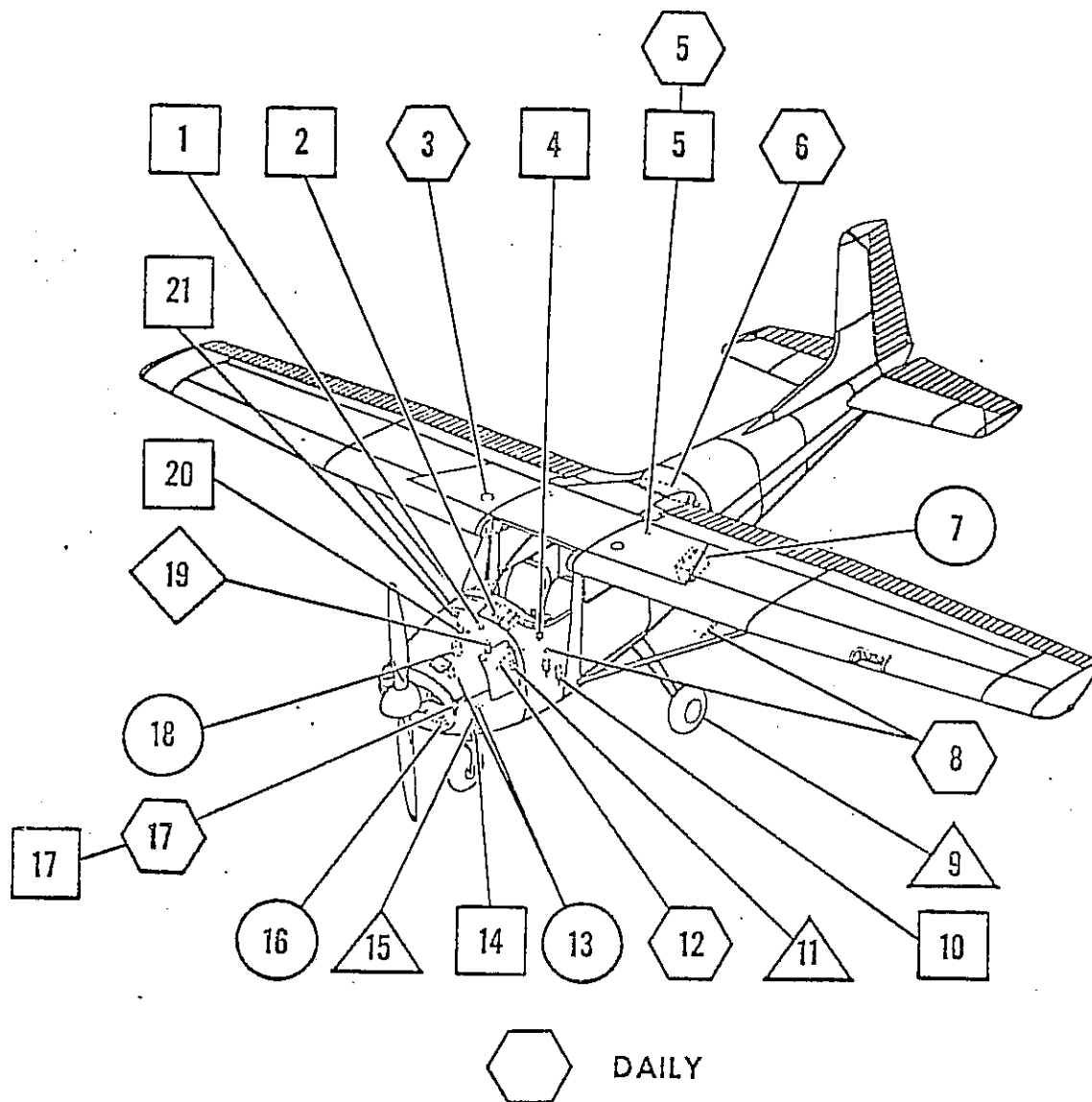


WREN AIRCRAFT CORPORATION
P. O. BOX 4115 MEACHAM FIELD
FORT WORTH, TEXAS 76106

817

WREN 460
INSPECTION MANUAL



3 FUEL TANK FILLERS

Fill after each flight. Keep full to retard condensation. Refer to paragraph 2-14 for details.

5 FUEL TANK SUMP DRAINS

If optional quick-drain valves are installed, drain off any water and sediment before the first flight of the day.

6 OXYGEN CYLINDER

Check for anticipated requirements before each oxygen flight. Refer to paragraphs 2-23 and 2-24 for details.

8 PITOT AND STATIC PORTS

Check for obstructions before first flight of the day.

12 OIL DIPSTICK

Check on preflight. Add oil as necessary. Refer to paragraph 2-16 for details.

SERVICING

Figure 2-4. Servicing and Lubrication - Sheet 1 of 6

17 FUEL STRAINER

Drain off any water and sediment before the first flight of the day.



50 HOURS

7 BATTERY

Check level of electrolyte every 50 hours (or at least every 30 days), oftener in hot weather. Refer to paragraph 2-18 for details.

13 18 ENGINE OIL SYSTEM

Change engine oil and external filter element every 50 hours. If not equipped with external filter, change engine oil and clean oil screen every 25 hours. Reduce these intervals under severe operating conditions. Refer to paragraph 2-16 for details.

16 INDUCTION AIR FILTER

Service every 50 hours, oftener under dusty conditions. Refer to paragraph 2-17 for details.



100 HOURS

1 FUEL/AIR CONTROL UNIT SCREEN

Remove and clean the screen in the bottom of the fuel/air control unit on fuel injection engines, then reinstall and resafety the screen.

2 GYRO INSTRUMENT AIR FILTERS

If not equipped with central air filter, replace every 100 hours and when erratic or sluggish responses are noted with normal suction gage readings. Refer to paragraph 2-17A for details.

4 FUEL LINE DRAIN PLUGS OR VALVES

Remove plugs and drain off any water and sediment. Reinstall and resafety plugs. Some aircraft use drain valves instead of drain plugs.

5 FUEL TANK SUMP DRAINS

If quick-drain valves are not installed, remove plugs and drain off any water and sediment. Reinstall and resafety plugs.

10 BRAKE MASTER CYLINDERS

Check fluid level and refill as required with MIL-H-5606 hydraulic fluid.

14 SHIMMY DAMPENER

Check fluid level and refill as required with MIL-H-5606 hydraulic fluid. Refer to paragraph 2-21 for details.

17 FUEL STRAINER

Disassemble and clean strainer bowl and screen.

SERVICING

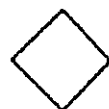
Figure 2-4. Servicing and Lubrication - Sheet 2 of 6

20 VACUUM SYSTEM OIL SEPARATOR

Remove, flush with solvent, and dry with compressed air.

21 SUCTION RELIEF VALVE SCREEN OR FILTER

Check inlet screen or filter for cleanliness. Remove, flush with solvent, and dry with compressed air to clean. On Garwin valves, remove retaining ring to remove screen. On filter-equipped valves, replace garter filter at engine overhaul periods.



500 HOURS

19 VACUUM SYSTEM CENTRAL AIR FILTER

Replace central air filter every 500 hours and when suction gage reading drops below 3.75 inches of mercury. Refer to paragraph 2-17A for details.



AS REQUIRED

9 TIRES

Maintain proper tire inflation as listed in the charts in Section 1. Also refer to paragraph 2-19.

11 GROUND SERVICE RECEPTACLE

Connect to 12-volt, DC, negative-ground power unit for cold weather starting and lengthy ground maintenance of the electrical system. Master switch should be turned on before connecting a generator type external power source; it should be turned off before connecting a battery type external power source. Refer to paragraph 12-14.

CAUTION

Be certain that the polarity of any external power source or batteries is correct (positive to positive and negative to negative). A polarity reversal will result in immediate damage to semiconductors in the airplane's electronic equipment.

15 NOSE GEAR SHOCK STRUT

Keep strut filled and inflate to correct pressure. Refer to paragraph 2-20 for details.

The military specifications listed throughout this book are not mandatory, but are intended as guides in choosing satisfactory materials. Products of most reputable manufacturers meet or exceed these specifications.

SERVICING

FREQUENCY (HOURS)

50

100

500

METHOD OF APPLICATION



HAND

GREASE
GUN

OIL
CAN

SYRINGE
(FOR POWDERED
GRAPHITE)

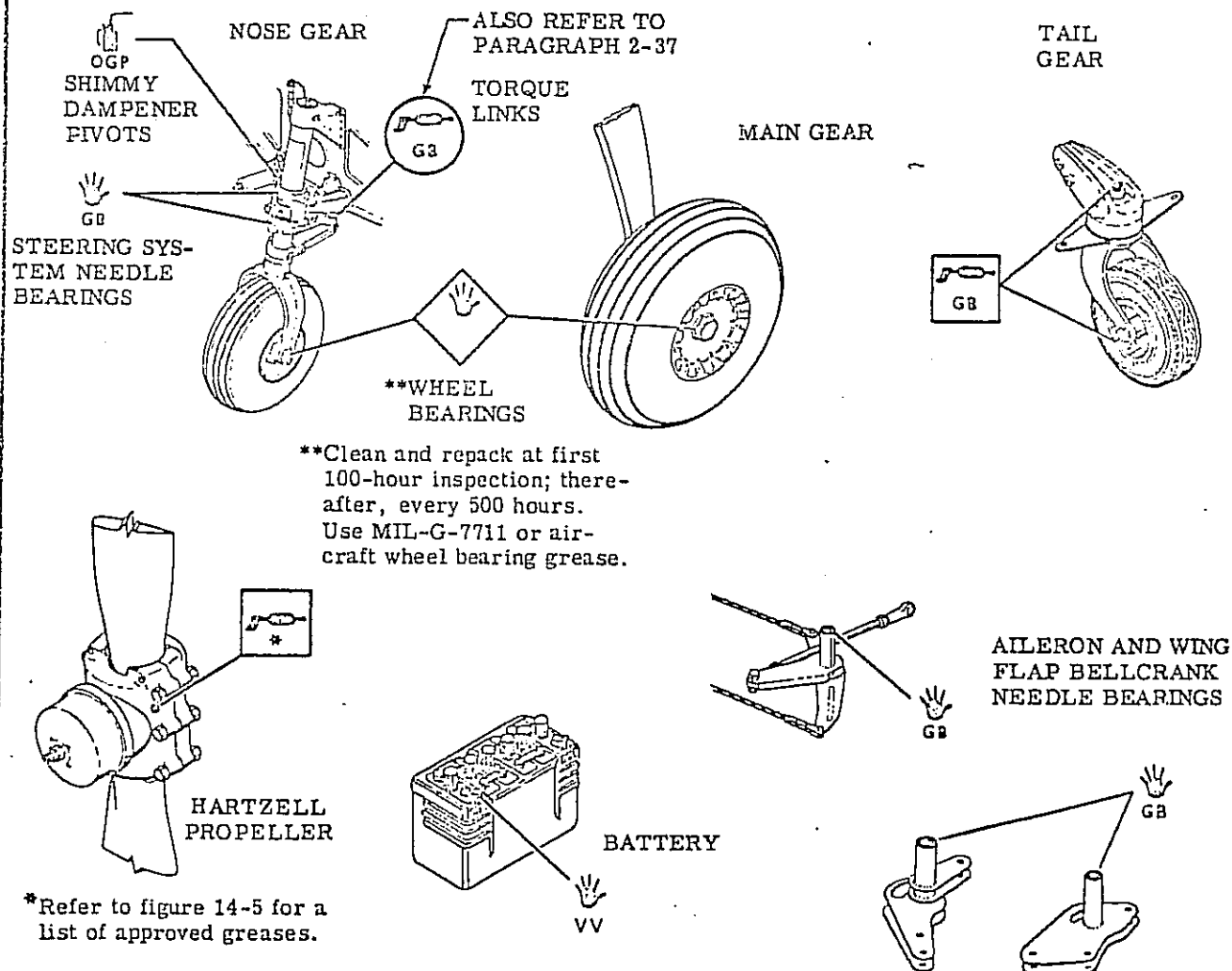
WHERE NO INTERVAL IS SPECIFIED,
LUBRICATE AS REQUIRED AND
WHEN ASSEMBLED OR INSTALLED.

NOTE

The military specifications listed below are not mandatory, but are intended as guides in choosing satisfactory materials. Products of most reputable manufacturers meet or exceed these specifications.

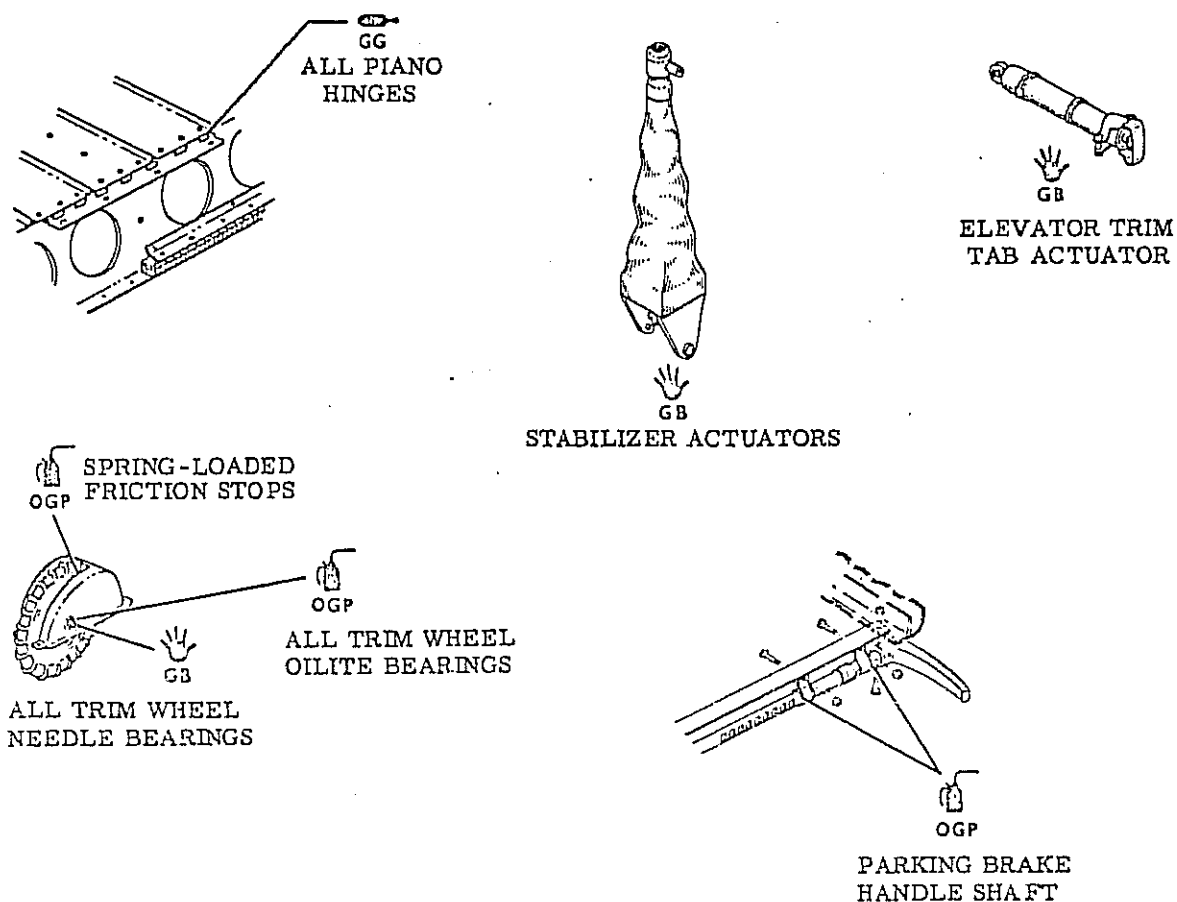
LUBRICANTS

GG — MIL-G-6711 POWDERED GRAPHITE
GB — MIL-G-7711 GENERAL PURPOSE GREASE
OGP — MIL-L-7870 GENERAL PURPOSE OIL
VV — VV-P-236 PETROLATUM



LUBRICATION

Figure 2-4. Servicing and Lubrication - Sheet 4 of 5



NOTES

Sealed bearings require no lubrication.

McCauley propellers are lubricated at overhaul and require no other lubrication.

Do not lubricate roller chains or cables except under seacoast conditions. Wipe with a clean, dry cloth.

Lubricate unsealed pulley bearings, rod ends, Oilite bearings, pivot and hinge points, and any other friction point obviously needing lubrication, with general purpose oil every 1000 hours or oftener if required.

Paraffin wax rubbed on seat rails will ease sliding the seats fore and aft.

Lubricate door latching mechanism with MIL-G-7711 general purpose grease, applied sparingly to friction points, every 1000 hours or oftener if binding occurs. Lubricate door latch striker with an automotive type door latch lubricant as necessary.

LUBRICATION

Figure 2-4. Servicing and Lubrication - Sheet 6 of 6

INSPECTION

To avoid repetition throughout the inspection, general points to be checked are given below. In the inspection, only the items to be checked are listed and details as to how to check, or what to check for, are excluded. The inspection covers several different models. Some items apply only to specific models, and some items are optional equipment that may not be found on a particular airplane.

CHECK AS APPLICABLE:

MOVABLE PARTS for lubrication, servicing, security of attachment, binding, excessive wear, safetying, proper operation, proper adjustment, correct travel, cracked fittings, security of hinges, defective bearings, cleanliness, corrosion, deformation, sealing, and tensions.

FLUID LINES AND HOSES for leaks, cracks, dents, kinks, chafing, proper radius, security, corrosion, deterioration, obstructions, and foreign matter.

METAL PARTS for security of attachment, cracks, metal distortion, broken spotwelds, corrosion, condition of paint, and any other apparent damage.

WIRING for security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration, and corroded terminals.

BOLTS IN CRITICAL AREAS for correct torque in accordance with the torque values given in the chart in Section 1, when installed or when visual inspection indicates the need for a torque check.

FILTERS, SCREENS, AND FLUIDS for cleanliness, contamination and/or replacement at specified intervals. Do not use solvent to clean the "dry" (paper element) induction air filters.

AIRPLANE FILE.

There are miscellaneous data, information, and licenses that are a part of the airplane file. The following is a check list for that file:

To be displayed in the airplane at all times:

1. Aircraft Airworthiness Certificate (Form FAA 1362).
2. Aircraft Registration Certificate (Form FAA 500A).

To be carried in the airplane at all times:

1. Airplane Radio Station License, if transmitter installed (Form FCC 404-2).
2. Weight and Balance Report or latest copy of Repair and Alteration Form (Form FAA-337).
3. Airplane Equipment List.
4. Airplane Log Book.
5. Engine Log Book.

In addition to checking that these documents are up-to-date and in accordance with current Federal Aviation Regulations, check FAA Airworthiness Directives and Cessna Service Letters for compliance at the time specified by them.

ENGINE RUN-UP.

Before beginning the step-by-step inspection, start, run up, and shut down the engine in accordance with instructions in the Owner's Manual. During the run-up, observe the following, making note of any discrepancies or abnormalities:

1. Engine temperatures and pressures.
2. Static rpm.

3. Magneto drop (See Owner's Manual).
4. Engine response to changes in power.
5. Any unusual engine noises.
6. Propeller response (See Owner's Manual).
7. Fuel tank selector and/or shut-off valve; operate engine on each tank position and off position long enough to make sure the valve functions properly.
8. Idling speed and mixture; proper idle cut-off.
9. Generator warning light or ammeter.
10. Suction gage.
11. Fuel flow indicator.

After the inspection has been completed, an engine run-up should again be performed to ascertain that any discrepancies or abnormalities have been corrected.

SCOPE AND PREPARATION.

The 50-hour inspection includes a visual check of the engine, propeller, and aircraft exterior for any apparent damage or defects; an oil and filter element change on aircraft equipped with an external oil filter; and accomplishment of lubrication and servicing requirements. Remove propeller spinner and engine cowling, and replace after the inspection has been completed.

If the airplane is not equipped with an external oil filter, the engine oil should be changed and the oil screen cleaned every 25 hours. Refer to paragraphs 2-16, 2-17, 2-18, and 2-36 for detailed instructions regarding servicing and lubrication requirements in an unusual environment.

The 100-hour (or periodic) inspection includes everything in the 50-hour inspection. Also loosen or remove all fuselage, wing, empennage, and upholstery inspection doors, plates, and fairings as necessary to perform a thorough, searching inspection of the aircraft. Replace after the inspection has been completed.

NOTE

Numbers appearing in the "AS SPECIFIED" column refer to the data listed at the end of the inspection chart.

PROPELLER.

- | | AS SPECIFIED | |
|--------------------------------------|----------------|---------------|
| | EACH 100 HOURS | EACH 50 HOURS |
| 1. Spinner and spinner bulkhead----- | ○ | ○ |
| 2. Blades----- | ○ | ○ |
| 3. Hub ----- | ○ | ○ |
| 4. Lubrication (Hartzell) ----- | ○ | ○ |
| 5. Bolts and/or nuts ----- | ○ | ○ |
| 6. Governor and control----- | ○ | ○ |

ENGINE COMPARTMENT.

Check for evidence of oil and fuel leaks, then clean entire engine and compartment, if needed, prior to inspection.

- | | | |
|--|---|---|
| 1. Engine oil, screen, filler cap, dipstick, drain plug and external filter element----- | ○ | 1 |
| 2. Oil cooler----- | ○ | |
| 3. Induction air filter (Also see paragraph 2-17.)----- | ○ | 2 |

		AS SPECIFIED	
		EACH 100 HOURS	
		EACH 50 HOURS	
4.	Induction airbox, air valves, doors, and controls -----	○	
5.	Cold and hot air hoses-----	○	
6.	Engine baffles -----	○	
7.	Cylinders, rocker box covers, and push rod housings-----	○	
8.	Crankcase, oil pan, reduction gear housing, accessory section, and front crankshaft seal-----	○	
9.	All lines and hoses-----	○	
10.	Intake and exhaust systems (Also see paragraph 12-101.)-----	○	
11.	Ignition harness -----	○	
12.	Spark plugs and compression check-----		○
13.	Crankcase and vacuum system breather lines -----	○	
14.	Electrical wiring -----	○	
15.	Vacuum pump, oil separator, and relief valve -----	○	
16.	Vacuum relief valve screen or filter -----		○ 3
17.	Engine controls and linkage-----	○	
18.	Engine shock mounts, engine mount structure, and ground straps-----	○	
19.	Cabin heater valves, doors, and controls-----	○	
20.	Starter, solenoid, electrical connections, and engagement lever -----	○	
21.	Starter brushes, brush leads, and commutator-----		○ 4
22.	Generator or Alternator, drive belt, pulley, and electrical connections-----	○	
23.	Generator or Alternator brushes, brush leads, and commutator or slip ring -----		○ 4
24.	Voltage regulator mounting and electrical leads -----	○	
25.	Magnetos (externally) and electrical connections -----	○	
26.	Bendix magneto breaker compartment and timing (Also see paragraph 12-77.) -----		○ 5
27.	Slick magneto timing-----		○ 6
28.	Slick magneto breaker compartment (Also see paragraph 12-71.) -----		○ 6
29.	Fuel injection fuel-air control unit, fuel pump, fuel manifold valve, fuel lines, and nozzles -----	○	
30.	Fuel-air control unit screen -----		○

		AS SPECIFIED	
		EACH 100 HOURS	
		EACH 50 HOURS	
31.	Carburetor-----	☐	☐
32.	Firewall-----	☐	☐
33.	Engine cowling -----	☐	☐
34.	Cowl flaps and control-----	☐	☐

FUEL SYSTEM.

1.	Fuel strainer, drain valve, and control -----	☐	☐
2.	Fuel strainer screen and bowl-----	☐	☐
3.	Electric fuel pump, throttle switch, and electric connections -----	☐	☐
4.	Fuel tanks, fuel accumulator tank, fuel lines, drains, filler caps, and placards -----	☐	☐
5.	Drain fuel and check tank interior, attachment, and outlet screens -----	☐	☐
6.	Fuel vents and vent valves -----	☐	☐
7.	Fuel selector and/or shut-off valve and placards -----	☐	☐
8.	Fuel quantity gages and transmitter units-----	☐	☐
9.	Engine primer-----	☐	☐
10.	Vapor return line and check valve -----	☐	☐

LANDING GEAR.

1.	Brake fluid, lines and hoses, linings, disc and clips, brake assemblies, and master cylinders -----	☐	☐
2.	Main gear wheels, wheel bearings, step and spring strut, tires, and fairings -----	☐	☐
3.	Main and nose gear wheel bearing lubrication -----	☐	☐
4.	Torque link lubrication (Also see paragraph 2-36.) -----	☐	☐
5.	Tail gear lubrication, nose gear strut servicing, and shimmy dampener servicing -----	☐	☐
6.	Tailwheel friction check (Also see paragraph 5-60.) -----	☐	☐
7.	Nose gear wheels, wheel bearings, strut, steering system, shimmy dampener, tire, fairing and torque links-----	☐	☐
8.	Tailwheel, tire, wheel bearings, steering, anti-swivel mechanism, tailwheel locking system, cables, and spring tube-----	☐	☐
9.	Parking brake system -----	☐	☐

AIRFRAME.

1. Aircraft exterior -----
2. Aircraft structure -----
3. Windows, windshield, and doors -----
4. Seats, stops, seat rails, upholstery, structure, and seat mounting -----
5. Safety belts and attaching brackets -----
6. Control column bearings, sprockets, pulleys, cables, chains, and turnbuckles -----
7. Control lock, control wheel, and control column mechanism -----
8. Instruments and markings -----
9. Gyro filter and central air filter (Also see paragraph 2-17A.) -----
10. Magnetic compass compensation -----
11. Instrument wiring and plumbing -----
12. Instrument panel, shockmounts, ground straps, cover, and decals and labeling -----
13. Defrosting, heating, and ventilating systems, and controls -----
14. Cabin upholstery, trim, sunvisors, and ash-trays -----
15. Area beneath floor, lines, hoses, wires, and control cables -----
16. Electrical horns, lights, switches, circuit breakers, fuses, and spare fuses -----
17. Exterior lights -----
18. Pitot and static systems -----
19. Stall warning sensing unit, and pitot and stall warning heaters -----
20. Radios and radio controls -----
21. Radio antennas -----
22. Battery, battery box, and battery cables -----
23. Battery electrolyte level (Also see paragraph 2-18.) -----
24. Oxygen system -----
25. Oxygen supply, masks, and hoses -----

CONTROL SYSTEMS.

In addition to the items listed below, always check for correct direction of movement, correct travel, and correct cable tension.

1. Cables, terminals, pulleys, pulley brackets, cable guards, turnbuckles, and fairleads -----

AS SPECIFIED

EACH 100 HOURS

EACH 50 HOURS

10

7

11

2. Chains, terminals, sprockets, and chain guards ----- ○
3. Trim control wheels, indicators, actuator, and bungee ----- ○
4. Travel stops ----- ○
5. All decals and labeling ----- ○
6. Flap control lever latch, flap rollers and tracks, flap position transmitter and linkage, flap position indicator, and flap electric motor and transmission----- ○
7. Elevator downspring system ----- ○
8. Rudder pedal assemblies and linkage----- ○
9. Skin and structure of control surfaces and trim tabs ----- ○
10. Balance weight attachment ----- ○

- 1 Each 25 hours, if not equipped with an external filter.
- 2 Each 300 hours, replace paper element filter.
- 3 Each 1000 hours, or to coincide with engine overhauls, replace garter-type filters.
- 4 Starters and generators each 200 hours; alternators, each 500 hours.
- 5 First 25 hours, each 100-hour inspection thereafter.
- 6 Check timing each 200 hours; check breaker compartment each 500 hours, unless timing is off.
- 7 Each 1000 hours, or to coincide with engine overhauls.
- 8 First 100 hours, each 500 hours thereafter.
- 9 First four 25 hours, each 100 hours thereafter.
- 10 Central filter each 500 hours and gyro filters at overhaul; gyro filters each 100 hours without central filter.
- 11 Anticipated requirements before each oxygen flight.

NOTE

A high-time inspection is merely a 100-hour inspection with the addition of an engine overhaul at the Continental-recommended overhaul periods given below. At the time of engine overhaul, constant-speed propellers, governors, and engine accessories should be overhauled.

O-200	1200 hours
O-300	1200 hours
GO-300	1000 hours
O-470	1200 hours
IO-470	1200 hours

PROCEDURES OF INSPECTION
of
WREN 460 FLYING CONTROL SYSTEM

This set of instructions are for the Mechanic making routine inspection of the Flap and Flite control system of the Wren 460. A separate set of instructions for the rigging of the control system is more elaborate and thorough (it is recommended the mechanic review these instructions to give him the fuller understanding of the system).

1. Inspection of Aileron System

(All the bearings in the aileron system are pre-lubricated sealed bearings that need no additional lubrication. All push rod ends are captive bronze to steel self-aligning type bearings that at each 100 hrs. should receive a few drops of light machine oil.

- a. Center the control (neutral position) wheel and lock with control lock.
- b. At wing Sta. 154 pass a $1/8$ " dia. rod through the aileron rigging holes that allow the $1/8$ " pin to pass through the upper skin, aileron bell crank and lower wing skin. (These pins place the aileron bell crank in its proper position).
- c. Check the Wrens teeth for proper alignment by using a 90° square reading the 90° angle from the upper leading edge skin line to the face of the Wrens teeth. (A tolerance of $1/8$ " either side is allowed). Adjustment is made by changing the length of the idler push rod from aileron bell crank to Wrens teeth gang coupler rod.)
- d. Check cable tension 40# $\pm$ 10.
- e. Visually inspect cables for chaffing and clearance.

2. Inspection of Flap System

- a. Lower flaps until the rigging holes in the flap spar align with the rigging holes in the upper and lower wing skin. Use the right inboard flap spool for key reference point.
- b. A visual check can be made on the other 5 spools by looking through the holes. If light can be seen, the spools are in alignment.

c. Check cable tension.

flap (center fwd.) 140# +0-20 (with flap cracked)

flap (center aft.) 140# +0-20 (with flap cracked)

flap (intr. fwd.) 140# +0-20 (with flap cracked)

flap (outbrd. fwd.) 60# $\pm$ 10 (with flap cracked)

d. All bearings in the flap system are pre-lubricated and sealed. A light application of machine oil should be made to the rod and ball joints.

e. The flap travel is governed by stops within the flap jack screw joint and will require no adjustment.

3. Inspection of ULS

a. All bearings are pre-lubricated and sealed. A light application of machine oil should be made to the push rod ball joint ends at each inspection.

4. Auto-trim system

a. All bearings are pre-lubricated and sealed. The chain over the sprockets should be greased with Mil-G-327, or equal.

b. Check cables to

stop (fwd of sprocket) 50# $\pm$ 10

stop (aft of sprocket) 10# to 15#

c. Check cables for chaffing.

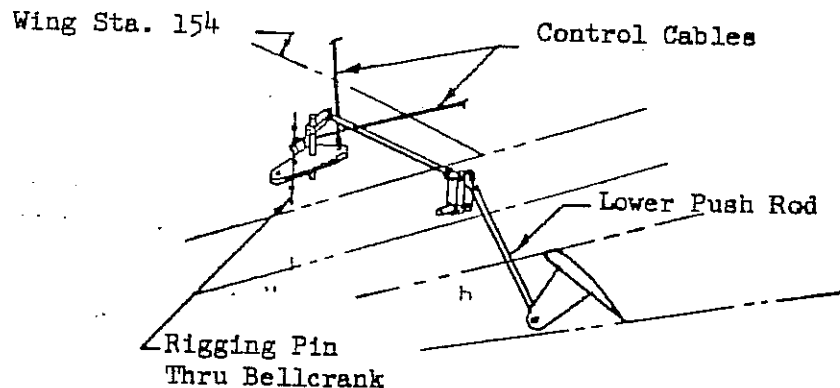
THE WREN 460

RIGGING INSTRUCTIONS

Due to the similarity between the Wren 460 and the Cessna 182 Control Systems the Cessna Service Manual provides much of the information required to perform general maintenance. All other information pertaining specifically to the rigging of the Wren 460 are as follows:

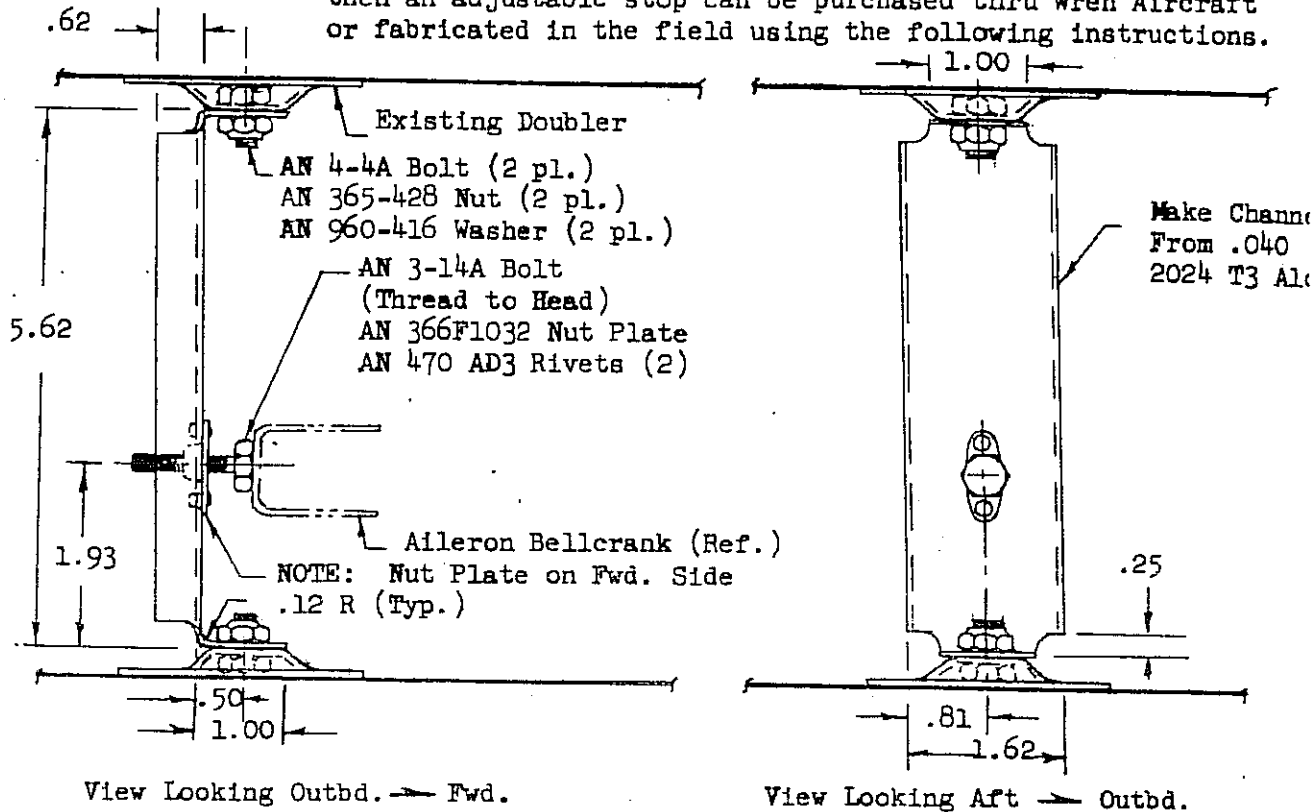
A. Rigging the Aileron Control System

1. On the control column, check that the upper left chain is engaged with the left aileron sprocket as described in the Cessna Service Manual.
2. Tape a bar across both control wheels in the neutral position.
3. Adjust the aileron control cables to align the rigging hole in the aileron bellcrank with the mating rigging holes in both upper and lower wing skins and insert a .125 diameter 10 inch long rigging pin (welding rod is quite suitable). Adjust the aileron control cables to 40 lbs. $\pm$ 10 lbs. and safety with 0.04 inch monel safety wire.



4. With a pin thru the aileron bellcrank rigging hole and the control wheel still taped in the neutral position adjust the lower aileron push rod as required to align the trailing edge of the aileron with the trailing edge of the inboard flap in the full up position $\pm .25$ inch but with both ailerons symmetrical with the flaps.
5. Remove the rigging pins and untape the bar from the control wheels. Operate the ailerons with the control wheel and check freedom of movement. With the use of an inclinometer or bubble protractor check aileron travel, 14° down 1° and 18° up 1° . (Operate the ailerons with the control wheel holding them hard against the stops.)

NOTE: On Wren S/N 1-460182G thru 19-460182G the aileron stops have been preset at the factory and no adjustment is provided. If due to damage or nature of a repair the proper aileron travel cannot be obtained then an adjustable stop can be purchased thru Wren Aircraft or fabricated in the field using the following instructions.



B. Rigging the Wrens Teeth

The Wrens teeth act as drag plates to equalize the drag induced by the opposite aileron when it is deflected down. These drag plates are interconnected with the aileron system at the aileron pivot assembly with an adjustable push rod. After the aileron has been properly rigged in accordance with the aileron rigging instructions adjust the Wrens teeth push rod so that the plates 'trail' when the aileron is in 'trail'. The drag plates 'trail' position can be determined by holding a square to the upper wing skin splice on the forward spar. If for some reason a drag plate does not trail with the others this can be corrected by removing the fairing cup and shimming under the drag plate on the forward or aft attach screws.

If the aileron is rigged properly, the drag plates will deflect outboard 60° with the opposite aileron deflected full down.

C. Wing Heaviness

The procedure outlined in Cessna Service Manual to correct wing heaviness is not as effective on the Wren 460 as trimming the

trailing edge of the aileron as described below.

1. Right wing heaviness -- in straight and level flight with the turn and bank ball centered using a power setting of 24 inches of manifold pressure and 2400 RPM with "hands off" on the control wheel the aircraft will start a right descending turn, the rate of this turn will determine the amount of correction required.

Using sheet metal pliers or standard pliers with two 2 inch metal strips turn the left aileron trailing edge down $1/16$ inch (full span) per 1 minute rate of turn.

2. Left wing heaviness -- repeat the above procedure but applied to the right aileron.

D. Rigging the Flap System

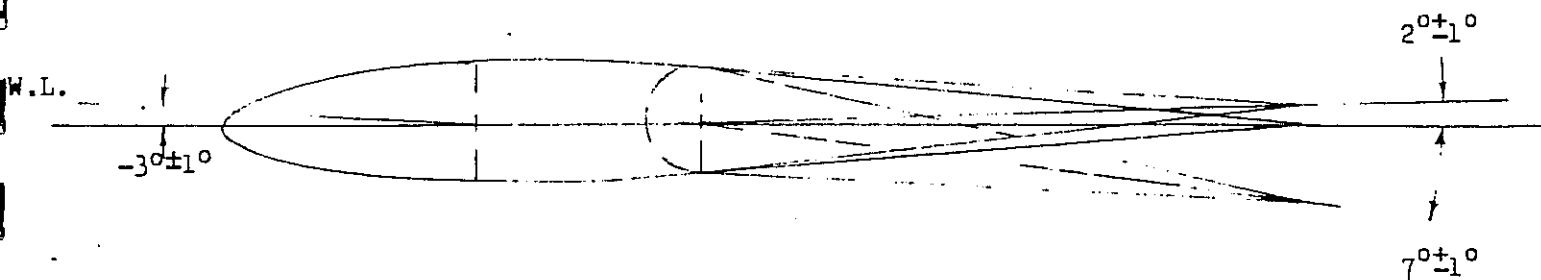
Rigging pin holes have been incorporated in the design of the Wren 460 being effective on Wren S/N 6-460182G and up. These holes are through the outer periphery of the flap cable spools and through the upper and lower wing skin. The procedures for adjustment are as follows:

1. With the inboard flaps disconnected from the inboard flap push rod insert a .125 diameter pin 10 inches long (welding rod is quite suitable) through the inboard right hand flap spool (flap motor attach spool). Adjust the flap cable-turn-barrels in the cabin to align the rigging pin holes on the inboard left hand flap spool and insert another rigging pin.
2. With the outboard flaps disconnected from the outboard flap push rods, adjust the intermediate flap cables (both sides) to align the intermediate flap spools rigging pin holes and insert a rigging pin in each.
3. Adjust the outboard flap cables (both sides) to align the outboard flap spools rigging pin holes and insert a rigging pin in each.
4. With all of the rigging pins in place adjust the flap cable tension being careful not to bend rigging pins out of alignment by applying too much tension to the forward or the aft cable. With a cable tensionometer set the inboard flap cables at 140 lbs. +0 -20 lbs. intermediate cables (both sides) at 140 lbs. +0 -20 lbs., outboard cables at 60 lbs. 10 lbs. Safety all flap cable turnbarrels with 0.04 inch monel safety wire.
5. Remove all rigging pins and run the flap motor to the up position.
6. Manually raise the flaps to the up position and mark the location of the flap attach bracket hole on the cove skin. Return the flaps to the down position and adjust the flap push rods to align with the mark on the cove skin. Connect the push rods to the flaps (the flap push rods are easier to attach in the 10° to 15° down-flap setting).

7. After the flap push rods have been temporarily installed operate the flaps to see if the push rod adjustment is sufficient to raise the flaps to the full up position without dragging down the flap motor (the flap motor should free wheel in the up position for a short period of time without throwing the circuit breaker).
8. After this final adjustment is made, tighten all check nuts and attach bolts. It is recommended to torque-paint all check nuts and attach bolts.
9. With an inclinometer or bubble protractor check the flap travel $30^{\circ} \pm 1^{\circ}$. If the travel is not in tolerance then an inspection of all flap spools, flap cables and attach fittings is recommended. If no damage is found or due to the nature of a repair the flap travel tolerance cannot be held then disregard the rigging pin holes described in Items 1 thru 5 and shorten all forward cables with the use of a shorter turnbarrel and lengthen all aft cables with the use of a long turnbarrel if the travel is greater than 30° . Reverse this procedure of rigging if the travel is less than 29° . This latter method of rigging is to be used on Wren S/N 1-460182G thru 5-460182G.

E. Rigging the U.L.S. Nose Control System

The nose control system is a positive mechanical linkage designed to give the required travels when the control surface is in the trail position with the elevator. If for some reason this system is out of adjustment due to damage or the nature of a repair the travels can be varied slightly by lengthening or shortening the control push rods. It is suggested that this be done by a trial and error method as it is difficult to recommend adjusting procedures without knowing the nature of the damage. The nose control travels are as shown in the figure below.



U.L.S. Nose Control System Travels and Tolerances

F. Rigging the Elevator and Elevator Trim Tab

The elevator control system and travel stops are not altered by the Wren design and should be rigged in accordance with the procedures outlined in the Cessna Service Manual.

The elevator trim tab travel is changed by the Wren design but adjustment to the stops are the same as described in the Cessna Service Manual. The Wren trim tab travels are 18° down 1° and 17° up 1° for S/N 1-460182H thru 19-460182G. Trim tab travel for S/N 20-460182H and up are 21° down 1° and 21° up 1° . If the trim tab cannot be adjusted to the full travel before the chain on the trim tab cockpit control wheel comes against the sprocket it will be necessary to loosen the trim tab control cable and reposition the chain on the sprocket to provide more travel.

G. Rigging the Rudder

The rudder system is not altered by the Wren design and the rigging instruction described in the Cessna Service Manual should be followed.

H. Balancing Control Surfaces

The elevator and rudder should be balanced in accordance with the Cessna Service Manual.

The aileron is manufactured with a slight over balance to accommodate painted surfaces. If the aileron requires rebalancing due to a repair or excessive painting, remove the aileron from the aircraft and install one inch long bolts through the aileron pivot brackets snugging nuts up against bearings. Place aileron on two knife edges resting on the two one inch bolts. Add steel or lead washers under the counterbalance lead attach bolts located on the outboard end of the aileron until the aileron balances on the knife edges.

PERFORMANCE - SPECIFICATIONS

WREN 460

GROSS WEIGHT: 2800 lbs

Speed: 161 mph
 153 mph

. 658 mi
 4.3 hrs
 153 mph
 872 mi
 5.0 hrs
 153 mph
 874 mi
 7.6 hrs
 115 mph
 1150 mi
 10.0 hrs
 115 mph
 1080 fpm

. 19,200 ft

. 300 ft
 605 ft

. 200 ft
 612 ft

EMPTY WEIGHT: Approximate 1690 lbs

BAGGAGE: 120 lbs

WING LOADING: Pounds/Sq Foot 16.1 lbs

POWER LOADING: Pounds/HP 12.2 lbs

FUEL CAPACITY: Total
 Standard Tanks 65 gal
 Optional Long Range Tanks 84 gal

OIL CAPACITY: Total. 12 qts

PROPELLER: Constant Speed, Dia 82 inches

POWER: Continental Engine, O-470-R
 230 rated HP at 2600 RPM

W E L C O M E

Welcome to ownership of the Wren 460 -- the Acre Airport Airplane.

Welcome to the group of airplane owners for whom an ordinary airplane just doesn't have enough utility.

You now own one of the finest, most forgiving airplanes in the world, an airplane that easily gets in and out of smaller patches than can an ordinary airplane being flown at maximum performance.

You'll like your new Wren 460. It will give you a sense of ease of handling, positive control, and peace of mind that you've seldom if ever had in an ordinary airplane.

In simple words, the Wren 460 is no ordinary airplane. You will come to enjoy and depend upon its out-of-the-ordinary performance ability.

A Word of Caution . . .

No form of transportation is completely safe. As long as humans control and operate airplanes, risk is bound to be involved.

The Wren 460 is a step forward in airplane safety, but don't let its forgiving nature breed carelessness. Remember, the Wren is still an airplane. Become acquainted with its remarkable abilities one step at a time.

When the chips are down, the Wren will give you really unusual performance. We suggest that you work up to this ultimate performance in easy stages. Right at the start the Wren 460 will get off shorter, fly slower, land shorter than you've ever before experienced in a plane of its size and weight class -- and do it without effort. But, there's more available when you come to know your Wren better.

The Wren 460 gives you the opportunity to use landing patches where no airplane ever dared to go before, BUT, for this very reason, hazards are not marked as they are around conventional airports. USE CAUTION, inspect the area from the ground first -- noting fences, wires, surface conditions,

This is just a word of warning, because it all seems so easy in a Wren that a pilot may be lulled into carelessness. Don't let it happen to you. You are a valued customer, we want to keep you that way.

SERVICE . . .

The basic airframe of your Wren 460 is a strong, reliable, dependable Cessna 182. It is delivered to you as new as if you had purchased it from a Cessna dealer.

We recommend that in your travels you look to Cessna dealers for any service or repairs that you may need.

A GUIDE TO COST OF OPERATION

	<u>Per Year</u>	<u>Per Hour</u>	<u>Per Hour</u>	<u>Per Hour</u>
Flight Hours per Year		300	500	700
Flight Miles per Year (152 m.p.h.) . . .		45,600	76,000	106,400
Gasoline: 13.9 gal./hr. @ 40¢/gal. . . .		\$ 5.56	\$ 5.56	\$ 5.56
Oil: 1 pt./hr. plus oil change every 25 hrs (12 qts. per change) @ 50¢/qt. . . .		\$.49	\$.49	\$.49
Airplane & Engine Maintenance		\$ 1.75	\$ 1.75	\$ 1.75
TOTAL OPERATIONAL COSTS (listed above). .		\$ 7.80	\$ 7.80	\$ 7.80
Reserve for Engine Overhaul.		\$ 1.75	\$ 1.75	\$ 1.75
Storage: at \$40 per month	\$480.00	\$ 1.60	\$.96	\$.69
Insurance (a guide for the following coverage):				
All risks hull coverage (Deductibles: In motion \$250.-- Not in motion \$ 50) (1st yr.--less in subsequent yrs.)	\$564.00			
Liability Coverage (Single limit \$250,000 policy)	\$124.00			
TOTAL INSURANCE (Industrial private business & pleasure use by a qualified pilot)	\$688.00	\$ 2.29	\$ 1.38	\$.98
COST PER HOUR		\$13.44	\$11.89	\$11.12
COST PER MILE cruise at 75% power, 152 m.p.h. . .		\$.086	\$.076	\$.072

For Depreciation: Consult your tax authority. To estimate the per hour or per mile cost, divide annual depreciation amount by annual hours or miles.

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EXTERIOR
INSPECTION
DIAGRAM

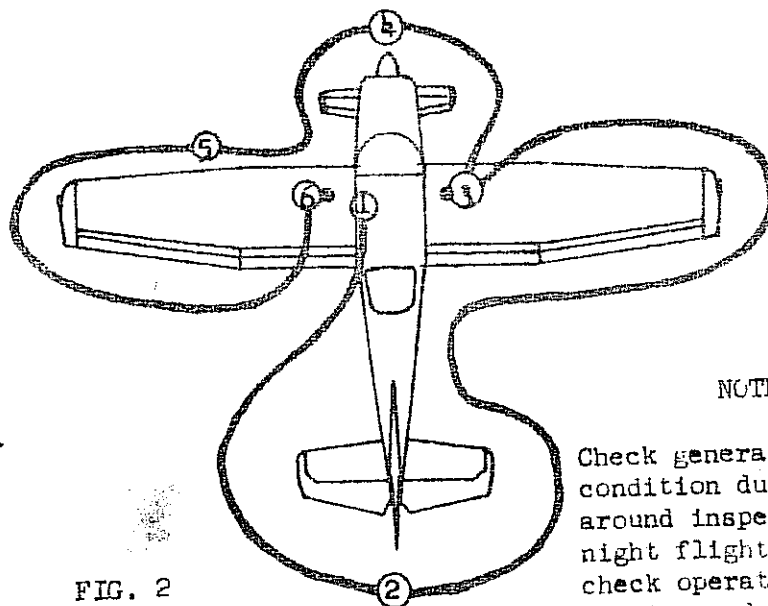


FIG. 2

NOTE

Check general aircraft condition during walk-around inspection. If night flight is planned, check operation of all lights, and make sure a flashlight is available.

- ①
 - a. Turn on master switch and check fuel quantity indicators; then turn master switch off.
 - b. Check ignition switch "OFF."
 - c. Check fuel tank selector valve on "BOTH ON."
 - d. On first flight of day and after each refueling, pull out strainer drain knob for about four seconds, to clear fuel strainer of possible water and sediment.
 - e. Remove control wheel lock.
 - f. Check baggage door for security.
- ②
 - a. Remove rudder gust lock, if installed.
 - b. Disconnect tail tie-down.
- ③
 - a. Check main wheel tire for proper inflation.
 - b. Inspect airspeed static source hole on side of fuselage for stoppage.
 - c. Disconnect wing tie-down.
- ④
 - a. Check propeller and spinner for nicks and security, and propeller for oil leaks.
 - b. Make visual check to insure that drain valve is closed after draining operation.
 - c. Check nose wheel strut and tire for proper inflation.
 - d. Disconnect nose tie-down.
 - e. Check carburetor air filter for restrictions by dust or other foreign matter.
 - f. Check oil level. Do not operate with less than nine quarts. Fill for extended flight.
- ⑤
 - a. Remove pitot tube cover, if installed, and check pitot tube opening for stoppage.
 - b. Check fuel tank vent opening for stoppage.
- ⑥
 - a. Same as ③

SECTION I

OPERATING CHECK LIST

This section is not a full check list form, but it does cover briefly all of the points that you should know for a typical flight.

The flight and operational characteristics of your airplane are normal in all respects. There are no "unconventional" characteristics or operations that need to be mastered. All controls respond in a normal way within the entire range of operation. All airspeeds mentioned are indicated airspeeds.

BEFORE ENTERING THE AIRPLANE ...

- (1) Make an exterior inspection in accordance with the drawing on the previous page.

BEFORE STARTING THE ENGINE ...

- (1) Seats and Seat Belts -- adjust and lock
- (2) Flight Controls -- check all controls for full travel
- (3) Brakes -- test and set
- (4) Master Switch -- "ON" *[Handwritten: (check master battery)]*
- (5) Cowl Flaps -- "OPEN" (Move lever to left, out of locking hole, to reposition.)
- (6) Elevator and Rudder Trim -- "TAKE-OFF" setting
- (7) Fuel Selector Valve -- "BOTH ON"
- (8) Turn all radio switches "OFF"

STARTING ENGINE ...

- (1) Carburetor Heat -- cold
- (2) Mixture -- rich
- (3) Propeller -- high RPM
- (4) Throttle -- cracked (one-half inch)
- (5) Primer -- as required
- (6) Ignition Switch -- "START" Hold until engine fires, but not longer than 30 seconds.
- (7) Ignition Switch -- release to "BOTH" (Immediately after engine fires)

NOTE

If engine has been overprimed, start with throttle open $1/4$ to $1/2$ full open. Reduce throttle to idle when engine fires.

NOTE

After starting, check for oil pressure indication within 30 seconds in normal temperatures and 60 seconds in cold temperatures. If no indication appears, shut off engine and investigate.

BEFORE TAKE-OFF ...

- (1) Throttle Setting -- 1700 RPM
- (2) Engine Instruments -- Check
- (3) Carburetor Heat -- check operation, then set to cold unless icing conditions prevail.
- (4) Ammeter -- check.
- (5) Suction Gage or Gyro Horizon Vacuum Warning Lights -- check. (4.5 inches of mercury desired, 3.75 to 5.0 acceptable; high and low suction warning lights out).
- (6) Magnetos -- check (50 RPM maximum differential between magnetos).
- (7) Propeller - cycle from high to low RPM; return to high RPM (full in). *28 in. vac. 3-4 sec. after pitch*
- (8) Flight Controls -- recheck.
- (9) Wing Flaps -- check operation and set 0° to 30°.
- (10) Cowl Flaps -- full "OPEN".
- (11) Elevator and Rudder Trim -- recheck "TAKE-OFF" setting.
- (12) Cabin Doors - closed and locked.
- (13) Flight Instruments and Radios -- set.

TAKE-OFF ...

Normal Take-off:

- (1) Wing Flaps -- up.
- (2) Carburetor Heat -- cold.
- (3) Power -- Full throttle and 2600 RPM.
- (4) Elevator Control -- raise nosewheel at 60 mph.
- (5) Climb Speed -- 90 MPH until all obstacles are cleared, then set up climb speed as shown in "NORMAL CLIMB" paragraph.

Maximum Performance Take-off:

- (1) Wing Flaps -- 30°.
- (2) Carburetor Heat -- cold.
- (3) Brakes -- apply.
- (4) Power -- Full throttle and 2600 RPM.
- (5) Brakes -- release.
- (6) Elevator Control -- maintain slightly tail-low attitude. *35 mph nose wheel*
- (7) Climb Speed -- 60 MPH until all obstacles are cleared, then set up climb speed as shown in "MAXIMUM PERFORMANCE CLIMB".
- (8) Wing Flaps -- up after obstacles are cleared.

CLIMB ...

Normal Climb:

- (1) Air Speed -- 100 to 120 MPH.
- (2) Power -- 23 inches and 2450 RPM.
- (3) Mixture -- full rich (unless engine is rough due to excessively rich mixture).
- (4) Cowl Flaps -- "OPEN" as required.

Maximum Performance Climb:

- (1) Air Speed -- 88 MPH (sea level) to 94 MPH (10,000 feet).
- (2) Power -- full throttle and 2600 RPM.

- (3) Mixture -- full rich (unless engine is rough).
- (4) Cowl Flaps -- full "OPEN"

CRUISING ...

- (1) Engine Power -- 15 to 23 inches of manifold pressure and 2200-2450 RPM
- (2) Cowl Flaps -- open as required
- (3) Elevator and Rudder Trim -- adjust
- (4) Mixture -- lean

LET-DOWN ...

- (1) Mixture -- rich
- (2) Power -- as desired
- (3) Carburetor Heat -- apply (if icing conditions exist)

BEFORE LANDING ...

- (1) Fuel Selector Valve -- "BOTH ON"
- (2) Mixture -- rich
- (3) Propeller -- high RPM
- (4) Cowl Flaps -- closed
- (5) Carburetor Heat -- apply before closing throttle
- (6) Airspeed -- 80 to 90 MPH (flaps retracted)
- (7) Wing Flaps -- 0° to 30° (below 95 mph)
- (8) Airspeed -- 50 to 80 MPH (flaps extended)
- (9) Elevator and Rudder Trim -- adjust

NORMAL LANDING ...

- (1) Landing Technique -- conventional for all flap settings.
Level out (flaps out) closer to runway & flaps down,

AFTER LANDING ...

- (1) Wing Flaps -- retract
- (2) Cowl Flaps -- "OPEN"
- (3) Carburetor Heat -- cold

SECURE AIRCRAFT

- (1) Mixture -- idle cut-off (pulled full out)

NOTE: Do not open throttle as engine stops since this actuates the accelerator pump.

- (2) All Switches -- off
- (3) Brakes -- set
- (4) Control Lock -- Installed

SECTION II

DESCRIPTION AND OPERATING DETAILS

The following paragraphs describe the systems and equipment whose function and operation is not obvious when sitting in the airplane. This section also covers in somewhat greater detail some of the items listed in the Check List form that require further explanation.

FUEL SYSTEM ...

Fuel is supplied to the engine from two tanks, one in each wing. The total usable fuel, in all flight conditions, is 60 gallons for standard tanks and 79 gallons for optional long range tanks.

NOTE

Unusable fuel is at a minimum due to the design of the fuel system. However, with 1/4 tank or less, prolonged uncoordinated flight such as slips or skids can uncover the fuel tank outlets, causing fuel starvation and engine stoppage when operating on a single tank. Therefore, to avoid this problem with low fuel reserves, the fuel selector should be set at "BOTH ON" position.

Fuel from each wing tank flows by gravity to a selector valve. Depending upon the setting of the selector valve, fuel from the left, right, or both tanks flows through a fuel strainer and carburetor to the engine induction system.

NOTE

Take off with the fuel selector valve handle in the "BOTH ON" position to prevent inadvertent take-off on an empty tank. However, when the selector is in the "BOTH ON" position, unequal fuel flow from each tank may occur after extended flight if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the tank in the "heavy" wing. The recommended cruise fuel management procedure for extended flight is to use the left and right tank alternately.

ELECTRICAL SYSTEM ...

Electrical energy is supplied by a 14-volt, direct-current system powered by an engine-driven generator. The 12-volt battery is located aft of the rear baggage compartment wall.

Circuit Breakers:

All electrical circuits in the airplane, except the clock circuit, are protected by circuit breakers. The clock has a separate fuse mounted adjacent to the battery. The stall warning transmitter and horn circuit, the optional gyro horizon tests lights circuit and the optional turn-and-bank indicator circuit are protected by a single automatically resetting circuit breaker mounted behind the instrument panel. The cigar lighter is protected by a manually reset type circuit breaker mounted directly on the back of the lighter behind the instrument panel. The remaining circuits are protected by "push-to-reset" circuit breakers on the instrument panel.

Rotating Beacon:

The optional rotating beacon should not be used when flying through clouds or overcast; the moving beams reflected from water droplets or particles in the atmosphere, particularly at night, can produce vertigo and loss of orientation.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM ...

The temperature and volume of airflow into the cabin can be regulated to any degree desired by manipulation of the push-pull "CABIN HEAT" and "CABIN AIR" knobs. Both control knobs are the double-button type with friction locks to permit intermediate settings.

NOTE

Always pull out the "CABIN AIR" knob slightly when the "CABIN HEAT" knob is out. This action increases the airflow through the system, increasing efficiency, and blends cool outside air with the exhaust manifold heated air, thus eliminating the possibility of overheating the system ducting.

Front cabin heat and ventilating air is supplied by outlet holes spaced across a cabin manifold just forward of the pilot's and copilot's feet. Rear cabin heat and air is supplied by two ducts from the manifold, one extending down each side of the cabin. Windshield defrost air is also supplied by a duct leading from the cabin manifold.

Separate ventilators supply additional air; one near each upper corner of the windshield supplies air for the pilot and copilot, and two ball and socket ventilators in the ceiling of the rear cabin supply air to the rear seat passengers.

STARTING ENGINE ...

Ordinarily the engine starts easily with one or two strokes of the primer in warm temperatures to six strokes in cold weather

3/4-1" - reverse pitch prop.

with the throttle open $\frac{1}{4}$ inch. In extremely cold temperatures it may be necessary to continue priming while cranking. Weak intermittent explosions followed by puffs of black smoke from the exhaust stack indicate overpriming or flooding. Excess fuel can be cleared from the combustion chambers by the following procedure: Set the mixture control full lean and the throttle full open; then crank the engine through several revolutions with the starter. Repeat the starting procedure without any additional priming.

If the engine is underprimed (most likely in cold weather with a cold engine) it will not fire at all. Additional priming will be necessary for the next starting attempt.

As soon as the cylinders begin to fire, open the throttle slightly to keep it running. *idle 1000 rpm.*

If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the armature.

TAXIING ...

The carburetor air heat knob should be pushed full in during all ground operations unless heat is absolutely necessary for smooth engine operation. When the knob is pulled out to the heat position, air entering the engine is not filtered.

Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips.

BEFORE TAKE-OFF ...

Since the engine is closely cowled for efficient in-flight cooling, precautions should be taken to avoid overheating on the ground. Full throttle checks on the ground are not recommended unless the pilot has good reason to suspect that the engine is not turning up properly.

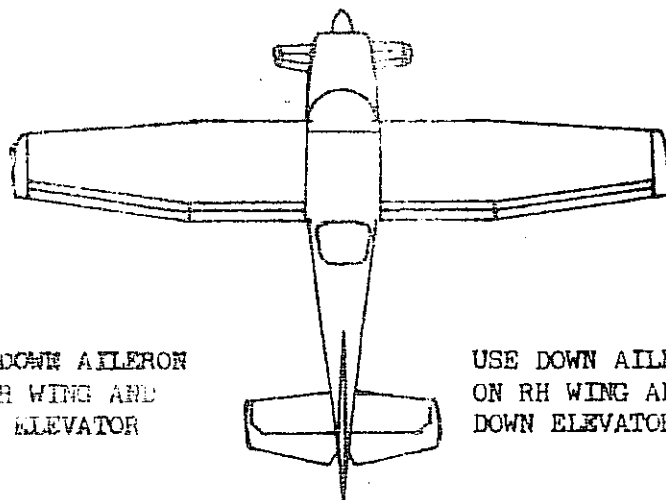
The magneto check should be made at 1700 RPM with the propeller in flat pitch as follows: Move the ignition switch first to "R" position and note RPM. Then move switch back to "BOTH" position to clear the other set of plugs. Then move switch to "L" position and note RPM. The difference between the two magnetos operated singly should not be more than 50 RPM. If there is a doubt concerning the operation of the ignition system, RPM checks at a higher engine speed will usually confirm whether a deficiency exists.

An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system or should be cause for suspicion that the magneto timing has been "bumped-up" and is set in advance of the setting specified.

TAXIING POSITION

USE UP AILERON ON
LH WING AND
NEUTRAL ELEVATOR

USE UP AILERON ON
RH WING AND
NEUTRAL ELEVATOR



USE DOWN AILERON
ON LH WING AND
DOWN ELEVATOR

USE DOWN AILERON
ON RH WING AND
DOWN ELEVATOR

WIND DIRECTION

NOTE

Strong quartering tail winds require caution. Avoid sudden bursts of the throttle and sharp braking when the airplane is in this attitude. Use the steerable nose wheel and rudder to maintain direction.

TAKE-OFF ...

It is important to check full-throttle engine operation early in the take-off run. Any signs of rough engine operation or sluggish engine acceleration is good cause for discontinuing the take-off.

Full throttle run-ups over loose gravel are especially harmful to propeller tips. When take-offs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it.

Most engine wear occurs from improper operation before the engine is up to normal operating temperatures, and operating at high powers and RPMs. For this reason the use of maximum power for take-off should be limited to that absolutely necessary for safety. Whenever possible, reduce take-off power to normal climb power.

Normal take-offs are accomplished with wing flaps up, cowl flaps open, full throttle, and 2600 RPM. Reduce power to 23 inches of manifold pressure and 2450 RPM as soon as practical to minimize engine wear.

Using 30° wing flaps reduces the ground run and total distance over the obstacle by approximately 30 per cent. Soft field take-offs are performed with 30° flaps by lifting the airplane off the ground as soon as practical in a slightly tail-low attitude. However, the airplane should be leveled off immediately to accelerate to a safe climb speed.

If 30° wing flaps are used for take-off, they should be left down until all obstacles are cleared. To clear an obstacle with wing flaps 30 degrees, the best angle-of-climb speed (59 mph, IAS) should be used. If no obstructions are ahead, a best "flaps up" rate-of-climb speed (91 MPH, IAS) would be most efficient. These speeds vary slightly with altitude, but they are close enough for average field elevations.

Take-offs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after take-off. The airplane is accelerated to a speed slightly higher than normal, then pulled off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

CLIMB ...

A cruising climb at 23 inches of manifold pressure, 2450 RPM (approximately 75% power) and 100 to 120 MPH is recommended to save time and fuel for the overall trip. In addition, this type of climb provides better engine cooling, less engine wear, and more passenger comfort due to lower noise level.

If it is necessary to climb rapidly to clear mountains or reach favorable winds at high altitudes, the best rate-of-climb speed should

SPINS ...

Intentional spins are prohibited in this airplane. Should an inadvertent spin occur, standard light plane recovery techniques should be used.

LANDING ...

Landings are usually made on the main wheels first to reduce the landing speed and the subsequent need for braking in the landing roll. The nosewheel is lowered gently to the runway after the speed has diminished to avoid unnecessary nose gear load. This procedure is especially important in rough field landings.

For short field landings, make a power off approach at 50 MPH, IAS with 30° flaps and land on the main wheels first. Immediately after touchdown, lower the nose gear to the ground, retract the flaps and apply heavy braking as required. For maximum brake effectiveness after all three wheels are on the ground, hold full nose up elevator and apply maximum possible brake pressure without sliding the tires.

SECTION III

OPERATING LIMITATIONS

OPERATIONS AUTHORIZED ...

Your Wren with standard equipment, as certificated under FAA Type Certificate No. 3A13 and Supplemental Type Certificate No. ~~44-111~~ SA485SW is approved for day and night operation under VFR.

MANEUVERS -- NORMAL CATEGORY ...

The airplane exceeds the requirements for airworthiness of the Civil Air Regulations, Part 3, set forth by the United States Government. Spins and aerobatic maneuvers are not permitted in normal category airplanes in compliance with these regulations. In connection with the foregoing, the following gross weight and flight load factors apply:

Maximum Gross Weight	2800 lbs.
Flight Load Factor Flaps Up.	+3.8 -1.52
Flight Load Factor Flaps Down.	+2.0

Your airplane must be operated in accordance with all FAA approved markings, placards and check lists in the airplane. If there is any information in this section which contradicts the FAA approved markings, placards, and check lists, it is to be disregarded.

AIRSPEED LIMITATIONS ...

The following are the certificated calibrated airspeed limits for your Wren:

Never Exceed (Glide or dive, smooth air)	193 MPH (red line)
Caution Range.	160-193 MPH (yellow arc)
Maximum Structural Cruising Speed.	160 MPH
(Level flight or climb)	
Normal Operation Range	160 MPH (green arc)
Maximum Speed Flaps Extended	95 MPH
Flap Operation Range	52-95 MPH (white arc)
Maneuvering Speed*	118.9 MPH

*The maximum speed at which abrupt control travel can be used without exceeding the design load factor

ENGINE OPERATION LIMITATIONS ...

Power and Speed.	230 BHP at 2600 RPM
--------------------------	---------------------

ENGINE INSTRUMENT MARKINGS ...

Oil Temperature Gage:

Normal Operating Range green arc
Do not Exceed. 225° F (red line)

Oil Pressure Gage:

Idling Pressure. 10 psi (red line)
Normal Operating Range 30-60 psi (green arc)
Maximum Pressure 100 psi (red line)

Manifold Pressure Gage:

Normal Operating Range 18-23 in. Hg (green arc)

Cylinder Head Temperature Gage:

Normal Operating Range 300-460°F (green arc)
Do not Exceed. 460°F (red line)

Tachometer:

Normal Operating Range 2200-2450 RPM (green arc)
Cautionary Range 2450-2600 RPM
Do not Exceed (Engine rated speed) 2600 RPM (red line)

Carburetor Air Temperature Gage:

Under possible icing conditions:

Normal Operating Range. 5° to 20°C (green arc)
Cautionary Range. 0° to 5°C (yellow arc)
Icing Range -20° to 0°C (red arc)

Fuel Quantity Indicators:

Empty. E (red line)

WEIGHT AND BALANCE ...

The following information will enable you to operate your Wren within the prescribed weight and center of gravity limitations. To figure the weight and balance for your particular airplane, use the Sample Problem, Loading Graph, and Center of Gravity Moment Envelope, as follows:

Take the licensed Empty Weight and Moment/1000 from the Weight and Balance Data Sheet, plus any changes noted on forms FAA-337 carried in your airplane, and write them down in the proper columns. Using the Loading Graph, determine the moment/1000 of each item to be carried. Total the weights and moments/1000 and use the Center of Gravity Moment Envelope to determine whether the point falls within the envelope, and if the loading is acceptable.

SAMPLE LOADING PROBLEM

	<u>Sample Airplane</u>	<u>Weight</u> (lbs)	<u>Moment</u> (lb-ins.) /1000)
1. Licensed Empty Weight (Sample Airplane) . .		1660	57.9
2. Oil - 12 Qts.*		22	.0.3
3. Pilot & Front Passenger		340	12.2
4. Fuel - (60.0 Gal. at 6#/Gal.)		360	17.3
5. Rear Passengers.		340	24.1
6. Baggage.		78	7.6
7. Total Aircraft Weight (Loaded)		2800	118.8
8. Locate this point (2800 at 118.8) on the center of gravity envelope, and since this point falls within the envelope the loading is acceptable.			

*Note: Normally full oil may be assumed for all flights.

SECTION IV

CARE OF THE AIRPLANE

If your airplane is to retain that performance and dependability, certain inspection and maintenance requirements must be followed. It is wise to follow a planned schedule of lubrication and preventative maintenance based on climatic and flying conditions encountered in your locality.

Keep in touch with a Wreer Dealer, and take advantage of his knowledge and experience. He knows your airplane and how to maintain it. He will remind you when lubrications and oil changes are necessary, and about other seasonal and periodic services.

GROUND HANDLING ...

The airplane is most easily and safely maneuvered during ground handling by a tow-bar attached to the nosewheel. Always use a tow-bar when one is available.

NOTE

When using the tow-bar, do not exceed the nosewheel turning angle of 29° either side of center.

MOORING YOUR AIRPLANE ...

Proper tie-down procedure is your best precaution against damage to your parked airplane by gusty or strong winds. To tie-down your airplane securely, proceed as follows:

- (1) Set the parking brake and install the control wheel lock.
- (2) Install a surface control lock over the fin and rudder.
- (3) Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing tie-down fittings.
- (4) Tie a rope through the nose gear torque link and secure the opposite end to a tie-down.
- (5) Securely tie the middle length of rope to the ring at the tail. Pull each end of the rope away at a 45° angle and secure it to the tie-downs positioned on each side of the tail.
- (6) Install a pitot tube cover.

WINDSHIELD-WINDOWS ...

The plastic windshield and windows should be kept clean and waxed at all times. To prevent scratches and crazing, wash them carefully with

plenty of soap and water, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used, but only to carry water to the surface. Rinse thoroughly, then dry with a clean, moist chamois. Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge so that it attracts dust particles in the air. Wiping with a moist chamois will remove both the dust and this charge.

Remove oil and grease with a cloth moistened with kerosene. Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, fire extinguisher or anti-ice fluid, lacquer thinner or glass cleaner. These materials will soften the plastic.

After removing dirt and grease, if the surface is not badly scratched it should be waxed with a good grade of commercial wax. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the plastic.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated. Canvas covers may scratch the plastic surface.

ALUMINUM SURFACES ...

The clad aluminum surfaces of your Wren may be washed with clear water to remove dirt; oil and grease may be removed with gasoline, naphtha, carbon tetrachloride or other non-alkaline solvents. Dulled aluminum surfaces may be cleaned effectively with an aircraft aluminum polish.

After cleaning, and periodically thereafter, waxing with a good automotive wax will preserve the bright appearance and retard corrosion. Regular waxing is especially recommended for airplanes operated in salt water areas as a protection against corrosion.

PAINTED SURFACES ...

The painted exterior surfaces of your new Wren require an initial curing period which may be as long as 90 days after the finish is applied. During this curing period some precautions should be taken to avoid damaging the finish or interfering with the curing process. The finish should be cleaned only by washing with clean water and mild soap, followed by a rinse with water and drying with cloths or a chamois. Do not use polish or wax, which would exclude air from the surface during this 90-day curing period. Do not rub or buff the finish and avoid flying through rain, hail or sleet.

Once the finish has cured completely, it may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings and tail and on the nose cap and propeller spinner will help reduce the abrasion encountered in these areas.

PROPELLER CARE ...

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to clean off grass and bug stains will assure long, trouble-free service. It is vital that small nicks on the propeller, particularly near the tips and on the leading edges, are dressed out as soon as possible since these nicks produce stress concentrations, and if ignored, may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with carbon tetrachloride or Stoddard solvent.

INTERIOR CARE ...

To remove dust and loose dirt from the upholstery and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with a foam-type detergent, used according to the manufacturer's instructions. Keep the foam as dry as possible and remove it with a vacuum cleaner, to minimize wetting the fabric.

The plastic trim, headliner, instrument panel and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with kerosene. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

INSPECTION SERVICE AND INSPECTION PERIODS ...

With your airplane you will receive an Owner's Service Policy. Coupons attached to the policy entitle you to an initial inspection and the first 100-hour inspection at no charge. If you take delivery from your Dealer, he will perform the initial inspection before delivery of the airplane to you. If you pick up the airplane at the factory, plan to take it to your Dealer reasonably soon after you take delivery on it. This will permit him to check it over and to make any minor adjustments that may appear necessary. Also, plan an inspection by your Dealer at 100 hours or 90 days, whichever comes first. This inspection also is performed by your Dealer for you at no charge.

Civil Air Regulations require that all airplanes have a periodic (annual) inspection as prescribed by the administrator, and performed by a person designated by the administrator. In addition, 100-hour periodic inspections made by an "appropriately-rated mechanic" are required if your airplane is flown for hire.

AIRPLANE FILE ...

There are miscellaneous data, information and licenses that are a part of the airplane file. The following is a check list for that file. In addition, a periodic check should be made of the latest Civil Air Regulations to insure that all data requirements are met.

- A. To be displayed in the airplane at all times:
 - (1) Aircraft Airworthiness Certificate (Form FAA-1362)
 - (2) Aircraft Registration Certificate (Form FAA-500A)
 - (3) Airplane Radio Station License (Form FCC-404, if transmitter installed)
- B. To be carried in the airplane at all times:
 - (1) Weight and Balance, and associated papers (latest copy of the Repair and alteration Form, Form-337, if applicable)
 - (2) Airplane Equipment List
- C. To be made available upon request:
 - (1) Airplane Log Book
 - (2) Engine Log Book

Most of the items listed are required by the United States Civil Air Regulations. Since the regulations of other nations may require other documents and data, owners of exported airplanes should check with their own aviation officials to determine their individual requirements.

LUBRICATION AND SERVICING PROCEDURES ...

Specific servicing information is provided here for items requiring daily attention. A Servicing Intervals Check List is included to inform the pilot when to have other items checked and serviced.

DAILY

Fuel Tank Fillers:

Service after each flight with 80/87 minimum grade fuel. The capacity of each tank is 32.5 gallons. When optional long range fuel tanks are installed, the capacity of each tank is 42.0 gallons.

Fuel Strainer:

Drain approximately two ounces of fuel before initial flight and after refueling to remove water and sediment. Make sure drain valve is closed after draining.

Oil Dipstick:

Check oil level before each flight. Do not operate on less than 9 quarts and fill if an extended flight is planned. The oil capacity is 12 quarts (13 quarts capacity if an optional oil filter is installed).

Oil Filler:

When preflight check shows low oil level, service with aviation grade engine oil; SAE 30 below 40°F. and SAE 50 above 40°F. Your Wren was delivered from the factory with straight mineral oil (non-detergent) and should be operated with straight mineral oil for the first 25 hours. The use of mineral oil during the 25-hour break-in period will help seat the piston rings and will result in less oil consumption. After the first 25 hours, either mineral oil or detergent oil may be used. If a detergent oil is used, it must conform to Continental Motors Corporation Specifications MHS-24.

Oxygen Cylinder and Filler Valve (Opt.):

Check oxygen pressure gage for anticipated requirements before each flight. Whenever pressure drops below 300 psi, use filler valve on left side of baggage compartment wall and refill cylinder with aviator's breathing oxygen (Spec. No. MIL-O-27210). Maximum pressure, 1800 psi.

SERVICING INTERVALS CHECK LIST ...**Each 25 Hours**

Battery -- Check and Service.

Engine Oil -- Change.

Engine Oil Screen -- Clean.

Carburetor Air Filter -- Clean or replace. Under extremely dusty conditions, daily maintenance of the filter is recommended.

Nose Gear Torque Links -- Lubricate.

Each 50 Hours

Oil Filter (Opt) -- Change engine oil and replace filter element.

Each 100 Hours

Fuel Strainer -- Disassemble and clean.

Fuel Tank Sump Drain Plugs -- Remove and drain.

Fuel Line Drain Plug -- Remove and drain.

Brake Master Cylinders -- Check and fill.

Shimmy Damper -- Check and fill.

Vacuum System Oil Separator (Opt.) -- Clean.

Suction Relief Valve Inlet Screen (Opt.) -- Clean.

Gyro Instrument Air Filters (Opt.) -- Replace. Replace sooner if erratic or sluggish responses are noted with normal suction gage readings.

Propeller -- McCauley propeller does not require lubrication between overhauls. Grease Hartzell propeller every 100 hours.

Each 500 Hours

Wheel Bearings -- Lubricate. Lubricate at first 100 hours and at 500 hours thereafter.

SERVICING REQUIREMENTS

Fuel:

Aviation Grade -- 80/87 Minimum Grade

Capacity Each Standard Tank --- 32.5 Gallons

Capacity Each Long Range Tank -- 42.0 Gallons

Below 40°F

Above 40°F

Use straight mineral oil. Either
aviation oil may be used. If detergent
oil is used, it must conform to Continental Motors

Oil

Check oil level before flight and fill if extended

M-0-27210

27-3-1-1 (Opt.)

27-3-1-1 (Opt.)

WREN 460

Serviceability

All Wren built components are extra heavy duty for hard continuous use, with minimal maintenance.

Wren built components can be easily repaired or duplicated in the field.

Cessna and Continental has service centers throughout the world.

As the Wren can use 80 octane alternate fuels are easier to find if an emergency deems it necessary.

The Wren utilizes a carburetor which results in easier servicing in the field.

Wren provides oversize inspection plates, in the wings, for easier servicing.

Flight Characteristics

The Wren utilizes much lower angles of attack to achieve its STOL performance than any other aircraft. It does not hang on the prop while utilizing its STOL performance.

It does not rely upon engine horsepower for its STOL performance.

Wind shears, power failures, etc., do not present the abnormal problems to the Wren that it does with other STOL aircraft.

The Wren does not have to operate behind the power curve.

Due to its flat attitude during STOL operations, forward visibility is unimpaired during all flight conditions.

There is the possibility of safe continued flight VFR in weather as low as 200 feet and 1/2 mile.

You have a much larger choice for an area of ground suitable for a precautionary landing.

Greatly improved safety in an engine out emergency landing. Slow touch down speeds are not dependent upon the engine.

Improved instrument approach characteristics. The Wren has a proven ability for a total zero zero approach and landing, utilizing a normal ILS.

Excellent cabin comfort and leg room on cross country flights, due to its large cabin. Good stability.

With cruise speeds of 168 mph, oversize tires - 160 mph, its range is almost 1,000 miles.

Patrol speeds of a true 50 mph for up to 13 hours, in a flat attitude, are possible.

With its low power requirement for slow speed patrol engine cooling is never a problem.

At speeds of 50 mph, tests have proven, the Wren is virtually inaudible. At this speed the Wren requires only 63 h.p. to keep it in level flight.

At speeds of 35 mph the Wren can be completely cross controlled with no resulting stall or spin.

Even with full flaps the Wren can be safely slipped.

Coordinated turns are "automatic" at slow speeds due to the Wrens unique aerodynamic features.

At slow speeds a 180 degree turn may be accomplished within as little as a 200 foot radius.

A full flap go around, even at full gross, involves nothing more than a simple application of full power. (The Wren is also capable of a full flap go around with only partial power, due to its lift system.) No flap adjustment need be made.

With the U.L.S. control (canard) the nose wheel may be lifted completely free of the ground with a forward roll of less than 15 feet.

The tri-geared Wren, with its 3 large oversize tires, gives great flotation in mud, sand, etc.

The Wren has a normal useful load of 1150 lbs, and 1950 lbs for limited use operations.

Unlike the Helio the Wren experiences no problems with ground operations in high gusty winds.

3/26

WREN OWNER

HERSIE W. YOUNG SR & SPARKIE CANNON
1713 Alco AVE
EL PASO, TX 79935

(915) 598-8555

WREN CABLE MFG.

— Beta PROP LINKAGE — ?

B.W. BROADIE'S AIR CRAFT
MECHAN FIELD, Ft WORTH, TX
(817) 626-1532

WREN RIGGING ADJUSTMENT

MARK L. SIMS

(505) 388-4225

PO BOX 1647

SILVER CITY NM 88061

WORKER W WREN PLANT - BENNYE - AEP

1986 OWNERS

SYVERTSON SIDNEY K
20 CUNTRY GLEN RD
FALE BROOK, CA 92028

619-728-7052

BROWN JAMES R
26575 NAMRATIL RD
ESTACADA, OR 97023

503-728-7052

✓ TOBIN ROBERT F
2340 HIGHWAY 101 NORTH
TILLAMOOK, OR 97141

503-842-4952 - duplicate

-7892 - Corporate

Long Pine Airport

619-876-4674

✓ MILNAR GREGORY B
2114 BURMA LANE
SOUTH ST PAUL, MN 55075

612-323-0871

✓ BISSINGER LESTER L D2067X
416 N 2ND ST
BRAINERD, MN 56401

218-824-3543
-4669

✓ HOLLERS RANCH CO H22 GIVE ME A
PO BOX 223 RICKS NO FUS
CODY, NB 69211 100 Star

402 823-415 Larry Holler
823-4218 Larry Holler

HARMON LEROY B
PO BOX 582
NEW PORT RICHEY, FL 33552

813- No #

BRENT GORDON R L12222
1985 MADISON AVE SUITE 1
MEMPHIS, TN 38104

901-725-7719

✓ PETERSON TODD
948 HAWKINS LANE 8
BUCKEYE, AZ 85326

✓ IOWA ILLINOIS GAS & ELEC CO
206 2ND ST
DAVENPORT, IA 52801

319-326-7111

A G E AVIATION INC
PO BOX 17009
SAN ANTONIO, TX 78217

512-924-5689

✓ LANDER DONALD M
54808 EL PRADO TRAIL
YUCCA VALLEY, CA 92284

619-365-4600

GENE MORGAN
 MORGAN 865-4410
 FAX 865-4669
 NAME & # D.N. Sullivan
 MAN
 → Right instructions

MEMO

from Hersey Young

To Michael Shyne Date 7/31/86 Time _____

I finally made connections
 with Mark Sims and he
 came to El Paso and re-
 signed over to me. - He
 left me a copy of the factory
 instruction & thought you
 might like to have. -
 leaving for Mexico in the morning
 but I will call you when I
 get back - maybe we can get
 together and you can check out
 my new book. - Hersey

WREN AIRCRAFT MODEL 460P PRODUCTION INSPECTION FORM

A/C # _____

Date Inspected _____

A/C S/N _____

Production Number _____

1. Are all parts used on wing assembly and installation from Wren stockroom? Yes No
2. Inspect wings per 300-200 and 300-201 and describe discrepancies (if any) on reverse side.
3. Are all parts used on the U.L.S. installation from Wren stock? Yes No
4. Inspect U.L.S. installation per 100-000 & 100-300 and describe discrepancies (if any) on reverse side.
5. Inspect the elevator aerodynamic counterbalance installation per 600-101 and describe discrepancies (if any) on reverse side.
6. Inspect the A/S pitot installation per 800-100 and describe discrepancies (if any) on reverse side.

Pre Flight Inspection:

I. Cable Tensions:

1. Elevator _____ 20 to 40 pounds
2. Rudder _____ 20 to 40 pounds
3. Aileron _____ 40 pounds $\pm$ 10
4. Elevator Trim _____ 10 to 15 pounds
5. Flap (center fwd.) _____ 40 pounds + 0 -20 w/flaps cracked
6. Flap (center aft) _____ 40 pounds + 0 -20 w/flaps cracked
7. Flap (inter. fwd.) _____ 40 pounds + 0 -20 w/flaps cracked
8. Flap (outbd. fwd.) _____ 60 $\pm$ 10 w/flaps cracked
9. Stabilizer (fwd. of sprocket) _____ 50 pounds $\pm$ 10
10. Stabilizer (aft of sprocket) _____ 10 to 15 pounds

Note: The above cable tensions should be taken with the flaps cracked, outboard vane pushrod disconnected.

II. Control Travel:

1. Aileron _____ 18° up; _____ 14° down $\pm 1^{\circ}$
2. Flap _____ $30^{\circ} \pm 1^{\circ}$
3. Rudder _____ 24° L & R $\pm 1^{\circ}$
4. Elevator _____ 26° up; _____ 17° down $\pm 1^{\circ}$
5. U.L.S. elev. _____ 2° up; _____ 7° down $\pm 1^{\circ}$
6. Trim tab _____ 21° up; _____ 21° down $\pm 1^{\circ}$
7. Stabilizer - 3° (std. position) flaps up _____
1" down $\pm .10$ (at stab. fwd. spar) w/flaps down _____

III. General:

1. Oil _____ 12 quarts
 2. Main wheel pressure _____ 25 psi* (8.00 x 6)
 3. Nose wheel pressure _____ 21 psi* (6.00/8.00 x 6)
- *If standard wheels are used fill M.W. to 32 psi and N.W. 29 psi

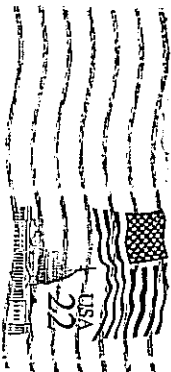
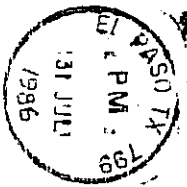
IV. Weight & Balance:

1. Weight A/C per Wren weighing instructions and fill out form.

V. 337 Form:

1. Fill out 337 Form and describe on reverse side all equipment changes made to A/C since the last 337 was issued. Briefly describe the Wren modification and give STC number.
2. Attach Wren weight and balance form with empty C.G. location.

Hersey W Young
1713 Peach Hlts
El Paso Texas
79935



C. Michael Shyne
P.O. Box 1705
1211 Cuba Ave.
Alamogordo, New Mexico
88310

AUG 1 1986

PERFORMANCE - SPECIFICATIONS

WREN 460

GROSS WEIGHT 2800 lbs

SPEED:

Top Speed at Sea Level. 161 mph
Cruise. 153 mph
75% Power at 6500 ft.

RANGE:

Cruise. 658 mi
75% Power at 6500 ft. 4.3 hrs
60 Gallons, No Reserve 153 mph
Cruise. 872 mi
75% Power at 6500 ft. 5.0 hrs
79 Gallons, No Reserve 153 mph
Optimum Range at 10,000 ft. 874 mi
60 Gallons, No Reserve 7.6 hrs
115 mph
Optimum Range at 10,000 ft. 1150 mi
79 Gallons, No Reserve 10.0 hrs
115 mph

RATE OF CLIMB AT SEA LEVEL 1080 fpm

SERVICE CEILING. 19,200 ft

TAKE-OFF:

Ground Run. 300 ft
Total Distance Over 50-Foot Obstacle. 605 ft

LANDING:

Ground Run. 200 ft
Total Distance Over 50-Foot Obstacle. 612 ft

EMPTY WEIGHT (Approximate) 1690 lbs

BAGGAGE. 120 lbs

WING LOADING: Pounds/Sq Foot 16.1 lbs

POWER LOADING: Pounds/HP 12.2 lbs

FUEL CAPACITY: Total

Standard Tanks. 65 gal
Optional Long Range Tanks 84 gal

OIL CAPACITY: Total. 12 qts

PROPELLER: Constant Speed, Dia 82 inches

POWER: Continental Engine. O-470-R
230 rated HP at 2600 RPM