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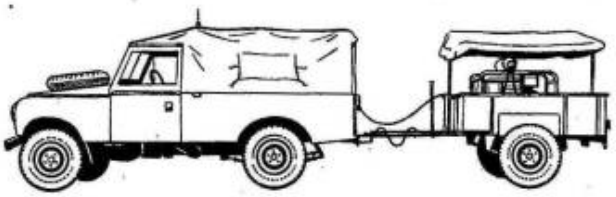

USER HANDBOOK

on

TRUCK, UTILITY, 3/4-TON, GS, (COMMAND) FFR AN/TRC-75 (DUPLEX), LAND ROVER, SERIES 2, 109-IN WB

PRINTED BY DEPARTMENT OF SUPPLY, CENTRAL DRAWING OFFICE, MARIBYRNONG, W.3.

1966

AMENDMENTS

AAO's	Amendment No.	Signature and Date

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SYNOPSIS

This long range Command Radio Station is designed for use in the field by Royal Australian Signals units. It is self contained and tows its own trailer-mounted power supply. Simplex operation can be maintained whilst the vehicle is on the move or stationary. In addition, duplex operation can be carried out when the vehicle is stationary with the aid of an additional static antenna.

General descriptive information and complete operating procedures for the Vehicular Single Sideband Communication System VC-103A (Radio Transceiver AN/TRC-75-Duplex, and Duplex Receiver 651E-1) are included in this User Handbook.

The station can be dismounted from the vehicle and used as a ground station.

NOTE

THIS HANDBOOK IS NOT TO BE USED AS AN AUTHORITY FOR DEMANDING STORES

Act at Once

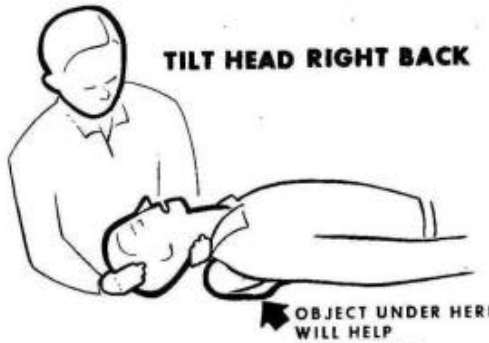
MOUTH-TO-MOUTH RESUSCITATION
OF ELECTRIC SHOCK VICTIMS

Every Second Counts

IF POSSIBLE, SWITCH OFF. PROTECT YOUR HANDS WITH DRY INSULATING MATERIAL AND PULL VICTIM CLEAR OF CONDUCTOR. LAY VICTIM ON HIS BACK. IF NOT EASY TO DO, WORK WHERE HE IS.

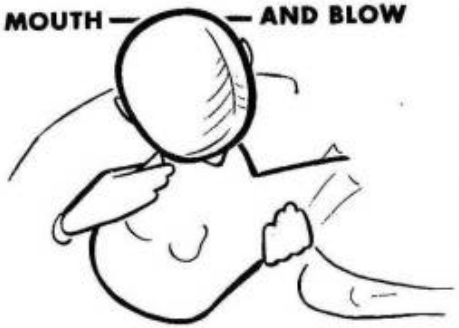
1 QUICKLY CLEAR MOUTH AND THROAT

2 TILT HEAD RIGHT BACK

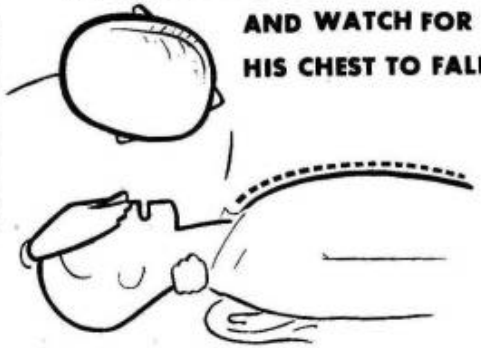


3 PINCH NOSE WITH FINGERS, AND TAKE DEEP BREATH WITH OPEN MOUTH

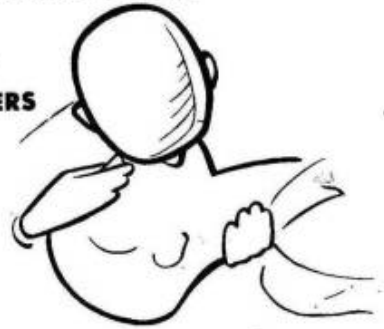
4 SEAL HIS MOUTH WITH YOUR MOUTH — AND BLOW



5 WHEN HIS CHEST RISES TURN YOUR HEAD, LISTEN FOR ESCAPING AIR, AND WATCH FOR HIS CHEST TO FALL



6 INHALE THEN BLOW AGAIN AND CONTINUE CYCLE UNTIL VICTIM RECOVERS



If Help near send for Doctor

MAKE YOUR FIRST 10 BREATHS FAST, THEN ABOUT 10-15 A MINUTE

Do not leave victim until help arrives

THIS METHOD MAY ALSO BE USED FOR DROWNING, SUFFOCATION, STRANGULATION, DRUG OVERDOSE, AND HEART ATTACK

WARNING

THE VOLTAGES EMPLOYED IN THIS EQUIPMENT CAN BE SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. EVERY REASONABLE PRECAUTION HAS BEEN OBSERVED IN DESIGN TO SAFEGUARD OPERATING PERSONNEL. THE POWER MUST BE SWITCHED OFF BEFORE HANDLING CONNECTIONS OR MAKING INTERNAL ADJUSTMENTS. FOR FIRST AID IN CASE OF ELECTRIC SHOCK, SEE THE NEXT PAGE OF THIS HANDBOOK.

(X)

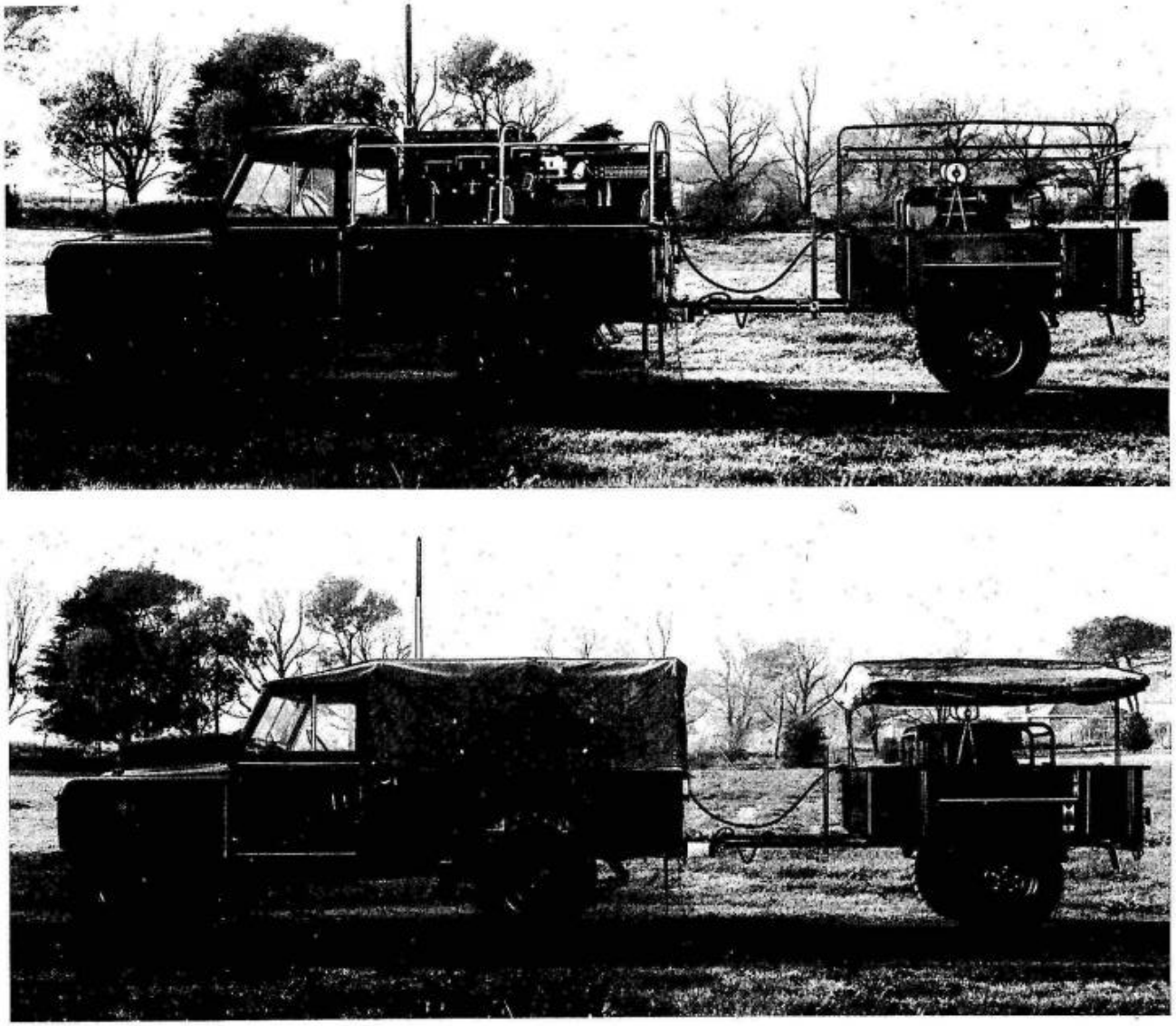


FIG 1 - THE COMPLETE STATION

CHAPTER ONE - GENERAL DESCRIPTION

SECTION 1 - PURPOSE AND FACILITIES

1. The Command Radio Station AN/TRC-75 (Duplex) (Fig 1) is designed for use in the field by RA Sigs units. The station consists of a modified Radio Set AN/TRC-75 (Fig 10), a Duplex Radio Receiver 651E-1 (Fig 14), and the associated equipment detailed in Section 7. It is a self-contained installation and tows its own trailer mounted power supply.

2. The vehicle is issued complete with the installation in an operational condition. The installation may be dismounted from the vehicle for use as a ground station and replaced easily and quickly.

3. The location of the various units of the installation is shown in Figs 3, 4, 5, and 6. The key to the reference numbers on these illustrations is given on page 3.

4. Simplex operation can be carried out whilst the vehicle is on the move or stationary, and double duplex operation can be carried out only whilst the vehicle is stationary.

5. The Radio Set AN/TRC-75 can operate individually to provide simplex transceiver facilities, and the duplex radio receiver unit can be used individually to receive SSB or AM signals. Together the sets provide facilities for duplex operation on two independent sidebands. The upper and the lower sidebands can carry speech, or speech plus VF telegraph signals provided that the appropriate ancillary equipment is made available outside the vehicle.

6. When duplex operation is required, it is necessary to erect a second antenna not closer than one hundred feet to the vehicle mounted antenna. It will be necessary to use at least 20 per cent separation of transmit and receive frequencies.

7. Provision is made for external traffic, when the vehicle is stationary, on the following:-

(a) One two-wire line and one four-wire line. Circuit patching is carried out in the vehicle, by means of the Jack Field Assembly, to determine the type of traffic to be applied to these channels.

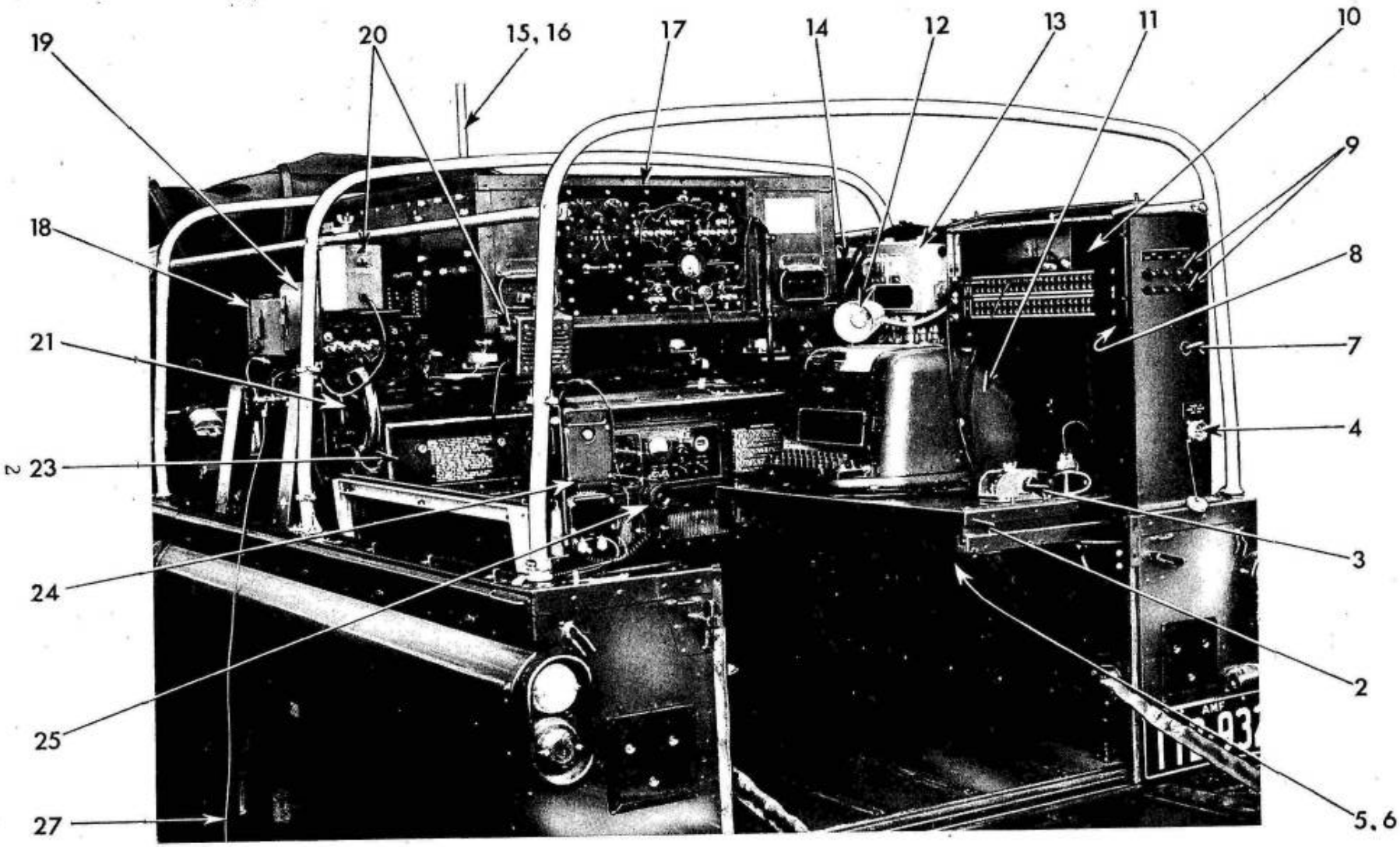


FIG 2 - LEFT-REAR VIEW OF STATION
(Refer to key on page 3)

KEY TO FIGS 2, 3, 4, AND 5

1	-	Vehicle earth terminal
2	-	Sliding Table Top
3	-	Key Telegraph Remote Control 'K' Mk 2
4	-	Primary power input connector
5	-	Junction Box - on underside of table top
6	-	Power Converter 770B-1 on underside of table top
7	-	Hole with grommet, for entry of external lines to Item 8
8	-	Terminals on base of Jack Field Box for 2-way and 4-way external lines
9	-	Terminals for external USB and LSB Send and Receive lines
10	-	Box, Jack Field and Stationery Assembly
11	-	Teletypewriter Set TT-4/TG, A, B, C/TG
12	-	Desk Lamp 'Companion', type BGE D42
13	-	Power Distribution Box
14	-	Network Hybrid Circuit (2)
15	-	Antenna Protective cover
16	-	HF Antenna AT-1011/U
17	-	Duplex Receiver 651E-1
18	-	Filter Band Suppression F-98/U
19	-	Terminal Telegraph TH-5/TG
20	-	Loud Speaker LS-166/U (2)
21	-	Telephone Set 'K' Aust No.1 (A set)
22	-	Support, Duplex Receiver 651E-1
23	-	Radio Set AN/TRC-75 (Duplex)
24	-	Telephone Set 'K' Aust No.1 (B Set)
25	-	Microphone, 602 KK
26	-	Headset and Cord, H70C
27	-	Earth spike lead

(b) Two four-wire lines, one for Send and Receive on the Upper Sideband and one for Send and Receive on the Lower Sideband. These lines are connected through to the Radio Sets and no circuit patching is necessary.

8. The facilities available are:-

(a) In a moving vehicle -

(i) Simplex voice 3A3 A and 3A3 J

(ii) Simplex morse A2 J

(b) In a stationary vehicle -

(i) Simplex voice 3A3 A and 3A3 J from local or remote position.

(ii) Simplex morse A2J.

(iii) Duplex machine telegraphy and duplex voice operation using equipment external to the vehicle.

(iv) Double duplex combined voice and machine telegraphy under the following conditions:-

From within the vehicle

Duplex speech - one side band
One direction machine telegraphy

External to the vehicle

Duplex speech - alternative side band
Duplex machine telegraphy

(v) Direct operation external to the vehicle -

Upper Sideband - Send and Receive
Lower Sideband - Send and Receive

9. Two monitor speakers (Fig 2) are mounted near the radio sets, one for each side band, and two Telephone Sets K (Fig 2) are supplied for termination of incoming telephone lines.

10. The equipment is capable of continuous operation over long period from its own power supply. A rapid and convenient method of selection of the required mode of operation and connection of ancillary equipment to utilize the voice channels, is a feature of the station.

11. Provision has been made for the station to be operated by a member of the crew located in the rear compartment of the vehicle. A further operator is accommodated in the front (passenger) seat. Whilst operating in the static role, the voice operator may be located outside the vehicle and the telegraph operator in the rear compartment of the vehicle.

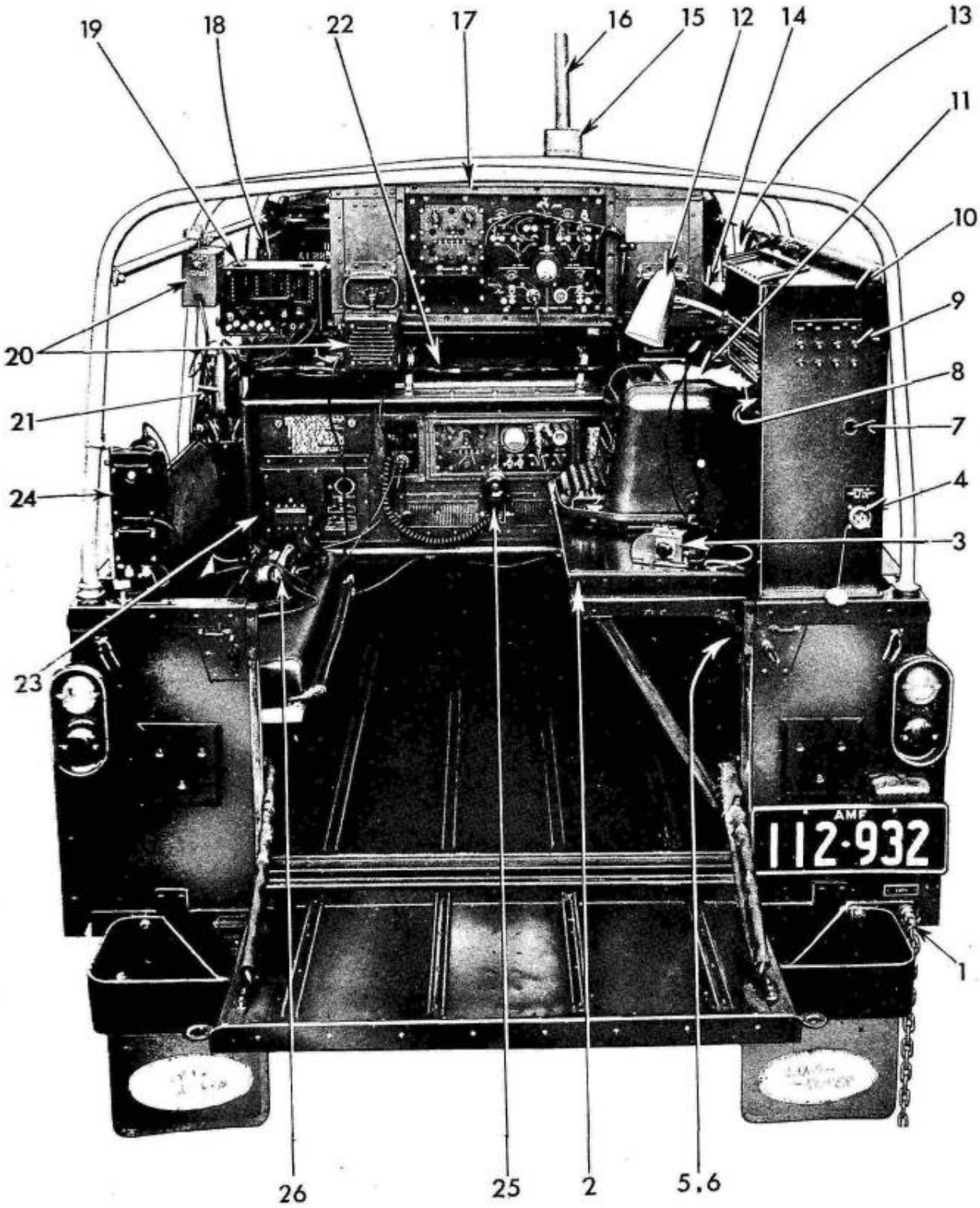


FIG 3 - REAR VIEW OF STATION

(Refer to key on page 3)

SECTION 2 - FREQUENCY RANGE

12. The station provides reliable long range, two-way communicatio in the HF radio band. It has 28,000 directly selectable frequencies in integral 1 kc/s steps from 2.0 Mc/s to 29.999 Mc/s, for both transceiver and receiver.

SECTION 3 - POWER SUPPLY AND REQUIREMENTS

POWER SUPPLY

13. All primary power requirements for the installation are provide by the 5 kVA generator set housed in the trailer drawn by the vehicle, whether the station is operating in the mobile role or in the static mounted or dismounted roles. In NO circumstances must the set be connected to a power supply other than 120V, 400 c/s, 3 phase.

14. The generator set is connected to the installation by a jumper cable, the plug of which connects with the socket (Fig 3, item 4) mounted on the rear wall of the vehicle body. Power is fed from the socket to the Power Distribution Box (see paras 18 to 22). Alternatively, when mounted or dismounted, power may be fed directly to the Power Distribution Box a the sockets are identical.

15. Operation in the mobile role will involve running the generator set whilst the vehicle and trailer are in motion. It will be necessary, however, to stop the vehicle whilst the generator set is started up or when adjustments of its controls are necessary.

16. A description of Generator Set, Diesel Engine, 5kVA, 120V, 400c/s, three phase, four wire, operating instructions, and information o servicing are contained in Chapters Six and Seven. A 100-ft length of cabl is supplied with the generator set (in addition to 10-ft cable), so that the s may be run at a distance from the station, when necessary.

WARNING

Do not connect or disconnect the power jumper lead or any other lead carrying power while the Generator Set is switched on

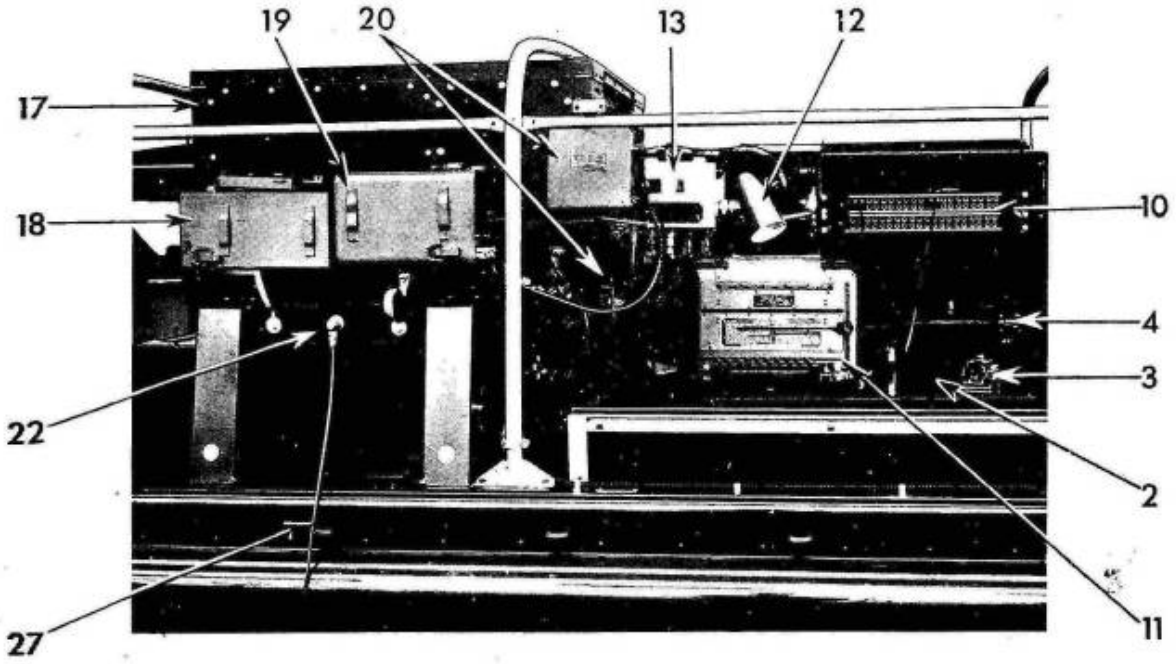


FIG 4 - LEFT VIEW OF STATION

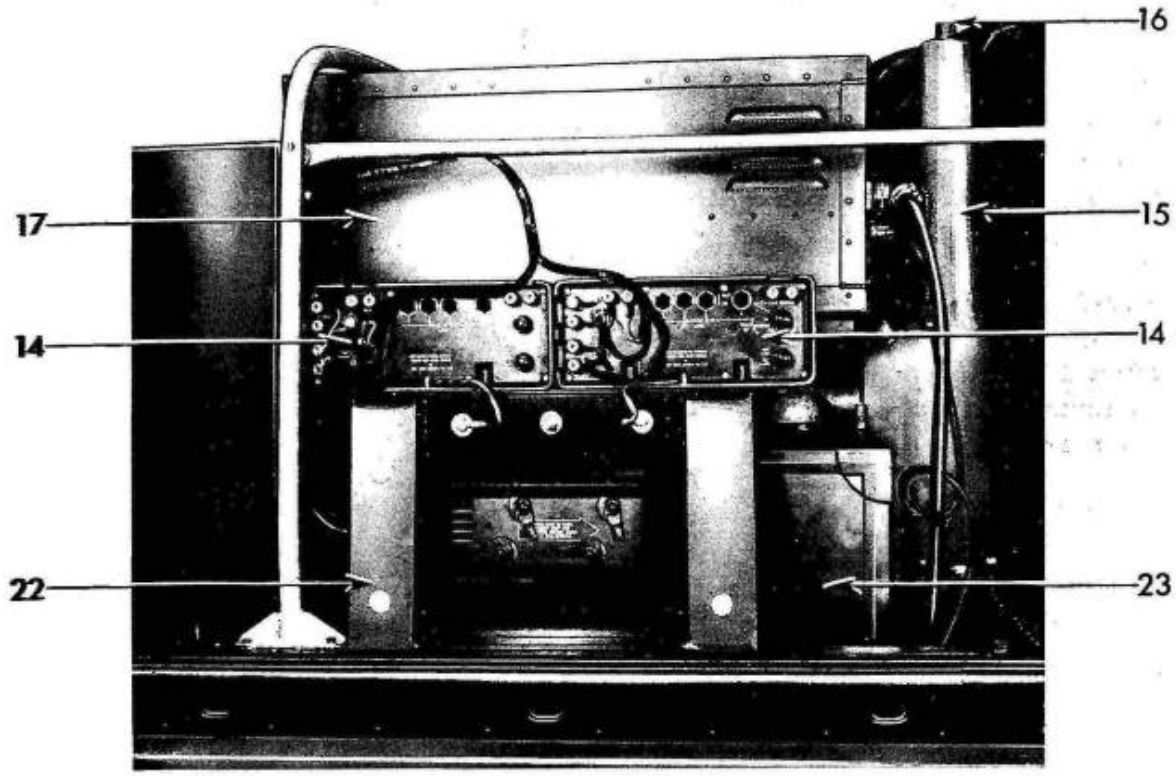


FIG 5 - RIGHT VIEW OF STATION

(Refer to key on page 3)

PRIMARY POWER REQUIREMENT

17. The primary power requirement is as follows:-

120V plus or minus 5V, 3 phase, 4 wire, 400 c/s plus or minus 20 c/s

Standby-receive	445	watts
Tuning	1,490	watts
Transmit	1,435	watts SSB
	2,150	watts AM
	2,390	watts Tone or CW

POWER DISTRIBUTION

General

18. The primary power supply is fed to the Power Distribution Box, either via the connector at the rear of the vehicle or, in the dismounted role, direct from the generator set via the 100-ft cable provided.

19. The locations of the Power Distribution Box in the vehicle and the power connector at the rear of the vehicle are shown in Figs 16 and 2, respectively. A schematic diagram showing the distribution of ac power is given in Fig 6.

Safety Arrangements

20. A link is provided on the Generator Set control panel for earthing the neutral conductor to the generator chassis, and this link MUST be in place. A resistance check between neutral and chassis should show a resistance not greater than 0.2 ohm.

21. Since the installation is completely self-contained a fault which would produce a dangerous voltage between vehicle and trailer or vehicle and earth will produce currents far in excess of those required to trip the circuit breakers. As a further safety precaution all units (including the Generator Set) are bonded to the Receiver Support or the vehicle body. Four earth spikes are provided for connection as follows:-

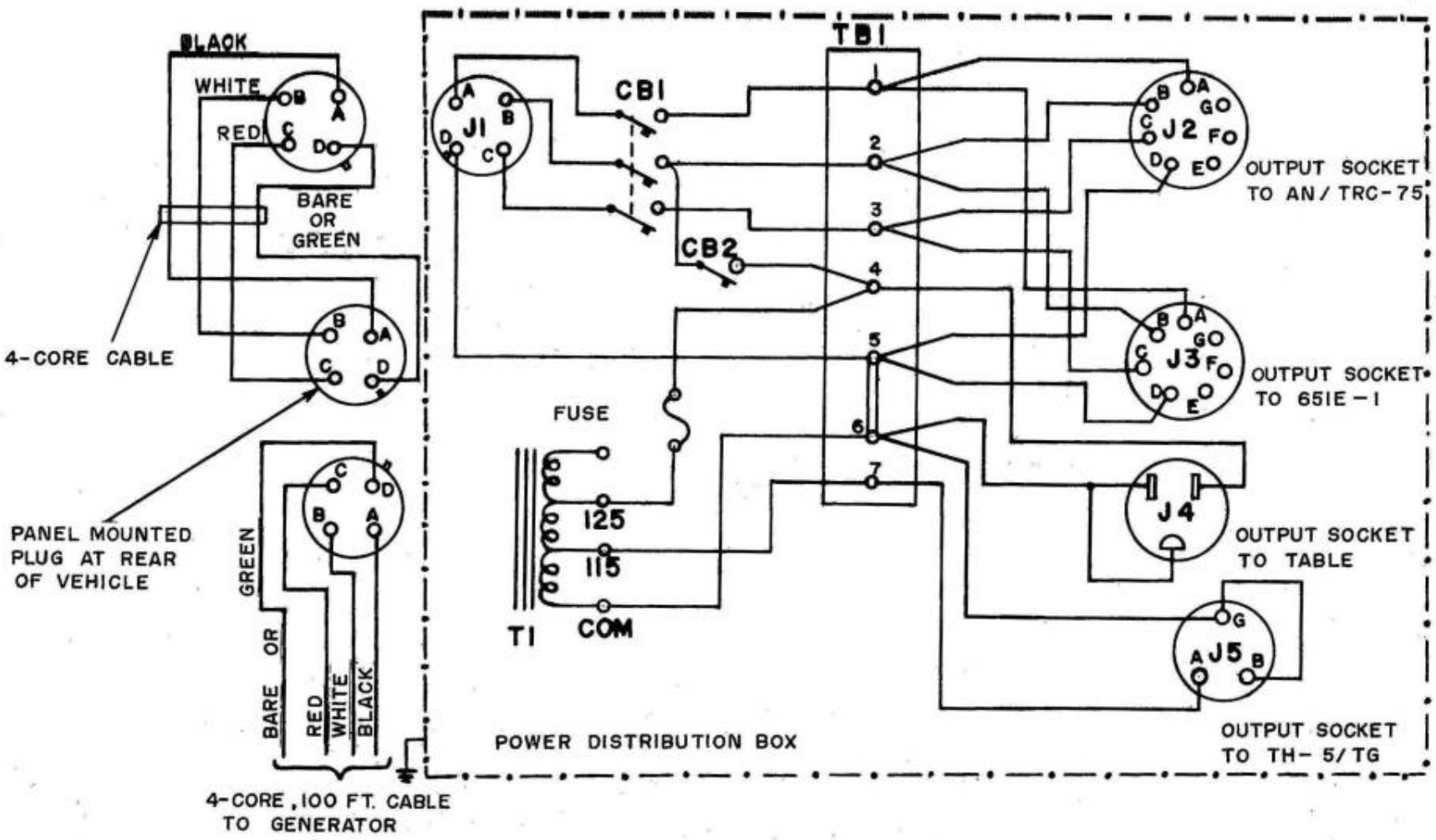
(a) One to each end of the Receiver Support.

(b) One to the vehicle earth terminal.

(c) One to the Ground Stud on the Generator Set Assembly.

22. The bonding cable between the generator chassis and the vehicle chassis provides a guard against a broken neutral conductor. This cable connects between the EARTH terminals on the vehicle and on the generator.

NOTE - See Warning (Page ix) and Shock Treatment (Page viii).



NOTE :- 1. ORIENTATION OF ALL 4-PIN SOCKETS IS KEYWAY OPPOSITE PIN "D"
2. PIN "D" (BARE OR GREEN WIRE) IS NEUTRAL

FIG 6 - DISTRIBUTION OF AC POWER

A long bonding cable (120-ft) is provided for static operation, and a short one (10-ft) for mobile use.

Power Distribution Box (Fig 16)

23. The Power Distribution Box incorporates a 3-phase circuit breaker to isolate the supply from all equipment, distributes the supply to the various equipments, and steps down the supply to the Terminal Telegraph TH-5/TG from 120V to 110V. A separate single phase circuit breaker is provided in the supply to TH-5/TG and the table top.

24. The colour coding of the power wiring follows American standards, and all power wiring must be treated with extreme caution. Black is NOT the neutral conductor, but is an active conductor. The neutral is either bare wire or green.

25. Correct phase sequence must be maintained, or the equipment will not operate correctly. Overspeed of blower motors and poor regulation results are symptoms of incorrect phase connection. Refer to the warning below.

WARNING

In the power cabling between the Power Distribution Box and the 400 c/s diesel generator the following connections must be used -

A - Black	-	Active phase 1
B - White	-	Active phase 2
C - Red	-	Active phase 3
D - Bare or Green	-	Neutral - connected to vehicle frame.

A single earth lead is provided to bond between the vehicle and the trailer, this lead must be connected whenever the equipment is operating (see para 22). A longer single earth lead is provided for use when the generator set is located at a distance from the vehicle.

INCORRECT CONNECTION MAY CAUSE DAMAGE TO EQUIPMENT OR FAILURE TO OPERATE.

Information on the treatment of electric shock is given on page (viii) at the front of the book

Power Converter Unit 770B-1 (Fig 2, item 6)

26. The teletypewriter TT-4/TG, A, B, C/TG (Fig 16) will not operate with a 400 c/s motor supply. The Power Converter Unit 770B-1 is provided to rectify the ac supply and provide a dc supply to the motor. Polarity of the dc supply is not important as the motor will rotate in the same direction for

either polarity. The unit is located on the under side of the sliding table top. Fig 7 shows the distribution of power to units on or adjacent to the table top.

SECTION 4 - ANTENNA SYSTEMS

VEHICLE ANTENNA BASE AND LEAD-IN

Antenna Mast Base AT-1011/U

27. The Antenna Mast base (Figs 8 and 9) is secured by six studs to the Antenna Mounting Plate. The mounting plate is screwed to the Antenna Stand which, in turn is bolted to the forward end of the vehicle body interior.

Lead-in

28. The External RF Conductor and Antenna Post Assembly is shown in Fig 9. The clamp is fitted around the live portion of the antenna base. The antenna post is set in a fixed protective rubber cover. This post fits into the antenna receptacle in the top of Radio Set AN/TRC-75. (See Figs 10 and 12).

Antenna Protective Cover

29. A rubber Mast Boot is fitted over the top of the Antenna base and, when lowered into position, shields the live portions of the antenna base and the conductor (Fig 8).

Vertical HF Antenna 1011/U (Whip antenna)

30. The first section of the antenna is screwed on to the top of the antenna base and further sections screw into each other. The minimum length to be used is 15-ft (four sections). This length is approximately the longest suitable for use in a mobile vehicle. Eight sections (30-ft) are provided for use when the station is operated while the vehicle is stationary. A canvas antenna bag is supplied for stowage of the antenna sections.

RECEIVE ANTENNA

31. A separate receive antenna is used with Duplex Receiver 651E-1 for duplex operation in the static role (see para 6). This antenna must be sited at least 100 ft from the vertical antenna installed in the vehicle. Any suitable antenna may be used for this purpose, eg, 15-ft whip antenna or 45-90 ft long, wire antenna (Mast, Telescopic, 27-ft, may be used). The antenna is connected to the receiver at connector J3 (Fig 26) by the Cable Assembly coaxial, 100 ft (approx) ADE(W)17-52A.

ELECTRIC SHOCK

32. Do not attempt to fasten or unfasten any connectors or adjust any

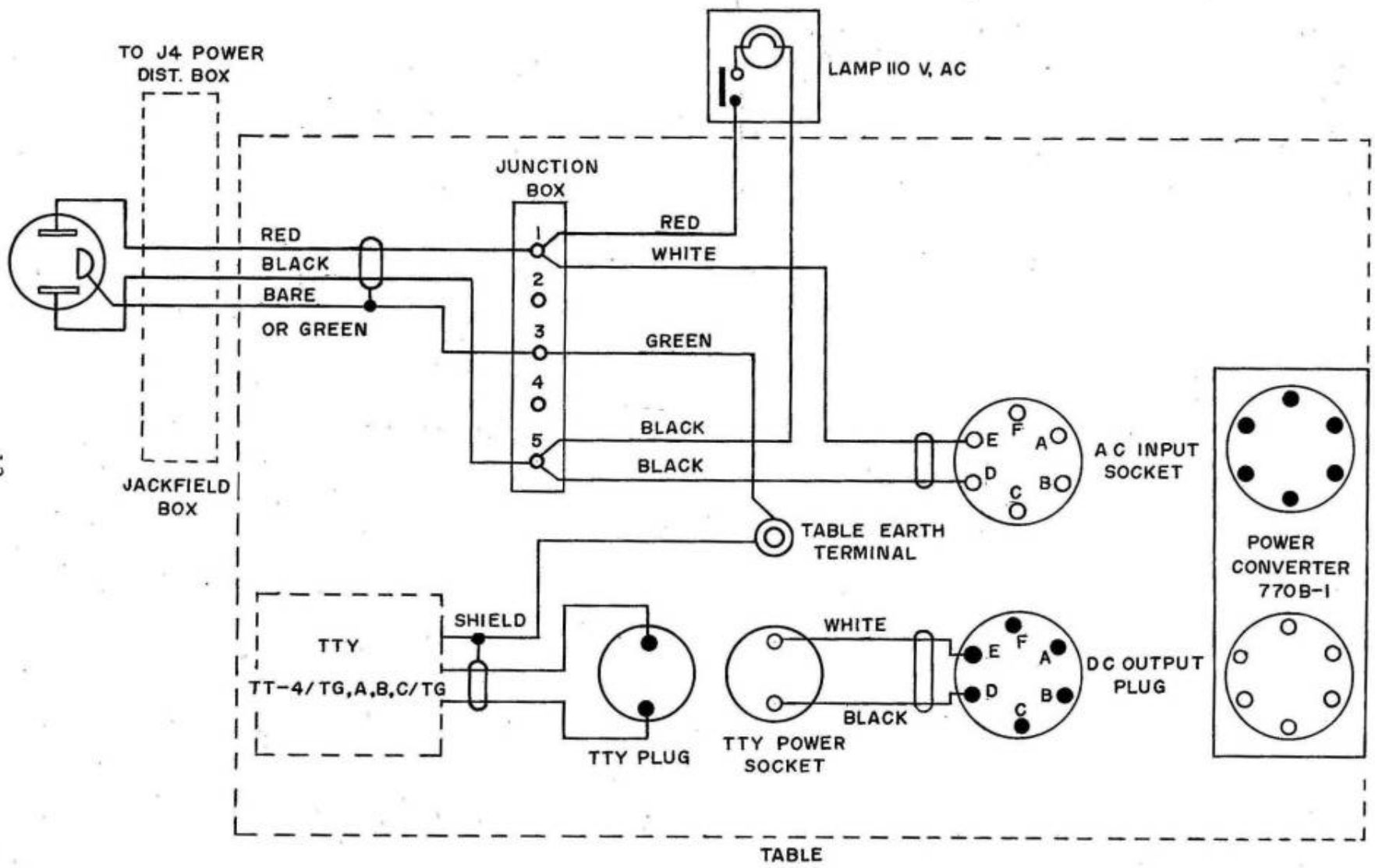


FIG 7 - DISTRIBUTION OF TABLE TOP POWER SUPPLY

part of the antenna, base or conductor strap until it has been verified that the whole installation and power supply are switched OFF. Instructions for the treatment of electric shock are given on page (viii) at the front of this book.

33. The warning printed on the protective cover of the antenna base best describes the position as follows:-

DANGER
HIGH VOLTAGE
DEATH ON CONTACT

34. When operating in the static or mobile roles check that the primary power source or generator earth (Fig 17,cable W10)and the main chassis earth (Fig 3, item 1) are properly connected.

SECTION 5 - INSTALLATION DETAILS

35. The radio set, associated equipment and accessories are listed in the Complete Equipment Schedules 1783, 3074, 3282 and 3572.

36. The following is a list of the main items of equipment included in the station installation kits:-

(a) Radio Set AN/TRC-75 (Duplex)

(b) Duplex Receiver, Radio 651E-1

(c) Headset, Electrical, H-70C/A1C, 7 ohm impedance, 2 earphone

(d) Microphone, Magnetic, 602 KK, 55 dB, 50 ohm

(e) Loudspeaker, Permanent Magnet, LS-166/U (2)

(f) Filter, Band Suppression, F-98/U

(g) Key, Telegraph, Interconnecting Box, remote control unit 'K' (Mk 2)

(h) Network, Hybrid Circuit (2)

(j) Power Converter 770B-1

(k) Power Distribution Box

(l) Telephone Set 'K' Aust No.1 (2)

(m) Teletypewriter TT-4/TG, A, B, C/TG

(n) Terminal Telegraph TH-5/TG

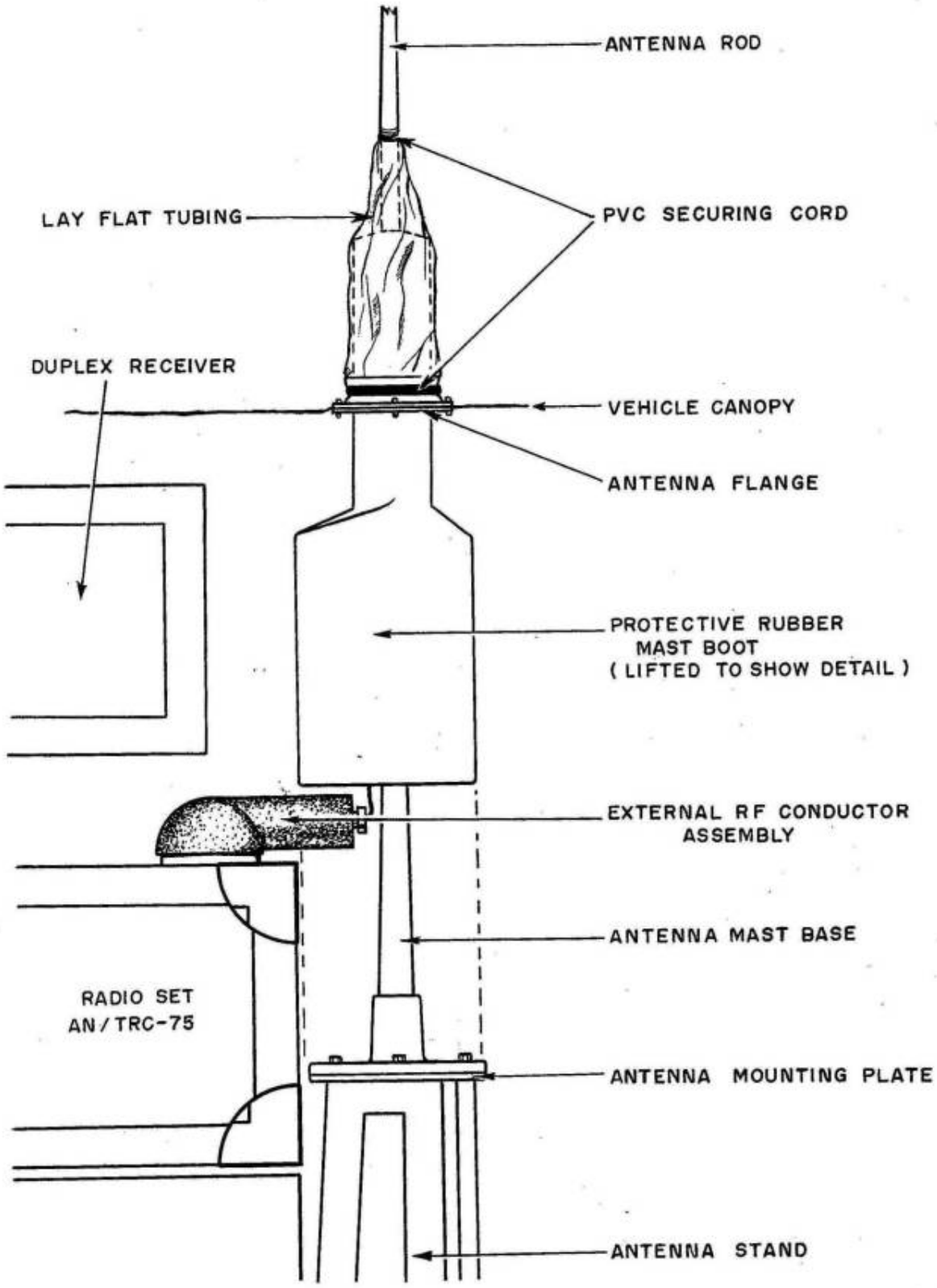


FIG 8 - ANTENNA, BASE, AND CONDUCTOR ASSEMBLY

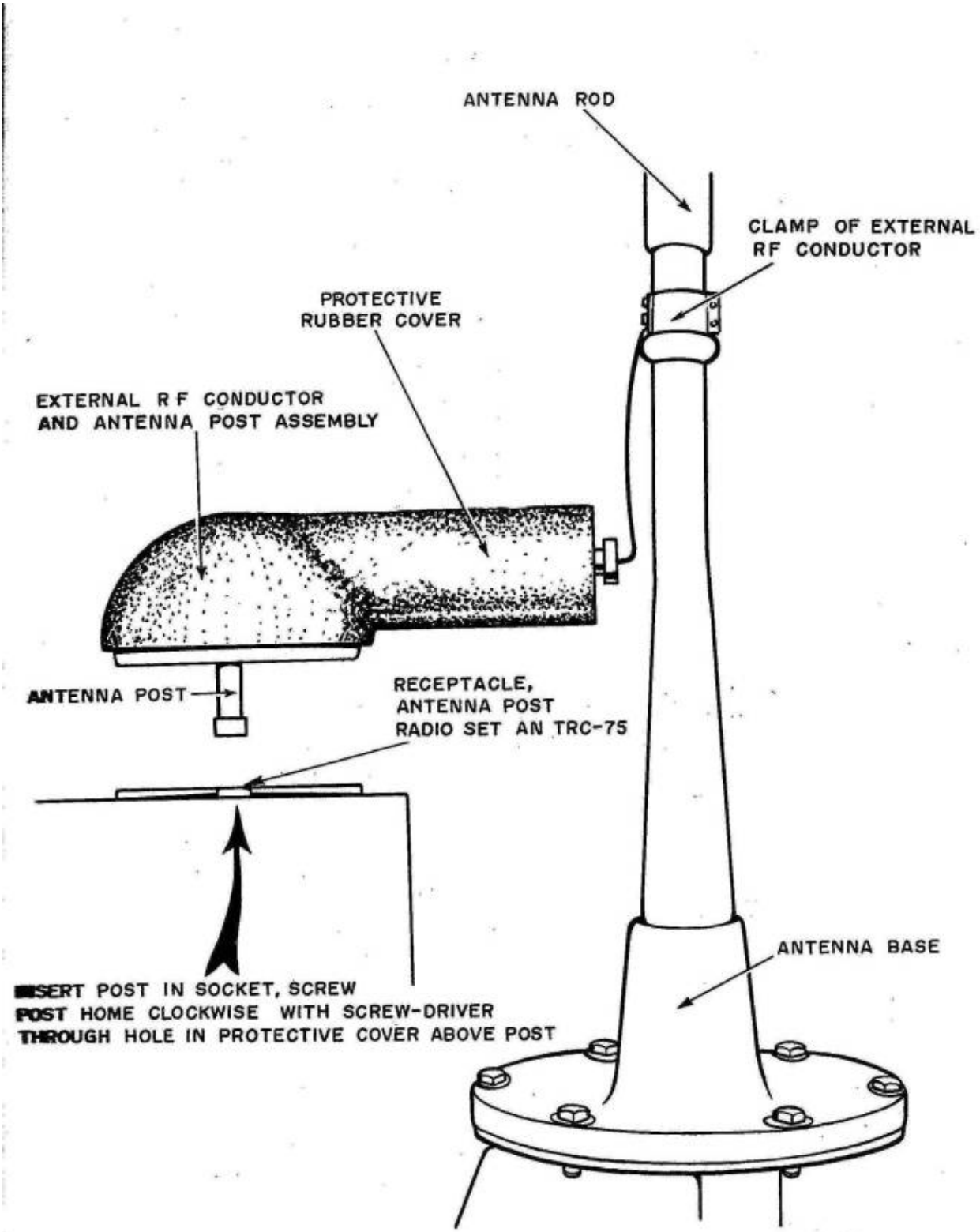


FIG 9 - RF CONDUCTOR CONNECTIONS

(p) Generator Set, Diesel Engine, 5kVA, 120V, 400c/s, 3-phase, 4-wire. (Trailer mounted and accessories Kit)

(q) Box, Jack Field and Stationery Assy

(r) Desk Lamp, 'Companion', type BGE D42

(s) Junction box

(t) Sliding table top

37. Detailed descriptions of the radio sets, their location and the methods of mounting them in the vehicle are given in Section 6. Details in regard to other equipment are contained in Section 3 and 7.

SECTION 6 - RADIO SET AN/TRC 75 (DUPLEX) AND DUPLEX RECEIVER 651 E-1

RADIO SET AN/TRC-75 (DUPLEX)

38. The Radio Set AN/TRC-75 (Duplex) (Fig 10) is a single sideband HF transceiver capable of transmitting and receiving on any one of 28,000 channels in the frequency band 2.0 Mc/s to 29.999 Mc/s. The control pan (Fig 23) provides direct selection of the 1 kc/s interval channel operating frequencies and direct digital read-out of the selected operating frequency. A new channel may be set up merely by turning the frequency selection control knobs.

39. In simplex operation of the station the transmit and receive circuits use a single common antenna. In duplex operation Radio Set AN/TRC-75 (Duplex) functions as the station transmitter with transmitted mod control provided by the control panel of Duplex Receiver 651E-1 (Fig 25).

40. The modular construction techniques utilized in Radio Set AN/TRC-75 permits the use of standardized plug-in sub-assemblies for ease o maintenance, repair, and interchangeability of sub-assemblies in several types of equipment. Major units of the radio set are constructed with mounting bases on which the modular units are installed. Modules are attached to the base with captive hold-down screws. The major units are detailed in the following sub-sections.

Radio Set Case CY-2600/TRC-75

41. The radio set case in which the main units and accessories of Radio Set AN/TRC-75 are housed, is constructed of aluminium. It consist of an outer shell, interior partitions and mountings, and removable top, front and rear covers. The front and rear covers are identical. They are attached to the case by locking handles and are sealed with waterproof

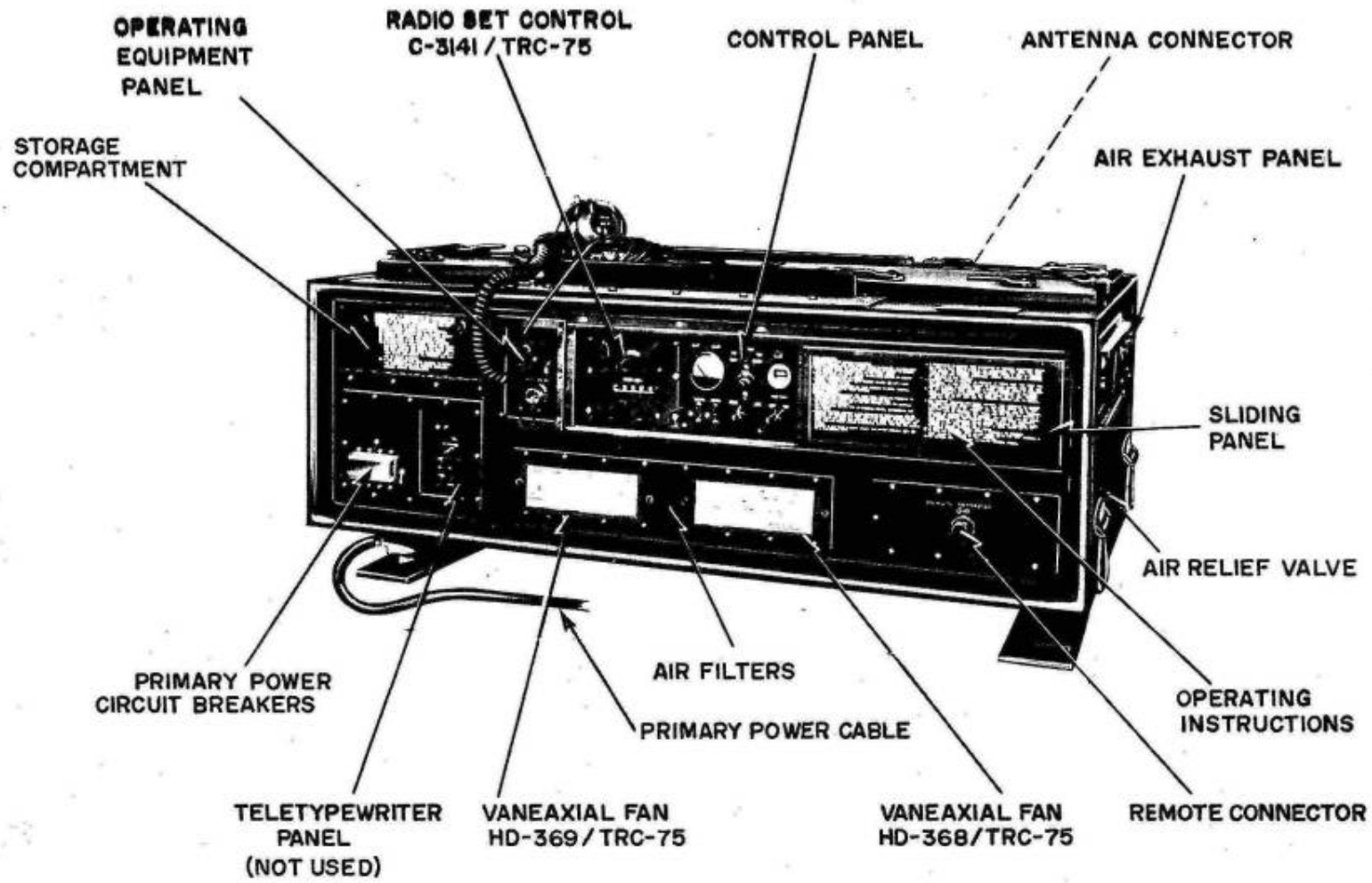


FIG 10 - RADIO SET AN/TRC-75 (DUPLEX)

gaskets. Four spring-loaded handles, two on each side are provided for carrying the case.

42. The case is mounted on shock absorbers, across the front end of the vehicle body as shown in Fig 2. It is secured by the catches of the two quick-disconnect mounting plates, one of which is bolted to each wheel arch (see Fig 32 and Table 11).

43. Under normal operating conditions, only the front cover of the case is removed. The top and rear covers permit access to the interconnecting cabling and components within the case.

44. The front panel of the case (see Fig 10) carries a primary power switch, a hinged door compartment, air-intake louvres, a transparent sliding panel, and two recessed panels. The sliding panel, when closed, covers the control panel (Fig 23) and must be opened to operate the set controls. The recessed panels (Fig 24) are used for the connection of a microphone, headset, and handset or loudspeaker. The microphone, headset and handset are stowed in the compartment behind the hinged door. A CW key is also connected to one of the recessed panels, through the harnes In the operation of this station the teletypewriter connections on the recesse panel are not used, but the unit is connected to the set through the harness and TH-5/TG.

45. A sliding panel (Fig 20) on the side of the radio set case, which covers an exhaust air outlet, must be opened before the set will operate. The primary power input connector (A of Fig 17) is located beneath the case below the primary power switch. The remote control connector (AA of Fig 17) for the interconnection cable (W4 of Fig 17) from the Duplex Receiver 651E-1, is located on the lower right portion of the radio set case front pan The top of the case has a feed through insulator for the connection of a whip or long wire antenna (AF of Fig 17).

46. Operating relays, interconnecting wiring terminal boards, audio amplifiers, directional coupler and control panel units are accessible after removal of the top cover of the case. Fig 11 shows the unit with the top cover removed. An interconnecting wiring diagram is mounted on the insid of the top cover. Operating instructions for the radio set when used as a transceiver are printed on the front panel of the case.

47. A rear view of the case with the cover removed, showing major units and accessories, is shown in Fig 12.

Radio Receiver R-761/ARC-58 (Fig 12)

48. The receiver contains fourteen modules mounted on the main chassis of the unit and held in place by captive hold-down screws. Th chassis with modules in place is enclosed in an aluminium case that serves the dual functions of a protective cover and an electrical shield. Input and

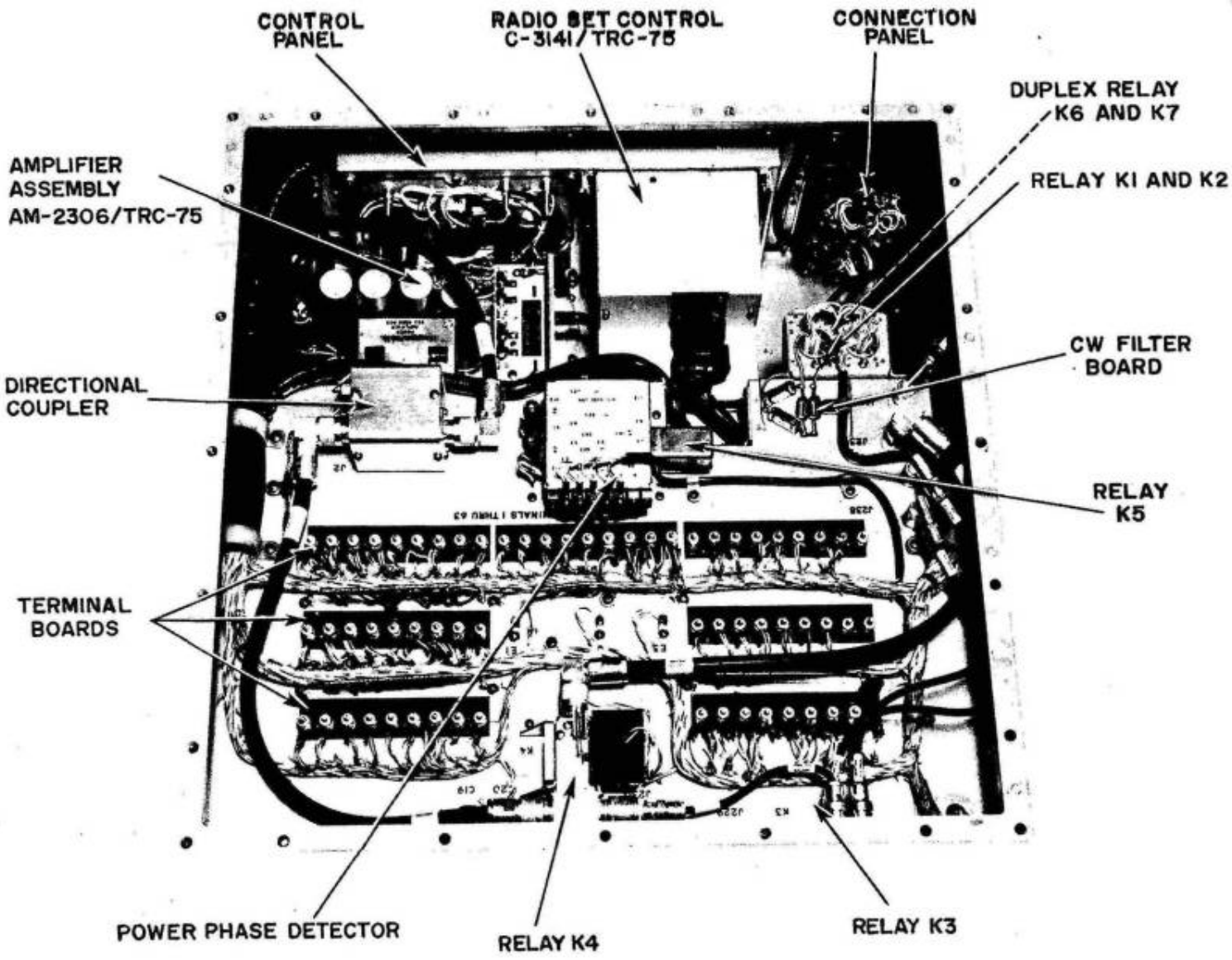


FIG 11 - RADIO SET AN/TRC-75 (DUPLEX) WITH TOP COVER REMOVED

output connectors are mounted on the front panel of the unit. A duct opening on the rear of the case provides an entrance for cooling air from the cooling-air supply.

49. The unit is a transceiver with some circuit elements common to both transmission and reception. It has a nominal RF output during transmission of 0.2 watt peak envelope power (PEP) in the 2.0 to 29.999 Mc/s frequency range. The unit is capable of receiving RF signals in the same frequency range.

50. Frequency generation is provided by a stabilized master oscillator referenced to a compact frequency standard having a high stability. The stabilized master oscillator provides the desired mixer frequencies to the double conversion super-heterodyne tuning circuits. Tuning of the unit is performed automatically by Servo circuits that receive tuning information from the Radio Set Control C-3141/TRC-75 (see paras 55 to 57).

51. Radio Receiver R-761/ARC-58 is capable of four separate modes of operation which can be individually selected at the Radio Set Control. These are:-

(a) Upper sideband (U) provides transmission of an upper sideband with the carrier suppressed at least 40 dB below peak envelope power, or reception of an upper sideband.

(b) Lower sideband (L) provides transmission of a lower sideband with the carrier suppressed at least 40 dB below peak envelope power, or reception of a lower sideband.

(c) Amplitude modulation (AM) provides transmission of an upper sideband with the carrier voltage suppressed 6 dB below peak envelope voltage, or reception in a 6 kc/s passband centred about a carrier frequency.

(d) Twin sideband (TWIN) provides transmission of both upper and lower sidebands of identical intelligence with the carrier suppressed at least 40 dB, or reception of both upper and lower sidebands of identical intelligence with the audio output of each sideband being combined as a single output.

Radio Transmitter T-730/TRC-75 (Fig 12)

52. This unit contains the power amplifier stages of Radio Set AN/TRC-75. Nominal input to the transmitter unit is 0.2 watt peak envelope power in the frequency range 2.0 Mc/s to 29.999 Mc/s, from Radio Receiver R-761/ARC-58. The transmitter unit linearly amplifies this input to a nominal 1-kW peak envelope power for delivery to the Antenna Coupler CU-749/TRC-75 (see para 61). Automatic servo controlled tuning circuits tune the transmitter unit. Two stages of amplification are used for the nominal 1 kW peak envelope power output.

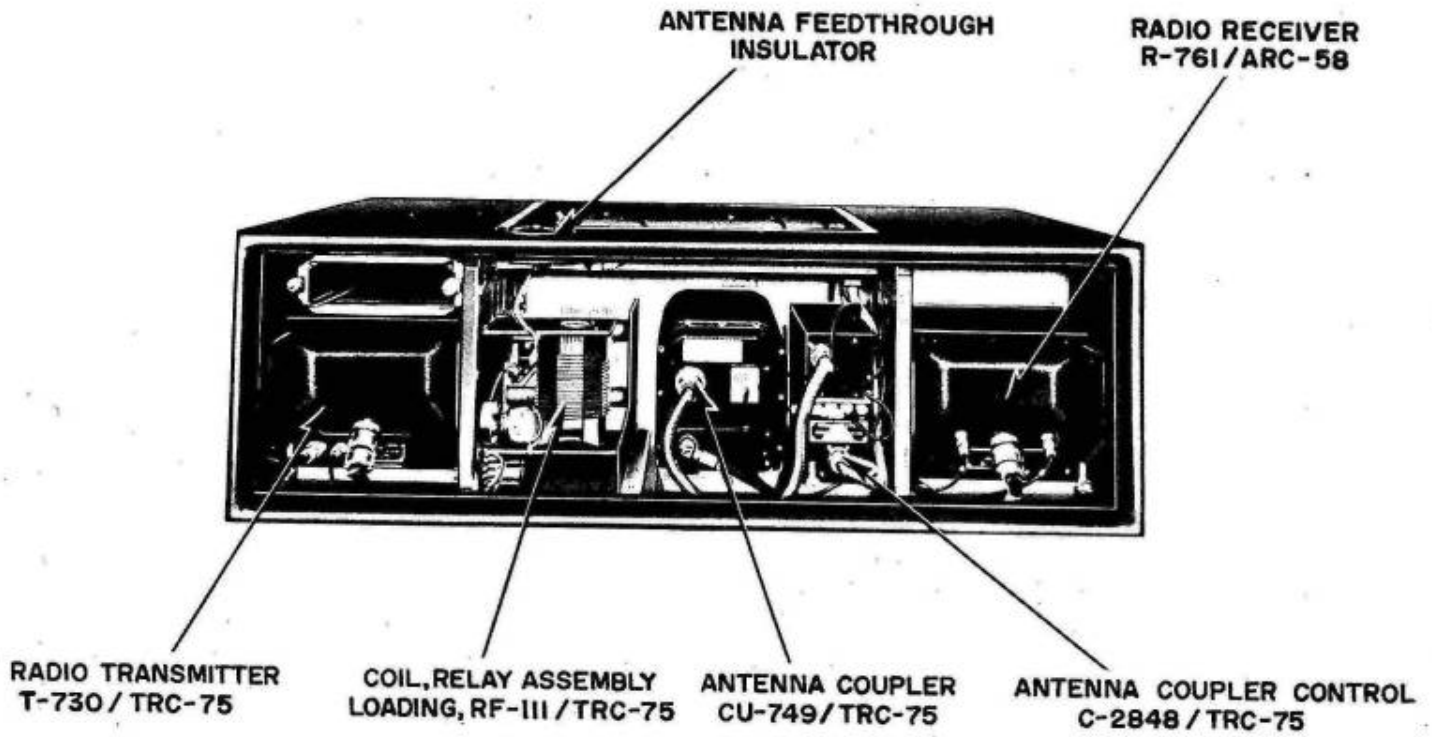


FIG 12 - RADIO SET AN/TRC-75 (DUPLEX) WITH REAR COVER REMOVED

53. The RF and power supply circuits are constructed as integral parts of the chassis of the transmitter unit. The only plug-in assemblies are two servo amplifiers. The power supply furnishes all the voltages and current requirements of the RF section, using 3 phase 120-volt (line to neutral) 400 cycle power.

54. The transmitter unit is protected by overload, thermal, and altitude protective devices. The main chassis, with all sub-assemblies in place, is enclosed in an aluminium case that serves as both protective cover and electrical shield. External connections are made at the front panel of the unit. Cooling air supply ducts are on the rear of the case.

Radio Set Control C-3141/TRC-75 (Fig 11)

55. Primarily, this control unit is a frequency selector for Radio Set AN/TRC-75. Frequency selection is accomplished by setting a combination of four front panel knobs (Fig 23) to obtain the desired frequency digits in a direct-reading dial. The knobs permit direct selection of megacycle, tenth-megacycle, tens-kilocycle, and unit-kilocycle increments. A frequency selection automatically initiates operation of a servo follow-up system that tunes Radio Set AN/TRC-75. The servo system is driven by a signal from a series of switches and precision resistors that are controlled by the four frequency selection knobs.

56. Other front panel controls on this control unit are:-

(a) Mode of operation selector (used during simplex operation)

(b) ON/OFF switch

(c) Volume control

57. The ON/OFF switch is coupled to a magnetic-release mechanism which automatically returns the switch to the off position if a fault should exist in Radio Set AN/TRC-75.

Control Panel (Figs 10 and 23)

58. The control panel of Radio Set AN/TRC-75 has a meter for measuring forward and reflected RF power output. An RF POWER switch is used with the meter. The standing wave ratio can be determined by using the meter readings with the graph reproduced in Fig 13. The meter reading in the reflected power position normally is very small when the radio set is connected to and operated with the proper antenna.

59. The control panel also has a meter for reading the line frequency of the primary power input.

60. The following are also located on the control panel (Fig 23) :-

(a) Audio volume control

(b) Panel light switch

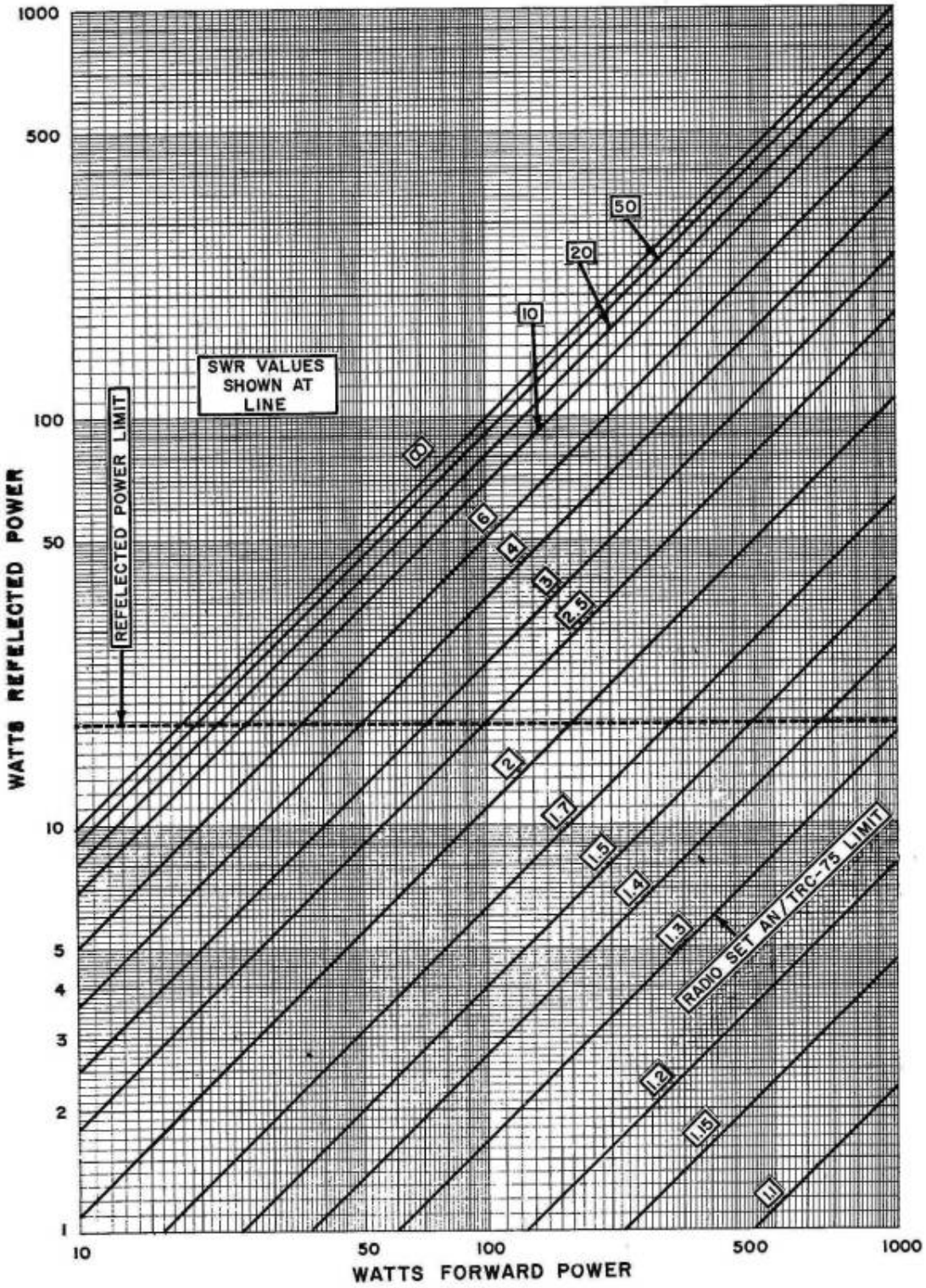


FIG 13 - STANDING WAVE RATIO GRAPH

(c) Transmitter high or low power switch
(d) Modulation mode selector switch
(e) Antenna selector switch

Antenna Coupler CU-749/TRC-75 (Fig 12)

61. This coupler contains elements and associated positioning motors which tune the antenna to the selected operating frequency for transmission and reception. Transmitted energy from the Radio Transmitter T-730/TRC-75 is coupled to the antenna coupler. Received energy passes through the antenna coupler to the Radio Receiver R-761/ARC-58, when the radio set is completely tuned, and directly to the receiver unit when the radio set is only coarsely tuned.

Antenna Coupler Control C-2848/TRC-75 (Fig 12)

62. This control contains a portion of the control circuits of the tuning and loading element motors located in the antenna Coupler. It also contains relay and switching circuits and two amplifiers that control the Antenna Coupler.

Vaneaxial Fans (Fig 10)

63. Fan HD-368/TRC-75 is a blower which provides air for cooling the Radio Transmitter T-730/TRC-75. It is mounted externally to the transmitter unit, inside the radio set case (behind the air intake louvres).

64. Fan HD-369/TRC-75 is a blower which provides air for cooling the Radio Receiver R761/ARC-58, the Antenna Coupler CU749/TRC-75, and the Antenna Coupler Control C-2848/TRC-75. It is mounted externally to these units, behind the air intake louvres of the radio set case.

65. The sliding door in the side of the radio set case (Fig 20), over the air exhaust louvres, must be opened fully and locked open before the Radio Set AN/TRC-75 can be operated.

Amplifier Assembly AM-2306/TRC-75 (Fig 11)

66. This assembly contains two Audio Frequency Amplifiers. Amplifier AM-476/A1C-10 amplifies audio signals from a microphone or a handset for transmission, and provides amplification of received signals from Radio Receiver R-761/ARC-58. Amplifier AM-2290/TRC-75 amplifies received audio to operate the loudspeakers.

Coil, Relay Assembly Loading RF111/TRC-75 (Fig 12)

67. This unit consists of four relays and two antenna loading coils. Operation of the associated relays determines whether one, both, or none of the antenna loading coils will be in series with the antenna, depending on the operating frequency. This coil unit is only used with the whip antenna (Fig 8). The coils electrically lengthen the whip antenna, thus increasing its efficiency.

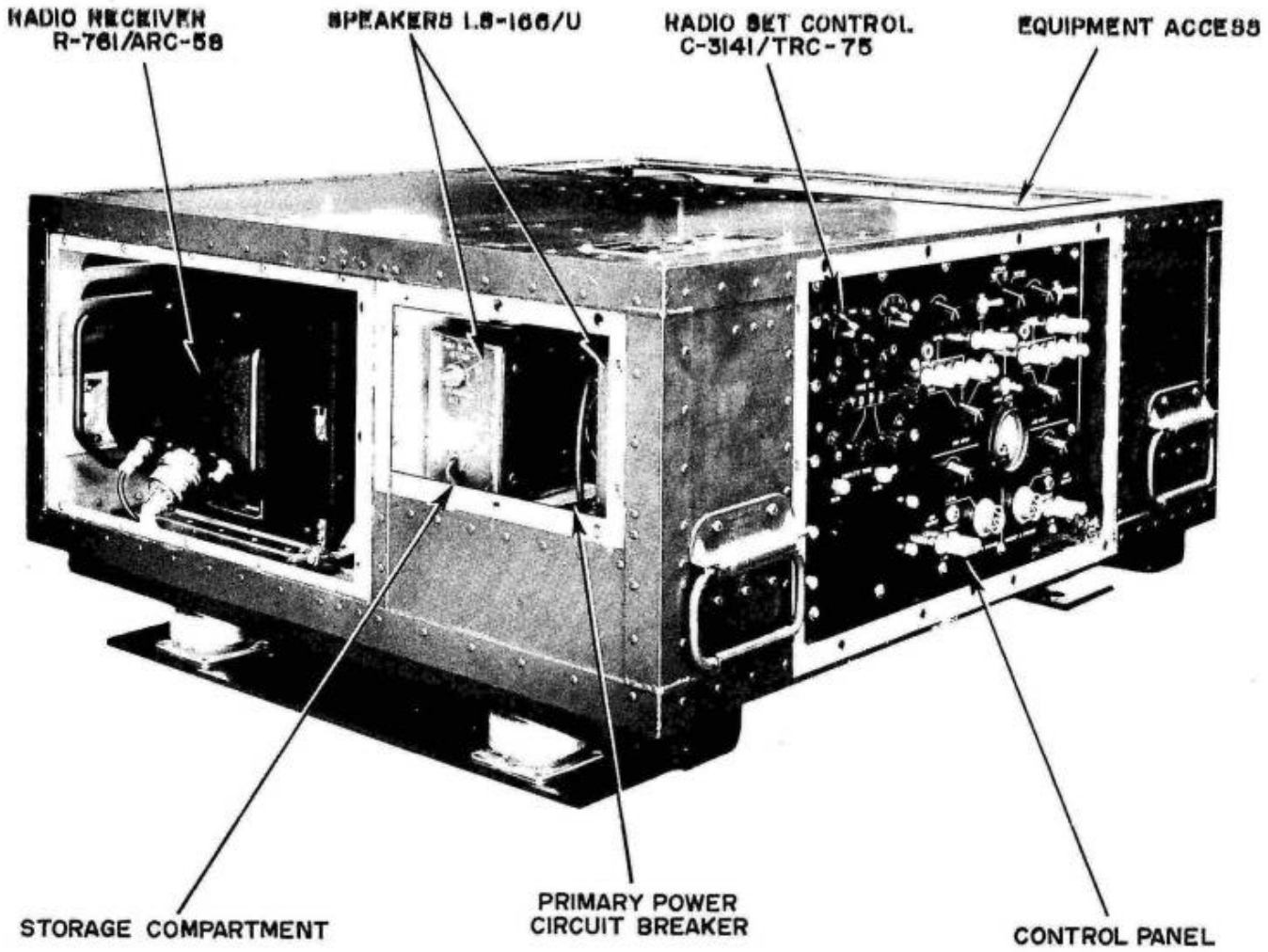


FIG 14 - DUPLEX RECEIVER 651E-1 (COVERS REMOVED)

DUPLEX RECEIVER 651E-1

68. This receiver (Fig 14) is a single sideband receiver that is capable of receiving on any of 28,000 channels in the frequency band 2.0 Mc/s to 29.999 Mc/s. The control panel (Fig 25) of this receiver provides direct manual selection of the 1 kc/s interval channel frequencies and direct-digital read out of the selected operating frequency. The panel also carries most of the operating controls for the overall station.

69. The Duplex Receiver 651E-1 is mounted across the body of the vehicle, above Radio Set AN/TRC-75, on the Duplex Receiver Support (Figs 28 and 29 and Table 9).

70. In simplex operation of the station, the duplex receiver functions as an independent monitoring receiver. In duplex operation of the station, the duplex receiver functions as a station receiver.

71. Duplex Receiver 651E-1 utilizes modular construction techniques, and most of the modules used in the receiver are also used in Radio Set AN/TRC-75. The use of standardized components simplifies maintenance of the station. The major units are described in the following Sub-Sections.

Radio Set Control C-3141/TRC-75 (Fig 14)

72. This control unit functions as the frequency selector for Duplex Receiver 651E-1. It also provides receiver mode selection during simplex operation of the station.

73. This control unit is the same type as that used in Radio Set AN/TRC-75 described in paras 55 to 57 (see Fig 11).

Radio Receiver R-761/ARC-58 (Fig 14)

74. This radio receiver is identical to that used in Radio Set AN/TRC-75 described in paras 48 to 51 (see Fig 12). The portions of those paragraphs which relate to transmission do not apply.

Amplifier Assemblies (Fig 15)

75. The amplifier assemblies include:-

(a) Two Audio Frequency Amplifiers 356F-1

(b) Two Audio Frequency Amplifiers AM-476/A1C-10

(c) A Vox amplifier

(d) A power supply furnishing 28 volts dc

76. The VOX amplifier consists of an AM-1524/URC module identical to that used with Radio Receiver R-761/ARC-58 (para 66), except that the circuitry used for automatic transmitter gain control in the exciter is not

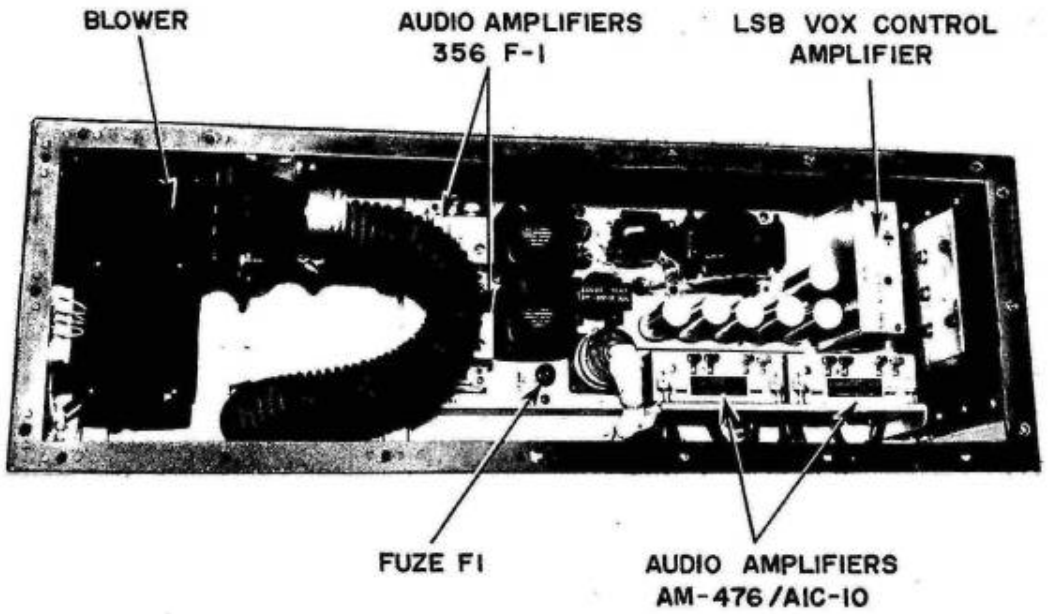


FIG 15 - DUPLEX RECEIVER 651E-1 - TOP ACCESS (COVER REMOVED)

provided. The standard module could however be used as the Vox amplifier in the Duplex Receiver 651E-1.

77. These assemblies amplify audio signals for transmission from 600-ohm lines, microphone or handset, and provide amplified receive signals for the loudspeakers and headset. Vox operation of lower sideband for the station is also controlled by these assemblies.

Duplex Receiver Case

78. This case houses the components of Duplex Receiver 651E-1. Screw fasteners allow the front cover to be removed for access to the control panel. A storage compartment (Fig 14) is provided in the case for the two loudspeakers. Two further removable panels (Figs 14 and 15) permit access to the units contained in the case. Power, antenna and interconnecting cable connections are made at the rear of the case (Fig 26). Audio line, microphone, and handset connections are made at the control panel (Fig 25), which also provides all control functions for Duplex Receiver 651E-1. Audio control functions and mode of operation for Radio Set AN/TRC-75 are also provided at this panel during duplex operation of the station. A meter on the panel monitors audio levels being supplied to the exciter in the Radio Set AN/TRC-75. Forced air cooling for the Radio Receiver R-761/ARC-58 of the Duplex Receiver 651E-1 is provided by a blower (Fig 15) mounted in the Duplex Receiver case.

79. The Duplex Receiver Case is resiliently mounted on the Radio Receiver Support (Fig 28, item 16). It is secured by the catches of the Quick-Disconnect Mounted Plates (Fig 28 and Table 9), bolted to the support below the ends of the receiver.

SECTION 7 - ASSOCIATED EQUIPMENT, HEADSET, MICROPHONE AND LOUDSPEAKERS

Headset, Electrical, H-70C/AIC, 7 ohms impedence, 2-earphone

80. (a) Simplex operation.- The jack for the headset plug is located on the recessed panel of the radio set and is marked HEADSET (see Fig 24).

(b) Duplex operation.- The two jacks for the headset plug on the panel of Duplex Receiver 651E-1 are marked HEADSET (see Fig 25). The Upper Sideband (USB) or the Lower Sideband (LSB) jack may be used, as required.

Microphone, Magnetic, 602KK, 55 dB, 50 ohms

81. (a) Simplex operation.- The jack for the microphone plug is located on the recessed panel of the radio set and is marked MIKE (see Fig 24).

(b) Duplex operation.- The two jacks for the plug of the microphone on the panel of Duplex Receiver 651E-1 are marked MIKE (see Fig 25). The Upper Sideband (USB) or the Lower Sideband (LSB) jack may be used, as required.

Loudspeakers, 600-ohm Permanent Magnet, LS-166/U

82. The two loudspeakers are housed in metal cases fitted with hold-down clamps and are stowed in the stowage compartment of Duplex Receiver 651E-1, (see Fig 14). When the station is operating the loudspeakers are normally secured by brackets in the positions shown in Figs 2 and 3. The speakers may be connected up as follows, when required:-

(a) Simplex operation.- The plug of the left hand loudspeaker is connected to the connector marked HANDSET, SPEAKER, AND REMOTE CONTROL, on the recessed panel of radio set AN/TRC-75 (Duplex) (see Fig 24). The other loudspeaker plug may be connected to the upper sideband (USB) or the lower sideband (LSB) jack, (both marked HANDSET AND SPEAKER) on the panel of Duplex, Receiver 651E-1 (Fig 25).

(b) Duplex operation.- Both loudspeakers may be connected to the panel of Duplex Receiver 651E-1, one to each of the jacks (USB) and (LSB) marked HANDSET AND SPEAKER (Fig 25).

FILTER, BAND SUPPRESSION F-98/U (Figs 4 and 29)

83. This is a two section filter used for simultaneous teletypewriter and telephone service. A band-pass section is used for the telegraph transmission, and a band-stop section provides the gap in the speech spectrum into which the VF telegraph signal is placed.

84. No adjustment is required in operation, and therefore no controls are provided. The unit is mounted on the forward end of the Mounting Frame assembly which is bolted to the left end of the Duplex Receiver Support.

KEY, TELEGRAPH, INTERCONNECTING BOX, REMOTE CONTROL UNIT 'K' (Mk 2)

85. This morse key is mounted on the sliding table top as shown in Fig 16. It provides facilities for hand speed morse signalling on the HF set. Two screw adjusters enable adjustment of key tension and gap. The key can be pivoted to the left to adjust the keying position.

NETWORK, HYBRID CIRCUIT (Figs 5 and 29, item 20)

86. Two of these units are secured to a mounting plate at the right end of the Duplex Receiver Support. They provide intercommunication between a four-wire system and a two-wire system operated through the patching panel.

87. Cross talk from this four-wire line being fed to the transmitter and from the receiver is reduced by 25 dB under good matching conditions, but will deteriorate under adverse conditions.

88. It is necessary to match the two-wire line by the inbuilt switched loads or an external load connected to terminals on the front panel. The inbuilt loads compensate for termination in Telephone Set 'K' on up to 2 miles (in 1/4 mile steps) of D10 line under wet or dry conditions.

TELEPHONE SET 'K' AUST No 1

89. Two of these sets are fitted as shown in Figs 2 and 3. The telephone is an Army field type with magneto or central battery operating facilities.

90. For further information see "Provisional Notes on the Telephone Set 'K' (2nd Edition)" - ADE Pamphlet No. 230.

TELETYPEWRITER TT-4A/A,B,C/TG (Figs 2 and 16)

91. This is a portable, standard communications, page printing teletypewriter designed for transmission and reception of messages under field conditions. Weighing 46.5 lb with a full roll of recorder paper, this teletypewriter is particularly suitable for transportation, and can be carried by one man. The teletypewriter and its dust cover are housed in an immersion proof cover which completely protects the equipment from the effects of the weather. This protective cover should be used when the machine is not in operation (all leads must be disconnected before fitting the cover). Interconnection with distant teletypewriters can be made from a dc telegraph line, wire line carrier system, or radio carrier system.

TABLE TOP

92. The sliding table top carries the teletypewriter and the morse key. A table lamp is mounted on the left end of the Patching Panel case. To adjust the table top depress the locking knob (Fig 16) and slide the table forwards.

TERMINAL TELEGRAPH TH-5/TG (Figs 2 and 29)

93. The Terminal Telegraph is a frequency-shift carrier modulator and demodulator. It modulates dc teletypewriter pulses to 1,225 c/s and 1,325 c/s in the send state and demodulates the same frequencies to dc pulses in the receive condition. The output dc pulses are capable of operating a teletypewriter magnet which requires a 20 mA current.

94. The unit is arranged for use in 2 wire, 4 wire and radio telegraph applications. However, it is not suitable for duplex operation, but must be considered as a one-way reversible, ie, the same frequencies are used in each direction.

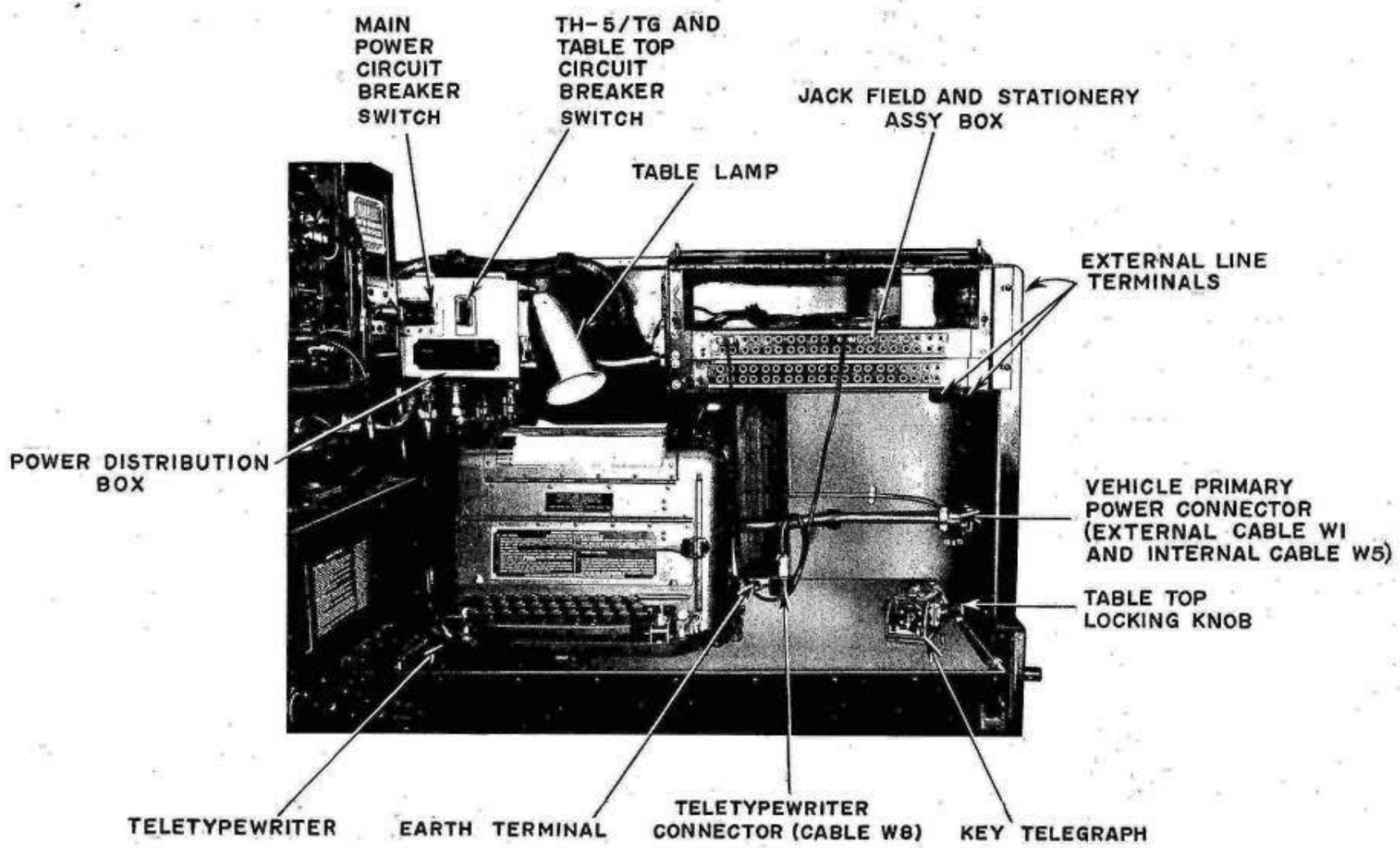


FIG 16 - TABLE TOP AND ADJACENT EQUIPMENT

95. The TH-5/TG also has facilities for generating a 20 c/s ringing signal but this is not used in this installation. For further information consult USA Technical Manual TM11-2237.

96. The Terminal Telegraph is bolted to the rear end of the Mounting Frame Assembly which is resiliently mounted on the Duplex Receiver Support (Fig 28 and Table 9).

BOX, JACK FIELD AND STATIONERY ASSEMBLY (Figs 2 and 19)

97. The wiring loom of the installation is terminated in the patching panel. All circuits are normally "through" as shown on the block diagram, Fig 18. The assembly is located over the sliding table top (see also Fig 16).

DESK LAMP

98. Desk lamp, 'Companion', type BGE D42 is fitted to the forward end of the Patching Panel case (see Fig 16).

JUNCTION BOX

99. This is a 5-way junction box used for distribution of power to items mounted on and adjacent to the sliding table top. It is secured to the under side of the table top (see Figs 2 and 27).

SECTION 8 - CONNECTING CABLES, WIRING LOOM, AND BONDING

100. The connector diagram (Fig 17) shows the inter-connecting cables, bonding cables and straps, and the wiring loom. References in the diagram connect with those used in Tables 1 and 2. The cables, straps and loom wires are identified in the tables as follows:-

(a) Table 1 - Interconnecting and bonding cables

(b) Table 2 - Wiring, bonding and earth connections, sub-divided as under:-

A. - Loom wiring connections

B. - Bonding and earth connections

NOTE:- Details of the Antennae conductor (item AF of Fig 17) as shown in Figs 8 and 9.

101. The wiring loom is also shown in Fig 33. The references on this illustration connect with those in Tables 1 and 2 and those on Fig 17.

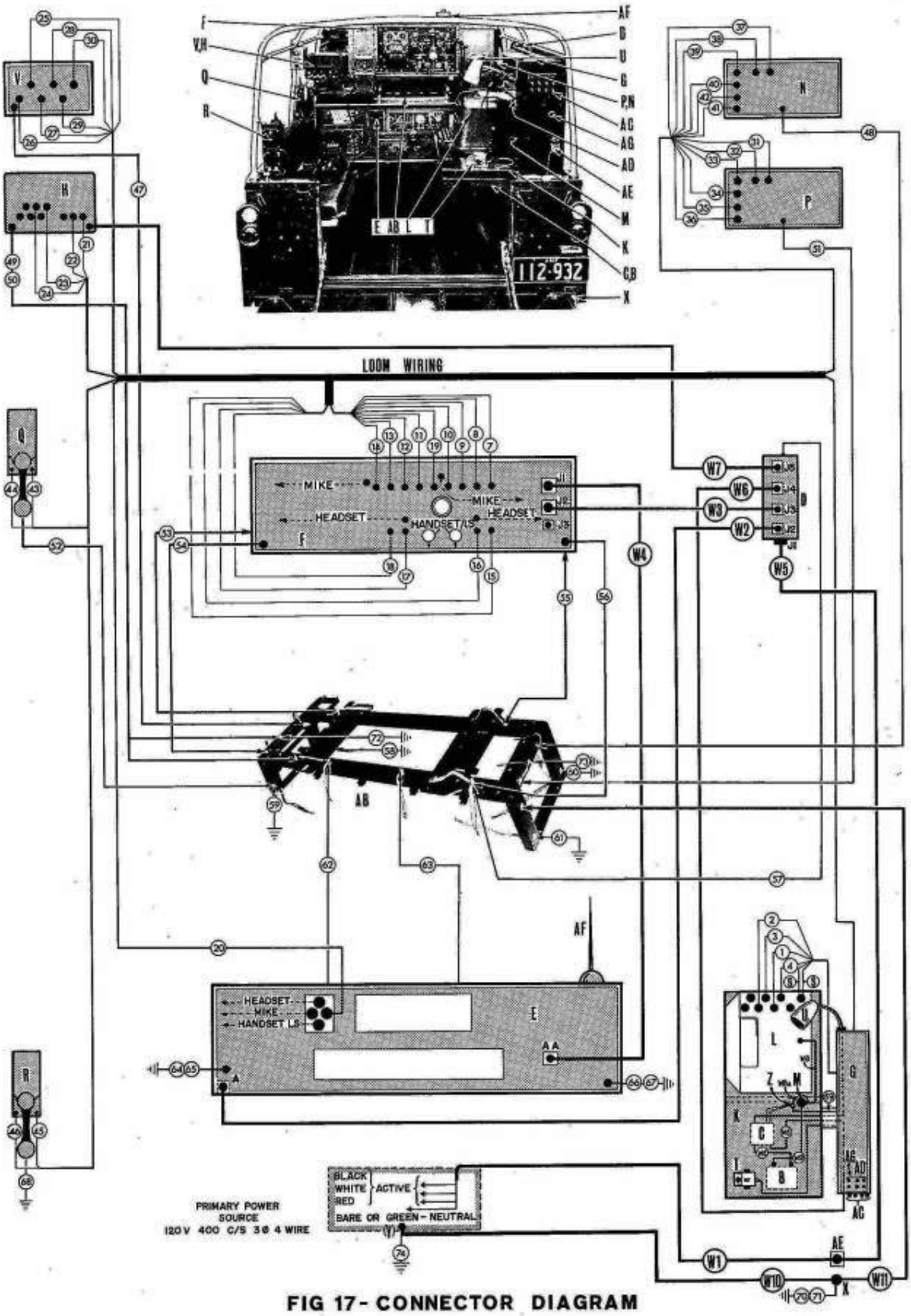


FIG 17- CONNECTOR DIAGRAM

102. Four earth-spike and lead assemblies and an earthing chain are provided. Details of these spikes and the chain are given at the end of Table 2B and the points of attachment are indicated in Fig 17.

103. The desk lamp (U) is connected to cable W6 in the Junction box (C) under the table top.

104. A block diagram showing the station circuits is given in Fig 18.

105. The following connectors are also issued in the station kit:-

(a) Cable Assembly, Power Electrical. In addition to the 8-ft primary power supply Cable W1, shown in Table 1 and Fig 17, and used to connect the primary power output of the generator set in the trailer to the input socket on the rear of the vehicle, an additional 100-ft extension connector is provided for use when a generator set is located at a distance from the vehicle.

(b) A long bonding cable (W10) (approx 120 ft) is also issued for the same conditions as in (a) above.

(c) Cable Assembly, Coaxial, 100-ft (approx). Used for connection of Duplex Receiver 651E-1 to a remote aerial.

TABLE 1 - IDENTIFICATION OF INTERCONNECTING AND BONDING CABLES

(Refer to Fig 17)

Identification and Purpose		Connecting Points	
Cable No.	Purpose	Marking on unit	Unit (letters in brackets are repeated on corresponding units on Fig 17 and on Fig 33).
W1	Primary power cable from power source.	- Power in -120V 400 c/s, 3 ph.	From Generator in trailer to Vehicle power input connector AE.
W10	Bonding lead. (Refer also to Chapter Six).	-	From vehicle earth (X) (see also Fig 3) to generator set earth terminal (Y).
W11	Bonding lead	-	Vehicle earth (X) to Receiver Support (AB)

TABLE 1 - (CONT'D)

Identification and Purpose		Connecting Points	
Cable No.	Purpose	Marking on unit	Unit (letters in brackets are repeated on corresponding units on Fig 17 and on Fig 33).
W2	Power cable from Power Distribution Box to Radio Set	J2 J201-A	From Power Distribution Box (D) to Radio Set AN/TRC-75 (E).
W3	Power cable from Power Distribution Box to Duplex Receiver 651E-1.	J3 POWER INPUT J2	From Power Distribution Box (D) to Duplex Receiver 651E-1 (F) (rear panel)
W4	Interconnecting Cable, radio set to receiver.	REMOTE CONNECTOR - AA REMOTE CABLE J1	From Radio Set AN/TRC-75 (E) to Duplex Receiver 651E-1 (F) (rear panel)
W5	Power Input Cable vehicle connector to Power Distribution Box	- (Connector on side of box) J1	Vehicle power input Connector AE to Power Distribution Box (D)
W6	Power cable from Power Distribution Box to units on table-top.	J4 -	From Power Distribution Box (D) via Box, Jackfield and Stationery Assembly (G) and Junction Box (C) under table-top to Power Converter 770B-1 (B) also under table-top.

TABLE 1 - (CONT'D)

Identification and Purpose		Connecting Points	
Cable No.	Purpose	Marking on unit	Unit (letters in brackets are repeated on corresponding units on Fig 17 and on Fig 33).
W7	Power cable from Power Distribution Box to Terminal Telegraph TH-5/TG	J5 - -	From Power Distribution Box (D) to Terminal Telegraph TH-5/TG (H) (This cable is part of the unit)
W8	Power cable of Teletypewriter Set TT-4/TG, A, B, C/TG	-	Lead is part of assembly of Teletypewriter Set (L) and its plug fits into table-top Connector (M). The lug on the other wire (W8A) of the lead is connected to the table-top earth terminal (Z).
W9	Power cable from Power Converter 770B-1 to teletypewriter motor power outlet.	- -	From Power Converter 770B-1 (B) to two pin connector (M) on table top.

NOTE: "Front" and "Rear" in Tables 1 and 2 are with reference to the vehicle and not individual items of equipment.

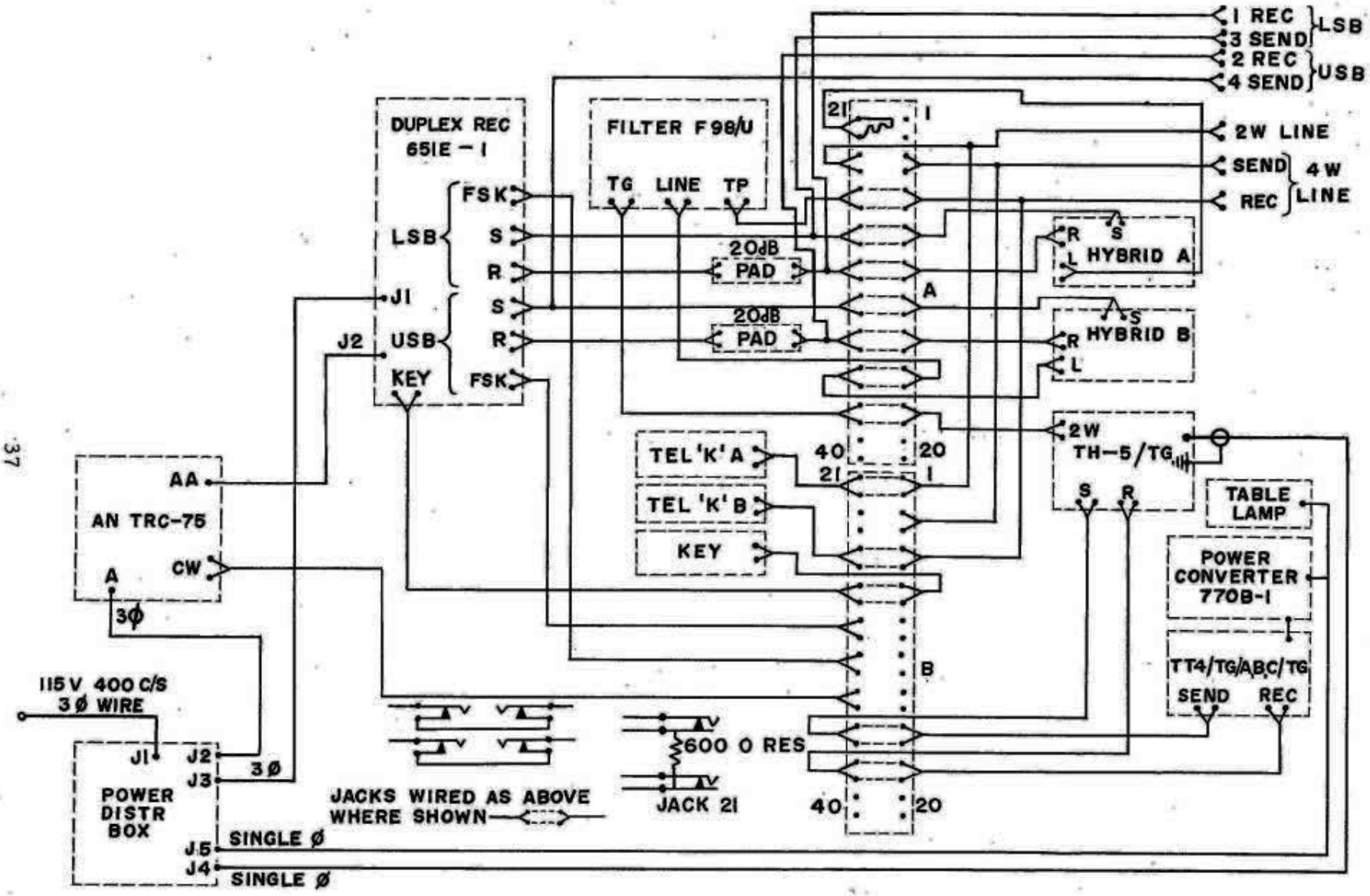


FIG 18 - BLOCK DIAGRAM SHOWING STATION CIRCUITS

TABLE 2 - WIRING. BONDING, AND EARTH CONNECTIONS

A - LOOM WIRING CONNECTIONS

NOTES

1. Each wire carries a small tag with number as shown below against unit and panel marking.
2. Letters in brackets after the names of units connect with those used on Figs 17 and 33.

Unit	No.	Panel Marking	Remarks
Teletypewriter TT-4/TG, A, B, C/TG (L) (Connections on left side at bottom of machine)	1	SEND 1	) Terminals
	2	SEND 2	) Note: Strap between
	3	REC 3	) SEND 2 and REC 3 to be
	4	REC 4	) open.
	S	) -	Screen leads (not numbered)
	S	) -	Thumbscrew ground terminal at right end.
Duplex Radio Receiver 651E-1 (F) (Connections on front panel)	7	FSK	right terminal)
	8	FSK	left terminal) LSB
	9	VOICE	right terminal)
	10	VOICE	left terminal)
	11	FSK	right terminal)
	12	FSK	left terminal) USB
	13	VOICE	left terminal)
	14	VOICE	right terminal)
	15	LINE	right terminal) LSB
	16	LINE	left terminal)
	17	LINE	right terminal) USB
	18	LINE	left terminal)
	19	KEY	plug
Radio Set AN/TRC-75 (Connection on front panel) (E)	20	KEY	plug
Terminal Telegraph TH-5/TG (H) (Connections on front panel)	21	REC	plug, (red)
	22	SEND	plug
	23	6	terminal) 2W
	24	4	terminal)

TABLE 2 - A (CONT'D)

Unit	No.	Panel Marking	Remarks
Filter Band Suppression F-98/U (V)	25	LINE	upper terminal
	26	LINE	lower terminal
	27	TP	lower terminal
	28	TP	upper terminal
	29	TG	lower terminal
	30	TG	upper terminal
Network, Hybrid Circuit A (rear unit) (P)	31	4W SEND	right terminal
	32	4W SEND	left terminal
	33	4W REC	upper terminal
	34	4W REC	lower terminal
	35	2W LINE	lower terminal
	36	2W LINE	upper terminal
Network, Hybrid Circuit B (forward unit) (N)	37	4W SEND	right terminal
	38	4W SEND	left terminal
	39	4W REC	upper terminal
	40	4W REC	lower terminal
	41	2W LINE	lower terminal
	42	2W LINE	upper terminal
Telephone Set 'K' - A (forward unit) (Q)	43	-	right terminal
	44	-	left terminal
Telephone Set 'K' - B (rear unit) (R)	45	-	right terminal
	46	-	left terminal
Line Terminals (AD) (on base of Box, Jack Field and Stationery assembly) (G). External wires are brought in through hole with Grommet (AG)	-	2W LINE (black and white)	rear pair of terminals
	-	4W SEND (orange and white)	middle pair of terminals
	-	4W REC (green and white)	forward pair of terminals (See identification plate inside rear wall of vehicle body, para 129(a) and Fig 16).
Line Terminals (AC) (on rear face of Box, Jackfield and Stationery Assembly) (G)	-	See para 129	Identification plate is located on rear body panel through which these terminals protrude (see para 129(b) and Fig 3).

TABLE 2 - A (CONT'D)

Unit	No.	Panel Marking	Remarks
Remote Control Unit 'K' Mk 2 (Morse Key) (T)	- -	- - (Black earth wire is secured to Key base)	) Two wires come up) through table-top. Terminal near rear of vehicle carries the red wire. Other wire is white.

B - BONDING AND EARTH CONNECTIONS

No.	ATTACHMENT POINTS	
	EQUIPMENT	SUPPORT OR VEHICLE
47	Filter Band Suppression F-98/U (V)- outer lower corner of front panel.	Support (AB) - forward end of top left side bar (12-in x 3/8-in)
48	Network Hybrid Circuit B (N) - bottom centre of front panel.	Support (AB) - forward end of top right side bar (8-in x 3/8-in)
49	Mounting Frame Assy (Fig 28 and Table 10) - rear of left side bar.	Support (AB) - rear of top left side bar (8-in x 1-in)
50	Telegraph Terminal TH-5/TG (H) - lower right corner.	Support (AB) - left end of rear cross bar. (8-in x 3/8-in)
51	Network Hybrid Circuit A (P) - bottom centre of front panel.	Support (AB) - rear end of top right side bar (8-in x 3/8-in)
52	Telephone Set 'K' - A (Q) - base	Support (AB) - lower bolt on left rear upright (6-in x 3/8-in)

TABLE 2 - B (CONT'D)

No.	ATTACHMENT POINTS	
	EQUIPMENT	SUPPORT OR VEHICLE
53 54 55 56	Duplex Receiver (F) - four lower corners	Support (AB) - two terminals on each cross-bar outside the ends of Quick Disconnect Mounting plates (Fig 28 and Table 9) (8-in x 1-in)
57	Power Distribution Box (D) - lower forward corner	Support (AB) - same terminal as for rear right strap from Duplex Receiver (55) (12-in x 1-in)
58 59 60 61	Support (AB) - lower bolts on four uprights	Vehicle body floor. (16-in x 1-in)
62 63	AN/TRC-75(E) - two front bolts of top of set case	Support (AB) - two terminals on rear cross bar, between the two Quick Disconnect Mounting plates (Fig 28 and Table 9)
64 65 66 67	AN/TRC-75 (E) - four lower corners of set	Vehicle body floor
68	Telephone Set 'K' - B (R) - base	Vehicle body - top of left rear panel
69	Jackfield and Stationery Assembly Box (G) - rear panel	Table top earth (Z) via earth terminal on strut supporting the table top
70	Earthing chain	Vehicle earth terminal (X)
71 72 73 74	) Three earth) spikes with) leads One (Generator) earth spike with lead	(71) Vehicle earth terminal (X) * (72) Centre of top left side bar of Support (AB) @ (73) Centre of top right side bar of Support (AB) @ (74) Generator earth terminal *

* 7-ft 6-in lead
@ 5-ft lead

SECTION 9 - WEIGHTS AND DIMENSIONS

106. The weights and dimensions of the vehicle, trailer, and radio sets are given in Table 3, below:-

TABLE 3 - WEIGHTS AND DIMENSIONS

Item	Weight (lb)	Length (ins)	Width (ins)	Height (ins)
Vehicle and Trailer				
Vehicle	Front axle 1,950 Rear axle 2,300 Total 4,250	179 (Front bumper to rear tow hook)	64 (Sides of guards)	81.5 (Canopy bows)
Trailer and Generator Set	Trailer 1,040 Gen. Set 760 Total 1,800	38	26	30
Radio Set AN/TRC -75	318	48.1/2	30.1/2	20
Radio Receiver 651E-1	156	33.3/4	31.1/4	14.3/8

107. Bridge Classification:-

Combined vehicle and trailer - 4

SECTION 10 - BRIEF TECHNICAL DESCRIPTION

GENERAL CHARACTERISTICS

108. (a) Frequency range and tuning

(i) Range - 2.0 Mc/s to 29.999 Mc/s

(ii) Channels - 28,000 available in 1 kc/s increments

(iii) Tuning method - Automatic, servo controlled.

(b) Modes

(i) Operating modes - Simplex and duplex

(ii) Modulation modes - Single Sideband (USB, LSB, ISB or TWIN Sidebands)
AM
CW
FSK (with converter)

(c) Frequency Selection - Independent direct-reading frequency selection for both transceiver and duplex receiver.

(d) Channel Selection time - 20 seconds nominal (to 60 seconds, depending on antenna)

(e) Frequency stability - 0.5 part per million under standard conditions. One part per million under Service conditions.

(f) Antenna - 15-ft whip or 45.0 to 95.0 -ft long wire (two antennas required for duplex operation)

(g) Primary power required - 120 volts ± 5V 400 c/s ± 20 c/s, 3-phase, 4-wire 2.5 kW, 90 per cent lagging power factor.

(h) Input power (380 to 420 c/s)

Standby-Receive	-	445 W
Tuning	-	1,490 W
Transient	-	1,435 W (SSB Voice)
		2,150 W (AM)
		2,390 W (CW or FSK)

(j) Environmental conditions

(i) Temperature range - 40° to +122°F (-40° to +50°C)

(ii) Ambient humidity - 0 to 95 per cent

(iii) Altitude - up to 10,000 ft above mean sea level

TRANSMITTING CHARACTERISTICS

109. (a) Noise output - 50 dB

(b) High power output

SSB 2.0 Mc/s to 15.0 Mc/s	900 W PEP
15.0 Mc/s to 29.999 Mc/s	750 W PEP
AM	180 W
CW and FSK	700 W

(c) Low power output

SSB	100 W to 200 W PEP
AM	40 W to 80 W
CW and FSK	100 W

(d) Distortion - Third order intermodulation distortion -

2.0 Mc/s to 20.0 Mc/s	-30 dB
20.0 Mc/s to 29.999 Mc/s	-25 dB

(e) Spurious output

Undesired sideband	-40 dB
Harmonic spurious	-40 dB
All others	-50 dB

(f) Duty cycle

FSK, SSB VOICE	-	continuous
AM	-	50 per cent

(g) Standing wave ratio - 1.3 to 1.0 (maximum)

RECEIVING CHARACTERISTICS

110. (a) Sensitivity

SSB	1 μV maximum for 10 dB signal-plus-noise to noise ratio at standard conditions
AM	3 μV maximum for 10 dB signal-plus-noise to noise ratio at standard conditions.

(b) Selectivity

SSB	2.6 kc/s minimum at 6 dB points 5.5 kc/s maximum at 60 dB points
AM	6.0 kc/s minimum at 6 dB points 10.8 kc/s maximum at 60 dB points

AVC characteristics - Not more than 9 dB in audio output for RF increase from 5 uV to 100,000 uV

AUDIO CHARACTERISTICS

111. (a) Bandwidth

3 kc/s nominal, either sideband

(b) Inputs

USB Line)	
LSB Line)	each -25 to +2 dBm, 600 Ohms, balanced
AM)	

(c) Microphone - Low impedance dynamic or carbon

(d) Outputs

USB Line)	each 0 dBm nominal into 600 Ohms
LSB Line)	balanced. (Attenuation in Jack Field
AM)	before going to Line - 20 dB)
Speaker	1 Watt nominal (adjustable) into 600 Ohms
Headset	6 dBm nominal (adjustable) into 9 Ohms
Distortion	15 per cent distortion

CHAPTER TWO - OPERATION OF STATION

SECTION 11 - INSTALLATION CHECK

112. When the Command Radio Station is received it should be checked to make sure that it contains all the items shown in the Complete Equipment Schedules Nos 1784, 3074, 3282 and 3572.

113. Report any deficiencies at once.

114. The equipment should function properly as soon as it has been correctly set up. If it does not respond to the operating instructions laid down in this Chapter and Chapter Three, the fact should be reported at once so that action to repair or to replace the offending item may be taken without losing time.

SECTION 12 - SETTING UP THE STATION

GENERAL

Siting the Station

115. The best location for radio equipment depends on the tactical situation and on local conditions. Consider the need for camouflage, the terrain, and possible sources of interference. The radio set will have a greater communication range if the antennas are high and clear of hills, buildings, cliffs, and wooded areas. Valleys and other low places are poor locations because the surrounding terrain absorbs the RF energy. Clear, strong signals cannot be expected if the radio set is operated under, or close to steel bridges, underpasses, or power lines. Large power units or other electrical machinery are possible sources of interference. If possible choose a location on a hilltop or other high place. A flat surrounding terrain is desirable. For duplex operation, the site must also provide an adequate location for the duplex receiving antenna at least 100 feet away from the transmitting antenna.

> WARNING
>
> The trailer mounted generator set, or other primary power source should not be switched on until all the connecting cables, wiring harness connection, and antenna have been checked and, where necessary, adjusted.

SETTING-UP

Mobile role

116. All equipments are already mounted in the vehicle. Ensure that all plug and terminal connections are properly made. A block diagram of the station circuits is reproduced in Fig 18, and a connector diagram and list of connecting cables are given in Fig 17 and Table 1. Harness wiring connections are shown in Fig 17 and Table 2 (see also Fig 33).

117. See that all units (including the generator set or other primary power source) are switched off, then connect the power cable (W1, Table 1 and Fig 17) and bonding lead (W10) between the generator set in the trailer and the vehicle. Check that all bonding straps are secure and that the earth chain is intact and making contact with the ground (see Table 2B).

118. Erect the vertical HF Antenna on the vehicle (see Section 4). Connect the earthing chain to the chassis earth (Fig 3).

119. Connect headset, microphone, and loudspeakers (Fig 27) according to requirements (see paras 80 to 82 and Chapter Three).

120. The station is now ready for use in the mobile role.

Static Use (additional steps)

121. Erect the receive antenna at least 100-ft but not more than 100 yards from the vehicle (see Section 4).

122. Connect the antenna to the input connector J3 on the rear panel (Fig 26) of the duplex receiver, by the coaxial cable (ADE(W)17-52).

123. Terminate external lines to the terminals on the bottom/rear of Box Jack Field and Stationery Assembly (Fig 16); see paras 129(a) and (b).

124. Drive the four earth spikes into the ground at the following points and connect the leads to the terminals indicated in Fig 17:-

(a) One near the vehicle earth terminal (X of Fig 17).

(b) One near each end of the Receiver Support (72 and 73 of Fig 17).

(c) One near the Generator Ground Stud Assembly (74 of Fig 17).

125. The station is now ready for use in the static role.

INDIVIDUAL ITEMS OF EQUIPMENT

126. Check and ensure that individual items of equipment are properly set up in accordance with the following:-

(a)	Radio Set AN/TRC-75) Duplex Radio Receiver 651E-1)	In accordance with the instructions given in Chapter Three.
(b)	Teletypewriter Set TT-4/TG, A, B, C/TG	Technical Manual Teletypewriter, TT-4/TG-TM11-2234 (7610-66-010-4087). (Copy issued with installation kit).
(c)	Filter Band Suppression F-98/U	USA Technical Manual TM11-2239.
(d)	Terminal Telegraph TH-5/TG	USA Technical Manual TM-11-2239.
(e)	Network, Hybrid Circuit	Provisional Notes on Network, Hybrid Circuit, 2nd Edition - ADE Handbook No. 428.
(f)	Telephone Set 'K' Aust Mk 1	Provisional Notes on Telephone Set 'K', 2nd Edition - ADE Pamphlet No. 230.
(g)	Generator Set, Diesel Engine, Bucknell Model EG-4005 (Trailer mounted) and accessories	Chapter Six and Seven of this User Handbook.

SECTION 13 - OPERATING THE STATION

WARNING

1. Do not switch sets on unless an antenna has been connected. The vertical HF antenna must be at least 15-ft long.
2. Do not switch power on to the installation until all antenna erection has been completed and protective covers are in place.
3. Refer to Paras 20, 21, 22, 32, 33, 34, Warning Note in Section 12, and Provisions of Chapter Three.
4. At all times the items of equipment must be bonded to the vehicle (including the Generator Set). See para 22 and Table 2.

TREATMENT FOR ELECTRICAL SHOCK IS GIVEN ON PAGE (viii)
AT FRONT OF BOOK

SWITCH-ON PROCEDURE

127. After completion of setting up in accordance with Section 12 and Chapter Three proceed as follows:-

(a) Start up the 5 kVA 400 c/s, 3-phase, diesel engine, generator set, mounted in the trailer, after referring to the instruction plate on the set and Chapters Six and Seven.

(b) Set voltage and check frequency after the motor has settled down.

(c) Switch on power to connecting cable W1, by setting the circuit-breaker switch on the generator set control panel at ON (UP position).

(d) Switch on both circuit breakers on the Power Distribution Unit. (Fig 16).

(e) Switch on circuit breaker switches of Radio Set AN/TRC-75 and Duplex Receiver (but first refer to Chapter Three).

(f) Open the ventilation door on Radio Set AN/TRC-75 (see para 65 and Fig 20).

(g) Move ON/OFF switches on Radio Set AN/TRC-75 and Duplex Receiver 651E-1 to the ON position.

(h) Set frequency selecting switches to required operating frequencies of both transmitter and receiver. (See Chapter Three).

(j) Check that circuit patching is arranged, in accordance with the desired traffic requirements (see para 128 and Fig 19). Connect any external lines that are to be used (static operation). Refer to para 129.

(k) Set the required type of modulation and mode of operation on the duplex receiver. (See Chapter Three).

(l) If the teletypewriter is to be used, check that the Terminal Telegraph TH-5/TG is connected up and set correctly. Set the Teletypewriter ON/OFF switch at ON.

(m) Press the microphone switch and allow the automatic tuning to complete its cycle. During tuning, an 800 c/s tone will be heard in the headset or speaker. At the completion of tuning two green lights will appear on the control panel of the Duplex Receiver 651E-1. (Refer to the instructions given in Chapter Three).

(n) The station is now ready to pass traffic.

NORMAL PATCHING CIRCUITS (See Fig 19 and key)

128.

2W	Through Hybrid 'A' (nearest to front of vehicle) to lower sideband.
4W	Receive pair through Filter F98/U and Hybrid 'B' to upper sideband. (Send pair not normally connected).
Teletypewriter	Through TH-5/TG to Filter, thus upper sideband.
Tel 'K'	A. Monitor 2W line. B. Monitor receive pair of 4W line.

NOTE

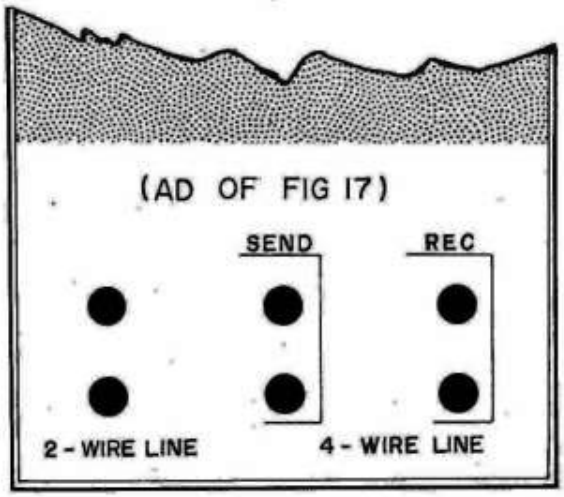
For 4W working the line may be patched directly to either sideband. Similarly other variation and transpositions may be seen from Fig 18.

EXTERNAL LINES

129. Provision is made for operation through external lines, as follows:-

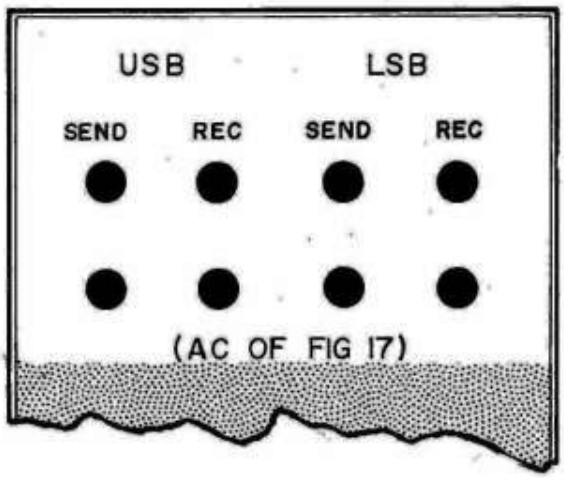
(a) 2-W and 4-W Lines. - A two-wire line and a four-wire line can be attached to the terminals located on the bottom of the Box, Jackfield and Stationery Assembly (refer to Fig 16 and AD of Fig 17). Circuit patching is necessary as indicated in para 128. The external wires are brought in to the terminals through the hole with a grommet (AG of Fig 17) in the body rear panel.

Connect wires to terminals as follows:-



2-W	4-W	
	Send	Rec
white	white	white
black	orange	green

(b) USB and LSB Lines. - Upper and Lower Sideband SEND and RECEIVE can be operated over these lines. As the terminals (see Fig 3) are connected directly to the radio sets, no circuit patching is necessary. The terminals for these lines are mounted on the rear face of the Box, Jack Field and Stationery Assembly (G of Fig 17) and protrude through the body rear panel. Connect wires to terminals as follows:-



USB		LSB	
Send	Rec	Send	Rec
grey	grey	grey	grey
red	yellow	orange	brown

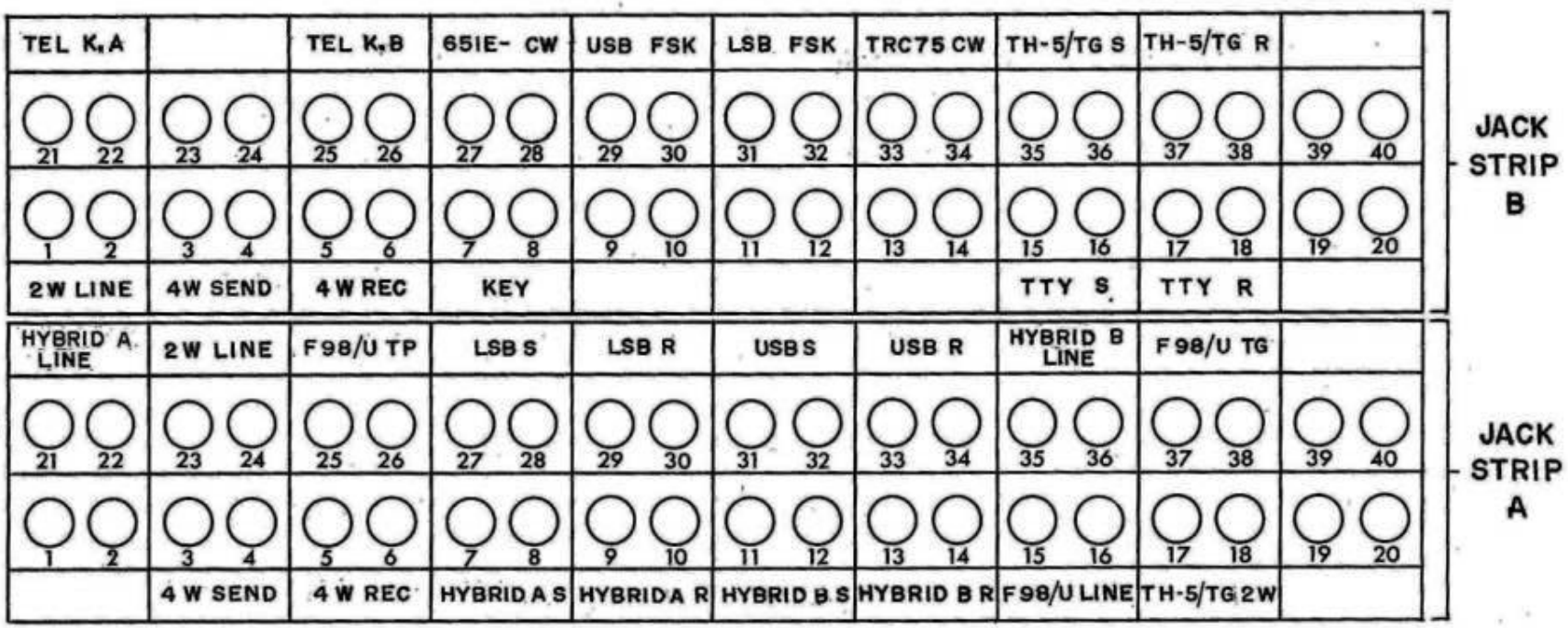


FIG 19 - PATCHING PANEL (JACK FIELD)

KEY TO FIG 19

(Letter and number references in brackets connect with Fig 17 and Table 2)

Jack Nos.	Unit	* Connection
JACK STRIP A		
1-2	Not Used	
3-4	External four-wire line (AD)	Send
5-6	External four-wire line (AD)	Receive
7-8	Front Network Hybrid C (P)	Send (31-32)
9-10	Front Network Hybrid C (P)	Receive (33-34)
11-12	Rear Network Hybrid C (N)	Send (37-38)
13-14	Rear Network Hybrid C (N)	Receive (39-40)
15-16	Filter, Band Suppression (N)	Line (25-26)
17-18	Terminal Telegraph (H)	2W Line (23-24)
19-20	Not used	
21-22	Front Network Hybrid C (P)	Line (35-36)
23-24	External two-wire line (AD)	Line
25-26	Filter, Band Suppression (V)	TP (27-28)
27-28	Lower Sideband (F)	Send (9-10)
29-30	Lower Sideband (F)	Receive (15-16)
31-32	Upper Sideband (F)	Send (13-14)
33-34	Upper Sideband (F)	Receive (17-18)
35-36	Rear Network Hybrid C (N)	Line (41-42)
37-38	Filter, Band Suppression (V)	TG (29-30)
39-40	Not used	

Jack Nos.	Unit	* Connection
JACK STRIP B		
1-2	External two-wire line (AD)	Line
3-4	External four-wire line(AD)	Send
5-6	External four-wire line(AD)	Receive
7-8	Key (morse) (T)	Terminals
9-10	Not used	
11-12	Not used	
13-14	Not used	
15-16	Teletypewriter (L)	Send (1-2)
17-18	Teletypewriter (L)	Receive (3-4)
19-20	Not used	
21-22	Front Telephone Set K (Q)	Terminals (43-44)
23-24	Not used	
25-26	Rear Telephone Set K (R)	Terminals(45-46)
27-28	Duplex Receiver 651E-1 (F)	CW (19)
29-30	Upper Sideband (F)	FSK (11-12)
31-32	Lower Sideband (F)	FSK (7-8)
33-34	Radio Set AN/TRC-75 (E)	CW (20)
35-36	Terminal Telegraph (H)	Send (22)
37-38	Terminal Telegraph (H)	Receive (21)
39-40	Not used	

* These circuits are also shown in Fig 18

OPERATION

130. Details of operation and of the adjustment of the radio sets are given in Chapter Three. Those relating to other major items of equipment are given in the publications listed in para 126.

> **WARNING**
>
> Do not switch on and operate the station until the instructions in Chapter Three have been studied

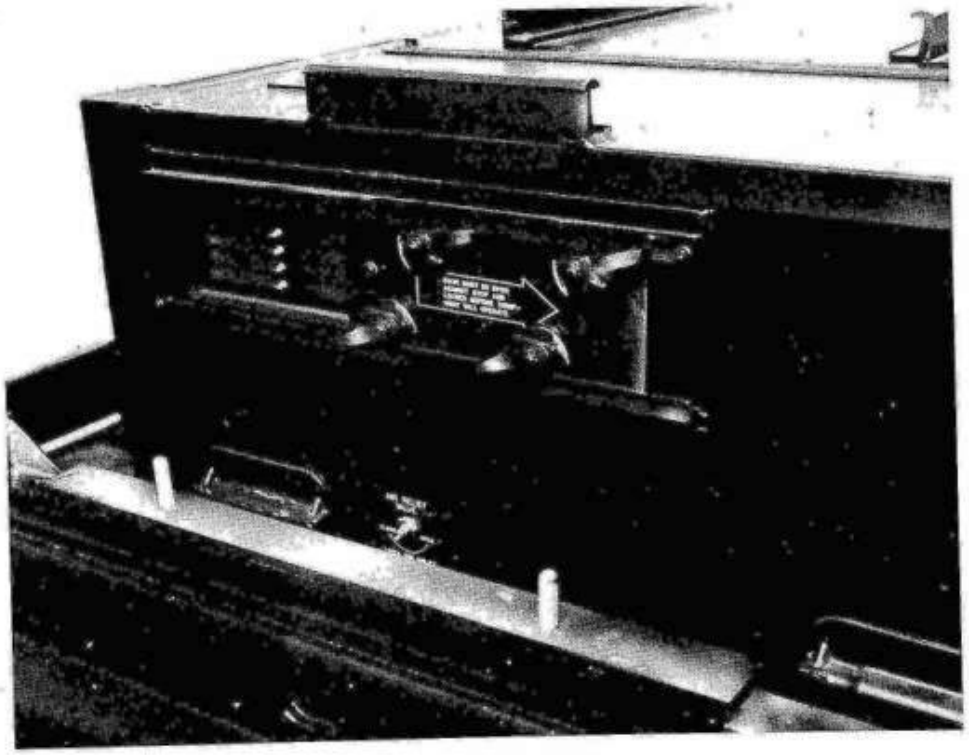


FIG 20 - VENTILATION - RADIO SET AN/TRC-75 (DUPLEX)

> **NOTE**
>
> Radio Set AN/TRC-75 cannot be operated until the ventilation door is fully opened and locked in position. This door is accessible from the right side of the vehicle - refer to paras 65 and 127 (f) and Fig 20.

CHAPTER THREE - OPERATION OF RADIO SET AN/TRC-75 (DUPLEX) AND DUPLEX RECEIVER 651 E-1

SECTION 14 - GENERAL

131. This station provides a vehicular single sideband communication system, the chief units of which are Radio Set AN/TRC-75 (Duplex) and Duplex Receiver 651E-1. This system has two major modes of operation, duplex and simplex.

132. In duplex operation, transmission is provided by the Radio Set AN/TRC-75 (Duplex) and reception is provided by Duplex Receiver 651E-1.

133. In simplex operation, the Radio Set AN/TRC-75 (Duplex) functions as a transceiver and the Duplex Receiver 651E-1 can be used as a monitor receiver.

134. Selection of duplex or simplex mode is made at the receiver 651E-1 control panel. In the duplex mode, certain AN/TRC-75 (Duplex) control functions are transferred to the Duplex Receiver 651E-1 control panel.

SECTION 15 - BRIEF PRINCIPLES OF OPERATION

DUPLEX OPERATION

135. In duplex operation, the system has the maximum capability of transmitting and receiving on two independent voice or tone signal channels. Input and output signal connections are made at the front panel of receiver 651E-1. Transmitter frequency selection is made at the radio set control on AN/TRC-75. The selection of the receiver frequency (separated at least 20 per cent from the transmitter frequency) is made at the radio set control on the receiver 651E-1 control panel, as also are the modulation and keying mode.

Transmitting

136. A simple block diagram of the transmit circuits is shown in Fig 21. The signal path for duplex operation is depicted by a bold line for clarity. Input signals from external equipment are applied to the system at the input circuits of receiver 651E-1. The types of input to be utilized are selected by switches associated with each sideband and applied to audio amplifiers.

137. The line input signal levels to the audio amplifiers are adjusted by the appropriate level controls. A VU meter is provided to observe the output level of either audio amplifiers, as selected by a switch on the control

panel. The amplified audio signals are applied to Radio Set AN/TRC-75 (Duplex) through the interconnecting cable (Fig 17, cable W4).

138. The input signals to the AN/TRC-75 are applied through operated contacts of the duplex transfer relay to the upper and lower sideband balanced modulators. The balanced modulator circuits suppress the carrier frequency and mechanical filters suppress the unwanted sideband. The resulting single sideband signals are both applied to the transmitter gain control circuit.

139. The transmitter gain control circuit consists of a gain-controlled amplifier that has its output maintained at a signal level that prevents over-driving of the power amplifier stages of Radio Transmitter T-730/TRC-75.

140. If AM operation is selected, a 300 kc/s carrier is automatically reinserted, reduced 6 dB, at the output of the transmitter gain control circuit. Only the upper sideband is used in AM operation. The modulated signal is then applied to Amplifier-Mixer AM-1528/URC. This mixer, using double conversion, converts the signal to a nominal 0.2 W RF signal in the frequency range of 2.0 Mc/s to 29.999 Mc/s.

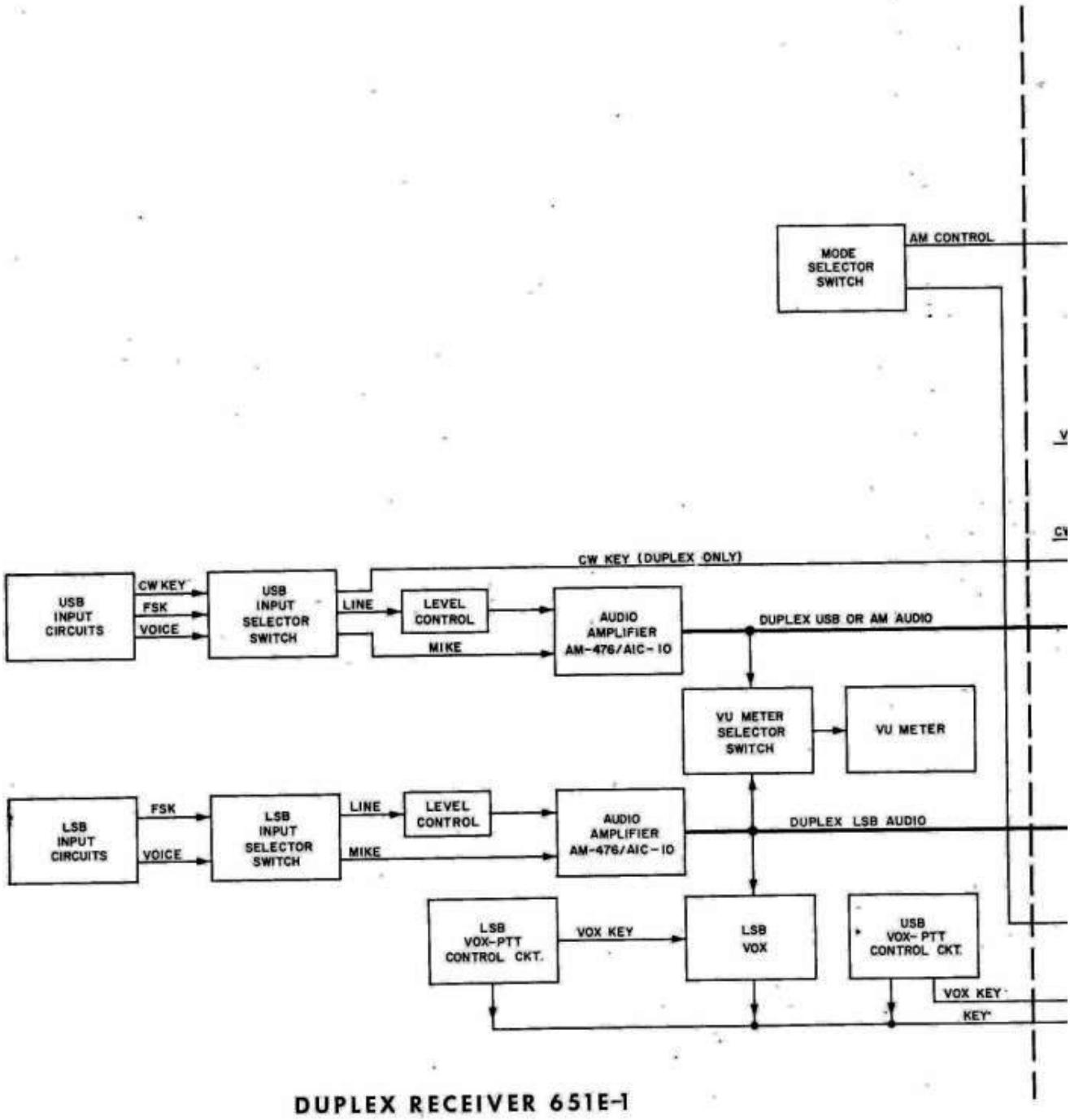
141. Injection frequencies used by the conversion stages of the AM-158/URC are furnished by the Mixer-Oscillator CV-465/URC. The R-761/ARC-58 output signal is applied to Radio Transmitter T-730/TRC-75, which linearly amplifies it to a nominal power level of 1.0 kW.

142. The transmitter output is applied to the Antenna Coupler CU-749/TRC-75 which couples the signal to the antenna, using loading Coil Assembly RF-111/TRC-75, as required. Antenna Coupler Control C-2848/TRC-75 contains a portion of the antenna coupling control circuits and operates in conjunction with the CU-749/TRC-75 to attain a complete antenna coupling and tuning system.

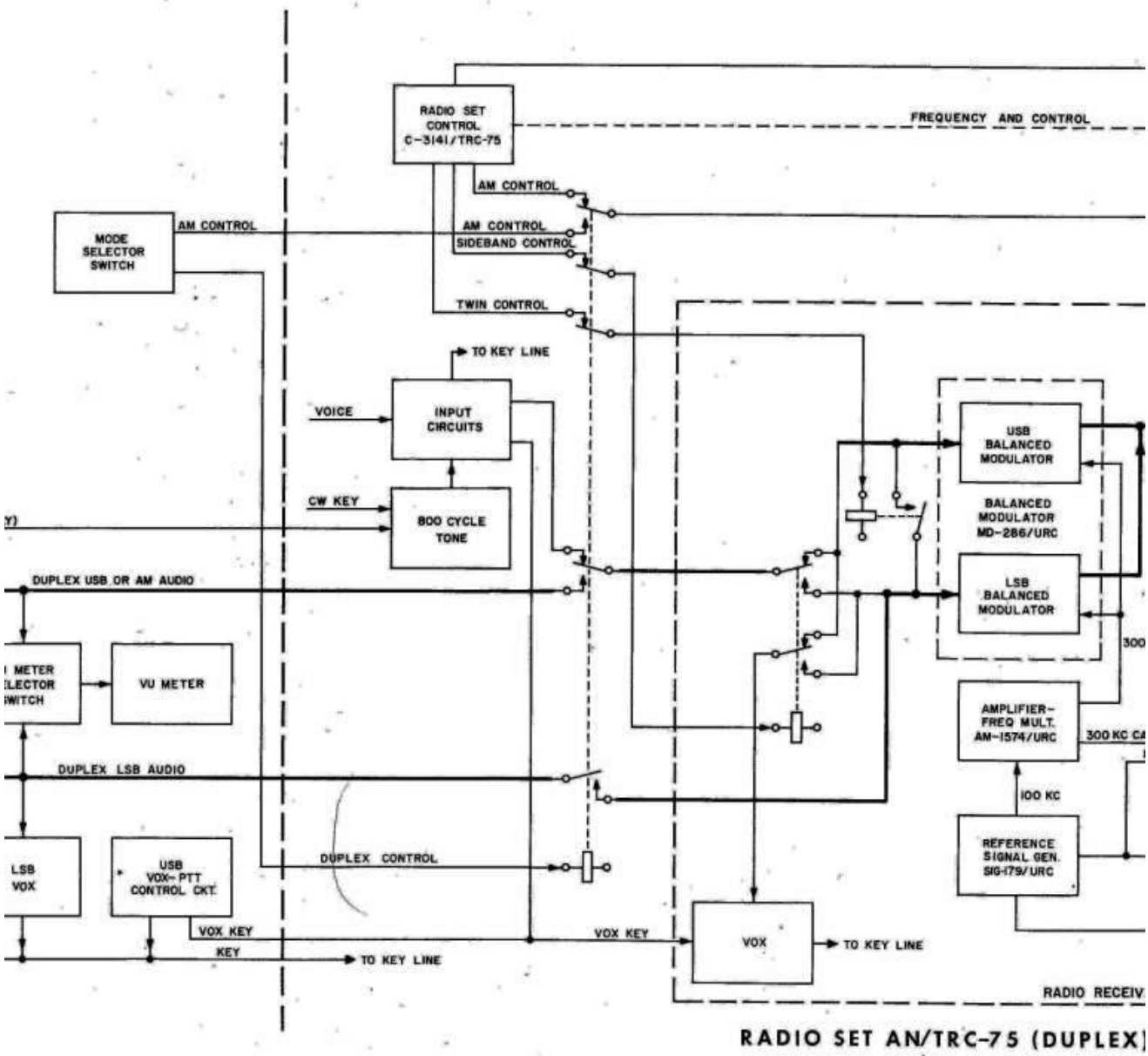
143. The transmitter can be keyed by the circuits associated with either sideband. Keying can be push-to-talk (PTT), voice operated (VOX), or CW. In VOX operation, the transmitter is keyed by the application of audio to either the lower sideband VOX amplifier in the receiver 651E-1, or the upper sideband VOX amplifier in radio set AN/TRC-75. In PTT operation, the VOX keying circuit is disabled unless the PTT switching circuit is completed. In CW operation, the transmitter is keyed by the hand key which operates a relay that applies an 800-cycle tone to the upper sideband and connects the grounded VOX key line to the transmitter key line.

Receiving

144. A simple block diagram of the system receive circuits is shown in Fig 22.



DUPLEX RECEIVER 651E-1



RADIO SET AN/TRC-75 (DUPLEX)

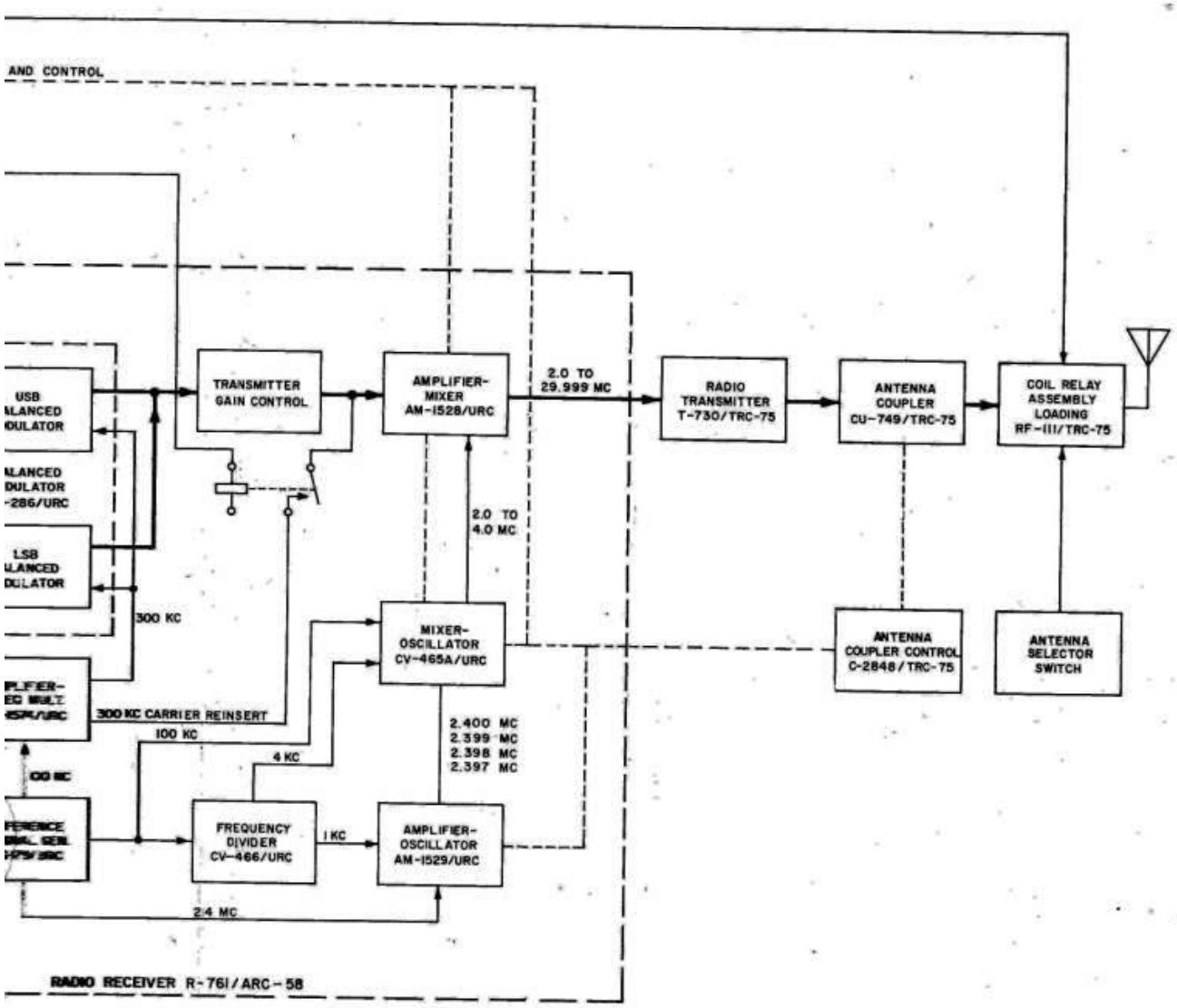


FIG 21 - SIMPLIFIED BLOCK DIAGRAM OF TRANSMIT CIRCUITS

145. Incoming RF signals from the duplex antenna are applied to Radio Receiver R-761/ARC-58 in the Duplex Receiver 651E-1. For an antenna separation of 100-feet, the duplex receiving frequency must be separated from the transmitting frequency by at least 20 per cent.

146. Use of a special filter would permit this frequency separation to be reduced to 10 per cent. However, this bandpass filter 635T-1 and its associated equipment are not supplied with this installation.

147. The input signal to the Radio Receiver R-761/ARC-58 is applied to Amplifier-Mixer AM-1528/URC where it is amplified and converted to an IF signal. The IF signal is applied to three amplifier-detector sub-assemblies that amplify the IF signal and recover the intelligence to operate monitoring devices. The selection relays select the desired detected output or outputs for application to the audio output circuits of Duplex Receiver 651E-1.

148. When Radio Set AN/TRC-75 (Duplex) is not transmitting, it reverts to the receive conditions. The duplex transfer relay limits the receive operation of Radio Set AN/TRC-75 in the duplex mode to upper sideband or AM as determined by the mode selector switch on the receiver 651E-1. Within these limits, AN/TRC-75 can be used to monitor the transmitting frequency whenever the transmitter is not keyed.

SIMPLEX OPERATION

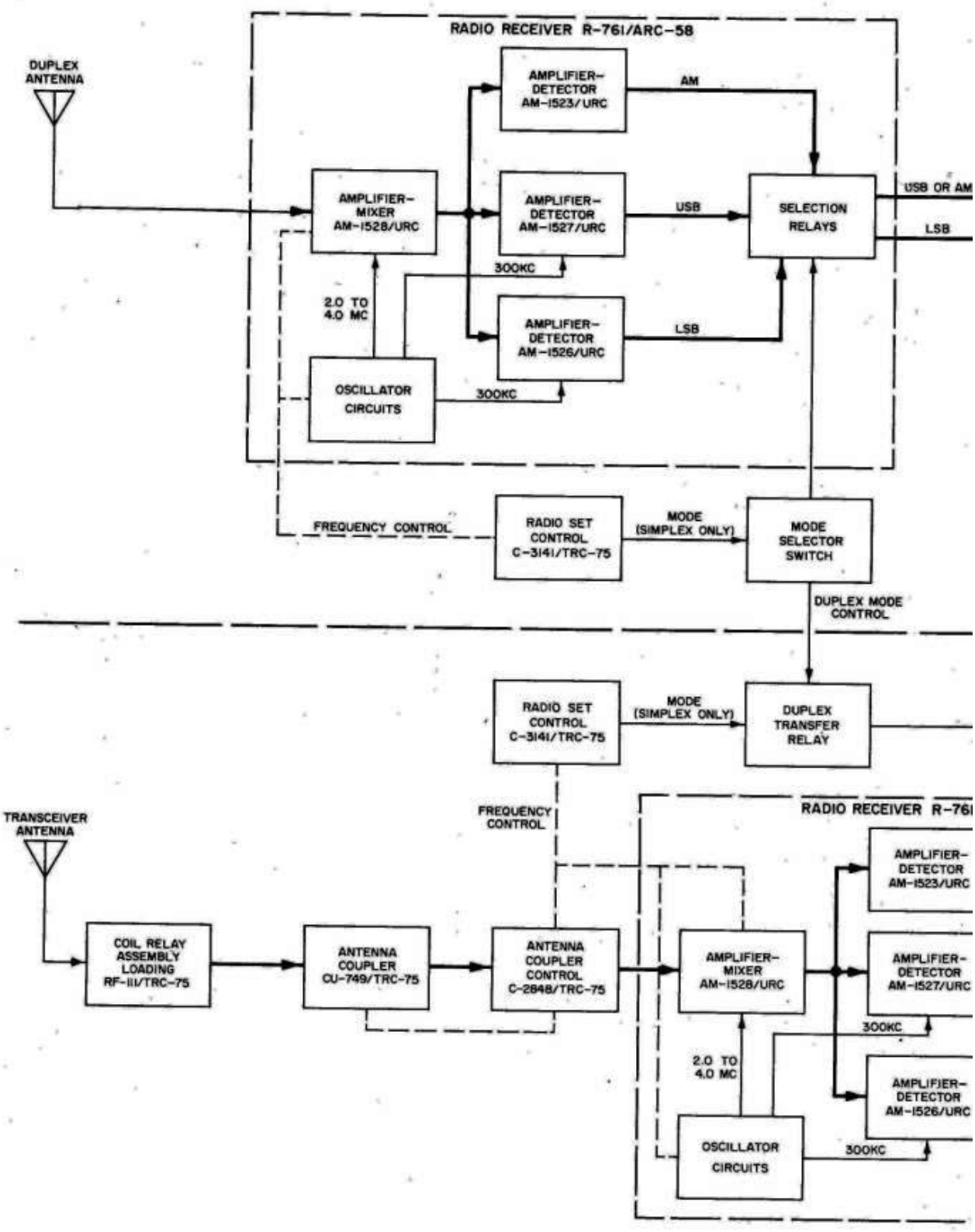
149. In simplex operation of the system, Radio Set AN/TRC-75 (Duplex) and Duplex Receiver 651E-1 function independently, except that the Duplex Receiver 651E-1 is disabled while Radio Set AN/TRC-75 is transmitting. All control functions and input and output connections for Radio Set AN/TRC-75 are then made at its own control panel.

Transmitting

150. Only one audio channel is provided by the Radio Set AN/TRC-75 (Duplex) during simplex operation. The audio signal is applied to the input circuits at the front panel of the radio set (see Fig 21). The signal from the input circuits is applied through normally closed contacts of the de-energized duplex transfer relay to the selection relays of the Radio Receiver R-761/ARC-58.

151. If the transmission mode is upper sideband (U), the signal is applied through the normally closed contacts of the sideband relay to the upper sideband balanced modulator.

152. If the transmission mode is lower sideband (L), the sideband relay is operated and the signal is applied to the lower sideband balanced modulator.


RADIO RECEIVER R-761/ARC-58
DUPLEX ANTENNA
AMPLIFIER-DETECTOR AM-1523/URC
AM
AMPLIFIER-MIXER AM-1528/URC
AMPLIFIER-DETECTOR AM-1527/URC
USB
SELECTION RELAYS
USB OR AM
LSB
300KC
2.0 TO 4.0 MC
AMPLIFIER-DETECTOR AM-1526/URC
LSB
OSCILLATOR CIRCUITS
300KC
FREQUENCY CONTROL
RADIO SET CONTROL C-3141/TRC-75
MODE (SIMPLEX ONLY)
MODE SELECTOR SWITCH
DUPLEX MODE CONTROL
RADIO SET CONTROL C-3141/TRC-75
MODE (SIMPLEX ONLY)
DUPLEX TRANSFER RELAY
TRANSCEIVER ANTENNA
FREQUENCY CONTROL
RADIO RECEIVER R-76
COIL RELAY ASSEMBLY LOADING RF-111/TRC-75
ANTENNA COUPLER CU-749/TRC-75
ANTENNA COUPLER CONTROL C-2848/TRC-75
AMPLIFIER-MIXER AM-1528/URC
AMPLIFIER-DETECTOR AM-1523/URC
AMPLIFIER-DETECTOR AM-1527/URC
300KC
2.0 TO 4.0 MC
AMPLIFIER-DETECTOR AM-1526/URC
OSCILLATOR CIRCUITS
300KC

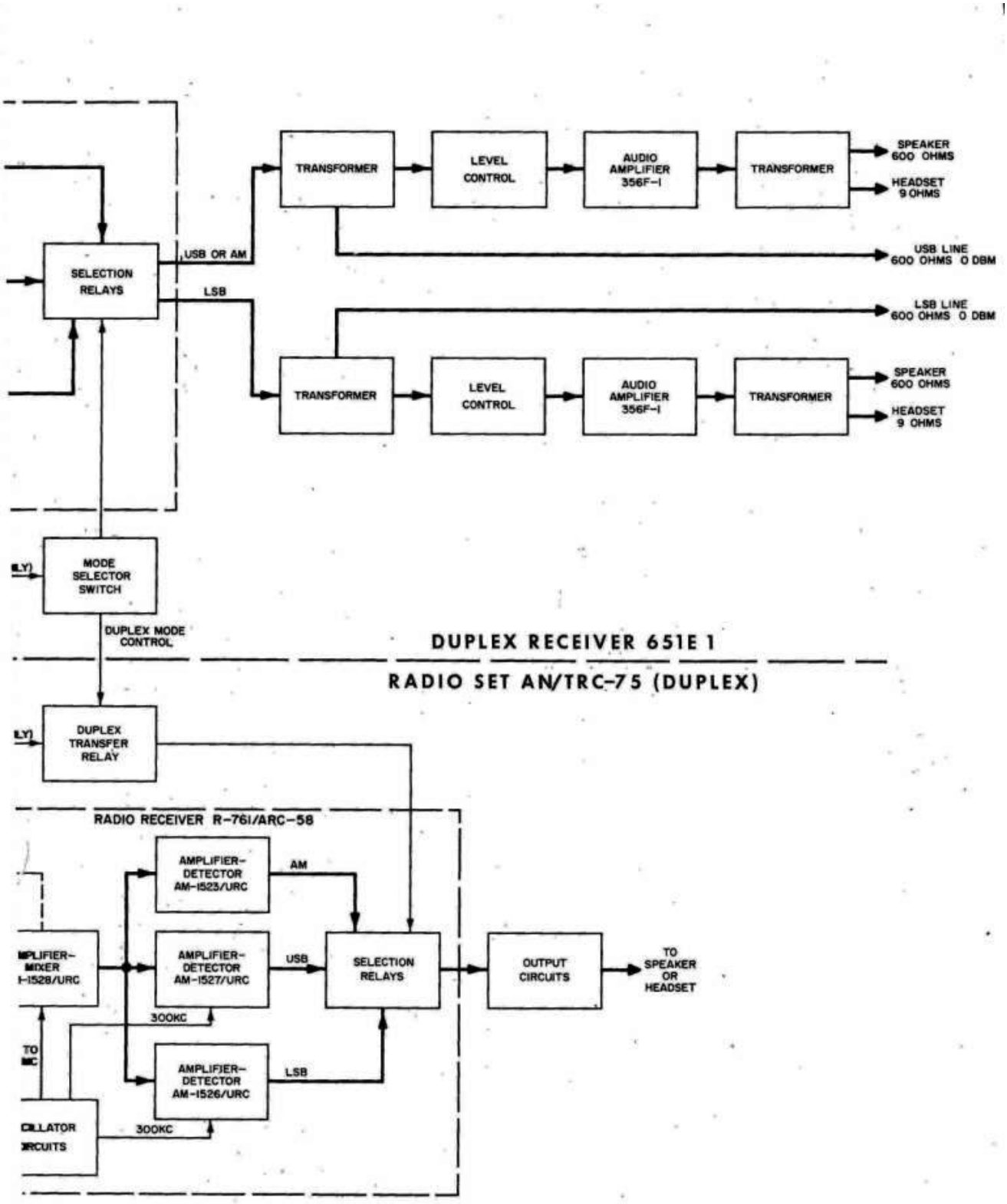


FIG 22 - SIMPLIFIED BLOCK DIAGRAM OF RECEIVE CIRCUITS

153. If the TWIN mode is selected, the sideband relay is de-energized and the twin relay is operated to apply the signal to both balanced modulators.

154. For AM operation, the input signal is applied to the upper sideband balanced modulator and the carrier re-insert relay is operated.

155. From the balanced modulators on, signal flow is the same as that described for duplex operation. Transmitter keying for simplex operation is also essentially the same as that for duplex operation. Note, however, that the sideband relay also transfers the audio input for the VOX circuit to the sideband in use.

Receiving

156. In simplex operation, Duplex Receiver 651E-1 may be used to monitor other frequencies, but it is disabled whenever Radio Set AN/TRC-75 is transmitting. This is accomplished by keying the Radio Receiver R/761-ARC-58 in the Duplex Receiver 651E-1 and placing it in a transmit condition. If operational requirements make this feature undesirable, then the inter-connecting cable (Fig 17, cable W4) from the Radio Set AN/TRC-75 (Duplex) may be disconnected from the Duplex Receiver 651E-1 at J1 (Fig 26). In this case, however, care must be exercised to ensure that the receiving frequency selected on Duplex Receiver 651E-1 is at least 20 per cent away from the transmitting frequency on Radio Set AN/TRC-75, to prevent damage to the receiver input circuits.

157. The AM-U-L-TWIN switch on the Duplex Receiver 651E-1 selects the type of signal received by that receiver during simplex operation only.

158. Except for the receiver disabling feature and independent mode selection, simplex reception is the same as that described for duplex operation in paras 144 to 148 and Figs 21 and 22.

SECTION 16 - LOCATION AND FUNCTION OF OPERATING CONTROLS

RADIO SET AN/TRC-75 (DUPLEX)

159. The operating controls, indicators, and connecting cables of Radio Set AN/TRC-75 (Duplex) are listed and described in Table 4 and illustrated in Figs 23 and 24. The order in which controls are listed does not constitute an operating sequence.

160. When in duplex operation, the Radio Set AN/TRC-75 (Duplex) controls provide preliminary set-up of the transmitter primary power, radio set off-on, transmitter operating frequency, RF power meter, power level, panel lights, and wire/whip antenna selection. The AM-U-L-TWIN switch, AUDIO VOL control, VOL control, and VOICE-CW-TTY switch of the radio set AN/TRC-75 (Duplex) are not in use in duplex operation.

DUPLEX RECEIVER 651E-1

161. The operating controls, indicators and connectors of the Duplex Receiver 651E-1 are listed and described in Table 5 and illustrated in Figs 25 and 26. The order in which the controls are listed does not constitute an operating sequence. The receiver control panel is divided into four general areas. The upport portion of the panel contains transmitting terminals and controls, and the lower portion contains receiving terminals and controls. Upper sideband functions are located on the left, and lower sideband functions are located on the right of the control panel.

TABLE 4 - RADIO SET AN/TRC-75 (DUPLEX), OPERATING CONTROLS, INDICATORS AND CONNECTORS

(FIGS 23 AND 24)

Name and Symbol	Location	Function
Microphone switch	Microphone	Initiates complete tuning of the radio set. Prepares the radio set for transmission of voice by grounding the VOX KEY line.
Primary power off-on circuit breakers (B)	Lower left corner of the radio set case front panel.	Controls 120-volt, 3-phase, 400-cycle ac primary power in the radio set. NOTE These circuit breakers are protected by a flexible cover. They should be operated with the cover in place. The circuit breakers are in the off position when the lever arms are pointing down.

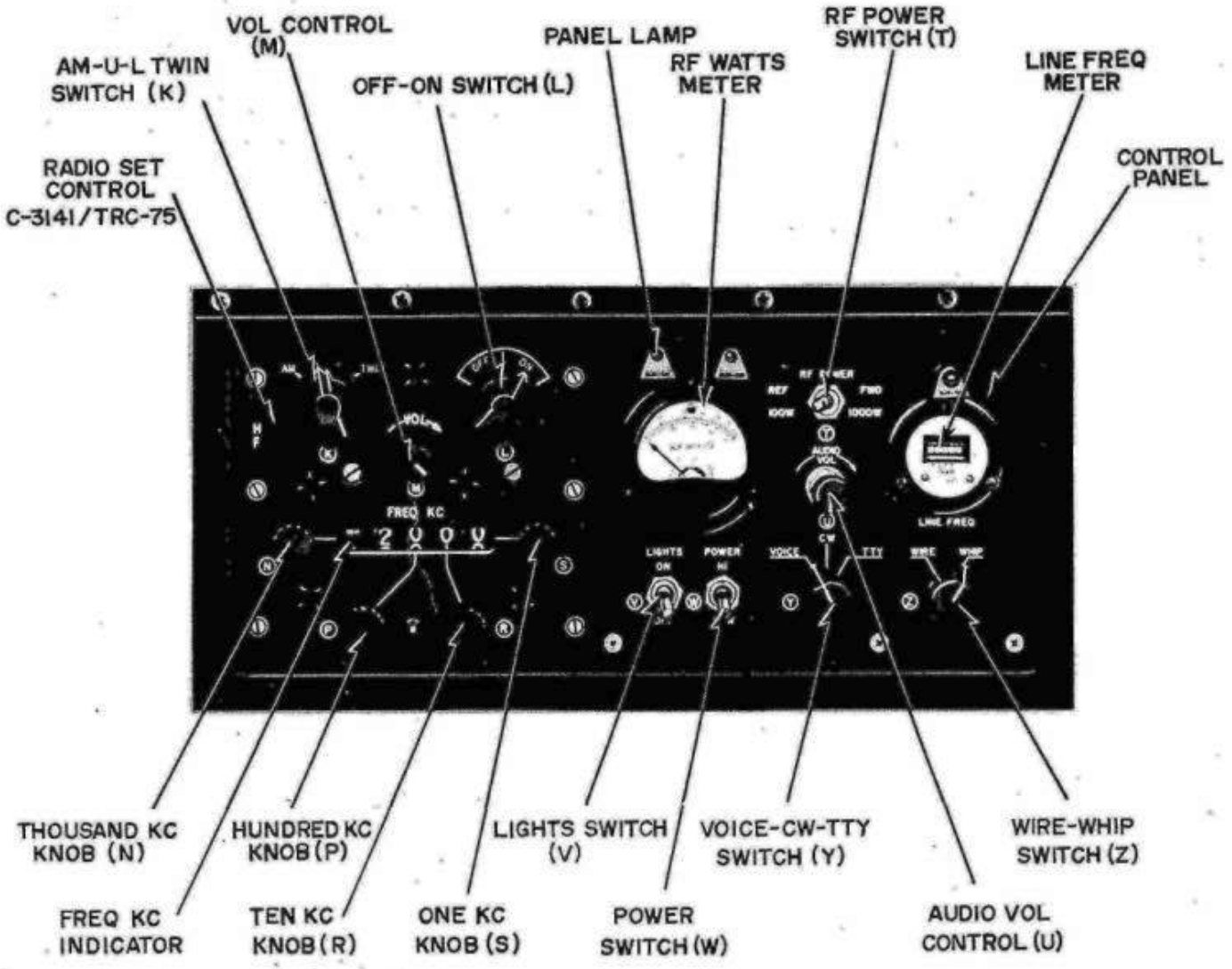


FIG 23 - CONTROL PANEL OF RADIO SET AN/TRC-75 (DUPLEX)

Name and Symbol	Location	Function
OFF-ON switch (L)	Upper right corner of Radio Set Control C-3141/TRC-75	Radio set off-on switch has automatic release feature which turns off radio set when a circuit fault exists, or prevents operation of the radio set when the exhaust air outlet panel is closed.
Frequency selection knobs (N) (P) (R) (S)	Radio Set Control C-3141/ TRC-75	Selection of operating frequency from 2.0 to 29.999 Mc/s in steps of 1, 10, 100, and 1,000 kc/s and initiation of automatic coarse-tuning when the radio set is turned on.
AM-U-L-TWIN switch (K)	Radio Set Control C-3141/TRC-75	Selection of amplitude modulation (AM), upper sideband (U), lower sideband (L), or double sideband (TWIN) during simplex operation.
VOICE-CW-TTY switch (Y)	Bottom centre of radio set control panel	Selection of voice, CW, or teletypewriter signals for transmission and reception in simplex operation. Initiates tuning for CW operation.
POWER HI-LOW switch (W)	Bottom left of radio set control panel	Selection of transmitter output power.
VOL control (M)	Radio Set Control C-3141/ TRC-75.	RF volume control of radio set.
AUDIO VOL control (U)	Centre of radio set control panel	Audio volume control.

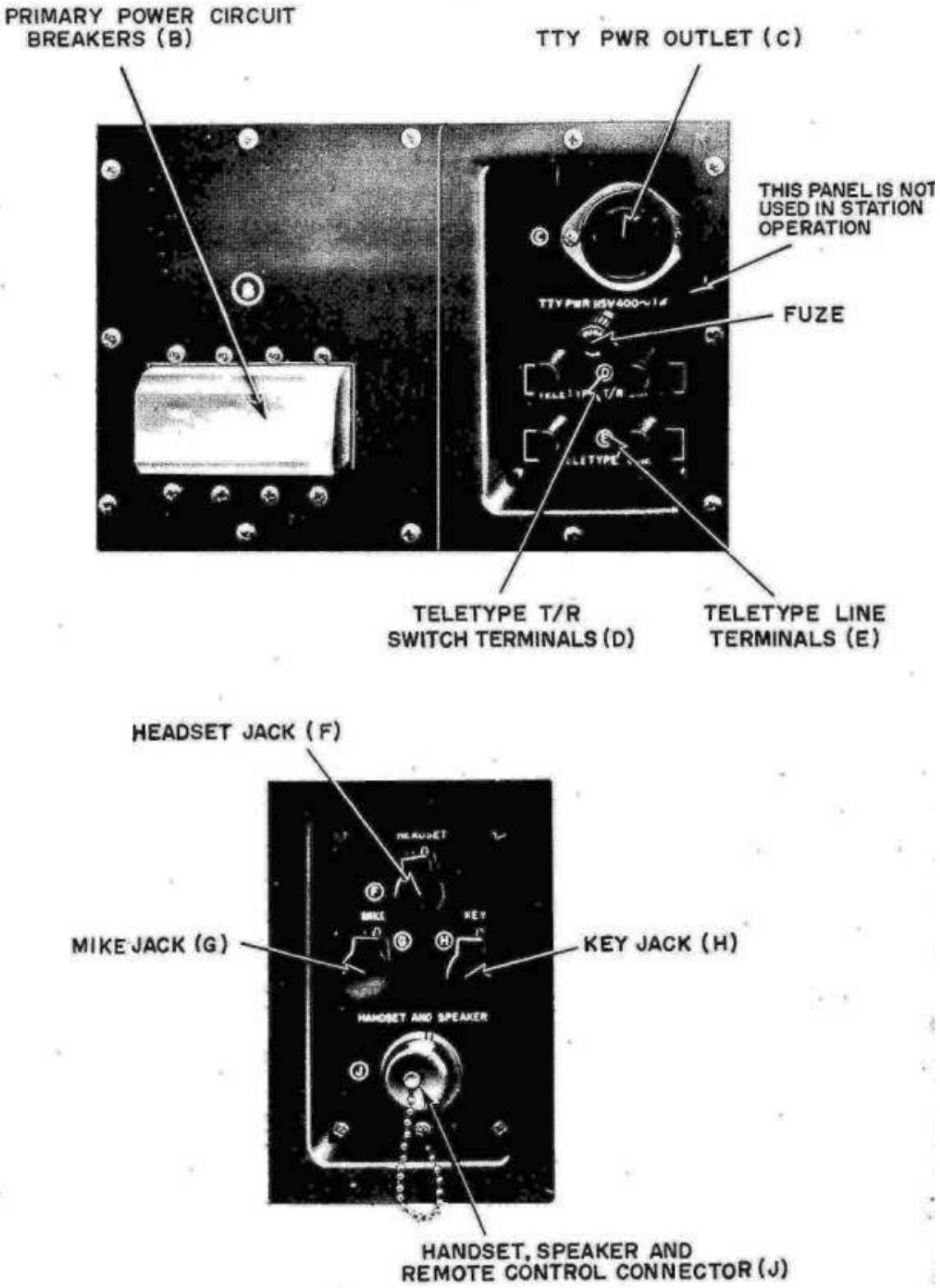


FIG 24 - CONNECTOR PANELS OF RADIO SET AN/TRC-75 (DUPLEX)

Name and Symbol	Location	Function
LIGHTS OFF-ON switch (V)	Bottom left corner of radio set control panel	Illumination of the radio set case control panel and Radio Set Control C-3141/TRC-75.
WIRE-WHIP switch (Z)	Bottom right of radio set control panel	Controls loading coil assembly RF-111/TRC-75. Operation of this switch from one position to the other causes the radio set to retune.
RF POWER switch (T) FWD (1,000W) REF (100W)	Upper centre of radio set control panel	Selection of meter readings showing transmitter output power to the antenna (FWD), or transmitter power reflected from the antenna (REF).
Exhaust air outlet panel	Right side of radio set case	Operates electrical interlock to prevent operation of radio set without exhaust air outlet open.
Teletypewriter panel - TTY PWR (C) FUSE TELETYPE T/R SWITCH (D) TELETYPE LINE (E)	Left side, front panel of radio set case	The connections on this panel are not used in operating this station.
Operating Equipment panel HEADSET jack (F) MIKE jack (G) KEY jack (H) HANDSET, SPEAKER remote control connector (J)	Left centre, front panel of radio set case	Connection points for headset, microphone, CW key, Handset, and speaker as required.

Name and Symbol	Location	Function
FREQ KC dial indicator	Radio Set Control C-3141/TRC-75	Direct readout of operating frequency in kilocycles selected by knobs (N) (P) (R) (S).
RF WATTS meter	Radio set control panel	Indicates transmitted or reflected RF power in watts.
LINE FREQ meter	Radio set control panel	Indicates primary power frequency in cycles per second.
REMOTE CONNECTOR (AA) (See Fig 10)	Lower right end of radio set case front panel	Connection point for remote control cable W4 from Duplex Receiver 651E-1.
PRIMARY POWER INPUT CONNECTOR (A)	Under set, below the primary power circuit breaker switch (B)	Connection for Cable W2 from Power Distribution Box.

TABLE 5 - DUPLEX RECEIVER 651 E-1, OPERATING CONTROLS, INDICATORS AND CONNECTORS

(* Key numbers refer to Fig 25, Duplex Receiver 651E-1 Control Panel)

Name and Symbol	Location/Key *	Function
Primary power circuit breakers	Bottom of storage compartment (Fig 14)	Control of 120-volt, 3-phase, 400-cycle primary power in the duplex receiver.
AM-U-L-TWIN switch (K)	1	Selection of amplitude modulated (AM), upper (U) or lower (L) sideband, or double sideband (TWIN) modes of operation for the duplex receiver when the MODE switch is in the SIMPLEX position. This control is disabled in DUPLEX operation.
VOL control (M)	2	RF volume control of duplex receiver.
OFF-ON switch (L)	3	Duplex receiver off-on. Has automatic release feature which turns off receiver when a circuit fault exists.
VOICE connectors (USB and LSB)	4 and 15	600 ohm audio input connectors for external voice circuits.
MIKE jack (USB and LSB)	5 and 13	Input connection for low impedance dynamic microphone.
LEVEL control (USB and LSB inputs)	6 and 14	Adjust input level of VOICE and FSK lines.
USB INPUT switch	7	Selects VOICE or FSK audio or CW KEY input to upper sideband.
FSK connectors (USB and LSB)	8 and 18	600 ohm audio input connectors for external FSK or single-tone circuits.

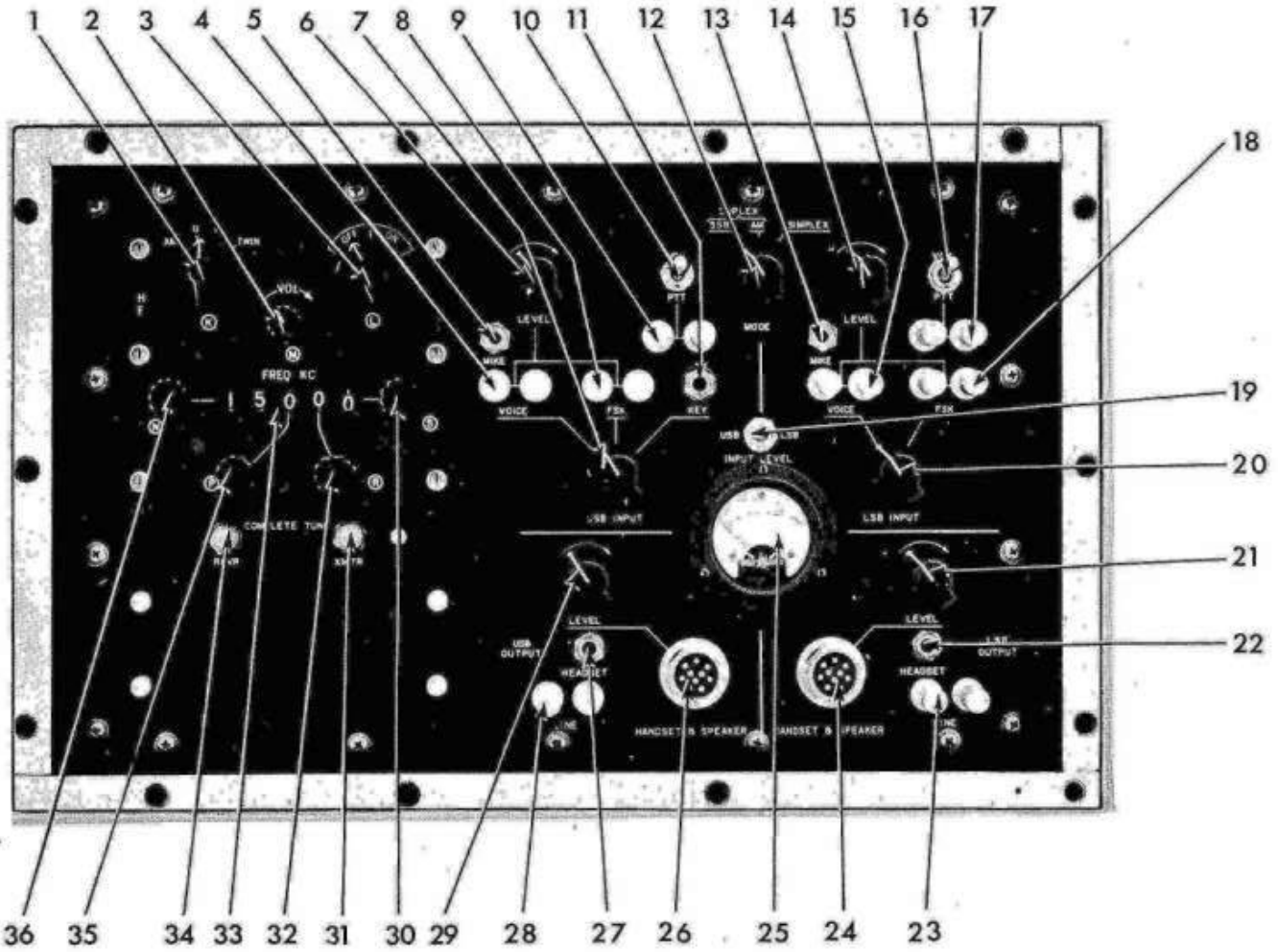


FIG 25 - CONTROL PANEL OF DUPLEX RECEIVER 651E-1

Name and Symbol	Location/Key*	Function
PTT connectors (USB and LSB)	9 and 17	Terminate external push-to-talk control lines.
VOX-PTT switch (USB and LSB)	10 and 16	Select VOX or push-to-talk operation for each sideband.
KEY jack	11	Input connector for CW key.
DUPLEX SSB/AM-SIMPLEX MODE switch.	12	Selects operating mode of system.
USB-LSB switch	19	Connects VU meter to either USB or LSB audio line to the AN/TRC-75 (Duplex).
LSB INPUT switch	20	Selects VOICE or FSK input to lower sideband.
LEVEL control (USB and LSB output)	21 and 29	Adjusts audio output level to speaker and headset.
HEADSET jack (USB and LSB)	22 and 27	Output connection for low-impedance headset.
LINE connectors (USB and LSB)	23 and 28	Output connections at 0 dBm level to external 600 ohm audio circuits.
HANDSET and SPEAKER connector (USB and LSB)	24 and 26	Output connections for 600 ohm speaker, handset, dynamic microphone, or carbon microphone.
INPUT LEVEL meter	25	Measures USB or LSB audio input to the AN/TRC-75 (Duplex).
Frequency control knobs (N) (P) (R) (S)	30, 32, 35, and 36	Selection of duplex receiver operating frequency from 2.0 to 29.999 Mc/s in steps of 1, 10, 100, and 1,000 kc/s.
XMTR COMPLETE TUNE indicator	31	Indicator lamp lights when transmitter is completely tuned.

Name and Symbol	Location/Key *	Function
FREQ KC dial	33	Indicates operating frequency of duplex receiver selected by control knobs (N) (P) (R) (S)
RCVR COMPLETE TUNE indicator	34	Indicator lamp lights when receiver is completely tuned.
REMOTE CABLE connector J1	Left rear of radio set case (Fig 26)	Connection point for control cable to the AN/TRC-75 (Duplex) (Cable W4).
POWER INPUT connector J2	Left rear of radio set case (Fig 26)	Input connection for primary power cable W3 to duplex receiver.
ANTENNA connector J3	Left rear of radio set case (Fig 26)	Input connector for duplex receiving antenna.

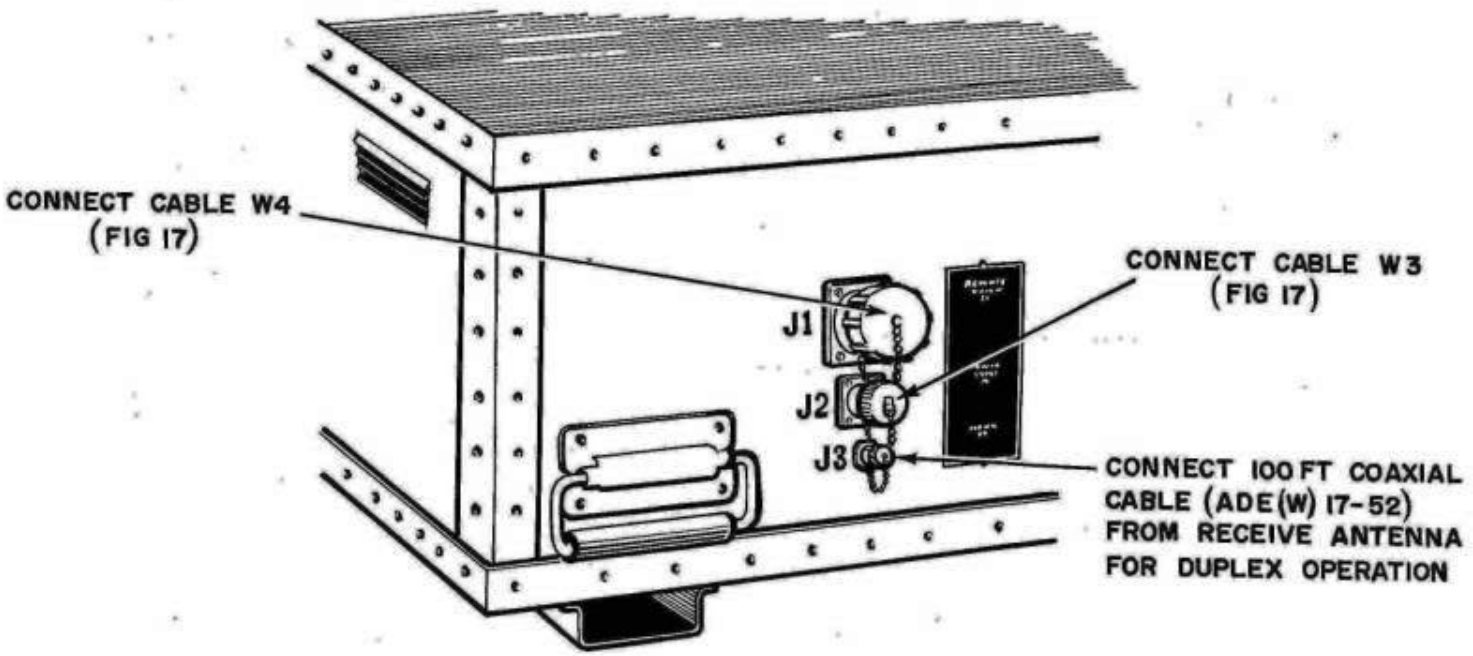


FIG 26 - REAR PANEL CONNECTORS - DUPLEX RECEIVER 651E-1

SECTION 17 - OPERATING PROCEDURES

GENERAL

162. Duplex SSB is the normal mode of operation for the system. This mode provides simultaneous transmission and reception on two independent audio channels (one for each sideband).

163. Duplex AM permits duplex operation on one audio channel only. Input and output connections for AM are made at the input and output connectors for the upper sideband channel.

164. In duplex operation, the Radio Set AN/TRC-75 (Duplex) is used as a transmitter and Duplex Receiver 651E-1 acts as an independent receiver. The control panel (Fig 25) of the Duplex Receiver 651E-1 provides output connections and control functions for the receiver, and audio input selection and level control for the transmit functions which are interconnected with Radio Set AN/TRC-75 (Duplex).

165. The keying operation for each sideband is selected by the VOX-PTT switches on the receiver 651E-1 control panel. During VOX operation, the transmitter is keyed when audio is applied to the transmit circuits. No external keying is required for this operation, when the local microphone is used. However, the microphone push-to-talk button must be depressed to complete the audio circuit in the microphone.

166. Push-to-talk operation of the system is, actually, a modification of VOX operation. Operating the VOX-PTT switches to the PTT position disables the VOX circuits. Closing the circuit of the PTT control line prepares the VOX circuits for operation by grounding the VOX KEY line. This type of operation permits VOX operation with normal circuits, but if the circuit being used has a noise level that would key the transmitter even when no intelligence is being transmitted, the control line can be switched off to prevent accidental transmitter keying. The switching in the lower sideband VOX circuit makes it desirable to place any audio line containing a high noise level on the lower sideband input. These circuits prevent the noise from lowering the transmitting power on the upper sideband when no intelligence is being transmitted on the lower sideband.

167. Standard push-to-talk operation may be obtained by removing the jumpers from terminals 31 to 32 and 35 to 36 on TB1 in the receiver 651E-1 and connecting jumpers from terminals 29 to 30, 30 to 31, and 33 to 34. The transmitter is then keyed by completing the PTT control circuits.

168. Placing the MODE selector switch in the SIMPLEX position allows Radio Set AN/TRC-75 (Duplex) to be operated as a normal transceiver and Duplex Receiver 651E-1 to be operated independently. All control functions and input and output connections for Radio Set AN/TRC-75

(Duplex) are then made at the control panel (Fig 23) and connector panel (Fig 24) of that radio set.

169. The Duplex Receiver 651E-1 may be used to monitor other frequencies, but it is disabled whenever the Radio Set AN/TRC-75 (Duplex) is transmitting. If operational requirements make this feature undesirable, the interconnecting cable (Fig 17, cable W4) may be disconnected from the Remote Cable J1 connector on the rear panel (Fig 26) of the Duplex Receiver 651E-1. In this case, however, care must be exercised to ensure that the receiving frequency selected is at least 20 per cent away from the transmitting frequency to PREVENT DAMAGE TO THE RECEIVER INPUT CIRCUITS.

170. The AM-U-L-TWIN switch on Duplex Receiver 651E-1 selects the type of signal received by this receiver during simplex operation only.

PRE-OPERATIONAL PROCEDURE

171. Refer to Section 11 and 12 regarding checking of the installation of the station and regarding siting and setting up procedures. These should be followed carefully, observing all the safety precautions given.

172. When fully satisfied that the station has been properly installed and connected up correctly, proceed to prepare the station for actual use, as in the following paragraphs.

Power System

173. Check that ALL power switches and circuit breakers for the entire station (including the generator set) are in the OFF position.

> NOTE
>
> The primary circuit breaker for Duplex Receiver 651-E1 is located inside the storage compartment (Fig 14)

VOX-PTT Switch

174. Check that the upper sideband VOX-PTT switch is in the PTT position. If this switch is in the VOX position when the radio set is energized, the complete tuning cycle will be initiated, thus placing the transmitter on the air prematurely.

Frequency Selection

175. Check that the frequency selected for the Duplex Receiver 651E-1 is at least 20 per cent away from the frequency selected for the

Radio Set AN/TRC-75 (Duplex).

Audio Signal Lines

176. CAUTION. Single-tone audio signal lines must be connected ONLY to the FSK line terminals to prevent damage to the transmitter. (Audio frequency-shift signals contain only one tone at a time and are therefore single-tone signals). If the operating mode is DUPLEX AM, connect audio input signals to the upper sideband only.

Lines, Microphone or CW Key

177. Connect 600-ohm lines, microphone or CW key, to the proper USB and LSB input connectors on the Duplex Receiver 651E-1, and set the USB and LSB INPUT selector switches to the corresponding positions. Only one type of input can be used at a time on each sideband.

External push-to-talk operation

178. If external push-to-talk operation is to be used with the 600-ohm lines, connect the push-to-talk control lines to the PTT connectors.

Lines, Speaker and/or Headset

179. Connect 600-ohm lines, speaker and/or headset, to the proper USB and LSB OUTPUT connectors.

Antenna Switch (Fig 23)

180. CAUTION. Make sure WIRE-WHIP switch (Z) is in the position corresponding to the antenna in use. If a whip antenna is used, make certain that it is extended to a minimum height of 15-feet. DO NOT OPERATE THE RADIO SET WITHOUT AN ANTENNA.

Exhaust Air Outlet Panel

181. Ensure that the exhaust air outlet panel (Fig 20) on the right side of the vehicle is fully open. This panel operates an exhaust air interlock switch. This switch must operate to allow the Radio Set AN/TRC-75 (Duplex) to be turned on for operation.

DUPLEX OPERATING PROCEDURES

182. For duplex operation, (after completion of the pre-operational check and setting up procedure) proceed as in the following paragraphs.

183. Apply power to the system (refer to para 127).

184. Switch the primary circuit breakers (B) (Fig 24) on the Radio Set AN/TRC-75 (Duplex) to the ON (up) position.

WARNING

If the main circuit breakers (Fig 16) of the Power Distribution Box or those of the radio set (Fig 24) will not remain in the ON position, do not attempt to operate the radio sets without maintenance

185. Check the LINE FREQ meter, located at the upper right corner of the radio set control panel (Fig 23) for a reading of 380 to 420 cycles. The two vaneaxial fans located behind the radio set case air intake louvres should be checked for operation (refer to paras 63 and 64 and Fig 10).

WARNING

If a reading of 380 to 420 cycles cannot be obtained, or if the vaneaxial fans do not operate, do not attempt to operate the radio set without maintenance. The primary power must be within limits and cooling air is required at all times when the radio set is energized

186. Rotate the OFF-ON switch (L) (Fig 23) on the radio set control panel to the ON position, making sure that the switch stays on. Allow a warm up period of 30 seconds.

WARNING

If the OFF-ON switch L will not remain ON without being held manually - and the air ventilation panel (Fig 20) is open - do not attempt to operate the radio set without maintenance

187. Place the MODE selector switch on the Duplex Receiver 651E-1 control panel (Fig 25) to DUPLEX SSB or DUPLEX AM, as desired, If the mode selected is DUPLEX AM set both the USB INPUT and LSB INPUT switches to the VOICE position.

NOTE

The following Radio Set AN/TRC-75 controls are NOT used in duplex operation and may be in any position:- AM-U-L-TWIN; VOL; VOICE-CW-TTY; and AUDIO VOL. (When a speaker or headset is connected to the radio set, USB transmit sidetone and tune-tone audio may be monitored. The AUDIO VOL control is then used to control volume.) The AM-U-L-TWIN switch on the Duplex Receiver 651E-1 is also not used in duplex operation.

188. At the Radio Set AN/TRC-75 control panel (Fig 23)select the desired transmitting frequency by rotating knobs (N) (P) (R) (S) until the desired frequency digits appear in the columns of the FREQ KC dial. At the Duplex Receiver 651E-1 control panel (Fig 25)set the desired receiving frequency by rotating knobs (N) (P) (R) (S) until the desired frequency digits appear in the columns of the FREQ KC dial. Make certain that this receiving frequency is separated from the transmitting frequency by at least 20 per cent.

NOTE

Under some circumstances, a separation of more than 20 per cent maybe necessary for frequencies below 10 Mc/s

189. Switch the primary circuit breaker (located in the storage compartment) (Fig 14) of the Duplex Receiver 651E-1 to the ON position.

190. Rotate the OFF-ON switch (L) (Fig 25) on the Duplex Receiver 651E-1 to the ON position. The receiver will now tune and the transceiver will coarse-tune. When receiver tuning is complete, the RCVR COMPLETE TUNE lamp (Fig 25) will light. This tuning requires about 20 seconds. An 800-cycle tune-tone is present in the radio set AN/TRC-75 (Duplex) during the tune-cycle.

NOTE

If the USB VOX-PTT switch is in the VOX position, the transmitter will automatically complete tuning. The transmitter radiates a 100-watt AM signal during the fine-tune portion of the cycle. Therefore, if radio silence is to be observed, this switch must be in the PTT position.

191. If the frequencies selected in the steps outlined in para 188 are in the frequency ranges 3.7 to 4.0 Mc/s, 7.7 to 8.0 Mc/s, or 15.7 to 16.0 Mc/s, momentarily rotate the 1,000 kc/s knob (N) to another frequency, then return to the desired frequency. The equipment does not automatically retune for small frequency changes within these ranges. This procedure ensures correct tuning and should be repeated every time the equipment is turned on.

192. When ready to transmit, operate the USB VOX-PTT switch (Fig 25) to VOX to complete transmitter tuning. Operating the microphone push-to-talk switch or completing the line PTT circuit will also initiate transmitter fine tuning. Completion of tuning is indicated when the tune-tone ceases and the XMTR COMPLETE TUNE lamp (Fig 25) lights. Complete tuning requires from 2 to 60 seconds. While the transmitter is tuning, observe the RF WATTS meter (Fig 23) for a reading of about 100-watts on the top scale with the meter RF POWER switch (T) in the FWD 1,000 W position.

193. To transmit, place POWER HI-LOW switch (W) (Fig 23) in the HI position for 1,000-watt output power or LOW position for 200-watt output power. Place the RF POWER meter switch (T) in the FWD 1,000 W position. The Radio Set AN/TRC-75 (Duplex) is transferred to the transmit condition either by the application of input audio (VOX operation) or by the completion of the push-to-talk switching circuit (PTT operation). When transmitting, observe RF WATTS meter (Fig 23) in the FWD 1,000W range. Observed readings should correspond to those listed in Table 6 for the operation and modulation modes selected - see page 82.

WARNING

Also observe the RF WATTS meter with the meter switch (T) in the REF 100W position at the start of transmission. Refer to Table 7 for REF meter readings corresponding to FWD meter readings. If the REF readings observed exceed those shown in the table, trouble is indicated and the equipment should be shut down for corrective maintenance

194. Select the desired type of audio input with the USB and LSB INPUT selector switches.

NOTE

The USB and LSB INPUT selector switches must be in the VOICE position for AM operation

WARNING

Do NOT operate the station on FSK alone (see para 176) until the FSK input circuits have been connected by patching at the Jack Field (refer to Fig 19 and Key)

195. If 600-ohm line inputs are used, adjust the level with the LEVEI controls (Fig 25) while observing the INPUT LEVEL meter (Fig 25) for the sideband being set. Set the input levels of the 600-ohm lines for FSK operation without speech for an indication of 100 on the INPUT LEVEL meter with a constant tone input. When transmitting audio signals containing combined FSK tone and speech, set tone alone to approximately 70 so that peaks on speech will not exceed 100 on the meter. Audio peaks for VOICE operation will normally be less than 100. Use the meter indications observed during use of the local microphone as a guide for adjusting typical VOICE line input levels.

196. Select VOX or PTT keying operation on USB and LSB. No difference in operation will be noted when using the local microphone, because even in VOX operation the microphone push-to-talk switch must be operated to complete the microphone audio circuit. If external 600-ohm lines are used, a key line must also be used when PTT operation is selected Normal operation of the system is VOX with no external key lines.

197. Adjust the VOL control (M) (Fig 25) on Duplex Receiver 651E-1 control panel to set the RF gain of the receiver.

198. Adjust the audio output to the USB and LSB speaker and/or headset with the OUTPUT LEVEL controls (Fig 25) for a comfortable audio level.

199. To change frequency, repeat the steps outlined in para 188.

200. For CW operation ensure that the circuit from the CW key to the Key jack on the Duplex Receiver control panel (Fig 25) is properly connected up. Set the Upper Sideband (USB) VOX-PTT switch at the VOX position, and set the USB INPUT selector at KEY. This initiates the complete tuning cycle. For CW operation with A2J emission the emitted frequency is then 800 c/s above the frequency set on the radio set panel. When working to a normal CW receiver and transmitter which uses a BFO for A1 operation, tune Radio Set AN/TRC-75 (Duplex) to a frequency 1 kc/s below the nominal operating frequency.

201. Close down. - To turn off the sets, rotate both ON/OFF switches (L of Fig 23 and 3 of Fig 25) to the OFF position and switch both primary circuit breakers (B of Fig 24 and Fig 14) to the OFF position. Also switch the main circuit breakers on the Power Distribution Box (Fig 16)to the OFF position.

SIMPLEX OPERATING PROCEDURES

General

202. In simplex operation, the Radio Receiver AN/TRC-75 (Duplex) functions as a normal transceiver and the Duplex Receiver 651E-1 may be used to monitor other frequencies. All transceiver control functions and input and output connections are made at Radio Set AN/TRC-75. The Duplex Receiver 651E-1 must be turned on for proper operation of the Radio Set AN/TRC-75 in the simplex mode because of a potential feedback circuit in the tune-indicate circuit. Also, Duplex Receiver 651E-1 is disabled whenever the Radio Set AN/TRC-75 is transmitting. If operating requirements make either of these conditions undesirable, then the interconnecting cable (Fig 17, cable W4) can be disconnected from REMOTE CABLE connector J1 (Fig 26) on the rear panel of Duplex Receiver 651E-1.

203. Before operating the station in the simplex mode, verify that the system is properly prepared for use according to the procedures outlined in paragraphs 115 to 127 and 171 to 181.

Radio Set AN/TRC-75 (Duplex)

204. The simplex operating procedures for Radio Set AN/TRC-75

(Duplex) are given, step by step, in the following paragraphs.

205. Check to ensure that the antenna is connected and set the WIRE-WHIP switch (Z) (Fig 23) to the proper position for the type of antenna used. Refer to the WARNING which precedes para 127. Check to see that the mode switch on the Duplex Receiver 651E-1 (Fig 25) is in the SIMPLEX position.

206. Connect the microphone to jack (G) (Fig 24) and headset to jack (F), or handset to jack (J).

207. Set the mode switch (Y) (Fig 23) to the VOICE position.

208. Set the main circuit breaker on the Power Distribution Box (Fig 16) to the ON position and turn on the primary power circuit breakers (B) (Fig 24) on the radio set. Check the input power frequency at the LINE FREQ meter (Fig 23) for an indication of 380 to 420 cycles.

209. Turn the OFF-ON switch (L) (Fig 23) to the ON position and wait 30 seconds for the equipment to warm up.

> NOTE
>
> The Duplex Receiver 651E-1 must be turned on for proper operation of the Radio Set AN/TRC-75 (Duplex) in the simplex mode (see para 202). If this is undesirable, disconnect the interconnectin cable as instructed in para 202.

210. Mode Selection. Set the mode switch (K) (Fig 23) for the type of operation desired (AM, U, L, or TWIN). In an emergency, use the TWIN mode, then both sidebands convey the same intelligence.

211. Frequency Selection. Select an operating frequency with knobs (N) (P) (R) (S). Move knob (N) one position and then return it to its original position (do this every time the set is switched on). This procedure ensures that the radio set will re-tune.

212. Listen for the tune-tone. The presence of tune-tone in the headset or handset indicates that the radio set is tuning and is not yet ready for use. If the tune-tone is present fore more than one minute, re-tune by turning knob (N) one position and returning it to its original position.

213. The radio set is now in the receive condition. Adjust the volume controls (M) and (U) for the desired output level.

214. To transmit. Select the power level with switch (W), press the microphone switch, wait for the tune-tone to cease, then talk into the microphone.

215. To receive after transmission. Stop talking or release the microphone switch.

216. CW operation. For CW operation connect the CW plug to jack (H) (Fig 24). Set switch (Y) to CW and complete necessary patching (see Figs 18 and 19). To transmit, operate the key. To receive, leave the key open. Repeat previous steps for tuning, etc, as required. For CW operation with A2J emission on the Upper Sideband (USB) the emitted frequency is then 800 c/s above the frequency set on the panel. When working to a normal CW receiver and transmitter which uses a BFO for A1 operation, tune Radio Set AN/TRC-75 to a frequency 1 kc/s below the nominal operating frequency. Similarly, on the Lower Sideband (LSB) the output frequency is 800 c/s below the frequency set on the panel of Radio Set AN/TRC-75 and the station should be tuned to 1 kc/s above nominal frequencies.

217. Teletypewriter operation. For teletypewriter (TTY) operation set switch (Y) to TTY. Select (U) (upper sideband) at switch (K). The teletypewriter panel (Fig 24) on Radio Set AN/TRC-75 is not used.

218. Close down. - To turn off the radio set, place the OFF-ON switch (L) (Fig 23) in the OFF position, turn off primary circuit breakers (B) (Fig 24) on radio set, and turn off the main circuit breakers on the Power Distribution Box (Fig 16).

Duplex Receiver 651E-1

219. The simplex operating procedures for Duplex Receiver 651E-1 are detailed in the following paragraphs.

220. Set the mode switch (Fig 25) to the SIMPLEX position.

221. Connect headset, handset, speaker, or 600-ohm lines to the appropriate output connectors.

222. Set the main circuit breakers on the Power Distribution Box (Fig 16) and the primary circuit breaker of the receiver (located in storage compartment) (Fig 14) at the ON position.

223. Switch the OFF-ON switch (L) (Fig 25) to the ON position and wait 30 seconds for the equipment to warm up.

224. Set the AM-U-L-TWIN switch (K) for the type of operation desired.

225. Frequency Selection. - Select the required operating procedure with knobs (N) (P) (R) (S) (Fig 25). Move knob (N) one position and then return it to its former position (this should be done every time the receiver is turned on). This procedure ensures that the receiver will re-tune.

> NOTE
>
> The Duplex Receiver 651E-1 is disabled whenever Radio Set AN/TRC-75 (Duplex) is transmitting in simplex operation. If this is undesirable disconnect the interconnecting cable as instructed in para 202. In this case, care must be exercised to ensure that the Duplex Receiver 651E-1 frequency is at least 20 per cent away from the radio set frequency, for an antenna separation of 100-feet.

226. When tuning is completed, the RCVR COMPLETE TUNE lamp (Fig 25) will light. If the lamp does not light within one minute, re-tune by turning knob (N) one position and then returning it to its former position.

227. Adjust the VOL control (M) and the output LEVEL controls to the desired level.

228. Close down. - To turn off Duplex Receiver 651E-1, switch the OFF-ON switch (L) (Fig 25) to the OFF position, turn off the primary circuit breaker located in the storage compartment (Fig 14), and turn off the main primary power circuit breakers on the Power Distribution Box (Fig 16).

TABLE 6 - RF WATTS METER, TYPICAL FORWARD (FWD) POWER READINGS

MODULATION MODE	OPERATION				POWER LEVEL
	AM	U	L	TWIN	
VOICE	180	750-900	750-900	750-900	HI
	40-80	100-200	100-200	100-200	LOW
CW		600-700	600-700	600-700	HI
		100	100	100	LOW
FSK		600-700	600-700	600-700	HI
		100-200	100-200	100-200	LOW

TABLE 7 - RF WATTS METER, MAXIMUM PERMISSIBLE REFLECTED (REF) POWER READINGS FOR VARIOUS VALUES OF FORWARD (FWD) POWER

POWER READING, WATTS	
FORWARD	REFLECTED *
100	1.5
400	7
700	12
1,000	16

*Reflected values are obtained from standing wave ratio (SWR) graph (Fig 13) for SWR of 1.3 to 1, which is the upper limit for Radio Set AN/TRC-75 (Duplex).

CHAPTER FOUR - USER SERVICING AND ADJUSTMENTS

SECTION 18 - GENERAL

229. No equipment can be expected to work properly unless it is kept in first class condition by regular servicing, conscientiously carried out. This servicing is the responsibility of the NCO or man who is in direct charge of the equipment and is responsible for its operation. It is not the responsibility of workshop or repair staffs, though workshop personnel may be called upon to carry out certain servicing tasks.

230. To guide the NCO or man responsible for the servicing, and to ensure that it is carried out regularly, the equipment is serviced on a task system. The tasks in the case of this radio station are detailed in this chapter.

231. Instructions regarding supervision of servicing, frequency of carrying out each task and recording the completion of tasks, will be issued by unit commanders.

SECTION 19 - SERVICING

OPERATOR'S SERVICING

Servicing tasks

232. Keep the equipment clean and dry. Remove any dirt that has accumulated on units, plugs and sockets, glass panels, dials and control knobs. Use a clean, moist, lint free cloth or a dry brush to clean the exterior of the radio set cases and associated equipments.

233. Check all controls, switches, lamps, fuses, panel designations, glass covers, jack flaps, binding posts, etc, and ensure that they are functioning correctly and are not loose or damaged.

234. Inspect all detachable connecting cables, loom wiring connections and bonding cables and straps. Ensure that they are correctly fitted. Check plugs and input and output jacks for tightness. Inspect cabling for poor insulation, fraying, or bad bonding of braiding at plugs and sockets.

235. Check headset and microphone pressel switches.

236. Ensure that all plug and socket outlets not in use are protected by their flaps or covers.

237. Inspect all mounting frames, carriers, etc, including antennae mountings, and ensure all screws, nuts, etc, are secure.

238. Check antenna connections for tightness and antenna for clearance of surrounding objects.

239. Ensure that good connections exist between earthing cables and straps and terminals on sets, mountings and vehicle chassis.

240. Remove and clean the air filters (Fig 10) on the front of Radio Set AN/TRC-75 (Duplex) after operating periods of 50 hours in dusty air or 200 hours in clean air.

241. Remove and clean the air filter in Duplex Receiver 651E-1 after similar periods of service. Access to the filter, which is mounted on the blower intake, is gained by removing the top access cover of the receiver case (Fig 15).

242. Make certain that the air exhaust panel (Fig 20) on the side of Radio Set AN/TRC-75 (Duplex) can be opened fully and that adequate air circulation is possible through the louvres on the radio set case and through the input and output louvres of the receiver 651E-1.

243. Primary circuit breaker switches on the sets and on the power distribution box should be inspected for correct operation. These circuit breaker switches should remain at ON when placed there, without being held manually.

Replacement of faulty lamps

244. To replace a panel lamp, unscrew the front glass shield of the lamp assembly, remove and replace the lamp, and replace the shield.

Replacement of a blown fuse

245. To replace a fuse, press in the fuse holder and turn in a counter clockwise direction. Remove the fuse holder and the fuse from the holder. Insert a new fuse, replace the fuse holder, press in, and turn in a clockwise direction to lock. DO NOT replace a faulty fuse with a new fuse of a larger current rating than the one removed. The Duplex Receiver 651E-1 has one fuse located inside the receiver, to protect the 28V dc power supply to the amplifier assembly (Fig 15).

ASSOCIATED EQUIPMENT

246. For further information on items other than the radio sets refer to the handbooks quoted in para 126.

CHAPTER FIVE - USE AS A GROUND STATION

SECTION 20 - DISMOUNTING THE EQUIPMENT AND RE-ASSEMBLY ON THE GROUND

DISMOUNTING THE EQUIPMENT

247. To facilitate the removal of the equipment from the vehicle for use in a ground station, or for maintenance purposes, the suggested sequence of the removal of the items has been set out in five stages.

248. These stages, arranged in tabulated form, are given in Tables 8 to 12. In most cases, the relative illustrations (Figs 27 to 31) are arranged on the pages facing the tables. Items have identification numbers common to all the tables and accompanying illustrations.

249. Items not normally removed from the vehicle, when a ground station is being set up, are listed in Table 13 and illustrated as far as possible in Fig 32.

250. To facilitate removal of items from the vehicle untie the plastic sleeve lacing and remove the sleeve and the bottom antenna section. The canvas body canopy should then be removed or rolled forward on to the top of the driving compartment.

RE-ASSEMBLY ON THE GROUND

251. The station should be laid out, in the ground station, with due regard to the position and length of the various wires of the harness and of connecting cables.

252. Locate the Support, Receiver 651E-1 over the radio set AN/TRC-75 (Duplex) in approximately the same relative position as in the vehicle. The Duplex Receiver 651E-1, Network Hybrid Circuit (2), Filter Band Suppression F-98/U, and Terminal Telegraph TH-5/TG should be remounted on the Support in their normal positions.

253. Other equipment removed from the vehicle must be located to allow the various wires, connectors and bonding straps to be attached.

254. It is IMPORTANT that all units in the ground station (including the Generator Set) should be bonded to the Receiver Support (Fig 28). An earth spike should be driven into the ground near each end of the Receiver Support and near the Generator Set (refer to para 124).

255. The 120 ft long bonding cable supplied may be used in lieu of cable W10 (Fig 17) and should be connected from the Earth Terminal on the Generating Set to the ground station.

256. The primary power cable 100-ft extension connector may be used to connect the normal primary power cable (Fig 17, cable W1) from the Generator Set, directly to connector J1 on the Power Distribution Box (this is the connector which, in the vehicle installation, carries cable W5 - Fig 17). Refer also to Fig 6.

257. If the vehicle antenna base is not being used, the whip antenna for the radio set AN/TRC-75 (Duplex) should be erected in the antenna connector on the top of the radio set (Figs 8, 9 and 10).

258. For duplex operation, an additional receive antenna should be erected. See para 31.

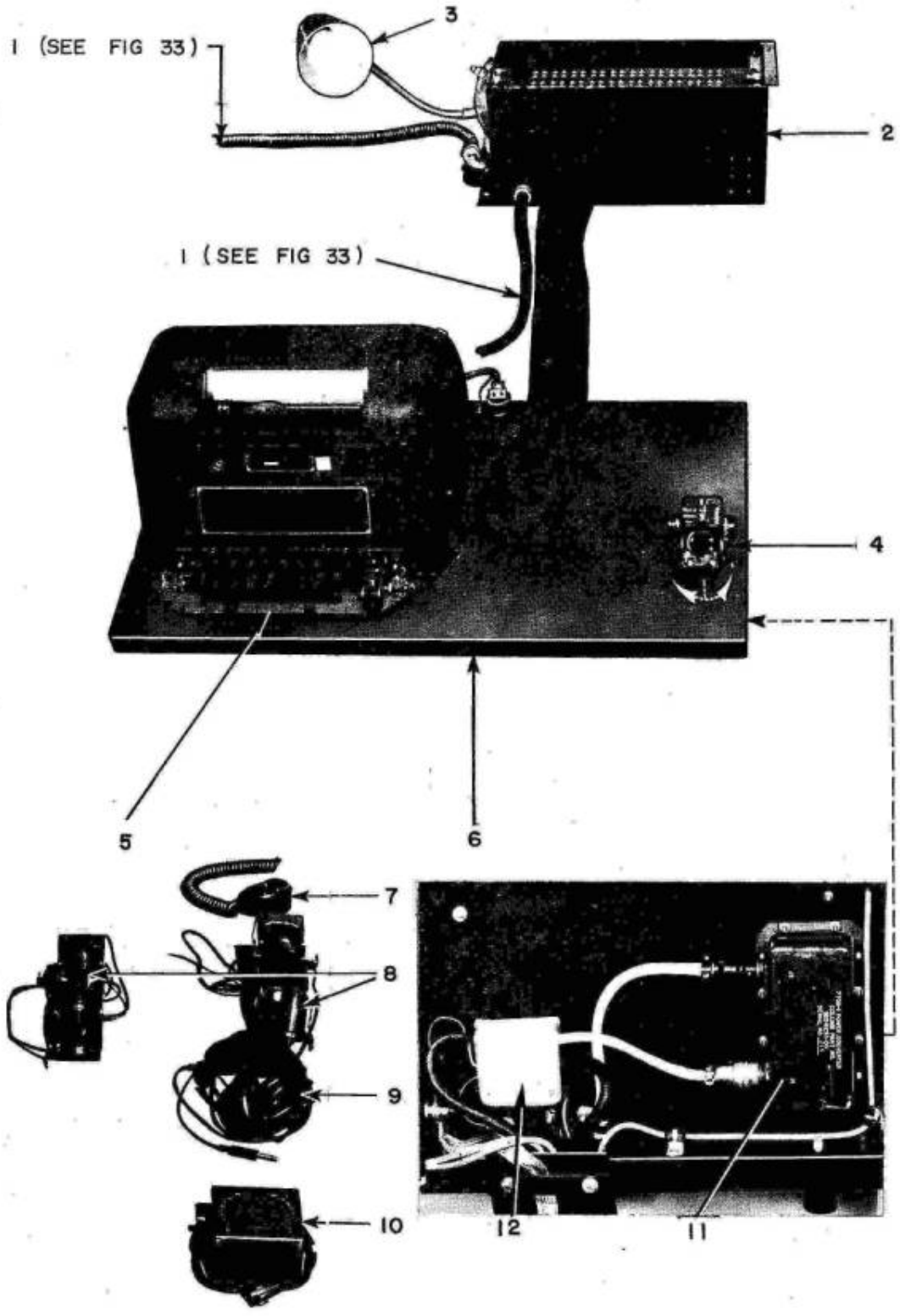


FIG 27 - DISMOUNTING EQUIPMENT - STAGE ONE

TABLE 8 - STAGE ONE

Item	Fig No.	Item No.	Disconnect from -
DISCONNECT -			
Primary power cable	17	W1	Vehicle power input connector (Fig 32, item 34).
Bonding cable	17	W10	Vehicle earth terminal (Fig 3, Item 1).
Bonding cable	17	W11	Receiver Support (Fig 28, item 16), and Vehicle earth terminal (Fig 3, item 1)
All harness wiring connections	27	1	(See also Fig 17)
Headset, Loudspeakers and Microphone	27	9, 10, 7	Radio sets (Figs 24 and 25)
Cables from Power Distribution Box	17	W2 to W7	Power Distribution Box, units, etc. (See also Figs 16 and 17).
External RF connector	9	-	Antenna Base and Radio Set.
Bonding straps (see para 102 and Table 2B)	17	-	Detach from units and vehicle not from Receiver Support. (Refer to Table 2B).
REMOVE -			
(a) As one unit:-			
(i) Box, Jack Field and Stationery Assy, with Desk	27	2	(See also Fig 16). Remove four screws holding unit to body panel (Fig 32, Item 35).
Lamp	27	3	
(ii) Wiring harness & Bonding Cable W11	27	1	Harness from spring clips.
(iii) Table Top (Fig 16) with:-	27	6	) Slide the table-top forward) and release it from the
Teletypewriter	27	5	) runners by removing the
Remote Control unit (Morse Key)	27	4	) five screws retaining the table-) top to the runners. Dismount
Power converter	27	11	) complete with other units.
Junction Box	27	12	
(b) Telephone Sets K (2)	27	8	Remove two screws, nuts and washers, securing each to its bracket on the canopy bows. Disconnect the earth straps.
(c) Headset, Loudspeakers and Microphone	27	9, 10 7	-

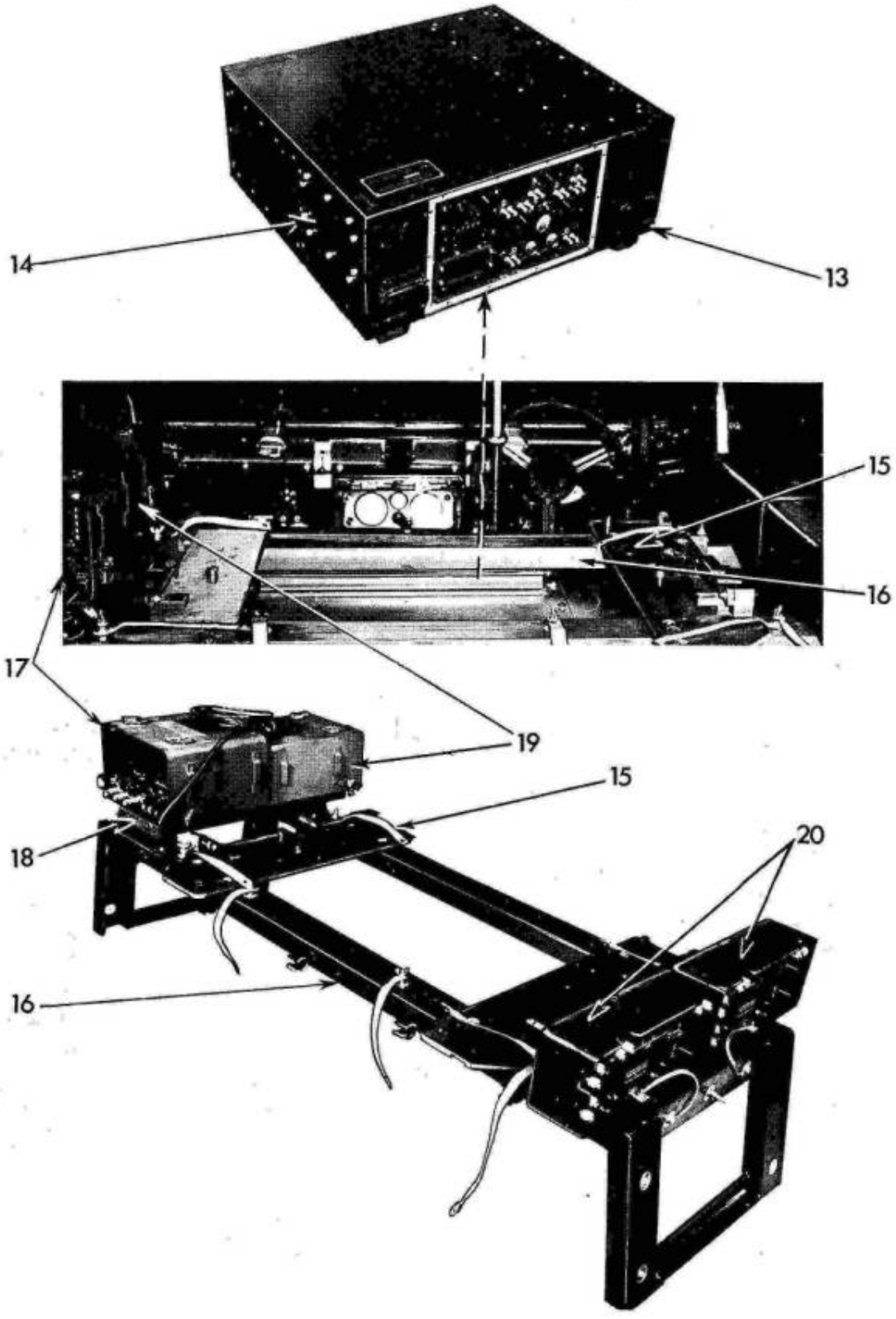


FIG 28 - DISMOUNTING EQUIPMENT STAGE TWO

TABLE 9 - STAGE TWO

Item	Fig No.	Item No.	Remarks
RELEASE -			
Catches of the Quick Disconnect Mounting Plates (4)	28	15	These catches hold Duplex Receiver 651E-1 in position in the vehicle. Press down the catches and pull them out from under the hooks. Rotate the four blocks clear of the receiver base.
Bonding straps	-	-	Disconnect from Duplex Receiver 651E-1.
REMOVE			
Duplex Receiver 651E-1	28	13	This set is very heavy (156 lb) and the greatest care should be exercised in removing this set. It is more easily removed over the top of the canopy frame.
(Loudspeakers can be placed in stowage compartment)	28	14	
RELEASE -			
Support, Duplex Receiver 651E-1	28	16	Remove the four nuts securing the support to the studs on the tops of the body sides.
Bonding straps	-	-	Disconnect those attached to the vehicle body.
REMOVE -			
Support, Duplex Receiver 651E-1	28	16	Remove the support complete with the two Quick Disconnect Mounting Plates (Fig 28, Item 15) and the units mounted at ends of the support (Fig 28, items 17, 19, and 20).

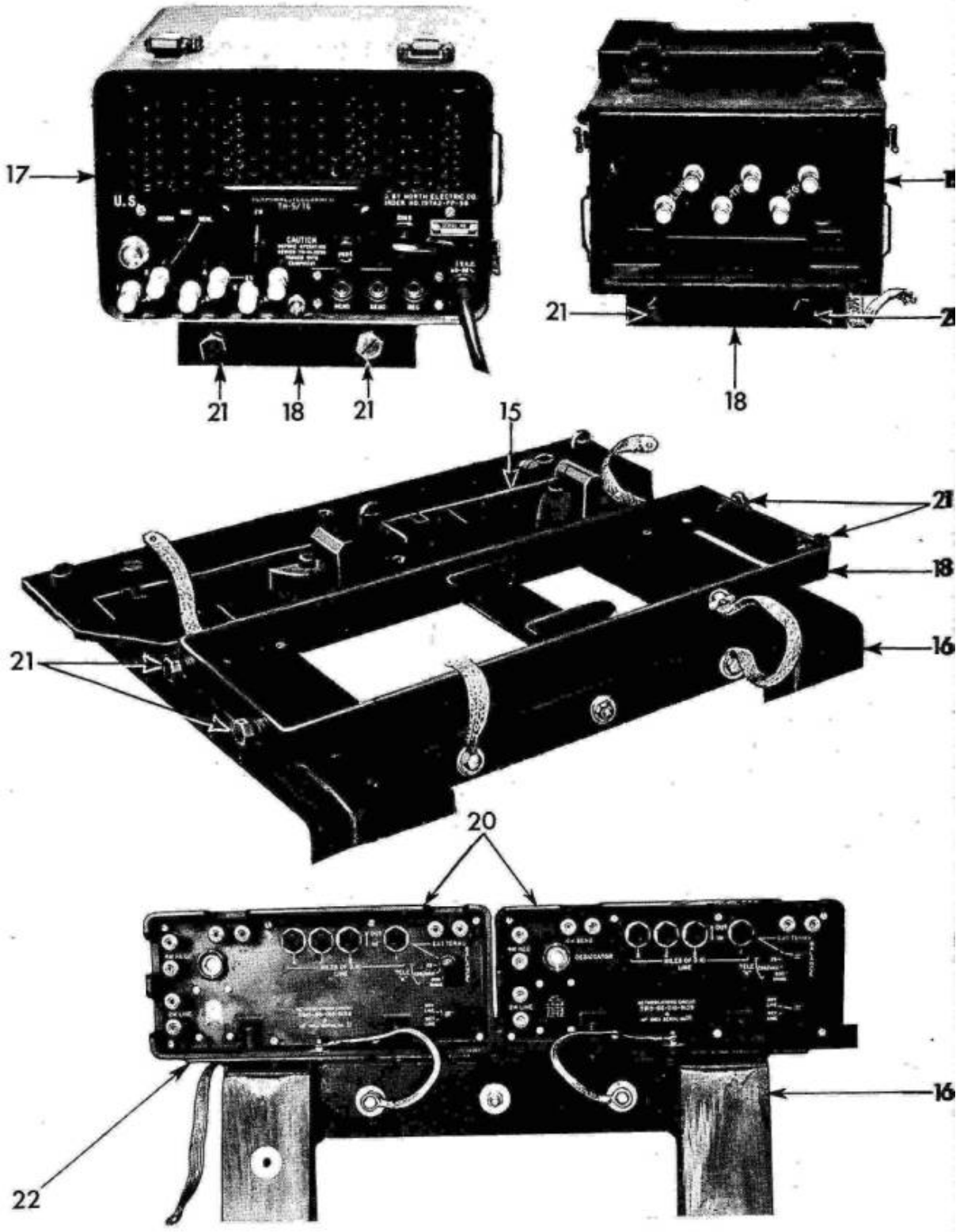


FIG 29 - DISMOUNTING EQUIPMENT - STAGE THREE

TABLE 10 - STAGE THREE

NOTE

The following items should not be removed from the Support, Duplex Receiver 651E-1, if the receiver is to be remounted on the Support for operation in a Ground Station

Item	Fig No.	Item No.	Remarks
REMOVE			
Terminal Telegraph TH-5/TG	29	17	Loosen the two set screws (item 21) below the unit, in the end of the Mounting Frame Assy (item 18) and lift the unit off the mounting.
Filter Band Suppression F-98/U	29	19	Loosen the two set screws (item 21) below the unit in the end of the Mounting Frame Assy (item 18) and lift the unit off the mounting.
Mounting Frame Assy (only if necessary)	28, 29	18	Remove the nuts, bolts, and washers from the centres of the four resilient mountings from below receiver support.
Network Hybrid Circuit (2)	29	20	Remove the two units together with Plate, Mounting (item 22), by removing the two nuts, screws and washers, holding the plate from below the Support (item 16).
Bonding straps	-	-	Disconnect from the Receiver Support, where necessary. (Item 16).

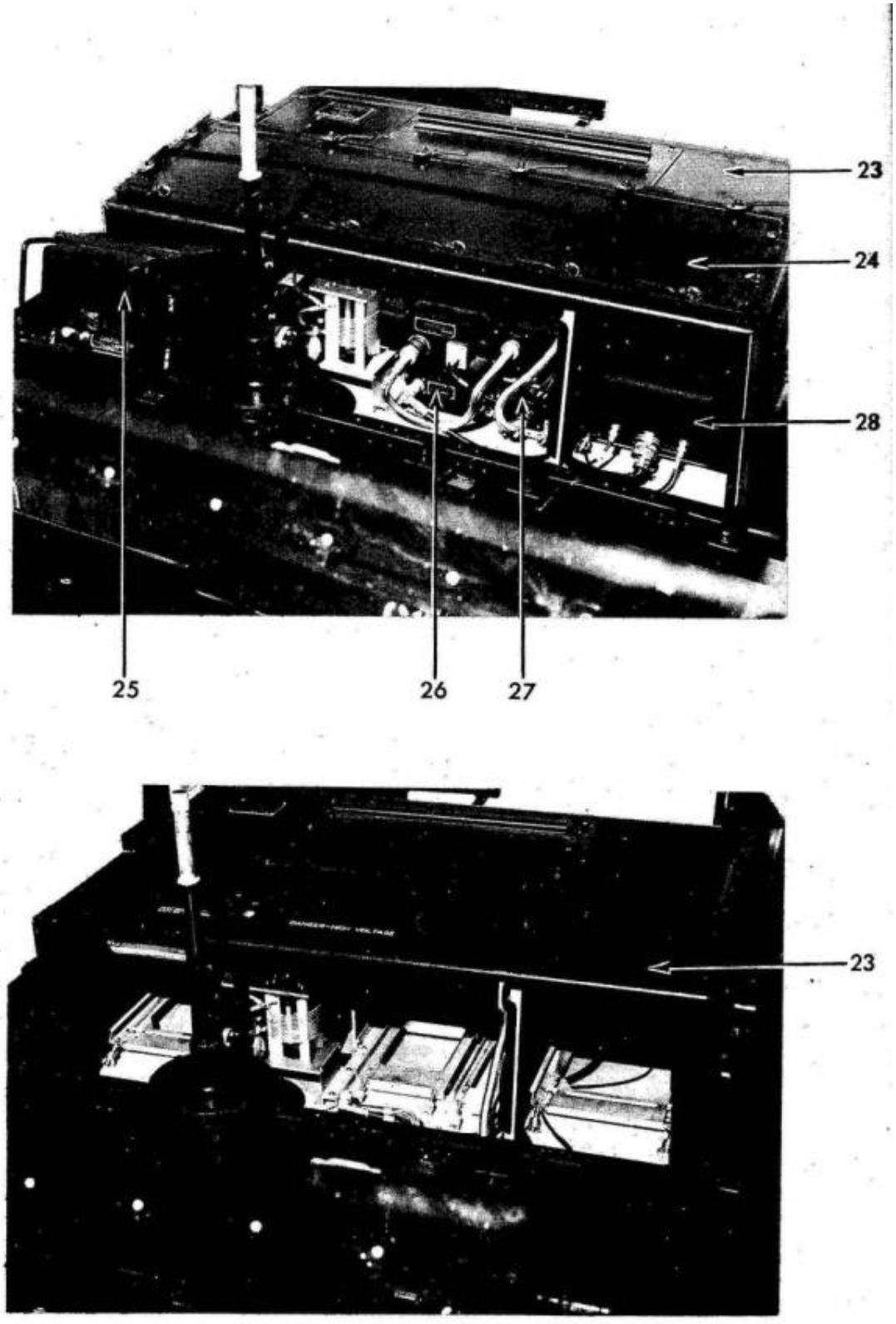


FIG 30 - DISMOUNTING EQUIPMENT - STAGE FOUR

TABLE 11 - STAGE FOUR

It is advisable, in view of the weight of Radio Set AN/TRC-75 (318 lb) to extract the four self-contained units listed in this table from the radio set case, prior to the removal of the unit from the vehicle

Item	Fig No.	Item No.	Remarks
REMOVE -			
Rear cover of Radio Set AN/TRC-75 (item 23)	30	24	The cover is held in place by 14 catches. Swing the handles anti-clockwise to release.
Bonding straps	-	-	Disconnect from Vehicle Body
Radio Transmitter T-730/TRC-75	30 12	25 -	) Release the two winged) or knurled nuts and swing
Antenna Coupler CU-749/TRC-75	30 12	26 -	) down the captive screws) holding each unit. Slide
Antenna Coupler Control C-2848/TRC-75	30 12	27 -	) the units out and lift) them clear of the rear) bar of the case and the
Radio Receiver R-761/ARC-58	30 12	28 -	) vehicle bulkhead.)
RELEASE -			
Catches of Quick Disconnect plate (4)	32	30	These catches hold Radio Set AN/TRC-75 in position in the vehicle. Press down the catches and pull them out from under the hooks. Rotate the four blocks clear of the set base.

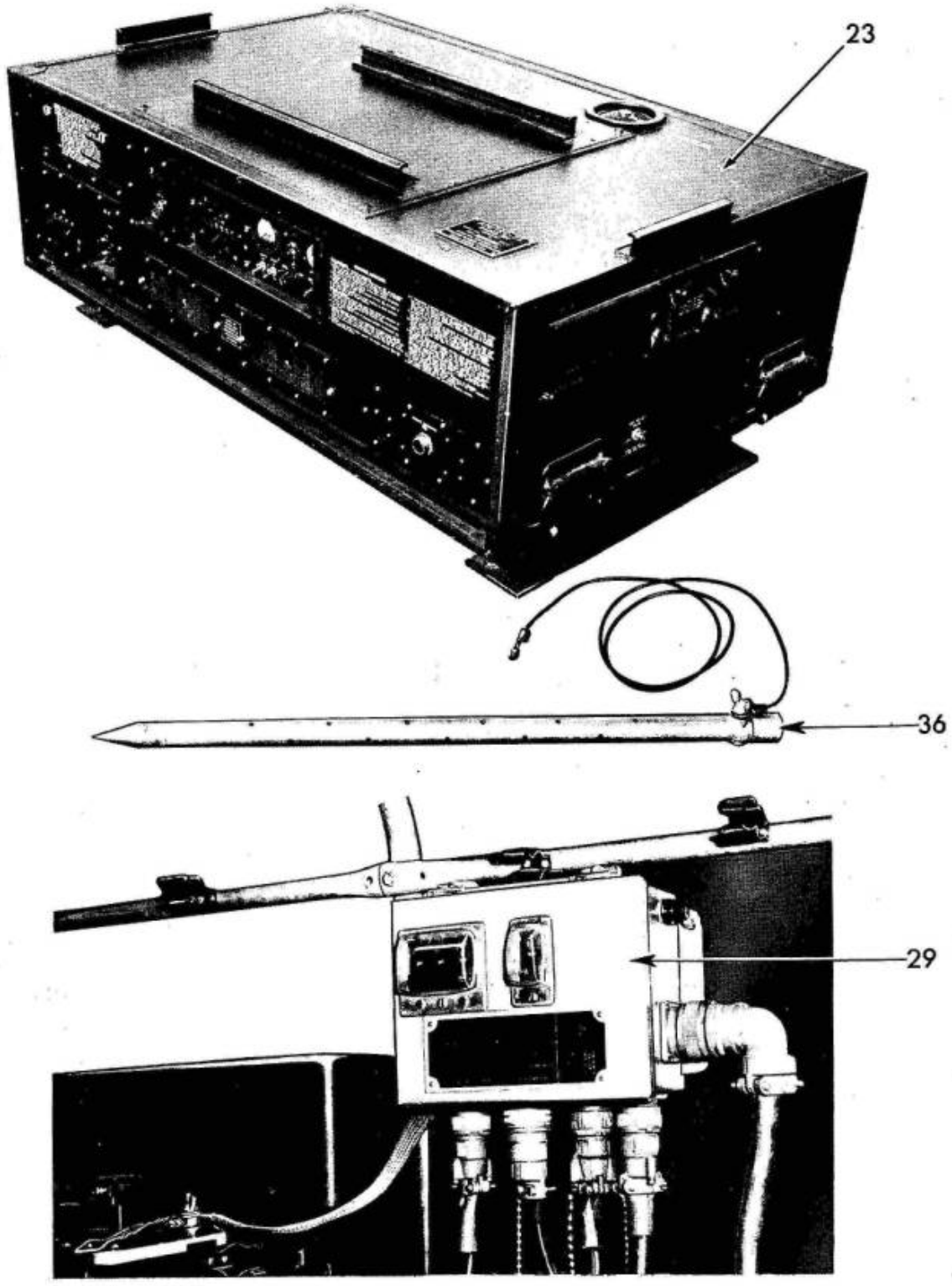


FIG 31 - DISMOUNTING EQUIPMENT - STAGE FIVE

TABLE 12 - STAGE FIVE

Item	Fig No.	Item No.	Remarks
REMOVE -			
Radio Set AN/TRC-75	31	23	The radio set is heavy, even after removal of the four self-contained units (see Table 11). Also, it must be handled with great care. The set is more easily extracted through the side of the vehicle over the top of the canopy side rail.
Box, Power Distribution	31	29	Remove the four screws, nuts and washers holding the unit to the body panel (Fig 32, item 35).
Spike, Earth and Lead Assembly (4)	31	36	Three are stowed in the vehicle and one in the trailer. (These are required for the ground station).
REMOVE - (only if required)			
Antenna Base	32	33	Remove the six bolts, nuts and washers which secure the base to the baseplate.

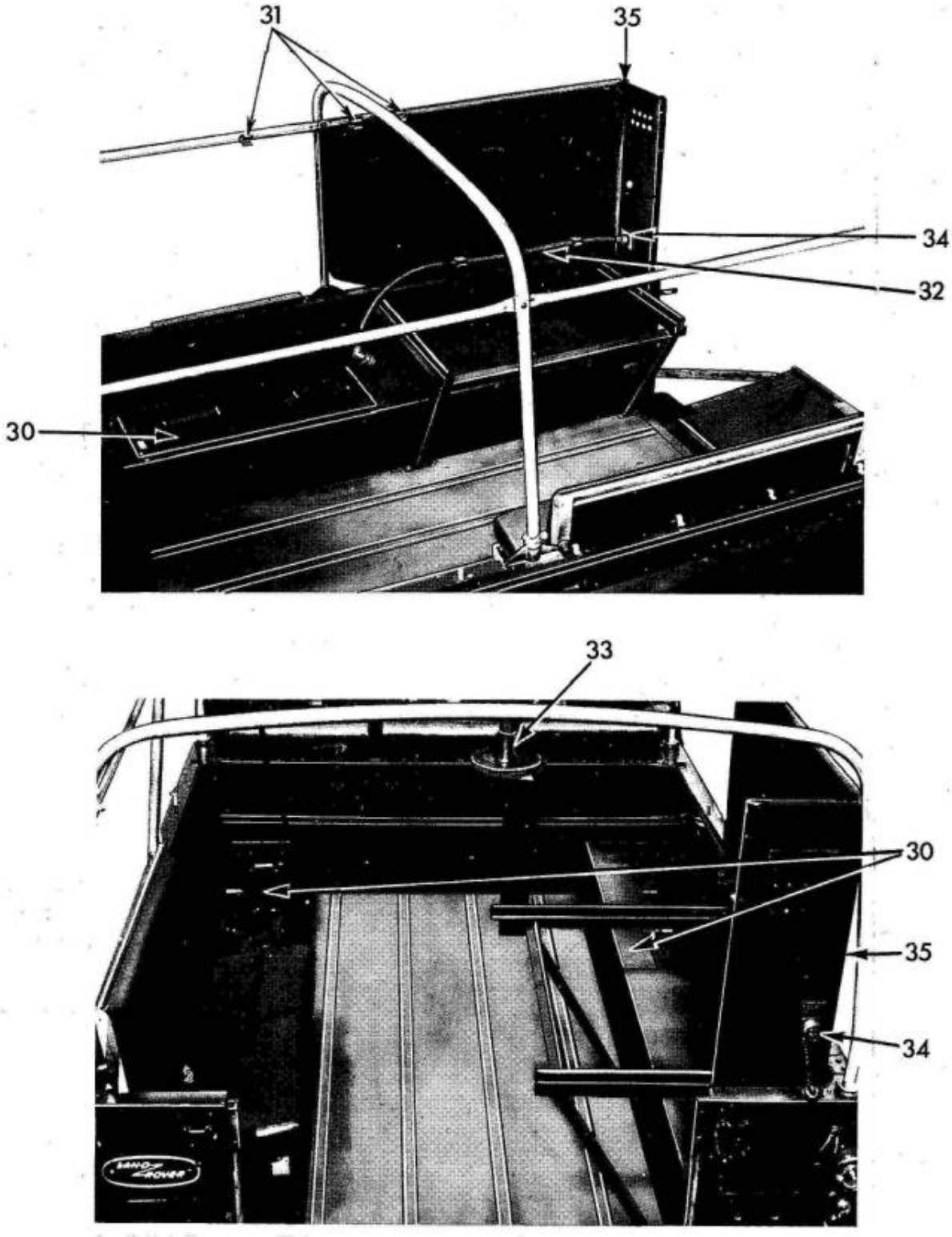


FIG 32 - ITEMS REMAINING IN VEHICLE

TABLE 13 - ITEMS REMAINING IN THE VEHICLE

Item	Fig No.	Item No.	Remarks
Quick Disconnect Mounting Plates (2)	32	30	The catches of these plates hold Radio Set AN/TRC-75 in position in the vehicle.
Clips	32	31	These clips hold the harness wiring in position.
Power Cable (Fig 17, W5)	32	32	This cable connects the primary power supply from the vehicle input connector (item 4) to the Power Distribution Box (see Table 12)
Vehicle input connector	32	34	-
Antenna Base (if not required)	32	33	Refer to Table 12
Body panel	32	35	-

SECTION 21 - REASSEMBLING THE STATION IN THE VEHICLE

259. The station should be re-assembled in the vehicle in the reverse order to that outlined in Section 20, Tables 8 to 12.

260. The block diagram of station circuits (Fig 18), the connector diagram (Fig 17), and loom wiring (Fig 33) should be consulted when re-connecting the various units.

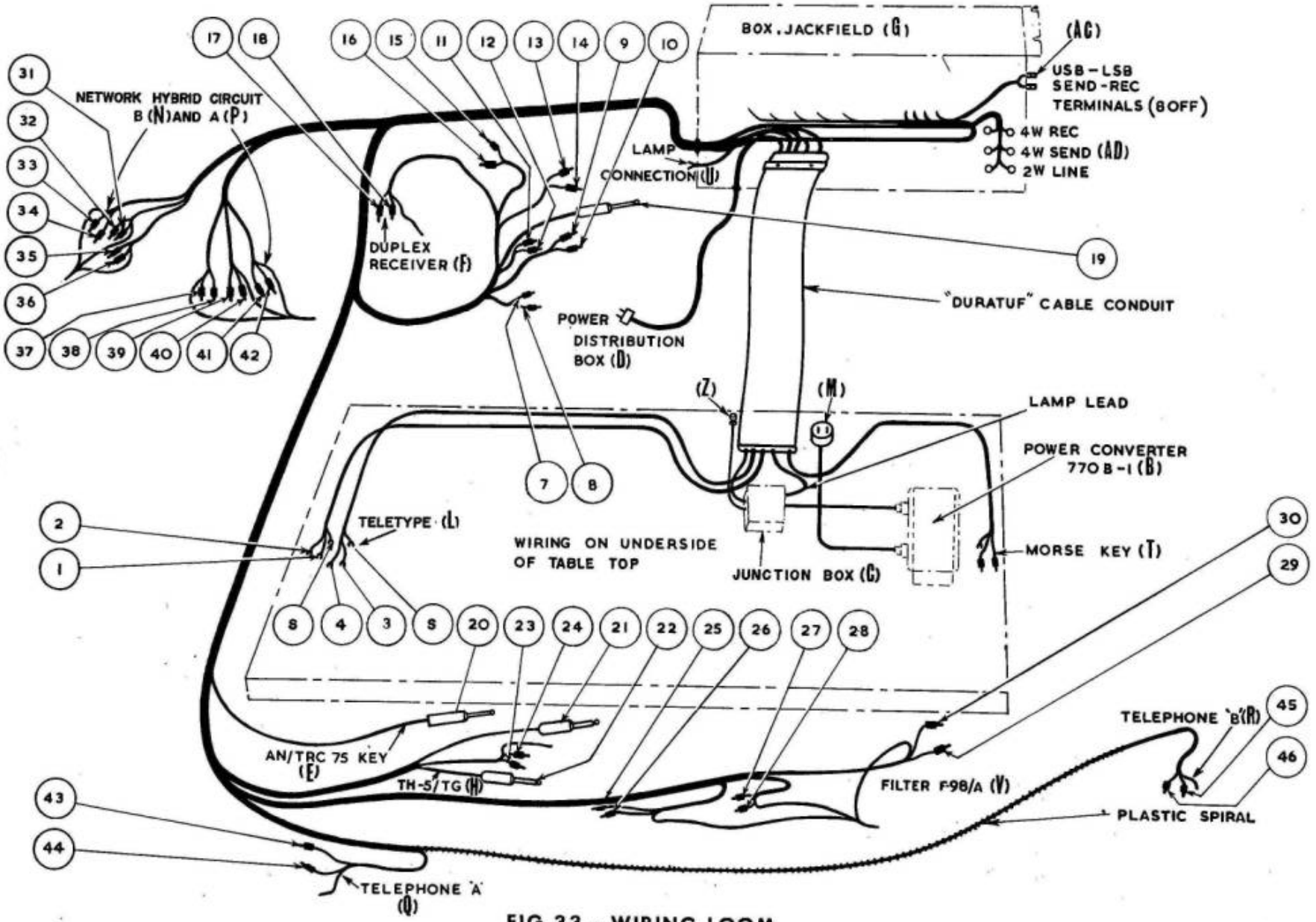


FIG 33 - WIRING LOOM

CHAPTER SIX - TRAILER MOUNTED GENERATOR SET

SECTION 22 - GENERATOR SET

GENERAL

261. A trailer mounted Generator Set, Diesel Engine, model EG-4005, and a spare generator set of the same model, are issued as part of the installation kit of the station. Refer to Complete Equipment Schedules 2169, 3282 and 3639.

262. Description, Operating Instructions, and servicing of the Generator Set model EG-4005 are detailed in Chapter Seven.

TRAILER MOUNTED SET

Setting-up (see para 117)

263. Primary power cable (see Table 1 and Fig 17, cable W1) should be connected to the Generator Set output connector J6 (see para 308 and Fig 39). The bonding lead (Table 1 and Fig 17, cable W10) should be attached to the ground stud assembly shown in Fig 39.

264. The muffler is stowed in the trailer (see Fig 36).

Operation

265. When the station is operated in the mobile role, the generator set controls cannot be adjusted. The generator set must be started up and adjusted to run correctly before the vehicle moves off. If it is necessary at any time to readjust the controls of the generator set, the vehicle must be stopped.

266. During static operation of the station it may be desirable to locate the generator set at a greater distance from the vehicle (refer to paras 16 and 105(a)). The method of stabilizing the trailer, when detached from the vehicle is described in Section 23.

REFER TO WARNINGS AT THE HEAD OF SECTION 13 OF THIS HANDBOOK

User Servicing and Adjustments

267. Whilst the generator set is mounted in the trailer it is not possible to swing the control panel cabinet out fully, for maintenance purposes (Section 28).

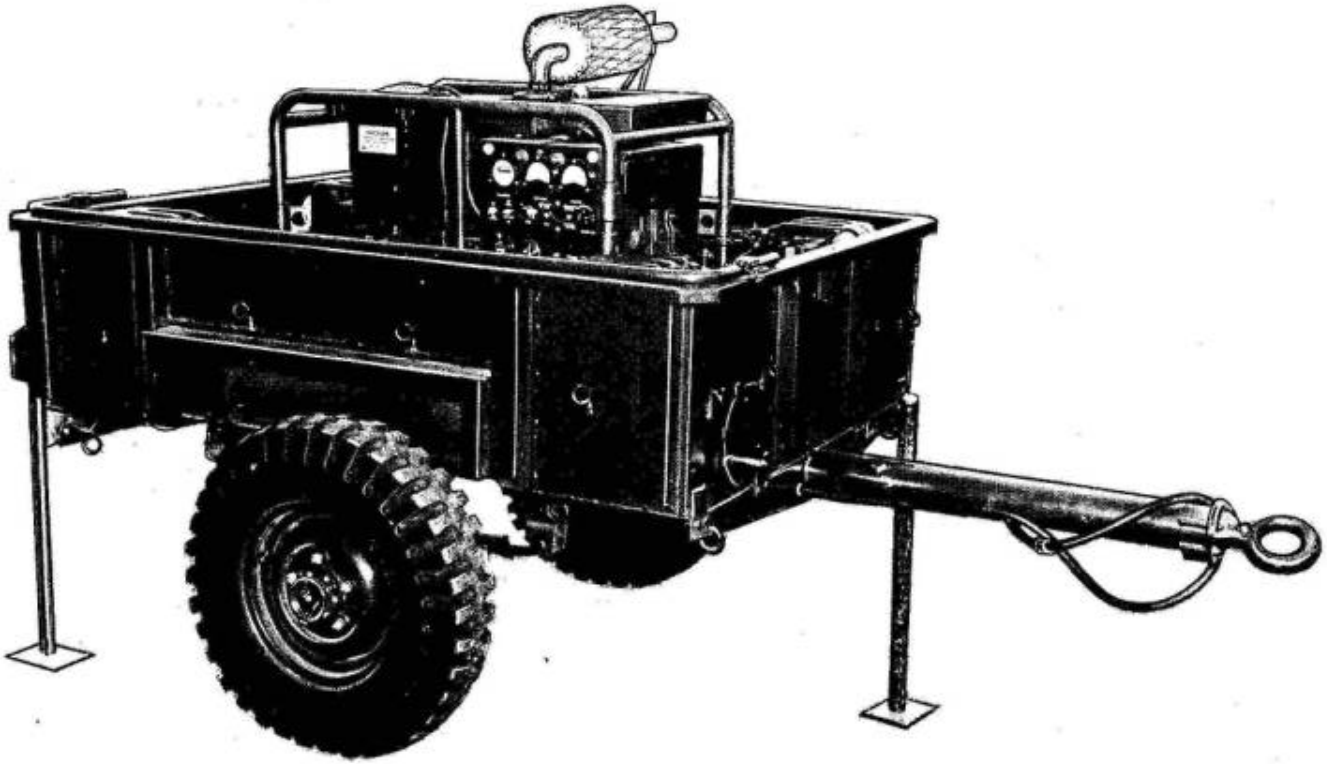


FIG 34 - TRAILER MOUNTED GENERATOR SET

268. It will be possible, however, to carry out all the operator maintenance, listed in Table 16 of Chapter Seven, whilst the generator set is in the trailer, with the exception of the task of cleaning the crankcase breather. Even when the set is removed from the trailer, this task should be carried out by a qualified technician, due to the inaccessibility of the breather.

269. To facilitate the changing of engine lubricant with the generator set in the trailer, a special drain pipe has been fitted to the crankcase drain cock and a suitable drain pan has been provided. This drain pipe should be left secured to the drain cock.

270. The maintenance tasks listed in Table 17 of Chapter Seven should be carried out by qualified technicians.

SECTION 23 - TRAILER

GENERAL

271. The generator set is mounted on a special base frame assembly in a 1/2-ton, 2-wheeled, trailer. A list of the trailer fittings is given below. These items are identified on illustrations as listed:-

Item	No.	Fig No.
Trailer, Cargo, 1/2-ton, 2-wheeled Aust No. 5 (CES 2169), complete with:-	1	34
Canopy	1	1
Canopy bow	1	36
Jack, supporting, trailer	1	35
Can, lubricating oil, 1 gallon	1	36
Jerrican, petroleum 4½ gallon	4	36
Muffler stowage clamp (on Base frame assy)	1	36
Tie Rod, canopy	2	36
End stay, top assembly, detachable	2	36
Jack levelling support assembly	2	36
Box small parts	1	36
Tray, oil, drip (in small parts box)	1	-
Base frame assembly	1	36
Earth Spike and 5-ft lead	1	-

272. The base frame assembly is of all-welded construction, and provides for the mounting of the generator set in the trailer and for the stowage of all fittings and accessories. The assembly is bolted to the trailer by 12 bolts, 3 at each corner, to the mudguard arches, front and rear.

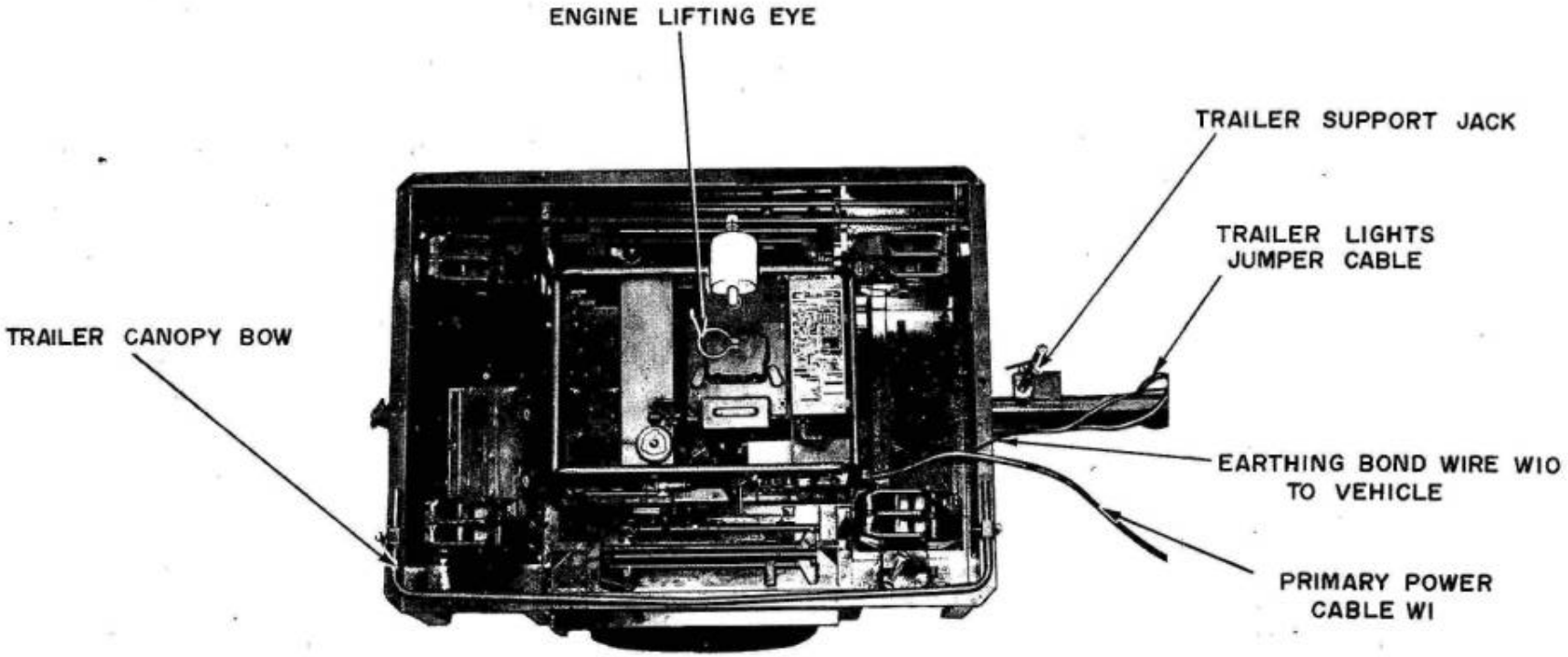


FIG 3.5 - PLAN VIEW OF GENERATOR SET IN TRAILER

273. The canopy supports are stowed in a set of cradles and clamps fitted to the base frame assembly. An erected frame, with and without the canopy, is shown in Fig 1.

SITING THE TRAILER

274. Care should be taken in siting the trailer when preparing for static operation of the station with the generator set and trailer remote from the vehicle. The generator set should be as level as possible and must not be operated with a tilt in excess of 15 degrees.

275. The two levelling jacks are to be fitted into the open bottoms of the stiffeners located at the rear corners of the trailer body. These jacks and the trailer support jack (permanently fitted to the front tow bar) (Figs 35 and 36) should be adjusted so that the trailer is level and stable.

USER SERVICING

276. The trailer must be maintained in good operational condition, and the repair or replacement of faulty parts should be carried out expeditiously.

277. Normally the framework, fittings, etc, do not require routine maintenance, but these should be inspected regularly. Tyre condition, tyre pressures and the condition of the wheel bearings should be checked periodically. Jerricans and the oil can should be refilled as and when necessary. Any oil spilt in the trailer should be wiped up immediately.

SAFETY PRECAUTIONS

278. When working on the generator set or trailer, care should be taken to avoid contact with parts which are, or may be, electrically alive, very hot, or revolving rapidly. Always check that the trailer jacks are firmly bedded before climbing into the trailer. Always use the wheels as climbing-in points, as they present the easiest and safest entry route.

SECTION 24 - DISMOUNTING THE GENERATOR SET

279. The lifting eye (shown in Fig 35), is intended for use when lifting the engine. Use the four porter-bar fittings when lifting the complete generator set. These fittings are at the centres of the four uprights of the generator set frame and can be seen in Fig 38. The set is mounted on four studs on the base frame assembly. Remove the four nuts and washers before lifting the set from the trailer. Care should be taken when lifting the set from the trailer, or replacing it, not to burr the thread on these mounting studs.

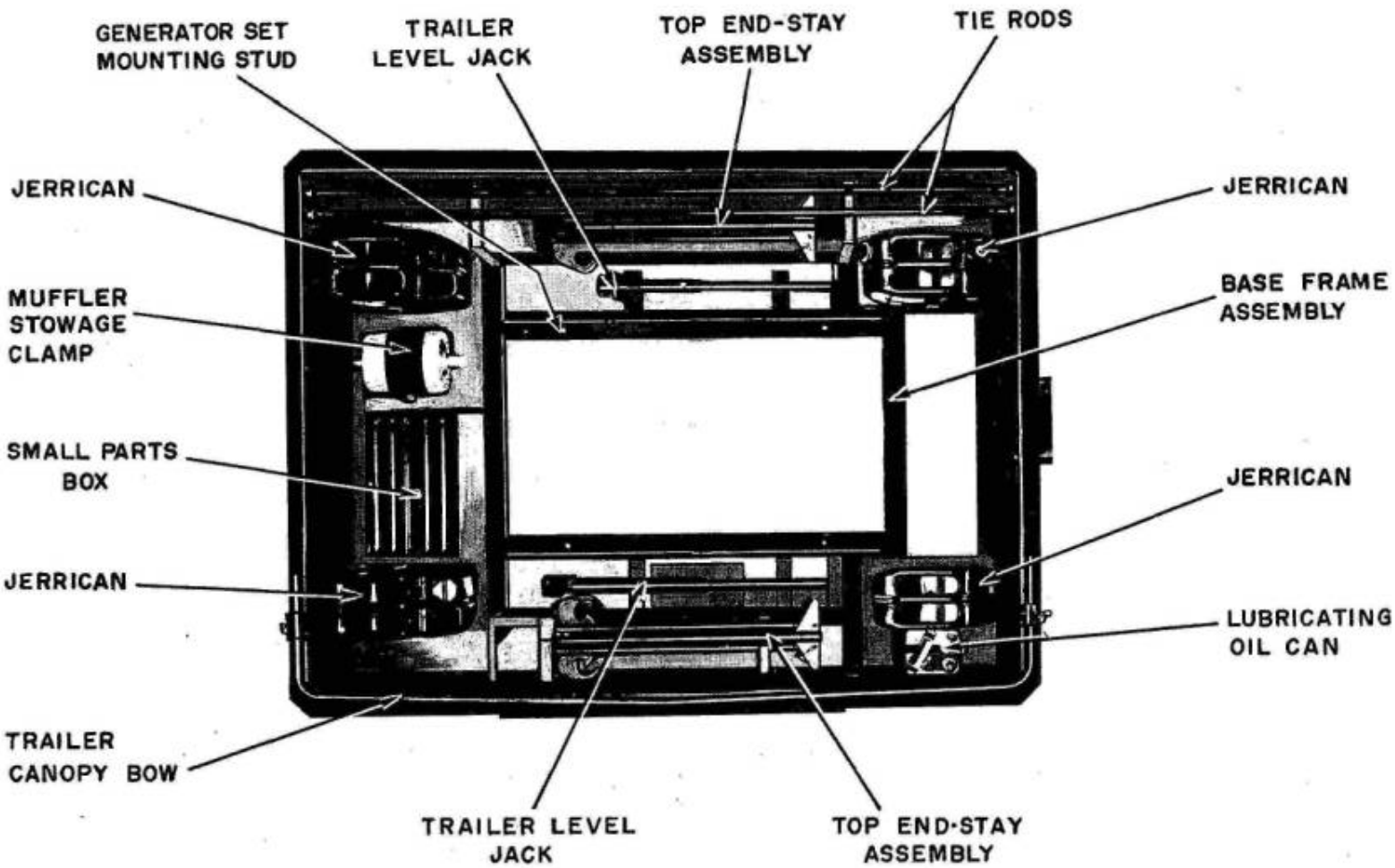
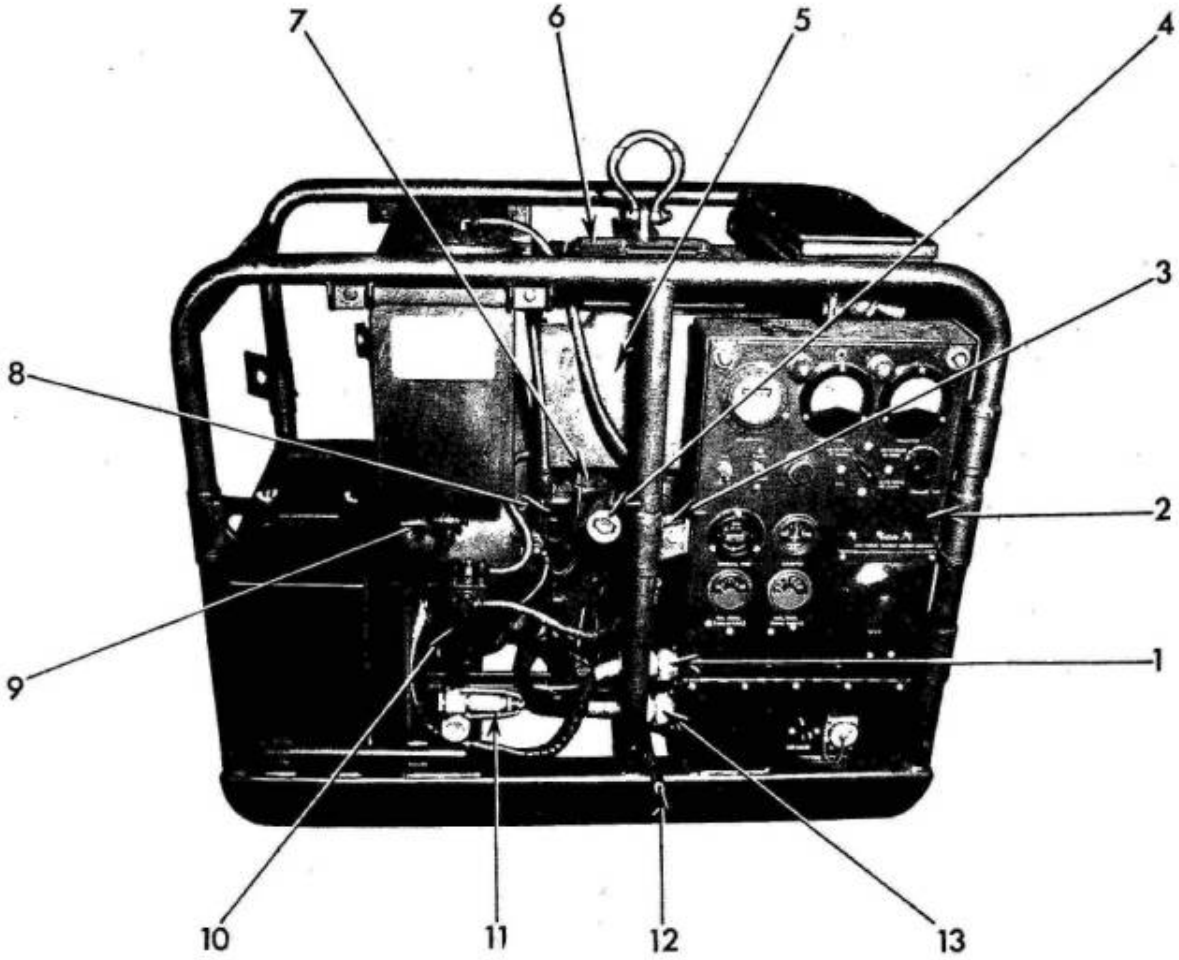


FIG 36 - TRAILER FITTINGS AND ACCESSORIES

280. The trailer should be carefully located on a level site and secured firmly in a horizontal position by the three support and levelling jacks, before the generator set is lifted off or lowered on to its mounting studs.

281. Ensure that the generator set is firmly bedded on a level site when it is operated out of the trailer.



1. Connector J3
2. Panel
3. Panel Hinge Bolt
4. Oil Filler Cap
5. Air Housing Door
6. Air Cleaner
7. Fuel Transfer Pump
8. Primary Fuel Filter
9. Fuel Drain
10. Secondary Fuel Filter
11. Cold Starting Device
12. Crankcase Drain Pipe
13. Connector J1

FIG 37 - GENERATOR SET-FRONT VIEW

CHAPTER SEVEN - DESCRIPTION, OPERATION AND MAINTENANCE OF THE GENERATOR SET

SECTION 25 - GENERAL DESCRIPTION

GENERAL

282. The engine-generator set, shown in Figs 37, 38 and 39 consists of a diesel engine, a generator, a voltage regulator, a control panel, and integral accessories.

FRAME

283. The engine-generator set is mounted in a welded tubular-steel frame. The frame bottom forms a skid for easy handling. The upright portions of the frame are fitted with porter-bar brackets for lifting or positioning the set. Shock mounts, between the set and the frame, damp the operating movements of the set.

DIESEL ENGINE.

284. The diesel engine is a four-stroke cycle, vertical, in-line, air-cooled diesel engine with overhead valves. Crankcase and cylinders are integral. Starting power is provided by a 24-volt system consisting of two 12-volt lead-acid batteries, a permanent-magnet battery-charging generator, and a starting motor. The engine is equipped with an engine driven fuel pump, a lubricating oil pump, fuel and oil strainers, filters, a muffler, and an air cleaner. A flyball type governor maintains a constant engine speed of 2000 rev/min which is the normal operating speed.
The engine comprises the following systems and parts:-

(a) Starting motor and battery

(b) Fuel system

(c) Oil system

(d) Cooling system

(e) Cylinder heads and valves

(f) Pistons, piston rings, and connecting rods

(g) Governor system

(h) Exhaust system

(j) Protective system

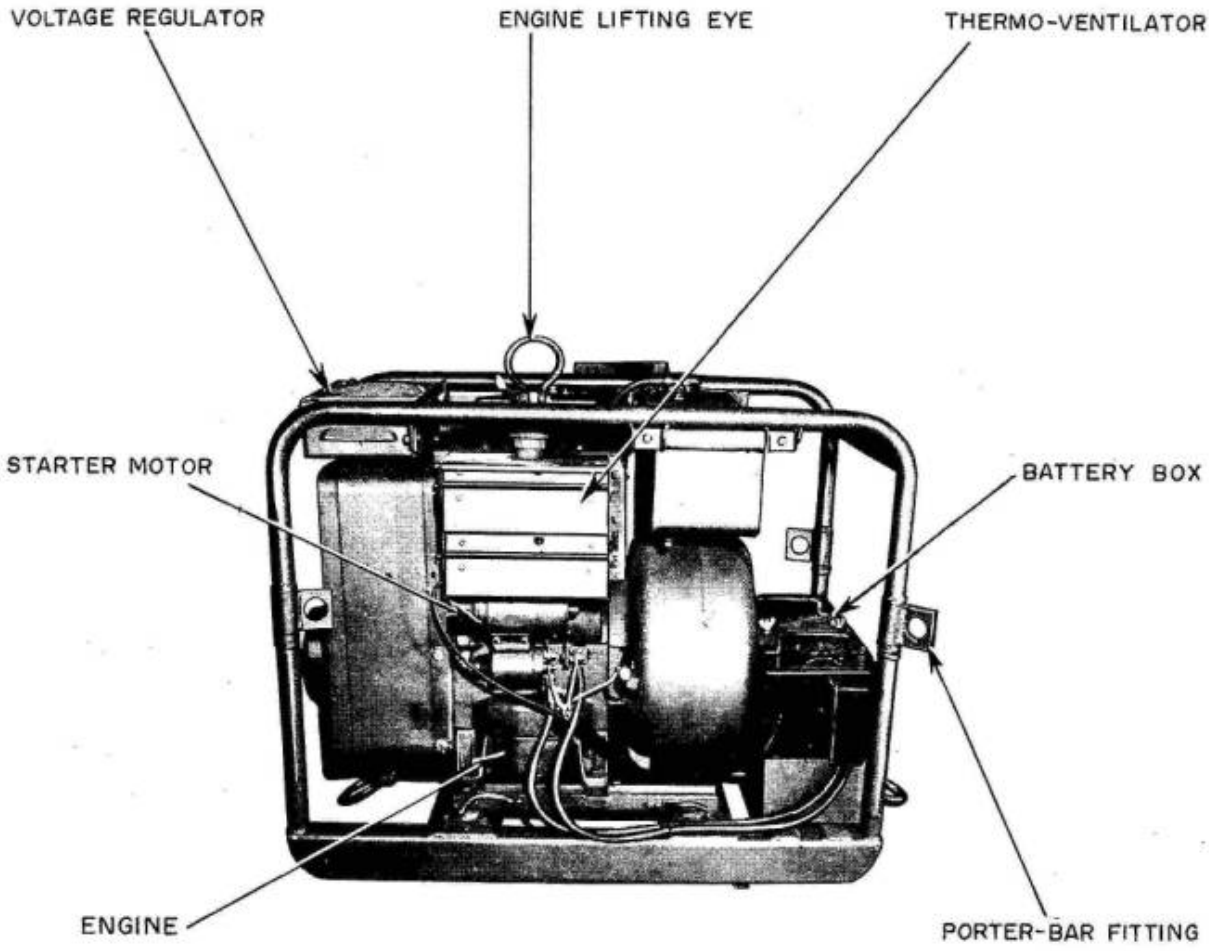


FIG 38 - GENERATOR SET - REAR VIEW

STARTING MOTOR AND BATTERY

285. A 24-volt starter which engages with the flywheel is mounted on the right hand side of the engine. A solenoid is energized causing a pinion to engage with an over-running clutch. The starter is protected from excessive speed by the over-running clutch which permits the engine to run faster than the starter before the pinion is disengaged. The batteries are two standard 12-volt, lead-acid type. These are maintained between 22 and 30 volts total, through a regulation system, by a battery charging generator mounted on the engine. Electrolyte specific gravity should be between 1.225 and 1.270.

FUEL SYSTEM

286. The fuel system provides a means of filtering, transporting and delivering fuel in a fine spray to each cylinder at the correct time for ignition. The system consists of a primary fuel filter, a fuel transfer pump, a secondary fuel filter, an injector pump, and an injection nozzle for each cylinder. The fuel transfer pump (diaphragm type) operates directly off the engine camshaft and draws fuel from the supply tank and delivers it through two filters to the injection pump. The injection pump meters fuel and distributes it at high pressure to each injection nozzle. Injection nozzles (one for each cylinder) open at a pre-set pressure delivering a fine spray of fuel to the cylinder pre-combustion chamber. To bleed off excess fuel after each injection cycle, fuel-return lines combine the leak-off fuel with the flow-through fuel and return both to the fuel supply tank.

OIL SYSTEM

287. A pressurized oil system provides lubrication to all moving parts of the engine. The oil system consists of an oil intake cup, an oil pump (gear type), a by-pass valve, an oil pressure gauge, a full-flow oil filter, oil lines, and drilled passages to deliver oil throughout the engine. Oil is held in the oil base. When drawn by the oil pump, oil passes through the full-flow filter. A line carries oil to the top of the rocker arm housing. Drilled passages in the crankshaft provide oil to the crankshaft bearings and the front camshaft bearing. Drilled passages in the crankshaft distribute oil to the connecting rod bearings. Drilled passages in the connecting rods carry oil to the piston pin bushings. A crankcase breather is included to aid in oil-consumption control. Normal oil pressure should be 25 psig (minimum).

COOLING SYSTEM

288. A cooling system (blown air) is provided to remove heat produced by normal operation. A blower-wheel mounted on the engine flywheel draws air in through the engine housing and forces it past both cylinders and out the right side of the engine. Air from the engine outlet is ducted out of the area. A thermostatically controlled shutter maintains

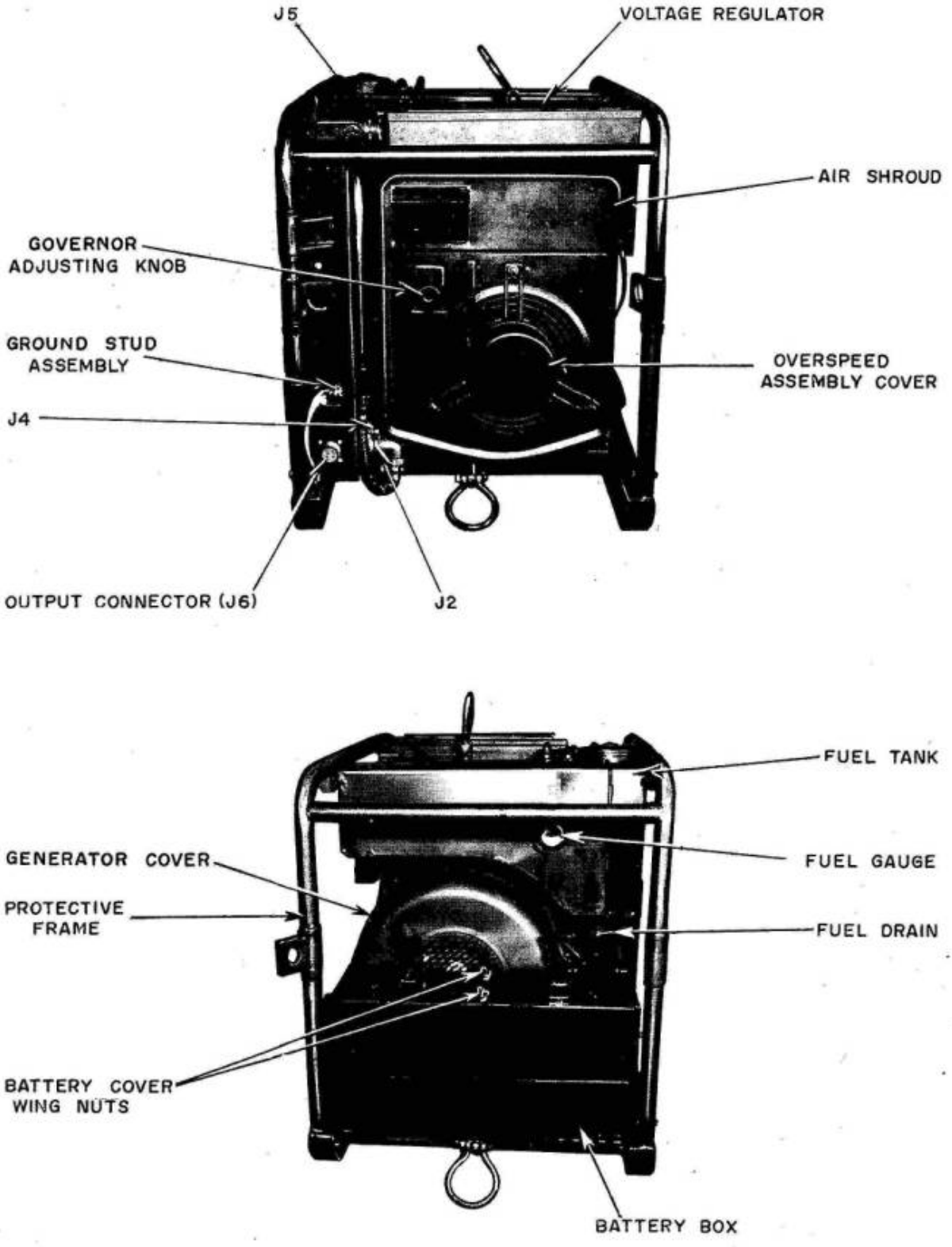


FIG 39 - GENERATOR SET - END VIEWS

optimum engine temperature. In addition a separate blower on the generator rotor draws air in through the rear of the generator and forces it out through ports near the engine oil base.

> CAUTION
>
> The air housing, including the exhaust shutter, must be in place when operating the engine. Over-heating and permanent damage could result from as little as one minute of operation without it.

CYLINDER HEADS AND VALVES

289. Cylinder heads are cast iron and each assembly has stellite faced valves, release type rotators, stellite inserts, guides, rocker arms, injection nozzles, and glow plugs. The push rods run through shields. The glow plugs are included for cold weather starting. An ether primer is included for extreme cold weather starting.

PISTONS, PISTON RINGS, AND CONNECTING RODS

290. The engine utilizes camground aluminum pistons. Each piston is tapered and fitted with three compression rings and an oil control ring. Pistons are connected to the connecting rods by full-floating piston pins. Snap-rings at each end hold the piston pins in place. At the lower end of each connecting rod is a half-shell precision bearing. At the upper end of each connecting rod is a semi-finished bushing.

GOVERNOR SYSTEM

291. The governor system maintains a constant engine speed during changes in power demands. The governor responds to changes in power demands by varying throttle position. Engine-Generator Set EG-4005 utilizes a constant speed flyball type governor, which is mounted on the camshaft gear. The governor consists of a ball, cup, and yoke. The yoke resting on the cup is connected to the governor arm, which is connected to the throttle lever. Any change in the engine speed is transmitted from the cup to the yoke and then to the throttle. Tension on the governor spring determines the speed at which the engine is governed.

EXHAUST SYSTEM

292. Engine exhaust is expelled through a manifold and muffler to the atmosphere. The muffler is designed to maintain the sound level below 90 dB at a horizontal distance of 10 feet when operating under full load. For protection from moisture, the muffler is provided with a raincap and a drain hole. Design life is 4000 hours.

ENGINE SAFETY DEVICES

293. Safety devices included in the system to protect the engine during operation, by automatically shutting down the engine, consist of the following:-

(a) Overspeed protection

(b) Over-heating protection

(c) Low-oil pressure protection

MAIN GENERATOR

294. Electric power is provided by a 24-pole, rotating field, stationary armature, alternating current generator mounted on and directly coupled to the diesel engine. The generator output is 5.0 kW at 0.8 power factor, 120/208V ac, 400 cycles per second, 3-phase. The rotor is a balanced slip-ring-connected wound field. Slip-rings are fabricated from corrosion-resistant metal, and are concentric with the shaft within 0.001 inch. Brushes are moulded of soft carbon. Brush springs are phosphor-bronze and are of the coiled spring constant tension type.

BATTERY CHARGING SYSTEM

295. Opposite the main generator is a smaller generator for maintaining the battery charge level between 22 and 30 volts. The battery charging generator is a permanent magnet rotating field type and supplies 60 V ac, 14 amps nominal, 3-phase. The output is rectified through a 3-phase, halfwave, silicon diode rectifier to provide 24 V ac nominal for charging the batteries.

VOLTAGE REGULATOR

296. The voltage regulator senses the output voltage in one phase and adjusts the output by changing the field current. Output voltage is compared to a standard reference voltage across a zener diode producing a control signal. A differential amplifier amplifies this control signal which biases a current control transistor in the ground leg of the field circuit, thereby controlling the field strength.

CURRENT TRANSFORMER BANK

297. The current transformer bank consisting of three toroids in series with each leg of the output, is used to monitor the output current. An inductance loop is taken off each toroid and through the rotary switch, S4C, fed to the ammeter to indicate output current.

GENERAL DATA

298. Engine Generator Set

Unit Designation	Engine-Generator Set, EG-4005

Dimensions:

Length	38-in	Height	30-in
Width	26-in	Weight	760-lb

Maximum Safe Operating Tilt:
15 degrees in any plane

299. Diesel Engine

Unit Designation	DJ-60M
Type	Diesel (4 cycle)
Cylinders	Two
Bore	3 1/4-in
Stroke	3 5/8-in
Compression Ratio	19:1
Total Displacement	60 cu in
Direction of Rotation (viewed from fan end)	Clockwise
Horsepower	10.5 (at 2,000 rev/min)

Pistons

Material	High Silicon Aluminium Alloy
Compression Rings	Three
Oil Ring	One (4 piece)

Crankshaft

Ductile iron-shot peened

Front main bearing	Two piece leaded bronze sleeve type
Rear main bearing	Roller

Valves

Material	Stellite faced steel
Valve Seat	Replaceable stellite inserts

Lubrication System

Pump	Gear Type, (gear driven)
Filter	Full-flow, Cartridge type
Capacity	Three quarts (US) + 1/2 quart for oil filter

Fuel System

Transfer Pump	Diaphragm type, Driven by Engine Camshaft
Fuel Filters	Two, Primary and Secondary
Tank Capacity	Six gallons (US) No. 2 Diesel Fuel, JP-4, or kerosene
Air Cleaner	Oiled Foam Type

Cooling System

Type	Forced air
Cooling Air	790 cfm (minimum)
Inlet Vent Area	70 sq in
Exhaust Vent	80 sq in

300. DC Electrical System

Voltage	24 V dc nominal
Generator	Permanent magnet, 3-phase, 60 V ac, 2,000 rev/min
Rectifier	Silicon Diodes, Halfwave, 3-phase
Starting Motor	24V dc nominal
Batteries	Two lead-acid, 12-volt, series connected

301. Main Generator

Model	EG-4005
Type	Rotating Field, 2,000 rev/min
Rating	5kW, 3-phase, 120/208V ac
Frequency	400 c/s
Power Factor	0.8
Exciter	Battery Charging Generator
Voltage Regulator	Transistorized

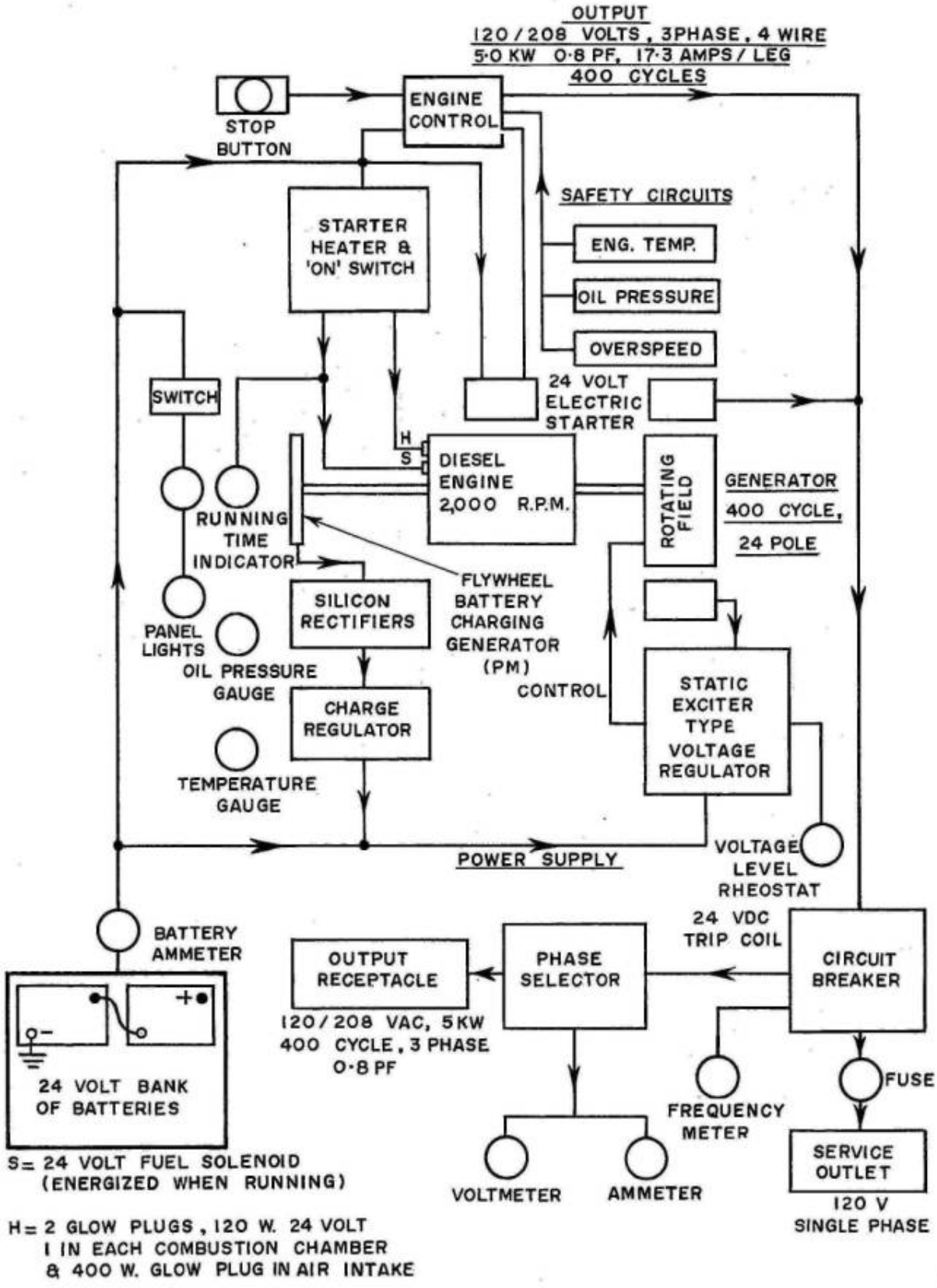


FIG 40 - BLOCK DIAGRAM

SECTION 26 - PREPARATION FOR USE

INSTALLATION

302. The generator set is bolted directly to the trailer bed using the four holes provided in the base of the skid assembly. When used as a portable unit, the set may be positioned directly on firm soil, concrete, or asphalt. The lifting eye shown in Fig 38 should not be used for lifting the complete generator set. The eye is intended to lift the engine only, for servicing. The porter-bar fittings should be used (see Fig 38). When mounted on a hard surface such as packed soil or concrete, rubber pads may be required to prevent the unit from walking due to operating vibrations. The location is determined primarily by the location of the equipment it is to operate. The set should be as close as possible to the equipment, because long power cables cause excessive voltage drop. Clearance must be provided to ventilate the set adequately and permit personnel access for operating and servicing the set. The set should be protected as much as possible from adverse weather conditions such as rain, snow, extreme solar heat, or sand and dust. It should never be operated in a position in excess of fifteen degrees from level in any direction. For best operation, the set should be at least level to the eye. Adequate ventilation is also required to support the engine combustion and supply air for the cooling system. It is imperative that both the inlet and exhaust ventilating ports be unobstructed to a distance of four feet minimum. If it is necessary to duct the exhaust because of space limitations, the thermal control shutters on the outlet duct must be free to operate according to engine demands. These shutters control the engine temperature by regulating the air flow and prevent a back flow of cold air after the engine has shut down.

INITIAL SET UP

303. After positioning the generator for operation, prepare the unit as follows:-

(a) Install the muffler on the exhaust manifold of the engine using the special elbow union and stays provided (see Fig 34). The manifold port is taped shut for shipping by masking tape which is easily removed.

(b) Remove the battery lifting strap and the oil filter wrench from the top of the battery box cover (Fig 39). Store in a safe place.

(c) Remove the battery box cover by releasing the two wingnuts (Fig 39) on the top.

(d) For purposes of shipping, the batteries are supplied dry and the jumper cable is stored separately. Install the jumper cable between batteries, if not already installed.

(e) Fill the batteries with electrolyte according to the instructions on the tags which are located on the top of the batteries. These batteries require approximately four and one half quarts of electrolyte apiece and the specific gravity of the solution should be between 1.225 and 1.270.

(f) Replace battery box cover and secure by wingnuts.

(g) Remove the oil filler cap (shown in Fig 37) and fill the engine crankcase with three and one half quarts of oil in accordance with Table 15. Replace the oil filler cap and tighten securely to prevent blowing oil during engine operation.

FUELING

304. To fuel the engine-generator set use No.1 or No.2 Diesel fuel. Furnace oil, kerosene, or JP-4 jet engine fuel may be used in emergencies. Use a low sulphur content fuel with a pour point (ability to filter) of at least 10 degrees. A low-sulphur content fuel will minimize ring sticking and bearing corrosion. Keep fuel in clean containers adequately protected from adverse weather conditions, and exposure to moisture. Tank capacity is approximately six gallons (US) of fuel. The engine generator will run a minimum of six hours at full load on a full tank of fuel. It is especially important in Diesel engines that the fuel be clean.

BLEEDING AND PRIMING FUEL SYSTEM

305. Prior to attempting to start the engine after an extended shut down, the fuel system must be bled. To bleed the fuel system, refer to Fig 41 and proceed as follows:-

(a) Remove air bleed plug on top of secondary filter (see Fig 37).

(b) Operate the priming lever on the fuel transfer pump until the bubbles cease to appear in the fuel flowing from the bleeder hole.

> NOTE
> If pump lobe on the camshaft is up, crank the engine one revoltuion before operating prime lever.

(c) Replace bleed plug.

(d) Return priming lever to disengage position for normal operation.

NOTE

In some cases it may be necessary to bleed the fuel lines to the injector nozzles. This is done by slightly loosening the line connections at the nozzles, and operating the fuel pump as in (b), until bubble-free fuel flows from the loosened connections. Tighten the connections after bleeding.

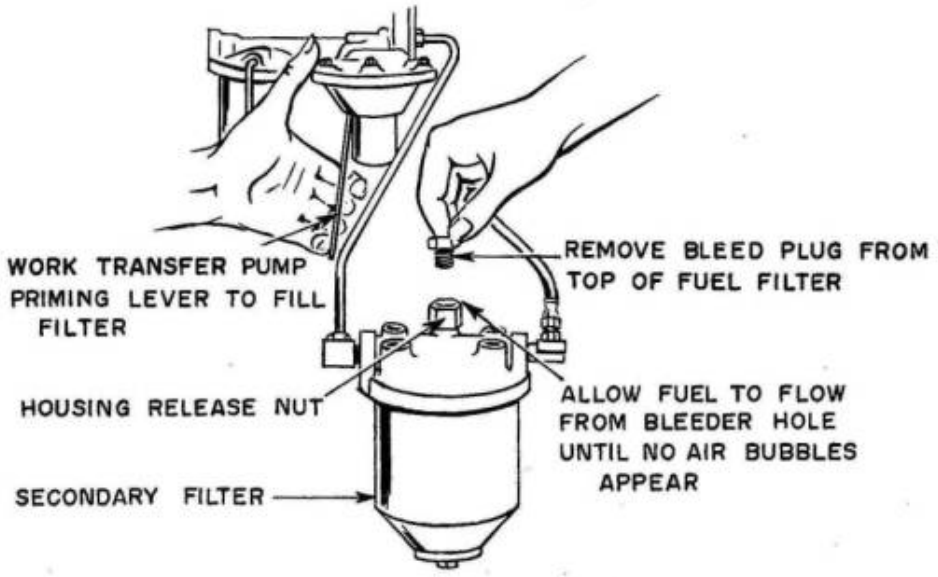


FIG 41 - PRIMING THE FUEL SYSTEM

GOVERNOR LINKAGE

306. Prior to operating the engine, lubricate the governor linkage as shown in Fig 42.

307. The governor linkage contains two ball joints which require lubrication. To service, disconnect all electrical connectors and remove cabinet hinge bolt (Fig 37). Swing out the control cabinet and remove the air housing door (Fig 37). The governor linkage ball joints are located on the right hand side of the air housing and high pressure fuel pump. To lubricate, separate the ball socket by shifting the spring-loaded sleeve away from the end of the sleeve. Use a nongumming lubricating oil or a powdered graphite lubricant. After servicing, replace air housing door and secure the control cabinet in position and connect all electrical connectors.

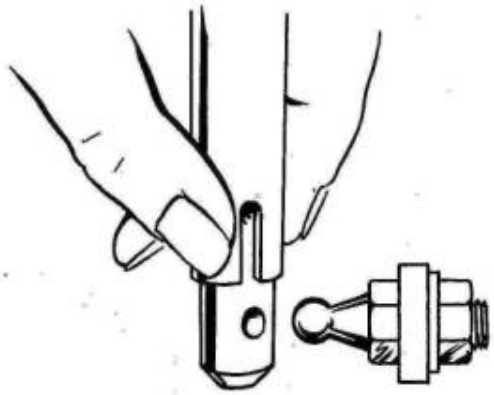


FIG 42 LUBRICATING BALL JOINTS

ELECTRICAL CONNECTION

308. Connect the load cable to the output connector. The plug must mate with J6 mounted on the side of the control cabinet.(see Fig 39). Refer to Table 14 for the proper connection.

> CAUTION
>
> Make certain that the wire size is adequate. Wire size must not be smaller than No.10 AWG

TABLE 14 - OUTPUT TERMINAL PINS

DESIRED OUTPUT	TERMINALS
208 Volts, 3 phase	A, B, C
4-wire Output	A, B, C, D (neutral)
120 Volts, Single phase	D to any other terminal*

* Single phase should only be used for light loads as it introduces an unbalanced conditions for the generator. This imbalance could have an undesireable effect on any three-phase load being operated at the same time.

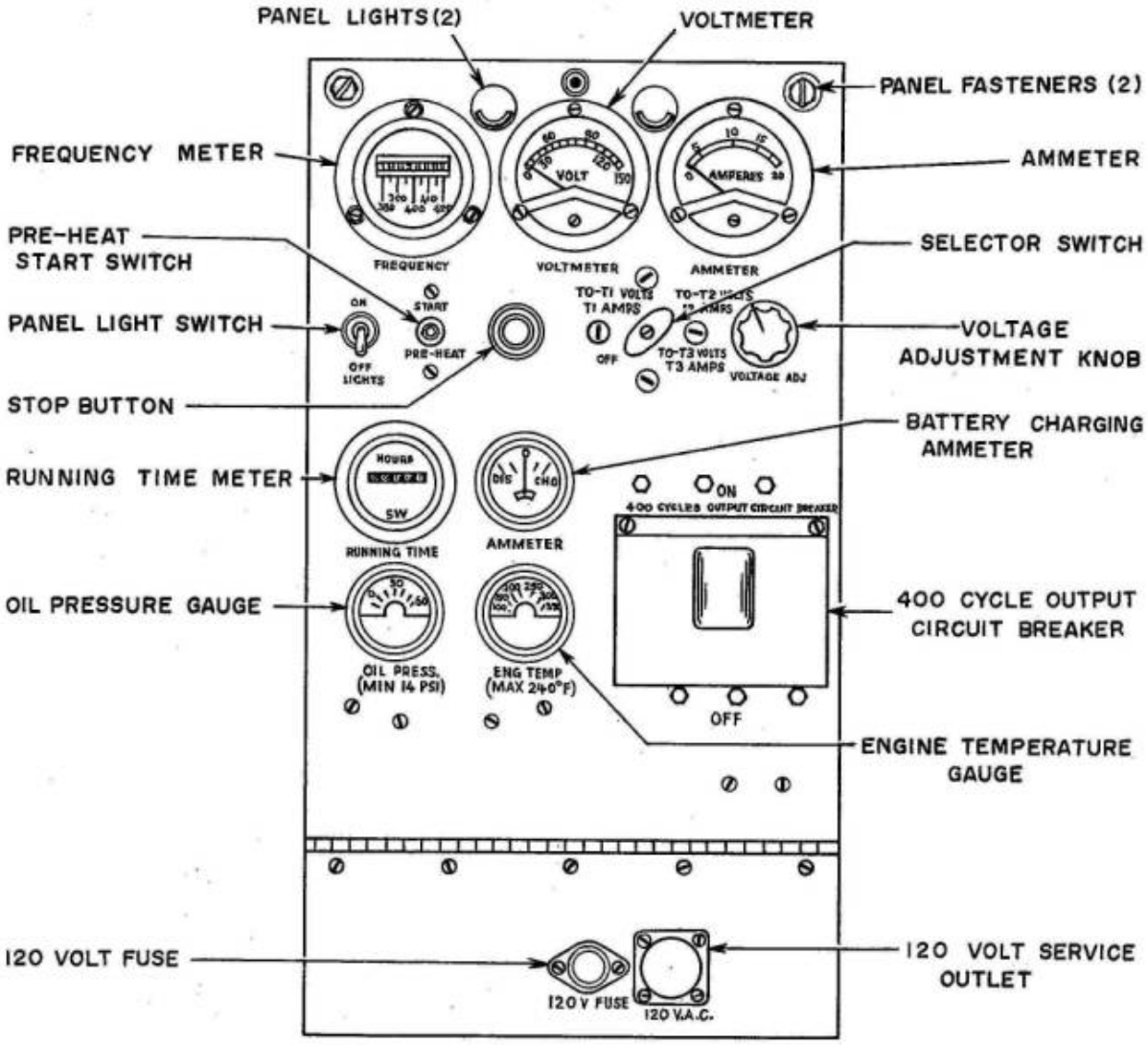


FIG 43 - CONTROL PANEL

INDICATORS AND CONTROLS

309. The engine-generator controls located on the control panel (with the exception of the fuel tank indicator) are shown in Fig 43 and listed below:-

(a)	FREQUENCY METER	The frequency meter is of the vibrating reed type and indicates frequencies between 380 and 420 cycles with an accuracy of ± 1 per cent.
(b)	VOLTMETER	The voltmeter is an ac type which indicates from 0 to 150 volts with a mid-scale accuracy of ± 2 per cent. Increments are 2 volts.
(c)	AMMETER	The ammeter is a sealed iron vane type. Current is indicated from 0 to 20 amperes. Circuit breaker trip is indicated by a red line at 17.4 amps.
(d)	RUNNING TIME METER	The running time meter is capable of reading 9999.9 engine operating hours. The meter operates off a 24-volt dc supply and is controlled by the hold relay K1.
(e)	BATTERY CHARGING AMMETER	The battery charging ammeter indicates both charge and discharge currents. Full scale reading is 150 per cent of rated maximum charging current.
(f)	OIL PRESSURE GAUGE	The oil pressure gauge is calibrated in pounds per square inch, in 10-pound increments. Safe operating pressure is indicated under the gauge.
(g)	ENGINE TEMPERATURE GAUGE	The engine temperature gauge is calibrated in degrees Fahrenheit. Safe operating temperature is indicated under the gauge.

(h) PANEL LIGHTS SWITCH

A panel light switch is provided to turn panel lights on and off. The switch is a single-pole, single-throw type.

(j) PRE-HEAT, START SWITCH

A PRE-HEAT, START switch is provided to energize the glow plugs and turn the induction air heater on, and to energize the starting motor.

(k) STOP SWITCH

A push type STOP switch is provided for stopping the engine. Pushing the STOP button de-energizes the fuel solenoid.

(l) SELECTOR SWITCH

The selector switch is a four position rotary switch used to measure the line-to-neutral voltage and current of each phase; OFF, TO-T1 volts T1-amps, T0-T2 volts T2-amps, T0-T3 volts T3-amps.

(m) 400 CYCLE OUTPUT CIRCUIT BREAKER

The circuit breaker interrupts all three output legs when

(i) the current in any one leg exceeds a preset limit,

(ii) anyone of the engine protective devices operates,

(iii) the START or STOP switch is operated,

(iv) the on-off switch on the circuit breaker is operated.

The circuit breaker has a rubber weather shield to protect the face from adverse weather conditions.

(n) 120-VOLT SERVICE OUTLET

A 120-volt output receptacle is mounted on the lower-panel. This is for single phase operations.

(p)	120-VOLT FUSE	A 10 amp, 120-volt fuse is mounted in the lower panel to provide overload protection for the operating equipment.
(q)	VOLTAGE ADJUSTER	The voltage adjuster is a rheostat mounted on the panel which provides a means of adjusting the output voltage.

START-UP

310. To start the engine-generator set under normal conditions at temperatures of 20° F and above proceed as follows:-

(a) Check for water in the fuel pump. Drain fuel lines if water is present.

(b) Check oil level, as shown in Fig 44, and add oil if required in accordance with Table 15. The oil filler cap is shown in Fig 37.

(c) Check to make certain that no load will be applied when the engine is started.

(d) Place the PRE-HEAT, START switch in the PRE-HEAT position (see Fig 43). Hold in this position for two minutes.

(e) Place the PRE-HEAT, START switch in the START position. Hold in this position until the oil pressure gauge indicates 15 PSIG and the engine starts, then release switch and allow it to return to neutral position.

(f) Check OIL PRESSURE GAUGE. Indication must be 25 PSIG minimum when engine is operating at normal rpm.

(g) Allow engine to warm-up for approximately five minutes before applying load.

(h) Apply load gradually if possible. Wait 15 to 20 minutes between each kilowatt step, especially for a new engine.

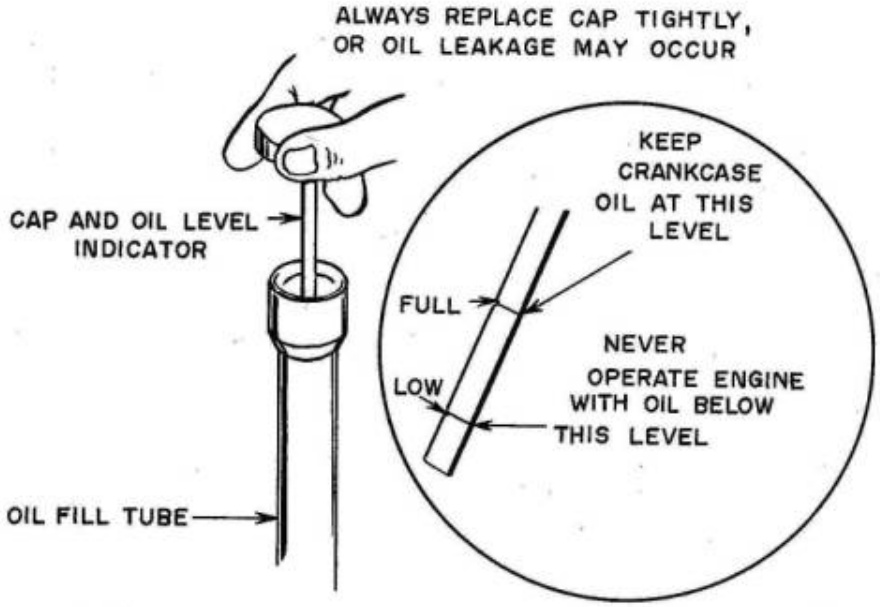
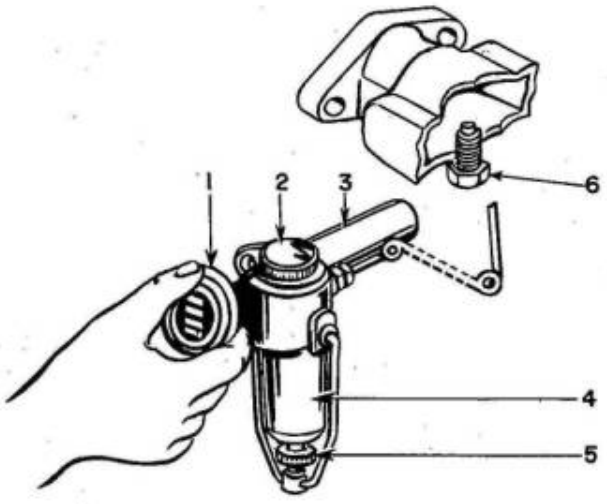


FIG 44 - CHECKING OIL LEVEL



1. Pump Handle
2. Piercing Shaft Knob
3. Pump Cylinder
4. Capsule with Starting Fuel
5. Knurled Nut
6. Injection Spray Nozzle

FIG 45 - ETHER PRIMING PUMP ASSEMBLY

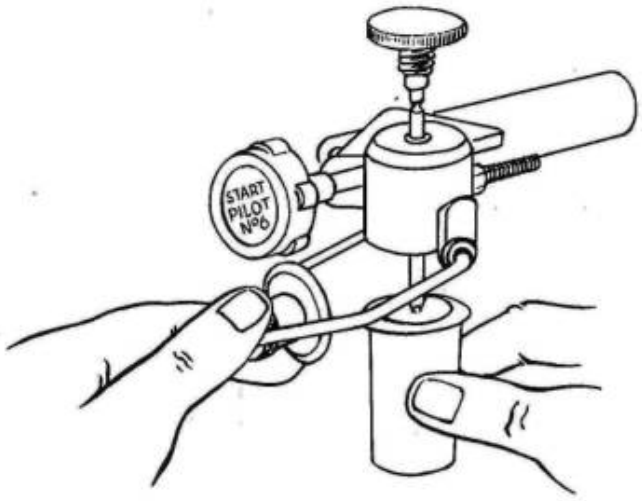


FIG 46 - INSTALLING ETHER CAPSULE

EXTREME COLD WEATHER STARTING

> WARNING
>
> Never attempt to start the engine using the ether starter aid in temperatures above 20°F

311. To start the engine-generator set in extreme cold weather (20°F and below) use the cold weather starting device. Refer to Fig 45 and proceed as follows:-

(a) Unscrew knurled nut (5) on bottom of holding clip.

(b) Pull piercing shaft (2) up, and insert an ether capsule (4) into capsule harness as shown in Fig 46.

(c) Tighten knurled nut to secure the capsule.

(d) Place the PRE-HEAT, START switch in the START position, allow engine to turn a couple of revolutions.

> CAUTION
>
> Do not energize glow plug when using ether starting aid.

(e) Prime pilot pump (3) by pumping handle (1).

> WARNING
>
> Do not prime pilot pump more than two strokes.

(f) Allow engine to start, then release the PRE-HEAT, START switch and allow it to return to neutral position.

SHUT-DOWN

312. To stop the engine-generator set proceed as follows:-

(a) Remove all or as much of the load as possible.

(b) Press the STOP button.

> CAUTION
>
> Carbon in exhaust system will occur in diesel engines operated consistently with light loads. To remedy this situation, operate the engine at full load occasionally, approximately five minutes prior to shut-down.

SECTION 28 - USER SERVICING

OPERATOR MAINTENANCE

313. The engine-generator set can be maintained in good operating condition by following a prescribed periodic preventive maintenance program. Of utmost importance is the operator maintenance which is a series of simple procedures not requiring any special tools or skills. Performing these procedures periodically in accordance with the schedule shown in Table 16 will keep the engine-generator set in good operating condition. Neglecting the routine service may result in the failure of the engine-generator at a time when it is urgently needed. In addition to the preventive maintenance certain periodic adjustments must be made, these are shown in Table 17.

VISUAL INSPECTION

314. Perform a visual inspection of the generator set every eight hours or less. When making the visual inspection, clean off any excess oil or dirt on the surfaces of engine. A clean engine will run cooler and more efficiently because the air can carry away the heat by direct contact with the walls. The visual inspection is a check on the general condition of the set and should include the following tasks:-

(a) Inspect the engine for excessive leakage.

(b) Check for leaking fuel and loose connections.

(c) Check all visible engine bolts (see Table 18 for torque requirements).

(d) Check the fuel supply to avoid running out of fuel. A certain amount of sediment will exist in the fuel tank (Fig 39). Running out of fuel or allowing the fuel level to drop low, will allow the sediment to get in to the fuel lines and could possibly clog the fuel filters. The fuel tank should be drained periodically through the use of the fuel tank drain (Fig 39).

FOAM TYPE AIR CLEANER

315. Every 200 hours clean the foam type air cleaner (see Fig 37) as follows:-

(a) Remove the two knurled nuts and washers on the air cleaner cover.

(b) Remove the air cleaner.

(c) Remove the element and retainer.

(d) Remove the gasket and discard it if it is worn or damaged.

(e) Separate the element from the retainer.

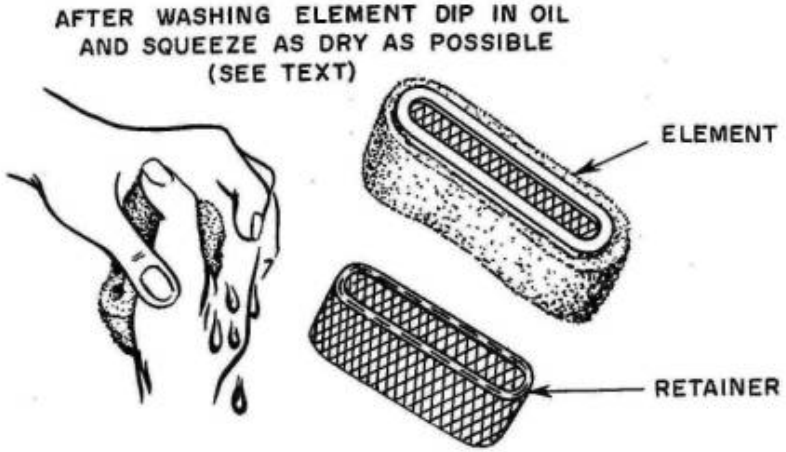


FIG 47 - SERVICING AIR CLEANER

(f) Wash the element in diesel fuel or gasoline. Immerse in cleaning fluid and squeeze several times.

(g) Squeeze the element, as shown in Fig 47, to remove as much cleaning fluid as possible.

(h) Moisten the element with clean engine oil, then squeeze as dry as possible.

(j) Insert the retainer in the element.

(k) Install the gasket (new one if required) in the air cleaner pan.

(l) Install the retainer and element in the air cleaner pan.

(m) Position the air cleaner cover over the element.

(n) Install two washers and two knurled nuts on the exposed studs.

(p) Tighten the knurled nuts.

CRANKCASE OIL CHANGE

> NOTE
>
> Table 16 specifies the oil and filter should be changed every 50 hours. However, if the weather conditions are extremely cold or if the atmosphere is dusty or dirty the oil and the filter should be changed more often.

316. To change the crankcase oil and replace the oil filter proceed as follows:-

(a) Disconnect the cabinet hinge bolt and connections J1, J2, and J3 (see Figs 37 and 39) and swing the control cabinet out.

(b) Install the extension in oil drain.

(c) Open the drain valve and drain the oil into the pan provided. Discard the oil.

> NOTE
>
> The engine should be hot to permit complete drainage. Change the oil only while the engine is still hot.

(d) Place a pan under the oil filter.

(e) Remove the filter by turning counterclockwise, using a filter wrench or strap wrench if required. Discard the old filter.

(f) Clean the filter mounting area with a clean cloth.

(g) Coat the gasket on the filter with clean engine oil.

(h) Install a new filter. Turning it clockwise until it is hand tight. Then using a filter or strap wrench turn the filter an additional one-half turn.

> CAUTION
>
> Do not over tighten the oil filter.

(j) Close the drain valve.

(k) Connect connectors J1, J2, and J3 and secure the cabinet hinge bolt securely.

(l) Remove the oil filler cap.

(m) Add oil, (refer to Table 15 for proper type). Add 3 1/2 quarts.

(n) Check the oil, install oil filler cap, and secure it.

CRANKCASE BREATHER

317. To clean the crankcase breather cap refer to Fig 48 and proceed as follows:-

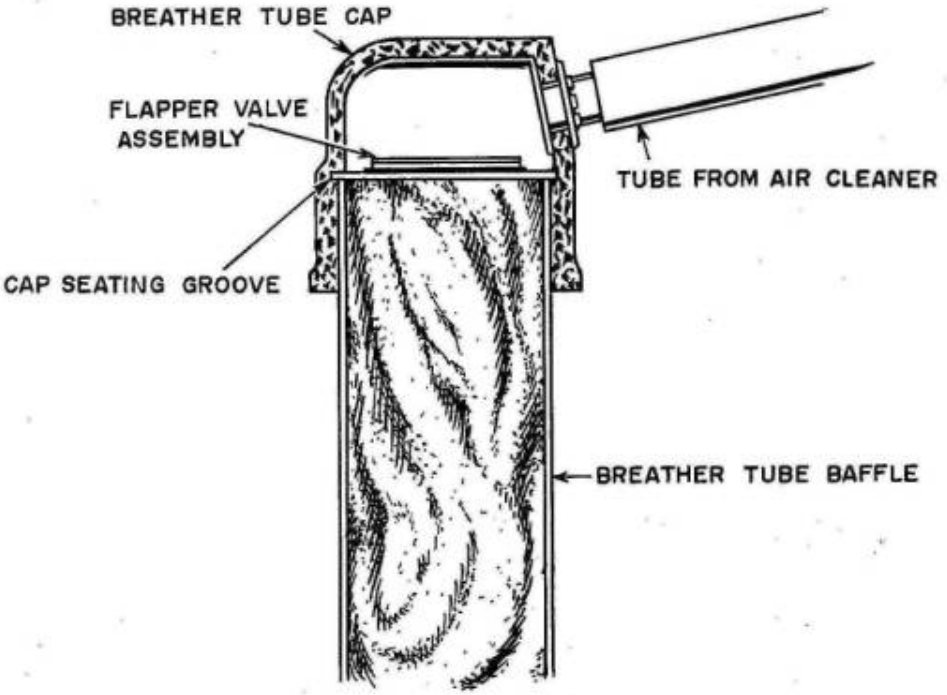


FIG 48 - CLEANING THE CRANKCASE BREATHER

(a) Remove the air housing door (see Fig 37).

(b) Remove the breather tube cap (see Fig 48).

(c) Using a knife pry off the flapper valve assembly.

> NOTE
>
> The flapper valve may be removed when the breather tube cap is removed. If the flapper is in the breather cap, it may be removed by placing both thumbs on the cap and pushing the flapper out of the cap.

(d) Wash the valve in fuel.

(e) Pull the baffle out of the breather tube; clean and replace it.

(f) Install the valve with the perforated disc toward the engine. Make certain that the cap is securely locked on the breather tube as excessive oil consumption will result if it is not properly seated in groove.

(g) Check the oil level after every eight hours of operation. Refer to Fig 44.

(h) Lubricate the governor linkage every 100 hours (see Fig 42).

BATTERY

318. To check the engine batteries proceed as follows:-

(a) Remove the battery box cover (see Fig 39) and battery caps.

(b) If batteries are dry, they should be filled with electrolyte, as described in paragraph 303.

(c) If batteries have electrolyte in them, use a hydrometer to check the specific gravity. The specific gravity should be between 1.225 and 1.270. If the specific gravity is below the proper level, charge the batteries immediately.

> NOTE
>
> The specific gravity reading should be compensated for low temperature of electrolyte.

(d) Check the level of electrolyte and add distilled water, if the level is low.

CAUTION

If water is added in freezing weather, charge the batteries immediately to prevent damage.

(e) Replace the battery caps.

(f) Check the battery terminals and connections, tighten if necessary.

(g) Clean the battery and battery terminals. Coat the terminals lightly with grease.

(h) Replace the battery box cover and secure with wingnuts (see Fig 39).

SEDIMENT BOWL - PRIMARY FUEL FILTER (Fig 37)

319. Clean the fuel sediment bowl on the fuel transfer pump, as follows:-

(a) Loosen the knurled nut at bottom of the bowl.

(b) Push the nut holder away from the bowl.

CAUTION

Hold the bowl to prevent it from falling and breaking.

(c) Remove the filter and gasket.

(d) Check the gasket. If damaged or worn, discard it.

(e) Wash the bowl and filter in clean fuel or gasoline.

(f) Install the gasket to the top of the filter assembly.

(g) Install the filter in the bowl.

(h) Position the bowl and pull the nut holder into position.

(j) Tighten the knurled nut.

GOVERNOR ADJUSTMENT

320. To adjust the governor refer to Fig 39 and proceed as follows:-

(a) Using a tachometer or strobe determine the engine speed.

(b) Change the spring tension by turning the governor adjustment knob (Fig 49). Turning knob clockwise increases the spring tension (by pulling keyed sleeve outward) and increases the engine speed. Turning knob counterclockwise decreases spring tension and decreases the engine speed.

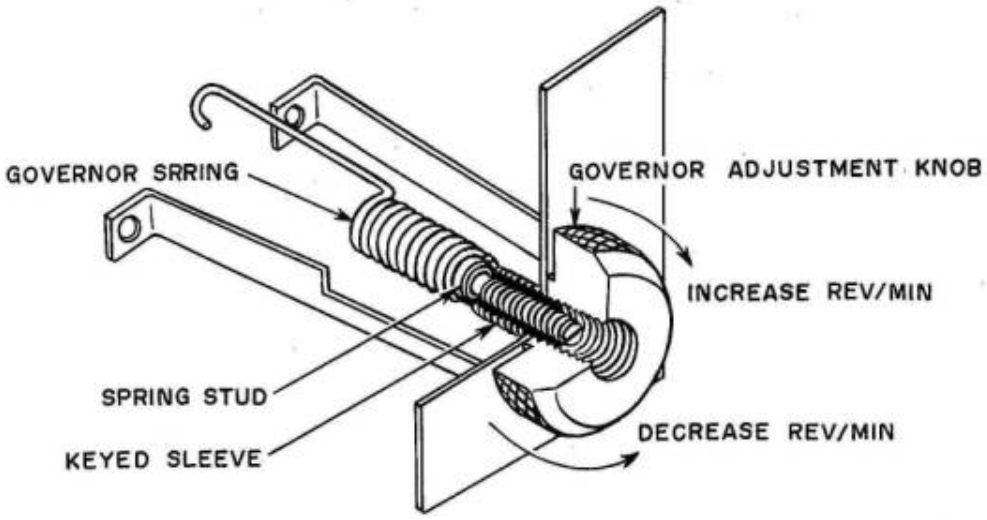


FIG 49 - GOVERNOR CONTROL

(c) If speed drops too much when full load is applied, adjust sensitivity for minimum speed drop, without hunting (constant changing of speed). This adjustment is made by holding the governor control knob steady and unscrewing the spring stud to use more coils.

(d) Compensate for reduced speed (caused by making more coils of spring operative) by turning knob until desired frequency is obtained.

(e) Set maximum-stop screw while gradually increasing the load to stop the throttle at smoke point.

(f) Set the minimum-stop screw to just fully close the throttle (no fuel injected).

VALVE CLEARANCE ADJUSTMENT

> NOTE
>
> Adjust valve clearance when engine is at room temperature (about 70 degrees F)

321. To adjust valve clearance proceed as follows:-

(a) Remove the muffler by loosening the union coupling (see Fig 34).

(b) Remove the lifting eye (see Fig 39).

(c) Remove the rocker cover by removing the four cap screws.

(d) Check the gasket, discard it if it is worn or damaged.

(e) Turn the flywheel so that the piston in the cylinder is between 10 degrees ATC and 45 degrees ATC on the power stroke.

(f) Adjust the valve clearance as shown in Fig 50. Clearance should be 0.009" for the intake valve, and 0.007" for the exhaust valve.

(g) Flush the rocker cover and oil line with clean fuel or gasoline. Clean the hole with a fine wire as shown in Fig 51.

(h) Install a new gasket on the rocker cover.

(j) Install the cover on top of the cylinder head.

(k) Install four cap screws and torque the screws to 8 to 10 foot-pounds.

(l) Install the lifting eye and hand tighten it.

(m) Install the muffler.

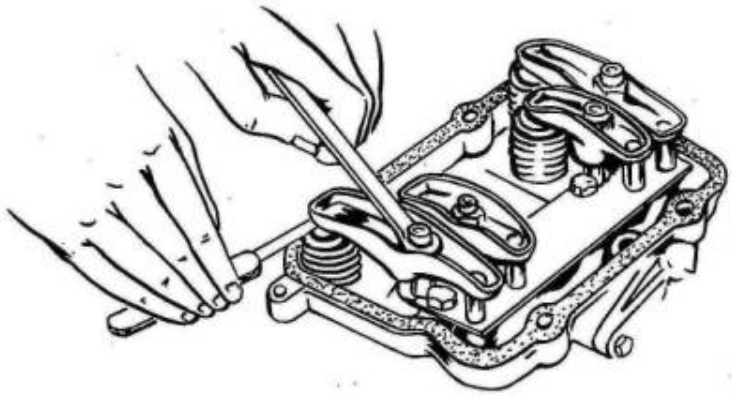
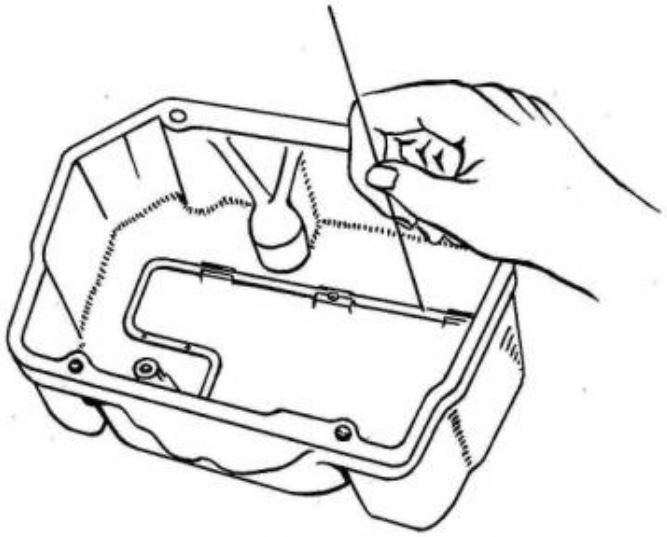


FIG 50 - VALVE ADJUSTMENT



FLUSH ROCKER BOX OIL LINE WITH FUEL AND CLEAN HOLES WITH FINE WIRE

FIG 51 - CLEANING ROCKER COVER

SECONDARY FUEL FILTER

322. To replace the element of the secondary fuel filter (see Figs 37 and 41) proceed as follows:-

(a) Remove the filter housing release nut.

(b) Remove the housing and discard the filter element.

(c) Wash out the housing in clean fuel, gasoline or solvent.

(d) Install a new filter element in the housing with the "top" on the outside.

(e) Replace the housing in the adapter and tighten the release nut.

TABLE 15

OIL SPECIFICATIONS

Temperature	Oil Grade
Above 30 degrees F	SAE 30
0 to 30 degrees F	SAE 10W or 5W-20
Below 0 degrees F	SAE 5W-20

TABLE 16
OPERATOR MAINTENANCE

Component	Maintenance Period-Hours 8	50	100	200	Applicable Paragraph
Inspect engine	X				314
Check fuel system	X				305 & 314
Check oil level	X				310
Lubricate governor link			X*		306 & 307
Service foam air cleaner				X*	315
Change crankcase oil		X			316
Change oil filter		X			316
Clean crankcase breather				X**	317
Check battery		X			318
Clean fuel sediment bowl				X*	319
Clean fuel filter				X*	319
Clean external surface or engine		X			314

* Service more often under dusty conditions.

* * Make certain cap is securely replaced or excessive oil consumption will result.

TABLE 17
ADJUSTMENT AND OVERHAUL

Component	Maintenance Period-Hours 500	1000	Applicable Paragraph
Secondary fuel filter		X*	322
Check valve clearance	X		321
Clean engine	X		314

* Service more often under dusty conditions.

TABLE 18

TORQUE REQUIREMENTS

Component	Torque in Foot-Pounds
Cylinder head bolt	44 to 46
Lifting bolt	25 to 30
Flywheel mounting bolt	65 to 70
Fuel pump mounting screw	15 to 20
Oil pump mounting screw	15 to 20
Rear main housing	44 to 46
Rocket cover	8 to 10
Exhaust manifold	20 to 25*
Lifting eye	Hand Tight

* Tighten exhaust manifold bolts evenly. Alternate from side to side to prevent warping or cracking the manifold.

SECTION 29 - FAULT DETECTION

323. When a malfunction in the engine-generator set is detected, perform a thorough visual check to determine the faulty component; pay particular attention to loose connections, broken wires, and loose components. Be on the lookout for indications of abnormal heating, burned or discolored insulation, and indication of smoke accumulation. Table 19 lists a sequence of faults which may be readily detected by the operator. Follow this sequence prior to disassembling the set. Remember, generally the malfunction will be caused by a single component, try to locate the faulty component before changing adjustments to other components.

TABLE 19

FAULT FINDING CHART

Fault	Possible Cause	Possible Remedy
Engine will not crank	Battery discharged Loose connections	Recharge battery Tighten connections
Engine cranks too hard	Incorrect grade of oil in crankcase Voltage Regulator	Drain crankcase and replace oil with proper grade Repair

TABLE 19 - (CONT'D)

Fault	Possible Cause	Possible Remedy
Engine will not start when cranked	Air in fuel system Lack of fuel Water in fuel Dirty fuel injectors Clogged fuel filter	Bleed the fuel system Fill fuel tank Bleed Clean fuel injectors Clean strainer (primary) Install new cartridge
Excessive oil consumption	Oil too light or diluted Clogged crankcase breather Rings not seated on new or rebuilt engine Worn engine Too much oil	Drain crankcase and replace oil with proper grade Clean Additional break-in time required Overhaul engine Drain excess oil
Black smokey exhaust, Excessive fuel consumption	Engine Overloaded	Reduce load to within rated capacity
Low-power under load	Poor grade or dirty fuel Poor compression Dirty air cleaner	Drain fuel tank and use only clean recommended fuel Tighten cylinder head bolts Clean or replace air cleaner
Engine stops while running	Fuel tank empty Safety switch operated	Fill tank with fuel Correct overheating or lubrication failure or change governor setting below overspeed cut-out level
Metallic thud when cold engine is first started	Low oil supply Oil diluted	Add recommended oil Change oil

TABLE 19 - (CONT'D)

Fault	Possible Cause	Possible Remedy
Engine races	Too much fuel injected STOP ENGINE IMMEDIATELY Hi-Press. pump seizure	Check governor and linkage Replace pump
Engine misfires	Faulty injection	Clean fuel system Use clean recommended fuel
Low oil pressure	Defective gauge Oil too light or diluted Oil too low Sludge on oil cup screen Faulty setting	Replace gauge Drain crankcase and refill with recommended grade Add oil Clean screen and oil pump Adjust setting
High oil pressure	Oil too heavy Defective gauge Clogged oil passages Oil relief stuck Faulty setting	Drain crankcase and refill with recommended grade Replace gauge Clean all oil lines and passages Clean by-pass Adjust setting
Engine overheating	Poor air circulation Improper lubrication Engine overloaded	Check ventilation Drain crankcase and refill with recommended grade Reduce load to rated capacity
Ammeter reads zero	400 cycle circuit breaker in off position Load disconnected from output connector	Place circuit breaker in on position Connect load to output connector.

TABLE 19 - (CONT'D)

Fault	Possible Cause	Possible Remedy
Ammeter reads zero	Open circuit in selector switch	Check for broken wires, faulty solder connections, or defective switch. Repair or replace faulty part.
	Open circuit in current transformer assembly.	Check for loose or broken wires or connections at current transformer assy.
	Open circuit in 400 cycle circuit breaker	Disconnect leads at circuit breaker. Place circuit breaker in "on" position and test each pole for open circuit. Replace circuit breaker if faulty.
	Brushes defective	Replace brushes
	Defective meter	Replace meter
Abnormally high ammeter reading	Engine generator set is overloaded	Reduce load to rated capacity
	Unbalanced load on three-phase operation	Balance load
	Short circuit across phases	Check output for short
Voltmeter reads zero on one or all phases with no load applied	Open circuit in voltmeter	Check for broken or loose connection. Disconnect and test meter for open circuit
		Replace voltmeter
	Open circuit in meter transfer switch circuit	Check for broken wires or connections. Check switch contacts
	Voltage Regulator	Check for broken wires or connections on voltage-regulator terminal board

TABLE 19 - (CONT'D)

Fault	Possible Cause	Possible Remedy
Low or zero reading on voltmeter	Defect in voltage regulator circuit	Check for broken wires or connections on voltage-regulator terminal board
	Short circuit across phases	Check output for short circuit
	Voltage Adj. incorrectly set	Reset control for proper output
Low or zero reading on one phase; normal, or high voltage readings on other phases	Open circuit or short circuit in voltage regulating circuit	Check for broken or loose connections on voltage-regulator terminal board
	Unbalanced load	Balance load
	Open circuit in meter transfer switch circuit	Check for broken wires or connections. Inspect switch contact.
		Repair or replace faulty part
High reading on voltmeter	Unbalanced load on three-phase	Balance load
	Voltage Adj. incorrectly set	Reset control for proper output
	Open circuit in 400 cycle circuit breaker	Disconnect leads from circuit breaker. Place circuit breaker in "on" position and test each pole for open circuit
	Defective voltmeter	Replace meter
Unsatisfactory radio-frequency suppression	Loose connections on radio suppression capacitors	Check for loose or broken connections
	Generator not properly grounded	Check ground connection
		Inspect all ground lock washers

NOTES