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REPORT NO. NE-25

UNCLASSIFIED

FLIGHT OPERATING INSTRUCTIONS

for

USAF MODEL X-4 AIRPLANE

PREPARED BY NORTHROP AIRCRAFT, INC.

HAWTHORNE, CALIFORNIA

Published under joint authority of the Commanding General, Army Air Forces, and the Chief of the Bureau of Aeronautics.

Commanding Officers will be responsible for bringing this Technical Order to the attention of all pilots cleared for operation of the subject aircraft as well as those undergoing Transition Flying Training as contemplated in AAF Regulation 50-16.

Appendix I of this publication shall not be carried on missions where there is a reasonable chance of its falling into the hands of an unfriendly nation.

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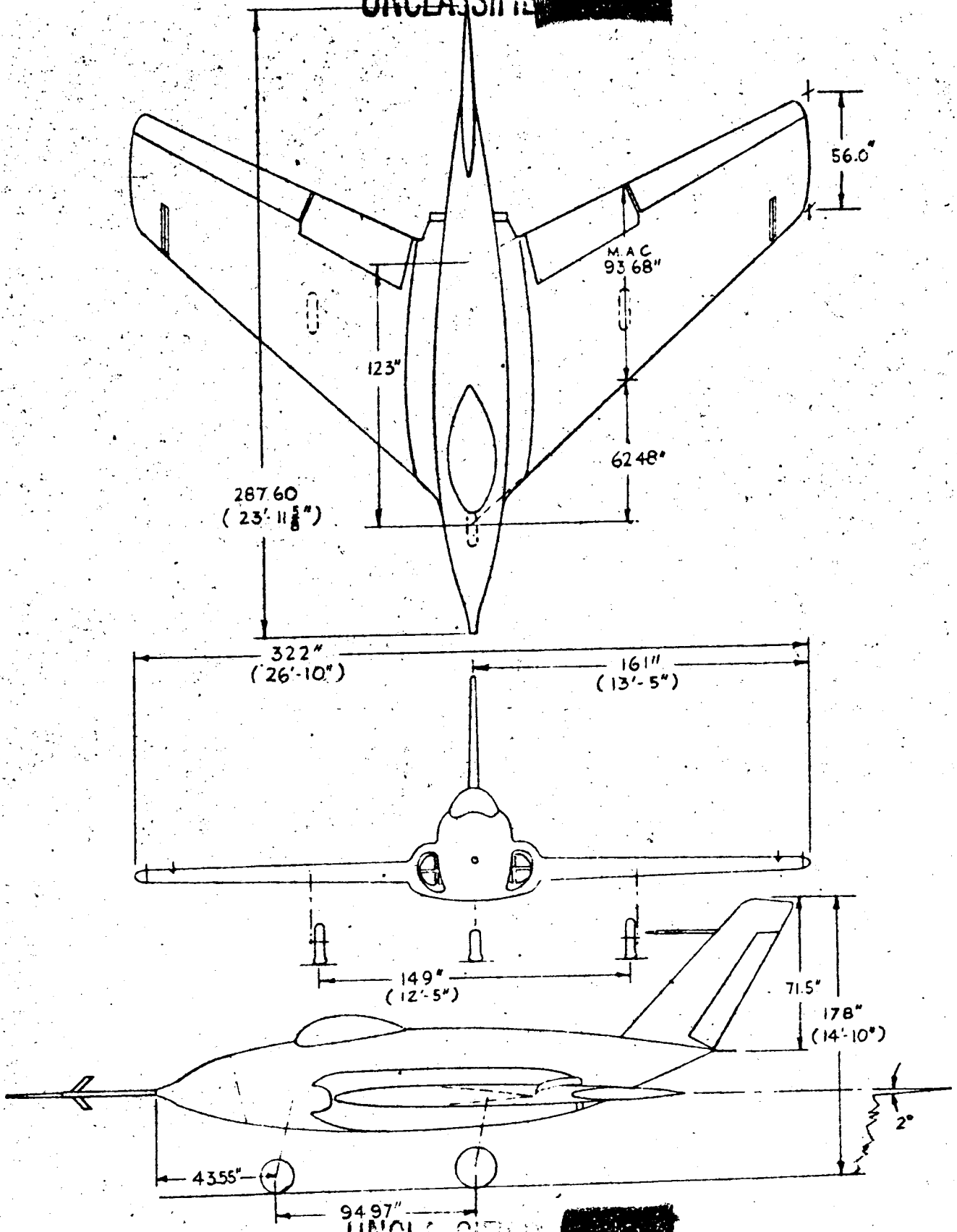


FIG. 1-1. THREE VIEWS OF AIRPLANE

SECTION I

DESCRIPTION

1-1. AIRPLANE. (See figure 1-1.)

1-2. GENERAL.

1-3. The airplane is a single place, all metal, twin jet propelled, low wing experimental airplane manufactured by Northrop Aircraft, Inc. for the purpose of aerodynamic research. The airplane is powered by two Westinghouse, type J30-WE-7-9 engines, each rated at 1600 pounds thrust at sea level. The wing is of multi-shear-web, riveted magnesium construction, covered by a machine-tapered skin. The fuselage is of semi-monocoque construction. The pilot is fully enclosed within the fuselage. The airplane has a wing span of 26 feet, 10 inches, a length of 23 feet, 3 inches, and height of 14 feet, 1 inch. The normal gross weight, with a full internal fuel load, radio, and accessory installations is 7200 pounds.

1-4. COCKPIT ENCLOSURE.- The cockpit area is covered by an enclosure assembly fastened to the fuselage structure by two open-hook-type hinges. The canopy and release mechanism are integral with the enclosure which can be jettisoned.

1-5. NORMAL ENCLOSURE RELEASE MECHANISM.- A yellow ball-handle at the right side of the enclosure is geared to enclosed torque tubes which extend longitudinally along both sides of the enclosure assembly to lock and unlock the enclosure. An outside release handle located on the left forward section of the enclosure provides a means of externally opening and closing the enclosure.

1-6. FLIGHT CONTROLS. (See figures 1-2, 1-3, and 1-4.)

1-7. DESCRIPTION.

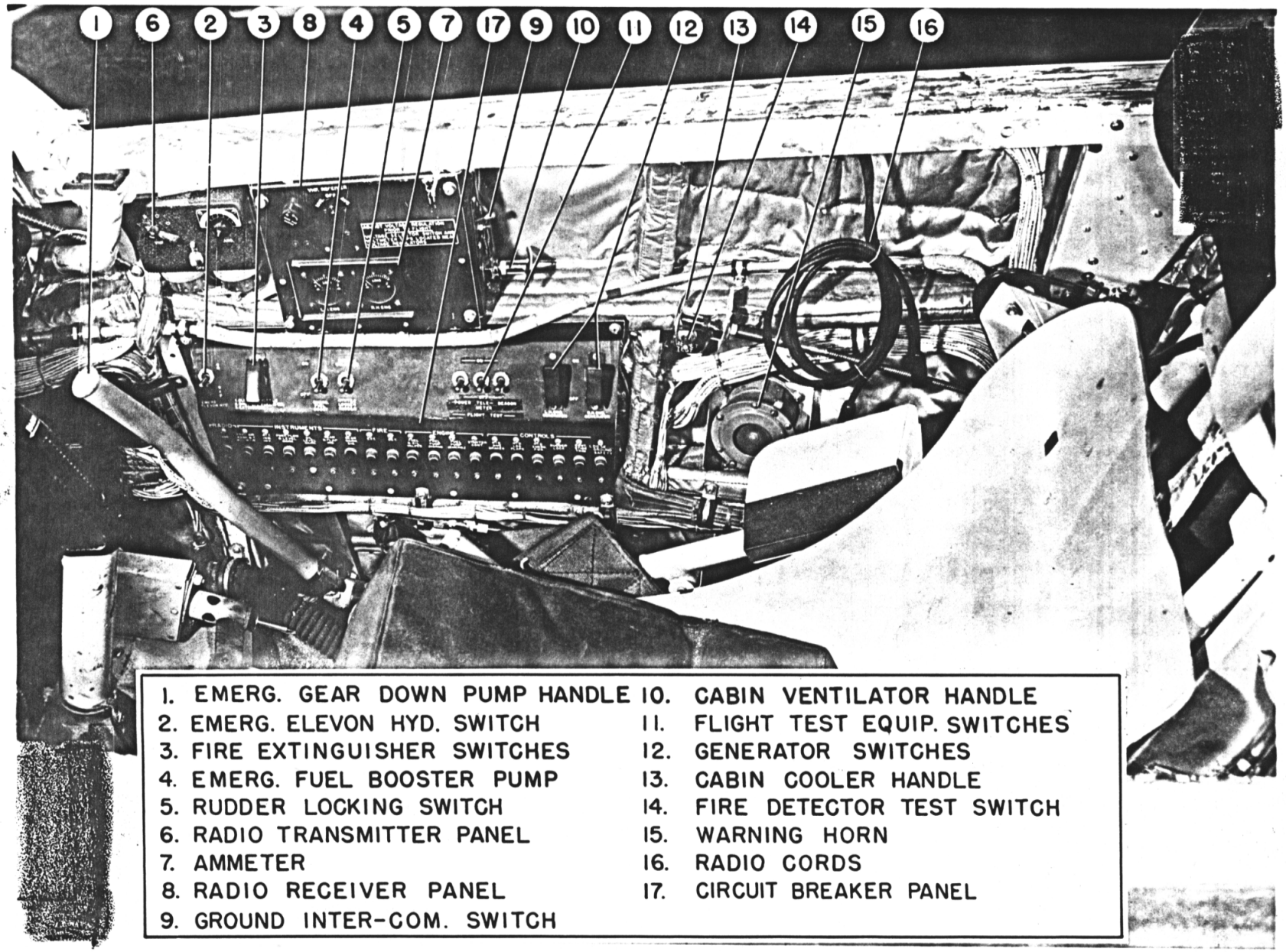
1-8. RUDDER.- Pilot movement of the conventional rudder pedals (see figure 1-4, ref. 31) operates an electrically powered actuator, which controls the rudder surface through a cable control system. Should the actuator become inoperative, a control switch (see figure 1-2, ref. 5) in the cockpit, when operated, will lock the actuator and rudder surface in the neutral position. The rudder actuator is geared to operate at four different speeds, each relative to the speed with which the pilot moves the rudder pedals. Moving the foot pedals at a rate which provides a rudder surface travel of 3.33 degrees per second, will close the actuator direction switch and start the actuator at the first gear speed, in the direction desired. Faster movement of the foot pedals at a rate equivalent to a rudder surface travel of 15 degrees per second, will close the second-speed switch, with the resulting actuator shift to the second-gear operation. A faster movement of the rudder foot pedals will activate the switch controlling the third-gear-speed of the operation of the actuator. This third-gear-speed will provide a rudder surface deflection equivalent to a travel velocity of 22.5 degrees per second. If a still higher rate of rudder surface deflection is required, the switch controlling the actuator's fourth-gear-speed will close the circuit when activated by moving the rudder foot pedals at a rate of speed equivalent to a rudder surface movement velocity of 30 degrees per second.

1-9. ELEVONS.- The elevon control surfaces, at the outer trailing edge of the wing, function as both elevator and aileron. A conventional cable control system, actuated by pilot movement of the

control stick, operates the servo valves which in turn operate the four hydraulic cylinders controlling the movement of the elevon surfaces. The hydraulic power used in the elevon operation is normally supplied by the engine-driven pumps. A standby pump is provided to furnish hydraulic power if these pumps fail. A switch, located on top of the control stick, permits the pilot to operate the standby pump for a short period of time. Sustained operation of the standby pump is accomplished by a switch on the pilot's switch panel.

1-10. ELEVATOR TRIM.- Elevator trimming of the elevon control surfaces, is accomplished by the pilot moving the control stick to the position necessary to maintain the desired flight attitude. An electrically operated hydraulic valve is actuated by movement of the slide-action switch on the control stick. This is an arrangement to reduce the applied stick force to zero with the control stick in any position from elevon neutral to 8 degrees up. The pilot must apply the initial force to maintain the trim position desired until the elevator switch is operated. Two speed rates for elevator trim have been provided, and both are automatically selected by conditions of flight. The pilot has no direct means of controlling the trim rate. With the landing gear in the up position, the slow rate of elevator trim is automatically selected, for both normal and high speed flight. When the landing gear is lowered for either take-off or landing, the fast trim rate is automatically selected.

1-11. DIVE BRAKES.- The dive brakes are controlled by a momentary-type toggle switch (see figure 1-3, ref. 5) mounted at the left-hand



1. EMERG. GEAR DOWN PUMP HANDLE
2. EMERG. ELEVON HYD. SWITCH
3. FIRE EXTINGUISHER SWITCHES
4. EMERG. FUEL BOOSTER PUMP
5. RUDDER LOCKING SWITCH
6. RADIO TRANSMITTER PANEL
7. AMMETER
8. RADIO RECEIVER PANEL
9. GROUND INTER-COM. SWITCH
10. CABIN VENTILATOR HANDLE
11. FLIGHT TEST EQUIP. SWITCHES
12. GENERATOR SWITCHES
13. CABIN COOLER HANDLE
14. FIRE DETECTOR TEST SWITCH
15. WARNING HORN
16. RADIO CORDS
17. CIRCUIT BREAKER PANEL

FIG. 1-2. COCKPIT - RIGHTHAND VIEW

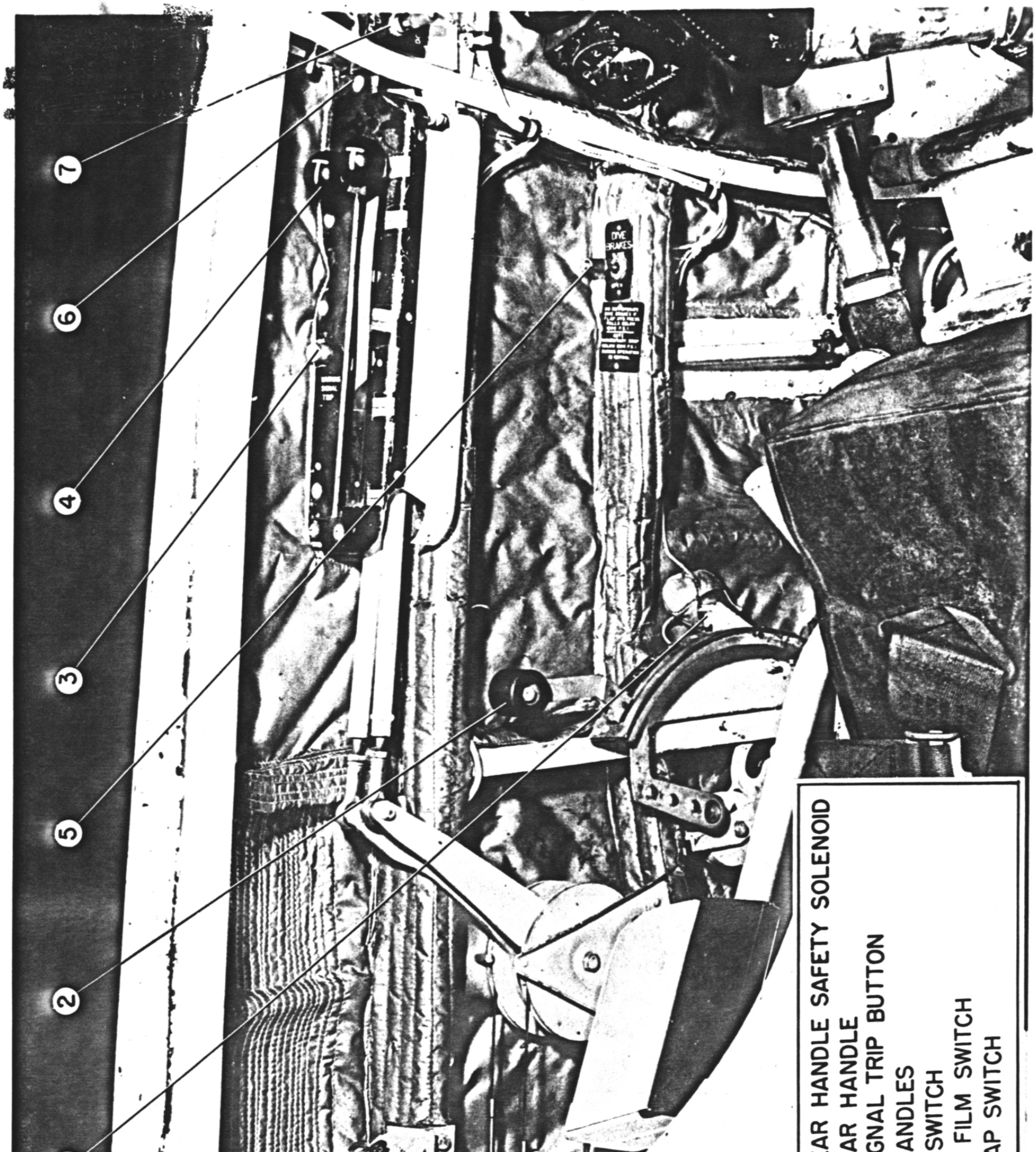
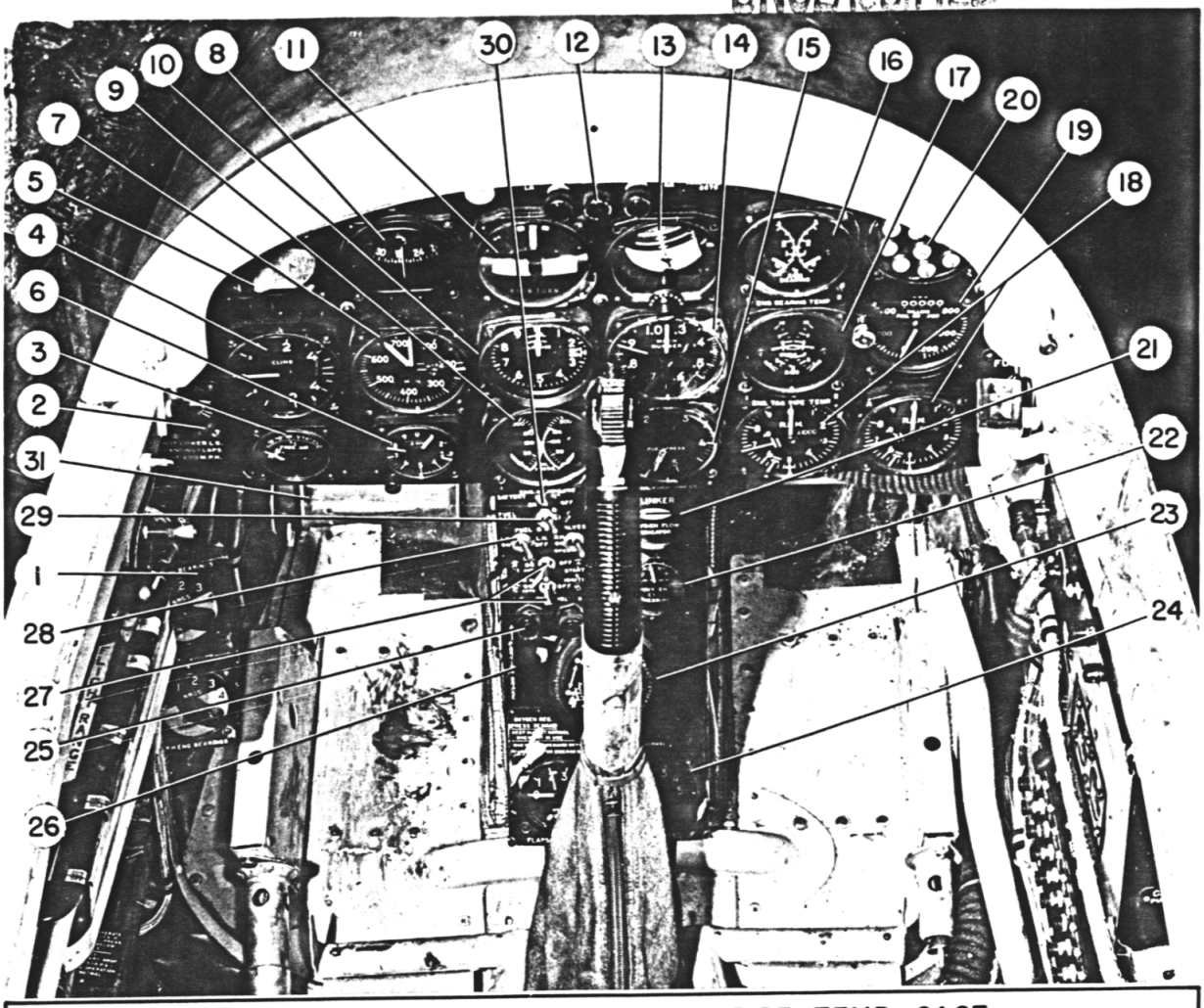


FIG. 1-3. COCKPIT - LEFTHAND VIEW



1. ENGINE BEARING SWITCHES
2. FLAP & DIVE BRAKE POSITION IND.
3. FREE AIR TEMP. GAGE
4. RATE OF CLIMB INDICATOR.
5. CLOCK
6. ACCELEROMETER
7. AIR SPEED INDICATOR
8. COMPASS
9. OIL PRESSURE GAGE
10. ALTIMETER
11. TURN & BANK INDICATOR
12. LANDING GEAR SAFE LIGHTS
13. UNIVERSAL ATTITUDE GRYO
14. MACH METER GAGE
15. FUEL PRESSURE INDICATOR
16. ENGINE BEARING TEMP. GAGE
17. TAILPIPE TEMP. GAGE
18. TACHOMETER
19. FUEL FLOW INDICATOR
20. LANDING GEAR DOOR IND. LIGHTS
21. OXYGEN BLINKER
22. OXYGEN PRESSURE GAGE
23. OXYGEN REGULATOR
24. HYDRAULIC PRESSURE GAGES
25. OIL LEVEL WARNING LIGHTS
26. PARKING BRAKE
27. STARTER SWITCHES
28. FUEL & OIL SHUT OFF SWITCHES
29. FUEL BOOSTER SWITCH
30. BATTERY SWITCH
31. RUDDER PEDALS

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FIG. 1-4. COCKPIT - FRONT VIEW

side of the cockpit. Electrically-actuated hydraulic valves operate the dive brake surfaces. With the dive brake control switch in the "OPEN" position, the dive brake surfaces will open until either the aerodynamic hinge moment overcomes the actuating cylinder, or the cylinder bottoms at a maximum surface deflection of 60 degrees. The dive brake control circuit is so designed that opening the dive brakes is impossible with the landing gear extended. However, dive brakes can be closed with landing gear extended.

1-12. LANDING FLAPS.- When only the lower surfaces of the split dive brakes are extended, the surfaces function as landing flaps. A momentary type toggle switch (see figure 1-3, ref. 7) is located at the lefthand side of the main instrument panel, immediately below the landing flap position indicator. The flaps are either raised or lowered by placing the control switch in either the "UP" or "DOWN" position. The flaps may be stopped at any time by releasing switch at the desired flap position. The flap-down-travel is limited to an extreme position of 30 degrees.

1-13. LANDING GEAR.

1-14. GENERAL.

1-15. The airplane is equipped with a hydraulically-actuated tricycle landing gear. Landing-gear fairing door locks are operated by movement of the landing-gear-control handle (see figure 1-3, ref. 2). The fairing doors are actuated automatically by movement of the gears. The main gears are equipped with spot-type brakes. A conventional shimmy damper is used on the nose gear. Provision for emergency extension of the gear has been made.

1-16. LANDING-GEAR CONTROLS.

1-17. DESCRIPTION.- The landing-gear control handle is located on

the lefthand side of the cockpit. Two door locks and one landing-gear lock installed on each landing gear are actuated by a conventional system of control cables, when operated by movement of the landing-gear control handle. The same handle also controls the hydraulic power that raises and lowers the landing gear. The system is so designed that the door locks are unlatched before the gears begin to lower. The landing-gear control handle must remain in the "DOWN" position during the entire period in which the gears are extended; after the landing gear has been raised and locked in position, the control handle must be returned to the neutral position.

1-18. LANDING-GEAR POSITION INDICATOR LIGHTS. (See figure 1-4, ref 12.)- Three green lights, one for each gear, are located at the top center of the instrument panel to indicate a safe landing-gear condition. A red, unsafe, light is installed at the left side of the enclosure. Each green light glows only after its respective gear is down and locked in position; the red light glows and the warning horn will sound when the landing gears are up and the airspeed of the airplane falls to 170 mph or below.

1-19. LANDING-GEAR SAFETY SWITCH.- A safety switch is installed on the lefthand main-gear strut to prevent the inadvertent raising of the gear before the airplane is airborne.

1-20. LANDING-GEAR WARNING.- At take-off, the warning horn (see figure 1-2, ref. 15) located on the cockpit rail opposite the pilot's shoulder, will sound and the red warning light will glow, when the landing gear is between the up and down lock positions. Depress the signal reset switch to shut off the horn; the light will continue to glow until the gear and gear door locks are closed.

1-21. LANDING-GEAR EMERGENCY EXTENSION.

1-22. Should the righthand engine hydraulic pump fail in operation, a hand pump (see figure 1-2, ref 1) located at the righthand side of the cockpit, is provided for emergency extension of the landing gear.

NOTE

The landing gear selector valve must be in the down position before actuating the emergency hand pump.

1-23. BRAKE CONTROLS.

1-24. The disc-type brakes are operated by conventional toe brake rudder pedals. The brake hydraulic system is self-contained and is affected by failure of the hydraulic system only if such failure bleeds the lefthand reservoir dry.

1-25. PARKING BRAKES.- A parking-brake handle (see figure 1-4, ref. 26) located at the bottom of the pilot's switch pedestal, is provided for setting the brake system with the airplane on the ground. To set the parking brakes, lift the parking-brake handle and depress both brake pedals to increase the hydraulic pressure. Place the parking-brake handle in the down position and allow the pedals to return to neutral. Release the parking brakes by depressing the brake pedals with a force greater than that originally used to set them; release both pedals.

WARNING

The parking brakes may be fully or partially on with no indication to the pilot. Always check the parking brakes before starting to taxi.

1-26. EMERGENCY BRAKES.- No installation has been provided for braking the airplane in an emergency.

1-27. ELECTRICAL SYSTEM.

1-28. DESCRIPTION.

1-29. The airplane is equipped with a 24-volt, single conductor electrical system, with internal power supplied by two engine-driven generators and a single battery. Operation of the voltage regulators and alternator is automatic. Two ammeters provide load indication for the pilot.

1-30. CIRCUIT BREAKERS.- Each electrical circuit in the airplane is provided with a thermal-type circuit breaker. The circuit breakers (see figure 1-2, ref. 17) are all installed on a panel located below the cockpit rail to the right and forward of the pilot. The circuit breakers for any particular circuit must be closed before the circuit can operate. Circuit breakers must be reset by pushing the circuit-breaker button switch for the circuit that has failed.

1-31. EXTERNAL POWER RECEPTACLE.- An external power source is essential for ground starting operation. Two external power receptacles located adjacent to each other are installed on the lefthand side of the fuselage aft of the cockpit canopy. The only type of ground power to use on this airplane is two GT-13 batteries. Do not use a rectifier unit.

1-32. BATTERY.- One 24-volt, 17 ampere-hour battery is provided as a source of internal electrical power during flight. The battery provides full voltage for ignition during the ground starting operation and for windmill starts during flight. At extremely low engine idling speeds, or if the generators should fail in operation, the battery will operate a limited number of items at reduced voltage.

1-33. BATTERY CONTROL SWITCH.- The pilot's battery control switch

(see figure 1-4, ref. 30) is located on the pilot's switch pedestal, immediately forward of the control stick. The switch is marked "BATTERY SWITCH" and has an "ON" and "OFF" position.

1-34. GENERATORS.- A 200-ampere generator is installed on each engine. The two generators are connected for parallel operation and are regulated for an output of 28.5 volts. Either generator will provide complete power requirements for the airplane.

1-35. GENERATOR CONTROL SWITCH.- Two control switches (see figure 1-2, ref. 12) located on the pilot's switch panel and marked "GENERATORS," "L.H." and "R.H." provide control over the generator operation.

1-36. FUEL SYSTEM. (See figure 1-5.)

1-37. GENERAL.

1-38. Fuel contained in each wing and in a single tank located immediately aft of the pilot, supply a total of 240 U.S. gallons, AN-F-48 or AN-F-28, Grade 100/130 fuel, under pressure to both engines. Of this, 225 gallons is usable fuel. The fuselage tank will hold 50 gallons of fuel at initial filling. This fuel is used first until the tank contains about 27 gallons, after which the wing tanks will supply fuel to maintain this 27-gallon level. A fuel system booster pump, installed in the fuselage tank, must operate continuously to prevent system cavitation. An emergency booster pump is provided for normal use during take-off and as a standby pump for emergency operation. Fuel is automatically transferred from the wing tanks to the fuselage tank using compressed air from the engines' compressor sections.

1-39. FUEL LOW-LEVEL WARNING LIGHT.- The fuel low-level warning light, located on the extreme righthand side of the instrument panel,

glows when the wing tanks are empty and only the fuselage tank contains fuel or if any malfunction stops the flow of fuel from the wing tanks to the fuselage tank. After the warning light first begins to glow, and with engine operating at 11,500 rpm, the fuselage tank will supply fuel to sustain a flight of seven-minutes at sea level, nine minutes at 10,000 feet altitude, eleven minutes at 20,000 feet altitude, 15 minutes at 30,000 feet altitude.

1-40. FUEL INDICATOR.- A fuel pressure gage and a voltmeter-type fuel-flow meter are installed on the instrument panel to provide indication of both the rate of fuel flow and the amount of fuel consumed.

1-41. FUEL SYSTEM CONTROLS.

1-42. FUEL BOOST PUMP SWITCHES.- Switches (see figure 1-4, ref. 29; figure 1-2, ref 4) are provided to control the operation of the system and standby booster pumps. Both booster pumps must be in operation during takeoff. At the pilot's discretion the standby booster pump is turned off after the airplane is airborne.

1-43. FUEL AND OIL SHUT-OFF VALVE SWITCHES. (See figure 1-4, ref 28.)- A single toggle switch, located on the pilot's control switch pedestal, marked "FUEL & OIL SHUT-OFF," controls operation of the fuel and oil shut-off valves for the left and right-hand engines.

1-44. OIL SYSTEM.

1-45. GENERAL.

1-46. Two separate, self-contained oil systems are installed in the airplane, each system supplying oil to one engine. Each oil system tank is built into the leading edge of the air intake duct of the particular engine it serves. The airplane oil system consists of

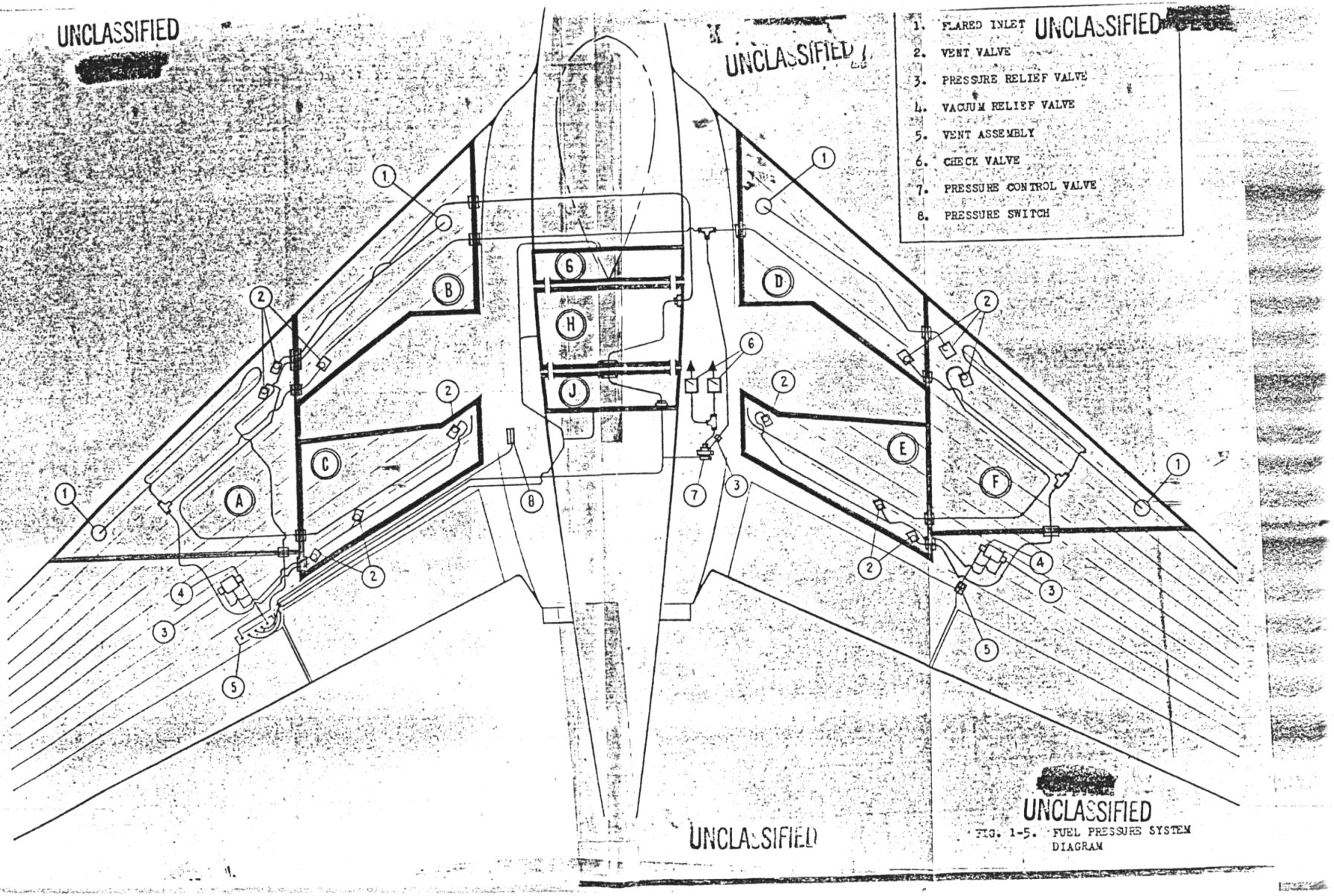

FIG. 1-5. FUEL PRESSURE SYSTEM DIAGRAM

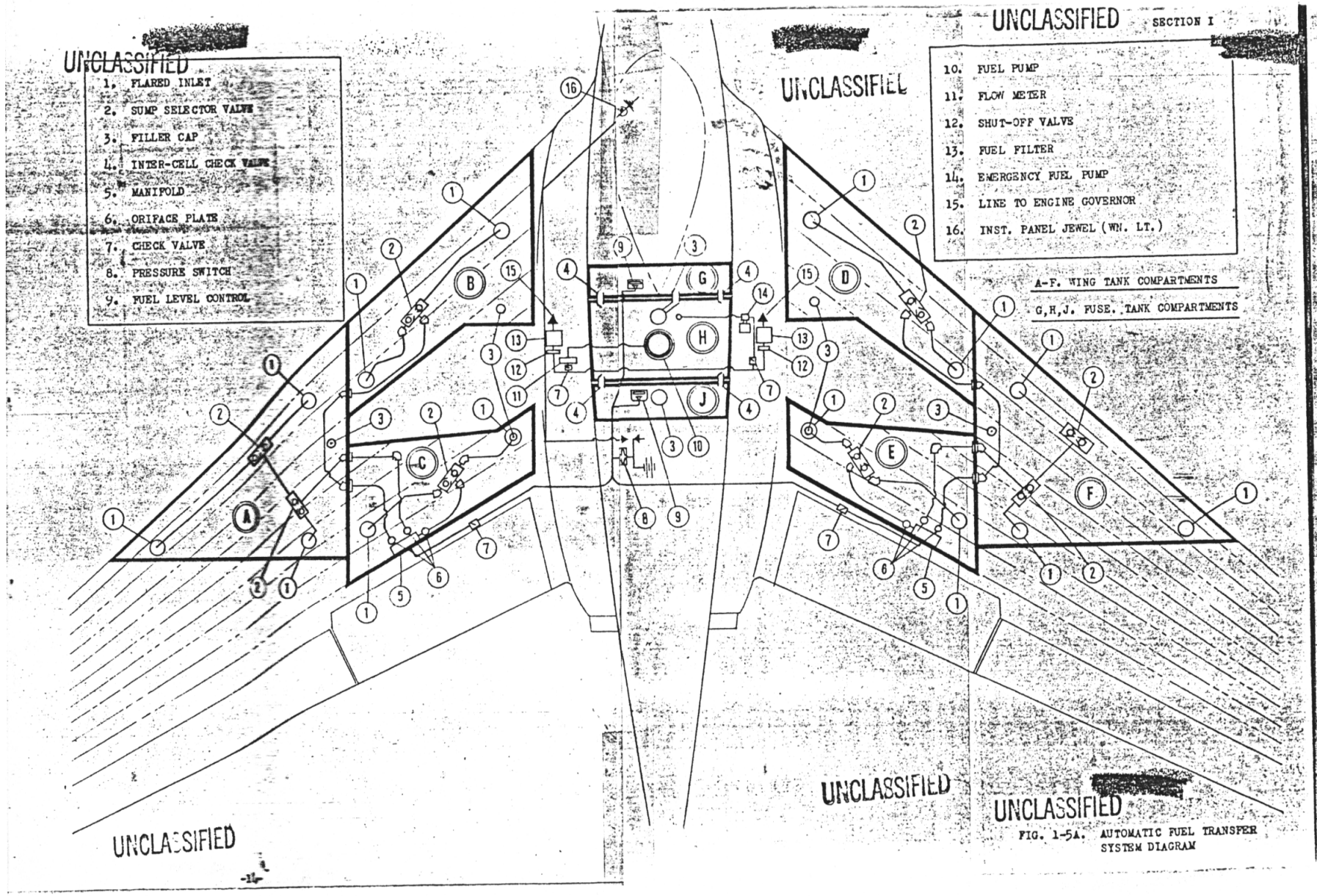

FIG. 1-5A. AUTOMATIC FUEL TRANSFER SYSTEM DIAGRAM

two tanks, oil pressure gages and the various lines, flow control units and manual controls needed to complete the systems.

1-47. OIL AND FUEL SYSTEM CONTROL SWITCH.- The oil and fuel systems shut-off valves are controlled by a single switch located on the pilot's switch pedestal.

1-48. OIL INDICATORS.- An oil pressure gage is installed on the instrument panel and an oil level warning light installed on the lower section of the pilot's pedestal. The warning light indicates when the oil has dropped to approximately two gallons.

1-49. HYDRAULIC SYSTEM.

1-50. GENERAL.

1-51. Two engine-driven 2,000 psi variable-displacement type hydraulic pumps supply power for the hydraulic system. The two-compartment hydraulic reservoir, each compartment with a capacity of 1.6 gallons of fluid, is located in the extreme nose of the fuselage. Each compartment supplies fluid to one engine-driven hydraulic pump. An electrically-driven hydraulic pump is provided for standby operation, should either or both of the main pumps fail. The lefthand engine hydraulic pump operates the lefthand dive brake cylinders, the inboard elevon cylinders and the landing flap cylinders. The righthand engine hydraulic pump operates the landing gear cylinders, the righthand dive-brake cylinders and the outboard elevon cylinders, and provides pressurization of the hydraulic reservoir. The standby pump provides a limited pressure sufficient only to operate the elevons and landing flaps. The hand pump operates only the emergency extension of the landing gear. Hydraulic temperature gages are provided. If the temperature reaches 160°F, land the airplane and

cease operation as soon as possible, to prevent further overheating of the hydraulic system.

1-52. HYDRAULIC SYSTEM CONTROLS.- The hydraulic system has no manual controls for normal operation. The system is automatically operated by the engine operation.

1-53. STANDBY HYDRAULIC PUMP SWITCH.- The standby pump control switch (see figure 1-2, ref. 2) is located on the pilot's switch panel and is marked "EMERG." "ELEVON HYD." "ON" "OFF." A switch located on the control stick is installed to provide momentary control over the standby pump for testing during flight.

1-54. ENGINES.

1-55. GENERAL.

1-56. The airplane is powered by two J30-WE-7-9 turbo-jet engines which develop a total static thrust of 3200 pounds at sea level.

1-57. ENGINE TEMPERATURE INDICATORS.

1-58. BEARING AND OIL TEMPERATURE GAGES AND SELECTOR SWITCHES. (See figure 1-4, ref. 16; figure 1-4, ref. 1.)- Dual indicating bearing and oil temperature gages are installed on the pilot's instrument panel. Two four-position selector switches are installed to the pilot's right. The first three positions of each switch will select the desired bearing giving temperature indication for that bearing on the temperature gage. The fourth positon will give an oil temperature reading on the oil temperature gage.

1-59. TAILPIPE TEMPERATURE GAGE.- This is a dual indication gage (see figure 1-4, ref. 17) registering the temperature of both tailpipes.

1-60. ENGINE CONTROLS. (See figure 1-3, ref. 4.)

1-61. GENERAL.- Engine speed is controlled by a throttle-adjusted combination all-speed governor and fuel pump. Two throttle levers at the pilot's left have stops and detents set for the following ratings:

"EMERG. POWER"	17,000 rpm
"RATED POWER"	15,700 rpm
"FLIGHT IDLE"	10,500 rpm
"GROUND IDLE"	5,000 rpm
"CUT-OFF"	

The tachometers (see figure 1-4, ref. 18) are calibrated to correspond to the engine rpm.

1-62. STARTER AND IGNITION SYSTEM.

1-63. GENERAL.- An external power source is essential for ground starting. The source of power is normally connected to the main power bus, but in starting it is isolated and connected only to the starter and the fuel booster pump. This provides full battery voltage on the main power bus for ignition and prevents discharging the battery by trying to start engines electrically in flight. The duration of the starting cycle is controlled to keep the power circuit closed until the starter current drops to approximately 160 amperes. The pilot can disconnect the starter at any time by momentarily depressing the starter switch to the "OFF" position. Windmill starting with the airplane traveling at an IAS of 200-220 mph, is the only means of starting the engines in flight. Ignition for starting is not automatically timed, but can be obtained by holding the starting switch closed as long as ignition is desired. The starter circuit is so designed that only one engine can be ground-started at a time.

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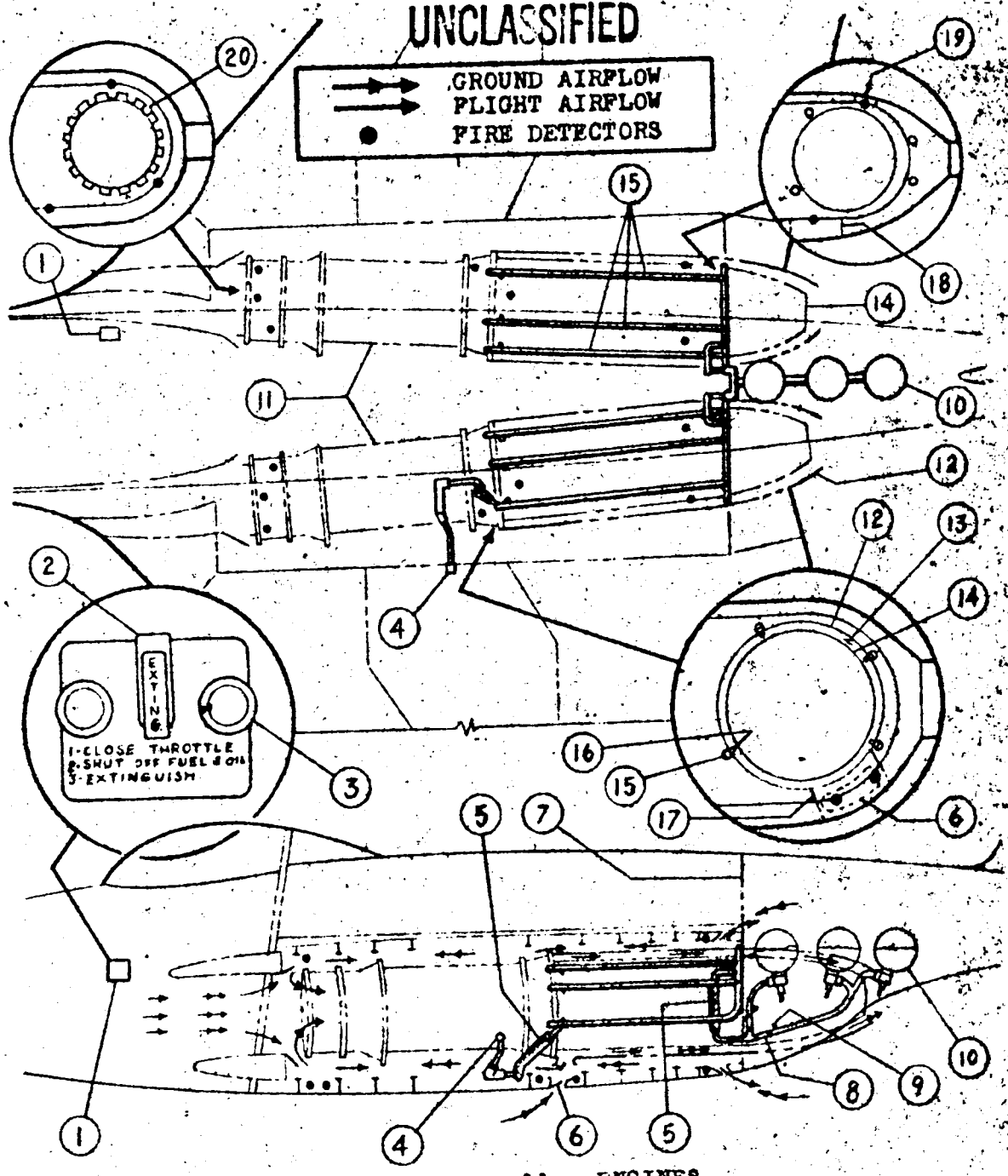

1. FIRE EXTINGUISHER CONTROLS
2. SWITCH
3. LAMP ASSEMBLY
4. GROUND QUICK DISCONNECT
5. HOSE ASSEMBLY
6. FLAPPER DOOR
7. FIRE WALL
8. CHECK VALVE ASSEMBLY
9. VENT CHECK
10. METHYL BROMIDE CONTAINERS
11. ENGINES
12. TAIL PIPE SHROUD
13. COOLING AIR GAP
14. TAIL PIPE
15. NOZZLES - FAN TYPE
16. JET NOZZLE INTO TAIL PIPE
17. SHROUD COOLING AIR DUCT
18. LOWER AIR EXIT
19. UPPER AIR EXIT
20. COOLING AIR DIFFUSER

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FIRE EXTINGUISHER SYSTEM SCHEMATIC

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1-64. STARTER AND IGNITION SWITCHES.- Each engine is provided with a combination starter-ignition control switch (see figure 1-4, ref. 27) located on the pilot's switch pedestal. The momentary toggle-type switches are marked "STARTER & IGN." with both "ON" and "OFF" positions.

1-65. FIRE EXTINGUISHER SYSTEM. (See figure 1-6.)

1-66. GENERAL.

1-67. A single shot methyl bromide fire extinguishing system is provided for controlling engine fires. Three sphere-shaped containers are located in the aft section of the fuselage.

1-68. FIRE EXTINGUISHER SYSTEM CONTROL SWITCHES.- The fire extinguisher switch control panel is located on the righthand side of the cockpit. A toggle-type operating switch (see figure 1-2, ref 3) covered by a red guard is provided for system operation. Two red warning lights, marked "L.H. ENGINE" and "R.H. ENGINE" are also located on the control panel. A test switch (see figure 1-2, ref. 14) is located aft of the control panel.

1-69. PILOT'S EJECTION SEAT.

1-70. GENERAL.

1-71. The pilot's seat is designed to propel the pilot, ejection seat and equipment assembly from the airplane under extreme emergency flight conditions at high speed. The seat catapult contains an explosive cartridge which provides a propulsion rate of 60 feet per second.

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SECTION II

NORMAL OPERATING INSTRUCTIONS

2-1. BEFORE ENTERING THE COCKPIT.

NOTE

Sufficient space will be found on the back of each page for pilot's notes on the aircraft's performance or operation.

2-2. RESTRICTIONS.

Nose gear tire limitation of 160 mph for take-off, landing, or taxi.

Do not lower landing gear or landing flaps above 200 mph.

Avoid steady yawing of more than 2-1/2° above 320 mph indicated airspeed.

No inverted flight or outside loops.

2-3. EXTERIOR INSPECTION.

a. See that the wheels are chocked and check condition of tires and shock struts.

b. Check for proper preflight inspection.

c. See that the pitot and duct covers are removed.

d. Check area in front of airplane for objects which could be drawn into the intake ducts. Be sure blast area behind the airplane is clear.

e. See that an external power source (2 GT-13 batteries) is connected to the airplane and that a ground crew observer has a headset and mike connected to the interphone jack in the nose-wheel well.

f. Ground crew fire extinguisher - Connected in LH wheel well.

g. Check forms 1A and F.

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2-4. ENTRANCE TO THE COCKPIT.

2-5. Entrance is gained by pulling out on the handle at the left side of the enclosure, allowing the enclosure to swing open.

2-6. ON ENTERING THE COCKPIT.

2-7. BEFORE STARTING THE ENGINES.

a. OXYGEN PRESSURE.- 400-450 psi.

b. ENCLOSURE JETTISON NITROGEN PRESSURE.- 1980 psi.

c. SEAT.- Safety pin in catapult, and enclosure cable linked to pin.

d. LANDING-GEAR EMERGENCY EXTENSION HANDLE.- See that the sear pin is inserted in the shaft detent and that the handle is in the stowed position with the safety wire and seal intact.

e. BATTERY SWITCH.- "ON."

f. INSTRUMENTS.- Check fuel quantity gage and set clock and altimeter.

g. CIRCUIT BREAKERS.- On.

h. FIRE DETECTOR SYSTEM.- Test operate.

i. PARKING BRAKE.- On.

j. GROUND CREW INTERPHONE.- Check.

k. THROTTLES.- "CUT-OFF" position.

2-8. FUEL SYSTEM MANAGEMENT.

2-9. Fuel flow is automatic. The fuel booster pump must be operating during all engine operations and the emergency booster pump is to be used for take-off and landing.

2-10. STARTING THE ENGINES.

a. FUEL BOOSTER PUMP.- Switch "ON."

b. FUEL VALVES.- L.H. and R.H. switch "ON."

c. STARTER-IGNITION.- Switch "ON."

d. When the engine reaches 2300 rpm, push the throttle handle forward to the "GROUND IDLE" position.

WARNING

If the engines fail to start after three attempts, cool the ignition coils for a 10 to 20 minute period.

If the engines fail to start, the pilot must make certain that the ground crew swab any residual fuel from the combustion chambers, before attempting another start.

e. TAILPIPE TEMPERATURE.- Observe for limits.

f. Slowly accelerate to idling speed (6000 to 7000 rpm).

g. Start the second engine in the foregoing manner.

h. FLIGHT CONTROLS.- Check the operation of all flight controls.

i. FUEL PRESSURE GAGE.- 12 to 15 psi.

j. GROUND CREW FIRE EXTINGUISHER.- Disconnected.

k. Pull downward on the handle to latch the enclosure.

CAUTION

When closing the enclosure over the cockpit, keep the operating release handle in the open position until the forward locking pins bottom in the slotted ends of both torque tubes.

Check to see that the forward edge of the enclosure fairs into the mold line of the fuselage nose surface. If the fairing is not perfect, either, or both, torque tubes have not engaged the forward enclosure pins. Push upward on the release handle to open the enclosure. Again close and engage the latching mechanism until the fairing between the fuselage and enclosure is perfect.

NOTE

Engine run-up check is generally made at the head of the runway when the throttles are advanced for T.O. thrust.

2-11. TAXIING INSTRUCTIONS.

2-12. The airplane will perform taxiing requirements with the throttles at "FLIGHT IDLE" or above. Do not retard the throttles below the "ground-idle" marking. Complete loss of combustion may result. When taxiing the airplane make certain that neither personnel nor other aircraft are within the jet blast area. Operate the engines at Military Power ("EMERG. POWER"), for take-off, emergency, or for flight-testing conditions. Limit engine operation at "EMERG. POWER" to periods of 15 minutes.

NOTE

Be sure that the parking brake is fully released before starting to taxi. See paragraph 1-25.

2-13. Cut taxiing time to a minimum. Fuel consumption with the engines operating on the ground is approximately the same as for flight. Taxiing turns should be made with rather a large radius. Use the brakes to steer the airplane when taxiing. Do not exceed 160 mph on the nose wheel.

2-14. BEFORE TAKE-OFF.

a. ENCLOSURE.- Secure.

b. RADIO.- Check.

c. HYDRAULIC PRESSURE AND TEMPERATURE.- Normal and below 160°F.

d. FLIGHT CONTROLS.- Checked.

e. FUEL BOOSTER PUMP.- "ON."

f. EMERGENCY FUEL BOOSTER PUMP.- "ON."

g. LANDING FLAPS.- Deflected as required.

h. When ready for take-off, apply the brakes, and advance both throttles full open and check all instruments.

2-15. TAKE-OFF.

2-16. NORMAL TAKE-OFF PROCEDURE.

a. With the engines full advanced, release the brakes for the run. Operate stick trigger switch to turn on emergency hydraulic pump for elevon power during take-off.

b. Maintain directional control of the airplane by a minimum use of the brakes until sufficient speed has been gained for the rudder to become effective.

c. Lift the airplane off the ground in a conventional manner by applying back-force to the control stick.

d. As soon as the airplane is airborne, retract the gear.

e. Raise the landing flaps as deemed advisable.

f. As soon as a safe altitude and airspeed have been reached, retard the throttles to rated power for the climb-out.

2-17. MINIMUM RUN TAKE-OFF.- Same as normal take-off.

2-18. ENGINE FAILURE DURING TAKE-OFF.- See Section III.

2-19. CLIMB.

2-20. Normal climbs are made at rated power settings.

2-21. NORMAL FLIGHT.

2-22. When climbing between 4000 and 20,000 feet altitude, expect an engine increase of 30 rpm per 1000 feet in altitude, for any given throttle setting. The engines will decrease rpm at any given throttle setting for each 1000-foot loss in altitude.

2-23. At altitudes above 30,000 feet, engine operation is subject to a "dead band" condition. This condition is marked by erratic burner combustion during which the engines will fail to respond to the controls. Should the engines encounter extreme "dead band" condition, total loss of engine combustion may occur. After such

a "flame out" occurs, the airplane must drop to a lower altitude before a "windmill" start is attempted.

2-24. During a terminal velocity dive and pull-out within the 10,000 foot to sea-level altitude range, no fuel is transferred from the wing tanks to the fuselage tank. The maneuver is of approximately 18.5 seconds duration and consumes 2.36 gallons of the fuselage tank's normal fuel level of 27 gallons. During the 18.5 seconds duration of the maneuver, the fuel low level warning signal lamp will flash. The balance of the airplane is maintained by both wing tanks simultaneously feeding the fuselage tank until they are empty.

2-24A. During maneuvers incurring negative accelerations, intermittent flashes of the oil low level warning lamp will occur. A light lasting less than 30 seconds is considered a false warning. A light of longer duration indicates that approximately three gallons of oil remain.

2-25. STALL, SPINS, AND DIVES.- Complete information is not yet available. For high speed dives, emergency elevon power shall be turned on before starting dive. It shall remain on until dive recovery is complete.

WARNING

Accumulation of ice on the leading edge of the wing adversely affects the stall characteristics of the airplane. Particular precaution must be observed when landing the airplane under these conditions.

2-27. Technique for landing the airplane is similar to that used in landing a conventional airplane with tricycle landing gear. The landing approach attitude of this airplane is about the same: tail slightly down as the main gears touch the ground and the nose gear touching after the original contact has been made.

2-28. Landing gear and landing flaps down only after flying speed has dropped below 200 IAS. Turn the emergency fuel booster pump "ON" before starting the final approach. Keep the engines operating at "FLIGHT IDLE" or above during the approach so that power may be more quickly applied should it be necessary to go around and to assure sufficient hydraulic pressure for the flight controls.

2-29. STOPPING THE ENGINES.

a. FLIGHT CONTROLS.- Neutral, landing flaps up.

b. THROTTLES.- "CUT-OFF."

c. FUEL PUMPS AND VALVES.- "OFF."

2-30. BEFORE LEAVING THE AIRPLANE.

a. RADIO.- "OFF."

b. GENERATORS.- "OFF."

c. BATTERY SWITCH.- "OFF."

d. WHEELS.- Chocked.

e. PARKING BRAKES.- Released.

f. Report any malfunctions to crew chief.

SECTION III

EMERGENCY OPERATING INSTRUCTIONS

3-1. EMERGENCY ESCAPE. (See figure 3-1.)

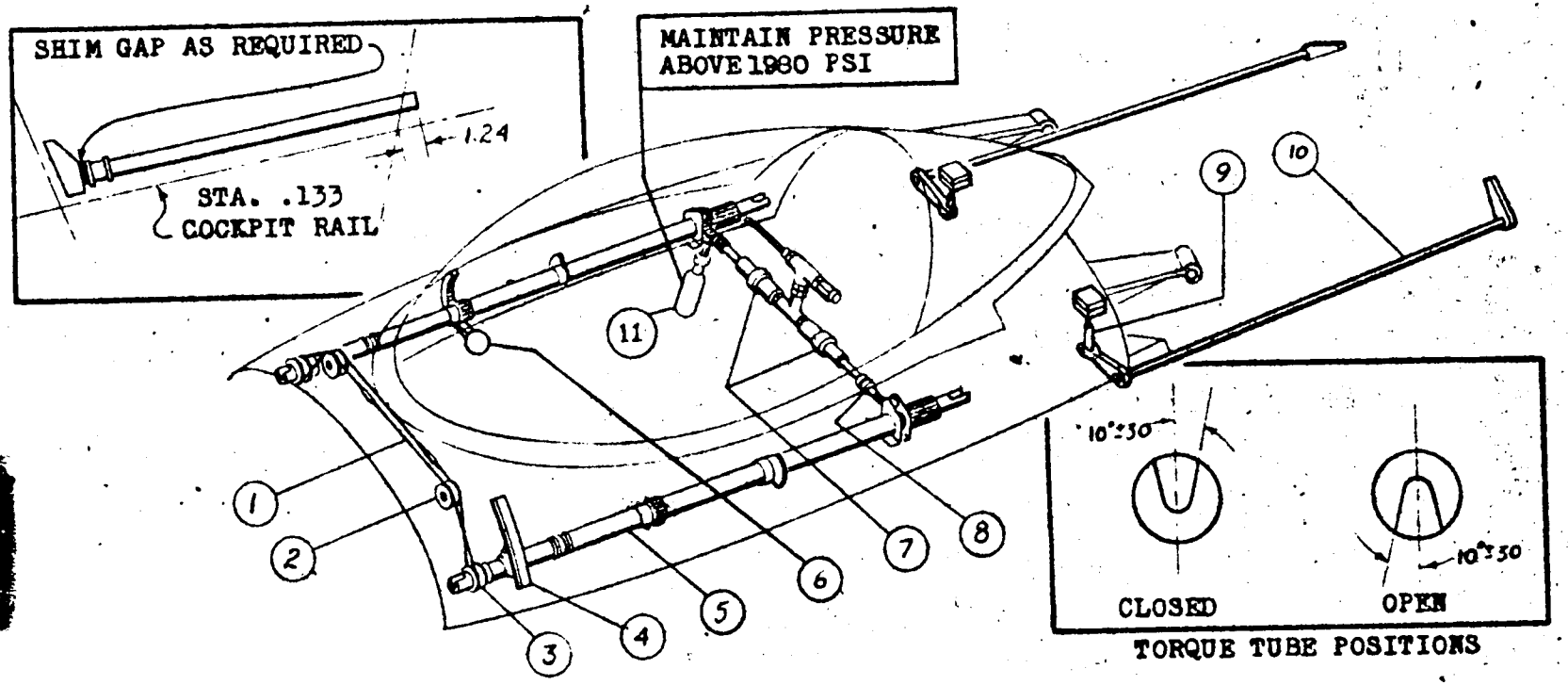
3-2. ENCLOSURE JETTISONING AND SEAT EJECTION.- The emergency jettisoning of the cockpit enclosure during flight and the ejection preparation of the pilot's seat is accomplished by a common operating linkage. When the decision is made to abandon the airplane, the pilot should grasp the seat arm rests and pull upward. This movement releases the nitrogen pressure from the bottle fastened to the back of the seat aft of the pilot's right shoulder. Pressure from the nitrogen bottle drives the actuating cylinder against the torque tube plungers. The plungers rotate the torque tubes and unlock the enclosure which jettisons from the airplane. Lifting the arm rests also pulls the catapult safety pin. The pilot should sit with arms close to the body, head against the headrest, and squeeze the trigger (see figure 3-1, ref. 16) to eject the seat assembly from the airplane.

3-3. FIRE IN FLIGHT.

3-4. ENGINE SECTION FIRE.- If a fire should occur in one of the engine sections as indicated by the fire detector light, close the throttle, shut-off the fuel and oil valve, turn off the generator of the affected engine, and operate the extinguisher discharge switch. (See figure 1-2, ref. 3.) In the event of a second fire, abandon the airplane.

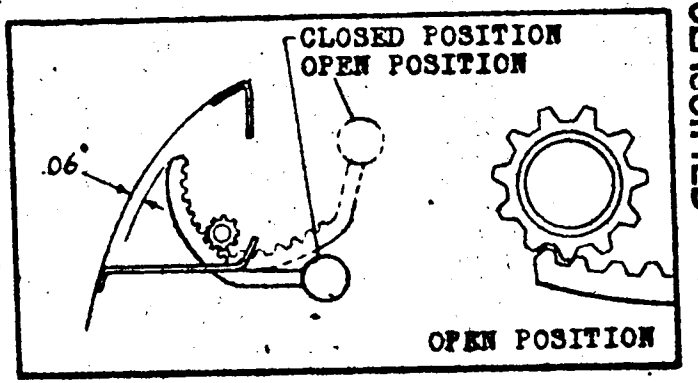
3-5. ENGINE FAILURE.

3-6. ENGINE FAILURE BEFORE LEAVING THE GROUND.- In the event of engine failure during the take-off run, don't take-off unless



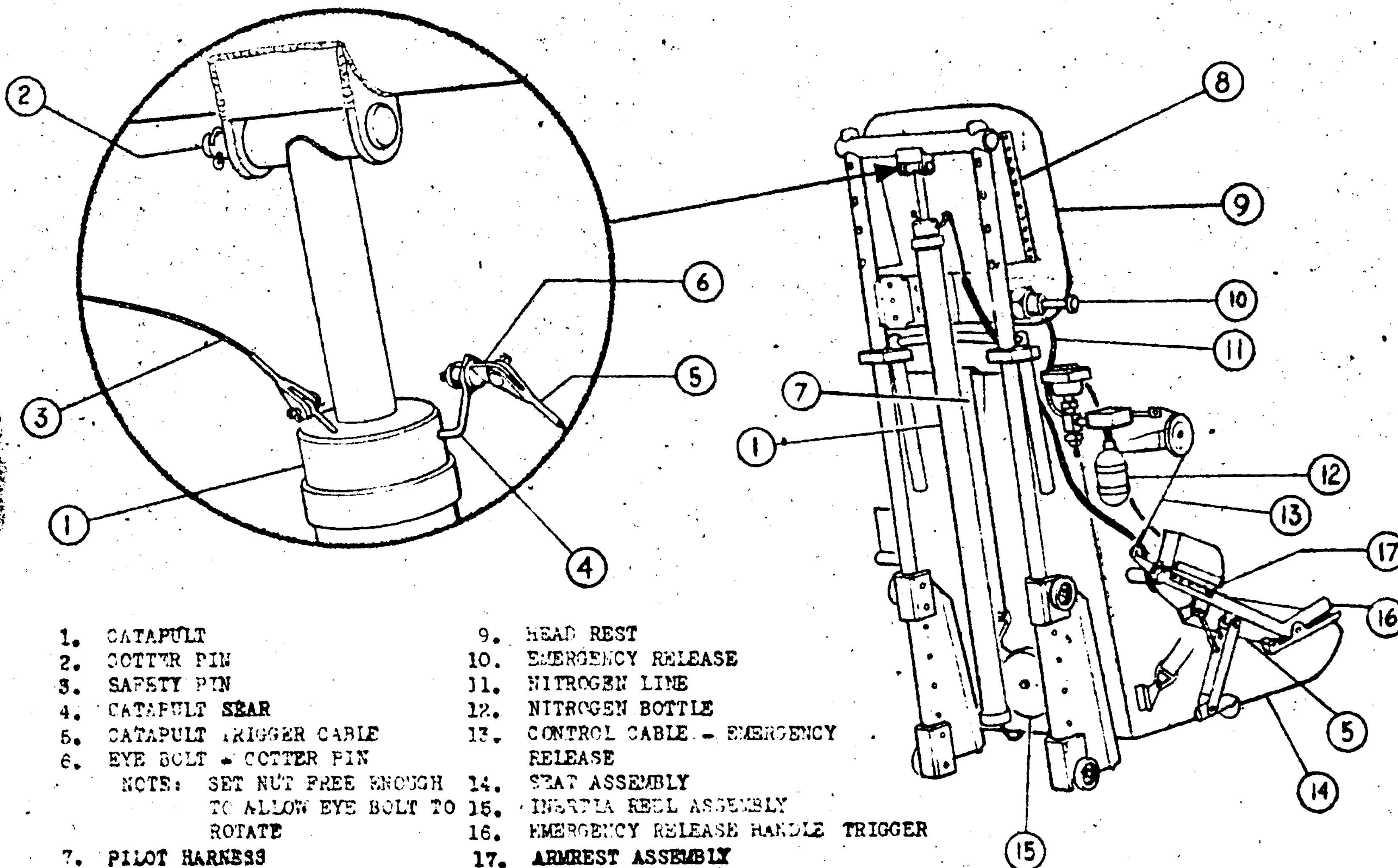
TORQUE TUBE POSITIONS

1. CABLE ASSEMBLY NOTE: ADJUST TURNBUCKLES TO OBTAIN 50 LBS PRELOAD ON CABLES
2. PULLEY
3. CABLE DRUM
4. EXTERNAL RELEASE HANDLE
5. TORQUE TUBE
6. INTERNAL RELEASE HANDLE
7. ACTUATING CYLINDERS
8. RACK-EMERGENCY RELEASE
9. LINK-TORQUE ARM
10. TORQUE SHAFT COUNTER BALANCING INSTALLATION
11. NITROGEN BOTTLE



INTERNAL RELEASE MECHANISM

FIG. 3-1. ENCLOSURE RELEASE MECHANISM - NORMAL AND EMERGENCY



1. CATAPULT
2. COTTER PIN
3. SAFETY PIN
4. CATAPULT SEAR
5. CATAPULT TRIGGER CABLE
6. EYE BOLT - COTTER PIN
   NOTE: SET NUT FREE ENOUGH TO ALLOW EYE BOLT TO ROTATE
7. PILOT HARNESS
8. HEAD REST SUPPORT BRACKET
9. HEAD REST
10. EMERGENCY RELEASE
11. NITROGEN LINE
12. NITROGEN BOTTLE
13. CONTROL CABLE - EMERGENCY RELEASE
14. SEAT ASSEMBLY
15. INERTIA REEL ASSEMBLY
16. EMERGENCY RELEASE HANDLE TRIGGER
17. ARMREST ASSEMBLY

FIG. 3-1A. PILOT'S SEAT & CATAPULT EJECTION MECH.

sufficient flying speed has been attained so that all obstacles can be cleared. Move the throttle of the affected engine to "CUT-OFF" immediately. If flying speed has not been reached or it is felt that an obstacle cannot be cleared, apply maximum brakes without skidding the tires. The gear cannot be retracted unless the weight of the airplane is off of the gear because of the safety switch installed on the main gear to forestall inadvertent retraction when the airplane is on the ground.

3-7. ENGINE FAILURE IN FLIGHT.

3-8. ONE ENGINE INOPERATIVE.

3-9. If one engine should fail during flight, trim the airplane to a level attitude. This airplane will perform remarkably well with only one engine operating. Avoid flying at high speeds during this emergency. Place the throttle in "RATED POWER" or above to assure sufficient hydraulic power for control, and immediately return to the base.

WARNING

Do not allow the speed of the operating engine to fall below 10,500 rpm or the hydraulic flow will drop below the flow required to operate the elevon and flap controls.

3-10. LANDING APPROACH WITH SINGLE ENGINE OPERATING.- When attempting a landing with only one engine operating, the approach procedure is similar to that used under normal circumstances.

THROTTLE.- "FLIGHT IDLE" position or above.

LANDING GEAR.- "DOWN" when flying speed drops below 200 mph IAS.

LANDING FLAPS.- "DOWN" when flying speed drops below 200 mph IAS.

3-11. BOTH ENGINES INOPERATIVE.

3-12. The hydraulic system must operate at a maintained minimum pressure of 2000 psi in order to actuate the various hydraulic units installed on the airplane. This minimum operating pressure of 2000 psi can only be maintained provided the engines are operating at 10,500 rpm ("FLIGHT IDLE" throttle position) or higher. Should both engines fail during flight, the only source of power available for operating the elevon and landing flap surfaces is the electrically-controlled hydraulic emergency "standby pump" which operates on the single 24 volt, 17 ampere battery. In this event all electrical equipment not essential to flying the airplane must be shut off to conserve the battery. The hydraulic "standby" pump control switch may be used intermittently during the descent. (See figure 1-2, ref. 2)

3-13. RESTARTING ENGINES IN FLIGHT.

3-14. In the event of a blowout in flight a windmill start may be effected in the following manner:

a. Be sure that the throttle or throttles are in the "CUT-OFF" position.

b. Pull the nose of the airplane up momentarily to drain the combustion chambers.

c. Increase the airspeed to about 200-220 mph.

d. Close the ignition switch and when the engine reaches the maximum rpm for the airspeed, slowly open the throttle.

e. Observe the tailpipe temperature gage for start, release the ignition switch and advance the throttle as desired.

3-15. HYDRAULIC SYSTEM FAILURE.

3-16. GENERAL.- The righthand engine-driven pump operates the

following units: Landing gear cylinders, righthand dive brake cylinders, the left and righthand outboard elevon cylinders. The lefthand engine-driven pump o erates the following units: Lefthand dive brake cylinders, left and righthand inboard elevon cylinders, and left and righthand landing flap cylinders. The electrical emergency (standby) hydraulic pump pressure line is connected into the pressure line of the lefthand engine-driven pump and operates the landing flaps and flight controls in the event of normal pump failure. The emergency (standby) pump is energized by a switch on the switch panel or by a push-button switch on the control stick handle. The hand pump operates the emergency extension of the landing gear only.

NOTE

If both hydraulic systems fail while the airplane is committed in flight maneuver, return the surface controls to neutral, by neutralizing the control stick before starting to operate the emergency "STANDBY" hydraulic pump.

3-17. BATTERY OPERATION OF "STANDBY" PUMP.- In event both engines fail in flight with the resulting loss of normal hydraulic operation, the battery, with all accessory electrical units on the airplane turned off, will operate the emergency "standby" hydraulic pump for approximately 22 minutes.

3-18. ELECTRICAL FAILURE.

3-19. FAILURE OF ONE GENERATOR.- If one generator should fail, turn "OFF" the respective switch. One generator will supply sufficient power to operate the airplane's equipment.

3-20. FAILURE OF BOTH GENERATORS.- In the event of failure of both generators, the battery will operate the electrical equipment for a limited time. Do not attempt lowering of the flaps or dive brakes when the main fuel booster pump and emergency hydraulic system are operating. The reduced voltage could cause a control valve to stick. If emergency hydraulic power is required on the battery alone, turn the emergency fuel booster pump "ON" and turn the main fuel booster pump "OFF." (See paragraph 3-17.)

3-21. FUEL SYSTEM FAILURE.

3-22. BOOSTER PUMP FAILURE.- Booster pump failure will result in intermittent engine operation and it is possible for complete engine failure at high power settings. If the engines should malfunction, immediately turn the emergency fuel booster pump "ON." If the engines resume normal operation, or can be restarted, leave the emergency pump on and turn the booster pump "OFF."

3-23. FUEL WARNING LIGHT.- The fuel low-level warning light will flash during a dive, pull-out, or climb when fuel is not being transferred to a fuselage tank. This should not cause concern because it is a normal condition. If the warning light comes on at any other time, land the airplane as soon as possible.

3-24. LANDING GEAR FAILURE.

3-25. There are no provisions for emergency retraction of the gear. If the gear should fail to extend, place the control handle in the "DOWN" position and operate the emergency handpump. Thirty strokes of the pump are required to lower the gear.

3-26. RUDDER ACTUATOR FAILURE.

3-27. If the rudder actuator should fail so that the surface cannot

be operated or controlled, level the airplane and turn the rudder actuator lock switch "ON." The switch is located on the righthand console. Operation of this switch causes the rudder actuator to shift to "free wheel" condition. Because of the actuator friction in this condition, the pilot must apply enough force on the rudder pedals to return the rudder to neutral. When the rudder reaches this position, a switch is operated which causes the actuator to shift gears to the actuator "LOCKED" condition.

SECTION IV

OPERATIONAL EQUIPMENT

4-1. OXYGEN SYSTEM. (See figure 4-1.)

4-2. GENERAL.

4-3. The airplane is equipped with a low-pressure demand-type oxygen system, operating at a working pressure of 425-450 psi. A single D-2 oxygen cylinder is installed just aft of the pilot's seat bulkhead.

4-4. OXYGEN FILLER VALVE.- The filler valve is secured to the bulkhead just aft of the pilot's seat.

4-5. USE OF OXYGEN.- Use oxygen above 10,000 feet, and at night use oxygen from the ground up.

4-6. COCKPIT COOLING AND VENTILATING AND DEFROSTING SYSTEMS.

4-7. GENERAL.

4-8. The airplane is equipped with cabin cooling, and cabin ventilation and defrosting systems. Cooling air, obtained from the boundary air layer ducts, is routed through heat exchangers which contain dry ice; then through a flex duct to the cabin. Ventilating air is obtained from an aperture in the nose, and is directed through numerous outlets around the enclosure.

4-9. CABIN COOLING SYSTEM CONTROL.- The control handle (see figure 1-2, ref 13) which is located adjacent to the righthand armrest of the ejection seat, is connected by a bowdenite cable to a valve assembly serving both heat exchangers. It is pulled forward as desired to allow the entrance of cooling air.

4-10. CABIN VENTILATING AND DEFROSTING CONTROL.- This control handle (see figure 1-2, ref. 10) is located immediately forward

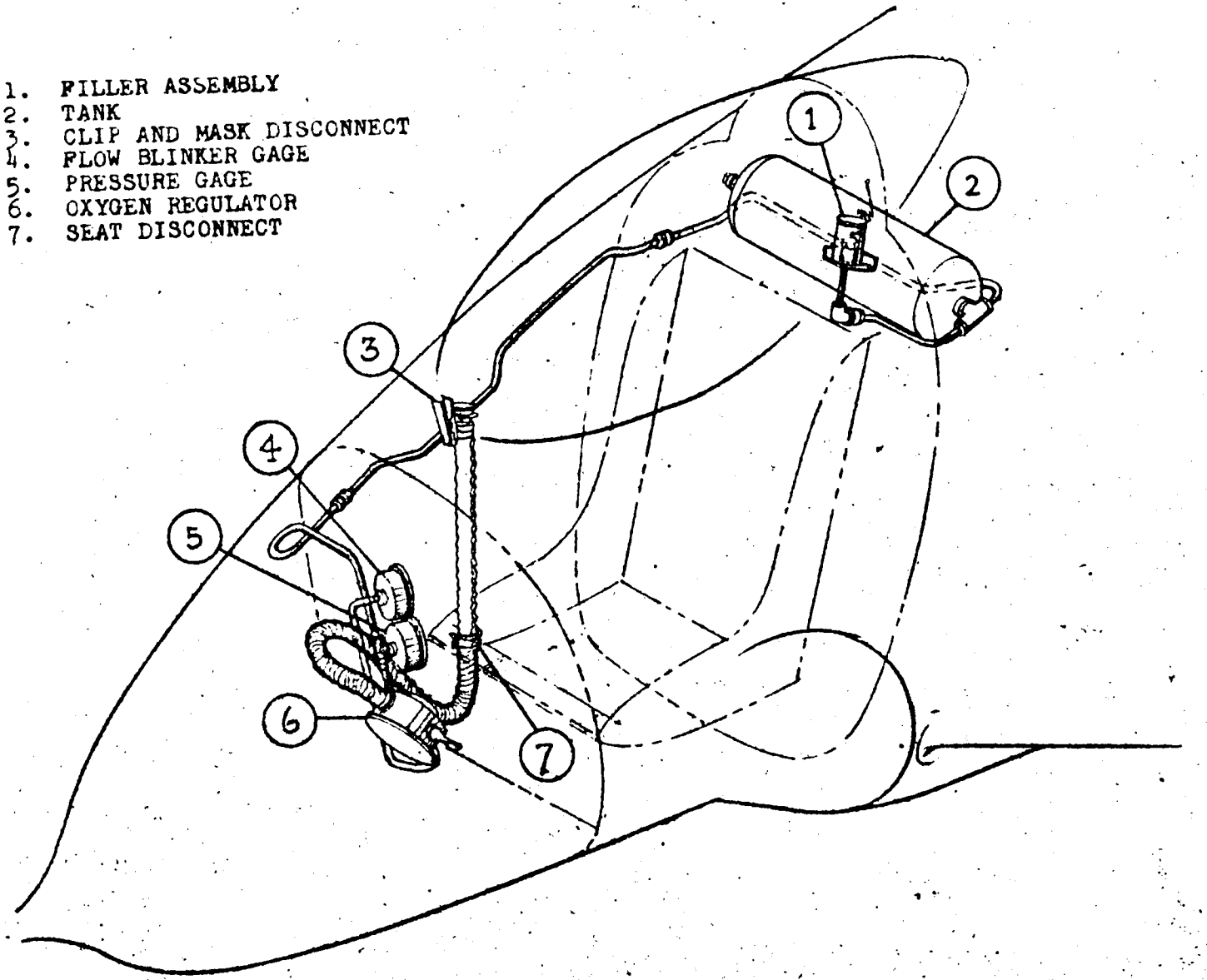


FIG. 4-1. OXYGEN SYSTEM DIAGRAM

of the cabin cooling control handle. It is pulled to operate, and actuates a valve in the nose section.

4-11. COMMUNICATION EQUIPMENT.

4-12. GENERAL.

4-13. The AN/ARC-5 radio equipment installed in the airplane is a complete multi-channel voice transmitting and receiving set covering the VHF (Very High Frequency) band between 100 and 150 megacycles. Under normal operating conditions the transmitting and receiving range of this equipment is slightly greater than the direct line of vision.

4-14. PILOT'S CONTROL UNIT.- The pilot's control unit is located to the right of the pilot below the cockpit rail. Switches marked "TRANSMITTER" and "RECEIVER", located on the control unit, control the four pre-set crystal-controlled channels of both transmitter and receiver. The "TRANSMITTER" switch is fixed in the number one position. An on-off switch and a "VOICE-CW-TONE" switch are located on the control unit. The "VOICE-CW-TONE" switch is set in the "VOICE" position.

4-15. MICROPHONE SWITCH.- The antenna switching circuit is transferred from the transmitter to the receiver by tripping the microphone "trigger" switch located on the control stick.

4-16. RECEIVER.- "MVC-OFF-AVC" switch is located aft of the pilot's control box and turns the receiver on and off.

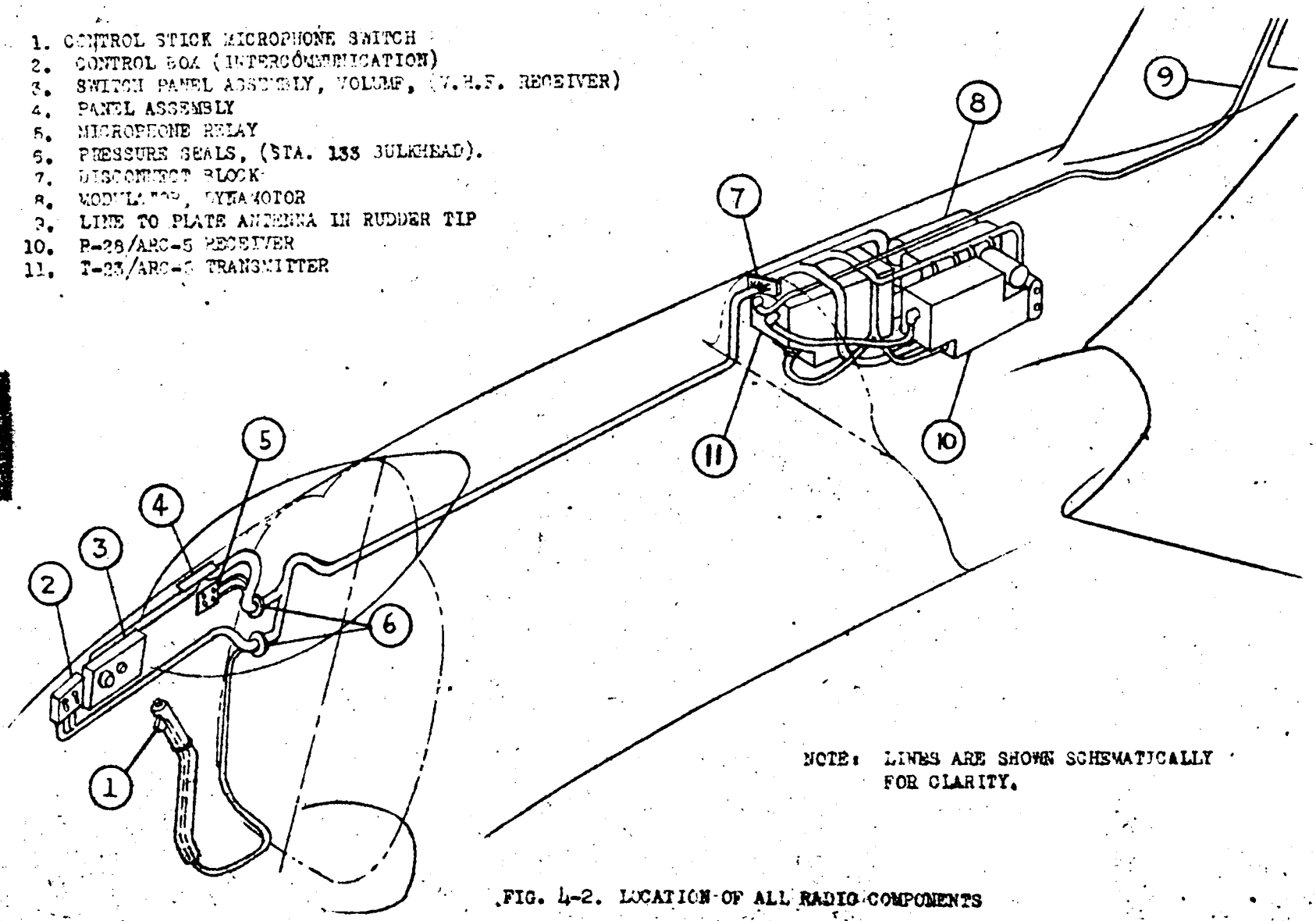
4-17. OPERATION.

4-18. TO START.

a. BATTERY SWITCH.- "ON."

b. "VHF" circuit breaker is closed.

1. CONTROL STICK MICROPHONE SWITCH
2. CONTROL BOX (INTERCOMMUNICATION)
3. SWITCH PANEL ASSEMBLY, VOLUME, (V.H.F. RECEIVER)
4. PANEL ASSEMBLY
5. MICROPHONE RELAY
6. PRESSURE SEALS, (STA. 133 BULKHEAD).
7. DISCONNECT BLOCK
8. MODULATOR, DYNAMOTOR
9. LINE TO PLATE ANTENNA IN RUDDER TIP
10. R-28/ARC-5 RECEIVER
11. T-23/ARC-5 TRANSMITTER



NOTE: LINES ARE SHOWN SCHEMATICALLY FOR CLARITY.

FIG. 4-2. LOCATION OF ALL RADIO COMPONENTS

c. "ON-OFF" switch (pilot's control box) - "ON" position.

d. "TRANSMITTER" selector switch is fixed in the number "1" position.

e. Transmitter "VOICE-CW-TONE" switch (pilot's control box) is fixed in the "VOICE" position.

f. Receiver "MVC-OFF-AVC" switch located aft of the pilot's control box is placed in the "MVC" position.

4-19. TO STOP.

a. Turn off pilot's control box "ON-OFF" switch.

b. Turn off the receiver switch.

APPENDIX I

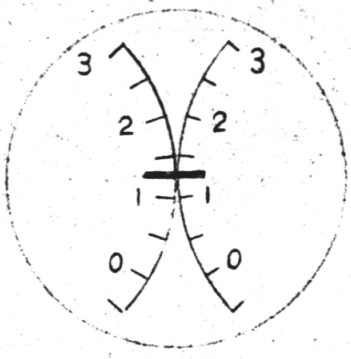
AIRSPEED CORRECTION TABLE

INSTR. IAS	CORRECT IAS				
	S.L.	10,000	20,000	30,000	35,000

NOTE

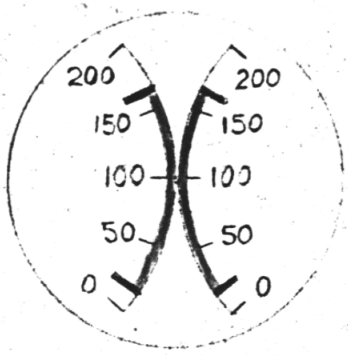
To be filled out by the pilot when information is available.

FIG. A-1. AIRSPEED CORRECTION TABLE



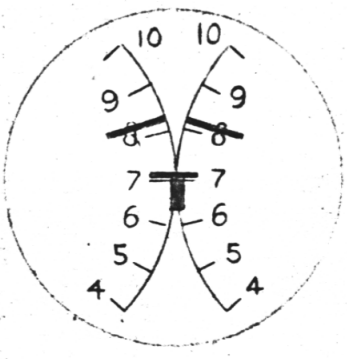
ENGINE BEARING TEMP.

- 132°C Max.



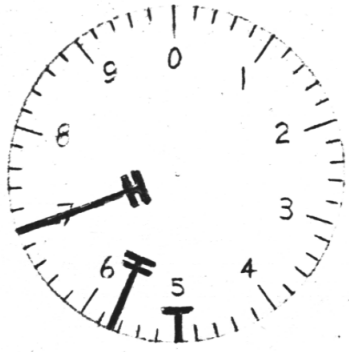
ENGINE OIL PRESSURE

- 15 psi Minimum
- 15-165 psi Operating Range
- 165 psi Maximum



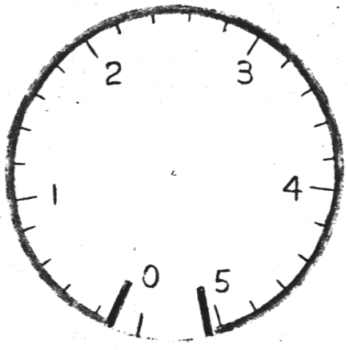
ENGINE TAILPIPE TEMP.

- 815°C Max. During Acceleration
- 704°C Max. Normal Power
- 648-704°C Normal Operating Range



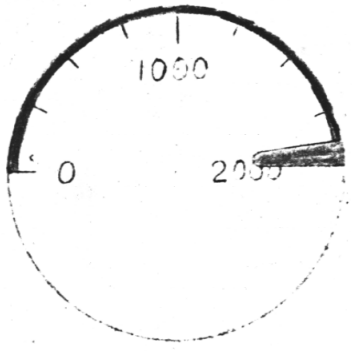
TACHOMETER

- 5000rpm Ground Idle
- 15,700 rpm Rated Power
- 17,000 rpm Emerg. Power



ENGINE FUEL PRESSURE

- 15 psi Min.
- 15-515 psi Operating Range
- 515 psi Maximum



NITROGEN PRESSURE

- Below 1950 psi not sufficient pressure
- 1950-2000 psi Operating Press.

[redacted]

FIG. A-2. INSTRUMENT RANGE MARKINGS (SHEET 1 OF 2 SHEETS)

UNCLASSIFIED

AIRSPEED

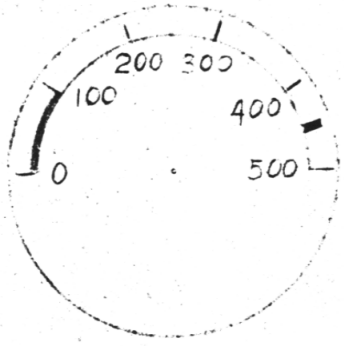
- 670 mph Maximum
- 200 mph Max. for lowering landing flaps and landing gear

MACHMETER

- .92 Maximum

ACCELEROMETER

- 3G Neg. Maximum
- 8G Pos. Maximum



OXYGEN PRESSURE

- 450 psi Minimum

FLAP HYDRAULIC PRESSURE

- 2150 psi Maximum
- 2000 psi Operating Pressure

LANDING GEAR HYD. PRESSURE

- 2150 psi Maximum
- 2000 psi Operating Pressure

FIG. A-3. INSTRUMENT RANGE MARKINGS (SHEET 2 OF 2 SHEETS)

UNCLASSIFIED

APPENDIX I.

OPERATING CHARTS

PREFACE

1. AIRSPEED INSTALLATION CORRECTION

   a. The Airspeed Installation Correction Table, Figure 1, lists the airspeed indicator installation error for various indicated airspeeds for flaps and landing gear retracted and flaps and landing gear extended. This information is not available and should be filled out by the pilot.

2. TAKE-OFF

   a. The Take-Off Chart, Figure 2, lists the take-off distances for various pressure altitudes, air temperatures, and gross weights, with and without tip tanks, with take-off power (100% rated engine speed, 17,000 rpm).

   b. Set the airplane altimeter to 29.92 and read pressure altitude. With air temperature in degrees Fahrenheit as obtained from the field weather station and pressure altitude, enter chart and determine required take-off distances.

   c. The chart take-off distances are 125% of the estimated optimum values.

3. LANDING

   a. The Landing Chart, Figure 3, lists the landing distance and approach speeds for various pressure altitudes and gross weights, with and without tip tanks.

   b. Approach with 0° flap deflection. Extend full flap after touching the ground. Do not extend flap before touching the ground.

   c. The chart landing distances are 125% of the estimated optimum values.

4. CLIMB

   a. The Climb Chart, Figure 4, lists the recommended indicated airspeed and rate of climb for various altitudes, and the time, horizontal distance, and fuel required to climb to various altitudes from [redacted]

4. Climb - Continued

sea level. The data on the left pertains to climb with Military Power (100% rated engine speed, 17,000 rpm) and the data on the right pertains to climb with Normal Power (96% rated engine speed, 15,700 rpm).

b. The fuel consumed during climb includes 22 gallons for warm-up and take-off, based on 5 minutes operation at maximum continuous power.

c. The chart fuel required is 115% of the estimated optimum values.

5. DESCENT

a. The Descent Chart, Figure 5, lists the recommended indicated airspeed and rate of descent for various altitudes, and the time, horizontal distance, and fuel required to descend from various altitudes to sea level at minimum power (62% rated engine speed, 10,500 rpm).

b. The fuel consumed during descent includes 42 gallons landing reserve. The landing reserve is based on 30 minutes operation with minimum power for level flight at sea level.

c. The maximum ground distance obtainable in power-off descent is 12 miles per 5000 feet of altitude lost at an indicated airspeed of 192 miles per hour.

d. The chart fuel required is 115% of the estimated optimum values.

6. FUEL ALLOWANCE

a. The Fuel Allowance Chart, Figure 6, lists the fuel required for combat operation at various altitudes, weights, and at Military and Normal Powers (100% rated engine speed and 92% rated engine speed, respectively). The fuel required is based on fuel flow at maximum level flight speed for the above conditions.

b. The chart fuel required is 115% of the estimated optimum values.

7. FLIGHT OPERATION INSTRUCTIONS

a. The Flight Operation Instruction Chart, Figure 7, shows the range obtainable with the airplane and the

7. Flight Operation Instructions - Continued

procedure for achieving this range. The chart may be used at any point in flight or for preflight planning. The initial conditions are the actual altitude of the airplane and the fuel in the airplane. The initial altitude is indicated at the top of the vertical columns and fuel quantities are indicated in the vertical columns of the operating chart. Two ranges are given corresponding to each initial altitude and fuel quantity. One range is based on level flight at the initial altitude. The other range is the maximum obtainable by immediately climbing to optimum altitude and level flight at optimum altitude. The range values include the horizontal distance covered during climb at Military Power (100% rated engine speed) and descent at reduced power. The fuel quantity includes the fuel required for climb and descent, and the fuel reserve for landing. No allowance is made for warm-up or take-off.

b. The lower portion of the chart shows the recommended range factor, engine speed, indicated airspeed, fuel flow, and ground speed for cruising at the initial altitudes indicated at the top of the columns, with varying wind. The let-down distance is shown for these conditions, but the procedure for let-down should be obtained from the Descent Chart, Figure 5. The range factor is used to correct the range, in the upper portion of the table, for varying wind. The corrected range is the product of range and the range factor corresponding to the wind.

c. Since the wind may be from any direction with respect to the airplane course, some question may arise as to the method of handling winds other than straight headwinds or tailwinds. For purposes of cruise control, all winds may be expressed as effective winds. This reduces the wind to one which would have the same effect on the airplane's ground speed if it were a straight head or tailwind. In other words, it is the component of wind in the direction of the airplane heading. For example, a 100 mph wind at 45 degrees to the course will be an effective headwind of about 75 miles per hour for an airplane whose still air cruising speed is 400 miles per hour. The ground speed along the course will be about 325 miles per hour.

d. The chart ranges are 85% of the estimated optimum values.

[redacted]

8. SAMPLE PROBLEM

a. It is desired to plan a flight of 300 miles distance in zero wind, consisting of the following:

(1) Warm-up and take-off from sea level.

(2) Climb at Military Power to optimum altitude.

(3) Cruise at optimum altitude.

(4) Descend to sea level.

(5) Land (30 minutes reserve at minimum power).

b. The fuel required is obtained as follows:

(1) The fuel for warm-up and take-off is 22 gallons, obtained from Figure 4.

(2) The fuel for climb, cruise, descent, and landing is 189 gallons, obtained by interpolating between the fuel quantities of 200 and 180 gallons corresponding to ranges of 332 and 223 miles, respectively, shown in Figure 7.

(3) The total fuel required is 211 gallons, obtained by adding the fuel required for warm-up and take-off to the fuel required for climb, cruise, descent, and landing.

c. The take-off ground run and total distance to take off over a 50-foot obstacle are 2326 and 3968 feet, respectively, obtained from Figure 2 assuming a 60°F. ambient temperature.

d. The recommended climbing speeds are as follow, obtained from Figure 4:

Altitude (Ft.)	Indicated Airspeed (mph)
0	377
5,000	363
10,000	350
15,000	338
20,000	327
25,000	316
30,000	299
35,000	279

[redacted]

8. Sample Problem - Continued

e. The recommended cruising power, approximate cruising airspeed, and approximate let-down distance are 86% rpm, 278 mph indicated, and 64 miles, respectively, obtained from Figure 7 corresponding to cruising at 35,000 feet altitude.

f. The recommended descent speeds are as follow, obtained from Figure 5, for minimum power (62% rated rpm):

Altitude (Ft.)	Indicated Airspeed (mph)
35,000	220
30,000	249
25,000	278
20,000	309
15,000	342
10,000	379
5,000	417
0	456

g. The landing ground run and total distance to land over a 50-foot obstacle are 1913 and 6739 feet, respectively, obtained from Figure 3.

AIRPLANE MODEL X-4

ENGINE MODEL XJ-30-WE

AIRSPEED INSTALLATION CORRECTION TABLE

IAS	CORRECTION
FLAPS AND GEAR RETRACTED	
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH

IAS	CORRECTION
FLAPS AND GEAR EXTENDED	
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH
MPH	ADD MPH

FIGURE I.

AIRCRAFT MODEL X-4

ENGINE MODEL XJ-30-WE

TAKE-OFF CHART

FLAPS 0° DEFLECTED HARD SURFACE RUNWAY WIND 0 MPH 0 KTS

CHART WEIGHT LIMITS (POUNDS)	PRESSURE ALTITUDE (FEET)	DISTANCE—FEET 60 F. GROUND ROLL	60 F. CLEAR 50 FEET	120 F. GROUND ROLL	120 F. CLEAR 50 FEET
7427	SEA LEVEL	2326	3968	2809	4610
	2000	2726	4515	3303	5293
	4000	3213	5164	3908	6120
	SEA LEVEL				
	2000				
	4000				
	SEA LEVEL				
	2000				
	4000				

FLAPS 0° DEFLECTED HARD SURFACE RUNWAY WIND 17 MPH 15 KTS

CHART WEIGHT LIMITS (POUNDS)	PRESSURE ALTITUDE (FEET)	DISTANCE—FEET 60 F. GROUND ROLL	60 F. CLEAR 50 FEET	120 F. GROUND ROLL	120 F. CLEAR 50 FEET
7427	SEA LEVEL	1780	3228	2183	3778
	2000	2107	3500	2591	4359
	4000	2508	4241	3094	5066
	SEA LEVEL				
	2000				
	4000				
	SEA LEVEL				
	2000				
	4000				

NOTES: (1) OPTIMUM TAKE-OFF DISTANCE IS 80% OF CHART VALUES.

BASED ON: Estimated Performance
DATA AS OF: 11-10-48

FIGURE 2.

[redacted] UNCLASSIFIED

AIRCRAFT MODEL
X-4

ENGINE MODEL
XJ-30-WE

LANDING CHART

HARD SURFACE RUNWAY

WIND 0 KNOTS

CHART WEIGHT LIMITS (POUNDS)	DESIGN APPROACH SPEED		DISTANCE - FEET					
	POWER							
	OFF	ON	AT SEA LEVEL		AT 2000 FEET		AT 4000 FEET	
	MPH	MPH	GROUND ROLL	CLEAR 50 FEET	GROUND ROLL	CLEAR 50 FEET	GROUND ROLL	CLEAR 50 FEET
6222	156	156	1913	6739	2014	7080	2128	7451

NOTES: (1) Approach with 0° flap.

(2) Extend full flap after touching ground.

(3) Optimum landing distance is 80% of the chart values.

LEGEND:
MPH: STATUTE MILES PER HOUR

BASED ON Estimated Performance
DATE 12-3-48

FIGURE 3.

[redacted] UNCLASSIFIED

AIRPLANE MODEL
X-4

ENGINE MODEL
XJ-30-WE

CLIMB CHART

NUMBER OF ENGINES OPERATING: TWO

CHART WEIGHT LIMITS 7427-5972 POUNDS					PRESSURE ALTITUDE (FEET)	CHART WEIGHT LIMITS 7427-5972 POUNDS				
EXTERNAL LOAD ITEMS NONE						EXTERNAL LOAD ITEMS NONE				
		FROM SEA LEVEL						FROM SEA LEVEL		
IAS	R/C	TIME	DISTANCE	FUEL		IAS	R/C	TIME	DISTANCE	FUEL
377	6940	0	0	22	SEA LEVEL	298	4480	0	0	22
363	5850	1	5	34	5000	288	3850	1	6	33
350	5020	2	10	44	10000	279	3300	2	13	43
338	4290	3	18	53	15000	271	2780	4	22	54
327	3620	4	27	63	20000	265	2330	6	34	65
316	2490	5	38	74	25000	258	1890	8	48	77
299	2310	7	53	85	30000	252	1470	11	65	90
279	1550	10	74	96	35000	248	1050	15	94	104
					40000					

NOTES:
(1) CLIMB AT 100% RPM AND RECOMMENDED IAS.
(2) WARM-UP AND TAKE-OFF ALLOWANCE.
(3) INCLUDING 22 GALLONS FOR WARM-UP AND TAKE-OFF.

NOTES:
(1) CLIMB AT 92% RPM AND RECOMMENDED IAS.
(2) WARM-UP AND TAKE-OFF ALLOWANCE.
(3) INCLUDING 22 GALLONS FOR WARM-UP AND TAKE-OFF.

LEGEND:
IAS-INDICATED AIR SPEED, MPH.
R/C-RATE OF CLIMB, FT. PER MIN.
TIME-MINUTES.
DISTANCE- GROUND STATUTE MILES.
FUEL-U.S. GALLONS.

BASED ON: Estimated Performance
DATA AS OF: 11-5-48

FIGURE 4.

[redacted] UNCLASSIFIED

FORM 50-50

AIRPLANE MODEL X-4

ENGINE MODEL XJ-30-WE

DESCENT CHART

NUMBER OF ENGINES OPERATING: TWO

PRESSURE ALTITUDE (FEET)	EXTERNAL LOAD ITEMS NONE				
			TO SEA LEVEL		
	IAS	R/D	TIME	DISTANCE	FUEL
40000					
35000	220	2320	9	64	55
30000	249	2560	7	50	53
25000	278	2977	5	38	51
20000	309	3560	4	27	49
15000	342	4267	3	18	48
10000	379	5120	2	11	45
5000	417	6200	1	5	44
SEA LEVEL	456	7822	0	0	42

NOTES: (1) MAINTAIN RECOMMENDED IAS AND MINIMUM RPM (62%)
(2) LANDING RESERVE.
(3) INCLUDING 42 GALLONS FOR LANDING RESERVE.
(4) THE GROUND DISTANCE IS 12 MILES PER FEET OF DESCENT WITH POWER OFF, AT 192 IAS.

LEGEND: IAS—INDICATED AIRSPEED, MPH.
R/D—RATE OF DESCENT, FT. PER MIN.
TIME—MINUTES
DISTANCE—GROUND STATUTE MILES
FUEL—U.S. GALLONS

BASED ON: Estimated Performance
DATA AS OF: 11-8-48

FIGURE 5.

[redacted] UNCLASSIFIED

AIRPLANE MODEL X-4

ENGINE MODEL XJ-30-WE

FUEL ALLOWANCE CHART

CHART WEIGHT LIMITS 7427-5972 POUNDS

PRESSURE ALTITUDE (FEET)	FUEL REQUIRED-U.S. GALLONS 100% RPM	92 % RPM
SEA LEVEL	15.1	10.5
5000	13.5	9.3
10000	11.8	8.2
15000	10.3	7.2
20000	8.9	6.3
25000	7.7	5.4
30000	6.5	4.6
35000	5.4	4.0
40000		

NOTES: VALUES ARE 15% CONSERVATIVE.

BASED ON: Estimated Performance
DATA AS OF: 11-8-48

FIGURE 6.

NACA Form No. 239C (5 May 48)

AIRPLANE MODEL(S) X-4

ENGINE(S): XJ-30-WE

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS 7427 TO 5972 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO (2)

LIMITS	TIME LIMIT	% RPM	TAIL PIPE TEMP. °C	OIL PRESS PSI
MILITARY	15 Min.	100		
NORMAL		92.4		

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT-Select figure in fuel column equal to or less than fuel on board. Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude for maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING-Subtract fuel required for take-off and climb to altitude. Then use chart as for IN FLIGHT above, adding initial climb distance to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight change), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain maximum range. All range values include allowances for descent distance and fuel plus reserve shown for landing. Climb distance and fuel are included where climbs are indicated.

IF YOU ARE AT Sea Level			IF YOU ARE AT 15000'			FUEL U.S. GAL.	IF YOU ARE AT 25000'			IF YOU ARE AT 35000'			FUEL U.S. GAL.	IF YOU ARE AT			IF YOU ARE AT		
RANGE IN AIRMILES			RANGE IN AIRMILES				RANGE IN AIRMILES			RANGE IN AIRMILES				RANGE IN AIRMILES			RANGE IN AIRMILES		
BY CRUISING AT Sea Level	OPT. ALT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15000'	OPT. ALT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 25000'	OPT. ALT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35000'	OPT. ALT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT	OPT. ALT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT	OPT. ALT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND 42 GALLON LANDING RESERVE)																			
195	35000	448	303	35000	515	242.5	420	35000	553	568	35000								
146	35000	332	241	35000	399	200	335	35000	436	452	35000								
109	35000	223	182	35000	290	160	255	35000	327	342	35000								
72	25000	110	123	35000	180	120	176	35000	218	233	35000								
35	15000	37	65	25000	74	80	96	35000	108	123	35000								

CRUISING AT Sea Level						CRUISING AT 15000'						EFFECTIVE WIND	CRUISING AT 25000'						CRUISING AT 35000'						EFFECTIVE WIND	CRUISING AT						CRUISING AT					
RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.	RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.		RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.	RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.		RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.	RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.
.7	89	0	469	539	350	.7	90	15	402	370	398	120 HW	.7	89	32	364	236	425	.9	88	58	291	196	406	120 HW										
.8	87	0	433	495	353	.9	88	16	377	335	396	80 HW	.3	88	34	346	266	439	.8	88	58	286	191	439	80 HW										
.9	84	0	397	439	357	.9	86	17	352	307	405	40 HW	.9	87	36	329	248	450	.9	87	61	281	187	470	40 HW										
1.0	81	0	365	395	365	1.0	85	18	331	285	418	0	1.0	86	38	314	235	469	1.0	86	64	278	184	502	0										
1.1	78	0	339	361	377	1.1	84	19	314	267	434	40 TW	1.1	85	40	301	224	489	1.1	86	67	274	181	536	40 TW										
1.3	76	0	317	338	396	1.2	82	20	298	255	455	80 TW	1.3	85	42	290	216	512	1.2	86	70	271	178	569	80 TW										
1.4	75	0	306	328	424	1.3	81	21	292	250	487	120 TW	1.3	84	44	284	211	542	1.3	85	74	265	174	598	120 TW										

SPECIAL NOTES

(1) MULTIPLY STATUTE UNITS BY .87 FOR CONVERSION TO NAUTICAL UNITS

EXAMPLE

If you are at 15,000 ft. with 160 gallons of fuel, you can fly 290 miles by climbing to 35,000 ft. immediately at 100% rpm. At 35,000 ft. cruise at 85% rpm and start letdown 64 miles from destination. With a 40 mph headwind the range will be .9x290 or 261 miles. Cruise at 87% rpm and start letdown 61 miles from destination.

LEGEND

EFFECTIVE WIND - HW, HEADWIND, TW, TAILWIND
RANGE FACTOR - RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. - GROUND SPEED - STATUTE MILES PER HR.
CAS - CALIBRATED AIRSPEED IN STATUTE MILES PER HOUR

DATA AS OF: 11-6-48 BASED ON: Estimated Performance

BASED ON GASOLINE FUEL

WF-0-4 JUNE 48 700

FIGURE 7.

[redacted]

PILOT'S AMPLIFIED CHECK LIST

X-4 AIRPLANES J-30-WE-7 & 9 ENGINES

For detailed operating instructions, refer to HB-25.

BEFORE STARTING ENGINES

1. Exterior check - General condition of the airplane.
2. Duct and pitot covers - Removed.
3. Check Forms 1A and 41B.
4. Wheel chocks - In place.
5. Engines - Properly checked.
6. Fuel, oil, hydraulic fluid - Quantities checked.
7. External power (2 GT-13 Batteries) - Connected.
8. Ground crew fire extinguisher - Connected in LH wheel well.
9. Oxygen pressure - 400-450 psi.
10. Enclosure jettison pressure - 1980 psi.
11. Seat - Safety pin in catapult and enclosure cable linked to pin.
12. Landing-gear emergency extension handle - Shear pin in shaft detent and handle stowed with safety wire and seal intact.
13. Battery switch - "ON."
14. Circuit breakers - On.
15. Fire detector system - Test operate.
16. Parking brake - On.
17. Ground crew interphone - Check.
18. Throttles - "CUT-OFF."
19. Instruments - Check fuel gage and set clock and altimeter.

STARTING THE ENGINES

1. Fuel booster pump switch - "ON."
2. Fuel valve switch - "OPEN."
3. Starter-ignition switch - "ON."
4. Throttle - At 2300 rpm move to "GROUND IDLE" position.
5. Tailpipe temperature - Observe for limits.
6. Slowly accelerate to 6000-7000 rpm.
7. Fuel pressure - 12-15 psi.
8. Start the second engine in the foregoing manner.

AFTER ALL ENGINES ARE STARTED

1. Hydraulic pressures - Check.
2. Flight controls - Check operation.
3. Generators - "ON," check voltages.
4. Enclosure - Closed and latched.
5. Ground crew fire extinguisher - Disconnected.
6. Parking brakes - Released. Check before taxiing.

BEFORE TAKE-OFF

1. Radio - Check.
2. Enclosure - Secure.
3. Hydraulic pressure and temperature - Normal and below 160°F.
4. Flight controls - Checked.
5. Fuel booster pump - "ON."
6. Emergency fuel booster pump - "ON."
7. Landing flaps - Deflected as required.
8. When ready for take-off, apply the brakes, and advance both throttles full open and check for normal instrument readings.

DURING FLIGHT

1. Apply brakes before retracting the gear.
2. Emergency fuel booster pump - "OFF."
3. Observe all flight restrictions.
4. Control cockpit cooling and defogging as desired.

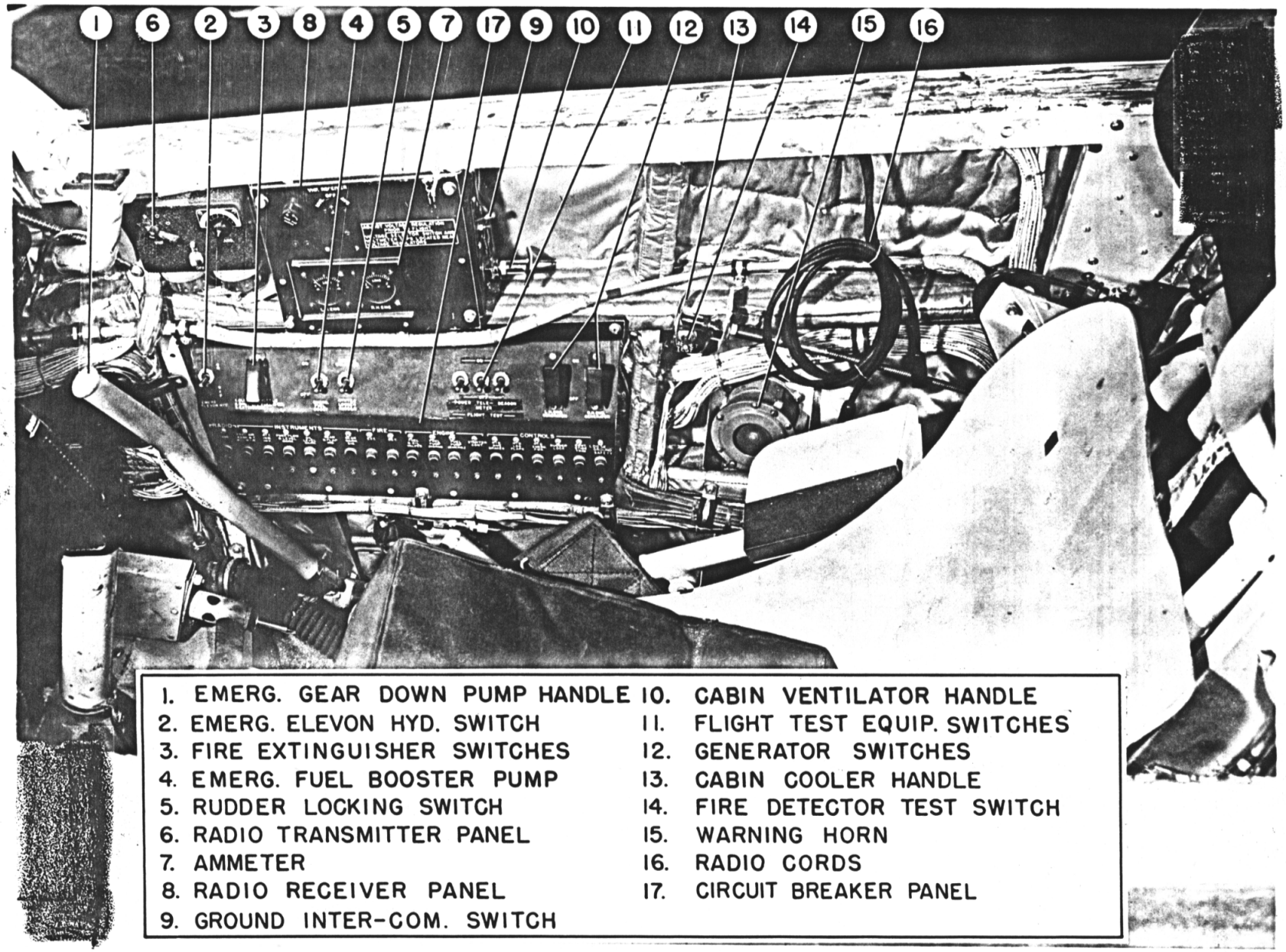
BEFORE LANDING

1. Check instruments.
2. Emergency fuel booster pump - "ON."
3. Hydraulic pressure - Normal.
4. Flaps and gear - Down under 200 mph.
5. Throttles - "FLIGHT IDLE" position during approach.

AFTER LANDING

1. Flight controls - Neutral, landing flaps up.
2. Throttles - "CUT-OFF."
3. Fuel pump and valves - "OFF."
4. Generators - "OFF."
5. Radio - "OFF."
6. Battery switch - "OFF."
7. Wheels - Chocked.
8. Brakes - Off.
9. Report any malfunctions to the crew chief.

[redacted]



1. EMERG. GEAR DOWN PUMP HANDLE
2. EMERG. ELEVON HYD. SWITCH
3. FIRE EXTINGUISHER SWITCHES
4. EMERG. FUEL BOOSTER PUMP
5. RUDDER LOCKING SWITCH
6. RADIO TRANSMITTER PANEL
7. AMMETER
8. RADIO RECEIVER PANEL
9. GROUND INTER-COM. SWITCH
10. CABIN VENTILATOR HANDLE
11. FLIGHT TEST EQUIP. SWITCHES
12. GENERATOR SWITCHES
13. CABIN COOLER HANDLE
14. FIRE DETECTOR TEST SWITCH
15. WARNING HORN
16. RADIO CORDS
17. CIRCUIT BREAKER PANEL

FIG. 1-2. COCKPIT - RIGHTHAND VIEW

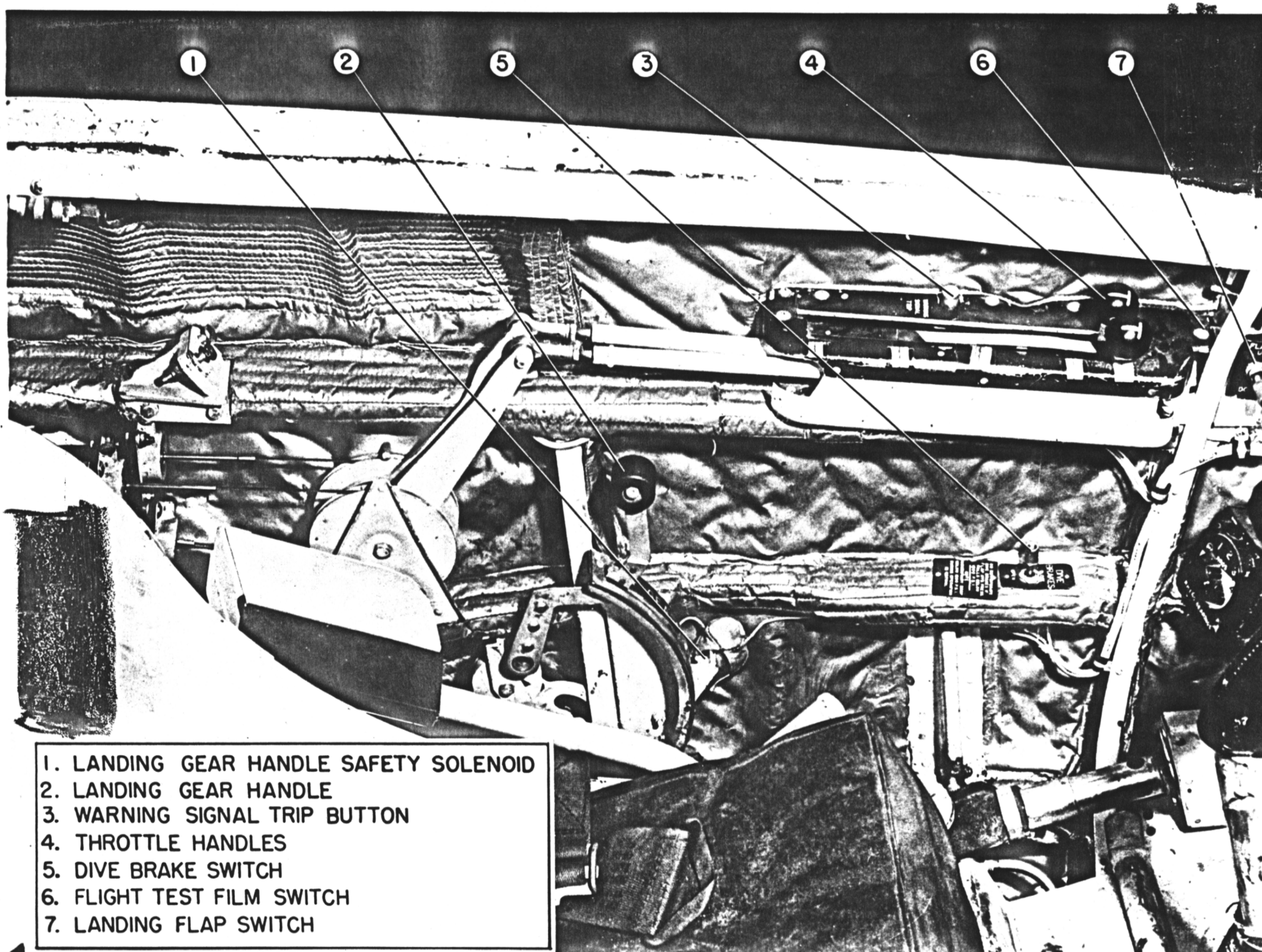
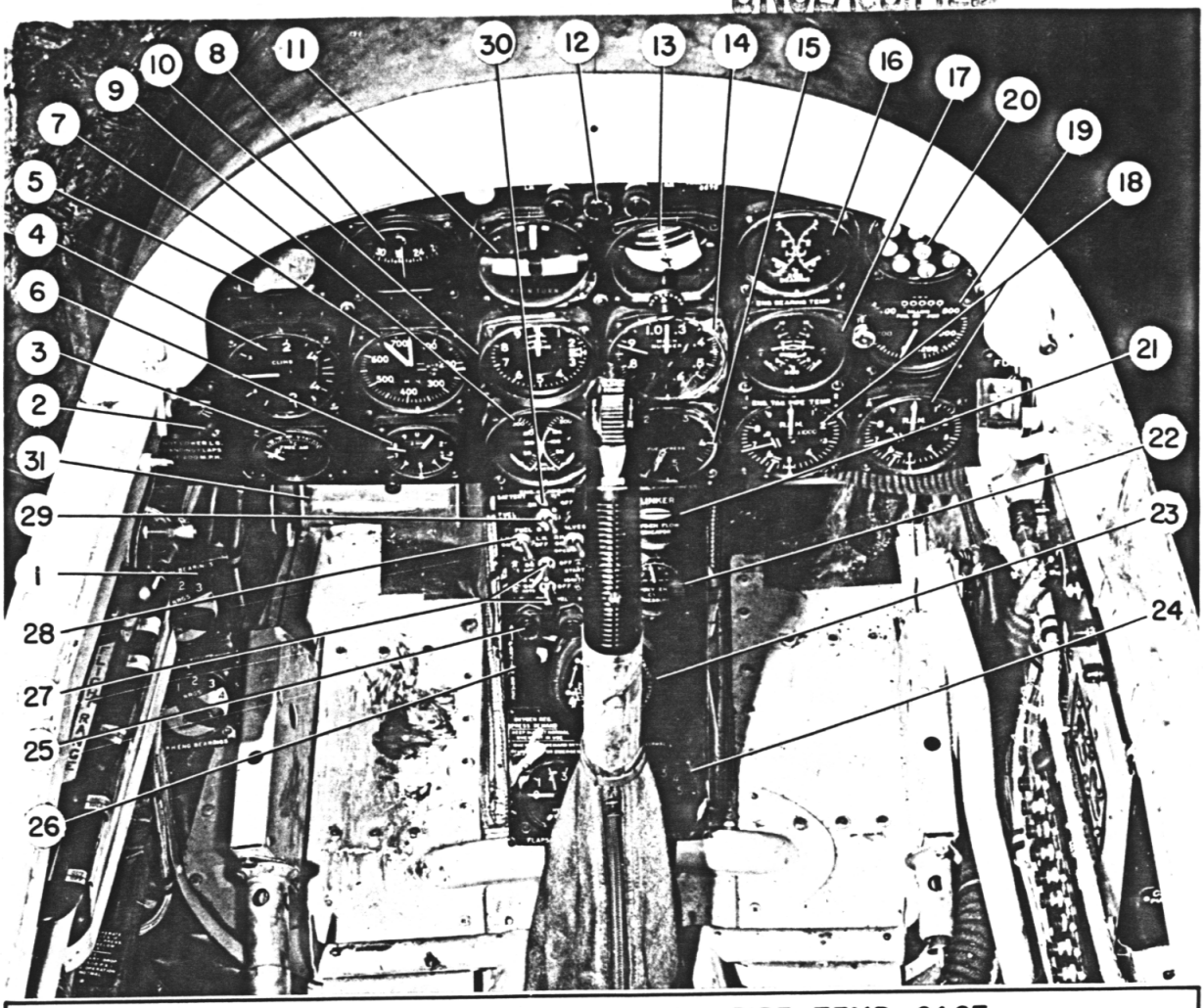


FIG. 1-3. COCKPIT - LEFTHAND VIEW



1. ENGINE BEARING SWITCHES
2. FLAP & DIVE BRAKE POSITION IND.
3. FREE AIR TEMP. GAGE
4. RATE OF CLIMB INDICATOR.
5. CLOCK
6. ACCELEROMETER
7. AIR SPEED INDICATOR
8. COMPASS
9. OIL PRESSURE GAGE
10. ALTIMETER
11. TURN & BANK INDICATOR
12. LANDING GEAR SAFE LIGHTS
13. UNIVERSAL ATTITUDE GRYO
14. MACH METER GAGE
15. FUEL PRESSURE INDICATOR
16. ENGINE BEARING TEMP. GAGE
17. TAILPIPE TEMP. GAGE
18. TACHOMETER
19. FUEL FLOW INDICATOR
20. LANDING GEAR DOOR IND. LIGHTS
21. OXYGEN BLINKER
22. OXYGEN PRESSURE GAGE
23. OXYGEN REGULATOR
24. HYDRAULIC PRESSURE GAGES
25. OIL LEVEL WARNING LIGHTS
26. PARKING BRAKE
27. STARTER SWITCHES
28. FUEL & OIL SHUT OFF SWITCHES
29. FUEL BOOSTER SWITCH
30. BATTERY SWITCH
31. RUDDER PEDALS

[redacted]

FIG. 1-4. COCKPIT - FRONT VIEW

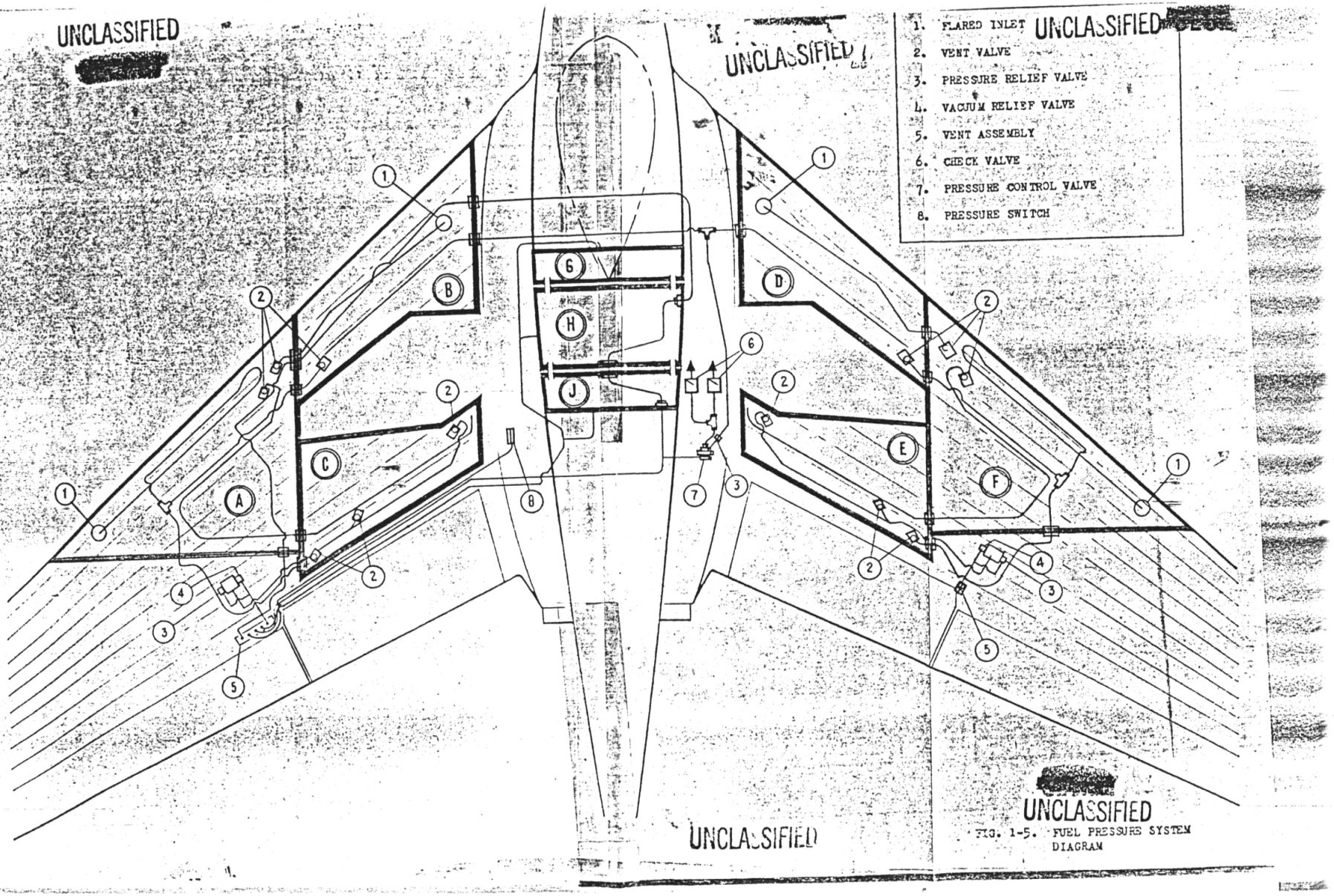


FIG. 1-5. FUEL PRESSURE SYSTEM DIAGRAM

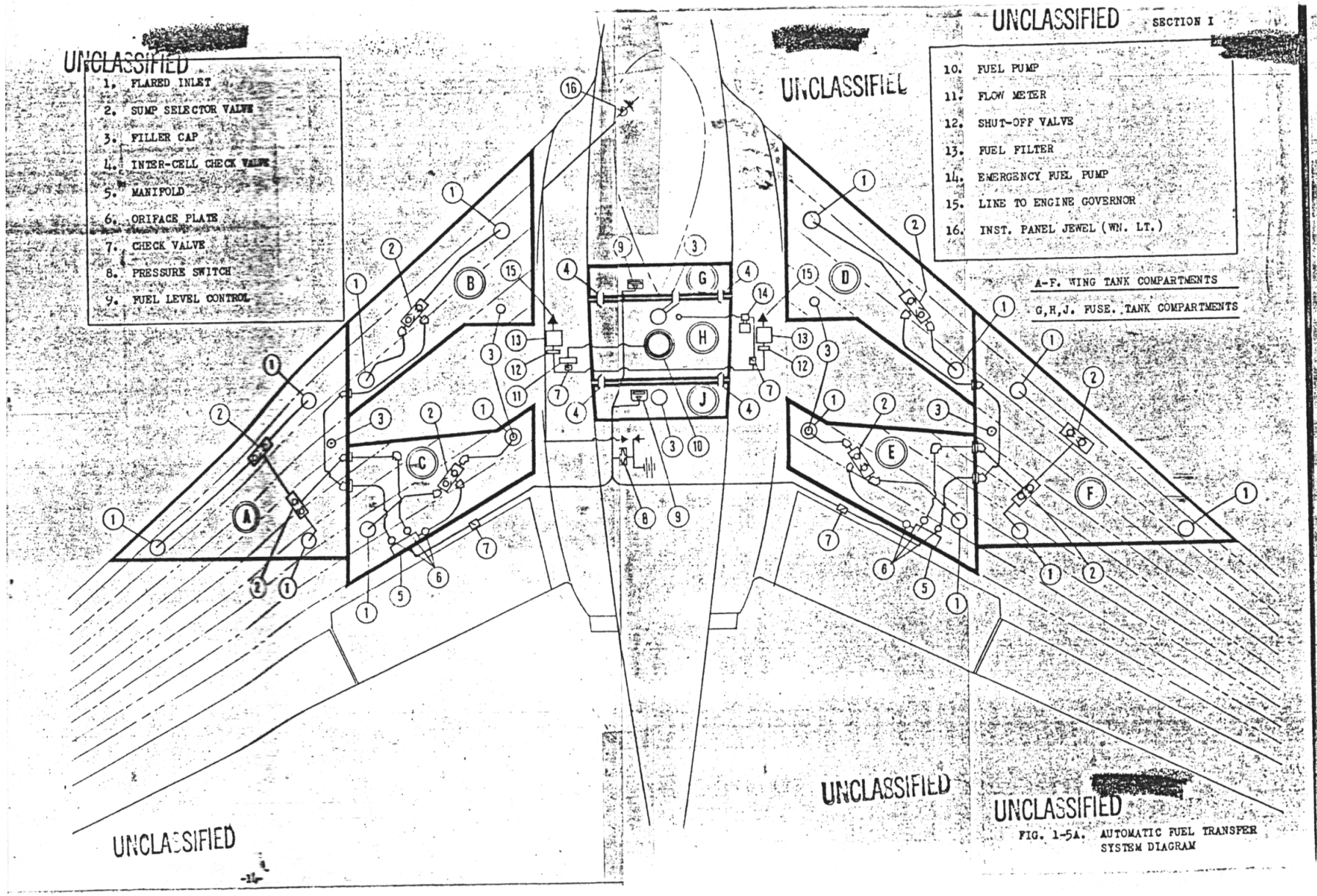
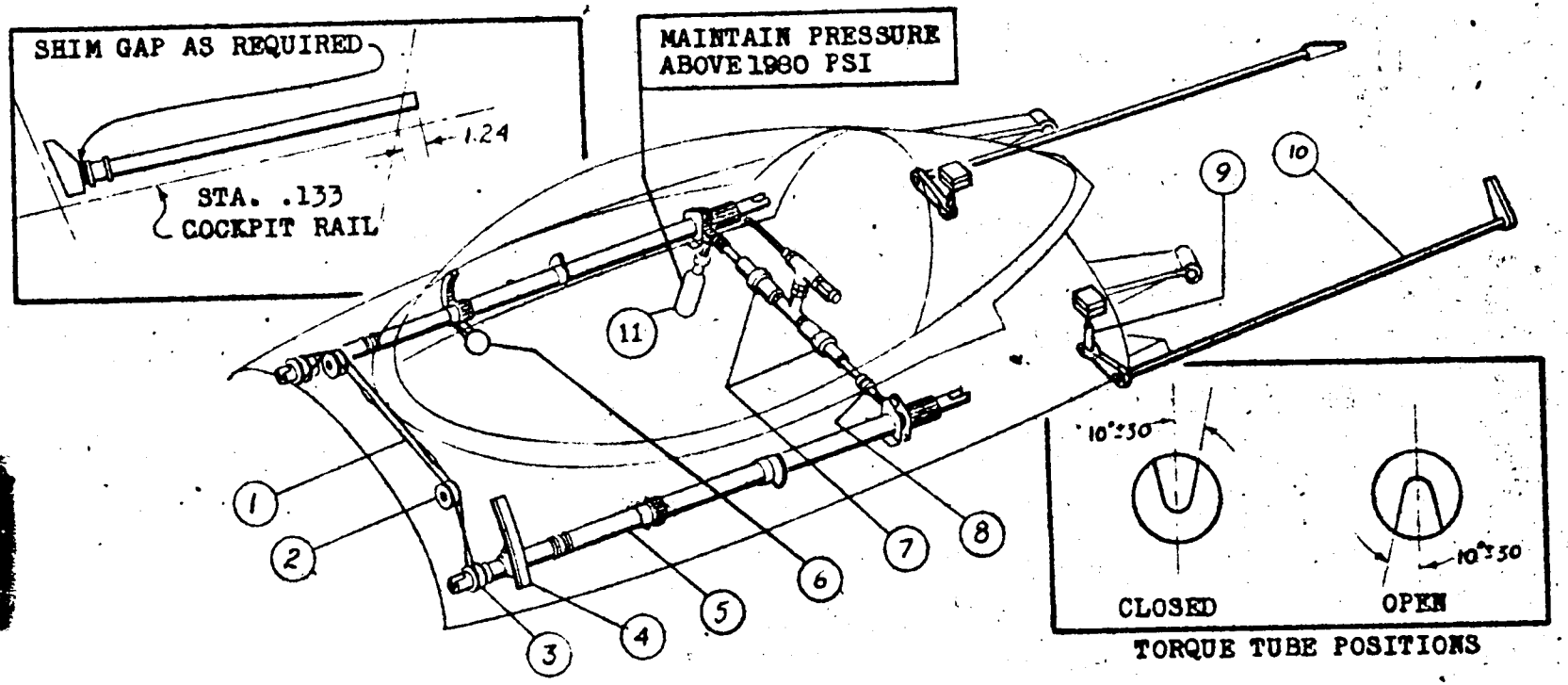
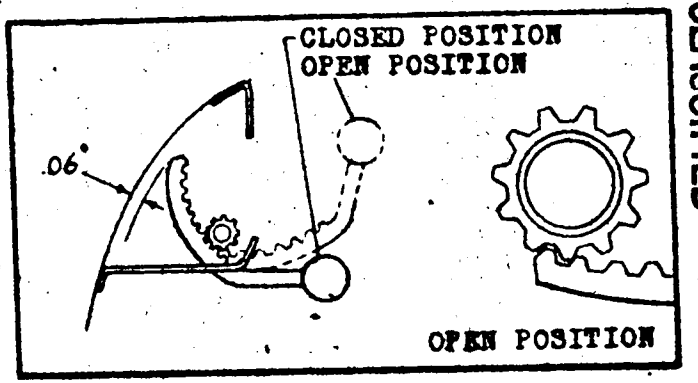


FIG. 1-5A. AUTOMATIC FUEL TRANSFER SYSTEM DIAGRAM



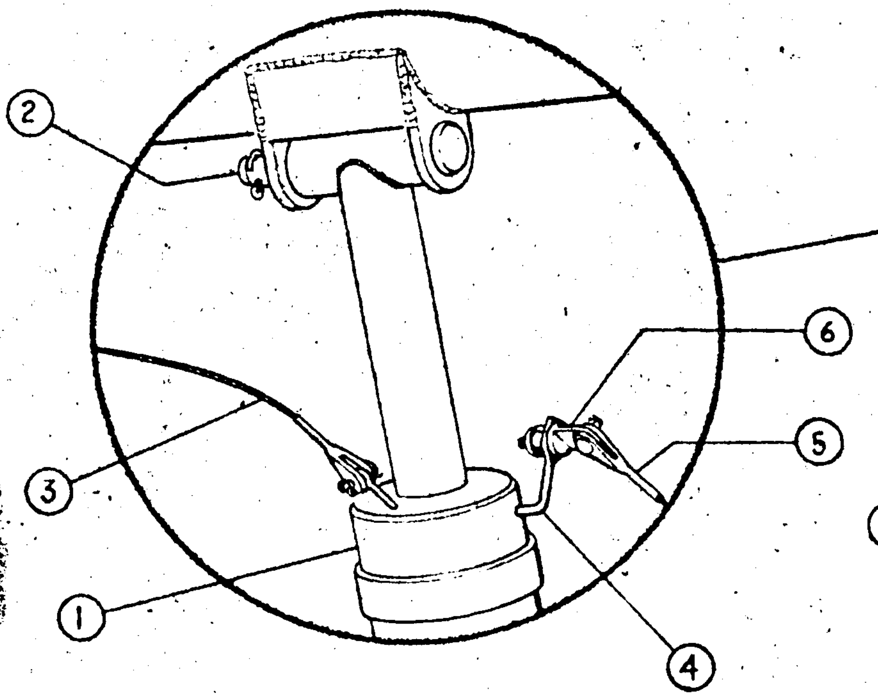
TORQUE TUBE POSITIONS

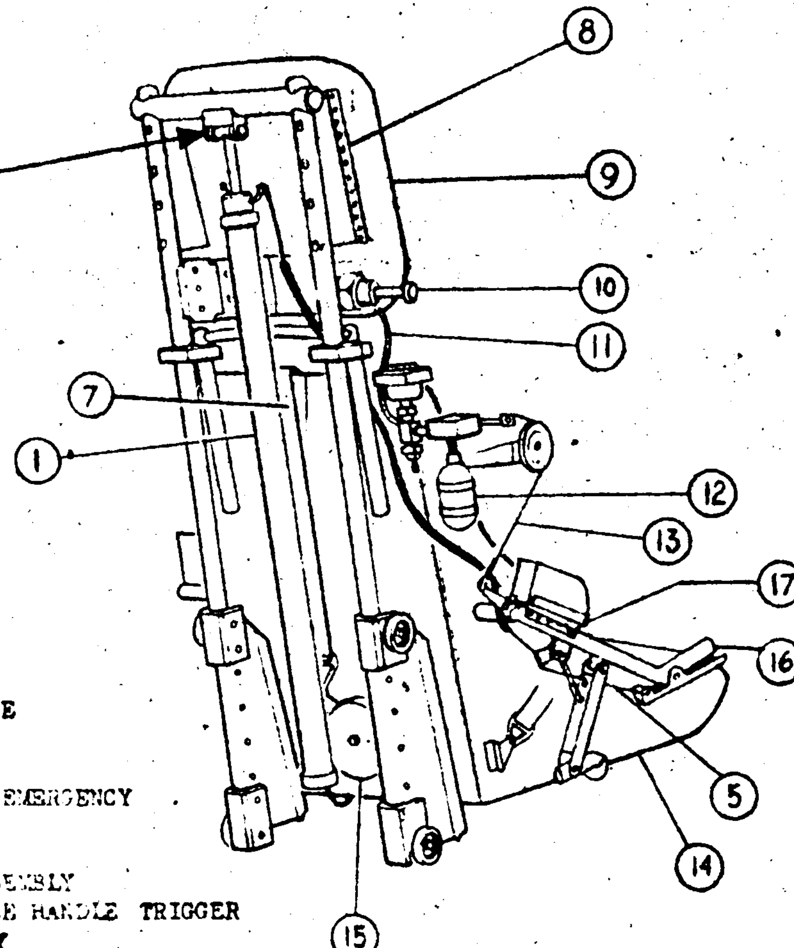
1. CABLE ASSEMBLY NOTE: ADJUST TURNBUCKLES TO OBTAIN 50 LBS PRELOAD ON CABLES
2. PULLEY
3. CABLE DRUM
4. EXTERNAL RELEASE HANDLE
5. TORQUE TUBE
6. INTERNAL RELEASE HANDLE
7. ACTUATING CYLINDERS
8. RACK-EMERGENCY RELEASE
9. LINK-TORQUE ARM
10. TORQUE SHAFT COUNTER BALANCING INSTALLATION
11. NITROGEN BOTTLE



INTERNAL RELEASE MECHANISM

FIG. 3-1. ENCLOSURE RELEASE MECHANISM - NORMAL AND EMERGENCY





1. CATAPULT
2. COTTER PIN
3. SAFETY PIN
4. CATAPULT SEAR
5. CATAPULT TRIGGER CABLE
6. EYE BOLT - COTTER PIN
   NOTE: SET NUT FREE ENOUGH TO ALLOW EYE BOLT TO ROTATE
7. PILOT HARNESS
8. HEAD REST SUPPORT BRACKET
9. HEAD REST
10. EMERGENCY RELEASE
11. NITROGEN LINE
12. NITROGEN BOTTLE
13. CONTROL CABLE - EMERGENCY RELEASE
14. SEAT ASSEMBLY
15. INERTIA REEL ASSEMBLY
16. EMERGENCY RELEASE HANDLE TRIGGER
17. ARMREST ASSEMBLY

FIG. 3-1A. PILOT'S SEAT & CATAPULT EJECTION MECH.

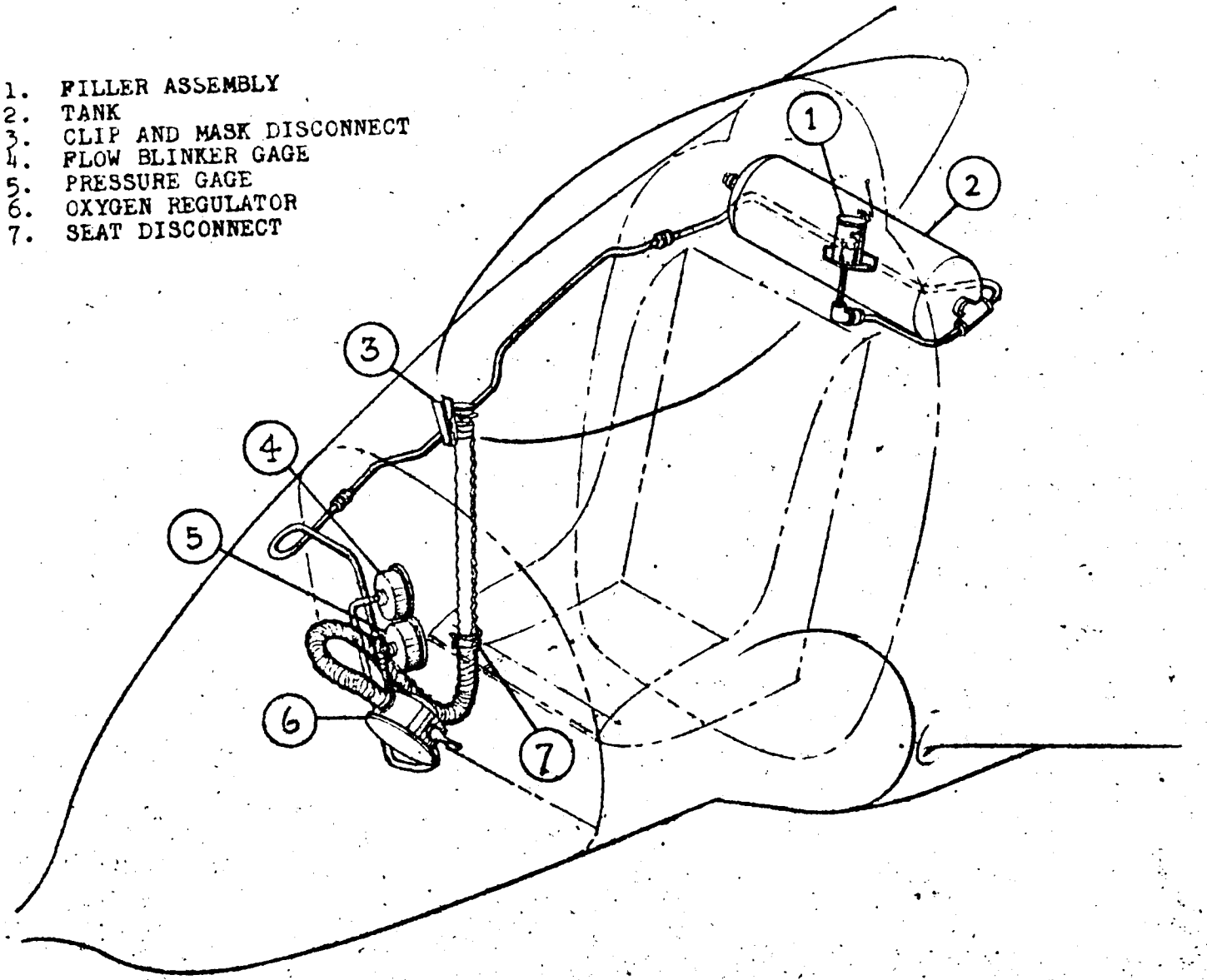
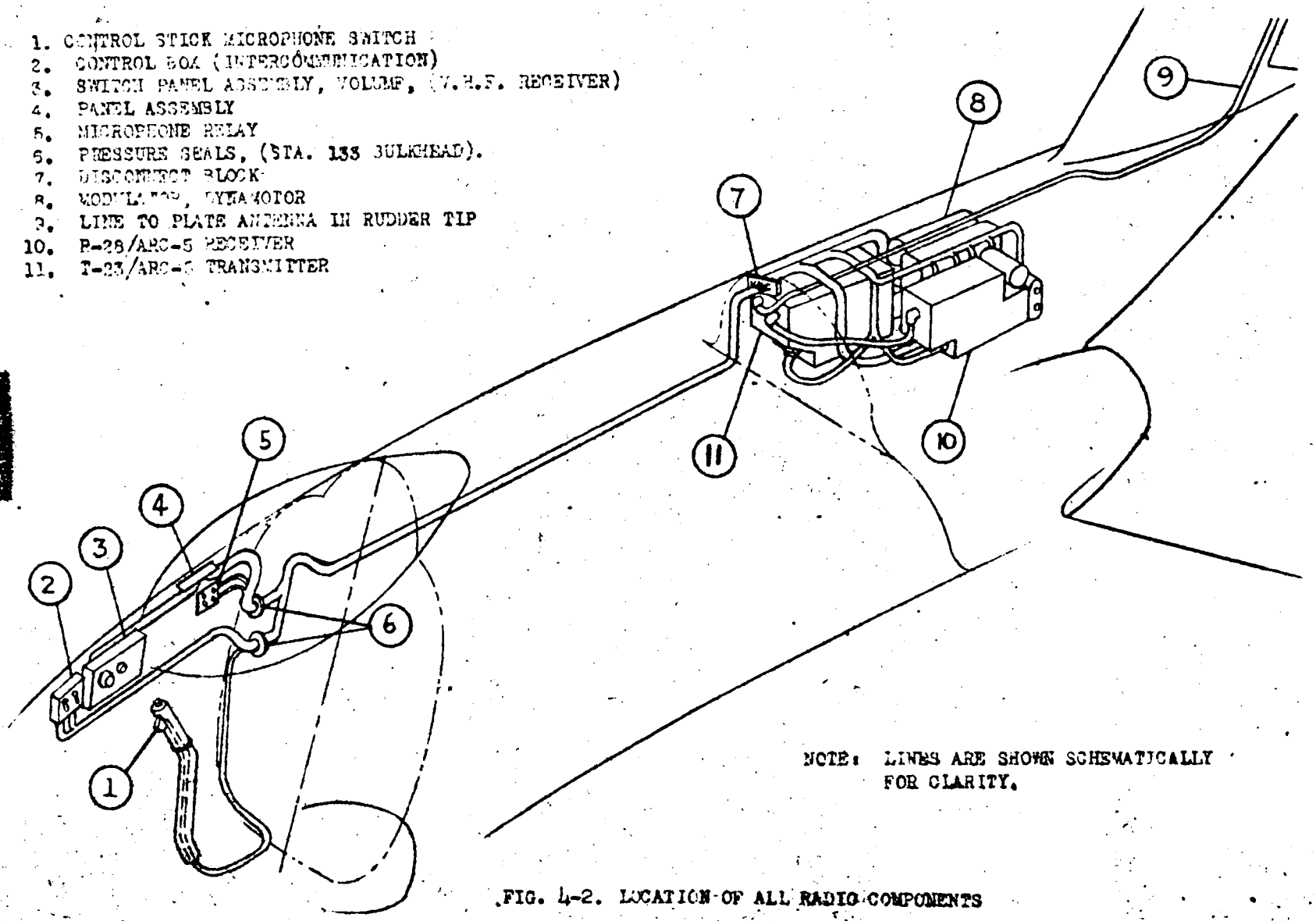


FIG. 4-1. OXYGEN SYSTEM DIAGRAM

1. CONTROL STICK MICROPHONE SWITCH
2. CONTROL BOX (INTERCOMMUNICATION)
3. SWITCH PANEL ASSEMBLY, VOLUME, (V.H.F. RECEIVER)
4. PANEL ASSEMBLY
5. MICROPHONE RELAY
6. PRESSURE SEALS, (STA. 133 BULKHEAD).
7. DISCONNECT BLOCK
8. MODULATOR, DYNAMOTOR
9. LINE TO PLATE ANTENNA IN RUDDER TIP
10. R-28/ARC-5 RECEIVER
11. T-23/ARC-5 TRANSMITTER



NOTE: LINES ARE SHOWN SCHEMATICALLY FOR CLARITY.

FIG. 4-2. LOCATION OF ALL RADIO COMPONENTS

NACA Form No. 239C (5 May 48)

AIRPLANE MODEL(S) X-4

ENGINE(S): XJ-30-WE

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS 7427 TO 5972 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO (2)

LIMITS	TIME LIMIT	% RPM	TAIL PIPE TEMP. °C	OIL PRESS PSI
MILITARY	15 Min.	100		
NORMAL		92.4		

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT-Select figure in fuel column equal to or less than fuel on board. Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude for maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING-Subtract fuel required for take-off and climb to altitude. Then use chart as for IN FLIGHT above, adding initial climb distance to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight change), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain maximum range. All range values include allowances for descent distance and fuel plus reserve shown for landing. Climb distance and fuel are included where climbs are indicated.

IF YOU ARE AT Sea Level			IF YOU ARE AT 15000'			FUEL U.S. GAL.	IF YOU ARE AT 25000'			IF YOU ARE AT 35000'			FUEL U.S. GAL.	IF YOU ARE AT			IF YOU ARE AT		
RANGE IN AIRMILES			RANGE IN AIRMILES				RANGE IN AIRMILES			RANGE IN AIRMILES				RANGE IN AIRMILES			RANGE IN AIRMILES		
BY CRUISING AT Sea Level	OPT. ALT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15000'	OPT. ALT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 25000'	OPT. ALT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35000'	OPT. ALT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT	OPT. ALT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT	OPT. ALT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND 42 GALLON LANDING RESERVE)																			
195	35000	448	303	35000	515	242.5	420	35000	553	568	35000								
146	35000	332	241	35000	399	200	335	35000	436	452	35000								
109	35000	223	182	35000	290	160	255	35000	327	342	35000								
72	25000	110	123	35000	180	120	176	35000	218	233	35000								
35	15000	37	65	25000	74	80	96	35000	108	123	35000								

CRUISING AT Sea Level						CRUISING AT 15000'						EFFECTIVE WIND	CRUISING AT 25000'						CRUISING AT 35000'						EFFECTIVE WIND	CRUISING AT						CRUISING AT					
RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.	RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.		RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.	RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.		RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.	RANGE FACTOR	% RPM	LET-DOWN DIST.	APPROXIMATE CAS	APPROXIMATE GPH	APPROXIMATE G.S.
.7	89	0	469	539	350	.7	90	15	402	370	398	120 HW	.7	89	32	364	236	425	.9	88	58	291	196	406	120 HW										
.8	87	0	433	495	353	.9	88	16	377	335	396	80 HW	.3	88	34	346	266	439	.8	88	58	286	191	439	80 HW										
.9	84	0	397	439	357	.9	86	17	352	307	405	40 HW	.9	87	36	329	248	450	.9	87	61	281	187	470	40 HW										
1.0	81	0	365	395	365	1.0	85	18	331	285	418	0	1.0	86	38	314	235	469	1.0	86	64	278	184	502	0										
1.1	78	0	339	361	377	1.1	84	19	314	267	434	40 TW	1.1	85	40	301	224	489	1.1	86	67	274	181	536	40 TW										
1.3	76	0	317	338	396	1.2	82	20	298	255	455	80 TW	1.3	85	42	290	216	512	1.2	86	70	271	178	569	80 TW										
1.4	75	0	306	328	424	1.3	81	21	292	250	487	120 TW	1.3	84	44	284	211	542	1.3	85	74	265	174	598	120 TW										

SPECIAL NOTES

(1) MULTIPLY STATUTE UNITS BY .87 FOR CONVERSION TO NAUTICAL UNITS

EXAMPLE

If you are at 15,000 ft. with 160 gallons of fuel, you can fly 290 miles by climbing to 35,000 ft. immediately at 100% rpm. At 35,000 ft. cruise at 85% rpm and start letdown 64 miles from destination. With a 40 mph headwind the range will be .9x290 or 261 miles. Cruise at 87% rpm and start letdown 61 miles from destination.

LEGEND

EFFECTIVE WIND - HW, HEADWIND, TW, TAILWIND
RANGE FACTOR - RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. - GROUND SPEED - STATUTE MILES PER HR.
CAS - CALIBRATED AIRSPEED IN STATUTE MILES PER HOUR

DATA AS OF: 11-6-48 BASED ON: Estimated Performance

BASED ON GASOLINE FUEL

WF-0-4 JUNE 48 700

FIGURE 7.

[redacted]

PILOT'S AMPLIFIED CHECK LIST

X-4 AIRPLANES J-30-WE-7 & 9 ENGINES

For detailed operating instructions, refer to HB-25.

BEFORE STARTING ENGINES

1. Exterior check - General condition of the airplane.
2. Duct and pitot covers - Removed.
3. Check Forms 1A and 41B.
4. Wheel chocks - In place.
5. Engines - Properly checked.
6. Fuel, oil, hydraulic fluid - Quantities checked.
7. External power (2 GT-13 Batteries) - Connected.
8. Ground crew fire extinguisher - Connected in LH wheel well.
9. Oxygen pressure - 400-450 psi.
10. Enclosure jettison pressure - 1980 psi.
11. Seat - Safety pin in catapult and enclosure cable linked to pin.
12. Landing-gear emergency extension handle - Shear pin in shaft detent and handle stowed with safety wire and seal intact.
13. Battery switch - "ON."
14. Circuit breakers - On.
15. Fire detector system - Test operate.
16. Parking brake - On.
17. Ground crew interphone - Check.
18. Throttles - "CUT-OFF."
19. Instruments - Check fuel gage and set clock and altimeter.

STARTING THE ENGINES

1. Fuel booster pump switch - "ON."
2. Fuel valve switch - "OPEN."
3. Starter-ignition switch - "ON."
4. Throttle - At 2300 rpm move to "GROUND IDLE" position.
5. Tailpipe temperature - Observe for limits.
6. Slowly accelerate to 6000-7000 rpm.
7. Fuel pressure - 12-15 psi.
8. Start the second engine in the foregoing manner.

AFTER ALL ENGINES ARE STARTED

1. Hydraulic pressures - Check.
2. Flight controls - Check operation.
3. Generators - "ON," check voltages.
4. Enclosure - Closed and latched.
5. Ground crew fire extinguisher - Disconnected.
6. Parking brakes - Released. Check before taxiing.

BEFORE TAKE-OFF

1. Radio - Check.
2. Enclosure - Secure.
3. Hydraulic pressure and temperature - Normal and below 160°F.
4. Flight controls - Checked.
5. Fuel booster pump - "ON."
6. Emergency fuel booster pump - "ON."
7. Landing flaps - Deflected as required.
8. When ready for take-off, apply the brakes, and advance both throttles full open and check for normal instrument readings.

DURING FLIGHT

1. Apply brakes before retracting the gear.
2. Emergency fuel booster pump - "OFF."
3. Observe all flight restrictions.
4. Control cockpit cooling and defogging as desired.

BEFORE LANDING

1. Check instruments.
2. Emergency fuel booster pump - "ON."
3. Hydraulic pressure - Normal.
4. Flaps and gear - Down under 200 mph.
5. Throttles - "FLIGHT IDLE" position during approach.

AFTER LANDING

1. Flight controls - Neutral, landing flaps up.
2. Throttles - "CUT-OFF."
3. Fuel pump and valves - "OFF."
4. Generators - "OFF."
5. Radio - "OFF."
6. Battery switch - "OFF."
7. Wheels - Chocked.
8. Brakes - Off.
9. Report any malfunctions to the crew chief.

[redacted]