50	49
55	53	55	56	55
60	58	61	61	60
65	63	66	66	66
70	68	72	---	---
75	74	77	---	---
80	79	82	---	---
85	84	---	---	---
90	89	---	---	---
95	95	---	---	---
100	100	---	---	---
105	105	---	---	---
108	108	---	---	---

KIAS/KCAS Diagram



PB345V124E-L battery type

5.5 STALL SPEED

Conditions
Power: MTOM

NOTE: The recovery altitude necessary is very dependent on the tempo of recovery.

Typical loss of altitude for recovery:	
Slow recovery without power:	150-250 ft
Normal recovery with power:	100 ft
Aggressive recovery	less than 100 ft

Depending on pilot skill, the altitude loss during wing level stall may be 250 feet or more.

NOTE: KIAS values may not be accurate at stall.

WEIGHT - POWER	BANK ANGLE	STALL SPEED					
		Flaps (+0)		Flaps (+1)		Flaps (+2)	
kg	Degrees	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
600 POWER ON	0°	**50**	*48*	**44**	*43*	**43**	*42*
600 RECUP.* ON	0°	**54**	*52*	**49**	*49*	**47**	*46*

NOTE: The aircraft is equipped with an aural and haptic stall warning system installed in the control stick handles.
*RECUP. = Recuperation

5.6 TAKE OFF DISTANCE

Conditions

Power: MPTOP (50kW)

Flaps: (+1)

Wind: Calm

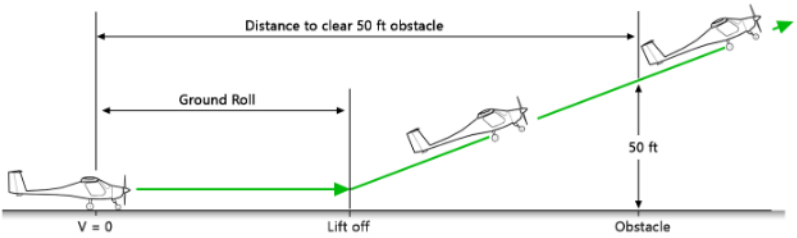
Mass: 600 kg

Runway condition: dry

Speed at lift off: 50 KIAS

Speed over the obstacle: 57 KIAS (V_X)

Take off performance data included in this POH are extrapolated from flight test results. These extrapolated values serve as an estimation of actual take off roll and total distance to clear a 50 ft obstacle (ground roll plus climb distance to clear obstacle).



Correction Factors

Headwind: Subtract 10% for each 12 knots headwind.
Tailwind: Add 10% for each 2 knots tailwind up to 10 knots.
Wet Grass: Add 18% to ground roll on dry grass.

Runway Slope

Increase table distances by 22% of the ground roll distance at sea level for each 1% of upslope.
Decrease table distances by 7% of the ground roll distance at sea level, for each 1% of downslope.

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
SL	Ground roll	Asphalt	208	230	240	250	268
	50 ft obst.		391	430	448	466	499
	Ground roll	Grass	236	260	272	283	304
	50 ft obst.		476	507	517	526	555

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
4000	Ground roll	Asphalt	276	295	304	313	330
	50 ft obst.		512	547	564	580	610
	Ground roll	Grass	312	335	345	355	375
	50 ft obst.		591	631	650	669	704

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
8000	Ground roll	Asphalt	337	355	363	371	387
	50 ft obst.		622	654	669	684	712
	Ground roll	Grass	382	402	412	421	438
	50 ft obst.		731	768	785	802	833

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
12000	Ground roll	Asphalt	393	409	417	424	438
	50 ft obst.		772	751	765	778	804
	Ground roll	Grass	445	464	472	481	497
	50 ft obst.		833	867	883	898	927

CAUTION: MTOP must be limited to 90 seconds (see Limitations - Section 2).

PB345V124E-L battery type

5.7 CLIMB PERFORMANCE

Conditions Power setting: MCP 48 kW or max continuous RPM 2300, whatever is reached first

Flaps: (0)

CAUTION: when battery temperatures are above 40 °C, prolonged high-power application (circuit patterns or prolonged climbs at MCP) may lead to battery high temperature.

CAUTION: in case of prolonged MCP applications (i.e. unusual continuous climb from take off to ceiling altitude), battery temperature may reach the caution range, depending on OAT. Avoiding continuous climbs at MCP setting when flying at high OAT is advisable. Alternating climb legs with short cruise phases at lower power settings is recommended.

5.7.1 RATE OF CLIMB (V_Y = 75 KIAS)

MASS/ AIR SPEED	Pressure Altitude (PA)	RATE OF CLIMB [ft/min]				
	ft	ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
600 kg/ V_Y 75 KIAS	0	683	658	647	636	615
	4000	602	580	570	560	541
	8000	439	423	415	408	393
	12000	276	265	260	255	246

NOTE: Electric motor power output is constant with altitude, but power is gradually reduced with altitude by the pilot to respect max RPM limit (2300).

5.7.2 CLIMB GRADIENT (V_X = 57 KIAS)

MASS/ AIR SPEED	Pressure Altitude (PA)	CLIMB ANGLE / GRADIENT
	ft	
600 kg/ V_X 57 KIAS	0	6.1 / 10.7
	4000	4.5 / 7.9
	8000	3.1 / 5.4
	12000	2 / 3.4

CAUTION: Expect the climb performance to degrade with increased outside air temperature.

5.8 CRUISE PERFORMANCE

Conditions Mass: 600 kg
Flaps: (0)
Altitude: Sea Level - ISA

The table presents cruise speeds at different power settings between minimum power for level flight (20 kW) and maximum continuous RPM power (36 kW).

POWER SETTING (EPSI)	RPM	KIAS	*KCAS*
[kW]	[1/min]	[kts]	*[kts]*
20	1780	71	*69*
25	1950	79	*78*
30	2120	87	*86*
35	2270	92	*92*
36	2300	93	*93*

NOTE: 36 kW power setting corresponds to 2300 RPM, max continuous RPM. The airspeed at this power setting is considered maximum cruise speed (93 KIAS).

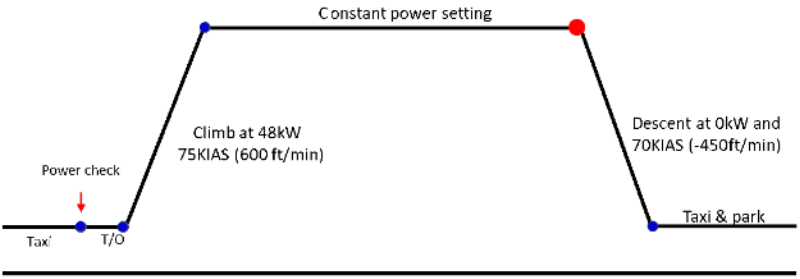
V_H= 93 KIAS (=93 KCAS) @2300 RPM

NOTE: Expect a 2% CAS decrease every 1000 ft of altitude increase, at the same RPM setting.

5.9 ENDURANCE AND RANGE

CAUTION: The available battery energy is a function of SOC and SOH. Both parameters must be considered for a correct endurance estimation. Reduction of SOH (usually due to aging/use) reduces the batteries' energy storage capability and, therefore, also endurance.

CAUTION: Always consider that battery temperature >40 °C at take off may affect the duration of flight, as the mission must be aborted when the in-flight battery temperature exceeds the caution threshold (50 °C).



Endurance and range
typical flight profile

The following tables present expected endurance for local flights (A-A flight) and endurance/range for cross country flights (A-B flight). VFR reserve is different for the two situations, 10 min or 30 min, in accordance with Ops.125.

5.9.1 LOCAL FLIGHT (A-A FLIGHT)

A local flight is defined as a flight starting from and landing at the same airfield (A to A flight). Typical flight profile is illustrated in Section 5.9.

NOTE: in the following table initial SOC is 100%. The energy used to climb to cruise altitude and for descent is already included in the calculation.

A-A FLIGHT ENDURANCE in minutes (+ *10* min reserve @20 kW)							
Cruise altitude [ft]	Cruise power [kW]	Battery State of Health - SOH [%]					
		100	80	60	40	20	0
1500	20	42 min	37 min	32 min	28 min	23 min	19 min
	25	34 min	30 min	26 min	23 min	20 min	17 min
	30	29 min	26 min	23 min	20 min	17 min	15 min
	35	26 min	23 min	20 min	18 min	15 min	13 min
2000	20	42 min	37 min	32 min	27 min	23 min	19 min
	25	35 min	30 min	27 min	23 min	20 min	17 min
	30	30 min	26 min	23 min	20 min	18 min	15 min
	35	26 min	23 min	21 min	18 min	16 min	14 min
4000	20	41 min	36 min	31 min	26 min	22 min	18 min
	25	35 min	31 min	27 min	24 min	21 min	18 min
	30	32 min	28 min	25 min	22 min	20 min	17 min
	35	29 min	26 min	24 min	21 min	19 min	17 min
6000	20	40 min	35 min	29 min	25 min	-	-
	25	36 min	32 min	28 min	25 min	-	-
	30	34 min	31 min	27 min	25 min	-	-
	35	32 min	29 min	27 min	24 min	-	-

CAUTION: the endurance values in the table above do not include the additional 10 min reserve at 20 kW. After using reserve, SOC = 0%..

5.9.2 CRUISE FLIGHT (A-B FLIGHT)

A cruise/cross-country flight is defined as a flight starting from airfield A and landing at a different airfield (A to B flight). Typical flight profile is illustrated in Section 5.9.

NOTE: in the following tables initial SOC is 100% The energy used to climb to cruise altitude and for descent is already included in the calculation.

A-B FLIGHT ENDURANCE in minutes (+ 30 min reserve @20 kW)							
Cruise altitude [ft]	Cruise power [kW]	Battery State of Health - SOH [%]					
		100	80	60	40	20	0
1500	20	22 min	17 min	12 min	8 min	-	-
	25	19 min	14 min	11 min	7 min	-	-
	30	16 min	13 min	10 min	7 min	-	-
	35	15 min	12 min	9 min	7 min	-	-
2000	20	22 min	17 min	12 min	-	-	-
	25	19 min	15 min	11 min	-	-	-
	30	17 min	13 min	10 min	-	-	-
	35	15 min	13 min	10 min	-	-	-
4000	20	21 min	-	-	-	-	-
	25	20 min	-	-	-	-	-
	30	19 min	-	-	-	-	-
	35	18 min	-	-	-	-	-
6000	20	-	-	-	-	-	-
	25	-	-	-	-	-	-
	30	-	-	-	-	-	-
	35	-	-	-	-	-	-

CAUTION: the endurance values in the table above do not include the additional 30 min reserve at 20 kW. After using reserve, SOC = 0%.

A-B FLIGHT RANGE in Nm (+ 30 min reserve @20 kW / 35 Nm) WIND = 0							
Cruise altitude [ft]	Cruise power [kW]	SOH [%]					
		100	80	60	40	20	0
1500	20	25 Nm	18 Nm	12 Nm	8 Nm	-	-
	25	23 Nm	17 Nm	12 Nm	8 Nm	-	-
	30	21 Nm	16 Nm	11 Nm	7 Nm	-	-
	35	19 Nm	15 Nm	11 Nm	7 Nm	-	-
2000	20	24 Nm	18 Nm	12 Nm	-	-	-
	25	23 Nm	17 Nm	12 Nm	-	-	-
	30	21 Nm	16 Nm	11 Nm	-	-	-
	35	20 Nm	15 Nm	11 Nm	-	-	-
4000	20	23 Nm	-	-	-	-	-
	25	22 Nm	-	-	-	-	-
	30	22 Nm	-	-	-	-	-
	35	21 Nm	-	-	-	-	-
6000	20	-	-	-	-	-	-
	25	-	-	-	-	-	-
	30	-	-	-	-	-	-
	35	-	-	-	-	-	-

CAUTION: the range values in the table above do not include the additional 30 min reserve at 20 kW. After using reserve, SOC = 0%.

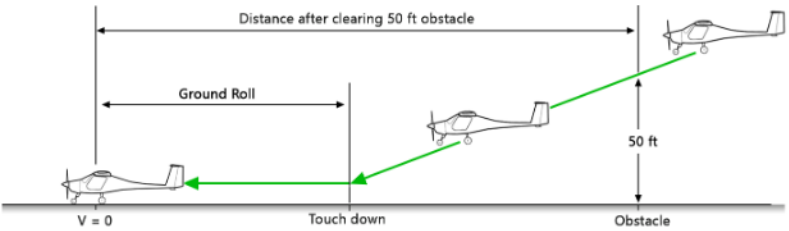
CAUTION: the table above is valid when wind is 0.

Example: A-B flight, battery SOH = 80%, expected range and endurance for a 2000 ft cruise flight @30 kW power setting are: 16 Nm range and 13 min endurance, with 30 minutes of reserve (in accordance with Ops.125).

5.10 LANDING DISTANCE

Conditions		
	Wind:	zero
	Runway:	dry and leveled
	Flaps:	(+2)
	Power:	CUT OFF
	Airspeed:	60 KIAS at 50 ft height
	Mass:	600 kg
	Brakes:	applied 1s after touch down

The landing performance data included in this POH are extrapolated from flight test results. These extrapolated values serve as an estimation of actual landing roll and total landing distance after clearing 50 ft obstacle (ground roll included). The aircraft's recuperation feature reduces the landing distance, however the more conservative calculations published in this chapter should be used.



Correction Factors

Headwind:	Subtract 10% from table distances for each 13 knots of headwind.
Tailwind:	Add 10% to table distances for each 2 knots of tailwind up to 10 knots.

Wet grass runway: Add 30% to ground roll distance for dry grass runway.

Sloped Runway

Increase table distances by 27% of the ground roll distance for each 1% of downslope.
Decrease table distances by 9% of the ground roll distance for each 1% of upslope.

CAUTION: The corrections should be used with caution since published runway slope data is usually the net slope from one end of the runway to the

other. Many runways will have portions of their length at greater or lesser slopes than the published slope, affecting the estimation of landing ground roll.

For operation in outside air temperatures colder than what's displayed in the following tables, use coldest data shown.

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
SL	Ground roll	Asphalt	170	180	183	186	196
	50 ft obst.		516	526	537	553	569
	Ground roll	Grass	180	190	193	196	207
	50 ft obst.		552	564	575	592	610

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
4000	Ground roll	Asphalt	182	199	206	213	232
	50 ft obst.		557	568	580	597	615
	Ground roll	Grass	192	210	217	225	245
	50 ft obst.		596	609	621	640	658

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
8000	Ground roll	Asphalt	205	225	233	241	263
	50 ft obst.		598	610	623	642	660
	Ground roll	Grass	216	237	246	254	277
	50 ft obst.		640	654	667	687	707

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
12000	Ground roll	Asphalt	232	255	264	274	299
	50 ft obst.		639	653	666	686	706
	Ground roll	Grass	245	268	278	289	315
	50 ft obst.		684	699	713	734	756

5.11 ENERGY CONSUMPTION

The following tables can be used for the estimation of energy consumption (%SOC) in different flight phases and typical mission scenarios. SOH of the battery must be taken into account because it affects the amount of energy (%SOC) used in each flight phase.

CAUTION: Always consider that battery temperature >40 °C at take off may affect the duration of flight, as the mission must be aborted when the in-flight battery temperature exceeds the caution threshold (50 °C). Battery temperature > 40 °C at take off may result in high in-flight battery temperatures when OAT is high or high power settings are applied.

NOTE: Flight phases are to be executed according to the procedures and parameters described in Section 4 - Normal procedures.

A typical flight can be made of several circuit patterns or can be a training sortie composed by different flight phases and cruise.

Circuit patterns with one charge

The following table provides information about maximum number of circuit patterns that can be performed starting with 100% SOC.

LOCAL FLIGHT with 100% SOC at take off	Battery State of Health (%SOH)					
	100	80	60	40	20	0
NUMBER OF TRAFFIC PATTERNS:	7	6	5	4	4	3
RESERVE:	+ 10 minutes (@ 20 kW power setting)					

NOTE: reference circuit pattern is a 6 Nm circuit at 1000 ft AGL.

Training sortie

The following table provides information about percentage of SOC needed for each flight phase.

FLIGHT PHASE		Battery State of Health (%SOH)					
		100	80	60	40	20	0
Take off and initial climb to 300 ft AGL	%SOC	5	5	6	6	7	8
1000 ft climb at V_Y - 48 kW	%SOC	8	9	10	11	12	14
10 min cruise - 20 kW (69 KCAS)	%SOC	18	20	23	25	28	31
10 min cruise - 25 kW (78 KCAS)	%SOC	23	26	29	32	35	40
10 min cruise - 30 kW (86 KCAS)	%SOC	28	31	35	95	43	49
10 min cruise - 35 kW (92 KCAS)	%SOC	34	37	42	46	51	58
Touch and go and climb to 300 ft AGL	%SOC	3	4	4	5	5	6
Energy for the first traffic pattern	%SOC	12	13	15	17	19	21
Energy for a generic traffic pattern	%SOC	11	12	14	15	17	19
Aborted landing and climb to 1000 ft AGL at V_Y - 64 kW	%SOC	8	9	10	11	13	14
SOC for Reserve	%SOC	18	20	23	25	28	31

5.12 MISSION PLANNING - EXAMPLES

Following examples show typical mission profiles and scenarios. Parameters for calculation are taken from tables in current Section 5 - Performance Data.

A) POINT OF NO RETURN (PNR) - CALCULATION EXAMPLE:

When flying the VELIS Electro outside the circuit pattern, it is important to estimate when the remaining energy is sufficient for a safe return to home base. The PNR (Point of No Return) in flight is when there is just sufficient SOC to return to base (and arrive there with 30%). This PNR is calculated for flights from point A to point A (A-A Flight). Most VELIS Electro flights are A-A.

NO WIND CONDITION - CALCULATION EXAMPLE

When flying in no wind conditions along a straight track, calculating PNR is not particularly difficult. There is enough SOC available to take off and fly toward the destination knowing, that as long as the flight does not proceed beyond the halfway point, it should be possible to make it back to home airfield safely.

If the take off is with 100% SOC, landing must be planned at minimum 30% SOC. Therefore total usable SOC is 70%. If (example) 10% of the SOC is used for the climb to cruise altitude, the remaining 60% is available for the cruise. Half of SOC available for cruising is 30%. So the turning back to the initial cruise point occurs after using 10% SOC for climbing and 30% of SOC available for cruise: PNR results at 60% of SOC (100%-10%-30% = 60%). The example assumes that cruise initial/final points are in proximity of the airport. "PNR REFERENCE TABLES" provided in this section can be used for easy calculation of PNR.

WINDY CONDITION - CALCULATION EXAMPLE

Cruise speed 85 kts (example), and outbound tailwind of 15 kts (from GPS ground speed reading). The difference between the IAS and TAS at VELIS Electro altitudes are negligible and is possible to consider IAS = TAS.

Therefore:
GS outbound: 85 kts + 15 kts (tailwind) = 100 kts

GS inbound: 85 kts - 15 kts (headwind) = 70 kts

The %SOC to PNR is calculated with the PNR equation:

PNR SOC = usable SOC x GS homebound / (GS homebound + GS outbound).

In this example: 70% x 70 kts / (100 kt + 70 kts) = 28%, that is the SOC used to reach PNR. So, in this example, PNR is 100% - 28% = 72%, where 100% is the initial SOC.

This is very important. When flying with a tailwind it is necessary to turn back to the point of origin much sooner.

PNR REFERENCE TABLES

The following tables provide quick reference for PNR calculation, depending on cruise power/speed and wind. PNR SOC is the SOC value at which the return to the initial cruise point is possible, with 30% SOC remaining.

20 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
69 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	69	67	64	62	60	58	56	53	51
	80	62	60	59	57	55	53	51	50	48
	70	56	54	53	51	50	49	47	46	44
	60	49	48	47	46	45	44	43	42	41

25 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
78 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	68	66	64	62	60	58	56	54	52
	80	61	60	58	57	55	53	52	50	49
	70	55	54	53	51	50	49	47	46	45
	60	49	48	47	46	45	44	43	42	41

30 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
86 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	67	65	63	62	60	58	57	55	53
	80	61	59	58	56	55	54	52	51	49
	70	55	53	52	51	50	49	48	47	45
	60	48	48	47	46	45	44	43	42	42

35 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
92 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	67	65	63	62	60	58	57	55	53
	80	60	59	58	56	55	54	52	51	50
	70	54	53	52	51	50	49	48	47	46
	60	48	47	47	46	45	44	43	43	42

Example:

Cruise flight @ 25 kW power setting (corresponding to 78 KCAS).

SOC at the beginning of the cruise phase = 80% SOC.

Wind: 10 kts headwind outbound (same amount inbound)

The SOC at which the return has to be initiated to be back at the initial point with 30% remaining SOC is PNR SOC = 52%.

B) A-B FLIGHT - MISSION PLANNING - CALCULATION EXAMPLE:

NOTE: all the values will be used purely as example

To compute the SOC needed for the mission, it is necessary to know:

- Battery SOH and SOC (system page of EPSI570C)
- The flight profile of the mission (phases)

The total SOC is computed by adding the SOC consumed in each phase.

CAUTION: Always consider that battery temperature >40 °C at take off may affect the duration of flight, as the mission must be aborted when the in-flight battery temperature exceeds the caution threshold (50 °C).

1) Determination of initial battery conditions (check EPSI570C)

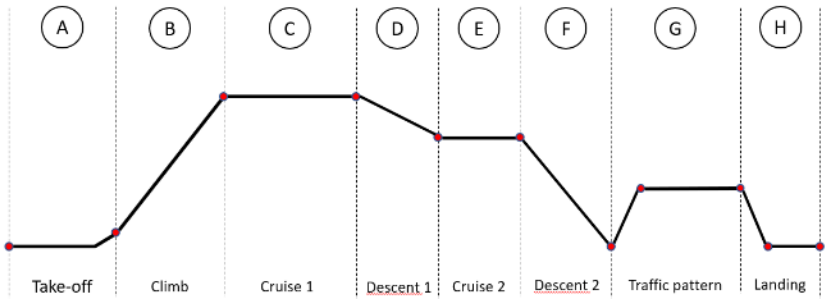
The following are the values that will be used in the example:

- SOH = 80%.
- SOC = 95%.

Battery SOH = 80% determines the use of SECOND COLUMN ("80") from the tables presented in Section 5.11 - Energy Consumption.

2) Determination of mission profile and flight phases

Define the mission profile and divide it into phases. Example:



The mission profile is divided in the following phases:

A) Take off

B) Climb (V_Y) at 48 kW - to 2000 ft AGL

C) Cruise 1 at 25 kW - for 5 min

D) Descent 1 - to 1000 ft AGL

E) Cruise 2 at 20 kW - for 10 min

F) Descent 2 - to airfield level

G) Generic traffic pattern - 1000 ft

H) Landing - to full stop

3) Calculation of energy (%SOC) used for each phase, using previous tables: all values are obtained from column SOH = 80%

A) Take off = 5 %SOC

B) Climb (V_Y) at 48 kW - to 2000 ft AGL = 2 x 9 %SOC = 18 %SOC

C) Cruise 1 at 25 kW - for 5 min = 0.5 x 26 %SOC = 13 %SOC

D) Descent 1 - to 1000 ft AGL = 0 %SOC

E) Cruise 2 at 20 kW - for 5 min = 0.5 x 20 %SOC = 10 %SOC

F) Descent 2 - to airfield level = 0 %SOC

G) Generic traffic pattern - 1000 ft = 12 %SOC

H) Landing - to full stop = 0 %SOC

4) Total %SOC necessary for the mission is the sum of %SOC used for each phase of the flight (use of a similar table is recommended):

Flight phase	Target/conditions	SOC required (SOH 80%)
A) Take off	-	*5*
B) Climb (V_Y) - at 48 kW	to 2000 ft	*18*
C) Cruise 1 - at 25 kW	5 min	*13*
D) Descent 1 - 0 kW	to 1000 ft	*0*
E) Cruise 2 - at 20 kW	5 min	*10*
F) Descent 2 - 0 kW	to airfield level	*0*
G) Generic traffic pattern	1000 ft	*12*
H) Landing	to full stop	*0*
	TOTAL SOC used:	**58**

5) Calculation of %SOC at landing:

%SOC at landing = Initial %SOC - mission %SOC = 95 - 58 = 37 %SOC

This value is > 30%SOC

Initial %SOC is sufficient for the mission, and remaining %SOC at landing (37%) is above the minimum prescribed in "limitations" (min SOC at landing 30%).

The mission can be safely flown.

NOTE: Recuperation should be considered strictly as air-braking device and not taken into account when planning cross country flights. The recuperated amount of energy when descending or braking using engine recuperation is insignificant compared to power consumption during climb or horizontal flight.

5.13 NOISE CHARACTERISTICS

Noise level according to ICAO Annex 16, Chapter 10:
Measured: 60.1 dB(A) Max. allow. noise level: 70.8 dB(A)

SUPPLEMENT
10-3B

SECTION 10 – SUPPLEMENT 10-3B

PB345V119E-L battery type - EMERGENCY PROCEDURES

When the aircraft is equipped with the PB345V119E-L battery type, this POH Supplement is applicable and entirely replaces the content of *Section 3 - Emergency procedures* - of the POH. This document must be carried in the airplane at all times. Information in this supplement adds to or replaces information in the basic POH.

POH SECTIONS	STATUS
SECTION 1: GENERAL	NO CHANGE
SECTION 2: LIMITATIONS	NO CHANGE
SECTION 3: EMERGENCY PROCEDURES	REPLACE
SECTION 4: NORMAL PROCEDURES	NO CHANGE
SECTION 5: PERFORMANCE	NO CHANGE
SECTION 6: WEIGHT AND BALANCE	NO CHANGE
SECTION 7: SYSTEM DESCRIPTION	NO CHANGE
SECTION 8: HANDLING, SERVICING AND MAINTENANCE	NO CHANGE

SECTION 10
SUPPLEMENT 10-3B

BATTERY TYPE PB345V119E-L
EMERGENCY PROCEDURES

Signature: _____

Stamp: _____

Date of Approval: _____

SECTION 3 – EMERGENCY PROCEDURES

TABLE OF CONTENTS

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3.1 INTRODUCTION

3.1.1 GENERAL NOTES AND DEFINITIONS

This section provides procedures for handling emergencies and critical flight situations. Although emergencies caused by airplane, systems, or engine malfunctions are extremely rare, the guidelines described in this section should be considered and applied as necessary should an emergency arise.

En-route emergencies caused by weather can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered.

In-flight mechanical problems will be extremely rare if proper preflight inspections and maintenance are practiced. Always perform a thorough walk-around preflight inspection before any flight to ensure that no damage occurred during the previous flight or while the airplane was on the ground.

Aircraft emergencies are very dynamic events. Because of this, it is impossible to address every action a pilot might take to handle a situation. However, four basic actions can be applied to any emergency:

Maintain Aircraft Control

Many minor aircraft emergencies turn into major ones when the pilot fails to maintain aircraft control. Remember, do not panic and do not fixate on a particular problem. To avoid this, even in an emergency: aviate, navigate, and communicate, in this order. Never let anything interfere with your control of the airplane. Never stop flying.

Analyze the Situation

Once you are able to maintain control of the aircraft, assess the situation. Look at the propulsion system parameters. Determine what the airplane is telling you.

Take Appropriate Action

In most situations, the procedures listed in this section will either correct the aircraft problem or allow safe recovery of the aircraft. Follow them and use good pilot judgment.

Land immediately

Continuation of the flight may be more hazardous than ditching or landing in terrain normally considered unsuitable.

Land as soon as possible

Find the nearest suitable area, such as an open field, at which a safe approach and landing is assured, and land without delay.

Land as soon as practical

The continuation of the flight and the landing site, such as the nearest available runway, is at the discretion of the pilot. It is not recommended to continue the flight beyond the nearest suitable landing area.

3.1.2 MEMORY ITEMS

Memory items are emergency procedures which require immediate reaction by the pilot.

The emergency procedures classified as memory items are identified in the POH by the following symbol beside the procedure name:

NOTE: it is recommended to get acquainted with memory items by means of dedicated ground training and accurate study of the procedures and required action sequence.

MEMORY ITEM PROCEDURES	
Procedure name	Section
BATTERY DISCONNECTED	3.5.5
ENGINE COOLANT PUMP FAILURE	3.5.18
POWER LEVER COMMUNICATION FAILURE	3.5.21

3.2 WARNING/CAUTION INDICATION SYSTEM

The aircraft is equipped with two main independent failure indication systems. The first is composed of the EPSI570C display and annunciator panel, which are software governed. This system informs the pilot about propulsion system component malfunctions and failures by means of warning/caution messages and aural warnings.

The second system is specifically designed to warn the pilot about battery overtemperature. It is analog and consists of battery temperature sensors and two warning LED lights, one for each battery pack, installed on the instrument panel. The overtemperature warning lights are activated when the analog sensors detect a battery temperature above 58 °C (warning range).

The 58 °C threshold coincides also with the temperature at which automatic disconnection of the battery is triggered by the digital system. This is accompanied by a warning message on EPSI570C and annunciator.

Example: front (F) battery overtemp warning light active

The digital and the analog systems are both operative at the same time (normal condition) and, in the event of battery overtemperature, the warning is signaled by both. In the case of EPSI570C display/software malfunction, the analog system remains operative.

NOTE: Battery overtemperature requires emergency procedures described in section Battery Overtemperature (3.5.7).

See section (3.2.1) for the list of warning and caution messages and appendix 9-A1 and section (7.6.5) for more information about the use of the EPSI570C, annunciator panel and battery overtemperature warning lights.

WARNING: Do not take off if any warning or caution appears on the EPSI570C display, annunciator panel or battery overtemperature warning lights.

Additionally, a third warning system is installed. It is a aural and haptic stall warning system in the control stick handles that are activated when the angle of attack becomes critical.

WARNING: Do not operate the engine in recuperation mode (see appendix 9-A1), when dealing with an EMERGENCY or parameter abnormalities, especially when dealing with engine or battery problems. Try to keep engine power setting at zero (0) or in positive range.

3.2.1 EPSI570C WARNING AND CAUTION MESSAGES

The following table presents the possible warning and caution messages that appear on the EPSI570C display.

WARNING: Do not take off if any warning or caution appears on the EPSI570C display, annunciator panel or battery overtemperature warning lights.

WARNINGS		
BATTERY WARNINGS		
Warning Message	**Description**	**Section**
BATTERY F/R DISCONNECTED DUE TO: OVERVOLTAGE / UNDERVOLTAGE / INTERLOCK ERROR / INTERNAL HW FAILURE	This message indicates that the system has automatically disconnected a battery pack due to one of the reasons listed.	3.4.9 3.5.5
BATTERY F/R DISCONNECTED DUE TO: OVERTEMPERATURE	This message indicates an automatic battery disconnection due to overtemperature.	3.5.7
ENGINE WARNINGS		
Warning Message	**Description**	**Section**
ENGINE OVERTEMPERATURE	Power controller temperature or motor temperature in warning range. Power controller derating is active.	3.5.10

CAUTIONS

BATTERY CAUTIONS

Caution Message	Description	Section
BATTERY F/R HIGH TEMPERATURE	The system has detected a battery temperature in the caution range.	3.4.9 3.5.6
BATTERY F/R ABOUT TO DISCONNECT	Battery temperature is rising into the warning range and system will disconnect the battery soon.	3.4.9 3.5.6
BATTERY F/R NOT PRESENT	The system is unable to communicate with the battery. (via CAN-bus communication system)	3.4.7 3.4.9 3.5.5 3.5.8
ONLY ONE BATTERY PACK IS ACTIVE	This caution appears when the power controller is ON and when motor RPM >300. Only one battery can delivery power. This message is meant to avoid the possibility of taking off with only one pack active and providing power.	3.4.7 3.4.9 3.5.5
BATTERY F/R OVERCURRENT	The system has detected an overcurrent from the battery.	3.4.9 3.5.11
BATTERY VOLTAGES NOT EQUAL	Difference between battery voltages is >5V.	3.4.5
SOC <30%	State of charge is less than 30%.	3.4.9 3.5.12
NO GO-AROUND AVAILABLE	Appears when SOC<15%. Batteries are almost discharged. Only few minutes of power left.	3.5.13
BATTERY F/R STARTUP FAILED	This message appears after turning the power enable switch on during ground operation.	3.4.5
BATTERY F/R SOC ADJUSTED	This message informs the pilot that SOC has been recalculated and updated.	3.5.14
BATTERY F/R LOW CELL VOLTAGE	The system has detected a low voltage in the battery cells.	3.5.15
BATTERY COOLANT PUMP 1/2 FAILURE	Battery coolant pump 1 or 2 malfunction.	3.5.16

BATTERY COOLANT FAN FAILURE	Battery coolant fan malfunction. This caution appears during recharging.	3.4.6
BATTERY F/R SELFTEST FAILED PBIT	The system has detected battery parameter anomalies during system startup.	3.4.5
BATTERY F/R SELFTEST FAILED LOW TEMP	The system has detected battery temperatures below the limit for startup (<0°C)	3.4.5
ENGINE CAUTIONS		
Caution Message	**Description**	**Section**
ENGINE HIGH TEMPERATURE	Power controller temperature or motor temperature in caution range. If temperatures keep increasing expect "Engine Overtemperature" warning message.	3.4.9 3.5.9
ENGINE COMMUNICATION FAILURE	Power setting can't be changed and remains at the last valid setting.	3.4.10 3.5.17
ENGINE COOLANT PUMP FAILURE	Engine coolant pump malfunction. Expect rise of power controller and motor temperatures, power derating and power cut off.	3.4.9 3.5.18
SYSTEM CAUTIONS		
Caution Message	**Description - Action**	
SYSTEM ISOLATION FAILURE	The system has detected a failure in the electrical insulation between high voltage and low voltage systems/lines.	3.5.19
DC/DC COMMUNICATION FAILURE	DC/DC system malfunction. Auxiliary battery might not be recharged.	3.4.8 3.5.20
DC/DC NOT WORKING	DC/DC system malfunction. Auxiliary battery might not be recharged.	3.4.8 3.5.20
POWER LEVER COMMUNICATION FAILURE	Power lever malfunction. Power setting can't be changed and remains at the last valid setting.	3.4.10 3.5.21

BATTERY CURRENT NOT EQUAL	Max permissible difference in electrical current between batteries is out of tolerance. This message also appears when one battery is disconnected (current is 0).	3.5.22
AUXILIARY BATTERY FAILURE	Auxiliary battery malfunction. No backup available in case of DC/DC converter failure.	3.14

3.3 AIRSPEEDS FOR EMERGENCY OPERATIONS

Maneuvering Speed:	100 KIAS
Best Glide Speed (flaps 0):	70 KIAS

Emergency Landing (Engine-out) - Final approach speeds:

Flaps 0	63 KIAS
Flaps +1	60 KIAS
Flaps +2	58 KIAS

3.4 GROUND EMERGENCIES

3.4.1 ENGINE SYSTEM FIRE ON GROUND

Should you encounter firewall-forward fire on the ground, react as follows:

1	Come to a complete standstill	-
2	MASTER switch	OFF
3	BATT EN switch	OFF
4	PWR EN switch	OFF
5	BATT REAR & BATT FRONT circuit breakers	DISENGAGE
6	PWR CTRL circuit breaker	DISENGAGE
7	Emergency ground egress procedure (3.4.4)	PERFORM

WARNING: A waterless agent fire extinguisher should be used in case of engine system fire.

WARNING: DO NOT attempt to restart the motor after an engine system fire.

3.4.2 BATTERY FIRE ON GROUND

A clear indication of battery fire is dense smoke and a distinctive chemical smell. Fire can develop quickly and aggressively. Should you encounter battery fire on the ground, react as follows:

1	Come to a complete standstill	-
2	MASTER switch	OFF
3	BATT EN switch	OFF
4	BATT REAR & BATT FRONT circuit breakers	DISENGAGE
5	Emergency ground egress procedure (3.4.4)	PERFORM

WARNING: Be aware that lithium battery fires are extremely dangerous because they are self-sustaining! They are a result of a chemical reactions and are impossible to extinguish. You can only prevent or delay fire propagation by continually cooling down the batteries and surrounding items with copious amount of water.

NOTE: expect battery overtemperature analog warning lights ON in case of battery fire/overtemperature.

WARNING: DO NOT attempt to restart the motor or to reconnect the batteries after a battery system fire. Aircraft should be under surveillance for at least 24h in a safe place where potential fire, caused by possible latent battery thermal runaway or late cell ignition, can not cause further damage to the surroundings.

3.4.3 EMERGENCY ENGINE SHUTDOWN ON GROUND

1	Power Lever	CUT OFF
2	MASTER Switch	OFF
3	BATT EN Switch	OFF
4	PWR EN Switch	OFF
5	PWR CTRL Circuit breaker	DISENGAGE

3.4.4 EMERGENCY GROUND EGRESS

1	Engine	SHUTDOWN
2	Parking brake	ENGAGE
3	Seat belts	RELEASE
4	Airplane	EXIT
5	Vicinity of airplane	EVACUATE

While exiting the airplane, make sure the evacuation path is clear of other aircraft, spinning propellers and/or other hazards.

3.4.5 BATTERY FAILURE AT SYSTEM START-UP

The system performs a self test on electrical components during the start-up phase. Batteries are included in the checks.

In case of battery malfunction during system test (or temperatures below 0°C) the following caution messages can appear:

EPSI570C message	Annunciator
BATTERY F/R SELFTEST PBIT/LOW TEMP FAILED *(amber)*	 or 
BATTERY F/R STARTUP FAILED *(amber)*	 or 

CAUTION: If these messages appear, do not continue start up. If reason is low battery temperature, try to start up when battery temperature is >0°C. If failure persists, or in case of other messages contact manufacturer.

EPSI570C message	Annunciator
BATTERY VOLTAGES NOT EQUAL *(amber)*	

1	DO NOT TAKE OFF	-

CAUTION: If this message appears, do not take off. Try to fully recharge batteries. If the message persists, contact manufacturer.

3.4.6 BATTERY COOLANT FAN FAILURE

The battery coolant fan is used during the recharging phase. If the battery coolant fan fails, charging power is derated to 0 kW (see also Section 8 for additional information about charging procedure) and the following caution message appears:

EPSI570C message	Annunciator
BATTERY COOLANT FAN FAILURE *(amber)*	

1	Recharging procedure	ABORT

NOTE: Contact manufacturer.

3.4.7 ONLY ONE BATTERY CONNECTED

If a battery is not detected in the CAN-bus communication line (also consequent to battery circuit breaker disengagement) there is no communication between the system controller and the battery. When this occurs the following message appears:

EPSI570C message	Annunciator
BATTERY F/R NOT PRESENT *(amber)*	

1	DO NOT TAKE OFF	-

Additionally, on EPSI570C the parameters of the battery that is not communicating are not available and are covered by a red cross (See section 9-A1 for details).

If communication with the battery is still possible, but the disconnection happens at the power line interface of the battery, the following message appears on the EPSI570C as soon as RPM reaches 300 RPM, to avoid take off with a single battery delivering power.

EPSI570C message	Annunciator
ONLY ONE BATTERY PACK IS ACTIVE *(amber)* (if RPM>300)	

1	DO NOT TAKE OFF	-

CAUTION: If these messages appear, do not take off. Check battery connectors. If the problem is not solved, contact manufacturer. If they appear in flight see Single battery disconnection emergency procedures (3.5.5).

3.4.8 DC/DC CONVERTER FAILURES

When the system detects a DC/DC converter failure, the auxiliary battery is not being recharged. This means the engine, several instruments and systems, required according to the MLE, will soon become inoperative. Expect one of the following caution messages to appear:

EPSI570C message	Annunciator
DC/DC COMMUNICATION FAILURE *(amber)*	
DC/DC NOT WORKING *(amber)* (if RPM>300)	

1	DO NOT TAKE OFF	-

CAUTION: If these messages appear, do not take off and contact manufacturer.

3.4.9 PROPULSION SYSTEM COMPONENT FAILURES

CAUTION: If any warning or caution messages related to propulsion system components appear while on the ground (engine or battery high temperature, engine overtemperature, battery overcurrent, coolant pumps, battery disconnection etc), do not take off.

If any warning or caution message appears while on the ground:

- If take off run is not initiated yet:

1	DO NOT TAKE OFF	-

CAUTION: Contact manufacturer.

- If the take off run is initiated and conditions (speed, available runway) permit safe aircraft stoppage:

1	Come to a complete standstill	PERFORM
2	MASTER switch	OFF

NOTE: If the warning/caution message is battery related, disengage affected battery circuit breaker. Expect additional caution messages caused by battery disconnection/single battery operation to appear.

3	MASTER switch	ON
4	Taxi off the runway (using low power setting)	PERFORM
5	Shutdown procedure (4.12)	PERFORM

- If conditions do not permit safe aircraft stoppage:

3	Take off	CONTINUE
4	Land	AS SOON AS PRACTICAL

CAUTION: Contact manufacturer.

3.4.10 POWER LEVER / ENGINE COMMUNICATION FAILURE

If a power lever or engine communication failure occurres, the power setting can't be adjusted by the pilot and remains at the last valid value before the communication loss. Expect one of the following caution messages to appear:

EPSI570C message	Annunciator
POWER LEVER COMMUNICATION FAILURE *(amber)*	
EPSI570C message	**Annunciator**
ENGINE COMMUNICATION FAILURE *(amber)*	

- If the take off run is not initiated yet:

1	PWR CTRL circuit breaker	DISENGAGE
2	Power lever	CUT OFF
3	Shutdown procedure (4.12)	PERFORM
4	Parking procedure (4.13)	PERFORM

- If take off run is initiated and there is enough runway to stop the aicraft or power/speed is not sufficient for lift off and climb:

1	PWR CTRL circuit breaker	DISENGAGE
2	Power lever	CUT OFF
3	Come to a complete standstill	PERFORM
4	Shutdown procedure	PERFORM
5	Push the aircraft off the runway	PERFORM
6	Parking procedure (4.13)	PERFORM

- If there is not enough runway available to stop, and power/speed is sufficient for lift off and climb: perform Engine / power lever communication failure (in flight) procedures (3.5.17 / 3.5.21).

NOTE: In the case of an engine communication failure, all parameters related to motor and power controller, including the parameters (RPM, kW) displayed on Kanardia instrument installed in front of the left seat, are covered with a red cross. The values displayed represent the last valid output.

CAUTION: Contact manufacturer.

3.5 IN-FLIGHT EMERGENCIES

3.5.1 COMPLETE POWER LOSS AFTER TAKE OFF

If complete power loss occurs immediately after becoming airborne and a runway landing is possible, abort with a runway landing. If, however, altitude attained precludes a runway stop, but is not sufficient to restart the motor, lower the nose to maintain airspeed and establish a glide attitude. In most cases, the landing should be made straight ahead, turning only to avoid obstructions. After establishing a glide for landing, perform as many of the checklist items as time permits.

1	Best Glide or Landing Speed (as appropriate)	ESTABLISH
2	BATT FRONT & BATT REAR Circuit breakers	DISENGAGE
3	PWR CTRL Circuit breaker	DISENGAGE
4	Flaps	AS REQUIRED
5	Land (emergency landing)	PREPARE TO LAND

WARNING: Do not change course or make turns if this is not of vital necessity! After having landed safely, ensure protection of the aircraft and vacate the runway to keep the runway clear for arriving and departing traffic. Do this calmly and carefully, so as to avoid injury and equipment damage.

WARNING: If a turn back to the runway is elected, be very careful not to stall the airplane.

Minimum recommended altitude for attempting a turn back to the runway:

Power loss in upwind leg	at least 700 ft AAL
Power loss in crosswind leg	at least 500 ft AAL

CAUTION: This maneuver is influenced by many factors like pilot skills, experience, reaction time, wind, presence of obstacles etc. Good situational awareness and pilot judgment is essential.

3.5.2 COMPLETE IN-FLIGHT POWER LOSS

If the power is lost at altitude, pitch down as necessary to establish best glide speed. While gliding toward a suitable landing area, attempt to identify the cause of the failure and correct it.

1	Best Glide Speed (flaps 0)	ESTABLISH 70 KIAS

- If time permits:

2	Motor restart in flight procedure (3.5.3)	ATTEMPT

- If restart is not effective:

3	Emergency landing procedure (3.9.1)	PERFORM

WARNING: High motor or power controller temperature may be indicative of an imminent complete propulsion system failure.

BEST GLIDE SPEED AND RATIO CONDITIONS:

Weight:	600 kg
Best Glide Speed - V_G (flaps 0):	70 KIAS
Max. Glide Ratio:	15:1

3.5.3 MOTOR RESTART IN FLIGHT

NOTE: The minimum height, at which a motor restart attempt can be made safely, is 1000 ft AAL.

Attempt to restart the motor in flight following these steps:

1	Power lever	CUT OFF
2	PWR EN Switch	OFF
3	MASTER Switch	OFF
4	PWR CTRL Circuit breaker	DISENGAGE
	After 3 seconds:	
5	PWR CTRL Circuit breaker	ENGAGE
6	MASTER SWITCH	ON
7	PWR EN Switch	ON
8	Power lever	SLOWLY INCREASE
	- If restart is not effective:	
9	Emergency landing procedure (3.9.1)	PERFORM

3.5.4 PARTIAL POWER LOSS

Possible causes for a partial loss of power include power controller, system controller or power lever malfunctions, fluctuating RPM or power derating intervention due to engine overtemperature. Check EPSI570C/annunciator for indication of malfunctions or abnormalities, or presence of caution or warning messages.

NOTE: If partial power loss is accompanied by engine overtemperature caution messages, the power loss is due to power derating activation. Perform Engine overtemperature procedures (3.5.10).

NOTE: A damaged propeller may cause extremely rough operation. If an out-of-balance propeller is suspected, immediately shut down engine and perform Emergency landing procedure (3.9.1).

Partial power loss at take off

Partial power loss is most critical during take off. The time available to assess the situation is limited and the pilot has to react quickly.

If partial power loss happens during take off run, and conditions permit a safe stoppage, the pilot has to abort the take off.

If the take off can't be aborted, perform the following:

1	Power available	ASSESS

NOTE: 35 kW is considered as minimum power that should be available for safe initial climb.

2	Airspeed	ESTABLISH Vx (57 KIAS)
3	Climb over the obstacles to safe altitude	PERFORM
4	Propulsion system parameters	CHECK/MONITOR
5	Land	AS SOON AS PRACTICAL

Partial power loss in flight

If a partial engine failure permits level flight, keep monitoring EPSI570C display/annunciator and instruments, and try to determine the cause of the power loss. Land at a suitable airfield as soon as practical.

If conditions do not permit safe level flight, move the power lever through the complete range to obtain the best operation possible and check the amount of available power. Use partial power as necessary to set up a forced landing pattern over a suitable landing field. Always be prepared for a complete power loss.

3.5.5 BATTERY DISCONNECTED

Single Battery Disconnection

Battery disconnection can be either manual, by disengaging the battery circuit breaker, or automatic, triggered by the system.

In case of automatic battery disconnection, the EPSI570C will display a warning message identifying which battery has been disconnected (F=Front or R=Rear) and the reason for disconnection.

NOTE: In case of automatic "battery f/r disconnected due to: overtemperature" see specific Battery overtemperature procedures (3.5.7).

EPSI570C message	Annunciator
BATTERY F/R DISCONNECTED DUE TO: OVERVOLTAGE / UNDERVOLTAGE / INTERLOCK ERROR / INTERNAL HW FAILURE *(red)*	 or

General procedure in case of single battery disconnection:

1	Affected battery circuit breaker	DISENGAGE
2	Reduce power	AS MUCH AS POSSIBLE
3	SOC, RFT, Battery temperature	MONITOR
4	Land	AS SOON AS PRACTICAL

Subsequent to automatic battery disconnection, the following caution messages will also appear (the second caution will be visible after the acknowledgment of the first):

EPSI570C message	Annunciator
ONLY ONE BATTERY PACK IS ACTIVE *(amber)*	
BATTERY CURRENT NOT EQUAL *(amber)*	

Subsequent, and consequently, to battery circuit breaker disengagement (this action will cause loss of communication with the battery and parameters such as battery temperature and voltage will no longer be available - see Appendix 9-A1 for details), also the following caution message will appear:

EPSI570C message	Annunciator
BATTERY F/R NOT PRESENT *(amber)*	 or

WARNING: Battery disconnection will reduce the aircraft endurance drastically. Monitor the remaining SOC and the RFT, and react accordingly. If the SOC does not permit reaching an airfield, set up a forced landing pattern over a suitable landing field and perform Emergency landing procedure (3.9.1).

WARNING: Max 40 kW of power with one battery operative. If possible, use power settings below 30 kW to avoid battery overcurrent or risk of disconnection due to undervoltage of the functional battery.

WARNING: Do not operate the engine in recuperation mode (see appendix 9-A1). Try to keep engine power setting at zero (0) or in positive range.

WARNING: Do not attempt to reconnect a battery that has been automatically or manually (by disengaging the circuit breaker) disconnected. After one battery is disconnected, the equal voltage between the two battery boxes it's not guaranteed anymore. Reconnecting one battery may lead to high very dangerous balancing current between the two batteries.

Double Battery Disconnection

Double battery disconnection shall be considered a Complete in-flight power loss, and requires Emergency landing procedure (3.9.1), without motor power:

1	Emergency landing procedure (3.9.1)	PERFORM

WARNING: Do not attempt to reconnect a battery that has been automatically or manually (by disengaging the circuit breaker) disconnected.

3.5.6 BATTERY HIGH TEMPERATURE

If battery temperature enters the caution range (between 51°C and 57 °C), EPSI570C and annunciator will display the following caution message:

EPSI570C message	Annunciator
BATTERY F/R HIGH TEMPERATURE *(amber)*	 or

Perform the following:

1	Power Lever	Reduce < 30 kW
2	Battery temperature	MONITOR

- If battery temperature remains in the caution range:

3	Land	AS SOON AS PRACTICAL

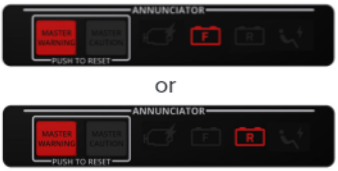
- If battery temperature continues to increase, exceeding 55°C, also the following message appears:

EPSI570C message	Annunciator
BATTERY F/R ABOUT TO DISCONNECT *(amber)*	 or 

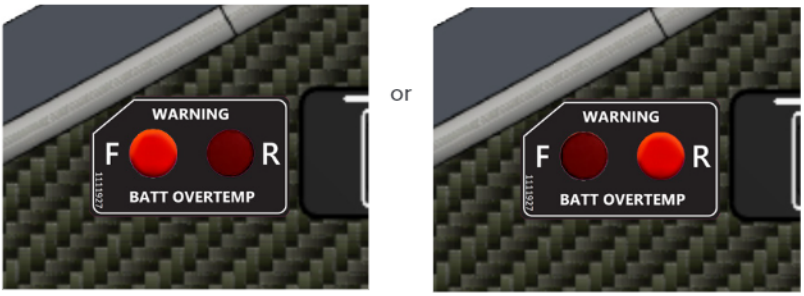
NOTE: The procedure remains the same as for the previous caution message "BATTERY F/R HIGH TEMPERATURE".

3.5.7 BATTERY OVERTEMPERATURE

If battery temperatures continue to rise, entering the warning range (≥ 58 °C), the battery is automatically disconnected by the system. Expect the following message to appear:

EPSI570C message	Annunciator
BATTERY F/R DISCONNECTED DUE TO OVERTEMPERATURE *(red)*	

Also expect the battery overtemperature warning light of the affected battery to illuminate (independent analog system):



Perform the following:

1	Reduce power	AS MUCH AS POSSIBLE
2	Affected battery circuit breaker	DISENGAGE *
3	Caution messages on EPSI570C following battery disconnection/circuit breaker disengagement	ACKNOWLEDGE
4	SOC and RFT	MONITOR
5	Other battery temperature and parameters	MONITOR

- If warning is signalled by both alert systems (battery overtemperature warning lights AND EPSI warning message):

6	Land	IMMEDIATELY
7	Airplane	EVACUATE

- If warning is signalled by only one of the alert systems (battery overtemperature warning lights only OR EPSI warning only):

6	Land	AS SOON AS POSSIBLE

* **NOTE**: After battery circuit breaker disengagement, communication with the battery is lost. The battery overtemp warning light will go off and battery parameters (such as temperature) will not be available (see Appendix 9-A1 for details). This does not mean that the overtemperature issue is solved.

CAUTION: Max 40 kW of power with one battery operative.

NOTE: High power settings or prolonged full power applications may cause overtemperature or "disconnection due to undervoltage" of the remaining battery.

WARNING: Battery overtemperature may induce battery thermal runaway. An indication of possible ongoing thermal runaway is dense smoke or chemical smell from battery compartments. This situation is extremely dangerous and can lead to battery fire. **Any warning light activation or presence of chemical smell/smoke requires immediate attention**.

WARNING: In presence of smoke or chemical smell, **land immediately.**

NOTE: See also Battery system fire procedure (3.6.2) for additional information about lithium battery fires and related procedures.

WARNING: Do not attempt to reconnect a battery that has been automatically or manually (by disengaging the circuit breaker) disconnected. After one battery is disconnected, equal voltage between the two battery boxes is not guaranteed anymore. Reconnecting one battery may cause a high and very dangerous current surge between the two batteries

CAUTION: Do not re-connect or use the overheated battery after landing. Contact manufacturer.

3.5.8 BATTERY NOT PRESENT

Single battery loss of communication

EPSI570C message	Annunciator
BATTERY F/R NOT PRESENT *(amber)*	 or

1	Single battery disconnection procedure (3.5.5)	PERFORM

Communication loss with one battery is indicated by a single caution message. Affected battery information (SOC, temperature) is not available and EPSI battery parameters are covered by a red cross as shown in Section 9-A1. The battery can supply power, but can't be monitored. A precautionary manual disconnection is required (HV BATT F/R circuit breaker disengagement), applying Single battery disconnection procedure (3.5.5).

Double battery loss of communication

EPSI570C message	Annunciator
BATTERY F NOT PRESENT *(amber)* **BATTERY R NOT PRESENT** *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Annunciator/ Batt warning lights	MONITOR
3	Land	AS SOON AS PRACTICAL *

A total communication loss with both batteries is signalled by two caution messages. Red crosses appear over the parameters of both batteries.

* **CAUTION:** SOC and RFT values are not available and residual endurance is difficult to assess, so excessive energy consumption could occur without the pilot realizing it. A power-off precautionary landing is recommended. Additionally, if batteries are below 15%SOC, the power for a go-around is not guaranteed.

3.5.9 ENGINE HIGH TEMPERATURE

If engine (motor or power controller) temperature enters the caution range (65 °C - 69 °C for power controller or 100 °C - 109 °C for the motor) the following caution message will be displayed on EPSI570C:

EPSI570C message	Annunciator
ENGINE HIGH TEMPERATURE *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Engine (motor or power controller) temperature	MONITOR
3	Engine coolant pump status	CHECK EPSI for failure messages

CAUTION: Engine temperature may increase due to engine coolant pump malfunction. Engine coolant pump malfunction is usually detected and signaled by a caution message (see 3.5.18). If the engine high temperature is caused by coolant pump failure expect temperatures to increase rapidly as soon as power is applied.

- If engine temperature remains in caution range:

4	Land	AS SOON AS PRACTICAL

WARNING: High power settings when the engine temperature is inside caution range will lead to the temperature entering the warning range, followed by engine overtemperature warning message.

NOTE: If power controller or motor temperature sensor failure occurs, the mission has to be aborted. In this case, Coolant IN and Coolant OUT temperature values (EPSI570C – SYSTEM page) can help the pilot identify engine cooling malfunction if temperatures rise abnormally.

3.5.10 ENGINE OVERTEMPERATURE

If engine temperature continues to increase and enters the warning range (70 °C for power controller and 110 °C for the motor), expect the following warning message to appear:

EPSI570C message	Annunciator
ENGINE OVERTEMPERATURE *(red)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Engine (motor or power controller) temperature	MONITOR

CAUTION: If engine temperature reaches the warning range **power derating** is activated (see 7.6.4 for power derating description). Full power will be available again only after the temperatures have dropped out of the warning range. Expect imminent power cut to zero in case of high power usage!

- If partial power is still available and the engine coolant pump is functional, perform the following:

3	Land	AS SOON AS POSSIBLE

- if engine overtemperature is associated with "engine coolant pump failure" message (3.5.18), power will very likely be derated to zero in a few seconds after power application. The recommended procedure is the following:

3	Power lever	CUT OFF
4	Best glide speed (flaps 0)	70 KIAS
5	Land (emergency landing)	PREPARE TO LAND

NOTE: Avoid unnecessary power application or recuperation mode. Residual power before final derating to 0 kW can be carefully used to adjust final approach path during the emergency landing final phase, or traffic/obstacle avoidance.

- if power is derated to zero:

3	Emergency landing procedure (3.9.1)	PERFORM

3.5.11 BATTERY OVERCURRENT

This message is usually associated with single battery operation and if the system detects excessive current drain from the functional battery.

The following caution message will appear on EPSI570C:

EPSI570C message	Annunciator
BATTERY F/R OVERCURRENT *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Battery status/current (of both batteries)	CHECK

- if both batteries are still connected (current of both batteries ≠ 0 A):

3	Battery temperatures and currents	MONITOR
4	Land	AS SOON AS PRACTICAL

- if one battery is disconnected (current = 0 A) and has caused overcurrent of the other:

3	Circuit breaker of battery delivering 0 A	DISENGAGE
4	Single Battery disconnection procedure (3.5.5)	PERFORM

CAUTION: Abort mission if the message appears while on the ground.

3.5.12 LOW STATE OF CHARGE (LOW SOC)

Battery SOC is indicated on the EPSI570C with two bars showing SOC percentage for each battery pack.

SOC bars are green when SOC % is between 100% and 30%, and turn amber below 30%.

When SOC % is lower than 30%, expect the following caution message to appear:

EPSI570C message	Annunciator
SOC<30% *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Remaining SOC and RFT	MONITOR
3	Land	PREPARE TO LAND

NOTE: A normal mission must terminate with SOC ≥ 30% at landing!

3.5.13 NO GO-AROUND AVAILABLE

If the flight continues and SOC% decreases to 15%, the following caution message appears:

EPSI570C message	Annunciator
NO GO-AROUND AVAILABLE *(amber)*	

CAUTION: The message above indicates that batteries are almost discharged and the remaining energy is only sufficient for a few minutes of flight. There is not enough energy left to perform a go-around safely.

1	Land	PREPARE TO LAND

WARNING: If SOC < 15%, applying full power may cause battery voltage to drop and eventual battery disconnection.

3.5.14 BATTERY SOC ADJUSTED

Battery malfunction may cause the system to recalculate the battery SOC. The updated values might be different from the previous. Remaining Flight Time (RFT) may change as well.

NOTE: This is not the case for normal SOC decrease during flight.

After SOC% is recalculated, expect the following caution message:

EPSI570C message	Annunciator
BATTERY F/R SOC ADJUSTED *(amber)*	 or

1	Updated SOC value	CHECK
2	SOC and RFT	MONITOR

CAUTION: The mission has to be re-planned according to new SOC and RFT values!

3.5.15 BATTERY CELL LOW VOLTAGE

When the system detects a low cell voltage in either of the battery boxes, expect the following caution message to appear:

EPSI570C message	Annunciator
BATTERY F/R LOW CELL VOLTAGE *(amber)*	 or 

1	Reduce power	AS MUCH AS POSSIBLE
2	SOC and RFT	MONITOR

CAUTION: If power is not adequately reduced, expect the affected battery to be disconnected automatically due to undervoltage.

NOTE: The caution message is triggered when the system detects a minimum cell voltage below 3100 mV in either of the battery boxes. Displayed SOC is linked to cell voltage. Expect also low SOC caution message (3.5.12) to appear with the message above. Battery voltage decreases rapidly, especially when high power is applied at low SOC.

- If the battery disconnects:

3	Single battery disconnection procedure (3.5.5)	PERFORM

CAUTION: In the case of battery undervoltage/overvoltage do not re-charge the battery. The battery has to be sent to an authorized maintenance organization for inspection. Contact manufacturer after the flight.

3.5.16 BATTERY COOLANT PUMP FAILURE

When the system detects a failure of one or both battery coolant pumps, expect the following caution messages to appear:

EPSI570C message	Annunciator
BATTERY COOLANT PUMP 1/2 FAILURE *(amber)*	

Single battery coolant pump failure

- If a single coolant pump fails (one caution message, for pump 1 OR 2):

1	Battery temperatures	MONITOR
2	Flight	Continue normally

Double battery coolant pump failure

- If both coolant pumps fail (two caution messages, one for pump 1 AND one for pump 2:

1	Reduce power	AS MUCH AS POSSIBLE
2	Battery temperatures	MONITOR
3	Land	AS SOON AS PRACTICAL

NOTE: Contact manufacturer after the flight.

CAUTION: With both pumps inoperative, battery temperature will start to steadily increase. Avoid prolonged use of power to prevent an excessive battery temperature increase.

3.5.17 ENGINE COMMUNICATION FAILURE

In the case of engine communication failure, the power setting can't be adjusted by the pilot and will stay the same as it was before the communication loss. The pilot has to evaluate the situation and assess whether there's enough power available to sustain level flight or return to base.

Expect the following caution message to appear:

EPSI570C message	Annunciator
ENGINE COMMUNICATION FAILURE *(amber)*	

1	Power Available	ASSESS

CAUTION: if communication is lost at high power settings and power can't be reduced, this may result in high power system component temperatures.

Assess the power available to determine if it is possible to return to base or to reach an alternate airfield or a suitable landing area. When at gliding

distance from the elected landing site and when ready for a power-out approach, switch the motor off:

2	PWR CTRL circuit breaker	DISENGAGE
3	Emergency landing procedure (3.9.1)	PERFORM

NOTE: In the case of engine communication failure, all parameters related to the motor and power controller, including the parameters (RPM, kW) displayed on the Kanardia instrument installed in front of the left seat, are covered by a red cross (see Section 9-A1 for more details). The values displayed represent the last valid output. Engine temperatures and other parameters will not be available and can't be monitored. Be prepared to the possibility of engine temperature rising, if communication was lost at high power settings. Power derating and propeller overspeed protection will remain active.

3.5.18 ENGINE COOLANT PUMP FAILURE

Engine coolant pump failure causes engine temperatures to rise immediately as power is applied. Power controller temperature will rise faster than motor temperature, and in a few seconds will cause power controller shut down and total loss of power at most useful power settings.

When the system detects a engine coolant pump failure, expect the following caution message to appear:

EPSI570C message	Annunciator
ENGINE COOLANT PUMP FAILURE *(amber)*	

React as follows:

1	Power lever	CUT OFF
2	Best glide speed (flaps 0)	70 KIAS
3	Engine (power controller and motor) temperatures	CHECK
4	Land (emergency landing)	PREPARE TO LAND

NOTE: Avoid unnecessary power application or recuperation mode. Residual

power before final derating to 0 kW can be carefully used to adjust final approach path during the emergency landing final phase, or for traffic/obstacle avoidance.

NOTE: See also Engine high temperature/overtemperature procedures (3.5.9 and 3.5.10) for caution and warning messages associated with engine high temperature and overtemperature.

3.5.19 ELECTRICAL SYSTEM INSULATION FAILURE

When the system detects an electrical insulation failure between high voltage and low voltage systems/wirings, expect the following caution message to appear:

EPSI570C message	Annunciator
SYSTEM ISOLATION FAILURE *(amber)*	

1	Land	AS SOON AS PRACTICAL

CAUTION: Contact manufacturer after the flight. Any inspection/troubleshooting by the pilot shall be avoided as it could lead to lethal electrical shock.

3.5.20 DC/DC CONVERTER FAILURES (IN FLIGHT)

When the system detects an DC/DC converter failure, expect one of the following caution messages to appear:

EPSI570C message	Annunciator
DC/DC COMMUNICATION FAILURE *(amber)*	
DC/DC NOT WORKING *(amber)* (if RPM>300)	

The DC/DC converter is the system that recharges the auxiliary battery. If the auxiliary battery is not being recharged, it will discharge during flight and aircraft instruments and essential systems will eventually become inoperative.

CAUTION: The system controller is powered by a DC/DC converter/aux battery. Also motor power will eventually be lost when aux battery is discharged.

1	AUX BATTERY Voltage	MONITOR
2	Land	AS SOON AS PRACTICAL

NOTE: aux battery guarantees at least 30 minutes of power.

3.5.21 POWER LEVER COMMUNICATION FAILURE

In the case of power lever communication failure, the power setting can't be changed by the pilot and it will stay the same as it was before the communication loss. The pilot has to evaluate the situation and assess whether there's enough power available to sustain level flight or return to base.

Expect the following caution message to appear:

EPSI570C message	Annunciator
POWER LEVER COMMUNICATION FAILURE *(amber)*	

1	Power Available	ASSESS
2	Engine and Battery temperatures	MONITOR

Assess the power available to determine if it is possible to return to base or to reach an alternate airfield or a suitable landing area.

When at gliding distance from elected landing site and when ready for a power-out approach, switch the motor off:

3	PWR CTRL circuit breaker	DISENGAGE
4	Emergency Landing (3.9.1)	PERFORM

3.5.22 BATTERY CURRENT NOT EQUAL

If the system detects disproportionate current drain between the two batteries, the following caution message will appear on EPSI570C:

EPSI570C message	Annunciator
BATTERY CURRENT NOT EQUAL *(amber)*	

1	Reduce power	AS MUCH AS POSSIBLE
2	Land	AS SOON AS PRACTICAL

NOTE: Contact manufacturer after the flight.

3.6 FIRE IN FLIGHT

3.6.1 ENGINE FIRE IN FLIGHT

1	PWR EN switch	OFF
2	MASTER switch	OFF
3	BATT EN switch	OFF
4	BATT REAR & BATT FRONT circuit breakers	DISENGAGE
5	Door windows	OPEN
6	Side-slip maneuver in direction opposite to the fire.	IF POSSIBLE
7	Land (emergency landing without motor power)	AS SOON AS POSSIBLE
8	Airplane	EVACUATE

3.6.2 BATTERY SYSTEM FIRE

Indication of battery fire is dense smoke and a distinctive chemical smell. Fire can develop quickly and aggressively. A battery system fire will trigger warning and cautions similar to those in a battery high temperature emergencies (see section 3.5.6). Expect battery high/overtemperature cautions and warnings to appear on the EPSI570C display and annunciator. Also expect BATT OVERTEMP WARNING light/s to illuminate. Should you encounter battery fire during flight, react as follows:

1	Affected battery circuit breaker	DISENGAGE
2	Land	IMMEDIATELY
3	Airplane	EVACUATE
4	Long range water type fire extinguisher (if available)	ACTIVATE

CAUTION: After battery circuit breaker disengagement the battery overtemp warning light will go off. This does not mean that the overtemperature issue is solved.

WARNING: Be aware that lithium battery fires are extremely dangerous because they are self-sustaining! They are a result of a chemical reactions

and are impossible to extinguish. You can only prevent or delay fire propagation by continually cooling down the batteries and surrounding items with a copious amount of water.

WARNING: The aircraft should be under surveillance for at least 24h due to possible latent battery thermal runaway or late cell ignition.

3.6.3 COCKPIT FIRE IN FLIGHT

If the cause of the fire is apparent and accessible, try first to locate the source of the fire and isolate it by disengaging the affected system or circuit breaker. If this is not effective, use a fire extinguisher (if available) or any other means to extinguish flames and land as soon as possible. Opening the vents may feed the fire, but to avoid incapacitating the crew from smoke inhalation, it may be necessary to rid cabin of smoke or fire extinguishing.

1	PWR EN switch	OFF
2	BATT EN switch	OFF
3	AVIONICS switch	OFF
4	MASTER Switch	OFF
5	Fire Extinguisher (if available)	ACTIVATE

WARNING: Should the fire extinguisher contain Halon gas, its operation can be toxic, especially in a closed area. After extinguishing fire, ventilate cabin by opening air vents and unlatching door (if required).

If airflow is not sufficient to clear smoke or fumes from cabin:

3	Door vents	OPEN

CAUTION: The door structure/hinge is not designed for intentional open-door operations. Be advised that the chance of door failure occurring is higher, as the airspeed at which the door is opened at increases.

4	Land (emergency)	IMMEDIATELY

3.7 SPINS

The airplane is not approved for intentional spins.

While the stall characteristics of the airplane make accidental entry into a spin extremely unlikely, spinning is possible. Spin entry can be avoided by using good airmanship: coordinated use of controls in turns, proper airspeed control and never abusing the flight controls with accelerated inputs when close to the stall.

If the controls are misapplied at the stall or abused accelerated inputs are made to the elevator, rudder and/or ailerons, an abrupt wing drop may be felt and a spiral or spin may be entered. In some cases it may be difficult to determine if the aircraft has entered a spiral or the beginning of a spin.

In any case, spin recovery technique is classic:

1	Power lever	CUT OFF
2	Roll input	Neutral
3	Rudder	Full deflection - opposite to the spin

As rotation is about to stop, or fully stopped:

4	Rudder	Neutralize
5	Control stick	Release control force towards neutral elevator position, roll input neutral
6	Horizontal flight	Resume (do not exceed g-load and airspeed limitations)

NOTE: the aircraft is equipped with an aural and haptic stall warning system in the control stick handles, that are automatically activated when critical AOA is approached.

3.8 EXCEEDING V_{NE}

Should the VNE be exceeded, reduce airspeed slowly and continue flying using gentle control deflections. Land safely as soon as possible and have the aircraft verified for airworthiness by authorized service personnel.

3.9 LANDING EMERGENCIES

If all attempts to restart the motor failed and an emergency landing is imminent, select a suitable field and prepare for landing.

A suitable field should be chosen as early as possible so that maximum time will be available to plan and execute the emergency landing. For emergency landings on unprepared surfaces, use full flaps if possible. Land on the main gear and hold the nose wheel off the ground as long as possible. If motor power is available, before attempting an "off airport" landing, fly over the landing area at a low but safe altitude to inspect the terrain for obstructions and surface conditions.

NOTE: Use of full (+2) flaps will reduce glide distance. Full flaps should not be selected until landing is assured.

3.9.1 EMERGENCY LANDING

1	Best Glide Speed	70 KIAS (flaps 0)
2	PWR CTRL circuit breaker	DISENGAGE
3	BATT FRONT & BATT REAR circuit breakers	DISENGAGE
4	Seat Belts	SECURED

Select a suitable field and prepare for the landing.

5	Flaps (when landing is assured)	+2

If time permits:

6	Radio	Transmit (121.5 MHz) MAYDAY, giving location and intentions
7	Transponder	SQUAWK 7700
8	ELT Switch	ON (if necessary)

NOTE: ELT transmission can be deactivated by resetting either the remote switch or the ELT control switch to ARM/OFF position. Please see [2] for additional details.

3.9.2 DITCHING

1	Best Glide Speed	70 KIAS (flaps 0)
2	Power lever	CUT OFF
3	BATT FRONT circuit breaker	DISENGAGE
4	BATT REAR circuit breaker	DISENGAGE
5	Life vests	CHECK
6	Loose items in cabin	SECURE
7	Seat belts	CHECK SECURED AND TIGHTEN
8	Radio	Transmit (121.5 MHz) MAYDAY
9	Transponder	SQUAWK 7700
10	ELT switch	ON
11	Approach	High seas, high wind: into the wind. Light wind, heavy swells: parallel to the swells
12	Doors	OPEN
13	AUX BATT circuit breaker	DISENGAGE
14	Flaps	+2
15	Landing at the lowest possible speed	PERFORM
16	Seat belts	Release immediately
17	Airplane	EVACUATE
18	Life vest and raft	Inflate when outside the cabin
19	Flotation Devices	INFLATE WHEN CLEAR OF AIRPLANE

NOTE: If available, life preservers should be donned and life raft should be prepared for immediate evacuation upon touchdown. Consider OPENING a door prior to assuming the emergency landing body position in order to provide a ready escape path.

It may be necessary to allow some cabin flooding to equalize pressure on the doors. If the doors cannot be opened, break out the windows and crawl through the opening.

3.9.3 LANDING WITH A DEFECTIVE MAIN LANDING GEAR TIRE

1	Land the airplane at the edge of the runway that is located on the side of the intact tire, so that changes in direction during roll-out due to the braking action of the defective tire can be corrected on the runway.
2	Land with the wing low on the side of the intact tire.
3	Direction should be maintained using the rudder. This should be supported by use of the brake. It is possible that the brake must be applied strongly - if necessary to the point where the wheel locks.

CAUTION: A defective tire is not easy to detect. The damage normally occurs during take off or landing and is hardly noticeable during fast taxiing. It is only during the lower taxiing speeds that a tendency to swerve occurs.

3.9.4 LANDING WITH DEFECTIVE BRAKES

Brake system deficiency is usually detected only after touch down, during ground roll deceleration phase. If brakes are inefficient:

1	Seat belts	CHECK FASTENED AND TIGHTENED
2	Master Switch	OFF
3	PWR CTRL circuit breaker	DISENGAGE

In case of single brake failure, release immediately brake pressure to avoid swerve due to asymmetric braking. Only if necessary apply very light pressure on the brakes, using nose wheel steering to compensate asymmetric braking.

Steer the aircraft gently during deceleration. Once the aircraft has stopped, restart the power and vacate the runway at low speed and using low power settings.

3.10 EPSI570C DISPLAY FAILURE

NOTE: All propulsion system protection features will remain operative in the case of EPSI570C failure. Propulsion system temperatures and other system parameters can't be monitored. Precautionary use of low power settings is recommended.

Total EPSI570C display failure (hardware failure)

- In the event of EPSI570C display failure (i.e. black or malfunctioning screen):

1	Reduce power	AS MUCH AS POSSIBLE
2	EPSI Circuit Breaker	DISENGAGE
3	Annunciator/ batt warning lights	MONITOR
4	Land	AS SOON AS PRACTICAL *

CAUTION: In case of EPSI hardware failure, stall warning system might be inoperative.

NOTE: If the failure only affects the EPSI display, the Kanardia instrument serves as backup for kW and RPM indication, and can be used together with other remaining instruments for the continuation of the flight (ASI, ALT, Compass, VSI, Horis).

Partial EPSI570C display failure (loss of communication)

- In the event of EPSI570C communication failure (see also page 9-A1-15):

1	Reduce power	AS MUCH AS POSSIBLE
2	Annunciator/ batt warning lights	MONITOR
3	Land	AS SOON AS PRACTICAL *

NOTE: In case of EPSI570C communication failure, the Kanardia instrument serves as backup for kW and RPM indication, and can be used together with other remaining instruments for the continuation of the flight (ASI, ALT, Compass, VSI, Horis).

* **CAUTION:** SOC and RFT values are not available and residual endurance is difficult to asses, so excessive energy consumption could occur without the pilot realizing it. A power-off precautionary landing is recommended. Additionally, if batteries are below 15%SOC, the power for a go-around is not guaranteed.

3.11 RADIO COMMUNICATION FAILURE

1	Switches, Controls	CHECK
2	Frequency	CHANGE
3	COM Circuit Breaker	CHECK
4	Headset	CHANGE
5	Transmission	ATTEMPT
if unsuccessful:		
6	transponder	SQUAWK 7600

3.12 PITOT STATIC SYSTEM MALFUNCTION

Static Source Blocked

If erroneous readings of the static source instruments (airspeed, altimeter and vertical speed) are suspected, the information from the GPS system should be used for situational awareness.

NOTE: Referring to the GPS for flying, adjust indicated airspeed during climb or approach. Use +10 KTS on top of standard procedure as guidance and observe the wind situation.

Pitot Tube Blocked

If only the airspeed indicator is providing erroneous information, and in icing conditions, the most probable cause is pitot ice. Descend into warmer air. If an approach must be made with a blocked pitot tube, use known pitch and power settings and the GPS ground speed indicator, taking surface winds into account.

1	Ground speed indicator	+10 KTS for procedures, observe winds

3.13 ELECTRIC TRIM FAILURE

Any failure or malfunction of the electric trim can be overridden by use of the control stick. If runaway trim servo is the problem, cut the circuit by disengaging the TRIM circuit breaker and land as soon as practical.

1	Airplane Control	GRASP STICK, MAINTAIN MANUALLY
	If problem is not corrected:	
2	TRIM Circuit Breaker	DISENGAGE
3	Power Lever	AS REQUIRED
4	Control Stick	MANUALLY HOLD PRESSURE
5	Land	AS SOON AS PRACTICAL

3.14 AUXILIARY BATTERY FAILURE

The auxiliary (aux) battery disconnects automatically in the case of malfunction, overvoltage and/or undervoltage. The low voltage systems are still powered by the DC/DC converter.

Expect the following caution message to appear:

EPSI570C message	Annunciator
AUXILIARY BATTERY FAILURE *(amber)*	

1	Land	AS SOON AS PRACTICAL

CAUTION: Do not take off if AUX BATT has low voltage (< 12.8V).

3.15 ICE BUILD-UP

Turn back or change altitude to exit icing conditions. Consider lateral or vertical path reversal to return to last “known good” flight conditions. Maintain VFR flight! Watch for signs of icing on the pitot tube. In case of pneumatic instrument failures, use the GPS information to reference to approximate ground speed. Plan the landing at the nearest airport, or a suitable off airport landing site in case of an extremely rapid ice build-up. Increase the speed to avoid stall.

Maneuver the airplane gently and leave the flaps retracted. When ice is built-up at the horizontal stabilizer, the change of pitching moment due to flaps extension may result of loss of elevator control. Approach at elevated speeds (+15 KTS, also if using the GPS as a reference).

WARNING: Failure to act quickly may result in an unrecoverable icing encounter.

CHECKLISTS

EMERGENCY PROCEDURES

NOTE: Memory items are emergency procedures which require immediate reaction by the pilot and are identified in the emergency checklist by the following symbol next to the procedure name:

It is recommended to get acquainted with memory items by means of dedicated ground training and accurate study of the procedures and required action sequence.

NOTE: Use of the following checklists is not obligatory and at the discretion of the owner/operator.

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GROUND EMERGENCIES

ENGINE SYSTEM FIRE ON THE GROUND	
Come to a complete standstill	-
MASTER switch	OFF
BATT EN switch	OFF
PWR EN switch	OFF
BATT REAR/BATT FRONT circuit breakers	DISENGAGE
PWR CTRL circuit breaker	DISENGAGE
Emergency ground egress procedure	PERFORM

BATTERY FIRE ON THE GROUND	
Come to a complete standstill	-
MASTER switch	OFF
BATT EN switch	OFF
BATT REAR/BATT FRONT circuit breakers	DISENGAGE
Emergency ground egress procedure	PERFORM

EMERGENCY ENGINE SHUTDOWN ON GROUND	
Power Lever	CUT OFF
MASTER Switch	OFF
BATT EN Switch	OFF
PWR EN Switch	OFF
PWR CTRL Circuit breaker	DISENGAGE

PB345V119E-L battery type

PB345V119E-L battery type

EMERGENCY GROUND EGRESS

Engine	SHUTDOWN
Parking brake	ENGAGE
Seat belts	RELEASE
Airplane	EXIT
Vicinity of airplane	EVACUATE

ANY CAUTION / WARNING MESSAGE AT TAKE OFF

If take off run is not initiated yet:

DO NOT TAKE OFF	-

If the take off run is initiated and conditions (speed, available runway) permit safe aircraft stoppage:

Come to a complete standstill	PERFORM
MASTER switch	OFF
Affected battery circuit breaker (if message is battery-related)	DISENGAGE
Taxi off the runway (using low power setting)	PERFORM
Emergency shutdown procedure	PERFORM

If conditions do not permit safe aircraft stoppage:

Take off	CONTINUE
Land	AS SOON AS PRACTICAL

POWER LEVER / ENGINE COMMUNICATION FAILURE

CAUTION:

POWER LEVER COMMUNICATION FAILURE (amber)

or

ENGINE COMMUNICATION FAILURE (amber)

If take off run is not initiated yet:

PWR CTRL circuit breaker	DISENGAGE
Power lever	CUT OFF
Shutdown procedure	PERFORM
Parking procedure	PERFORM

If take off run is initiated and there is enough runway to stop the aircraft
or power/speed is not sufficient for lift off and climb

PWR CTRL circuit breaker	DISENGAGE
Power lever	CUT OFF
Come to a complete standstill	PERFORM
Shutdown procedure	PERFORM
Push the aircraft off the runway	PERFORM
Parking procedure	PERFORM

If there is not enough runway available to stop, and power/speed is sufficient for lift off and climb:

perform Engine / power lever communication failure (in flight) procedures

PB345V119E-L battery type

IN FLIGHT EMERGENCIES

COMPLETE POWER LOSS AFTER TAKE OFF	
Best Glide or Landing Speed (as appropriate)	ESTABLISH (70 - 60 KIAS)
BATT REAR/BATT FRONT circuit breakers	DISENGAGE
PWR CTRL Circuit breaker	DISENGAGE
Flaps	AS REQUIRED
Land (emergency landing)	PREPARE TO LAND

COMPLETE IN-FLIGHT POWER LOSS	
Best Glide speed (flaps 0)	70 KIAS
If time/altitude permits:	
Motor restart in flight procedure	ATTEMPT
If restart is not effective:	
Emergency landing procedure	PERFORM

PB345V119E-L *battery type*

MOTOR RESTART IN FLIGHT	
Power lever	CUT OFF
PWR EN Switch	OFF
MASTER Switch	OFF
PWR CTRL Circuit breaker	DISENGAGE
After 3 seconds:	
PWR CTRL Circuit breaker	ENGAGE
MASTER switch	ON
PWR EN switch	ON
Power lever	Slowly increase
If restart is not effective:	
Emergency landing procedure	PERFORM

PB345V119E-L battery type

PB345V119E-L battery type

PARTIAL POWER LOSS (at take off)	
If it is not possible to stop the aircraft before the end of the runway, lift off and:	
Power available	ASSESS (at least 35 kW for safe climb)
Airspeed	Vx (57 KIAS)
Climb over obstacles	PERFORM
Propulsion system parameters (EPSI)	CHECK/MONITOR
Land	AS SOON AS PRACTICAL

PARTIAL POWER LOSS (in flight)	
EPSI570C/annunciator	CHECK for Caution/ Warning messages
If conditions do not permit safe level flight:	
Emergency landing procedure (use partial power as necessary)	PERFORM
If conditions permit safe level flight:	
EPSI570C and instruments	MONITOR
Land	AS SOON AS PRACTICAL

BATTERY DISCONNECTED (single battery)

OR


WARNING:

BATTERY F/R DISCONNECTED DUE TO:
OVERVOLTAGE / UNDERVOLTAGE
/ INTERLOCK ERROR
/ INTERNAL HARDWARE FAILURE (red)

Affected battery circuit breaker	DISENGAGE
Other EPSI messages sub-sequent to disconnection	ACKNOWLEDGE
SOC, RFT, battery temperature	MONITOR
Reduce power	AS MUCH AS POSSIBLE
Land	AS SOON AS PRACTICAL

DOUBLE BATTERY DISCONNECTION

Emergency landing procedure	PERFORM

PB345V119E-L battery type

PB345V119E-L battery type

BATTERY HIGH TEMPERATURE
(temperature in caution range)

CAUTION:

BATTERY F/R HIGH TEMPERATURE (amber)

followed by (if temperature increases more):

BATTERY F/R ABOUT TO DISCONNECT (amber)

Power lever	Reduce <30 kW
Battery temperature	MONITOR

If battery temperature remains in the caution range:

Land	AS SOON AS PRACTICAL

BATTERY OVERTEMPERATURE
(temperature in warning range)

WARNING:

BATTERY F/R DISCONNECTED DUE TO:
OVERTEMPERATURE (red)

Reduce power	AS MUCH AS POSSIBLE
Affected battery circuit breaker	DISENGAGE
Other EPSI messages sub-sequent to disconnection	ACKNOWLEDGE
SOC and RFT	MONITOR

*If battery overtemperature is signalled by Warning light **AND** EPSI caution message:*

Land	IMMEDIATELY
Airplane	EVACUATE

*If battery overtemperature is signalled by on system only (Warning light **OR** EPSI caution message):*

Land	AS SOON AS POSSIBLE

BATTERY NOT PRESENT (single batt)

CAUTION:

BATTERY F/R NOT PRESENT (amber)

Affected battery circuit breaker	DISENGAGE
Other EPSI messages sub-sequent to disconnection	ACKNOWLEDGE
SOC, RFT, battery temperature	MONITOR
Reduce power	AS MUCH AS POSSIBLE
Land	AS SOON AS PRACTICAL

BATTERY NOT PRESENT (double batt)

CAUTION:

BATTERY F NOT PRESENT (amber)

and

BATTERY R NOT PRESENT (amber)

Reduce power	AS MUCH AS POSSIBLE
Annunciator/ batt warning lights	MONITOR
Land	AS SOON AS PRACTICAL

A power-off precautionary landing is recommended (SOC not available)

PB345V119E-L battery type

ENGINE HIGH TEMPERATURE
(temperature in caution range)

CAUTION:

ENGINE HIGH TEMPERATURE (amber)

Reduce power	AS MUCH AS POSSIBLE
Engine temperature	MONITOR
Engine cooling pump status (EPSI messages)	CHECK EPSI for failure messages

If engine temperature remains in caution range:

Land	AS SOON AS PRACTICAL

ENGINE OVERTEMPERATURE
(temperature in warning range, continues from Engine High Temperature)

WARNING:

ENGINE OVERTEMPERATURE (red)

CAUTION: POWER DERATING ACTIVE
If partial power is still available and the engine coolant pump is functional, perform the following:

Land	AS SOON AS POSSIBLE

If also coolant pump is not functional (caution message - engine coolant pump failure):

Power lever	CUT OFF (use residual power on final)
Best Glide Speed	70 KIAS (flaps 0)
Land (emergency landing)	PREPARE TO LAND

If power is derated to zero:

Emergency landing procedure	PERFORM

PB345V119E-L battery type

BATTERY OVERCURRENT

CAUTION:

BATTERY F/R OVERCURRENT (amber)

Reduce power	AS MUCH AS POSSIBLE
Battery status/current (of both batteries)	CHECK
if both batteries are still connected (current of both batteries ≠ 0 A):	
Battery temperatures and currents	MONITOR
Land	AS SOON AS PRACTICAL
if one battery is disconnected (current = 0A), and caused overcurrent to the other:	
Circuit breaker of battery delivering 0 A	DISENGAGE
Single Battery disconnection procedure	PERFORM

LOW STATE OF CHARGE (SOC)

CAUTION:

SOC < 30% (amber)

Reduce power	AS MUCH AS POSSIBLE
Remaining SOC and RFT	MONITOR
Land	PREPARE TO LAND

PB345V119E-L battery type

PB345V119E-L battery type

NO GO-AROUND AVAILABLE

CAUTION:

NO GO-AROUND AVAILABLE (amber)

Land	PREPARE TO LAND

WARNING: If SOC < 15%, applying full power may cause battery voltage to drop and eventual battery disconnection

BATTERY SOC ADJUSTED

CAUTION:

BATTERY F/R SOC ADJUSTED (amber)

Updated SOC value	CHECK
SOC and RFT	MONITOR

BATTERY CELL LOW VOLTAGE

CAUTION:

BATTERY F/R LOW CELL VOLTAGE (amber)

Reduce power	AS MUCH AS POSSIBLE
SOC and RFT	MONITOR
If affected battery is disconnected due to undervoltage:	
Battery disconnected (single batt) procedure	PERFORM

BATTERY COOLANT PUMP FAILURE

MASTER CAUTION

CAUTION:

BATTERY COOLANT PUMP 1/2 FAILURE (amber)

If a single coolant pump fails (pump 1 or pump 2):

Battery temperatures	MONITOR
Flight	Continue normally

If both coolant pumps fail (two caution messages):

Reduce power	AS MUCH AS POSSIBLE
Battery temperatures	MONITOR
Land	AS SOON AS PRACTICAL

ENGINE COMMUNICATION FAILURE

MASTER CAUTION

CAUTION:

ENGINE COMMUNICATION FAILURE (amber)

Power available	ASSESS

When at gliding distance from the elected landing site and when ready for a power-out approach:

PWR CTRL circuit breaker (motor will quit)	DISENGAGE
Emergency landing procedure	PERFORM

PB345V119E-L battery type

ENGINE COOLANT PUMP FAILURE


CAUTION:

ENGINE COOLANT PUMP FAILURE (amber)

Power lever	CUT OFF
Best glide speed	70 KIAS (flaps 0)
Engine temperatures	CHECK
Land (emergency)	PREPARE TO LAND (use residual power for obstacle avoidance only)

ELECTRICAL SYSTEM INSULATION FAILURE

CAUTION:

SYSTEM ISOLATION FAILURE (amber)

Land	AS SOON AS PRACTICAL

CAUTION: Any inspection/troubleshooting by the pilot shall be avoided as it could lead to lethal electrical shock.

DC/DC CONVERTER FAILURES

CAUTION:

DC/DC COMMUNICATION FAILURE (amber)

or, if RPM >300:

DC/DC NOT WORKING (amber)

AUX BATTERY Voltage	MONITOR
Land	AS SOON AS PRACTICAL

PB345V119E-L battery type

POWER LEVER COMMUNICATION FAILURE

MASTER CAUTION

CAUTION:

POWER LEVER COMMUNICATION FAILURE (amber)

Power available	ASSESS
Engine and Battery temperatures	MONITOR

When at gliding distance from the elected landing site and when ready for a power-out approach:

PWR CTRL circuit breaker (motor will quit)	DISENGAGE
Emergency landing procedure	PERFORM

BATTERY CURRENT NOT EQUAL

MASTER CAUTION

CAUTION:

BATTERY CURRENT NOT EQUAL (amber)

Reduce power	AS MUCH AS POSSIBLE
Land	AS SOON AS PRACTICAL

AUXILIARY BATTERY FAILURE

MASTER CAUTION

CAUTION:

AUXILIARY BATTERY FAILURE (amber)

Land	AS SOON AS PRACTICAL

PB345V119E-L battery type

PB345V119E-L battery type

FIRE IN FLIGHT

ENGINE FIRE IN FLIGHT	
PWR EN switch	OFF
MASTER switch	OFF
BATT EN switch	OFF
BATT REAR & BATT FRONT circuit breakers	DISENGAGE
Door windows	OPEN
Side-slip - direction opposite to the fire	IF POSSIBLE
Land (emergency)	AS SOON AS POSSIBLE
Airplane	EVACUATE

BATTERY SYSTEM FIRE	
Affected battery circuit breaker	DISENGAGE
Land	IMMEDIATELY
Airplane	EVACUATE
Long range water type fire extinguisher (if available)	ACTIVATE

COCKPIT FIRE	
ALL Switches	OFF
Fire Extinguisher (if available)	ACTIVATE
Door vents	OPEN
Land (emergency)	IMMEDIATELY

SPIN	
Power lever	CUT OFF
Roll input	Neutral
Rudder	Full deflection, direction opposite to the spin
As rotation is about to stop, or fully stopped:	
Rudder	Neutralize
Control stick	Release force towards neutral elevator position, roll input neutral
Horizontal flight	Resume, do not exceed airspeed/g limits

PB345V119E-L battery type

PB345V119E-L *battery type*

EMERGENCY LANDING	
Best Glide Speed	70 KIAS (flaps 0)
PWR CTRL circuit breaker	DISENGAGE
BATT FRONT & BATT REAR circuit breakers	DISENGAGE
Seat Belts	SECURED
Flaps (when landing is assured)	+2
If time permits:	
Radio	Transmit (121.5 MHz) MAYDAY
Transponder	SQUAWK 7700
ELT Switch	ON (if necessary)

DITCHING	
Best Glide Speed	70 KIAS (flaps 0)
Power lever	CUT OFF
BATT FRONT & BATT REAR circuit breakers	DISENGAGE
Life vests	CHECK
Loose items in cabin	Secure
Seat belts	CHECK SECURED AND TIGHTEN
Radio	Transmit (121.5 MHz) MAYDAY
Transponder	SQUAWK 7700

Continue ➔

DITCHING (continue)	
ELT switch	ON
Approach direction	High seas, high wind: into the wind. Light wind, heavy swells: parallel to the swells
Doors	OPEN
AUX BATT circuit breaker	DISENGAGE
Flaps	+2
Landing at the lowest possible speed	PERFORM
Seat belts	Release immediately
Airplane	EVACUATE
Life vest and raft	Inflate when outside the cabin
Flotation Devices	INFLATE WHEN CLEAR OF AIRPLANE
LANDING WITH DEFECTIVE BRAKES	
Seat belts	CHECK FASTENED AND TIGHTENED
Master Switch	OFF
PWR CTRL circuit breaker	DISENGAGE
Steer gently	-
Once the aircraft has stopped:	
Engine	Re-start
Vacate runway at low speed/low power setting	PERFORM

PB345V119E-L battery type

EPSI570C DISPLAY FAILURE

Display failure (black screen, hardware malfunction):

Reduce power	AS MUCH AS POSSIBLE
EPSI Circuit Breaker	DISENGAGE
Annunciator/ Batt Overtemp warning lights	MONITOR
Land	AS SOON AS PRACTICAL

EPSI570C communication failure:

Reduce power	AS MUCH AS POSSIBLE
Annunciator/ Batt Overtemp warning lights	MONITOR
Land	AS SOON AS PRACTICAL

RADIO COMMUNICATION FAILURE

Switches, Controls	CHECK
Frequency	CHANGE
COM Circuit Breaker	CHECK
Headset	CHANGE
Transmission	ATTEMPT

If unsuccessful:

Transponder	SQUAWK 7600

PITOT STATIC MALFUNCTION

Refer to GPS for flying:

Ground speed indicator	+10 KTS for procedures, observe winds

PB345V119E-L *battery type*

ELECTRIC TRIM FAILURE	
Airplane Control	GRASP STICK, MAINTAIN MANUALLY
TRIM Circuit Breaker	DISENGAGE
Power Lever	AS REQUIRED
Control Stick	Manually hold pressure
Land	AS SOON AS PRACTICAL

PB345V119E-L battery type

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SUPPLEMENT
10-5B

SECTION 10 – SUPPLEMENT 10-5B

PB345V119E-L battery type - PERFORMANCE DATA

When the aircraft is equipped with the PB345V119E-L battery type, this POH Supplement is applicable and entirely replaces the content of *Section 5 - Performance Data* - of the POH. This document must be carried in the airplane at all times. Information in this supplement adds to or replaces information in the basic POH.

POH SECTIONS	STATUS
SECTION 1: GENERAL	NO CHANGE
SECTION 2: LIMITATIONS	NO CHANGE
SECTION 3: EMERGENCY PROCEDURES	NO CHANGE
SECTION 4: NORMAL PROCEDURES	NO CHANGE
SECTION 5: PERFORMANCE DATA	REPLACE
SECTION 6: WEIGHT AND BALANCE	NO CHANGE
SECTION 7: SYSTEM DESCRIPTION	NO CHANGE
SECTION 8: HANDLING, SERVICING AND MAINTENANCE	NO CHANGE

SECTION 10
SUPPLEMENT 10-5B

BATTERY TYPE PB345V119E-L
PERFORMANCE DATA

Signature: _____

Stamp: _____

Date of Approval: _____

SECTION 5 – PERFORMANCE DATA

TABLE OF CONTENTS

5.1 INTRODUCTION

The performance tables and diagrams on the following pages show the performance of the airplane. The data presented in these tables and diagrams has been derived from test–flights using an airplane, motor and batteries in good operating condition, and was corrected to standard atmospheric conditions 15 °C and 1013.25 mb at sea level.

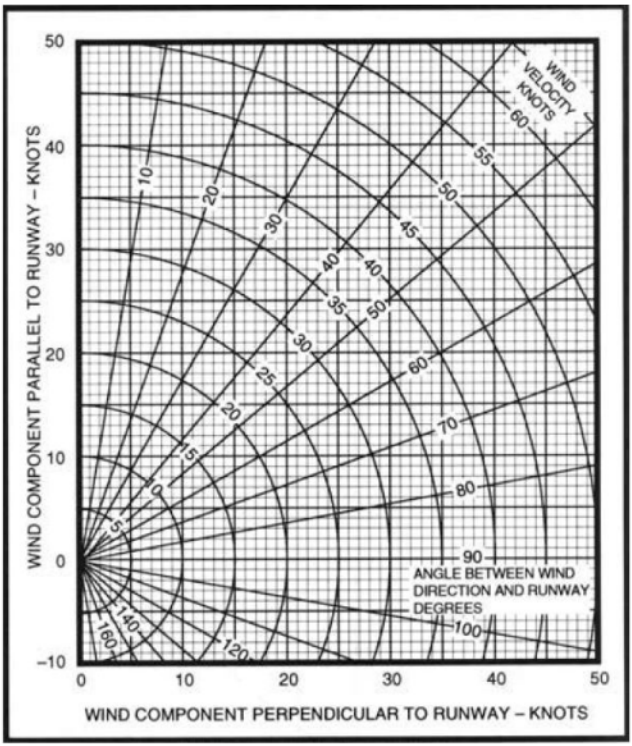
The performance tables do not take into account the expertise of the pilot or the maintenance condition of the airplane. The performance illustrated in the tables can be achieved if the indicated normal procedures are followed and the airplane is maintained properly.

The energy consumption during cruise is based on propeller RPM and power settings. Some undefined variables such as the batteries state of health, contamination of the aircrafts surface, or turbulence could influence flight distance and flight duration. For this reason, it is of utmost importance that all available data is used when calculating the range and endurance.

5.2 OUTSIDE AIR TEMPERATURE FOR ISA-CONDITION

Pressure Altitude [ft]	ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
SL	0	10	15	20	30
1000	-2	8	13	18	28
2000	-4	6	11	16	26
3000	-6	4	9	14	24
4000	-8	2	7	12	22
5000	-10	0	5	10	20
6000	-12	-2	3	8	18
7000	-14	-4	1	6	16
8000	-16	-6	-1	4	14
9000	-18	-8	-3	2	12
10000	-20	-10	-5	0	10
11000	-22	-12	-7	-2	8
12000	-24	-14	-9	-4	6
13000	-26	-16	-11	-6	4
14000	-28	-18	-13	-8	2

5.3 WIND COMPONENT



EXAMPLE:

Runway Heading:	10°
Wind Direction:	60°
Angle between wind and runway:	50°
Wind Velocity:	15 Knots
Component parallel:	~9,6 Knots
Component perpendicular:	~11,5 Knots

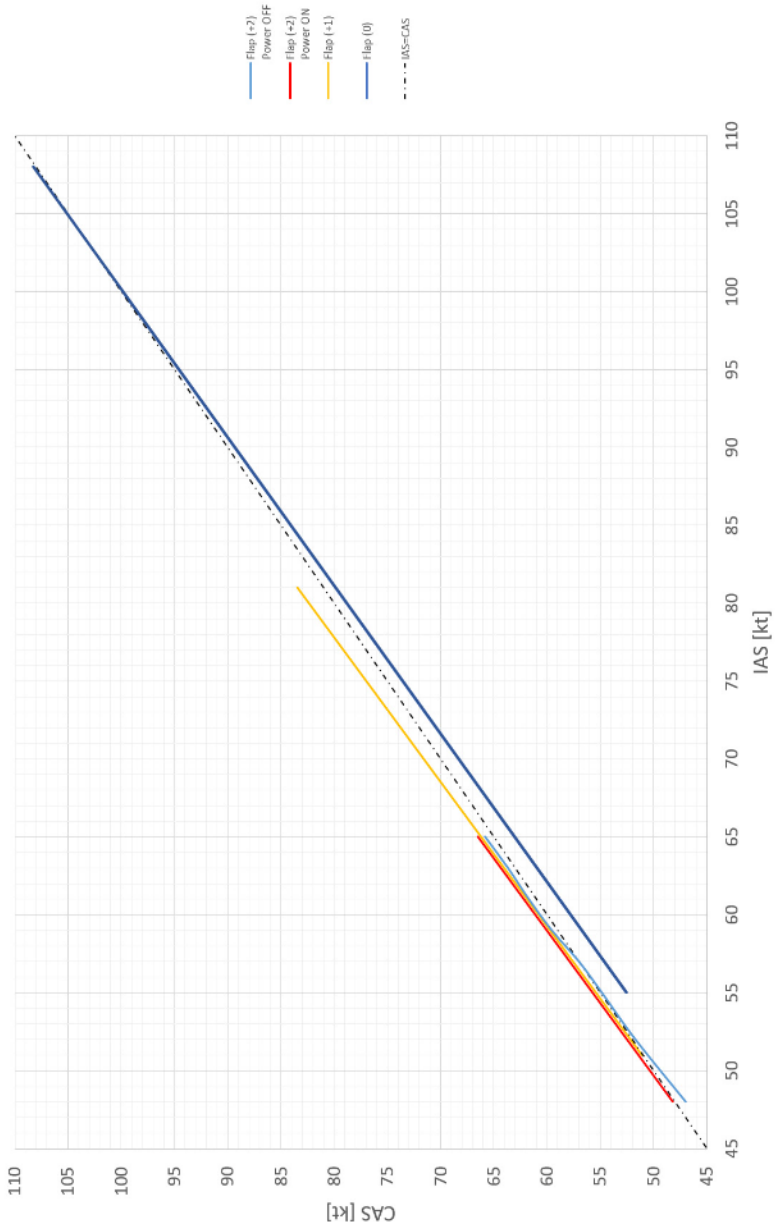
5.4 AIRSPEED CALIBRATION

Conditions
Power: power level for level flight, or idle when indicated.

NOTE: Indicated airspeed values assume zero instrument error.

KIAS	KCAS			
	Flaps (0) level flight	Flaps (+1) level flight	Flaps (+2) level flight	Flaps (+2) idle
50	---	50	50	49
55	53	55	56	55
60	58	61	61	60
65	63	66	66	66
70	68	72	---	---
75	74	77	---	---
80	79	82	---	---
85	84	---	---	---
90	89	---	---	---
95	95	---	---	---
100	100	---	---	---
105	105	---	---	---
108	108	---	---	---

KIAS/KCAS Diagram



5.5 STALL SPEED

Conditions
Power: MTOM

NOTE: The recovery altitude necessary is very dependent on the tempo of recovery.

Typical loss of altitude for recovery:	
Slow recovery without power:	150-250 ft
Normal recovery with power:	100 ft
Aggressive recovery	less than 100 ft

Depending on pilot skill, the altitude loss during wing level stall may be 250 feet or more.

NOTE: KIAS values may not be accurate at stall.

WEIGHT - POWER	BANK ANGLE	STALL SPEED					
		Flaps (+0)		Flaps (+1)		Flaps (+2)	
kg	Degrees	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
600 POWER ON	0°	**50**	*48*	**44**	*43*	**43**	*42*
600 RECUP.* ON	0°	**54**	*52*	**49**	*49*	**47**	*46*

NOTE: The aircraft is equipped with an aural and haptic stall warning system installed in the control stick handles.
*RECUP. = Recuperation

5.6 TAKE OFF DISTANCE

Conditions

Power: MPTOP (50kW)

Flaps: (+1)

Wind: Calm

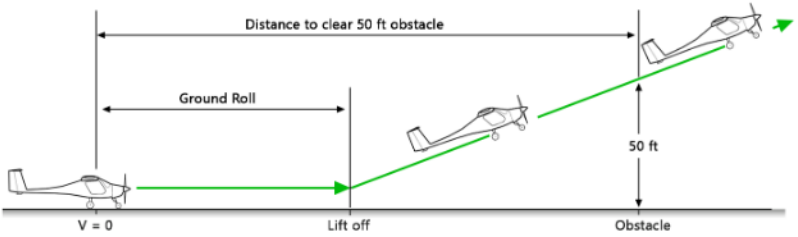
Mass: 600 kg

Runway condition: dry

Speed at lift off: 50 KIAS

Speed over the obstacle: 57 KIAS (V_x)

Take off performance data included in this POH are extrapolated from flight test results. These extrapolated values serve as an estimation of actual take off roll and total distance to clear a 50 ft obstacle (ground roll plus climb distance to clear obstacle).



Correction Factors

Headwind: Subtract 10% for each 12 knots headwind.
Tailwind: Add 10% for each 2 knots tailwind up to 10 knots.
Wet Grass: Add 18% to ground roll on dry grass.

Runway Slope

Increase table distances by 22% of the ground roll distance at sea level for each 1% of upslope.
Decrease table distances by 7% of the ground roll distance at sea level, for each 1% of downslope.

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
SL	Ground roll	Asphalt	208	230	240	250	268
	50 ft obst.		391	430	448	466	499
	Ground roll	Grass	236	260	272	283	304
	50 ft obst.		476	507	517	526	555

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
4000	Ground roll	Asphalt	276	295	304	313	330
	50 ft obst.		512	547	564	580	610
	Ground roll	Grass	312	335	345	355	375
	50 ft obst.		591	631	650	669	704

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
8000	Ground roll	Asphalt	337	355	363	371	387
	50 ft obst.		622	654	669	684	712
	Ground roll	Grass	382	402	412	421	438
	50 ft obst.		731	768	785	802	833

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
12000	Ground roll	Asphalt	393	409	417	424	438
	50 ft obst.		772	751	765	778	804
	Ground roll	Grass	445	464	472	481	497
	50 ft obst.		833	867	883	898	927

CAUTION: MTOP must be limited to 90 seconds (see Limitations - Section 2).

5.7 CLIMB PERFORMANCE

Conditions Power setting: MCP 48 kW or max continuous RPM 2300, whatever is reached first

Flaps: (0)

CAUTION: when battery temperatures are above 40 °C, prolonged high-power application (circuit patterns or prolonged climbs at MCP) may lead to battery high temperature.

CAUTION: in case of prolonged MCP applications (i.e. unusual continuous climb from take off to ceiling altitude), battery temperature may reach the caution range, depending on OAT. Avoiding continuous climbs at MCP setting when flying at high OAT is advisable. Alternating climb legs with short cruise phases at lower power settings is recommended.

5.7.1 RATE OF CLIMB (V_Y = 75 KIAS)

MASS/ AIR SPEED	Pressure Altitude (PA)	RATE OF CLIMB [ft/min]				
	ft	ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
600 kg/ V_Y 75 KIAS	0	683	658	647	636	615
	4000	602	580	570	560	541
	8000	439	423	415	408	393
	12000	276	265	260	255	246

NOTE: Electric motor power output is constant with altitude, but power is gradually reduced with altitude by the pilot to respect max RPM limit (2300).

5.7.2 CLIMB GRADIENT (V_X = 57 KIAS)

MASS/ AIR SPEED	Pressure Altitude (PA)	CLIMB ANGLE / GRADIENT
	ft	
600 kg/ V_X 57 KIAS	0	6.1 / 10.7
	4000	4.5 / 7.9
	8000	3.1 / 5.4
	12000	2 / 3.4

CAUTION: Expect the climb performance to degrade with increased outside air temperature.

5.8 CRUISE PERFORMANCE

Conditions Mass: 600 kg
Flaps: (0)
Altitude: Sea Level - ISA

The table presents cruise speeds at different power settings between minimum power for level flight (20 kW) and maximum continuous RPM power (36 kW).

POWER SETTING (EPSI)	RPM	KIAS	*KCAS*
[kW]	[1/min]	[kts]	*[kts]*
20	1780	71	*69*
25	1950	79	*78*
30	2120	87	*86*
35	2270	92	*92*
36	2300	93	*93*

NOTE: 36 kW power setting corresponds to 2300 RPM, max continuous RPM. The airspeed at this power setting is considered maximum cruise speed (93 KIAS).

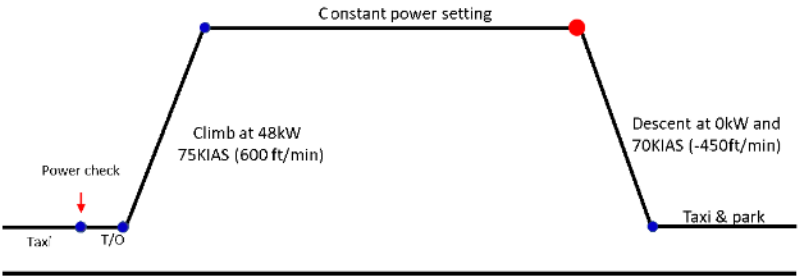
V_H= 93 KIAS (=93 KCAS) @2300 RPM

NOTE: Expect a 2% CAS decrease every 1000 ft of altitude increase, at the same RPM setting.

5.9 ENDURANCE AND RANGE

CAUTION: The available battery energy is a function of SOC and SOH. Both parameters must be considered for a correct endurance estimation. Reduction of SOH (usually due to aging/use) reduces the batteries' energy storage capability and, therefore, also endurance.

NOTE: For better battery lifetime management, avoid flying with battery temperature above 45°C.



Endurance and range
typical flight profile

The following tables present expected endurance for local flights (A-A flight) and endurance/range for cross country flights (A-B flight). VFR reserve is different for the two situations, 10 min or 30 min, in accordance with Ops.125.

5.9.1 LOCAL FLIGHT (A-A FLIGHT)

A local flight is defined as a flight starting from and landing at the same airfield (A to A flight). Typical flight profile is illustrated in Section 5.9.

NOTE: in the following table initial SOC is 100%. The energy used to climb to cruise altitude and for descent is already included in the calculation.

A-A FLIGHT ENDURANCE in minutes (+ *10* min reserve @20 kW)							
Cruise altitude [ft]	Cruise power [kW]	Battery State of Health - SOH [%]					
		100	80	60	40	20	0
1500	20	50 min	45 min	40 min	35 min	29 min	24 min
	25	41 min	37 min	33 min	29 min	25 min	21 min
	30	35 min	32 min	28 min	25 min	22 min	18 min
	35	31 min	28 min	25 min	22 min	19 min	17 min
2000	20	50 min	45 min	40 min	35 min	29 min	24 min
	25	41 min	37 min	33 min	29 min	25 min	21 min
	30	36 min	32 min	29 min	26 min	22 min	19 min
	35	32 min	29 min	26 min	23 min	20 min	17 min
4000	20	50 min	44 min	39 min	34 min	29 min	23 min
	25	43 min	38 min	34 min	30 min	26 min	22 min
	30	38 min	35 min	31 min	28 min	24 min	21 min
	35	35 min	32 min	29 min	26 min	23 min	20 min
6000	20	49 min	44 min	38 min	33 min	28 min	-
	25	44 min	40 min	36 min	31 min	27 min	-
	30	41 min	37 min	34 min	30 min	27 min	-
	35	38 min	35 min	32 min	29 min	26 min	-

CAUTION: the endurance values in the table above do not include the additional 10 min reserve at 20 kW. After using reserve, SOC = 0%.

5.9.2 CRUISE FLIGHT (A-B FLIGHT)

A cruise/cross-country flight is defined as a flight starting from airfield A and landing at a different airfield (A to B flight). Typical flight profile is illustrated in Section 5.9.

NOTE: in the following tables initial SOC is 100% The energy used to climb to cruise altitude and for descent is already included in the calculation.

A-B FLIGHT ENDURANCE in minutes (+ 30 min reserve @20 kW)							
Cruise altitude [ft]	Cruise power [kW]	Battery State of Health - SOH [%]					
		100	80	60	40	20	0
1500	20	30 min	25 min	20 min	15 min	9 min	-
	25	25 min	21 min	17 min	13 min	9 min	-
	30	22 min	19 min	15 min	12 min	9 min	-
	35	20 min	17 min	14 min	11 min	8 min	-
2000	20	30 min	25 min	20 min	14 min	9 min	-
	25	26 min	21 min	17 min	13 min	9 min	-
	30	23 min	19 min	16 min	13 min	9 min	-
	35	21 min	18 min	15 min	12 min	9 min	-
4000	20	29 min	24 min	19 min	-	-	-
	25	27 min	23 min	19 min	-	-	-
	30	25 min	22 min	18 min	-	-	-
	35	24 min	21 min	18 min	-	-	-
6000	20	29 min	-	-	-	-	-
	25	28 min	-	-	-	-	-
	30	27 min	-	-	-	-	-
	35	27 min	-	-	-	-	-

CAUTION: the endurance values in the table above do not include the additional 30 min reserve at 20 kW. After using reserve, SOC = 0%.

A-B FLIGHT RANGE in Nm (+ 30 min reserve @20 kW) WIND = 0							
Cruise altitude [ft]	Cruise power [kW]	SOH [%]					
		100	80	60	40	20	0
1500	20	32 Nm	27 Nm	22 Nm	16 Nm	11 Nm	-
	25	30 Nm	25 Nm	20 Nm	15 Nm	10 Nm	-
	30	28 Nm	23 Nm	19 Nm	14 Nm	10 Nm	-
	35	26 Nm	22 Nm	18 Nm	14 Nm	10 Nm	-
2000	20	32 Nm	27 Nm	21 Nm	16 Nm	11 Nm	-
	25	30 Nm	25 Nm	20 Nm	15 Nm	10 Nm	-
	30	28 Nm	23 Nm	19 Nm	15 Nm	10 Nm	-
	35	26 Nm	22 Nm	18 Nm	14 Nm	10 Nm	-
4000	20	32 Nm	26 Nm	21 Nm	-	-	-
	25	30 Nm	25 Nm	20 Nm	-	-	-
	30	29 Nm	25 Nm	20 Nm	-	-	-
	35	28 Nm	24 Nm	20 Nm	-	-	-
6000	20	31 Nm	-	-	-	-	-
	25	31 Nm	-	-	-	-	-
	30	30 Nm	-	-	-	-	-
	35	30 Nm	-	-	-	-	-

CAUTION: the range values in the table above do not include the additional 30 min reserve at 20 kW. After using reserve, SOC = 0%.

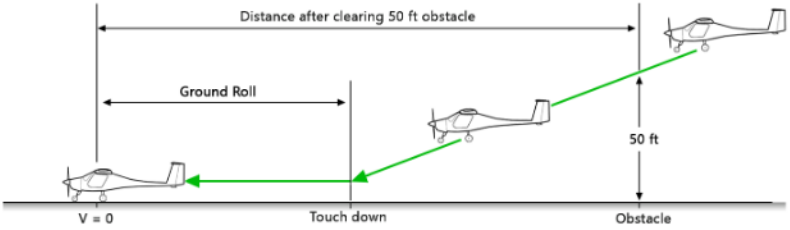
CAUTION: the table above is valid when wind is 0.

Example: A-B flight, battery SOH = 80%, expected range and endurance for a 4000 ft cruise flight @30 kW power setting are: 25 Nm range and 22 min endurance, with 30 minutes of reserve (in accordance with Ops.125).

5.10 LANDING DISTANCE

Conditions		
	Wind:	zero
	Runway:	dry and leveled
	Flaps:	(+2)
	Power:	CUT OFF
	Airspeed:	60 KIAS at 50 ft height
	Mass:	600 kg
	Brakes:	applied 1s after touch down

The landing performance data included in this POH are extrapolated from flight test results. These extrapolated values serve as an estimation of actual landing roll and total landing distance after clearing 50 ft obstacle (ground roll included). The aircraft's recuperation feature reduces the landing distance, however the more conservative calculations published in this chapter should be used.



Correction Factors

Headwind:	Subtract 10% from table distances for each 13 knots of headwind.
Tailwind:	Add 10% to table distances for each 2 knots of tailwind up to 10 knots.

Wet grass runway: Add 30% to ground roll distance for dry grass runway.

Sloped Runway

Increase table distances by 27% of the ground roll distance for each 1% of downslope.
Decrease table distances by 9% of the ground roll distance for each 1% of upslope.

CAUTION: The corrections should be used with caution since published runway slope data is usually the net slope from one end of the runway to

the other. Many runways will have portions of their length at greater or lesser slopes than the published slope, affecting the estimation of landing ground roll.

For operation in outside air temperatures colder than what's displayed in the following tables, use coldest data shown.

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
SL	Ground roll	Asphalt	170	180	183	186	196
	50 ft obst.		516	526	537	553	569
	Ground roll	Grass	180	190	193	196	207
	50 ft obst.		552	564	575	592	610

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
4000	Ground roll	Asphalt	182	199	206	213	232
	50 ft obst.		557	568	580	597	615
	Ground roll	Grass	192	210	217	225	245
	50 ft obst.		596	609	621	640	658

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
8000	Ground roll	Asphalt	205	225	233	241	263
	50 ft obst.		598	610	623	642	660
	Ground roll	Grass	216	237	246	254	277
	50 ft obst.		640	654	667	687	707

PRESSURE Altitude [ft]	DISTANCE [m]	Runway Surface	TEMPERATURE				
			ISA -15°C	ISA -5°C	ISA	ISA +5°C	ISA +15°C
12000	Ground roll	Asphalt	232	255	264	274	299
	50 ft obst.		639	653	666	686	706
	Ground roll	Grass	245	268	278	289	315
	50 ft obst.		684	699	713	734	756

5.11 ENERGY CONSUMPTION

The following tables can be used for the estimation of energy consumption (%SOC) in different flight phases and typical mission scenarios. SOH of the battery must be taken into account because it affects the amount of energy (%SOC) used in each flight phase.

NOTE: Flight phases are to be executed according to the procedures and parameters described in Section 4 - Normal procedures.

NOTE: For better battery lifetime management, avoid flying with battery temperature above 45°C.

A typical flight can be made of several circuit patterns or can be a training sortie composed by different flight phases and cruise.

Circuit patterns with one charge

The following table provides information about maximum number of circuit patterns that can be performed starting with 100% SOC.

LOCAL FLIGHT with 100% SOC at take off						
NUMBER OF TRAFFIC PATTERNS:	Battery State of Health (%SOH)					
	100	80	60	40	20	0
From 100% to 30% SOC:	7	6	5	4	3	3
From 100% to 0% SOC:	10	9	8	7	6	5
Go-around available to terminate the flight after reaching 30% SOC:	3	3	3	3	3	2

CAUTION: with SOC 0% the aircraft has no reserve.

NOTE: reference circuit pattern is a 6 Nm circuit at 1000 ft AGL.

Training sortie

The following table provides information about percentage of SOC needed for each flight phase.

FLIGHT PHASE		Battery State of Health (%SOH)					
		100	80	60	40	20	0
Take off and initial climb to 300 ft AGL (40 sec)	%SOC	4	5	5	6	8	10
1000 ft climb at V_Y - 48 kW (100 sec @MTOM)	%SOC	8	8	10	12	14	16
10 min cruise - 20 kW (69 KCAS)	%SOC	18	19	22	26	31	37
10 min cruise - 25 kW (78 KCAS)	%SOC	22	24	28	33	38	48
10 min cruise - 30 kW (86 KCAS)	%SOC	26	29	34	39	47	57
10 min cruise - 35 kW (92 KCAS)	%SOC	31	35	38	45	55	66
Touch and go and initial climb to 300 ft AGL (30 sec)	%SOC	3	3	4	5	6	7
Energy for initial take off and first traffic pattern	%SOC	11	12	14	16	19	23
Energy for touch and go and traffic pattern	%SOC	10	11	13	15	17	21
Aborted landing and climb to 1000 ft AGL at V_Y - 64 kW (70 sec)	%SOC	8	8	10	11	14	17

CAUTION: the values found in energy consumption tables in this section are valid only for SOC>25%. Mission planning must always consider 30% SOC as minimum value at landing (see Section 2.15 - *Operational restrictions*). In circumstances when SOC≤25% it is recommended use the RFT as reference for the termination of the flight. At SOC≤25%, the SOC evolves differently in order to provide more safety margin and energy consumption estimations found in the table above are not applicable.

5.12 MISSION PLANNING - EXAMPLES

Following examples show typical mission profiles and scenarios. Parameters for calculation are taken from tables in current Section 5 - Performance Data.

A) POINT OF NO RETURN (PNR) - CALCULATION EXAMPLE:

When flying the VELIS Electro outside the circuit pattern, it is important to estimate when the remaining energy is sufficient for a safe return to home base. The PNR (Point of No Return) in flight is when there is just sufficient SOC to return to base (and arrive there with 30%). This PNR is calculated for flights from point A to point A (A-A Flight). Most VELIS Electro flights are A-A.

NO WIND CONDITION - CALCULATION EXAMPLE

When flying in no wind conditions along a straight track, calculating PNR is not particularly difficult. There is enough SOC available to take off and fly toward the destination knowing, that as long as the flight does not proceed beyond the halfway point, it should be possible to make it back to home airfield safely.

If the take off is with 100% SOC, landing must be planned at minimum 30% SOC. Therefore total usable SOC is 70%. If (example) 10% of the SOC is used for the climb to cruise altitude, the remaining 60% is available for the cruise. Half of SOC available for cruising is 30%. So the turning back to the initial cruise point occurs after using 10% SOC for climbing and 30% of SOC available for cruise: PNR results at 60% of SOC (100%-10%-30% = 60%). The example assumes that cruise initial/final points are in proximity of the airport. "PNR REFERENCE TABLES" provided in this section can be used for easy calculation of PNR.

WINDY CONDITION - CALCULATION EXAMPLE

Cruise speed 85 kts (example), and outbound tailwind of 15 kts (from GPS ground speed reading). The difference between the IAS and TAS at VELIS Electro altitudes are negligible and is possible to consider IAS = TAS.

Therefore:
GS outbound: 85 kts + 15 kts (tailwind) = 100 kts

GS inbound: 85 kts - 15 kts (headwind) = 70 kts

The %SOC to PNR is calculated with the PNR equation:

PNR SOC = usable SOC x GS homebound / (GS homebound + GS outbound).

In this example: 70% x 70 kts / (100 kt + 70 kts) = 28%, that is the SOC used to reach PNR. So, in this example, PNR is 100% - 28% = 72%, where 100% is the initial SOC.

This is very important. When flying with a tailwind it is necessary to turn back to the point of origin much sooner.

PNR REFERENCE TABLES

The following tables provide quick reference for PNR calculation, depending on cruise power/speed and wind. PNR SOC is the SOC value at which the return to the initial cruise point is possible, with 30% SOC remaining.

20 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
69 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	69	67	64	62	60	58	56	53	51
	80	62	60	59	57	55	53	51	50	48
	70	56	54	53	51	50	49	47	46	44
	60	49	48	47	46	45	44	43	42	41

25 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
78 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	68	66	64	62	60	58	56	54	52
	80	61	60	58	57	55	53	52	50	49
	70	55	54	53	51	50	49	47	46	45
	60	49	48	47	46	45	44	43	42	41

30 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
86 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	*67*	*65*	*63*	*62*	*60*	*58*	*57*	*55*	*53*
	80	*61*	*59*	*58*	*56*	*55*	*54*	*52*	*51*	*49*
	70	*55*	*53*	*52*	*51*	*50*	*49*	*48*	*47*	*45*
	60	*48*	*48*	*47*	*46*	*45*	*44*	*43*	*42*	*42*

35 kW		Tailwind outbound, headwind inbound (kts)				No wind	Headwind outbound, tailwind inbound (kts)			
92 KCAS		-20	-15	-10	-5	0	5	10	15	20
INITIAL SOC:	90	*67*	*65*	*63*	*62*	*60*	*58*	*57*	*55*	*53*
	80	*60*	*59*	*58*	*56*	*55*	*54*	*52*	*51*	*50*
	70	*54*	*53*	*52*	*51*	*50*	*49*	*48*	*47*	*46*
	60	*48*	*47*	*47*	*46*	*45*	*44*	*43*	*43*	*42*

Example:

Cruise flight @ 25 kW power setting (corresponding to 78 KCAS).

SOC at the beginning of the cruise phase = 80% SOC.

Wind: 10 kts headwind outbound (same amount inbound)

The SOC at which the return has to be initiated to be back at the initial point with 30% remaining SOC is PNR SOC = 52%.

B) A-B FLIGHT - MISSION PLANNING - CALCULATION EXAMPLE:

NOTE: all the values will be used purely as example

To compute the SOC needed for the mission, it is necessary to know:

- Battery SOH and SOC (system page of EPSI570C)
- The flight profile of the mission (phases)

The total SOC is computed by adding the SOC consumed in each phase.

1) Determination of initial battery conditions (check EPSI570C)

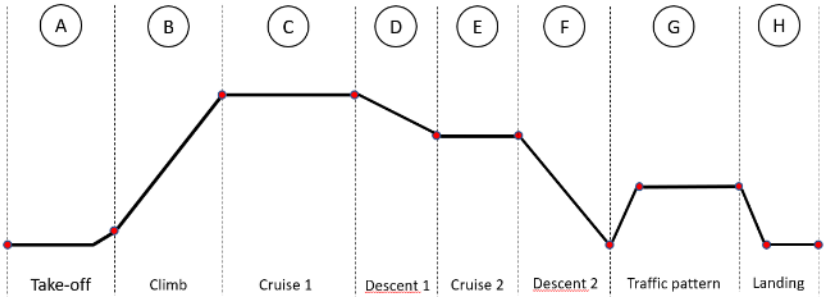
The following are the values that will be used in the example:

- SOH = 80%.
- SOC = 95%.

Battery SOH = 80% determines the use of SECOND COLUMN ("80") from the tables presented in Section 5.11 - Energy Consumption.

2) Determination of mission profile and flight phases

Define the mission profile and divide it into phases. Example:



The mission profile is divided in the following phases:

A) Take off

B) Climb (V_Y) at 48 kW - to 2000 ft AGL

C) Cruise 1 at 25 kW - for 5 min

D) Descent 1 - to 1000 ft AGL

E) Cruise 2 at 20 kW - for 5 min

F) Descent 2 - to airfield level

G) Generic traffic pattern - 1000 ft

H) Landing - to full stop

3) Calculation of energy (%SOC) used for each phase, using previous tables: all values are obtained from column SOH = 80%

A) Take off = 5 %SOC

B) Climb (V_Y) at 48 kW - to 2000 ft AGL = 2 x 8 %SOC = 16 %SOC

C) Cruise 1 at 25 kW - for 5 min = 0.5 x 24 %SOC = 12 %SOC

D) Descent 1 - to 1000 ft AGL = 0 %SOC

E) Cruise 2 at 20 kW - for 5 min = 0.5 x 19% SOC = 10 %SOC

F) Descent 2 - to airfield level = 0 %SOC

G) Generic traffic pattern - 1000 ft = 11 %SOC

H) Landing - to full stop = 0 %SOC

4) Total %SOC necessary for the mission is the sum of %SOC used for each phase of the flight (use of a similar table is recommended):

Flight phase	Target/conditions	SOC required (SOH 80%)
A) Take off	-	*5*
B) Climb (V_Y) - at 48 kW	to 2000 ft	*16*
C) Cruise 1 - at 25 kW	5 min	*12*
D) Descent 1 - 0 kW	to 1000 ft	*0*
E) Cruise 2 - at 20 kW	5 min	*10*
F) Descent 2 - 0 kW	to airfield level	*0*
G) Generic traffic pattern	1000 ft	*11*
H) Landing	to full stop	*0*
	TOTAL SOC used:	**54**

5) Calculation of %SOC at landing:

%SOC at landing = Initial %SOC - mission %SOC = 95 - 54 = 41 %SOC

This value is > 30%SOC

Initial %SOC is sufficient for the mission, and remaining %SOC at landing (41%) is above the minimum prescribed in "limitations" (min SOC at landing 30%).

The mission can be safely flown.

CAUTION: the values found in SOC consumption tables in Section 5.11 - *Energy consumption* - are valid only for SOC>25%. Mission planning must always consider 30% SOC as minimum value at landing (see Section 2.15 - *Operational restrictions*). In circumstances when SOC≤25%, it is recommended to use the RFT as reference for the termination of the flight.

NOTE: Recuperation should be considered strictly as air-braking device and not taken into account when planning cross country flights. The recuperated amount of energy when descending or braking using engine recuperation is insignificant compared to power consumption during climb or horizontal flight.

5.13 NOISE CHARACTERISTICS

Noise level according to ICAO Annex 16, Chapter 10:
Measured: 60.1 dB(A) Max. allow. noise level: 70.8 dB(A)

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