PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED
AIRPLANE FLIGHT MANUAL

MOONEY

M20J

Advanced Trainer

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE FEDERAL AVIATION REGULATIONS, AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL.
THIS DOCUMENT MUST BE CARRIED IN THE AIRCRAFT AT ALL TIMES.

MOONEY AIRCRAFT CORPORATION
P.O. BOX 72, KERRVILLE, TEXAS 78029-0072

SERIAL NUMBER: _____

REGISTRATION NUMBER: _____

FAA APPROVED: Henry A Armstrong 8-28-89

Henry A. Armstrong, Manager
Airplane Certification Office
FEDERAL AVIATION ADMINISTRATION
Fort Worth, Texas
76193-0150

FAA APPROVED in Normal Category based on CAR PART 3; applicable to Model M20J S/N listed above only.

ISSUED 8 - 89
REV. A 3-90
REV. B 1-92

MANUAL NUMBER 3210

LIST OF EFFECTIVE PAGES

ORIGINAL . . . . . 8 - 89
REVISION A . . . . . 3 - 90
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Always destroy superseded pages when inserting revised pages.

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This POH/AFM effective beginning with M20J, S/N 24-1686-14

LIST OF EFFECTIVE PAGES (con't.)

LOG OF REVISIONS

REVISION NUMBER	REVISED PAGES	DESCRIPTION OF REVISIONS	FAA APPROVED	DATE
B	Title Page, i thru iv	Revised Data to reflect REV. B changes.		
	1-3, 1-4, 2-7, 2-18, 7-9, 7-21, 7-23	REVISED DATA		
	1-5, 1-6, 2-6	RELOCATED DATA		
	1-7, 1-8, 3-9, 3-10	ADDED AND REVISED DATA		
	4-5, 4-6, 4-13	DELETED DATA	Charles D. Lovell for M. M. Cuday	1/22/92

The revised portions of affected page are indicated by vertical black lines in the margin.

No. 3210
REVISION B

LOG OF REVISIONS (con't.)

REVISION NUMBER	REVISED PAGES	DESCRIPTION OF REVISIONS	FAA APPROVED	DATE

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No. 3210
REVSION B

INTRODUCTION

This Pilot's Operating Handbook conforms to GAMA Specification No. 1 and includes both manufacturers material and FAA APPROVED material required to be furnished to the pilot by the applicable Federal Aviation Regulations. SECTION IX contains supplemental data supplied by Mooney Aircraft Corporation.
SECTION I contains information of general interest to the pilot. It also contains definitions of the terminology used in this Operators Manual.
This Pilot's Operating Handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in an up to date status.

All limitations, procedures, safety practices, servicing and maintenance requirements published in this POH/AFM are considered mandatory for the Continued Airworthiness of this airplane in a condition equal to that of its original manufacture.

DESCRIPTIVE DATA

ENGINE

Number of engines	1
Engine Manufacturer	TEXTRON-Lycoming
Model	IO-360-A3B6D
Recommended TBO	2000 Hours
Type	Reciprocating, aircooled, fuel injected.
Number of cylinders	4, Horizontally opposed
Displacement	361 Cu. In. (5915.7 cc)
Bore	5.125 In. (13.02 cm)
Stroke	4.375 In. (11.11 cm)
Compression ratio	8.7:1

Fuel System

Type	Fuel Injection Flow
Make	Bendix, RSA-5-AD1
Fuel - Aviation Gasoline	100 Octane or 100LL (min. grade)

Accessories

Magnetos	Bendix D4LN 2021 or D4LN3021
Spark Plugs	18 MM X .750-20 Thd. Connection
Alternator	Prestolite 12V, 60A
Starter	Prestolite 12 Volts

Ratings:

Maximum Continuous Sea Level-BHP/RPM	.200/2700

PROPELLER

Number	1
Manufacturer	McCauley*
Model Number	B2D34C214/90DHB-16E*
Number of Blades	2
Diameter Max.	74.0 in. (187.9 cm)*
Min.	73.0 in. (185.4 cm)*
Type	Constant Speed

Governing	Hydraulically controlled by engine oil
Blade Angles @ 30 in. Sta.(75 cm):	
Low	13.9 degrees +/- .2 degrees*
High	33.0 degrees +/- .5 degrees*

FUEL

Minimum Fuel Grade (Color)	100 Octane (Green)/100 LL (Blue)
Total Capacity	66.5 U.S. Gal. (251.8 Liters)(55.4 Imp. Gal.)
Usable	64.0 U.S. Gal. (242.4 Liters)(53.3 Imp. Gal.)

OIL

Total Oil Capacity	8 Qts. (7.57 Liters)
Oil Capacity Minimum for Flight	5 Qts. (4.73 Liters)
Oil Filter	Full Flow

Oil grades, specifications and changing recommendations are contained in SECTION VIII.

LANDING GEAR

TYPE: Electrically operated, fully retractable tricycle gear with rubber shock discs. The main wheels have hydraulically operated disc brakes. The nose wheel is fully steerable 14° left or right of center.

Wheel Base	71 9/16 in. (181.73 cm)
Wheel Track	110 in. (279.4 cm)
Tire Size:	
Nose	5.00 x 5 (6 ply)Type III
Main	6.00 x 6 (6 ply)Type III
Tire Pressure:	
Nose	49 PSI
Main	30 PSI
Min. Turning Radius (No brakes applied)	41 ft. (12.5 m)

MAXIMUM CERTIFICATED WEIGHTS

Gross Weight	2740 Lbs. (1243 Kg)
Baggage Area	120 Lbs. (54.4 Kg)
Hat Rack	10 Lbs. (4.54 Kg)
Cargo (Rear Seats Folded Down)	340 Lbs. (154.2 Kg)

STANDARD AIRPLANE WEIGHTS

Basic Empty Weight	See Page 1-10
Useful Load	Varies with installed equipment

See SECTION VI for specific airplane weight.

CABIN AND ENTRY DIMENSIONS

Cabin Width (Maximum)	43.5 In. (110.5 cm)
Cabin Length (Maximum)	114 In. (290 cm)
Cabin Height (Maximum)	44.5 In. (113 cm)
Entry Width (Minimum)	29.0 In. (73.4 cm)
Entry Height (Minimum)	35.0 In. (88.9 cm)

BAGGAGE SPACE AND ENTRY DIMENSIONS

Compartment Width	24 In. (60.9 cm)
Compartment Length	35 In. (88.9 cm)
Compartment Height	35 In. (88.9 cm)
Compartment Volume	
S/N 24-1686-14	17.0 cu. ft. (.481 cu m)
S/N 24-1687-14 thru 24-2999	15.3 Cu. Ft. (.433 cu m)
Cargo Area (with rear seats folded down)	33.0 Cu. Ft. (.924 cubic meters)
Entry Height (Minimum)	20.5 In. (52.1 cm)
Entry Width	17.0 In. (43.2 cm)
Ground to Bottom of Sill	46.0 In. (116.8 cm)

SPECIFIC LOADINGS

Wing Loading @ Maximum Gross Weight	15.68 Lbs./Sq. Ft. (79.03 Kg/Sq. m)
Power Loading @ Maximum Gross Weight	13.7 Lbs./HP (6.21 Kg/HP)

IDENTIFICATION PLATE

All correspondence regarding your airplane should include the Serial Number as depicted on the identification plate. The identification plate is located on the left hand side, aft end of the tail cone, below the horizontal stabilizer leading edge.
The aircraft Serial Number and type certificate are shown.

SYMBOLS, ABBREVIATIONS & TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY & SYMBOLS

GS	GROUND SPEED - Speed of an airplane relative to the ground.
KCAS	KNOTS CALIBRATED AIRSPEED - The indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KIAS	KNOTS INDICATED AIRSPEED - The speed of an aircraft as shown on its airspeed indicator. IAS values published in this handbook assume zero instrument error.
KTAS	KNOTS TRUE AIRSPEED - The airspeed of an airplane relative to undisturbed air which is the KCAS corrected for altutude and temperature.
V_a	MANEUVERING SPEED - The maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{fe}	MAXIMUM FLAP EXTENDED SPEED - The highest speed permissible with wing flaps in a prescribed extended position.

V_{le}	MAXIMUM LANDING GEAR EXTENDED SPEED - The maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{lo}	MAXIMUM LANDING GEAR OPERATING SPEED -The maximum speed at which the landing gear can be safely extended or retracted.
V_{ne}	NEVER EXCEED SPEED - The speed limit that may not be exceeded at any time.
V_{no}	MAXIMUM STRUCTURAL CRUISING SPEED - The speed that should not be exceeded, except in smooth air, and then only with caution.
V_s	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable.
V_{so}	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_x	BEST ANGLE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_y	BEST RATE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain in altitude in the shortest possible time with gear and flaps up.

ENGINE POWER TERMINOLOGY

BHP	BRAKE HORSEPOWER - The power developed by the engine.
CHT	CYLINDER HEAD TEMPERATURE - Operating temperature of engine cylinder(s) being monitored by a sensor unit. Expressed in°F.
EGT	EXHAUST GAS TEMPERATURE - Temperature of the exhaust gas fuel/air mixture during engine operation.
MCP	MAXIMUM CONTINUOUS POWER - The maximum power for takeoff, normal,abnormal or emergency operations.
MP	MANIFOLD PRESSURE - Pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).
RPM	REVOLUTIONS PER MINUTE - Engine speed.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demon-strated Crosswind	The velocity of the crosswind component for which adequate control of the airplane during takeoff and landing test was actually demonstrated during certification. The value shown Velocity is NOT considered to be limiting.
g	Acceleration due to gravity.
Service Ceiling	The maximum altitude at which aircraft at gross weight has the capability of climbing at the rate of 100 ft/min.

ENGINE CONTROLS & INSTRUMENTS TERMINOLOGY

Propeller Control	The control used to select engine speed.
Throttle Control	The control used to select engine power by controlling MP.

ENGINE CONTROLS & INSTRUMENTS TERMINOLOGY (con't.)

Mixture Control	Provides a mechanical linkage to the fuel injector mixture control to control the size of the fuel feed aperture, and therefore the air/fuel mixture. It is the primary method to shut engine down.
CHT Gauge	Cylinder head temperature indicator used to determine that engine operating temperature is within manufacturers specifications.
EGT Gauge	Exhaust gas temperature indicator used to identify correct lean fuel flow mixtures for various power settings.
Tachometer	An instrument that indicates rotational speed of the engine. The speed is shown as propeller revolutions per minute (RPM).
Propeller Governor	The device that regulates the RPM of the engine/propeller by increasing or decreasing the propeller pitch, through a pitch change mechanism in the propeller hub.

METEOROLOGICAL TERMINOLOGY

AGL	Above ground level.
Density Altitude	Altitude as determined by pressure altitude and existing ambient temperature. In standard atmosphere (ISA) density and pressure altitude are equal. For a given pressure altitude, the higher the temperature, the higher the density altitude.
Indicated Altitude	The altitude actually read from an altimeter when, and only when, the barometric subscale has been set to Station Pressure.
ISA	INTERNATIONAL STANDARD ATMOSPHERE assumes that (1) The air is a dry perfect gas; (2) The temperature at sea level is 15 ^{o} Celsius (59^{o} F); (3) The pressure at sea level is 29.92 inches Hg (1913.2 mb); (4) The temperature gradient from sea level to the altitude at which the temperature is -56.5^{o} C (-69.7 ^{o} F) is -0.00198^{o} C (-0.003564^{o} F) per foot.
OAT	OUTSIDE AIR TEMPERATURE - The free air static temperature, obtained either from inflight temperature indications or ground meteorological sources. It is expressed in ^{o} C.
Pressure Altitude	The altitude indicated when Kollsman Window is set to 29.92 In. Hg. or 1013.2 MB. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.

WEIGHT AND BALANCE TERMINOLOGY

Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Basic Empty Weight	The actual weight of the airplane and includes all operating equipment (including optional equipment) that has a fixed location and is actually installed in the aircraft. It includes the weight of unusable fuel and full oil.

WEIGHT AND BALANCE TERMINOLOGY (con't.)

Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. in % MAC	Center of Gravity expressed in percent of mean aerodynamic chord.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
MAC	Mean Aerodynamic Chord.
Maximum Weight	The maximum authorized weight of the aircraft and its contents as listed in the aircraft specifications.
Moment	product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Tare	The weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Usable Fuel	Fuel available for airplane propulsion.
Useful Load	The basic empty weight subtracted from the maximum weight of the aircaft. This load consists of the pilot, crew if applicable, fuel, passengers, and baggage.

POWER PLANT LIMITATIONS

Number of Engines	1
Engine Manufacturer	TEXTRON Lycoming
Engine Model Number	IO-360-A3B6D
Engine Operating Limits for Takeoff and Continuous Operations:	
Maximum Power	200 BHP
Maximum Engine Speed	2700 RPM
Transient Engine RPM Limit	2970 RPM for 3 seconds or less
Max. Cylinder Head Temperature	475° F (246° C)
Maximum Oil Temperature	245° F (118° C)
Oil Pressure	
Normal Operating	60-90-PSI
Minimum (IDLE ONLY)	25 PSI
Maximum (cold oil)	100 PSI
Fuel Pressure	
Minimum	14 PSI
Maximum	30 PSI
Fuel Grade (Color)	100/130 (Green) 100LL (Blue)
Number of Propellers	1
Propeller Manufacturer	McCauley
Propeller Model Number	B2D34C214/90DHB-16E
Propeller Diameter:	
Min.	73.0 In. (185.4 cm)
Max. (No cutoff allowed)	74.0 In. (187.9 cm)
Propeller Blade Angles @ 30 In. sta.:	
Low	13.9° +/- .2°
High	33.0° +/- .5°
Propeller Operating Limits	2700 RPM

100LL fuel is calibrated at 5.82 lb/gal.(.69 Kg/liter)
100/130 octane fuel is calibrated at 6.0 lb/gal.(.72 Kg/liter)

| NOTE |

No cutoff allowed on propeller when de-ice boots are installed.

POWER PLANT INSTRUMENT MARKINGS

INSTRUMENT	REDLINE (MINIMUM LIMIT)	GREEN ARC (NORMAL OPERATING)	YELLOW ARC (CAUTION RANGE)	REDLINE (MAXIMUM LIMIT)
Tachometer		1950 - 2700	1500 - 1950	2700 RPM
Cylinder Head Temperature		300 - 475° F (149 - 246° C)		475° F (246° C)
Oil Temperature		150 - 245° F (65 - 118°. C)		245° F (118° C)
Oil Pressure	25 PSI	60 - 90 PSI	(IDLE ONLY) 25 - 60 PSI *	100 PSI
Fuel Pressure	Radial Red Line Min. 14 PSI	14 - 30 PSI		30 PSI
* Yellow Arc (starting and warm-up range)				90-100 PSI

|NOTE|

Refer to TEXTRON-Lycoming Engine Maintenance and Operators Manual Section on Engine Specifications and Operating Limits for recommended cruise power and temperature limitations.

FUEL LIMITATIONS

|NOTE|

A reduced fuel quantity indicator is installed in each tank. The bottom tip of these indicators shows the 25 U.S. gallon (94.7 liters) (20.8 IMP. Gal.) usable fuel level in each tank.

|NOTE|

An optional visual fuel quantity gauge may be installed on top of each tank and is to be used as a reference for refueling tanks only.

Standard Tanks: (2) . . . . . 33.25 U.S. Gal. each (126 Liters)(27.7 Imp. Gal.)

Total Fuel: . . . . . 66.5 U.S. Gal (252 Liters)(55.4 Imp. Gal.)

Usable Fuel: . . . . . 64.0 U.S. Gal (247 Liters)(53.3 Imp. Gal.)

Unusable Fuel: . . . . . 2.5 U.S. Gal (9.5 Liters)(2.1 Imp. Gal.)

Fuel Grade (and Color):

100 Octane . . . . . minimum grade aviation fuel (green).

100LL . . . . . (low lead) aviation fuel (blue) with a lead content limited to 2 cc per gallon is also approved.

~ ~ ~ ~ ~ ~

~ CAUTION ~

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To reduce the possibility of ice formation within the aircraft or engine fuel system it is permissable to add ISO-PROPYL alcohol to the fuel supply in quantities NOT TO EXCEED 1% of the total fuel volume per tank. DO NOT add other additives to the fuel system due to potential deteriorating effects within the fuel system.FUEL LIMITATIONS

WEIGHT LIMITS

Maximum Weight (takeoff and landing) . . . . 2740 lb.(1243 Kg.)

Maximum Weight in Baggage Compartment . . . . . 120 lb. (54.4 Kg.) @ Fuse. Sta. 95.5

Maximum Weight in Hatrack . . . . . 10 lb. (4.54 Kg.) @ Fuse. Sta. 119.0

Maximum Weight in Cargo Area (Rear seats folded down) . . . . . 340 lbs. (154.2 Kg) @ Fuse. Sta. 70.7

CENTER OF GRAVITY LIMITS (GEAR DOWN)

Most Forward . . Fuse. Sta. 41.0 IN.(103 cm) @ 2250 LBS(1120 Kg). 13.4% MAC

Intermediate Forward . Fuse. Sta. 41.8 IN.(106 cm) @ 2470 LBS.(1120 Kg) 14.7% MAC

Forward Gross . . . Fuse. Sta. 45.0 IN.(113 cm) @ 2740(1243 Kg) 20.1% MAC

Aft Gross . . . Fuse. Sta. 50.1 IN.(126 cm) @ 2740 lb.(1243 Kg.) 38.7% MAC

MAC (at Wing Sta. 93.83) (238 cm) . . . . . 59.18 IN.(150 cm)

Datum (station zero) is 5 inches(12.5 cm) aft of the center line of the nose gear attaching bolts, and 33 inches(84 cm) forward of the wing leading edge at wing station 59.25(150 cm).

MANEUVER LIMITS

This airplane must be operated as a Normal Category airplane. Aerobatic maneuvers, including spins, are prohibited.

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//WARNING//

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Takeoff maneuvers, prolonged sideslips or steep descents when the selected fuel tank contains less than 8 gallons (48.0 lbs., 30.3 liters, 6.6 IMP. Gal.) of fuel have not been demonstrated and may cause loss of power.

|NOTE|

Up to 290 foot altitude loss may occur during stalls at maximum weight.

Slow throttle movement required at airspeed above 165 KIAS. Above 165 KIAS, rapid throttle movement may result momentary propeller RPM overspeed.

FLIGHT LOAD FACTOR LIMITS

Maximum Positive Load Factor
- Flaps Up . . . . . +3.8 g.
- Flaps Down (33 °) . . . . . +2.0 g.

Maximum Negative Load Factor
- Flaps Up . . . . . -1.5 g.
- Flaps Down . . . . . 0.0 g.

FLIGHT CREW

Pilot 1
Maximum Passenger seating configuration 3

OPERATING LIMITATIONS

If this airplane is not equipped with an approved oxygen system and flight operations above 12,500 feet are desired, this airplane must be, (1) equipped with supplemental oxygen in accordance with FAR 23.1441, (2) operated in accordance with FAR 91.32 and (3) equipped with avionics in accordance with FAR 91 or FAR 135.

KINDS OF OPERATION LIMITS

This is a Normal Category airplane approved for VFR/IFR day or night operations when equipped in accordance with FAR 91.

DO NOT OPERATE IN KNOWN ICING CONDITIONS.

Autopilot Limitations - See SECTION IX.

KINDS OF OPERATION EQUIPMENT LIST

The following equipment was approved during Type Certification and must be installed and operable for each kind of operation as specified.

|NOTE|

The KINDS OF OPERATION EQUIPMENT list may not include all the equipment as required by applicable operating rules.

SEE NEXT PAGE FOR LISTINGS.

The following placards must be installed on the exterior of the aircraft at the locations specified.

TIRE PRESSURE 30 PSI
(207 KPA)
–761

ON MAIN GEAR DOORS

TIRE PRESSURE 49 PSI
(338 KPA)
–759

ON NOSE GEAR DOOR

FUEL–100 (GREEN) or
100LL (BLUE) MIN. OCT.
32 U.S. GAL

STANDARD

FUEL–100 (GREEN) or
100LL (BLUE) MIN. OCT.
121.2 LITERS USEABLE

OPTIONAL

FUEL–100 (GREEN) or
100LL (BLUE) MIN. OCT.
26.6 IMP GAL USEABLE

OPTIONAL

ON FUEL TANK CAPS

TOWING LIMITS

–700

WARNING

DO NOT EXCEED
TOWING LIMITS

–701

ON NOSE GEAR LEG

DO NOT PUSH
–009

ON LEADING EDGE OF HORIZONTAL
STABILIZER AND TRAILING EDGE
OF BOTH SIDES OF RUDDER

NO STEP
–007

ON INBOARD END OF FLAPS, WING LEADING
EDGES AND WING AHEAD OF FLAPS

HOIST POINT

-011

ON UNDERSIDE OF WINGS (2 PLCS)

FUEL DRAIN

UNDER EACH WING NEAR SUMP DRAINS

PITOT DRAIN

UNDER LEFT HAND WING LEADING EDGE NEAR FUSELAGE

GASCOLATOR DRAIN

UNDER FUSELAGE AFT OF NOSE WHEEL WELL

STATIC DRAIN

UNDER TAILCONE AFT OF WING TRAILING EDGE

J90DEC-8

FORCED LANDING EMERGENCY

POWER OFF - GEAR RETRACTED OR EXTENDED

Emergency Locator Transmitter	ARMED
Seat Belts/Shoulder Harnesses	SECURE
Cabin Door	UNLATCHED
Fuel Selector	OFF
Mixture	IDLE CUTOFF
Magneto/Starter	OFF
Wing Flaps	Full DOWN (33 Degrees)
Landing Gear	DOWN or UP Depending on Terrain
Approach Speed	71 KIAS
Master Switch	OFF, prior to landing

POWER ON - GEAR RETRACTED

Emergency Locator Transmitter	ARMED
Seat Belts and Shoulder Harnesses	SECURE
Cabin Door	UNLATCHED
Fuel Selector	OFF
Throttle	CLOSED
Mixture	IDLE CUTTOFF
Magneto/Starter	OFF
Wing Flaps	Full DOWN (33^{o})
Master Switch	OFF
Approach Speed	As Slow As Possible
Wings	Keep LEVEL

SYSTEMS EMERGENCIES

PROPELLER

PROPELLER OVERSPEED

Throttle	RETARD
Oil Pressure	CHECK
Propeller	DECREASE, set if any control avaliable
Airspeed	REDUCE
Throttle	AS REQUIRED to maintain RPM below 2700 RPM

FUEL

LOW FUEL FLOW

Check Mixture	ENRICH
Fuel Selector	Fullest TANK

If condition persists, use Fuel Boost Pump as necessary and LANDING SHOULD BE MADE AS SOON AS PRACTICABLE.

ELECTRICAL

ALTERNATOR OVERVOLTAGE
(Voltage warning light illuminated steady/Alternator C/B may be tripped.)

Alternator Field Circuit Breaker . . RESET or PULL out, then PUSH IN

If circuit breaker will not reset, the following procedures are required:

1. Reduce electrical load.
2. Land, when practical, to correct malfunction.

ALTERNATOR OUTPUT LOW AND AMMETER SHOWING DISCHARGE
(Voltage warning light flashing)

Radio Master . . . . . OFF
Master Switch . . . . . OFF, then ON
If Warning Light is still flashing, the following steps are required:
Non-Essential Electrical Equipment . . . . Turn OFF one at a time
Ammeter . . . . . CHECK
for charging condition as each unit of Electrical Equipment is turned OFF
- If still showing discharge:
Alternator Field Circuit Breaker . . . . . PULL
Non-esential electrical equipment . . OFF to conserve battery power

LAND AS SOON AS PRACTICABLE

| NOTE |

A tripped main alternator circuit breaker can only be caused by a shorted alternator circuit and cannot be corrected by resetting the breaker. This should be verified by attempting to reset the breaker not more than one time. If this fails, pull alternator field circuit breaker. Turn off all non-essential electrical equipment and terminate the flight as soon as practical. Repair the malfunctioning alternator prior to next flight.

LANDING GEAR

FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY

Airspeed . . . . . 132 KIAS or less
Landing Gear Actuator Circuit Breaker . . . . . PULL
Gear Switch . . . . . DOWN
Manual Gear Extension Mechanism . LATCH FORWARD/LEVER BACK,
to engage manual extension mechanism

| NOTE |

Slowly pull "T" handle 1 to 2 inches (2.5 to 5.1 cm) to rotate clutch mechanism and allow it to engage drive shaft.

T-Handle . . . . . .PULL (7 to 20 times
and RETURN until gear is down and locked,
GEAR DOWN light illuminated; STOP when resistance is felt.
- - - SYSTEM MAY BECOME DAMAGED - - -
Visual Gear Down Indicator . . . . . CHECK ALIGNMENT
by viewing from directly above the indicator.

~ CAUTION ~

Continuing to pull on T-Handle after GEAR DOWN light ON will bind actuator; electrical retraction MAY NOT be possible until binding is eliminated.

Return lever to normal position and secure with latch. Reset Landing Gear Actuator Circuit Breaker.

//WARNING//

Do not operate landing gear electrically with manual extension system engaged.

Windshield . . . . . CLEAN
Cabin Air Inlet . . . . . UNOBSTRUCTED

9. Right Wing -
Fuel Tank Sump Drain . . . . . DRAIN until clear
Right Main Gear, Shock Discs, Tire, Doors & Linkage . . INSPECT
Wheel Chock . . . . . REMOVE
Tank Vent . . . . . UNOBSTRUCTED
Tiedown Ropes/chains . . . . . REMOVE
Landing/Taxi Lights . . . . . INSPECT lens/bulbs
Fuel Tank . . . . . CHECK QUANTITY-SECURE CAP

|NOTE|

The reduced fuel indicator is located in the filler neck. This indicator is used to indicate usable fuel capacity of 25 U.S. gallons (94.7 liters) (20.8 IMP. gal.)

|NOTE|

The optional visual fuel quantity gauge is to be used for partial refueling purposes only; DO NOT use for preflight check.

Wing Tip, Lights & Lens . . . . . INSPECT
Aileron and attach points . . . . . INSPECT
Flap and attach points . . . . . INSPECT
Control Linkages . . . . . INSPECT
General Skin Condition . . . . INSPECT-REMOVE ice, snow or frost

10. Baggage Door . . . . . Verify SECURED
Verify inside latch mechanism is properly secured.
(Check outside handle operation)
RETURN TO COCKPIT - MASTER/ROCKER SWITCHES . . OFF

BEFORE STARTING CHECK

Preflight Inspection . . . . . COMPLETED
Seats, Seat Belts/Shoulder Harness . . . . ADJUST & SECURE
Magneto/Starter Switch . . . . . OFF
Master Switch . . . . . OFF
Radio Master Switch . . . . . OFF
Fuel Boost Pump . . . . . OFF
Alternate Static Source . . . . . Push OFF
Pitot Heat . . . . . OFF
Throttle . . . . . .CLOSED
Propeller . . . . . HIGH RPM
Mixture . . . . . .IDLE CUTOFF
Cowl Flaps . . . . . .VERIFY OPEN
Parking Brake . . . . . SET
Wing Flap Switch . . . . . CENTERED (Flaps UP)
Cabin Vent . . . . . AS DESIRED
Cabin Heat . . . . . PUSH OFF
Defrost . . . . . PUSH OFF
Fuel Selector . . . . . FULLEST TANK
Directional Gyro (slave/free switch) . . . . SLAVED (if installed)
Circuit Breakers . . . . . CHECK
Emergency Locator Transmitter . . . . . ARM
Radios . . . . . SET FREQUENCIES (Non-digital radios)
Radio Blower . . . . . CHECK - Master Switch ON, then OFF
Landing Gear Switch . . . . . DOWN
RED Emergency Gear Handle . . . . . DOWN & LATCHED
Internal/External Lights . . . . . OFF
Passengers . . . . . Emergency/General Information briefing

Refer to SECTION IX for Optional Equipment Checks.

Obtain local information prior to engine start.

ENGINE START

~ CAUTION ~

When battery will not start engine, inspection should be conducted to determine reason. If determination is made that battery voltage is low, servicing of the battery is essential and charging for at least one hour should be done before engine is started. The battery or other electrical circuits may be damaged if aircraft is operated with a low battery.

Throttle . . . . . 1/4 OPEN
Propeller . . . . . HIGH RPM
Mixture . . . . . FULL FORWARD
Master Switch . . . . . ON
Annunciator Lights . . . . . PRESS TO TEST
(All lights except 'START POWER ON" should illuminate)
Fuel Boost Pump . . . . . ON
to Establish Pressure, then OFF
Mixture . . . . . IDLE-CUTOFF
Propeller Area . . . . . CLEAR
Magneto/Starter Switch . . . . . TURN and PUSH to START
release to BOTH when engine starts.

|NOTE|

"START POWER" warning light should illuminate when magneto/starter switch is in "START" position.

|NOTE|

Cranking should be limited to 30 seconds and several minutes allowed between cranking periods to permit the starter to cool.

Mixture . . . . . Move slowly and smoothly to RICH
Throttle . . . . . Set at 1000 to 1200 RPM
Engine Oil Pressure . CHECK GREEN ARC - if MINIMUM OIL PRESSURE
is not indicated within 30 seconds,
STOP ENGINE and determine problem.
Ammeter . . . . . CHECK
(Turn Ldg. Lt. ON; observe negative movemet of needle)
Fuel Flow Indicator . . PUSH "TEST/USED" button MOMENTARILY
to stop digits from flashing.

FLOODED ENGINE START

Fuel Boost Pump . . . . . OFF
Throttle . . . . . FULL FORWARD
Mixture . . . . . IDLE CUTOFF
Magneto/Starter Switch . . . . . TURN and PUSH to START
release to both when engine starts.
Mixture . . . . . FULL FORWARD
Throttle . . . . . Retard to 1200 RPM

|NOTE|

Landing information for reduced flap settings are not available. See SECTION V for landing Distance tables.

~ CAUTION ~

The landing gear may retract during landing roll if landing gear switch is inadvertently placed in the UP position.

TAXI AFTER LANDING

Throttle	1000 to 1200 RPM
Boost Pump	OFF
Wing Flaps	RETRACT
Cowl Flaps	OPEN
Trim	RESET to Takeoff
Avionics/Radios	As required
Lighting	As required

SHUTDOWN

Parking Brake	SET
Throttle	1000 to 1200 RPM
	(until cylinder head temperature starts to drop)
Radio Master	OFF
Internal/External Lights	OFF
Pitot Heat	OFF
Magneto/Starter Switch	Grounding Check
Mixture	IDLE CUTOFF
Magneto/Starter Switch	OFF when propeller stops
Master Switch	OFF
Oxygen System (if equipped)	OFF

SECURING AIRCRAFT

Magneto/Starter Switch	OFF/Key removed
Master Switch	VERIFY OFF
Radio Master	VERIFY OFF
Electrical Switches	VERIFY OFF
Parking Brake	RELEASE and install wheel chocks

For extended parking:

Control wheel	SECURED

with seat belts, cabin vents CLOSED,
TIE DOWN aircraft at wing and tail points.

BLANK

3. **SPARE (FILLER)** (14 Volt A/C)

4. **RADIO MASTER**
The Radio Master Switch/Circuit Breaker operates a relay supplying power to the radio buss bars. Since the relay is energized to cut the power to the radio buss, failure of the relay coil will still allow power to the radio buss. Energizing the starter automatically energizes the relay and disconnects the radios from the buss.

5. **ALTERNATE STATIC SOURCE VALVE**
Pulling alternate static source valve to full aft position changes the source of static air for the altimeter, airspeed indicator and rate-of-climb indicator from outside of the aircraft to cabin interior. Airspeed and altimeter readings are affected slightly when alternate static source is used (Refer to SECTION V).

6. **STROBE LIGHT SWITCH/CIRCUIT BREAKER**
Pushing ON the strobe light combination switch/circuit breaker turns on the wing tip and tail strobe lights. Should a short occur,the combination switch/circuit breaker will automatically trip to the OFF position.

7. **NAVIGATION LIGHT SWITCH/CIRCUIT BREAKER**
Pushing ON the navigation light combination switch/circuit breaker turns on the wing tip and tail navigation lights. Should a short occur,the combination switch/circuit breaker will automatically trip to the OFF position.

8. **RECOGNITION LIGHT SWITCH/CIRCUIT BREAKER (IF INSTALLED)**
Pushing ON the recognition light combination switch/circuit breaker turns on the recognition light. Should a short occur,the combination switch/circuit breaker will automatically trip to the OFF position.

9. **TAXI/LANDING LIGHT SWITCHES (L & R)**
Select and PUSH split switches ON to turn desired set of lights on. Push switches OFF to turn desired set of lights off. Lights should be operated only for short time periods while not in flight to preclude overheating of lamp. Overload protection is achieved by circuit breakers in the panel.

10. **PITOT HEAT SWITCH/CIRCUIT BREAKER**
Pushing ON the pitot heat combination switch/circuit breaker turns on the heating elements within the pitot tube. Should a short occur, the combination switch/circuit breaker will automatically trip to the OFF position.

11. **OPTIONAL/ELECTRIC TRIM SWITCH/CIRCUIT BREAKER (IF INSTALLED)**
This switch is normally left in the ON position and serves as both a circuit protector and as a master disconnect for the electric trim system in the event of a malfunction.

12. **FUEL BOOST PUMP SWITCH**
Pushing ON or OFF the switch/circuit breaker controls operation of the electric fuel boost pump. Use of the fuel boost pump should be limited to starting, takeoff, switching fuel tanks, landing and emergency situations. The fuel boost pump is capable of supplying fuel to the engine at the rated quantities and pressures to permit the engine to develop rated power.

13. **THROTTLE CONTROL**
Pushing the throttle control forward increases the manifold pressure thereby increasing the engine power. Pulling the control aft decreases the manifold pressure thereby decreasing the engine power.

14. **PROPELLER CONTROL**
Pushing the propeller control forward increases engine RPM; pulling the control aft decreases the engine RPM. The control is of the vernier type and fine adjustments of RPM can be obtained by turning the knob clockwise to increase RPM and counterclockwise to decrease RPM. The knob should not be turned in any closer than 1/8" to the panel nut face.

15. **MIXTURE CONTROL**
The mixture control allows the pilot to adjust the fuel-air ratio (mixture) of the engine. Pushing the control forward richens the mixture. Pulling the control full aft closes the idle cutoff valve shutting down the engine. The control is of the vernier type and fine adjustments of the mixture can be obtained by turning the knob clockwise to richen the mixture, and counterclockwise to lean. The knob should not be turned in any closer than 1/8" to the panel nut face.

16. **COWL FLAP CONTROL**
Pulling the cowl flap control full aft opens the cowl flap doors allowing additional airflow to properly cool the engine on the ground and during low speed high power climbs. During cruise the cowl flaps may be partially opened, (control pulled aft approximately three inches) if necessary, to maintain oil and cylinder head temperatures within the normal operating range.

17. **PARKING BRAKE CONTROL**
Depressing the brake pedals and pulling the parking brake control sets the parking brake. Pushing in the parking brake control releases the parking brake.

18. **STAND-BY VACUUM SWITCH** (If installed)
PUSH this switch ON if vacuum warning light illuminated or Vacuum Pressure goes below 4.75 In. vac. pressure

19. **FLAP SWITCH AND INDICATOR**
The flap switch, in a recess on the right of the console, operates the electrically actuated wide span wing flaps. Holding the spring-loaded switch in the FLAPS DOWN position lowers the flaps to the desired angle of deflection. Simply releasing downward pressure on the switch allows it to return to the OFF position, stopping the flaps at any desired intermediate position during extension. When FLAPS UP position is selected, flaps will retract to full UP position unless the switch is returned to the neutral position for a desired intermediate setting.

| NOTE |

Placing switch in the UP position retracts the flaps completely.

Wing flap position is mechanically indicated through a cable mounted directly to the flap jackshaft. A pointer in the flap position indicator indicates flap position. The intermediate mark in the pointer range is the flap TAKEOFF setting (15 degrees).

20. **CABIN VENT CONTROL (FRESH AIR)**
Pulling the cabin vent control AFT opens the vent control to allow fresh air from NACA vents located on both sides of the airplane forward cabin. Optimum use of the cabin vent control is described in the Cabin Environment Section.

21. **CABIN HEAT CONTROL**
Pulling the cabin heat control turns on cabin heat. To lower cabin temperature the cabin heat control is pushed forward toward the OFF position. Optimum use of the cabin heat control is described in the Cabin Environment Section.

22. **DEFROST CONTROL**
Pulling the defrost control decreases air flow to the lower cabin and increases air flow to the windshield in the front of the glareshield area. Optimum use of the defrost control is described in the Cabin Environment Section. The optional blower motor switch is activated when the control is pulled aft. This turns on a fan within the ventilation system to move more air over the windshield.

23. **GASCOLATOR CONTROL**
The gascolator, located to the left of the console on the floorboard, allows the pilot

FUEL SYSTEM

Fuel is carried in two integral sealed sections of the forward inboard area of the wings. Total usable fuel capacity is 64 gallons (242.4 liters)(53.3 Imp. Gal.). Both tanks have fuel level indicators visible through the filler ports. These indicators show the 25-gallon (94.7 liters)(20.8 Imp. Gals.) level in each tank. There are sump drains at the lowest point in each tank for taking fuel samples to check for sediment contamination or condensed water accumulation.

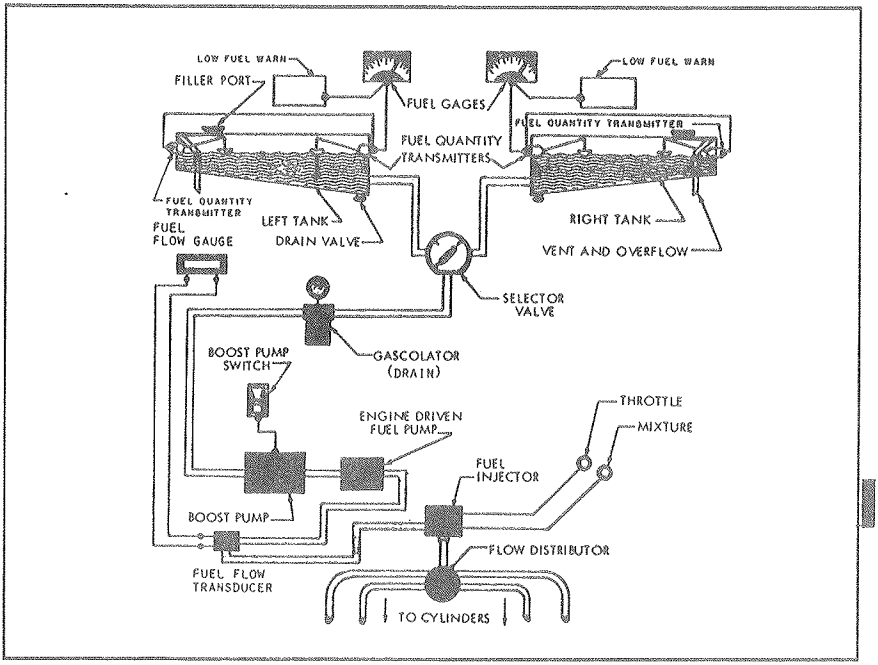

FIGURE 7-6 - FUEL SYSTEM SCHEMATIC

The recessed three-position fuel selector handle aft of the console on the floor allows the pilot to set the selector valve to LEFT tank, RIGHT tank, or OFF position. The gascolator, located to the left of the selector valve in the floorboard, is for draining condensed water and sediment from the lowest point in the fuel lines before the first flight of the day and after each refueling.

Fuel feeds from one tank at a time to the selector valve and through the electric fuel pump (boost pump) enroute to the engine-driven pump and the fuel injector unit. The electric fuel pump is capable of supplying sufficient pressure and fuel flow for rated engine performance should the engine driven pump fail.

Electric fuel-level transmitters in the tanks operate the fuel gauges. The master switch actuates the fuel quantity indicator system to maintain an indication of fuel remaining in each tank. The fuel pressure gauge registers fuel pressure in the line to the injector. Vents in each fuel tank allow for overflow and ventilation.

The optional, visual fuel quantity indicators located in each wing tank are to be used for PARTIAL FUEL LOADING only and not for preflight inspection purpose.

Fuel Flow is presented digitally and indicates volume of fuel being used in GPH (pounds or liters optional) and/or total fuel used. Optional fuel flow systems are available and each depicts its information differently. Refer to appropriate operational procedure for specific data. A "Fuel Flow Memory" switch is located in the top of the right hand radio panel to shut off the memory circuit if the aircraft is to be stored for long periods of time.

ELECTRICAL SYSTEM

ALTERNATOR & BATTERY

A standard 12-volt, 35-ampere-hour storage battery (in the tailcone) and a 14 Volt, 70 ampere self-rectifying alternator (24-volt, 10-ampere-hour system optional) supply electrical power for equipment operation. The ammeter depicts battery charge/discharge rate. A power loss in the alternator or voltage regulator will be shown as a discharge reading on the ammeter; a discharged battery will be indicated by a high-charge reading.
The voltage regulator adjusts alternator output to current load while maintaining a constant voltage level. A voltage warning light illuminates steadily when voltage limits are exceeded and flashes when voltage is low.

~ ~ ~ ~ ~ ~ ~
~ CAUTION ~
~ ~ ~ ~ ~ ~ ~

Starting with an external power source should not be done while the battery is completely depleted. It will not accept the high charge rate from the alternator and electrical failure may result.

SCHEMATIC (SEE FIGURE 7-7)

CIRCUIT BREAKER PANEL (SEE FIGURE 7-8)

Push-pull, or rocker switch-circuit breakers automatically break the electrical current flow if the system or unit receives an overload, thus preventing damage to electrical wiring.
The main circuit breaker panel is in the extreme right panel. Figure 7-8 illustrates the main circuit breaker panel with its push-pull circuit breakers. All rocker switch-circuit breakers are at the bottom of the flight panel.
The alternator push-pull circuit breaker on the main breaker panel furnishes an emergency overload break between alternator and the main buss. Since the alternator is incapable of output in excess of the circuit breaker capacity, a tripped breaker normally indicates a fault within the alternator. Since the alternator is then cut out of the power circuit, the storage battery supplies electrical power in steadily diminishing output with master switch ON.
The alternator field has a push-pull circuit breaker to furnish an emergency break in the alternator field excitation circuit in the event of alternator or voltage regulator malfunction. If regulator output voltage exceeds limits, the red voltage warning light illuminates steadily.
Turning off radio master switch and then turning master switch **OFF** and **ON**, will reset the voltage regulator. The overvoltage annunciator light should remain out. If overvoltage light comes on again, pulling out alternator-field circuit breaker cuts alternator out of the power circuit. Once again the battery is the only source of electrical power; therefore, all electrical equipment not essential for flight should be turned off and the flight terminated as soon as practical to correct the malfunction.

| NOTE |

The circuit breakers installed in the panel may vary depending on installed equipment per customer order.

ANNUNCIATOR PANEL

The landing gear lights, low fuel lights, voltage light, vacuum warning light and starter engaged light are grouped in the annunciator panel. A test switch and dim switch, are also found in the panel and each of the lights and switches are discussed elsewhere in this section.

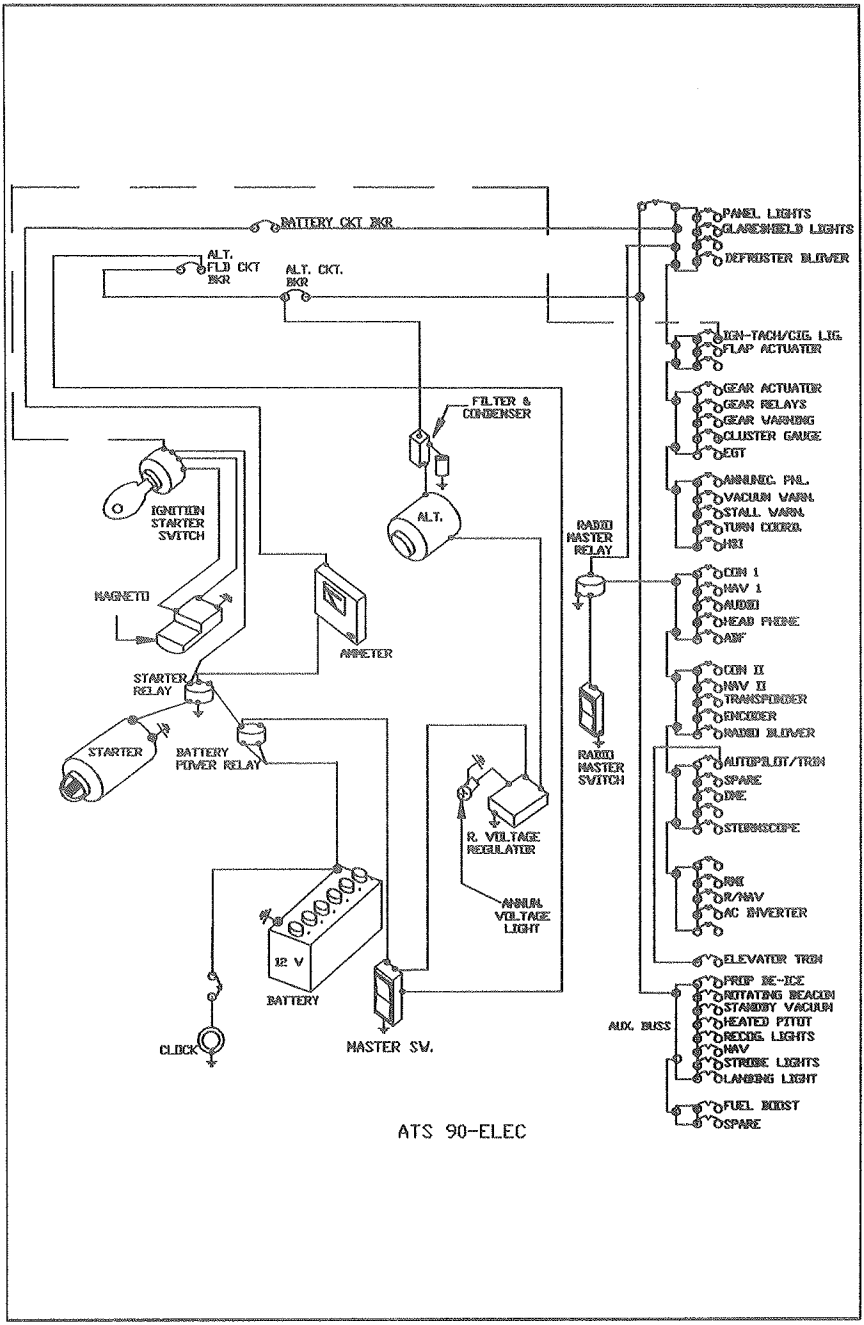

FIGURE 7-7 A T - ELECTRICAL SCHEMATIC

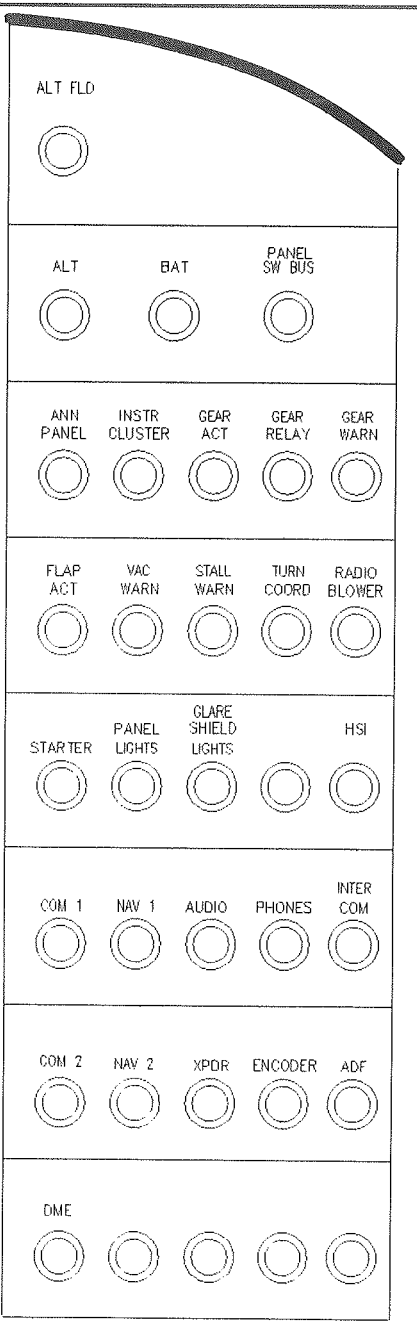

FIGURE 7-8 - CIRCUIT BREAKER PANEL