

CIRCUIT DRAWINGS, REQUIREMENT TABLES, CIRCUIT DESCRIPTIONS, X SPECIFICATIONS, WIRING LISTS AND TERMINAL ASSIGNMENT LISTS DESCRIPTION

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1. GENERAL

1.01 This section gives a general description of the information which is used together with Bell System Practices in maintaining central office circuits and apparatus.

1.02 This section is reissued to revise the information on the existing SD drawing classifications, and to add an AC classification. Since the issue covers a general revision, arrows ordinarily used to indicate changes are omitted.

1.03 The general requirements and definitions covered in Section 020-010-711 apply to the X specifications and circuit requirement tables as well as to the Bell System Practices.

1.04 For a general description of sequence charts (SC), operational sketches (OS) and associated reference material (RM) issued primarily for plant training purposes, see Section 005-130-101.

2. CIRCUIT DRAWINGS

Circuit Schematic Drawings

2.01 Circuit schematic drawings consist primarily of appropriate graphical symbols or conventions representing the apparatus components such as relays, inductors, capacitors and resistors interconnected by a circuit pattern. The present standard circuit schematic drawings, called "SD drawings" from the prefix used in numbering this series, are used by engineering and plant forces of the Associated Companies and by the Western Electric Company. The drawing numbers in this series consist of three parts, namely, the prefix SD (referred to above), a 5-digit base number or for the newer systems (Electronic Switching or Private Line Systems) a base number consisting of a single digit and a letter followed by three digits, and with either base number a 2-, 3-, 4-, or 5-digit suffix; i.e., SD-25000-01 or SD-2A000-01.

2.02 A new type of schematic drawing in the SD series, called "Detached-Contact Type Schematic Drawing" is now being used. A detailed description of this type of drawing is covered in Section 005-109-101.

2.03 Apparatus conventions and connections on the SD drawings show only electrical interconnections and operational characteristics in order to facilitate tracing the circuit operation. Functional designations are usually assigned to apparatus to aid in identifying different items. A summary of wiring and cabling conventions used in schematic drawings is contained in Bell System Practices, Section 005-108-111.

2.04 Where cross connections are subject to periodic changes the application, location and assignment of terminals and the type and color of wire used, which have sometimes been covered in Bell System Practices, have been included on more recent SD drawings. Whenever existing SD drawings are reissued consideration will be given to the inclusion of this type of information.

2.05 Cabling, terminal assignment, lead multiplying and some cross-connecting information is included on circuit schematic drawings in separate figures to show the method of wiring between units of equipment and pieces of apparatus. These figures, previously referred to as cross-connection figures, are now referred to as "cabling diagrams" to distinguish them from the cross-connection information referred to in Paragraph 2.04 above.

2.06 The several types of notes included on SD drawings are as follows:

Circuit Notes: Pertaining to the operation of the circuit such as fusing, features or options, network and job record information.

Equipment Notes: Covering circuit engineering information such as restrictions of apparatus, size of wires, length and resistance of leads, etc.

Information Notes: Information of a general nature which cannot be included in other more specific types of notes and including such information as interrupter intervals or timing, position of switches, normal post-spring operation, etc.

Cross-Connection Notes: Explanatory notes covering information in the cross-connection information table.

Test Notes: Associated with circuit timing, transmission test and electrolytic capacitor test requirements tables.

Sheet Notes: These notes are used to clarify information on that particular sheet of the drawing.

2.07 Working limits information such as maximum and minimum external circuit loops, maximum conductor loops, minimum insulation resistance, allowable earth potentials and voltage limits are included on SD drawings where applicable.

2.08 The suffix numbers used on circuit schematic drawings are -01 to -09. Each number in this series indicates a separate and distinct drawing and is assigned serially to each drawing required to complete the schematic series for a single circuit. In order to avoid showing more than one extensive optional arrangement on a single drawing, separate drawings are made which are identical except for the optional arrangement. Each of these drawings has the same base number but a different suffix such as -01, -02, etc. Only one drawing is used to show the optional circuit arrangements if wiring changes are not extensive. Where more than one sheet is required they shall be numbered -01, -02, etc, followed by additional numerals or a combination of a letter and numerals.

2.09 A classification letter A, AC, AR, B or D is added to the issue number on all issues of SD drawings subsequent to Issue 1. This classification letter which is intended to indicate the manner in which the change should be applied is used as follows:

Class A: *Use* — Inoperative electrical or mechanical condition, or unsatisfactory maintenance or operating condition where the circuit or equipment will not function satisfactorily, *even temporarily*.

Application — Immediate action shall be taken to correct the condition on all jobs in the hands of the WEC_o or the customer.

Record — No record of figures and options (such as wiring and apparatus) previously shown on the drawing shall be maintained.

Class AC: *Use* — To provide a new feature or option *which must be applied on an A basis on certain jobs* to correct an inoperative electrical or mechanical condition, or unsatisfactory operating or maintenance condition where the circuit or equipment will not function satisfactorily.

Application — Immediate action shall be taken to correct the condition on those jobs affected, both in the hands of the WECO and the customer. The change shall be applied as specified on the drawing and change notice.

Record—A detailed record of figures and options (such as wiring and apparatus) previously shown on the drawing shall be maintained.

Class AR: *Use* — Unsatisfactory electrical or mechanical condition, or unsatisfactory maintenance or operating condition of the circuit or equipment, *which may be allowed to exist on a temporary basis.*

Application — This change shall be made on all jobs in the hands of the WECO or the customer. Those jobs in the hands of the WECO shall have the change made before turnover to the customer, except where turnover would be delayed, in which case the change shall be applied as soon as possible after turnover.

Record — No record of figures and options (such as wiring and apparatus) previously shown on the drawing shall be maintained.

Class B: *Use* — To incorporate urgent improvements in design resulting in better operating, testing, or maintenance conditions, longer life, or important savings; or to add urgent new features.

Application — This change shall be processed by the WECO in sufficient time to enable them to accept orders for changed products not later than 6 months after release of final information by BTL. When the 6 months interval cannot be met, the interval required shall be established by agreement between the Equipment and Building Engineer of the AT&TCo and and WECO Equipment Standards Engineer. When urgency warrants changing job engineering or incurring appreciable loss through scrapping or conversion, the application to products in manufacture shall be established by agreement among the Equipment and Building Engineer of the AT&TCo, the BTL Engineer and the WECO Equipment Standards Engineer.

Record—A detailed record of figures and options (such as wiring and apparatus) previously shown on the drawing shall be maintained.

Class D: *Use* — (a) To incorporate improvements in design, or to add new features not sufficiently urgent to require a class B application.

(b) To facilitate manufacture.

(c) To effect a cost reduction not sufficiently important to justify a class B application.

(d) Routine changes such as changes in ratings, titles, clarification of notes, etc.

Application — This change shall be processed by the WECO in sufficient time to enable them to accept orders for changed products not later than 12 months after release of final information by BTL.

When the 12 months interval cannot be met, the interval required shall be established by agreement between the Equipment and Building Engineer of the AT&TCo and the WECO Equipment Standards Engineer.

Record — A detailed record of figures and options (such as wiring and apparatus) previously shown on the drawing shall be maintained.

2.10 The following ratings are used on circuit schematic drawings:

(a) **AT&TCo Standard:** Drawings that have been approved for general use throughout the Bell System.

(b) **A&M Only (Additions and Maintenance Only):** Drawings that are no longer recommended for general use in connection with installation of new equipment but which may be used for additions to, or maintenance of, existing equipment.

(c) **Mfr. Disc. (Manufacture Discontinued):** Drawings that are no longer recommended for new installations or for additions to existing equipment except where it is economical to equip previously wired circuits.

(d) **AT&TCo Provisional:** Drawings covering designs which are not yet standardized but for which standardization is contemplated.

(e) **AT&TCo Provisional Standard:** This rating has not been used since 1940 but was used prior to this time to cover drawings where development work had been completed and the new arrangements could be used generally throughout the Bell System.

(f) **Special or AT&TCo Special:** Drawings which are intended for use under special conditions only and do not apply generally throughout the Bell System.

2.11 Prior to the standardization of SD drawings circuit schematic drawing numbers were prefixed by the letters A, K, ST, WR or ES or the schematics were shown as a figure on wiring T drawings. In general, circuit schematic drawings rated "Special" are shown as ES drawings and the base numbers and suffix numbers for these drawings are assigned in the same manner as for SD drawings. Some of the earlier ES drawings were assigned 6-digit numbers without a suffix.

Wiring Diagrams

2.12 Wiring diagrams are made up by the Western Electric Company to show the actual method and type of wiring installation with respect to the physical arrangement of equipment as viewed from the wiring side, methods of running and terminating wire, type and color of wire used, etc. These diagrams are prepared using circuit schematic drawings as a basis and ordinarily carry the same 5-digit base number as the associated SD drawings. These diagrams ordinarily use the prefix T and are called T drawings although not all drawings with the prefix T are necessarily wiring diagrams. Prior to the standardization of SD drawings, separate wiring diagrams did not ordinarily carry the same number as the corresponding schematic drawing and a cross reference to the number of the schematic drawing was included in a note on the wiring diagram.

2.13 The different methods and systems used in preparing wiring drawings, i.e., Full Line Method, Highway System, Airline System, Simplified Airline System and Manufacturing Schematic System, are covered in detail in Section 005-105-101.

2.14 Suffixes for standard wiring diagram T drawings are ordinarily assigned serially from -11 up using as many numbers as required for all the sheets of the drawing.

2.15 Two types of notes appear on wiring diagrams, i.e., Manufacturing Notes and Engineering Notes. Manufacturing Notes cover shop and field instructions and explanation of symbols used on the drawing. Engineering Notes cover job engineering information not required by the shop or field but which are required for

applying various figures and optional wiring conditions on the circuit. Included in the Engineering Notes is a record of the issue of the circuit schematic drawing with which that issue of the wiring diagram agrees.

2.16 Wiring diagrams for most step-by-step switches are included on a combination equipment specification and wiring drawing which uses the equipment drawing prefix ED and a 5-digit base number.

2.17 Some of the older power ringing, charge and discharge wiring diagrams made from ES drawings, were given the prefix H, a 3-digit base number, 200-299 for manual, 500-599 for panel and crossbar and 900-999 for step-by-step and a 3-digit suffix assigned serially from 100 up.

Job Drawings

2.18 Some special wiring diagrams, individual to a particular office, are made up as job drawings using a prefix T, a 4-digit base number assigned to the particular office and a 3-digit suffix. Examples of this type of drawing are power ringing, charge and discharge circuits, switchboard multiple cabling and cross connections, step-by-step multiple arrangements, etc. When certain types of job drawings such as step-by-step multiple arrangements are changed a suffix N is added after the 3-digit numerical suffix on the existing drawing to indicate that this drawing covers the multiple arrangement prior to the change. The new issue of the drawing is made up without the N designation to indicate the arrangement after the change. These records are of particular advantage during installation periods.

3. REQUIREMENT TABLES

Circuit and Timing Requirements

3.01 Each SD drawing which shows adjustable apparatus includes one or more tables of circuit requirements. The requirements may either be in a table marked "Circuit Requirements" or in a table marked "Timing Requirements." These tables are arranged so they can

be cut out to form pages each of which is not larger than letter size. A detailed description of circuit requirements tables is contained in Section 005-120-101.

3.02 Tables marked "Circuit Requirements" cover electrical and mechanical requirements applicable to apparatus such as relays, drops, signals and rotary selectors. Certain other types of apparatus such as sequence switches, clutches, trip magnets, bells, buzzers, position clocks, keys and ringers are listed only where special requirements are involved. In some cases tables marked "Circuit Requirements" may contain timing requirements.

3.03 Tables marked "Timing Requirements" are used to cover the timing requirements applied by the timing test set and requirements expressed in pulses per second and in per cent break of the pulse cycle. Timing requirements are in some cases necessary for relays and timed relay interrupter circuits. These requirements supplement the direct current flow requirement shown in the circuit requirements tables.

3.04 More recent circuit requirements tables include information necessary for isolating apparatus to be worked on and this information will be included on reissues of older circuit requirements tables whenever practical.

3.05 The circuit requirement table for earlier circuit drawings either forms a part of the "BT" sheet (method of operation sheets) or is located on the schematic or on a separate drawing. When the circuit requirements table is part of the method of operation sheets it is found on the last pages. The number of the table in this case is the same as the method of operation sheet, e.g., BT-431289, BA-16891 or BK-695 where T-431289, A16891 or K695, respectively, is the associated drawing number.

Transmission Test Requirements

3.06 Transmission test requirement tables, as described in Section 005-121-101, are shown on SD drawings covering circuits through which subscriber talking or transmission paths are established.

3.07 Two general types of transmission test requirements tables are shown on SD drawings. One type covers 1000-cycle loss requirements and the other type covers gain requirements at single frequencies and gain and loss requirements at multifrequencies.

Electrolytic Capacitor Test Requirements

3.08 A table containing transmission test requirements for certain electrolytic capacitors has been included on SD drawings where these capacitors were used. A detailed description of the electrolytic capacitor test requirements tables is covered in Section 032-100-102. Where specific requirements are not shown on the SD drawing, general requirements are covered in Section 032-110-701.

4. CIRCUIT DESCRIPTIONS

4.01 Circuit descriptions (CD sheets) are prepared in connection with SD drawings. They contain text material and supporting illustrations, when required, to describe the purposes, functions, method of operation, etc, which may not be readily apparent from an inspection of the circuit schematic drawing. Circuit description sheets are issued on letter-size pages and carry the prefix CD, the same base number and the first two digits of the suffix of the corresponding SD drawing.

4.02 Circuit descriptions generally provide the following information:

- (a) General use and/or purpose of circuit and general method of operation.
- (b) Detailed description of the method of operation.
- (c) Electrical working limits such as conductor loops, insulation resistance, earth potentials, voltages, etc.
- (d) A list of circuit functions.
- (e) A list of connecting circuits.
- (f) Reasons for reissue.

4.03 In order to keep the complete explanation of design up to date with circuit changes, circuit descriptions corresponding to some of the more recent new or reissued SD drawings will include, where applicable, the following information:

- (a) Explanatory cross-connection information for larger complicated circuits where the major portion of this information is on the SD drawing.
- (b) Information for removing all or a part of a circuit from service.
- (c) Information necessary to respond intelligently to alarms and signals and to assist in the interpretation of alarm signals and trouble conditions.
- (d) Photographs, dimensions and simplified sketches of a test set covered by a single SD drawing.
- (e) Explanation of the functional designations of the operating elements used in the circuit.
- (f) Manufacturing test requirements.

4.04 Existing circuit descriptions will be reissued to include the information in Paragraph 4.03, whenever practicable, and it is intended that wherever such information is included it will supersede any corresponding information in Bell System Practices for the particular circuit involved.

4.05 Changes in circuit descriptions resulting from corresponding changes in the circuit schematic drawing are covered either by appendices to, or where the changes are extensive by a reissue of, the circuit description. In the case of a reissue all applicable information in outstanding appendices is incorporated in the new issue.

4.06 The information now included on CD sheets was formerly shown on "BT" or "Method of Operation" sheets. The BT or Method of Operation sheets were essentially the same as the present CD sheets except that they

also included circuit requirements tables. Earlier method of operation sheets carried the same manner as the associated schematic drawing with a B added in front of the prefix. Some of the earlier sheets for step-by-step equipment carried the prefix E although later a B was used the same as in the case of other types of equipment.

5. X SPECIFICATIONS

5.01 Prior to January 1, 1929, the requirements and adjusting procedures for apparatus were covered in specifications of the X-70000 to X-72499 series. After January 1, 1929 requirements and adjusting procedures were covered in Bell System Practices in the A400 and B400 divisions. The B Series sections have been, and the A Series sections will be, converted to Plant Series sections. Some of these specifications which have not been replaced by Bell System Practices are still in good standing.

6. WIRING LISTS

6.01 Wiring lists tabulate all circuits installed in an office showing circuit name, wiring schematic drawing number, wiring diagram number, figures and options used, quantities of circuits equipped and wired only, notes covering any special treatment, and in some cases location of equipment. Some of the newer wiring lists also include figures and options of wiring schematic drawings listed. Wiring lists carry a prefix "T" and use a 4-digit base number assigned to a particular office or to a particular unit in an office. Wiring lists also carry a 4-digit suffix of which the first three digits correspond

to the Western Electric Company specification number, indicating the type of equipment involved in that particular wiring list and the last digit is assigned serially from 0, 1, etc, depending on the number of drawings required to contain all of the information for each type of equipment.

7. TERMINAL ASSIGNMENT (POWER PUNCHING) LISTS

7.01 It has been necessary in some cases, where many different circuits are terminated on the same terminal strip, to provide lists of punchings in a manner which will permit identification of the punchings with the terminals shown on the drawings. These lists have been made up by the Western Electric Company and are mounted on heavy cardboard so that they may be left hanging on the equipment near the terminal strips involved.

7.02 One sheet of a terminal assignment (power punching) list usually covers a number of frames or switchboard sections and is identified by the name and number of the forms or sections involved. The terminal strips are also identified, e.g., miscellaneous power, C.T.S., D.P.T.S., etc. The wiring drawings and figures, designation of leads and termination of the leads on the apparatus, together with the punching number of the terminal strip, are included in this list.

7.03 Whenever possible the information, formerly shown in terminal assignment lists, is now included on wiring diagrams and equipment drawings.