RANGER

PILOT OPERATING HANDBOOK

_____

Aircraft Serial Number

_____

Aircraft N Number

19825 141st Pl NE
Woodinville, WA 98072

VASHONAIRCRAFT.COM

Revision: 5

Date: 8/30/2024

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REVISION SUMMARY

SECTION	REVISION	DATE
1	5	8/30/2024
2	5	8/30/2024
3	5	8/30/2024
4	5	8/30/2024
5	5	8/30/2024
6	5	8/30/2024
7	5	8/30/2024
8	5	8/30/2024
9	1	10/29/2018
A1	1	10/29/2018
A2	5	8/30/2024
FRONT COVER	1	10/29/2018
REAR COVER	1	10/29/2018

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INTRODUCTION

The aircraft is compliant with the following standards:

- Design: ASTM F 2245
- Construction: ASTM F 2563
- Continued Airworthiness: ASTM F 2295
- Pilot Operating Handbook: ASTM F 2746

Manufacturer Contact Information:

Vashon Aircraft
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Woodinville, WA 98072
Phone: 425-527-9944
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Data location and contact information for recovery of certification documentation should Vashon Aircraft lose its ability to support this aircraft:

www.vashonaircraft.com

This handbook has been prepared to inform the pilot of the features and systems incorporated in the VASHON RANGER R7. Recommended operating procedures and performance data are provided so that maximum utilization can be obtained with the utmost of safety, economy, and serviceability. A companion manual, the Vashon Aircraft RANGER R7 Flight Training Supplement (FTS), mirrors the content of this manual but presents operating procedures at a greater level of detail than can effectively be presented in this handbook.

It is strongly recommended that the pilot be familiar with the aircraft, the RANGER R7 FTS, and this manual prior to flight.

The words “WARNING”, “CAUTION”, and “NOTE” are used throughout the handbook with the following definitions:

WARNING
AN OPERATING PROCEDURE, PRACTICE, OR CONDITION, ETC. WHICH MAY RESULT IN INJURY OR FATALITY IF NOT CAREFULLY OBSERVED OR FOLLOWED.

CAUTION
AN OPERATING PROCEDURE, PRACTICE, OR CONDITION, ETC. WHICH IF NOT STRICTLY OBSERVED MAY DAMAGE THE AIRCRAFT OR EQUIPMENT.

NOTE
An operating procedure, practice, or condition, etc.

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SECTION 1: GENERAL

GENERAL
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1.1 THREE VIEW – NORMAL GROUND ATTITUDE

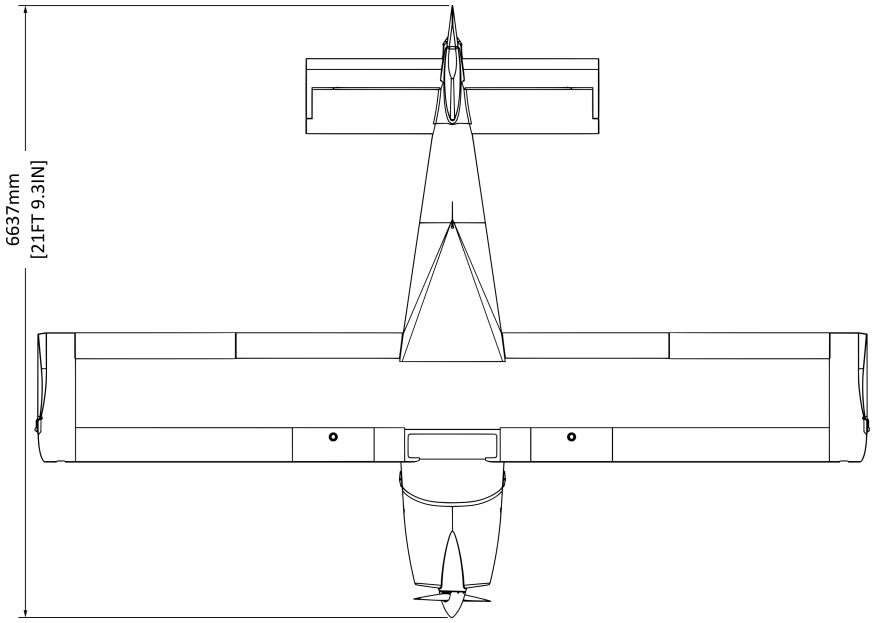

FIGURE 1-1 TOP VIEW

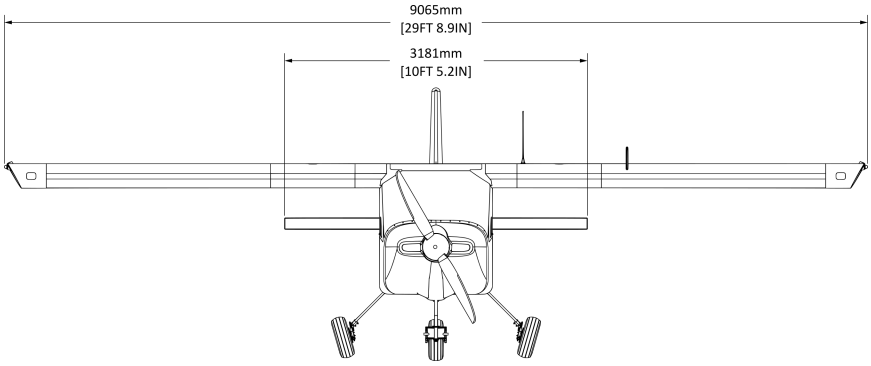

FIGURE 1-2 FRONT VIEW

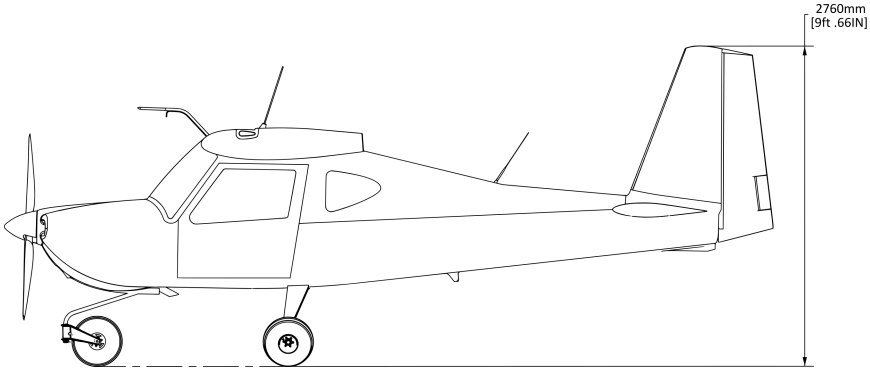

FIGURE 1-3 SIDE VIEW

1.2 DESCRIPTIVE DATA

1.2.1 ENGINE

Number of Engines: 1

Engine Manufacturer: Teledyne Continental Motors

Engine Model Number: O-200-D

Engine Type: Normally aspirated, direct drive, air-cooled, horizontally opposed, carburetor equipped, four-cylinder engine with 201.0 cu. In. displacement.

Horsepower Rating: 100 BHP at 2750 RPM

1.2.2 PROPELLER

Propeller Manufacturer: CATTO

Propeller Model Number: 2B70x48

Number of Blades: 2

Propeller Diameter: 70 in

Propeller Type: Fixed Pitch

1.2.3 AVIONICS

Avionics Manufacture: Dynon Avionics

Model: Skyview HDX

Circuit Protection: AFS Electronic Circuit Breakers

1.2.4 BATTERY

Battery Manufacturer: EarthX Inc.

Battery Type: Lithium Iron Phosphate (LiFePO4)

Number of Cells: 4 (in series)

Battery Model Number: ETX680C

Normal Operating Range: 12.8-14.6 volts

Normal Operating Temp: -22 ° F (-30 °C) – 140° F (60°C)

Battery Dimensions: 5.9 in (L) x 3.4 in (W) x 4.5 in (H)

Battery Weight: 3.9 lbs.

Battery life expectancy: 8 years

1.3 SUMMARY OF PERFORMANCE SPECIFICATIONS

ITEM	SPECIFICATION
Gross Weight	1320 lbs
Top Speed (@ Gross Weight)	117 KIAS
Cruise (@ Gross Weight, 2750 RPM, 7500 FT Density Altitude)	114 KTAS
Range (@ Gross Weight, 2750 RPM, 7500 FT Density Altitude, 30 Min Reserve)	501 NM
Rate of Climb (@ Gross Weight, VY 75 KIAS, Sea Level)	833 FT/MIN
Angle of Climb over 50 Ft Obstacle (@ Gross Weight, Vx 60 KIAS, Sea Level)	1191 FT
Stall – Landing Configuration (@ Gross Weight Vso)	41 KIAS
Stall – Takeoff Configuration (@ Gross Weight Vso)	43 KIAS
Stall – Cruise Configuration (@ Gross Weight, Vs)	45 KIAS
Total Fuel Capacity	28.0 US GAL
Wing Tanks Fuel Capacity	25.5 US GAL
Reserve Tank Fuel Capacity	2.5 US GAL
Approved Fuel Types	100 LL
Maximum Engine Power	100 HP @ 2750

SECTION 2: OPERATING LIMITATIONS

OPERATING LIMITATIONS
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2.1 GENERAL

This section lists all power plant and airframe operating limitations. These limitations are also indicated in the aircraft in the form of placards, instrument color markings, and audio warnings. The aircraft placards, instrument color markings, and audio warnings are to be the authority if an inconsistency exists with this manual.

WARNING
ALL OPERATING LIMITATIONS MUST BE STRICTLY ADHERED TO FOR REASONS OF SAFETY AND SERVICEABILITY.

2.2 FLIGHT OPERATIONS

The VASHON RANGER R7 aircraft is a Certified Special Light Sport Aircraft (S-LSA) and is designed for operation in the Light Sport Category.

Flight in VFR conditions only is approved providing that the aircraft is operating as specified under Part 91 of the Federal Air Regulations (F.A.R.'s).

Provided that the aircraft is appropriately equipped (Cascade model), the aircraft may be flown under IFR. However, in the United States of America, all flights (VFR and IFR) are to be conducted in VMC (Visual Meteorological Conditions), as per the applicable LSA standards and regulations.

WARNING
FLIGHT IN IMC CONDITIONS IS PROHIBITED FOR ALL RANGER MODELS

WARNING
FLIGHT INTO KNOWN ICING CONDITIONS IS PROHIBITED.

2.3 AIRSPEED LIMITATIONS

AIRSPEED DESIGNATION	IAS (kts)
Stall Flaps Down (@ gross weight 1320 lbs) (VSO)	41
Stall (@ gross weight 1320 lbs) (VS)	45
Flap Operating Range (VSO – VFE)	41-90
Normal Operating Range (green arc)	45-103
Maneuvering (VA – blue line)	90
Maximum Structural Cruise (VNO)	103
Caution Range (yellow arc)	103-131

AIRSPEED DESIGNATION	IAS (kts)
Never Exceed (VNE – red line)	131
Maximum Direct Crosswind Component	15 kts
Maximum Wind Limitation	30 kts

NOTE

CAS Calibrated airspeed is indicated airspeed (IAS) corrected for installation and instrument error.

IAS Indicated airspeed is the airspeed read directly from the airspeed indicator on the aircraft, driven by the pitot-static system.

TAS Speed of the aircraft relative to the air mass in which it is flying.

VNE Maximum safe airspeed, not to be exceeded at any time.

VNO Not to be exceeded except in smooth air only and then with caution.

VFE Not to be exceeded with flaps extended.

VA No full or abrupt control movements allowed above this airspeed.

2.4 CEILING

Service Ceiling 12,000 ft

2.5 FLIGHT LOAD FACTORS

Category	Limit Load Factor
Light Sport	+4.0g/-2.0g

2.6 PROHIBITED MANEUVERS

Aerobatics prohibited

Intentional spins prohibited

2.7 POWER PLANT LIMITATIONS

Tachometer		
	Normal Range (green arc)	900 to 2750 RPM
	Caution Range (yellow arc)	675 to 900 RPM
	Maximum (red line)	2750 RPM
Cylinder Head Temperature		
	Minimum for Take-Off	205°F
	Normal in Cruise (green arc)	205° to 385°F
	Caution Range (yellow arc)	385° to 445°F
	Maximum (red line)	445°F
Oil Temperature		
	Minimum for Take-Off	75°F
	Normal in Cruise	170° to 220°F
	Caution Range (yellow arc)	220° to 240°F
	Maximum (red line)	240°F
Oil Pressure		
	Minimum at Idle (red line)	10 PSI
	Normal Operation	30 to 60 PSI
	Maximum – Cold (red line)	100 PSI
Fuel Pressure (NOT APPLICABLE FOR S/N 1023 AND ON)		
	Minimum	0.1 PSI
	Maximum (red line)	6.0 PSI
	(0.3 PSI in the system when SkyView displays 0 PSI)	

2.8 FUEL LIMITATIONS

Fuel		
	Type	100 LL Aviation Fuel
	Capacity	28.0 US Gallons (total)
	Capacity	27.5 US Gallons (useable)
Unusable Fuel		
	Level Flight	0.5 US Gallons

NOTE
When there is less than 2.5 gallons of useable fuel remaining, the EFIS will display a red light and the word "LOW" above HDRTNK

2.9 AIRSPEED/POWER PLANT INDICATOR MARKINGS
Limitations are displayed electronically.

2.10 OPERATING LIMITATIONS
Limitations are displayed electronically.

2.11 PASSENGER WARNING
Displayed on instrument panel:

THIS AIRCRAFT WAS MANUFACTURED IN ACCORDANCE WITH LIGHT SPORT AIRCRAFT AIRWORTHINESS STANDARDS AND DOES NOT CONFORM TO STANDARD CATEGORY AIRWORTHINESS REQUIREMENTS

WARNING
INTENTIONAL SPINS ARE PROHIBITED
FLIGHT INTO IMC (INSTRUMENT METEOROLOGICAL CONDITIONS) IS PROHIBITED.

2.12 MISCELLANEOUS PLACARDS

N number on outside of aircraft, 2 places

Stainless steel data plate on outside of aircraft

Fuel type and capacity (near each fuel cap)

N number on instrument panel

LIGHT-SPORT on the inside of each door

Instrument panel switches are all labeled

OPEN/CLOSE near latch handle on inside of each door

OPEN near latch handle on outside of each door

THROTTLE above throttle knob, **PUSH OPEN** on knob

MIXTURE above mixture knob, **PULL LEAN** on knob

FUEL PUSH ON/PULL OFF above fuel valve knob

CARB HEAT above carb heat knob, **PULL HOT** on knob

CABIN HEAT above cabin heat knob, **PULL ON** on knob

BAGGAGE CAPACITY MAXIMUM 100 LBS on baggage bulkhead

5A MAX adjacent to 12 volt power outlet

ELT adjacent to instrument panel switch

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SECTION 3: EMERGENCY PROCEDURES

EMERGENCY PROCEDURES
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3.1 GENERAL

This section covers the recommended procedures to follow during emergency and adverse flight conditions. As it is not possible to define every type of emergency that may occur, it is the pilot's responsibility to use sound judgment based on personal experience and knowledge of the aircraft to determine the best course of action.

It is mandatory that the pilot be familiar with this entire manual, in particular, the "Emergency Procedures" section prior to flight.

NOTE

All airspeeds in this section are indicated airspeed (IAS) unless stated otherwise.

For the Ranger, the Indicated Air Speed (IAS) has been corrected by The SkyView system to display Calibrated Air Speed (IAS).

3.2 FIRE

3.2.1 ENGINE FIRE DURING START

If the fire is believed to be confined to the intake or exhaust system (result of flooding engine):

- Continue cranking engine with starter
- Throttle – FULL OPEN
- Mixture – IDLE CUT-OFF
- Inspect aircraft thoroughly for damage and cause prior to restart

If fire persists or is not limited to intake or exhaust system:

- Fuel Shut-Off Valve – PULL OUT-OFF
- Electrical switches – ALL OFF
- Ignition switch – OFF
- Exit Aircraft
- IF EQUIPPED – Direct fire extinguisher through the air outlet tunnel at the bottom of the cowl

3.2.2 ENGINE FIRE IN FLIGHT

- Fuel Shut-Off Valve – PULL OUT-OFF
- Ignition switch – OFF
- Effect an expedited descent and land immediately
- Radio – MAYDAY 121.5 MHz (or frequency in use)

WARNING
DO NOT ATTEMPT TO RESTART ENGINE.

- Master switch – OFF
- On Final Approach
  - Airspeed – 60 kts (55 kts minimum)
  - Flaps – DOWN after intended point of landing assured
  - Touchdown with minimum airspeed particularly if landing on rough terrain.

3.2.3 ELECTRICAL FIRE

An electrical fire is usually indicated by an odor of hot or burning insulation.

- Electrical Switches – ALL OFF (Both Master and Alternator OFF) (leave ignition switches ON)
- Doors &/or Air Vent – OPEN if necessary for smoke removal and ventilation
- Use hand fire extinguisher if equipped and available
- Land immediately (or as soon as practical if location for safe landing is not available)

3.3 ENGINE MALFUNCTION

3.3.1 ENGINE FAILURE ON TAKE-OFF

WARNING
IN THE EVENT OF ENGINE FAILURE, THE CONTROL STICK MUST BE IMMEDIATELY AND AGGRESSIVELY MOVED FORWARD TO PREVENT LOSS OF AIRSPEED.

- Airspeed – 60 kts IAS (55 kts IAS minimum)

If airborne and sufficient runway remains:

- Throttle – CLOSED
- Land using maximum braking after touchdown.

If airborne and insufficient runway remains for landing, attempt an engine restart if altitude permits:

- Ignition Switch – BOTH
- Fuel Shut-Off Valve – CHECK ON – PUSH
- Mixture – FULL RICH – PUSH
- Fuel Pump – ON
- Carburetor Heat – ON – PULL

If no restart is possible:

- Select most favorable landing area ahead
- Flaps – FULL DOWN
- Fuel Shut-Off Valve – OFF
- Ignition switch – OFF

WARNING
MAINTAIN FLYING SPEED AT ALL TIMES AND DO NOT ATTEMPT TO TURN BACK TOWARD THE RUNWAY UNLESS SUFFICIENT ALTITUDE HAS BEEN ACHIEVED.

Just before touchdown:

- Master switch – OFF
- Touchdown with minimum airspeed particularly if landing on rough terrain.

3.3.2 ENGINE AIR RESTART

- Maintain Airspeed – 60 kts IAS (55 kts IAS minimum)
- Ignition Switch – BOTH
- Fuel Shut-Off Valve – CHECK ON – DOWN
- Mixture – FULL RICH – PUSH
- Fuel Pump – ON
- Carburetor Heat – ON
- If restart not possible, change throttle and/or mixture settings in attempt to restart
- Follow “Forced Landing Procedure” if unable to restart

NOTE

The engine starter may be engaged in flight should the propeller stop windmilling.

3.3.3 PARTIAL POWER LOSS/ROUGH RUNNING

- Follow the engine air restart procedures
- Land as soon as possible using “Precautionary Landing Approach” procedures

3.3.4 ABNORMAL OIL PRESSURE/TEMPERATURE INDICATIONS

Oil pressure and temperature problems are usually related with one affecting the other. Before any drastic action is taken, cross check other engine instruments and control settings in an attempt to determine the source of the problem.

High oil temperature is generally a result of loss of oil or overheating (note CHT). If the situation remains unchecked, oil pressure usually drops resulting in possible engine damage.

Power should be reduced while maintaining cruise airspeed; land as soon as practical.

Low or zero oil pressure is usually caused by a failed pressure relief valve, oil pump, loss of oil, high oil temperature or a defective gauge. A landing should be made as soon as practical using minimum RPM changes. Plan a “Precautionary Landing Approach” as complete engine failure is possible at any time.

3.4 LANDING EMERGENCIES

3.4.1 PRECAUTIONARY LANDING APPROACH

A precautionary landing approach should be used whenever power is still available, but a complete power failure is considered imminent. Maintain a higher and closer pattern than normal in attempt to remain in gliding distance of the intended touchdown point. Use the normal landing procedures in addition:

- Airspeed – 60 kts recommended (55 kts minimum)
- Throttle – CLOSED when in gliding distance of runway
- Flaps – LOWER AS NEEDED to increase approach descent angle

NOTE

Slipping the aircraft by cross controlling the rudder and ailerons will increase the rate of descent either with or without flaps.

NOTE

If a crosswind exists, place the lower wing into the wind.

WARNING

INDICATED AIRSPEED IN A FULL RUDDER DEFLECTION SLIP IS 3 KT HIGHER THAN IN COORDINATED FLIGHT.

3.4.2 FORCED LANDING (COMPLETE POWER FAILURE)

If the engine cannot be restarted in flight, trim the aircraft to the recommended glide speed. Remain within gliding distance of the intended point of landing. Maintain a higher and closer pattern than normal, making allowance for wind.

Extending flaps or slipping the aircraft can lose additional altitude. Diving the aircraft in an attempt to lose altitude when flying into a headwind will only increase the required landing distance.

- Maintain best glide – 60 kts
- Fuel Shut-Off Valve – OFF – PULL OUT
- Flaps – UP to maximize glide range
- Radio – MAYDAY 121.5 MHz (or frequency in use)
- Attempt to position the aircraft approximately 1000 feet above ground level (AGL) when on downwind and abeam the intended point of landing.
- Ignition switches – BOTH OFF
- On Final Approach:
    - Airspeed – 60 kts IAS (55 kts IAS minimum
    - Flaps – DOWN after intended point of landing assured
- Master switch – OFF
- Touchdown with minimum airspeed particularly if landing on rough terrain.

3.4.3 DITCHING

Should it become necessary to make a forced landing over water, follow the “Forced Landing Procedures” in addition to the following:

- Land into wind if high winds are evident or parallel to swells with calm winds
- Flaps – UP (allows higher nose attitude at touchdown)
- Door – UNLATCH (just before touchdown) and wedge an object in the lower part of the door to keep it open.
- Contact the water with nose high attitude
- After coming to complete stop – EXIT AIRCRAFT

NOTE

Aircraft cannot be depended upon to provide flotation after contacting the water.

3.5 UNUSUAL FLIGHT CONDITIONS

3.5.1 EMERGENCY DESCENT

It may be necessary to get to a lower altitude as rapidly as possible. This could be due to engine fire or any other situation demanding an immediate and rapid descent.

- Reduce throttle to IDLE
- Increase mixture to RICH (if engine is running)
- Increase airspeed to 103 kts IAS (rough air)
- Increase airspeed to 120 kts IAS (smooth air)
- Use 30-45 degree turns (turns will slightly improve descent rate but will add complexity)
- Bellow 90 kts IAS use full flaps DOWN to reduce distance traveled while descending
- Recover at an appropriate altitude

3.5.2 STALLS

The RANGER R7 stall characteristics are conventional. Additionally, the RANGER R7 is equipped with an Angle of Attack (AoA) system that warns of impending stall via visual indication and audio indications beginning approximately 5 knots above stall speed.

Aileron control response in a fully stalled condition is marginal. Large aileron deflections will aggravate a near stalled condition and their use is not recommended to maintain lateral control. The rudder is very effective and should be used for maintaining lateral control in a stalled condition with the ailerons placed in a neutral position.

To recover from a stall, proceed as follows:

- Nose attitude – LOWER with relaxation of back pressure on control stick
- Throttle – FULL OPEN simultaneously with relaxation of back pressure on stick
- Use rudder to maintain lateral control

3.5.3 SPINS

If a spin is inadvertently entered, immediate recovery should be initiated. The recovery procedure is as follows:

- Throttle – CLOSED
- Rudder – FULL DEFLECTION opposite direction of rotation
- Elevator – SLIGHTLY FORWARD OF NEUTRAL
- Ailerons – NEUTRAL POSITION

When rotation stops (1/2 – 1 turn after recovery initiated):

- Rudder – NEUTRALIZE
- Nose Attitude – RAISE smoothly to level flight attitude

WARNING
DURING THE SPIN RECOVERY, THE AIRSPEED WILL BUILD VERY RAPIDLY WITH A NOSE LOW ATTITUDE. DO NOT USE FULL OR ABRUPT ELEVATOR CONTROL MOVEMENTS.

3.5.4 INADVERTANT ICING

Flight into known icing is strictly PROHIBITED. But in the event that flight into icing has been encountered there are some actions that will help resolve the dangers involved in accumulating ice.

- TURN back to where you came from. A 180 degree turn back to conditions unsupportive of ice will stop the accumulation
- CLIMB/DESCEND back to an altitude that did not previously support ice.
- Carb heat ON to reduce the possibility of engine interruption from the air filter icing over.
- Defrost valve ON and cabin heat ON to aid in clearing the windscreen from ice.
- Adjust throttle for highest RPM within the green arc.
- Monitor pressure altitude and airspeed vs GPS speed and altitude. Major divergences could indicate a pitot/static blockage

These maneuvers will help reduce the furtherance of ice buildup, but it may take considerable time before it is clear from the aircraft

3.5.5 RUNAWAY TRIM MOTOR

If the trim motor should begin to run uncommanded in either direction the following actions should be taken:

- Autopilot Switch – OFF
- Elevator – HOLD against out of trim condition
  - Airspeed may be reduced as a way to lessen the amount of stick force required to maintain level flight
- Land as soon as possible

3.5.6 SEVERE TURBULENCE

- To prevent overstressing the aircraft do not exceed 103 kts in rough air.
- To minimize personal discomfort, decrease the IAS below 90 kts.

Maintain a level flight attitude rather than flying by reference to the EFIS as the pitot-static indications may become very erratic.

3.5.7 IN-FLIGHT OVERSTRESS

Should an overstress occur due to exceeding the airspeed and/or load factor limits, aggressive maneuvering should be immediately terminated.

- Fly at a reduced airspeed (65 – 75 kts) IAS to a suitable landing point.
- DO NOT under any circumstances make large control movements or subject the aircraft to additional G loadings above that required for straight and level flight.

After landing, the aircraft should be inspected by a mechanic or repairman prior to the next flight.

3.5.8 LOSS OF PRIMARY INSTRUMENTS

It is extremely rare to get a full shutdown of EFIS screens in flight. As a VFR aircraft you will have to be comfortable flying by sight and sound in the unlikely event this occurs.

In the event that one or more of the primary flight instruments is unreliable, X'ed out or blacked out, display the appropriate primary flight instruments on the MFD (Co-Pilot side if equipped) EFIS.

Before continuing with some troubleshooting, set power at a level that ensures an unintentional stall is not encountered. If both screens have blacked out, then a loss of engine display is also encountered. Make sure power is not set to full as it will likely overspeed the engine.

If the primary flight instruments are inoperative on both EFIS screens, turn off the Autopilot, Avionics and Master. Turn on the PFD EFIS using backup battery by pressing and holding the far-left menu button. If primary flight instruments return, land at an appropriate airport, preferably with aircraft services to aid in resolving the issue.

If problem is not resolved using backup battery, turn on the Master switch and wait for the PFD to power up. Recycling the Master switch may resolve a glitch but will not resolve a physical short or interruption of the circuit so there is a high chance the encountered problem will return. With all screens blacked out it is recommended that you land at the nearest airport within your abilities as a pilot. Do not create a second emergency by trying to resolve the first. If you are familiar with the area, you may choose an airport that you are comfortable with, even if it is a little further than other airports.

Landing the aircraft without flight instruments will require sensitivity to sight, sounds and even feel. Buffeting and vibrations of the aluminum fuselage normally precede a stall in the aircraft. Use of Flaps are recommended, as the buffeting will be louder and a lower airspeed is achieved before a stall.

3.5.9 LOSS OF FLIGHT CONTROLS

The elevator and aileron flight controls are operated through pushrods to the control stick. The rudder is operated through cables to the rudder pedals.

Loss of elevator control: In the event that connection between the stick and the elevator are broken there are three other methods to control pitch: trim, auto pilot, and throttle.

Trim can be used in a wide range of airspeeds to control pitch. With full flaps, there will be enough trim to lift the nose sufficiently for a nose up landing. The use of throttle should be used to gently settle the aircraft to the runway.

In the event that trim has been disabled or the elevator is frozen in one position, use throttle to maintain level attitude and turn on the LEVEL button on the auto pilot. It may be that the autopilot is still connected to the “good” portion of the elevator control. If the aircraft is not controllable with autopilot, or use of the auto pilot produced uncontrollable results, turn off the auto pilot.

If trim and auto pilot are ineffective in controlling pitch, then throttle is your only tool. By adding more throttle you will get a nose up action; by reducing the amount of throttle you will get a nose down action. Take some time to get comfortable with the resulting action of throttle before bringing it in for a landing.

Loss of aileron control: In the event that connection between the stick and the ailerons are broken the use of rudder to control roll is more than adequate to bring the aircraft to a safe landing. Practicing proficiency in “steering” the aircraft in the air without use of the ailerons is recommended on flights where there is no emergency.

Loss of rudder control: In the event that connection between the rudder and the rudder pedals are broken the use of aileron to control direction is more than adequate to bring the aircraft to a safe landing. Upon landing use brakes as normal if available. If brakes are also inoperative it would be advisable to pull mixture control to LEAN after landing just in case the ailerons are not able to keep you on the runway. This will prevent striking objects with the propeller spinning.

3.6 ELECTRICAL FAILURES

3.6.1 ALTERNATOR FAILURE

An alternator failure is indicated by a voltage indication less than 13.1 volts.

- Turn OFF all non-essential electrical equipment to conserve battery power.

WARNING
ELECTRICAL FUEL PUMP OPERATION DEPENDS UPON SUFFICIENT BATTERY POWER. TURN FUEL PUMP ON ONLY IN CASE OF LOW FUEL INDICATION ON THE EFIS.

- Avionics switch – OFF

NOTE
The primary EFIS and GPS will continue to operate on their internal battery.

- Land as soon as possible as the battery will furnish electrical power for a limited time only.

3.6.2 OVERVOLTAGE CONDITION

An overvoltage condition is indicated by a voltage indication in excess of 14.5 volts.

- ALT switch – OFF
- Turn OFF all non-essential electrical equipment to conserve battery power.
- Avionics switch – OFF
- Land as soon as possible as the battery will furnish electrical power for a limited time only.

3.6.3 BATTERY FAULT

The EarthX battery has an internal diagnostic circuit that is connected to the Skyview HDX EFIS. The warning will say “BATT CONTACT LOW” and will be paired with a flashing light under the “BATT” text, in the lower right hand corner of the EFIS. **Most of the time, this warning is NOT a safety of flight issue, unless it is in conjunction with a charging system failure.** Interpretation of the battery fault warning is shown below:

“BATT” LIGHT	VOLTAGE	DIAGNOSIS	RECOMMENDED ACTION
Slow Flashing (5s on/5s off) (> 1 hour time period)	13.2V – 14.6V	Weak or failing cell	Discontinue use. If in flight, this is not an immediate issue unless it is in conjunction with a charging system failure.
Slow Flashing (5s on/5s off) (< 30 min. time period)	13.2V – 14.6V	Cell to cell charge levels are not balanced	May come on briefly during periods of high current charging until the cells are automatically balanced. Try charging with the Optimate Lithium charger.
Solid Light	Any voltage	BMS electronic issue	Discontinue use. If in flight, this is not an immediate issue unless it is in conjunction with a charging system failure.
Short Flashing (2s on/2s off)	Any voltage	High battery temperature (> 75°C / 170°F)	Let battery cool down prior to cranking or charging. If in flight, this is not an immediate issue, but if it continues on subsequent flights, investigate and mitigate high temperature at battery location.

3.6.4 TRIPPED CIRCUIT BREAKER

The Ranger’s circuit protection consists of electronic circuit breakers (ECB’s) built into the Advanced Control Module (ACM), which can be accessed from the Skyview HDX EFIS. If a circuit breaker is tripped, a message will appear that says “ACM FAULT”.

To view the state of the circuit breakers on the Skyview HDX EFIS, press “DISPLAY” and then “ACM”.

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SECTION 4: NORMAL PROCEDURES

NORMAL PROCEDURES
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4.1 GENERAL

This section covers all recommended normal operating procedures using a checklist format whenever possible with additional information if further explanation is required.

NOTE

For convenience and more detail please utilize the Abbreviated Checklist.

NOTE

All recommended airspeeds in this section are INDICATED AIRSPEED (IAS) with the aircraft loaded to the maximum gross weight of 1320 lbs.

4.2 PREFLIGHT INSPECTION

4.2.1 CABIN

- Left Door – OPEN check condition, operation
- Master Switch – ON
- Flight Control Locks – REMOVE
- Flaps – FULL DOWN, check indication on EFIS
- Header Tank – check FULL indication on EFIS
- Fuel gauge – check FUEL LEVEL indication on EFIS (no take-off with less than 4 gallons of total fuel in wing tanks)
- Master Switch – OFF
- EFIS – POWER OFF
- Check Rudder Pedal pins
- ELT – check OFF
- Baggage – RESTRAINED

4.2.2 LEFT MAIN LANDING GEAR

- Tire – CONDITION, proper inflation 25-30 PSI
- Brake – CHECK condition, no leakage
- Axle Nut – CHECK cotter pin installation
- Wheel Attach Bolts – CHECK proper installation
- Brake Line – CHECK condition, no leakage at either end
- Wheel Chocks – REMOVE

4.2.3 LEFT WING

- Flap – CHECK condition, security
- Inboard Access Plates, Fwd & Aft – CHECK proper screw installation
- Outside Air Temperature (OAT) probe – CHECK condition
- Flap Hinge Pins – CHECK installation
- Outboard Access Plate –CHECK proper screw installation
- Inboard Aileron Hinge Bracket – CHECK bolt/washer/nut installation
- Aileron Pushrod – CHECK installation, freedom of bearing, jamnut tight
- Aileron – CHECK condition, straightness of trailing edge, freedom of movement
- Tie-Down – UNTIE RESTRAINT from eyelet, REMOVE eyelet (as desired)
- Wing Lower Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Wing Upper Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Outboard Aileron Hinge Bracket – CHECK bolt/washer/nut installation
- Wing Tip – CHECK condition, NAV/Strobe light, access plate installation
- Landing Light – CHECK condition, all screws installed
- Pitot/Static/AoA & Fuel Vent Mast – CHECK attachment to wing
- Pitot/Static/AoA & Fuel Vent – all ports CLEAN & OPEN
- Wing Leading Edge – CHECK overall condition, no dents, damage, missing or loose rivets
- Fuel Outlet – DRAIN fuel sample, CHECK for leakage
- Fuel Sample – CHECK for water or sediment contamination
- Fuel Cap – REMOVE
- Fuel Level – CHECK
- Fuel Cap – INSTALLED
- Comm Antenna – CHECK condition & security

4.2.4 NOSE SECTION

- Windscreen – CHECK overall condition, all screws installed, cleanliness
- Exhaust Pipe – CHECK condition, security of attachment
- Nose Landing Gear Leg – CHECK attachment to fuselage
- Cowling – CHECK condition, screws properly installed on bottom edge
- Nose Tire – CHECK condition, proper inflation 20-25 PSI
- Nose Wheel – CHECK axle bolt/washer/nut installation
- Nose Landing Gear Fork – CHECK pivot nut cotter pin installation, pivot flange stop screw installation
- Wheel Chocks – REMOVE
- Cowl Door – OPEN
- Engine Oil – CHECK quantity, color, and clarity
- Cowl Door – CLOSED
- Left Air Inlet – CHECK unobstructed
- Left Side Cowl Hinge Pin – CHECK proper installation, security
- Propeller and Spinner – CHECK condition, security
- Cowl Attach Screws aft of spinner – CHECK for proper installation
- Right Air Inlet – CHECK unobstructed
- Right Side Cowl Hinge Pin – CHECK proper installation, security
- Top Cowl Hinge Pin Retainer – CHECK proper installation, security

4.2.5 RIGHT WING

- Wing Leading Edge – CHECK overall condition, no dents, damage, missing or loose rivets
- Fuel Outlet – DRAIN fuel sample, CHECK for leakage
- Fuel Sample – CHECK for water or sediment contamination
- Fuel Cap – REMOVE
- Fuel Level – CHECK
- Fuel Cap – INSTALLED
- Landing Light – CHECK condition, all screws installed
- Wing Tip – CHECK condition, NAV/Strobe light, access plate installation
- Outboard Aileron Hinge Bracket – CHECK bolt/washer/nut installation
- Wing Upper Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Wing Lower Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Tie-Down – UNTIE RESTRAINT from eyelet, REMOVE eyelet (as desired)
- Aileron – CHECK condition, straightness of trailing edge, freedom of movement
- Aileron Pushrod – CHECK installation, freedom of bearing, jamnut tight
- Inboard Aileron Hinge Bracket – CHECK bolt/washer/nut installation
- Outboard Access Plate – CHECK proper screw installation
- Flap – CHECK condition, security
- Flap Hinge Pins – CHECK installation
- Inboard Access Plates, Fwd & Aft – CHECK proper screw installation

4.2.6 RIGHT MAIN LANDING GEAR

- Tire – CONDITION, proper inflation 25-30 PSI
- Brake – CHECK condition, no leakage
- Axle Nut – CHECK cotter pin installation
- Wheel Attach Bolts – CHECK proper installation
- Brake Line – CHECK condition, no leakage at either end
- Wheel Chocks – REMOVE

4.2.7 FUSELAGE (RIGHT SIDE)

- Right Door – OPEN check condition, operation
- Fuel Outlet – DRAIN fuel sample, CHECK for leakage
- Fuel Sample – CHECK for water or sediment contamination
- ELT Antenna – CHECK condition & security
- Fuselage Lower, Right Side, & Upper Surfaces – CHECK overall condition, no dents, damage, missing or loose rivets

4.2.8 EMPENNAGE

- Vertical Stabilizer (Right Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Horizontal Stabilizer (Right Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Right Elevator – CHECK condition, freedom of movement
- Rudder – CHECK condition, proper attachment, freedom of movement
- Rudder Anti-Servo Tab – CHECK attachment of pushrod, presence of cotter pin, free play not greater than 3 mm/1/8 inch
- Rudder Cables – CHECK proper attachment to rudder horn, presence of cotter pins in cable attach nuts
- Tie-Down – UNTIE RESTRAINT from hole in structure
- Left Elevator – CHECK condition, freedom of movement
- Left Elevator Trim Tab – CHECK attachment of actuator, hinge pin safety wire, free play not greater than 3 mm/1/8 inch
- Trim Motor Access Plate – CHECK proper screw installation
- Horizontal Stabilizer (Left Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Vertical Stabilizer (Left Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Nav Antenna (if installed) – CHECK condition & security

4.2.9 FUSELAGE (LEFT SIDE)

- Fuselage Lower, Left Side, & Upper Surfaces – CHECK overall condition, no dents, damage, missing or loose rivets

4.3 PRE-START

- Rudder Pedal Position – ADJUST as necessary/desired
- Seat Belt/Shoulder Harness/Crotch Strap – FASTENED & SNUG
- Passenger Briefing – PERFORMED
- Doors – CLOSED and LATCHED
- Master Switch – ON
- Avionics Switch – ON
- Autopilot Switch – ON
- Alternator Field Switch – ON
- Flaps – UP
- Fuel Valve – OPEN (PUSH IN)
- Throttle – ADJUST FRICTION
- Mixture – RICH (PUSH IN)
- Carburetor Heat – COLD
- Nav/Strobe Lights – ON, strobe for day ops, nav for night ops

4.4 ENGINE START

CAUTION

DO NOT START ENGINE WITH OUTSIDE AIR TEMPERATURE BELOW -13°F (-25°C) OR ABOVE 122°F (50°C).

- Prime – AS REQUIRED using carburetor accelerator pump.
  - Engine Cold – fully open then close the throttle 3 to 5 times.
  - Engine Hot – do not prime before starting.

NOTE

The amount of prime required depends on engine temperature. Familiarity and practice will enable the operator to accurately estimate the amount of prime to use.

- Throttle – 1/8 in OPEN
- Brakes – HOLD
- Propeller – CLEAR
- Ignition Key – START, release to BOTH after engine fires
- Throttle – 900 to 1000 RPM
- Oil Pressure – CHECK 10 PSI min within 30 seconds or immediately shutdown the engine
- Voltmeter – 13.5 to 14.4 Volts (at 1000 RPM)

CAUTION

LIMIT THE USE OF THE STARTER TO 10 SECONDS DURATION MAXIMUM WITH A 20 SECOND COOLING OFF PERIOD BETWEEN EACH STARTER ENGAGEMENT.

4.5 AFTER START

- Landing Light – ON, pulse for day ops, steady for night ops
- COM Radio – TUNE as desired, ADJUST volume
- Intercom – CHECK functionality, ADJUST volume, squelch as desired

4.6 TAXIING

Taxiing during high winds requires the conventional use of the flight controls. With a headwind or quartering headwind, place the control stick full aft and into the wind.

With a tailwind or quartering tailwind, use the opposite procedures. The use of the wheel brakes in conjunction with the rudder will assist the pilot in maintaining directional control.

- Engine Gauges – CHECK
- Brakes – RELEASE
- Taxi rpm – 900–1000 RPM until oil temp over 75° F (24° C)

4.7 BEFORE TAKEOFF

- Brakes – HOLD
- Flight Controls – CHECK freedom of movement, proper operation
- Flight Instruments – CHECK & SET
- Fuel Valve – CHECK OPEN
- Fuel Quantity Indication – CHECK (no take-off with less than 4 gallons of total fuel in wing tanks)
- Trim – SET for takeoff – tab “in-trail” with left elevator
- Flaps – SET – 20° or UP (as desired)
- Doors – CHECK Closed and Latched
- Engine Run-Up
    - Elevator – STICK BACK
    - Minimum Oil Temp 75° F
    - Throttle – 1700 RPM
    - Ignition Key
        - L then BOTH, note RPM drop
        - R then BOTH, note RPM drop
          (max drop – 150 RPM)
          (max difference between drops – 75 RPM)
    - Carb Heat – ON, note increase in carb temp, then COLD
    - Engine Instruments – CHECK
        - Normal Indications
        - Volt Meter – CHECK
- Throttle – IDLE
- Seat Belt, Pilot and Passenger – FASTENED & SNUG
- Brakes – RELEASE

NOTE

Extended periods of ground operation with carburetor heat ON should be avoided as the air filter is bypassed when carburetor heat is selected.

NOTE

High power operation (above 1500 RPM) and engine run-up should be made into the wind and kept to a minimum especially during high temperature conditions.

4.8 TAKE-OFF (NORMAL)

- Control Stick – halfway between neutral and aft
- Throttle – smoothly FULL OPEN
- Elevator Control –
  - RAISE NOSE just clear of ground, release back pressure on stick as required
- Rotate – LIFT OFF 45 kts IAS
- Climb – 75 kts IAS
- Flaps – UP
- Trim – AS REQUIRED to hold desired airspeed

During crosswind conditions, place the control stick into the wind (up wind aileron UP) and raise the nose just clear of the ground as early in the take-off roll as possible to improve rudder authority and prevent drifting or premature lift-off. When taking off with a left crosswind and full power, right rudder is a limiting factor.

4.9 TAKE-OFF (OBSTACLE)

During an obstacle take-off, use the normal take-off procedures with the following exceptions:

- Flaps – 20°
- Hold Brakes – until application of full power
- Lift – Off – 45 kts IAS
- Climb – 60 kts IAS (best angle of climb) until clear of obstacle

4.10 TAKE-OFF (SOFT FIELD)

For soft field take-off, use the normal take-off procedures with the following exceptions:

- Flaps – 20°
- Elevator Control – RAISE NOSE to Take-Off Attitude
- Lift-Off – as EARLY as possible
- After Lift-Off – LEVEL FLIGHT to obtain safe margin of airspeed prior to climb

WARNING
THE AIRCRAFT WILL LIFT-OFF AT VERY LOW IAS BUT CONTINUED CLIMB-OUT BELOW 60 KTS IMMEDIATELY AFTER TAKE-OFF IS NOT RECOMMENDED.

4.11 CLIMB

- Throttle – FULL
- Airspeed –
  - Best Rate 75 kts IAS
    Flaps – UP
  - Best Angle 60 kts IAS
    Flaps – 20°
  - Cruise-climb 85 kts IAS
    Flaps – UP
- Trim – AS REQUIRED to hold desired airspeed

4.12 CRUISE

- Flaps – CHECK UP
- Level-off – TRIM as required
- Airspeed – ACCELERATE to desired cruise airspeed above
  103 kts IAS in smooth air only
- Throttle – SET to cruise power
- Mixture – LEAN when below 75% power
- Engine Gauges – CHECK

4.13 DESCENT

- Airspeed – AS DESIRED
  103 kts IAS to 131 kts IAS in smooth air only
- Throttle – REDUCE as desired (2750 RPM max)
- Mixture – ADJUST as required
- Flaps – UP (above 90 kts IAS),
  AS DESIRED (below 82 kts IAS)
- Trim – AS REQUIRED to hold desired airspeed

The descent should be made with enough power to maintain cylinder head and oil temperatures in green arc. If possible, avoid windmilling the engine with the propeller by reducing airspeed or increasing power.

4.14 LANDING (NORMAL)

- Seat Belt – Pilot and Passenger – FASTENED & SNUG
- Mixture – RICH
- Brakes – CHECK firm then release
- Ignition Switch – BOTH ON
- Throttle – AS DESIRED to control rate of descent
- Carburetor Heat – ON
- Trim – AS REQUIRED
- Flaps – AS DESIRED (below 82 kts IAS)
- Approach Speed – 55-60 kts IAS
- Touchdown – MAIN WHEELS FIRST
- After Touchdown –
    - Elevator Control – FULL AFT
    - Brakes – AS REQUIRED

The best technique for use on soft or rough fields is to fly the landing approach at minimum speed carrying power into the landing flare and using an extreme nose high landing attitude so as to touchdown with minimum airspeed.

During gusty wind conditions, fly the landing approach at approximately 5 kts above normal and touchdown with the nose slightly lower than for a normal landing.

Crosswind approaches can best be accomplished by using the wing down top rudder method touching first on the downwind side main wheel, followed by the other main wheel, and finally lowering the nose wheel all the while keeping the stick into the wind.

4.15 LANDING (OBSTACLE)

Use of normal landing procedures in addition:

- Flaps – FULL DOWN
- Approach Airspeed – 55 kts
- Throttle – AS DESIRED to control rate of descent
- Slip aircraft as necessary to increase rate of descent

NOTE

If a crosswind exists, place the lower wing into the wind. Indicated airspeed in a full-rudder deflection slip is 3 kt higher than in coordinated flight.

WARNING

A RELATIVELY HIGH RATE OF DESCENT IS POSSIBLE IN THIS CONFIGURATION WHEN AT FULL GROSS WEIGHT AND THE THROTTLE CLOSED. IF AIRSPEED IS ALLOWED TO DECREASE BELOW 55 KTS, LEVEL OFF CAN ONLY BE ASSURED WITH AN APPLICATION OF POWER.

4.16 LANDING (BALKED)

Use of normal landing procedures in addition at the time of going around:

- Throttle – FULL OPEN
- Carburetor Heat – COLD
- Flaps – 20°
- Airspeed –
  - Best Angle 60 kts IAS
    Flaps – 20° until clear of obstacle, then
  - Best Rate 75 kts IAS
    Flaps – UP

4.17 SHUTDOWN

- Throttle – 900 to 1000 RPM
- ELT – CHECK LIGHT OFF & CHECK no signal on 121.5 MHZ
- Mixture – IDLE CUT-OFF
- Ignition Key – OFF Avionics – OFF Master – OFF
- Tie Down – CHOCK two wheels minimum

NOTE

If high winds are anticipated, the aircraft should be hangered. If the aircraft must be left out, park with the aircraft headed into the wind and use additional tie-down ropes for security. Place the flaps in the full up position and secure the control stick full aft with the lap belt.

SECTION 5: PERFORMANCE

PERFORMANCE
TABLE OF CONTENTS

5.1 GENERAL

This data is to inform the pilot what can be expected from the aircraft in the way of performance and to assist in preflight planning.

The data has been compiled from both estimated calculations and actual flight test using average piloting techniques, with an aircraft and engine in good operating conditions. All information is corrected for standard atmospheric conditions.

Note

For the Ranger, the Indicated Air Speed (IAS) has been corrected by The SkyView system to display Calibrated Air Speed (CAS).

5.2 AIRSPEED CALIBRATION TABLE

CALIBRATED AIRSPEED	INDICATED AIRSPEED
45	45
50	50
55	55
60	60
65	65
70	70
75	75
80	80
85	85
90	90
95	95
100	100
110	110
120	120
130	130

5.3 STALL SPEEDS (KIAS)

FLAP POSITION	1150 lbs	1320 lbs
UP	42.0	45
20°	40.0	43
FULL DOWN	38.3	41

5.4 TAKE-OFF PERFORMANCE – (Gross Weight)

PRESS ALTITUDE (FT)	TEMP (°F)	TAKE-OFF DISTANCE (FT)	
		GROUND ROLL	50 FT OBSTACLE
SEA LEVEL	0	180	439
	20	288	703
	40	391	953
	60	489	1191
	80	582	1419
	100	671	1636
2000	0	364	888
	20	471	1147
	40	572	1393
	60	668	1628
	80	760	1851
	100	847	2064
4000	0	548	1335
	20	653	1590
	40	752	1832
	60	846	2062
	80	937	2282
	100	1023	2492
6000	0	731	1781
	20	834	2032
	40	931	2269
	60	1024	2496
	80	1113	2711
	100	1197	2917
8000	0	914	2226
	20	1015	2472
	40	1110	2705
	60	1202	2927
	80	1289	3139
	100	1372	3342

5.5 CLIMB PERFORMANCE

PRESS ALTITUDE (FT)	TEMP (°F)	MAX RATE OF CLIMB (FT/MIN)	
		AT 1320 lbs	AT 1150 lbs
SEA LEVEL	0	1031	1194
	20	962	1125
	40	896	1059
	60	833	997
	80	774	937
	100	717	880
2000	0	913	1077
	20	845	1009
	40	780	944
	60	719	883
	80	660	824
	100	605	768
4000	0	796	959
	20	729	892
	40	665	829
	60	605	769
	80	547	711
	100	492	656
6000	0	679	842
	20	613	777
	40	551	714
	60	491	655
	80	435	598
	100	381	544
8000	0	562	726
	20	498	661
	40	436	600
	60	378	542
	80	323	486
	100	270	433

5.6 LANDING PERFORMANCE – (GROSS WEIGHT)

DENSITY ALTITUDE (FT)	APPROACH SPEED (KIAS)	LANDING DISTANCE (FT)	
		GROUND ROLL	50 FT OBSTACLE
0	55	284	1079
2500	55	339	1151
5000	55	395	1223
7500	55	450	1294

NOTE
Decrease the distances shown by 10% for each 5 knots of headwind.

NOTE
The data given is with flaps fully extended.

5.7 CRUISE PERFORMANCE – (GROSS WEIGHT)

DENSITY ALTITUDE (FT)	RPM	TAS (KTS)	FUEL BURN (GAL/HR)	ECONOMY (NM/GAL)	ENDURANCE (H:MM)	RANGE (NM)
2500	2500	114	6.9	16.5	4:03	460
	2750	117	7.7	15.2	3:37	424
5000	2500	112	5.8	19.3	4:49	538
	2750	115	6.8	16.9	4:06	471
7500	2500	111	5.4	20.7	5:10	572
	2750	114	5.8	19.8	4:49	547
10000	2500	110	5.2	21.3	5:22	589
	2650	113	5.4	20.9	4:43	534

NOTE

Mixture may be leaned to peak EGT when below 75% power.

NOTE

No fuel allowance is made for take-off, climb, descent, or reserve.

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SECTION 6: WEIGHT AND BALANCE

WEIGHT AND BALANCE
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6.1 GENERAL

It is the pilot's responsibility to ensure that the aircraft is loaded properly and within the weight and balance limitations. All flight performance, procedures and characteristics are based on this prerequisite.

The actual licensed empty weight and CG of a specific aircraft can be found on the Weight and Balance Form which is a permanent part of the aircraft's file and onboard documentation. All additional changes to the aircraft's empty weight and CG after the time of manufacture must also be attached or indicated. From this information and the following instructions, the pilot can easily determine the useful load and proper loading distribution for the aircraft.

6.2 INSTALLED OPTIONAL EQUIPMENT LIST

ITEM	WEIGHT (lbs)	ARM (in)	MOMENT (in-lbs)
SV-HDX1100 EFIS (right side)			
GTN 650XI Navigator (Cascade)			
AFD 440 Navigator (Cascade)			
PDA360EX Audio Panel (Cascade)			
AMX 240 Audio Panel (Cascade)			
GMA 245 Audio Panel (Cascade)			
GA-35 WAAS Antenna (Secondary, Cascade)			
AV-520 VOR/LOC/GS Antenna (Cascade)			
SV-Knob-Panel			
Tanis Heater TA2925-1			
TOTAL			

6.3 SAMPLE LOADING PROBLEM

ITEM	ARM (IN) (LIMITS 112.13 – 117.64)	SAMPLE AIRPLANE	
		WEIGHT (LBS)	MOMENT (IN-LBS)
EMPTY AIRCRAFT WITH OIL & UNUSABLE FUEL	112.26	882	99014
PILOT	121.50	185	22478
PASSENGER	121.50	185	22478
BAGGAGE – MAIN	150.04	20	3001
BAGGAGE – AFT	174.03	0	0
HEADER FUEL	88.40	15.0 (2.5 GAL @ 6LBS/GAL)	1326
WING FUEL	107.20	33.0 (5.5 GAL @ 6LBS/GAL)	3538
TOTAL	**115.03**	**1320**	**151835**

6.4 YOUR AIRPLANE

ITEM	ARM (IN) (LIMITS 112.13 – 117.64)	SAMPLE AIRPLANE	
		WEIGHT (LBS)	MOMENT (IN-LBS)
EMPTY AIRCRAFT WITH OIL & UNUSABLE FUEL			
PILOT	121.50		
PASSENGER	121.50		
BAGGAGE – MAIN	150.04		
BAGGAGE – AFT	174.03		
HEADER FUEL	88.40	15.0 (2.5 GAL @ 6LBS/GAL)	1326
WING FUEL	107.20	(___GAL @ 6LBS/GAL)	
TOTAL			

6.5 LOADING GRAPH

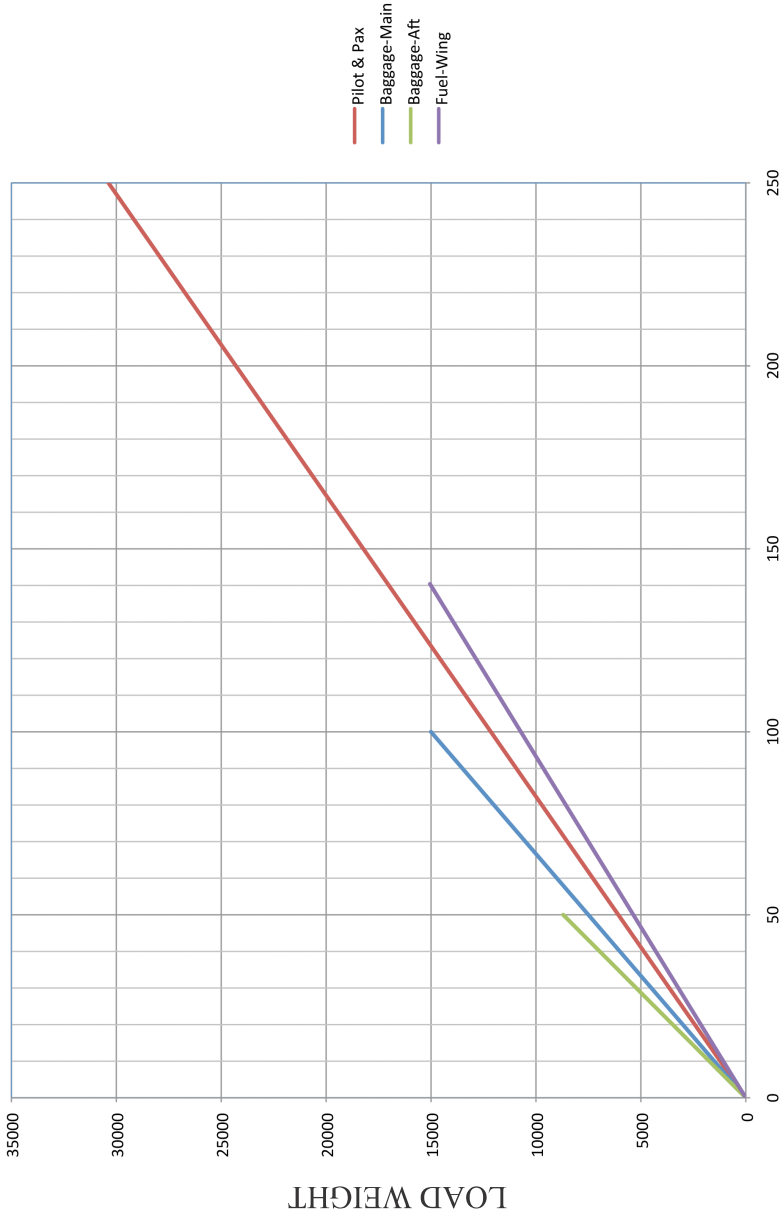

FIGURE 6-1 LOADING GRAPH

6.6 FLIGHT ENVELOPE

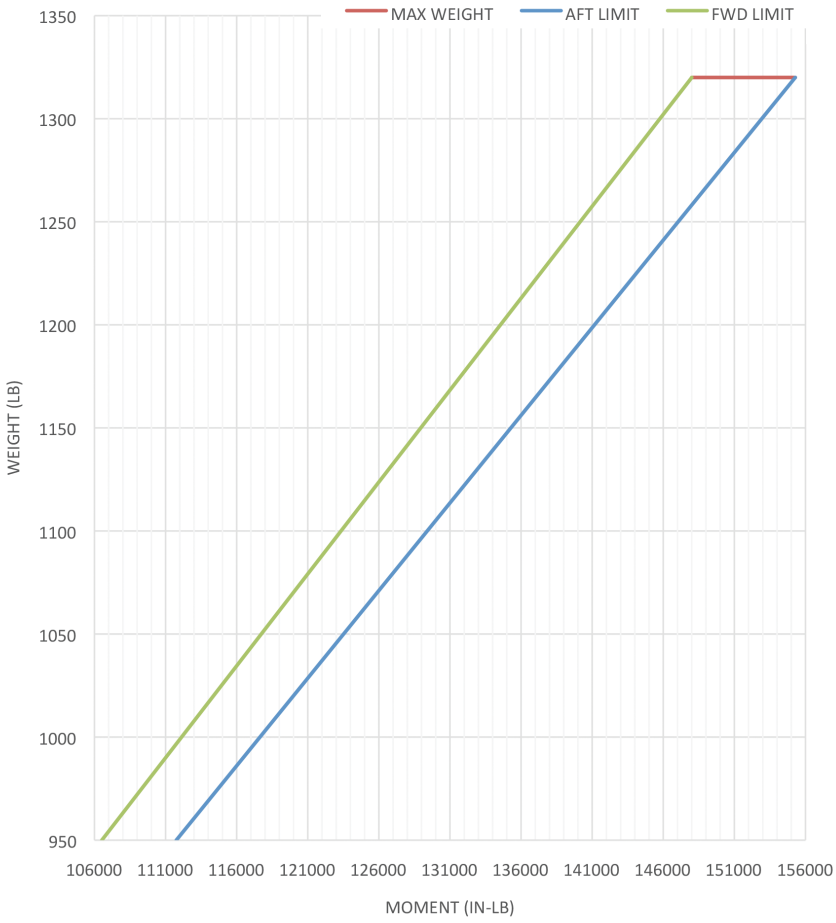

FIGURE 6-2 FLIGHT ENVELOPE

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SECTION 7: DESCRIPTION OF AIRCRAFT & SYSTEMS

DESCRIPTION OF AIRCRAFT & SYSTEMS
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7

7.1 GENERAL

The Ranger is an S-LSA certified aircraft with an all-metal monocoque design and features a cantilever high-wing, two-seats-in-side-by-side configuration, fixed tricycle landing gear with a castering nosewheel.

7.2 AIRCRAFT SPECIFICATIONS

Exterior Dimensions		
	Span	29 ft 6 in
	Length	21 ft 9 in
	Height	8 ft 4 in
	Wing Area	135.6 ft2
Weights		
	Empty Weight	875 lbs (typical)
	Gross Weight	1320 lbs
Loading		
	Wing Loading	9.7 lbs/ft^2
	Power Loading	13.2 lbs/hp

Performance (1150 lbs)		
	Top Speed	119 kts
	Cruise Speed	117 kts (2750 RPM @ 7500 ft DA)
	Range	506 nm
	Cruise Speed	113 kts (2500 RPM @ 7500 ft DA)
	Range	519 nm
	Stall – Flaps Up	42 kts
Ground Performance		
	Take-off Distance	384 ft
	Landing Distance	265 ft
Climb/Ceiling		
	Rate of Climb	1000 ft/min
	Ceiling (estimated)	12,000 ft

Performance (1320 lbs)		
	Top Speed	117 kts
	Cruise Speed	114 kts (2750 RPM @ 7500 ft DA)
	Range	501 nm
	Cruise Speed	111 kts (2500 RPM @ 7500 ft DA)
	Range	524 nm
	Stall – Flaps Up	45 kts
Ground Performance		
	Take-off Distance	489 ft
	Landing Distance	285 ft
Climb/Ceiling		
	Rate of Climb	833 ft/min
	Ceiling (estimated)	12,000 ft

7.3 FLIGHT CONTROLS

The Ranger's flight control system consists of primary and secondary control systems. The primary control system serves to safely control the Ranger during flight. It includes control of the ailerons, elevator and rudder. The secondary control system consists of the wing flaps control and elevator trim tab control.

The following table shows the Ranger's control surfaces, movement, axes of rotation, and type of stability.

Primary Control Surface	Airplane Movement	Axes of Rotation	Type of Stability
Aileron	Roll	Longitudinal	Lateral
Elevator	Pitch	Lateral	Longitudinal
Rudder	Yaw	Vertical	Directional

7.3.1 PRIMARY CONTROLS

The Ranger has conventional ailerons and elevators that are operated with a stick and are mechanically actuated via systems of pushrods and bell cranks.

The rudder is operated with overhead pivoting rudder pedals and is actuated via cables. Each set of rudder pedals is independently adjustable to accommodate variations in height and body proportions of both pilot and passenger.

Flight control checks on the ground should include checking for movement in the proper direction and full travel in all directions.

7.3.2 SECONDARY CONTROLS

Wing Flaps

The Ranger is equipped with plain flaps with settings at 0°, 20°, and 40°. The flaps are extended or retracted by using the flap rocker switch on the instrument panel. Pressing the lower part of the rocker switch once will extend the flaps to the 20° position & pressing it again will extend the flaps to the 40° position. Pressing the upper portion of the rocker switch will retract the flaps from 40° to the 20° position, then from 20° to 0°

The flap position is displayed on the EFIS screen with the signal coming from a position potentiometer inside the flap linear actuator. The flap position can also be confirmed by looking out the window.

Trim Control

The aircraft is trimmed in flight by changing the position of a tab on the left elevator. The elevator trim tab control lever is operated via a hat switch located on the control stick.

The Dynon Avionics Autopilot, when engaged, can also provide automatic trim control – Auto-trim.

7.4 INSTRUMENT PANEL

7.4.1 GENERAL

The Ranger is equipped with Dynon's SkyView system. SkyView is an integrated glass panel avionics system. Its capabilities include Primary Flight Display (PFD) information, Engine Monitoring, GPS moving map with procedure and enroute charts, two-axis approach-capable Autopilot, Mode-S Transponder with 2020-compliant ADS-B Out capability, ADS-B Traffic and Weather (US only), and COM Radio.

The Ranger comes standard with a single 10" Dynon HDX SkyView (older models with Skyview Classic). An additional 10" SkyView panel is included as an upgrade option (recommended).

Figure 7-1 Instrument Panel (Redwood Model)

7.4.2 INSTRUMENT & AVIONICS EQUIPMENT LIST

INSTRUMENTS	STANDARD	OPTIONAL
SV-HDX1100 EFIS (left side)	X	
SV-HDX1100 EFIS (right side)		X
SV-ADAHRS-200	X	
SV-EMS-220	X	
SV-BAT-320	X	
COM SYSTEM	STANDARD	OPTIONAL
SV-COM-760 VHF Transceiver (current)	X	
SV-COM-T25 VHF Transceiver (superseded)	X	
SV-COM-C25 VHF Transceiver (superseded)	X	
SV-INTERCOM-2S Intercom	X	
GTN 650XI Navigator (Cascade only)		X
AFD 440 Navigator (Cascade only)		X
PDA360EX Audio Panel (Cascade only)		X
AMX 240 Audio Panel (Cascade only)		X
GMA 245 Audio Panel (Cascade only)		X
NAV SYSTEM	STANDARD	OPTIONAL
SV-XPNDR-261 Mode S Transponder	X	
SV-GPS-2020 GPS Antenna/Receiver Module (primary)	X	
SV-ADS-B-472	X	
GA-35 WAAS Antenna (Secondary, Cascade only)		X
AV-520 VOR/LOC/GS Antenna (Cascade only)		X
AUTOPILOT SYSTEM	STANDARD	OPTIONAL
SV-32 Autopilot Servo (roll)	X	
SV-42 Autopilot Servo (pitch)	X	
SV-AP-PANEL Autopilot Panel	X	
SV-Knob-Panel		X

Table 7-1: Instrument and Avionics Equipment List

7.5 FLIGHT INSTRUMENTS

The primary instrument is the Dynon Avionics SkyView HDX EFIS as shown in Figure 5-7. As an option, a second SV-HDX1100 EFIS may be installed. SkyView HDX features icon-driven touch controls and simplified screen navigation for reduced workload.

Figure 7-2: SV-HDX1100 Electronic Flight Instrument System

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7.6 ELECTRICAL SYSTEM

Electrical System Schematic

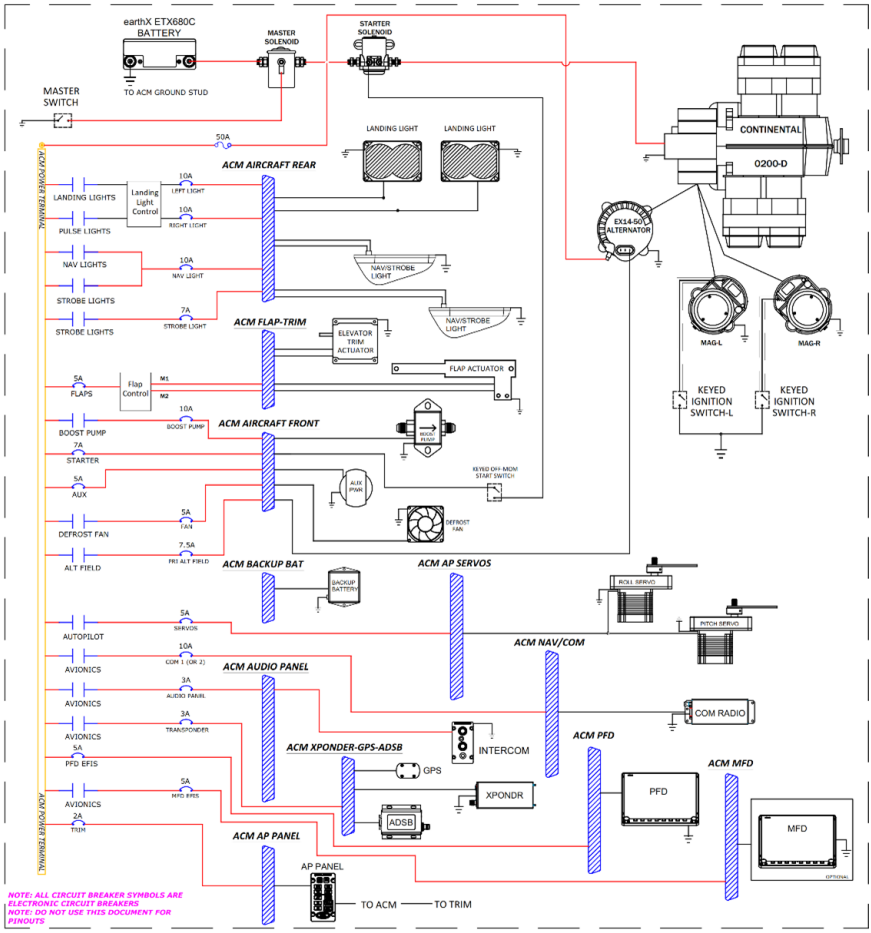

FIGURE 7-3 ELECTRICAL SYSTEM

7.7 FUEL SYSTEM

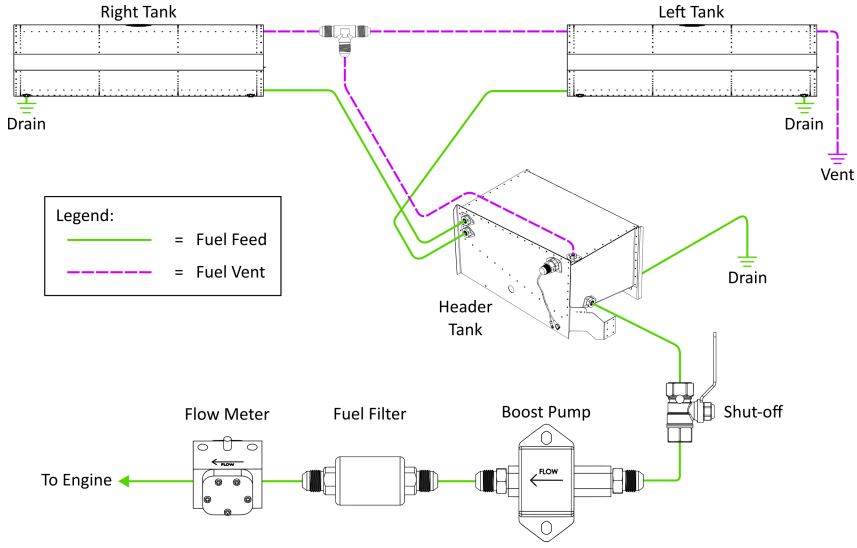

FIGURE 7-4 FUEL SYSTEM

7.8 ENGINE

Engine Description		
	Make	Continental Motors, Inc.
	Model	O-200-D
	Displacement	201 in3 / 3.29 liter
	Ignition	Dual Bendix S4LSC-21 Magnetos
	Carburetor	MA3-SPA
	Rated Power	100 HP / 74.5 kW @ 2750 RPM
Fuel		
		See Ground Handling & Servicing - Section 8.5
Oil		
		See Ground Handling & Servicing - Section 8.6

7.9 PROPELLER

Propeller		
	Make	Catto
	Model	2B-70x48
	Blades	2
	Diameter	70 in
	Type	Fixed Pitch
	Construction	Composite blade, wood core

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SECTION 8: GROUND HANDLING & SERVICING

GROUND HANDLING & SERVICING
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8.1 GROUND HANDLING

The aircraft can easily be moved by hand with the use of a towbar.

- Pulling and pushing pressure can be applied to the propeller at the root of the blade.
- When applying pressure to any surface on the aircraft, verify the pressure is being applied to areas with spars beneath the skin.
- Become familiar with the dimensions of the aircraft listed in Section 1 to avoid the wings and tail making contact with objects.

8.2 TOWING INSTRUCTIONS

Use the supplied towbar.
Slide towbar ends over the spacers protruding from the sides of the nose fork.

For towing with a tug, verify that the ends of the tow bar fit properly over the supplied spacers on the nose fork.

CAUTION
DO NOT FORCE THE NOSEWHEEL BEYOND THE STOP BOLTS. THE NOSE PIVOT IS DESIGNED TO ROTATE 58° FROM NEUTRAL/STRAIGHT.

8.3 TIE-DOWN INSTRUCTIONS

- Wing Tie-downs: You have been supplied with 2 tie-down eyebolts. These thread into the forward spar about 3ft from the tip

CAUTION
DO NOT THREAD THE EYEBOLTS INTO THE AFT SPAR AS THIS COULD INTERFERE WITH THE AILERONS.

- Tail Tie-down: There is a built-in tiedown ring provided at the bottom of the tail.

- Using these three points secure the aircraft to the ground using rope or other appropriate methods.

CAUTION
DO NOT APPLY A FORCE ON THE TIEDOWNS THAT CAUSES THE AIRCRAFT TO FLEX THE WINGS OR GEAR LEGS.

8.4 JACKING INSTRUCTIONS

Using a common, low profile floor jack lift the aircraft using Jacking Fixture P/N 710013 available for purchase from Vashon Aircraft.

- Chock the wheels not being lifted
- Verify clearance from objects, especially wingtips
- Place fixture at the bottom of the of the gear leg

8.5 FUEL

8.5.1 GENERAL

The Continental O-200-D engine installed in the Ranger R7 is certified for operation with 100LL Blue aviation fuel. If the minimum fuel grade is not available, use the next higher available grade. **Never use lower grade fuel.**

8.5.2 FUELING PROCEDURE

Plane stopped, engine and master power OFF. Attach grounding cable to exhaust pipe.

Use a ladder to gain access to the filler cap (located on the upper surface of each wing at approximately 30% of the distance from the cabin to the wing tip.)

- Remove filler cap
- Insert fuel nozzle, add desired amount of fuel.
- Remove fuel nozzle
- Visually check fuel level
- Replace fuel cap
- Wipe away any spilled fuel
- Re-locate ladder to opposite wing to gain access to the filler cap and repeat
- Return ladder to storage location.
- Remove grounding cable from exhaust pipe.

Adjust the fuel totalizer quantity upon powering up the EFIS

- Select MENU softkey
- Touch ENGINE TOOLS in menu
- Touch FUEL
- Make adjustment

8.6 OIL

8.6.1 SPECIFICATION

Aircraft piston engine ashless-dispersant oil which meets specification SAE J-1899.

Aircraft piston engine non-dispersant mineral oil which meets specification SAE J-1966 (first 25 hours of engine operation or until oil consumption stabilizes).

8.6.2 RECOMMENDED OIL GRADE

Above 40°F ambient air, sea level – SAE 50 or Multi Viscosity

Below 40°F ambient air, sea level – SAE 30 or Multi Viscosity

8.6.3 OIL SUMP CAPACITY

5.0 Quarts 4.73L

8.6.4 OPERATIONAL OIL LEVEL

Due to the ½ quart that sits in the oil cooler, it is recommended to operate the engine at 4.5 quarts as measured on the dipstick

NOTE

Adding oil beyond 4.5 quarts will result in the surplus being vented in flight

8.6.5 OIL CHANGE CONSUMABLES

- Tempest Oil Filter AA48162
- Oil sump crush gasket MS35769-11
- .032 Safety Wire

8.7 WHEELS

8.7.1 TIRES

All three tires are 6.00 x 6 size and 4 ply load rating.

8.7.2 INFLATION PRESSURE

Nose Tire: 20-25 PSI

Main Tires: 25-30 PSI

8.7.3 BRAKE LINING KIT

Matco PN WHLBRL-1

8.8 ELT SYSTEM

Refer to ACK Model E-04 ELT Installation Manual and Operation Manual for instructions

8.8.1 MAIN BATTERY

- Located behind the baggage compartment.
- The battery pack is attached to the ELT with (4) screws.
- ELT will have to be removed from mounting tray
- Expiration date is etched on the battery pack

8.8.2 ALERT BATTERY

- Located behind the Pilot EFIS mounted to the bottom of the instrument panel bay
- Top half of Audio Alert is removed with (4) screws
- CR2 3V Lithium battery
- Expiration on packaging, on the battery or 10 years, whichever is less

8.8.3 REMOTE SWITCH BATTERY

- Located on left side of panel, accessed through Pilot EFIS opening
- Remove from panel by removing both nuts over the buttons
- Split Remote switch by removing (3) screws
- 28L 6V Lithium battery
- Expiration on packaging, on the battery or 10 years, whichever is less

8.9 AIRCRAFT BATTERY

Battery Manufacturer: EarthX Inc.

Battery Model Number: ETX680C

Battery life expectancy: 8 years

- Remove NEGATIVE cable first
- Remove POSITIVE cable last
- Install POSITIVE cable first
- Install NEGATIVE cable last

8.10 SPARK PLUGS

Manufacturer	Part Number	Socket	Electrode
Champion Aerospace	REM40E	7/8” Deep Socket	.016-.021”
Champion Aerospace	REM437BY	7/8” Deep Socket	.016-.021”
Tempest Aviation	UREM40E	7/8” Deep Socket	.016-.021”
Tempest Aviation	UREM37BY	7/8” Deep Socket	.016-.021”

8.11 TORQUE VALUES TABLE

Item	ft-lbs	in-lbs	N-m
Plug, Oil Sump Drain	15.8-17.5	190-210	21.5-23.7
Oil Filter	16.0-18.0	192-216	21.7-24.4
Spark Plugs [1]	25.0-30.0	300-360	33.9-40.6

CONTINENTAL O-200-D

NOTE

[1] Lubricate spark plug threads with spark plug manufacturer’s recommended lubricant.

8.12 CLEANING INSTRUCTIONS

8.12.1 CLEANING THE AIRCRAFT

Use of common cleaning agents used for automotives is appropriate for cleaning the aircraft aluminum structure of the aircraft. Spray wax and ceramic coatings are an easy way to keep the shine up on the aircraft while protecting the paint against corrosive agents.

NOTE

Take care around edges and corners of vinyl, wiping away from them and not into them as much as possible.

8.12.2 CLEANING THE WINDSCREEN AND WINDOWS

The windscreen and windows are made of extruded acrylic.

- Clean with a product designed for acrylic/Plexiglass windows. DO NOT use any cleaners that contain ammonia.
- Use a new microfiber towel to prevent debris from causing micro scratches.
- Avoid circular movements using fwd/aft movements instead.

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SECTION 9: SUPPLEMENTARY INFORMATION

SUPPLEMENTARY INFORMATION
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9.1 FAMILIARIZATION FLIGHT PROCEDURES

9.1.1 TAKE-OFF & CLIMB

Normal take-off followed by climb at 75 kt IAS to selected target altitude (suggest 3,000 to 4,000 ft AGL)

Strive to maintain target airspeed during climb.

While climbing, perform left and right turns of approximately 90° heading change using not more than 30° bank.

Strive to keep slip/skid ball centered while rolling into and out of turns.

9.1.2 CRUISE

Upon reaching target altitude, level-off and allow the aircraft to accelerate to cruise speed. Trim as required to minimize pilot workload. Reduce power if/as required to keep engine speed below 2750 RPM.

Strive to maintain target altitude while the aircraft accelerates.

Once established in level, hands-off flight perform left and right turns of 180 to 360° heading change using not more than 45° bank.

Strive to keep slip/skid ball centered while rolling into and out of turns. Strive to maintain target altitude throughout.

For added challenge, increase maximum bank angle to 60° and/or begin and end turns with the nose pointed at preselected points on the horizon.

Strive to keep slip/skid ball centered while rolling into and out of turns. Strive to maintain target altitude throughout.

Strive to begin and end turns with the nose exactly on point.

9.1.3 SLOW FLIGHT

Reduce power and allow the aircraft to decelerate to 60 kt IAS while maintaining target altitude. Trim as required to minimize pilot workload. Adjust power if/as required to achieve target airspeed while maintaining altitude.

Strive to maintain target altitude. Strive to keep slip/skid ball centered during power changes.

Once established in level, hands-off flight perform left and right turns of 180 to 360° heading change using not more than 45° bank.

Strive to keep slip/skid ball centered while rolling into and out of turns. Strive to maintain target airspeed and altitude throughout.

For added challenge, increase maximum bank angle to 60° and/or begin and end turns with the nose pointed at preselected points on the horizon.

Strive to keep slip/skid ball centered while rolling into and out of turns. Strive to maintain target altitude throughout.

Strive to begin and end turns with the nose exactly on point.

Lower flaps to ½ deflection and repeat exercises listed above using target airspeed of 57 kt IAS.

Lower flaps to full deflection and repeat exercises listed above using target airspeed of 55 kt IAS.

Raise flaps and re-establish level hands-off flight at 60 kt IAS.

9.1.4 STALLS, POWER-OFF

Reduce power to idle and maintain wings level flight while increasing nose-up attitude to maintain target altitude until aircraft stalls. Stall will be noted by the nose pitching-down abruptly and rolling right or left up to 15°.

While approaching the stall, maintain wings-level using rudder only and keeping the ailerons neutral. Upon stall, release stick back pressure and increase power to 18 inches manifold pressure. Allow the aircraft to accelerate to 60 kt IAS and re-establish wings level climbing flight.

Strive to maintain wings level using only rudder.

Strive to maintain target altitude as airspeed decays to the stall.

Strive to quickly and smoothly reduce stick back pressure, increase power, and accelerate to 60 kt IAS after the stall.

Establish 30° bank turn to the right and repeat above exercise.

Establish 30° bank turn to the left and repeat above exercise.

Lower flaps to ½ deflection and repeat exercises listed above.

Lower flaps to full deflection and repeat exercises listed above.

9.1.5 STALLS, POWER-ON

Establish full power, wings level climb at 65 kt IAS. Increase nose-up attitude by approximately 15° and maintain that attitude as airspeed decays to the stall.

Stall will be noted by the nose pitching-down abruptly and rolling right or left up to 15°.

While approaching the stall, maintain wings-level using rudder only and keeping the ailerons neutral. Upon stall, release stick back pressure and re-establish wings level climbing flight at target airspeed.

Strive to maintain constant pitch attitude as airspeed decays to the stall. Strive to maintain wings level using only rudder. Strive to quickly and smoothly reduce stick back pressure, accelerating to target climb airspeed after the stall.

Establish 30° bank turn to the right and repeat above exercise.

Establish 30° bank turn to the left and repeat above exercise.

Lower flaps to ½ deflection and repeat exercises listed above.

9.1.6 CRUISE & DESCENT

Re-establish cruise flight and choose heading to landing pattern entry point.

When at appropriate point, reduce power to establish 500 ft/min descent while maintaining a particular airspeed between 100 and 110 kt IAS. Initiation of descent should be selected so as to arrive over the landing pattern entry point at proper traffic pattern altitude and target airspeed.

Strive to maintain airspeed while varying descent rate as little as possible. Strive to make pitch and power adjustments as small and as smooth as possible.

9.1.7 APPROACH & LANDING

Enter the landing pattern at target airspeed and altitude. Maintain traffic pattern altitude and adjust power so as to arrive downwind opposite the target touchdown point at 80 kt IAS and at target altitude. Smoothly reduce power to idle maintaining target altitude until airspeed decays to 65 kt IAS. Lower flaps to ½ deflection and allow airspeed to decay to 55 kt IAS. Maintain target airspeed by allowing altitude to decay.

Choose point for base turn so as to allow for arrival at the target touchdown point while maintaining engine power at idle. Vary descent rate by lowering flaps to full deflection.

Choose point for turn to final so as to allow for ground contact at the target touchdown point at minimum airspeed while maintaining engine power at idle.

Descent rate may be increased by slipping the aircraft.

Descent rate may be decreased by addition of engine power.

Strive to maintain target airspeed until initiating the landing flare. Strive to touchdown at target touchdown point at minimum airspeed without the need to add power or slip the aircraft. Strive to touchdown on runway centerline. Strive to touchdown as smoothly as possible.

Maintain nose-high attitude after touchdown as long as possible after touchdown.

Apply brakes if/as required to stop before the end of the runway or make the next runway turn-off.

Raise flaps and taxi back to parking.

Strive to use the brakes as little as possible while maintaining control using rudder and throttle. Strive to taxi as straight as possible staying as close to the taxiway centerline as possible.

Shut down the engine and aircraft electrical systems, secure the cockpit, and exit the aircraft

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APPENDIX 1

V-SPEED REFERENCE CARD

FLIGHT PHASE	V speed	KIAS
Take-Off & Climb	Vr (Normal)	45
	Vr (Short/Soft)	35/F20
	Vx	60/F20
	Vy	75
	Cruise Climb	85
In-Flight	Va	90
	Vfe	90
	Vs	50
	Vso	46
	Vno	103
	Vne	131
	Vglide (min sink)	59
	Vglide (max dist)	63
Maneuvers	Chandelle/Lazy 8	95
	Steep Turns	95
Approach	Downwind/Base/Final	80/70/60
Landing	Normal	60
	Short	55
	Balked	60/F20

APPENDIX 2

FUEL QUANTITY DIP-TUBE

The pilot should directly measure the amount of fuel in each wing tank by holding a calibrated fuel quantity dip-tube vertically at the center of the fuel cap opening in each wing tank.

Dip-tubes are available for purchase from Vashon Aircraft if original tube has been lost or broken

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