SYSTEMS FAMILIARIZATION MANUAL

FOR CH-47A HELICOPTERS

BOEING
VERTOL DIVISION

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INTRODUCTION

This booklet has been prepared by Vertol Division, The Boeing Company to provide you with a condensed reference to the various major systems of your CH-47A (Chinook) helicopter. This booklet has been designed for insertion into the present Condensed Check List binder. The information herein will not be revised on a 90-day revision cycle, but will be reissued approximately every six months.

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*Indicates illustration

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SECTION I

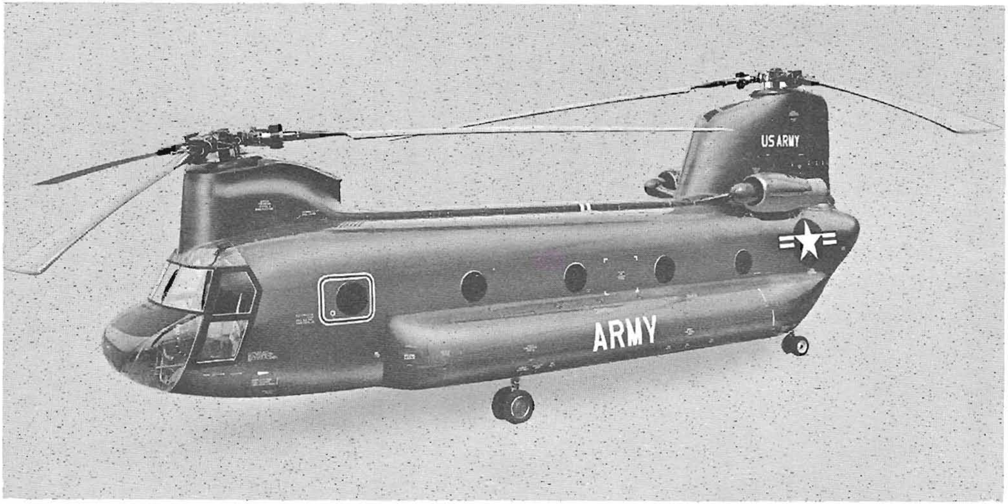
GENERAL INFORMATION

THE HELICOPTER.

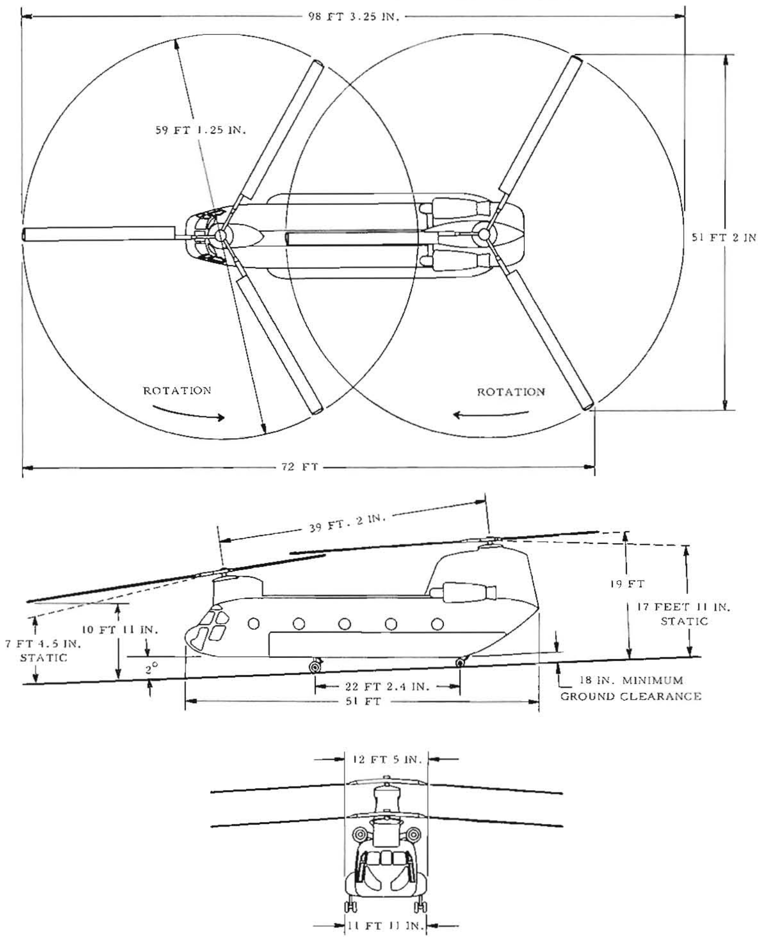
GENERAL.

The model CH-47A is manufactured by Vertol Division, The Boeing Company. It is a twin-turbine-engine tandem-rotary-wing aircraft designed for transportation of cargo, troops, and weapons. The helicopter is powered by two Lycoming T55-L-5 shaft-turbine engines mounted on the aft fuselage. The engines simultaneously drive two tandem 3-bladed rotary wings through a combining transmission, drive shafting, and reduction transmissions. The forward transmission is mounted in the forward pylon above the cockpit (forward cabin section). The aft transmission, the combining transmission, and drive shafting are located in the aft pylon section. Drive shafting from the combining transmission to the forward transmission is housed within a tunnel along the top of the fuselage. A gas-turbine auxiliary power unit, which supplies hydraulic pressure for starting the engines, is mounted in the aft pylon section. A pod on each side of the fuselage contains a fuel tank. The helicopter is equipped with four nonretractable dual-wheel landing gear. The wheels of the aft gear are full-swivel type. An entrance door is located at the forward right side of the cabin fuselage section. At the rear of the cabin fuselage section is a hydraulically powered loading ramp. The pilot's seat and controls are located at the right side of the cockpit; the copilot's seat and controls are on the left. The normal gross weight of the helicopter is 25,500 pounds,

CH-47A HELICOPTER



OVERALL DIMENSIONS



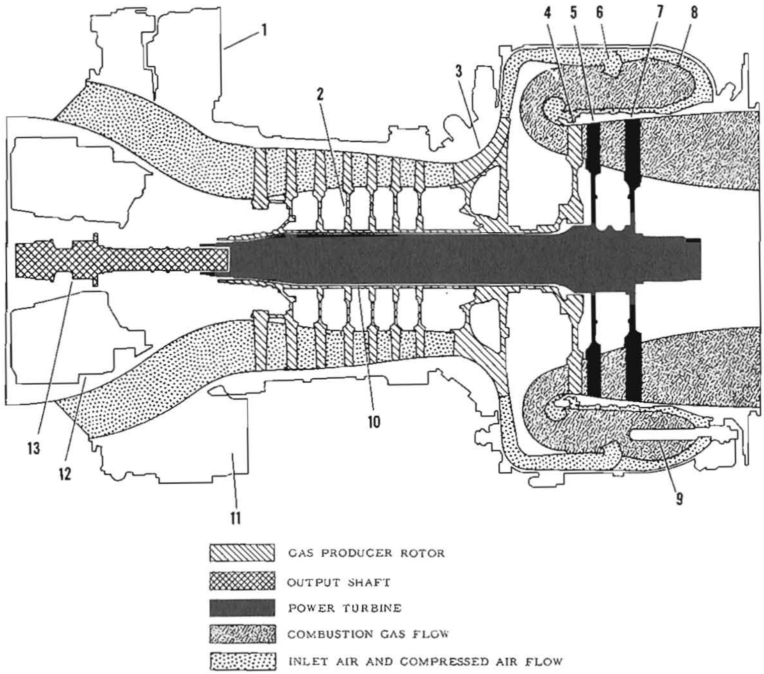
the design gross weight is 27,500 pounds, and the maximum alternate gross weight is 33,000 pounds.

ENGINES.

GENERAL.

The helicopter is powered by two Lycoming T55-L-5 shaft-turbine engines housed in separate nacelles mounted externally next to the aft pylon section. Each engine develops 2,200 shaft horsepower at military power and 1,850 shaft horsepower at normal rated power. The T55-L-5 engine is made up of two main sections: A gas producer section and a power turbine section. The gas producer supplies hot gases for driving the power turbine; it also mechanically drives an engine accessory gear box. The power turbine shaft extends coaxially through the gas producer rotor and rotates independently of it. The gas producer section and the power turbine section are connected only by the hot gases passing from one section to the other. During starting of the engine, air enters the engine inlet and is compressed as it passes through the seven axial stages and one centrifugal stage of the compressor rotor. The compressed air passes through a diffuser. Some of the air enters the combustion chamber where it is mixed with starting fuel and is ignited by two igniter plugs located at approximately the 3 and 9 o'clock positions; some of the air is directed to fuel vaporizers. After the engine is started, the igniter plugs and starting fuel are automatically shut off, and metered fuel is supplied to the vaporizers. Hot expanding gases leave the combustion chamber and drive a single-stage compressor turbine, which drives the compressor rotor. Remaining energy from the combustion gases drives the two-stage power turbine which drives the power

ENGINE



1 STARTER DRIVE PAD
2 AXIAL COMPRESSOR
3 CENTRIFUGAL COMPRESSOR
4 COMPRESSOR TURBINE
5 FIRST-STAGE POWER TURBINE
6 FLOW SPILITTER SCOOP
7 SECOND-STAGE POWER TURBINE
8 COMBUSTION CHAMBER
9 VAPORIZER
10 POWER TURBINE SHAFT
11 ACCESSORY GEAR BOX
12 OIL TANK CAVITY
13 OUTPUT SHAFT

output shaft to the engine transmission. The T55-L-5 engine lubrication system consists of an integral oil tank which is located inside the air inlet housing and is serviced with approximately 4 gallons of lubricating oil of which 1.85 gallons is usable.

ENGINE POWER CONTROL SYSTEMS.

Each engine is controlled by a separate power control system consisting of controls in the cockpit and a fuel control unit on the engine. Each system provides automatic control of both engine gas producer rotor speed and power turbine speed in response to any setting of the engine controls selected by the pilot. Both engine gas producer rotor speed (nI) and power turbine speed (nII) are controlled by the fuel control unit, which varies the amount of fuel delivered to the engine fuel vaporizers. The fuel control unit automatically prevents power changes from damaging the engine regardless of the rate and sequence in which they are applied. Fuel flow is automatically modified to compensate for changes in outside air temperature and compressor discharge pressure.

ENGINE FUEL CONTROL UNITS.

Each engine fuel control unit contains a dual element fuel pump, a gas producer speed governor, a power turbine speed governor, an acceleration-deceleration control, a shaft power and torque limiter, a shutoff valve, and a main metering valve. Mounted on the fuel control unit are two levers: a gas producer lever and a power turbine lever. The output power of the power turbine (a function of speed and torque) is limited by limiting the maximum fuel flow to the gas producer. The maximum gas producer rotor speed is set by the engine condition lever in the cockpit. The engine condition lever electromechanically positions the gas producer lever, which controls the shutoff valve and the operating level of the gas producer. During flight the engine condition lever is left at the maximum limit and the output shaft speed is regulated by the power turbine speed governor. The power turbine lever is electromechanically positioned by the engine beep trim switches. The output shaft torque is limited by the shaft output torque limiter, which reduces the maximum fuel flow when the power turbine speed is reduced. The position of the main metering valve is determined by the gas producer speed governor, power turbine speed governor, the acceleration-deceleration control, or the shaft power and torque limiter, depending on engine requirements at that time. The governor or the control unit demanding the least fuel flow overrides the others in regulating the metering valve.

The power turbine speed governor senses the speed of the power turbine and regulates the amount of fuel which is supplied to the gas producer. This slows down or speeds up the gas producer rotor so that the power turbine, and therefore the rotary-wing system, remains mains at nearly constant speed as the loads vary. When the pitch of the rotary-wing blades is zero, the amount of power being supplied by either engine is at a minimum. As the pitch is increased, more power is required from the engine to maintain constant rotary-wing speed; thus power turbine speed (nII) starts to drop. The power turbine speed governor senses the drop of nII and increases the amount of fuel to the gas producer, thus creating more hot gases for the power section of the engine. This increases nII until it has returned to the governor setting. Decreasing pitch causes nII to increase. The power turbine governor senses this increase and reduces the amount of fuel to the gas producer, thus decreasing the amount of hot gases for the power turbine and reducing nII to the governor setting.

The power turbine speed governor design is such that it will allow the power turbine output speed to decrease approximately five percent when the power loading varies from minimum to full load. This characteristic, droop, is eliminated by a droop eliminator linked to the thrust control rod. The droop eliminator automatically advances the power turbine lever to compensate for droop as pitch is increased. Another type of droop, which is only transient, occurs as a result of the time required for the engine to respond to changing loads.

ROTARY-WING SYSTEM.

GENERAL.

The helicopter receives its lift from the rotary-wing system which consists of two fully articulated counter-rotating rotary wings. The forward rotary wing is driven by the forward transmission through a short vertical drive shaft. The aft rotary wing is driven by the aft transmission through a vertical rotary-wing drive shaft. Each rotary wing is made up of three rotary-wing blades which are interchangeable on their own head and a rotary-wing head. The rotary-wing head consists of a hub connected to three pitch-varying shafts by three horizontal hinge pins. These pins permit blade flapping. Stops on the top and the bottom of the hub limit the blade flapping motion. Mounted coaxially over the pitch-varying shafts are pitch-varying housings to which the blades are attached by vertical hinge pins. These pins permit blade leading and lagging. Each pitch-varying shaft is connected to the pitch-varying housing by a laminated tie bar. Blade pitch changes are made through the pitch-varying shaft and housing. A direct-action shock absorber is attached to the blade socket and to the pitch-varying housing. When the inboard end of each shock absorber is disconnected, the blades can be folded in either direction about the vertical hinge pins. Each rotary-wing blade is constructed of fiberglass boxes supported by ribs and bonded to a steel D-spar. This spar forms the leading edge of the blade. Balance weights, used to keep the blade in track, are contained in the blade tip. Seven lubricating oil tanks are contained in each rotary wing: a tank on the top of the hub with oil for the horizontal hinge pin bearings, and a separate tank for each vertical hinge pin bearing set and for each pitch-varying bearing set.

TRANSMISSION SYSTEM.

GENERAL.

Engine power is supplied to the rotary wings through a mechanical transmission system. The transmission system consists of a forward transmission, an aft transmission, a combining transmission, two engine transmissions, and drive shafting. Power from the engine transmissions is transmitted through separate drive shafts to the combining transmission. The combining transmission combines the power of the engines and transmits it at reduced shaft speed through drive shafts to the forward and aft transmissions. Further speed reduction occurs in these transmissions. Engine speed is reduced to rotary-wing speed by an overall ratio of 66:1.

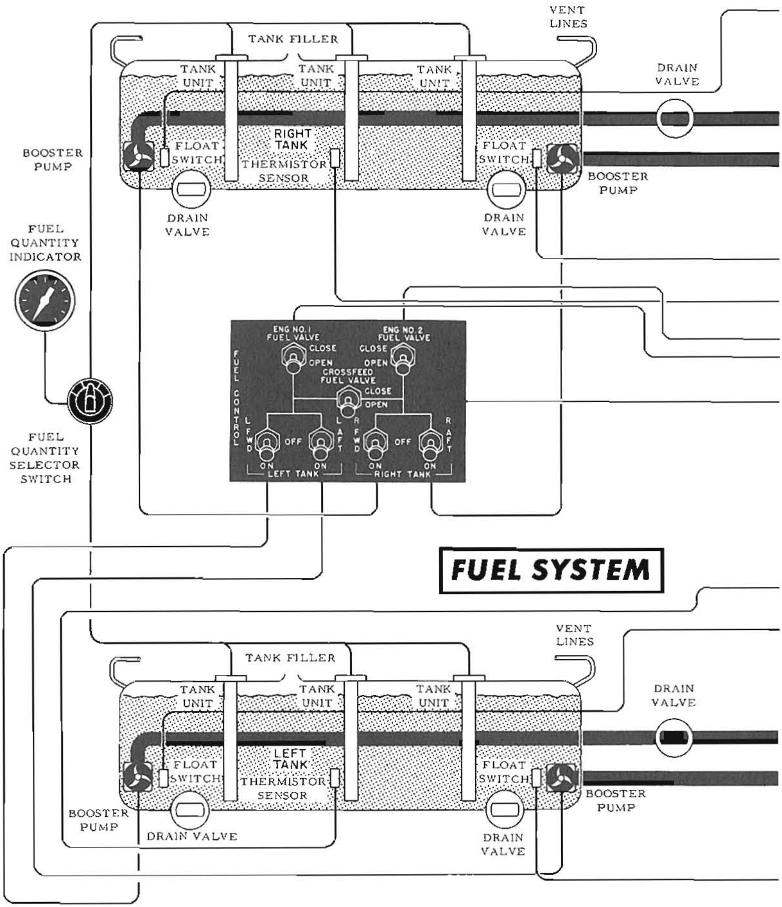
Each transmission has a completely separate lubrication system. Oil pumps supply oil to lubricating jets in the transmissions. An oil pump for the engine transmissions and the combining transmission is contained in the top of the combining transmission below a three-compartment sump. The forward transmission oil pump is mounted on the bottom of the forward transmission. The oil pump for the aft transmission is on the accessory gear box. Three oil coolers are located in the aft pylon section. One cooler, composed of three separate sections, is for each engine transmission and the combining transmission. The other two coolers are for the forward and aft transmissions. Air for these coolers is drawn into the pylon section by a fan driven by the aft transmission.

Mounted on the rear of the aft transmission is an accessory gear box. This gear box receives power through a sprag overrunning clutch to drive two generators, three hydraulic pumps, one lubricating pump, and one hydraulic motor. The sprag clutch permits operation of the accessories by the auxiliary power unit without the aft transmission operating. A sprag clutch is also contained in each engine transmission. If an engine fails, the transmission system will continue to function without drag from the inoperative engine. Each engine transmission has a magnetic chip detector plug which is connected to a respective red warning light inside the aft pylon above the transmission oil coolers. Magnetic drain plugs are installed in the other transmissions. A dephasing unit is built into the combining transmission to permit quick dephasing and phasing of the rotary wings.

FUEL SUPPLY SYSTEM.

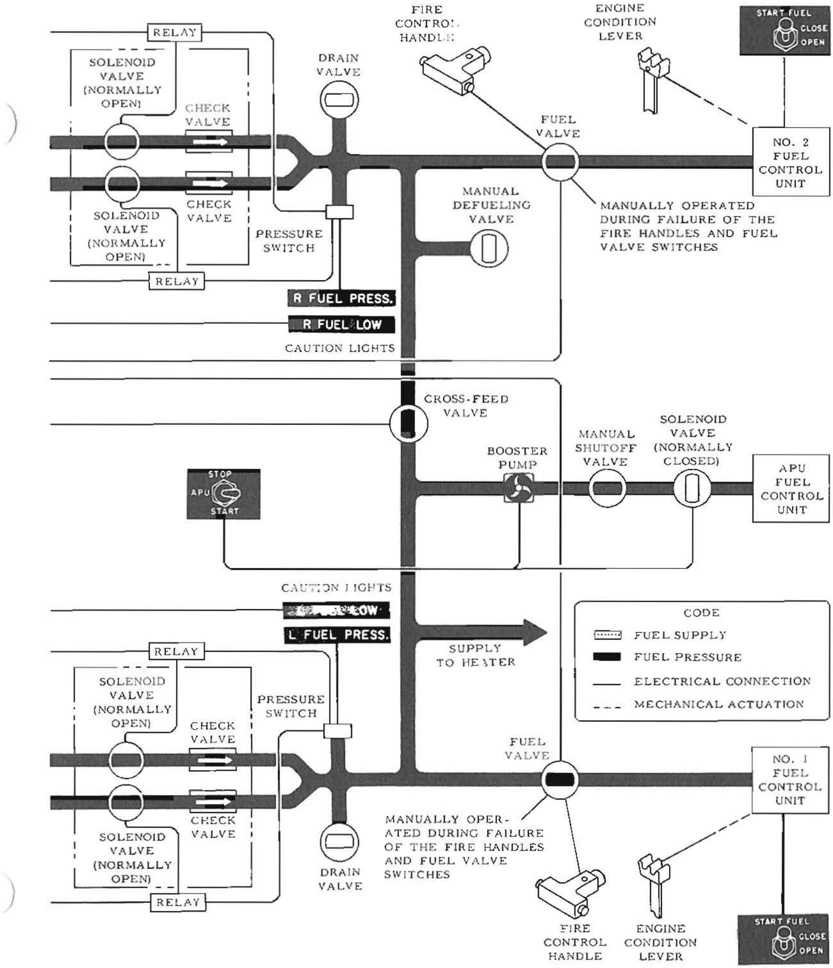
GENERAL.

The fuel supply system furnishes fuel for the two engines, the heater, and the auxiliary power unit (apu). This system consists of two separate fuel systems connected by a crossfeed line and valve. Each system consists of a fuel tank contained in a respective pod on the side of the fuselage, two ac operated fuel booster pumps, two float-controlled solenoid valves, and a fuel valve (firewall fuel shutoff). Each booster pump delivers fuel under pressure to a respective solenoid valve. Fuel flows from the normally open float control solenoid valve through the fuel valve and thence through the fuel control unit. Float switches next to the booster pumps inside the fuel tank and a pressure switch downstream of the solenoid valves are electrically connected to the solenoid valves through relays. If a float switch becomes exposed from the fuel and the differential pressure across the respective solenoid valve is less than 10 psi, as sensed by the pressure switch, the solenoid valve will close. If one of the booster pumps fails or becomes exposed, a check valve prevents flow back into the tank. Vent lines extend along the top of each fuel tank; fuel cannot escape through these lines in normal helicopter attitudes. Fuel is normally delivered from the left tank to the apu fuel control unit by a separate dc operated booster pump. Fuel system switches are located on the overhead panel in the cockpit; caution lights are located on the console.



TANK FILLER
VENT LINES
TANK UNIT
TANK UNIT
TANK UNIT
DRAIN VALVE
RIGHT TANK
BOOSTER PUMP
FLOAT SWITCH
THERMISTOR SENSOR
FLOAT SWITCH
BOOSTER PUMP
DRAIN VALVE
DRAIN VALVE
FUEL QUANTITY INDICATOR
ENG NO.1 FUEL VALVE
CLOSE
OPEN
ENG NO.2 FUEL VALVE
CLOSE
OPEN
CROSSFEED FUEL VALVE
CLOSE
OPEN
FUEL CONTROL
L FWD
OFF
L AFT
R FWD
OFF
R AFT
ON
ON
LEFT TANK
ON
ON
RIGHT TANK
FUEL QUANTITY SELECTOR SWITCH
TANK FILLER
VENT LINES
TANK UNIT
TANK UNIT
TANK UNIT
DRAIN VALVE
LEFT TANK
FLOAT SWITCH
THERMISTOR SENSOR
FLOAT SWITCH
BOOSTER PUMP
BOOSTER PUMP
DRAIN VALVE
DRAIN VALVE

FUEL SYSTEM


RELAY
SOLENOID VALVE (NORMALLY OPEN)
CHECK VALVE
CHECK VALVE
SOLENOID VALVE (NORMALLY OPEN)
RELAY
DRAIN VALVE
PRESSURE SWITCH
R FUEL PRESS.
R FUEL LOW
CAUTION LIGHTS
FIRE CONTROL HANDLE
ENGINE CONDITION LEVER
START FUEL
CLOSE
OPEN
FUEL VALVE
NO. 2 FUEL CONTROL UNIT
MANUAL DEFUELING VALVE
MANUALLY OPERATED DURING FAILURE OF THE FIRE HANDLES AND FUEL VALVE SWITCHES
CROSS-FEED VALVE
STOP
APU
START
BOOSTER PUMP
MANUAL SHUTOFF VALVE
SOLENOID VALVE (NORMALLY CLOSED)
APU FUEL CONTROL UNIT
CAUTION LIGHTS
LOW
L FUEL PRESS.
SUPPLY TO HEATER
CODE
FUEL SUPPLY
FUEL PRESSURE
ELECTRICAL CONNECTION
MECHANICAL ACTUATION
RELAY
SOLENOID VALVE (NORMALLY OPEN)
PRESSURE SWITCH
CHECK VALVE
FUEL VALVE
CHECK VALVE
SOLENOID VALVE (NORMALLY OPEN)
RELAY
DRAIN VALVE
MANUALLY OPERATED DURING FAILURE OF THE FIRE HANDLES AND FUEL VALVE SWITCHES
NO. 1 FUEL CONTROL UNIT
FIRE CONTROL HANDLE
ENGINE CONDITION LEVER
START FUEL
CLOSE
OPEN

ELECTRICAL POWER SUPPLY SYSTEM.

GENERAL.

Alternating current is the primary source of power used to operate the electrical and electronic equipment. Two ac generators (alternators), driven by the accessory gear box on the aft transmission, produce 208-volt 3-phase 400-cycle current. The accessory gear box is driven by either a hydraulic motor powered by the auxiliary power unit or by the aft transmission through a sprag clutch. The ac system provides 28-volt direct current through two transformer-rectifiers located in the forward section of the left fuselage pod. Direct current is also supplied by a 24-volt nickel-cadmium battery. On the ground, both 208-volt 3-phase alternating current and 28-volt direct current are supplied by connecting an external power source to the external power receptacles. If only ac external power is utilized, dc power is supplied by the helicopter transformer-rectifiers. If both ac and dc external power is used, the transformer-rectifiers are automatically disconnected from the buses. If only dc external power is available, the apu must be used to provide ac power. Circuits are protected by circuit breakers. The electrical load is divided between the two ac generators. Should one generator fail, the other automatically will take over the entire load.

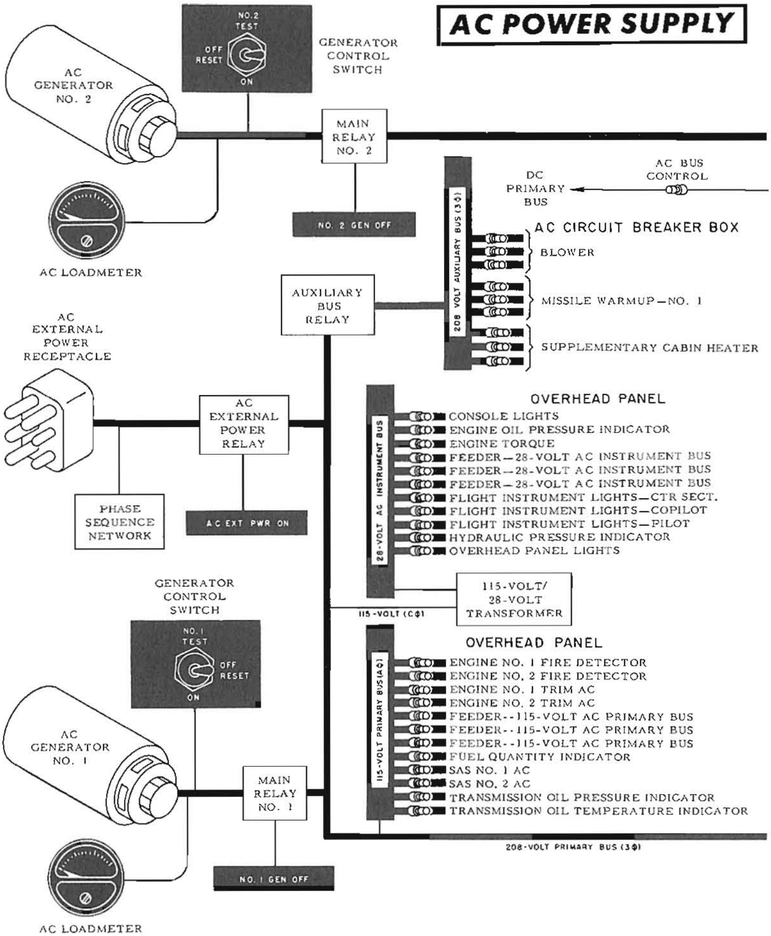
AC SYSTEM.

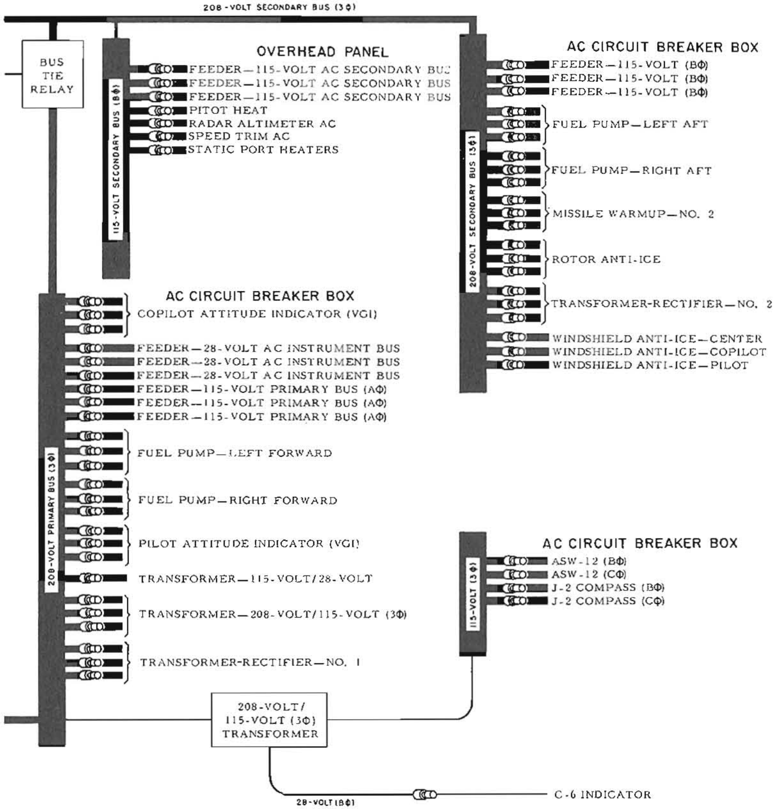
The ac system supplies 208-volt 3-phase 400-cycle current from the No. 1 ac generator to a primary 3-phase bus and from the No. 2 ac generator to a secondary 3-phase bus. An auxiliary 3-phase bus is connected to the primary bus through an auxiliary bus relay. The ac operated equipment is powered by these three buses. Some of the equipment is operated by 115-volt single-phase alternating current. Other equipment is operated by 28-volt ac power supplied through a transformer. The ac system is protected from overvoltage, undervoltage, and underfrequency conditions by a generator control panel. A bus tie relay is located between the primary and secondary 3-phase buses. If either generator fails, this bus tie relay closes automatically to connect the disabled bus to the operating generator. This ensures the continuous operation of all ac equipment. During engine starting, the No. 2 generator, the No. 2 transformer-rectifier, and the 208-volt ac, 3-phase auxiliary bus are cut out of the system to reduce the starting load on the auxiliary power unit. External ac power is supplied to the ac buses of the helicopter by connecting the external ac power source to the ac external power receptacle. Application of external power closes the ac external power relay which connects the power source to the primary bus. If the primary bus is already energized by the helicopter generators, an interlock circuit between the external power relay and the main relays prevents the use of external power. If the external power phase sequence is unlike that of the helicopter bus, a phase sequence network prevents the external power relay from closing.

DC SYSTEM.

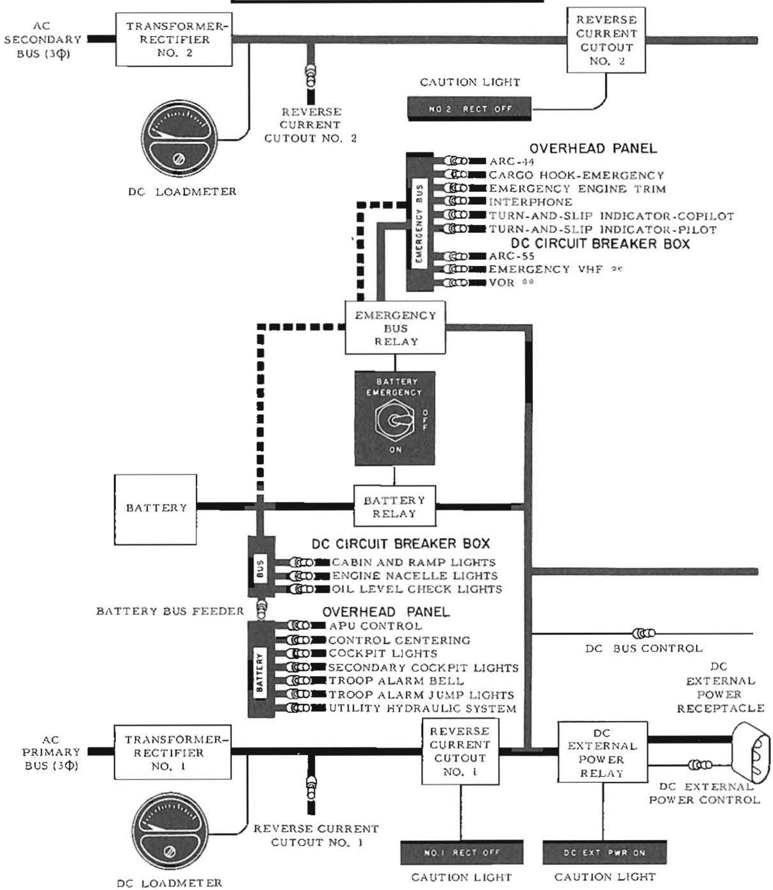
The dc system supplies 28-volt direct current from the No. 1 transformer-rectifier to a primary bus and from the No. 2 transformer-rectifier to a secondary bus. The ac system supplies input power to the

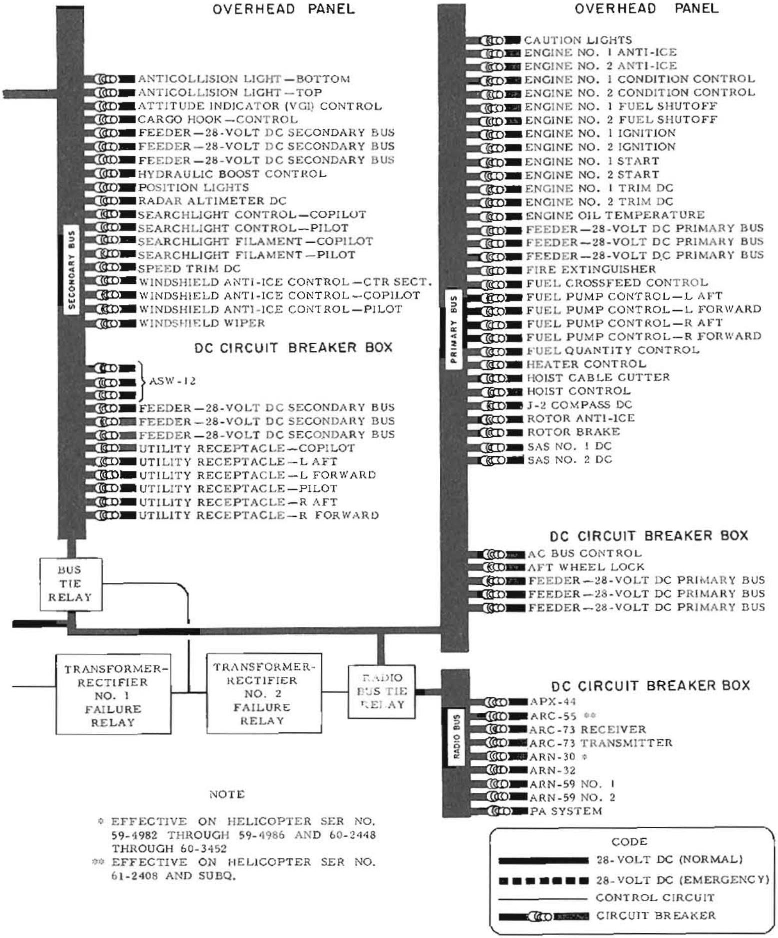
AC POWER SUPPLY




208-VOLT SECONDARY BUS (3Φ)
BUS TIE RELAY
OVERHEAD PANEL
115-VOLT SECONDARY BUS (BΦ)
FEEDER—115-VOLT AC SECONDARY BUS
FEEDER—115-VOLT AC SECONDARY BUS
FEEDER—115-VOLT AC SECONDARY BUS
PITOT HEAT
RADAR ALTIMETER AC
SPEED TRIM AC
STATIC PORT HEATERS
AC CIRCUIT BREAKER BOX
208-VOLT SECONDARY BUS (3Φ)
FEEDER—115-VOLT (BΦ)
FEEDER—115-VOLT (BΦ)
FEEDER—115-VOLT (BΦ)
FUEL PUMP—LEFT AFT
FUEL PUMP—RIGHT AFT
MISSILE WARMUP—NO. 2
ROTOR ANTI-ICE
TRANSFORMER-RECTIFIER—NO. 2
WINDSHIELD ANTI-ICE—CENTER
WINDSHIELD ANTI-ICE—COPILOT
WINDSHIELD ANTI-ICE—PILOT
AC CIRCUIT BREAKER BOX
208-VOLT PRIMARY BUS (3Φ)
COPILOT ATTITUDE INDICATOR (VGI)
FEEDER—28-VOLT AC INSTRUMENT BUS
FEEDER—28-VOLT AC INSTRUMENT BUS
FEEDER—28-VOLT AC INSTRUMENT BUS
FEEDER—115-VOLT PRIMARY BUS (AΦ)
FEEDER—115-VOLT PRIMARY BUS (AΦ)
FEEDER—115-VOLT PRIMARY BUS (AΦ)
FUEL PUMP—LEFT FORWARD
FUEL PUMP—RIGHT FORWARD
PILOT ATTITUDE INDICATOR (VGI)
TRANSFORMER—115-VOLT/28-VOLT
TRANSFORMER—208-VOLT/115-VOLT (3Φ)
TRANSFORMER-RECTIFIER—NO. 1
AC CIRCUIT BREAKER BOX
115-VOLT (3Φ)
ASW-12 (BΦ)
ASW-12 (CΦ)
J-2 COMPASS (BΦ)
J-2 COMPASS (CΦ)
208-VOLT/ 115-VOLT (3Φ) TRANSFORMER
28-VOLT (BΦ)
C-6 INDICATOR

DC POWER SUPPLY




OVERHEAD PANEL
ANTICOLLISION LIGHT—BOTTOM
ANTICOLLISION LIGHT—TOP
ATTITUDE INDICATOR (VGI) CONTROL
CARGO HOOK—CONTROL
FEEDER—28-VOLT DC SECONDARY BUS
FEEDER—28-VOLT DC SECONDARY BUS
FEEDER—28-VOLT DC SECONDARY BUS
HYDRAULIC BOOST CONTROL
POSITION LIGHTS
RADAR ALTIMETER DC
SEARCHLIGHT CONTROL—COPILOT
SEARCHLIGHT CONTROL—PILOT
SEARCHLIGHT FILAMENT—COPILOT
SEARCHLIGHT FILAMENT—PILOT
SPEED TRIM DC
WINDSHIELD ANTI-ICE CONTROL—CTR SECT.
WINDSHIELD ANTI-ICE CONTROL—COPILOT
WINDSHIELD ANTI-ICE CONTROL—PILOT
WINDSHIELD WIPER
SECONDARY BUS
DC CIRCUIT BREAKER BOX
ASW-12
FEEDER—28-VOLT DC SECONDARY BUS
FEEDER—28-VOLT DC SECONDARY BUS
FEEDER—28-VOLT DC SECONDARY BUS
UTILITY RECEPTACLE—COPILOT
UTILITY RECEPTACLE—L AFT
UTILITY RECEPTACLE—L FORWARD
UTILITY RECEPTACLE—PILOT
UTILITY RECEPTACLE—R AFT
UTILITY RECEPTACLE—R FORWARD
BUS TIE RELAY
TRANSFORMER-RECTIFIER NO. 1 FAILURE RELAY
TRANSFORMER-RECTIFIER NO. 2 FAILURE RELAY
RADIO BUS TIE RELAY
OVERHEAD PANEL
CAUTION LIGHTS
ENGINE NO. 1 ANTI-ICE
ENGINE NO. 2 ANTI-ICE
ENGINE NO. 1 CONDITION CONTROL
ENGINE NO. 2 CONDITION CONTROL
ENGINE NO. 1 FUEL SHUTOFF
ENGINE NO. 2 FUEL SHUTOFF
ENGINE NO. 1 IGNITION
ENGINE NO. 2 IGNITION
ENGINE NO. 1 START
ENGINE NO. 2 START
ENGINE NO. 1 TRIM DC
ENGINE NO. 2 TRIM DC
ENGINE OIL TEMPERATURE
FEEDER—28-VOLT DC PRIMARY BUS
FEEDER—28-VOLT DC PRIMARY BUS
FEEDER—28-VOLT DC PRIMARY BUS
FIRE EXTINGUISHER
FUEL CROSSFEED CONTROL
FUEL PUMP CONTROL—L AFT
FUEL PUMP CONTROL—L FORWARD
FUEL PUMP CONTROL—R AFT
FUEL PUMP CONTROL—R FORWARD
FUEL QUANTITY CONTROL
HEATER CONTROL
HOIST CABLE CUTTER
HOIST CONTROL
J-2 COMPASS DC
ROTOR ANTI-ICE
ROTOR BRAKE
SAS NO. 1 DC
SAS NO. 2 DC
PRIMARY BUS
DC CIRCUIT BREAKER BOX
AC BUS CONTROL
AFT WHEEL LOCK
FEEDER—28-VOLT DC PRIMARY BUS
FEEDER—28-VOLT DC PRIMARY BUS
FEEDER—28-VOLT DC PRIMARY BUS
DC CIRCUIT BREAKER BOX
APX-44
ARC-55 **
ARC-73 RECEIVER
ARC-73 TRANSMITTER
ARN-30 *
ARN-32
ARN-59 NO. 1
ARN-59 NO. 2
PA SYSTEM
RADIO BUS
NOTE
* EFFECTIVE ON HELICOPTER SER NO. 59-4982 THROUGH 59-4986 AND 60-2448 THROUGH 60-3452
** EFFECTIVE ON HELICOPTER SER NO. 61-2408 AND SUBQ.
CODE
28-VOLT DC (NORMAL)
28-VOLT DC (EMERGENCY)
CONTROL CIRCUIT
CIRCUIT BREAKER

transformer-rectifiers. A radio bus is connected to the primary bus through a radio bus tie relay which opens during engine starting to reduce starting load. An emergency bus is connected to the primary bus through an emergency bus relay. The 24-volt nickel-cadmium (chemically basic) battery, located in the forward section of the left fuselage pod, supplies emergency dc power and power for the apu starting circuits through a battery relay. The battery capacity is 11 ampere-hours. A bus tie relay is located between the primary and secondary buses. If either transformer-rectifier fails, the respective transformer-rectifier failure relay energizes and the bus tie relay closes automatically to connect the disabled bus to the operating transformer-rectifier. This ensures continuous operation of all dc equipment. External dc power is supplied to the dc buses of the helicopter by connecting the external dc power source to the dc external power receptacle. Application of external power closes the dc external power relay which connects the power source to the primary bus. If the polarity of the external power is reversed, a blocking diode in the circuit of the external power relay prevents that relay from closing.

HYDRAULIC POWER SUPPLY SYSTEM.

GENERAL.

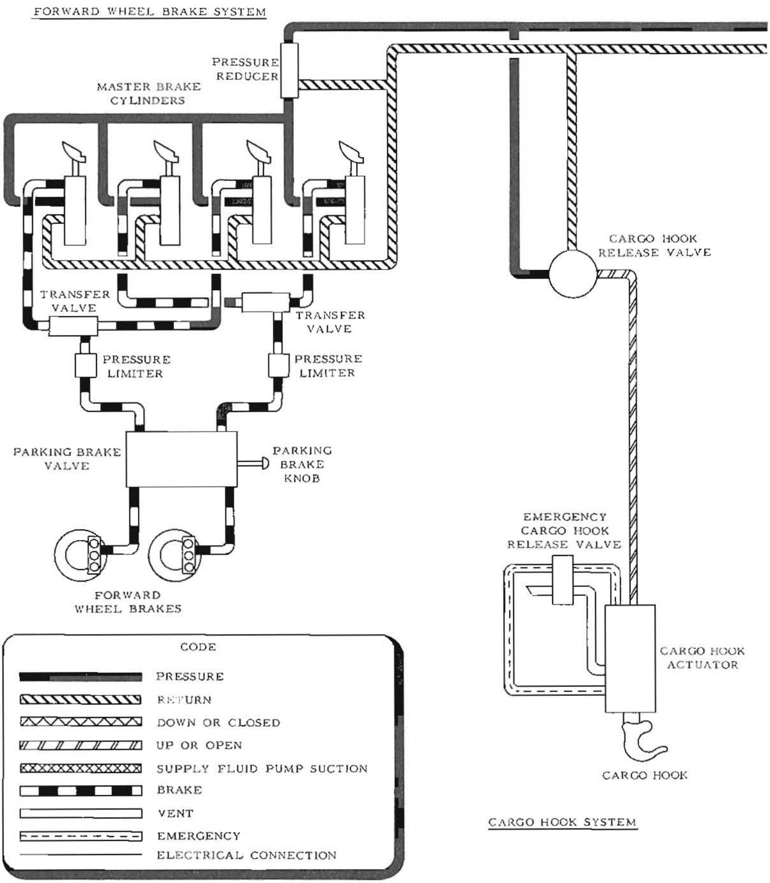
The hydraulic power supply system is made up of three completely separate systems: a No. 1 flight control system, a No. 2 flight control system, and a utility system. Each system contains a separate variable-delivery pump and a separate tank. The No. 1 flight control system powers one set of the four dual upper boost actuators, one set of the three dual stability augmentation system extensible links, and one set of four dual stick boost actuators. The No. 2 flight control system powers the other set of each of the above actuators. The utility system supplies hydraulic power to operate the auxiliary power unit motor-pump, the two engine starter motors, the ramp actuating cylinders, the cargo door actuator hydraulic motor, the brakes, the swivel locks, the rotor brake, the cargo hook actuator, the winch hydraulic motor, and the accessory gear box motor. The starting section of the utility system contains an accumulator and a hand pump. When fully charged, the accumulator contains enough pressurized fluid to operate the auxiliary power unit motor-pump for apu starting. Another accumulator is contained in the utility system for the rotor brake. This accumulator provides reserve supply of pressure for the rotor brake when the utility system is not operating. Mounted on each accumulator is a separate air pressure indicator. Normal operating pressure for the hydraulic systems is 3,000 psi. During engine starting, the auxiliary power unit delivers 4,000 psi to run the engine starter motors. Pressure reducers are contained in each system for reducing main pressure to the pressure required for operation of various units of equipment. The capacity of each flight control system tank is 10.5 pints of fluid. The utility system tank capacity is 12.7 pints of fluid with the ramp up.

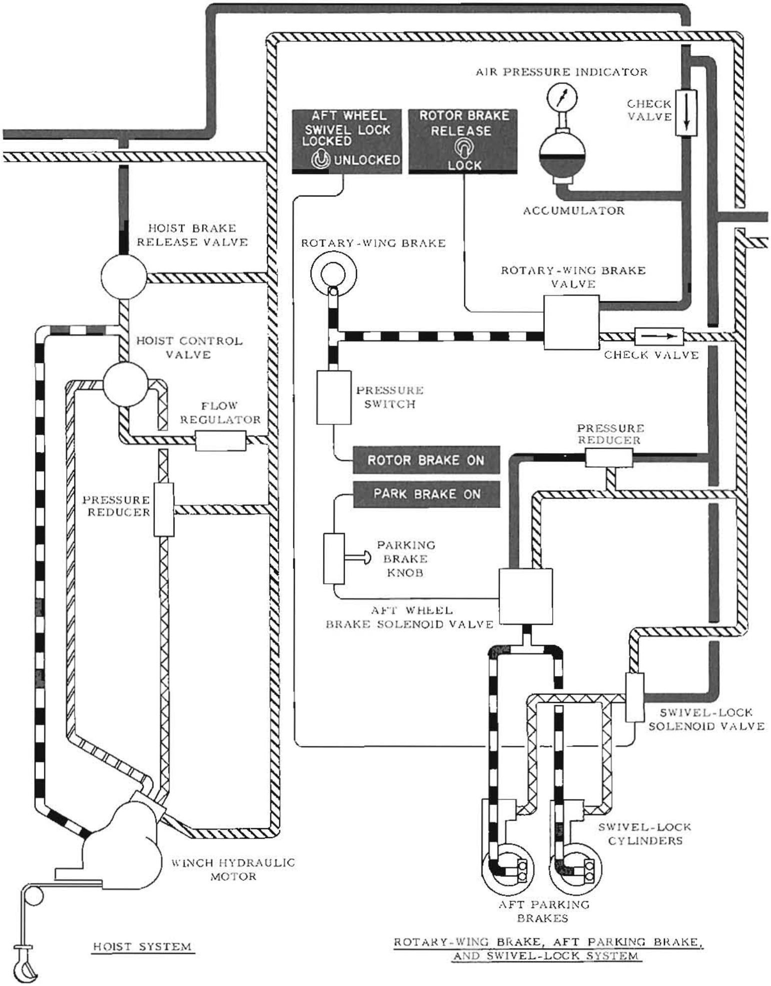
FLIGHT CONTROL SYSTEM.

GENERAL.

The helicopter is controlled by changing the pitch of the blades either collectively or individually. Pitch

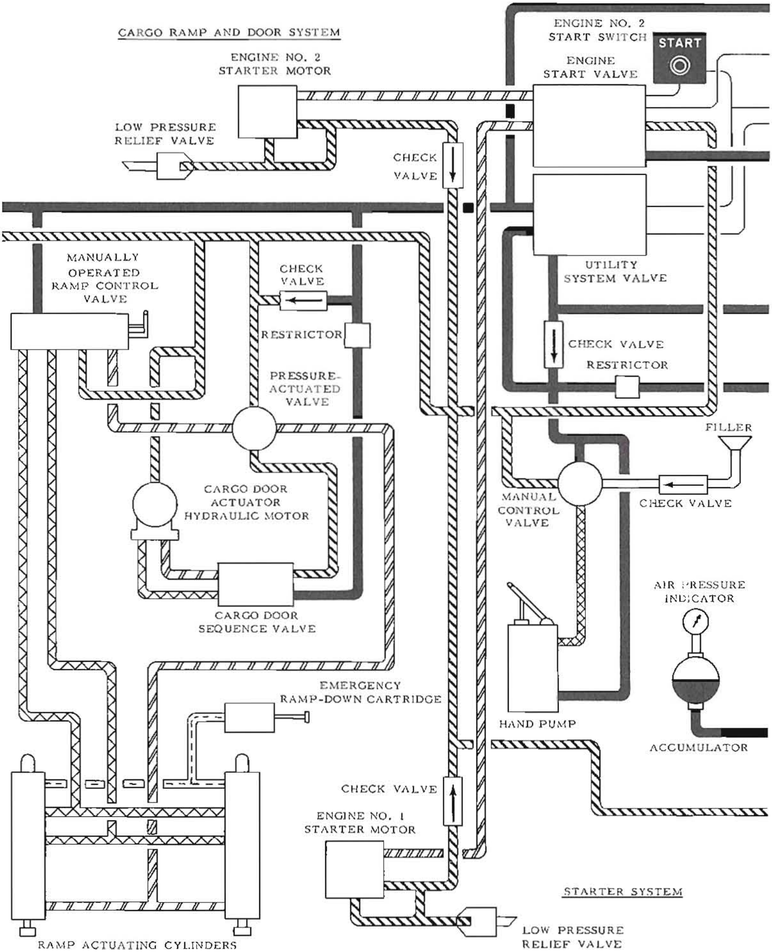
HYDRAULIC SYSTEM - UTILITY

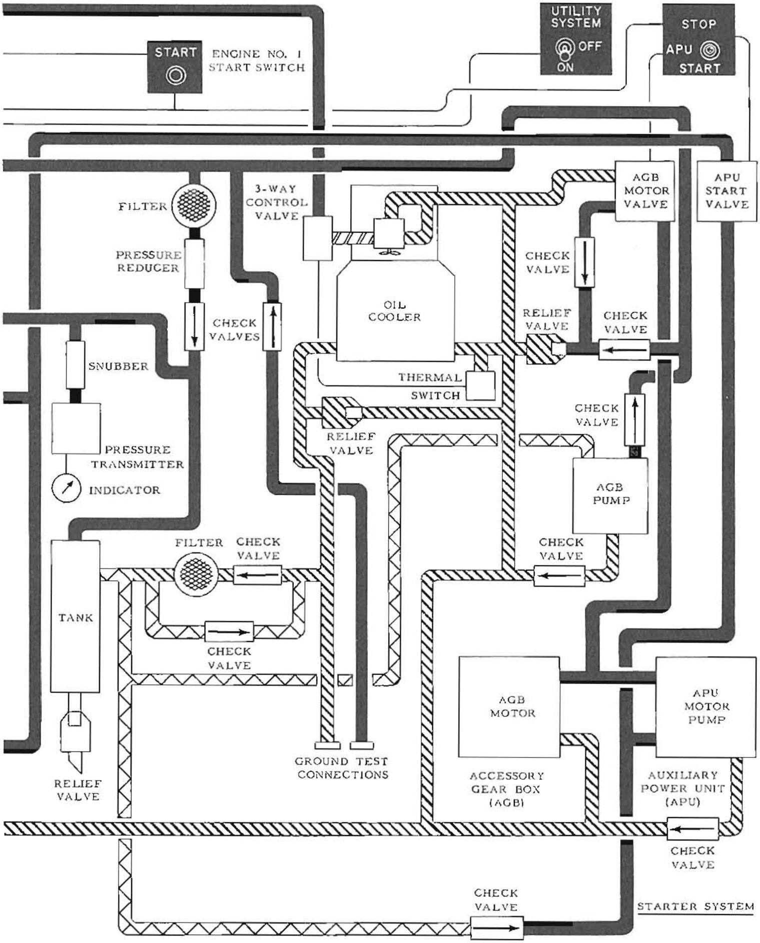




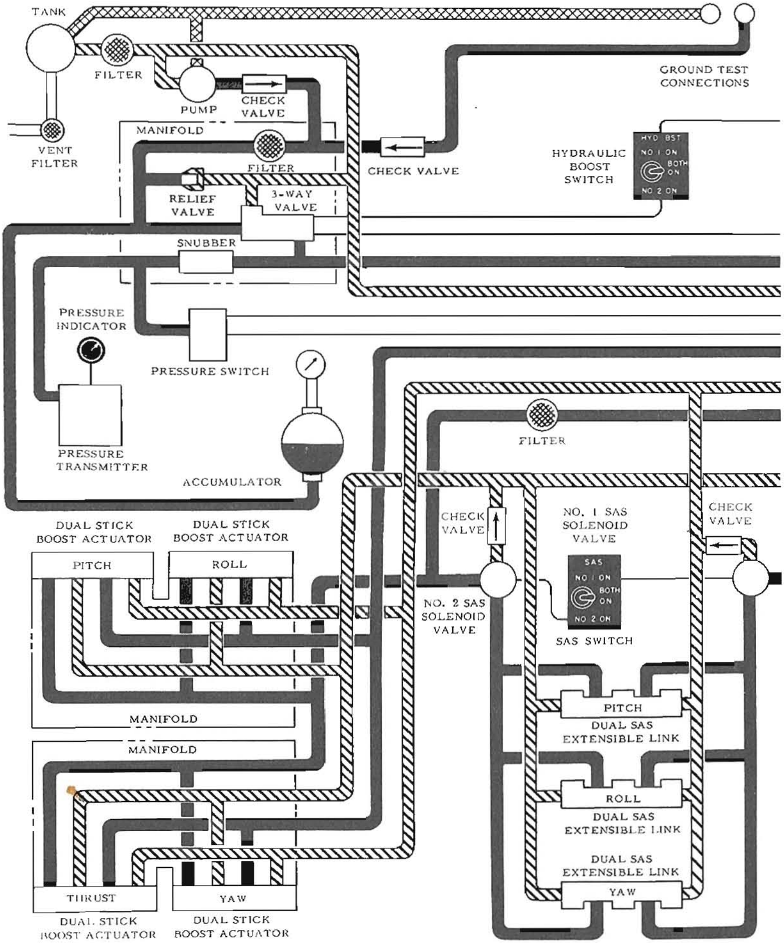
HOIST SYSTEM

ROTARY-WING BRAKE, AFT PARKING BRAKE, AND SWIVEL-LOCK SYSTEM

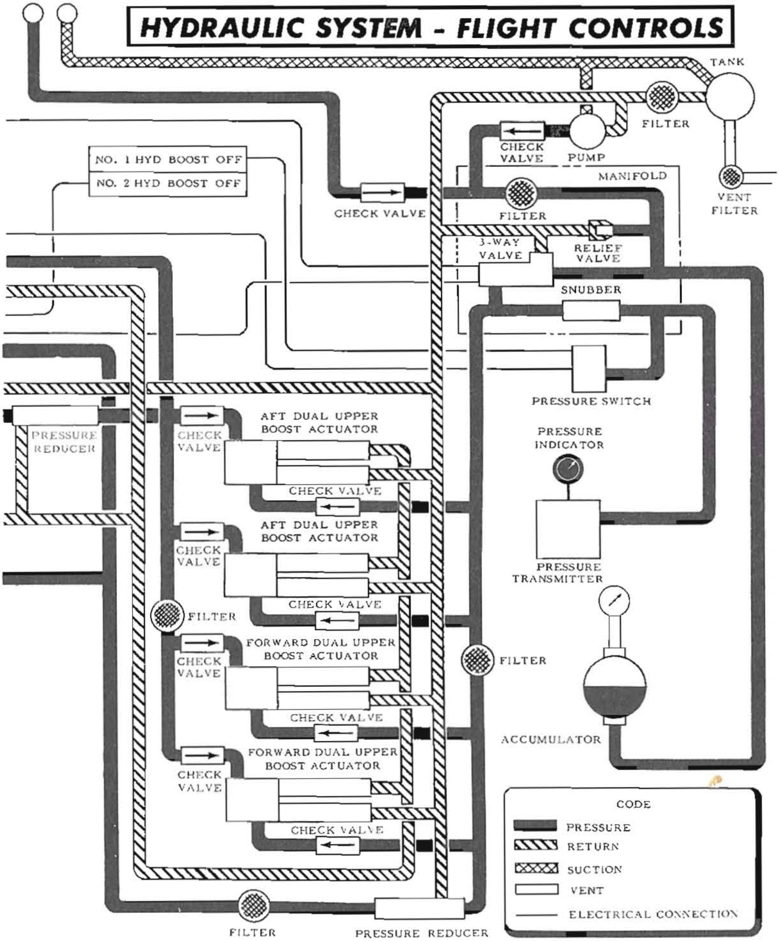

CARGO RAMP AND DOOR SYSTEM
ENGINE NO. 2
START SWITCH
START
ENGINE NO. 2
STARTER MOTOR
ENGINE
START VALVE
LOW PRESSURE
RELIEF VALVE
CHECK
VALVE
MANUALLY
OPERATED
RAMP CONTROL
VALVE
CHECK
VALVE
UTILITY
SYSTEM VALVE
RESTRICTOR
CHECK VALVE
RESTRICTOR
PRESSURE-
ACTUATED
VALVE
FILLER
CARGO DOOR
ACTUATOR
HYDRAULIC MOTOR
MANUAL
CONTROL
VALVE
CHECK VALVE
AIR PRESSURE
INDICATOR
CARGO DOOR
SEQUENCE VALVE
EMERGENCY
RAMP-DOWN CARTRIDGE
HAND PUMP
ACCUMULATOR
CHECK VALVE
ENGINE NO. 1
STARTER MOTOR
STARTER SYSTEM
LOW PRESSURE
RELIEF VALVE
RAMP ACTUATING CYLINDERS



STARTER SYSTEM


TANK
FILTER
PUMP
CHECK VALVE
VENT FILTER
MANIFOLD
FILTER
GROUND TEST CONNECTIONS
CHECK VALVE
HYDRAULIC BOOST SWITCH
HYD BST
NO 1 ON
BOTH ON
NO 2 ON
RELIEF VALVE
3-WAY VALVE
SNUBBER
PRESSURE INDICATOR
PRESSURE SWITCH
PRESSURE TRANSMITTER
ACCUMULATOR
FILTER
DUAL STICK BOOST ACTUATOR
DUAL STICK BOOST ACTUATOR
PITCH
ROLL
CHECK VALVE
NO. 1 SAS SOLENOID VALVE
CHECK VALVE
SAS
NO 1 ON
BOTH ON
NO 2 ON
NO. 2 SAS SOLENOID VALVE
SAS SWITCH
MANIFOLD
MANIFOLD
PITCH
DUAL SAS EXTENSIBLE LINK
ROLL
DUAL SAS EXTENSIBLE LINK
DUAL SAS EXTENSIBLE LINK
YAW
THRUST
YAW
DUAL STICK BOOST ACTUATOR
DUAL STICK BOOST ACTUATOR

HYDRAULIC SYSTEM - FLIGHT CONTROLS



changes are made by the pilot's movement of the flight controls which include a thrust control rod, a cyclic stick, and directional pedals. The pilot's controls are interconnected with the copilot's controls. Flight control movements are transmitted through a system of bellcranks and push-pull tubes to a mixing unit located just aft of the cockpit adjacent to the forward transmission. The control movements are mixed to give the correct lateral cyclic and pitch motions to the rotary wings through dual hydraulically powered actuators. These boost actuators are located under each swashplate. Each set of the dual actuators is powered by a separate hydraulic flight control system. The helicopter is vertically controlled with the thrust control rod through application of equal collective pitch to both rotary wings. Directional control is obtained with the directional pedals by imparting equal but opposite lateral cyclic pitch to the rotary wings. Lateral control is obtained by application of equal lateral cyclic pitch to the rotary wings with the cyclic stick. The helicopter is controlled longitudinally with the cyclic stick through application of equal but opposite collective pitch to both rotary wings.

DUAL STABILITY AUGMENTATION SYSTEM (SAS) (AN/ASW-24).

The Stability Augmentation System (SAS) automatically maintains stability about the pitch, roll, and yaw axes of the helicopter. With SAS, it is possible to fly "hands off" for several minutes, and make coordinated turns, using the cyclic stick, through a wide range of forward speeds. SAS provides only limited authority (16 percent in the pitch axis, 20 percent in the roll axis, and 40 percent in the yaw axis); sufficient overtravel has been built into the SAS so that the pilot retains complete control in case of failure of the system. The basic components of the SAS are: three dual extensible links, two SAS amplifiers (control boxes), and a control switch mounted on the overhead switch panel. Power to operate and control the SAS is supplied by the 28-volt dc primary bus and the 115-volt ac primary bus through four circuit breakers labeled NO. 1 SAS DC, NO. 1 SAS AC, NO. 2 SAS DC, and NO. 2 SAS AC, located on the overhead circuit breaker panel.

DIFFERENTIAL COLLECTIVE PITCH SPEED TRIM.

A fully automatic differential collective pitch (dcp) speed trim system in incorporated in the flight control system to provide a positive cyclic stick gradient and static speed stability. With increased stabilized forward airspeed, the cyclic stick position is further forward than it is at a decreased stabilized forward airspeed. Without the dcp speed trim system, the stick gradient would be negative at an increased stabilized airspeed. If flight airspeed is constant and the helicopter is temporarily displaced longitudinally by gusty wind conditions causing an airspeed change, the speed trim system will return the helicopter to its original airspeed.

LONGITUDINAL CYCLIC SPEED TRIM.

A fully automatic longitudinal cyclic speed trim system and a manual longitudinal cyclic speed trim system are incorporated in the flight control system. The longitudinal cyclic trim system reduces the angle of attack of the fuselage relative to the airstream as forward airspeed is increased, thus reducing fuselage drag. A longitudinal cyclic trim actuator is installed under each of the swashplates. Signals are automatically transmitted to these actuators by either the speed trim control box or by commanded signals from the manual longitudinal cyclic speed trim switches on the console. When using the semi-automatic method of trimming, the cyclic trim indicators mounted on the center instrument panel are used.

LANDING GEAR SYSTEM.

GENERAL.

The landing gear system consists of four nonretractable dual-wheel landing gear mounted under the fuselage pods. The forward wheels are fixed fore and aft. The aft wheels are full-swivel (360°) type which can be locked in a trailed position. Each gear has an individual air-oil shock strut.

BRAKE SYSTEM.

GENERAL.

The four wheels of the forward landing gear are equipped with single-disk hydraulic brakes; the four wheels of the aft landing gear are equipped with single-disk hydraulic parking brakes. Only the forward brakes are applied by depressing either the pilot's or copilot's brake pedals. Both the forward brakes and the aft parking brakes can be applied and brake pressure can be maintained by pulling out the parking brake knob while the brake pedals are depressed. Hydraulic pressure for the brakes is supplied by the utility hydraulic system.

EMERGENCY EQUIPMENT.

ENGINE FIRE EXTINGUISHER SYSTEM.

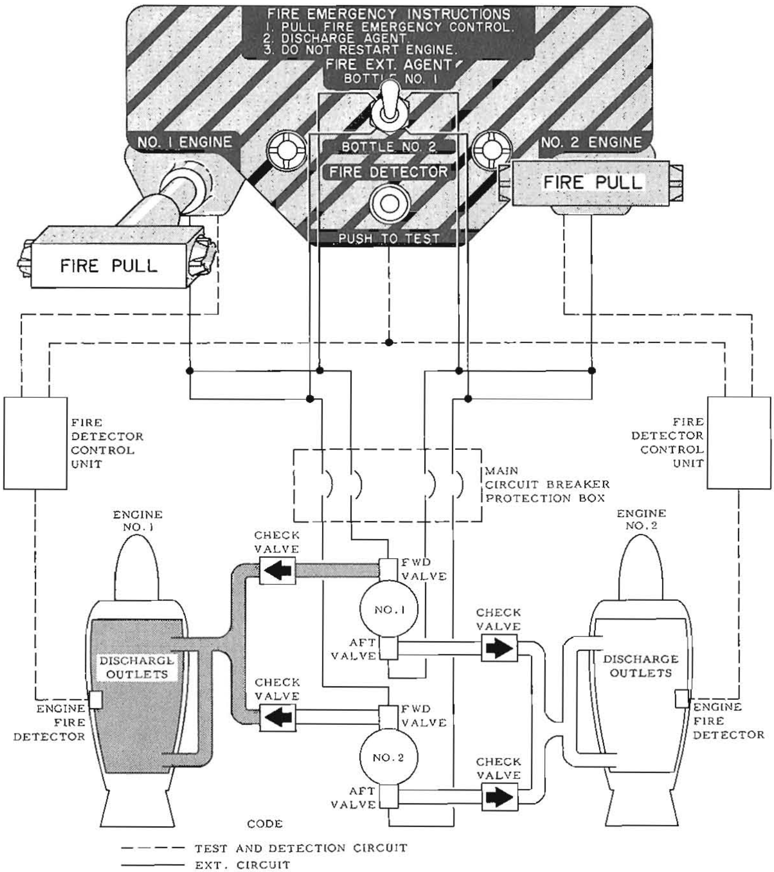
The engine fire extinguisher system enables either the pilot or the copilot to extinguish a fire in either engine compartment. The system consists of two fire control handles, a fire extinguisher agent switch, and a fire detector test switch on the instrument panel; two extinguisher agent containers mounted on the overhead structure at stations 482.00 and 502.00; and a main circuit breaker protection box mounted on the overhead structure at station 534.00. The containers are partially filled with monobromotrifluoromethane (BRF3C) and pressurized with nitrogen or oxygen. The agent in one or both of the containers can be discharged into either compartment. Selection of the compartment is made by pulling the appropriate fire control handle. Selection of the container is made by placing the fire extinguisher agent switch in the appropriate position.

AUXILIARY POWER UNIT.

GENERAL.

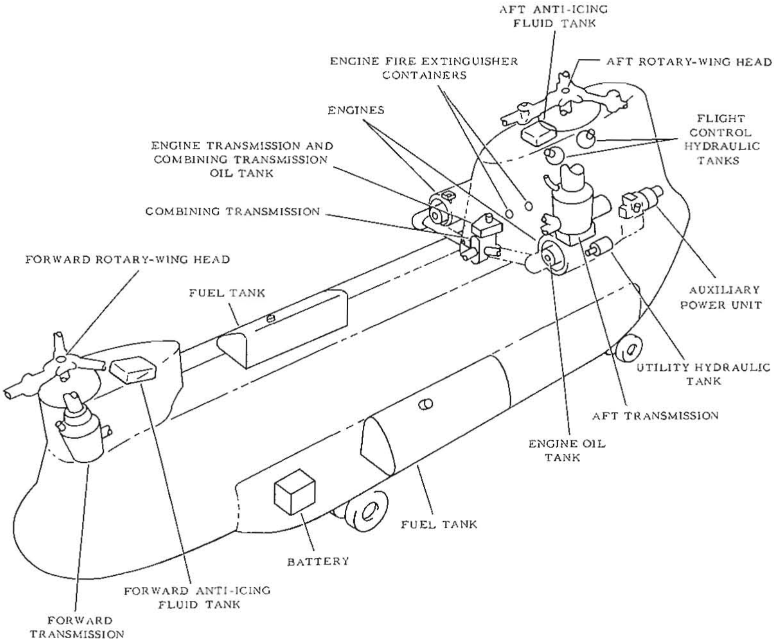
The T-62T-2 gas turbine auxiliary power unit (apu) is mounted in the lower portion of the aft pylon section above the ramp. Intake air is drawn through an opening in the right-hand side of the aft pylon section and the exhaust is discharged through a tunnel outlet on the centerline of the aft pylon section. The basic components of the apu are the gas turbine engine, reduction drive assembly, hydraulic motor-pump, and the fuel control. The apu provides hydraulic pressure from the motor-pump mounted on the reduction drive assembly

ENGINE FIRE DETECTION AND EXTINGUISHING SYSTEM



to hydraulically actuate the accessory gear box motor which rotates the accessory gear box pump, thus supplying the necessary 4,000 psi pressure to actuate the main power plant (T55-L-5) starter motors. The apu can also be used to provide an alternate source of hydraulic pressure for the utility hydraulic system. The apu has a usable output shaft drive speed of 6,000 rpm producing a normal rated gas turbine output of 55 horsepower at sea level, 125°F. The apu oil supply is integral and contained within the sump of the reduction drive assembly. The maximum allowable oil consumption is 0.1 pounds/hour. The apu receives fuel from the helicopter fuel system through a fuel booster pump, a manual fuel shutoff valve, and an electrically controlled solenoid valve. The maximum allowable fuel consumption of the apu is 73 pounds/hour. The specific fuel consumption is 1.3 pounds/shaft horsepower/hour. Internal sensing switches indicate overspeeding, excessive exhaust gas temperatures (1060°F), and low oil pressure through warning lights on the apu control panel. The apu control switch, tachometer, and warning lights are located on the overhead switch panel.

SERVICING DIAGRAM



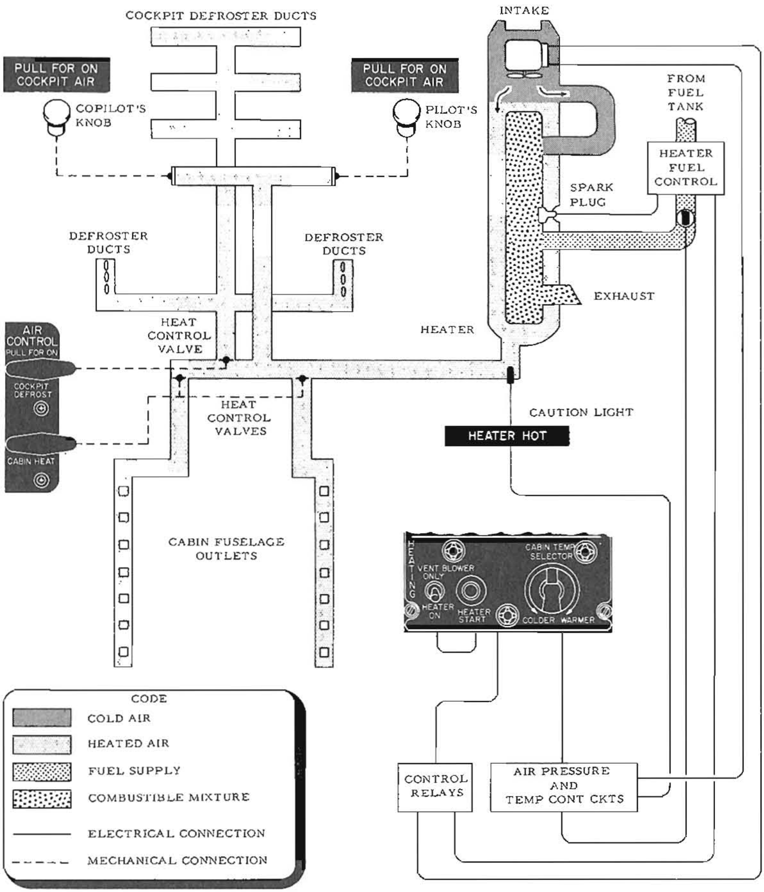
SPECIFICATIONS

ANTI-ICING FLUID	MIL-F-5566, MIL-A-6091
ENGINE & APU FUEL	MIL-J-5624, GRADE JP-4
ENGINE & APU OIL	MIL-L-7808
ROTARY-WING HEAD OIL	MIL-L-7808
TRANSMISSION OIL: FWD	MIL-L-7808
COMB	MIL-L-7808
AFT	MIL-L-7808
HYDRAULIC FLUID	MIL-H-5606
ENGINE FIRE EXTINGUISHER AGENT	BRF_3C (CARTRIDGE)
TIRE PRESSURE: FWD	165 PSI
AFT	165 PSI

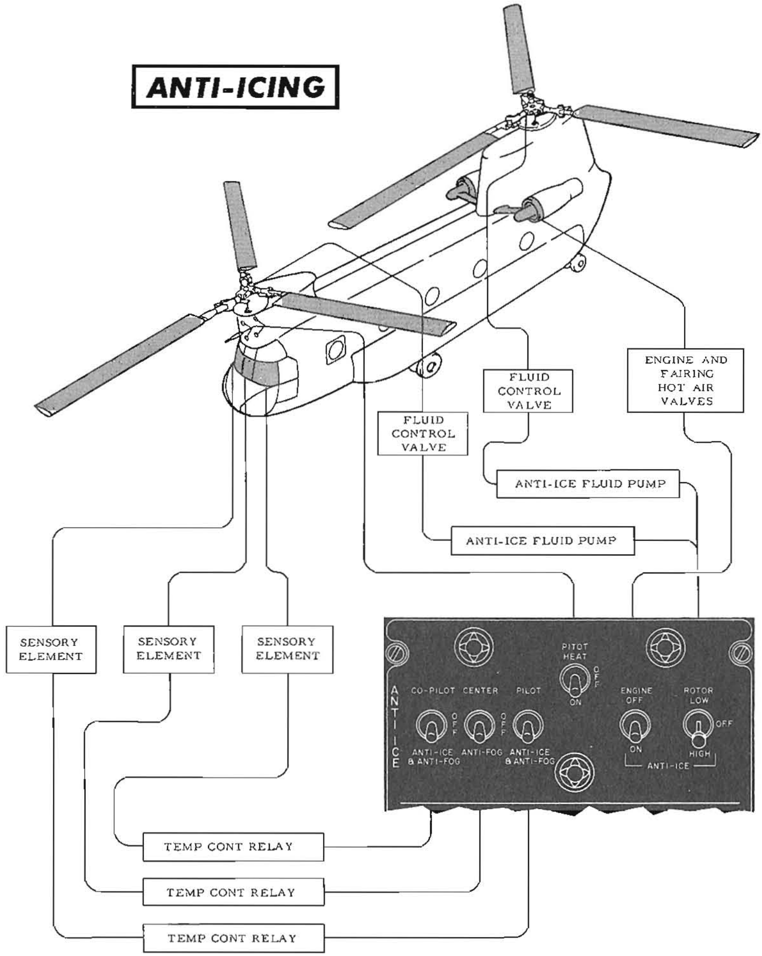
COMMUNICATION & ASSOCIATED ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	FUNCTION	OPERATOR	RANGE	LOCATION
INTERPHONE	SB-329/AR	INTERCOMMUNICATION BETWEEN CREW MEMBERS	PILOT, COPILOT, TROOP COMMANDER, HOIST OPERATOR, AND GROUND CREW	ALL CREW STATIONS AND EXTERIOR STATIONS	THREE INT PANELS ON THE CONSOLE, HOIST OPERATOR'S STATION, TWO EXTERIOR STATIONS
INTERPHONE	C-1611/AIC	INTERCOMMUNICATION BETWEEN CREW MEMBERS	PILOT, COPILOT, TROOP COMMANDER, HOIST OPERATOR, RAMP STATION, AND GROUND CREW	ALL CREW STATIONS AND EXTERIOR STATIONS	THREE INT PANELS ON THE CONSOLE, HOIST OPERATOR'S STATION, RAMP STATION, TWO EXTERIOR STATIONS
PUBLIC ADDRESS		PASSENGER ALERTING	PILOT AND TROOP COMMANDER	CABIN FUSELAGE SECTION	CONTROL PANEL ON CONSOLE, EIGHT AMSPEAKERS IN CABIN FUSELAGE SECTION
FM LIAISON SET	AN/ARC-44	TWO-WAY FM COMMUNICATION	PILOT AND COPILOT	50 MILES	CONTROL PANEL ON CONSOLE
UHF RADIO SET	AN/ARC-55	TWO-WAY UHF COMMUNICATION	PILOT AND COPILOT	LINE OF SIGHT	CONTROL PANEL ON CONSOLE
VHF RADIO SET	AN/ARC-73 OR AN/ARC-73A	SHORT RANGE 2-WAY VHF COMMUNICATION	PILOT AND COPILOT	LINE OF SIGHT	CONTROL PANEL ON CONSOLE
DIRECTION FINDER SET	AN/ARN-59 (V)	AUTOMATIC DIRECTION FINDING AND HOMING	PILOT AND COPILOT	50 TO 100 MILES FOR RANGE SIGNALS; 100 TO 150 MILES FOR BROADCAST SIGNALS	CONTROL PANEL ON CONSOLE
VHF NAVIGATION SET	AN/ARN-30A OR AN/ARN-30D	RECEIVES OMNIDIREC-TIONAL RADIO RANGE BEARING INFORMATION AND VHF VOICE	PILOT AND COPILOT	LINE OF SIGHT	CONTROL PANEL ON CONSOLE
MARKER BEACON SET	AN/ARN-32 OR R-1041/ARN	VISUAL AND AURAL MARKER BEACON RECEPTION	PILOT AND COPILOT	LOCAL	CONTROLS ON CONSOLE
RADAR ALTIMETER	AN/APN-22	ALTITUDE MEASURING	PILOT AND COPILOT	10,000 FEET OVER LAND 20,000 FEET OVER WATER	INDICATOR AND CONTROLS ON INSTRUMENT PANEL
IFF SET	AN/APX-44	IDENTIFICATION AND TRACKING	PILOT AND COPILOT	LINE OF SIGHT	CONTROL PANEL ON CONSOLE
EMERGENCY VHF COMMAND TRANSMITTER	T-366A/ARC	EMERGENCY TRANSMISSION	PILOT AND COPILOT	LINE OF SIGHT	CONTROL PANEL ON CONSOLE
HIGH FREQUENCY RADIO SET	AN/ARC-95	LONG RANGE 2-WAY COMMUNICATIONS	PILOT AND COPILOT	TO 2,000 MILES	CONTROL PANEL ON CONSOLE
RANGE OF TRANSMISSION AND RECEPTION IS DEPENDENT UPON MANY VARIABLES INCLUDING WEATHER CONDITIONS, TIME OF DAY, OPERATING FREQUENCY, POWER OF TRANSMITTER, AND ALTITUDE OF HELICOPTER.					

HEATING AND VENTILATING SYSTEM



ANTI-ICING

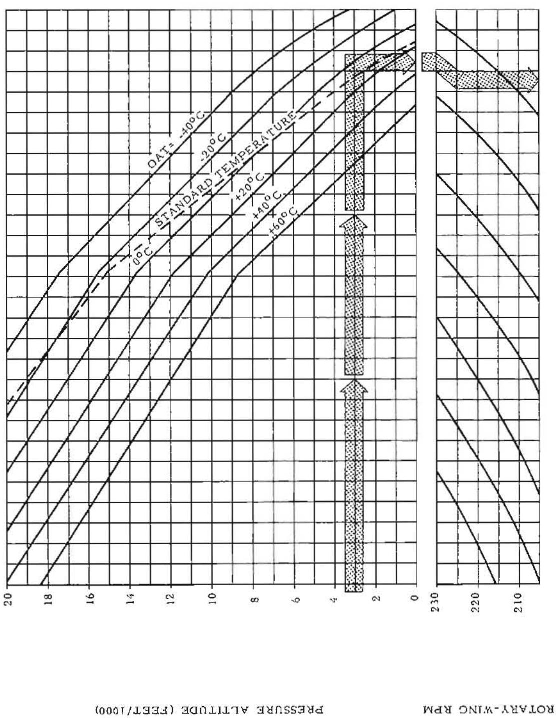


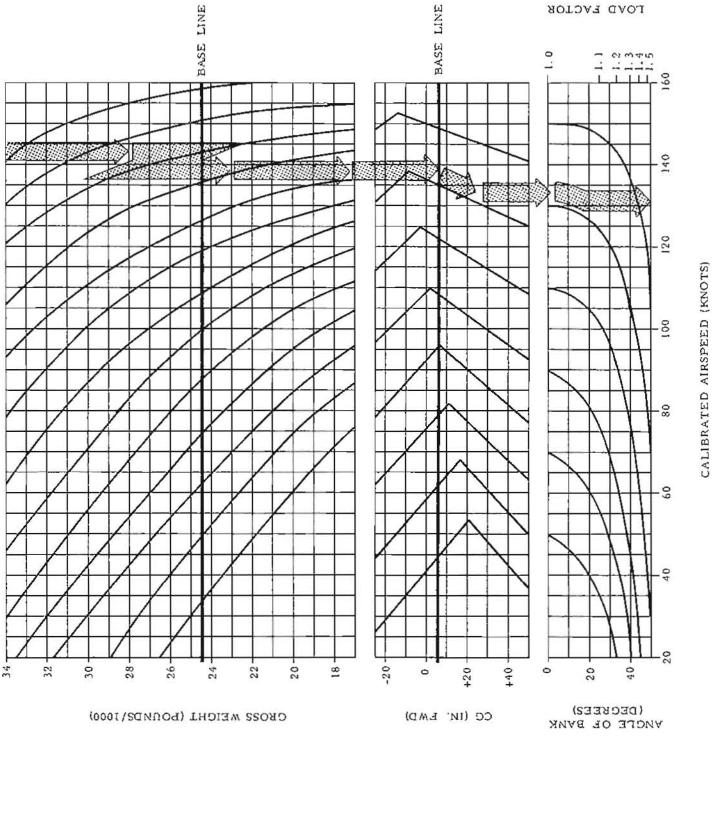
ENGINE AND FAIRING HOT AIR VALVES
FLUID CONTROL VALVE
FLUID CONTROL VALVE
ANTI-ICE FLUID PUMP
ANTI-ICE FLUID PUMP
SENSORY ELEMENT
SENSORY ELEMENT
SENSORY ELEMENT
PITOT HEAT
OFF
ON
ANTI ICE
CO-PILOT
CENTER
PILOT
OFF
OFF
ANTI-ICE & ANTI-FOG
ANTI-FOG
ANTI-ICE & ANTI-FOG
ENGINE OFF
ON
ROTOR LOW
OFF
HIGH
ANTI-ICE
TEMP CONT RELAY
TEMP CONT RELAY
TEMP CONT RELAY

INCIPIENT BLADE STALL SPEED

NOTE: 1. INCIPIENT BLADE STALL IS A CONDITION FREE FROM BLADE STALL BY A SATISFACTORY MARGIN FOR CRUISING OPERATION.

DATA BASIS: ESTIMATED
DATE: 26 AUGUST 1960

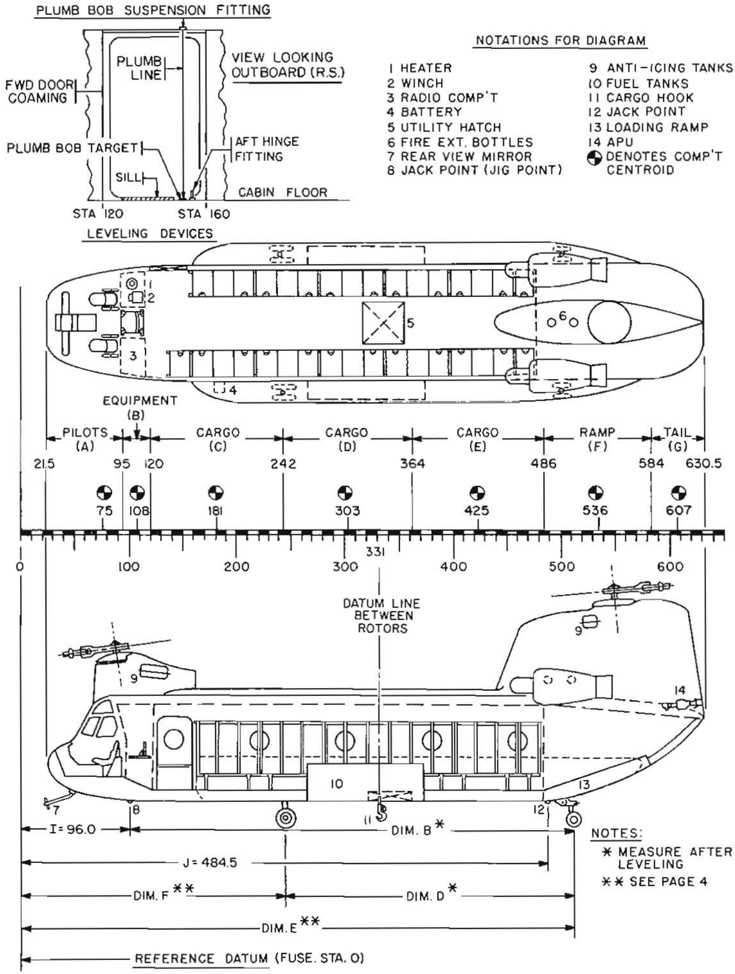




GROSS WEIGHT (POUNDS/1000)
34
32
30
28
26
24
22
20
18
BASE LINE
CG (IN. FWD)
-20
0
+20
+40
BASE LINE
ANGLE OF BANK (DEGREES)
0
20
40
LOAD FACTOR
1.0
1.1
1.2
1.3
1.4
1.5
CALIBRATED AIRSPEED (KNOTS)
20
40
60
80
100
120
140
160

SECTION II

WEIGHT AND BALANCE DATA



≡ JP-4 ≡
FUEL LOADING CHART
(MIL-F-5624B)

WEIGHT (LB)	ARM = 317.3 MOM/1000	WEIGHT (LB)	ARM = 317.3 MOM/1000	WEIGHT (LB)	ARM = 317.3 MOM/1000
50	15.9	1450	460.1	2850	904.3
100	31.7	1500	476.0	2900	920.2
150	47.6	1550	491.8	2950	936.0
200	63.5	1600	507.7	3000	951.9
250	79.3	1650	523.5	3050	967.8
300	95.2	1700	539.4	3100	983.6
350	111.1	1750	555.3	3150	999.5
400	126.9	1800	571.1	3200	1015.4
450	142.8	1850	587.0	3250	1031.2
500	158.7	1900	602.9	3300	1047.1
550	174.5	1950	618.7	3350	1063.0
600	190.4	2000	634.6	3400	1078.8
650	206.2	2050	650.5	3450	1094.7
700	222.1	2100	666.3	3500	1110.6
750	238.0	2150	682.2	3550	1126.4
800	253.8	2200	698.1	3600	1142.3
850	269.7	2250	713.9	3650	1158.1
900	285.6	2300	729.8	3700	1174.0
950	301.4	2350	745.7	3750	1189.9
1000	317.3	2400	761.5	3800	1205.7
1050	333.2	2450	777.4	3850	1221.6
1100	349.0	2500	793.3	3900	1237.5
1150	364.9	2550	809.1	3950	1253.3
1200	380.8	2600	825.0	4000	1269.2
1250	396.6	2650	840.8	*4037	1280.9
1300	412.5	2700	856.7	4050	1285.1
1350	428.4	2750	872.6	**4095	1299.3
1400	444.2	2800	888.4	4100	1300.9

NOTES:

1. Two fuselage tanks. Fuel consumed simultaneously; 621 gallons, 50% self-sealing and; 630 gallons, non-self-sealing.
2. Asterisk (*) indicates approximate weight and moment for full fuselage tanks (50% self-sealing) at 6.5 pounds per gallon.
3. Double asterisk (**) indicates approximate weight and moment for full fuselage tanks (non-self-sealing) at 6.5 pounds per gallon.
4. Total weight of fuel is dependent upon the specific gravity and temperature. Therefore, the notation "FULL" does not appear on the fuel quantity gages. Variation should be anticipated in gage readings when tanks are full.

OIL LOADING CHART		
TWO TANKS INTEGRAL WITH ENGINES 3.7 GALLONS USABLE ARM = 480.7		
GALLONS	WEIGHT (LB)	MOM/1000
1	8	3.8
2	15	7.2
3	23	11.1
3.7	28	13.5

NOTE:

Total capacity of two tanks is 5.9 gallons.

$$5.9 \text{ Gals.} = \begin{cases} \text{Usable} & 3.7 \text{ Gals.} \\ \text{Unusable} & 2.2 \text{ Gals.} \\ \quad \text{Oil in Lines} & 1.1 \text{ Gals.} \end{cases}$$

Unusable 2.2 Gals. + Oil in Lines 1.1 Gals. = 3.3 Gals. Unusable Oil (See Chart A)

ANTI-ICING FLUID WEIGHT AND MOMENT TABLE			
PER TANK		FWD TANK ARM = 124.0	AFT TANK ARM = 520.0
GALLONS	WEIGHT (LB)	MOMENT/1000	
1	7	.9	3.6
2	14	1.7	7.3
3	22	2.7	11.4
4	29	3.6	15.1
5	36	4.5	18.7
6	43	5.3	22.4
7	50	6.2	26.0
8	58	7.2	30.2
9	65	8.1	33.8
10	72	8.9	37.4
11	79	9.8	41.1
12	86	10.7	44.7
13	94	11.7	48.9
14	101	12.5	52.5
15	108	13.4	56.2
16	115	14.3	59.8
17	122	15.1	63.4
18	130	16.1	67.6
19	137	17.0	71.2
20	144	17.9	74.9

EXAMPLE:

15 gallons each tank, weight (108 + 108) = 216 pounds; moment/1000 (13.4 + 56.2) = 69.6

NOTES:

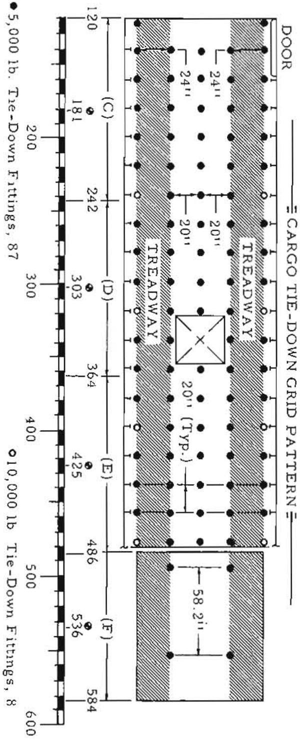
1. Anti-icing fluid based upon 85% isopropyl alcohol and 15% glycerine which equals 7.17 pounds per gallon.

2. Total capacity is 40 gallons (2 tanks) or 288 pounds.

COMPARTMENT DATA

COMPARTMENT DESIGNATION	PILOTS' (A)	EQUIP. (B)	CARGO (C)	CARGO (D)	CARGO (E)	RAMP (F)	TAIL (G)
CENTROID Inches from Ref Datum	75	108	181	303	425	*536	607
FORWARD LIMIT Inches from Ref Datum	21.5	95	120	242	364	486	584
AFT LIMIT Inches from Ref Datum	95	120	242	364	486	584	630.5
MAXIMUM CAPACITY Pounds			15250	15250	15250	3000	
FLOOR AREA Square Feet			76.3	76.3	76.3	*61.8	
VOLUME Cubic Feet			491.3	491.3	491.3	*373.8	
MAXIMUM CAPACITY Pounds per Square Foot			200	200	200	300	
TREADWAY Max uniformly distributed load over limited area of 1 square foot or max load per wheel.			2500	2500	2500	2500	
CENTER SECTION Between treadway-max uniformly distributed load over limited area of 1 square foot or max load per wheel.			1000	1000	1000	1000	

NOTES
1. RAMP (F) * based upon ramp open, level with floor plane.
2. Centroids for Compartments C, D, E & F are based upon floor area.
3. All volumes based upon projection of floor area to ceiling.



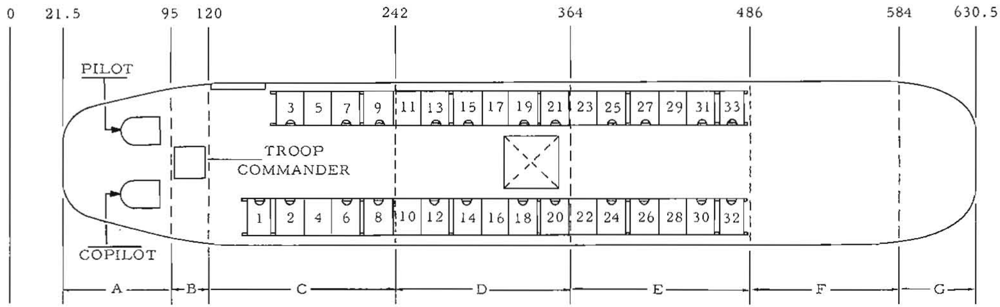
● 5,000 lb. Tie-Down Fittings, 87

○ 10,000 lb Tie-Down Fittings, 8

CARGO COMPARTMENT TABLE

COMPARTMENT	C	D	E	F
CENTROID (ARM)	181	303	425	536
WEIGHT (LB)	MOM/1000 for Arms Listed Above			
5	1	2	2	3
10	2	3	4	5
20	4	6	9	11
30	5	9	13	16
40	7	12	17	21
50	9	15	21	27
60	11	18	26	32
70	13	21	30	38
80	14	24	34	43
90	16	27	38	48
100	18	30	43	54
200	36	61	85	107
300	54	91	128	161
400	72	121	170	214
500	91	152	213	268
600	109	182	255	322
700	127	212	298	375
800	145	242	340	429
900	163	273	383	482
1000	181	303	425	536
1100	199	333	468	590
1200	217	364	510	643
1300	235	394	553	697
1400	253	424	595	750
1500	272	455	638	804
1600	290	485	680	858
1700	308	515	723	911
1800	326	545	765	965
1900	344	576	808	1018
2000	362	606	850	1072

COMPARTMENT	C	D	E	F
CENTROID (ARM)	181	303	425	536
WEIGHT (LB)	MOM/1000 for Arms Listed Above			
2200	398	667	935	1179
2400	434	727	1020	1286
2600	471	788	1105	1394
2800	507	848	1190	1501
3000	543	909	1275	1608
3500	634	1061	1488	
4000	724	1212	1700	
4500	815	1364	1913	
5000	905	1515	2125	
5500	996	1667	2338	
6000	1086	1818	2550	
6500	1177	1970	2763	
7000	1267	2121	2975	
7500	1358	2273	3188	
8000	1448	2424	3400	
8500	1539	2576	3613	
9000	1629	2727	3825	
9500	1720	2879	4038	
10000	1810	3030	4250	
10500	1901	3182	4463	
11000	1991	3333	4675	
11500	2082	3485	4888	
12000	2172	3636	5100	
12500	2263	3788	5313	
13000	2353	3939	5525	
13500	2444	4091	5738	
14000	2534	4242	5950	
14500	2625	4394	6163	
15000	2715	4545	6375	
15500	2806	4697	6588	



PERSONNEL DATA

COMPT	A	B	C					D						E					
Location or Seat No.	Pilot's	Troop Cdr's	1	2 & 3	4 & 5	6 & 7	8 & 9	10 & 11	12 & 13	14 & 15	16 & 17	18 & 19	20 & 21	22 & 23	24 & 25	26 & 27	28 & 29	30 & 31	32 & 33
Arm	74.5	104.9	151.0	171.0	191.0	211.0	231.0	251.0	271.0	291.0	311.0	331.0	351.0	371.0	391.0	411.0	431.0	451.0	471.0
One Person:																			
Weight	200	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
MOM/ 1000	14.9	27.3	39.3	44.5	49.7	54.9	60.1	65.3	70.5	75.7	80.9	86.1	91.3	96.5	101.7	106.9	112.1	117.3	122.5
Two Persons:																			
Weight	400	-	-	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520
MOM/ 1000	29.8	-	-	88.9	99.3	109.7	120.1	130.5	140.9	151.3	161.7	172.1	182.5	192.9	203.3	213.7	224.1	234.5	244.9

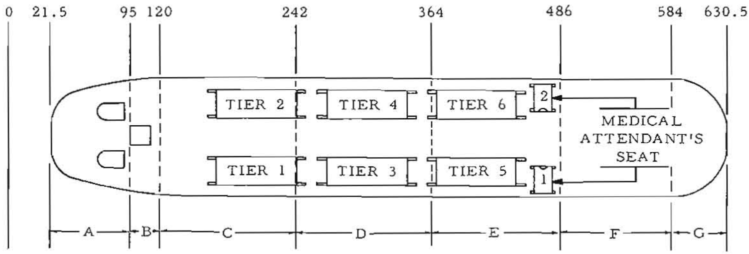
TABLE OF MOMENTS FOR PERSONNEL MOVEMENT
(MOMENT/1000)

Seat No.	Troop Cdr's	1	2 or 3	4 or 5	6 or 7	8 or 9	10 or 11	12 or 13	14 or 15	16 or 17	18 or 19	20 or 21	22 or 23	24 or 25	26 or 27	28 or 29	30 or 31	32 or 33
Arm	104.9	151.0	171.0	191.0	211.0	231.0	251.0	271.0	291.0	311.0	331.0	351.0	371.0	391.0	411.0	431.0	451.0	471.0
One Person	27.3	39.3	44.5	49.7	54.9	60.1	65.3	70.5	75.7	80.9	86.1	91.3	96.5	101.7	106.9	112.1	117.3	122.5
Seats 32 or 33	95.2	83.2	78.0	72.8	67.6	62.4	57.2	52.0	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2	
Seats 30 or 31	90.0	78.0	72.8	67.6	62.4	57.2	52.0	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2		
Seats 28 or 29	84.8	72.8	67.6	62.4	57.2	52.0	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2			
Seats 26 or 27	79.6	67.6	62.4	57.2	52.0	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2				
Seats 24 or 25	74.4	62.4	57.2	52.0	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2					
Seats 22 or 23	69.2	57.2	52.0	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2						
Seats 20 or 21	64.0	52.0	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2							
Seats 18 or 19	58.8	46.8	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2								
Seats 16 or 17	53.6	41.6	36.4	31.2	26.0	20.8	15.6	10.4	5.2									
Seats 14 or 15	48.4	36.4	31.2	26.0	20.8	15.6	10.4	5.2										
Seats 12 or 13	43.2	31.2	26.0	20.8	15.6	10.4	5.2											
Seats 10 or 11	38.0	26.0	20.8	15.6	10.4	5.2												
Seats 8 or 9	32.8	20.8	15.6	10.4	5.2													
Seats 6 or 7	27.6	15.6	10.4	5.2														
Seats 4 or 5	22.4	10.4	5.2															
Seats 2 or 3	17.2	5.2																
Seat 1	12.0																	

NOTES:

1. Add moment for troop movement aft. Plus (+) sign. Subtract for movement forward. Minus (-) sign.

2. Based on 260 pounds per troop.



LITTER PATIENT DATA					
COMPARTMENT			C	D	E
TIER			1 & 2	3 & 4	5 & 6
ARM			208	308	408
NUMBER OF PATIENTS	1	WEIGHT	250	250	250
		MOM/1000	52.0	77.0	102.0
	2	WEIGHT	500	500	500
		MOM/1000	104.0	154.0	204.0
	3	WEIGHT	750	750	750
		MOM/1000	156.0	231.0	306.0
	4	WEIGHT	1000	1000	1000
		MOM/1000	208.0	308.0	408.0
	5	WEIGHT	1250	1250	1250
		MOM/1000	260.0	385.0	510.0
	6	WEIGHT	1500	1500	1500
		MOM/1000	312.0	462.0	612.0
	7	WEIGHT	1750	1750	1750
		MOM/1000	364.0	539.0	714.0
	8	WEIGHT	2000	2000	2000
		MOM/1000	416.0	616.0	816.0

MEDICAL ATTENDANT DATA	
COMPARTMENT	E
SEAT	1 & 2
ARM	471.0
ONE ATTENDANT:	
WEIGHT	200
MOM/1000	94.2
TWO ATTENDANTS:	
WEIGHT	400
MOM/1000	188.4

NOTES:

Litters listed on Chart "A".
Each tier contains 4 litters.

EXTERNAL CARGO HOOK LOADING CHART

ARM = 331.0		ARM = 331.0	
WEIGHT (LB)	MOM/1000	WEIGHT (LB)	MOM/1000
5	2	3000	993
10	3	3500	1159
20	7	4000	1324
50	17	4500	1490
100	33	5000	1655
200	66	5500	1821
300	99	6000	1986
400	132	6500	2152
500	166	7000	2317
600	199	7500	2483
700	232	8000	2648
800	265	8500	2814
900	298	9000	2979
1000	331	9500	3145
1100	364	10000	3310
1200	397	10500	3476
1300	430	11000	3641
1400	463	11500	3807
1500	497	12000	3972
1600	530	12500	4138
1700	563	13000	4303
1800	596	13500	4469
1900	629	14000	4634
2000	662	14500	4800
2200	728	15000	4965
2400	794	15500	5131
2600	861	16000	5296
2800	927		

NOTE:

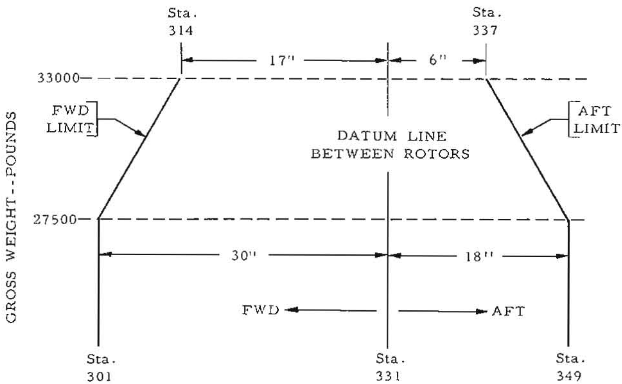
External cargo hook capacity is 16000 pounds.

NOTES FOR CENTER OF GRAVITY TABLE

1. Explanation of center of gravity limits:

Fwd - The forward CG limit is 30 inches forward of the datum line between rotors, up to the gross weight of 27500 pounds. This limit varies in a linear manner from 30 inches forward at the gross weight of 27500 pounds to 17 inches forward of the center line between rotors, at the gross weight of 33000 pounds. (See illustration below.)

Aft - The aft CG limit is 18 inches aft of the datum line between rotors, up to the gross weight of 27500 pounds. This limit varies in a linear manner from 18 inches aft at the gross weight of 27500 pounds to 6 inches aft of the datum line between rotors, at the gross weight of 33000 pounds. (See illustration below.)



2. Gross weight limitations:

Takeoff_____________Pounds*
Landing_____________Pounds*

*NOTE: Service activities shall insert, or substitute, current figures from latest applicable technical order covering operating restrictions.

CENTER OF GRAVITY TABLE

GROSS WT POUNDS	FWD. C.G. LIMIT							C.G. LIMITS							AFT C.G. LIMIT						GROSS WT POUNDS
	301	302	303	305	307	309	311	314	317	321	326	331	337	340	342	344	346	347	348	349	
	MOMENT/1000																				
16000	04816	04832	04848	04880	04912	04944	04976	05024	05072	05136	05216	05296	05392	05440	05472	05504	05536	05552	05568	05584	16000
16200	04876	04892	04909	04941	04973	05006	05038	05087	05135	05200	05281	05362	05459	05508	05540	05573	05605	05621	05638	05654	16200
16400	04936	04953	04969	05002	05035	05068	05100	05150	05199	05264	05346	05428	05527	05576	05609	05642	05674	05691	05707	05724	16400
16600	04997	05013	05030	05063	05096	05129	05163	05212	05262	05329	05412	05495	05594	05644	05677	05710	05744	05760	05777	05793	16600
16800	05057	05074	05090	05124	05158	05191	05225	05275	05326	05393	05477	05561	05662	05712	05746	05779	05813	05830	05846	05863	16800
17000	05117	05134	05151	05185	05219	05253	05287	05338	05389	05457	05542	05627	05729	05780	05814	05848	05882	05899	05916	05933	17000
17200	05177	05194	05212	05246	05280	05315	05349	05401	05452	05521	05607	05693	05796	05848	05882	05917	05951	05968	05986	06003	17200
17400	05237	05255	05272	05307	05342	05377	05411	05464	05516	05585	05672	05759	05864	05916	05951	05986	06020	06038	06055	06073	17400
17600	05298	05315	05333	05368	05403	05438	05474	05526	05579	05650	05738	05826	05931	05984	06019	06054	06090	06107	06125	06142	17600
17800	05358	05376	05393	05429	05465	05500	05536	05589	05643	05714	05803	05892	05999	06052	06088	06123	06159	06177	06194	06212	17800
18000	05418	05436	05454	05490	05526	05562	05598	05652	05706	05778	05868	05958	06066	06120	06156	06192	06228	06246	06264	06282	18000
18200	35478	05496	05515	05551	05587	05624	05660	05715	05769	05842	05933	06024	06133	06188	06224	06261	06297	06315	06334	06352	18200
18400	05538	05557	05575	05612	05649	05686	05722	05778	05833	05906	05998	06090	06201	06256	06293	06330	06366	06385	06403	06422	18400
18600	05599	05617	05636	05673	05710	05747	05785	05840	05896	05971	06064	06157	06268	06324	06361	06398	06436	06454	06473	06491	18600
18800	05659	05678	05696	05734	05772	05809	05847	05903	05960	06035	06129	06223	06336	06392	06430	06467	06505	06524	06542	06561	18800
19000	05719	05738	05757	05795	05833	05871	05909	05966	06023	06099	06194	06289	06403	06460	06498	06536	06574	06593	06612	06631	19000
19200	05779	05798	05818	05856	05894	05933	05971	06029	06086	06163	06259	06355	06470	06528	06566	06605	06643	06662	06682	06701	19200
19400	05839	05859	05878	05917	05956	05995	06033	06092	06150	06227	06324	06421	06538	06596	06635	06674	06712	06732	06751	06771	19400
19600	05900	05919	05939	05978	06017	06056	06096	06154	06213	06292	06390	06488	06605	06664	06703	06742	06782	06801	06821	06840	19600
19800	05960	05980	05999	06039	06079	06118	06158	06217	06277	06356	06455	06554	06673	06732	06772	06811	06851	06871	06890	06910	19800
20000	06020	06040	06060	06100	06140	06180	06220	06280	06340	06420	06520	06620	06740	06800	06840	06880	06920	06940	06960	06980	20000
20200	06080	06100	06121	06161	06201	06242	06282	06343	06403	06484	06585	06686	06807	06868	06908	06949	06989	07009	07030	07050	20200
20400	06140	06161	06181	06222	06263	06304	06344	06406	06467	06548	06650	06752	06875	06936	06977	07018	07058	07079	07099	07120	20400
20600	06201	06221	06242	06283	06324	06365	06407	06468	06530	06613	06716	06819	06942	07004	07045	07086	07128	07148	07169	07189	20600
20800	06261	06282	06302	06344	06386	06427	06469	06531	06594	06677	06781	06885	07010	07072	07114	07155	07197	07218	07238	07259	20800
21000	06321	06342	06363	06405	06447	06489	06531	06594	06657	06741	06846	06951	07077	07140	07182	07224	07266	07287	07308	07329	21000
21200	06381	06402	06424	06466	06508	06551	06593	06657	06720	06805	06911	07017	07144	07208	07250	07293	07335	07356	07378	07399	21200
21400	06441	06463	06484	06527	06570	06613	06655	06720	06784	06869	06976	07083	07212	07276	07319	07362	07404	07426	07447	07469	21400
21600	06502	06523	06545	06588	06631	06674	06718	06782	06847	06934	07042	07150	07279	07344	07387	07430	07474	07495	07517	07538	21600
21800	06562	06584	06605	06649	06693	06736	06780	06845	06911	06998	07107	07216	07347	07412	07456	07499	07543	07565	07586	07608	21800
22000	06622	06644	06666	06710	06754	06798	06842	06908	06974	07062	07172	07282	07414	07480	07524	07568	07612	07634	07656	07678	22000
22200	06682	06704	06727	06771	06815	06860	06904	06971	07037	07126	07237	07348	07481	07548	07592	07637	07681	07703	07726	07748	22200
22400	06742	06765	06787	06832	06877	06922	06966	07034	07101	07190	07302	07414	07549	07616	07661	07706	07750	07773	07795	07818	22400
22600	06803	06825	06848	06893	06938	06983	07029	07096	07164	07255	07368	07481	07616	07684	07729	07774	07820	07842	07865	07887	22600
22800	06863	06886	06908	06954	07000	07045	07091	07159	07228	07319	07433	07547	07684	07752	07798	07843	07889	07912	07934	07957	22800
23000	06923	06946	06969	07015	07061	07107	07153	07222	07291	07383	07498	07613	07751	07820	07866	07912	07958	07981	08004	08027	23000
23400	07043	07067	07090	07137	07184	07231	07277	07348	07418	07511	07628	07745	07886	07956	08003	07981	08027	08050	08074	08097	23200
23200	06983	07006	07030	07076	07122	07169	07215	07285	07354	07447	07563	07679	07818	07888	07934	08050	08096	08120	08143	08167	23400
23600	07104	07127	07151	07198	07245	07292	07340	07410	07481	07576	07694	07812	07953	08024	08071	08118	08166	08189	08213	08236	23600
23800	07164	07188	07211	07259	07307	07354	07402	07473	07545	07640	07759	07878	08021	08092	08140	08187	08235	08259	08282	08306	23800
24000	07224	07248	07272	07320	07368	07416	07464	07536	07608	07704	07824	07944	08088	08160	08208	08256	08304	08328	08352	08376	24000
24200	07284	07308	07333	07381	07429	07478	07526	07599	07671	07768	07889	08010	08155	08228	08276	08325	08373	08397	08422	08446	24200
24400	07344	07369	07393	07442	07491	07540	07588	07662	07735	07832	07954	08076	08223	08296	08345	08394	08442	08467	08491	08516	24400
24600	07405	07429	07454	07503	07552	07601	07651	07724	07798	07897	08020	08143	08290	08364	08413	08462	08512	08536	08561	08585	24600
24800	07465	07490	07514	07564	07614	07663	07713	07787	07862	07961	08085	08209	08358	08432	08482	08531	08581	08606	08630	08655	24800

CENTER OF GRAVITY TABLE

GROSS WT POUNDS	FWD. C.G. LIMIT							C.G. LIMITS												AFT C.G. LIMIT	GROSS WT POUNDS
	301	302	303	305	307	309	311	314	317	321	326	331	337	340	342	344	346	347	348	349	
	MOMENT/1000																				
25000	07525	07550	07575	07625	07675	07725	07775	07850	07925	08025	08150	08275	08425	08500	08550	08600	08650	08675	08700	08725	25000
25200	07585	07610	07636	07686	07736	07787	07837	07913	07988	08089	08215	08341	08492	08568	08618	08669	08719	08744	08770	08795	25200
25400	07645	07671	07696	07747	07798	07849	07899	07976	08052	08153	08280	08407	08560	08636	08687	08738	08788	08814	08839	08865	25400
25600	07706	07731	07757	07808	07859	07910	07962	08038	08115	08218	08346	08474	08627	08704	08755	08806	08858	08883	08909	08934	25600
25800	07766	07792	07817	07869	07921	07972	08024	08101	08179	08282	08411	08540	08695	08772	08824	08875	08927	08953	08978	09004	25800
26000	07826	07852	07878	07930	07982	08034	08086	08164	08242	08346	08476	08606	08762	08840	08892	08944	08996	09022	09048	09074	26000
26200	07886	07912	07939	07991	08043	08096	08148	08227	08305	08410	08541	08672	08829	08908	08960	09013	09065	09091	09118	09144	26200
26400	07946	07973	07999	08052	08105	08158	08210	08290	08369	08474	08606	08738	08897	08976	09029	09082	09134	09161	09187	09214	26400
26600	08007	08033	08060	08113	08166	08219	08273	08352	08432	08539	08672	08805	08964	09044	09097	09150	09204	09230	09257	09283	26600
26800	08067	08094	08120	08174	08228	08281	08335	08415	08496	08603	08737	08871	09032	09112	09166	09219	09273	09300	09326	09353	26800
27000	08127	08154	08181	08235	08289	08343	08397	08478	08559	08667	08802	08937	09099	09180	09234	09288	09342	09369	09396	09423	27000
27200	08187	08214	08242	08296	08350	08405	08459	08541	08622	08731	08867	09003	09166	09248	09302	09357	09411	09438	09466	09493	27200
27400	08247	08275	08302	08357	08412	08467	08521	08604	08686	08795	08932	09069	09234	09316	09371	09426	09480	09508	09535	09563	27400
27500	08278	08305	08333	08388	08443	08498	08553	08635	08718	08828	08965	09103	09268	09350	09405	09460	09515	09543	09570	09598	27500
27600		08335	08363	08418	08473	08528	08584	08666	08749	08860	08998	09136	09301	09384	09439	09494	09550	09577	09605		27600
27800		08396	08423	08479	08535	08590	08646	08729	08813	08924	09063	09202	09369	09452	09508	09563	09619	09647	09674		27800
28000			08484	08540	08596	08652	08708	08792	08876	08988	09128	09268	09436	09520	09576	09632	09688	09716			28000
28200			08545	08601	08657	08714	08770	08855	08939	09052	09193	09334	09503	09588	09644	09701	09757	09785			28200
28400			08605	08662	08719	08776	08832	08918	09003	09116	09258	09400	09571	09656	09713	09770	09826	09855			28400
28600				08723	08780	08837	08895	08980	09066	09181	09324	09467	09638	09724	09781	09838	09896				28600
28800				08784	08842	08899	08957	09043	09130	09245	09389	09533	09706	09792	09850	09907	09965				28800
29000				08845	08903	08961	09019	09106	09193	09309	09454	09599	09773	09860	09918	09976	10034				29000
29200				08906	08964	09023	09081	09169	09256	09373	09519	09665	09840	09928	09986	10045					29200
29400					09026	09085	09143	09232	09320	09437	09584	09731	09908	09996	10055	10114					29400
29600					09087	09146	09206	09294	09383	09502	09650	09798	09975	10064	10123	10182					29600
29800					09149	09208	09268	09357	09447	09566	09715	09864	10043	10132	10192	10251					29800
30000					09210	09270	09330	09420	09510	09630	09780	09930	10110	10200	10260						30000
30200						09332	09392	09483	09573	09694	09845	09996	10177	10268	10328						30200
30400						09394	09454	09546	09637	09758	09910	10062	10245	10336	10397						30400
30600						09455	09517	09608	09700	09823	09976	10129	10312	10404	10465						30600
30800						09517	09579	09671	09764	09887	10041	10195	10380	10472							30800
31000							09641	09734	09827	09951	10106	10261	10447	10540							31000
31200							09703	09797	09890	10015	10171	10327	10514	10608							31200
31400							09765	09860	09954	10079	10236	10393	10582	10676							31400
31600							09828	09922	10017	10144	10302	10460	10649	10744							31600
31800							09890	09985	10081	10208	10367	10526	10717								31800
32000								10048	10144	10272	10432	10592	10784								32000
32200								10111	10207	10336	10497	10658	10851								32200
32400								10174	10271	10400	10562	10724	10919								32400
32600								10236	10334	10465	10628	10791	10986								32600
32800								10299	10398	10529	10693	10857	11054								32800
33000								10362	10461	10593	10758	10923	11121								33000

C.G. LIMITS

NOTES