PILOT'S HANDBOOK OF

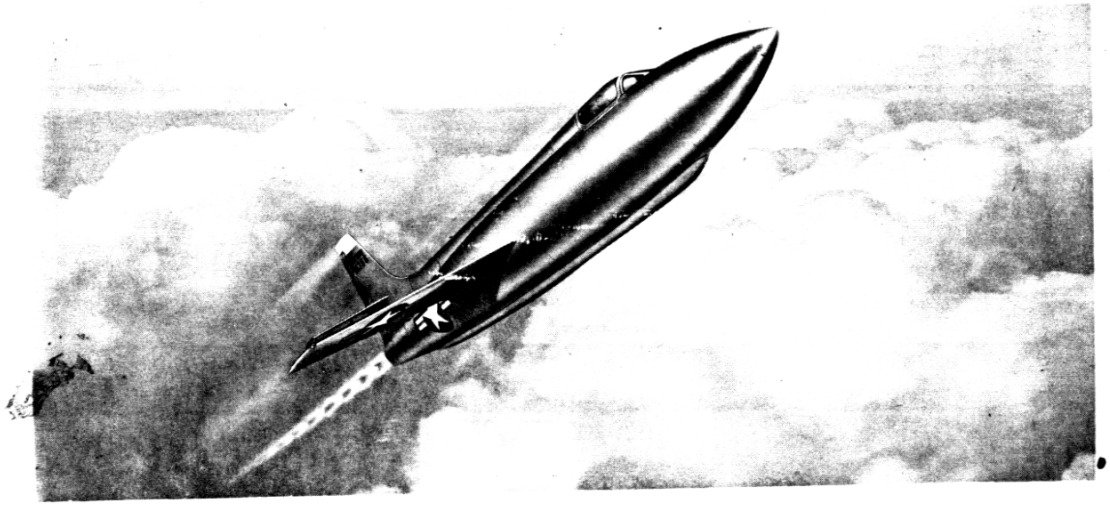
FLIGHT OPERATING INSTRUCTIONS FOR X-1A, B & D AIRPLANE

SERIAL NO'S. 48-1384, 48-1385, & 48-1386
MFG. MODEL DESIGNATION 58 A, B, & D

POWERED WITH ONE MODEL XLR11-RM-5 ENGINE
(MANUFACTURER & MODEL DESIGNATION
REACTION MOTORS INC. - E6000C4)

MANUFACTURED BY
BELL AIRCRAFT CORPORATION

CONTRACT W33-038 AC20062 SPECIFICATION NO. 58-947-001



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ILLUSTRATIONS

INTRODUCTION

This handbook contains the information necessary to enable USAF personnel to safely fly the X-1A, X-1B and X-1D aircraft. The handbook is divided into four sections and an appendix to facilitate easy comprehension. Read the whole book for a complete understanding of the aircraft, or use the various sections as references.

SECTION I - DESCRIPTION

This section contains an overall description of the aircraft, its equipment, systems, controls and a brief discussion on the principles of rocket operation.

SECTION II - NORMAL OPERATING INSTRUCTIONS

This section contains the procedure steps to be accomplished by the pilot from the time he approaches the aircraft until completion of the mission.

SECTION III - EMERGENCY OPERATING INSTRUCTIONS

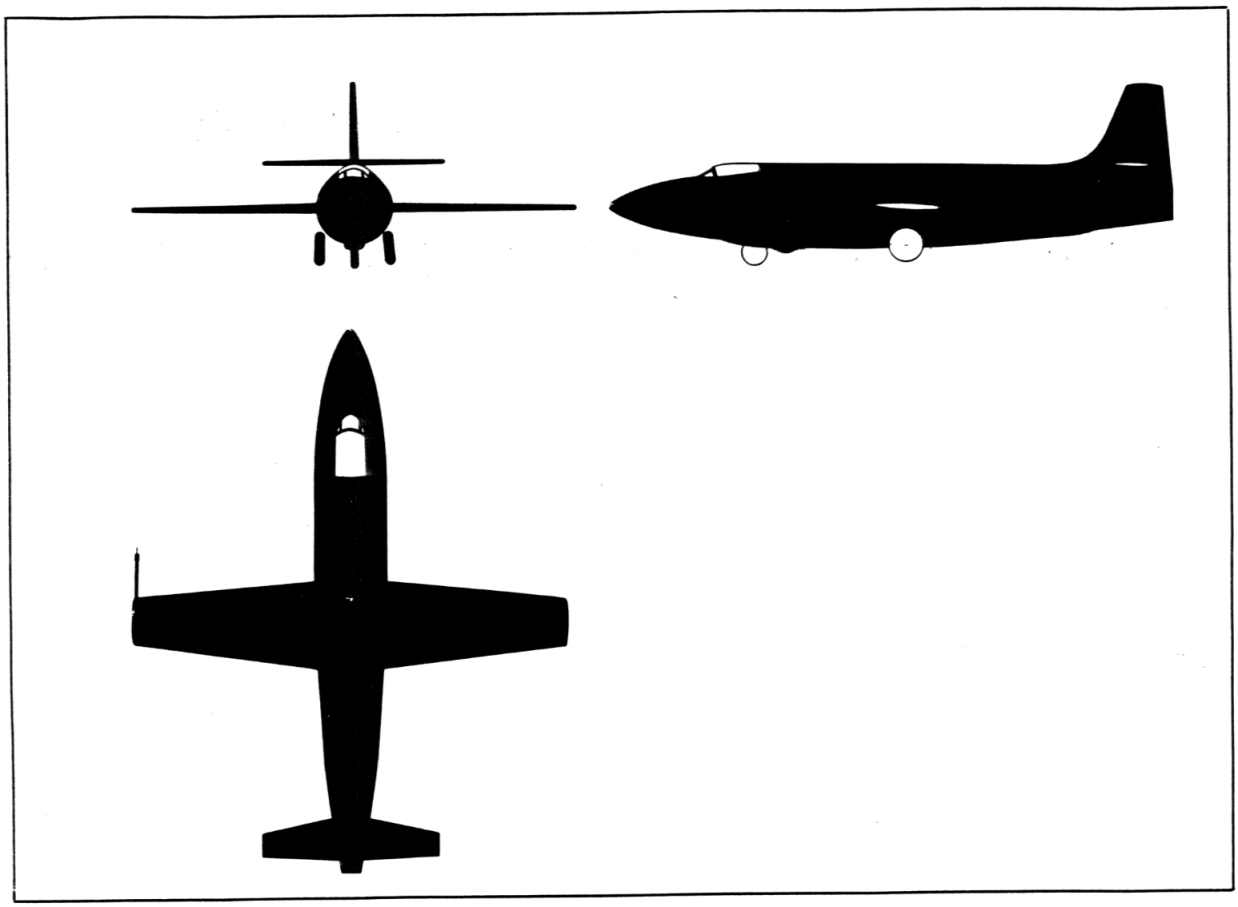
The procedures necessary to meet any emergencies which might be expected are set forth in this section.

SECTION IV - OPERATIONAL EQUIPMENT

The instructions for operating the equipment that is not actually essential for flight are contained in this section.

APPENDIX I

This section contains the charts for flight operations and limitations.



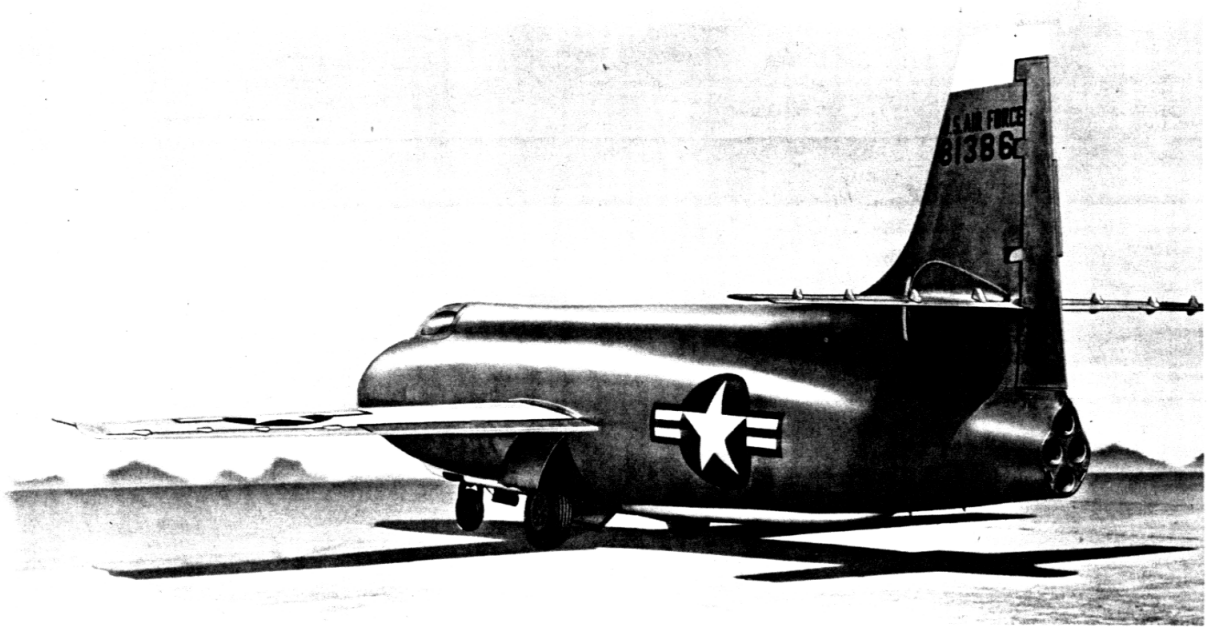


Figure 1-1. The Airplane

SECTION I

DESCRIPTION

1-1. THE AIRPLANE.

1-2. GENERAL. The X-1A, X-1B and X-1D are high altitude, high speed midwing research aircraft. The mission of these aircraft is piloted, high altitude, high speed flight testing of various research components. They are designed for air launching from a mother airplane.

1-3. Over-all dimensions and gross weight are:

Length	426.58 in.
Span	366 in.
Height (top of vertical fin to ground)	128.37 in.
Wheel base	161.13 in.
Tread	51 in.
Stress design gross weight	10,668 lbs.

1-4. POWER PLANT.

1-5. GENERAL. Power is furnished by a bipropellant liquid rocket engine utilizing an alcohol-water mixture as the fuel, and liquid oxygen as the oxidizer. The fuel and oxidizer are forced under low inert gas pressure to a turbine-driven pump which delivers the propellants to the engine at operating pressures.

1-6. ENGINE. The engine is a model XLR11-RM-5 four thrust chamber unit, incorporating injectors and igniters, the engine control, and the turbine-driven pump assembly.

1-7. PRINCIPLES OF ROCKET OPERATION.

1-8. Heat energy derived from the combustion of fuel and oxidizer at high pressure and temperature is converted into kinetic energy of motion by expansion of the combustion gases to a lower pressure and temperature through an exhaust nozzle. The fact that the gases, which have appreciable weight, are accelerated by their expansion through the nozzle means that force has been exerted on them to speed them up. The reaction to this force, acting on the forward end of the combustion chamber, gives the engine a forward push. Thrust is not caused by any push of the exhaust gases on the outside air; a rocket engine will operate more efficiently where rarefied air will reduce friction resistance. The power obtained from a rocket engine varies directly with the speed of the aircraft and engine thrust. The power developed at 600 knots at 6000 pounds thrust would be approximately 11,000 horsepower. At 1200 knots and 6000 pounds thrust the horsepower developed would be approximately 22,000. At about 325 knots, thrust and horsepower would balance.

1-9. TURBINE-DRIVEN PROPELLANT PUMP.

1-10. GENERAL. The model 6M325CF-1 turbine-driven pump consists of the fuel pump, oxidizer pump, turbine, governor, overspeed control, gas generator, valves, tubing and necessary wiring and switches. (Figure 1-2.) The pump turbine is operated by passing pressurized hydrogen peroxide through the solid catalyst (manganese dioxide) of the gas generator, where decomposition occurs, resulting in a mixture of oxygen and superheated steam which is directed against the blades of the turbine wheel. Thus, the turbine drives the fuel and oxidizer pumps. Control gas (nitrogen), at a regulated constant pressure, is applied to the inlet of the governor to act as a balance for the fuel manifold pressure which is applied to the float of the governor. As the fuel manifold pressure varies, the constant pressure of the control gas will cause the governor supply valve to increase or decrease the N_2 pressure on the control valve; this increases or decreases the flow of H_2O_2 to the gas generator, thus varying the flow of propellants to the engine. In the event the fuel manifold pressure exceeds the established value, the governor will close the supply valve and open a bleed valve reducing the H_2O_2 flow and throttling the flow to the gas generator. Low fuel manifold pressure will cause the governor to close the bleed valve and increase the H_2O_2 flow. If the turbine overspeeds, a switch controlled by a centrifugal mechanism closes the H_2O_2 emergency cut-off control valve, the control valve and the emergency cut-off valve, thus stopping the pump. In addition a second circuit is closed, energizing the overspeed coil of the overspeed interlock and release relay, which opens the circuit to the governor supply valve, shutting off the nitrogen to the H_2O_2 valve through the governor. This circuit also lights the "TURBINE OVERSPEED" light on the instrument panel, and holds the system in the overspeed condition until the "TURBINE OVERSPEED RESET" button on the panel is held in momentarily, which returns the system to an operating status.

1-11. POWER PLANT CONTROLS.

1-12. THROTTLE. The throttle (6, figure 1-3) operates four electrical switches which are connected to the four thrust chambers through the motor control, in series with the four chamber selector switches (16, figure 1-5), and the emergency cut-off switch (7, figure 1-4). Progressive movement of the throttle from its "OFF" position will result in 25, 50, 75 and 100% increments of rated thrust, when the four chamber selector switches are "ON".

1-13. CHAMBER SELECTOR SWITCHES. The four chamber selector switches (16, figure 1-5) are wired in series with the throttle in such a manner that any of the chambers may be turned on or off in conjunction with throttle movement. If chamber switches one and four are turned "ON", and switches two and three are turned "OFF", when the throttle is moved full forward, only chambers one and four will fire.

1-14. IGNITER TEST SWITCH. The igniter test switch (9, figure 1-6) enables the pilot to test the operation of the four thrust chamber igniters, and the turbine pump control components, independently of the thrust chambers when moved from "OFF" to "ON".

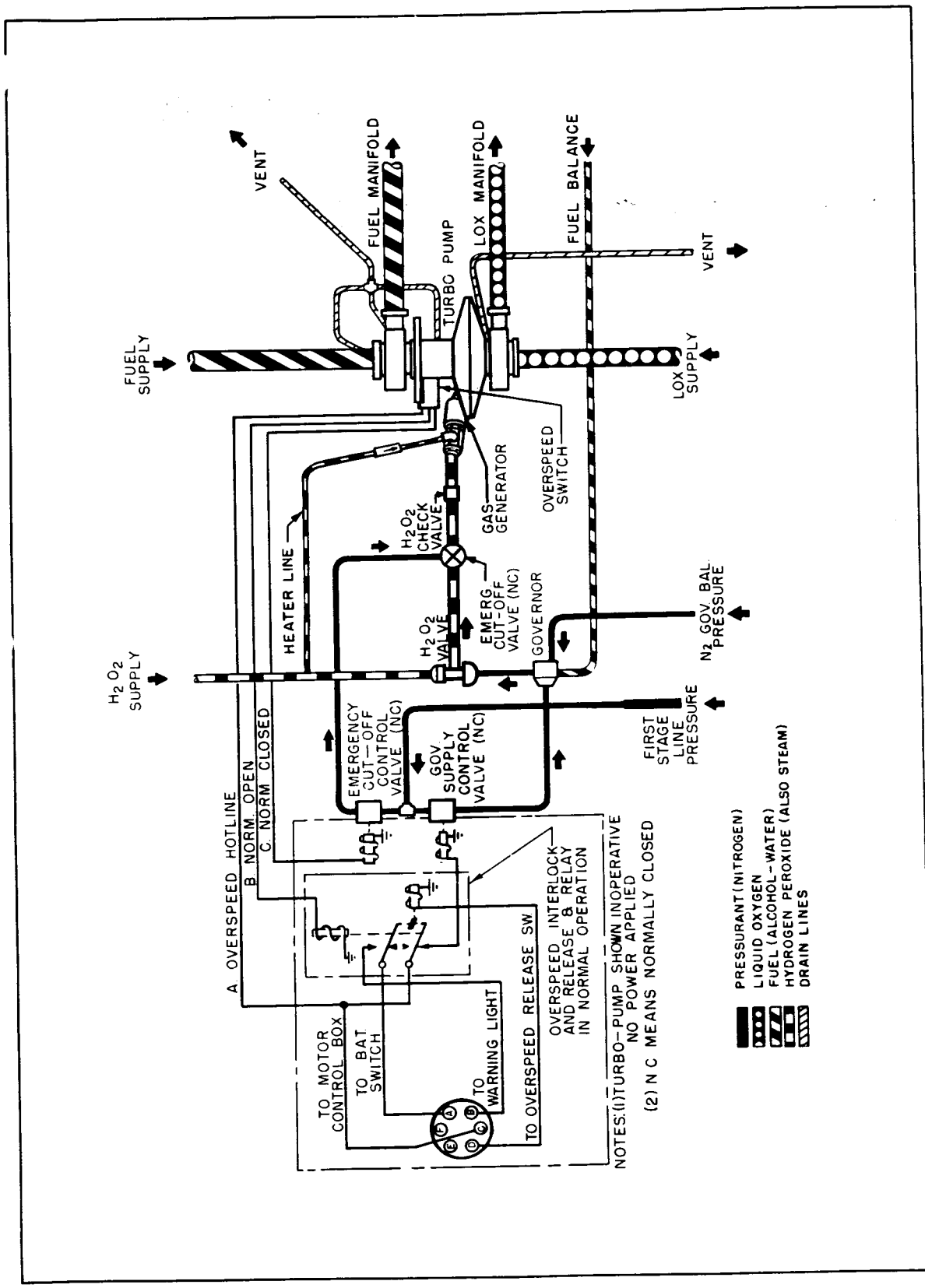
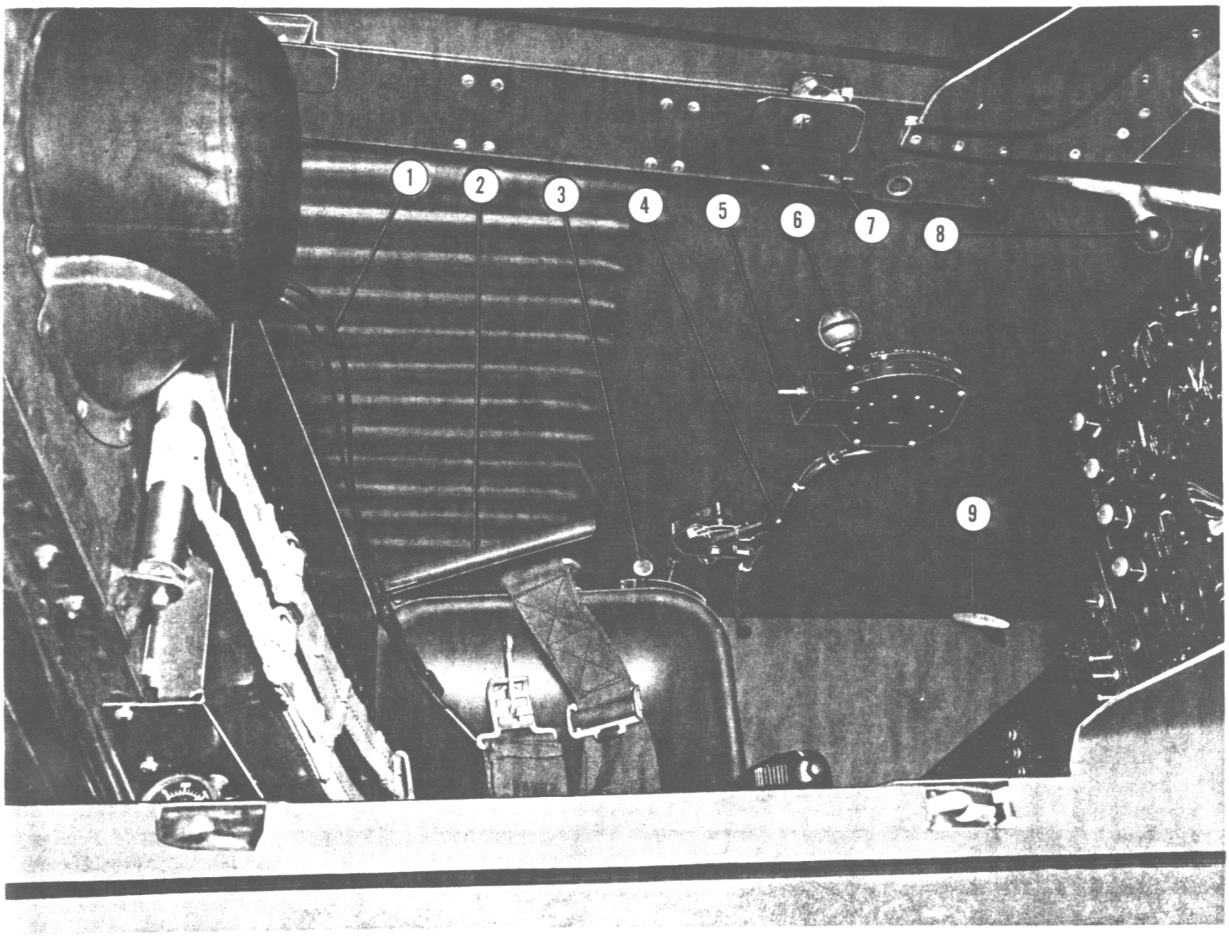
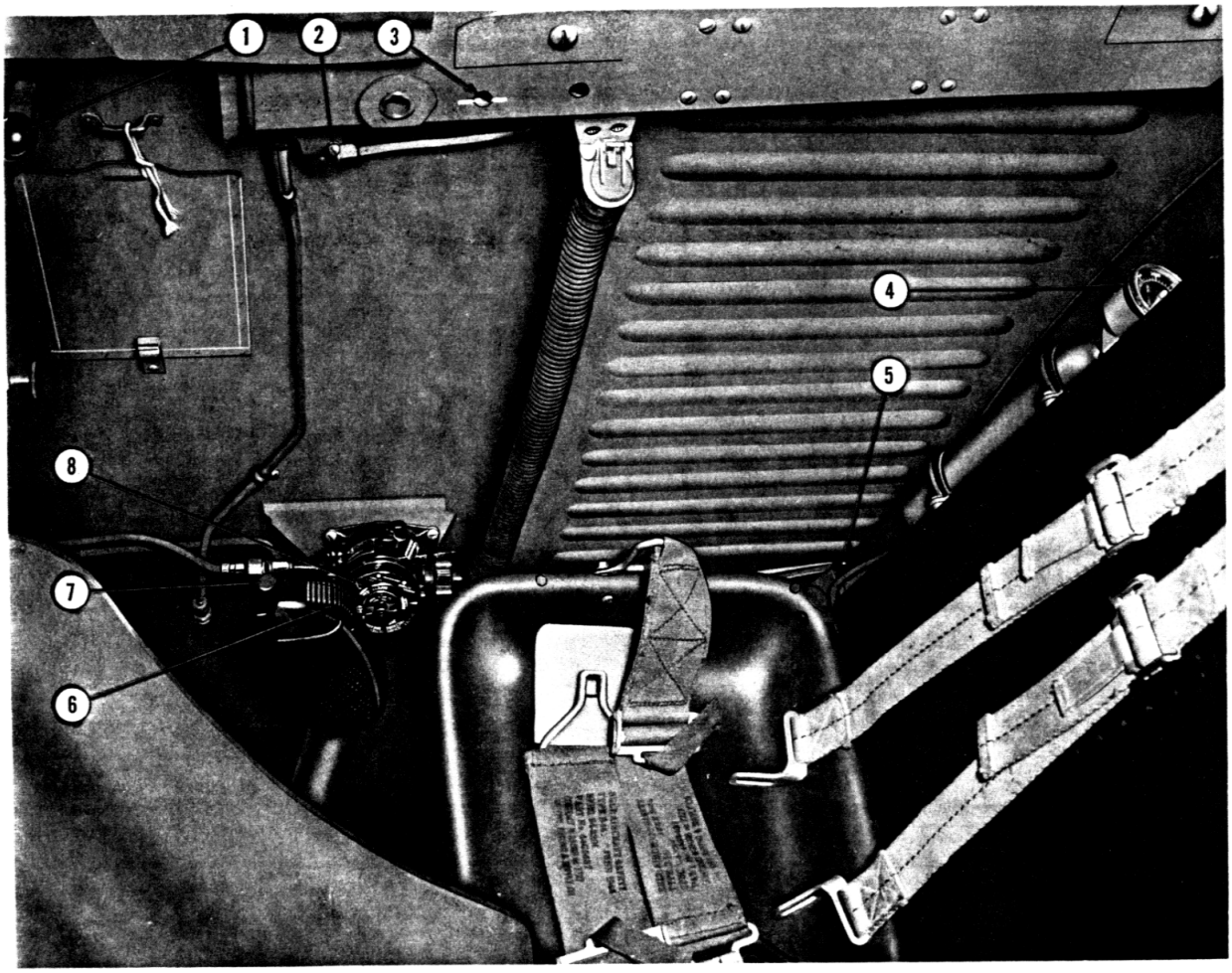


Figure 1-2. Turbine-Driven Pump Schematic Diagram



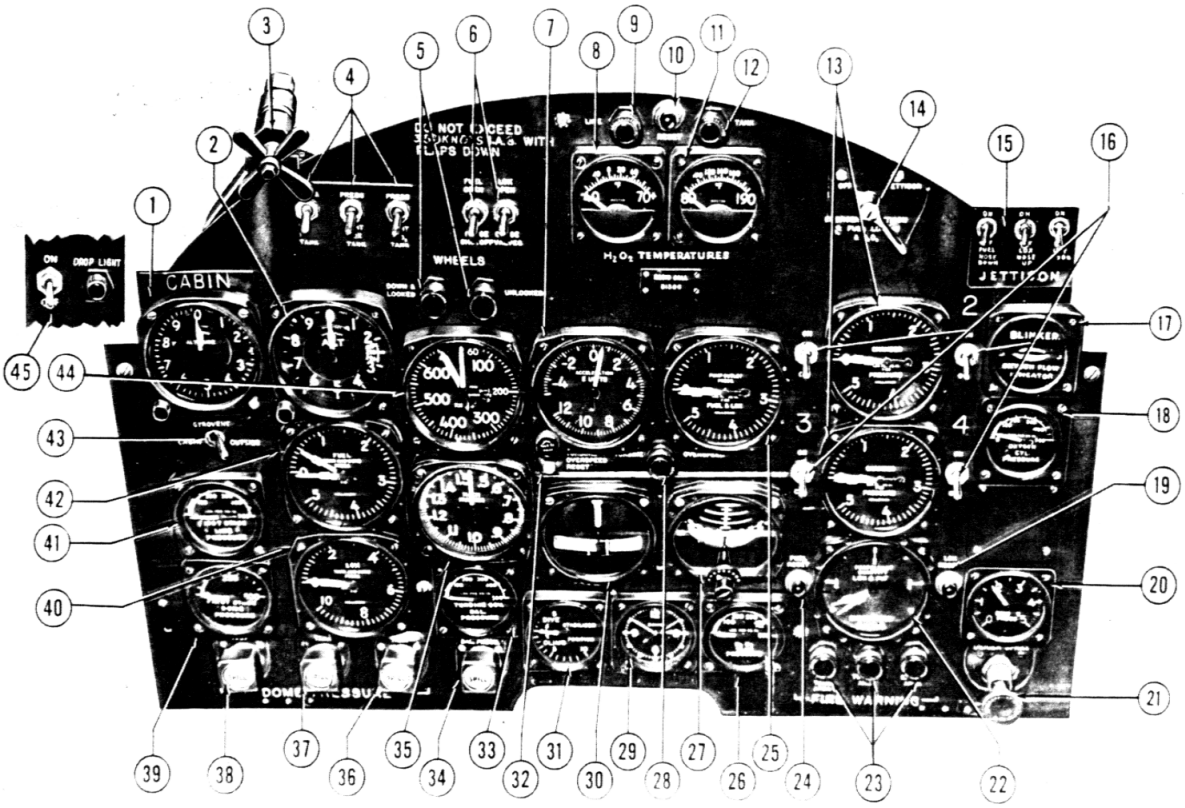
1. Radio Leads
2. Landing Gear Control Lever
3. Harness Release
4. Stabilizer Manual Control Lever
5. Flap Switch
6. Throttle
7. Canopy Lock Indicator
8. Canopy Locking Lever
9. Canopy Emergency Release Handle

Figure 1-3. Left Side View of Cabin



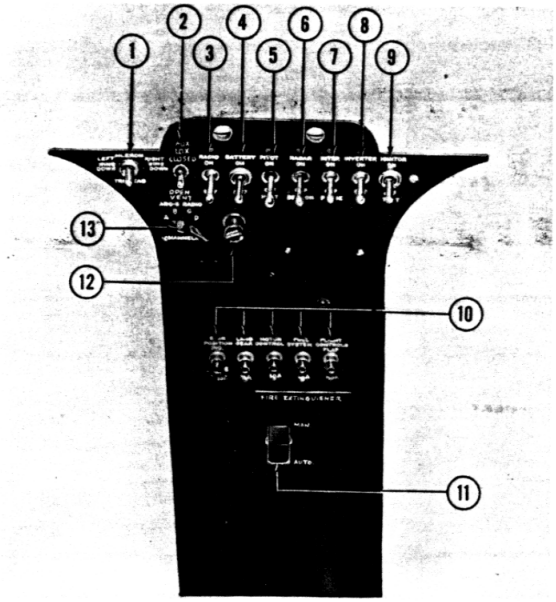
1. Canopy Locking Lever
2. Canopy Pressure Seal Valve
3. Canopy Lock Indicator
4. Emergency Jettison Tank Pressure Gage
5. Cabin Pressure Dump Valve Control Lever
6. Stabilizer Actuator Switch
7. Emergency Cut-Off Switch
8. Oxygen Regulator

Figure 1-4. Right Side View of Cabin



1. Cabin Altimeter
2. Aircraft Altimeter
3. Windshield Defroster Control Valve
4. Tank Vent and Pressurizing Switches
5. Landing Gear Warning Lights
6. Fuel and Lox Shut-Off Valve Switches
7. Accelerometer
8. H_2O_2 Line Temperature Gage
9. H_2O_2 Line Temperature Warning Light
10. H_2O_2 Temperature Relay Reset Button
11. H_2O_2 Tank Temperature Gage
12. H_2O_2 Tank Temperature Warning Light
13. Chamber Pressure Indicators
14. Emergency Jettison Valve
15. Jettison Switches
16. Chamber Selector Switches
17. Oxygen Blinker
18. Oxygen Cylinder Pressure Gage
19. Lox Quantity Reset Button
20. Source Pressure Gage
21. Windshield De-icing Pump
22. Fuel and Lox Quantity Gage
23. Fire Warning Lights
24. Fuel Quantity Reset Button
25. Pump Outlet Pressure Indicator
26. H_2O_2 Tank Pressure Gage
27. Attitude Gyro
28. Turbine Overspeed Warning Light
29. Clock
30. Turn and Bank Indicator
31. Stabilizer Position Indicator
32. Turbine Overspeed Reset Button
33. Turbine Governor Balance Pressure Indicator
34. Turbine Governor Balance Pressure Regulator and Spill Valve
35. Machmeter
36. Lox Tank and Dome Loading Regulator and Spill Valve
37. Fuel Tank and Dome Loading Regulator and Spill Valve
38. First Stage Dome Loading Regulator and Spill Valve
39. First Stage Dome Pressure Gage
40. Lox Tank and Dome Pressure Gage
41. First Stage Line Pressure Gage
42. Fuel Tank and Dome Pressure Gage
43. Gyro Vent Selector Switch
44. Airspeed Indicator
45. Drop Light and Switch

Figure 1-5. Instrument Panel



1. Aileron Trim Tab Switch
2. Lox Auxiliary Vent Switch
3. Radio Switch
4. Battery Switch
5. Pitot Heat Switch
6. Radar Switch
7. Interphone Switch
8. Inverter Switch
9. Igniter Test Switch
10. Circuit Breakers
11. Fire Extinguisher Selector Switch
12. Radio Output Control
13. Radio Channel Selector Switch

Figure 1-6. Switch Panel

1-15. TURBINE PUMP GOVERNOR BALANCE PRESSURE REGULATOR AND SPILL VALVE. The valve marked "TURB. GOV. BAL. PRESS" (34, figure 1-5), regulates the N_2 pressure on the pump governor, resulting in the control of pump output and manifold pressures.

1-16. TURBINE OVERSPEED RESET. The button marked "TURBINE OVERSPEED RESET" (32, figure 1-5), is pressed to return the governor to an operating status by releasing the overspeed interlock and relay after turbine overspeeding has occurred.

1-17. EMERGENCY CUT-OFF SWITCH. The emergency cut-off switch on the control stick (7, figure 1-4) shuts off all the chambers when actuated in the event of an emergency. A latching relay holds the circuits in an inoperative condition until the battery switch is momentarily turned "OFF", which returns circuits to an operating status.

1-18. POWER PLANT INDICATORS.

1-19. CHAMBER PRESSURE INDICATORS. The chamber pressure indicators (13, figure 1-5) denote the operating pressures in the thrust chambers. The upper indicator registers the pressure in number one and two chambers, and the lower indicator registers the pressure in number three and four chambers.

1-20. PUMP OUTLET PRESSURE INDICATOR. The pump outlet pressure indicator (25, figure 1-5) registers the pressure of the propellants delivered to the manifolds from the pump.

1-21. TURBINE GOVERNOR BALANCE PRESSURE INDICATOR. The turbine governor balance pressure indicator (33, figure 1-5) registers the N_2 pressure at the turbine governor.

1-22. TURBINE OVERSPEED WARNING LIGHT. The light marked "TURBINE OVERSPEED" (28, figure 1-5), lights when the turbine overspeeds and the overspeed control shuts the pump off. The light will stay on and the pump will be inoperative until the "TURBINE OVERSPEED RESET" button is pressed, returning the pump and overspeed control to operating status.

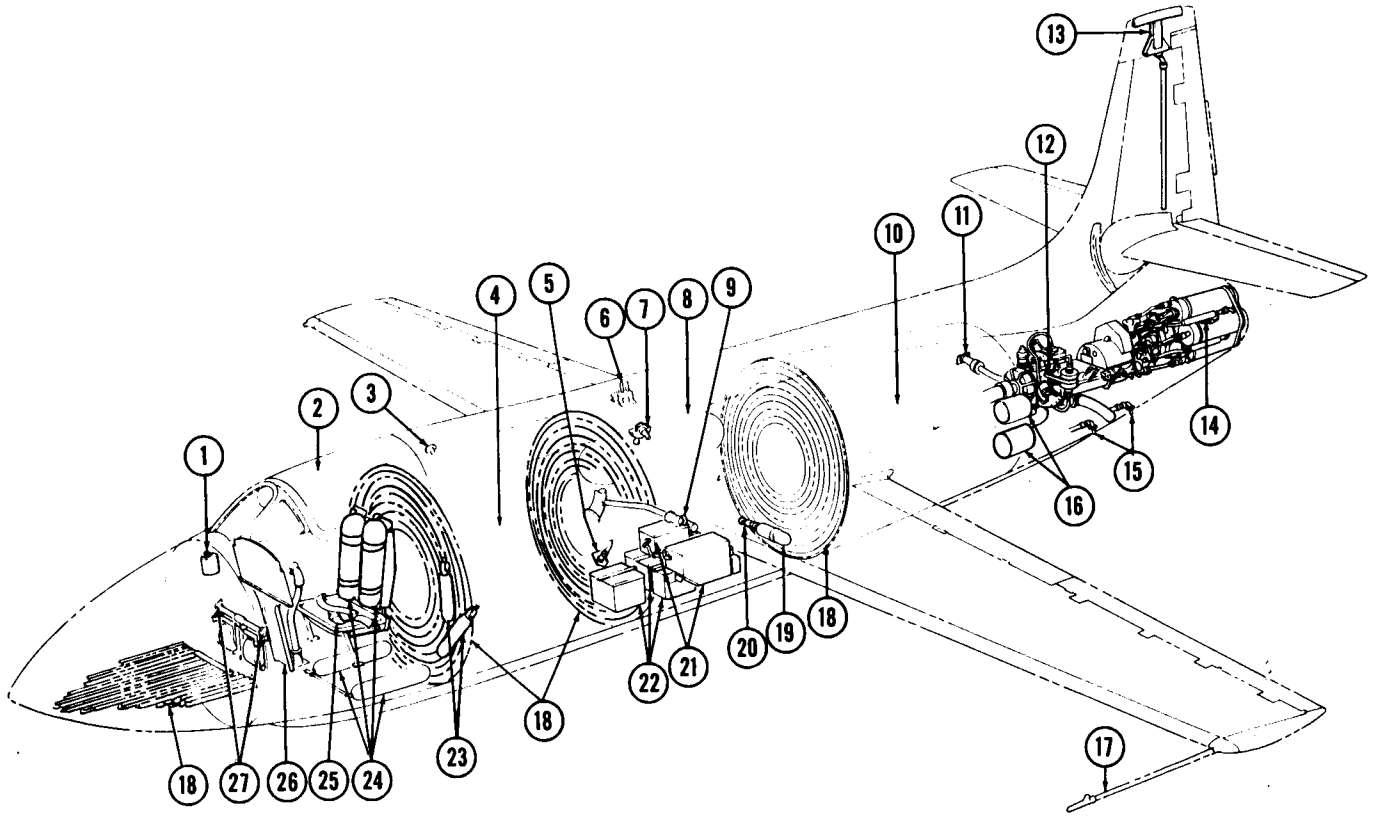
1-23. FUEL SYSTEM.

1-24. GENERAL. The fuel system consists of the fuel tank, fuel tank relief and magnetic pop-off valve assembly, the pressurizing and vent valve assembly, the fuel flowmeter generator and indicator, shut-off valve, jettison valve, fuel pump unit of the turbine-driven pump, fuel manifold and the fuel system components of the motor control. Fuel is forced from the tank by low pressure inert gas (N_2) through the flowmeter generator and shut-off valve to the pump; the pump delivers fuel to the manifold where a pressure sensing line is connected to the pump governor to balance the nitrogen pressure, ultimately determining the speed of the turbine. When a chamber is fired, fuel flows from the manifold, through the igniter fuel control valve, into the igniter fuel manifold, where it is diverted to the four igniter feed lines. (See figure 1-9.) The fuel flows through the check valve into the igniter orifice and screen assembly, and is then injected into the throat of the venturi mixing tube of the igniter, where it is mixed with gaseous oxygen prior to burning in the igniter chamber. As pressure increases to 45 psi as a result of combustion, a series of controls opens the fuel propellant valve allowing fuel to flow through the main metering orifice, around the chamber (for cooling purposes), to the injector, and then into the thrust chamber to burn with the liquid oxygen. When combustion pressure reaches approximately 155 psi, the igniter fuel control valves close and normal operation ensues.

1-25. FUEL SPECIFICATION AND GRADE.

1-26. The fuel used in this aircraft shall conform to a mixture of specially denatured alcohol, Specification MIL-A-6091 and water, having a specific gravity of .860 ± .020 at 15.6°C (60°F). The system is serviced from the right side of the aircraft (11, figure 1-7), and the nominal capacity is 570 U.S. gallons.

1-27. FUEL SYSTEM CONTROLS.



1. De-icing Fluid Tank
2. Canopy
3. Oxygen Filler
4. Lox Tank
5. Nitrogen Filler
6. External Power Receptacle
7. Hydrogen Peroxide Filler
8. Hydrogen Peroxide Tank
9. Lox Filler
10. Fuel Tank
11. Fuel Filler
12. Turbine Pump
13. Pick-Axe Antenna
14. XLR11-RM-5 Motor
15. AN/APN-60 Antennas
16. AN/APN-60 Radar Installation
17. Pitot Tube
18. Tube Bundles (Nitrogen)
19. Main Wheel Door Actuator Air Bottle
20. Main Wheel Door Actuator Air Bottle Filler
21. AN/ARC-5 Radio Installation
22. Batteries
23. Fire Extinguisher Bottles
24. Oxygen Bottles
25. Safety Belt
26. Switch and Circuit Breaker Panel
27. Hydraulic Brake Cylinders

Figure 1-7. General Arrangement Diagram

1-28. FUEL SHUT-OFF VALVE SWITCH. The fuel shut-off valve switch (6, figure 1-5) opens or closes the fuel shut-off valve, establishing or terminating fuel flow to the turbine pump. Switch positions are "OPEN" and "CLOSE".

1-29. FUEL TANK VENT SWITCH. The "FUEL TANK" vent switch (4, figure 1-5) opens the tank vent valve to vent the tank when moved to "VENT". Moving the switch to "PRESS" closes the valve to permit pressurizing the tank.

1-30. FUEL JETTISON SWITCH. The "JETTISON" switch marked "FUEL" (15, figure 1-5) opens the fuel jettison valve when moved from "OFF" to "ON," thereby jettisoning a portion or all the fuel from the aircraft. When only the fuel is jettisoned, the aircraft will assume a nose-heavy attitude.

1-31. FUEL SYSTEM INDICATORS.

1-32. FUEL QUANTITY GAGE. The fuel quantity gage (22, figure 1-5) denotes the amount of fuel remaining in the tank. The "FUEL RESET" button (24, figure 1-5) is pressed to reset the gage after the tank is filled.

1-33. LIQUID OXYGEN SYSTEM.

1-34. GENERAL. The liquid oxygen system consists of the supply tank, tank pressure and vent valve, auxiliary vent valve, flowmeter generator, jettison valve, shut-off valve, the lox unit of the turbine pump and the lox components of the motor control. Liquid oxygen is forced from the tank by low pressure inert gas through the flowmeter generator and shut-off valve to the pump. The pump delivers the lox to the engine manifold at operating pressure. A continuous overboard bleed is maintained whenever the lox shut-off valve is open to rid the main line of air and gaseous oxygen and to cool the line, pump and manifold to prevent vaporization. During a start, lox flows from the manifold through evaporator coils which encircle the main fuel line of each chamber. (See figure 1-9.) Warm atmosphere in the vicinity of the coil vaporizes the lox into gaseous oxygen which is utilized in the igniter oxygen propellant manifold and individual feed lines to provide a smooth immediate start. The oxygen passes through the igniter oxygen valves and check valves into the igniter venturi mixing tube where it is mixed with fuel prior to burning in the igniter chamber. When combustion occurs and pressure increases to 45 psi, the main oxygen propellant valve is opened and lox flows to the chamber to burn with the fuel. As chamber pressure increases to 155 psi, the igniter oxygen valve is closed, stopping the flow of gaseous oxygen to the chamber.

1-35. LIQUID OXYGEN SPECIFICATION AND GRADE. The liquid oxygen used in this aircraft shall be commercially pure with a specific gravity of 1.14 at -183°C (-297°F). The system is serviced from the left side of the aircraft (9, figure 1-7); the nominal capacity is 500 U.S. gallons.

1-36. LIQUID OXYGEN SYSTEM CONTROLS.

1-37. LIQUID OXYGEN SHUT-OFF VALVE SWITCH. The switch marked "LOX SHUT-OFF VALVE" (6, figure 1-5) establishes flow of lox to the lox unit of the turbine-driven pump when moved to "OPEN". Moving the switch to "CLOSE" terminates the flow.

1-38. LIQUID OXYGEN TANK VENT SWITCH. The "LOX TANK" vent switch (4, figure 1-5) opens the vent valve to vent the lox tank when moved to "VENT". Moving the switch to "PRESS" closes the valve, permitting pressurization of the tank.

1-38A. LIQUID OXYGEN AUXILIARY VENT VALVE SWITCH. The "AUX LOX VENT" switch (2, figure 1-6) opens the auxiliary vent valve in the ventral fin area when moved to "VENT" to facilitate filling and venting during climb. The vent closes when the switch is moved to "CLOSE".

1-39. LIQUID OXYGEN JETTISON SWITCH. The "JETTISON" switch marked "LOX" (15, figure 1-5), opens the jettison valve of the lox system when moved from "OFF" to "ON", thereby expelling the lox overboard. When only the lox is jettisoned, the aircraft assumes a tail-heavy attitude.

1-40. LIQUID OXYGEN SYSTEM INDICATORS.

1-41. LIQUID OXYGEN QUANTITY GAGE. The lox quantity gage (22, figure 1-5), denotes the amount of liquid oxygen in the tank. The "LOX RESET" button (19, figure 1-5) is pressed to reset the gage after tank is filled.

1-42. HYDROGEN PEROXIDE SYSTEM.

1-43. GENERAL. The H_2O_2 system consists of the supply tank, pressurizing vent relief valve and bursting head assembly, jettison valve, propellant valve, emergency shut-off valve, gas generator and the turbine section of the turbine-driven propellant pump. The supply tank is pressurized by the nitrogen system at approximately 415 psi to force the H_2O_2 through the propellant valve, emergency shut-off valve, and the gas generator, where the H_2O_2 decomposes and becomes oxygen and superheated steam to drive the turbine. The flow of H_2O_2 is controlled by the pump governor as described in paragraph 1-10. A thermal bulb in the tank and another in the line of the propellant valve are connected to indicators on the instrument panel. An additional bulb in the line and another in the tank are connected to indicators in the mother ship.

1-44. H_2O_2 SPECIFICATION AND GRADE. The hydrogen peroxide used in this system shall be 90% pure having a specific gravity of 1.396 at 17.8°C (64°F). The system is serviced from the upper right side of the fuselage (7, figure 1-7) and the capacity is 37 U.S. gallons.

1-45. H_2O_2 SYSTEM CONTROLS.

1-46. H_2O_2 TANK VENT SWITCH. The switch marked "H_2O_2 TANK" (4, figure 1-5) opens the vent valve of the tank to vent the tank when moved to "VENT". Moving the switch to "PRESS" closes the valve, permitting the tank to be pressurized.

1-47. H_2O_2 JETTISON SWITCH. The "JETTISON" switch marked "H_2O_2" (15, figure 1-5) opens the jettison valve of the system when moved from "OFF" to "ON", thereby expelling a portion or all the H_2O_2 overboard.

1-48. H_2O_2 SYSTEM INDICATORS.

1-49. H_2O_2 TANK PRESSURE GAGE. The H_2O_2 tank pressure gage (26, figure 1-5) registers the N_2 pressure applied to the hydrogen peroxide in the tank.

1-50. H_2O_2 TEMPERATURE GAGES. The gages marked "H_2O_2 TEMPERATURES" (11 and 8, figure 1-5) indicate the temperature of the H_2O_2 in the tank and in the main line.

1-51. H_2O_2 TEMPERATURE WARNING LIGHTS. The warning lights (9 and 12, figure 1-5) indicate abnormal H_2O_2 temperatures. The "TANK" warning light will light if the temperature of the H_2O_2 in the tank rises rapidly to an abnormally high temperature, warning the pilot to jettison the supply. After the temperature returns to normal, the "RESET" button (10, figure 1-5) is pressed to reset the temperature relay and turn the warning light off. The "LINE" warning light (9, figure 1-5) will light if the temperature of the H_2O_2 in line drops near the freezing point, warning the pilot to jettison a portion of the supply to purge the line and so raise the temperature. After line temperature returns to normal, the "RESET" button is pressed to reset the line temperature relay and turn the light off.

1-52. NITROGEN SYSTEM.

1-53. GENERAL. The nitrogen system consists of a series of interconnected tube bundles, shut-off valve, strainer, reducing regulators and valves, and suitable tubing, fittings and connections. The system is charged to 4500 psi through the filler connection on the right side of the fuselage (5, figure 1-7). A 5500 psi frangible disc protects the system against overcharging. The N_2 pressure from the tube bundles is reduced by the first stage regulator to approximately 415 psi to pressurize the H_2O_2 tank, the lox and fuel tank pressure regulators, the flap actuator, the down side of the landing gear actuators, the stabilizer actuator pressure regulator, the motor control, the "FUEL TANK", "LOX TANK" and "TURB. GOV. BAL. PRESS" adjusting valves, the Anti-G suit regulator, the canopy seal regulator, the turn-and-bank and gyro orifices, the windshield defroster and the various control valves. (See figure 1-8.) The tube bundle pressure is also piped to the landing gear pressure regulator, where the pressure is reduced to 1500 psi to operate the up side of the landing gear actuators. In the motor control, the 415 psi pressure flows through the engine nitrogen manifold and the four check valves to the tee fitting (see figure 1-9). From one side of the tee, the gas flows through the igniter oxygen bleed orifice, the igniter check valve, the igniter chamber and into the thrust chamber where it is discharged with the exhaust. From the other side of the tee, the gas flows through an orifice in the outlet of the oxygen propellant valve, the main oxygen check valve, thrust chamber head, the oxygen injectors and the thrust chamber, thus bleeding the lines and chambers. To cool the spark plugs, the gas flows through the four spark plug bleed orifices, to the igniter plug chamber, cooling the plugs, then into the chamber where it is discharged with the exhaust. This line transmits chamber pressure to the 45 and 155 psi chamber pressure switches on the control box. When a propellant control valve for a chamber opens, nitrogen flows from the manifold through the valve in two courses: in one it pressurizes the accumulator causing the hydraulic fluid to actuate the fuel propellant valve; in the second course, the gas flows through the delay check valve to the dome of the oxygen propellant valve, causing it to open. When the chamber fires, the gas flows through the igniter oxygen control valve to the dome of the igniter oxygen propellant valve, causing the valve to open.

1-54. MOTOR HYDRAULIC SYSTEM.

1-55. GENERAL. The hydraulic system is a closed system consisting of the four accumulators, lines and orifices (figure 1-9). Nitrogen pressure actuates the pistons of the accumulator forcing hydraulic fluid through the metering orifice, thereby actuating the piston in the fuel propellant valve. In this manner, the fuel valves are slowly opened, allowing the turbopump governing system to supply the increased fuel demand when chambers are started, without reducing fuel manifold pressure and starving the operating chambers.

1-55A. ELECTRICAL SYSTEM.

1-55B. GENERAL. The electrical system is a single-wire, 24-volt d-c system supplied by two AN3150 and one 58-752-016 batteries, and protected by manual reset circuit breakers on the switch panel (10, figure 1-6). An inverter and a transformer supply a-c current for the various components of the aircraft. The inverter supplies 250VA, 400-cycle, single-phase power at 115 volts for the fuel and lox quantity indicator circuits, and the transformer supplies 400-cycle, single-phase power at 26 volts to the transmitters and indicators for the pump outlet pressures, chamber pressures, and the lox and fuel tank and dome pressures. An external power receptacle in the dorsal fin area (6, figure 1-7) is used to supply power from an external source during ground testing, or from the mother aircraft during captive flight.

1-55C. ELECTRICAL SYSTEM CONTROLS.

1-55D. BATTERY SWITCH. The battery switch (4, figure 1-6) disconnects the batteries from the aircraft's electrical circuits when moved to "OFF". When moved to "ON", the battery relay is energized, completing the circuit. The switch is moved to "OFF" when external power is applied to prevent by-passing the external power to the batteries.

1-55E. INVERTER SWITCH. The inverter switch (8, figure 1-6) energizes the inverter circuit when moved to "ON" if the "BATTERY" switch is "ON" or external power is applied.

1-55F. EXTERNAL POWER RECEPTACLE SWITCH. The external power receptacle switch, mounted on the aft end of the external power receptacle (6, figure 1-7), energizes or de-energizes the external power relay when moved to "ON" or "OFF," thereby eliminating the need for removing the external power cordage from the receptacle.

1-56. FLIGHT CONTROL SYSTEM.

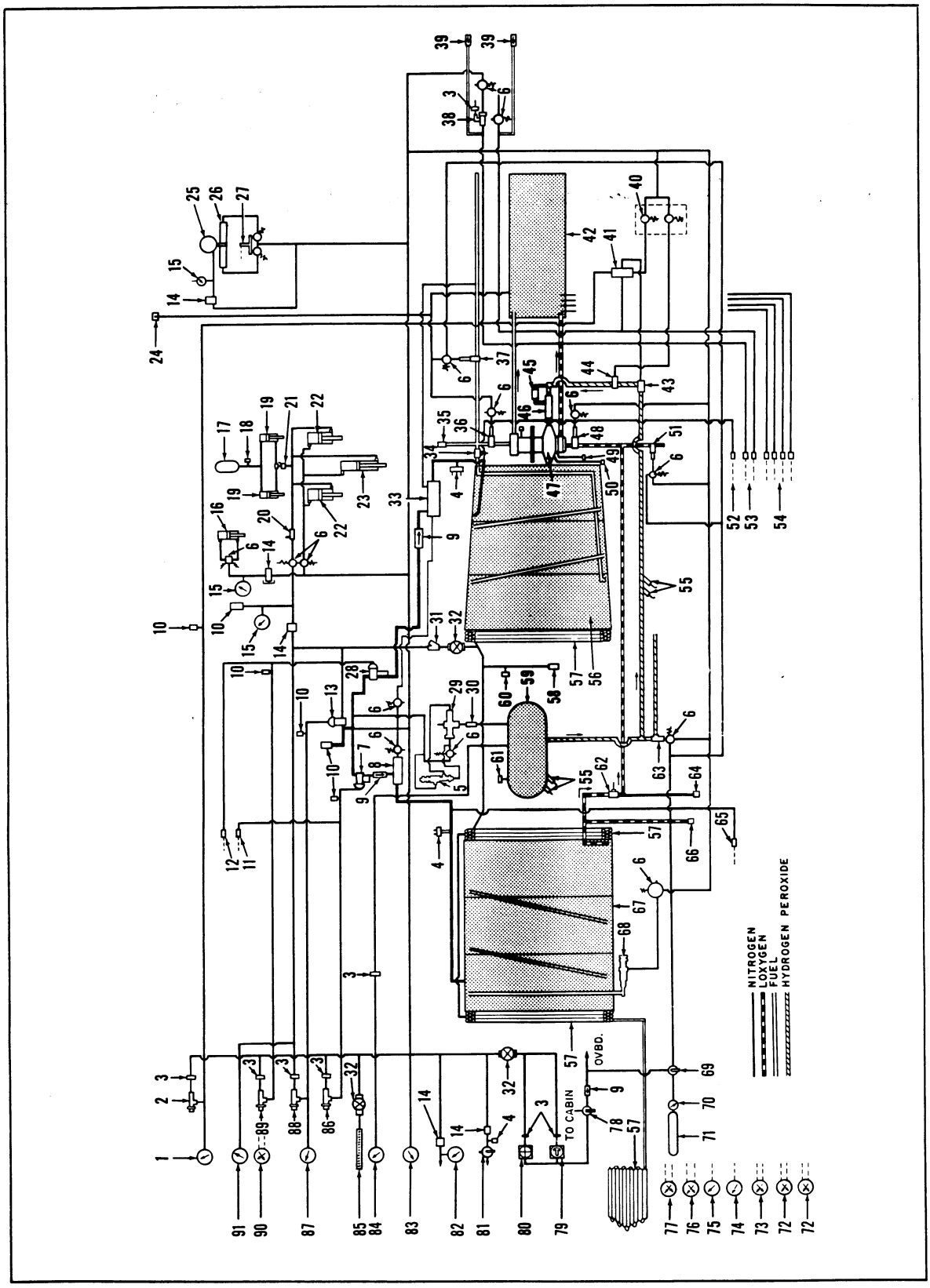


Figure 1-8. Nitrogen and Power Plant Schematic Diagram (Sheet 1 of 2 Sheets)

1. Turbine Governor Balance Pressure Gage
2. Turbine Governor Balance Pressure Regulator and Spill Valve
3. Orifice
4. Magnetic Pop-Off and Relief Valve
5. H_2O_2 Tank Pressurizing Valve
6. Solenoid Valve
7. Lox Tank Pressure Regulator
8. Lox Tank Pressurizing and Vent Valve
9. Check Valve
10. Relief Valve
11. Lox Dome Pressure Transmitter
12. Fuel Dome Pressure Transmitter
13. First Stage Pressure Regulator
14. Pressure Regulator
15. Pressure Gage
16. Flap Actuating Cylinder
17. Main Wheel Door Bottle
18. Main Wheel Door Bottle Charging Valve
19. Main Wheel Door Actuating Cylinders
20. Mechanical Check Valve (Operated by Uplock Release)
21. Sequence Valve (Opens when Main Wheels are up)
22. Main Wheel Actuating Cylinders
23. Nose Wheel Actuating Cylinder
24. N_2 Bleed Connection from Mother Aircraft
25. Stabilizer Actuator Motor
26. Stabilizer Actuator Control Assembly
27. Stabilizer Actuator Control Valves
28. Fuel Tank Pressure Regulator
29. H_2O_2 Tank Vent, Pressurizing, Relief Valve and Frangible Disc
30. Liquid Separator and Strainer
31. Nitrogen Strainer
32. Manual Shut-Off Valve
33. Fuel Tank Pressurizing and Vent Valve
34. Fuel Flowmeter Generator
35. Fuel Filler Valve
36. Fuel Shut-Off Valve
37. Fuel Jettison Valve
38. Lox Bleed Shut-Off Valve
39. Purge Check Valve
40. Turbo Pump Control Box
41. Turbo Pump Governor
42. XLR11-RM-5 Motor
43. H_2O_2 Propellant Valve
44. Emergency H_2O_2 Shut-Off Valve
45. Gas Generator Heater Line and Check Valve
46. Gas Generator
47. Turbo Pump
48. Lox Shut-Off Valve
49. Lox Pump Drain
50. Turbine Exhaust
51. Lox Jettison Valve
52. Fuel Tank Pressure Transmitter
53. Manifold Pressure Transmitters
54. Chamber Pressure Transmitters
55. H_2O_2 Temperature Pickups
56. Fuel Tank
57. N_2 Tube Bundles
58. N_2 Filler Valve
59. H_2O_2 Tank
60. Frangible Disc
61. H_2O_2 Tank Filler
62. Lox Flowmeter Generator
63. H_2O_2 Jettison Valve
64. Lox Top-Off Connection
65. Lox Tank Pressure Transmitters
66. Lox Filler Valve
67. Lox Tank
68. Auxiliary Lox Vent Valve
69. Emergency Jettison Control Valve
70. Filler and Pressure Gage Assembly
71. Emergency Jettison Air Bottle
72. Chamber Pressure Gage
73. Lox and Fuel Quantity Gage
74. H_2O_2 Line Temperature Gage
75. H_2O_2 Tank Temperature Gage
76. Manifold Pressure Gage (Fuel and Lox)
77. Lox Tank and Dome Pressure Gage
78. Cabin Pressure Selector Valve
79. Turn and Bank Indicator
80. Attitude Gyro
81. Canopy Seal Control Valve
82. Anti-G-Suit Supply Pressure Gage
83. First Stage Line Pressure Gage
84. H_2O_2 Tank Pressure Gage
85. Windshield Defroster
86. Lox Dome Loader and Spill Valve
87. First Stage Dome Pressure Gage
88. First Stage Dome Loader and Spill Valve
89. Fuel Dome Loader and Spill Valve
90. Fuel Tank and Dome Pressure Gage
91. N_2 Source Pressure Gage

Figure 1-8. Nitrogen and Power Plant Schematic Diagram (Sheet 2 of 2 Sheets)

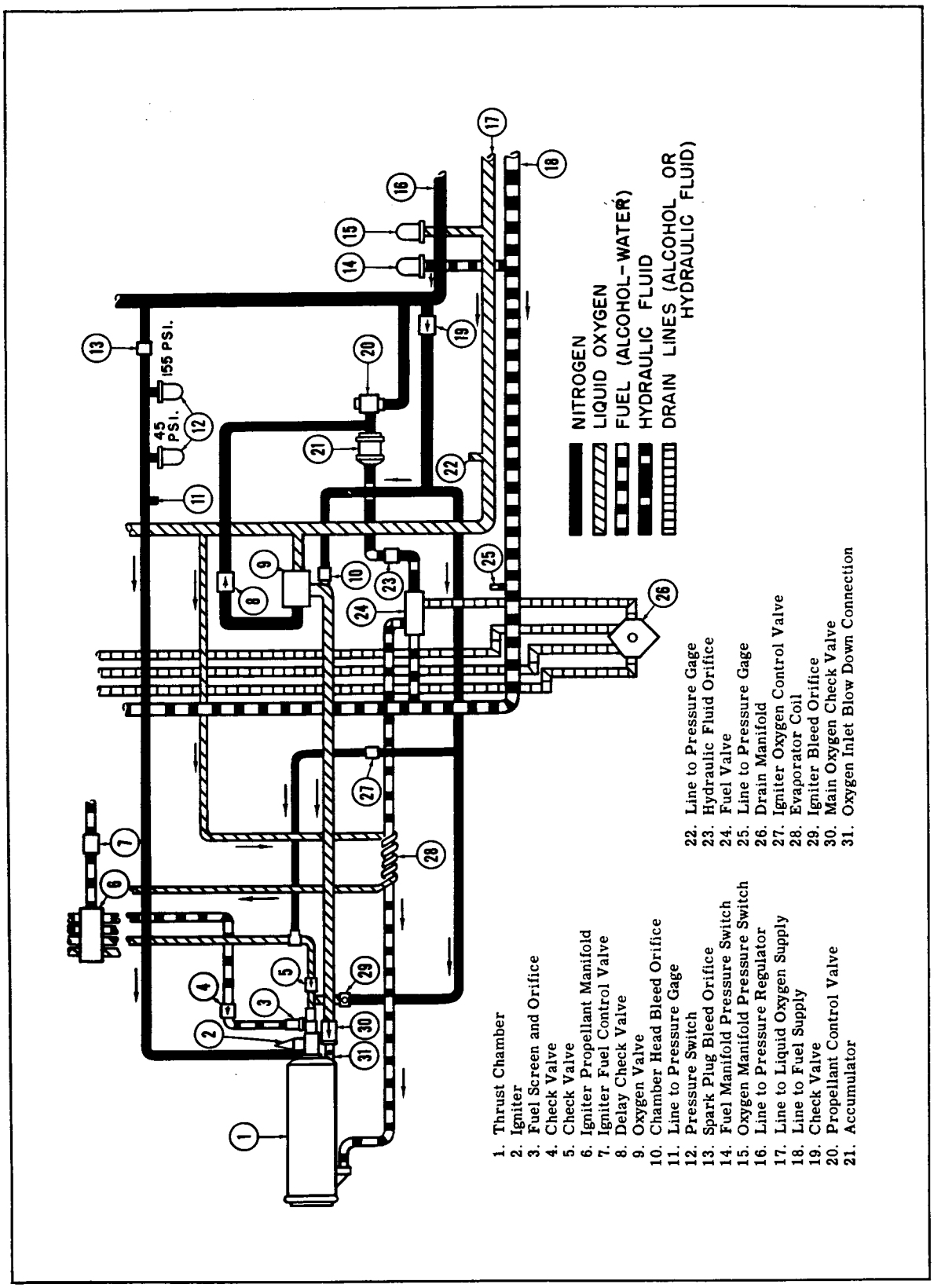


Figure 1-9. Motor Schematic Diagram (Typical Single Chamber)

1-57. GENERAL. The flight control system includes the control stick and rudder pedals in a standard configuration.

1-58. STABILIZER. The stabilizer is adjustable from neutral to 4 ±1/2 degrees up and 9 ±1/2 degrees down to trim the aircraft longitudinally.

1-59. AILERON TRIM TAB. An electrically controlled trim tab on the right aileron is used to trim the aircraft laterally.

1-60. FLIGHT CONTROL SYSTEM CONTROLS.

1-61. STABILIZER ACTUATOR SWITCH. The switch (6, figure 1-4) on the control stick will energize the stabilizer actuator when moved fore or aft. Moving the switch forward will trim the aircraft nose down; moving the switch aft will trim the aircraft nose up. In the event of an electrical failure the actuator control valve may be operated by the lever (4, figure 1-3) on the left side of the cockpit.

1-62. AILERON TRIM TAB SWITCH. The switch marked "AILERON TRIM TAB" (1, figure 1-6) will actuate the tab on the right aileron to trim the aircraft laterally. Switch positions are "RIGHT WING DOWN" and "LEFT WING DOWN".

1-63. FLAP SWITCH. The flaps are raised or lowered when the "FLAP" switch (5, figure 1-3) is moved to "UP" or "DOWN".

1-64. FLIGHT CONTROL SYSTEM INDICATORS.

1-65. STABILIZER POSITION INDICATOR. The indicator marked "STABILIZER POSITION" (31, figure 1-5) indicates the position of the stabilizer in regard to the longitudinal axis of the aircraft.

1-66. LANDING GEAR SYSTEM.

1-67. GENERAL. The tricycle-type landing gear is retracted and extended by pneumatic pressure supplied by the nitrogen system of the aircraft. An air bottle, charged on the ground, supplies 160 psi pressure to the open side of the main wheel door actuators. (See figure 1-8.) As the main wheels reach their retracted position, a sequence valve is operated which supplies the 1500 psi up landing gear pressure to the close side of the door cylinders. A hydraulic brake on each main wheel is operated by the toe plates of the rudder pedals.

1-68. LANDING GEAR SYSTEM CONTROLS.

1-69. LANDING GEAR CONTROL LEVER. The lever (2, figure 1-3) on the left side of the cockpit extends the gear when moved down and retracts the gear when moved up. Movement of the lever operates the mechanical locks and actuates the switches which control the solenoid valves. The lever is locked in the down position and is released by moving it inboard. In the event of pressure failure, the gear falls free and locks in the down position when the lever is moved down. Coincidently, when the lever is moved down, the tank vent valves are opened.

1-70. LANDING GEAR SYSTEM INDICATORS.

1-71. LANDING GEAR LINE PRESSURE GAGE. The line pressure gage (located in the H_2O_2 tank compartment) indicates the pressure in the up side of the landing gear system.

1-72. LANDING GEAR WARNING LIGHTS. The lights marked "WHEELS" (5, figure 1-5) indicate the position of the landing gear. When the light marked "DOWN AND LOCKED" is lighted the gear is in a safe landing condition. The light marked "UNLOCKED" lights when the gear is in transit or in unsafe landing condition. Both lights are out when the gear is up and locked.

1-73. FIRE DETECTION SYSTEM.

1-74. GENERAL. Three fire detection circuits are installed in the fuselage: one circuit in the engine area; one in the turbine area; and one in the hydrogen peroxide tank area. The indicator lights (23, figure 1-5) are the press-to-test type.

1-74A. FIRE EXTINGUISHER SYSTEM.

1-74B. GENERAL. The fire extinguisher system (figure 1-10) consists of the two dibromodifluoromethane (CF_2Br_2) bottles in the left instrumentation compartment, pressure gages, discharge indicators, relays, H_2O_2 tank section discharge tubes, turbine pump section distributor ring and the engine section discharge tube. The system is designed to operate manually or automatically in conjunction with the fire detection system. When operated automatically, if one of the fire detectors is activated, the extinguisher system will be discharged, the fuel and lox shut-off valves will close and the engine will shut off. The system is charged through the filler (1, figure 1-10) to approximately 1200 psi.

1-74C. FIRE EXTINGUISHER SYSTEM CONTROLS.

1-74D. FIRE EXTINGUISHER SELECTOR SWITCH. The fire extinguisher selector switch (11, figure 1-6) will discharge the system when moved to "MAN" and will connect the system to the fire detection system for automatic operation when moved to "AUTO".

1-74E. FIRE EXTINGUISHER SYSTEM INDICATORS.

1-74F. PRESSURE GAGES. The pressure gages (2, figure 1-10) indicate the pressure in each CF_2Br_2 bottle.

1-74G. DISCHARGE INDICATORS. The discharge indicators (9, figure 1-10) provide an external indication whether either CF_2Br_2 bottle or the system has been discharged.

1-75. INSTRUMENTS.

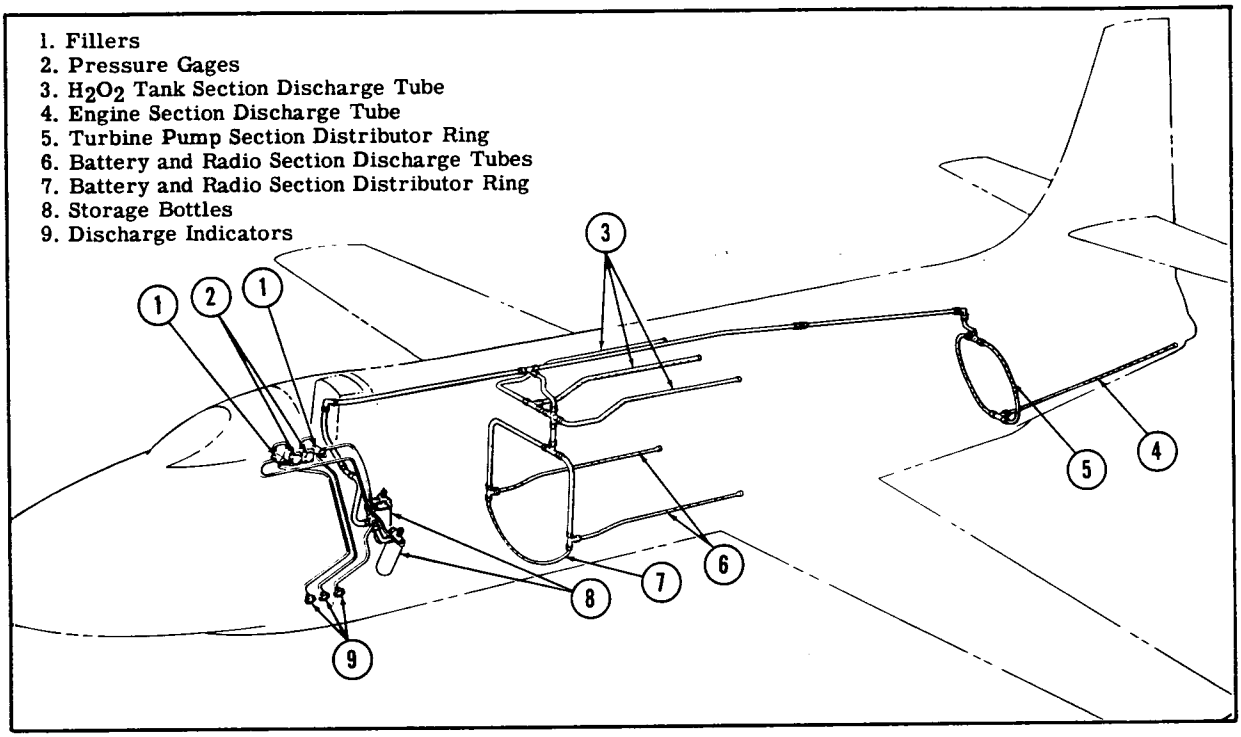


Figure 1-10. Fire Extinguisher System.

1-76. GENERAL. The source pressure, first stage line pressure, first stage dome pressure, turbine governor balance pressure, landing gear line pressure, H_2O_2 tank pressure, anti-G suit supply pressure, and emergency jettison pressure gages are direct reading. The fuel tank and dome pressure, lox and fuel quantity, pump outlet pressure, the chamber pressure gages and the stabilizer position indicator are connected to their respective transmitters and operate on a-c current. The H_2O_2 tank and line temperature gages and their transmitters operate on d-c current. The bank-and-turn indicator and attitude gyro operate from the first stage line pressure; the exhaust from the gyro instruments is utilized to pressurize the cabin. The air speed indicator, accelerometer and machmeter are pitot-static operated. The cabin altimeter is a standard type C-12 and the aircraft altimeter is a standard type C-19. The oxygen cylinder pressure gage denotes the supply pressure and the flow indicator shows when oxygen is being consumed.

1-77. EMERGENCY JETTISON SYSTEM.

1-78. GENERAL. The emergency jettison system consists of the supply tank, shut-off valve and tubing to the jettison valves. The system is designed to jettison the fuel, lox, and H_2O_2 simultaneously in case of an emergency such as an electrical or nitrogen failure.

1-79. EMERGENCY JETTISON SYSTEM CONTROLS.

1-80. EMERGENCY JETTISON VALVE. The valve marked "EMERGENCY JETTISON FUEL, LOX AND H_2O_2" (14, figure 1-5) allows the pressure from the supply tank to open the jettison valves of the fuel, lox, and H_2O_2 systems when moved from "OFF" to "JETTISON".

1-81. EMERGENCY JETTISON SYSTEM INDICATORS.

1-82. EMERGENCY TANK PRESSURE GAGE. The gage (4, figure 1-4) registers the pressure available in the emergency jettison system supply tank.

1-83. DROPLIGHT SYSTEM.

1-84. GENERAL. The droplight system consists of the light and switch (45, figure 1-5) which are connected in series with a light adjacent to the drop handle in the mother airplane and the mother airplane's battery. The switch is turned "ON" prior to a drop, and if, for any reason, the drop is not to be made, the pilot turns the switch "OFF", thereby notifying the mother airplane not to complete the drop.

1-85. OPERATIONAL EQUIPMENT.

1-86. GENERAL. The operational equipment covered in Section IV, includes the oxygen system, communications, radar installation, cabin pressurization, anti-G system, and defrosting system.

PILOT'S NOTES

SECTION II

NORMAL OPERATING INSTRUCTIONS

NOTE

Sufficient space has been provided after each paragraph in this section for pilot's notes on aircraft performance or operation.

2-1. BEFORE ENTERING CABIN.

2-2. RESTRICTIONS.

Do not lower flaps over 345 knots.
Do not lower landing gear over 250 knots.
Calculated gross weight for flight is 16,805 on X-1A and X-1D and 16,816 on X-1B.

THESE LIMITATIONS AND RESTRICTIONS ARE SUBJECT TO CHANGE AND LATEST SERVICE DIRECTIVES AND ORDERS MUST BE CONSULTED.

2-3. DROP-AWAY GROSS WEIGHT AND BALANCE.

a. Check drop-away and anticipated landing gross weight and balance. (Refer to Handbook of Weight and Balance AN 01-1B-40.)

2-4. EXTERIOR CHECK.

a. Check forms F and I for status of the aircraft.

CAUTION

When aircraft is ground tested and loaded while resting on the landing gear, the tires must be inflated in accordance with instructions on the lower main wheel door. Main wheels should be on greased plates while loading.

b. Check that fuel, lox, H_2O_2, N_2, emergency jettison, main wheel door auxiliary air, de-icing, defogging canisters, fire extinguisher and oxygen systems are serviced for flight, and all plugs, tape or covers are removed from tank vents.

c. Check aircraft for security of mounting in shackle and sway braces.

d. Check electrical, radio, lox top-off, oxygen, vent tubes, and N_2 connections to mother airplane.

e. Check that fuel manifold and governor have been bled.

f. Check for loose, damaged or open access doors and cowling.

g. Check control surfaces for damage, security of mounting and general condition.

h. Check vent tubes and fuel, lox, and hydrogen peroxide jettison tubes between aircraft and mother ship for security of mounting and general condition.

i. Turn radar beacon switch "ON".

2-5. ON ENTERING PILOT'S COMPARTMENT.

a. Connect oxygen mask, anti-G suit connection and radio cordage. Check oxygen regulator "100%".

b. Radio switch "ON". Check radio operation on proper channel.

c. Close and lock canopy.

d. Check landing gear control lever up.

e. Check "FIRST STAGE LINE", FIRST STAGE DOME" and "SOURCE PRESSURE". Adjust "FIRST STAGE DOME" as necessary.

f. Check "FUEL TANK", "LOX TANK", and "TURB. GOV. BAL. PRESS" regulator valves closed and domes spilled.

g. Check all circuit breakers in.

h. Check "JETTISON" switches "OFF".

i. "IGNITER TEST" switch "OFF".

j. "H_2O_2 TANK", "FUEL TANK" and "LOX TANK" switches "VENT".

k. "FUEL SHUT-OFF VALVE" switch "CLOSE".

l. "LOX SHUT-OFF VALVE" switch "CLOSE".

m. "EMERGENCY JETTISON" valve "OFF".

n. Chamber switches "OFF".

o. Throttle "OFF".

p. "FIRE EXTINGUISHER" switch "AUTO".

q. "BATTERY" switch "ON".

r. "AUX LOX VENT" switch "VENT".

2-6. BEFORE DROP-AWAY.

a. Check source pressure.

b. Check "FIRST STAGE LINE" pressure 415-425 psi.

c. "INVERTER" switch "ON".

d. Check "RADAR BEACON" switch "ON".

e. "FLAP" switch "DOWN".

f. Check stabilizer position.

g. Check aileron trim tab position.

h. "GYRO VENT" switch "CABIN".

i. "H_2O_2 TANK" switch "PRESS".

j. Check fuel dome pressure zero.

k. "FUEL TANK" switch "PRESS".

l. Check with operator in carrier for lox top-off, N_2, and oxygen lines disconnected.

m. "AUX LOX VENT" switch "CLOSE" and "LOX TANK" switch "PRESS".

n. "FUEL" and "LOX" shut-off switches "OPEN".

o. Check H_2O_2 tank and line temperatures.

p. Check and/or reset lox and fuel quantity gages.

q. Pressurize fuel tank at less than three psi per second.

r. Pressurize lox tank at less than three psi per second.

s. Load turbine governor balance line to desired pressure.

t. Have observer in mother airplane confirm jettison test.

CAUTION

When making jettison test, move in sequence "FUEL", "LOX" and "H_2O_2" "JETTISON" switches to "ON" and immediately return to "OFF".

u. Pitot heat as necessary.

v. Droplight switch "ON".

WARNING

If for any reason drop is not to be made, turn droplight switch "OFF".

2-7. DROP-AWAY AND FLIGHT.

a. "INTERPHONE" switch "OFF".

b. "FLAP" switch "UP" at 260-300 knots.

c. Chamber switches "ON" at five second intervals.

d. Throttle to desired position.

NOTE

If the chamber fails to fire as indicated by a lack of a chamber pressure gage reading and no noticeable acceleration, return the chamber switch to the "OFF" position within four seconds. Otherwise, the thermal delay relay protecting the igniters will cut out, and firing of subsequent chambers will not be possible. If lox pump cavitation is the cause, this will be detected by an abnormally low lox manifold pressure. If lox pump cavitation causes the turbine pump to overspeed, the overspeed warning light will light and the turbine reset button must be held in momentarily before attempting another start.

e. Turn another chamber switch "ON".

f. Adjust governor balance pressure as necessary to maintain pump outlet pressures in desired range.

WARNING

Lox pressure must never be higher than fuel pressure. The governor balance pressure affects both pressures equally; it cannot change individual pressures.

g. Adjust stabilizer and aileron trim tab as necessary.

h. Turn chamber switches "OFF" at two second intervals when propellants are nine-tenths consumed (see Figure A-3) and move throttle to "OFF".

i. Release governor balance pressure by pressing button on valve.

j. Jettison fuel, lox and H_2O_2 by moving "JETTISON" switches "ON".

k. Vent tanks as soon as propellants are exhausted to conserve source pressure.

2-8. STALLS.

2-9. SPINS.

2-10. DIVES.

2-11. APPROACH AND LANDING.

a. Move landing gear control lever down at 220-250 knots.

b. Move "FLAP" switch "DOWN".

c. Make approach glide at 180-200 knots.

d. Land at 130-145 knots.

2-12. BEFORE LEAVING CABIN.

a. "INVERTER" switch "OFF".

b. "RADAR" switch "OFF".

c. "PITOT HEAT" switch "OFF".

d. "RADIO" switch "OFF".

e. "FLAP" switch "UP".

f. "FUEL TANK", "LOX TANK" and "H_2O_2 TANK", switches "VENT".

g. Shut-off valve switches "CLOSE".

h. Check chamber switches and throttle "OFF".

i. Release first stage pressure by pressing button on valve.

j. "BATTERY" switch "OFF".

k. Direct ground crew to purge and "BLOW DOWN".

PILOT'S NOTES

SECTION III

EMERGENCY OPERATING INSTRUCTIONS

3-1. ENGINE FAILURE.

NOTE

Abnormal engine operation, rough running, manifold pressure pulsation or automatic shutdown may be caused by pump cavitation, pump output not within desired ranges, propellant manifold pressure differential too great, chamber pressures or tank pressures not within desired ranges, governor balance pressure or governor supply pressure incorrect.

3-2. TURBO PUMP CAVITATION.

a. Turn chamber switches "OFF".

b. Hold "TURBINE OVERSPEED RESET" button in.

c. Turn chamber switches "ON" at five second intervals.

3-3. THRUST CHAMBER BURNOUT.

a. Turn chamber switch "OFF" if chamber pressure drops while manifold pressures remain within desired range, or engine emits a loud scream or howl.

b. Continue to operate on remaining chambers if operation is normal.

NOTE

In the event there is a possibility of exhausting the propellants, with the possible resultant burnout of all chambers, shut off all the chambers by pressing the button (7, figure 1-4) on the control stick.

3-4. FIRE.

3-5. ON GROUND.

WARNING

Use a water foam or water when fighting an H_2O_2 fire. Never use carbon dioxide or carbontetrachloride.

a. "FIRE EXTINGUISHER" switch "MAN".

b. "SHUT-OFF VALVE" switches "CLOSE".

3-6. DURING FLIGHT.

3-7. If any of the "FIRE WARNING" lights light, the fire extinguisher will discharge, the shut-off valves will close and the motor control will shut down the motor.

a. Immediately contact chase pilot for reading.

b. Abandon the aircraft at your discretion if fire is confirmed.

3-8. Chase pilot does not confirm fire.

a. If chase pilot does not confirm fire, and lights go out after motor shuts down, jettison propellants and make a normal landing.

b. Abandon the aircraft at your discretion if lights stay on.

3-9. BAIL OUT.

3-10. In the event it becomes necessary to abandon the aircraft:

a. Pull up to decelerate to a safe speed if control is available.

b. Jettison the canopy.

c. Roll over, release safety belt and shoulder harness and kick free.

3-11. ELECTRICAL SYSTEM FAILURE.

3-12. COMPLETE FAILURE. In the event of a complete failure of the electrical system, some of the controls and much of the equipment will be inoperative. The flaps, aileron trim, stabilizer stick switch and the solenoid operated valves will be inoperative. However, the stabilizer may be trimmed by the use of the manual control lever (4, figure 1-3) on the left side of the cockpit.

a. "EMERGENCY JETTISON" valve "JETTISON".

b. All electrical switches "OFF".

c. Trim stabilizer with manual lever.

d. Land approximately 30 knots above normal speed.

3-13. PARTIAL FAILURE. When a partial failure occurs, turn off all electrical units to conserve remaining battery power for landing operations.

a. "EMERGENCY JETTISON" valve "JETTISON".

b. "INVERTER" switch "OFF".

c. "RADAR BEACON" switch "OFF".

d. "PITOT HEAT" switch "OFF", unless icing conditions prevail.

e. "RADIO" switch "OFF".

f. Make a normal landing.

3-14. NITROGEN SYSTEM FAILURE.

3-15. If the nitrogen system fails, the failure may be isolated by observing the instruments on the panel and operating the adjustable valves.

PILOT'S NOTES

SECTION IV

OPERATIONAL EQUIPMENT

4-1. OXYGEN SYSTEM.

4-2. GENERAL. The low pressure oxygen system consists of four type D-2 cylinders, two mounted under the cabin floor, and two in the right equipment compartment, the pressure gage, flow indicator and the type A-14 regulator.

4-3. OXYGEN SYSTEM CONTROLS.

4-4. REGULATOR. The regulator (8, figure 1-4), when set at "NORMAL" regulates the flow of oxygen in accordance with the pilot's needs. When set at "100% OXYGEN", no dilution occurs and pure oxygen is supplied. The supply is depleted much more rapidly with the regulator at "100%". (See figure 4-1.)

4-5. OXYGEN SYSTEM INDICATORS.

4-6. OXYGEN PRESSURE GAGE. The pressure gage (18, figure 1-5) indicates the pressure in the system.

4-7. OXYGEN FLOW INDICATOR. The flow indicator or "BLINKER" (17) shows when oxygen is being consumed by the pilot.

WARNING

Use 100% oxygen at all times. The cabin is pressurized by N_2 gas from the gyro vent, and in the event of regulator malfunction the pilot would breathe N_2 gas.

4-8. COMMUNICATIONS EQUIPMENT.

4-9. GENERAL. The communications equipment is an AN/ARC-5 VHF command set, consisting of a R-28/ARC-5 receiver, a T-23/ARC-5 transmitter, a MD-7/ARC-5 modulator, a headset and microphone.

4-10. COMMUNICATIONS CONTROL. The "ARC-5 RADIO CHANNELS" switch (13, figure 1-6) selects any one of the four channels "A", "B", "C" or "D". The control knob marked "INCREASE OUTPUT" controls the audio strength of the signal. The "RADIO" switch turns the set "ON" or "OFF". The button on the throttle (6, figure 1-3) is held in to transmit.

4-11. RADAR INSTALLATION.

4-12. GENERAL. The AN/APN-60 radar beacon consists of a RT-126/APN-60 receiver-transmitter, a DY-56/APN-60 dynamotor unit, a "BIRD" filter and the transmitter and receiver antennas. The set receives signals from an interrogating ground station within the range of 2700 to 2900 megacycles. When interrogated, the set transmits a signal preset within the range of 2800 to 2920 megacycles to the interrogating station, enabling the ground station to establish the range and azimuth of the aircraft up to 50,000 feet in the radar line of sight to approximately 150 miles.

4-13. RADAR CONTROLS. The beacon is turned "ON" or "OFF" by the "RADAR BEACON" switch (6, figure 1-6).

4-14. CABIN PRESSURIZATION SYSTEM.

4-15. GENERAL. The cabin is pressurized by the exhaust from the gyro instruments.

4-16. CONTROLS. The "GYRO VENT" switch (43, figure 1-5) directs the instrument exhaust overboard when moved to "OUTSIDE", and into the cabin for pressurization when moved to "CABIN". A dump valve controlled by the lever (5, figure 1-4) dumps the pressure when actuated.

4-17. ANTI-G SUIT SYSTEM.

GAGE PRESSURE - PSI								
CABIN ALTITUDE FEET								BELOW
	400	350	300	250	200	150	100	100
40,000	7.7	6.6	5.5	4.4	3.3	2.2	1.1	Danger - Descend Below 10,000 feet altitude Dump Cabin Pressure and turn "Gyro Vent" valve to "OUTSIDE".
35,000	5.7	4.9	4.1	3.2	2.4	1.6	0.8	
30,000	4.2	3.6	3.0	2.4	1.8	1.2	0.6	
25,000	3.4	2.9	2.4	1.9	1.4	1.0	0.5	
20,000	2.7	2.3	1.9	1.5	1.2	0.8	0.4	
15,000	1.8	1.5	1.3	1.0	0.8	0.5	0.3	
10,000	1.3	1.1	0.9	0.7	0.6	0.4	0.2	

Figure 4-1. Oxygen Duration Chart - Approximate Man Hours
Regulator Control Lever "100% Oxygen"

4-18. Provisions have been made for the Anti-G suit.

4-19. DEFROSTING SYSTEM.

4-20. GENERAL. The defrosting system consists of the defrosting tube clamped to the left side of the windshield, the control valve (3, figure 1-5), and tubing to the N_2 first-stage line. Opening the valve will allow N_2 gas to flow across the inside of the windshield from holes in the tube, thereby defrosting the windshield. A dehydrating canister piped to the pilot's oxygen mask prevents fogging.

PILOT'S NOTES

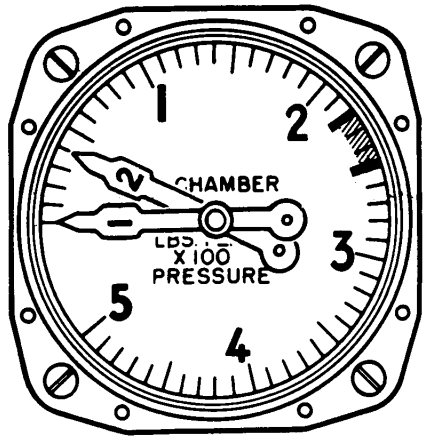
APPENDIX I

OPERATIONAL DATA

I. A. S.	CORRECTED I. A. S.

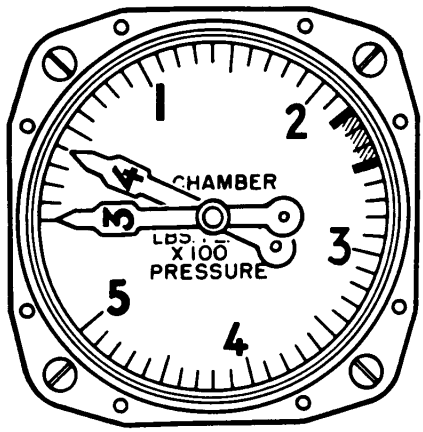
Figure A-1. Airspeed Correction Table

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



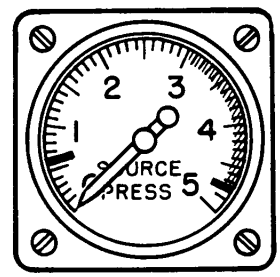
CHAMBER PRESSURE 1 AND 2

- 220 PSI Minimum Operating Pressure
- 220-250 PSI Normal Operating Pressure
- 250 PSI Maximum Operating Pressure



CHAMBER PRESSURE 3 AND 4

- 220 PSI Minimum Operating Pressure
- 220-250 PSI Normal Operating Pressure
- 250 PSI Maximum Operating Pressure

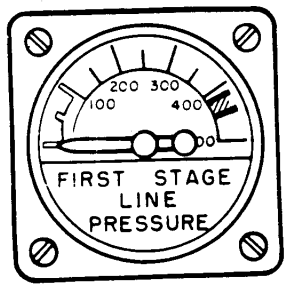


SOURCE PRESSURE

- 600 PSI Minimum Operating Pressure
- 3000-4800 PSI Drop-Away Pressure
- 4800 PSI Maximum Pressure

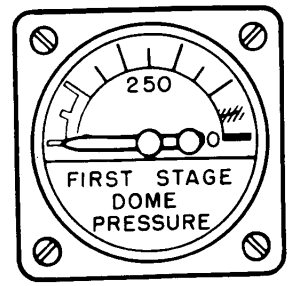
- Red
- Green

Figure A-2. Instrument Markings Diagram (Sheet 1 of 4 Sheets)



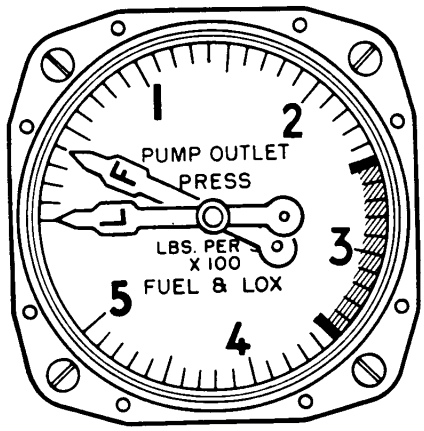
FIRST STAGE LINE PRESSURE

- 415 PSI Minimum Operating Pressure
- 415-440 PSI Normal Operating Pressure
- 440 PSI Maximum Operating Pressure



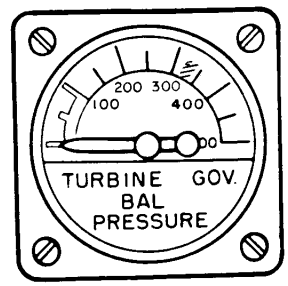
FIRST STAGE DOME PRESSURE

- 430-460 PSI Normal Operating Pressure
- 500 PSI Maximum Pressure



PUMP OUTLET PRESSURE

- 250 PSI Minimum Operating Pressure
- 250-350 PSI Normal Operating Pressure
- 350 PSI Maximum Operating Pressure



TURBINE GOV.
BALANCE PRESSURE

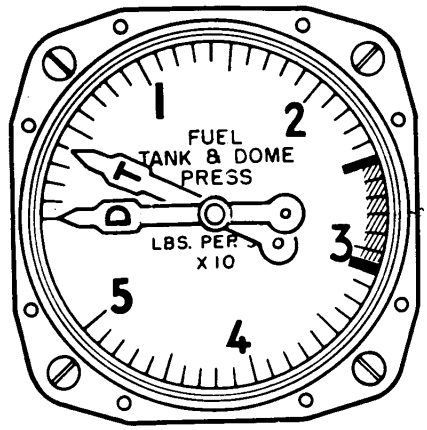
- 338 - 348 PSI Normal Operating Pressure

NOTE

Operating pressure will vary with each individual governor.

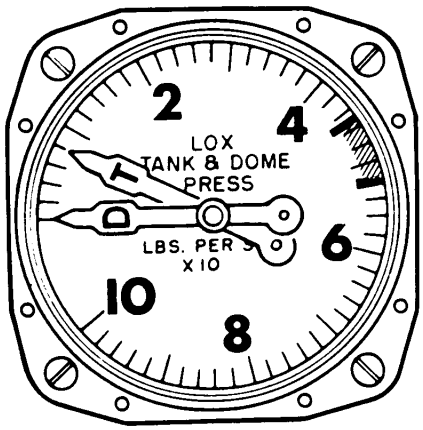
- Red
- Green

Figure A-2. Instrument Markings Diagram (Sheet 2 of 4 Sheets)



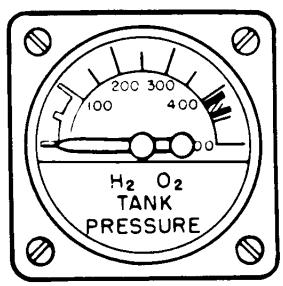
FUEL TANK AND DOME PRESSURE

- 25 PSI Minimum Operating Pressure
- 25-31 PSI Normal Operating Pressure
- 31 PSI Maximum Operating Pressure



LOX TANK AND DOME PRESSURE

- 45 PSI Minimum Operating Pressure
- 45-52 PSI Normal Operating Pressure
- 52 PSI Maximum Operating Pressure

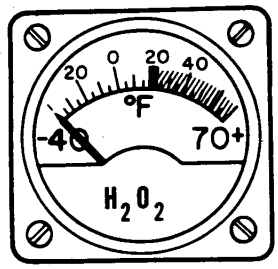


$H_2 O_2$ TANK PRESSURE

- 415 PSI Minimum Operating Pressure
- 415-440 PSI Normal Operating Pressure
- 440 PSI Maximum Operating Pressure

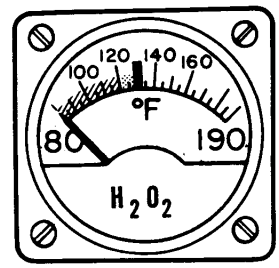
- Red
- Green

Figure A-2. Instrument Markings Diagram (Sheet 3 of 4 Sheets)



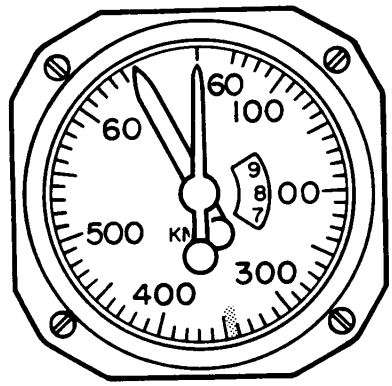
H_2O_2 LINE TEMPERATURE

- 20 Degrees Minimum Temperature
- 20-70 Degrees Normal Operating Temperature



H_2O_2 TANK TEMPERATURE

- 80-120 Degrees Normal Operating Temperature
- 120-130 Degrees CAUTION possible Decomposition
- 130 Degrees Maximum Temperature JETTISON



AIRSPEED INDICATOR

- 345 Knots Maximum IAS for Flaps

- Red
- Green
- Yellow

Figure A-2. Instrument Markings Diagram (Sheet 4 of 4 Sheets)

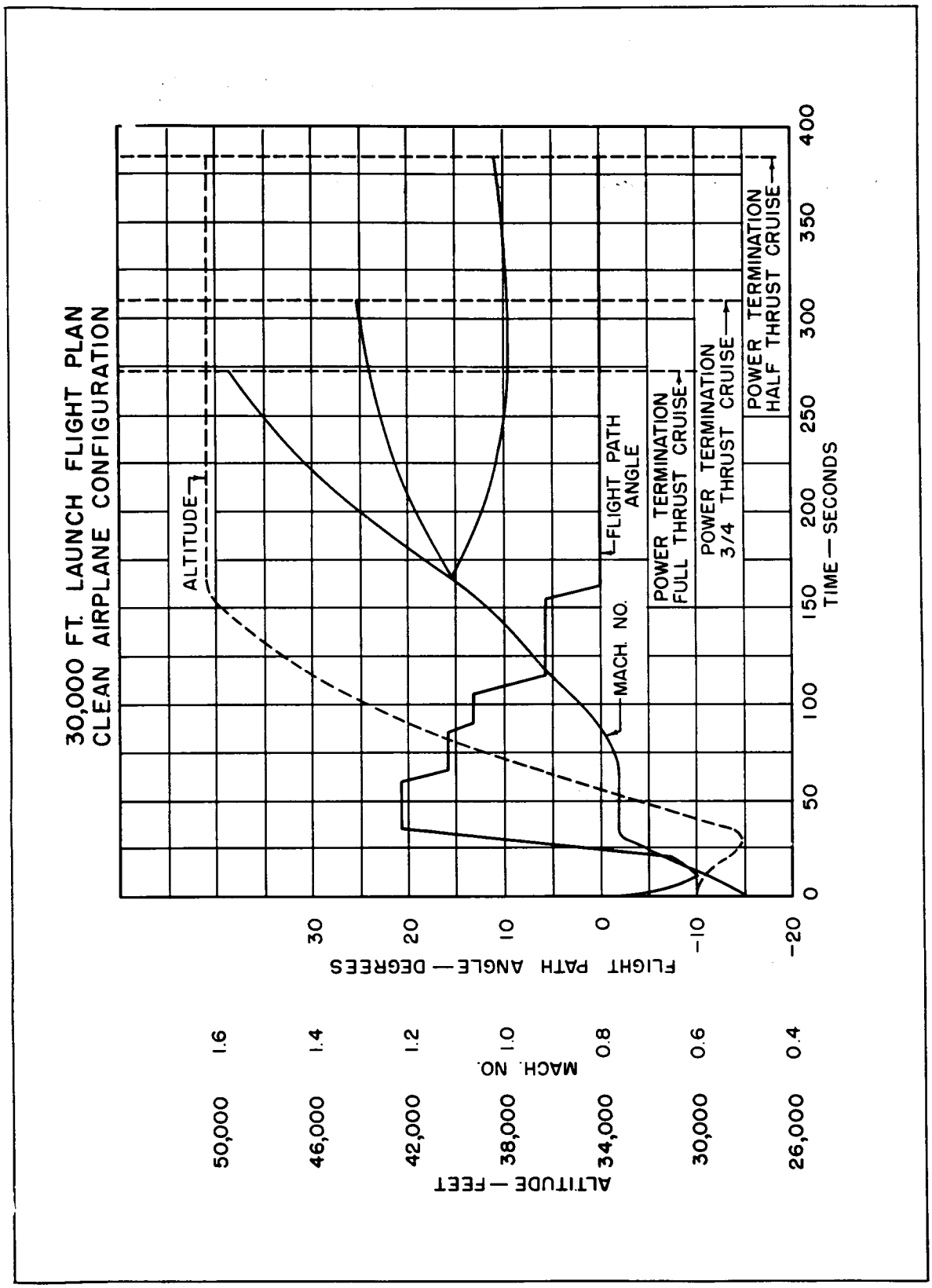


Figure A-3. Estimated Flight Plan Chart

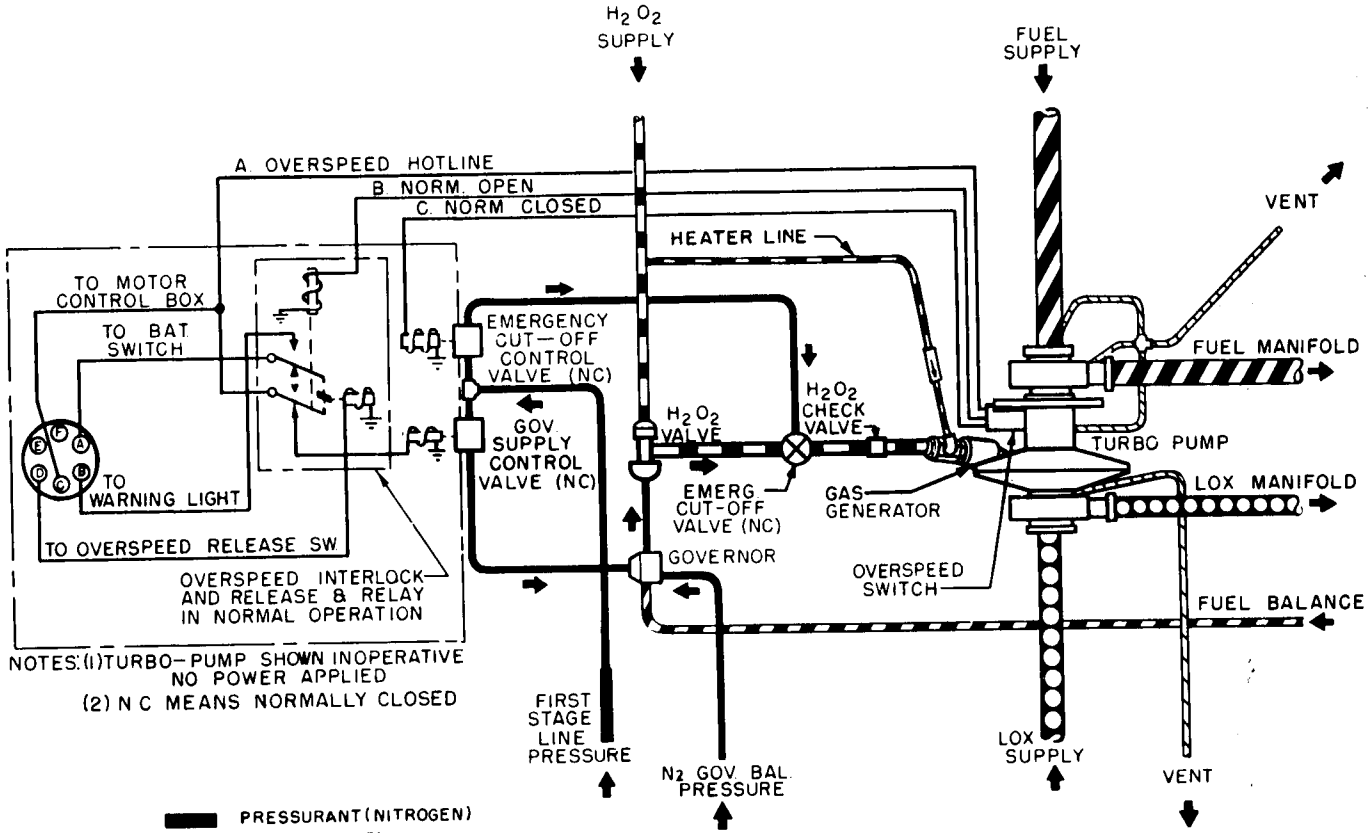
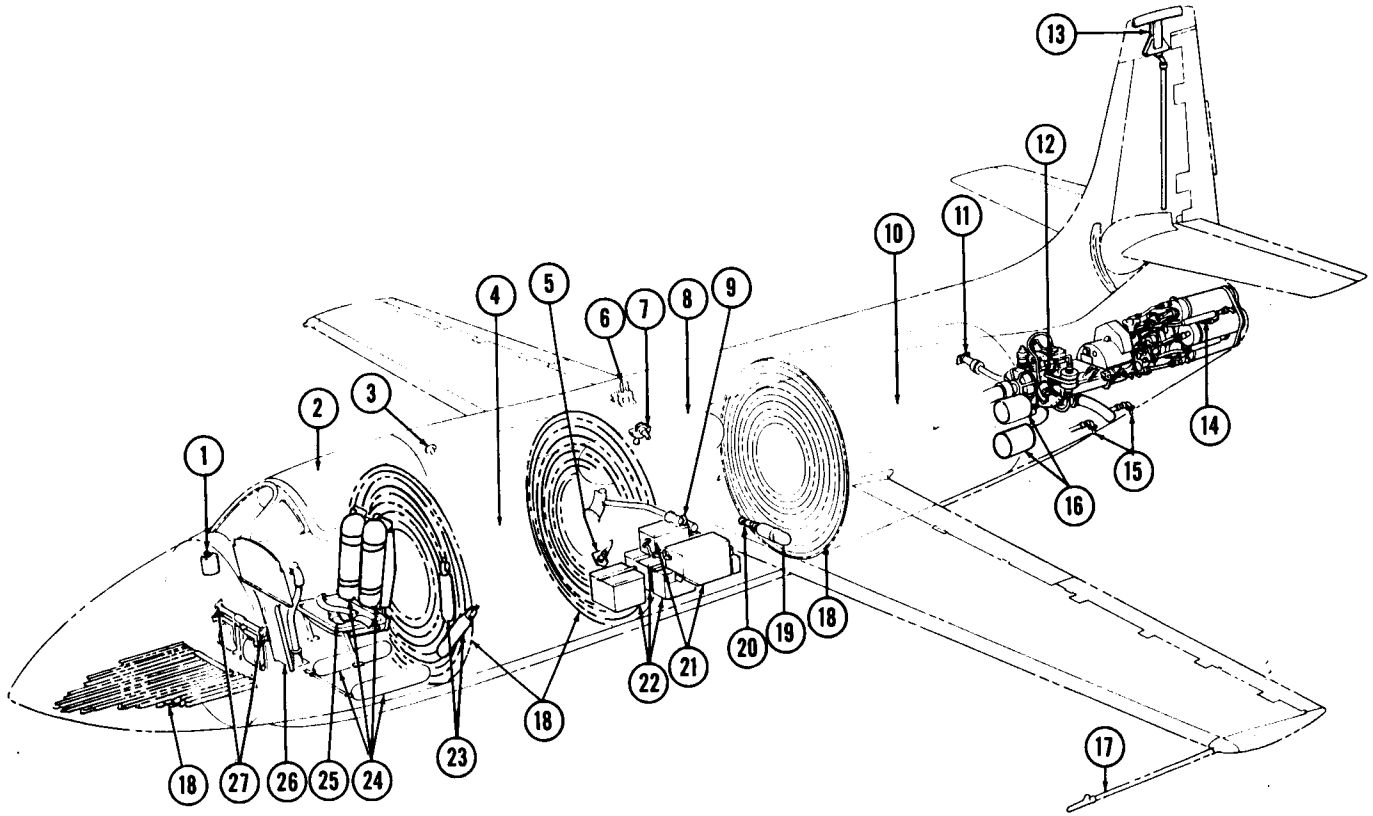


Figure 1-2. Turbine-Driven Pump Schematic Diagram



1. De-icing Fluid Tank
2. Canopy
3. Oxygen Filler
4. Lox Tank
5. Nitrogen Filler
6. External Power Receptacle
7. Hydrogen Peroxide Filler
8. Hydrogen Peroxide Tank
9. Lox Filler
10. Fuel Tank
11. Fuel Filler
12. Turbine Pump
13. Pick-Axe Antenna
14. XLR11-RM-5 Motor
15. AN/APN-60 Antennas
16. AN/APN-60 Radar Installation
17. Pitot Tube
18. Tube Bundles (Nitrogen)
19. Main Wheel Door Actuator Air Bottle
20. Main Wheel Door Actuator Air Bottle Filler
21. AN/ARC-5 Radio Installation
22. Batteries
23. Fire Extinguisher Bottles
24. Oxygen Bottles
25. Safety Belt
26. Switch and Circuit Breaker Panel
27. Hydraulic Brake Cylinders

Figure 1-7. General Arrangement Diagram

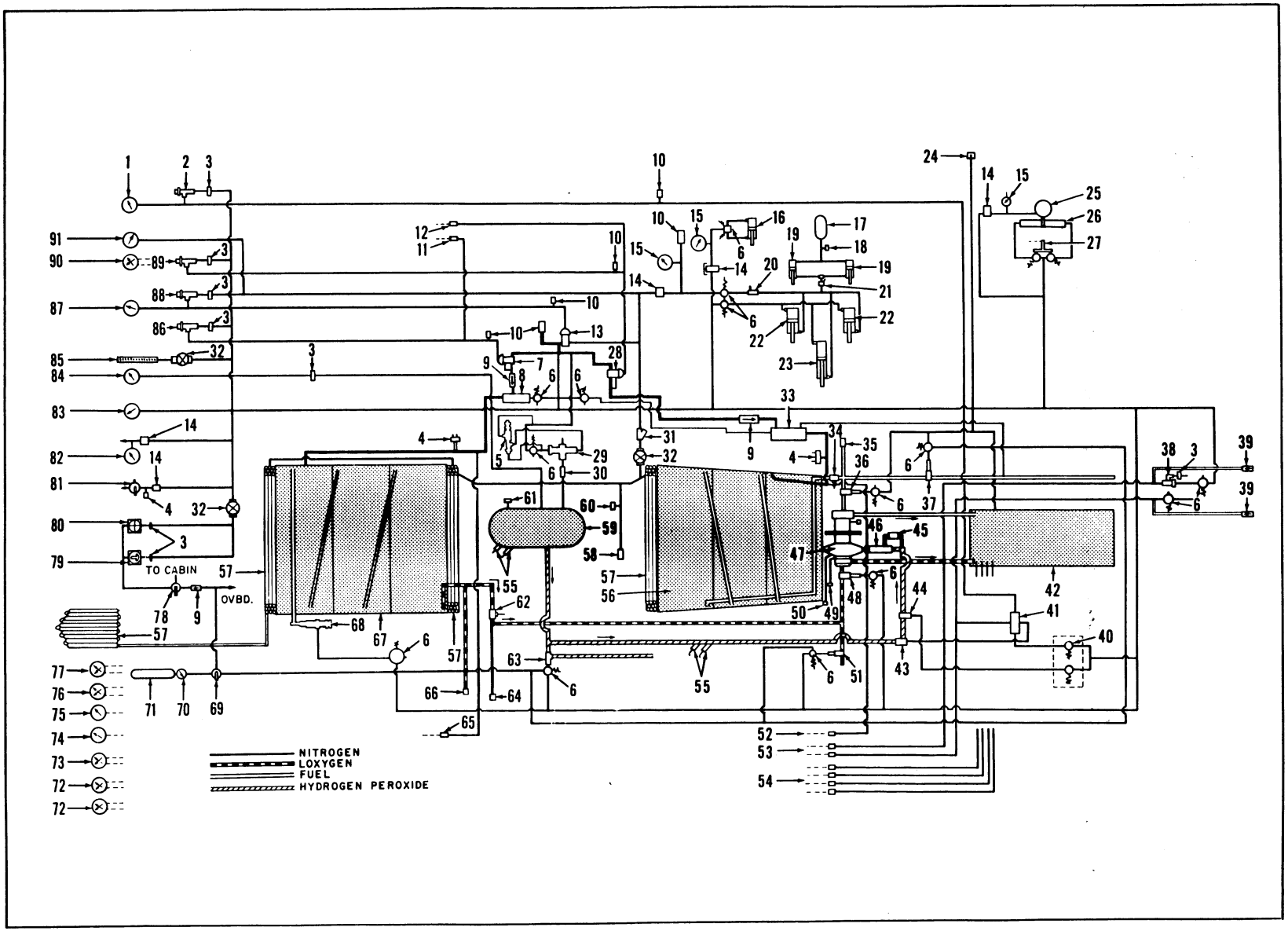
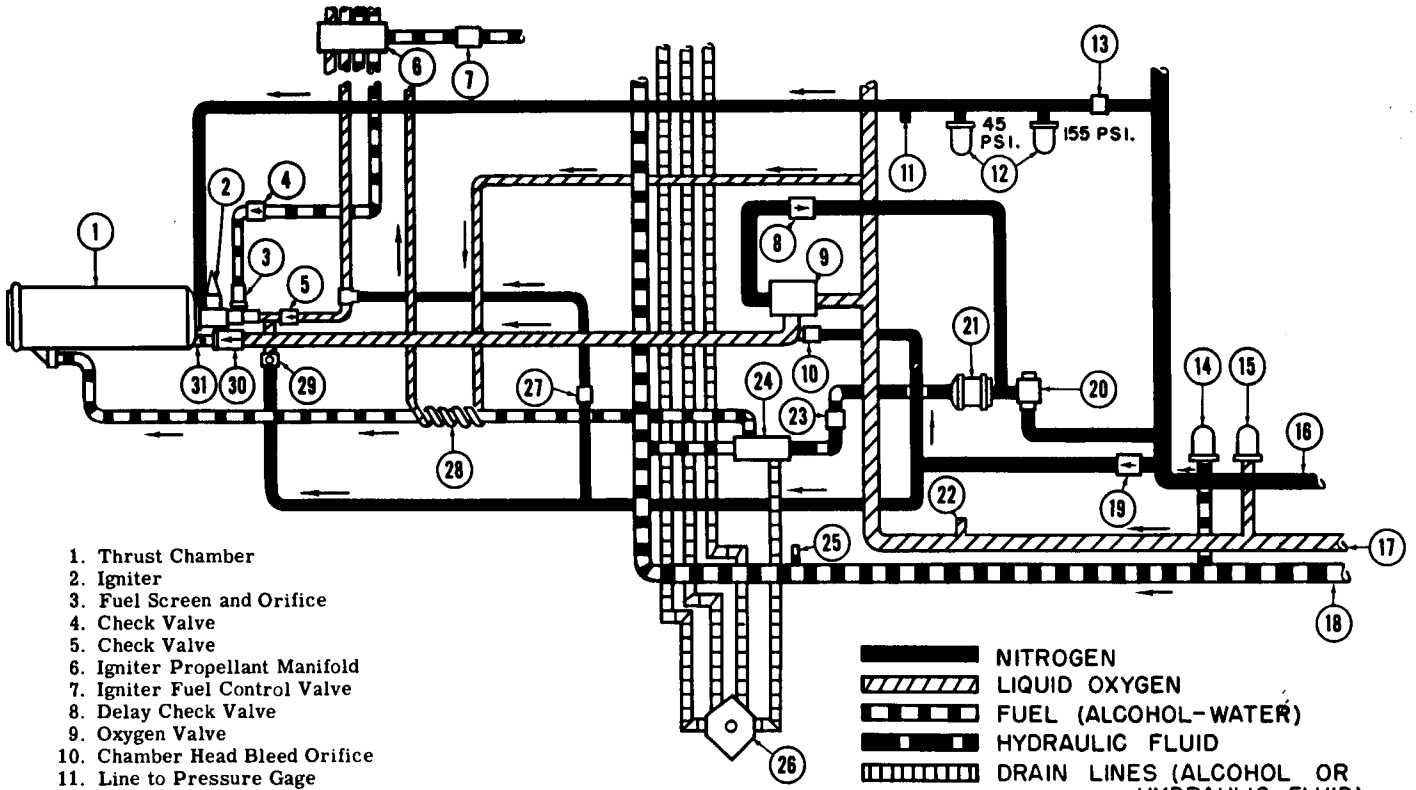


Figure 1-8. Nitrogen and Power Plant Schematic Diagram (Sheet 1 of 2 Sheets)

1. Turbine Governor Balance Pressure Gage
2. Turbine Governor Balance Pressure Regulator and Spill Valve
3. Orifice
4. Magnetic Pop-Off and Relief Valve
5. H_2O_2 Tank Pressurizing Valve
6. Solenoid Valve
7. Lox Tank Pressure Regulator
8. Lox Tank Pressurizing and Vent Valve
9. Check Valve
10. Relief Valve
11. Lox Dome Pressure Transmitter
12. Fuel Dome Pressure Transmitter
13. First Stage Pressure Regulator
14. Pressure Regulator
15. Pressure Gage
16. Flap Actuating Cylinder
17. Main Wheel Door Bottle
18. Main Wheel Door Bottle Charging Valve
19. Main Wheel Door Actuating Cylinders
20. Mechanical Check Valve (Operated by Uplock Release)
21. Sequence Valve (Opens when Main Wheels are up)
22. Main Wheel Actuating Cylinders
23. Nose Wheel Actuating Cylinder
24. N_2 Bleed Connection from Mother Aircraft
25. Stabilizer Actuator Motor
26. Stabilizer Actuator Control Assembly
27. Stabilizer Actuator Control Valves
28. Fuel Tank Pressure Regulator
29. H_2O_2 Tank Vent, Pressurizing, Relief Valve and Frangible Disc
30. Liquid Separator and Strainer
31. Nitrogen Strainer
32. Manual Shut-Off Valve
33. Fuel Tank Pressurizing and Vent Valve
34. Fuel Flowmeter Generator
35. Fuel Filler Valve
36. Fuel Shut-Off Valve
37. Fuel Jettison Valve
38. Lox Bleed Shut-Off Valve
39. Purge Check Valve
40. Turbo Pump Control Box
41. Turbo Pump Governor
42. XLR11-RM-5 Motor
43. H_2O_2 Propellant Valve
44. Emergency H_2O_2 Shut-Off Valve
45. Gas Generator Heater Line and Check Valve
46. Gas Generator
47. Turbo Pump
48. Lox Shut-Off Valve
49. Lox Pump Drain
50. Turbine Exhaust
51. Lox Jettison Valve
52. Fuel Tank Pressure Transmitter
53. Manifold Pressure Transmitters
54. Chamber Pressure Transmitters
55. H_2O_2 Temperature Pickups
56. Fuel Tank
57. N_2 Tube Bundles
58. N_2 Filler Valve
59. H_2O_2 Tank
60. Frangible Disc
61. H_2O_2 Tank Filler
62. Lox Flowmeter Generator
63. H_2O_2 Jettison Valve
64. Lox Top-Off Connection
65. Lox Tank Pressure Transmitters
66. Lox Filler Valve
67. Lox Tank
68. Auxiliary Lox Vent Valve
69. Emergency Jettison Control Valve
70. Filler and Pressure Gage Assembly
71. Emergency Jettison Air Bottle
72. Chamber Pressure Gage
73. Lox and Fuel Quantity Gage
74. H_2O_2 Line Temperature Gage
75. H_2O_2 Tank Temperature Gage
76. Manifold Pressure Gage (Fuel and Lox)
77. Lox Tank and Dome Pressure Gage
78. Cabin Pressure Selector Valve
79. Turn and Bank Indicator
80. Attitude Gyro
81. Canopy Seal Control Valve
82. Anti-G-Suit Supply Pressure Gage
83. First Stage Line Pressure Gage
84. H_2O_2 Tank Pressure Gage
85. Windshield Defroster
86. Lox Dome Loader and Spill Valve
87. First Stage Dome Pressure Gage
88. First Stage Dome Loader and Spill Valve
89. Fuel Dome Loader and Spill Valve
90. Fuel Tank and Dome Pressure Gage
91. N_2 Source Pressure Gage

Figure 1-8. Nitrogen and Power Plant Schematic Diagram (Sheet 2 of 2 Sheets)



1. Thrust Chamber
2. Igniter
3. Fuel Screen and Orifice
4. Check Valve
5. Check Valve
6. Igniter Propellant Manifold
7. Igniter Fuel Control Valve
8. Delay Check Valve
9. Oxygen Valve
10. Chamber Head Bleed Orifice
11. Line to Pressure Gage
12. Pressure Switch
13. Spark Plug Bleed Orifice
14. Fuel Manifold Pressure Switch
15. Oxygen Manifold Pressure Switch
16. Line to Pressure Regulator
17. Line to Liquid Oxygen Supply
18. Line to Fuel Supply
19. Check Valve
20. Propellant Control Valve
21. Accumulator
22. Line to Pressure Gage
23. Hydraulic Fluid Orifice
24. Fuel Valve
25. Line to Pressure Gage
26. Drain Manifold
27. Igniter Oxygen Control Valve
28. Evaporator Coil
29. Igniter Bleed Orifice
30. Main Oxygen Check Valve
31. Oxygen Inlet Blow Down Connection

Figure 1-9. Motor Schematic Diagram (Typical Single Chamber)

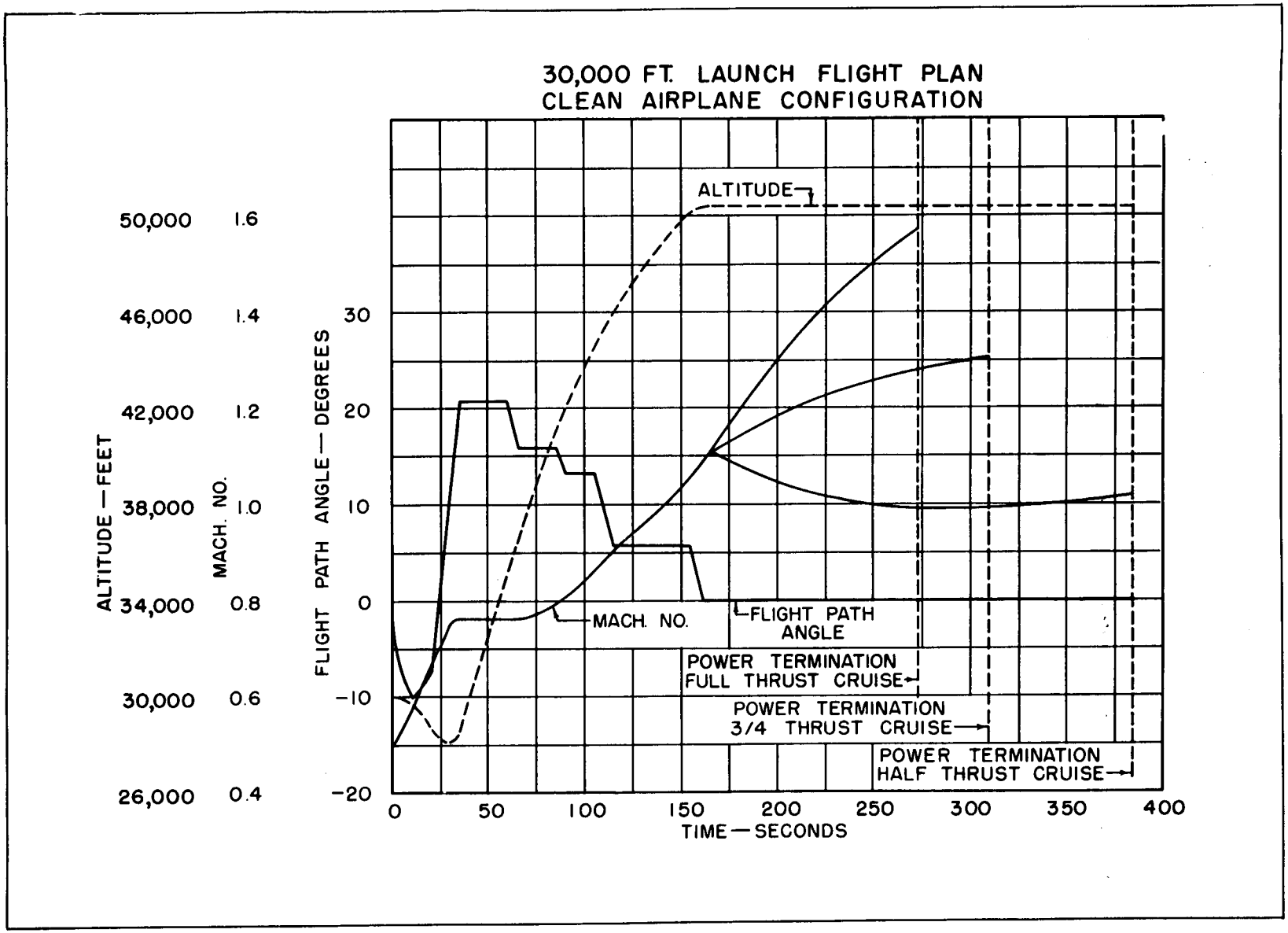


Figure A-3. Estimated Flight Plan Chart