OWNERS' HANDBOOK

FOR

OPERATION AND MAINTENANCE

OF

THE PIPER PACER

MODEL PA-20 AIRPLANE

AND

THE PIPER TRI-PACER

MODEL PA-22 AIRPLANE

PIPER AIRCRAFT CORPORATION, LOCK HAVEN, PA.

Additional copies of this manual can be obtained by writing to the SERVICE DEPARTMENT, PIPER AIRCRAFT CORPORATION, Lock Haven, Pennsylvania. Order by Code Number 751-190.

PRICE $1.00

TABLE OF CONTENTS

SECTION ONE — Page

Design Features

I. Specifications ---- 7
II. Power Plant and Propeller ---- 9
III. Fuselage and Wings ---- 9
IV. Landing Gear ---- 11
V. Empennage ---- 12
VI. Control System ---- 13
VII. Fuel System ---- 17
VIII. Electrical System ---- 17
IX. Finish ---- 19
X. Cabin Features ---- 19

SECTION TWO

Operating Instructions

I. Flight Procedure ---- 23
1. Starting ---- 23
2. Warm-up and Ground Check ---- 23
3. Take-off, Climb and Stalls ---- 24
4. Cruising ---- 25
5. Approach and Landing ---- 28
6. Ground Handling and Mooring ---- 30
7. Weight and Balance ---- 30

SECTION THREE

General Maintenance

I. Leveling and Rigging ---- 31
II. Tire Inflation ---- 33
III. Battery Service ---- 33
IV. Brake Service ---- 34
V. Landing Gear Service ---- 37
VI. Fuel Requirements ---- 42
VII. Care of Windshield and Windows ---- 43

SECTION FOUR

Inspections ---- 44

SECTION FIVE

Warranty ---- 55

PICTURES AND ILLUSTRATIONS

Page

Figure 1—Piper Pacer and Tri-Pacer ---------- 6

Figure 2—Engine Installation—Pacer and Tri-Pacer ---------- 8

Figure 3—Landing Gear—Pacer and Tri-Pacer ---------- 10

Figure 4—Hydrasorb Installation—Pacer and Tri-Pacer ----- 12

Figure 5—Control System—Ailerons and Elevators (Pacer) -- 14

Figure 6—Control System—Ailerons and Elevator Interconnection (Tri-Pacer) ---------- 15

Figure 7—Control System—Rudders and Flaps (Pacer and Tri-Pacer) ---------- 16

Figure 8—Fuel System—Pacer and Tri-Pacer ---------- 18

Figure 9—Electrical System—Pacer and Tri-Pacer ---------- 20

Figure 10—Instrument Panel Arrangements—Pacer and Tri-Pacer ---------- 10

Figure 11—Fuel Consumption Chart—Pacer and Tri-Pacer ---- 26

Figure 12—Altitude Performance Chart—Pacer and Tri-Pacer - 27

Figure 13—Engine Power Chart—Pacer and Tri-Pacer -------- 29

Figure 14—Battery Installation—Pacer and Tri-Pacer -------- 34

Figure 15—Nose Wheel Installation ---------- 38

Figure 16—Nose Wheel Oleo Break-Down ---------- 40

FOREWORD

THIS manual covers operation and maintenance of the Piper Pacer and the Piper Tri-Pacer, Models PA-20 and PA-22. These airplanes are basically similar, the principal differences being in the landing gear and related parts. They are, therefore, logically and conveniently treated together in this Handbook, with the differences in specifications and operation being brought out at the appropriate points.

The new Pacer and Tri-Pacer models provide more speed, comfort, reliability, economy of operation, and overall efficiency per unit of investment, than any four place personal plane heretofore produced in quantity. To obtain and maintain the maximum in utility and pleasure in the use of his airplane, the operator should carefully study the information provided for that purpose in this Handbook.

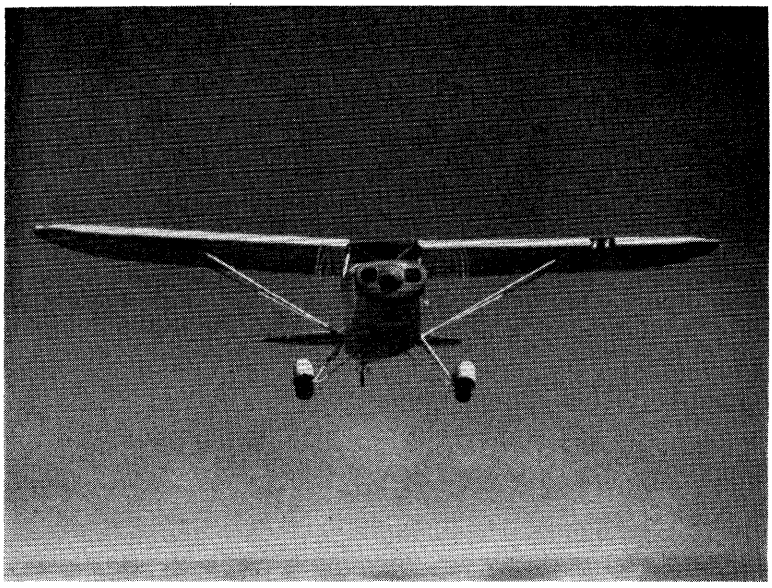


Figure 1

SECTION ONE

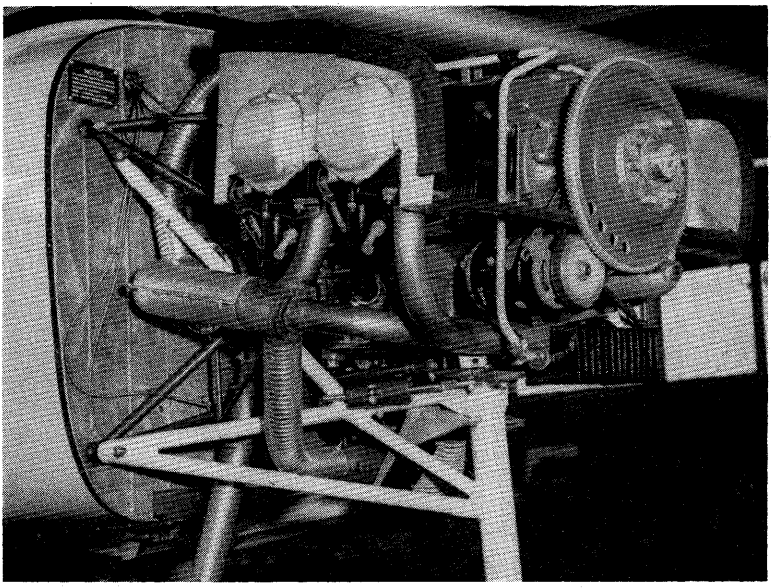
DESIGN FEATURES

I. SPECIFICATIONS:

	PA-20 "135"	*PA-22 "135"*
Engine	Lyc. O-290-D2	Lyc. O-290-D2
HP and RPM	135 at 2600	135 at 2600
Gross Weight (lbs.)	1950	1950
Empty Weight (Standard) (lbs.)	1020	1060
Useful Load (lbs.)	930	890
Wing Span (ft.)	29.3	29.3
Wing Area (sq. ft.)	147.5	147.5
Length (ft.)	20.4	20.4
Height (in.)	74.5	100
Propeller Diameter (max. in.)	74.0	74.0
Power Loading	14.4	14.4
Wing Loading	13.2	13.2
Baggage Capacity	50	50
Fuel Capacity	36	36
Tire Pressure (lbs.)	20	22 (Main) 15 (Nose)
Top Speed (mph)	139	137
Cruising Speed (75% power at sea level MPH)	125	123
Optimum Cruising Speed (75% power, 7000′ MPH)	134	132
Stalling Speed (mph)	48*	48*
Take-off Run (ft.)	1220*	1220*
Take-off over 50′ barrier (ft.)	1600*	1600*
Landing Roll (ft.)	500*	500*
Landing Distance over 50′ barrier (ft.)	1280*	1280*
Best Rate of Climb Speed (mph)	84	84
Rate of Climb (ft. per min.)	620	620
Best Angle of Climb Speed (mph)	70	70
Best Angle of Climb (ratio)	1:11	1:11
Service Ceiling	15,000	15,000
Absolute Ceiling	17,500	17,500
Fuel Consumption (gal./hr.—75% power)	7.7	7.7
Cruising Range	580	570

* Flaps Extended.

Performance figures are for standard airplanes flown at gross weight under standard conditions at sea level.



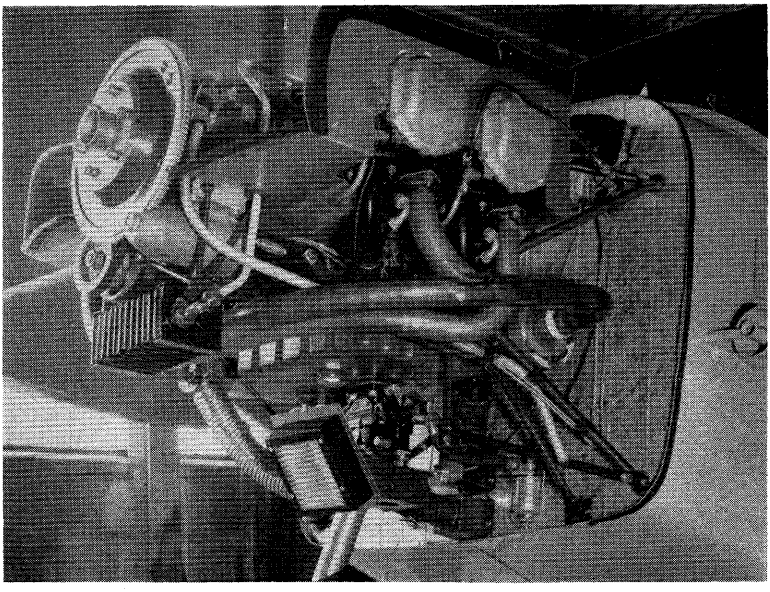


Figure 2

II. POWER PLANT AND PROPELLER:

The Pacer and Tri-Pacer are equipped with a Lycoming Model 0-290-D2 engine rated at 135 horse power at 2600 RPM. Operation and maintenance details on this engine are provided in the Engine Manual accompanying this Handbook.

The engine installation is practically the same in both models (See Figure 2) except that the carburetor airbox, bottom cowl, and exhaust tail pipe are modified in the PA-22 to accommodate the nose gear. A stainless steel cross-over exhaust system, incorporating an effective muffler, provides efficient exhaust elimination as well as heat for the cabin and carburetor heating systems.

A thirteen plate oil radiator in the nose cowl assures adequate oil cooling under the most severe heat conditions. If, under winter flying conditions, the oil temperature becomes undesirably low (under 120°F.) it is recommended that an oil radiator baffle covering part of the radiator be installed. This baffle is obtainable from the factory.

A Sensenich Metal Propeller, Design M-76AM-2, with a 74″ diameter and a 57″ pitch is standard equipment on both the PA-20 and the PA-22.

III. FUSELAGE AND WINGS:

The fuselage frame of the Pacer and Tri-Pacer is constructed of steel tubes welded together to form a rigid structure. A number of highly stressed members are of chromemolybdenum steel (4130). Other members are of 1025 steel.

Repairs to the fuselage can be made in the manner approved by the Civil Aeronautics Authority Manual No. 18, and repair facilities for this type of construction are available universally.

The fuselage is made corrosion resistant by the application of a coat of zinc chromate, followed by a sealer coat of nitrate dope. A third coat of dope-proof lacquer is sprayed on the fuselage members wherever fabric comes in contact with the structure. If the airplane is to be used in salt water areas, the fuselage can be metallized prior to applying the zinc chromate and dope; at the same time the interior of the tubing is coated with linseed oil to prevent internal corrosion.

The wing framework consists of riveted aluminum ribs mounted on extruded aluminum spars with tubular drag and compression struts and high strength stainless steel drag wires. Aluminum sheet

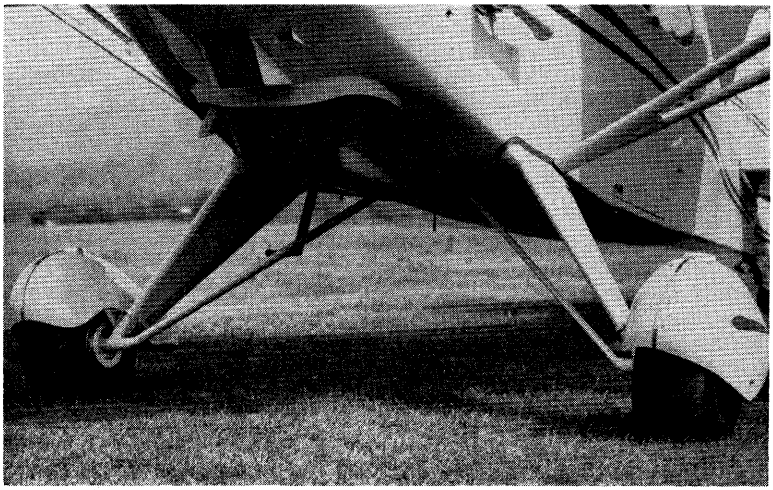


Figure 3

is used to form the leading edge and the aileron false spar. An ash wing tip bow provides a light tough member which can withstand considerable wing tip shock without failing.

The wings are attached to the fuselage at the wing hinge fittings on upper fuselage members, and by means of the lift struts which bolt to the lower fuselage members and to the wing spar fittings. The lift struts can be adjusted in length by turning in or out the forked fittings at the lower ends. This adjustment is used to set the rigging of the wings. Any lifting of the airplane at the struts should be done at the extreme end of the strut and not in the center, to prevent bending the struts.

IV. LANDING GEAR AND BRAKES:

Both the PA-20 and PA-22 landing gears incorporate Hydrasorb shock units, consisting of automotive type hydraulic shock absorbers combined with light shock cords. Otherwise the under-carriages on the two models are dissimilar as described below:

The Conventional landing gear on the Pacer incorporates Hayes D-3-13-A-1 wheels fitted with 8:00x4 full balloon tires. The brakes are Hayes hydraulic expander tube type, actuated through separate master cylinders at the toe brake units on the rudder pedals. Tire pressure must be maintained at 20 lbs. to prevent tire slippage on the wheels and to produce even wear.

A Scott 6" steerable full swivel tail wheel, Model 3-24B, is used, equipped with a solid rubber tire. Practically all directional ground control can be accomplished with the steerable tail wheel, reducing brake wear.

The only maintenance required on the PA-20 main landing gear is periodic greasing of the hingle bolts, inspection of the shock cords, and inspection of the steel hinge bolt bushings which can be replaced if worn. The tail wheel should be greased regularly and the attaching bolts kept snug.

Tri-Pacer Landing Gear—The main gear on the PA-22 is similar in construction to that on the PA-20 but attached to the fuselage farther aft. It is supplemented by a rugged oleo nose wheel unit bolted to the engine mount at the firewall. Main wheels are Cleveland Aircraft Products 600x6, Model C-38500H, incorporating Cleveland hydraulic brakes, Model C-2000H-7. The nose wheel is the same as the main wheels except for the brake drum, and is Model C-38501-H.

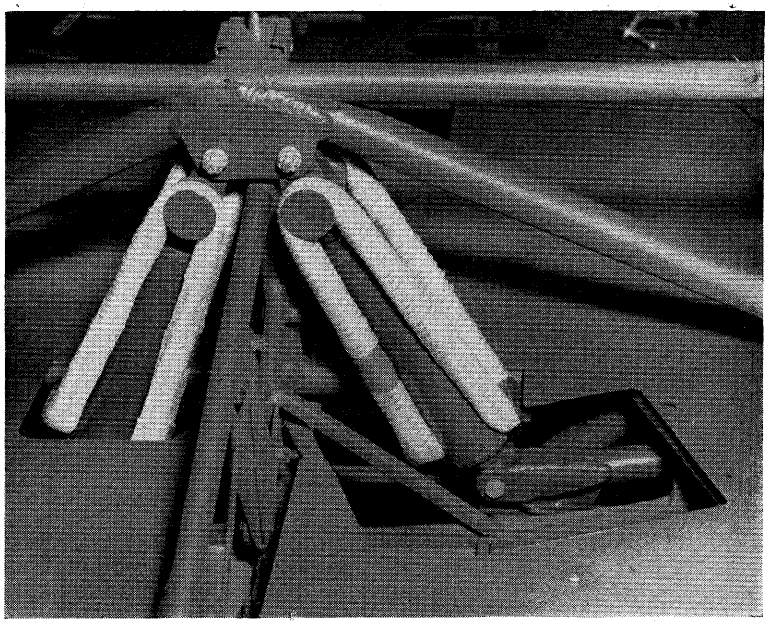


Figure 4

A hand brake control located under the center of the instrument panel actuates the Tri-Pacer's hydraulic brakes. The brake handle is connected by a cable with a brake master cylinder attached to the motor mount in the engine compartment.

A parking brake valve is attached to the master cylinder, with the control located on the left side of the instrument panel. In applying the parking brake, first pull the brake handle back, next pull out the parking brake control, then release the brake handle. To disengage the parking brake, simply push in its control.

The nose wheel is steerable through a 40-degree arc by the rudder pedals which actuate steering rods attached to steering arms at the top of the nose wheel unit.

V. EMPENNAGE:

The units which make up the empennage are the Fin, Rudder, Stabilizers and Elevators. They are all constructed of tubular steel with steel channel ribs. The control surface hinges have bronze

bushing inserts and should be oiled with light oil occasionally. Stainless steel tie rods brace the stabilizer to the fin and fuselage. The tail brace wires should not be used for lifting or handling the airplane.

Caution must be exercised in using the stabilizers for lifting or lowering the tail of the airplane. The stabilizer adjusting mechanism is easily damaged by application of excessive handling loads on the stabilizer.

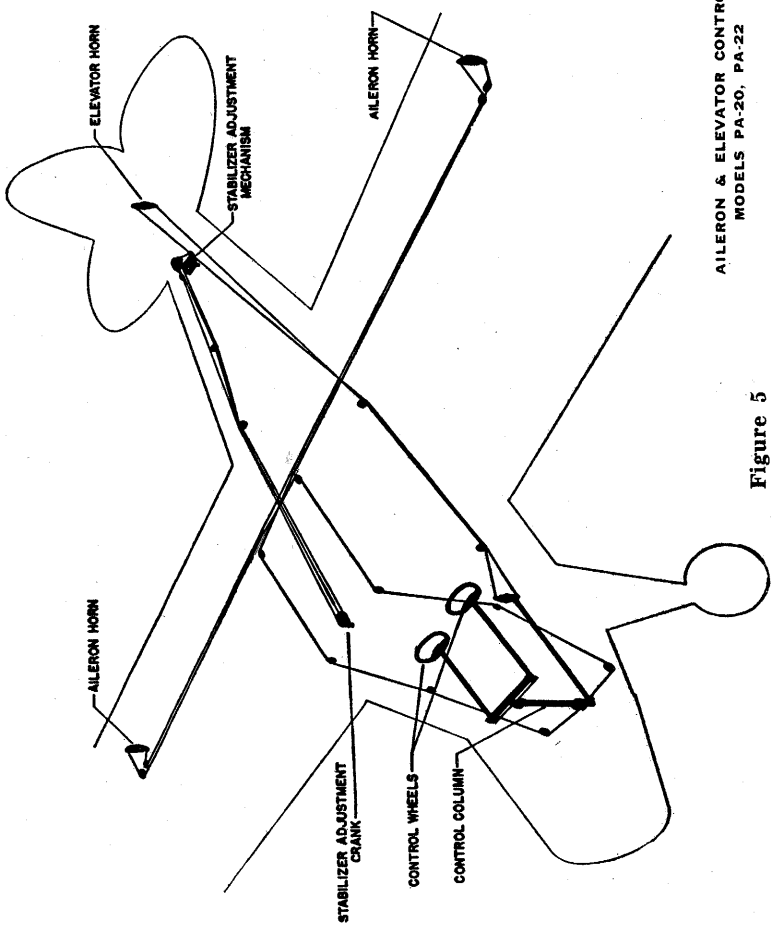
On the PA-22, steering during ground handling should not be done with the rudder, which may become distorted if mishandled. A steering handle is provided with each airplane, anchored under the rear seat, and should be used for moving the plane on the ground.

VI. CONTROL SYSTEM (Figures 5, 6 and 7):

The Pacer and Tri-Pacer are equipped with conventional dual wheel flight controls. The flap control handle is located between and ahead of the front seats. The flaps have three positions—Up, one-half down, and full down. The full flap position is used for maximum effect in landing and take-offs, while the half flap position is used when intermediary results are desired.

The stabilizer adjustment control is located overhead between the front seats and is connected to the stabilizer adjustment mechanism at the stabilizer by an endless cable. A permanently automatic tension adjustment, which consists of an idler pulley held in place near the rear main pulley by a tenson spring, maintains correct tension on the stabilizer cable and prevents cable slippage. The system normally requires no attention except for lubrication and inspection.

The control system of the Tri-Pacer differs from that of the Pacer in that the rudder pedals are connected directly to the nose wheel for ground steering instead of to the tail wheel, and the aileron cables are interconnected with the rudder cables to provide automatically coordinated aileron and rudder controls for simplified handling in the air. The interconnection incorporates a spring, located behind the baggage compartment, and is arranged so that although in level flight a movement of the ailerons results in proper rudder action to give coordinated turns, still the controls can be crossed if desired to obtain slips or skids.



AILERON & ELEVATOR CONTROLS
MODELS PA-20, PA-22

Figure 5

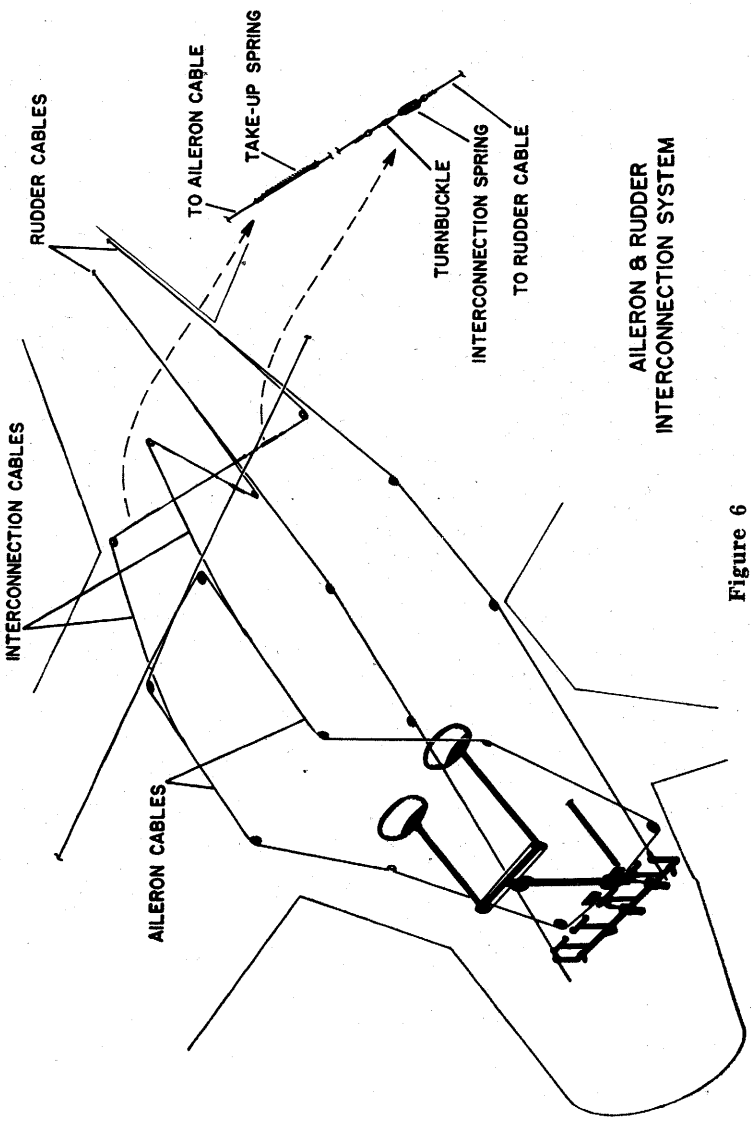
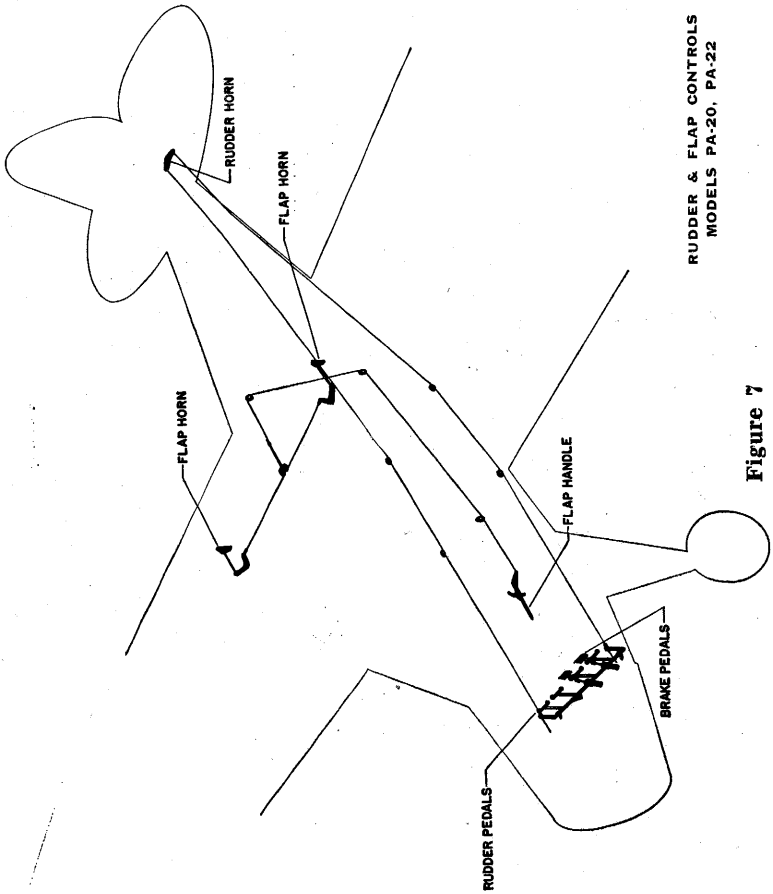

RUDDER CABLES
TO AILERON CABLE
TAKE-UP SPRING
TURNBUCKLE
INTERCONNECTION SPRING
TO RUDDER CABLE
INTERCONNECTION CABLES
AILERON CABLES
AILERON & RUDDER
INTERCONNECTION SYSTEM

Figure 6



RUDDER & FLAP CONTROLS
MODELS PA-20, PA-22

Figure 7

VII: FUEL SYSTEM (Figure 8).

Two eighteen-gallon fuel tanks located in the wings provide fuel storage in the PA-20 and PA-22. Both tanks have outlet lines at the front and the rear, providing positive flow in all normal flight attitudes. The tanks are drained individually according to the position of the fuel selector valve on the left forward cabin wall.

The rear fuel line from the right tank has a low point under the right front seat at which point is located a quick drain gascolator. The drain in this gascolator, which should be checked frequently for water or sediment, is reached through an opening in the right landing gear belly fairing.

An electric fuel gauge is located on the left side of the instrument panel, with a switch for checking the quantity in either tank on the same gauge. Care must be taken to assure that the fuel gauge switch and the fuel gauge selector valve are on the same tank.

The main fuel strainer, through which all fuel going to the carburetor flows, is located on the lower left engine side of the firewall. It is provided with a quick drain and should be drained regularly.

Fuel screens are provided at tank outlets, in the strainer and at the carburetor.

The engine primer pump on the right side of the instrument panel takes fuel from the main gascolator and pumps it directly to all four cylinders on the engine. The primer must be locked in at all times except when in use, to prevent malfunctioning of the engine.

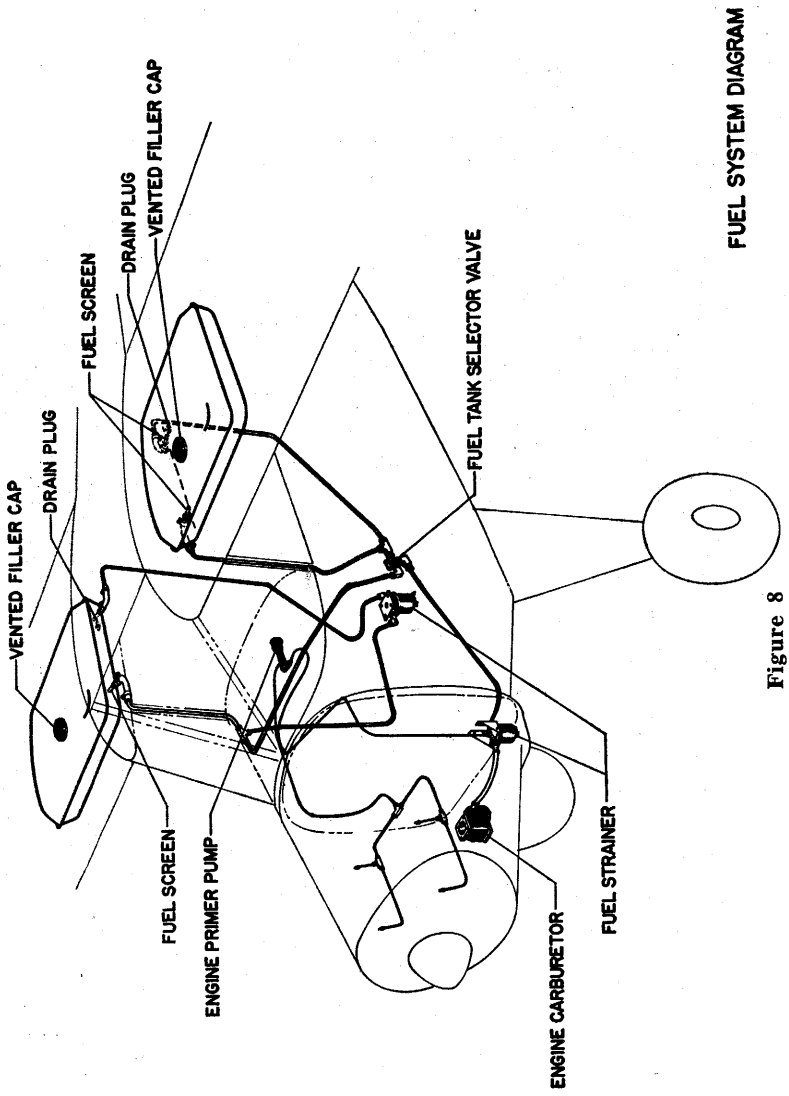
An idle cut-off is incorporated in the mixture control so that full extension of the control stops the flow of fuel at the carburetor. The cut-off should always be used to stop the engine.

VIII. ELECTRICAL SYSTEM:

The master switch for the electrical system is located on the master switch fuse box under the left side of the pilot's seat. In the "up" position of this switch the main fuse is engaged; the "down" position is for the spare fuse, and the central position is "off."

The starter button, which is in a line directly from the battery to the starter, is installed on the bottom of the master switch fuse box. The starter can be operated with the master switch "on" or "off."

Circuit breakers for the radio, lights and generator are in a bracket under the left side of the instrument panel. These units auto-



FUEL SYSTEM DIAGRAM

Figure 8

matically break the electrical circuit if an overload is applied to the system, preventing damage to any electrical component. To reset the circuit breakers, simply push in the buttons. Continual popping out of a circuit breaker button indicates trouble in the electrical system and should be investigated immediately.

A 12-volt 33-ampere hour battery, enclosed in a stainless steel battery box, is mounted under the right front seat (See Section Three, III, Battery Service).

The position and panel lights are operated by a rheostat switch on the left side of the instrument panel. The position lights are turned on with the first movement of the knob; panel light intensity is increased by further rotation of the control. A dome light switch is incorporated in the speaker-dome light unit in the center of the cabin ceiling.

The landing light switch, on the lower left part of the instrument panel, controls two landing lights in the left wing. These lights are installed at different angles, the one directed downward to be used for taxiing and the upper beam for landing.

A voltage regulator, attached to the engine side of the firewall, is incorporated in the electrical system to maintain the required voltage of the battery.

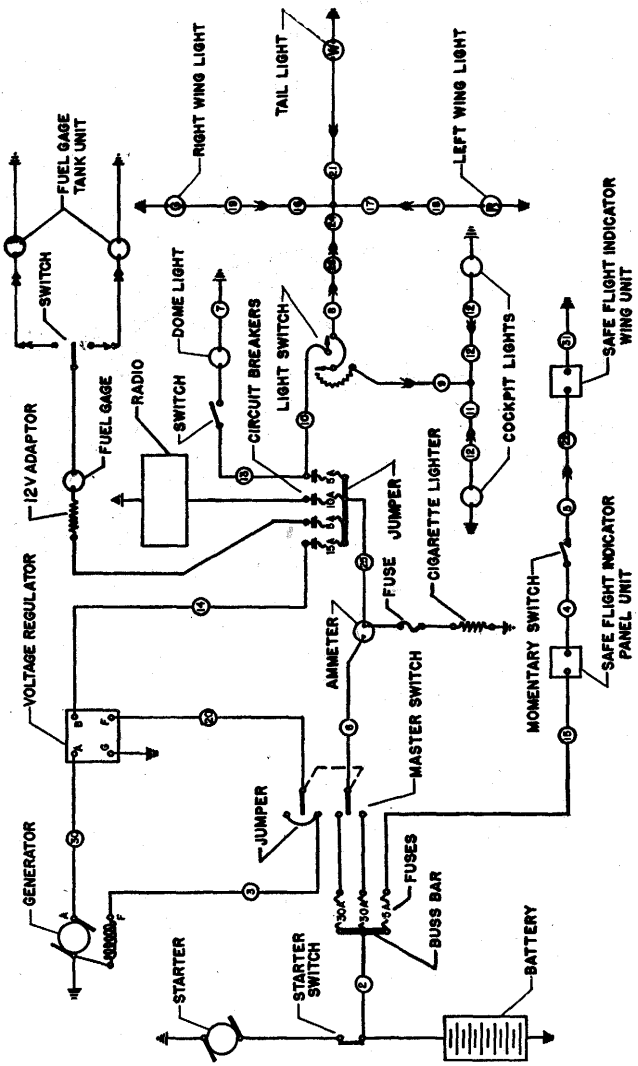
IX. FINISH:

The Duraclad finish on the Pacer and Tri-Pacer consists of fire resistant butyrate dope on the fabric surfaces, and enamel on all metal surfaces. Duraclad provides, in addition to the fire resisting qualities, a high-luster, more attractive finish which has a much longer life than earlier nitrate finishes.

All of the surfaces, inside and outside, are finished in Duraclad. This finish must not be covered over with any incompatible materials. The use of different materials from those originally applied will damage the finish.

X. CABIN FEATURES:

The instrument panel on the PA-20 and PA-22 is designed to accommodate any normal grouping of instruments from basic engine and flight units through the advanced gyro instruments, by interchanging panel cover plates and one insert plate on the main panel.



ELECTRICAL SYSTEM DIAGRAM

Figure 9

All flight and engine instruments except the Gyro Horizon can be installed by removing the face plate and inserting the instruments. If an Artificial Horizon is to be installed, the small panel insert plate on the left side of the main panel should be replaced with one with a larger hole for accommodating the Horizon. Three different face plates are available, one for standard instruments, one for primary instruments or primary plus a Directional Gyro, and one for both Gyro instruments as well as primary and standard instruments.

The radio equipment is installed on the left side of the instrument panel or under the panel in front of the pilot. (See Radio Manual for detailed instructions).

The front seat is adjustable through its six inch range by means of a control lever under the front center of the seat. To adjust the seat forward, raise the locking lever allowing the seat to move ahead to the desired position. To adjust the seat rearward, raise the lever and press the seat back against the seat adjustment spring. In fixing the seat in any given position be sure that the locking lever has been pushed fully down to engage the latch completely.

To remove the front seat for access to the battery or for other purposes of maintenance, first remove the forward stop pin located between the front seat cushions. Then release the lock, allowing the seat to move as far forward as it will go. Tilt the seat back and up, disengage the seat return spring, and lift the seat out of its tracks.

The rear seat area is readily converted to a cargo compartment by removing or folding the rear seat. To remove the seat, detach the cushion from the lower support tube, remove the support tube from the rear, then the front sockets, and unlace the back cushion and canvas from the upper support tube. If desired, the back cushion and canvas can be folded rearward into the baggage compartment instead of being removed completely.

Although access to the baggage compartment is normally through the baggage compartment door, it may occasionally be desirable to load baggage through the rear door by raising the rear seat forward. To make room for bulky packages in the baggage compartment, the compartment top can be detached by snapping out the spring clips which hold the top panel in position.

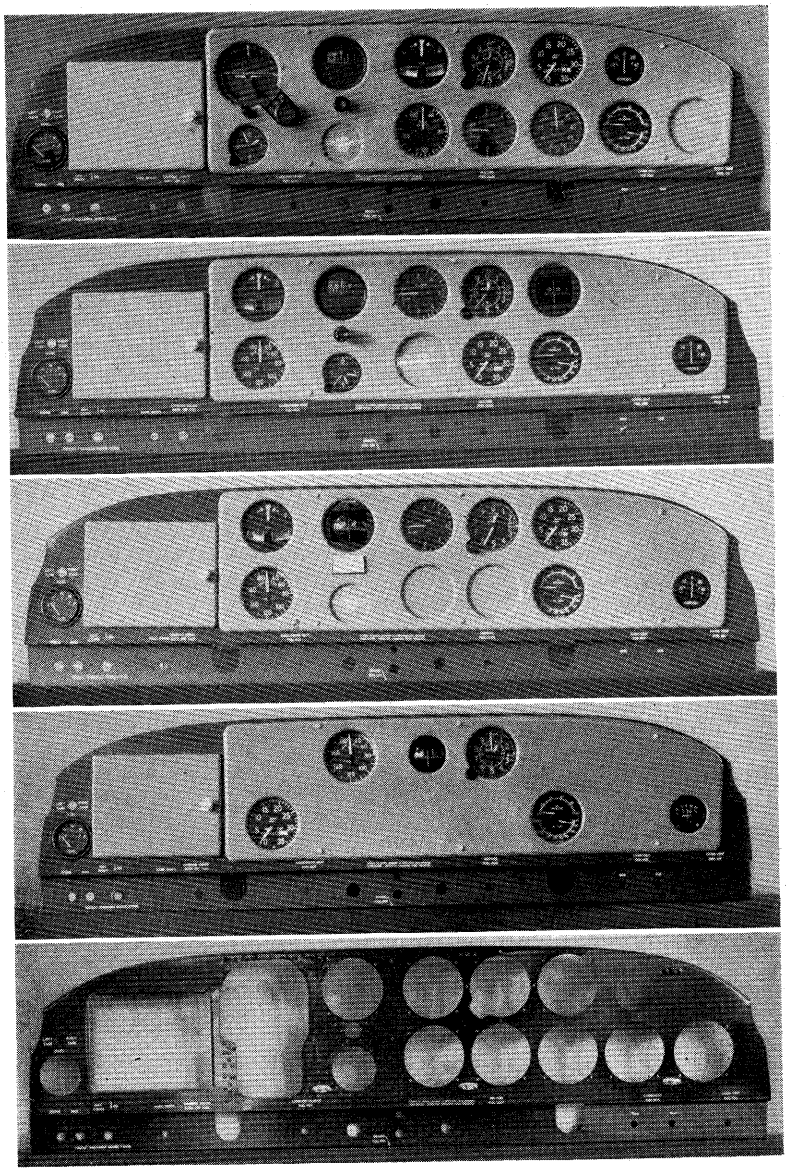


Figure 10

SECTION TWO

OPERATING INSTRUCTIONS AND PERFORMANCE

I. FLIGHT PROCEDURE:

1. STARTING:

When the engine is cold, prime three to five strokes after turning fuel valve to the proper tank. Push mixture control to full rich, carburetor heat off, and open throttle one-eighth to one-quarter of an inch. If the engine is extremely cold, it should be pulled through by hand four to six times.

Next turn the ignition switch to "both" and, with brakes set, engage the starter. If the engine does not start in the first few revolutions, open the throttle while the engine is turning over with the ignition on. When the engine starts, reduce the throttle.

If the above procedure does not start the engine, reprime and repeat the process. Continue to load the cylinders by priming or unload by turning the engine over with the throttle open. If the engine still doesn't start, check for malfunctioning of ignition or fuel system.

When the engine is warm, do not prime, but turn ignition switch to "both" before engaging starter. The engine should start after it has rotated through about four compression strokes.

2. WARM UP AND GROUND CHECK:

As soon as the engine starts, the oil pressure should be checked. If no pressure is indicated within thirty seconds, stop the engine and determine the trouble.

Warm up the engine at 800 to 1000 R. P. M. for not more than two minutes in warm weather, four minutes in cold weather. The magnetos should be checked at 1800 R. P. M., the drop not to exceed 100 R. P. M. The engine is warm enough for take-off when the throttle can be opened without engine faltering.

Carburetor heat should be checked during the warm up to make sure the heat control operation is satisfactory and to clear out the engine if any ice has formed. It should also be checked in flight occasionally when outside air temperatures are between 20° and 70° to see if icing is occurring in the carburetor. In most cases when the engine loses speed without apparent cause, the use of carburetor heat will correct this condition.

3. TAKE-OFF, CLIMB AND STALLS:

A. PA-20

The stabilizer adjustment should be set approximately in the neutral position for take-off. Fuel selector should be on the correct tank, carburetor heat off, mixture rich. The flaps can be lowered if desired but should be retracted as soon as climbing airspeed has been reached to achieve maximum rate of climb. The best rate of climb air speed at gross weight is 84 M. P. H. At lighter weights the best climbing airspeed will be reduced somewhat.

The gross weight power off stalling speed with full flaps of the PA-20 as well as the PA-22 is 48 M. P. H. With flaps up the stalling speed increases about 4 M. P. H.

B. PA-22

Take-off in the Tri-Pacer is accomplished as follows:

(a). Set stabilizer trim to approximately neutral with exact setting determined by the loading of the plane.

(b). Apply full throttle, allowing plane to maintain its level attitude until take-off speed (50-60 M. P. H.) is approached, then ease back control wheel to obtain climbing attitude.

(c). For take-offs in heavy grass, snow, or in other speed retarding surfaces, drag on the landing gear can be reduced by raising the nose wheel off of the surface during the take-off run by applying back pressure on the control wheel shortly after the throttle is opened.

(d). The application of full flaps as take-off speed is approached, will, as in the case of the PA-20, reduce the take-off run about 20 per cent. Flaps can be pulled down before the take-off run is started but will reduce the acceleration of the plane somewhat if kept down throughout the take-off.

(e). Crosswind take-offs in the Tri-Pacer should be made similarly to those in normal winds, with directional control maintained during and after the take-off roll by use of the rudder pedals. It may be desirable to hold the nose wheel on the ground somewhat longer than usual in strong cross winds.

(f). Taxiing Technique—Visibility and control in taxiing the PA-22 is so improved that the usual tendency is to taxi at excessive speeds. The apparent speed of the plane on the ground is deceiving, so that on a hard surface a ground speed of 60 M. P. H., can easily be reached at about 1500 R. P. M., with the pilot under the impres-

sion that he is traveling much more slowly. 1000 R. P. M. will eventually give a ground speed of about 40 M. P. H., and even a high idling R. P. M. may result in undesirably fast taxi speeds on occasion.

Considerable care should therefore be taken during taxiing to hold down engine R. P. M., and to maintain reasonably low taxi speeds. High speed taxiing causes undue wear and strain on tires, brakes, and landing gear, and may result in damage from collision, upsetting, or other accidents. DO NOT TAXI FAST.

A limited amount of directional control during taxiing can be effected with the control wheel. If gradual turns are to be made during taxiing, or during the landing roll or take-off run, steering with the wheel may frequently be desirable.

4. CRUISING:

The cruising speeds of the PA-20 and PA-22 are determined by many factors including power setting, altitude, temperature, and equipment on the airplane such as antennas, venturi tubes and fenders.

The normal cruising power is 75% of the rated horse-power of the 135 horse-power engine, or 101 horse-power. The specification cruising speed of the average Pacer is 125 M. P. H., at 75% of power at sea level under standard atmospheric conditions. For the average Tri-Pacer this figure is 123 M. P. H. For altitude cruising speeds, see Figure 12, and for altitude power curves, see Figure 13.

Maintaining 75% of power at altitudes up to 7,000 feet, above which this power setting can no longer be obtained, results in an increase in true air speed of about 1.3 M. P. H. per thousand feet of altitude over sea level. Indicated airspeed will normally decrease about 1 M. P. H., per thousand feet if 75% power is maintained. If the True Air Speed at sea level at 75% of power is 125 M. P. H., therefore, at 7,000 feet at 75% of power the True Air Speed will equal 134 M. P. H., while indicated air speed equals 118 M. P. H.

With a fixed pitch propeller 75% of power can be maintained at altitude by increasing the R. P. M. as altitude is increased. The maximum continuous engine speed for all operations is 2600 R. P. M.

Fuel consumption during sea level cruising is given on Figure 11. The consumption is determined by the various flight conditions. At 75% of power at altitude, fuel consumption will be somewhat higher than at that power setting at sea level, even with the mixture properly leaned.

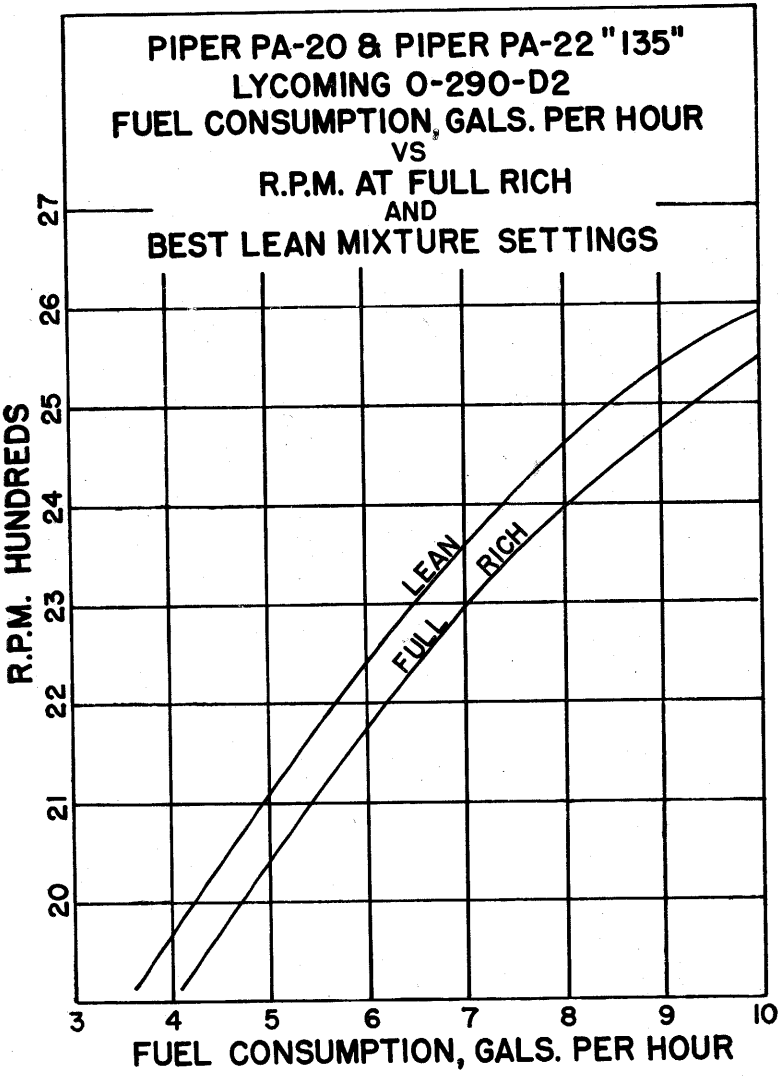

PIPER PA-20 & PIPER PA-22 "135"
LYCOMING O-290-D2
FUEL CONSUMPTION, GALS. PER HOUR
VS
R.P.M. AT FULL RICH
AND
BEST LEAN MIXTURE SETTINGS
R.P.M. HUNDREDS
20
21
22
23
24
25
26
27
LEAN
FULL RICH
3
4
5
6
7
8
9
10
FUEL CONSUMPTION, GALS. PER HOUR

Figure 11

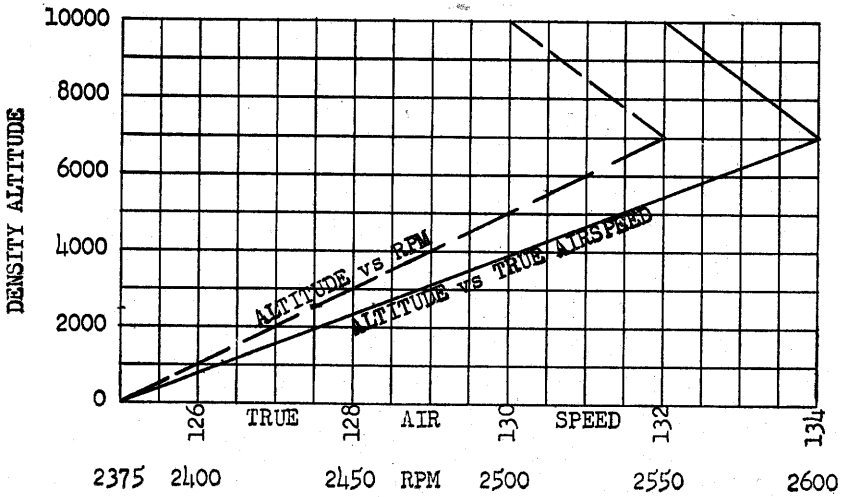
ALTITUDE VS AIRSPEED & RPM AT 75% POWER CRUISE

Model - PA-20 135
Mixture - Leaned to Maximum RPM

Propeller - Fixed Pitch Metal, 58"
Max. Level Flight RPM, Sea Level - 2600 RPM

PROCEDURE FOR MAINTAINING 75% RATED POWER WITH INCREASED ALTITUDE

Starting at 2375 RPM at Sea Level, increase RPM by 25 per thousand feet of altitude. If Manifold Pressure is used, starting at 25" M.P. at Sea Level, allow M.P. to decrease 1/2" per thousand feet of increased altitude.
At 7000', RPM will approximate 2550, M.P. 22" Hg. and T.A.S. 134 MPH.



For use with Model PA-22 135, deduct 2 MPH from T.A.S.

Figure 12

Correct use of the mixture control will reduce fuel consumption very appreciably. The mixture should be leaned during cruising flight at all times over 5000 feet and at lower altitudes at the owner's discretion. The mixture should also be leaned at full throttle at any time at which an increase in R. P. M. can be obtained.

To adjust the mixture properly, pull out the control slowly until a decrease in R. P. M. is noted; then push the control forward just enough to regain the lost R. P. M.

A cruise-stop is incorporated in the throttle mechanism of each PA-20 and PA-22. This stop is set to give 75% of power at low altitudes under normal conditions. If a higher or lower power setting is desired, it can be obtained by installing or removing small spacers in the throttle friction lock according to instructions attached to the throttle.

The cruise-stop is intended to give consistent power settings at lower altitudes without reference to the tachometer. It also provides a more or less fixed R. P. M., the variance of which indicates the presence of ice or other causes of malfunction.

To determine the proper cruising R. P. M. for 75% of power, fly the aircraft as near sea level as practicable at full throttle until maximum speed is reached. Note the R. P. M. at top speed, level flight. Then reduce the maximum R. P. M. by 10% and cruise at 90% of full R. P. M. The correct cruising R. P. M., which is the proper setting for the cruise-stop, will give specification cruising airspeed and fuel consumption.

The continuous use of carburetor heat during cruising flight increases fuel consumption. Unless icing conditions in the carburetor are severe, do not cruise with the carburetor heat on. Apply full carburetor heat only for a few seconds at intervals determined by icing severity.

5. Approach and Landing:

The approach technique is the same on both the PA-20 and the PA-22. Trim the plane to a 75-80 M. P. H. glide, after flaps have been lowered at a speed of 80 M. P. H. or less. Mixture should be full rich, fuel on proper tank, and carburetor heat off unless carburetor icing conditions prevail. Reduce the speed during the flare out, and touch the ground in a standard three point position approximately at stalling speed (50-60 M. P. H.).

On the Tri-Pacer the landing technique may vary somewhat from this point on. The control wheel should be held back far

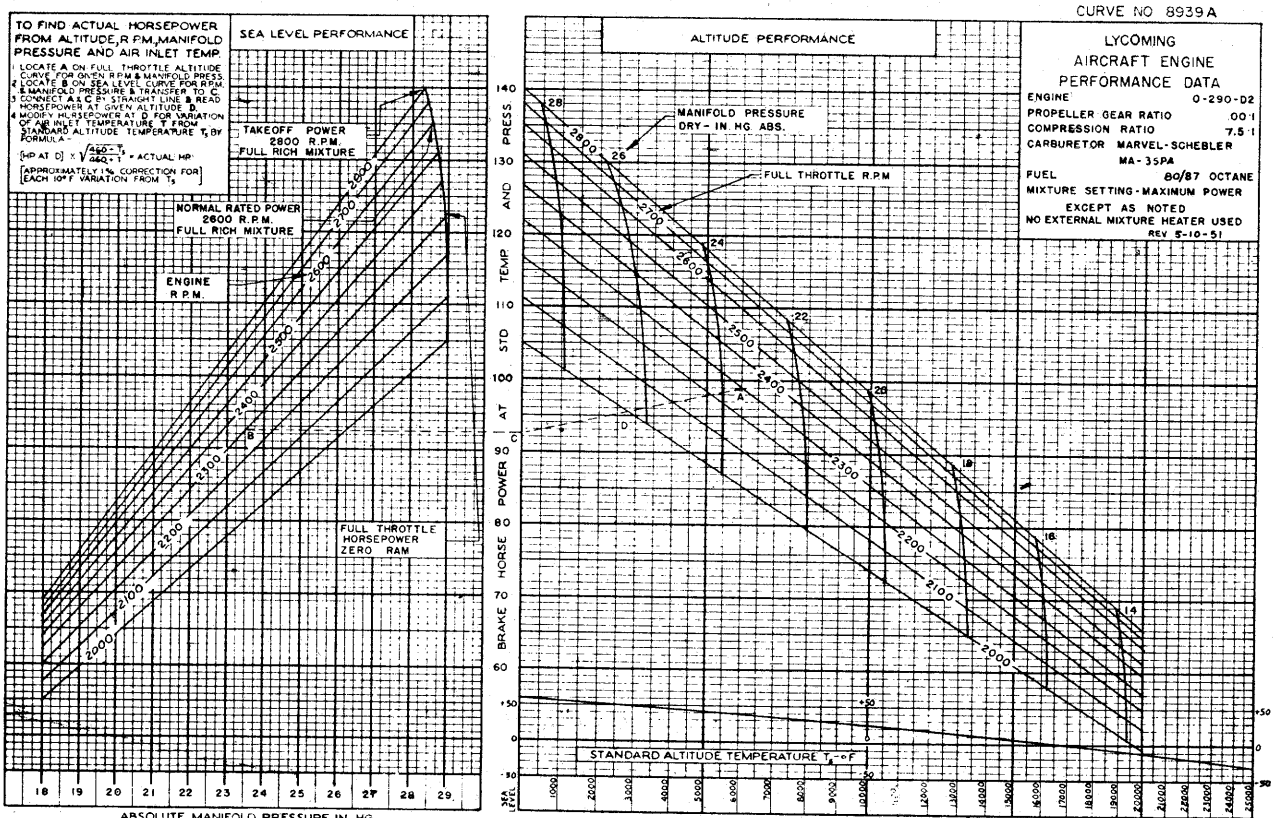

CURVE NO 8939A
TO FIND ACTUAL HORSEPOWER FROM ALTITUDE, R.P.M., MANIFOLD PRESSURE AND AIR INLET TEMP.
1 LOCATE A ON FULL THROTTLE ALTITUDE CURVE FOR GIVEN R.P.M. & MANIFOLD PRESS.
2 LOCATE B ON SEA LEVEL CURVE FOR R.P.M. & MANIFOLD PRESSURE & TRANSFER TO C.
3 CONNECT A & C BY STRAIGHT LINE & READ HORSEPOWER AT GIVEN ALTITUDE D.
4 MODIFY HORSEPOWER AT D FOR VARIATION OF AIR INLET TEMPERATURE T FROM STANDARD ALTITUDE TEMPERATURE T_s BY FORMULA –
(HP AT D) × $\sqrt{\frac{460+T_s}{460+T}}$ = ACTUAL HP
[APPROXIMATELY 1% CORRECTION FOR EACH 10° F VARIATION FROM T_s]
SEA LEVEL PERFORMANCE
TAKEOFF POWER 2800 R.P.M. FULL RICH MIXTURE
NORMAL RATED POWER 2600 R.P.M. FULL RICH MIXTURE
ENGINE R.P.M.
FULL THROTTLE HORSEPOWER ZERO RAM
ABSOLUTE MANIFOLD PRESSURE, IN HG
ALTITUDE PERFORMANCE
MANIFOLD PRESSURE DRY - IN. HG. ABS.
FULL THROTTLE R.P.M
BRAKE HORSE POWER AT STD TEMP AND PRESS
STANDARD ALTITUDE TEMPERATURE T_s - °F
PRESSURE ALTITUDE IN FEET
LYCOMING
AIRCRAFT ENGINE
PERFORMANCE DATA
ENGINE 0-290-D2
PROPELLER GEAR RATIO .00:1
COMPRESSION RATIO 7.5:1
CARBURETOR MARVEL-SCHEBLER MA-3SPA
FUEL 80/87 OCTANE
MIXTURE SETTING - MAXIMUM POWER EXCEPT AS NOTED
NO EXTERNAL MIXTURE HEATER USED
REV 5-10-51
8939A

Figure 13

enough to keep the plane in a nose high attitude as long as possible. This shortens the landing run by producing maximum drag on the wings. As the plane slows down, allow the nose wheel to drop to the ground and apply brakes.

In high wind conditions, particularly in strong crosswinds, it may be desirable to approach the ground in a more nearly level attitude at an air speed which assures ample controllability regardless of gusts. In this case the ground can be contacted at air speeds appreciably higher than in normal landings, and the airplane held in a level attitude at all times on the ground to reduce wind effect. It is always best to contact the ground at the minimum practicable speed consistent with landing conditions.

Crosswind landings in a PA-22 should be approached as with the PA-20, with drift being compensated for by holding the windward wing down or by crabbing into the wind. The airplane should be straightened out the instant before ground contact, and then controlled on the ground with the steerable nose wheel which should be held on the ground with forward control wheel pressure.

6. GROUND HANDLING AND MOORING:

The PA-20 is moved about on the ground by pushing on the struts or stabilizer. Moving of the PA-22 is most easily accomplished with the nose wheel steering handle provided with each plane.

Tie-downs are provided at the wing-strut intersections on both models. The tail wheel leaf spring on the Pacer and the tail skid on the Tri-Pacer should be used for tail anchorage.

In windy conditions the flaps should be lowered fully and the control wheel restrained with a safety belt to prevent the control surfaces from becoming damaged.

7. WEIGHT AND BALANCE:

For weight and balance data see the weight and balance form supplied with each airplane, which gives the exact weight of the airplane and permissible center of gravity conditions.

SECTION THREE

GENERAL MAINTENANCE

I. LEVELING AND RIGGING:

A. PA-20

(1) Leveling—Place adjustable jacks or blocks under the axle extension so that the jacks or blocks do not touch the brake lines or connections. Raise each wheel by pushing up on the lift struts on one side and pulling down on the opposite side. All lifting or pulling pressure must be applied as near to the wing attachment points as possible so as to be sure that the lift struts will not be bowed. Raise the tail to approximate level flight position and support it on an adjustable jack or block.

To level the airplane laterally and longitudinally, remove lower right wing root fairing, drop a plumb bob on a string from the hole located on the side of the upper door frame member approximately 5¾ inches aft of the front door frame member, to the center punch mark located on the seat front tube just inside the door. Adjust the jacks or blocks until the plumb bob centers over the mark.

(2). Dihedral Angle—Stretch a length of string from wing tip to wing tip along the top of the wing at the front spar location. Measure down from the string to the top of the fuselage front wing hinge fittings a distance of 4⅞ inches. Adjust the front lift strut fork fittings in or out to produce this dimension.

To check for equal dihedral in each wing, use a 30-inch level held spanwise against the underside of the wing at the front spar location. Note the amount of off level on one wing and see if the other wing has the same amount of off level. Adjust the front lift strut forks in on one side and out on the other to get the same amount of off level in both wings. Check the 4⅞-inch dimension after this adjustment to see that it has not been effected by the equalizing adjustment.

(3). Wash Out—Place a 1⅜-inch block under the wing at the rear spar location at the outboard aileron rib. Place a 30-inch level chordwise across this block with the front end of the level at the front spar location. The bubble will center if the wing has the proper 2½ degree washout. Adjust the rear lift strut forks in or out to bring the bubble to center.

(4). Tail Assembly—Level the stabilizers at the rear spar with the airplane in level position. Adjustment is accomplished by the tightening and loosening of the tail brace wires. Take up as

many turns as the opposite wires are let out, to keep the same tension on the wires. Do not scratch or mar the wires with pliers or wrenches as this may cause the wires to fracture. Plumb the rudder hinge line. Slight adjustments can be accomplished by firmly pushing against the fin rear spar in that direction required to bring the hinges in line. The streamline tail braces wires should be lined up with the air-stream or a whistling noise will result.

(5). Control Surface Travels:

Aileron	15° up	15° down
Elevator	24° up	12° down
Rudder	16° R	16° L
Stabilizer	1° up	6½° down
Flaps	40° down	

B. PA-22

The Tri-Pacer is rigged the same as the Pacer but must be leveled differently. To level the PA-22 longitudinally, after placing the main wheels in jacks for lateral leveling, adjust the height of the nose gear by spacing it up with blocks or lowering it by letting air out of the nose wheel tire. This adjustment should be continued until the leveling plumb bob is suspended in the correct position as in the PA-20 procedure.

C. PA-22 Control System Rigging:

In the control system of the Tri-Pacer to provide automatically coordinated aileron and rudder controls for simplified air control, and to increase stability in flight, the aileron control cables are connected to the rudder cables by means of an interconnecting cable. The interconnection incorporates a spring and is arranged so that although in level flight a movement of the ailerons results in the proper rudder action to give coordinated turns, still the controls can be crossed if desired to obtain slips or skids.

In rigging the control system of the PA-22, this procedure should be followed:

1. Center the nose wheel, rudder pedals, rudder and ailerons with the interconnecting cables slack at turnbuckles, located behind the baggage compartment.

2. Check the airplane in flight for proper trim with the interconnecting cables slack.

3. During the flight check, if ailerons do not line up with the flap trailing edges equally, adjust the aileron tab to obtain proper aileron position.

4. If airplane is wing heavy with ailerons in proper position, adjust the rear strut fork on the wing heavy side inward to obtain correct trim. Each ten degrees of wing heaviness in flight requires approximately one turn of the strut fitting.

5. If the airplane skids in flight when the wings are level, it is out of rig directonally. To correct this conditon, bend the leading edge of the fin in the direction towards which the airplane skids. Be careful not to depress the fin far enough to cause fabric wrinkles.

6. After the plane is trimmed properly directionally and laterally, tighten the interconnecting cables with the coil springs just beginning to become extended.

7. Check the trim of the plane in flight again to see that trim has not been affected by step 6, and to see that interconnecting cables are at correct tension to give properly coordinated controls. If the interconnecting cable tension is excessive, too much rudder movement will result from aileron movement, causing a skid. If the cables are not tight enough, the rudder will not move far enough when the control wheel is rotated to give coordinated turns. Proper tension will give coordinated turns at cruising speeds when either the wheel or the rudder controls are moved.

II. TIRE INFLATION:

For maximum service from the tires, keep the PA-20 main wheels inflated to 20 lbs., the PA-22 main wheels at 22 lbs., and the PA-22 nose wheel at 15 lbs. Reverse the tires on the wheels, if necessary, to produce even wear.

III. BATTERY SERVICE:

A Reading 12 volt, 33 ampere hour battery is installed under the right front seat in a stainless steel battery box. Access to the battery is obtained by removing the front stop pin, sliding the seat forward, and tilting it back.

The battery should be checked frequently for proper fluid level, but must not be filled above the baffle plates. All connections must be clean and tight.

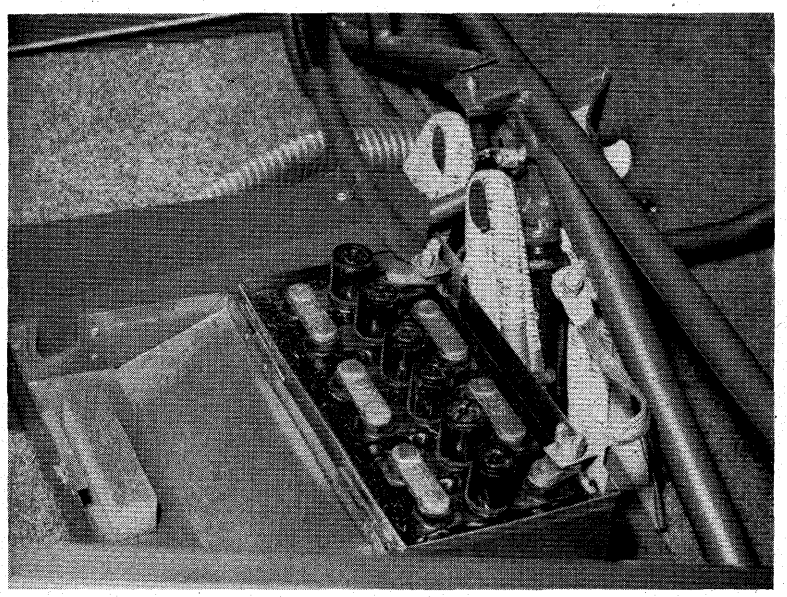


Figure 14

If the battery is not up to proper charge, recharge starting with a charging rate of 4 amps and finishing with 2 amps. If a quick charge is desired for the battery the master switch must be off during charging.

IV. BRAKE SERVICE:

A. PA-20

The brake system is filled with Univis No. 40 (petroleum base) hydraulic brake fluid. This should be checked at every 100 hour inspection and replenished when necessary.

Do not use mineral or vegetable base brake fluids when refilling system. When it is necessary to refill the brake system or when the brakes become spongy due to air in the lines, the following procedure should be used:

(a). To fill the brake system, remove the filler plugs on the master cylinders. Remove bleeder screw from tee on the brake line at the right wheel, attaching line

from pressure can. Pump fluid into the system until the master cylinder is full. Repeat procedure for left brake. Then replace filler plugs and bleeder screws. Check brakes for satisfactory operation.

If pressure can is not available an open can with a line attached may be used, provided can is held higher than master cylinders.

(b). Air in the brake lines causes faulty operation which can be corrected by bleeding the brake system as follows:

(a). Check entire system for breaks or leaks.

(b). Romove bleeder screw from particular brake unit and insert bleeder hose. Place free end in a clean receptacle.

(c). Remove filler plug from master cylinder of the particular brake which is being bled.

(d). Fill master cylinder with Univis #40 hydraulic fluid and keep cylinders full during bleeding process.

(e). Work the brake pedal rapidly to force fluid through bleeder hose into receptacle. Pinch hose shut during return of pedal to off position. Release pressure on hose, and push pedal on rapidly again. While fluid is flowing, restrict bleeder hose and allow brake pedal to return slowly to off position. Continue this process until no more air bubbles are observed coming through bleeder hose. The system is then properly bled.

(f). Replace bleeder screw; check to see that master cylinders are full, and replace filler plugs. Check brakes for satisfactory operation.

No adjustment of the brake clearances is necessary on the Pacer brakes. If, after extended service, the brakes become less effective, the brake segments can be easily replaced as follows: Remove the wheels to expose the brake shoe blocks, then slip blocks from their retainer clips with a screwdriver. Replace with new brake segments and reinstall the wheels.

Wheels are quickly removed by taking off the hub caps, removing the cotter pin from the hub nut and unscrewing the nut. The wheel can then be pulled freely from the axle.

All flight and engine instruments except the Gyro Horizon can be installed by removing the face plate and inserting the instruments. If an Artificial Horizon is to be installed, the small panel insert plate on the left side of the main panel should be replaced with one with a larger hole for accommodating the Horizon. Three different face plates are available, one for standard instruments, one for primary instruments or primary plus a Directional Gyro, and one for both Gyro instruments as well as primary and standard instruments.

The radio equipment is installed on the left side of the instrument panel or under the panel in front of the pilot. (See Radio Manual for detailed instructions).

The front seat is adjustable through its six inch range by means of a control lever under the front center of the seat. To adjust the seat forward, raise the locking lever allowing the seat to move ahead to the desired position. To adjust the seat rearward, raise the lever and press the seat back against the seat adjustment spring. In fixing the seat in any given position be sure that the locking lever has been pushed fully down to engage the latch completely.

To remove the front seat for access to the battery or for other purposes of maintenance, first remove the forward stop pin located between the front seat cushions. Then release the lock, allowing the seat to move as far forward as it will go. Tilt the seat back and up, disengage the seat return spring, and lift the seat out of its tracks.

The rear seat area is readily converted to a cargo compartment by removing or folding the rear seat. To remove the seat, detach the cushion from the lower support tube, remove the support tube from the rear, then the front sockets, and unlace the back cushion and canvas from the upper support tube. If desired, the back cushion and canvas can be folded rearward into the baggage compartment instead of being removed completely.

Although access to the baggage compartment is normally through the baggage compartment door, it may occasionally be desirable to load baggage through the rear door by raising the rear seat forward. To make room for bulky packages in the baggage compartment, the compartment top can be detached by snapping out the spring clips which hold the top panel in position.

The main wheels are removed by detaching hub caps and dust caps, removing the axle nuts, and sliding the wheel from the axle. To remove the nose wheel, remove one axle nut, slide the axle through the nose wheel fork, and drop the wheel from its fork. In reinstalling the nose wheel, the axle nuts should not be drawn up tight enough to bind wheel bearings.

Tires (600x6 balanced four ply on all wheels) are dismounted from wheels by (1) deflating tubes; (2) removing wheel from axle; (3) taking stop nuts from wheel through-bolts; (4) withdrawing the two halves of wheel from tire.

V. LANDING GEAR SERVICE:

The Hydrasorb units on the PA-20 and the PA-22 incorporate a hydraulic shock absorber unit and two 8″x⅝″ shock cords. The units can be removed for servicing as follows (1) raise the airplane until the main wheels do not touch; (2) tilt the front seat back; (3) remove the upper Hydrasorb attaching bolts and allow the gear to drop down; (4) detach lower end of units.

The shock cords on the Hydrasorb units should be replaced if they become weakened. The hydraulic units cannot be repaired and must also be replaced when worn.

The nose wheel mounting on the PA-22 is readily removed for service as follows:

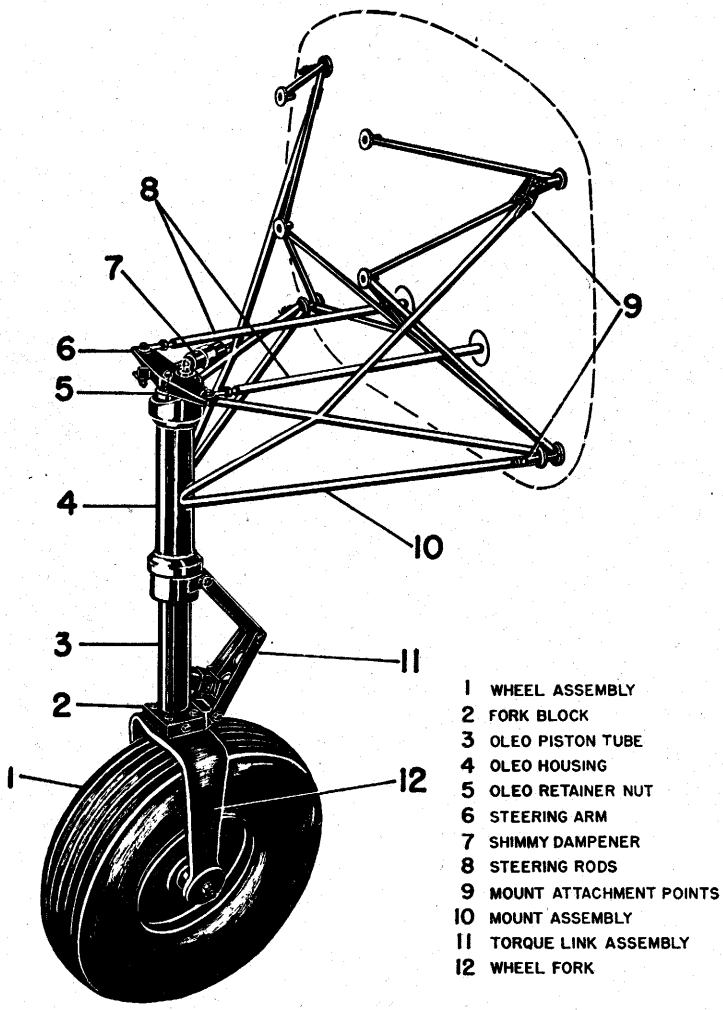
1. Push tail of plane down until tail skid rests on ground. Hold tail in this position with tie down or by resting a load on the stabilizer. (It is suggested that sand bags be laid on a plywood sheet on the inboard part of the stabilizers. Care must be taken not to damage the stabilizer adjustment mechanism or the fabric.) This raises nose wheel from the ground so that it can be removed.

2. Remove bottom cowl.

3. Detach steering rods from nose wheel steering arms at top of strut.

4. Remove nuts from lower motor mount bolts, on firewall, and drive the bolts back to the motor mount bushings, being careful not to drive the bolts completely through the bushings as all the engine weight will be applied to upper motor mount attachments, causing damage to the mount. Then remove bolts from upper attachment of nose wheel mount to motor mount.

5. Slide nose wheel unit forward and down to clear it of motor mount.



NOSE WHEEL INSTALLATION

Figure 15

The nose wheel shock absorbing unit is an oleo-pneumatic strut in which the air operating under pressure serves as the taxiing shock absorber, while the oil absorbs the major loads. The entire oleo can be detached from the nose wheel mount as follows: (See Figure 15).

1. After detaching bottom cowl, unsafety the oleo retainer nut on top of unit, and remove cap screw in top of steering arm assembly.

2. Remove through bolt from steering arm assembly and detach assembly.

3. Insert screw driver in slot in retainer nut and hold screw driver against the oleo housing to prevent the nut from turning.

4. Rotate oleo unit by turning nose wheel to unscrew the unit from the retainer nut. When the nut is free the oleo may be removed from its housing.

Replacement of the oleo is done by reversing this procedure. A dust shield is located on top of the upper bearing and should be properly in place there after the oleo is reinstalled. At this time the sealing of the bearings should also be checked, and the retainer nut pulled down to the proper position. To get a snug fit of the oleo strut on the bearings, pull the nut up tight, then back it off enough so that the oleo can be rotated freely but has no play.

The chrome-plated oleo piston tube is removed in order to replace seals, which consist of 2 "O" rings and a rubber wiper strip, located on the bearing block assembly. The oleo unit can be disassembled with the nose wheel housing and the outer tube of the oleo strut in place on the airplane as follows:

1. Let air escape from air valve at top of unit, then remove valve core.

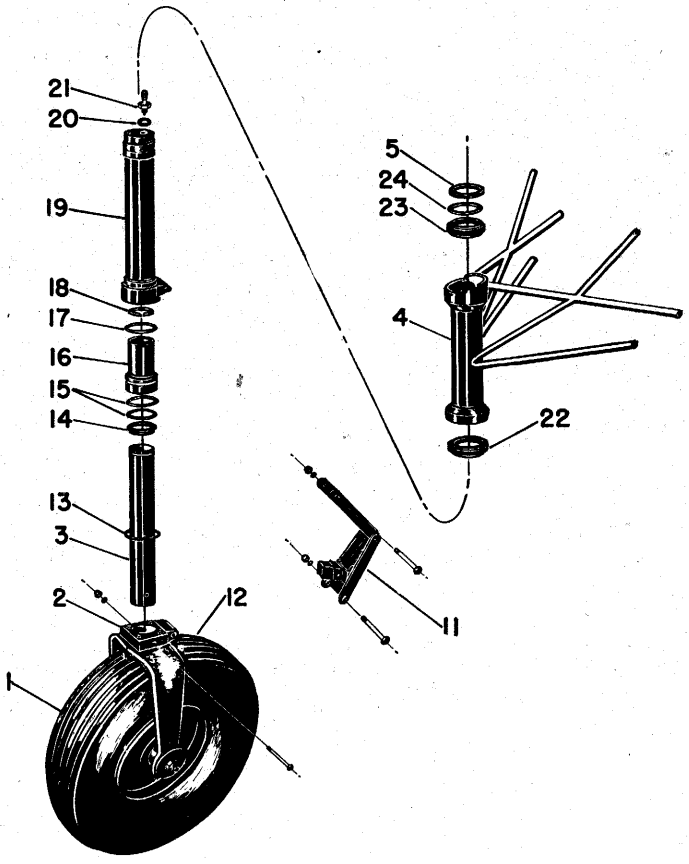
2. Detach lower end of oleo torque link assembly from fork block.

3. Remove lower snap ring, located inside and at bottom of outer oleo strut tube, with small nosed pliers.

4. Slide piston tube and bearing block assembly out of outer tube. Oleo fluid will flow from the outer tube and much of it can be caught in a container and reused.

5. Remove upper snap ring on piston tube.

1 WHEEL ASSEMBLY
2 FORK BLOCK
3 OLEO PISTON TUBE
4 OLEO HOUSING
5 OLEO RETAINER NUT
11 TORQUE LINK ASSEMBLY
12 WHEEL FORK
13 LOWER SNAP RING
14 WIPER STRIP
15 INNER "O" RING & BACKUP WASHER
16 BEARING BLOCK
17 OUTER "O" RING
18 UPPER SNAP RING
19 OUTER OLEO TUBE
20 AIR VALVE GASKET
21 AIR VALVE
22 LOWER BEARING
23 UPPER BEARING
24 DUST SHIELD



NOSE WHEEL OLEO BREAK-DOWN

Figure 16

6. Slide bearing block off top of piston tube, taking precaution not to damage "O" rings in the process.

To reassemble the oleo unit, reverse this procedure, being very careful to see that the snap rings are properly reinstalled.

No. 40 Univis petroleum base hydraulic oil is used in the nose oleo. To add oil to the unit, first release all the air through the air valve, allowing the oleo to compress fully. Next remove the air valve core and fill the unit through this opening, extending the strut slowly while adding fluid. Compress the oleo again to within ¼" of full compression, allowing excess oil to overflow and working out any trapped air. Then reinsert the air valve and pump up the strut.

The nose wheel oleo strut of the Tri-Pacer is properly extended when 3½ inches of the chrome plated tube is exposed with the plane in normal ground attitude at normal light weight (no occupants or baggage). This dimension is controlled by changing the air pressure in the unit.

To add air to the nose gear, first unfasten the right side of the bottom engine cowl. Unscrew the air valve cap on top of the oleo unit and attach a high capacity air hose or pump. Increase the air pressure in the oleo until five or six inches of the chrome strut is exposed. Then release air from the valve in short spurts until the 3½" dimension is obtained. Rock the airplane longitudinally, working the nose wheel oleo to make sure of proper extension after normal operation.

Shimmy of the steerable nose wheel is controlled by means of a shimmy dampener which is attached to the right side of the nose wheel mount. This dampener should require no servicing other than routine inspection during periodic checks. In case of damage or malfunctioning, the dampener should be replaced rather than repaired. In installation of the dampener, vertical alignment of the piston rod with nose wheel steering arm must be maintained to prevent binding of the rod during its full travel.

If found to need additional oil, the dampener can be filled with Univis No. 40 as follows:

1. Remove unit from its attachment.
2. Remove cotter pin from end of piston rod.

3. Slide piston rod forward as far as possible until aft end is completely inside cylinder.

4. Refill with hydraulic oil, making sure that all air is excluded from the cylinder.

5. Push piston rod back in place, replace cotter pin and then replace unit.

Steering of the nose wheel is effected by use of the rudder pedals which actuate steering rods connected to steering arms at the top of the nose wheel unit. The length of the steering rods can be adjusted at either end by turning in or out threaded eye bolts. Adjustment is normally accomplished at the forward end of the rods, and should be done in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals and the rudder are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the plane follows a perfectly straight line. Turning arc of the nose wheel is 20 degrees in each direction and is adjusted at stops on the steering arm.

VI. FUEL REQUIREMENTS:

Aviation Grade 80 octane gasoline should be used in the Pacer and Tri-Pacer.

The tank and line sumps should be drained regularly to remove water or sediment.

The oil capacity of the Lycoming 0-290-D2 is 8 quarts. It is recommended that engine oil be changed every 50 flying hours or sooner under unfavorable conditions. The minimum safe quantity of oil required is 3½ quarts. The following grades are recommended for the specified temperatures:

Temperatures above 40° F.	S.A.E. 50
Temperatures 30° F. to 75° F.	S.A.E. 40
Temperature 10° F. to 55° F.	S.A.E. 30
Temperatures below 30° F.	S.A.E. 20

VII. CARE OF WINDSHIELD AND WINDOWS:

The windshield and windows are made of plexiglas and a certain amount of care is required to keep them clean and clear. The following procedure is suggested:

1. Flush with clean water and dislodge excess dirt, mud, etc., with your hand.

2. Wash with mild soap and warm water. Use a soft cloth or sponge (Do not rub).

3. Remove oil, grease or sealing compounds with a cloth soaked in kerosene.

NOTE: Do not use gasoline, alcohol, benzene, carbon tetrachloride, lacquer thinner, or window cleaning sprays.

4. After cleaning, apply a thin coat of hard polishing wax. Rub lightly with soft dry cloth.

5. A severe scratch or mar can be removed by using jewelers rouge to rub out scratch, smooth on both sides and apply wax.

SECTION FOUR

INSPECTION INSTRUCTIONS

ENGINE SECTION

ITEM 1—ENGINE OPERATION:

Run engine to minimum 120° oil temperature—check full throttle static R.P.M. both magnetos.
Check magnetos 100 R.P.M. drop at 1800.
Check carburetor heat 100 R.P.M. drop at full throttle.
Check ignition switch for operation.
Check idle R.P.M. 550-600 carburetor heat-off.
Oil pressure (minimum idle 25. Normal 65-85).
Master switch on check generator and voltage regulator for operation.
Battery fully charged will show very slight indication on Ammeter at full throttle.
Check idle cut-off at 800 R.P.M. Engine should cut off clean.

Lycoming O-290-D-2 *Maximum R.P.M. 2600*

Static R.P.M. Wood Fixed Pitch	2200-2400
Static R.P.M. Metal Fixed Pitch	2150-2450
Static R.P.M. Koppers Aeromatic	2550-2600

ITEM 2—ENGINE MOUNT AND ATTACHMENTS:

Check engine mount for damage and cracks at gussets or in corners.
Inspect protective finish on mount; sand and touch up bare areas.
Inspect rubber shock mounts for rubber deterioration and tension.
Engine mount bolts should be tightened to 60 to 80 inch pounds.
Check mount bolts for safety.

ITEM 3—COWLING AND BAFFLES:

Clean and inspect engine cowling for dents and cracks at hinges and reinforcement.
Check for tension adjustment on cowl doors at latch.
Tension prevents vibration and cowl cracking.
Check baffles for cracks and felt installation to prevent chafing.

ITEM 4—MAGNETOS, WIRING AND SHIELDING:

Check magneto for secure attachment.
Check breaker point housing for excessive oil.
Check points for gap and pitting. Gap setting .012".
Check plug wiring connections at magneto and wire insulation for deterioration and chafing.
Check for grommets at baffles.

ITEM 5—OIL DRAIN AND SAFETY PLUG:

Drain oil and check for metal particles.
Remove, clean and check oil screen for metal particles.
Change oil filter if installed and check flexible lines for deterioration.

ITEM 6—OIL RADIATOR:

Inspect oil radiator for evidence of leaks and chafing around baffles.
Check lines for deterioration and chafing.
Check core for clear air passage.

ITEM 7—SPARK PLUG SERVICE:

Remove plugs, bomb blast and clean.
Plugs with badly burned electrodes should be replaced.
Reset gap to .025".
Reinstall using thread lubricant to prevent seizing and torque to 300 to 360 inch pounds or 30 foot pounds.

ITEM 8—STARTER:

Check starter motor for mounting security.
Check commutator for excessive wear and bridging.
Inspect wiring insulation for deterioration and connections.
Check ring gear for damaged teeth and nose cowl clearance.
Check starter shaft bushings for play.
Check brush retention and tension springs.

ITEM 9—GENERATOR AND WIRING:

Check generator mounting for security.
Check brush retention and condition of tension springs.
Replace worn brushes before there is any danger of brush failure.
Brush worn over 3/16 of an inch should be replaced.
Check generator drive belt for ¾" hand deflection.

ITEM 10—CARBURETOR AND HEATER:

Check carburetor for mounting security.
Inspect carburetor bowl for cracks, particularly at inlet.
Drain carburetor float chamber and check inlet finger screen-resafety.
Operate throttle in cockpit to be sure that throttle arm hits stops in open and closed positions without binding or sticking.
Check operation of mixture control for binding or sticking and full rich position.
Inspect carburetor air box for security and cracks—heater valve for full travel.
Check rubber intake hose connections for deterioration and clamp security.
Check intake system for leaks and cracks.
Clean air filter in kerosene and saturate with No. 10 oil and allow to drain before installation.

ITEM 11—FUEL LINES AND STRAINER:

Check fuel lines for leaks and hose deterioration.
Check hose supports for security and chafing.
Drain and clean fuel strainer and resafety.
Check for stains around fuel system indicating leaks.
Check all connections for tightness.

ITEM 12—EXHAUST STACK AND MUFFLER:

Check stack flanges for security, cracks and leaks.
Remove all heater and muffler shrouds and inspect for corrosion, cracks and leaks that might transfer gas to the cockpit, particularly through the cabin heater system.
Check tailpipe, muffler and stacks for security at all clamps and slip joints.
Check cabin heater box and control valve for operation.
Check cabin and carburetor heat flexible tubing for security and general condition.

ITEM 13—ENGINE CONTROLS AND FIREWALL:

Check firewall for open holes and gas leaks from engine compartment.
Check all controls for grommets and sealing putty.

PROPELLER SECTION

ITEM 14—PROPELLER:

Remove spinner and check for cracks or dents in spinner and back plate.
Check propeller for excessive dents or irregularities.
Metal propeller hub bolts are to torque from 350 to 375 inch pounds.

ITEM 15—PROPELLER OPERATION:

Check operation and limitations sheet No. 58 furnished with each Aeromatic Model F200-H Propeller for proper operation.
Comply with instructions furnished covering installation of Aeromatic Model F200-H Propeller with Hydro-actuated control.

ITEM 16—GOVERNOR AND CONTROLS:

Governor and controls. Follow Propeller Manufacturer's instructions.

COCKPIT, PASSENGER AND CARGO SECTION

ITEM 17—SEATS:

Check rear seat canvas for adjustment and deterioration.
Check front seat fore and aft adjustment and lubricate track.
Check condition of safety belts and operation of buckles.

ITEM 18—WINDSHIELD:

Check weatherstripping for security in channels and for weather leaks.
Visual check for cracks, crazing, distortion and discoloration.

ITEM 19—POWER PLANT INSTRUMENTS:

Check power plant instruments for mounting security.
Check connections and plugs.
Check placards and limitation markings.

Lycoming O-290-D-2 Series Engine:

Tach.:

Red Line	2600 R.P.M.
Green Arc	500—2600 R.P.M.

Oil Pressure:

(Same as O-235 Series Engine). See Above.

Oil Temperature:

Red Line	245°
Yellow Arc	40°—120°
Green Arc	120°—245°

ITEM 20—FLIGHT INSTRUMENTS:

Check flight instruments for mounting security.
Check connections and plugs.
Check placards and limitation markings.
Air Speed:

Red Line	158 M.P.H.
Yellow Arc	126-158 M.P.H.
Green Arc	51—126 M.P.H.
Flaps Extended	
White Arc	46—80 M.P.H.

ITEM 21—SWITCHES, LIGHTS-FUSES:

Check battery cable connections for security.
Check panel on left side to read, "Circuit Breakers under panel."
Check circuit breaker wire connectors for security and insulating sleeves.
Check position and landing light switches on panel for placards and operation—green, right wing—red, left wing and white, tail light.
Check cockpit lights for operation and rheostat for dimming action.
A circuit breaker will be used on all circuits except the Stall Warning Indicator.

ITEM 22—INTERIOR TRIM:

Check cockpit post fairings and all metal trim for security.
Check control column boot and pulley covers for security.
Check floor mat for attachment.

ITEM 23—DOOR LATCH AND HINGES:

Check door hinge and rivets for looseness.
Check door latch plunger for complete extension to prevent doors opening while taxiing.
Check door for improper fit or damage resulting in air leaks.

ITEM 24—ENGINE CONTROLS:

Check mixture control for panel placard and operation for smoothness.
Check carburetor heat for panel placard and smoothness of operation.
Check throttle for smooth operation and operation of friction lock.
Check primer for operation and leaks behind the panel.
Check cabin heat for panel placard and full travel of heater butterfly valve.
Check rear seat heater and under floor tube for possible interference with controls and control cables.
Check ignition switch for panel and terminal security.
Check for placard. Off, Left, Right and Both.

ITEM 25—CONTROL COLUMN AND ATTACHMENTS:

Check under floor extension of control column.
Check column mounting bearings.
Check fork in connector tube for wear and play.
Check control column pulleys for wear and alignment.
Check turnbuckles for safety—maximum three (3) threads showing.
Check Universal Joints for excessive wear.
Check fiber guides forward of panel for wear, also shaft bearings in panel.

ITEM 26—RUDDER PEDALS AND LINKAGE:

Check rudder pedal assembly for play and travel freedom.
Lubricate hinges and torque tube bearings and check for safety.
Check rudder pedal return springs for attachment.

ITEM 27—FLAP CONTROLS:

Check flap handle for placard and condition of ratchet for two flap positions.
Check flap cable and pulley through inspection opening on under side of fuselage.
Remove fuselage belly access door and check flap pulleys at top and bottom of fuselage.
Through the zipper opening in the top upholstering check the two flap cable pulleys and turnbuckles—maximum three (3) threads showing.
Remove rear wing butt fairings and check cable fairleads.
Through wing inspection openings check the attachment of flap return springs.

ITEM 28—CABLES AND PULLEYS:

Check all cables for broken strands.
Remove butt fairings and check top deck aileron pulleys for wear and security.
Check aileron pulleys at both ends of panel.
Remove covers and check pulleys—front floorboards.

ITEM 29—FLIGHT CONTROL OPERATIONS:

Check aileron, rudder and elevator controls from cockpit for smooth operation.
Check wheel or stick for neutral position with controls surfaces streamlined.

ITEM 30—TRIM TAB CONTROLS:

Check stabilizer trim control for smooth operation.
Check indicator against stabilizer for proper position.

ITEM 31—FUEL SELECTOR VALVE:

Check fuel valve for smooth operation.
Check placard for "On" and "Off" positions.
Check valve for leaks.

LANDING GEAR

ITEM 32—SHOCK STRUTS:

Check shock cords for deterioration and hydraulic unit for operation. When worn out this sealed unit must be replaced.
Check nose oleo unit for operation, leaks and looseness. (PA-22)

ITEM 33—AXLES AND WHEELS:

Remove wheels, wash, check and relubricate bearings.
Check brake shoes for wear and drums for scoring.
Check brake expander tube for leaks.
Install wheel and axle nut only tight enough to remove end play.

ITEM 34—TIRES AND FAIRINGS:

Check tires for 22 pounds of air pressure in main wheels, 15 lbs. in nose wheel (PA-22). PA-20 main wheels 20 lbs.
Replace tires that have cord showing.
Check gear fairings for security and chafing.

ITEM 35—BRAKES AND OPERATION:

Check brake reservoirs for fluid and assembly for leaks.
Check operation and holding ability of parking brake.

ITEM 36—LANDING GEAR:

Hoist aircraft and check gear bushings, vee bushings are replaceable if worn.
Check for skin wrinkles indicative of inside damage.

ITEM 37—TAIL WHEEL:

Check tail wheel and spring assembly for looseness.
Check condition of tail spring pad.
Remove wheel, wash and repack bearing.

FUSELAGE

ITEM 38—FABRIC CONDITION:

Check condition of fabric with the eraser end of a pencil, particularly on top surfaces.

Check the finish for cracks or checks. Sand out and repaint all checks or cracks to preserve the fabrics.

ITEM 39—WING FITTINGS:

With wing root fairings removed inspect wing fittings with a flashlight and magnifying glass for minute cracks in the ears.

Check bolts to be sure there are no threads in bearing and bolts are properly safetied.

Check wing fitting holes for elongation by having some one pull up and down on the wing tips.

ITEM 40—LANDING GEAR FITTINGS:

Remove both landing gear fairings and inspect all fittings with flashlight and magnifying glass for signs of cracks or hole elongation.

ITEM 41—FUSELAGE STRUCTURE:

Through inspection openings and through the baggage compartment cover check the condition of all tubing for rust, damage and protective coating.

Check all wood stringers for damage and security.

ITEM 42—DEBRIS ACCUMULATION:

Check the bottom of the fuselage and fabric under floor boards for bolts, nuts and other objects that might jam controls or pulleys.

Check the rear of fuselage for open drain grommet.

If considerable dirt or oil exist on the fuselage bottom, use a non-caustic soap and wash out the dirt to prevent fabric rot.

ITEM 43—CONTROL CABLES AND PULLEYS:

Check for broken control cable strands by sliding a cloth over the cable in vicinity of fairleads.

Check upper and lower elevator turnbuckles for safety and maximum of three threads showing outside of barrel.

Check bungee spring attachment at elevator horns and both pulleys at stabilizer yoke for wear and safety.

Check four rudder cable fairleads and cables for wear aft of baggage compartment.

Check four rudder pulleys on cockpit floor for wear and safety and check condition of pulley covers.

ITEM 44—FAIRINGS:

Check tail assembly fairings for cracks and missing metal screws.

WINGS, AILERONS AND FLAPS

ITEM 45—WING-FABRIC:

Check left and right wing fabric for holes, cracks or checks in the finish and open drain grommets at each rib bay trailing edge. (Fabric usually deteriorates on the upper surface of the wing or along the trailing edge.)

Install inspection grommets at drag wire fittings to inspect drag wires for tension and wing ribs and compression members for damage.

ITEM 46—STRUTS-LIFT:

Check right and left wing strut fittings for elongation by having some one lift up and down on the wing.

Check bolts for fitting attachment to the spar.

Check struts for dents or cracks, also sight down strut trailing edge to ascertain that struts are straight.

Check strut end forks and fork lock nut. The maximum number of threads allowed outside the strut end is fifteen.

ITEM 47—WING BOLTS:

Check strut attachment bolts to be sure there are no threads in bearing and bolts are properly safetied.

ITEM 48—AILERONS:

Check both ailerons for wrinkles which are possible signs of structural damage.

Check each rib bay for an open drain grommet.

Check condition of fabric and finish, refinishing any dope cracks, checks, or ringworm.

ITEM 49—AILERON HINGES:

Check aileron hinge legs for security at rear spar and false spar.

Check hinge pins for wear and safety. Worn or loose pins must be replaced.

ITEM 50—AILERON CONTROLS:

Remove inspection covers and check the two cables in each wing for interference and chafing.

Check the two pulleys in each wing for condition, wear and safety and lubricate pulley bearings.

Check wear and safety of the two fairleads in each wing.

15° up 15° down -/- 2°.

Stops are installed on center hinge and on control column.

Stop at aileron should engage first to allow for full travel of ailerons.

Check the four aileron horn bolts for wear, threads in bearing and safety.

Check the two turnbuckles in left wing and one turnbuckle and shackle connector in the right wing. Turnbuckles safetied and no more than three threads showing outside the barrel.

To locate broken strands at fairleads or pulleys slide a cloth over the cable, all cables with broken strands are to be replaced.

ITEM 51—FLAPS:

Check fabric condition of both flaps with a pencil eraser end for deterioration.

Check condition of finish for cracks, checks, or ringworm and refinish any that exist.

Any internal structural damage will cause wrinkles on the fabric surface.

ITEM 52—FLAP ATTACHMENTS:

Each flap has two hinges and two hinge legs that are riveted to the wing false spar and attached with a single bolt to the wing rear spar.

Lowering the flaps at over 80 M.P.H. can cause possible damage to these hinge legs so a careful inspection is recommended. Check stop in up position for streamline of flap.

Check the hinge pins for wear and installation of washers and safety.

ITEM 53—FLAP MECHANISM:

Check fafnir rod end bearings and push pull tube for clearance through hole drilled in the fafnir bearing rod to check minimum distance the push pull tube is screwed in the fafnir rod. Be sure lock nut is tight.

Ascertain through inspection that both flap return springs are secure and in good condition. Operate flaps and check springs to be sure they do not chafe, bind or interefere with other controls of adjacent structure.

Check travel:

Full Flap 40 -/- 2°.

Check bellcrank casting for cracks, particularly at the ears and for safety and security of the bracket.

ITEM 54—WING ROOT FAIRINGS:

Check left and right top wing root fairings for tension, adjustable through a hole at the trailing edge.

Check all metal screws for security and the fairing for cracks.

EMPENNAGE

ITEM 55—STABILIZER:

Check stabilizer fabric condition and drain grommets for restrictions.

Check stabilizer rear hanger tube and front link tube for hinging action.

Small holes are drilled in the fuselage tube and stabilizer link tube to drop oil in for lubrication. Lubrication of these tubes is very important and often neglected, resulting in the tubes freezing up.

Lift up and down on the stabilizer checking for excessive play in the stabilizer yoke screw. The nut on the bottom of the screw pulley will take up play if excessive.

Check stabilizer yoke casting for cracks and link tube ears for worn bolts and safety.

ITEM 56—FIN:

Inspect vertical fin for fabric condition and finish.

Check for wrinkles, dents and signs of internal damage.

ITEM 57—RUDDER:

Inspect fabric cover on the rudder for fabric and dope condition.
Check bottom of rudder for an open drain grommet.
Check rudder for alignment and possible internal damage usually indicated by a wrinkle in the fabric.
Inspect rudder hinge pins for wear and safety.
Check hinge bushings for play, these bushings are pressed in and should be replaced when worn.
Check rudder stops to ascertain full travel:
16° Right and 16° Left -/- 2°.

ITEM 58—ELEVATORS:

Check fabric condition and finish on the elevators.
Check for open drain grommets along the elevator trailing edge.
Sight one elevator against the other for alignment.
Check hinge pins and bushings for wear and replace any worn pins or bushings.
Check elevator cable horns for safety, worn bolts and clearance in travel.
Check elevator stops to ascertain full travel:
24° up—12° down -/- 2°.

ITEM 59—EXTERNAL BRACING:

Check empennage rigging wires for corrosion and cracks or nicks that might result in failure.
Check fittings for alignment with the wire and bolts for safety.
Rigging wires should be taut with little hand deflection.
Check each wire to be sure there are no loose fork lock nuts.

ITEM 60—RUDDER AND ELEVATOR CONTROLS:

Check rudder and elevator horns for worn bolts and safety with no threads in bearing.
Check horns for alignment with the cable and freedom of travel.
Check top and bottom cable turnbuckles for safety and a maximum of three threads showing outside the barrel.
Sight the cables through the fuselage for interference and chafing.

ITEM 61—ELECTRICAL SYSTEM:

Check wiring for chafing, clamping.
All terminals tight.
Bonding straps secure.
Landing lights—mounting and operation.
Navigation lights—mounting and operation.
Battery installation—terminals secure. Charged, acid spillage.
Radio installation for security and operation.
Safe Flight Indicator for operation.
Circuit breakers or fuses for security.

ITEM 62—FLOATS OR SKIDS:

Sight check rigging.
All brace wires tight and safetied.
Water ballast, if carried.
No leaks in floats. Structure OK.

ITEM 63—

All C. A. A. Mandatory Bulletins complied with.

Note: All the information in Inspection Instructions, along with a check list for 25-50 and 100 hour inspections can be obtained in special form from the Piper Aircraft Corporation.

SECTION FIVE

WARRANTY

Piper Aircraft Corporation hereby warrants each new airplane and part manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any part or parts thereof which shall, within ninety (90) days after delivery of such airplane or part to the original purchaser or fifty (50) hours of operation, whichever shall first occur, be returned to it with transportation charges prepaid and which its examination shall disclose to its satisfaction to have been defective. No other warranty shall be implied by law or otherwise, and no other or further obligation or liability shall be incurred by Piper Aircraft Corporation by reason of the sale of any airplane or part thereof or its use whether for breach of warranty (expressed or implied by law, or otherwise) or negligence in manufacture, or otherwise. Upon the expiration of the period above stated, any such obligation or liability shall terminate. In no event shall Piper Aircraft Corporation be liable for special or consequential damages. No distributor, dealer, agent, or employee of Piper Aircraft Corporation is authorized to extend any other or further warranty, or incur any additional obligation, in its behalf in connection with the sale of its products.

This warranty shall not apply to any airplane or part manufactured by Piper Aircraft Corporation which shall have been repaired or altered outside of its factory, or which has been subject to misuse, negligence or accident.

Piper Aircraft Corporation makes no warranty whatever with respect to engines, wheels, propellers, ignition apparatus, starting devices, generators, batteries, instruments or other trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers.

PIPER AIRCRAFT CORPORATION.