Version: 2.0
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Introduction

The complete information on the Commander 115 TC consists of this documents, pleas several specialized handbooks. All handbooks are available in your Flight Simulator X\FSD International\Pilot Manuals folder on your hard drive. They may also be accessed through your Windows Start Menu.

The following is a complete listing of the installed handbooks:

Handbook	Description
Panel Handbook	Complete manual for operating panel controls and explanation of their functions
Load Manager Handbook	Details all of the functions of the Load Manager and their proper operation
Realism Module Handbook	Full description of the operation and function of the Realism Module
Totalizer Handbook	Detailed description of the functions and usage of the fuel Totalizer
GNS 480 Manual	Complete pilot handbook for the Garmin GNS 480 included with the Commander
SL30 Manual	Handbook for the Apollo NAV2/COM2 radio included with the Commander
KR 87 Manual	Manual for the Bendix King KR 87 ADF radio
ST55X Autopilot Manual	Pilot handbook for the STEC ST55X autopilot and inconnected modules

This handbook is provided with the Commander 115 TC to allow the pilot to attain as much knowledge about the airplane and its operation as possible. It is not intended as a textbook on basic flying techniques but is oriented towards those areas specific to the 115 TC. The pilot should become familiar with the contents of this handbook and use them to guide his operations of the airplane.

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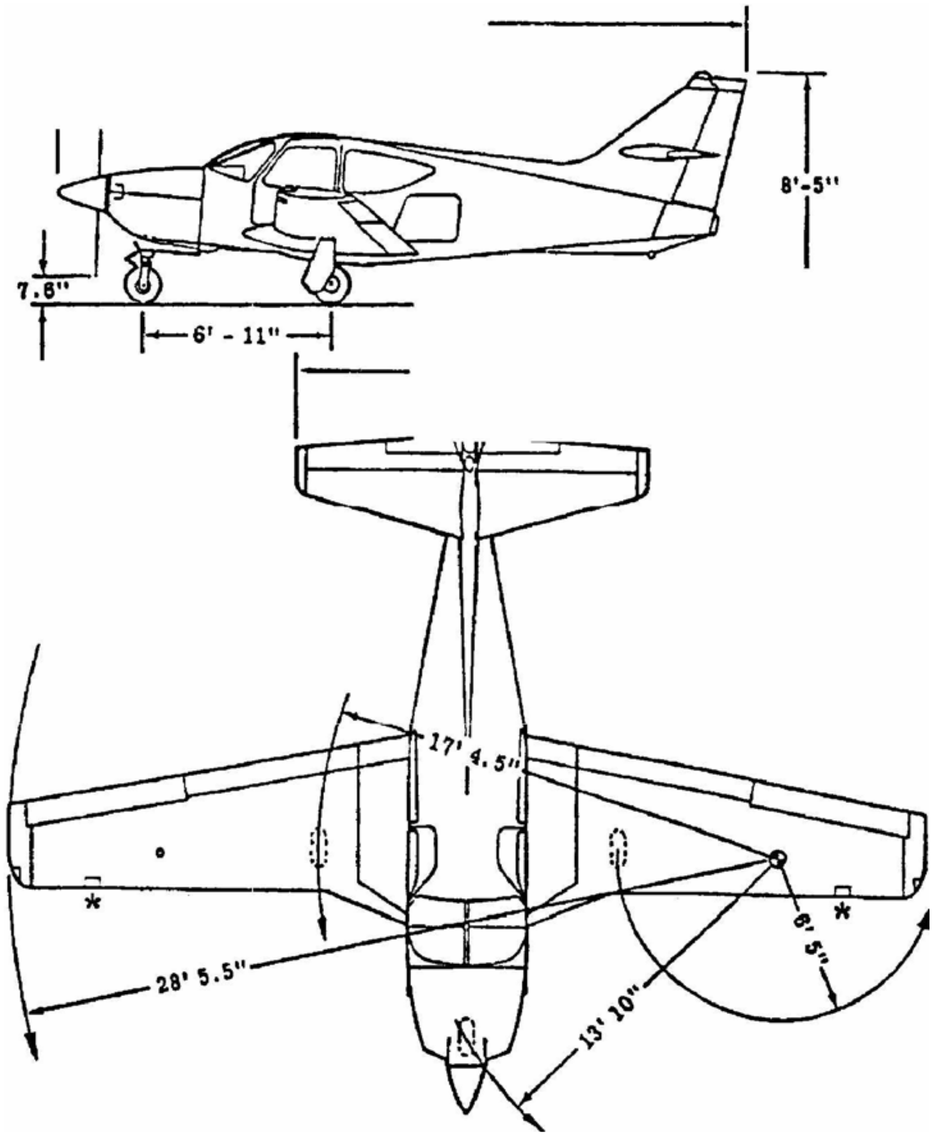

8'-5"
7.6"
6' - 11"
17' 4.5"
28' 5.5"
6' 5"
13' 10"

1 Descriptive Data

1.1 ENGINE

Manufacturer	Textron Lycoming
Model	TIO-540-AG1A
Number of Cylinders	6
Displacement	541.5 cu. in. (8.87 l)
Maximum Power	270 HP @ 2,700 RPM
Recommended TBO	2,000 hours

1.2 PROPELLER

Manufacturer	McCauley
Model	B3D32C419/82 NHA-5
Type	Constant-Speed, Hydraulic
Number of Blades	3
Diameter	77" (1.96 m)

1.3 WEIGHTS

Maximum Ramp	3,260 lbs. (1,478.71 kg)
Maximum Take-off	3,250 lbs. (1,474.17 kg)
Standard Empty	2,102 lbs. (953.45 kg)
Max Baggage Compartment	200 lbs. (90.72 kg)
Standard Useful Load	1,158 lbs. (525.26 kg)

1.4 FUEL & OIL CAPACITY

Fuel	90 US gal./88 usable (340.65 liters/333.08 usable)
Oil	8 quarts (7.57 l)

1.5 WING AREA/LOADINGS

Wing Area	152 sq. ft. (14.12 sq. m)
Wing Loading	21.4 lbs./sq. ft.(104.48 kg/sq. m)
Power Loading	12.5 lbs./hp. (5.67 kg/hp)

1.6 PERFORMANCE SPEEDS

Maximum	164 kts. (304 kph)
Performance Cruise (75% Power)	160 kts. (297 kph)
Economy Cruise (65% Power)	155 kts. (287 kph)
Long Range Cruise (55% Power)	149 kts. (276 kph)
Stall (Cruise Configuration)	60 kts. (111 kph)
Stall (Landing Configuration)	54 kts. (100 kph)

1.7 TAKEOFF PERFORMANCE

Ground Roll	1,145 ft. (348.99 m)
Distance over 50 ft. Obstacle	1,985 ft. (605.02 m)

1.8 CLIMB PERFORMANCE

Initial S.L. Rate of Climb	1,070 ft./min.(326.14 m/min.)
Service Ceiling	16,800 ft.(5,120.64 m)

1.9 RANGE

Range @ Performance Cruise	855 NM @ 14.3 gph.(54.13 lph)
Range @ Economy Cruise	940 NM @ 12.6 gph.(47.69 lph)
Range @ Long Range Cruise	1005 NM @ 11.2 gph.(42.39 lph)

1.10 LANDING PERFORMANCE

Ground Roll	720 ft. (219.46 m)
Distance over 50 ft. Obstacle	1,200 ft. (365.77 m)

2 Limitations

This section presents the airplane operating limitations, required instrument markings and the significance thereof, and the required placards. All material included in this section has been approved by the Federal Aviation Administration. Observance of all operating limitations is required by the Federal Aviation Regulations. Similarly all required instrument markings and placards must be maintained in a legible and usable condition on the airplane.

2.1 SPEED LIMITATIONS

SPEED	SYMBOL	KCAS	KIAS	SIGNIFICANCE
Never Exceed ASL 12500 ft 16000 ft 20000 ft 24000 ft	V_{NE}	 186 175 161 147	 187 176 161 147	Do not exceed this speed in any operation.
Maximum Structural Cruise ASL 12500 ft 16000 ft 20000 ft 24000 ft	V_{NO}	 148 139 128 117	 148 139 128 117	Do not exceed this speed except in smooth air, and then only with caution.
Maneuvering 3250 lbs. 2658 lbs. 2023 lbs.	V_A	 118 109 95	 118 109 95	Do not make full or abrupt control movements above this speed.
Maximum Flap Extended To 1st flap (9 deg) 2nd flap (25 deg) Full flap (35deg)	V_{FE}	 150 120 109	 151 121 111	Do not exceed these speeds with the given flap deflection.
Maximum Landing Gear Operating	V_{LO}	130	130	Do not extend or retract the landing gear above this speed.
Maximum Landing Gear Extended	V_{LE}	186	187	Do not exceed this speed with landing gear extended.
Maximum Vent Open	---	130	130	Do not exceed this speed with storm vent open.

2.2 FLAP LIMITS

Approved Takeoff Range: 0° to 20°
Approved Landing Range: 0° to 35

2.3 FLIGHT LOAD FACTOR LIMITS
Flaps 0° +3.8 G's - 0 G
Flaps 35° +2.0 G's - 0 G

2.4 AIRSPEED INDICATOR MARKINGS

MARKING	KCAS VALUE OR RANGE	SIGNIFICANCE
White Arc	58-114	Full Flap Operating Range. Lower limit is maximum weight zero thrust stall speed in the landing configuration. Upper limit is maximum speed allowable with flaps fully extended.
Green Arc	65-160	Normal Operating Range. Lower limit is maximum weight zero thrust stall speed with flaps and landing gear retracted. Upper Inuit is maximum structural cruising speed.
Yellow Arc	160-185	Caution Range. Operations must be conducted with caution and only in smooth air.
Red Radial Line	186	Never Exceed Speed. Maximum speed for all operations.

2.5 AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Flaps Up:	maintain 85 KIAS
Wing Flaps 20°:	maintain 80 KIAS
Maneuvering Speed:	
3250 Lbs	118 KIAS
2600 Lbs	109 KIAS
2023 Lbs	95 KIAS
Maximum Glide:	
3250 Lbs	86 KIAS
2600 Lbs	76 KIAS
2023 Lbs	66 KIAS
Precautionary Landing	
With Engine Power:	approach speed 75 KIAS
Without Engine Power:	approach speed 75 KIAS
Flaps :	35°

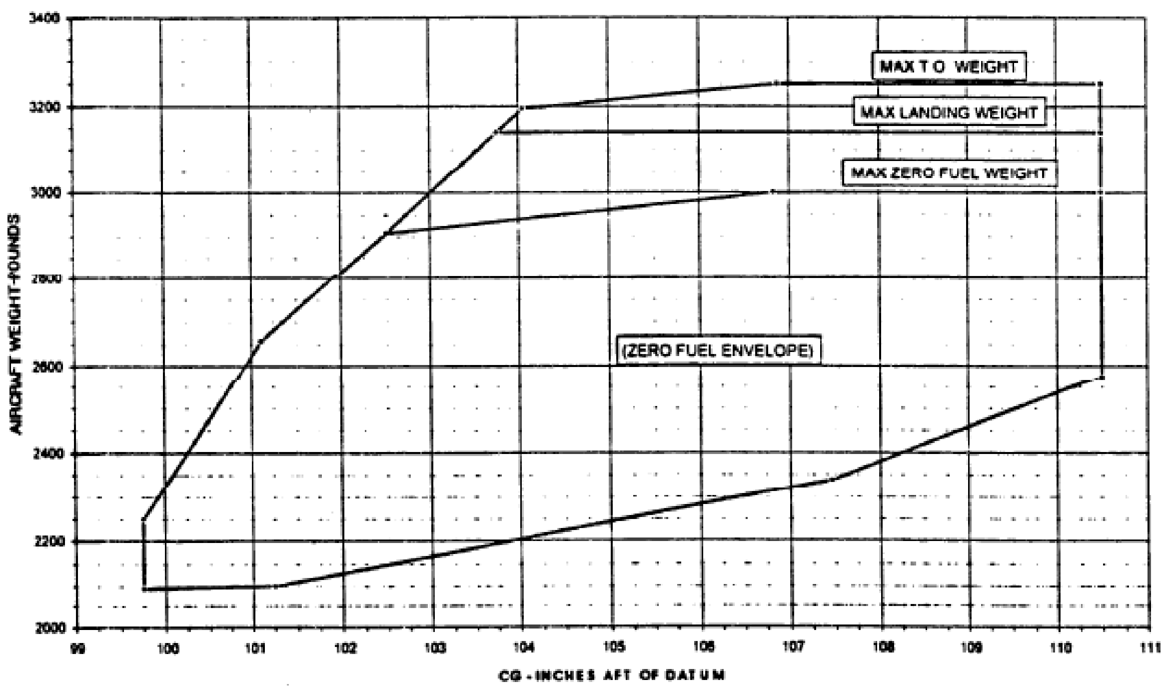
2.6 POWER PLANT AND PROP LIMITATIONS

Maximum Power:	260 BHP Rating
Engine Operating Limits for Takeoff and Continuous Operations	
Maximum Engine Speed:	2700 RPM
Maximum Cylinder Head Temperature:	500 °F (260 °C)
Maximum Oil Temperature	245°F (118 °C)
Oil Pressure, Minimum:	25 PSI
Maximum:	115 PSI
Fuel Injector Inlet Pressure	
Minimum: 12 PSI Maximum:	45 PSI
Fuel Nozzle Pressure,	Maximum: 9.5 PSI, 27.5 gal/hr
Propeller Blade Angle at the 30 Inch Blade Station	
Low:	12.6°
High:	33°

2.7 ENGINE INSTRUMENT MARKINGS

Instrument	RED LINE MIN	YELLOW ARC	GREEN ARC	RED LINE MAX
Manifold Pressure InHg	--	--	10-29	39
Tachometer - RPM	--	2500-2700	2200-2400	2100
Fuel Flow - GPH PSI	--	--	0-22	
Cylinder Head Temp.	500-550	--	200-500	500
Oil Temperature °F	--	--	100-250	250-270
Oil Pressure - PSI	30	90-110	60-90	115
Fuel Pressure - PSI	10	--	10-58	58

2.8 CENTER OF GRAVITY LIMITS



2.9 GENERAL OPERATION LIMITS BY TYPE

INSTRUMENT SYSTEM OR EQUIPMENT	KIND OF OPERATION		
	DAY	NIGHT	IFR
Alternate induction air system	X	X	X
Alternate static source	X	X	X
Alternator	X	X	X
Altimeter. sensitive	X	X	X
Ammeter	X	X	X
Auxiliary fuel pump	X	X	X
Battery	X	X	X
Circuit breakers	X	X	X
Compass	X	X	X
Flap position indicator	X	X	X
Engine Gauges	X	X	X
Gear locked lights (3)	X	X	X
Gear system. emergency	X	X	X
Gear warn light	X	X	X
Gear warning horn system	X	X	X
Gyro. attitude	-	-	X
Gyro. directional	-	-	X
Gyro. turn & bank indicator or turn coordinator	-	-	X
Instrument panel lighting	--	X	-
Exterior Lights	-	X	-
Propeller governor	X	X	X
Propeller spinner	X	X	X
Stall warning system	X	X	X
Steering system. nose wheel	X	X	X
Switch. alternator master	X	X	X
Switch. battery master	X	X	X
Tachometer	X	X	X
Trim indicators	X	X	X
Voltage regulator	X	X	X
Voltmeter	X	X	X

2.10 PLACARDS

MANEUVERING SPEED 3250 LBS. 118 KCAS
GEAR OPERATING SPEED 130 KCAS
SEE POH FOR ADDITIONAL
V_{NE} V_{LO} & V_A LIMITATIONS

V_{NE} - NEVER EXCEED

ALTITUDE	KIAS
12,500	185
15,000	176
17,500	167
20,000	158
22,500	150
25,000	141

3 Emergency Procedures

Emergencies caused by airplane or engine malfunctions are rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by cardul flight planning and good judgment when unexpected weather is encountered. Should an emergency arise, the basic guidelines described in this section are to be applied as necessary to alleviate the problem.

The procedures contained herein are not intended to constitute basic flight instruction but are intended to supplement those principles relating to emergencies that each pilot acquires in the process of learning to fly and obtaining FAA pilot certification.

Checklists are provided to assist a pilot where it would be reasonable for a pilot to refer to one. Where reference to a checklist would be impractical, or where the material is not amenable to a checklist form, or where additional material is helpful, amplified procedures are provided following the checklist section.

3.1 ENGINE FAILURES

3.1.1 ENGINE FAILURE DURING TAKEOFF ROLL

Throttle -	IDLE
Brakes -	APPLY
Flaps -	RETRACT
Mixture -	IDLE CUT-OFF
Ignition -	OFF
Battery Master Switch -	OFF

3.1.2 ENGINE FAILURE IN FLIGHT

Airspeed -	MAINTAIN 86 KIAS
Auxiliary Fuel Pump -	ON - CHECK PRESSURE
Alternate Induction Air -	ON
Mixture -	SET FULL RICH
Fuel Selector -	SELECT FULLEST TANK
Ignition Switch -	CHECK BOTH

3.1.3 IN-FLIGHT ENGINE RESTART PROCEDURES

[NOTE : If propeller stops, use normal starting procedures.]

Airspeed -	MAINTAIN 86 KIAS
Fuel Selector -	SELECT FULLEST TANK

[NOTE : Do not use the BOTH position. Selecting fullest tank will minimise start time]

Auxiliary Fuel Pump -	ON
Mixture -	RICH
Ignition Switch -	CHECK BOTH ON
Throttle -	AT LEAST 1/2 OPEN

After engine has restarted:

Throttle -	SET AS REQUIRED
auxiliary Fuel Pump -	OFF
Mixture -	LEAN as required

3.2 EMERGENCY LANDINGS

3.2.1 EMERGENCY LANDING WITHOUT ENGINE POWER

Seatbacks -	UPRIGHT, LOCKED
Seats, Belts & Harnesses -	SECURE
Loose Objects -	SECURE
Emergency Locator Transmitter -	ON
Transponder -	CODE 7700
Airspeed -	MAINTAIN 85 KIAS (flaps UP)
	MAINTAIN 75 KIAS (flaps 35 Deg)
Auxiliary Fuel Pump -	OFF
Fuel Selector -	OFF
Landing Gear -	DOWN, CHECK LOCKED

[NOTE : If the landing site chosen appears to have an extremely soft surface, recommended that landing gear remains retracted.]

Mixture -	IDLE CUT-OFF
Ignition Switch -	OFF
Wing Flaps -	35 Deg (recommended)
Battery & Alternator & Master Switches -	OFF when landing assured.

[NOTE : Stall warning will not be available with electrical system turned off].

Touchdown -	TAIL LOW
Brakes -	AS REQUIRED

3.2.2 PRECAUTIONARY LANDING WITH ENGINE POWER

Seatbacks -	UPRIGHT, LOCKED
Seats, Belts & Harnesses -	SECURE
Loose Objects -	SECURE
Sharp objects in clothing -	REMOVE & STOW
Radio -	TRANSMIT MAYDAY on area frequency and 121.5 MHz (if time permits)
Emergency Locator Transmitter -	ON (if circumstances so warrant)
Transponder -	CODE 7700 (if circumstances so warrant)
Airspeed -	MAINTAIN 85 KIAS (flaps UP) MAINTAIN 75 KIAS (flaps 35 Deg)
SURVEY	Selected Landing Site - OVERFLY, noting terrain, obstacles & hazards
SWITCHES	ALL SWITCHES (except battery & alternator masters & ignition) - OFF
Auxiliary Fuel Pump -	OFF
Fuel Selector -	BOTH
Landing Gear -	DOWN, VERIFY LOCKED
Mixture -	FULL RICH
Propeller Control-	FULL INCREASE RPM
Flaps -	35 Deg (recommended)
Power -	AS REQUIRED
Airspeed -	75 KIAS
Battery & Alternator & Master Switches -	OFF when landing assured.

[NOTE : Stall warning will not be available with electrical system turned off]

Touchdown -	TAIL LOW
Brakes -	AS REQUIRED

3.2.3 DITCHING

[NOTE : AIRCRAFT HAS NOT BEEN TESTED IN ACTUAL DITCHING. FOLLOWING ARE AIRCRAFT MANUFACTURERS RECOMMENDATIONS]

Seatbacks -	UPRIGHT, LOCKED
Seats, Belts & Harnesses -	SECURE
Loose Objects -	SECURE
Sharp objects in clothing -	REMOVE & STOW
Radio -	TRANSMIT MAYDAY on area frequency and 121.5 MHz (if time permits)
Emergency Locator Transmitter -	ON (if circumstances so warrant)
Transponder -	CODE 7700 (if circumstances so warrant)
Airspeed -	85 KIAS (flaps UP) 75 KIAS (flaps 35°)
Auxiliary Fuel Pump -	OFF
Fuel Selector -	BOTH
Landing Gear -	UP
Mixture -	FULL RICH
Propeller Control -	FULL INCREASE RPM

Flaps - 20 Deg (recommended)
Cowl Flap - CLOSED
Power - SET TO MAINTAIN 300 FT/MIN DESCENT AT 75 KIAS
Approach
High Winds, Heavy Seas - INTO WIND
Light Winds, Heavy Swells - PARALLEL TO SWELLS
Touchdown - LEVEL AITITUDE AT 300 FT/MIN DESCENT. Do not flare.
Airplane - EVACUATE.

[NOTE : If necessary, open vent window(s) and flood cabin to equalize pressure so that cabin doors can be opened.]

Life Vests, Raft - INFLATE *OUTSIDE* AIRCRAFT

3.3 ICING

3.3.1 INADVERTENT ICING ENCOUNTER

1. Pitot Heat - ON
2. Defrost Control- FULL ON
3. Engine RPM - INCREASE TO 2700 (enrich mixture as required)
4. Alternate Air - PULL ON
5. Course - REVERSE OR ALTER as required to avoid icing.

Evasive action should be initiated immediately when icing conditions are encountered.
6. Altitude - CHANGE to an altitude less conducive to icing.

IF ICING CONDITIONS CANNOT BE ESCAPED:

6. Airplane - LAND AT NEAREST AIRPORT. With extremely rapid ice build-up, plan for an off-airport forced landing.
7. Approach Speed - INCREASE 5 TO 20 KIAS depending on ice accumulation.

3.3.2 OBSTRUCTED STATIC SOURCE

1. Alternate Static Source - ON
2. Heat & Defrost Controls - ON
3. Cabin Air Vents - CLOSED

3.3.3 OBSTRUCTED PITOT SOURCE

1. Pitot Heat Switch - ON

NOTE
Use familiar pitch attitude/power settings to achieve desired airspeeds if airspeed indicator readings appear to remain unreliable.

3.4 LANDING GEAR MALFUNCTION PROCEDURES

3.4.1 LANDING GEAR FAILS TO RETRACT

(Green Gear Locked And/Or Red Gear Warn lights Remain On)

1. Gear Motor Circuit Breaker - CHECK IN
2. Emergency Gear Extension Valve Knob - CHECK FULL UP
3. Landing Gear Switch - RECYCLE

If landing gear still fails to retract:

4. Landing Gear Switch - DN
5. Landing Gear Lights - VERIFY 3 GREEN
6. Airplane - LAND AS SOON AS PRACTICAL for repairs.

3.4.2 LANDING GEAR FAILS TO EXTEND

(Green Gear Locked Light(s) Fails To Illuminate and Red Gear Warn Light Remains On)

1. Gear Light Press- To-Test Switch - CHECK green light bulb integrity
2. Gear Motor Circuit Breaker – CHECK IN
3. Landing Gear Switch - RECYCLE

If an unsafe indication persists, proceed as follows:

4. Gear Motor Circuit Breaker - PULL
5. Landing Gear Switch - CHECK DN
6. Wing Flaps – FULL EXTEND

NOTE
Gear Warning horn will activate as flaps exceed approximately 20°

7. Power - MINIMUM FOR FLIGHT CONDITIONS
8. Airspeed - REDUCE TO 80 KIAS.
9. Emergency Extension Valve Knob - PULL OUT & PUSH DOWN
10. Landing Gear Lights - VERIFY 3 GREEN

NOTE
If the nose gear fails to extend, it may be necessary to cycle the rudder pedals, reduce power, and/or reduce the airspeed.

3.4.3 GEAR WARN LIGHT ILLUMINATES

(Gear Up Selected)

1. Gear Motor - CHECK AUDIBLY for operation.
2. Airspeed - CHECK for normal gear retracted performance.

LANDING GEAR MALFUNCTION PROCEDURES (CON'T)

3. Gear Motor Circuit Breaker -- PULL if gear appears to be retracted and flight is to be continued to a maintenance facility.

NOTE
For landing gear extension at destination reset the Gear Motor Circuit Breaker.

3.4.4 GEAR WARN LIGHT ILLUMINATES
(Gear On Selected)

1. Landing Gear Locked Lights - CHECK 3 GREEN
2. Gear Motor - CHECK AUDIBLY for operation.
3. Gear Motor Circuit Breaker -- PULL until just prior to landing, then RESET.

3.4.5 GEAR UP LANDING

1. Seatbacks - UPRIGHT
2. Seats, Seat Belts, Shoulder Harnesses -- SECURE
3. Loose Objects - SECURE
4. Radio -- TRANSMIT MAYDAY to A TC or on 121.5 mHz (if circumstances so warrant)
5. Emergency Locator Transmitter - ON (if circumstances so warrant)
6. Transponder - CODE 7700 (if circumstances so warrant) 7. Airspeed -85 KIAS (flaps UP)
1. 75 KIAS (flaps 20°)
7. Fuel Selector Valve - BOTH (OFF if power is oft)
8. Mixture - FULL RICH (IDLE CUT-OFF if power is oft) 10. Propeller Control - FULL INCREASE RPM
11. Wing Flaps - 20° (recommended)
12. Touchdown -- TAIL LOW
13. Elevator Control - FULL AFT
14. Mixture -- IDLE CUT-OFF
15. Fuel Selector Valve - OFF
16. Airplane - EVACUATE after coming to stop.

3.4.5 LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

1. Before Landing Checklist -- COMPLETE
2. Loose Objects -- SECURE
3. Gear Motor Circuit Breaker -- IN
4. Approach -- NORMAL (full flap)
5. Landing -- TAIL LOW as SMOOTHLY as possible
6. Braking -- MINIMUM necessary.
7. Taxi -- SLOWLY clear of runway.
8. Engine -- SHUTDOWN before inspecting landing gear system.

LANDING GEAR MALFUNCTION PROCEDURES (CON'T)

3.4.6 LANDING WITH ONE RETRACTED OR UNLOCKED MAIN GEAR
(Or Flat Main Tire)

1. Before Landing Checklist - COMPLETE
1. NOTE
2. If it is suspected that a tire is defective prior to retraction, it is recommended that the gear remain extended.
3. Loose Objects - SECURE
4. Approach - NORMAL (full flap)
5. NOTE
6. Select a runway with a crosswind component from ihe same side as the good main gear/tire.
7. Touchdown - ON GOOD MAIN GEAR FIRST
8. Aileron - BANK AWAY FROM DEFECTIVE GEARITIRE as long as possible.
9. If one main gear was still retracted, or the airplane begins to lower the wing on the defective
10. Mixture - IDLE CUT-OFF
11. Fuel Selector - OFF
12. Battery & Alternator Master Switches - OFF

3.4.7 LANDING WITH A DEFECTIVE NOSE GEAR
(Or Flat Nose Tire)

1. Before Landing Checklist - COMPLETE

NOTE
If it is suspected that a tire is defective prior to retraction, it is recommended that the gear remain extended.

2. Loose Objects - SECURE
3. Approach - NORMAL (full flap)
4. Touchdown - SLIGHTLY TAIL LOW
5. Rollout - NOSE HIGH
6. If the nose gear was still retracted, or the airplane begins to lower the nose toward the ground:
7. Mixture -- IDLE CUT-OFF
8. Fuel Selector – OFF
9. Battery & Alternator Master Switches - OFF

3.5 ELECTRICAL SYSTEM EMERGENCIES

3.5.1 EXCESSIVE CHARGING INDICATED ON AMMETER

1. Alternator Master Switch - OFF
2. Alternator Circuit Breaker -- PULL
3. All Non-Essential Electrical Equipment - OFF
4. Flight -- TERMINATE as soon as practical.

3.5.2 BATIERY DISCHARGE INDICATED ON AMMETER

(Red Low Volts Light Illuminated)

5. All Non-Essential Electrical Equipment - OFF
6. Voltmeter -- CHECK between 24 & 28 volts.
7. Ammeter - CHECK. If ammeter now shows charging, alternator is now back on line
8. Electrical equipment may be turned on as desired.
9. If ammeter continues to show discharge:
10. Alternator Master Switch - CYCLE OFF & BACK ON

NOTE
Battery power may be required to excite alternator. Keep battery master switch ON.

11. Voltmeter - CHECK between 24 & 28 volts.
12. Ammeter - CHECK. If ammeter now shows charging, alternator is now back on line. Electrical equipment may be turned on as desired.

If ammeter continues to show discharge:

13. Alternator Master Switch - OFF
14. All Non-Essential Electrical Equipment - OFF
15. Flight -TERMINATE as soon as practical.

NOTE
Excessive load on alternator, or alternator failure, will cause discharge indications on the ammeter and a continuous reduction in voltage on the voltmeter.

3.5.3 CIRCUIT BREAKER/CIRCUIT BREAKER SWITCH TRIPPING

1. Affected Circuit Breaker -- RESET
2. If circuit breaker/circuit breaker switch continues to trip:
3. Circuit Breaker - LEAVE TRIPPED
4. Affected Equipment - OFF

If avionics master circuit breaker switch has tripped:

1. All Avionics Individual Power Switches - OFF
2. Individual Avionics Circuit Breakers - CHECK FOR TRIPPED BREAKER. Do not reset this circuit breaker.
3. Avionics Master Switch - RESET ON
4. Individual Avionics Switches - ON, one at a time (most essential avionics first).
5. NOTE
6. When radio at fault is turned on, the avionics master circuit breaker switch may again trip.

3.5.4 AVIONICS MASTER CIRCUIT BREAKER SWITCH FAILURE

1. Avionics Master Switch - OFF
2. Energy Saver Switch - ON
3. Radios - USE # 1 COM/NA V and aircraft speakers for remainder of flight.

3.6 MISCELLANEOUS ABNORMALITIES

3.6.1 EXTREME TURBULENCE ENCOUNTER

1. Airspeed - MANEUVERING SPEED (observe speed for flight weight)
2. Flaps - UP
3. Landing Gear -- RETRACTED
4. Seat Belts & Shoulder Harnesses - SECURED
5. Loose Objects - SECURE

3.6.2 EMERGENCY DESCENT

1. Landing Gear - DOWN below 130 KIAS
2. Flaps - UP
3. Throttle - IDLE
4. Prop Control- HIGH RPM
5. Airspeed - 187 KIAS below 12,500 ft

3.6.3 VACUUM PUMP FAILURE

INDICATED BY ILLUMINATION OF FAILURE INDICATOR(S)

If failure on one vacuum pump indicated:

1. Flight - CONTINUE

If failure on both vacuum pumps indicated:

1. Flight
2. If in VFR conditions - CONTINUE
3. If in IFR conditions - Revert to standard partial panel procedures

3.7 AMPLIFIED EMERGENCY PROCEDURES

The following Amplified Procedures elaborate upon information contained in the Operational Checklists section. These procedures also contain information not readily adaptable to a checklist format and material to which a pilot could not be expected to refer in resolution of a specific emergency.

3.7.1 ENGINE FAILURE

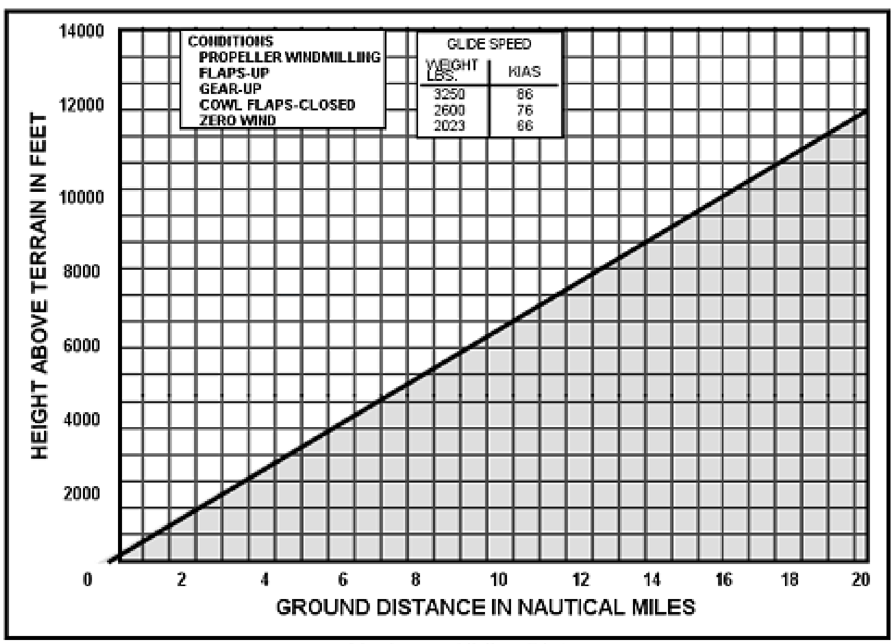
If an engine failure occurs during the takeoff run, the pilot's main concern should be to stop the airplane on the remaining runway. Those extra items in the checklist are to add protection should the runway be too short for the resulting rollout.

In flight, prompt reduction of pitch attitude to obtain and maintain a proper glide speed upon experiencing an engine failure is paramount. If the failure has occurred shortly after takeoff, a landing should be planned straight ahead with only small changes in direction to avoid obstructions.

NOTE
Under some types of engine failure increased glide range can be achieved by pulling the propeller aft to the full decrease rpm position.

3.7.2 Glide Distance

While gliding towards a forced landing site, time and altitude permitting, an effort should be made to determine the cause of the power loss and correct it. If the cause cannot be determined then an emergency landing without engine power must be accomplished.



Maximum Gliding Distance

3.7.3 EMERGENCY LANDINGS

If all attempts to restart the engine fail, continue towards the previously selected forced landing site and prepare for the landing as outlined under the Emergency Landing Without Engine Power checklist.

During a forced landing it is incumbent on the pilot to continue to fly the airplane. Damage and/or injuries can be minimized if the pilot exerts control over the airplane until it comes completely to a stop. If an off-airport precautionary landing is elected by the pilot. for whatever reason. he has an advantage over the pilot who has experienced an engine failure. He should use this advantage to complete as normal a landing as possible. generally following the Precautionary Landing With Engine Power checklist.

3.7.4 LANDING WITHOUT ELEVATOR CONTROL

In the event of loss of primary pitch control (elevator) a landing may still be made through the use of pitch trim and power controls. Using these controls, the airplane should be established on a long final approach.

Establish horizontal flight at approximately 100 KIAS, and then extend the landing gear and 20° flaps. Adjust the power and elevator trim to maintain level flight at 90 to 100 KIAS. Initiate a descent for landing upon reaching a normal descent point by reducing power appropriately. Slight adjustments of trim may be needed to maintain airspeed. Upon reaching flare height slowly reduce power while adding small amounts of nose up trim to allow touchdown on the main gear.

3.7.5 FIRES

Engine fires in flight are extremely rare in properly maintained airplanes. However, the appropriate checklist procedures should be followed if one is encountered. After the fire is extinguished, execute a forced landing. Do not attempt to restart the engine to avoid regenerating the fire. Electrical fires are usually signaled by the odor of burning insulation. Deactivate the airplane electrical system and refer to the applicable checklist for resolution of this emergency.

3.7.6 EMERGENCY OPERATION IN CLOUDS

Depending upon the specific equipment installed, a total vacuum failure or a total electrical failure may cause a loss of some gyro instruments. If the failure affects the primary gyros, the attitude and directional gyros, the turn and bank indicator or turn coordinator can be referenced while exiting the clouds. The 1148 is equipped with two vacuum pumps. The failure of one pump will not affect the operation of the vacuum driven instruments. A failed pump should be replaced prior to further IFR operation.

The airplane is quite stable in pitch and roll, and these attributes should be fully utilized to help the pilot, who may not be fully proficient in partial panel instrument flight, out of this circumstance. The airplane should be controlled in pitch by small inputs of the elevator trim. Turns should be shallow and should be initiated and stopped by application of rudder. The aircraft clock or the pilot's watch may be used to time turns. Altitude changes are accomplished by power changes and. if needed. adjustment of the pitch trim.

3.7.7 INADVERTENT FLIGHT INTO ICING CONDITIONS

Flight into known icing conditions is prohibited. In the event of an inadvertent icing encounter it is imperative that action be initiated to vacate these conditions, right now!! A 1800 turn and, often, a climb is appropriate. In any case, the pilot must take prompt action to get out of the icing conditions. If the icing conditions persist and cannot be escaped, then the airplane should be flown to the nearest suitable airport and landed. If airframe ice builds extremely rapidly, the pilot should plan for an off-airport forced landing. Approach speeds should be increased 5 to 20 KIAS depending upon icing severity.

3.7.8 STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter, and vertical speed) are suspected, the alternate static source should be selected, thereby supplying cabin static pressure to these instruments. To avoid excessive errors on these instruments, the heater and defroster should be on and the overhead vents should be closed. (Calibration Charts in Section 5 are provided to illustrate airspeed and altitude errors associated with the use of the alternate static source.

3.7.9 MAGNETO MALFUNCTION

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrich the mixture to determine if continued operation on BOTH magnetos is possible. If not, switch to the good magneto and proceed to the nearest airport for repairs.

3.7.10 ENGINE DRIVEN FUEL PUMP FAILURE

A failure of the engine driven fuel pump will be shown by a sudden reduction in the unmetered fuel pressure indication (and in the fuel flow indication) immediately prior to a loss of power while operating on a tank containing adequate fuel. Activation of the auxiliary fuel pump will restore engine power. Proceed to the nearest airport for repairs.

3.7.11 LOW OIL PRESSURE

If a low oil pressure indication is accompanied by nominal oil temperature, there is a possibility that the oil pressure transducer or relief valve are malfunctioning. A landing should be made at the nearest airport to inspect for the source of the low indication.

If a total loss of oil pressure is accompanied by a rise in oil temperature, an engine failure is probably imminent. Reduce to the minimum engine power and execute a precautionary landing while power still exists.

3.7.11 HIGH CYLINDER HEAD/OIL TEMPERATURE

If high cylinder head and/or oil temperature indications are experienced, open the cowl flaps. Enrich the mixture and increase airspeed if practical, or reduce power. If temperatures remain excessive, proceed to the nearest airport to investigate the cause.

3.7.12 PROPELLER OVERSPEED

If the propeller governor should fail, allowing the propeller pitch to flatten, the engine will overspeed. In this instance, close the throttle immediately and reduce airspeed. As the situation stabilizes, use the throttle to control engine speed as though the propeller had a fixed pitch. Proceed to the nearest airport at reduced airspeed and power, observing the engine rpm limits.

3.7.13 LANDING GEAR MALFUNCTIONS

There are several checks that should be made in the event of a landing gear malfunction. Check landing gear circuit breakers in; reset if necessary. Check inoperative gear position light for possible bulb failure using the press-to-test switch.

If a positive gear down and locked indication cannot be obtained with normal extension procedures repeated one additional time, proceed with emergency gear extension procedures. A positive gear extension is indicated by:

1) Green locked lights.
2) Absence of red gear warn light and
3) Absence of gear warning horn with throttle idle or flaps full down.

3.7.14 ELECTRICAL SYSTEM MALFUNCTIONS

After periods of heavy usage, such as prolonged cold weather starts or extended periods overtaxing, the battery charge level will have dropped low enough to accept higher than normal charge rates during the initial part of the flight. However, after approximately 30 minutes, the ammeter indication should have decreased steadily toward a zero reading and the voltmeter should indicate between 24 and 30 volts.

If the charging rate remains above this value for an extended period of time, there is a possibility that the battery may overheat and evaporate electrolyte at an excessive rate. To preclude the possibility of an overcharging condition affecting the battery, the alternator master switch should be turned off and the flight terminated. Electrical load should be reduced to an essential minimum if an immediate landing is impractical.

A continuous discharge rate shown on the ammeter during flight accompanied by the eventual illumination of the Low Volts light generally indicates:

1. Alternator and/or voltage regulator malfunction. or
2. Excessive load on the electrical system.

First, the electrical load must be reduced. If the ammeter continues to show a discharge, the alternator master switch should be turned off to isolate the alternator from the electrical system. With the alternator off the entire electrical load is placed on the battery and all non-essential electrical equipment should be turned off to reduce the discharge rate of the battery.
When operating with both the battery master and alternator master switches OFF it should be remembered that certain electrical equipment will be inoperative, such as :

1. Wing flaps
2. Landing gear operating system (except emergency extension system)
3. Landing gear lights and warning system
4. Fuel gages
5. Engine temperature gauges

6. Oil pressure gage
7. Manifold pressure gage
8. Tachometer
9. Stall warning system
10. Gyros, part (depends on specific equipment) I 1. All lighting, interior and exterior
11. All avionics (except EL T)
12. Vacuum pump failure indicators (SIN 14654 and subsequent)

3.7.15 VACUUM SYSTEM MALFUNCTION

Suction to operate the direction gyro and attitude indicator is provided by two engine-driven vacuum pumps. A suction gauge monitors the system for indication of correct suction pressure. Normal suction pressure is 5.1 (± .1) inches of mercury. Directly below the suction gauge are two vacuum pump failure indicators. These indicators are either mechanical (SIN 14541 thru 14653) or electrical (SIN 14654 and subsequent). A vacuum pump failure will be indicated when the suction of that pump drops to 3.5 inches of mercury.

If the failure of one vacuum pump is indicated then flight may be continued under VFR, night, and IFR conditions. One vacuum pump is adequate to provide suction for the direction gyro and attitude indicator. However, vacuum pump redundancy is lost. The inoperative pump should be repaired as soon as practical to return that redundancy.

If the failure of both vacuum pumps is indicated, then the direction gyro and attitude indicator should be considered inoperative. In VFR and night conditions flight may be continued. If the failure of both pumps is indicated in IFR conditions then standard procedures should be followed and the aircraft landed as soon a practical. The aircraft cannot be flown again in IFR conditions until at least one of the vacuum pumps has been repaired.

4 Normal Procedures

This section provides basic guidelines for normal operation of this airplane. The procedures contained herein are not intended to constitute basic flight instruction but are intended to supplement those principles relating to normal flight operations that each pilot acquires in the process of learning to fly and obtaining FAA pilot certification.

Checklists are provided to assist a pilot where it would be reasonable for a pilot to refer to one. Where reference to a checklist would be impractical or where the material is not amenable to a checklist form. or where additional material is helpful, amplified procedures are provided following the checklist section.

4.1 AIRSPEEDS FOR NORMAL OPERATION

Except as noted, the following speeds are based on a maximum weight of 3250 pounds and may be used at any lesser weight.

TAKEOFF:

Normal Initial Climb	80 - 90 KIAS
Short Field Takeoff [Flaps 20 at 50 Ft]	73 KIAS

ENROUTE CLIMB - FLAPS AND GEAR RETRACTED:

Normal	100 - 120 KIAS
Best Rate of Climb. Sea Level	100 KIAS
Best Rate of Climb. 8000 Feet	100 KIAS
Best Rate of Climb. 12000 Feet	88 KIAS

LANDING APPROACH:

Normal Approach Flaps Up	80 - 90 KIAS
Normal Approach Flaps 35 Deg	75- 85 KIAS
Short Field Approach Flaps 35 Deg	74 KIAS
Balked Landing:	
Maximum Power - Flaps 20°	70 - 75 KIAS

MAXIMUM RECOMMENDED TURBULENT AIR PENETRATION SPEED:

3250 Lbs	118 KIAS
2600 L b	109 KIAS
2023 Lbs	95 KIAS
Maximum Demonstrated Crosswind	19 Knots

4.2 PREFLIGHT INSPECTION

COCKPIT

1.	Pilot's Operating Handbook -	AVAILABLE TO PILOT
2.	Airplane Documents -	REVIEWED
3.	Weight and Balance -	CHECKED
4.	Controls Lock -	REMOVED
5.	Parking Brake -	SET
6.	Landing Gear Selector Switch -	ON
7.	Alternate Static Source -	OFF
8.	Ignition Switch -	OFF
9.	Electrical Switches -	OFF
10.	Avionics Master Switch -	OFF
11.	Circuit Breakers -	SET
12.	Battery Master Switch -	ON

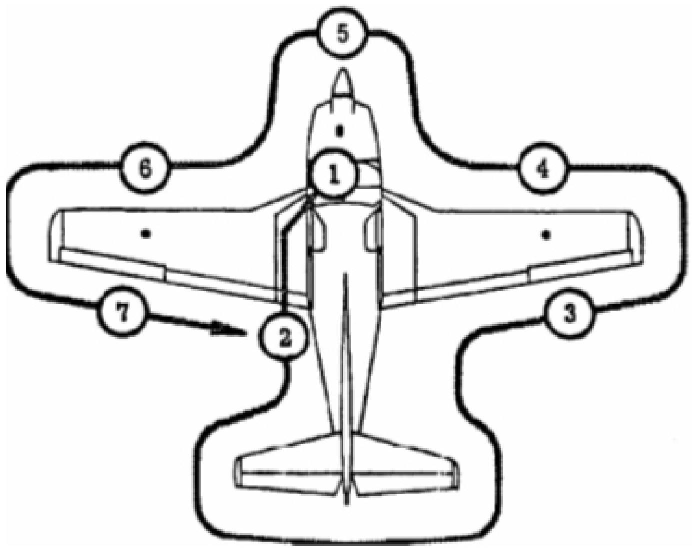
[NOTE : Do not activate the airplane's electrical system when anyone is within or near the propeller's arc to prevent potential injury which could result from an electrical malfunction].

13.	Landing Gear Locked Lights --	3 GREEN
14.	Fuel Quantity Gauge -	CHECK

[NOTE : Useable fuel quantities above approximately 28 U.S. gallons per tank are not gaugeable].

15.	Battery Master Switch -	OFF
16.	Rudder Trim -	SET
17.	Elevator Trim -	SET
18.	Fuel Selector Valve -	BOTH

4.3 EXTERNAL



LEFT SIDE OF TAILCONE AND EMPENNAGE

1. 1. Baggage Door - CLOSED & LOCKED
2. 2. Static Port - UNOBSTRUCTED
3. 3. Empennage - INSPECT
4. 4. Rudder & Elevator - CHECK freedom of movement & security.
5. 5. Trim Tabs - CHECK position & security
6. 6. Rudder Gust Lock - REMOVE
7. 7. Tail Tie-Down - REMOVE

RIGHT SIDE OF TAILCONE AND RIGHT WING TRAILING EDGE

1. 1. Static Port - UNOBSTRUCTED
2. 2. Wing Flap - INSPECT
3. 3. Aileron - CHECK freedom of movement & security.

RIGHT WING LEADING EDGE
1. 1. Fuel Vent - UNOBSTRUCTED
2. 2. Wing Tie-Down - REMOVE
3. 3. Fuel Quantity - CHECK VISUALLY for level & agreement with gauge.

[NOTE: A reduced fuel indicator is located in the fuel filler neck to show a useable fuel quantity of approximately 24 gallons].

4. Fuel Filler Cap - SECURE
5. Fuel Tank Sump - DRAIN AT LEAST 1 CUPFUL, visually inspect for water, proper grade (color) sediment,
6. Check valve CLOSED.
7. Right Main Gear, Tire, & Wheel Well- INSPECT
8. Gear Safety & Stall Warn Disable Squat Switch - INSPECT

9. Landing Gear Limit Switches (2) -	INSPECT
10. Chocks - REMOVE	
11. Right Wheel Well Fuel Drain -	DRAIN AT LEAST 1 CUPFUL, visually inspect
12. Check valve CLOSED.	

RIGHT WING TRAILING EDGE

1. Aileron -	CHECK freedom of movement & security.
2. Wing Flap --	INSPECT

PREFLIGHT INSPECTION - NOSE

1. Fuel Gascolator	DRAIN AT LEAST 1 CUPFUL, visually inspect
2. Check valve	CLOSED.
3. Exhaust Tailpipe -	CHECK SECURE
4. Nose Gear, Tire & Wheel Well	INSPECT
5. Nose Gear Limit Switches	INSPECT
6. Propeller & Spinner -	INSPECT
7. Engine Cooling Air Inlets -	CHECK UNOBSTRUCTED
8. Engine Induction Air Inlet -	CHECK UNOBSTRUCTED
9. Cowl Flap -	CHECK POSITION & SECURITY
10. Oil Quantity -	CHECK. minimum 6 quarts
11. Chocks -	REMOVED & STOWED

LEFT WING LEADING EDGE

1. Fuel Vent -	UNOBSTRUCTED
2. Wing Tie-Down -	REMOVE
3. Fuel Quantity -	CHECK VISUALLY for level

[NOTE: A reduced fuel indicator is located in the fuel filler neck to show a useable fuel quantity of approximately 24 gallons].

4. Fuel Filler Cap -	SECURE
5. Fuel Tank Sump -	DRAIN AT LEAST 1 CUPFUL, visually inspect
6. Check valve	CLOSED.
7. Right Main Gear, Tire, & Wheel Well-	INSPECT
8. Landing Gear Limit Switches (2) -	INSPECT
9. Chocks - REMOVE	
10. Right Wheel Well Fuel Drain -	DRAIN AT LEAST 1 CUPFUL, visually inspect
11. Stall Warning Vane -	CHECK freedom of movement & audible horn

[NOTE: The aircraft battery master switch must be ON to check stall horn. Then move the STALL CKT switch in the left wheel-well from the NORM to the spring loaded TEST position while the stall vane is moved upwards].

LEFT WING TRAILING EDGE

1. Aileron -	CHECK freedom of movement & security.
2. Wing Flap --	INSPECT

4.4 STARTING ENGINE

BEFORE STARTING ENGINE

1. Preflight Inspection -	COMPLETE
2. Seats, Seat Belts, & Shoulder Harnesses -	ADJUST & SECURE
3. Landing Gear Selector Switch -	ON
4. Electrical Switches -	OFF
5. Avionics Master Switch -	OFF
6. Circuit Breakers -	SET
7. Cowl Flap -	OPEN
8. Fuel Selector Valve -	BOTH
9. Brakes -	TEST & SET

[NOTE: FLIGHTSIM does not model the startup procedure of the Lycoming engine which requires engine cranking with mixture at idle cut-off. Normal Flight Sim engine start-up procedures apply.

NORMAL START

1. Throttle -	OPEN 1/2 INCH
2. Propeller Control -	HIGH RPM
3. Mixture -	FULL RICH
4. Alternate Induction Air -	PUSH COLD
5. Propeller Area -	call "CLEAR"
6. Battery & Alternator Master Switches -	ON
7. Landing Gear Locked Lights -	3 GREEN
8. Voltmeter - CHECK battery volts -	20-24 volts.
9. Auxiliary Fuel Pump Switch --	ON
10. Fuel Pressure - GREEN ARC	14 - 45 PSI

4.5 BEFORE TAXI

1. Anti-Collision Light -	ON
2. Avionics Master Switch -	ON
3. Radios -	SET
4. Parking Brake -	RELEASE

4.6 TAXI

1. Brakes -	CHECK
2. Nose Wheel Steering -	CHECK
3. Compass -	CHECK against known taxiway heading.
4. Directional Gyro -	ALIGN to compass, set runway HDG bug

4.7 BEFORE TAKEOFF

1. Parking Brake -	SET
2. Seats, Belts & Harnesses -	CHECK SECURE
3. Flight Controls -	FREE & CORRECf movement.
4. Instruments -	CHECK & SET
S. Auxiliary Fuel Pump Switch -	ON
6. Fuel Quantity -	RECHECK adequate for planned flight.
7. Mixture -	FULL RICH
8. Fuel Selector Valve -	BOTH
9. Rudder Trim -	SET as desired.
10. Elevator Trim -	SET as desired.
11. SET Throttle for run-up check -	ENGINE SPEED 1800 RPM
12. Magnetos CHECK R, BOTH & L -	RPM drop should not exceed 175 on either magneto
13. Constant Speed Propeller control -	EXERCISE, CHECK RPM CONTROL
14. RETURN THROTTLE TO IDLE -	CHECK IDLE SPEED MAINTAINED WITH THROTTLE CLOSED
15. Engine Instruments -	CHECK
16. Suction Gauge -	CHECK vacuum & operation of both pumps.
12. Throttle -	1000 RPM
13. Quadrant Friction -	SET
14. Cowl Flap -	RECHECK OPEN
15. Wing Flaps -	SET per takeoff checklist.
16. Cabin Doors -	CLOSED & LATCHED (both lower & upper latches)
17. Strobe Lights -	AS DESIRED
18. Brakes -	RELEASE

4.8 NORMAL TAKEOFF

1. Wing Flaps -	SET 0 to 20 DEG
2. Power -	FULL THROTTLE & 2700 RPM
3. Mixture -	FULL RICH (or leaned for smooth operation above 5000 ft.)
4. Elevator Control -	ROTATE AT 70 KIAS
5. Initial Climb Speed -	80 to 90 KIAS
6. Brakes -	APPLY momentarily.
7. Landing Gear -	RETRACT
8. Wing Flaps -	RETRACT (if extended)

4.9 SHORT FIELD TAKEOFF

1. Wing Flaps -	SET 20 DEG
2. Brakes -	APPLY & HOLD
3. Power -	FULL THROTTLE & MAX RPM
4. Mixture -	FULL RICH

[NOTE: leaned for smooth operation and increased power above 5000 ft]

5. Brakes -	RELEASE
6. Elevator Control -	ROTATE AT 68 KIAS
7. Climb Speed -	73 KIAS until obstacles cleared, then increase.
8. Brakes -	APPLY momentarily.
9. Landing Gear -	RETRACT after obstacles cleared.
10. Wing Flaps -	RETRACT after airspeed reaches 80 KIAS.

4.10 BEFORE LANDING

1. Seats, Seat Belts, Shoulder Harnesses -	SECURE
2. Auxiliary Fuel Pump Switch -	ON
3. Fuel Selector Valve -	BOTH
4. Landing Gear -	EXTEND, 3 GREEN
5. Mixture -	FULL RICH (or set for altitude)
6. Propeller -	HIGH RPM

4.11 LANDING - NORMAL LANDING

1. Airspeed -	80 to 90 KIAS
2. Wing Flaps -	AS REQUIRED (35 Deg recommended)
3. Airspeed -	75 to 85, flaps 35°
4. Trim -	ADJUST as required.
5. Gear -	CHECK 3 GREEN
6. Touchdown -	ON MAIN WHEELS
7. Braking -	MINIMUM required.

4.12 SHORT FIELD LANDING

1. Wing Flaps -	35 Deg
2. Airspeed -	74 KIAS

[NOTE: This airspeed is recommended in smooth air only. Increase as required for actual weather conditions. Expect increased landing distances with any increase in airspeed].

3. Trim -	ADJUST as required.
4. Gear -	CHECK 3 GREEN
5. Power -	REDUCE TO IDLE at or before crossing obstacle.
6. Touchdown -	MAIN WHEELS FIRST
7. Braking -	HEAVY
8. Wing Flaps -	RETRACT for maximum braking.

4.13 BALKED LANDING / GO-AROUND

1. Power-	FULL THROTTLE & 2700 RPM
2. Landing Gear -	RETRACT
3. Wing Flaps -	RETRACT TO 20°
4. Airspeed -	70 to 75 KIAS

[NOTE : When positive rate of climb is established] :

5. Wing Flaps -	RETRACT progressively as airspeed increases.
6. Cowl Flaps-	OPEN

4.14 AFTER LANDING

1. Auxiliary Fuel Pump Switch -	OFF
2. Strobe Lights -	OFF
3. Cowl Flaps -	OPEN
4. Wing Flaps -	UP

4.15 SHUTDOWN

1. Throttle -	IDLE
2. Parking Brake -	SET
2. CHECK EGT -	WAIT UNTIL IN GREEN
3. Electrical Equipment -	OFF
4. Avionics Master Switch -	OFF
5. Mixture -	IDLE CUT-OFF
6. Ignition Switch -	OFF
7. Battery & Alternator Master Switches	OFF
8. Control Lock -	INSTALL
9. Fuel Selector Valve -	OFF

4.16 AMPLIFIED PROCEDURES

4.16.1 PREFLIGHT INSPECTION

The Preflight Inspection Checklist is recommended prior to any series of flights by one pilot on any given day. Prior to any flight at least fuel and oil quantity should be checked and the fuel purity and type verified.

After major maintenance has been performed, all control surfaces and the elevator trim tabs should be examined closely for security and for proper direction of travel in response to control inputs. All inspection plates should be checked for reinstallation and security. If the airplane has been waxed the static ports should be checked for blockage.

If the airplane has been stored outside for any period of time the engine area and other points of entry should be checked for evidence of bird occupancy. The induction air filter should be inspected and cleaned if needed. The pitot and static ports and fuel tank vents should be checked for blockage by dirt, bugs, or other residue. Fuel tanks should be carefully checked for water or other contamination by draining generous amounts at all drain points in the fuel system. All control surfaces and control surface travel stops should be examined for wind damage.

If the airplane has been operated from muddy or slushy fields, the landing gear wheel wells, limit switches. and the squat switch should be examined for cleanliness and serviceability. If operations have included gravel fields, the propeller leading edges should have any nicks dressed out as they are discovered.

Fuel caps should be inspected for any deterioration periodically to avoid fuel leakage in flight or water infiltration while parked.

If night flight is contemplated, the operation of all lighting, interior and exterior, should be checked and a flashlight should be carried in a location readily available to the pilot.
In cold weather, remove all traces of ice, snow, or frost from al] flying surfaces_ Be sure that no accumulations of ice or slush have formed inside any control surfaces. Check the static and pitot ports and both fuel vents for blockage by ice.

4.16.2 STARTING ENGINE

Cold starts are typically accomplished with a 4 to 6 second prime using the auxiliary fuel pump. Hot starts, and starts with a suspected flooded engine, should not include any prime at all.
Weak intermittent firing followed by puffs of black smoke from the exhaust stack is an indication of over-priming or flooding. If the engine is under-primed it will not fire at all. However, neither will any tiring be evident for some period of cranking during a hot or flooded start.

If prolonged cranking is necessary, allow the starter motor to cool after approximately 30 seconds of cranking. Excessive cranking will build heat enough to damage the starter motor.
After starting, if oil pressure is not indicating within 30 seconds under normal atmospheric temperatures stop the engine and investigate. In cold conditions somewhat longer time will be required to build oil pressure. Lack of oil pressure, if uncorrected, can lead to serious engine damage.

4.16.3 TAXIING

When taxiing, move at a safe speed using the minimum power necessary to sustain that speed without dragging the brakes. If taxiing over gravel surfaces use the minimum engine power necessary to avoid damage to propeller leading edges.

While taxiing, the airplane controls should be positioned to minimize any potential overturning tendency brought on by winds or prop/jet blast from nearby aircraft. Into a headwind, use slight up elevator to lighten the nose gear load and hold ailerons into any crosswind component. Taxiing downwind, keep the elevator down to prevent any lifting tendency at the tail and hold the ailerons away from any crosswind component, again to prevent any lifting of the upwind wing.

4.16.4 BEFORE TAKEOFF

WARM-UP
The engine is closely cowled to produce minimum drag in cruising flight. However, except under the most extreme conditions, no special procedures are necessary during ground operations. Maximum power runups are net recommended except as necessary to correct maintenance discrepancies.

MAGNETO CHECK
Check the operation of the magnetos at 1800 RPM. When operating on a single magneto the drop in engine speed should not exceed 175 RPM. The difference in engine speed while operating on each single magneto should be no more than 50 RPM. If there is reason to question the magneto check, the mixture may be leaned to peak power and the magnetos rechecked. At higher altitudes this leaning may be required for a smooth magneto check. If doubt still remains, a magneto check at a higher power, say 2000 to 2200 RPM, should confirm the presence or absence of a problem. If a magneto problem is present, do not fly the airplane until the problem is corrected.
An absence of an apparent drop in engine speed during a magneto check may be an indication of faulty grounding of one side of the ignition system and should be checked because of the hazard this condition presents to ground personnel in the vicinity of the airplane while parked.

ALTERNATOR CHECKS
Alternator function can be verified prior to flight by noting ammeter and voltmeter indications. The ammeter should be showing a gradually decreasing charge indication as the battery recovers from the engine start. The voltmeter will show a nominal 28 volts if the alternator is on line or a nominal 24 volts if only the battery is functioning.

TAKEOFFS
POWER APPLICATION
Power should be checked early in the takeoff run for adequacy. Manifold pressure should be approximately equivalent to 29 inches less 1 inch per 1000 feet above sea level. Engine speed should be 2700 RPM.

NOTE
The engine speed should be approximately 2650 RPM while the airplane is static with full throttle applied because of the propeller low pitch stop setting. This should increase to and stabilize at 2700 RPM early in the takeoff roll as the propeller is unloaded and the governor takes control.

Lack of achievement of the above power levels or any indication of sluggish engine response or other abnormality is reason to abort the takeoff and determine the reason(s).
If the runway surface is gravel, the power should be applied slowly, consistent with field length constraints, to minimize the chance of gravel being sucked into the propeller and the resulting damage.

Following application of power for takeoff, recheck and reset (if needed) the quadrant friction knob to maintain power control settings.

MIXTURE SETTINGS
For most takeoff operations the mixture should be full rich. However, at takeoff altitudes above 5000 feet the mixture may be leaned for smooth operation. If takeoff field length is at all critical at higher altitudes, then the mixture should be leaned as required for smooth operation and increased power.

WING FLAP SETTINGS
Takeoff is approved with flap settings from 0° to 20° For normal takeoffs a setting of 10° is recommended to provide a shorter ground roll than will be achieved with no flaps and a better initial climb than will result with 20°. The use of 20° flaps is recommended for obstacle clearance takeoffs in accordance with the Short Field Takeoff chart in Section 5 or for any minimum ground run takeoff.

Due to low climb performance available, flap settings greater than 20° are not approved for takeoff.

FUEL
The fuel selector valve should be in the BOTH position for all takeoffs. The pilot must determine the adequacy of the fuel on board to complete the planned flight in accordance with all FAR 91 requirements. The pilot must also determine that, with the airplane loaded and fueled for tlight, the operation will be conducted within weight and balance limits.

Takeoffs with less than 11 gallons of usable fuel are not recommended.

TAKEOFF TECHNIQUE
Crosswind and soft field takeoff procedures are conventional in all respects.

NOTE
Maximum demonstrated crosswind is 19 knots

Short field takeoff procedures are conventional and takeoffs should be conducted in accordance with the conditions specified on the Short Field Takeoff charts of Section 5 in order to achieve the performance included in the chart. The pilot must judge, based on his experience, whether the available runway is adequate for a normal takeoff. If question exists then the short field procedures should be used following conservative verification of field length adequacy using the performance charts.

LANDING GEAR RETRACTION
Landing gear should normally be retracted after reaching the point down the runway beyond which a wheels down landing on the remaining runway could no longer be made. Before initiating the retraction cycle, tap the brakes to stop all main wheel rotation. After retraction is complete verify that the gear locked lights are out and the gear warn light is out.

ENROUTE CLIMB
Normal climbs can be conducted at 100 to 120 KIAS with the power set to 24 inches Hg or full I throttle if less, 2500 rpm, and mixture set to 18 gallons per hour or full rich. These settings correspond to approximately 75% power and are represented for quick reference by the upper extent of the major green arc markings on the manifold pressure gauge, tachometer, and fuel flow gauge. This combination provides a reasonable combination of rate of climb, visibility over the nose, cabin noise level, and speed over the ground.

If higher climb performance is necessary or desired, the best rate of climb speed should be used along with maximum available power. Best rate of climb speed is a constant 100 KIAS at sea level through 8000 feet. At 8000 feet, the speed may be reduced to 90 KIAS decreasing above 8000 feet at the rate of 1 knot per 2000 fect. Maximum power for climb is with full throttle, 2700 rpm, and mixture set full rich. Above 8000 feet, if necessary, the mixture may be leaned for smooth operation.

If a nearby obstruction requires a steeper climb angle, the best angle of climb speed should be used along with maximum available power. Best angle of climb speed is 75 KlAS at sea level increasing linearly to 82 KIAS at 10000 feet. This type of climb should only be of short duration to avoid overheating the engine.

CRUISE
Normal cruising is conducted at 75% power and below. At higher powers the mixture may not be leaned, thereby producing inefficient mileage. At power settings of 75% and below the mixture should be leaned. The cruise, range, and endurance performance provided in Section 5 is based upon the use of a best economy mixture strength. This mixture is achieved with the use of the EGT gauge by leaning slowly to peak EGT as discussed below.

A best power mixture strength may also be used if desired by leaning with reference to the EGT gauge to 100°F rich of peak EGT. This will result in speeds that are 3 - 4 KT AS faster than shown for the same flight and power conditions in Section 5 and fuel consumption figures approximately 2 - 3 GPH higher at a given horsepower.

At higher altitudes, engine speeds above 2500 rpm may be used for cruising flight as shown by the narrow green arc on the tachometer. This allows use of75% power to a higher altitude with a modest increase in cabin noise due to the higher rpm. Specific power settings can be determined by referenLe to the Section 5 Cruise charts.

LEANING BY REFERENCE TO THE EGT GAUGE
Exhaust gas temperature is a very accurate reflection of mixture strength in an operating piston engine. This absolute accuracy is reduced slightly by the realities of uneven mixture distribution between cylinders and other anomalies associated with manufactured hardware, but EGT remains as the most accurate and simplest method of leaning the engine under all atmospheric conditions.

To lean this engine to a best economy mixture strength, and to achieve the fuel flows reflected in the Section 5 cruise, range, and endurance data, move the mixture control to produce an indicated fuel flow of 2 to 3 GPH greater than predicted for your power setting (in the cruise charts). Allow the EGT indication to stabilize, and then slowly lean until the EGT indication peaks and begins to fall. Then enrich en the mixture until the EGT again peaks and begins to fall. Finally lean the mixture back to the peak EGT level as observed previously.

CAUTION: Leaning to peak EGT is limited to power settings of 75% and below.

At some power setting combinations in some airplanes engine roughness may occur before peak EGT is achieved. In this case set the mixture just rich enough for smoothness. As always monitor fuel consumption as the flight progresses.

The engine may also be leaned to a best power mixture strength for approximately a 3 KTAS increase in speed at a 6 to 10% reduction in range.

STALLS
Stall characteristics for this airplane are entirely conventional with flaps up and down. An aural warning of an approaching stall is provided when the airplane angle of attack is equivalent to that in un-accelerated flight as the airspeed comes to within 5 to 10 KCAS of the stall.

BEFORE LANDING
The flap and gear speeds on [he airplane provide the pilot with good spaced control for blending with traffic at today's airports. It is suggested that 10° flaps is a suitable arrival flap setting. The landing gear should be extended on downwind, or passing the final approach fix on an instrument approach. Then on final the effective flaps on the airplane can provide a steep descent capability over any surrounding obstructions.

Gear extension should be confirmed by three (3) green locked lights, an absence of the red gear warn light, and an absence of the gear warning horn when the throttle is moved to idle andior the tlaps are fully extended

LANDING

FUEL
The fuel selector valve should be in the BOTH position for all landings.

MIXTURE SETTINGS
For most landing operations the mixture should be full rich. However, at landing altitudes above 5000 feet the mixture may be leaned for smooth operation for a possible subsequent go-around as follows: Briefly apply maximum available power. At altitudes above 5000 feet lean the mixture as needed to produce smooth operation.

WING FLAP SETTINGS
Landing is approved with flap settings from 0° to 35° For normal landings a setting of 35° is recommended to provide a slower touchdown, shorter ground roll, and less brake wear than will be achieved with any lesser flap setting.

LANDING TECHNIQUE
Crosswind and soft field landing procedures are conventional in all respects.

NOTE
Maximum demonstrated crosswind is 19 knots

Short field landing procedures are conventional and landings should be conducted in accordance with the conditions specified on the Short Field Landing charts of Section 5 in order to achieve the performance included in the chart. The pilot must judge, based on his experience, whether the available runway is adequate for a normal landing. If question exists then the short field procedures should be used following conservative verification of field length adequacy using the performance charts.

BALKED LANDING
If a go-around is necessary, the wing flaps should be reduced to 200 immediately after full power is applied. If obstacle clearance is not a factor and the airplane will remain in the traffic pattern for another landing approach it is recommended that the landing gear remain extended.

COLD WEATHER OPERATION

STARTING
Prior to starting on a cold morning, pull the propeller through several "blades" by hand to break loose the cold components and to save some battery energy.

Whenever in the vicinity of a propeller, assume the ignition switch is turned on. When pulling the propeller through the airplane should be chocked and tied down and the mixture should be in Idle Cut-Off.

Whenever possible and for cold weather starts the use of preheat and an external power source are recommended.

OPERATION
During cold weather, an oil temperature indication may remain low through all pre-takeoff preparations. After a reasonable warm-up period (say 5 minutes) at 1000 rpm accelerate the engine several times to a higher speed. If the engine accelerates smoothly and the oil pressure remains normal the engine is ready for takeoff.

HOT WEATHER OPERATION
No special procedures are required in hot weather. Avoid prolonged engine operation on the ground.

Monitor engine temperatures during all operations .

5 Performance

The performance data in this section are provided so that a pilot may plan his flights with confidence. The data are based on flight tests of an airplane in good service condition. The corrections shown for other than standard atmospheric conditions are based upon physical relationships and conform to accepted practice. Factors which have not been accounted for include humidity, runway slope, and runway surface condition (wetness, snow, roughness, etc.).

The performance data presented are representative of the general level of performance which can be achieved with any Commander 115 TC. However, the normal variations inherent in any complicated manufactured product can cause some differences from one example to the next. Variations in pilot technique can cause further differences. The condition of the airplane, propeller, and engine, and the presence of external optional equipment and after-market items can influence performance. These and other indeterminate variables caused by atmospheric turbulence, unforecast wind conditions, etc. make it imperative for the pilot to be conservative in his flight planning.

Use the data for guidance but don't plan a takeoff or landing when only 100 foot excess runway is predicted or don't plan a trip with less than a ten gallon margin. Pilot training for FAA airman certification, experience in the particular airplane, good judgment, conservative planning, and attention to all FAR rules applicable to the flight will contribute to a safe and enjoyable trip.

5.1 COMMANDER 115 TC PERFORMANCE AND OPERATING LIMITATIONS

Engine Management	The turbo-supercharged engine in this particular installation means simplified engine management is possible at all flight levels. Maximum continuous cruise power (78%) is available at all flight levels from sea level to 25,000 ft which is the Commander 115TC's certified ceiling.
Ceiling	Operations above the certified ceiling of 25,000 ft are prohibited. There are a number of reasons that dictate the certified ceiling in aircraft certification, some of which are aerodynamic limits but one factor that becomes critical at high altitudes is the engine's cooling system ability to dissipate heat in the extremely thin air encountered at high altitudes, notwithstanding the atmosphere's very low ambient temperatures found at these altitudes.
Power Settings	The maximum permitted continuous cruise power setting for this engine is 29 In. Hg (manifold pressure boost) at 2400 RPM, which translates to 78% power. This power setting is available at all flight levels up to the certified ceiling of 25,000 ft. Full rated power (37 In. Hg. @ 2575 RPM) may be used until 6000 ft in a maximum performance climb. However, the long-term use of power settings above the maximum continuous power rating results in high engine wear, increased maintenance costs, decreased engine life expectancy and it results in excessive fuel consumption.

PERFORMANCE SPEEDS

Maximum	164 kts. (304 kph)
Performance Cruise (75% Power)	160 kts. (297 kph)
Economy Cruise (65% Power)	155 kts. (287 kph)
Long Range Cruise (55% Power)	149 kts. (276 kph)
Stall (Cruise Configuration)	60 kts. (111 kph)
Stall (Landing Configuration)	54 kts. (100 kph)

TAKEOFF PERFORMANCE

Ground Roll	1,145 ft. (348.99 m)
Distance over 50 ft. Obstacle	1,985 ft. (605.02 m)

CLIMB PERFORMANCE
Initial S.L. Rate of Climb 1,070 ft./min.(326.14 m/min.)
Service Ceiling 16,800 ft.(5,120.64 m)

RANGE
Range @ Performance Cruise 855 NM @ 14.3 gph.(54.13 lph)
Range @ Economy Cruise 940 NM @ 12.6 gph.(47.69 lph)
Range @ Long Range Cruise 1005 NM @ 11.2 gph.(42.39 lph)

LANDING PERFORMANCE
Ground Roll 720 ft. (219.46 m)
Distance over 50 ft. Obstacle 1,200 ft. (365.77 m)

5.1.1 CRUISE PERFORMANCE in Standard Atmospheric conditions

78% Power: 29 In. Hg @ 2400 RPM	
4000 feet	155 Kts
8000 feet	162 Kts
12000 feet	168 Kts
16000 feet	175 Kts
20000 feet	182 Kts
24000 feet	190 Kts

71% Power: 27 In. Hg @ 2300 RPM	
4000 feet	150 Kts
8000 feet	155 Kts
12000 feet	161 Kts
16000 feet	168 Kts
20000 feet	175 Kts

24000 feet	182 Kts

63% Power: 25 In. Hg @ 2300 RPM	
4000 feet	144 Kts
8000 feet	150 Kts
12000 feet	156 Kts
16000 feet	163 Kts
20000 feet	170 Kts
24000 feet	177 Kts

5.1.2 TAKEOFF Performance in Standard Atmospheric conditions

Airport Elevation (In Feet)	**Ground Roll (Feet)**	**Takeoff over a 50 ft Obstacle (In Feet)**
Sea Level	1250	2150
2,000	1450	2300
4,000	1700	2800
6,000	1970	3850
8,000	2300	6900

5.2 Airframe Performance Specifications

V_A - MANEUVERING / TURBULENT AIR PENETRATION SPEED

Speed (KIAS)	Aircraft Weight (lbs.)
117	3,305
113	3,000
103	2,491

V_{FE} - MAXIMUM FLAPS EXTENDED SPEED

Speed (KIAS)	**Flap Setting (degrees)**
149	0 - 20
121	20 - 25
112	35 / full

V_{LE} - MAXIMUM SPEED –
LANDING GEAR EXTENDED 186 KIAS

V_{LO} - MAXIMUM GEAR
OPERATING SPEED 130 KIAS (extend & retract)

V_{NO} - MAXIMUM STRUCTURAL CRUISING SPEED

162 KIAS to 12,500 ft
153 KIAS at 15,000 ft
145 KIAS at 17,500 ft
138 KIAS at 20,000 ft
130 KIAS at 22,500 ft
122 KIAS at 25,000 ft

V_{NE} - NEVER EXCEED SPEED

186 KIAS to 12,500 ft
176 KIAS at 15,000 ft
167 KIAS at 17,500 ft
158 KIAS at 20,000 ft
150 KIAS at 22,500 ft
141 KIAS at 25,000 ft

V_S - STALL SPEED (AT MAXIMUM WEIGHT)

65 KIAS

V_S - STALL SPEED (LANDING CONFIGURATION)

60 KIAS

V_X - OBSTACLE CLEARANCE CLIMB SPEED

85 KIAS

VY - BEST INITIAL RATE-OF-CLIMB SPEED

75 KIAS

Best Glide Speed	
Weight (lbs.)	Speed (KIAS)
3,305	85
3,000	81
2,491	74

Airspeeds for Emergency/Abnormal Operations Engine Failure After Takeoff	
Wing Flaps Up	Wing Flaps 20°
85 KIAS	80 KIAS

Maneuvering Speeds	
Weight (lbs.)	Speed (KIAS)
3,305	117
3,000	113
2,494	103

Maximum Glide Performance	
Weight (lbs.)	Speed (KIAS)
3,305	85
3,000	81
2,494	74

Emergency Descent			
Smooth Air		Rough Air	
Altitude (ft.) ASL	Speed (KIAS)	Weight (lbs.)	Speed (KIAS)
25,000	139	3,305	117
22,500	149	3,000	113
20,000	157	2,491	103
17,500	167		
15,000	176		
12,500	187 (V_{NE})		

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6 Airplane and Systems Descriptions

This section provides a description of the airplane and its systems.

6.1 GENERAL

The Model 115 TC is a four place, low wing, all-metal, retractable gear airplane powered by a six cylinder, turbocharged, fuel injected Lycoming engine that is equipped with a McCauley all-metal three blade, constant speed propeller. Access to the cabin is through two lockable cabin doors, one on each side of the airplane and a lockable baggage door on the left side of the fuselage. The cabin interior is provided with four seats. The airplane is equipped with a retractable tricycle landing gear system and incorporates a steerable nose wheel and toe-operated hydraulic disc brakes.

6.2 AIRFRAME

FUSELAGE
The fuselage consists of the nose section, center section and aft section. The nose section, extending from fuselage station 22.00 to 62.50, houses the powerplant and retractable nose landing gear. Nose landing gear doors, which open and close as the gear is extended or retracted, form an aerodynamically smooth nose section during flight.

The nose section is joined to the center fuselage section at fuselage station 62.50, which is also the location of the engine firewall. The center fuselage, which contains the main cabin area and baggage compartment, extends from fuselage station 62.50 to 178.00 where it is jointed to the aft fuselage section. The center fuselage section houses the seats for pilot and three passengers, and has two doors that afford access to the airplane from either side.

The pilot area is equipped with a wide-vision windshield and large door windows.

The aft fuselage section, extending from fuselage station 178.00 to 263.00, is permanently secured to the center fuselage section and provides structural attachment points for the empennage tlight surfaces and controls. This section houses the battery, hydraulic power pack unit and various control surface cables. Aluminum flooring supported by longitudinal beams and bulkheads extends from the firewall aft through the baggage compartment. The center wing structure is attached to the fuselage so that a part of the wing torque is absorbed by the fuselage structure. The aft tail cone is capped by a stinger containing mounts for a tail navigation light and optional strobe light.

WINGS
Each wing is of all-metal stressed-skin construction incorporating spars, formed ribs and an integral fuel tank contained in a three-rib section, forward of the main spar. The main spar of each wing is joined together at the center of the fuselage with spar cap splices.

The wing is installed in the lower center fuselage section. It is secured to the fuselage load-bearing frames and fittings by bolts and nuts at stations 85.00, 123.00 and forward of station 148.00. Access plates located at various points on the lower skin of the wing provide access for inspection and repair of the fuel system and the flight control cabling. Landing gear fitting/retraction mechanisms are installed in the basic wing structure to provide attach points for the main landing gear.

An opening in the inboard leading edge of each wing serves as a ram air intake for the lower cabin ventilation system. An electrically operated wing flap is installed between the fuselage and aileron on each wing. The flaps are attached to the aft wing spar by hinge assemblies. Metal ailerons, extending outboard from the flaps to wing station 189.00, are attached to the aft wing spar by hinge assemblies.

EMPENNAGE
The empennage consists of the vertical and horizontal stabilizers, rudder, and elevators. The vertical fin assembly is made of two separate components; an upper assembly which is mated at the horizontal stabilizer, and a lower stub assembly which is integral with the aft tail cone structure.

A rudder control surface is attached to the vertical stabilizer at two hinge points. A fin cap contains provisions for mounting the VHF navigation antenna and the flashing beacon. A flush air intake on the right side of the dorsal fin provides air for in-flight cabin ventilation.

The horizontal stabilizer, consisting of a fixed stabilizer and movable elevator surface, is attached to the lower vertical stabilizer stub assembly. The horizontal and vertical stabilizers utilize stressed and beaded skin construction to provide maximum strength with minimum structural components. The horizontal tail is of single unit construction with a fixed forward surface and a hinged elevator control surface. The elevator provides mounting attachment for a tip-fairing at each outboard end for streamlined appearance.

6.3 FLIGHT CONTROLS

AILERON CONTROL SYSTEM
The aileron control wheels are mechanically interconnected through a series of control chains, sprockets and cables. Control cables extend aft from the control column passing under the floor structure and through idler pulleys to a bracket assembly. The cables are then routed through the bracket assembly and out through the wing to the aileron bell cranks. Adjustable push-pull rods connect the aileron bell cranks to the ailerons. An aileron balance assembly is mounted on the outboard end of each aileron. The aileron and rudder control systems are interconnected by springs, providing improved stability.

AILERON TRIM TAB
A fixed-position trim tab is attached to the left aileron. A right wing heavy condition may be corrected by bending the trim tab down. Bending the tab up will correct a left wing heavy condition. Use forming block when bending tab, and do not bend more than 20° in either direction.

ELEVATOR CONTROL SYSTEM
The elevator is of all metal construction. It consists of two segments connected by a torque tube and is attached to the aft spar of the horizontal stabilizer. Each segment has three hinge points. The elevators are operated by the fore and aft movement of the control column. Elevator arms, attached to the control column in the console tunnel, are connected to the control cables which are routed through a series of pulleys to the elevator bell crank. The bell crank is connected to the elevator horn with a push-pull rod. When the control wheel is moved forward or aft the cables move in opposite directions, turning the bell crank, which in turn pushes or pulls the control rod, causing the elevators to move up or down. Two turnbuckles, installed in the elevator control system between fuselage stations 205.00 and 230.50, permit control cable tension adjustment.

ELEVATOR TRIM SYSTEM
Controllable trim tabs, located on the inboard trailing edge of each elevator segment, are operated by an elevator trim tab control wheel installed in the center console. A portion of the trim tab control wheel extends through the center console, and when rotated, actuates the trim tab through a mechanical linkage consisting of cables, chains and jackscrew assembly and push rods that attach to the trim tab. Turnbuckles are utilized for rigging and adjusting cable tensions. An indicator strip, visible through a slot in the console, indicates neutral, nose up or nose down positions. Rotating the wheel forward, toward the nose-down indicator will provide nose down trim; rotation in the opposite direction produces nose-up trim. As the elevator is moved up and down, the position of the tabs changes in a trailing edge up or down direction respectively for improved longitudinal stability.

RUDDER CONTROL SYSTEM
Dual rudder-brake control pedals enable the pilot or copilot to control the rudder, brakes, and nose wheel steering. The rudder control system consists of mechanical linkage and cables connecting the rudder pedals to the rudder. The rudder pedals are connected to rudder bars, which in turn are connected to the rudder bell crank with push-pull rods. Cables are attached to the bell crank and are routed aft through a series of pulleys to the rudder horn. When force is applied to one rudder pedal, the cables move in opposite directions, turning the rudder horn and rudder. The pedals are connected to the nose wheel steering system with cables and bungee assemblies which act as return springs for the rudder pedals. The rudder pedals are interconnected to the aileron controls as outlined in the aileron control system for improved lateral stability.

RUDDER TRIM SYSTEM
A rudder trim control knob, labeled RUDDER TRIM is mounted to the left of the console, below the lower edge of the instrument panel, and provides manual control of trim around the vertical axis. Directional trimming results from the inputs to the rudder control system of the rudder trim bungee spring which is biased by the position of the trim knob. Rotation of knob clockwise will yaw the airplane to the right, opposite rotation will yaw the airplane to the left. An indicator is incorporated in the switch panel above the trim knob to indicate rudder trim position.

GROUND CONTROL
The nose wheel steering system is tied in with the rudder trim system and is controlled by movement of the rudder/brake pedals. A combination of cables, bungees, bell cranks, turnbuckles and pulleys operate the nose wheel steering and give the airplane a minimum turn radius of 28' 5.5". Nose wheel turning limit is + 300.

WING FLAPS

Long span single slotted wing flaps are provided Wing flap position is controlled by a three-position switch mounted immediately to the left of the right control wheel. Flap position is displayed on an electrical indicator I mounted above the flap switch. Power from the electric motor is transmitted to the flaps through a jackscrew connected to a torque tube, and from the torque tube to the flaps with push-pull rods. To extend the wing flaps, the wing flap switch must be depressed and held DOWN until the desired degree of extension is reached After the desired flap extension is obtained, releasing the switch allows it to return to the center OFF position. When flap retraction is necessary, place the switch up. The switch will remain in the UP position without manual assistance due to an over-center design within the switch. With the flaps extended in flight, placing the flap switch UP will retract the flaps in approximately 7 seconds. Gradual flap retraction can be accomplished by intermittent operation of the flap switch to UP. Normal full flap extension in flight will require approximately 7 seconds. After the flaps reach maximum extension or retraction, limit switches will automatically shut off the flap motor; however, when the flaps reach the fully retracted position. the wing flap switch should be returned to the center-off position. An additional limit switch is installed on the flap motor drive to activate the gear warning system when flaps are extended 25 degrees or more with the landing gear retracted No appreciable change in elevator trim is required over the full flap extension range, however, minor changes in trim may be required depending on airspeed and airplane loading. Normally there will be a slight nose down trim change.

LANDING GEAR

The airplane is equipped with a retractable hydraulically operated, tricycle landing gear that includes a steerable nose wheel and self-adjusting disc brakes on the main landing gear wheels. Landing shocks are absorbed in the nose gear by a conventional oleo strut assembly, and by an oleo strut connecting rod arrangement connected to the trailing arm of the main landing gear. Nose wheel steering is controlled by a cable-pulley system attached to the nose gear and to the rudder/brake pedal and is actuated by depressing the rudder/brake pedals from either pilot's position. The single-disc, dual piston, hydraulic brakes are operated by individual master brake cylinders attached to the rudder/brake pedals. The brakes are actuated by applying toe pressure to the top of the rudder/brake pedals. The airplane is also equipped with a parking brake system which operates from the master brake cylinders and is actuated by a parking brake control knob. A shimmy damper is attached to the fixed and movable portions of the nose gear strut to provide a dampening action on the gear. An emergency extension valve, located on the left side of the center console, is used for emergency extension of the gear. This valve bypasses hydraulic fluid directly to the reservoir, allowing the gear to drop by gravity; gear extension is assisted by down springs. The emergency gear extension knob is spring-loaded to prevent accidental operation and must be pulled out and then pushed down to operate.

The main landing gear retracts inward and upward into wheel wells in the lower side of the wing. The nose landing gear retracts aft and upward into the wheel well. Mechanically operated doors connected to the landing gear by link assemblies open and close during the extension and retraction cycle. A flat surface on the fixed portion of the nose gear keeps the landing gear centered when the gear is retracted. Retraction and extension of the landing gear is controlled by an electro-hydraulic power pack that is actuated by the position of the landing gear selector switch mounted on the instrument panel. When the landing gear selector switch is placed in the UP position, the landing gear retracts until the gear up pressure switch is actuated. When the gear up pressure switch is actuated, the hydraulic power pack pump is shut off and all three gears are retained the up-lock position by a hydraulic pressure lock. A loss of 250 PSI hydraulic pressure will energize the hydraulic power pack and buildup pressure to the pressure switch setting.

When the landing gear selector switch is placed in the DOWN position. the hydraulic pressure lock is released and hydraulic fluid is directed to the down side of the landing gear actuator cylinders extending the gear until the pressure switch is actuated. When the pressure switch is actuated the hydraulic power pack pump is shut off and all three gears are held in the down lock position by over center braces assisted by trapped hydraulic pressure. A ground contact switch on the right main gear. assists in preventing landing gear retraction while on the ground caused by an unintentional positioning of the landing gear selector switch to the UP position.

Landing gear position indicators and a warning horn system are provided to alert the pilot when the landing gear is in the up. or down and locked position. Position indicators are installed in front of the pilot near the gear selector switch. These indicators are individual red and green lights. (SIN 1454 I thru 14624) or the indicators on the annunciator panel (SIN 14625 and subsequent). The gear down position is indicated by three green lights. The unsafe red (GEAR WARN) light indicates the gear is in transit or not fully down and locked. There is no electrical indication of gear being fully retracted other than all indicator lights being extinguished. When the landing gear extends to the full down position three landing gear down switches are actuated causing the green lights to illuminate. indicating the gear is down and locked.

6.4 BAGGAGE COMPARTMENT

The baggage compartment is located in the aft portion of the cabin area. Access is through the baggage door on the left side of the airplane. or through the cabin area behind the rear passenger seats. Volume of the baggage compartment is twenty two (22) cubic feet and maximum allowable baggage weight is two hundred (200) pounds. When loading the airplane, refer to the Weight and Balance section of the Pilots Operating Handbook to assure that airplane loading meets all requirements and restrictions. All loads should be securely fastened using the cargo net and the tie-down rings (4) located in the comers of the baggage compartment, to prevent movement during airplane operations.

CAUTION: Passengers should not be allowed to ride in the baggage compartment under any circumstances. Do not carry hazardous material.

6.5 IGNITION SYSTEM

The engine is equipped with dual magnetos. The two magnetos provide two independent ignition systems for the engine. Each ignition system has a shielded harness assembly and a set of radio shielded spark plugs. Each cylinder utilizes two (2) spark plugs. The left magneto fires the bottom spark plugs in cylinders one (1) three (3) and five (5), and the top plugs in cylinders two (2) and four (4) and six (6). The right magneto provides spark for the opposite spark plugs.

INDUCTION AIR SYSTEM

Induction ram air for the engine comes from the outside corner of the left engine cooling air inlet. This air flows through ductwork to an air box which holds an air filter and then through further ductwork to the engine throttle body. Heated engine cooling air below the cylinders can be routed to the induction system through a door downstream of the:: filter, controlled by the pilot with the ALT AIR push-pull control to provide an alternate source of air to the engine should the filter become blocked.

6.6 EXHAUST SYSTEM

The engine is equipped with a cross-over exhaust system feeding a single tailpipe which protrudes. through the lower right cowling at the firewall. Exhaust stacks are flange-mounted to each cylinder exhaust port and collect at the muffler assembly which lays across below the forward engine area. A heat shroud is fitted around the muffler to provide a source of heated air for the cabin heater and defroster systems.

6.7 FUEL INJECTION SYSTEM

Filtered air is introduced into the engine through the servo regulator body, then flows into an air intake riser where it is distributed to each cylinder by individual intake pipes. The amount of air entering the engine is controlled by a throttle valve (butterfly) contained in the body of the fuel injection servo regulator. Fuel is metered and distributed to the individual cylinders by the servo regulator and fuel flow divider valve. The fuel-air ratio is determined by the position of the throttle valve and air sensing functions of the servo regulator. Fuel and air are mixed within the cylinder. The fuel injection system consists of the air flow sensing and fuel control sub-systems. Components of the injection system are: the servo valve, fuel control unit, fuel flow divider valve, and air bleeder nozzles. The servo valve and fuel control unit are contained within the throttle body casting, installed on the engine intake manifold air inlet. Priming is provided by the fuel injection system. A separate priming system is not required.

6.9 ENGINE COOLING SYSTEM

COWLING - The cowling consists of two molded fiberglass assemblies which have contoured inlets to control expansion of cooling air as it enters, a fixed opening around the tailpipe, and a single cowl flap on the left lower side of the cowl to control airflow through the cooling system. The cowl flap position is controlled by the pilot using the cowl flap control lever on the center console.

BAFFLE INSTALLATION - Sheet metal baffles are installed on the engine to provide optimum cooling airflow around the engine cylinders and accessory components. Ductwork is provided off the aft right baffle to direct cooling air to the oil cooler. Silicon rubber seals are used to stop air leaks where the inner cowl surfaces meet the baffles and assure that the cooling air moves properly. These baffles, seals, and ducts are carefully designed and positioned to maintain proper cooling efficiency. Their alteration or damage will cause improper air circulation and engine overheating.

6.10 STARTER

A light weight Lycoming starter is installed on the lower left front side of the engine. The starter drive pinion engages the engine flywheel ring gear to provide direct cranking of the engine. The starter relay, installed on the battery box in the tail cone, is energized by a key-operated, spring-loaded ignition starter switch. When starting the engine, avoid energizing the starter for more than 30 seconds, and allow at least 5 minutes between cranking periods to permit the starter to cool.

6.11 ACCESSORIES

FUEL PUMP - A diaphragm type, self-regulated engine-driven pump is installed on the aft lower left side of the engine accessory housing. This pump provides a continuous flow of fuel to the engine without pressure variations. The pump design allows the auxiliary pump to move fuel through it to the engine in the event it becomes inoperative and for the purpose of initial engine priming and starting.

VACUUM PUMPS - Suction to operate the directional and attitude gyros is provided by two engine driven vane type vacuum pumps. See VACUUM SYSTEM description later in this section.

ENGINE MOUNT
The engine mount is a welded tubular structure attached to the firewall at five (5) points. The structure serves as an engine mount and nose gear mount. The mount has four (4) points that the engine attaches to and uses two rubber shockmounts at each point. The bonded rubber and metal shockmounts are designed to reduce the transmission of engine vibrations to the airframe.

AUXILIARY FUEL PUMP
The electric auxiliary fuel pump is located on the: right forward side of the firewall, and is controlled by a two-position toggle circuit breaker switch labeled FUEL PUMP. The auxiliary fuel pump is used as a boost pump in starting and in the event of engine-driven fuel pump failure. For further Fuel System information refer to the Maintenance Manual.

FUEL MANAGEMENT
It is the pilot's responsibility to ascertain that there is sufficient fuel on board the airplane to safely complete the planned flight. A visual check of each fuel tank should be made, and this should be compared with quantity indicated on the fuel tank gauges. When fuel quantities are checked, the airplane should be level to assure that any fuel quantity indication, either visual or electrical, will be accurate. During cruise alternate fuel tanks, if necessary, to maintain lateral trim. When planning flight, allow enough reserve fuel for safe completion of flight and to assure compliance with FAR 91 reserve requirements.

FUEL CONTAMINATION
To avoid fuel contamination always service the airplane from fuel facilities that utilize proper filter systems to remove impurities and water accumulations from the bulk fuel. If filtering facilities are not available, filter the fuel through a quality grade chamois. Fuel tanks should be serviced after the last flight of each day to reduce condensation and allow any entrapped water accumulations to settle to the fuel system drains prior to the next flight. Prior to the first flight of the day, and after each refueling, the wing tank sumps, wheel well drains, and the gascolator should be drained to assure proper fuel and lack of contamination. If contamination is present in the fuel sample, continue to drain all sample points until fuel is clear.

FUEL TANK VENT SYSTEM
The fuel tanks are vented to atmosphere through vent scoops on the lower outboard wing surfaces and under the center fuselage. These vents must be free of obstructions and should be checked prior to the first flight of the day. Should a vent become obstructed it could result in fuel starvation and possible engine stoppage.

FUEL QUANTITY INDICATOR
The fuel quantity indicating system consists of a dual fuel quantity indicator located on the engine instrument sub-panel, electrically connected to the fuel quantity transmitters installed in each fuel tank. The fuel quantity indicating circuit is equipped with two damping resistors within the transmitter. These resistors dampen indicator needle oscillations, caused by irregular movement of the transmitter float, during flight through rough air. The fuel quantity transmitters and indicators have been calibrated at the factory and should not require recalibration; however, if the system does require recalibration, this should be done by a licensed A& P mechanic in accord with the current Maintenance Manual.

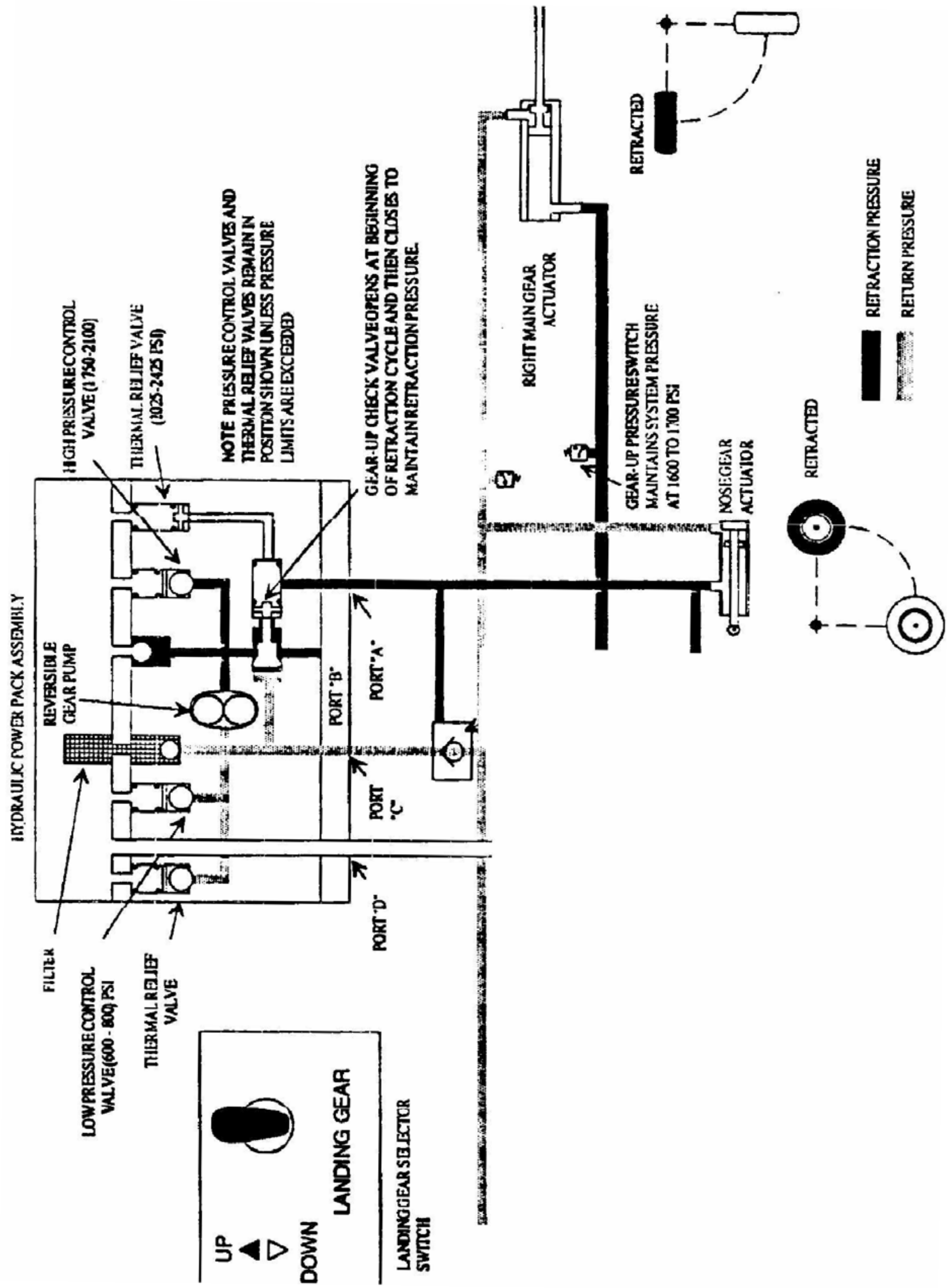
Ungaugeable fuel begins at 28 gallons. The battery and/or alternator master switches must be ON for the fuel quantity indicator to function.

6.12 HYDRAULIC SYSTEMS

LANDING GEAR EXTENSION/RETRACTION SYSTEM
The hydraulic power supply is an integrated hydraulic pack containing a reversible, electric motor driven hydraulic pump, a reservoir, pressure control valves, a thermal relief valve and a gear up check valve. The power pack is located in the left forward area of the fuselage tail cone and is accessible through the left aft baggage compartment panel. The sale function of the hydraulic power pack is to raise and lower the tricycle landing gear.

When the landing gear selector switch is pulled out slightly to clear the detent and placed in the UP position, hydraulic fluid, under pressure, is directed to the UP side of the landing gear actuators, causing the gear to start to retract. Fluid on the DOWN side of the actuator flows back to the reservoir. Movement of the gear from the DOWN and LOCKED position deactivates a down position switch, located on each gear drag link, causing the three gear DOWN and LOCKED lights to extinguish, illuminating the red GEAR WARNING light. As each gear is fully retracted, it activates a gear up position switch, and when all three gear up switches have activated the GEAR WARNING light extinguishes. A pressure switch, located in the UP hydraulic line, actuates when the pressure in the line reaches 150 (± 50) PSI and shuts off the hydraulic pack motor. A gear up check valve in the return line to the hydraulic pack closes, trapping pressure in the line, causing a hydraulic lock which holds the gear up. A loss of 250 PSI of pressure in the UP line will be sensed by the pressure switch, which will allow the hydraulic pump to run and build the pressure back up the 1650 (±50) PSI.

Placing the gear selector switch in the DOWN position, directs hydraulic fluid to the down side of the actuator. Fluid in the UP line flows back to the reservoir and the gear extends. As the gear starts down, the up position switches deactivate and the GEAR WARNING light illuminates. When the gear is fully extended with the drag links over center, the down position switches activate, illuminating the three green DOWN and LOCKED lights, and the red GEAR WARNING light extinguishes. A pressure switch in the down line shuts off the hydraulic pack when pressure in the line reaches 500 (±SO) PSI. A "pilot" check valve in the down line closes. trapping hydraulic pressure, locking the gear down with a hydraulic lock in the down line, plus a mechanical over center lock. If anyone of the three down position switches fails to actuate when the gear is fully extended. that gears corresponding green light will not illuminate, the GEAR WARNING light will remain illuminated. the down pressure switch will be bypassed electrically, and the hydraulic pump will continue to operate.


HYDRAULIC POWER PACK ASSEMBLY
REVERSIBLE GEAR PUMP
HIGH PRESSURE CONTROL VALVE (1750-2100)
THERMAL RELIEF VALVE
NOTE: PRESSURE CONTROL VALVES AND THERMAL RELIEF VALVES REMAIN IN POSITION SHOWN UNLESS PRESSURE LIMITS ARE EXCEEDED
GEAR-UP CHECK VALVE OPENS AT BEGINNING OF RETRACTION CYCLE AND THEN CLOSES TO MAINTAIN RETRACTION PRESSURE.
RIGHT MAIN GEAR ACTUATOR
RETRACTED
GEAR-UP PRESSURE SWITCH MAINTAINS SYSTEM PRESSURE AT 1600 TO 1700 PSI
NOSE GEAR ACTUATOR
RETRACTED
RETRACTION PRESSURE
RETURN PRESSURE
PORT "A"
PORT "B"
PORT "C"
PORT "D"
FILTER
LOW PRESSURE CONTROL VALVE (600 - 800) PSI
THERMAL RELIEF VALVE
UP
DOWN
LANDING GEAR
LANDING GEAR SELECTOR SWITCH

LANDING GEAR EXTENSION/RETRACTION SYSTEM (CON'T)

A high pressure control valve limits system pressure to 1800-2000 PSI during the retraction cycle and a low pressure control valve limits system pressure to 600-700 PSI during the extension cycle. A relief valve limits system pressure to 2025-2424 PSI when pump is not operating.
An emergency gear extension system is provided. Placing the emergency gear extension valve in the GEAR DOWN position opens the emergency dump valve and bypasses the fluid from the up side of the gear actuators back to the reservoir. This relieves the hydraulic lock when holds the gear up and allows gravity, assisted by a spring on each gear, to extend the gear. The gear cannot be retracted with the emergency dump valve open, since the pressure will continually be relieved through the valve.

GEAR LOCKED LIGHTS AND GEAR WARN LIGHT - Three green gear locked indicator lights, incorporated in the main annunciator panel, provide an electrical indication that each main and nose landing gear is down and locked. Gear up is indicated by the gear WARN light and the three gear locked lights being out.

As a reminder that the gear is retracted, the gear warning horn will sound and the red gear WARN light will illuminate whenever the throttle is retarded below approximately the 14 in Hg position (at low altitude) with the gear still retracted, or when flaps are extended 25 degrees or more with the gear retracted (regardless of throttle position). The battery and/or alternator master switches must be on for gear warning.

EMERGENCY GEAR EXTENSION VALVE - A red emergency gear extension knob (installed in the forward left side of the center console) is provided for use in the event of a total electrical system or hydraulic pump failure. The valve relieves pressure which normally retains the landing gear in the up position, allowing spring assisted gravity free fall to extend the gear. To operate, pull knob out and push down. Knob must be in up position for normal gear operation.

6.13 ELECTRICAL SYSTEM

The airplane is equipped with a 28 volt direct current electrical system powered by an engine driven alternator. A 24 volt lead-acid battery provides power for engine starting. Electrical power is supplied to airplane circuits through a main bus, a circuit breaker switch bus, and an avionics bus. An over-voltage relay protects electrical equipment from hamful transient voltages.

BATTERY
A 24 volt, 10 ampere-hour, lead-acid battery provides power for engine starting and acts as a backup power source. The battery is located in the aft fuselage section and is accessible through the baggage compartment.

ALTERNATOR
A 28 volt, 63 amp alternator (SIN 14541 thru 14572) or a 28 volt, 80 amp alternator (SIN 14573 and subsequent) is installed on the forward lower right side of the engine. A belt from the alternator pulley, to a pulley which is integral with the aft propeller flange, drives the alternator at 3.2 times the speed of the engine.

MASTER SWITCHES
Two toggle switches control the electrical system and are located at the left end of the lower switch panel. The left switch, labeled BAIT MASTER, controls battery power to the airplane. The right switch, labeled ALT MASTER, controls alternator output.

For normal operations, both master switches should be ON. With the ALT MASTER turned OFF, the entire electrical load is placed on the battery. Therefore, all non-essential electrical equipment should be turned off and the flight should be terminated as soon as practical when operating with the ALT switch OFF. Use the Emergency Gear Extension procedure when extending gear with the alternator off.

VOLT/AMMETER
The panel mounted digital volt/ammeter will indicate current flow, in amperes, from the alternator to the battery, or from the battery to the electrical system. With the engine operating and both the battery and alternator master switches ON, the ammeter should indicate on the charge (+) side. In the event of an alternator malfunction, or if the electrical load demand exceeds the alternator output, the ammeter will indicate on the discharge (-) side. When the ammeter continues to display on discharge side, electrical load must be reduced until ammeter indicates on charge side. The volt/ammeter also allows the pilot to monitor bus voltage, and when used in conjunction with the ammeter, provides an excellent indication for electrical system operation. When system is operating normally, voltmeter will read between 24 and 30 volts, generally at approximately 28 volts.

A low voltage reading (less than 24 volts) or a slow decrease in the voltage reading, accompanied by a very low charging reading on the ammeter, indicates the al '.ernator is becoming overloaded. If this situation occurs, reduce the load by turning off non-essential equipment. Voltmeter reading should return to normal (approximately 28 volts) and the ammeter reading should increase. If this occurs, proceed with night, but use caution in increasing electrical load. A low voltage reading (less than 12 volts) or a slowly decreasing voltmeter reading, accompanied by a discharge reading on the ammeter, indicates the alternator is not on the line and the battery is carrying the entire load. This situation will result in a complete loss of electrical power when the battery becomes discharged. To correct the condition, immediately reduce the electrical load to the minimum essential for safe operation. Place ALT master switch OFF and back to ON. If voltmeter reading returns to normal (approximately 28 volts) and ammeter shows a charge, alternator is on the line and operating normally. Place deactivated equipment back in operation, one unit at a time, while monitoring voltmeter and ammeter for abnormal indications, and continue normal operation.
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If voltmeter reading does not return to normal and ammeter continues to show discharge, a fault exists in the alternator system. Place ALT master switch OFF and prepare to terminate flight as soon as practical.

It is essential to reduce the electrical load as much as possible prior to attempting to reset the alternator. If an overload caused the alternator to drop off line initially, the alternator will not come back on the line until the over load condition is corrected.

Heavy electrical usage~ such as prolonged cold weather engine starts or extended period •• of ground operation, may reduce the battery charge enough for it to accept higher than normal charging rates during the initial part of the flight. This will be indicated by higher than normal ammeter readings. After reasonable period of time (approximately thirty minutes), ammeter readings should return to normal. If high ammeter readings continue after this time period, there is a possibility the battery may overheat and evaporate electrolyte at an excessive rate. To preclude the possibility of damaging the battery, turn ALT switch OFF, reduce electrical load to the essential minimum, and terminate flight as soon as practical.

6.14 LIGHTING

EXTERIOR LIGHTING

STROBE LIGHTS - Optional strobe lights may be installed at each wing tip and at the aft end of the tail cone. The lights are controlled by the STROBE LIGHTS circuit breaker switch.

NOTE
Strobe lights should not be used when tlying through clouds, haze, or snow to avoid disorientation due to the flashback.

POSITION LIGHTS - Conventional navigation lights are installed on each wing tip and on the aft end of the tail cone. The lights are controlled by the POS LIGHTS circuit breaker switch.

ANTI-COLLISION LIGHT - A t1ashing beacon anti-collision light is installed on the top of the vertical fin. The light is controlled by the BCN LIGHTS circuit breaker switch.

NOTE
The anti-collision light should not be used when flying through clouds, haze, or snow to avoid disorientation due to the flashback.

LANDING AND TAXI LIGHTS
A landing light is mounted on both wing leading edges near the wing tip and a taxi light is mounted on each main landing gear strut. These lights are controlled by the LOG LIGHTS and TAXI LIGHTS circuit breaker switches. It is acceptable to use the taxi lights in flight to supplement the landing lights, however, under some atmospheric conditions some reflection from the propeller will be evident.

6.15 PITOT PRESSURE SYSTEM
Impact pressure (pitot pressure) is sampled by a heated pitot tube installed near the center of the left wing on the lower surface. Pitot system tubing is routed from the pitot head, aft of the spar structure, inboard to the wing root and into the cabin. A drain plug is located eight inches left of airplane centerline, immediately aft of the spar. From the drain plug, the tubing runs forward through the center console, to the instrument panel where it is connected to the airspeed indicator. The pilot heat is controlled by a circuit breaker switch, labeled PITOT HEAT, on the switch panel to the left of the pilot's control wheel.

6.16 STATIC PRESSURE SYSTEMS

SHIP'S STATIC
Static ports are located on both sides of the aft fuselage at station 205.00. Tube routing from the static pressure ports is up to a tee at the airplane centerline, then forward, under the upper cabin upholstery, to the windshield area. The line is then routed to the alternate static valve (which doubles as a drain), then to the instrument panel where it is coupled to the altimeter, airspeed and vertical speed indicators.

ALTERNATE STATIC
A toggle-type alternate static source valve is installed at the far lower left of the instrument panel. In the event the static ports become obstructed, causing erroneous static pressure instrument readings, the alternate static source valve should be placed in the ON position to provide an alternate source of static pressure. When the alternate source valve is in the ON position, the normal static ports are isolated and static pressure for the airspeed indicator, altimeter and vertical speed indicator is supplied from inside the cabin. It is recommended that side windows be closed when operating on alternate static source.

VACUUM SYSTEM
Suction to operate the directional and attitude gyros is provided by two engine driven vane type vacuum pumps. The pumps, installed on the engine accessory housing, are gear driven through couplings. A vacuum regulator is used to control system pressure. A vacuum gauge, located below the engine instrument sub-panel, indicates the system pressure level. Two failure indicators, located directly below the vacuum gauge, give the pilot prompt notification of the failure of either vacuum pump.

7 Terminology

Accelerate-Stop Distance	The distance required to accelerate an aircraft to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the aircraft to a stop.
Accelerate-Go Distance	The distance required to accelerate an aircraft to a specified speed and, assuming failure of an engine at the instance that speed is attained, continue takeoff on the remaining engine to a height of 50 feet.
Center of Gravity (CG)	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.
Climb Gradient	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval
Directional Gyro (DG)	Directional Gyro is a gyroscopic navigation instrument capable of providing the pilot with a constant directional reference not subject to temporary errors characteristic of a magnetic compass. Occasional Magnetic Variation (MAG-VAR) must still be adjusted. The vacuum type is operated by the air flow generated by the aircraft vacuum system while electrical type is operated by aircraft power supply.
Emergency Pressurization System (EPS).	Activates when the aircraft cabin altitude exceeds the safety limit of 10,500 feet.
Engine Speed (RPM) Gauge	Indicates engine rotational speed based on a figure of 100% at 1540 propeller rpm.
Engine Torque Meter	Indicates shaft output torque in percent (100% torque at 1540 rpm equals 1000 shaft horsepower).
Flight Director	A flight director system (FDS) combines many of the primary navigation instruments to provide an easily interpreted display of the aircraft's flight path. The pre-programmed path, automatically computed, furnishes the steering commands necessary to obtain and hold a desired path. The computed path is controlled by the autopilot (AP), and is slaved to the current AP mode of operation (HDG/NAV/ALT). In case of ILS approach, the FDS computer is slaved to the ILS navigation beam for lateral and vertical steering directions.
Inlet Turbine Temperature Gauge (ITT)	Indicates operating temperature in the turbine. The red line is used to indicate maximum allowable temperature.
International standard atmosphere	(1) The air is a dry perfect gas. (2) The temperature at sea level is 15° Celsius (59° Fahrenheit). (3) The pressure at sea level is 29.92 inches of mercury (1013.2 millibars). (4) The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003564°F) per foot and zero above that altitude.

Maximum Takeoff Weight (MTOW)	Maximum weight approved for the start of the takeoff run.
Outside Air Temperature (OAT)	The free air static temperature obtained either from in-flight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility.
Pressure Altitude	Station Pressure Altitude measured from standard sea level pressure (29.92 inches of mercury) (1013.2 millibars) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero. Actual atmospheric pressure at field elevation.
Temperature Recovery	(Ram Rise) Indicated Pressure Altitude Aerodynamic heating which occurs to a temperature probe and increases as a function of Mach number. Indicated Outside Air Temperature (OAT) must be reduced by the Ram Rise to derive the true OAT, also referred to as Static Air Temperature. The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 millibars).