

535

TO 1C-123K-1

JUN 3 1980

FLIGHT MANUAL

USAF SERIES

C-123K

AND

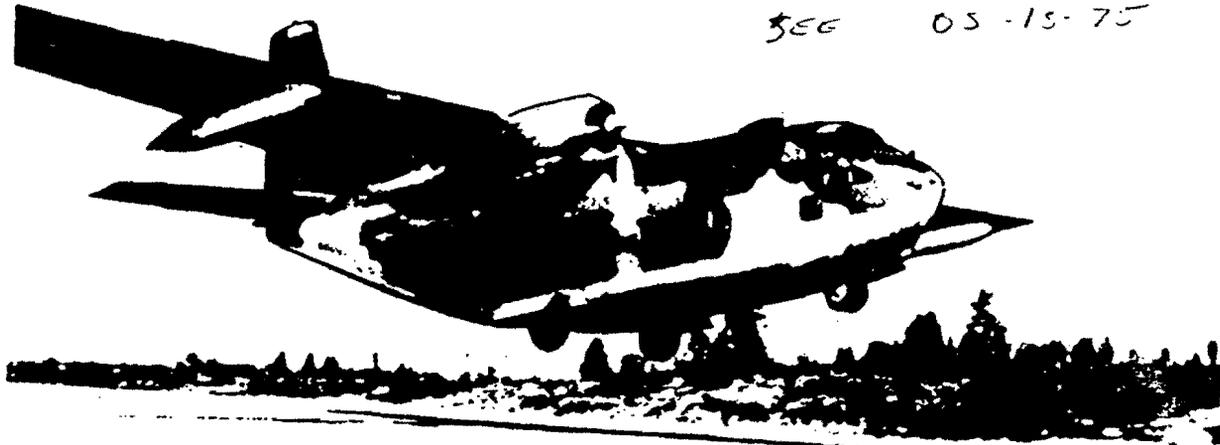
UC-123K

AIRCRAFT

F41608-78-G-0053

SEE 05-15-74

SEE 05-15-75



This Change Supersedes Operational Supplement T.O. 1C-123K-1S-72 Dated 21 June 1978 and Safety Supplement T.O. 1C-123K-1SS-73 Dated 24 October 1979.

See Numerical Index and Requirement Table, T.O. 0-1-1-3 for current status of flight Manuals, Safety Supplements, Operational Supplements and Flight Crew Checklists.

Commanders are responsible for bringing this publication to the attention of all Air Force personnel cleared for operation of subject aircraft.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

1 AUGUST 1968

CHANGE 13 20 MARCH 1980

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original01 Aug 68	Change527 Sep 71	Change101 Apr 77
Change115 Mar 69	Change615 Jun 72	Change1112 May 78
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A1-6 - A1-9	10				
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A2-6	8				
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A5-1 - A5-2	10				
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A5-2B Blank	10				
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A5-40 Blank	10				
A6-1	8				
A6-2	10				
A6-3	9				

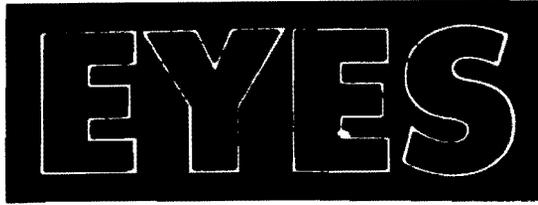
TIME COMPLIANCE TECHNICAL ORDER LISTING

Time Compliance Technical Orders, which are referred to in this manual, are listed below together with the corresponding title. For further information concerning effectivity, etc., refer to the appropriate Technical Order.

T.C.T.O. NO	TITLE
1C-123K-515	INSTALLATION OF MASTER WARNING LIGHT, C-123K AIRCRAFT
1C-123K-516	MODIFICATION OF ELECTRICAL SYSTEM, C-123K AIRCRAFT
1C-123K-517	REWORK OF THE C-123K ELECTRICAL SYSTEM TO ACCOMMODATE FIELD WEAKENING DEVICE IN JET ENGINE STARTER CIRCUITS
1C-123K-523	INSTALLATION OF MS24185-D1 RELAY IN CONJUNCTION WITH REVERSE CURRENT RELAY
1C-123K-524	REWIRING OF JET ENGINE STARTER GENERATOR CIRCUIT TO ACCOMMODATE FIELD WEAKENING, C/UC-123K AIRCRAFT
1C-123-545	MODIFICATION OF LANDING GEAR CIRCUIT
1C-123-566C	MODIFICATION OF ILS/VOR TACAN WIRING
1C-123-584	PROVIDE FOR INSTALLATION OF SPEECH ENCRYPTION EQUIPMENT TSEC/KY-8
1C-123-587	INSTALLATION OF AIRBORNE LOUDSPEAKER SYSTEM C-123 AIRCRAFT
1C-123-589	INSTALLATION OF FM-622A NARROW BAND VHF/FM RADIO
1C-123-598	INSTALLATION OF FUEL CELL EXPLOSION SUPPRESSANT, C-123
1C-123-609	INSTALLATION OF AN/APX-72 RADAR EQUIPMENT (IFF)
1C-123-624	REPLACEMENT OF BLOW-UP VALVE AND FILTER RESTRICTOR, FLAP HYDRAULIC CONTROL SYSTEM
1C-123B-628	INSTALLATION OF AN/ARA-25 AND AM3969/ARC RADIO IN C-123 AIRCRAFT
1C-123B-629	INSTALLATION OF AN/ARC-44 AND AN/ARA-31 RADIO IN C-123 SERIES AIRCRAFT
1C-123B-630	INSTALLATION OF WILCOX 807 VHF RADIO IN C-123B AIRCRAFT
1C-123B-631	INSTALLATION OF 618T-1 RADIO IN C-123B AIRCRAFT
1C-123B-635	INSTALLATION OF ADDITIONAL COMMUNICATIONS EQUIPMENT, C-123 AIRCRAFT
1C-123(N)K-501	DEMOMIFICATION OF NC-123K AIRCRAFT
1C-123(U)K-507	IMPROVED PESTICIDE SPRAY SYSTEM

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..... **on this page first**

SCOPE . . . This manual contains the necessary information for safe and efficient operation of the C-123K. These instructions provide you with a general knowledge of the aircraft, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and therefore, basic flight principles are avoided.

SOUND JUDGMENT . . . Instructions in this manual are for a crew inexperienced in the operation of this aircraft. This manual provides the best possible operating instructions under most circumstances, but it is a poor substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures.

PERMISSIBLE OPERATIONS . . . The Flight Manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations (such as asymmetrical loading) are prohibited unless specifically covered herein. Clearance must be obtained from the Flight Manual Manager before any questionable operation is attempted which is not specifically permitted in this manual.

HOW TO BE ASSURED OF HAVING LATEST DATA . . . Refer to T.O. 0-1-1-3 and monthly supplement thereto for listing of current Flight Manuals, Checklist and Operational and Safety Supplements.

STANDARDIZATION AND ARRANGEMENT . . . Standardization assures that the scope and arrangement of all Flight Manuals are identical. The manual is divided into ten fairly independent sections to simplify reading it straight through or using it as a reference manual.

SAFETY SUPPLEMENTS AND OPERATIONAL SUPPLEMENTS . . . Information involving safety will be promptly forwarded to you by Safety Supplements. TWX-type Safety Supplements covering loss of life (called Interim Safety Supplements), will get to you in 48 hours; those concerning serious damage to equipment within 10 days by mail (in a formal printed form). Operational information not involving safety but of an urgent nature will be forwarded to you by Operational Supplements. These will be forwarded by TWX (interim) or by mail (formal), depending upon the urgency of the information. Interim supplements are normally replaced by formal printed supplements at an early date. Formal printed supplements are identified by red letters "SS" for safety supplements and black letters "OS" for operational supplements printed around the borders of the pages. The currency of Safety Supplements and Operational Supplements affecting your airplane and Flight Manual can be determined by referring to the weekly index, Cargo Aircraft Safety Supplements (T.O. 0-1-1-3). The title block of each supplement and the title page of this manual should also be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements - current supplements must be complied with, but there is no point in restricting your operation by complying with a replaced or rescinded supplement. As a further aid, supplement summaries for both Safety Supplements and Operational Supplements are included in this manual following the A page; however, these summaries can be only as current as this manual.

CHECKLIST . . . The Flight Manual contains only amplified checklists. Abbreviated checklists have been issued as separate technical orders - see the back of the title page for T.O. number of your latest checklist. Line items in the Flight Manual and checklists are identical with respect to arrangement and item number. Whenever a Safety Supplement or Operational Supplement affects the abbreviated checklist, write in the applicable change on the affected checklist page. As soon as possible a new checklist page, incorporating the supplement, will be issued. This will keep handwritten entries of Safety Supplement and Operational Supplement information in your checklist to a minimum.

HOW TO GET PERSONAL COPIES . . . Each flight crewmember is entitled to personal copies of the Flight Manual, Safety Supplements, Operational Supplements and Checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your supply personnel - it is their job to fulfill your Technical Order requests. Basically, you must order the required quantities on the Publications Requirement Table (T.O. 0-1-1-3). Technical Orders 00-5-1 and 00-5-2 give detailed information for properly ordering these publications. Make sure a system is established at your base to deliver the publications to the flight crews immediately upon receipt.

FLIGHT MANUAL AND CHECKLIST BINDERS . . . Loose leaf binders and sectionalized tabs are available for use with your manual. These are obtained through local purchase procedures are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies, Part 1). Binders are also available for carrying your condensed (abbreviated) checklist. These binders contain plastic envelopes into which individual checklist pages are inserted. They are available in two capacities and are obtained through normal Air Force supply under the following stock list numbers: 7510-766-4269 and -4270 for 25 and 40 envelope binders respectively. Check with your supply personnel for assistance in securing these items.

WARNINGS, CAUTIONS, AND NOTES . . . The following definitions apply to "Warnings", "Cautions", and "Notes" found throughout the manual.

WARNING - Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed

CAUTION - Operating procedures, techniques, etc., which will result in damage to equipment if not carefully followed.

NOTE - An operating procedure, technique, etc., which is considered essential to emphasize.

SHALL, WILL, SHOULD, AND MAY . . . The following definitions apply to the words "Shall", "Will", "Should", and "May" found throughout the manual.

The words "Shall" or "Will" are to indicate a mandatory requirement.

The word "Should" is to indicate a nonmandatory desire or preferred method of accomplishment.

The word "May" is to indicate an acceptable or suggested means of accomplishment.

YOUR RESPONSIBILITY - TO LET US KNOW . . . Every effort is made to keep the Flight Manual current. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions, regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded through your Command Headquarters to Hq. Warner Robins ALC, Robins AFB, Georgia, 31098, Attn: MMSRDD.

CODING . . . Information without any coding is applicable to all C-123 aircraft. Information applicable to aircraft with A/A 45Y spray system **(A)**. Information applicable to aircraft with improved pesticide spray system (IPSS) **(B)**.

ABBREVIATIONS . . . The following abbreviations and their meaning used in this manual are:

HV	Hi - volume
recirc	recirculating
ULV	ultra low volume

SERIAL NUMBERS

C-123K CODE	AF SERIAL NO.	C-123K CODE	AF SERIAL NO.	C-123K CODE	AF SERIAL NO.
501	54-691	555	55-4553	609	55-4555
502	54-698	556	54-592	610	54-584
503	54-581	557	54-669	611	55-4570
504	54-610	558	54-612	612	55-4508
505	54-602	559	55-4565	613	55-4547
506	54-674	560	54-651	614	54-701
507	54-689	561	54-690	615	55-4528
508	54-659	562	54-582	616	54-601
509	54-678	563	54-670	617	54-658
510	54-713	564	54-667	618	54-640
511	54-677	565	54-681	619	57-6291
512	54-685	566	54-622	620	57-6289
513	54-621	567	55-4507	621	57-6290
514	55-4509	568	54-594	622	56-4371
515	54-606	569	54-619	623	57-6293
516	54-688	570	55-4552	624	56-4384
517	54-650	571	55-4562	625	55-4520
518	54-686	572	54-694	626	55-4525
519	54-604	573	54-662	627	56-4374
520	54-696	574	54-626	628	55-4532
521	54-682	575	54-629	629	56-4362
522	54-620	576	54-591	630	54-596
523	54-654	577	54-687	631	56-4373
524	55-4523	578	54-632	632	56-4386
525	56-4360	579	54-565	633	54-600
526	54-714	580	54-706	634	55-4544
527	54-684	581	55-4533	635	54-618
528	54-699	582	55-4568	636	54-635
529	55-4514	583	55-4566	637	54-704
530	54-703	584	54-707	638	55-4511
531	54-609	585	55-4567	639	55-4564
532	54-695	586	54-636	640	54-576
533	54-709	587	54-653	641	55-4577
534	54-711	588	55-4559	642	55-4506
535	54-700	589	56-4387	643	54-586
536	55-4517	590	55-4515	644	55-4545
537	55-4512	591	54-595	645	54-605
538	54-615	592	54-645	646	55-4531
539	54-580	593	55-4548	647	54-593
540	54-616	594	54-634	648	54-661
541	54-627	595	55-4536	649	54-648
542	54-642	596	54-599	650	54-577
543	55-4546	597	54-590	651	54-598
544	54-679	598	55-4527	652	54-693
545	56-4365	599	57-6294	653	54-613
546	55-4554	600	56-4359	654	54-697
547	54-637	601	56-4363	655	54-578
548	55-4524	602	55-4510	656	54-607
549	54-608	603	56-4377	657	55-4535
550	54-680	604	55-4561	658	54-639
551	55-4518	605	55-4574	659	55-4550
552	54-692	606	55-4542	660	54-617
553	56-4361	607	55-4569	661	54-583
554	54-579	608	54-4571	662	55-4543

SERIAL NUMBERS (Cont'd)

C-123K CODE	AF SERIAL NO.	C-123K CODE	AF SERIAL NO.	C-123K CODE	AF SERIAL NO.
663	56-4375				
664	55-4576				
665	54-585				
666	54-683				
667	54-628				
668	54-624				
669	54-633				
670	54-656				
671	54-671				
672	54-643				
673	54-675				
674	54-649				
675	54-603				
676	55-4556				
677	54-673				
678	54-625				
679	54-660				
680	54-663				
681	54-664				
682	54-668				

UC-123K

C-123K

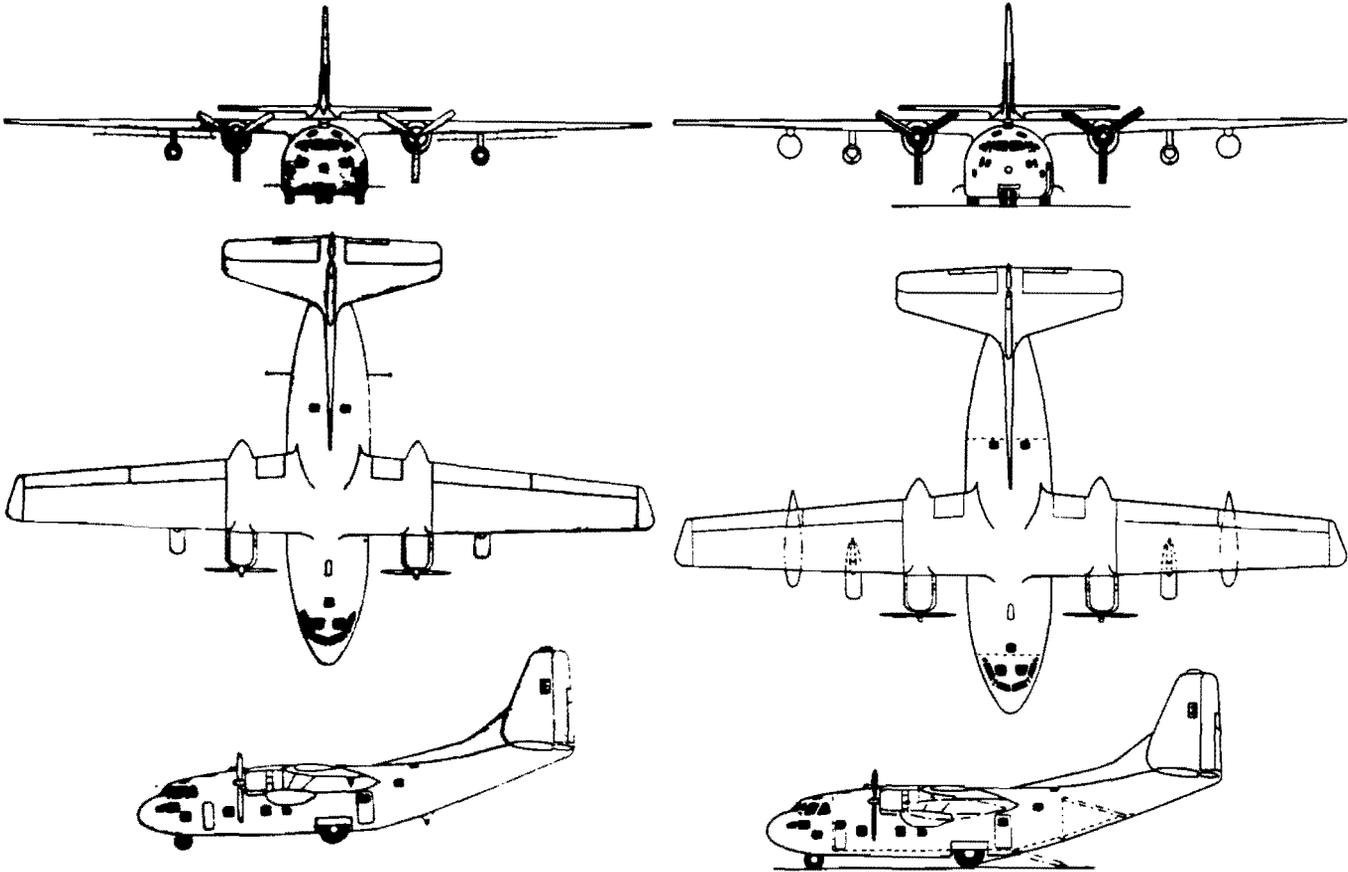


Figure 1-1

OPERATIONAL SUPPLEMENT
FLIGHT MANUAL
USAF SERIES
C-123K AND UC-123K
AIRCRAFT

THIS PUBLICATION SUPPLEMENTS TO 1C-123K-1 DATED 1 AUGUST 1968.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

This publication is required for official use or for administrative or operational purposes only. Distribution is limited to U.S. Government agencies. Other requests for this document must be referred to Warner Robins ALC/MMEDT, Robins AFB, GA, 31098.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

30 NOVEMBER 1981

SHORT TITLE: CORRECTION TO ENGINE WARM-UP CHECK

1. PURPOSE.

To advise aircrews of correction to ENGINE WARM-UP check.

2. INSTRUCTIONS.

Page 2-12, ENGINE WARM-UP paragraph is amended to add item 8 to read as follows:

*8. IFF/NAV radios - As required/STANDBY. P, CP

THE END

FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

This page is published with each Safety and Operational Supplement. It provides a comprehensive listing of the current Flight Manuals, Flight Crew Checklist, Safety Supplements and Operational Supplements. If you are missing any publications listed on this page, see your Publications Distribution Officer and get your copy.

FLIGHT MANUAL	DATE	CHANGE NO.
1C-123K-1	1 Aug 68	13 - 20 Mar 80

FLIGHT CREW CHECKLIST	DATE	CHANGE NO.
1C-123K-1CL-1	1 Aug 75	7 - 20 Mar 80
1C-123K-1CL-2	1 Aug 68	3 - 1 Apr 77
1C-123K-1CL-3	1 Aug 68	5 - 5 Mar 79
1C-123K-1CL-4	1 Apr 77	Original

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
S-74	1 Apr 81	Change to Airspeed Limits	Sec V
S-75	30 Nov 81	Correction to Engine Warm-Up Check	Sec II

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION
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TO 1C-123K-1S-74

APR 20 1981
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OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

USAF SERIES

C-123K AND UC-123K

AIRCRAFT

THIS PUBLICATION SUPPLEMENTS TO 1C-123K-1 DATED 1 AUGUST 1968.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

1 APRIL 1981

SHORT TITLE: CHANGE TO AIRSPEED LIMITS

1. PURPOSE.

To advise aircrews of changes to airspeed limits with the cargo door open.

2. INSTRUCTIONS.

a. Page 5-4A, figure 5-1 (sheet 4), AIRSPEED, MAXIMUM WITH CARGO DOOR OPEN is changed to read as follows:

140 KNOTS MAXIMUM WITH CARGO DOOR OPEN AND RAMP CLOSED

b. Page 5-8, AIRSPEED LIMITATIONS paragraph is amended to add the following:

140 knots maximum with cargo door open and ramp closed

THE END

AFLC RAFB, GA

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FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

This page is published with each Safety and Operational Supplement. It provides a comprehensive listing of the current Flight Manuals, Flight Crew Checklist, Safety Supplements and Operational Supplements. If you are missing any publications listed on this page, see your Publications Distribution Officer and get your copy.

FLIGHT MANUAL	DATE	CHANGE NO.
1C-123K-1	1 Aug 68	13 - 20 Mar 80

FLIGHT CREW CHECKLIST	DATE	CHANGE NO.
1C-123K-1CL-1	1 Aug 75	7 - 20 Mar 80
1C-123K-1CL-2	1 Aug 68	3 - 1 Apr 77
1C-123K-1CL-3	1 Aug 68	5 - 5 Mar 79
1C-123K-1CL-4	1 Apr 77	Original

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
S-74	1 Apr 81	Change to Airspeed Limits	Sec V

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION
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DESCRIPTION

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THE AIRCRAFT.

Built by the Aircraft Division of the Fairchild Industries as a medium assault cargo aircraft, the aircraft as modified to the C-123K configuration is a two engine, high wing, land monoplane, of all metal, semi-monocoque construction with auxiliary jet engines. The nose section, which houses the pilot and copilot, is of steel tube truss construction for maximum crash protection. Power is supplied by two supercharged radial engines equipped with three-bladed, constant-speed, full feathering, reversible pitch propellers and two single-rotor, axial-flow turbojet engines mounted on pylons outboard of the reciprocating engines. The jet engines provide thrust augmentation for take-off, emergency flight conditions, and landing approaches. The aircraft is primarily a troop transport and cargo carrier with the capability of operating from short, hastily prepared airfields. Other uses include the resupply of ground troops by air, evacuation of wounded, and the transport of paratroops and their equipment to

the drop zone. The UC-123K is a C-123K modified for chemical spraying mission; however, it is not restricted to chemical spray missions. The spray system can be readily removed and the aircraft used for limited cargo and troop carrying operations.

Note

All references to engine-out operation refer to operation on one reciprocating engine. Operation on single jet engine will be designated.

SIZE.

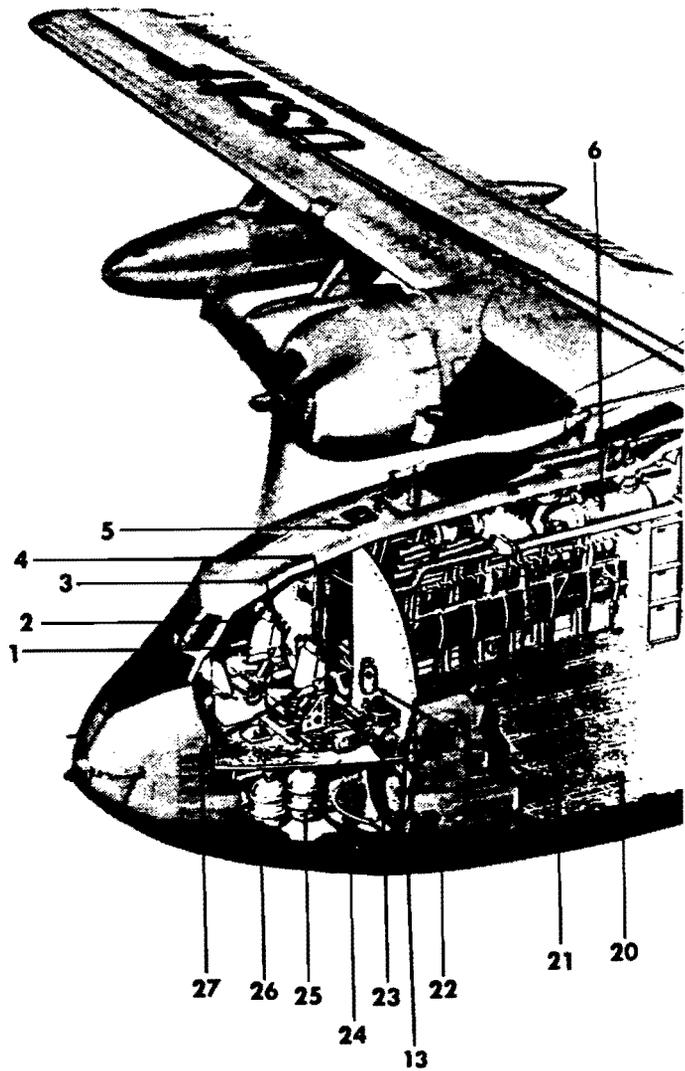
The overall dimensions of the aircraft are approximately as follows:

Wing span	110 ft.
Length	76 ft. 4 in.
Height	34 ft. 6 in.
Tread	12 ft. 7 in.

The contour of the aircraft fuselage is such that a rectangular cross section exists throughout the main cargo hold except in the wheel well area. This permits easy handling and stowage of numerous types of bulky cargo. The tricycle landing gear positions the entire cargo compartment in a level attitude when the aircraft is parked. The height of the floor above the ground is approximately 32 inches, depending on tire and strut inflation. A door is installed on the left side of the crew compartment and in each side of the aft cargo compartment for the purpose of loading passengers and litter patients; the aft troop doors are also used for discharging paratroopers during flight. A hydraulically-operated ramp and cargo door system, which forms an integral part of the aft cargo compartment, facilitates the loading and unloading of troops, general cargo and vehicles. The cargo compartment dimensions are:

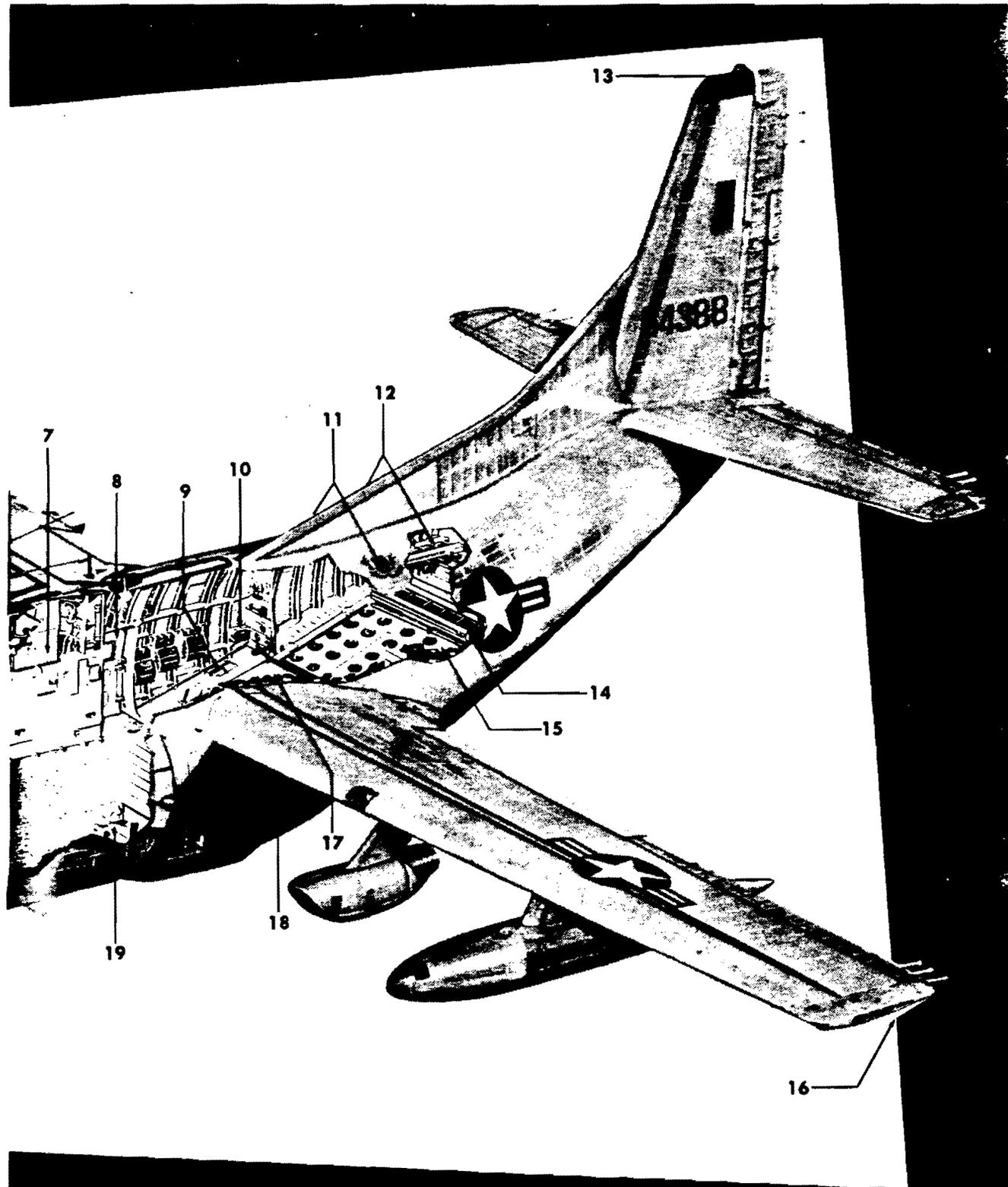
Length	35 ft.
Length (less ramp and bail-out chute)	26 ft. 6 in.
Width (at wheel wells)	9 ft. 2 in.
Width (maximum)	13 ft. 4 in.
Height (at wing center section)	8 ft. 2 in.
(between cargo door hinge line and ground)	8 ft. 4 in.
Area of cargo floor	315 sq. ft.
Volume of cargo space	2420 cu. ft.

- 1. COPILOT'S STATION
- 2. PORTABLE OXYGEN BOTTLE
- 3. SPARE LAMPS STOWAGE BOX
- 4. NAVIGATOR'S STATION
- 5. FORWARD ESCAPE HATCH
- 6. HEATER COMPARTMENT
- 7. AUXILIARY POWER PLANT
- 8. AFT TROOP DOOR
- 9. AUXILIARY GROUND LOAD-
ING RAMP
- 10. DATA CASE
- 11. AFT ESCAPE HATCHES
- 12. AFT HATCH LADDERS
- 13. ANTI-COLLISION LIGHTS
- 14. PORTABLE LADDER
- 15. CARGO DOOR
- 16. WING ANTI-ICING EXHAUST
- 17. CARGO RAMP
- 18. AFT TROOP DOOR
- 19. STOWAGE BOX
- 20. CARGO COMPARTMENT
- 21. PORTABLE OXYGEN BOTTLE
- 22. FORWARD ENTRANCE DOOR
- 23. WATER CONTAINER
- 24. DRIFTMETER
- 25. MAP AND DATA CASE
- 26. OXYGEN BOTTLES
- 27. PILOT'S STATION



GENERAL

Figure 1-1

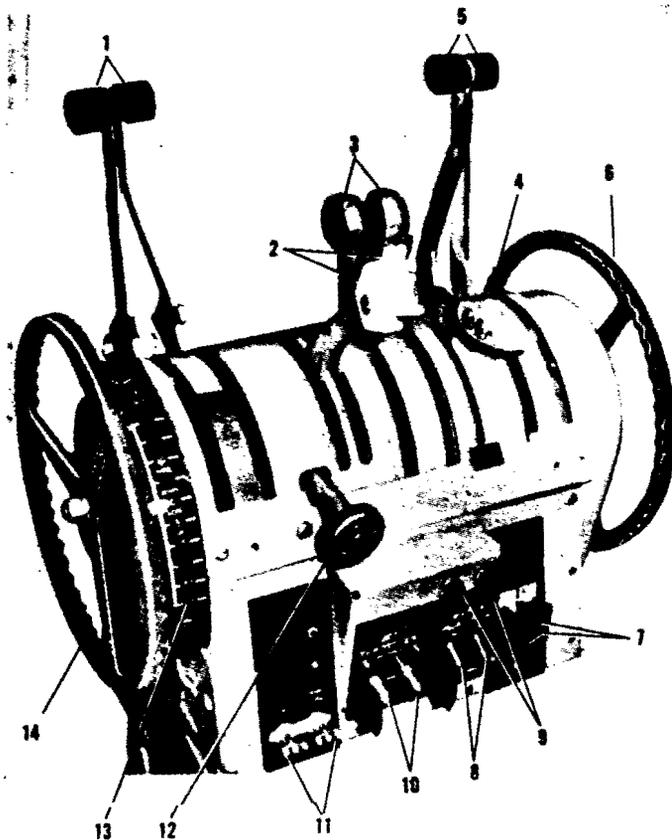


ARRANGEMENT

Figure 1-2

17506

1-3



CONTROL QUADRANT

1. THROTTLE LEVERS (PILOT'S)
2. PROPELLER LEVERS
3. MIXTURE LEVERS
4. WING FLAP LEVER
5. THROTTLE LEVERS (COPILOT'S)
6. ELEVATOR TRIM TAB WHEEL (COPILOT'S)
7. SUPERCHARGER SWITCHES
8. WATER INJECTION CONTROL SWITCHES
9. WATER INJECTION RESET SWITCHES
10. JET ENGINE THROTTLE CONTROL SWITCHES
11. LANDING LIGHT SWITCHES
12. FRICTION CONTROL KNOB
13. ELEVATOR TRIM TAB INDICATOR
14. ELEVATOR TRIM TAB WHEEL (PILOT'S)

Figure 1-3

GROSS WEIGHT.

The design gross weight of the aircraft is 54,000 pounds. For detailed weight information, refer to WEIGHT LIMITATIONS, Section V.

CREW.

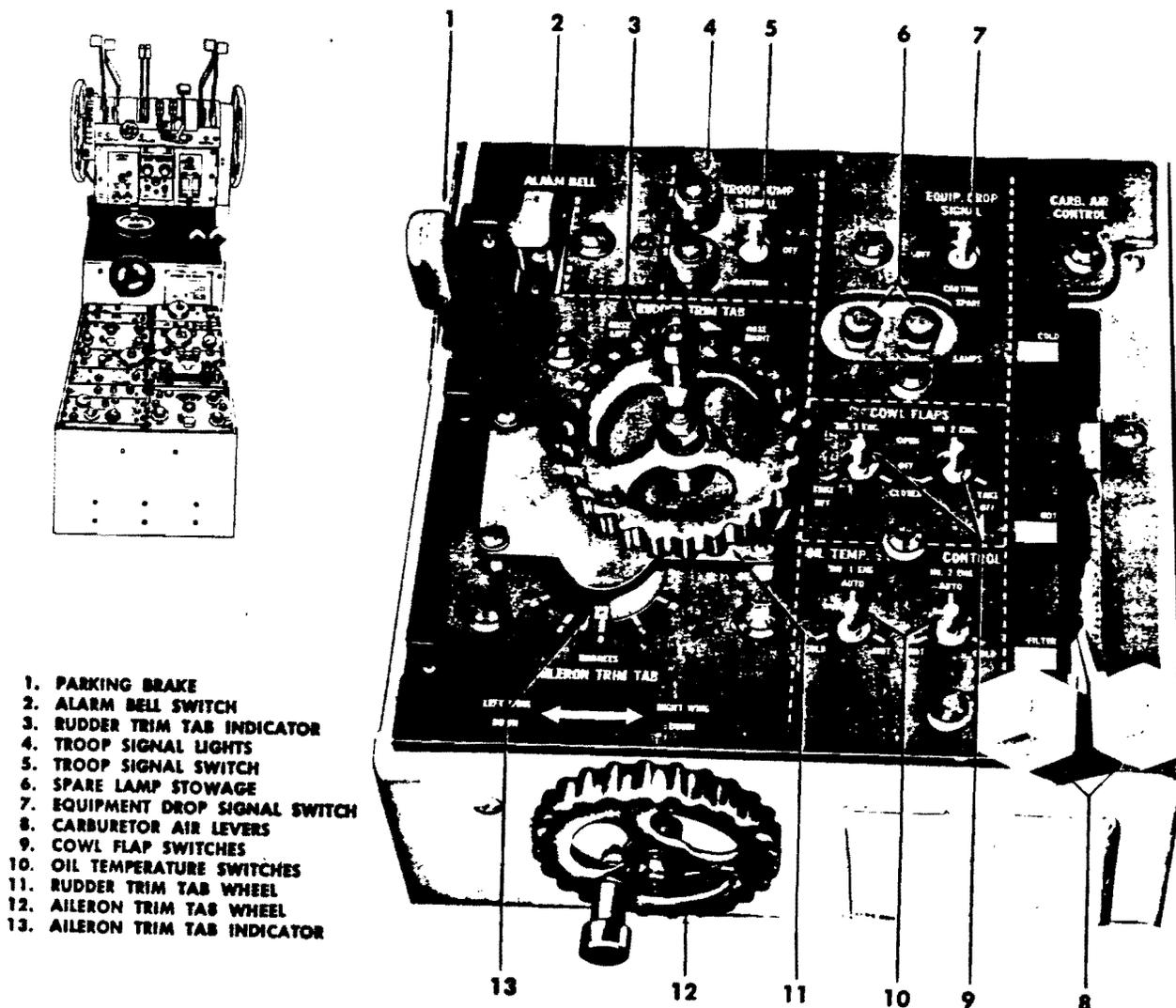
The flight crew normally consists of the pilot, copilot and flight mechanic. On some aircraft, a navigator's position is also included. Refer to MINIMUM CREW REQUIREMENTS, Section V.

RECIPROCATING ENGINES.

The R2800-99W, 18-cylinder, twin-row, aircooled engine is equipped with a single-stage, two-speed supercharger, torquemeter, and water injection system. At sea level standard day conditions, the maximum power ratings are 2050 bhp at 2700 rpm without water injection and 2400 bhp at 2800 rpm when the water injection system is employed.

THROTTLES.

Two interconnected sets of throttle levers (figure 1-3), one set for the pilot and the other for the copilot, are provided on the control quadrant. The positions of the throttle levers, which are connected by mechanical linkage to the carburetors, are OPEN, CLOSED and REVERSE THRUST. Movement of the throttles toward the OPEN position causes the carburetor throttle valves to open, resulting in increased engine power and forward thrust. When the throttles are moved toward the CLOSED position, the throttle valves close until the idle setting is reached resulting in decreased engine power. When the pilot's throttle levers are lifted over the reverse stops and moved aft of the CLOSED position into the REVERSE THRUST range, a mechanical linkage, between the throttles and the reverse control boxes in the pedestal, actuates the switches which energize the decrease pitch solenoid valves to start the reversing operation. Refer to PROPELLER REVERSE PITCH CONTROL, this section. As aft movement of the throttles is continued, engine power is increased to approximately 80% of METO Power. Return to positive propeller pitch and forward thrust operation is accomplished by moving the throttle levers forward of the CLOSED position. The elevators and rudder are automatically locked when the right throttle is moved into REVERSE THRUST, and the nose gear strut is compressed, in order to prevent damage to the elevator and rudder surfaces and control systems during reverse operation. Refer to REVERSE LOCK, this section.



1. PARKING BRAKE
2. ALARM BELL SWITCH
3. RUDDER TRIM TAB INDICATOR
4. TROOP SIGNAL LIGHTS
5. TROOP SIGNAL SWITCH
6. SPARE LAMP STOWAGE
7. EQUIPMENT DROP SIGNAL SWITCH
8. CARBURETOR AIR LEVERS
9. COWL FLAP SWITCHES
10. OIL TEMPERATURE SWITCHES
11. RUDDER TRIM TAB WHEEL
12. AILERON TRIM TAB WHEEL
13. AILERON TRIM TAB INDICATOR

(TYPICAL)

17509

pilot's CONTROL PANEL

Figure 1-4

Throttle Reverse Stop.

A mechanical stop system is incorporated into the engine control quadrant and pilot's throttles to prevent the inadvertent movement of the throttles into the REVERSE THRUST range during flight. This mechanical cam arrangement requires that the throttles be lifted approximately 1-1/8 in. until the cam followers clear the stop in the quadrant.

Flight Controls Throttle Stop.

In addition to the reverse stops, a flight controls stop (figure 1-5), is provided on the pilot's set of throttles to preclude the possibility of attempting to takeoff with the flight controls locked. The stop mechanism consists of a metal arm, mechanically linked to the flight controls lock lever, and a red-painted tab that stops either throttle when the arm is in the engaged position. When the flight controls lock lever is pulled back to the LOCKED position, the stop arm is raised and the red metal tab limits the travel of one throttle to approximately 35 in. Hg manifold pressure. The tab may be manually moved so that it stops either the right or left throttle, leaving the other free to advance to the maximum power setting. Since each of the copilot's throttles moves in conjunction with the corresponding throttle on the pilot's side, the action of the stop mechanism also limits the use of the copilot's throttles when the flight controls are locked.

FRICION CONTROL KNOB.

A manually operated friction lock allows locking of the throttle and propeller levers. The friction control knob (figure 1-3), is located between the propeller levers and the pilot's throttles. Movement of the knob as indicated by the arrows increases or decreases the friction on the levers.

MIXTURE LEVERS.

Two mixture levers (figure 1-3), one for each engine, are located on the engine quadrant. Mechanical linkage connecting each lever with the mixture control valve of the corresponding carburetor permits the levers, to control the size of fuel feed aperture, and thus, the fuel/air mixture. Lever positions are RICH, AUTO LEAN, and IDLE CUT-OFF. The handle latch must be lifted before the lever can be moved aft toward the IDLE CUT-OFF position. Manual leaning is accomplished by placing the levers at intermediate positions. Refer to MANUAL LEANING, Section VII.

CARBURETOR AIR LEVERS.

Two carburetor air levers (figure 1-4), one for each engine, are located on the pilot's control panel. Lever positions are COLD, HOT, and FILTER. These levers select the condition of air supplied to the carburetors. Mechanical linkage connects each lever to air inlet doors in the corresponding carburetor air duct. The cold air entrance is just inside the cowling. The hot air entrance collects heated air from around the exhaust manifolds. The filtered air entrances are located on each side of the nacelle in the side cowling panels. All entrances direct air into the central duct which is built into the top panel of the cowling and leads to the carburetor air intake. Refer to CARBURETOR AIR CONTROL, Section VII.

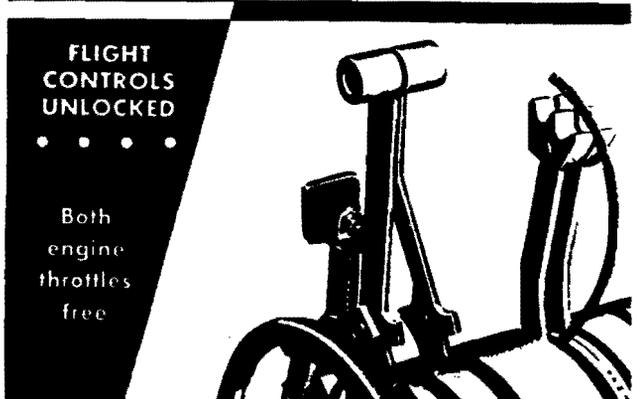
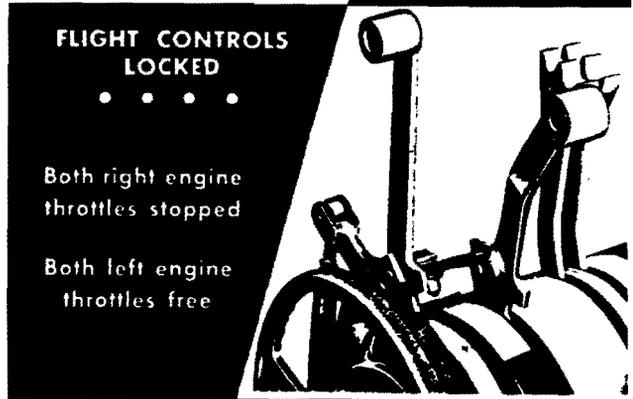
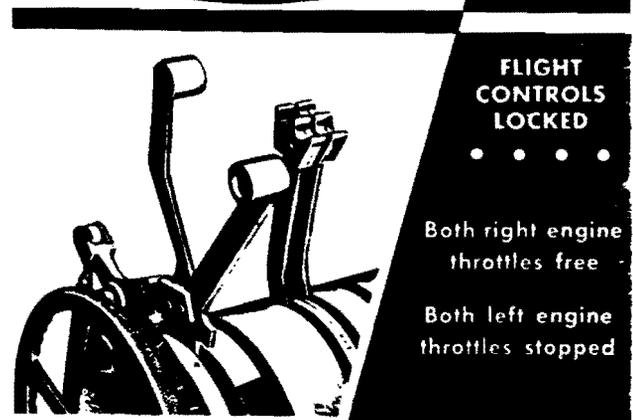
IGNITION SWITCHES.

Each engine low-tension ignition system is controlled by a four-position magneto switch (figure 1-7), on the engine starting panel. Switch positions are OFF, R, L, and BOTH. Each switch shorts to ground, in various combinations, the outputs of its corresponding magneto. In the OFF position the output from both R and L magneto units is grounded. In L position, the R magneto unit output is grounded, so that only the L magneto unit output is available for firing one spark plug in each cylinder. In the R position, the L magneto unit is grounded, so that only R magneto unit is available for firing the other spark plug in each cylinder. In the BOTH position, the output of neither magneto is grounded and both plugs in each cylinder are fired. Positions OFF and BOTH are normal positions; L and R are test positions only.

**flight controls...
THROTTLE
STOP**

(ON PILOT'S THROTTLES ONLY)

RED TAB MAY BE MANUALLY MOVED FROM RIGHT TO LEFT TO STOP EITHER THROTTLE.



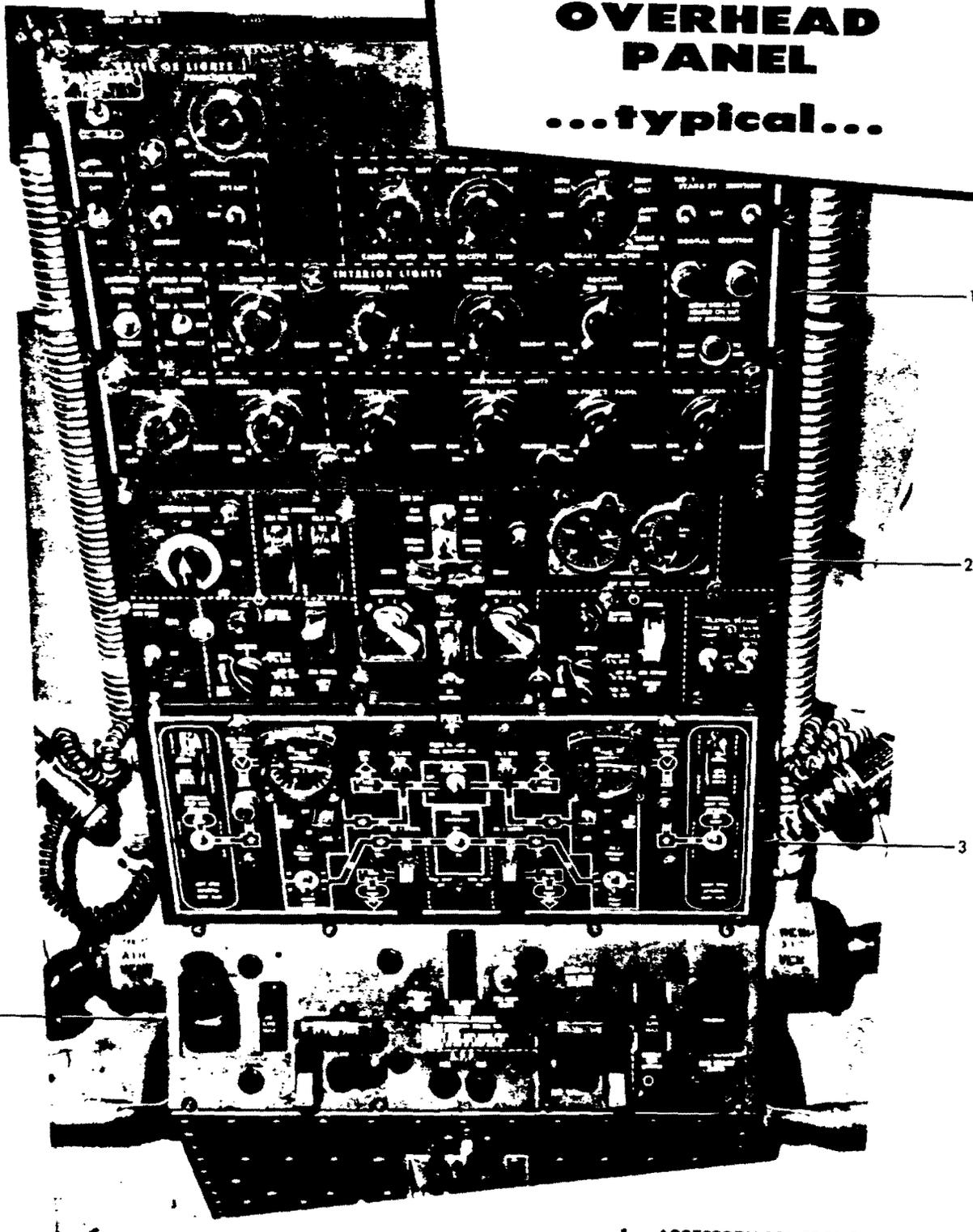
Throttle stop is mechanically connected to flight controls lock

Figure 1-5

26001

OVERHEAD PANEL

...typical...



- 1. ACCESSORY CONTROL PANEL
- 2. ENGINE STARTING PANEL
- 3. FUEL SELECTOR PANEL
- 4. ENGINE EMERGENCY PANEL

Figure 1-6

NORMAL PRIMER SWITCH.

A spring-loaded, three-position toggle switch (figure 1-7), on the engine starting panel controls the operation of the fuel primer solenoid on each engine. When the switch is held in the ENG. NO. 1 position, the primer solenoid on the left engine opens permitting fuel to flow under boost pump pressure to the primer discharge nozzles directly below the carburetor throttle valve. In a similar manner, priming is accomplished on the right engine when the switch is held in the ENG. NO. 2 position. When released, the switch returns to the spring-loaded center (off) position, and the primer solenoid closes. The fuel passes through the coils of a fuel heater unit after leaving the primer solenoid, but is not heated since the fuel heater unit is not energized when the normal prime switch is used. Power for the operation of the primer solenoids is supplied by the 28-volt dc primary bus.

HOT PRIME SWITCH.

A spring-loaded, three-position toggle switch (figure 1-7), located on the engine starting panel controls the operation of the hot fuel priming system. When the switch is held in the ENG. NO. 1 position, the primer solenoid on the left engine opens allowing fuel under boost pump pressure to flow through the fuel heating unit to the primer discharge nozzles directly below the carburetor throttle valve. At the same time, the fuel heater unit is energized so that the priming fuel is heated to provide better vaporization. A similar sequence occurs on the right engine when the switch is held in the ENG. NO. 2 position. When the switch is released, it returns to the center (off) position, closing the primer solenoid and deenergizing the fuel heater unit. Power for the primer solenoids and fuel heater units is supplied by the 28-volt dc primary bus. Refer to Section VII 10, a complete description and Section IX, for operating procedures for the hot fuel priming system.

STARTER SWITCH.

A three-position, spring-loaded switch (figure 1-7), located on the engine starting panel controls the operation of the two direct-cranking engine starters. In the NO. 1 position, primary bus power is supplied to operate the 28-volt dc engine starter of the left engine. At the same time the 28-volt dc Induction Vibrators are energized. The vibrators, augmenting magneto output, boost voltage in each cylinder during the cranking operation. In the No. 2 position of the switch, a similar starting operation is performed for the right engine. When the switch is released, it automatically returns to the center (off) position. The switch is provided with a metal shield to prevent inadvertent energizing of the starters.

SUPERCHARGERS.

Each engine is equipped with a single-stage, two-speed supercharger, mechanically geared to the engine crankshaft through a hydraulically operated clutch arrangement. Oil pressure from the engine lubrication system is used to operate the supercharger clutches and is controlled by a solenoid-type selector valve mounted on top of the engine rear section. The centrifugal-type impeller is driven at a low or high speed ratio depending upon the altitude and power requirement.

Supercharger Switches.

Two guarded switches (figure 1-3), on the control quadrant, one for each engine, select the impeller speed for their respective engines. When the switches are placed in the guarded LOW position, the solenoid-operated selector valves direct engine oil pressure to the low speed clutches for low blower operation of the engines. Likewise, when placed in HIGH, the superchargers are shifted to the high speed ratio for high blower operation. Electrical power for shifting the superchargers is supplied by the 28-volt dc primary bus.

WATER INJECTION SYSTEM.

Two identical water injection systems, one for each engine, are installed to permit the attainment of higher engine power outputs, in either forward or reverse range, without danger of detonation. This is accomplished by leaning the fuel/air mixture to approximately the "best power" setting and substituting a water-alcohol mixture for the excess fuel normally used as a coolant in the cylinder. At the same time, the limit manifold pressure must be reduced slightly since the "best power" mixture enables the engine to produce the desired additional power at a reduced manifold pressure. Refer to INSTRUMENT RANGE MARKINGS, Section V. The water-alcohol mixture is contained in a stainless steel tank mounted on the aft side of the firewall in each nacelle. The 14-gallon supply is normally sufficient to last approximately ten minutes. When the system is energized, an electrically-driven pump in the bottom of the tank supplies the fluid under pressure to the water injection regulator mounted on the intermediate rear section of each engine. However, before the system can be energized, a switch operated by engine oil pressure must be closed. This feature prevents the inadvertent application of water pressure to the regulator when the engine is shut down, by shutting off the water injection pump and closing a shut-off valve between the tank and the regulator. From the regulators, the pressure flows

to and position the derichment valve on the carburetor, as soon as the pump is energized. When the power is advanced above the idle range, the fuel is metered at a reduced fuel-to-air ratio, enabling the engine to deliver best power. As engine power is increased to a predetermined value (approximately 37 in. Hg), the water regulator begins to meter water-alcohol to the engine in proportion to the mass airflow through the carburetor. When the system is turned off, or when the supply of fluid is exhausted, the derichment valve automatically restores the necessary rich mixture for "dry" operation. Electrical power for the operation of the system is supplied by the 28-volt dc primary bus. For water-alcohol specification, refer to Servicing, Figure 1-62.

Water Injection Switches and Indicator Lights.

Two water injection control switches (figure 1-3), and two water injection reset switches (figure 1-3), are mounted on the control quadrant to control operation of the No. 1 and No. 2 engine water injection systems. When the control switches are placed in ON, 28-volt dc primary bus power is made available to the reset switches for starting the pumps and to the two water injection indication lights (figure 1-59), on co-pilot instrument panel. When either of the reset buttons is depressed, power is applied to the water injection pump relay (provided the oil pressure switch is closed) to accomplish opening of the water shut-off valve and starting of the water pump (provided the fire emergency shutdown handle is not pulled out). The amber indicator light will then go out, indicating that system water pressure is available for use. Any further illumination of the light indicates depletion of the water-alcohol supply, low oil pressure or lack of water pressure due to pump or other mechanical failure.

COWL FLAP SWITCHES.

A four-position cowl flaps switch (figure 1-4), for each engine is located on the pilots' control panel. The switch positions are OPEN, CLOSE, TAKE-OFF, and OFF. In the OPEN position, power is supplied to a 28-volt dc reversible motor which operates a multiple screw-jack arrangement that opens the flaps. The CLOSE position reverses the motor and closes the flaps. The TAKE-OFF position automatically sets the flaps at approximately 14 degrees open. In the OFF position the motor is not energized. Intermediate cowl flap positions are obtained by toggling the switch to the OPEN or CLOSE positions and then to OFF. Limit switches in the cowl flap actuator motors automatically prevent overtravel, and set the take-off position. The cowl flaps switch, however, is completely inoperative in all positions when its respective fire emergency shutdown handle is pulled. Refer to FIRE EMERGENCY SHUTDOWN HANDLE and FIRE EXTINGUISHING AGENT DISCHARGE SWITCH, this section.

TORQUEMETER SYSTEM.

A torquemeter system is installed on each engine which makes possible a measurement of the actual engine power output delivered to the propeller shaft. Refer to CALCULATION OF BRAKE HORSEPOWER, Section VII, for a discussion of the relationship between torque pressure and brake horsepower. Power developed within the engine is transmitted to the propeller through a reduction gear arrangement resulting in a torque load on the propeller shaft. As a result of diagonal splines machined in the outer rim of the reduction drive fixed gear, the gear moves forward slightly in response to the torque applied. This forward motion is sensed by a master torque cylinder which then meters boosted engine oil pressure from a separate pump to each of five additional torque cylinders spaced around the circumference of the reduction drive fixed gear. The oil pressure, acting on the pistons in the torque cylinders, exactly counterbalances the forward thrust of the reduction drive fixed gear and thus serves as an indication of the torque delivered by the engine to the propeller.

ENGINE INSTRUMENTS.

The engine instruments are grouped together on the center portion of the instrument panel and provide indications of power output as well as temperature and pressure conditions within the engines. Illumination of the instruments is provided by red floodlights and luminous dial markings. Refer to INTERIOR LIGHTING, Section IV.

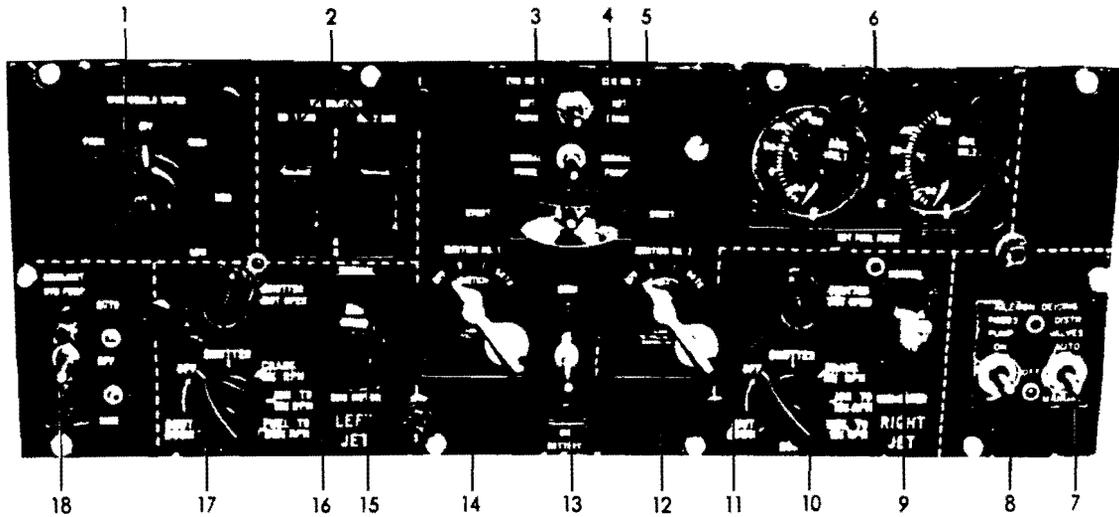
Tachometers.

A synchronous-motor tachometer indicator (figure 1-58) for each engine is mounted on the engine instrument panel. A tachometer generator installed on the left side of each engine accessory drive section revolves at a speed proportional to the speed of the engine. By automatic synchronous action, the motor in the indicator repeats the movements of the generator. Indicator motor rpm is interpreted and given in terms of engine rpm by the pointer. The tachometer circuit is electrically independent of the aircraft's electrical system.

Manifold Pressure Gages And Purge Valve Buttons.

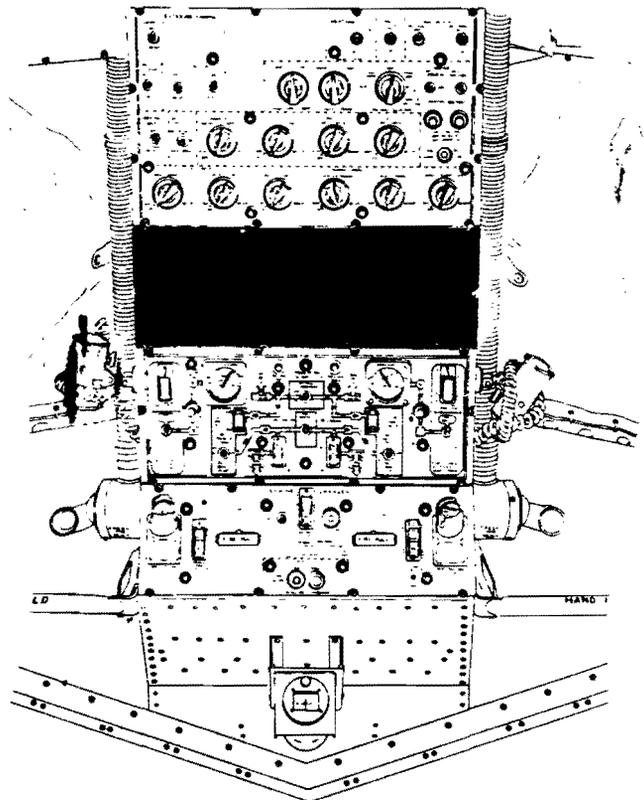
The manifold pressure gage (figure 1-58), for each engine indicates the pressure of the fuel/air mixture in the intake manifold. Manifold pressure from the blower section is directed through a pressure line to a diaphragm-operated indicator on the engine instrument panel. A purge valve button (figure 1-58), for each manifold pressure is located on the engine instrument panel. The button is marked PUSH TO DRAIN. Operation of the valve permits moisture or

ENGINE START PANEL



1. WINDSHIELD WIPER SWITCH
2. OIL DILUTION SWITCHES
3. HOT PRIME SWITCH
4. NORMAL PRIME SWITCH
5. ENGINE STARTER SWITCH
6. HOT PRIME TEMPERATURE GAGES
7. AILERON DEICING DISTRIBUTION VALVES SWITCH
8. AILERON DEICING PRESSURE PUMP SWITCH
9. RIGHT JET ENGINE MOTOR SWITCH
10. RIGHT JET ENGINE START SWITCH
11. RIGHT JET SHUTTER NOT OPEN WARNING LIGHT
12. ENGINE IGNITION SWITCH (NO. 2 RECIPROCATING)
13. BATTERY SWITCH
14. ENGINE IGNITION SWITCH (NO. 1 RECIPROCATING)
15. LEFT JET ENGINE MOTOR SWITCH
16. LEFT JET SHUTTER NOT OPEN WARNING LIGHT
17. LEFT JET ENGINE START SWITCH
18. AUXILIARY HYDRAULIC PUMP SWITCH

Figure 1-7



foreign matter to be drawn into the engine to clear the pressure lines.

Torquemeters.

Torque oil pressure existing within the torque cylinders is transmitted through a capillary tube to an autosyn torque pressure transmitter on each engine. These 26-volt, 400-cycle ac instruments transmit an electrical signal through an amplifier to a corresponding torque pressure indicator (figure 1-58) mounted on the engine instrument panel. Each indicator is calibrated to read torque pressure in psi.

Ignition Analyzer Equipment.

Provisions have been made for the installation of a portable airborne ignition analyzer for use either during flight or ground operation. All necessary equipment except the analyzer itself has been installed, the connecting cables and leads being stored in the lead storage locker located (figure 4-34) on the right side of the cargo compartment forward bulkhead. Basically, this equipment provides a means of analyzing a malfunctioning ignition system and determining the cause of the system's abnormal operation.

Oil Temperature Indicators.

Right and left engine oil temperature indicators (figure 1-58), are located on the engine instrument panel. Oil temperature is measured by a bulb which is installed in the sump of each engine oil supply tank and which transmits the temperature of the oil electrically to the indicator on the engine instrument panel. The indicator is calibrated in degrees centigrade. Operating power is supplied from the 28-volt dc primary bus.

Oil Pressure Indicators.

Right and left engine oil pressure indicators (figure 1-58), are located on the engine instrument panel. Oil under pressure is directed from an oil pressure passage in the engine to the oil pressure transmitter which is located in the lower right side of the engine mount. The transmitter sends an electrical signal, proportional to the pressure to which it is subjected, to the indicator where it is registered in pounds per square inch. Power for operation of the oil pressure indicating system is obtained from the primary single-phase ac bus through a 26-volt step-down transformer.

Fuel Pressure Indicators.

Two fuel pressure indicators (figure 1-58), one for the fuel supply of each engine, are located on the engine instrument panel. A fuel pressure transmitter installed in each engine fuel system transmits a signal, relative to the fuel pressure to which it is subjected, to the indicator where it is registered in pounds per square inch (psi). Power for operation of the fuel pressure indicating system is obtained from the 115-volt primary single-phase ac bus through a 26-volt step-down transformer.

Cylinder Head Temperature Indicators.

Cylinder head temperature indicators (figure 1-58), one for each engine, are mounted on the engine instrument panel. Temperature measured by a bulb installed in the aft side of the No. 4 cylinder of each engine is electrically transmitted to a 28-volt dc indicator. Operating power is supplied from the 28-volt dc primary bus. Each indicator is calibrated in degrees centigrade.

Carburetor Air Temperature Indicators.

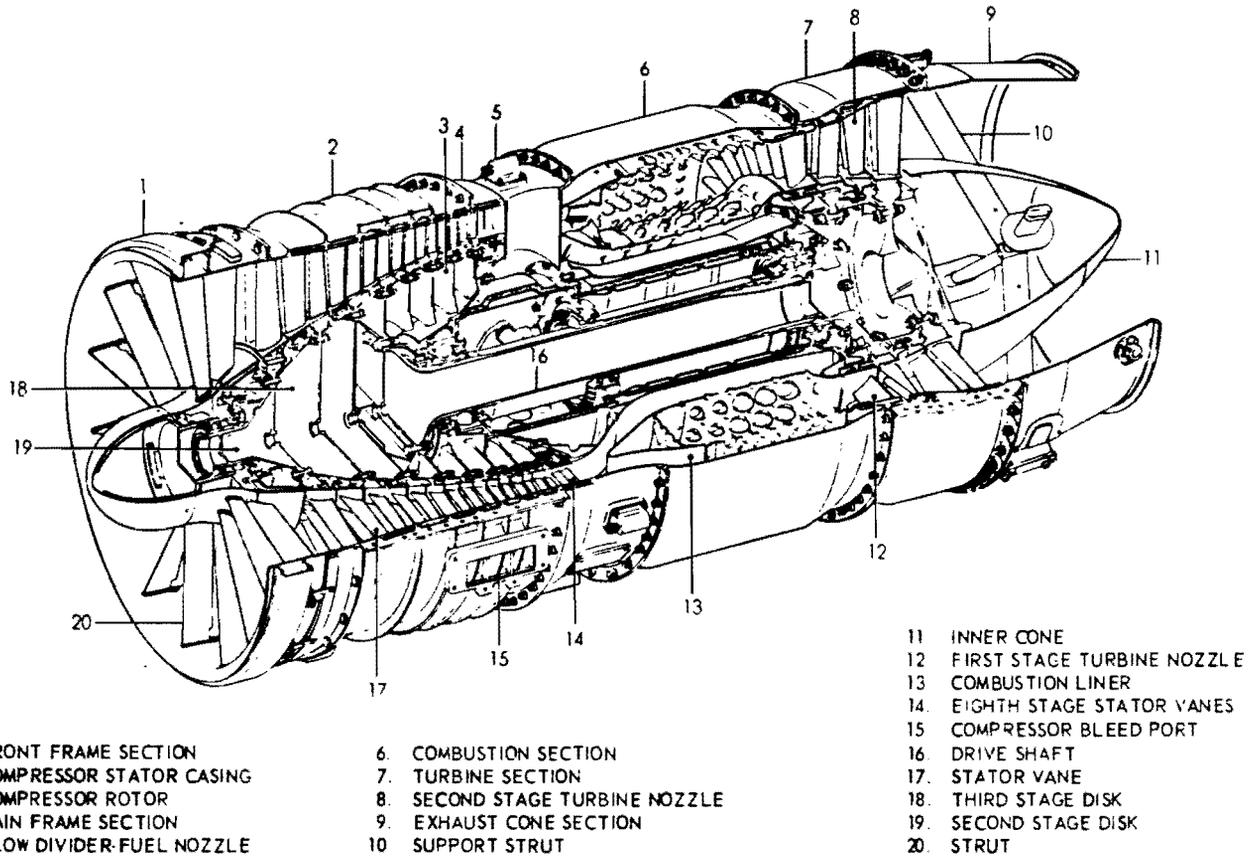
Temperature of the air entering the carburetors is indicated by two carburetor air temperature indicators (figure 1-58), one for each engine, located on the engine instrument panel. Temperature measured by a bulb installed in the rubber duct at the top of each carburetor is electrically transmitted to a 28-volt dc indicator which is calibrated in degrees centigrade. Operating power is supplied from the 28-volt dc primary bus.

Hot Prime Temperature Gages.

The temperature of the fuel passing through the priming system is sensed by a bulb-type thermometer in the fuel outlet reservoir of the fuel heater unit. The temperature is then indicated on two temperature gages (figure 1-7), located on the engine starting panel. These gages are calibrated in degrees centigrade and indicate the temperature of the fuel regardless of whether the hot prime or the normal prime switch is used. Electrical power for the gages is supplied by the 28-volt dc primary bus.

JET ENGINES.

The J85-GE-17 (figure 1-8), is a single-rotor, axial-flow turbojet engine, consisting of an eight stage axial-flow compressor driven by a two-stage turbine, an annular combustion section, variable inlet guide vanes, a fixed-area concentric exhaust cone, and an integrated control system. At sea level standard day static conditions, the maximum thrust rating is 2850 pounds at 100% rpm. The major components of the engine include the front frame section, compressor section (stator and rotor), main frame section, turbine section (stator and rotor), exhaust section, accessory drive section (accessory gearbox), lubrication system, fuel and control system, air system and electrical system.



JET ENGINE CUTAWAY

Figure 1-8

Each engine is supported at three points from its respective pylon secured to the wing outer panel. Fuel and electrical power for the engine are supplied from the basic aircraft sources. Engine starting, ignition, throttle actuation, air inlet door control, and motoring functions are electrically controlled by switches located on the pilot's overhead panel and the control pedestal quadrant. Jet engine performance is monitored by tachometer, exhaust gas temperature, fuel pressure, fuel flow and oil pressure instruments located on the engine instrument panel. Each engine has a self-contained oil system.

JET ENGINE FUEL CONTROL SYSTEM.

The jet engine fuel control system regulates the gas generator speed as a function of throttle shaft position by metering the proper fuel flow for steady-state and transient operation. The system also regulates the position of the compressor inlet guide vanes and the interstage bleed valves. Jet engine fuel, besides being used for combustion, is also used as a lubricant for the main fuel pump, as servo fluid for positioning the compressor variable geometry actuator, and as a

coolant for the engine oil. The engine fuel control system consists of a two-stage fuel pump, hydro-mechanical fuel control, overspeed governor, oil cooler, pressurizing valve, manifold drain valve, 12 fuel nozzles, two compressor variable geometry actuators, fuel flowmeter, fuel pressure transmitter, and overboard drains. The control system regulates the rate of engine fuel flow for variations in air density, air temperature, and engine rpm. When the jet engine start switch is placed to the SHUTTER position, the jet firewall valve is opened to provide fuel through the aircraft wing and jet engine pylon fuel line to the jet engine. The jet fuel boost pumps are controlled by the jet fuel boost pump switches (figure 1-16). The fuel, under pressure, is directed to the main metering valve and a small quantity of fuel is also supplied to the variable geometry actuator servo where it is used as hydraulic fluid. When the jet start switch is placed to the FUEL TO 38% RPM position, the throttle control circuit is energized moving the throttle actuator arm from the off to the idle position. The metering valve regulates fuel flow in response to engine demands. The metered fuel is directed through the oil

cooler to the fuel pressurizing valve and fuel manifold. Twelve fuel nozzles direct the fuel into the combustion section. The main fuel control governor, controlled by the fuel control throttle setting acts upon the metering valve to maintain the correct quantity of fuel for the selected setting.

Jet Engine Fuel Pump.

The jet engine fuel pump assembly consists of a single-element positive-displacement pump, centrifugal boost pump, screen, and a pressure relief valve. The fuel pump is mounted on and is driven by the jet engine accessory gearbox. The fuel pump supplies high-pressure fuel control and to the overspeed governor servos.

Main Fuel Control.

The main fuel control is a hydro-mechanical unit, mounted to the fuel pump, that selects and regulates the power output of the jet engine by establishing fuel flow limits for all operating conditions, including starting and temperature or atmospheric pressure changes. The unit also positions the variable air inlet vanes and bleed valves to a defined schedule during transient and steady-state engine operation and functions as a positive fuel shutoff valve.

Overspeed Governor.

The overspeed governor is hydro-mechanical, self-contained unit, mounted to and driven by the jet engine accessory gearbox, and is functionally in series with the main fuel control. If the jet engine overspeeds, the overspeed governor overrides the main fuel control by bypassing fuel back to the fuel pump inlet port.

Oil Cooler.

The jet engine fuel is routed through a shell and tube heat exchanger type oil cooler, mounted on the oil tank. Fuel flowing through the tubing absorbs heat from the hot jet engine oil flowing over the tubes.

Pressurizing and Drain Valves.

The fuel pressurizing valve ensures proper fuel pressure to operate both the main control servos and the variable geometry actuators during engine starting and other low fuel flow conditions. The drain valve drains the fuel manifolds and associated piping at jet engine shutdown.

Fuel Nozzles.

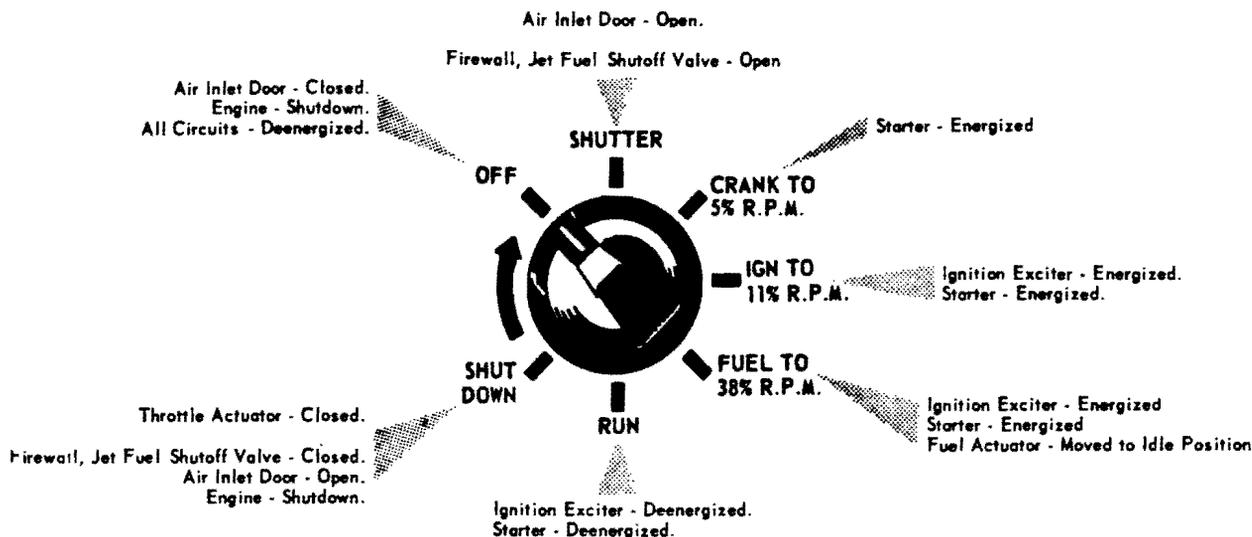
Twelve main fuel nozzles provide the correct spray pattern of metered fuel flow to the combustion chambers over the entire operating range of the engine. During starting, low-pressure fuel in the primary passage sprays toward the igniter tip for ignition. At higher speeds, the increased fuel pressure opens the flow divider which allows the fuel to flow into the secondary passage and into the spin chamber, where it merges with the primary fuel spray, and then into the mid-annulus of the combustion liner. The air shroud sweeps air across the nozzle orifice to prevent carbon buildup.

Variable Geometry Actuators.

Two variable geometry actuators position the variable vanes and the bleed valves as scheduled by the main fuel control in response to variations in compressor speed and engine inlet air temperature.

JET ENGINE CONTROLS.

The jet engines are electrically controlled by switches on the pilot's control quadrant (figure 1-3) and engine start panel (figure 1-7). Each engine has a start switch (figure 1-9), a throttle switch, and a motor-ing switch. Electrical power is obtained from the aircraft 28-volt dc flight emergency bus.



NOTES: ● Throttle switch controls engine rpm from idle to maximum.

JET ENGINE START SWITCH

Figure 1-9.

Start Switches.

Starting and shutdown of the jet engines are controlled by sequence - type rotary switches, one for each engine, located on the overhead engine start panel (figure 1-7). All circuits are deenergized in the OFF position. When turned clockwise to SHUTTER, the engine pod air inlet door opens and the firewall jet fuel shutoff valve opens. The jet fuel boost pump in the nacelle tank must be energized by the jet fuel boost pump switch on the fuel selector panel (figure 1-16). When turned to FUEL TO 38% the starter, ignition, and throttle control circuits are energized, the throttle control solenoid moves the throttle actuator from off to the idle position. When the engine reaches idle speed, approximately 50% rpm, turn switch to the RUN position. The starter and ignition circuits are now deenergized and the throttle switch is armed to control the engine rpm between idle and maximum. Positioned to SHUTDOWN, the jet fuel shutoff valve closes, and the throttle actuator arm rotates to the off position, stopping the fuel flow, and shutting down the engine. The pod air inlet door remains open until the switch is positioned to OFF. Refer to figure 1-9.

CAUTION

- Allow ten minutes between complete operating cycles of the pod air inlet door to permit adequate cooling of the actuator. A complete cycle is defined as door opened and closed or door closed and opened.
- Once a start is initiated, the jet engine start switch must be rotated clockwise to prevent inadvertent cranking or possible damage to the starter/generator.

Note

The time restriction applies to inflight operation of the shutter door with high air load imposed.

Throttle Switches.

A throttle switch for each jet engine, mounted on the control quadrant (figure 1-3), provides the means to select any desired engine thrust from idle to maximum. The spring-loaded, three-position throttle

switches have an unmarked neutral position with the other positions placarded ADVANCE and RETARD. The switch applies 28-volt dc power to a rotary actuator, which is attached to the jet engine throttle arm, and positions the throttle to obtain the desired engine rpm. The throttle switches may be overridden, regardless of their position, by the engine start switches or motoring switches.

Motoring Switches.

An engine motoring switch for each jet engine is located next to its respective engine start switch on the overhead start panel (figure 1-7). This is a two-position switch, placarded NORMAL and ENG. MOTOR,

and allows the jet engine to be motored by the starter without energizing the ignition and throttle actuator circuits. Motoring the engine provides the pilot with a means of cooling an overheated engine, blowing out a fire, or blowing out excess quantities of fuel before starting the jet engine. Placing the switch to the ENG. MOTOR position opens the jet pod air inlet door, the jet fuel firewall shutoff valve, energizes the starter, and deenergizes the ignition and throttle circuits. The operation of the switch in the ENG. MOTOR position overrides the throttle and engine start switches.

CAUTION

When motoring a jet engine, the corresponding jet fuel boost pump must be operating to insure lubrication of the jet engine fuel control unit, except in an emergency.

Inlet Door Not Open Indicator Light.

An amber warning light for each jet engine (figure 1-7), and placarded SHUTTER NOT OPEN, will illuminate if operation of a jet engine is attempted and its pod air inlet door fails to open normally. The lights will illuminate momentarily during transition of the doors from closed to open.

JET ENGINE OIL SYSTEM.

Each jet engine has an independent, pressurized, closed-circuit recirculating lubrication system to furnish oil to the engine parts and accessories which require lubrication during engine operation. A lubrication and scavenge pump, oil tank, oil cooler, and oil filter are mounted on the engine. The lubrication and scavenge pump draws oil from the tank, pumps it through the oil cooler, through the oil filter, and into the accessory gearbox. A portion of the oil services the gearbox and the remainder is routed to the bearings, gears, and seals of the engine. Return oil collects in the engine sumps and is scavenged by the lubrication and scavenge pump and returned to the oil tank. Oil tank capacity is 4 quarts, with 2.5 quarts usable. For type of oil, refer to Servicing, Figure 1-62.

Lubrication and Scavenge Pump.

The lubrication and scavenge pump is a positive displacement pump consisting of six pump elements mounted along a common drive shaft and contained in a common housing. One element is the lubrication pump; the other five are scavenge elements. The operating elements of the pump extend into the oil tank from the pump flange on which the oil tank is mounted. Oil, under pressure, is pumped directly to the oil cooler, through the oil filter, into the gearbox where it is distributed throughout the system. A pressure relief valve is installed at the pump outlet and, if the output pressure becomes excessive due to cold starting or restricted oil flow, will open at a predetermined pressure to discharge the oil back into the oil tank. Scavenged oil from the engine sumps is pumped directly back into the oil tank.

Oil Tank.

The oil tank is mounted on the aft flange of the lubrication and scavenge pump and includes an air chamber,

a dwell chamber, and a system of vent tubes. The air chamber collects air, returned to the oil tank in the air-oil mixture from the sumps by the scavenge pump elements, and directs it back to the sumps to maintain equilibrium in the system. The dwell chamber in the oil tank limits the volume of entrained air in the tank. The vent system in the oil tank maintains a positive pressure in the lubrication system to insure its proper operation during altitude changes or negative "g" operation.

Oil Cooler.

The jet engine oil cooler is a liquid-to-liquid type heat exchanger consisting of numerous rows of tubing. The jet engine fuel and oil flow simultaneously through adjoining passages and heat from the engine oil is absorbed by the fuel. If the oil cooler becomes clogged, causing an increase in oil pressure, a bypass valve opens and the engine oil will bypass the heat exchanging elements.

Oil Filter.

A full-flow, in-line type oil filter assembly is mounted in the lubrication and scavenge pump housing and contains a screen element and a bypass valve. The screen filters out oil contaminants over 40 microns in size, and is removable for cleaning. If the oil filter becomes clogged, causing an increase in oil pressure, a bypass valve opens to permit a direct flow of oil through the unit without filtration.

JET ENGINE INSTRUMENTS.

All jet engine instruments are grouped together on the engine instrument panel, directly beneath the reciprocating engine instruments (figure 1-58), and consist of tachometers, oil pressure, fuel pressure, fuel flow, and exhaust gas temperature indicators. The instruments are illuminated by red floodlights and luminous dial markings.

Tachometers.

Jet engine speed is measured electrically by a tachometer generator installed on the accessory section of each engine. The tachometer generator is gear-driven by the engine and generates an electrical current proportional to the speed of the engine turbine rotor. The tachometer generator current energizes a motor in the instrument panel-mounted indicator, which turns a dial pointer around a scale calibrated in percent rpm. The tachometer circuit is electrically independent of the aircraft electrical system.

Oil Pressure Indicators.

Jet engine lubricating system oil pressures are measured by pressure transmitters installed between the oil pump outlet and the oil filter inlet of

each engine. The oil pressures are converted to electrical currents which are connected to instrument panel-mounted indicators that are calibrated in pounds per square inch (psi) of oil pressure. Electrical power to operate the oil pressure indicator circuits is obtained from the aircraft 26-volt, 400-cycle ac, single-phase bus.

Fuel Pressure Indicators.

The jet engine fuel pressures are measured by pressure transmitters installed between the fuel strainer and the fuel control unit inlet on each engine. The fuel pressures are converted to electrical currents which are connected to instrument panel-mounted indicators that are calibrated in pounds per square inch (psi) of fuel pressure. Electrical power to operate the fuel pressure indicator circuits is obtained from the aircraft 26-volt, 400-cycle ac, single-phase bus.

Fuel Flow Indicators.

Fuel flow rates to the jet engines are measured by a transmitter installed between the fuel pump overspeed governor outlet and the oil cooler inlet of each engine. Fuel flow is converted to electrical currents and connected to instrument panel-mounted indicators that are calibrated in pounds per hour. Electrical power to operate the fuel flow indicator circuits is obtained from the aircraft 115-volt, 400-cycle ac, single-phase primary bus.

Exhaust Gas Temperature Indicators.

Eight thermocouples are installed on the exhaust cone of each jet engine, spaced around its circumference with two different immersion depths projecting into the exhaust stream, and function to produce an electrical current proportional to the temperature to which they are subjected. The thermocouple currents control instrument panel-mounted indicators that are calibrated in degrees centigrade. The exhaust gas temperature indicator circuits are completely independent of the aircraft electrical system.

PROPELLERS.

Each reciprocating engine drives a Hamilton Standard hydromatic three-bladed, constant speed, full feathering, reversible pitch propeller. This propeller incorporates an integral oil system with a 3.3-gallon capacity, an emergency provision for replenishing propeller oil with engine oil, and a system for deicing the blades by means of electrically heated elements. Refer to Servicing, Figure 1-62, for specification of oil to be used in the propeller oil sump.

PROPELLER LEVERS.

Engine rpm is regulated by two propeller levers (figure 1-3), on the engine control quadrant. The rpm is increased by moving the desired lever toward INCREASE RPM and decreased by moving toward DECREASE RPM. These controls are overridden during feathering or reversing operations. A mechanical connection exists between the levers and the propeller control unit mounted on the aft portion of the propeller hub. This connection provides a means of changing the compression on a speeder spring in the propeller governor which controls the operation of a pilot valve. When the propeller is governed on speed, compression of the speeder spring is balanced by the centrifugal force of a set of flyweights and the pilot valve remains closed, or neutral. By moving one of the levers toward the INCREASE RPM position, the speeder spring is compressed farther. The centrifugal force on the flyweights is now insufficient to balance the additional force, and the speeder spring opens the pilot valve, directing oil pressure to one side of the operating piston in the propeller dome and causing the blades to move toward low pitch. As engine speed increases (due to smaller blade angle) the flyweights develop sufficient centrifugal force to balance the load on the speeder spring, the pilot valve returns to neutral, and the engine speed stabilizes at the higher selected rpm. A reverse sequence of events takes place when a lever is moved toward DECREASE RPM, in which case the pilot valve moves in the opposite direction directing oil to the other side of the operating piston.

FEATHERING SWITCHES.

Propeller feathering operations are controlled by two, three-position, push-button type switches (figure 1-57), on the engine emergency panel. Depressing either switch will close a relay causing the corresponding propeller auxiliary oil pump to operate and at the same time will energize the high pitch solenoid valve. A timer-solenoid will hold the feather switch depressed for approximately 18 seconds while the feathering action takes place. The feathering switch should then return to the neutral position. Pulling out on the feathering switch will cause the propeller to unfeather. A blade cam switch, mounted on the No. 1 blade assembly of each propeller, automatically prevents pitch reversal if the feather switch is held out too long. Plastic guards protect the feather switches from inadvertent operation. Electrical power is supplied from the 28-volt dc flight emergency bus.

BACKUP FEATHERING SYSTEM - (SOME AIRCRAFT)

In the event of a malfunction in the primary feathering system, such as an inoperative feathering pump

or a control wiring open circuit, a backup feathering system is provided. The backup system for each propeller consists of a guarded backup feathering pump switch on the overhead engine emergency control panel, a backup feather pump relay and associated wiring, and a backup feathering pump. If a propeller must be feathered and the primary system fails, actuating the applicable BACKUP FEATHERING PUMP switch will energize the backup feather pump relay, deenergize the primary feather pump relay circuitry, and energize the backup feathering pump which furnishes oil to the propeller direct from the engine oil tank. If the normal pro-

PELLER feathering button is depressed, but the propeller does not feather due to a depleted propeller oil supply, the propeller sump float switch will automatically energize the backup feathering pump circuits without the BACKUP FEATHERING PUMP switch being in the ON position. Electrical power is supplied from the 28-volt dc flight emergency bus.

PROPELLER REVERSE PITCH CONTROL.

Reversing and unreversing of the propellers is accomplished hydraulically and is controlled by two solenoid-operated valves in the propeller oil control

unit. These valves are operated electrically by the feathering and reversing circuits, and control the flow of propeller oil to the operating piston in the dome assembly. When the throttles are moved into the **REVERSE THRUST RANGE**, a mechanical linkage between the throttles and the reverse control boxes in the pedestal actuates the switches which energize the decrease pitch solenoid valve to start the reversing operation. The propeller auxiliary oil pump is energized to supplement the pressure from the main propeller oil pump. This causes the blades to change pitch faster and reduce the degree of momentary engine overspeed when full reversing power is applied rapidly. In addition, the propeller reversing relay is wired to the start control switches of the jet engines which shuts down the jet engines and closes the jet engine air inlet shutter when the propellers are reversed during landing. Unreversing is accomplished by moving the throttles forward out of the **REVERSE THRUST** range. When this is done, the switches and relays in the reverse control boxes deenergize the decrease pitch solenoid and energize the increase pitch solenoid, moving the blades from a negative pitch to a positive pitch. The auxiliary pump is again energized to expedite the cycle. When the blades reach a preset positive blade angle, a cam-operated switch on the No. 1 blade grounds a relay system in the reverse control box which deenergizes the increase pitch solenoid and shuts off the propeller auxiliary oil pump, thus returning the system to constant speed operation. Power for the operation of the increase and decrease pitch solenoids is supplied by the 28-volt dc flight emergency bus.

PROPELLER REVERSE PITCH INDICATING LIGHTS.

Two press-to-test indicator lights, one for each propeller, are located on the pilot's or copilot's instrument panel and are placarded **NR. 1 REVERSE** and **NR. 2 REVERSE**. The lights illuminate when the propeller blades have reached an angle of 4° toward reverse, beyond the low pitch stop, and remain illuminated until the propeller blades have returned to the high pitch position. Power for the system is from the 28-volt dc primary bus with circuit protection through the propeller oil replenish circuit breaker.

PROPELLER OIL REPLENISH SWITCHES AND WARNING LIGHTS.

Whenever the oil level in either propeller oil sump falls below safe limits, a float switch turns on a warning light (figure 1-58) on the pilot's instrument panel. Two oil replenish switches (figure 1-58), one for each engine, located adjacent to the warning lights, control

solenoid oil metering valves which allow engine oil to refill the selected propeller oil sump. The **ON** position of the propeller oil replenish switch completes the circuit from the 28-volt dc primary bus through the coil of the solenoid valve in the auxiliary oil metering assembly and to ground through the float switch. Engine oil is allowed to transfer through the metering assembly to the selected propeller oil sump. When the sump is sufficiently filled, the float switch opens the circuit ground turning off both the metering valve and the warning light. In the **OFF** position the system is inoperative.

OIL SYSTEM.

An individual pressure-type oil system with dry sump and an external oil tank lubricates each reciprocating engine. Each tank has a capacity of approximately 40 gallons with an additional volume of eight gallons for expansion. The system is of the conventional type with a double-walled hopper mounted inside each tank to hasten warm-up and isolate diluted oil during cold weather operation. During warm-up, the oil returning from the engine is prevented from mixing with the congealed oil in the tank by a thermo-statically operated diverter-segregator valve which automatically diverts the oil to the hopper or the tank, depending upon the temperature of the oil. Refer to **DIVERTER-SEGREGATOR VALVE**, Section VII, for a more complete discussion of the operation of this valve. Provisions for oil dilution are also included in the system through the diverter-segregator valve in the bottom of the tank. Cooling of the oil is accomplished by a radiator installed in an air duct in the lower portion of each nacelle. These coolers incorporate thermostatic temperature control and surge protection. Oil specification and grade are listed in Servicing, Figure 1-62.

OIL TEMPERATURE SWITCHES.

Oil temperature switches (figure 1-4), located on the pilots' control panel, control the oil cooler exit doors. A 28-volt dc motor-driven actuator, powered by the flight emergency bus, is located in the bottom of each nacelle at the oil cooler duct exit, and positions the oil cooler door. These switches have four positions: **AUTO**, **HOT**, **COLD** and an unmarked off or neutral position. The **AUTO** position supplies power to the floating control which is located in the engine oil supply line and which contains a temperature sensing element. The floating control automatically regulates

the oil temperature by electrically positioning the oil cooler exit doors according to the temperature demand. When placed in the COLD or HOT positions, electrical power bypasses the floating control and directly energizes the exit door actuators, thus setting the doors according to the switch selection. The center unmarked off or neutral position of the switch stops the doors in their last position. The switch, however, is completely inoperative in all positions when its respective fire emergency shutdown handle is pulled. Refer to FIRE EMERGENCY SHUTDOWN HANDLE and FIRE EXTINGUISHING AGENT DISCHARGE SWITCH, this section.

OIL DILUTION SWITCHES.

Each oil dilution switch (figure 1-7), located on the engine starting panel, controls the 28-volt dc oil dilution solenoid valve and is utilized during cold weather to thin the engine oil with fuel before shutdown. The oil dilution switches, when positioned ON, energize solenoid valves, which allow fuel to mix with the lubricating oil. These momentary-contact switches are spring-loaded to the OFF position and guarded in the OFF or non-dilute position. Refer to COLD WEATHER PROCEDURES, Section IX, for use of the oil dilution system.

AUXILIARY OIL LONG RANGE SYSTEM.

On some aircraft an auxiliary oil system is installed to supplement the engine oil system during long range missions. The oil supply is contained in a 55-gallon drum located on the right side of the fuselage just forward of the wheel well. Tubing is routed from the drum to the dipstick opening of each engine oil tank. Pressure for pumping the oil is provided by a hand pump mounted on the drum. A selector valve is provided for selection of the desired engine tank to be replenished. When this system is installed, the engine oil tank dipsticks are removed and stowed at station 185 on the right side of the aircraft.

FUEL SYSTEM.

RECIP ENGINE FUEL SYSTEM.

Each reciprocating engine is provided with its own separate fuel system. Provisions for crossfeeding are made by connecting the systems with a crossfeed line. Facilities for engine priming, oil dilution and vapor return from the carburetor are incorporated into each system, as are firewall shut-off valves for preventing fuel flow to the engine should an emergency arise. The specification and grade of fuel used in operation of the aircraft are given in Servicing, Figure 1-62.

**OIL TEMPERATURE
..... control**

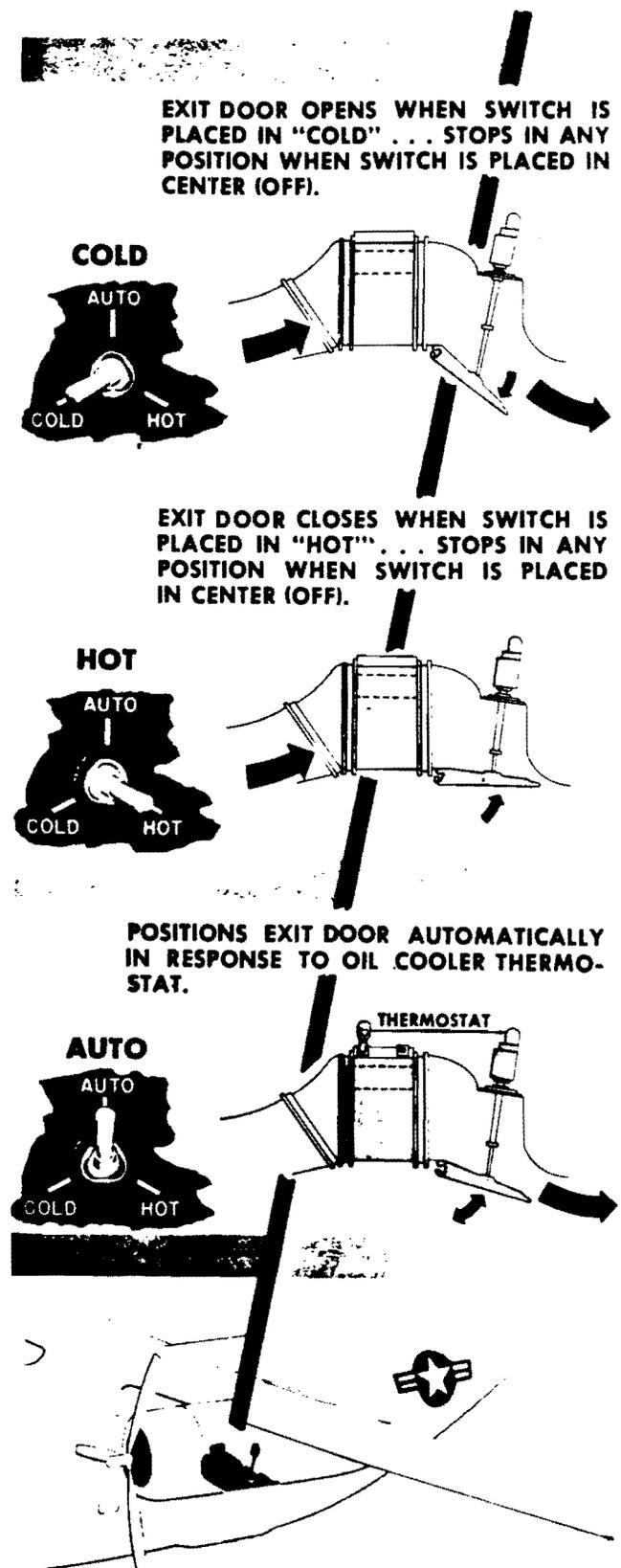


Figure 1-10

SYSTEM COMPONENTS.

A self-sealing fuel tank in each nacelle comprises the normal fuel supply. Each tank is housed within a cradle which forms the rear half of the complete nacelle and which may be jettisoned in an emergency. Provisions are made for the installation of an external drop tank under each wing outer panel. Fuel pressure is provided by an electrically-operated, submerged-type boost pump in each nacelle tank, an electrically-operated air compressor in each external drop tank pylon assembly and a gear-driven fuel pump on each engine. Refer to figure 1-11.

SYSTEM OPERATION.

When the crossfeed valves are closed, separating the systems, each engine-driven pump draws fuel from its respective nacelle tank through a strainer and forces it into the carburetor. Crossfeed operation is used to balance the fuel quantity in the nacelle tanks or to supply fuel from one nacelle tank to the opposite engine when the same side engine has been shut down. See Section VII for fuel crossfeed operating procedures. When the external drop tanks are in use, the air compressors pump air into the external drop tanks forcing fuel from each drop tank through a fuel level control valve in its respective nacelle tank. When the fuel in the nacelle tank reaches a preset capacity, the fuel level control valve closes, shutting off fuel flow from the drop tank. If the compressor is operating and the fuel flow from the drop tank is cut off by the fuel level control valve, a relief valve in the air pressure line opens, preventing excessive air pressure build-up in the drop tanks. Refer to FUEL MANAGEMENT, Section VII. A check valve in the fuel supply line from each nacelle tank insures that fuel is pumped from all tanks to the operating engine or engines and not from one tank to another. A vapor return line, which extends from each carburetor to its corresponding nacelle tank, returns the vapor accumulated in the carburetor fuel supply line to the tank. Fuel for the operation of the auxiliary power unit is taken from the right engine fuel supply line while that for the combustion heater system is taken from both main fuel supply lines. On aircraft AF54-667 and subsequent, a relief valve is installed in each heater fuel supply line to vent pressure due to thermal expansion of trapped fuel.

Fuel Shut-off Switches.

Two switches (figure 1-16), controlling the 28-volt dc motor-driven fuel shut-off valves are located on the fuel selector panel. The flow of fuel in each nacelle is shut off at the firewall in an emergency by positioning the applicable fuel shut-off valve switch to the CLOSED position. Moving this switch to the guarded OPEN position will open the valve and again allow fuel to flow to the engine. Each fire emergency shut-down handle, when pulled, overrides the respective fuel shut-off switch to automatically close this valve in an

emergency. Electrical power for the operation of the nacelle fuel shut-off valves is supplied by the 28-volt dc flight emergency bus.

Fuel Crossfeed Switch.

Positioning the crossfeed switch (figure 1-16), on the fuel selector panel to ON actuates both motor-driven crossfeed valves, allowing fuel to flow between the left and right fuel supply lines thus enabling one nacelle tank to supply all engines. Positioning the crossfeed switch to OFF closes both crossfeed valves. Power for the crossfeed valve is taken from the 28-volt dc primary bus.

Boost Pump Switches.

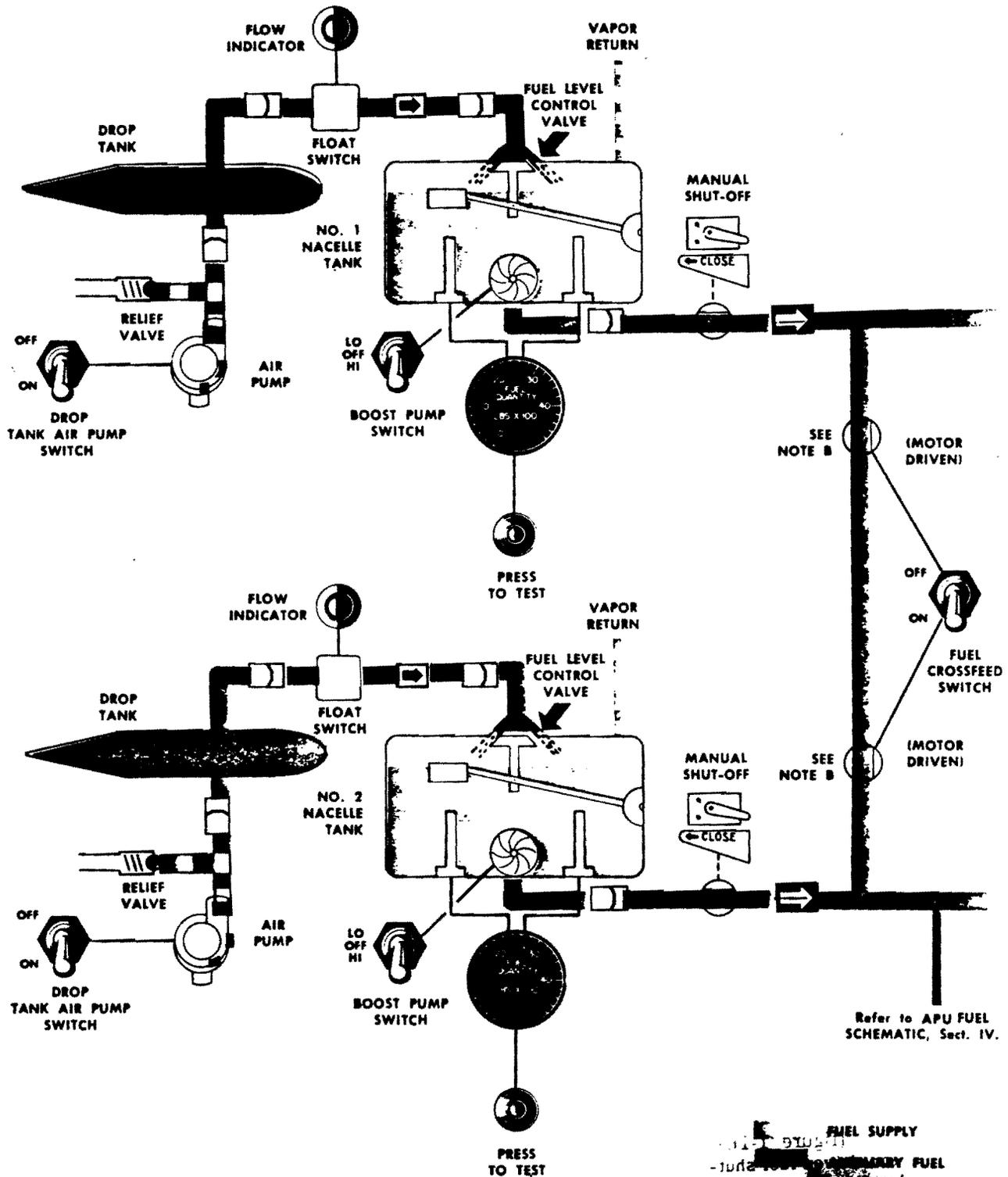
Two nacelle tank boost pump switches (figure 1-16), one left and one right, with LO, OFF and HI positions, are located on the fuel selector panel. Each switch electrically operates its respective nacelle tank boost pump. For low speed boost pump operation, the switch is positioned to LO; for high speed, to HI. The center OFF position renders the boost pumps inoperative. Power for the boost pumps is taken from the 28-volt dc primary bus.

Nacelle Tank Jettison Switches.

Two jettison switches, one for each nacelle tank, are located on the overhead engine emergency panel. Each guarded, two-position, SAFE-DROP nacelle tank jettison switch (figure 1-57), when turned to the DROP position, will electrically actuate the jettison shackles and release the corresponding nacelle tank. The switches are safety-wired and guarded in the SAFE position by red plastic switch guards. Power for operation of the nacelle tank jettisoning system is obtained from the 28-volt dc flight emergency bus.

Drop Tank Air Pump Switches.

Two drop tank air pump switches (figure 1-16), are used to energize their respective pumps. These switches are mounted on the fuel selector panel. One switch controls an air compressor for the right external drop tank; the other switch controls an air compressor for the left external drop tank. Each switch has two positions: ON and OFF. Positioning an air pump switch to ON provides fuel transfer between its respective drop and nacelle tank. Nacelle tank fuel level is controlled by a mechanical float level control valve in each nacelle tank. This float-type valve automatically regulates the flow of fuel from the external drop tank to the nacelle tank when the external drop tank air pump is operating. An air relief valve, installed on each drop tank, prevents a buildup of excessive tank pressure and provides vacuum relief when

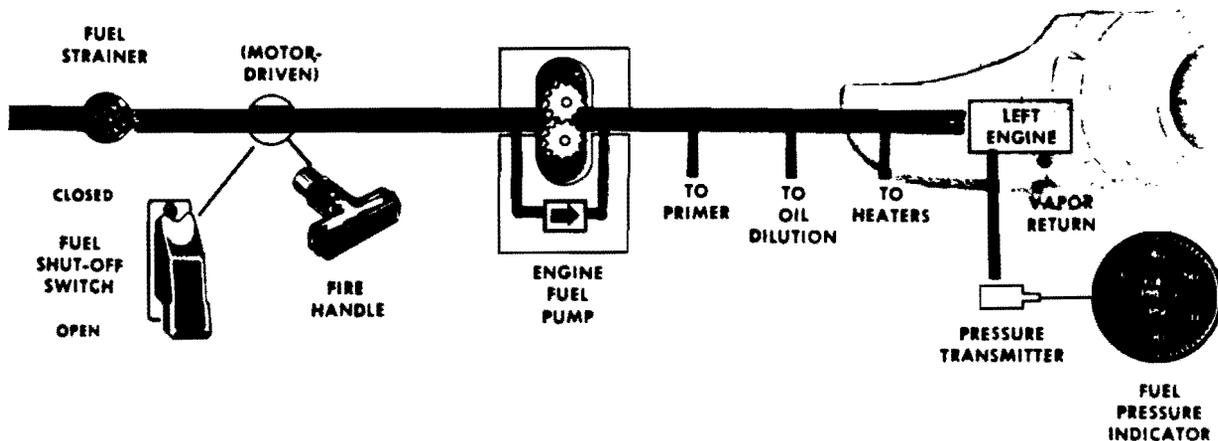


Refer to APU FUEL SCHEMATIC, Sect. IV.

RECIP FUEL SYSTEM

Figure 1-11. (Sheet 1 of 2)

FUEL SUPPLY
 PRIMARY FUEL
 The
 fuel shut-off
 This switch
 open the valve
 flow to the engine. Each time
 when pulled, overrides
 switch to automatically close



B . . . Fuel crossfeed valves are designed to provide thermal pressure relief in either direction.

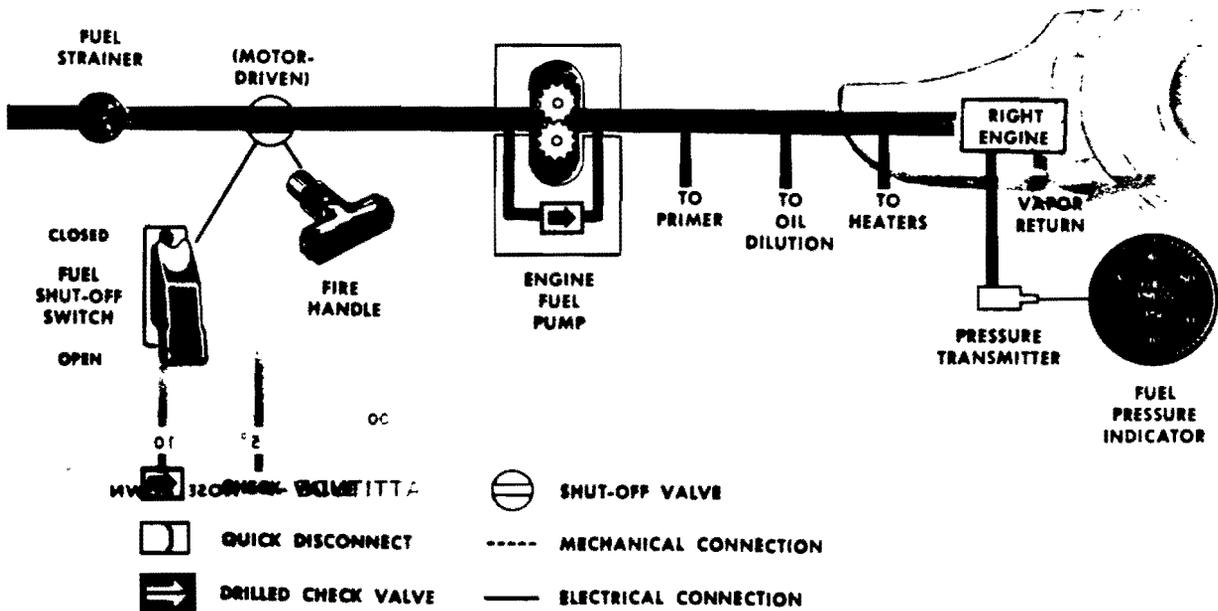


Figure 1-11. (Sheet 2 of 2)

FUEL QUANTITY

- WINGS—LEVEL ATTITUDE ASSUMED
- FUEL DENSITY—6.0 LB/GAL AT STANDARD DAY CONDITIONS.

QUANTITY DATA
(ALL TANKS)



NOTE

If Fire Suppressant Foam (TCTO 1C-123-598) is not installed, fully serviced nacelle fuel quantity will be 728.5 gallons with 724 gallons usable.

TANKS	FULLY SERVICED		USABLE FUEL	
	GALLONS	POUNDS	GALLONS	POUNDS
NO. 1 NACELLE	706.5	4239	702	4212
NO. 2 NACELLE	706.5	4239	702	4212
NO. 1 EXTERNAL DROP	441	2646	436	2616
NO. 2 EXTERNAL DROP	441	2646	436	2616
TOTALS	2285	13770	2276	13656

THREE-POINT ATTITUDE (NORMAL FLIGHT 2° NOSE UP)

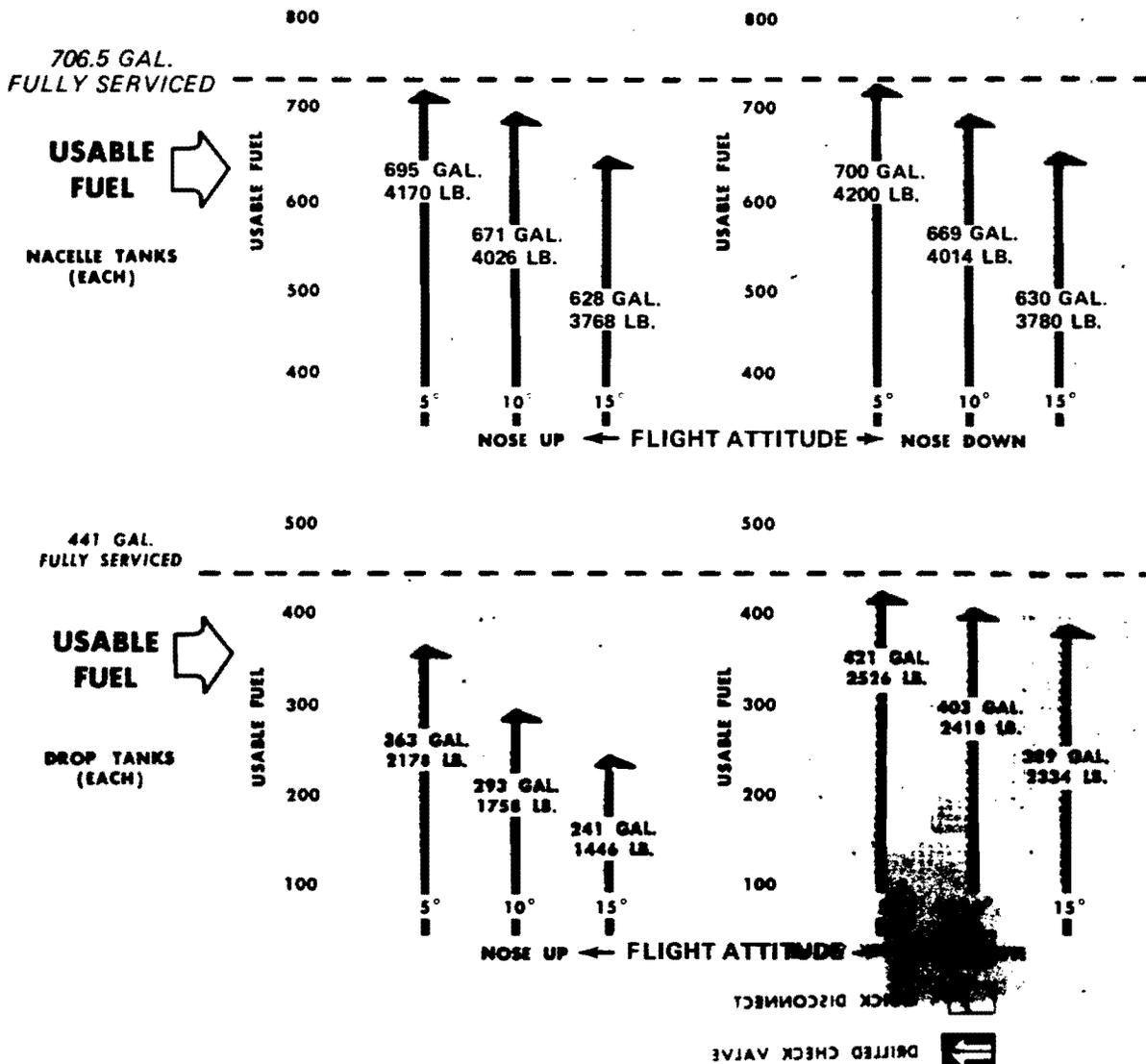


Figure 1-12

the pressure inside the tank falls below ambient pressure. Power for the drop tanks air pumps is taken from the 28-volt dc primary bus.

Drop Tank Jettison Switches.

A two-position jettison switch (figure 1-16), for each drop tank installation is located at the extreme opposite ends of the fuel selector panel. Positioning either switch to DROP will jettison its respective external tank by electrically actuating the tank release shackles. The SAFE position of the jettison switch is safety-wired in the guarded position to prevent inadvertent actuation. Power for jettisoning the external drop tanks is obtained from the 28-volt dc flight emergency bus.

Manual Fuel Shut-off Valves.

A manually operated shut-off valve is installed in the main fuel supply line in each nacelle, on the left side immediately aft of the firewall. The control arm is normally safety-wired in the open position but may

be closed to prevent flow of fuel from the tank when the fuel line is disconnected for maintenance purposes.

Fuel Quantity Indicators.

Two electrically operated fuel quantity indicators (figure 1-16), are mounted on the fuel selector panel, and are controlled by two capacitance-type tank units. (Refer to figure 1-11). The indicators are calibrated in hundreds of pounds and register separate fuel level readings for each nacelle tank. Readings must be multiplied by 100 to obtain indicated pounds of fuel. Each indicator may be tested by a test button located adjacent to the indicators. Power for operation of the system is obtained from the 115-volt primary single-phase ac bus.

Fuel Quantity Indicator Test Buttons.

Two test buttons (figure 1-16), located near the fuel quantity indicators on the fuel selector panel provide a check of correct fuel quantity indicator operation. When each test button is depressed, the fuel

AUXILIARY FUEL .. Long Range System

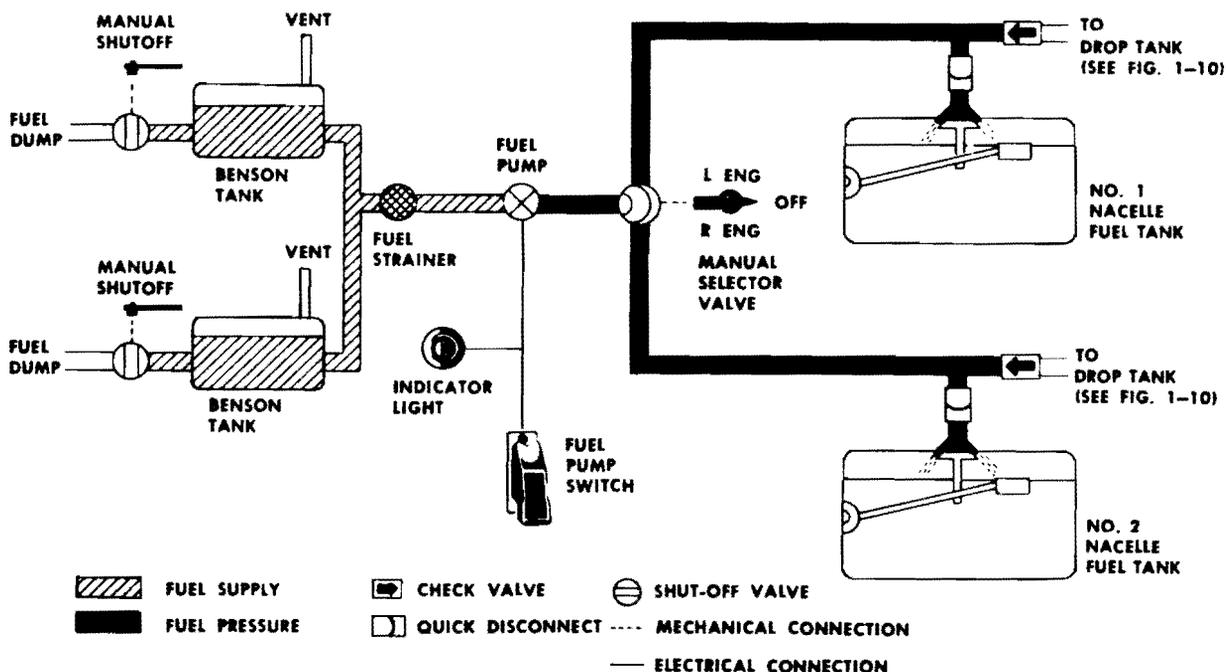
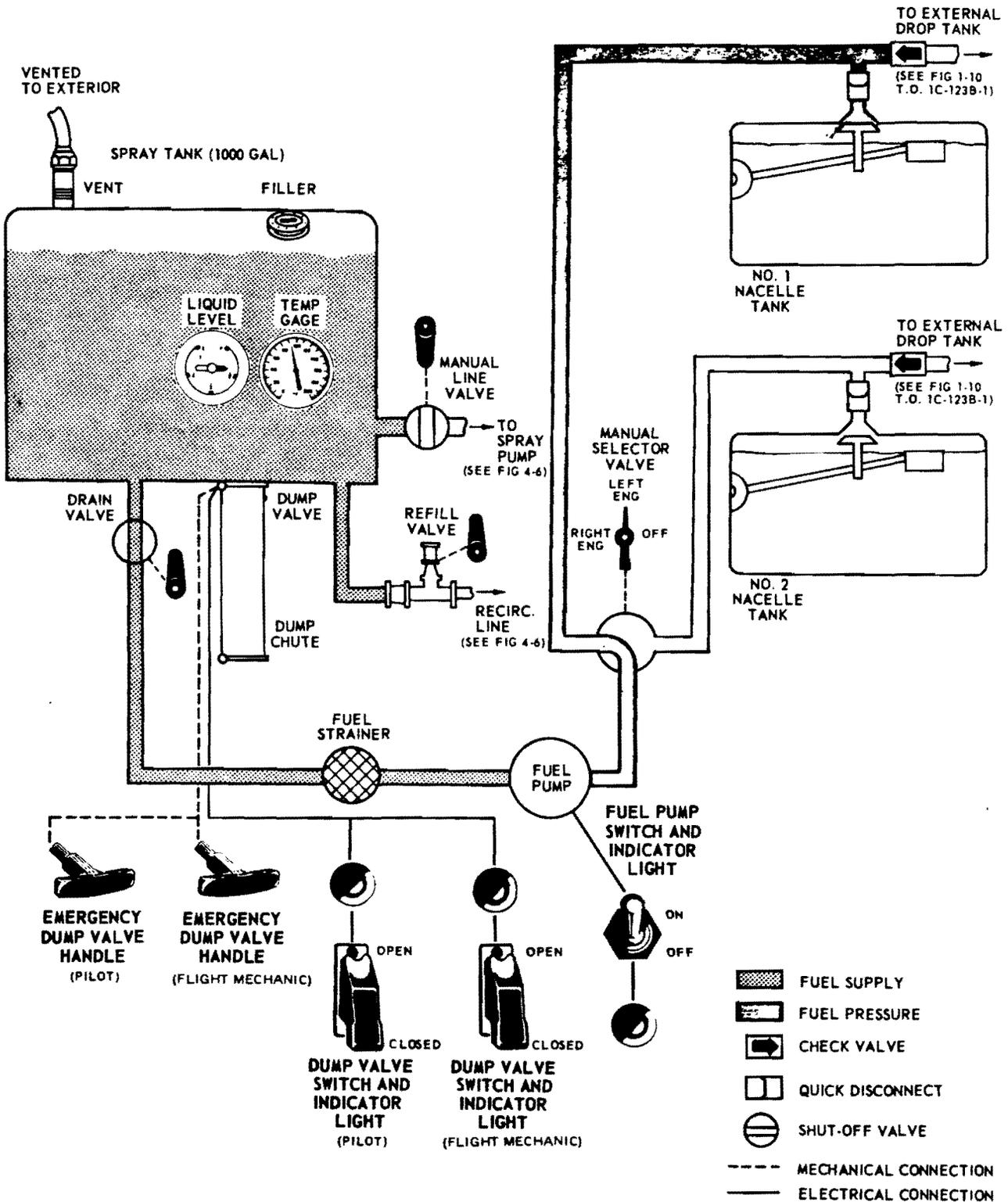


Figure 1-13



AUXILIARY FUEL long range system A/A45Y-1 Equipped Aircraft **A**

Figure 1-14

1. MANUAL FUEL SELECTOR VALVE
2. OUTLET LINES (TO NACELLE TANKS)
3. INLET LINE (FROM SUPPLY TANK)
4. FUEL PUMP INDICATOR LIGHT
5. FUEL PUMP SWITCH
6. FUEL STRAINER
7. FUEL PUMP

AUXILIARY FUEL TRANSFER PUMP AND CONTROL PANEL

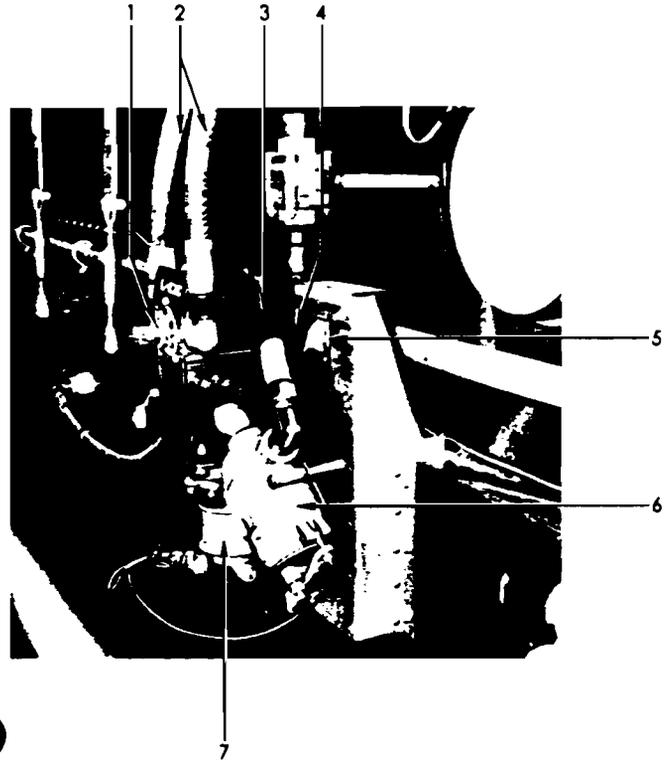


Figure 1-15

quantity indicator needle should rotate toward minimum dial indication. The test button should be depressed only long enough to displace the indicator pointer. Releasing the button allows the needle to return to its original position.

Drop Tank Fuel Flow Indicator Lights.

Two amber indicator lights (figure 1-16), one for each external drop tank, are located on the fuel selector panel. Each of these lights is controlled automatically by a float switch in the fuel transfer line between the external drop tank and its corresponding nacelle tank. Each light receives power only when its corresponding air pump switch is turned ON and the fuel transfer line is empty of fuel. This condition may occur before the transfer has begun as well as after the transfer of fuel has been completed. Power for the indicator lights is taken from the 28-volt dc primary bus.

AUXILIARY FUEL LONG RANGE SYSTEM.

On some aircraft an auxiliary fuel supply is contained in two 500-gallon Benson tanks to replenish the nacelle fuel tank supply in a manner similar to the external drop tank system. The two Benson tanks are installed side-by-side in the center of the fuselage, each being vented through their respective side of the fuselage, just forward of the wheel well at floor level. A fuel control panel, mounted at the forward end of the tanks, contains a fuel pump and motor, fuel strainer, selector valve, control switch and indicator light. Fuel is routed from the Benson tanks, through the selector valves and check valves, to a "tee" connection in the line from the external drop tanks to the main tanks. Power for the system is 28-volt dc, with circuit protection through a fuse on the main electrical equipment panel above the right wheel well.

In addition, a fuel dump system is provided for each Benson tank. When the manually operated fuel dump valves are opened, fuel is jettisoned through sections of hose and out the aft troop door.

AUXILIARY FUEL LONG RANGE SYSTEM (A/A45Y-1 EQUIPPED AIRCRAFT).



The UC-123K aircraft is equipped for long range ferry missions by utilizing the 1000-gallon spray tank as an auxiliary fuel tank. Refer to figure 1-14. When the spray system is used for this purpose, the following components are added to the configuration: fuel strainer, fuel pump, fuel selector valve, a fuel pump switch and indicator light and fuel lines to the nacelle tanks. These added parts with exception of

the fuel lines are located on a fuel panel (figure 1-15) which is mounted on the aft left side of the spray unit base. During operation, fuel is pumped from the tank through the spray tank drain line and a filter, to the manual fuel selector valve. From that point it is routed to either nacelle tank, depending upon the setting of the manual valve. A vent line is routed from the top of the spray tank to the aircraft exterior. The dump system as described in Section IV for the spray configuration may also be used to dump fuel should an emergency warrant such action.

JET FUEL SYSTEM.

The jet engines are provided with a separate fuel system (figure 1-17), which is independent of the reciprocating engine fuel system, except that both systems use the same nacelle tanks for normal fuel supply. Each nacelle tank normally supplies fuel to the engine on its respective side and/or the engine on the opposite side during crossflow operation. The specification and grade of fuel used in operation of the aircraft are given in Servicing, Figure 1-62.

SYSTEM COMPONENTS.

Each nacelle fuel tank contains an electrically operated jet engine fuel boost pump, lines, check valve, fire wall shutoff valve, fuel filter and jet engine fuel control unit (figure 1-17).

Jet Fuel Boost Pumps.

Fuel is supplied to the jet engines by two electrically operated submerged boost pumps, one in each nacelle fuel cell. These pumps have no connection with the reciprocating engine fuel system. Electrical power to operate the pumps comes from 28 vdc flight emergency bus. The pumps are controlled by the jet fuel boost pump switches.

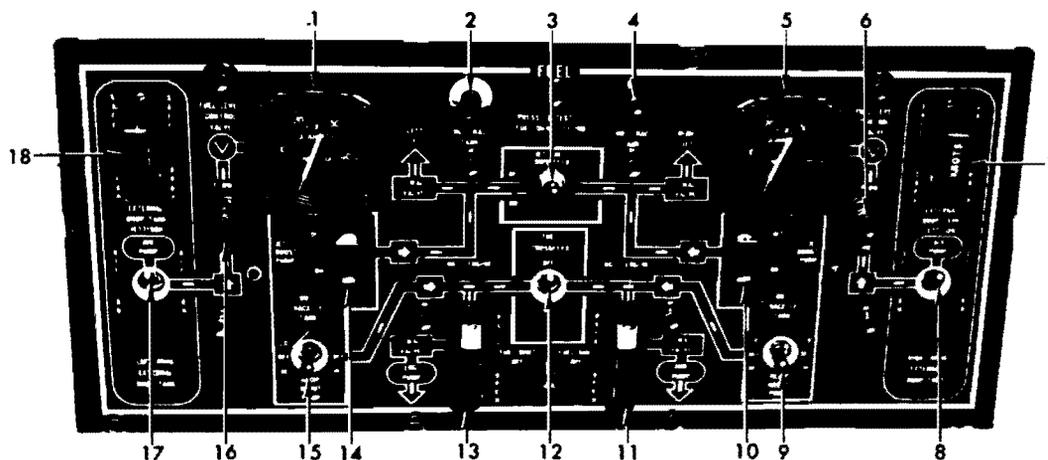
Note

The nacelle tank boost pump switches have no control over the operation of the jet engine boost pumps.

Jet Fuel Boost Pump Switches.

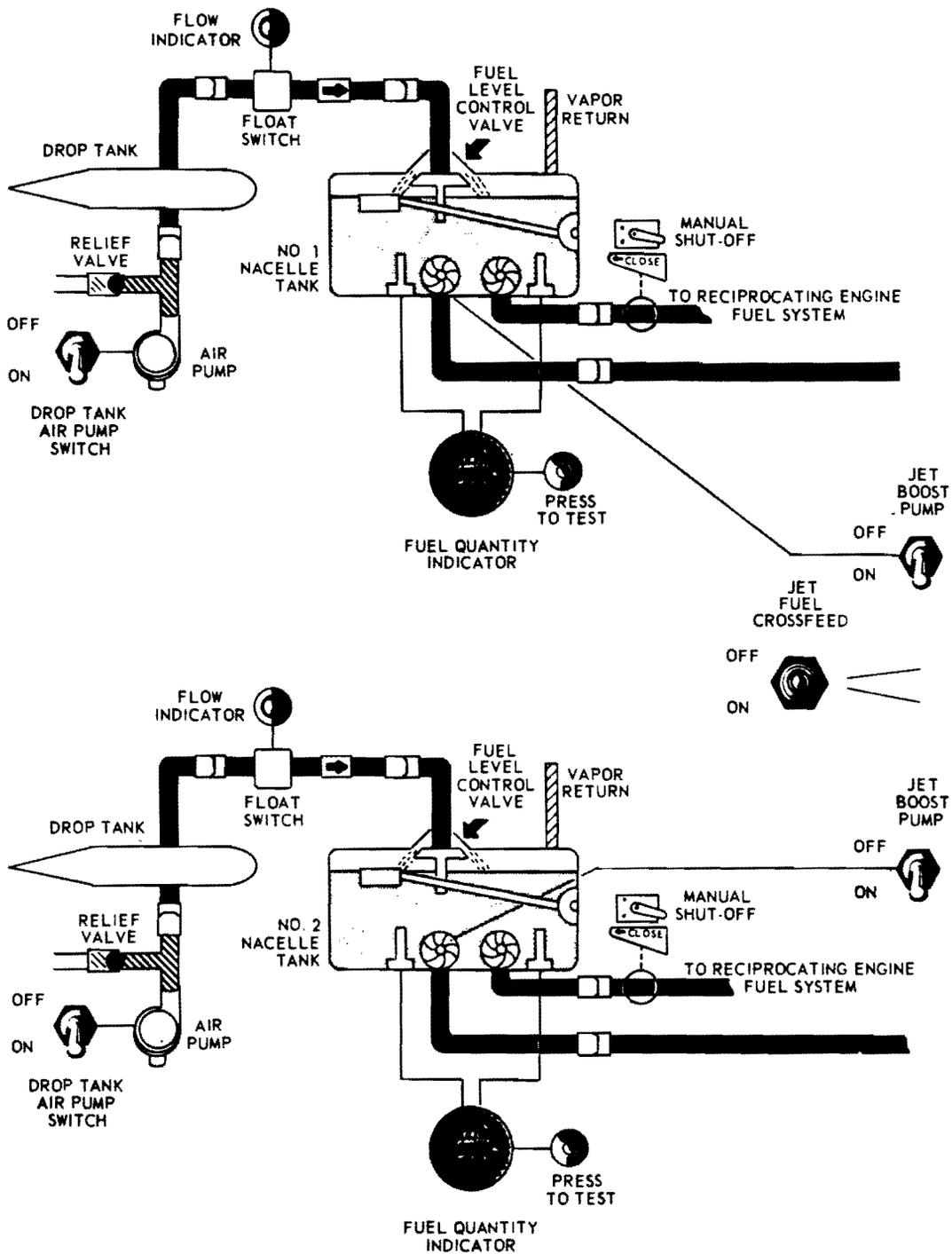
Two guarded jet fuel boost pump switches, located on the fuel selector panel, (figure 1-16), control their respective jet fuel boost pumps. These two-position switches, placarded ON and OFF, energize the jet fuel boost pumps when in the ON position.

FUEL SELECTOR PANEL



- | | |
|--|--|
| 1. FUEL QUANTITY INDICATOR (NO. 1 NACELLE) | 10. JET ENGINE BOOST PUMP (NO. 2 NACELLE) |
| 2. FUEL QUANTITY PRESS-TO-TEST BUTTON (NO. 1 NACELLE) | 11. FUEL SHUT-OFF SWITCH (NO. 2 RECIPROCATING ENGINE) |
| 3. JET FUEL CROSSFEED SWITCH | 12. RECIPROCATING ENGINE FUEL CROSSFEED SWITCH |
| 4. FUEL QUANTITY PRESS-TO-TEST BUTTON (NO. 2 NACELLE) | 13. FUEL SHUT-OFF SWITCH (NO. 1 RECIPROCATING ENGINE) |
| 5. FUEL QUANTITY INDICATOR (NO. 2 NACELLE) | 14. JET ENGINE BOOST PUMP SWITCH (NO. 1 NACELLE) |
| 6. FUEL FLOW INDICATOR LIGHT (FROM RT. EXTERNAL DROP TANK) | 15. RECIPROCATING ENGINE BOOST PUMP SWITCH (NO. 1 NACELLE) |
| 7. EXTERNAL DROP TANK JETTISON SWITCH (RIGHT WING) | 16. FUEL FLOW INDICATOR LIGHT (FROM LEFT EXTERNAL DROP TANK) |
| 8. EXTERNAL DROP TANK AIR PUMP SWITCH (RIGHT WING) | 17. EXTERNAL DROP TANK AIR PUMP SWITCH (LEFT WING) |
| 9. RECIPROCATING ENGINE BOOST PUMP SWITCH (NO. 2 NACELLE) | 18. EXTERNAL DROP TANK JETTISON SWITCH (LEFT WING) |

Figure 1-16



JET FUEL SYSTEM

Figure 1-17 (Sheet 1 of 2)

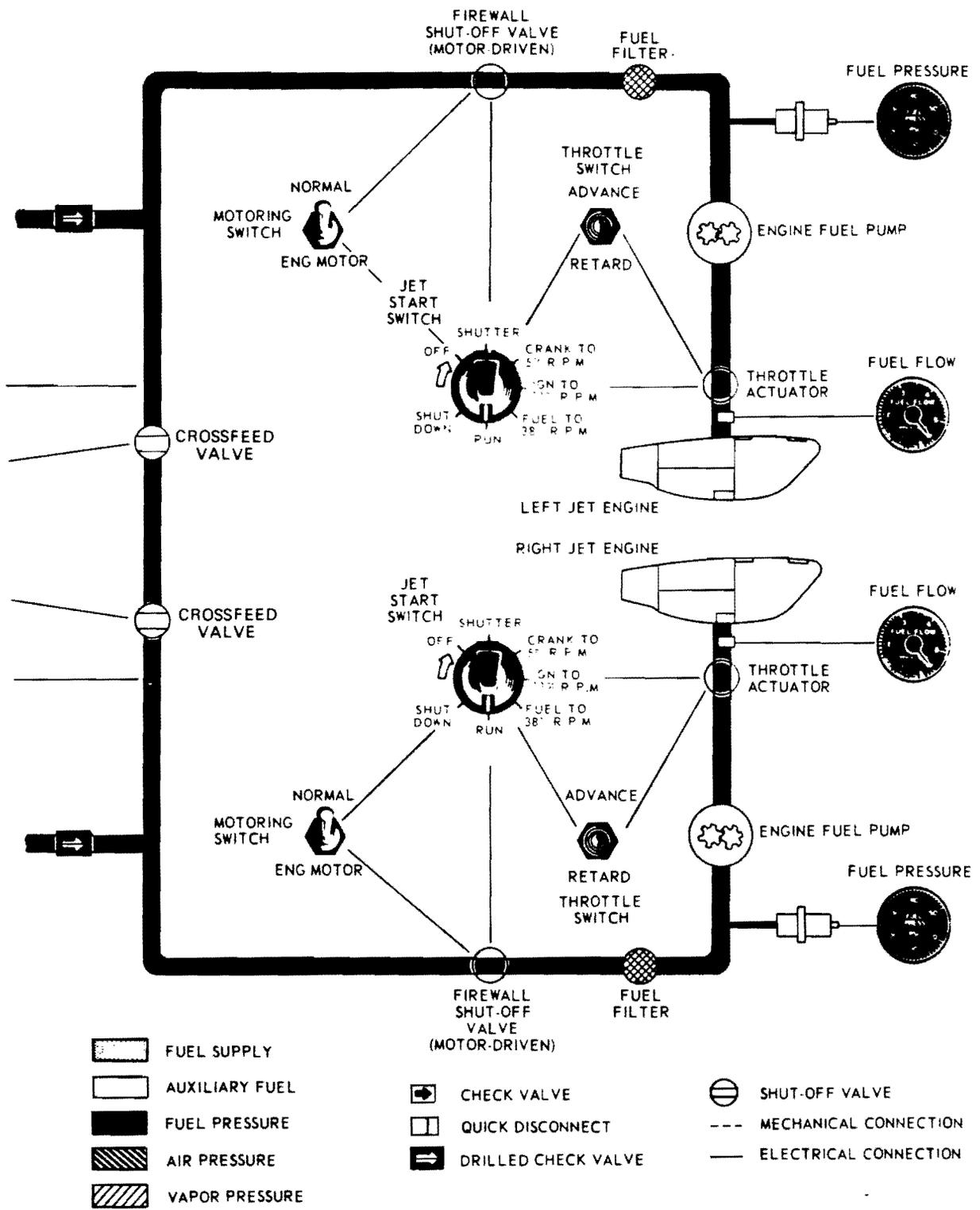


Figure 1-17 (Sheet 2 of 2)

Jet Fuel Firewall Shutoff Valves.

Fuel flow to the jet engines can be shut off by a motor-driven valve in each jet engine fuel supply line. These valves, located in the wing directly above the jet engine pylon, are electrically operated with 28-volt dc power from the flight emergency bus and are individually controlled by the jet engine start switches in the crew compartment. The valves remain closed until the start switch is positioned to SHUTTER. This switch position opens the valve allowing fuel to reach the jet engine for starting. All fuel flow is shut off at the valve by positioning the start switch to SHUT-DOWN.

Note

The fuel shutoff switches on the overhead fuel selector panel in the crew compartment have no control over the flow of fuel to the jet engines.

JET FUEL CROSSFEED VALVES.

Two crossfeed valves are installed in the crossfeed line connecting the jet engine fuel systems. The valves are controlled by the jet fuel crossfeed switch located on the fuel selector panel. Power to operate the crossfeed valves is supplied by the 28-volt dc flight emergency bus.

JET FUEL CROSSFEED SWITCH.

A two-position switch (figure 1-16), placarded ON and OFF and located on the fuel selector panel, controls the two jet fuel crossfeed valves. Positioning the switch in the ON position opens the crossfeed valves. Both jet engines can now be supplied by one nacelle tank by energizing the jet fuel boost pump in the desired tank.

JET FUEL SYSTEM OPERATION.

When the jet fuel crossfeed valves are closed, each engine is supplied by its respective fuel boost pump. When the jet crossfeed valves are open, the selected nacelle tank and boost pump directs fuel to either or both jet engines. Two check valves in the jet fuel lines prevent fuel being pumped from one nacelle tank to the other.

ELECTRICAL SYSTEM.

Basically, the electrical power demands of the aircraft are met by engine-driven 28-volt dc generators. A battery and an auxiliary power unit are provided to supply power during special or emergency situations. During stationary ground operation, an external power source may be connected. The dc power from any of the sources is normally supplied to the 28-volt dc busses, by which it is distributed throughout the aircraft. Whenever practical, the aircraft's electrical equipment employs 28-volt dc power directly. To supply power for ac equipment, the 28-volt dc supply is used to drive 115-volt, 400-cycle single-phase and three-phase inverters. Power for electrical control of the jet engines, jet engine fuel system, and jet engine pod anti-icing system is obtained from the flight emergency bus through the jet junction box (figure 1-31). The junction box is located on the right side of the fuselage in the cargo compartment forward of the main landing gear wheel well area. The junction box contains circuit breakers and relays necessary for operation of the jet engine systems. Circuit breakers, located on the ac relay and circuit breaker panel at the forward end of the left main landing gear wheel well, provides jet engine instrumentation power from the primary single-phase 115-volt ac bus and the 26-volt ac bus.

DC POWER SYSTEM.

The aircraft's 28-volt direct current electrical system is the single-wire, ground-return type generally employed in modern aircraft. A battery, generators and an auxiliary power unit comprise the major power source components of the system. To assume the power load during ground operation, an external power receptacle is provided on the right side of the fuselage immediately forward of the main gear well. The voltage in the system is automatically regulated to provide a constant output throughout the rated load range of the engine-driven generators. Heavy interconnecting wiring between strategically located junction boxes forms the medium of dc power distribution. A flight emergency bus is provided to assure continued operation of essential equipment directly from the battery in the event all generators fail. The primary and flight emergency busses are normally connected together whenever the aircraft is on the ground or any generator is operating in flight; they are automatically separated if a complete generator failure occurs in flight, and only the flight emergency bus remains connected to the battery. An emergency communications bus is provided for UHF command, VHF command, and interphone operation. This bus is normally con-

ected to the primary bus, and, therefore, is automatically deenergized if all generator power is lost. Should use of this radio equipment become necessary, the emergency communications bus may be energized momentarily from the flight emergency bus. Power for ground blowers, scoop deicing, certain radio equipment, and control of cargo compartment dome lighting is taken from a secondary dc bus which is automatically deenergized at any time less than two engine-driven generators are operating. The automatic disconnect feature may be bypassed manually if use of the above equipment becomes necessary. For circuits affected by the various busses refer to the DC Electrical System, Figures 1-19 through 1-25.

Battery.

A 24-volt, 34-ampere-hour, nickle-cadmium battery is installed in the base of the right electrical equipment compartment forward of the main gear well. The battery is used to start the APU and to provide an emergency source of power for critical instruments if the electrical system should fail. Power for operation of the alarm bells, and troop and equipment drop signal systems is taken directly from the battery, and the battery switch need not be on for operation of this equipment. A quick-disconnect on the battery cable permits complete isolation of the battery for removal.

Reciprocating Engine-driven Generators.

Two 300 ampere, engine driven, wide speed range, direct current generators are installed on the accessory section of each engine. Generators 1 and 3 are installed on the left reciprocating engine and 2 and 4 are installed on the right reciprocating engine. These generators supply the aircraft's total electrical demands during normal operation by supplying the dc busses driving the ac inverters and recharging the battery. A constant 28-volt dc output is delivered by generators 1 and 2 at approximately 1200 rpm. Full 300 amperes are available at 1500 rpm and above.

Note

The generators are capable of sustaining a 50% overload for five minutes; 100% overload for five seconds.

Jet Engine Starter/Generators.

The starter/generator on each jet engine, in addition to providing turbine rotation during starting, furnishes auxiliary dc electrical power when the jets are operating. This 300-ampere, 28-volt power is supplied to the aircraft electrical system through the flight emergency bus.

Note

The generators are capable of sustaining a 50% overload for five minutes; 100% overload for five seconds.

Auxiliary Power Unit.

An auxiliary power unit (figure 1-20), located over the right main gear well, consists of a 200-ampere starter-generator driven by a two-cylinder internal combustion engine. This unit supplies a standby source of dc power during take-offs and landings or during emergency operations. When no external power source is available, the auxiliary power unit may also be used to start the engines and to supply power for ground checks. For full description of APU controls and operation refer to Section IV.

Note

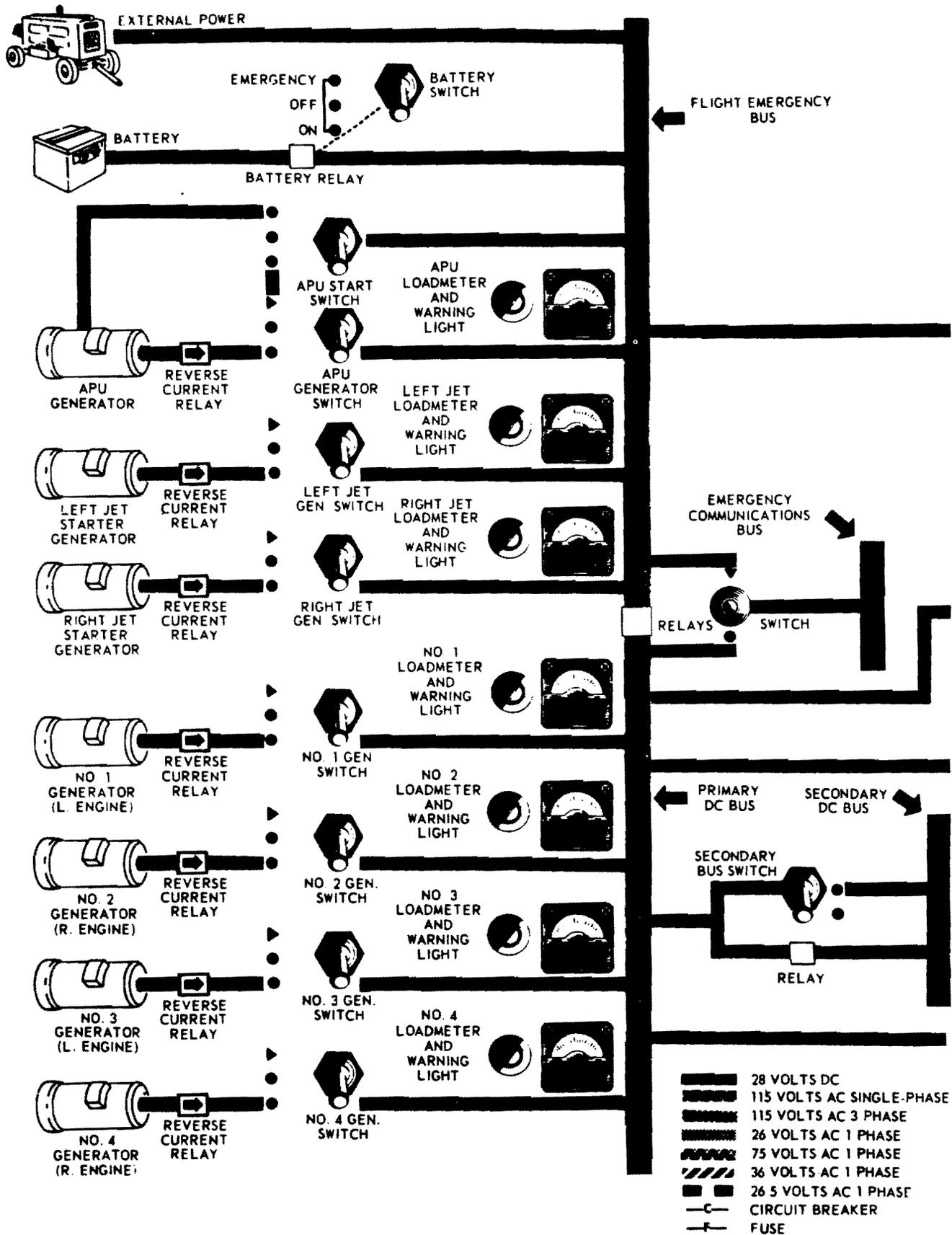
Although the generator is rated at 200 amperes, only 175 amperes are continuously available due to horsepower limitations of the driving engine.

External Power Receptacle.

An external power receptacle (figure 1-20), on the right side of the fuselage forward of the main gear well permits the use of an external generator to supply power to the dc bus during ground operations.

Flight Emergency Bus Relay.

The relay which connects or disconnects the flight emergency bus and the primary dc bus is energized whenever any of the aircraft's generators (reciprocating, jet or APU) are operating and connected to the primary dc bus or the flight emergency bus or the aircraft is on the ground. Energization of the relay when the aircraft is on the ground results from the operation of the drag link switch on the forward wall of the right wheel well and operation of the downlock switch on the right gear assembly. The micro-switch in the right drag brace affecting the flight emergency bus relay closes whenever the gear is retracted or the aircraft is on the ground. The right downlock switch is closed whenever the right main gear is down and locked. Consequently, the aircraft's right main gear must be down and locked and the aircraft must be on the ground in order to have the flight emergency bus and primary dc bus connected together when no generator is operating. This allows external ground power to power all of the busses.



ELECTRICAL FLOW diagram

Figure 1-18 (Sheet 1 of 2)

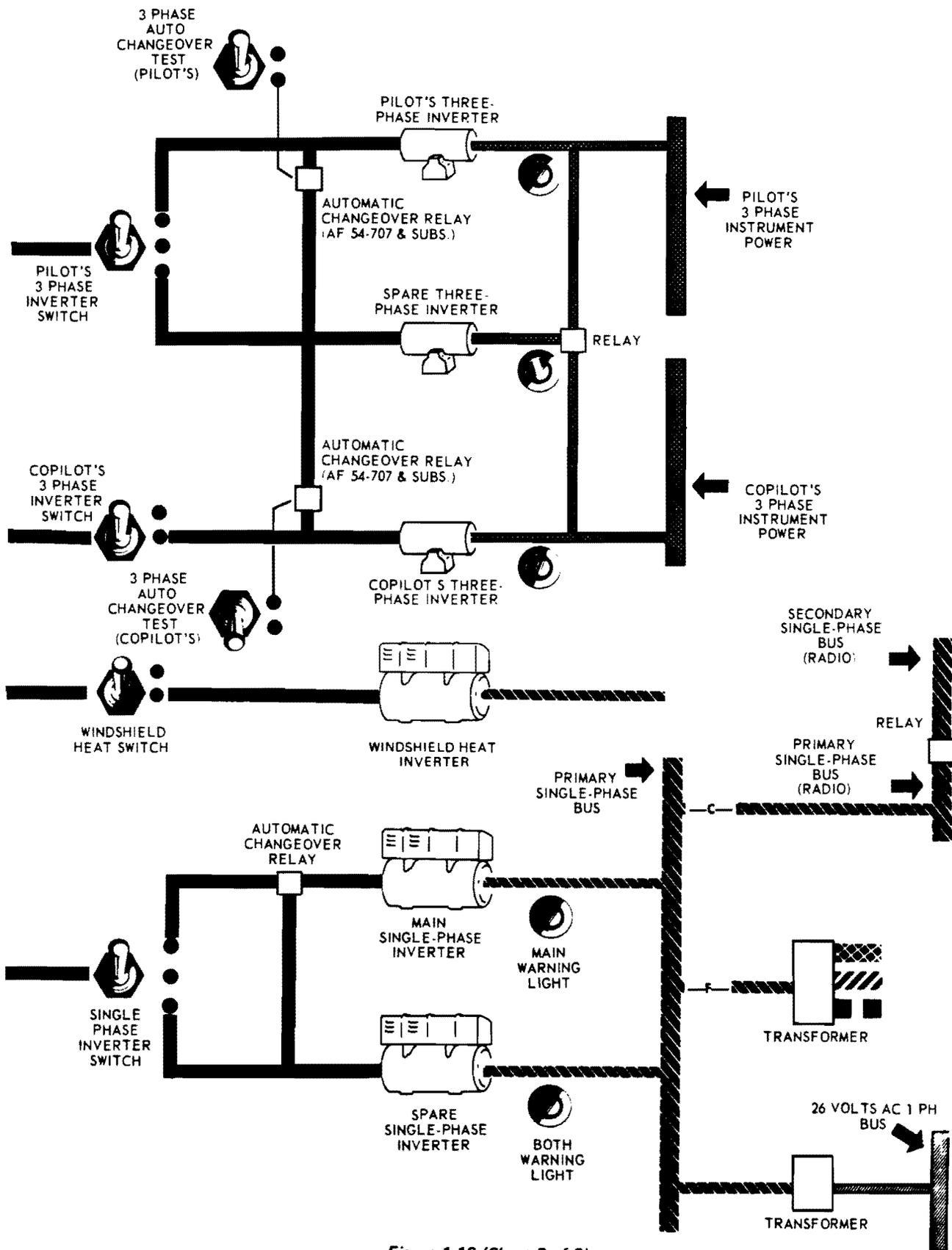


Figure 1-18 (Sheet 2 of 2)

Reciprocating Engine Generator Switches and Warning Lights.

Guarded generator switches on the copilot's instrument panel control engine-driven generator operation. The switches (figure 1-58) have OFF, ON and RESET positions. The OFF position of any switch disconnects the corresponding generator from the primary dc bus. The ON position permits the generator output to supply power to the dc bus. The RESET position, which is a momentary contact position, resets the generator field control relay preparatory to reconnecting the generator to the bus after an over-voltage condition has tripped the field control relay. Red warning lights (figure 1-58), one for each generator, are mounted adjacent to the generator switches. These lights indicate by glowing that the corresponding generator has been disconnected from the primary dc bus.

Jet Engine Generator Switches and Warning Lights.

Two generator switches (figure 1-58), located on the copilot's instrument panel, are placarded ON, OFF, and RESET. The generator supplies electrical power

to the flight emergency bus when the switch is placed ON. The OFF position removes the generator from the bus.

The RESET position resets the generator control unit.

Two red warning lights above the generator switches illuminate when the generators are disconnected from the flight emergency bus and generator switches are ON. The light goes out when the switch is moved to OFF.

Secondary Bus Switch.

A guarded, two-position, secondary bus switch (figure 1-58), is mounted on the copilot's instrument panel. The switch positions are NORMAL and MONITOR. In NORMAL position of the switch, the secondary bus is automatically energized by the primary bus whenever two or more reciprocating engine generators are connected to the primary dc bus. Loss of output from all but one of the reciprocating engine generators will automatically cause the secondary bus to be deenergized. However, should operation of the equipment supplied by the secondary bus become necessary, the secondary bus may be reenergized by positioning the switch to MONITOR, thus bypassing the automatic disconnect feature. The secondary bus supplies 28-volt dc power for the ground blowers, air scoop ice guard, control of cargo compartment lighting, certain radio equipment, radar altimeter, TACAN, TALAR, liaison, VOR, and the secondary ac bus relay.