Arion Aircraft

Lightning XS

Pilot's Operating Handbook

N77PW

NOTE: Yellow highlighted text indicates items that need to be verified during Phase 1 testing.

Table of Contents

Aircraft Identifying Information

N-Number: N77PW
Aircraft Type: Arion Lightning XS
Aircraft Serial Number: 187
Engine Manufacturer/Make: Continental Motors
Engine Model: Titan XIO340
Engine Serial Number:

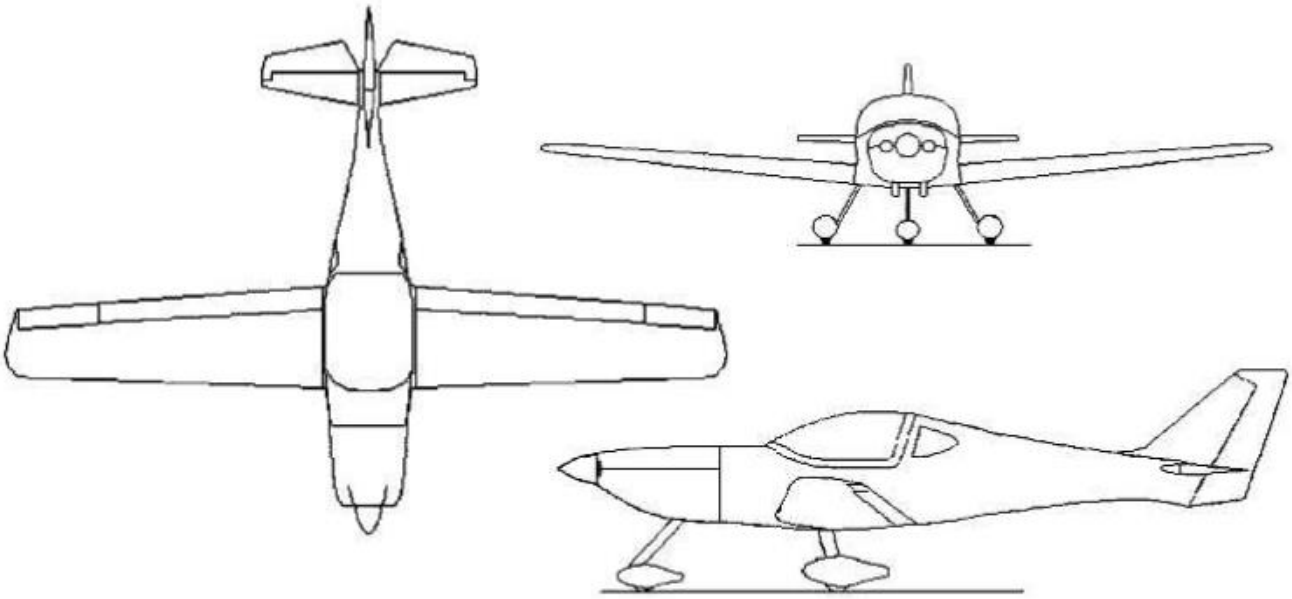

Figure 1. Aircraft Views

Performance and Specifications

Aircraft Specifications

SPAN: ……..	27’ 0”
LENGTH: …….	20’ 4”
HEIGHT: …….	7’ 10”

SPEED:

Maximum at Sea Level ……..	180 ktas
Cruise, 75% Power at 8,000 Ft ……..	160 ktas

RANGE (includes 3 gal. for taxi, takeoff & climb):

75% @ 8000’ , no reserve …….	700 sm
55% @ 8000’ no reserve …….	880 sm
75% @ 8000’, one hour (10 gal) reserve ……..	500 sm
55% @ 8000’, one hour (10 gal) reserve ……..	680 sm

RATE OF CLIMB AT SEA LEVEL …….…. 1,500 FPM

SERVICE CEILING ……..……. 19,500 FT

TAKEOFF PERFORMANCE: ……. ……..…… 800 Ft

LANDING PERFORMANCE: ……..……..…… 1000 Ft

STALL SPEED (CAS):
- Flaps Up, Power Off …… 60knts
- Flaps Down, Power Off …… 50knts

MAXIMUM WEIGHT (Normal Category): ……. 1750 Lbs
EMPTY WEIGHT ……. 1082 Lbs
MAXIMUM USEFUL LOAD: …….. 668Lbs
BAGGAGE ALLOWANCE …… 75 Lbs
WING LOADING (Pounds/ Sq. Ft) …… 18Lbs
POWER LOADING (Pounds/ HP) ……. 10 Lbs
FUEL:
- Capacity …… 40 Gal Total
- Type ……. 100 LL

OIL CAPACITY ……. 8 Qts
ENGINE: Continental X340 …….. IO-340
PROPELLER: Sensenich 2 blade carbon adjustable

V Speeds

The aircraft V-speeds are the airspeeds that the aircraft performs at during various maneuvers and operating conditions. They specify both the speed limitations of the aircraft and the best airspeeds for different types of flight.

	SPEED	IAS	REMARKS
V_{NE}	Never Exceed Speed	180 knts	Do not exceed this speed in any operations.
V_{NO}	Maximum Structural Cruising Speed	120 knts	Exceed this speed only in smooth air.
V_A	Maneuvering Speed	110 knts	Do not make full control movements above this speed. Full elevator deflection will result in a 6g load at this speed.
$V_{FE\ full}$	Maximum Flap Extended Speed, Full Flaps	75 knts	Do not exceed this speed with full flaps down
$V_{FE\ half}$	Maximum Flap Extended Speed, Half Flaps	90 knts	Do not exceed this speed with half flaps down
Vy	Best Rate of Climb	85 knts	
$V_{y\ cruise\ climb}$	Best Rate of Climb for Cruising	100knts	
Vx	Best Angle of Climb	75 knts	
Vs	Stall Speed Clean	60 kias	

Vso	Stall Speed, Power Off	50 knts	
Vs1	Stall Speed, Power On	60 knts	

Airspeed Indicator Markings

The airspeed indicator is color coded to show the airspeeds for different operating conditions. The following table shows the different airspeed ranges and corresponding colors.

MARKING	IAS VALUE OR RANGE	SIGNIFICANCE
White Arc	**51-75 kias**	Full Flap Operating Range. Lower limit is Vso. Upper limit is maximum speed with flaps extended
Green Arc	**60-120 kias**	Normal Operating Range. Lower limit is Vs. Upper limit is maximum structural cruising speed
Yellow Arc	**120-180 kias**	Operations must be conducted with caution and only in smooth air.
Red Line	**180 kias**	Maximum speed for all operations

Performance

The performance of the aircraft can be used to predict the range and fuel efficiency as shown below. These performance values are calculated based on values recorded in the testing phase of the aircraft's development.

Cruise Performance at 8,000':

KIAS	RPM	MAP	Fuel Flow	% Power
160	2550	23"	10 GPH	75%
150	2350	22"	9 GPH	65%
140	2250	21"	8GPH	55%

No Wind Range at 8,000':

* All range calculations include 3 gal. for engine start, taxi, takeoff and climb.
* Engine is leaned for best economy.

One hour (10.5 gal.) reserve:

75% Power …….. 500 sm
65% Power …….. 590 sm
55% Power …….. 680 sm

No Reserve:

75% Power …….. 700 sm
65% Power …….. 790 sm
55% Power …….. 880 sm

Weight and Balance

To fly the aircraft safely the weight and balance limitations need to be adhered to. The total weight of the aircraft and it's load (including passengers, baggage, and fuel weight) must be below the maximum allowable weight for the given flight category. The location of the total CG of the aircraft and carried load must also be within the designated range as measured from the indicated datum.

Maximum Weights:

Normal Category= 1750 Lbs

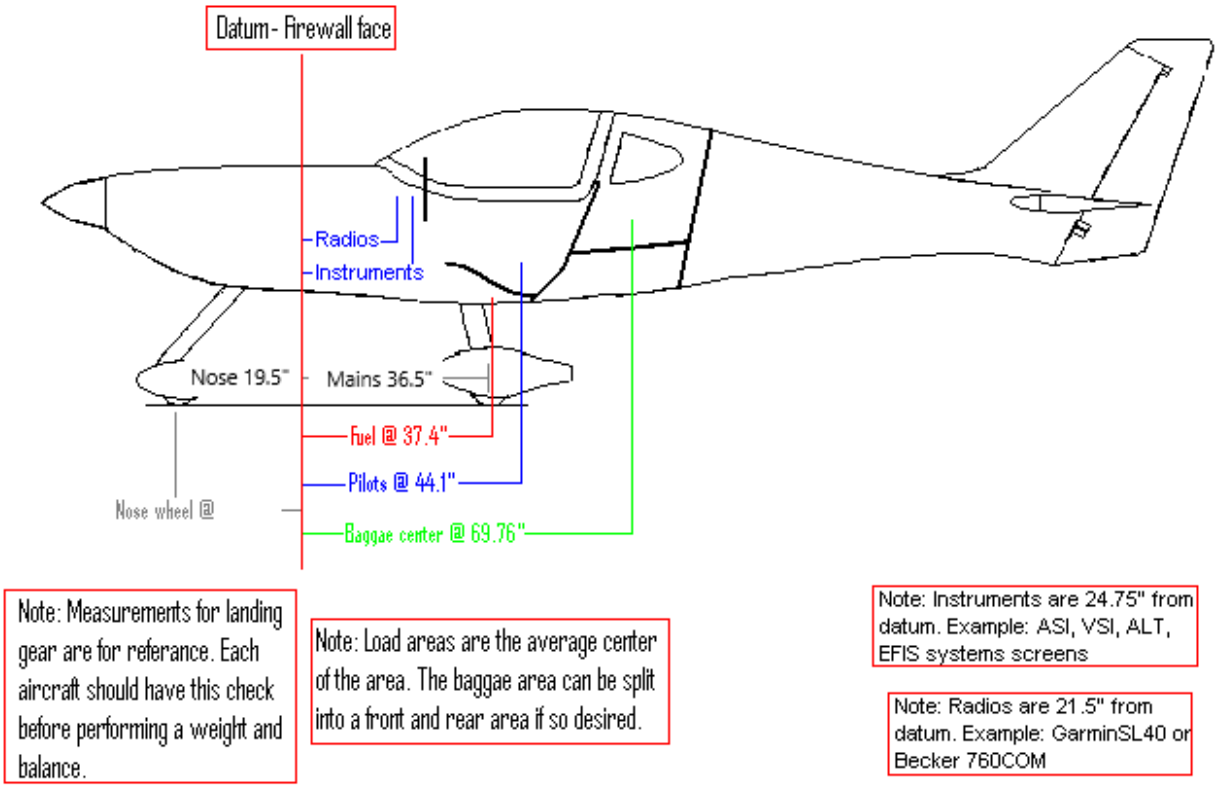

Figure 2. Load Diagram

Sample Weight and Balance Calculation

To calculate the weight and balance for an aircraft you need to know the weights of the aircraft and what it's carrying as well as know the position arm of the center of gravity (CG) of each weight with respect to the aircraft's datum point (in this case the firewall). Then the moment of each weight can be calculated by multiplying the weight by the arm.

Then to calculate the position of the total CG you divide the total moment by the total weight as shown below. To operate the aircraft safely both weight and CG location need to be within the ranges that are designated in the aircraft specifications.

CG = Total Moment / Total Weight

Weight and Balance Data

To calculate the weight and balance, the aircraft should be weighed empty in level flight attitude (includes 8 qts. of oil, no fuel). Then have the weights and locations of the baggage, passengers, and baggage added to that empty value.

For this aircraft, the weight and balance are calculated as follows:

Datum: Firewall
Level Point: Cockpit top rail longitudinally and across the cockpit
Baggage capacity: 75 lbs

Forward CG Limit: 26.5"
Aft CG Limit: 34"

Aircraft Type	Lightning XS
Date:	2/28/2020
N number	**N77PW**
Serial #	187
Datam	Firewall
Level Point	Cockpit top rail longitudinaly, Across the cock pit

Notes: Weighed with all components, unuseable fuel and 7qts oil.

Forward Limit	28
Aft Limit	32

Initial W+B

	Weight	**ARM**	**Moment**
Front	233	-19.5	-4543.5
Left	427	36.5	15585.5
Right	422	36.5	15403
total	1082		26445
CG		24.4408503	

Baggage capacity to 50 lbs

Empty Aircraft: Unuseabl fuel and operation fluids

	Weight		**Moment in/lbs**
Empty Weight	1082		26445
Center of Gravity		24.4408503	

Forward CG min weight

	Weight		**Moment in/lbs**
Empty Weight	1082	24.4408503	26445
Pilot	200	44.1	8820
Fuel	72	37.4	2692.8
Baggage	0	69.76	0
Total	1354		37957.8
Center of Gravity		28.0338257	

Flying weight max gross

	Weight	**Arm**	**Moment in/lbs**
Empty Weight	1082	24.4408503	26445
Pilot and pass	420	44.1	18522
Baggage	50	69.76	3488
Fuel	240	37.4	8976
Total	1792		57431
Center of Gravity		32.0485491	

Engine Information

The below is the basic information about the engine installed in the aircraft, including the recommended oil grades. Additional engine information can be found in the Engine & Propeller Handbook.

Model: ……..Continental IOX340, Fuel Injection
HP: ……180
Fuel: ……..91/96 or 100/130 octane minimum 100LL
Oil Filter: …..Champion CH48110

Avg Ambient Air	MIL-L-6082 Grades	Ashless Dispersant Grades
Above 80 F	SAE 60	SAE 60, 20W50
Above 60 F	SAE 60	SAE 60
30-90 F	SAE 40	SAE 40, 50
0-70 F	SAE 30	SAE 30, 40
Below 10 F	SAE 20	SAE 30 or 20W30

Oil Sump Capacity …….. 8 U.S. Quarts
Minimum Safe Quantity ...4 U.S. Quarts

Operating Conditions

The table below shows the optimal cylinder head and oil temperatures as well as oil pressures for operating the aircraft under different conditions. When running the aircraft, any large variation from these values could indicate a serious issue with one of the components.

Cylinder Head Temperature	
For Take-Off	150 °F
Max	475 °F
Normal Cruise	400 °F
Oil Temperature	
For Takeoff	120 °F
Normal	180-210 °F
Max	240 °F
Oil Pressure	
Idle Minimum	25 psi
Normal Low	60 psi
Max	90 psi

Operating Procedures

Preflight Inspection

Cabin

a) POH and AROW -- Available in Airplane
b) Aeronautical Charts – CURRENT AND APPROPRIATE TO FLIGHT
c) Control locks or seat belt securing stick—RELEASE
d) Fire extinguisher—CHECK Ignition Switch -- OFF
e) Electrical Switches—OFF
f) Master Switch – ON
g) Engine gauges and flight instruments – NO RED X's
h) Vertical Power—NO TRIPS OR FAULTS
i) Flight time—RESET
j) Fuel quantity— CHECK
k) Strobe, position, and landing lights—CHECK
l) Flaps – DOWN
m) Master Switch – OFF

Empennage

a) Tail Tie-Down -- DISCONNECT
b) Control Surfaces -- CHECK freedom of movement and security
c) Static Sources (both sides of fuselage) –CHECK open and clear
d) Nav/Strobe--CHECK condition
e) Elevator Trim Linkage—SECURE

Right Wing

a) Aileron -- CHECK freedom of movement and security
b) Flap -- CHECK security
c) Nav/Strobe--CHECK condition
d) Right Landing Light -- CHECK condition
e) Wing Tie-Down -- DISCONNECT
f) Main Wheel Tire -- CHECK condition and proper inflation
g) Chock -- REMOVE
h) Right Wing Tank – SAMPLE for no contaminants
i) Fuel Quantity -- CHECK VISUALLY
j) Fuel Filler Cap – SECURE

Nose

a) Engine Oil Level -- CHECK, do not operate with less than 4 quarts
b) Propeller and Spinner -- CHECK for nicks and security
c) Cowl Hinge Pins – CHECK for security
d) Engine Air Inlets -- CHECK for no restrictions
e) Nose Wheel Tire -- CHECK for condition and proper inflation
f) Gascolator Drain – SAMPLE for no contaminants (turn on fuel pump briefly to pressurize)
g) Chock -- REMOVE

h) Fuel Tank Vents -- CHECK for no blockage

Left Wing

a) Wing Tie-Down -- DISCONNECT
b) Main Wheel Tire -- CHECK for condition and proper inflation
c) Chock -- REMOVE
d) Left Wing Tank – SAMPLE for no contaminants
e) Fuel Quantity -- CHECK VISUALLY
f) Fuel Filler Cap -- SECURE
g) Pitot/AOA-- REMOVE cover and VERIFY no blockages
h) OAT probe—CHECK condition
i) Left Landing Light -- CHECK condition
j) Nav/Strobe--CHECK Condition
k) Aileron -- CHECK freedom of movement and security
l) Flap -- CHECK security

Before Starting Engine

a) Preflight Inspection – COMPLETE
b) Towbar—REMOVED
c) Passenger Briefing—COMPLETE
d) Shoulder Harnesses -- ADJUST and LOCK
e) Fuel Selector– LEFT or RIGHT
f) Avionics on Backup Battery
g) Electrical Switches – OFF
h) Canopy—ADJUST
i) Brakes – HOLD

Starting Engine

a) Mixture –RICH
b) Throttle—cracked ½”
c) Master Switch/Alternator – ON
d) Vertical Power—CHECK no faults or trips
e) Prime—ON FOR 1-2 SECONDS (None if engine warm)
f) Flaps -- UP
g) Propeller Area -- CLEAR
h) Ignition Switch – START (30 seconds 6 times max)
i) Oil Pressure -- CHECK rising within 30 seconds
j) Throttle—800-1000 RPM
k) Avionics– ON
l) Fuel Pump—OFF
m) Mixture—LEAN for taxi
n) Nav Lights—ON
o) COM radio—SET frequencies
p) ATIS/AWOS—CHECK
q) Altimeter—SET
r) Fuel quantity—RESET as needed

s) Landing Lights—as desired

Taxi

a) Brakes—TEST
b) Mag Compass, Heading Indicator, Turn Indicator—CHECK proper for operation

Before Takeoff

a) Brakes -- HOLD
b) Canopy Latch (3 Points) – SECURE
c) Flight Controls -- FREE and CORRECT
d) Altimeter—SET
e) Flight Instruments – CHECK
f) Fuel Quantity--CHECK
g) Oil Temperature—CHECK in the green
h) Vertical Power—CHECK no faults or trips
i) Fuel Selector– LEFT or RIGHT
j) Mixture -- LEAN for altitude or RICH <3000'
k) Elevator and Aileron Trim – NEUTRAL
l) Wing Flaps—SET for takeoff
    a. Throttle -- 1700 RPM
    b. Magnetos -- CHECK (125 max drop, 50 diff. max)
    c. Engine Instruments -- CHECK
m) Throttle – IDLE CHECK
n) Throttle—800-1000 RPM
o) Friction Lock--ADJUST
p) Radios – SET
q) Transponder--SET
r) Flight Plan—ENTER as desired
s) Strobe Lights—ON
t) Landing Lights—as desired
u) Fuel Pump -- ON
v) Takeoff Briefing—COMPLETE

Takeoff

Normal Takeoff

a) Wing Flaps – UP
b) Throttle -- FULL OPEN
c) Elevator Control – ROTATE at 55 KIAS
d) Climb Speed—90-110 KIAS

Short Field Takeoff

a) Wing Flaps – 10 Deg
b) Brakes – APPLY
c) Throttle – FULL OPEN (check RPM)
d) Brakes – RELEASE
e) Elevator Control – ROTATE at 55 KIAS
f) Climb Speed – 70 KIAS

In Route Climb

a) Airspeed – 90-130 KIAS
b) Throttle – 2700 RPM max
c) Fuel Pump – OFF at 1000 feet AGL
d) Fuel Pressure – CHECK
e) Autopilot—ENGAGE >800 AGL as desired
f) CHT—monitor

Cruise

a) Throttle – 2100-2700 RPM (75% max recommended)
b) Trim – ADJUST
c) Mixture – LEAN to 50 deg F rich of peak
d) Compass and Heading Indicator—CHECK

Descent/Before Landing

a) Shoulder Harnesses—SECURE
b) Fuel Selector—to fullest tank
c) Mixture—ADJUST for altitude
d) Autopilot—OFF
e) Fuel Pump—ON

Landing

Normal Landing

a) Approach speed—75-80 KIAS
b) Wing Flaps—20 deg.
c) Final approach—70 KIAS (full flaps)

Short Field Landing

a) Wing Flaps—FULL DOWN
b) Final Approach—60 KIAS
c) Wing Flaps—UP upon touchdown
d) Brakes—APPLY heavily

After Landing

a) Flaps – UP
b) Fuel Pump – OFF

c) Canopy—ADJUST as desired

Engine Shutdown

a) Throttle – IDLE
b) Flaps—DOWN
c) Electrical Switches-- OFF
d) CHT—VERIFY DECREASE
e) Fuel Pump—VERIFY OFF
f) Mixture – IDLE CUT-OFF
g) Ignition Switch—OFF
h) Ignition Key – REMOVE
i) Fuel Remaining, Hobbs and Tach Time—RECORD as needed
j) Master Switch – OFF
k) Fuel Selector—OFF

Securing Aircraft

a) Wheel Chocks, Wing & Tail Tie-Downs –INSERT and SECURE as needed
b) Pitot/AOA cover--SECURE
c) Master and Electrical Switches – verify OFF
d) Canopy—CLOSED
e) Canopy Cover and Cowl Plugs—SECURE as needed
f) Postflight walkaround—COMPLETE

EMERGENCY PROCEDURES

Airspeeds For Emergency Operation

Engine Failure After Takeoff:
- Wing Flaps Up …… 78 KIAS
- Wing Flaps Down …….. 70 KIAS

Maneuvering Speed (Va) ……. 110 KIAS
Maximum Glide …… 90 KIAS

Engine Failures

Engine Failure During Takeoff Run

a) Throttle –IDLE
b) Brakes – APPLY
c) Wing Flaps – RETRACT
d) Mixture – IDLE CUT-OFF
e) Ignition Switch – OFF
f) Back-up Battery – Leave ON
g) Master Switch – OFF

Engine Failure Immediately After Takeoff

a) Airspeed – 70 kias
b) Mixture – IDLE CUT-OFF
c) Fuel Selector Valve – OFF
d) Ignition Switch – OFF
e) Wing Flaps – AS REQUIRED
f) Back-up Battery – Leave ON
g) Master Switch – OFF

Engine Failure During Flight

a) Airspeed – 90 kias
b) Fuel Pump – ON
c) Fuel Selector – SWITCH TANKS
d) Mixture – RICH
e) Carb Heat—ON
f) Ignition Switch – BOTH, LEFT, RIGHT
g) If Engine Does Not Restart—EXECUTE FORCED LANDING

Forced Landing Without Engine Power

a) Airspeed – 90 kias (flaps up), 80 kias (flaps down)
b) Fuel Pump—OFF
c) Mixture—IDLE CUTOFF
d) Fuel Selector—OFF

e) Ignition Switch—OFF
f) Canopy—OPEN before touchdown
g) ELT--ON
h) Flaps—AS REQUIRED (full down prior to touchdown)
i) Back-up Battery – Leave ON
j) Master switch--OFF

Fires

During Start On Ground

a) Cranking – CONTINUE, to get a start which would suck the flames and accumulated fuel through the carb and into the engine.
b) If engine starts:
c) Power – 1700 RPM for a few minutes
d) Engine – SHUTDOWN and inspect for damage
e) If engine fails to start:
f) Throttle – FULL OPEN
g) Mixture – IDLE CUT-OFF
h) Cranking – CONTINUE
i) Fire Extinguisher – ACTIVATE
j) Engine – SECURE
k) Crew--EVACUATE

Engine Fire In Flight

a) Mixture – IDLE CUT-OFF
b) Fuel Selector Valve – OFF
c) Back-up Battery – Leave ON
d) Master Switch – OFF
e) Cabin Heat and Vents – CLOSE
f) Airspeed—100+ KIAS
g) Forced Landing—EXECUTE

Electrical Fire In Flight

a) Master Switch – OFF
b) Avionics Switch – OFF
c) All Other Switches (except ignition) – OFF
d) Cabin Heat and Vents – CLOSE
e) Fire Extinguisher – ACTIVATE as needed
f) Cabin—VENTILATE if absolutely necessary or when fire is extinguished

Cabin Fire

a) Master Switch – OFF
b) Cabin Heat and Vents – CLOSE
c) Fire Extinguisher – ACTIVATE
d) Cabin—VENTILATE if absolutely necessary or when fire is extinguished

Wing Fire

a) Nav Lights – OFF
b) Strobe Lights—OFF
c) Landing Lights – OFF
d) Pitot Heat – OFF
e) Sideslip—AS NEEDED to keep fire away from cabin

Electrical

Alternator Over-Voltage

a) Alternator switch—OFF
b) Nonessential electrical equipment—OFF
c) Alternator—VERIFY circuit interrupted (Vertical Power)
d) LAND as soon as conditions permit

Note: Standby battery will power EFIS for ~1 hour. COM radio, ADS-B receiver, transponder, and autopilot servos will not function.

Alternator Low Voltage

a) Avionics switch—OFF
b) Master switch (alt & batt)---OFF
c) Master switch—ON
d) Alternator—VERIFY acceptable voltage (Vertical Power)
e) Avionics switch—ON

If low voltage warning occurs again:

a) Alternator switch—OFF
b) Nonessential electrical equipment—OFF
c) LAND as soon as conditions permit

Note: Standby battery will power EFIS for ~1 hour. COM radio, ADS-B receiver, transponder, and autopilot servos will not function.

Aircraft Electrical Power Failure

a) Unnecessary electrical equipment--OFF
b) LAND as soon as conditions permit

Note: Standby battery will power EFIS for ~1 hour. COM radio, ADS-B receiver, transponder, and autopilot servos will not function.

Other Emergencies