CAA APPROVED ROTORCRAFT
Flight Manual for
Model MC-4C Helicopter
Manufactured by
McCULLOCH MOTORS CORPORATION - AIRCRAFT DIVISION
9775 Airport Blvd., Los Angeles 45, California

This Helicopter must be operated in compliance with
the "operating limitations" herein

Type Certificate
NO: 6-H-3

Registration No:

_____

Approved by: Anner M. Glover
Chief Aircraft Engineering Branch

Date of Approval: February 17, 1953

McCULLOCH MC-4C HELICOPTER

REVISIONS

Revision No.	PAGES	CAA APPROVAL	DATE OF APPROVAL
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	and 32	AMA.	4-17-53

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SECTION I.

OPERATING LIMITATIONS

SECTION I - OPERATING LIMITATIONS

(OPERATION IN ACCORDANCE WITH THIS SECTION IS MANDATORY)

1. 1 WEIGHT LIMITS

a. Maximum take-off and Landing weight - 2300 pounds

NOTE

THIS HELICOPTER SHALL BE OPERATED IN ACCORDANCE WITH THE APPROVED LOADING INSTRUCTIONS CONTAINED IN SECTION IV HEREIN.

1. 2 CENTER OF GRAVITY

a. Forward limit station: 93. 5
b. Aft limit station: 98. 0
c. Datum line (Station 0) is 2. 5 inches forward of front rotor centerline
d. Baggage compartment limitation: 200 lbs. total, 40 lbs. per square foot concentrated load

1. 3 ENGINE OPERATING LIMITS

For Aircooled Motors Incorporated, Engine Type 6A4-200-C6

a. Maximum Operation: 3100 RPM, 200 BHP - Full throttle at sea level
b. Minimum Operation: 2900 RPM
c. Avoid continuous operation with rotors engaged from 1200 to 1500 RPM
d. Fuel: Minimum Octane 91/98
e. Temperatures:

(1) Cylinder head. Maximum: 530°F (277°c)
(2) Engine oil inlet maximum: 230°F (110°c)
(3) Transmission oil maximum: 230°F (110°c)

f. Oil pressure (normal temperature): 40 to 60 psi at 3100 RPM, 25 psi at idle
g. Maximum permissible drop on single magneto: 200 RPM

1. 4 ROTOR SPEEDS

Maximum RPM: 508
Minimum RPM: 400

1. 5 AIR SPEEDS

a. The never exceed speed (V_{NE}) is 90 MPH C. A. S. Below 7000 ft.
b. Above 7000 ft. reduce (V_{NE}) 4 M.P.H. per 1000 ft.

1.6 FLIGHT LIMITATIONS

a. Avoid operation in shaded area of Fig. 1, page 4
b. Instrument flight prohibited
c. Acrobatic maneuvers prohibited
d. Rearward flight or hovering down wind at speeds in excess of 20 MPH prohibited
e. Nose wheel ground contact speeds in excess of 20 MPH prohibited
f. Do not hit blade stops in ground operation by excessive use of lateral and directional controls
g. Above 7000 feet, reduce V_{NE} 4 MPH per 1000 feet
h. Avoid rapid cycling of longitudinal control

1.7 PLACARDS

a. At aft end of center floor board

(1) NOTICE - This helicopter must be operated in compliance with the operating limitation specified in the CAA approved rotor-craft flight manual
(2) Instrument Flight prohibited
(3) Aerobatic maneuvers prohibited
(4) Solo from right seat only
(5) Nose wheel ground contact in excess of 20 MPH prohibited
(6) Do not hit blade stops in ground operation by excessive use of lateral and directional controls
(7) Avoid rapid cycling of longitudinal control

b. On Instrument Panel Next to Airspeed Indicator

(1) Above 7000 feet, reduce V_{NE} 4 MPH per 1000 feet

1.8 INSTRUMENT MARKINGS

General:

Red radial lines: Maximum and minimum limits
Yellow arc: Take off and precautionary range
Green arc: Normal operating range
Red arc: Operation prohibited

a. Engine oil temperature

Red radial lines 38°C and 110°C
Green arc: 38°C to 110°C

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b. Engine oil Pressure

Red radial lines: 40 and 60 psi
Green arc: 40 to 60 psi

c. Transmission oil temperature and Pressure

A warning light on the instrument panel comes on when transmission oil pressure drops below 3 psi or temperature exceeds 235°F

d. Engine Tachometer

Red radial lines: 2900 and 3100 RPM
Green arc: 2900 to 3100 RPM
Yellow arc: 1200 to 1500 RPM

e. Rotor Tachometer
Red radial lines: 400 and 508 RPM
Green arc: 400 to 508 RPM

f. Air Speed Indicator

Red radial line: 90 MPH (78 Knots)
Green arc: 55 to 90 MPH (48 to 78 Knots)
Yellow arc: 0 to 55 MPH (0 to 48 Knots)

g. Carburetor Air Temperature

Red radial line: at 50°c
Green arc: 25 to 50°c
Yellow arc: 0 to 25°c

h. Cylinder Head Temperature

Red radial line: 277°c

1. 9 FUEL RESERVE

a. Tank capacity: 35 U. S. gallons
b. Usable fuel: 34 U. S. gallons
c. Non-usable fuel: 1 U. S. gallons

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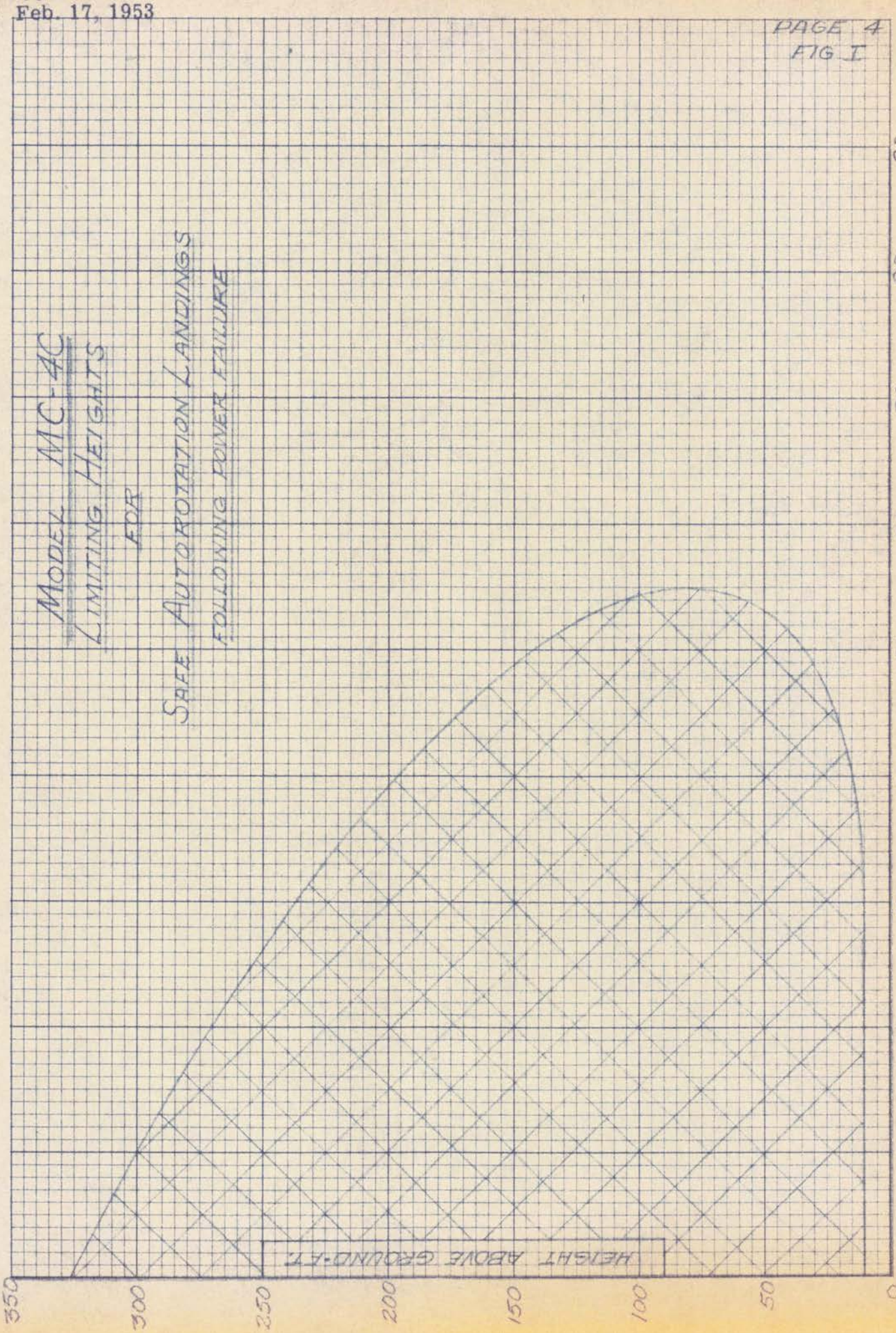
FIG I

MODEL MC-4C
LIMITING HEIGHTS
FOR
SAFE AUTOROTATION LANDINGS
FOLLOWING POWER FAILURE



SECTION II

OPERATING PROCEDURES

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SECTION II - OPERATING PROCEDURES

2. 1 FLIGHT CONTROLS

a. General

The helicopter is controlled during flight by means of a throttle, collective stick, cyclic stick and rudder pedals. These controls are installed for both crew members.

b. Collective Pitch Control

Collective pitch sticks are located at the left side of the pilot and co-pilot seats. Upward motion of the stick increases the pitch of all blades simultaneously and to the same degree. Movement of the stick in a downward direction decreases blade pitch in a similar manner. Increasing the collective pitch increases the lift of the rotors and consequently will cause the helicopter to climb. Decreasing collective pitch decreases the rotor lift permitting controlled descent. The throttle control is incorporated into the collective pitch sticks. Throttle control linkage is arranged to automatically increase engine power with increase in collective pitch (and vice versa) to help maintain constant rotor RPM. Changes in collective pitch must be manually coordinated with a change in throttle setting to bring about climb, descent or a change of forward speed. Operating friction of the collective pitch stick may be varied to suit the individual pilot by means of a friction control device, located under boot at aft end of lever. A locking strap is provided on the collective pitch lever between the two pilots' seats to be used for locking the lever in the down position before engaging clutch.

c. Longitudinal Control

Longitudinal control is obtained through the forward and aft motion of the cyclic pitch sticks. When the cyclic pitch stick is moved forward it causes both swashplates to tilt forward which in turn causes one complete cyclic pitch change of the blades per rotor revolution. With the swashplate tilted forward the rotor blades assume a higher pitch angle in the retreating sector of the plane of rotation of the blades and a lower pitch angle in the advancing sector which causes the blades to fly low in front and high in back thus inducing a forward lifting component in the rotor system. This will, when coordinated with the proper application of collective pitch and throttle, cause forward flight at the desired speed. Rearward flight is similarly accomplished by moving the cyclic pitch stick in an aft direction. When the cyclic stick is moved fore and aft, in addition to tilting the front and rear swashplates to produce cyclic pitch it also, through a special linkage, moves these swashplates vertically, one up and the other down. Thus if the cyclic

stick is pushed forward, the front swashplate is raised while the rear one is lowered. This decreases the collective pitch on the front rotor and increases it on the rear rotor. In this way the thrust is decreased on the front rotor and increased on the rear rotor which increases the control caused by the cyclic pitch change.

d. Lateral Control

Lateral control is obtained by displacement of the cyclic pitch stick in a lateral direction, which inclines both swashplates laterally and brings about flight in a lateral direction in the same manner as described under longitudinal control. Displacement of the cyclic pitch stick to the right causes the helicopter to fly to the right. Displacement of the cyclic pitch stick to the left causes flight in that direction.

e. Directional Control

Directional control or change in aircraft heading is provided by means of a duel set of rudder pedals. Forward motion of the left pedal results in a change of heading to the left. The movement of the rudder pedals produces this directional change in the same manner as described under lateral control except that one rotor is tilted toward one side while the other rotor is tilted toward the other side. This results in opposing lateral thrusts of the front and rear rotors, moving the aircraft about a vertical axis.

2. 2 POWER PLANT AND TRANSMISSION

a. General

The helicopter is powered by an Aircooled Motors Inc. 6A4-200-C6 six cylinder aircooled engine. The engine is mounted in the aft section of the fuselage and is separated from the forward fuselage section by a stainless steel firewall. The engine is mounted in a horizontal position facing aft. Cooling is accomplished by means of a centrifugal type fan, mounted on the hub attachment which pumps air through shrouds surrounding the cylinders. The helicopter is equipped with a gravity type fuel system which provides 34 gallons of usable fuel to the engine. The lubrication system consists of an oil cooler, ducted to the engine fan, and an automatic temperature control valve. Power is transmitted from the engine by means of a short shaft to a belt drive assembly. The belt drive utilizes twelve V-belts which operate on two pulleys. A controllable idler pulley in the belt drive system permits clutching and declutching of the engine from the rotors and in the upper belt drive pulley is incorporated an over-running clutch which permits the rotors to automatically turn free in case of engine failure. Power is transmitted from the belt drive by shafts to the fore and aft reduction gear

boxes. These gear boxes are comprised of a ring gear, pinion gear, case bearings and lubrication system. Total reduction in the transmission is at the ratio of 7.01:1.

b. Throttle Control

Throttle control is obtained through actuation of a grip on the collective pitch sticks. The throttle control is interconnected in such a way with the collective pitch system as to automatically change the throttle setting to help maintain rotor RPM with changes of collective pitch. The throttle setting can be changed independently of collective pitch when needed by turning the grip. Turning the grip clockwise opens the throttle, and counter-clockwise closes the throttle.

c. Mixture Control

Fuel air mixture is controlled by means of a push-pull type flexible control. The actuating knob is located at the lower right side of the control panel. Mixture is full rich when the knob is pushed completely in.

d. Carburetor Air Temperature

Carburetor air temperature is controlled by a flexible type push-pull control located at the lower left side of the control panel. When the knob is pushed completely in carburetor air heat is off. This control actuates a valve in the carburetor heater box and regulates the hot air flow from the muffler.

e. Starter Control

The starter is manually engaged by pulling the starter handle down. This handle is located on the cockpit ceiling between the pilot and co-pilot. The handle is spring loaded and will return to its original position when released.

f. Ignition System

The ignition system is a conventional installation which is controlled by a four position switch wired to the engine magnetos. This control is located in the lower center of the control panel.

g. Lubrication System Engine

The engine has an oil capacity of 9.8 quarts including that required to fill the oil cooler. The oil cooler is ducted to the engine cooling fan and

includes a bypass valve which automatically controls the flow of oil through the cooler as required to maintain satisfactory oil temperature.

h. Clutch Control

The idler pulley in the belt drive is operated as a clutch by actuation of a cockpit control. This control consists of an actuation lever located on the cabin ceiling, a worm gear and cables which connect to the pulley. To engage the belts the handle should be turned clockwise six and one half turns (at the rate of about one turn per second). The handle should always be in the disengaged position when starting the engine.

i. Lubrication System Gear Boxes

Each gear case is equipped with an oil pump and cooling fins for the lubricant. A warning light on the instrument panel illuminates when gear case oil exceeds 235°F or oil pressure is less than 3 P.S.I.

j. Fuel System

The helicopter is equipped with a gravity type fuel system. It consists of the fuel tank, fuel quantity gage, strainer, shut-off valve and necessary lines and fittings. The fuel tank is of aluminum welded construction and has a total capacity of 35 U.S. gallons of which 34 gallons are usable. There is a fuel shut-off valve located on the bulkhead aft of the pilot at approximately the centerline of the aircraft.

2.3 LANDING GEAR

a. General

This helicopter is equipped with conventional tricycle type landing gear which incorporates air-oil shock struts. Parking and toe brakes are provided to simplify taxiing and mooring.

b. Parking Brakes

The parking brakes are located in the two main wheel assemblies and are hydraulically actuated. The lever that locks the parking brake is located on the pilot's floor near the bottom of the instrument panel. The helicopter must be completely stopped and the toe brakes must be

pushed down before the parking brake is applied.

c. Toe Brakes

Toe brakes are provided to simplify taxiing and to act as a means of decelerating during rolling landings. Toe brakes are actuated by the use of the right hand set of rudder pedals. Actuating the left rudder pedal brakes the left wheel and causes the helicopter to turn to the left. The brakes should always be applied gradually to avoid undue strain on the landing gear structure and on the brakes themselves.

2.4 ROTOR SYSTEM

a. Rotor blades are of all metal construction and are connected to the rotor hub by means of a linkage which permits blade flapping, lead ad and lag, and pitch change. The pitch of the blades is controlled by the rod assemblies connecting the blade pitch arms to the swash plate.

b. Rotor Brake

A rotor brake is provided as a means for quickly stopping the rotor during ground operation. The brake is mounted on the front gear case and is actuated by a lever on the cockpit ceiling. A safety clip on the actuation lever holds the lever in the disengaged position and must be unlatched before the brake can be operated. When operating the rotor brake always be certain that the engine is stopped or that the clutch is disengaged.

2.5 EQUIPMENT

a. Safety Belts

Both seats are equipped with individual web type safety belts which incorporate friction type locking devices.

b. Cabin Doors

The cabin doors are jettisonable for emergency exit. The doors are jettisoned by unlatching the door in the normal manner and then pulling the emergency release handle located at the upper forward corner of the doors.

c. Electrical System

(1) Electrical power is supplied by means of a 28 volt generator which is belt driven by the engine. The power output of the generator is controlled by means of a voltage regulator. A 50 amp-hr. storage battery located in the baggage compartment supplies power to all items which are electrically operated or controlled. A warning light on the instrument panel will illuminate when generator output voltage is lower than the battery voltage. There is a voltameter on the instrument panel which indicates the general output. A switch panel on the instrument panel includes the electrical system master switch along with individual switches for all lights and other electrically controlled devices along with the manually set circuit breakers. NOTE- DO NOT OVERRIDE CIRCUIT BREAKERS. An external power receptacle is provided for use when starting the helicopter.

(2) Lights

There is a fixed (ground adjustable) landing light and taxi light mounted on the lower nose of the aircraft. These lights are controlled by a switch on the collective stick. Standard position lights are mounted on the helicopter in the conventional manner. Cockpit map light, baggage compartment light and lights for the instrument panel are provided and are all controlled from switches located on the switch panel. A dimming rheostat is provided on the console for adjustment of instrument and console lighting intensity.

(3) Radio Equipment

The helicopter is equipped with the following radio equipment: (1) VHF Receiver (ARV Type R-19); (2) Two VHF Transmitters (ARC Type T-11A and ARC Type T-13); (3) Range Receiver (ARC Type R-11-A).

The control panel for these units is located on the instrument panel within easy reach of the pilot and copilot.

2.6 NORMAL OPERATING INSTRUCTIONS

a. Before entering cockpit

1. Have a thorough understanding of Operating Limits (Section I).
2. Determine take-off weight and balance (Section IV - Weight and Balance).
3. Check flight plan for best flight procedure (Section III Performance Information).
4. Make visual inspection to determine the following:

a. Pitot cover off
b. Tire and shock struts at proper inflation
c. All access doors secured
d. All covers removed
e. Mooring ropes and chocks removed
f. Fuel and oil quantity at proper level
g. Gas tank filler cap secured
h. External power plugged in if available
i. Fire extinguisher operator standing by if available

b. Upon Entering Cockpit

1. Inspect and adjust safety belt
2. Adjust rudder pedals
3. Parking brakes as required
4. Rotor brake off and handle guard in place
5. Circuit breakers on
6. Check fuel quantity
7. Set altimeter
8. Carburetor air on cold
9. Check movement of flight controls
10. Master switch on
11. All other electrical switches off

c. Starting the Engine

CAUTION
COLLECTIVE PITCH STICK LOCKED FULL DOWN

1. Belt drive disengaged
2. Fuel shut-off valve on
3. Rich mixture control
4. Pump throttle to prime engine if necessary
5. Ignition switch on both
6. Pull starter control handle to engage starter

NOTE: RELEASE STARTER HANDLE AFTER ENGINE FIRES. IF ENGINE FAILS TO START AFTER 30 SECONDS OF STARTER ENGAGEMENT RELEASE STARTER HANDLE AND WAIT TWO MINUTES BEFORE REPEATING STARTING PROCEDURE.

7. When engine starts it should idle at 1500 RPM
8. Disconnect external power plug

CAUTION

IF OIL PRESSURE IS NOT INDICATED WITHIN 30 SECONDS AFTER ENGINE STARTS SHUT DOWN ENGINE AND DETERMINE CAUSE

d. Rotor Engagement

1. Collective pitch stick locked full down
2. Rudder pedals and cyclic stick in neutral
3. Engine speed 1500 RPM
4. Slowly wind clutch engaging crank as necessary until rotors begin to turn. Continue to wind until handle is in fully engaged position.
5. After rotors are engaged check gear case oil pressure and temperature warning light. Light should be out for proper operation.

CAUTION

ROTOR RPM AND ENGINE RPM INDICATOR NEEDLES MUST ALWAYS BE SUPERIMPOSED ON ONE ANOTHER WHEN ENGINE IS DRIVING ROTOR. ANY OTHER CONDITION INDICATES BELT SLIPPAGE, TACHOMETER SYSTEM MALFUNCTIONING OR OTHER MECHANICAL DRIVE FAILURE. IF THIS CONDITION EXISTS SHUT DOWN ENGINE AND INVESTIGATE.

e. Warm Up and Ground Check

1. Idle at 1500 RPM until engine oil temperature and oil pressure is within the green arc.
2. Carburetor heat as required.
3. Open throttle to increase engine speed and check generator warning light when engine speed exceeds 2000 RPM for proper operation of the generator. Check voltammeter, for proper indication.
4. Check response of controls at 3100 RPM full low pitch by gently moving cyclic stick and rudder pedals. Observe rotor tip for correct movement and track. Avoid extreme application of cyclic

and/or rudders to prevent hitting blade stops.

5. Check magnetos at 2700 RPM engine speed and slight collective pitch. Maximum allowable drop is 200 RPM on either magneto, with no engine roughness.
6. With engine RPM stabilized at 3100 RPM in full low pitch, close throttle to check separation of tachometer needles for proper overrunning clutch operation.

f. Taxiing

1. Release parking brake.
2. Taxi at 3100 engine RPM, using sufficient collective pitch and throttle to make helicopter light but firm on ground.
3. Govern taxi speed by application of cyclic stick. Apply slight movement of cyclic stick against any cross wind to stabilize aircraft.
4. Control heading by application of rudder pedals or toe brakes.

CAUTION

DURING TAXI OPERATION THE HELICOPTER HAS A TENDENCY TO TURN TO THE RIGHT WHEN ACCELERATING AND TO THE LEFT WHEN DECELERATING. THEREFORE IT IS RECOMMENDED THAT RAPID ACCELERATION AND DECELERATION BE AVOIDED WHEN TAXIING,
A HIGH POWER SETTING, CONSISTANT WITH THE ABILITY TO MAINTAIN ENOUGH WEIGHT ON THE MAIN LANDING GEAR FOR LATERAL STABILITY, WILL REDUCE THE TURNING TENDENCY AND IS THEREFORE RECOMMENDED FOR TAXIING.

> **CAUTION**
>
> AVOID EXTREME APPLICATION OF CONTROLS WHILE TAXIING TO AVOID HITTING BLADE STOPS WITH BLADES.

5. Caution must be exercised when taxiing in congested areas to maintain adequate rotor blade clearance.

g. Take-Off

1. Head aircraft into wind if feasible.
2. Rudder and cyclic stick as necessary.
3. Mixture rich.
4. Carburetor air cold.
5. Advance throttle to maintain 3100 engine RPM and pull collective pitch stick slowly upward until the ship becomes airborne. Maintain 3100 RPM by coordination of throttle control with application of collective pitch.
6. Maintain heading by rudder pedals and level attitude by cyclic pitch stick.
7. Upon leaving ground climb immediately to an altitude of 2-1/2 to 10 feet.
8. From this hovering position the helicopter can be then accelerated into forward flight and hence into a climb.

NOTE: IF CONDITIONS ARE SUCH THAT THE SHIP WILL NOT HOVER, THEN A RUNNING TAKE-OFF MAY BE ACCOMPLISHED. THIS MAY NECESSITATE RIDING ON THE NOSE WHEEL WITH THE MAIN GEAR OFF THE GROUND. THESE GROUND RUNS SHOULD BE TERMINATED IF GROUND SPEEDS IN EXCESS OF 20 MPH ARE NECESSARY TO COMPLETELY EFFECT THE TAKE-OFF. THE TAKE-OFF DISTANCE CHART REVEALS THE ALTITUDE AND TEMPERATURE RANGE WHERE IT IS POSSIBLE TO BE COMPLETELY AIRBORNE BY 20 MPH.

h. Flight Characteristics

1. The rotors are counter-rotating, therefore it is not necessary to compensate for changes in rotor pitch or power with movement of the rudder pedals.

2. During power and autorotational glides, normal rotor speed should be maintained by reducing the blade pitch and throttle setting as required.

i. Normal Landing

1. Parking brake off.
2. Maintain normal rotor speed during approach.
3. Slowly decrease collective pitch to maintain desired rate of descent.
4. Ease back on cyclic pitch stick and increase collective pitch and throttle as landing spot is neared until ship is hovering approximately 2 1/2 - 10 feet above spot.
5. From levelhovering attitude, decrease collective pitch and throttle slowly until wheels contact landing surface. Exercise care to prevent lateral movement of helicopter upon contact.
6. As wheels contact surface, reduce collective pitch.
7. Keep helicopter straight with rudder pedals and move forward about one half revolution of the wheels to relieve the tires of lateral deflection.

j. Running Landing (on smooth terrain only)

1. Approach angle may be varied but shallow angle is more easily executed.
2. 20 MPH or less is recommended ground contact speed; however, ground contact speeds above 20 MPH may be made if the nose wheel is held off to a ground speed not to exceed 20 MPH.
3. On running landings deceleration is obtained by maintaining nose high attitude during initial part of landing run and then using foot brakes for remainder of run.

k. Stopping Engine and Rotors

1. Idle helicopter with minimum collective pitch and 1500 RPM engine speed until a definite decrease of engine temperature is obtained.
2. Pull mixture control to "Idle cut-off" position.
3. Set all electrical and magneto switches to "Off" position.
4. Apply rotor brake to bring rotors to a standstill.

1. Night Flight

    1. Check all lights for proper operation and alignment.
    2. Use taxi light for hovering near ground, taxiing and acceleration part of take-off run.
    3. Use landing light for climb out and landing approach.

NOTE

LANDING LIGHT WILL ILLUMINATE GROUND FROM HEIGHTS UP TO 1000 FEET.

2. 7 EMERGENCY OPERATING INSTRUCTIONS

a. Engine Failure

1. Engine failure during Take-off.

> **CAUTION**
>
> IN ORDER TO EFFECT A SAFE AUTOROTATION LANDING AFTER ENGINE FAILURE, TAKE-OFF OPERATION SHOULD BE CONDUCTED IN ACCORDANCE WITH THE RESTRICTIONS SHOWN ON HEIGHT VELOCITY DIAGRAM PAGE 4.

In the event of power failure during take-off when the aircraft is below a 10 ' altitude, the momentum of the rotors at maximum RPM will provide for a relatively easy landing. Apply back cyclic and collective pitch as needed to reduce forward speed and reduce vertical velocity at contact. As the height, at which engine failure occurs, increases, the collective pitch must be initially lowered in order that the rotor speed may be maintained. The amount and duration of collective reduction depends upon the height above the ground at which engine failure occurs. As the ground is approached back cyclic and collective should be used as needed to decrease forward and vertical velocity. In this connection the horizontal velocity may be reduced to zero before ground contact if so desired. Ground contact should be established with relatively high nose attitude.

2. Engine Failure above 325 ft. Altitude

(a) Immediately decrease collective pitch as necessary to maintain a rotor speed of 440 RPM.
(b) Establish a steady glide speed of 45 - 60 MPH.

NOTE: SPEED FOR BEST RATE OF DESCENT 58 MPH CAS.

(c) At an altitude of about 50 ft. begin to steadily apply back cyclic stick to decrease forward speed.
(d) At approximately 10 ft. coordinate collective pitch with aft movement of cyclic stick to cushion landing. At ground contact a nose high landing on the main landing gear is accomplished.

NOTE

IN THIS HELICOPTER IT IS NOT NECESSARY TO BREAK THE STEADY GLIDE PATH BY A CHARACTERISTIC FLARING AT SOME GIVEN HEIGHT ABOVE THE GROUND BUT MAY BE OPERATED SUCH THAT A CONTINUOUS FLARE EXTENDING TO THE POINT OF GROUND CONTACT CAN BE ACCOMPLISHED.

(e) Maintain nose high attitude to obtain zero or low forward speed while on ground. Gently allow nose to come down while helicopter is at a standstill.

(f) Running autorotational landings may be accomplished by contacting runway at a forward speed in a nose high attitude (on main landing gear).

CAUTION

CARE MUST BE EXERCISED TO MAINTAIN COLLECTIVE PITCH FOR DIRECTION CONTROL UNTIL FORWARD RUN HAS BEEN STOPPED. CARE MUST ALSO BE EXERCISED TO AVOID SCRAPING TAIL CONE ON RUNWAY AS THE RESULT OF AN EXTREMELY NOSE HIGH ATTITUDE;

b. Bailing Out

1. Set controls for level flight, if possible.
2. Jettison door.
3. Release safety belt
4. Dive out door as far as possible to clear aircraft.

c. Fire

1. Shut off all switches.

2. Close fuel valve.
3. Make autorotation landing if sufficient altitude and landing area is available. See paragraph 2.7 (2).

c. Ditching with Power

1. Descend to hovering altitude over water.
2. Turn all electrical switches, except ignition, to Off Position.
3. Unbuckle parachute harness.
4. Jettison door on high side of cabin.
5. Maintain level attitude and accomplish normal landing. As contact is made with water, apply sideward stick causing rotor blades to strike water.
6. Release safety belt.
7. Climb out door and clear aircraft as quickly as possible.

e. Ditching without Power

1. Unbuckle parachute harness.
2. Turn off all electrical switches including ignition.
3. Make autorotative glide at 45 to 60 MPH, maintaining normal rotor speed of approximately 440 RPM.
4. Apply back pressure on stick to arrest forward flight at approximately 10 ft. altitude.
5. Apply collective pitch to cushion landing.
6. As contact is made with water, level helicopter and apply sideward stick causing rotor blades to strike water.
7. Jettison door on high side of cabin.
8. Release safety belt.
9. Climb out door and clear aircraft as quickly as possible.

SECTION III

PERFORMANCE DATA

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SECTION III

PERFORMANCE DATA

3. 1 Take-off Chart

Take-off distances are based upon a vertical take-off to an altitude of 2. 5 ft. where altitude and temperature permit and then accelerating at this altitude to a speed of 60 MPH CAS followed by a climb out at this speed. Where altitude and temperature do not permit hovering, the acceleration is made along the ground until the ship can be made airborne.

3. 2 Landing Distance

The landing distance chart is based upon a flared type autorotational landing entered from a steady glide of 60 MPH CAS.

3. 3 Rate of Climb

Climb data are based upon climbing at full throttle 3100 RPM at best rate of climb speed of 60 MPH CAS. Above 2500 ft. mixture may be leaned to improve performance.

3. 4 Hovering Ceiling vs. Temperature

Charts show hovering ceiling both in and out of ground effect.

3. 5 Airspeed Calibration

This chart compares calibrated airspeed with the indicated airspeeds as read by the indicator.

3. 6 Crosswind and Downwind Operation

When hovering or landing, adequate flight control can be maintained in winds up to 20 MPH.

FIG 2

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MC-4C

G.W. = 2300 LBS.

RATE OF CLIMB VS. PRESSURE ALTITUDE
FOR OFF-STANDARD CONDITIONS
TIAS = 60 MPH

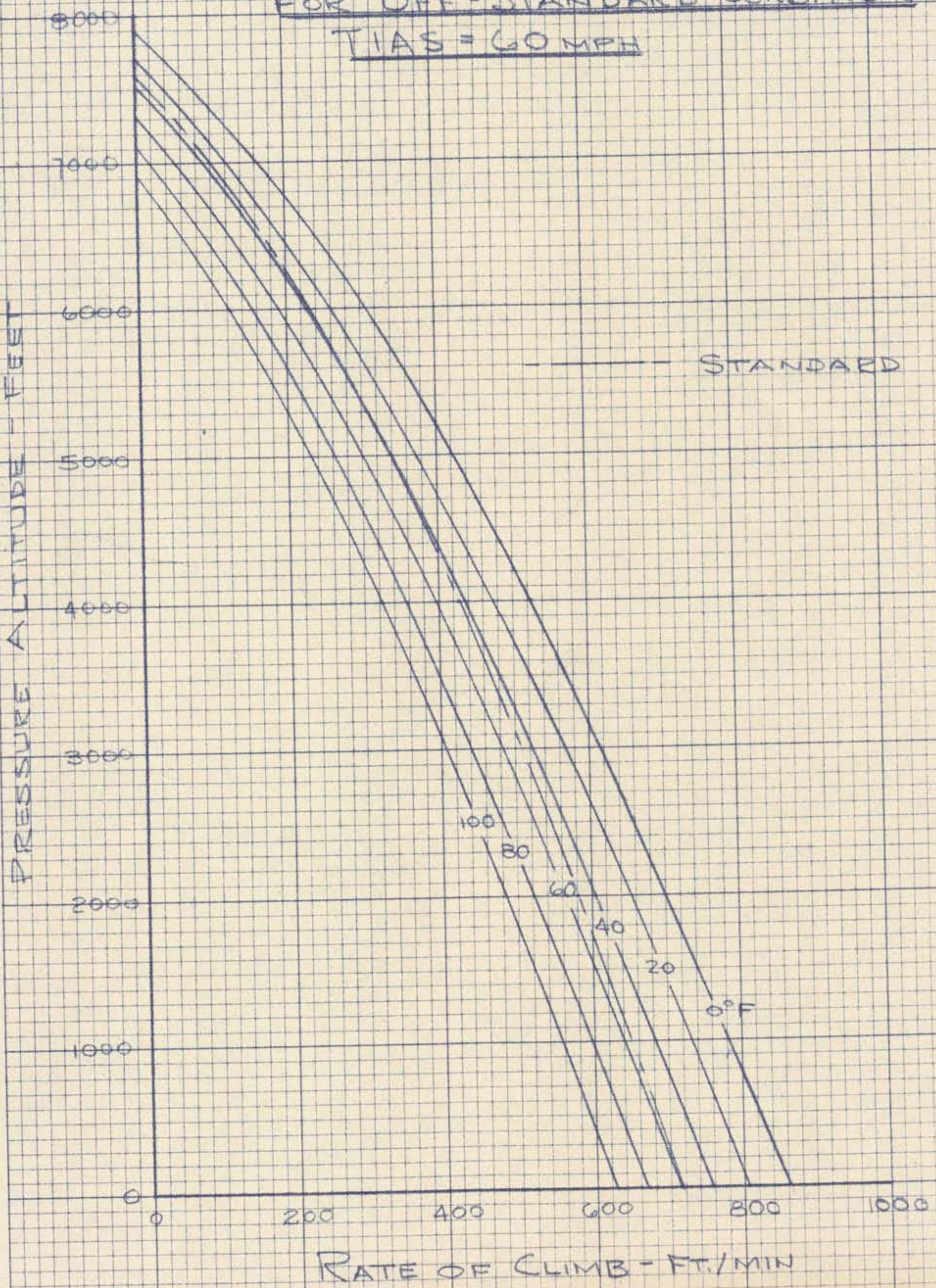

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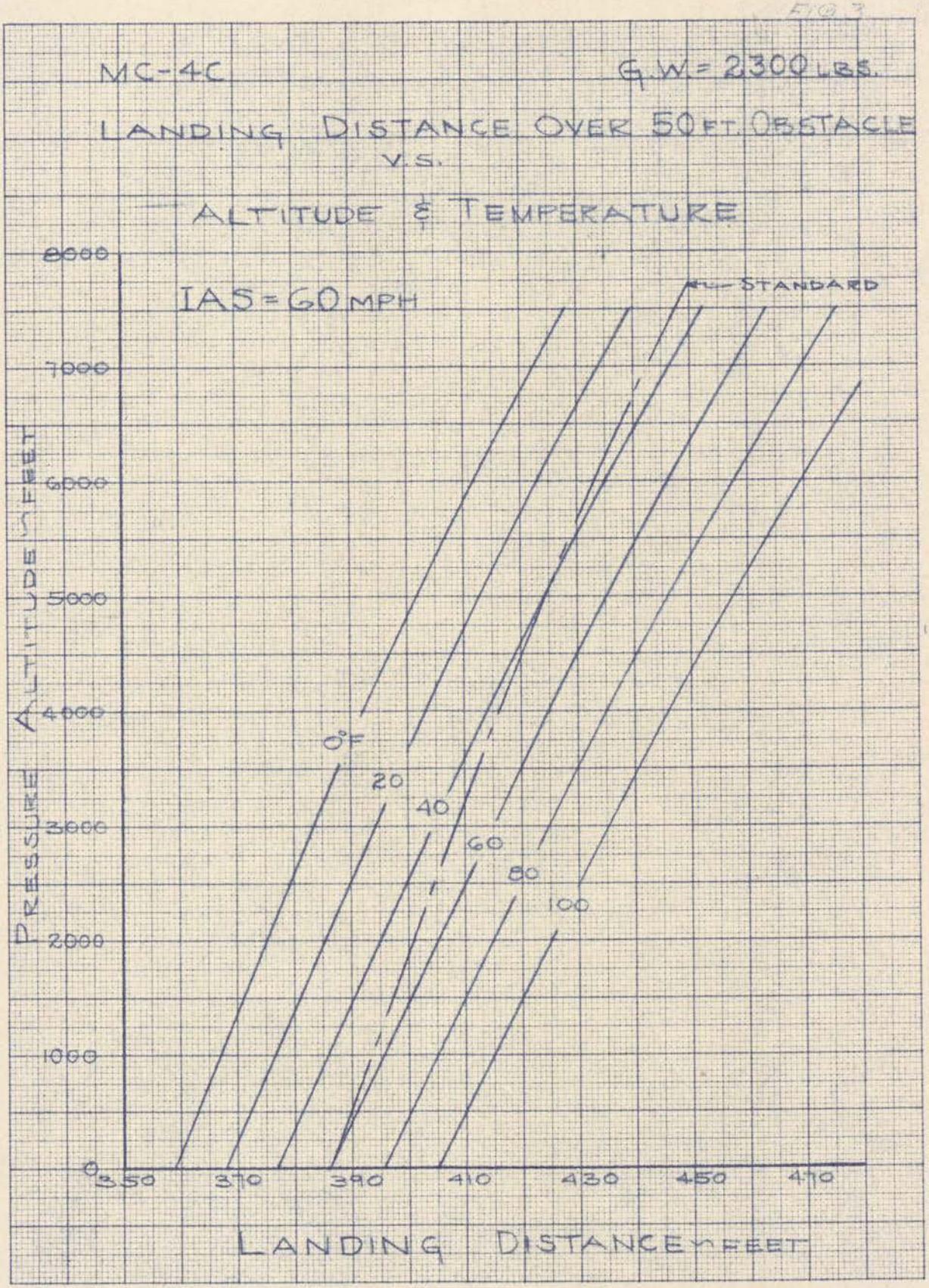
FIG 7



MC-4C

GROSS WEIGHT = 2300 LBS

TAKE-OFF DISTANCE V.S. PRESSURE ALTITUDE AT VARIOUS TEMPERATURES

TIAS = 60 MPH.

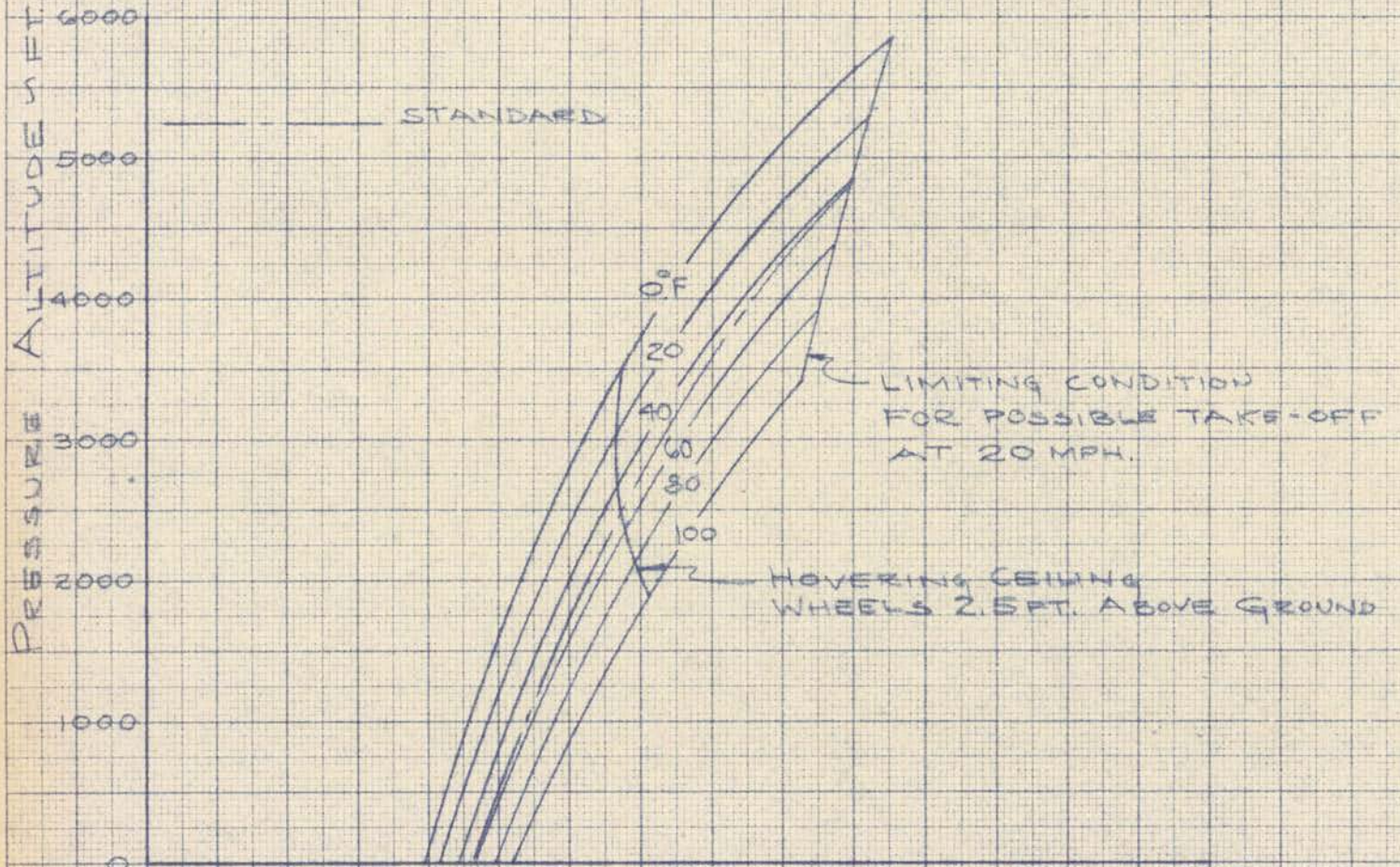


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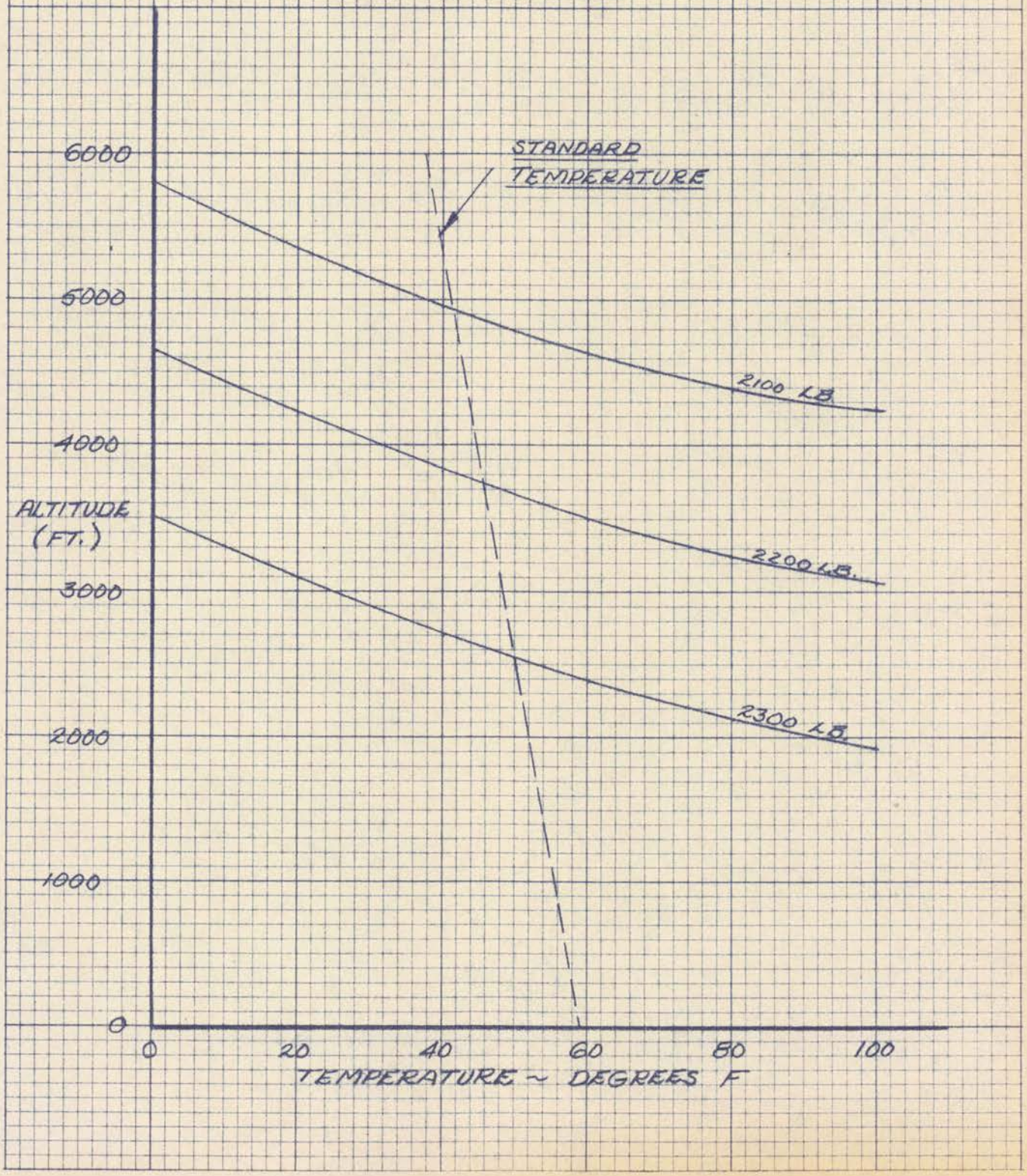
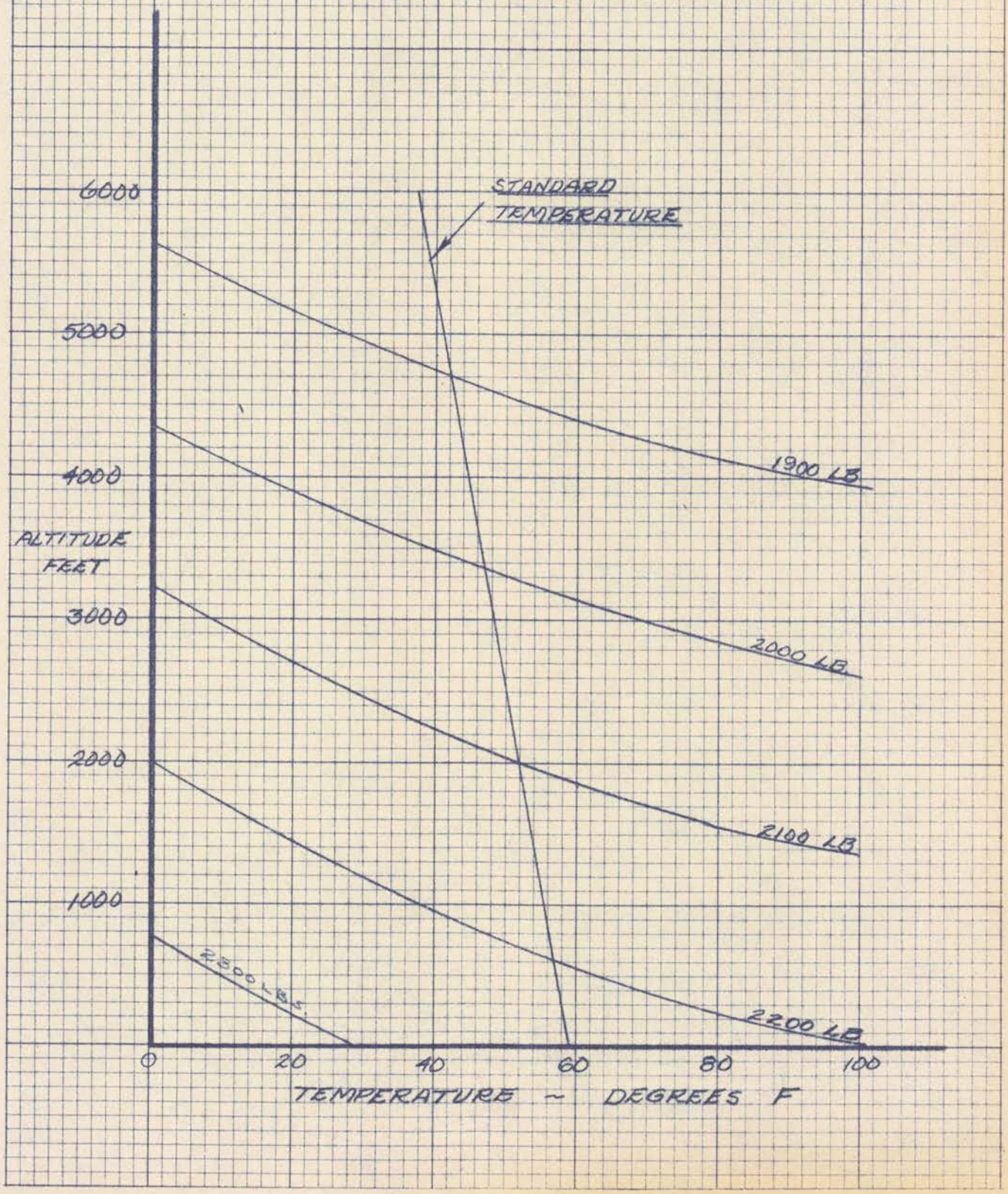
FIG 4

MODEL MC-4C
HOVERING CEILING VS GROSS WEIGHT AND TEMPERATURE IN GROUND EFFECT



MODEL MC-4C
HOVERING CEILING VS GROSS WEIGHT AND TEMPERATURE
OUT OF GROUND EFFECT



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MC-4C
AIRSPEED CALIBRATION
INDICATED AIRSPEED
VS.
CALIBRATED AIRSPEED

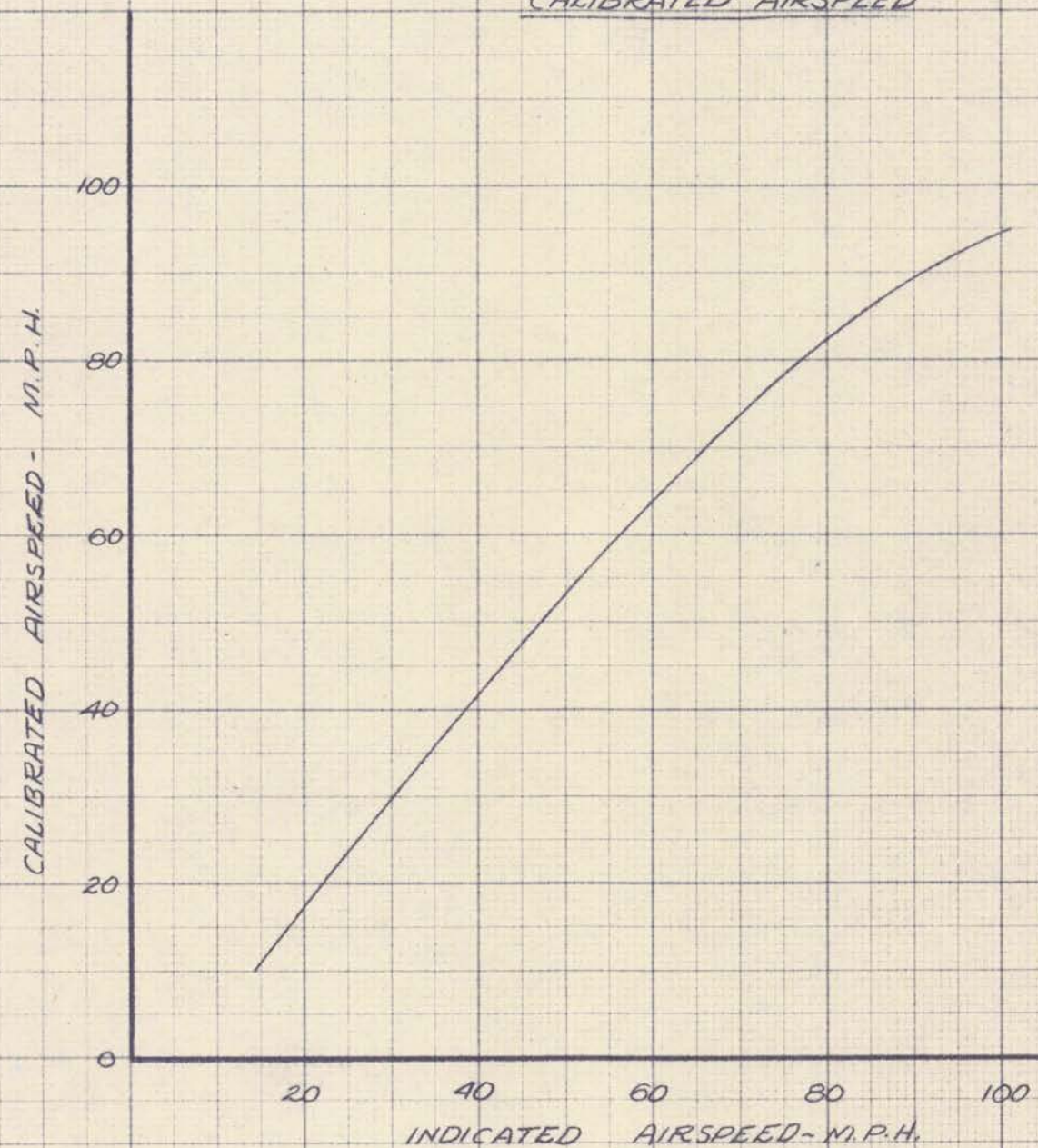

FIG. 7

SECTION IV

WEIGHT AND BALANCE DATA AND LOADING INSTRUCTIONS

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SECTION IV

WEIGHT AND BALANCE DATA AND LOADING INSTRUCTIONS

4. 1 GENERAL

a. The weight and balance data and loading instructions included herein are provided in order that the helicopter will be operated within its certified weight and balance limits. Operation outside these limits is prohibited. It is the responsibility of the operating personnel to see that the helicopter is never loaded to exceed these limits.

b. Weight Limits

The gross weight of the helicopter should never exceed 2300 lbs.

c. Location of Datum

The datum for horizontal balance is structural Station 0 which is located 160.0 inches forward of the jig point. The jig point is a hole drilled in a gusset at the intersection of two fuselage tubes with the upper longeron on the right hand side of the helicopter.

d. Center of Gravity Limits

1. Forward 93. 5 inches aft of datum.
2. Aft 98. 0 inches aft of datum.

4. 2 WEIGHT RECORDS

a. General

The helicopter has been weighed prior to delivery and the delivery weight empty is given in the Basic Weight and Balance Record. The delivered helicopter includes all items which are marked with a check (✓) in the Equipment List. Any change in the Delivery Basic Weight and Balance brought about by repair or modification of the helicopter in the field shall be recorded on Form ACA337 and this new weight and balance data should also be entered on the Basic Weight and Balance Record in this manual on Chart C.

4. 3 USE OF CHART "E"

a. To the running total weight and moment/100 obtained from chart "C" add the weight and moment/100 of the items of removable load (pilot, co-pilot, fuel, oil, baggage, ballast) obtained from the tables included in chart "E". The total obtained is the "TAKE-OFF" gross weight and moment/100.

b. On the center of gravity limits table determine whether or not the values of weight and moment arrived at in 4. 3 (a), gives a CG that falls within the allowable center of gravity range.

c. To assure that the helicopter will remain within the balance range throughout the flight, deduct the weight and moment/100 for the expendable items (fuel, etc.) and check the resultant on the center of gravity chart. If additional load will be picked up at some point during the mission a check on the balance should be made.

d. If the moment/100 for the weight of the particular mission being checked falls outside the limits shown on the center of gravity table the helicopter is not properly loaded. If possible the load should be redistributed to bring the helicopter within limits. If the machine is still tail heavy, ballast as required should be carried. This ballast should preferable be installed in the co-pilot's seat and secured with the safety belt.

4. 4 LOADINGS

Loadings should be based on actual crew weights including parachutes when carried. The most forward condition exists when the helicopter is full of fuel and is carrying a heavy pilot and co-pilot. The most aft condition occurs when a very light pilot is flying solo with a light fuel load.

a. Example Loading

The helicopter will take off with crew of two and full fuel, will fly to a point 50 miles away, drop off the co-pilot. The helicopter will be loaded with three 50 pound sacks of mail and will return to its original base.

1. For Flight Out

	Wt.	Moment/100
Weight empty (from Chart C)	1630	1686
Oil - 2.0 gallons (Chart E, Table III)	15	2
Fuel - 30 gallons (Chart E, Table II)	180	167
Pilot - 210 lbs. including chute (Chart E, Table I)	210	115
Co-Pilot - 170 lbs. including chute (Chart E, Table III)	170	94
TOTAL	2209	2064

Enter Table V, center of gravity limits, at 2200 lbs. (nearest round figure), read across until moment /100 nearest 2064 is reached. This shows CG to be between 93.5 and 94.5 which is within specified limits.

Check for no fuel condition

	Wt.	Moment/100
Total as determine in (a)	2209	2067
Subtract fuel	-180	-167
No Fuel Total	2029	1900

From Table V, it is seen that the CG for this condition is between 93.5 and 94.5. Therefore machine balances for the entire flight.

2. For Flight Back

	Wt.	Moment/100
Weight empty (Chart C)	1630	1686
Oil Full (Chart E, Table III)	15	2
Fuel-gage indicates 18 gallons) (Chart E, Table II)	108	100
Pilot - 210 including chute (Chart E, Table I)	210	115
Mail-lashed in center of baggage compartment (Chart E, Table IV)	150	143
TOTAL	2113	2046

From Table V, CG is between 95.5 and 96.5 and is therefore satisfactory.

Check for no fuel condition

	Wt.	Moment/100
Total as determined in (b)	2113	2046
Less fuel	-108	-100
No Fuel Total	2005	1946

From Table V, CG is at 97.5 and is therefore satisfactory.

4.5 LIMITATIONS

a. Baggage Compartment Floor

Not over 200 pounds should be carried in the baggage compartment. Weight shall be distributed so as to not exceed concentrated loads of more than 40 pounds/square foot.

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CHART E

TABLE I
CREW OR BALLAST TABLE

Wt.	Arm	Moment/100
10	55	6
20	55	11
30	55	17
40	55	22
50	55	28
60	55	33
70	55	39
80	55	44
90	55	50
100	55	55
110	55	61
120	55	66
130	55	72
140	55	77
150	55	83
160	55	88
170	55	94
180	55	99
190	55	104
200	55	110
210	55	115
220	55	121
230	55	127
240	55	132

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CHART E

TABLE II
FUEL TABLE

Gal.	Lb.	Arm	Moment/100
1	6	93	6
2	12	93	11
3	18	93	17
4	24	93	22
5	30	93	28
6	36	93	33
7	42	93	39
8	48	93	45
9	54	93	50
10	60	93	56
11	66	93	61
12	72	93	67
13	78	93	73
14	84	93	78
15	90	93	84
16	96	93	89
17	102	93	95
18	108	93	100
19	114	93	106
20	120	93	112
21	126	93	117
22	132	93	123
23	138	93	128
24	144	93	134
25	150	93	140
26	156	93	145
27	162	93	151
28	168	93	156
29	174	93	162
30	180	93	167
31	186	93	172
32	192	93	179
33	198	93	184
34	204	93	190
35	210	93	195

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CHART E

TABLE III
OIL TABLE

Gal.	Lb.	Arm	Moment/100
2.00	15	128	2

TABLE IV
BAGGAGE OR CARGO TABLE

Wt.	Arm	Mom/100	Arm	Mom/100	Arm	Mom/100	Arm	Mom/100	Arm	Mom/100
10	85.0	9	90	9	95	10	100	10	105	11
20	85.0	17	90	18	95	19	100	20	105	21
30	85.0	26	90	27	95	29	100	30	105	32
40	85.0	34	90	36	95	38	100	40	105	42
50	85.0	43	90	45	95	48	100	50	105	53
60	85.0	51	90	54	95	57	100	60	105	63
70	85.0	60	90	63	95	67	100	70	105	74
80	85.0	68	90	72	95	76	100	80	105	84
90	85.0	77	90	81	95	86	100	90	105	95
100	85.0	85	90	90	95	95	100	100	105	105
110	85.0	94	90	99	95	105	100	110	105	116
120	85.0	100	90	108	95	114	100	120	105	126
130	85.0	111	90	117	95	124	100	130	105	137
140	85.0	119	90	126	95	133	100	140	105	147
150	85.0	128	90	135	95	143	100	150	105	158
160	85.0	136	90	144	95	152	100	160	105	168
170	85.0	145	90	153	95	162	100	170	105	179
180	85.0	153	90	162	95	171	100	180	105	189
190	85.0	162	90	171	95	181	100	190	105	200
200	85.0	170	90	180	95	190	100	200	105	210

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CHART E

TABLE V

Center of Gravity Limits

Fwd. Limit Sta. 93.5
Aft Limit Sta. 98.0
Gross Weight Not To Exceed 2300 Lbs.

WEIGHT AND BALANCE TABLE

c.g. location	93.5	94.5	95.5	96.5	97.5	98.0
Gross Wt.	Moment/100					
1700	1590	1607	1624	1641	1658	1666
1725	1613	1630	1647	1665	1682	1691
1750	1636	1654	1671	1689	1706	1715
1775	1660	1677	1695	1713	1731	1740
1800	1683	1701	1719	1737	1755	1764
1825	1706	1725	1743	1761	1779	1789
1850	1730	1748	1767	1785	1804	1813
1875	1753	1791	1809	1828	1838	
1900	1777	1796	1812	1834	1853	1862
1925	1800	1819	1828	1858	1877	1887
1950	1823	1843	1862	1882	1901	1911
1975	1846	1866	1886	1906	1926	1936
2000	1870	1890	1910	1930	1950	1960
2025	1893	1914	1934	1954	1974	1985
2050	1917	1937	1958	1978	1999	2009
2075	1940	1961	1982	2002	2023	2034
2100	1964	1985	2006	2027	2048	2058
2125	1987	2008	2029	2050	2072	2083
2150	2010	2032	2053	2075	2096	2107
2175	2034	2055	2077	2099	2121	2132
2200	2057	2079	2101	2123	2145	2156
2225	2080	2103	2125	2147	2169	2181
2250	2104	2126	2149	2171	2194	2205
2275	2127	2150	2173	2195	2218	2230
2300	2151	2174	2197	2220	2243	2254

nn-1-9

• BASIC WEIGHT and BALANCE RECORD •

CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT & BALANCE

AIRPLANE MODEL MC-4C SERIAL NO. _____

CHART C SHEET

DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE				RUNNING TOTAL BASIC AIRPLANE		
				ADDED (+)		REMOVED (—)				
	IN	OUT		WEIGHT	MOMENT / 100	WEIGHT	MOMENT / 100	WEIGHT	MOMENT / 100	

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EQUIPMENT LIST - SERIALS 1000-1005

Chk.	No.	Item	Manufacturer and Part No.	WT.	Arm
		ROTORS			
	1	3 Blades Fwd.	McCulloch Motors Aircraft Div. Dwg. 22113-5	52.8	2.5
	2	3 Blades Aft	McCulloch Motors Aircraft Div. Dwg. 22113-7	52.5	194.5
	3	Rotor Brake Installation	McCulloch Motors Aircraft Div. Dwg. 27621		
		ENGINE AND ENGINE ACCESSORIES - FUEL AND OIL SYSTEMS			
	101	1 Engine	Franklin 6A4-200-C-6 Modified per McCulloch Motors Dwg. 27575	301.0	126.0
	102	1 Starter	Delco Remey-1109662	18.0	109.0
	103	1 Cooling Fan	McCulloch Motors Aircraft Div. Dwg. 22540	11.5	146.0
	104	Oil Cooler	McCulloch Motors Aircraft Div. Dwg. 27507 (Modified Harrison 8518115)	8.5	137.0
	105	Carb. Air Heater	McCulloch Motors Aircraft Div. Dwg. 27545	1.0	117.0
	106	System Fuel and Oil		4.0	120.0
	107	Unusable Fuel		6.0	93.0
		LANDING GEAR			
	201	2 Main Wheel and Brake Assembly	B.F. Goodrich D-3-142M wheel D-2-113 Brake Assy. Modified per McCulloch Motors Dwg. 22224	9.5	127.0
	202	2 Main Wheel Tires	B.F. Goodrich 500-4-Type III 4-ply tire rating with regular tube	13.0	127.0
	203	2 Main Shock Struts	McCulloch Motors Aircraft Div. Dwg. D75732	9.0	125.0

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EQUIPMENT LIST - SERIALS 1000-1005 (cont)

Chk.	No.	Items	Manufacturer and Part No.	Wt.	Arm
	205	1 Nose Wheel	B.F. Goodrich B-3-41A	2.0	33.0
	206	1 Nose Wheel Tire and Tube	B.F. Goodrich - 10.00 smooth contour - 6-ply rating with regular tube	3.75	33.0
	207	1 Nose Shock Strut	McCulloch Motors Aircraft Div. Dwg. No. D76000	3.7	30.00
		ELECTRICAL EQUIPMENT			
	301	Generator	McCulloch Motors Aircraft Div. Dwg. 27533 (Modified Pierson B-2450)	23.0	137.0
	302	Battery	An3151-2	56.0 (spec)	106.0
	303	Voltage Regulator	AN1042-5 Bendix Type 1042-5	3.4	117.0
	304	Generator Cutout	BuAer E-1600-1	2.6	116.0
	305	Lighting Sys.	McCulloch Motors Aircraft Dwg. 22828 and 22844	Use Actual Wt.	
		INTERIOR EQUIPMENT			
	401	Flight Manual			
	402	Maintenance Manual			
	403	2 Seats (Cushions and Backs)		14.0	56.0
	404	2 Safety Belts	Brown Line-WB2000	2.0	59.0
	405	2 Cabin Doors	McCulloch Motors Aircraft Div. Dwg. 22975	23.0	47.0
	406	Cabin Heat Instal.	McCulloch Motors Dwg. 27894	Use Actual Wt.	
		INSTRUMENTS			
	450	Airspeed Indicator	AN5860-2	.50	25.0
	451	Altimeter	AN5760-4B	1.3	25.0
	452	Compass	Kollsman Type B-21	1.0	25.0
	453	Manifold Press. Gage	U.S. Gage Co. - AW-2-3/4-14F	1.0	25.0
	454	Fuel Quantity Gage	Liquidometer-LA 102-19 Modify per McCulloch Mtrs. Aircraft Div.Dwg. 27857	.7	25.0

EQUIPMENT LIST - SERIALS 1000-1005 (cont)

Chk.	No.	Items	Manufacturer and Part No.	Wt.	Arm
		INSTRUMENTS			
	455	Cylinder Head Temp.	AN5536-1	1.5	21.0
	456	Dual Tachometer	AN5530-2 Modify per McCulloch Motors Aircraft Div. Dwg. 27825	1.6	25.0
	457	Voltammeter	NAF-1091E-60-Weston	.6	25.0
	458	Oil Press. Gage	AN5771-2	.4	25.0
	459	Oil Temperature	AN5790-6	1.0	25.0
	460	Transmission Oil Warning Light	AN3157-2 (2 Req.)		25.0
	461	Pitot Static Head	Kollsman - B6	3.	6.0
		MISCELLANEOUS EQUIPMENT (OPTIONAL)			
	600	Radio Control Unit	ARC - Type 39	2.0	29.0
	601	VHF Receiver No. 1	ARC - Type R-19	8.3	14.0
	602	Range Receiver No. 1	ARC - Type R-11A	9.0	18.0
	603	VHF Transmitter No. 1	ARC - Type T-11A	3.4	24.0
	604	VHF Transmitter No. 2	ARC - Type T-13	3.4	14.0
	605	Junction Box	ARC - Type J-13	1.5	15.0