EXPANSION OF EXISTING DIAL CENTRAL OFFICE SWITCHBOARDS

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1. GENERAL

1.1 This section is intended to provide REA borrowers, consulting engineers, contractors and other interested parties with technical information for use in the design and construction of telephone systems of REA borrowers. It covers in particular major expansions of existing dial switchboards.

2. BASIC INFORMATION

2.1 A major central office expansion may be defined as an addition which exceeds the wired capacity of the switchboard and which will require major units of equipment. These units will include frames, interunit cabling and cable runway. A minor central office addition is an addition of equipment to existing frames where space and wiring are already available. It may consist of only a few lines, linefinders, selectors, connectors or trunks. Minor additions are simple to install and are not within the scope of this section.

2.2 When the major expansion of an existing dial switchboard becomes necessary, careful consideration should be given to the following items: (1) a study of the traffic in the existing equipment to establish the actual unit calls-per-line and per-station and the usage for each intraoffice and interoffice trunk group. Experience has shown that the average unit calls-per-line which were assumed for an initial dial installation often does not fit the particular office and it will be advantageous to determine the actual usage. The methods of making the necessary traffic studies are described in TE & CM-515, "Telephone Traffic - Measurements." This is the only way to make sure that the correct amount of equipment for intraoffice and interoffice trunks will be ordered for the addition. A major expansion also offers a chance to correct unbalanced loads on linefinder and connector groups; (2) a calculation of the probable increase in the power requirements. Connecting companies that are using power from the 48-volt power plant should also be contacted to determine their future requirements. This will show whether the capacities of the existing powerboard, power wiring, battery and charger are adequate for the increased load; (3) a review of the present switching diagram to determine the possible points of access from the present to the proposed equipment. It will also show what directory numbers may be assigned in the new addition and whether any changes will be necessary in existing directory numbers; (4) a review of the present floor plan to determine what space is available for the new equipment or what new space must be provided.

3. TYPES OF SWITCHBOARDS

3.1 Switchboards may be classified according to their basic design as step-by-step switch, motor-switch, all-relay, crossbar, and electronic. The electronic type has not yet come into general use and need not be discussed further in this section.

3.2 Switchboards may further be classified as terminal-per-line and terminal-per-station. The terminal-per-line connector has a terminal assigned for each line regardless of the number of parties on the line. This type of connector usually registers three digits; tens, units, and party. The terminal-per-station connector has a terminal for each station and registers only two

digits; the tens and units. The frequency or code for ringing a station is preassigned to the terminal. Until recently, practically all of the smaller switchboards were terminal-per-line, but for the past several years REA has recommended that most switchboards be terminal-per-station because of the greater flexibility in assigning stations to lines and better compatability with direct distance dialing.

3.3 Some small switchboards with a designed ultimate capacity of 100 lines or less have their linefinders and connectors tied directly together and are referred to as linefinder-connector types. This is also true of some all-relay switchboards which have a designed ultimate capacity of 200 lines and which operate "broadspan," that is, with all the lines having access to all the linefinder-connector links.

3.4 Many switchboards, regardless of the number of lines, have selectors interposed between linefinders and connectors and are called linefinder-selector-connector switchboards, or sometimes just "selector types."

4. EXPANSION OF LINEFINDER-CONNECTOR SWITCHBOARDS

4.1 It may prove to be quite costly to expand a linefinder-connector switchboard beyond its wired capacity. This may be true of step-by-step switch type boards and is almost always true of all-relay types. When selectors must be added the existing connections between the linefinders and connectors must be opened and the selectors interposed. A selector will be required for each of the existing linefinders as well as for each new linefinder. Interoffice trunks presently accessed from connector levels will have to be accessed from the new selector levels. This usually means that connector type interoffice trunks must be replaced with selector type trunks. It is, therefore, suggested that a quotation, including both material and installation be obtained from the equipment supplier before proceeding with a major expansion of a linefinder-connector switchboard in order to make sure that such an expansion is feasible.

5. EXPANSION OF LINEFINDER-SELECTOR-CONNECTOR SWITCHBOARDS

5.1 Usually it is not difficult to expand a linefinder-selector-connector switchboard. All equipment, intraoffice and interoffice, line equipments, etc., are compatible with the new equipment. The new frames should be the same height as the existing equipment. A factor to be considered is the operating range of the expanded switchboard. If the existing equipment was purchased several years ago, it may have a capability of operating over line loops of only 1100 or 1200 ohms. The present specifications for new dial switchboards require a capability of 1500 ohms. When new equipment is purchased to expand an existing switchboard which has a capability of only 1100 or 1200 ohms, some or all of the new equipment may have circuits which are identical with those used on new 1500 ohm switchboards. Nevertheless, the over all capability of the expanded switchboard will not exceed its initial capability. This is true because the new circuits will be working with the older circuits and will be limited by the operating range of the latter.

5.2 It is possible to expand an existing switchboard with equipment of a different manufacturer, or with equipment of the same manufacturer, but of a different type. This usually introduces complications and should not be considered except in unusual cases where it is not feasible to expand with the same type as the existing switchboard. Some of the disadvantages are: (1) complications may be encountered in interconnecting the circuits of two different types of equipment; (2) the access to all interoffice trunks from two types of equipment through adapters if necessary; and (3) the burden of maintaining two different types of equipment with the different adjustments and testing procedures that it involves.

5.3 It should be noted that the expansion of common control equipment may involve the addition of certain common equipment at those stages where the capacity of the existing common equipment is being exceeded. For example, markers, number groups, etc. This will increase the cost and space per line over that of an expansion not requiring the additional common equipment.

5.4 It would be prudent to obtain a quotation covering materials and installation from the manufacturer of the present equipment to determine how much the addition will cost. There have been some cases where it was found more economical to replace the entire switchboard than to make a substantial addition.

6. CHANGING FROM TPL TO TPS

6.1 The preferred standard for new switchboards is terminal-per-station. If a substantial addition is to be made to an existing terminal-per-line switchboard, it may be desirable to make the addition as terminal-per-station or to convert the entire switchboard to terminal-per-station, depending upon the circumstances. Step-by-step switch type and crossbar equipments can be converted from terminal-per-line to terminal-per-station as a general rule. All-relay equipment does not readily lend itself to conversion to terminal-per-station operation. Step-by-step switch type equipment will usually require the addition of bunching blocks at the distributing frame for deriving party lines. A different interrupter will also be required to provide terminal-per-station features. If automatic toll ticketing or automatic number identification (ANI) is equipped, the identifier must be capable of identifying terminal-per-line, terminal-per-station or both as required. If the entire switchboard is being converted from terminal-per-line to terminal-per-station, it may be found to be more economical to replace the existing connector circuits rather than attempt to modify them. The switches can usually be reused. Other elements, such as line equipments, linefinders, and selectors, can be reused without change. Crossbar equipment can usually be converted from terminal-per-line to terminal-per-station by the addition of one or more number groups. The supplier of the equipment should be consulted about the plans for expansion so that important details will not be overlooked and the cost determined.

7. MODIFICATION OF EXISTING LONG LINE ADAPTERS

7.1 During the expansion of the central office, it may be found necessary to provide 72 volts at the long line adapters as described in TE & CM-325, "Application Guide for the Preparation of Detailed Dial Central Office Equipment Requirements," Paragraph 2.062. The existing long line adapters may not have been arranged initially to tap into an auxiliary 24-volt power supply as described in the latest issue of the central office equipment specifications, REA Form 558. If not, these adapters can be modified and a booster power supply added to increase the available voltage from 48 volts to 72 volts where this procedure would overcome transmission problems. It should be understood that this procedure may not necessarily increase the range of the existing long line adapter to 3000 ohms, although the current in the line will be increased. The increased current will help in the operation of bridged tap isolators where low current flow in existing long line adapters is a problem. Under no circumstances should this modification be used in the expectation that it is a substitute for the proper use of loading coils and the maintenance of proper end sections as described in REA TE & CM-424, "Design of Subscriber Loop Plant."

8. USE OF REGISTER-SENDERS WITH DIRECT RESPONSE SWITCHBOARDS

8.1 The numbering pattern for an existing step-by-step switchboard may become too complex to be handled by the conventional direct response circuitry or facilities for customer key pulsing may be required. It is now possible to interpose a bank of register-senders between the present linefinders and selectors which will, in effect, convert the switchboard into a common-control step-by-step system. This provides translation facilities to handle complex numbering plans for toll and extended area service and also customer key pulsing. Other features may be added with the aid of register-senders, such as MF signaling, alternate routing, class of service marking, etc. Further information is contained in REA TE & CM-350, "Basic Types of Switching Systems." If the expansion of the system introduces problems in numbering or pulsing, it is suggested that the supplier of the central office equipment be consulted about whether a register-sender is a requirement to solve the problem.

FIGURE 1

LIMITING RESISTANCE OF OUTSIDE PLANT PORTION OF SUBSCRIBER LOOP WHEN PLANT IS PARTLY AERIAL AND PARTLY UNDERGROUND

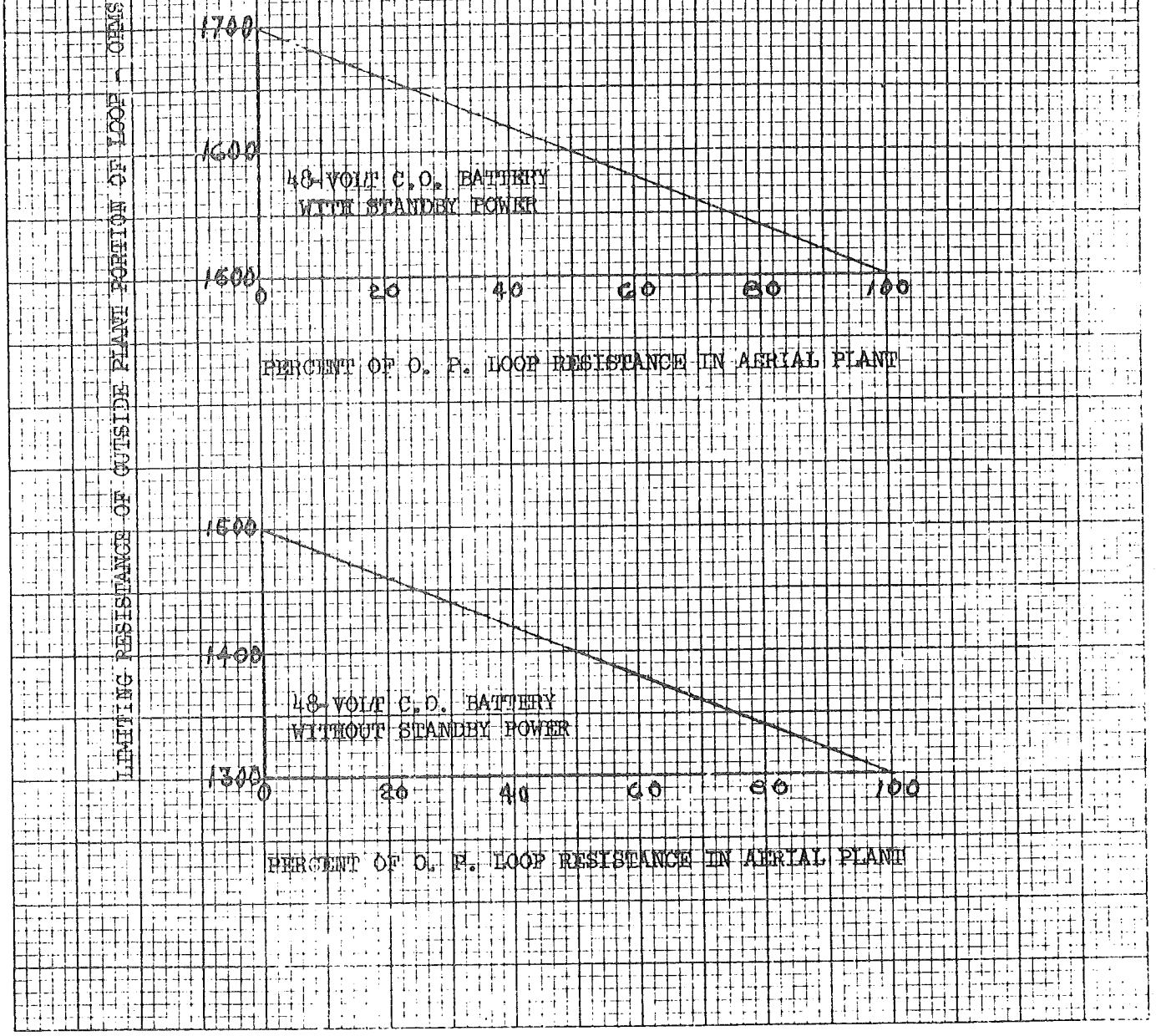

FIGURE 2

REGISTER-SENDER CONTROL OF STEP-BY-STEP SWITCHING SYSTEM