SUBJECT

LANDING GEAR

1. The landing gear consists of two independent units, one mounted under each nacelle. The gear retracts into the nacelles leaving only the bottom of the wheels projecting. Each wheel is mounted on two shock absorber struts of the oleo type. The retracting mechanism is hydraulically operated, employing the constant flow system actuated by an engine driven pump. An indicating system consisting of a warning horn and four warning lights is provided to enable the pilot to ascertain the position of the landing gear.

2. Safety latches are provided to lock the wheels in the safe landing position. The retracting gear operates positively in both directions and requires less than 30 seconds to fully retract or extend. (Automatically engaging flight wheel brakes are incorporated to prevent the wheels from rotating after they are retracted).

Landing Gear Hydraulic Control Handle

3. The landing gear hydraulic control handle is located on the hydraulic control panel between the wing flap control and the hydraulic hand pump. Its motion corresponds to that of the wing flap control valve except that it cannot be placed on the UP position when the landing gear safety latch is in place. The control should be left in the NEUTRAL position in flight at all times when it is not in use. When the airplane has come to rest on the ground, place the landing gear control in the DOWN position and ensure that the safety latch lever is clipped to the floor. This will prevent rise or fall of pressure in the landing gear retracting struts caused by changes in air temperature.

Landing Gear Safety Latch Control

4. When the landing gear is fully extended, the upper landing gear truss is hooked to the front spar by means of a safety latch. The latch is controlled by a lever which is mounted on the floor to the right of the Captain's seat. When the lever is full forward (parallel to the floor) the latch is held in place under positive lock. The landing gear cannot be raised with the latch lever in this position as the landing gear control handle is locked by means of a mechanism interconnecting the safety latch and the landing gear control. At no time attempt to lower the landing gear with the latch locked to the floor (POSITIVE LOOK POSITION).

5. Releasing the clip which locks the safety latch lever to the floor allows the lever to assume a position making approximately a 45 degree angle with the floor (SPRING LOCKED POSITION). In this middle position, the latch is under spring loading, but the landing gear control is still locked against up movement, although it may be moved down.

(CONTINUED)

LANDING GEAR

6. The third position of the latch lever is full back (LATCH RAISED), in which position the safety latch lever is almost vertical. In this position, the latch is pulled clear of the retracting strut hook and the landing gear control handle is no longer locked.

7. The landing gear safety latch should be locked to the floor at all times when the airplane is on the ground. It should not be unlocked during take-off until the aircraft is airborne and the Captain orders "GEAR UP".

Landing Gear Indicating Mechanism

8. A horn located on the forward side of the bulkhead behind the First Officer's seat will sound whenever the throttles are closed if one or both sides of the Landing Gear are retracted, unlatched, or the control handle is not in the NEUTRAL position. The horn is operated by fine switches; one on each landing gear truss, one on each throttle control and one on the landing gear control handle. Red and green lights on the instrument panel also form part of the indicating system. The indicating system will operate as follows:

(1) Both wheels up, landing gear control in "NEUTRAL"; red lights will remain "ON". The horn will sound when one or both throttles are closed.

(2) Both wheels down and not locked, control - "NEUTRAL"; red lights "ON". Horn will sound when one or both throttles are closed.

(3) Both wheels down and locked, control not in "NEUTRAL"; red lights "ON". Horn will sound when one or both throttles are closed.

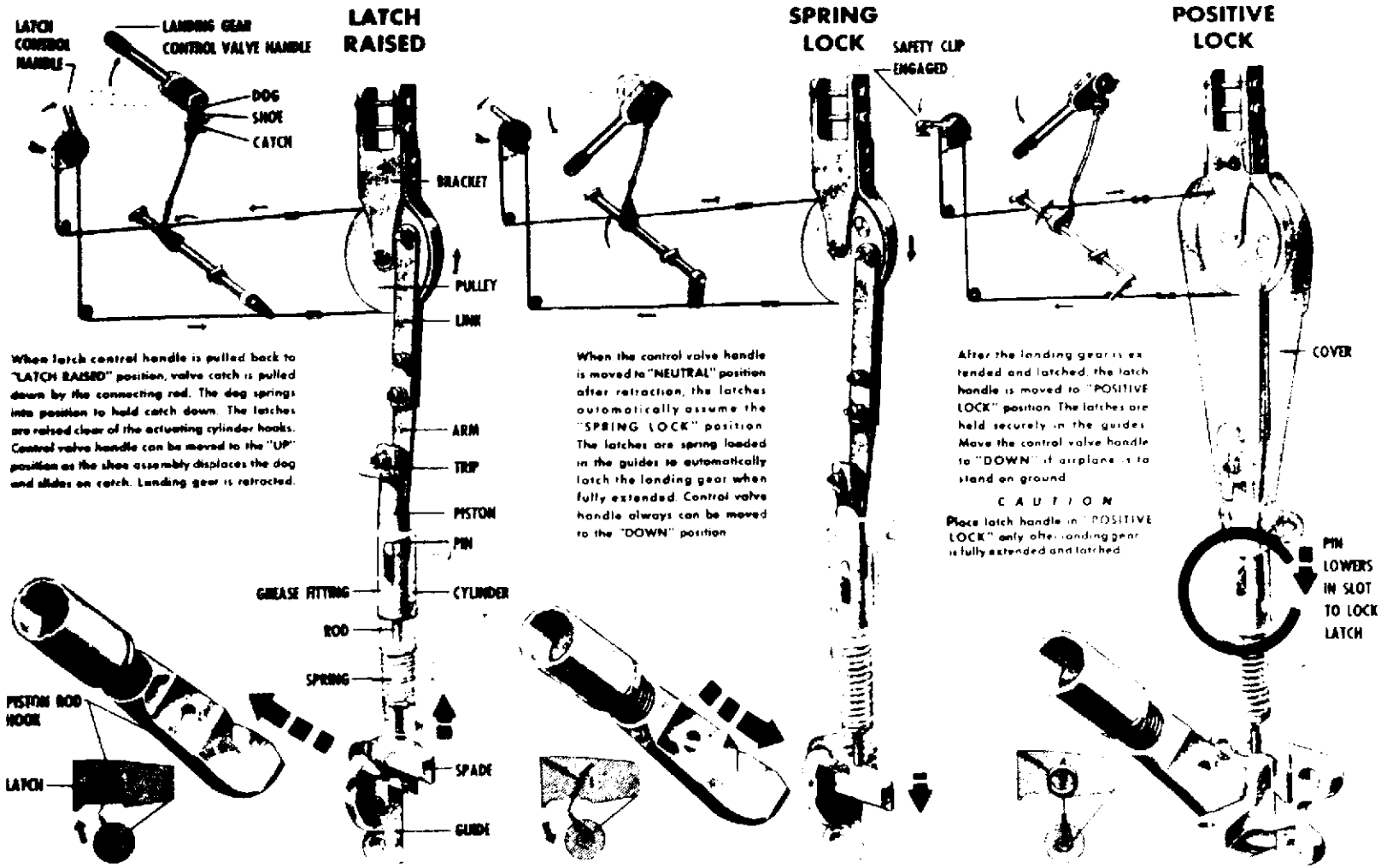
(4) One wheel down and locked, control in NEUTRAL; red light "ON". Horn will sound when one or both throttles are closed.

(5) One wheel down and not locked, control in NEUTRAL; red light "ON". Horn will sound when one or both throttles are closed.

(6) Both wheels down and locked, control valve in NEUTRAL; green light "ON". Horn will not sound.

Heavy Landing

9. If a heavy landing has been made, it must be reported to Maintenance, who will immediately examine the main landing gear, its attachments and adjacent main structure for evidence of possible damage.



LANDING GEAR SAFETY LATCH

DC-3

Landing Gear Retracting Procedure

12. Pull latch lever full back to the LATCH RAISED position. Red Lights will go "ON"

13. Swing landing gear control handle out and up from the NEUTRAL to the UP position. - Wheels will retract if lines are under pressure.

14. Move landing gear control to NEUTRAL position as soon as landing gear is fully retracted. Safety latch will snap back to "SPRING LOCKED", and red lights will stay "ON".

15. If, for any reason, the landing gear cannot be retracted with engine pump pressure, operate the hydraulic hand pump. Place landing gear control in NEUTRAL when operation is completed.

16. At frequent intervals during flight, the Captain and First Officer should visually check the position of the landing gear in the nacelles. If a wheel has lowered, pull the latch lever full back to the LATCH RAISED position and move the landing gear control to the UP position. Return control valve to NEUTRAL.

NOTE: During a normal take-off, the time required to retract the landing gear during a steady climb at 120 mph I.A.S. (105k) is 11½ seconds.

Landing Gear Extension Procedure

17. Move landing gear control lever from NEUTRAL to DOWN; making sure that the latch lever is in the SPRING LOCKED position. If one or both the throttles are closed, the horn will sound and the red warning light will remain "ON" until the wheels are down and latched in the safe landing position, with the control handle in NEUTRAL.

18. Return the control valve to the NEUTRAL position after the pressure in the landing gear down line as indicated on the front gauge reaches 500 pounds. If the wheels are down and latched in the safe landing position, the horn will not sound with the throttles either open or closed, but the red light will go off and the green light will go on.

19. & 20. (Unassigned)

21. Lock the safety latch lever in the floor before landing.

NOTES:

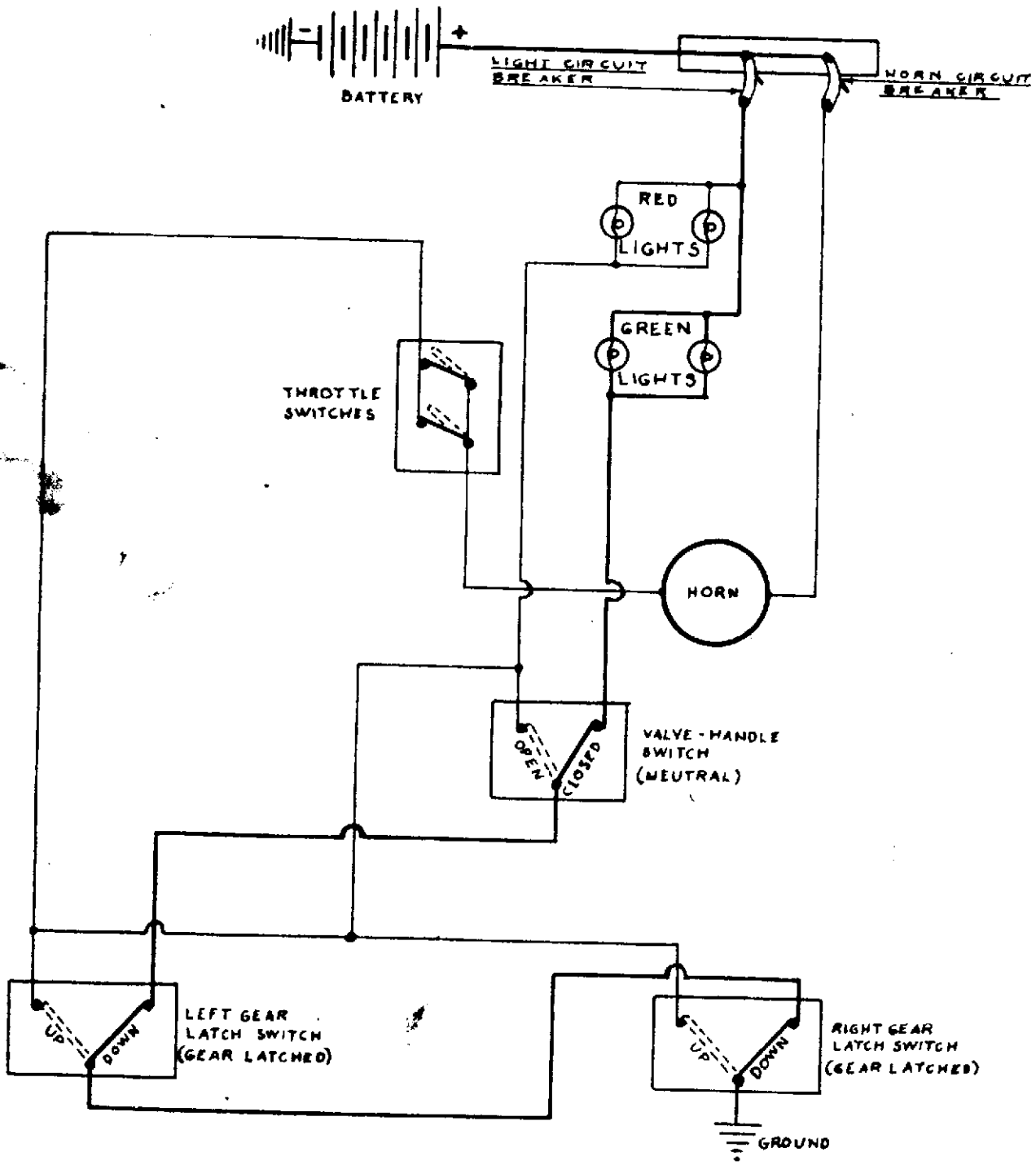
(1) There are times, previous to extending the gear, when the latch lever may inadvertently be pulled up all the way to the LATCH RAISED position instead of allowing it to remain in its normal middle position (SPRING LOCKED) at an angle of 45 degrees to the floor. Under these conditions, the landing gear can be extended, but it will not latch in the down position.

(2) The latch might also be pulled all the way back preparatory to retracting the gear and then, due to circumstances, not be retracted.

(3) When the latch lever is pulled all the way back to the LATCH RAISED position, it is locked in this position by a "dog" at the landing gear control handle. Under the above two conditions, it can be released by either of the following methods:

(a) Reach back and trip the "dog" at the landing gear selector lever by means of the small knob attached to it, which should re-engage the latches.

(b) In the event the operation of the "dog" is found too difficult, raise the landing gear control to the "UP" position slightly which will trip the latch handle. The gear may retract part way, but it is not necessary to wait for the gear to completely retract. If this method is used, the landing gear control lever should be placed in the DOWN position and the extension of the gear completed as in the normal procedure.
(Refer to "GENERAL ATTANGEMENT - Hydraulic System").



SCHEMATIC DIAGRAM
WARNING SYSTEM DC-3 LANDING GEAR

R Vigneau

WINGS FLAPS

1. The wing flap control valve is located on the hydraulic control panel, which is on the right hand side of the aft bulkhead of the Flight Compartment. The flap control valve provides for three positions "UP", "NEUTRAL", and "DOWN". A wing flap indicator is mounted at the left hand side of the instrument panel in front of the Captain's seat. The flap control valve is so mounted that the lever is slightly above the horizontal when in the "NEUTRAL" position. The control lever must be swung out into the aisle in order to clear the slots which hold it in "NEUTRAL" when it is desired to operate the flaps. The control lever should be kept in "NEUTRAL" when not in use during flight but when the airplane is on the ground it should be left in the "UP" position to equalize the pressure in the lines which varies due to thermal expansion.

To Lower the Flaps

2. Move the flap control lever from "NEUTRAL" to "DOWN"

3. When the flaps reach the desired position, as shown on the wing flap position indicator, return the lever to "NEUTRAL"

CAUTION: Do not lower flaps above 112 mph (97 knots) I.A.S.

To Raise the Flaps

4. Move the control lever from "NEUTRAL" to "UP"

5. Return the flap lever to "NEUTRAL" when flaps are fully retracted.

MINIMUM EQUIPMENT REQUIREMENTS FOR SCHEDULED FLIGHTS

1. The information on the following pages is issued as a guide to all concerned and may be used to determine:

   (1) whether a flight should proceed under any given circumstances, subject always to the concurrence of the Captain on the Flight affected.

   (2) the items of serviceable flight equipment required under circumstances where all of the normal complement of flight equipment is not operative.

2. Prior to release of an aircraft by Aircraft Maintenance or Inspection Personnel for dispatch when items of flight equipment are unserviceable or inoperative, the following notification will be given:

   (1) Flight Dispatch will be advised as to the unserviceable or inoperative equipment in order that they may obtain the concurrence of the Captain in accepting the aircraft for flight.

   (2) The Captain will be advised as to the equipment which is inoperative or unserviceable by means of a note to this effect in this effect in the aircraft logbook.

3. When any equipment on the aircraft is known to be inoperative at flight time and it is desired to dispatch the aircraft from a Main Base, Maintenance Base or Maintenance Station for operation without correcting the existing condition, either to prevent a delay or because the means are not available to make the appropriate correction, the aircraft may be dispatched provided that:

   (1) the inoperative unit will not adversely affect the airworthiness of the aircraft, and

   (2) the inoperative unit is not one of the required items of equipment as listed in the following tables under the minimum equipment which must be serviceable prior to dispatch of an aircraft from a Main Base, Maintenance Base or Maintenance Station.

ITEM no	Quantity of equipment which must be serviceable prior to dispatch of an aircraft from a Main Base. V.F.R. Day	V.F.R. Night	I.F.R. Day or Night	FLIGHT EQUIPMENT	Quantity of equipment which must be serviceable prior to take-off of an aircraft from other than a Main Base. V.F.R. Day	V.F.R. Night	I.F.R. Day or Night
1	One	One	Two	Airspeed Indicator	One	One	Two
2	One	One	Two	Electrically Heated Pitot Tube	-	-	Two
3	One	One	Two	Altimeter	One	One	Two
4	One	One	One	Rate of Climb Indicator	-	-	One
5	One	One	One	Magnetic Compass	One	One	One
6	One	One	One	(1) Gyrosyn Compass	Not required if magnetic compass serviceable.		One
	One	One	One	(2) Directional Gyro	Not required if (1) serviceable.		One
7	Two	Two	Two	Engine Tachometer	One, provided both manifold pressure gauges serviceable.		Two
8	Two	Two	Two	Oil Pressure Gauge	One, provided oil pressure warning unit on side of inoperative gauge is serviceable.		
9	Two	Two	Two	Oil Temperature Gauge	One, provided the cylinder head temperature gauge is serviceable on the engine with inoperative oil temp. gauge.		
10	Two	Two	Two	Cylinder Head Temperature Gauge	One, provided the oil temperature and oil pressure gauges are serviceable on the engine with inoperative. Cylinder Head Temperature Gauge.		
11	Two	Two	Two	Manifold Pressure Gauge	One, provided tachometer serviceable, both engines.		Two

ISSUED: January 10, 1957.
EFFECTIVE: January 1, 1957.

ITEM no	Quantity of equipment which must be serviceable prior to dispatch of an aircraft from a Main Base. V.F.R. Day	V.F.R. Night	I.F.R. Day or Night	FLIGHT EQUIPMENT	Quantity of equipment which must be serviceable prior to take-off of an aircraft from other than a Main Base. V.F.R. Day	V.F.R. Night	I.F.R. Day or Night
1	One	One	Two	Airspeed Indicator	One	One	Two
2	One	One	Two	Electrically Heated Pitot Tube	-	-	Two
3	One	One	Two	Altimeter	One	One	Two
4	One	One	One	Rate of Climb Indicator	-	-	One
5	One	One	One	Magnetic Compass	One	One	One
6	One	One	One	(1) Gyrosyn Compass	Not required if magnetic compass serviceable.		One
	One	One	One	(2) Directional Gyro	Not required if (1) serviceable.		One
7	Two	Two	Two	Engine Tachometer	One, provided both manifold pressure gauges serviceable.		Two
8	Two	Two	Two	Oil Pressure Gauge	One, provided oil pressure warning unit on side of inoperative gauge is serviceable.		
9	Two	Two	Two	Oil Temperature Gauge	One, provided the cylinder head temperature gauge is serviceable on the engine with inoperative oil temp. gauge.		
10	Two	Two	Two	Cylinder Head Temperature Gauge	One, provided the oil temperature and oil pressure gauges are serviceable on the engine with inoperative. Cylinder Head Temperature Gauge.		
11	Two	Two	Two	Manifold Pressure Gauge	One, provided tachometer serviceable, both engines.		Two

ISSUED: January 10, 1957.
EFFECTIVE: January 1, 1957.

ITEM No	Quantity of equipment which must be serviceable prior to dispatch of an aircraft from a Main Base. V.F.R. DAY	V.F.R. NIGHT	I.F.R. DAY OR NIGHT	FLIGHT EQUIPMENT	Quantity of equipment which must be serviceable prior to take-off of an aircraft from other than a Main Base. V.F.R. DAY	V.F.R. NIGHT	I.F.R. DAY or NIGHT
26	Each Tank	Each Tank	Each Tank	Oil Tank Measuring Device	-	-	-
27	One	One	One	Log Book (Airplane and Engine)	Temp. Log Sheets	Temp. Log Sheets	Temp. Log Sheets
28	-	-	All	Passenger Cabin and Compt. Lights	-	-	-
29	-	Forward position lights (steady or flashing) and flashing tail lights.	Forward position lights (steady or flashing) and flashing tail lights.	Flashing forward (Red and Green) position lights and (Red and White) tail lights.	-	Forward position lights continuous white tail light.	Forward position lights continuous white tail light (at night).
30	-	Two	Two	Landing Lights	-	One	One
31	-	Two	Two	Three-minute Flares	-	Two	Two (At night)
32				COMMUNICATIONS:			
	One	One	One	(1) Communication Unit	Where V.H.F. ground facilities available (4) can be substituted for (1).		
	Two	Two	Two	(2) Nav. Receiver (Red and Green)	One	One	Two
	-	One	Two	A.D.F.	-	-	One
	One	One	One	(3) Marker Receiver	Not required provided all concerned advised.		
	One	One	One	(4) V.H.F. Communications Unit	Unless specifically required, (1) can be substituted for (4).		

ISSUED: January 10, 1957.

EFFECTIVE: January 1, 1957.

ELECTRICAL SYSTEM FAILURE

1. Battery

(1) The nominal no-load voltage of the two 12 volt batteries in series when fully charged is approximately 26.5 volts. (On the ground, with no generators operating to charge the battery, the indicated voltage should not be less than 22 volts for normal operation of radio and electrical equipment).

(2) It is important that an aircraft be dispatched with a well charged battery. A discharged battery can lead to difficulty during or after take-off if the electrical load is heavy. This becomes particularly important if it is necessary to feather a propeller, since the propeller feathering load is high. With a discharged battery and a high generator load requirement, the additional feathering load may overload the generators and trip the generator circuit breakers, depending on the feathering time. If the propeller does feather, the load requirement on the operative generator with a low battery could be excessively high causing the generator circuit breaker to trip.

2. External Power Supply

Except under abnormal conditions, an external power supply should be plugged in for ground operation and engine starting, to save the aircraft battery for normal enroute operation. The master switch controls whichever source of power is connected, so that, with the external power supply plugged in, the master switch should be "ON".

3. Generators

The generators cut in at an average of 1,000 engine RPM, depending on the battery voltage. The voltage regulators are set at 28 volts, so that this is the normal generator voltage as indicated by the voltameter. The generators deliver their full rated output of 75 amperes each at 1,400 engine RPM. The generators share the load equally and should normally be balanced within 10 amperes. Excessive unbalance indicates that the system requires servicing but does not require action on the part of the flight crew unless the unbalance results in a generator charging rate exceeding 75 amps. or the system voltage exceeds 28.5 volts. The high generator should then be switched "OFF" and the electrical loads reduced so as not to exceed the 75 amps. maximum load rating of the other generator.

4. Both Generators Inoperative

(1) Generator(s) must be operative on take-off but if it is necessary to operate the aircraft en-route with the battery as the only source of electrical power:

(a) Switch off all electrical loads that are not absolutely essential for the operation of the aircraft.

(b) Use only that radio equipment necessary at the time be switching off all other units at the radio circuit breaker panel.

(c) The inverter power requirement is high, and the inverter system can be switched "OFF" in emergency, remembering that those units requiring AC power will be inoperative - both radio compass ADFs, and fluxgate compass.

5. Generator Operation with High Loads

(1) It is important that the generator load be monitored at all times on the ground and in flight to check that it does not become excessive to the point where the generator circuit breakers trip if exceeding the 75 ampere rating.

(2) The capacity of the generators may be exceeded due to heavy electrical loads perhaps coupled with a low battery.

(3) If the circuit breaker(s) should trip:-

(a) Reduce the electrical load requirement as much as possible by switching off non-essential radio and electrical loads.

(b) Set both Generator Switches "OFF".

(c) Set Generator Circuit Breakers "ON".

(d) Set both Generator Switches "ON" <u>together.</u>

(4) If the generator circuit breakers open again when the generators are switched "ON", it may mean that the battery is excessively low, requiring a high battery charging rate from the generator. The procedure then is as follows:-

(a) Set both generator switches "OFF"
(b) Reduce the electrical load requirement to a minimum
(c) Set Battery Master Switch "OFF"
(d) Set Generator Circuit Breakers "ON"
(e) Set both Generator Switches "ON" together.

(continued)

5. This procedure disconnects the low battery from the main bus, relieving the generators of an excessively high load requirement. If the aircraft electrical load can be reduced to an absolute minimum following this procedure the Master Switch can again be set "ON". If the generator load does not exceed 75 amps. on any one generator the high load should start to reduce in a few minutes as the battery becomes charged. If the generator load does not drop within ten minutes it probably means the battery is defective and it may be necessary to set the Master Switch "OFF" and proceed on generators only, keeping in mind that electrical services will become inoperative below generator cut-in speed on landing. Using this procedure, the generator load may be approximately 40 amps. or more, dependent on the electrical circuits in operation.

6. It is important not to allow the battery to become excessively discharged on the ground with the engines inoperative, or idling below generator cut-in speed, or with an aircraft load requirement so high that the generators cannot handle it at relatively low ground operating RPM.

OPERATION IN TURBULENT CONDITIONS

1. In normal level flight, the wing supports a load equal to the weight of the airplane. The load is increased beyond the airplane's weight by manoeuvers such as turns, pull-ups, push-downs and by atmospheric turbulence and gusts.

2. The airplane is designed to withstand loads up to 2-½ times its weight (2½ G or load factor 2.5) which at maximum level flight speed is produced by a 30 foot per second gust. If, at over maximum level flight speed the wing should strike such a gust or if, at maximum level flight speed the wing should strike a gust during a turn or pull-up, the resultant load will exceed the structural limitations, and damage will result.

3. An upward gust has the same effect on a wing as a sudden increase of the wing's angle attack. As the speed at which the wing strikes the gust increases, the change in angle of attack decreases, but the load produced by the change in angle of attack increases as the square of the speed. Thus the resultant additional load is directly proportional to the speed at which the wing strikes the gust.

4. To avoid subjecting the airplane to a load factor which it is not designed to withstand, in turbulent conditions the airspeed must be reduced. However, at low speed the airplane is flying close to the stalling speed, and a sudden increase in angle of attack produced by an upward gust, may precipitate a stall. Therefore the safe speed for flying through turbulent conditions lies between these limitations.

5. The DC-3 is most stable, more manoeuverable and structurally safe in turbulence at 140 MPH I.A.S. (120K) with flaps and wheels up.

6. When reducing speed it is advisable to reduce power and wait for the speed to drop without simultaneously pulling up the airplane. This is to avoid combining acceleration due to the pull-up with that resulting from the turbulence. The reduction in speed should be observed when actually in a turbulent area or when an encounter with a sharply defined front or other area of possible turbulence is anticipated.

7. Flaps should not be used in turbulence, and wheels should not be lowered as the increased drag means a decrease of reserve power for down drafts.