INSTRUCTION BOOK

FOR

SWITCHBOARD BD-80-T1
AND
ASSOCIATED EQUIPMENT

RESTRICTED

PUBLISHED BY AUTHORITY
OF
THE CHIEF SIGNAL OFFICER

JANUARY 12, 1938

INSTRUCTION BOOK

FOR

SWITCHBOARD BD-80-T1
AND
ASSOCIATED EQUIPMENT

R E S T R I C T E D

Notice:- This document contains information affecting the national defense of the United States within the meaning of the Espionage Act (U.S.C. 50:31, 32). The transmission of this document or the revelation of its contents in any manner to any unauthorized person is prohibited.

The information contained in documents marked RESTRICTED will not be communicated to the public or to the press, but it may be communicated to any person known to be in the service of the United States, and to persons of undoubted loyalty and discretion who are cooperating in governmental work. (AR 330-5)

Published by Authority

of

The Chief Signal Officer

January 12, 1938

TABLE OF CONTENTS

TABLE OF CONTENTS

(Continued)

LIST OF ILLUSTRATIONS

Photographs

Drawings and Diagrams (Attached)

Signal Corps Laboratories Drawings

A.T.& T. Co. Drawings and Descriptions

Operator's Telephone Circuit, Schematic	SD-15024-011
Operator's Telephone Circuit, Circuit Description	CD-15024-01
Operator's Telephone Circuit, Wiring Diagram	T-15024-30
Universal Cord and Ringing Circuit, Schematic	SD-15178-01
Universal Cord and Ringing Circuit, Circuit Description	CD-15178-01
Universal Cord and Ringing Circuit, Wiring Diagram	T-15178-30
Night Alarm and Fuse Alarm, Schematic	SD-15025-011
Night Alarm and Fuse Alarm, Schematic	SD-15025-012
Night Alarm and Fuse Alarm, Circuit Description	CD-15025-01
Night Alarm and Fuse Alarm, Wiring Diagram	T-15025-31
Switchboard Test Circuit, Schematic	SD-15174-01
Switchboard Test Circuit, Wiring Diagram	T-15174-30
Voltmeter Test Circuit, Schematic	SD-15118-01
Voltmeter Test Circuit, Circuit Description	CD-15118-01
Voltmeter Test Circuit, Wiring Diagram	T-15118-30
Method of Grounding Framework	SD-12726-01
Explanation of Air Line Wiring Diagrams	Sec. 4 of Handbook 0

INSTRUCTION BOOK

FOR

SWITCHBOARD BD-80-T1
AND
ASSOCIATED EQUIPMENT

SECTION I

GENERAL USE AND DESCRIPTION

1. General Use. The Switchboard BD-80-T1 (one or more sections), main distributing frame, and power equipment comprises a complete transportable telephone exchange or central office for use at Corps, Army and higher headquarters. The number of Switchboards BD-80-T1 to be used in any given installation is determined by the particular tactical situation and the anticipated traffic requirements. The equipment may be installed any place under cover. It is estimated that the time required for a complete installation of the central office equipment will be less than 6 hours.

2. General Description.

a. Switchboard BD-80-T1. The components are the switchboard and the main distributing frame vertical section.

(1) Switchboard (Description and Capacity). The switchboard is a complete, transportable, single-position, two-panel, manually-operated telephone switchboard for serving both magneto and common-battery lines, and is arranged for handling both types of local calls as well as originating and terminating toll traffic. Universal cord circuits are employed. Lamp signals are provided for the common-battery lines and the cord circuits. Drop signals are provided for the magneto lines. The line and multiple jacks are wired to a binding-post panel at the rear of the switchboard. The multiple jacks are also extended in 8-foot lengths of flexible rubber-jacketed cable to spade terminal strips. By these means, facilities are provided for rapid multiple connections from one switchboard unit to other identical units. The construction provides for the use of one to six units. The binding-post panel at the rear of each switchboard provides for connections with spade terminal strips and through 35-foot lengths of rubber-jacketed cable to the main distributing frame. Rubber-jacketed cable and spade terminal strip facilities are provided for connections to exchange battery, ringing current, etc. The equipment of each switchboard is as follows:

Equipment	
Operator's positions	1
Operator's telephone circuit	1
Dialing Circuit	1
Auxiliary and emergency operator's telephone circuit	1
*Local battery (magneto) signals	40
*Local battery (magneto) answering jacks	40
*Local battery (magneto) multiple jacks	80
Common battery signals	60
Common battery answering jacks	60
Common battery multiple jacks	120
Cord circuits	15
Transfer key circuit	1
Night alarm circuit	1
Fuse alarm circuit	1
Emergency ringing circuit	1
Keyshelf and framework ground circuit	1

*May be used for local-battery (magneto) lines, toll lines, or interoffice two-way ring-down trunks.

Each Switchboard BD-80-T1 is equipped with 40 local-battery (magneto) and 60 common-battery line circuits. The overall size of the Switchboard BD-80-T1 is 6 feet 3-1/2 inches high, 26-1/2 inches wide, and 36 inches deep, and the uncrated weight is 609 pounds. A substantial case is provided for transportation, the total weight being 1009 pounds.

(2) Main Distributing Frame. One frame vertical is furnished as a component part of each Switchboard BD-80-T1. In an installation where only one Switchboard BD-80-T1 is used, one frame vertical is sufficient. For an installation of three Switchboards BD-80-T1, three main-frame verticals are required. In any installation using more than one frame vertical, these verticals are bolted together to form the main distributing frame. Each vertical section is complete within itself for terminating and cross connecting 100 lines to the switchboard. Each line is provided with carbon-block arresters and heat coils. A series of binding posts is provided on the line side, and another series of binding posts is provided after the arresters, for cross connecting to binding-post strips on the switchboard side. The binding posts on the switchboard side connect through a 35-foot rubber-jacketed cable to the spade terminal strip engaged with the binding posts of the switchboard terminal panel. Each vertical frame section is 6 feet 2 inches high, 16 inches wide, and 23 inches deep. The weight per individual vertical section is 185 pounds including cables. The crated weight is 385 pounds.

b. Power Equipment. This equipment comprises two 48-volt banks of batteries (one bank in service and one bank on charge), a battery rack, a test and power distribution cabinet, a power panel, a relay rack, a cable rack, and a complete set of switchboard tools. Such equipment or the equivalent is required with each installation of one or more Switchboards BD-80-T1. For those installations where commercial a-c or d-c power is not available, a power source is necessary also.

SECTION II

DETAILED DESCRIPTION

3. Switchboard BD-80-T1. The switchboard is a modified Western Electric Co. #12 switchboard.

a. Front Equipment Layout. The front-equipment layout is shown on drawing ES-D-5329-A; and the keyshelf layout is shown on drawing ES-D-5331-A. The installed equipment is listed also in paragraph 2a(1) above. It will be noted that the front equipment is arranged on a 2-panel basis.

b. Rear Layout. The rear of the switchboard is shown in the photograph Fig. 4. The lower section of the switchboard is occupied by the cords and a rack upon which are mounted all cord-circuit relays, operator's telephone-circuit apparatus, and switchboard fuses. The upper section of the switchboard is occupied by the jack and signal equipment, the cabling therefrom, and the binding-post panel. The binding-post panel is formed of two gated sections opening down the center for access to the jack and signal equipment and the wiring. The binding-post panel provides 900 binding posts in 18 vertical rows of 50 binding posts per row. These binding posts are arranged to lock down on the cable spade terminal strips. The binding posts are loosened or tightened by means of a screw driver. The purpose of the binding-post panel is to facilitate the connection of switchboards in multiple and connections to the main distributing frame. Three binding posts are wired to each line and multiple jack tip, ring, and sleeve, the sleeve and cut-off contacts of these jacks being extended in the rubber-jacketed cable for connection to another switchboard position. See drawings ES-D-5326-A and ES-D-5327-A.

c. Multiple Arrangement. The arrangement of cabling for connecting the multiples between switchboards and connecting to the main distributing frame for a three-section installation and a six-section installation, is shown on drawing ES-D-5323-A.

d. Circuits.

(1) Line Circuit, Magneto. The local-battery (magneto) line circuit is shown on drawing ES-D-5327-A.

d. Circuits. (Cont'd)

(2) Line Circuit, Common Battery. The common-battery line circuit is shown on drawing ES-D-5326-A.

(3) Universal Cord and Ringing Circuit. These circuits are shown on drawings SD-15178-01, and T-15178-30, Figs. 1, A, 2 and G. The circuit description is given in CD-15178-01.

(4) Operator's Telephone Circuit. This circuit is shown on drawings SD-15024-011 and T-15024-30, Figs. 1, A, D, E, H, K, N, R and 3. The circuit description is given in CD-15024-01.

(5) Auxiliary and Emergency Operator's Telephone Circuit. This circuit is shown on drawing ES-A-5333-A.

(6) Night Alarm and Fuse Alarm Circuits. These circuits are shown on drawings SD-15025-011, SD-15025-012, and T-15025-31, Figs. 1, 2, 3, 5 and 6. The circuit description is given in CD-15025-01.

(7) Switchboard Test Circuit. This circuit is shown on drawings SD-15174-01 and T-15174-30, Figs. 1, 2, 3, 4, 5, 6, 9 and 11. The apparatus is mounted in the test and distribution cabinet.

(8) Voltmeter Test Circuit. This circuit is shown on drawings SD-15118-01 and T-15118-30, Figs. 1, 2 and A. Fig. A is located on the relay rack. The negative side of the test battery should be grounded. The circuit description is given on CD-15118-01.

(9) Dial Circuit. A dial circuit is furnished for each position per drawings SD-15024-011 Fig. 3, and T-15024-30 Fig. 3. The circuit description is given in CD-15024-01, par. 7. It is intended that dial trunk equipment be installed on the relay rack when required.

(10) 110 Volt Service Connections. (For drying out units, soldering iron, lights, etc.) This circuit is shown on drawing ES-D-5324-A.

(11) Method of Grounding Framework. The method is shown on drawing SD-12726-01 Fig. 2.

(12) Explanation of Air Line Wiring Diagrams. This explanation is given in Western Electric Co., Installation Department Handbook O, section 4, attached.

4. Main Distributing Frame. This frame is composed of as many vertical sections as required for a given installation. These sections are modified Western Electric Co. standard units. Each section mounts four bakelite binding-post panels on the line side and each panel mounts 100 binding posts. 200 of these binding posts are for terminating 100 lines, and the other 200, connected on the switchboard side of the

arresters and heat coils, are for cross connecting to the switchboard side of the frame. The frame mounts four bakelite binding-post panels on the switchboard side, each containing 50 binding posts for cross connecting. These binding posts are soldered to the individual conductors (tip and ring) in the 35-foot lengths of rubber-jacketed cable for connection to the switchboard binding-post panel.

5. Power Equipment.

a. Delco Plant. This power source is a Delco 3-kw, 120-volt, d-c gasoline-kerosene driven engine generator plant as manufactured by the Domestic Engineering Corp. A manufacturer's instruction book is attached to the unit. The engine is started by 48-volt battery (using the generator as a motor) or by hand cranking. A 32-volt tap from this battery furnishes ignition current. The battery bank which is not connected to the telephone switchboard is used for this purpose. The battery bank used for engine starting and ignition is thrown on charge after the engine has been started. The Delco plant provides a surplus of output for an exchange of six Switchboards BD-80-T1 including lights and a telegraph office. The Delco plant weighs about 940 pounds.

b. Homelite Plant. This power source is a Homelite, 650-watt, 120-volt, d-c gasoline engine driven plant as manufactured by the Homelite Corporation. This unit is started by means of a rope starter. A built-in magneto furnishes ignition current. A manufacturer's instruction book is attached to the unit. The weight is 73 pounds. This plant is adequate for battery-charging purposes.

c. Batteries. Two 48-volt groups of batteries are advisable for each installation as a safety factor and in order that one group may be on charge from the gas engine plant while the other group is connected to the telephone switchboard. The batteries are the heavy duty BA-46. These batteries require the attention characteristic of acid-type batteries. A battery rack is provided to mount the batteries in a workmanlike manner.

d. Test and Distribution Cabinet. One such cabinet is required in each installation of Switchboards BD-80-T1 regardless of whether one or six switchboards are installed. The cabinet is mounted on the top of the most central switchboard in a given installation. See photographs Figs. 2, 7 and 8. This cabinet provides for line and switchboard tests by the voltmeter-battery method and also serves as a power distribution point between the power plant and the individual switchboards for battery, ringing circuits, ground, night-alarm, fuse-alarm and operator's telephone transfer circuit. The wiring diagram is shown on drawing ES-D-5330-A.

e. Power Panel. One power panel is required in an installation of Switchboards BD-80-T1. This panel comprises a framework, a panel mounting charge-discharge switches to power plant or rectifier, and a rheostat, a rectifier (for installations where 110-volt a-c power is available), a 110-volt a-c operated "Sub Cycle" ringer, a Holtzer-Cabot rotary converter ringing machine including step-up transformer. The input is 46 volts d.c. and the ringing output is 80 volts a.c. 19 cycles. The frame is arranged to assemble in installation with the relay rack mentioned in paragraph 5f below. The wiring diagram is shown on drawing ES-D-5330-A. See also the photographs Figs. 9 and 10.

f. Relay Rack. One relay rack is required in an installation of Switchboards BD-80-T1. The relay rack is frame-mounted to assemble with the power-panel frame. The rack mounts the night-alarm and fuse-alarm circuits and equipment, dial-trunking circuits, and all other features common to any installation of Switchboards BD-80-T1. See the photograph Fig. 10.

g. Cable Rack. Five 5-foot cable racks are provided to support overhead the rubber-jacketed cable between the switchboard and the main distributing frame, two 10-inch widths being used for this purpose, and between the main distributing frame and the power panel, using three 5-inch widths. These rack sections are bolted together in straight runs or L runs as desired. See drawing ES-D-5322-A.

h. Switchboard Tools. One set of switchboard tools is required for an installation of Switchboards BD-80-T1.

SECTION III

INSTALLATION

6. Typical Layout. Before starting any installation, the general layout of the equipment to be installed should be decided upon in view of local conditions. A typical floor-plan layout is shown on drawing ES-D-5322-A for a three-switchboard installation. Necessary deviations from this plan will be determined by the local conditions. In any event the batteries and power source should be installed in an inclosure separate from the switchboards and terminal equipment, in order that the switchboard room may be reasonably quiet and free from battery fumes.

7. Setting Up and Connecting Equipment.

a. Remove the equipment from the cases and crates with extreme care, preserving the cases and crates for future transportations. The crates are opened by removing the flathead machine screws along the edges of the crate. Care at all times in handling the equipment will greatly minimize maintenance troubles in the subsequent operation of the equipment.

b. Erect the switchboard, or switchboards, in the desired location.

c. Erect the main distributing frame within cabling distance of the switchboard, bolting together as many vertical sections as the number of switchboards installed. Where feasible, bolt the frame to the floor.

d. Install the cable racks between switchboard and main distributing frame.

e. Install the test and distribution cabinet on the top of the central switchboard.

f. Install the battery rack, batteries, power panel, and relay rack in the selected locations. Bolt the relay rack to the power panel. Mount the rectifier and fuse box on the power-panel frame, if required.

g. Install the cable rack between the main distributing frame and the power panel.

h. Install the rubber-jacketed cabling in the cable racks between the main distributing frame and switchboard, between switchboards as shown on drawing ES-D-5323-A, from the distribution and test cabinet to each switchboard section as shown on drawing ES-D-5330-A, to the power panel as shown on drawing ES-D-5325-A, and to the relay rack as shown on drawing ES-D-5330-A.

i. Insert fuses in the clips on the relay panel at the rear of the switchboards and plug in the operator's telephone sets.

j. Install ground rods and cable for power panel and main distributing frame.

k. Connect incoming lines to the binding posts on the line side of the main distributing frame and cross connect with jumper wire to the binding posts on the switchboard side. Install carbon blocks and heat coils.

l. Connect the batteries in two 48-volt groups and connect to the power panel. Throw the power-panel dischage switch connecting one of the battery groups to the distribution and test cabinet and the switchboard positions.

m. Start the rotary-converter ringing machine and check the individual switches on each switchboard to see that they are thrown to machine ringing.

n. Test all cord and line circuits. In order to use the test cabinet, install a 45-volt Battery BA-26 connecting the positive side of the battery to the fuse on the relay rack and the negative side of the battery to ground.

o. Insert designation strips applicable to the scheme of installation.

p. Operate the power plant as required to charge batteries or furnish lights if commercial power is not available. If d-c power is available, use it, adjusting the charging rate at the rheostat on the power panel. If a-c power is available, use the rectifier for battery charging.

SECTION IV

OPERATION

8. Switchboard. The operation of the switchboard is characteristic of the usual commercial practice. The drop signals indicate a call on a magneto line. Line lamps indicate a call on a common-battery line. In either case the answering plug (back plug) is inserted in the jack associated with the signal and the ringing and talking key in line with the plug used thrown to the locking-listening position. To call a number, insert the calling plug (front plug) in the desired party's line or multiple jack, whichever is within reach, and operate the key to the nonlocking ringing position. Supervision on common-battery lines is provided by lamp signals which are located between the keys and the plugs. A lighted lamp indicates that the calling or called party has disconnected or not answered. The magneto supervisory lamps are located on the face of the board directly above the associated plugs. Ring-off or recall is indicated by a lighted lamp. An operator's transfer key is provided. The operation of this key transfers the cord circuits of one position to the operator's circuit of the next position. A night-alarm release key is provided on the key shelf of each position. This key should be operated after each actuation of the night-alarm circuit. An operator's monitoring key is provided which causes low transmission loss. These keys are designated on the under side of the key shelf.

SECTION V

MAINTENANCE

9. Factors. The greatest single factor contributory to trouble-free operation is careful handling of the equipment in packing and unpacking, in transportation and in installation. After the installation has been completed periodic routine tests of all line circuits and cord circuits should be made. All fuses and heat coils should be inspected periodically. In order to maintain high transmission through the cord circuits all plugs should be cleaned periodically using light oil and cake rouge. Particular attention is required of the line force to maintain good low-resistance, high-insulation lines. Detailed descriptions of the adjustment of switchboard equipment including operate and nonoperate current values, are given in the circuit drawings and the individual descriptions thereof. The storage batteries should be watered regularly and maintained in a high state of charge. All connections should be inspected frequently.