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EQUIPMENT ENGINEERING GUIDE

Western Electric Company
INCORPORATED

KEARNY EQUIPMENT ENGINEERING DEPARTMENT

APRIL 1946

EQUIPMENT ENGINEERING GUIDE

PREFACE

Accuracy, thoroughness and efficiency are some of the essential factors in the attainment of a high standard of engineering performance. These factors can be made effective only through the application of an accepted system of Equipment Engineering procedure which is necessary to the realization of the best performance. The plan described herein has been prepared as an aid to the Equipment Engineer in accomplishing a high standard of workmanship. To be of maximum benefit, the application of this plan must be consistent and habitual.

Even though a prescribed system of procedure is conscientiously applied by an engineer, his responsibilities require logical thought, foresight, imagination, and visualization throughout the process of his work.

A clear style of writing is also highly desirable to enable the engineer to write technical letters and to edit specification notes which leave no doubt of their meaning.

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This revision covers changes throughout, although the same fundamental system of orderly engineering procedure is retained.

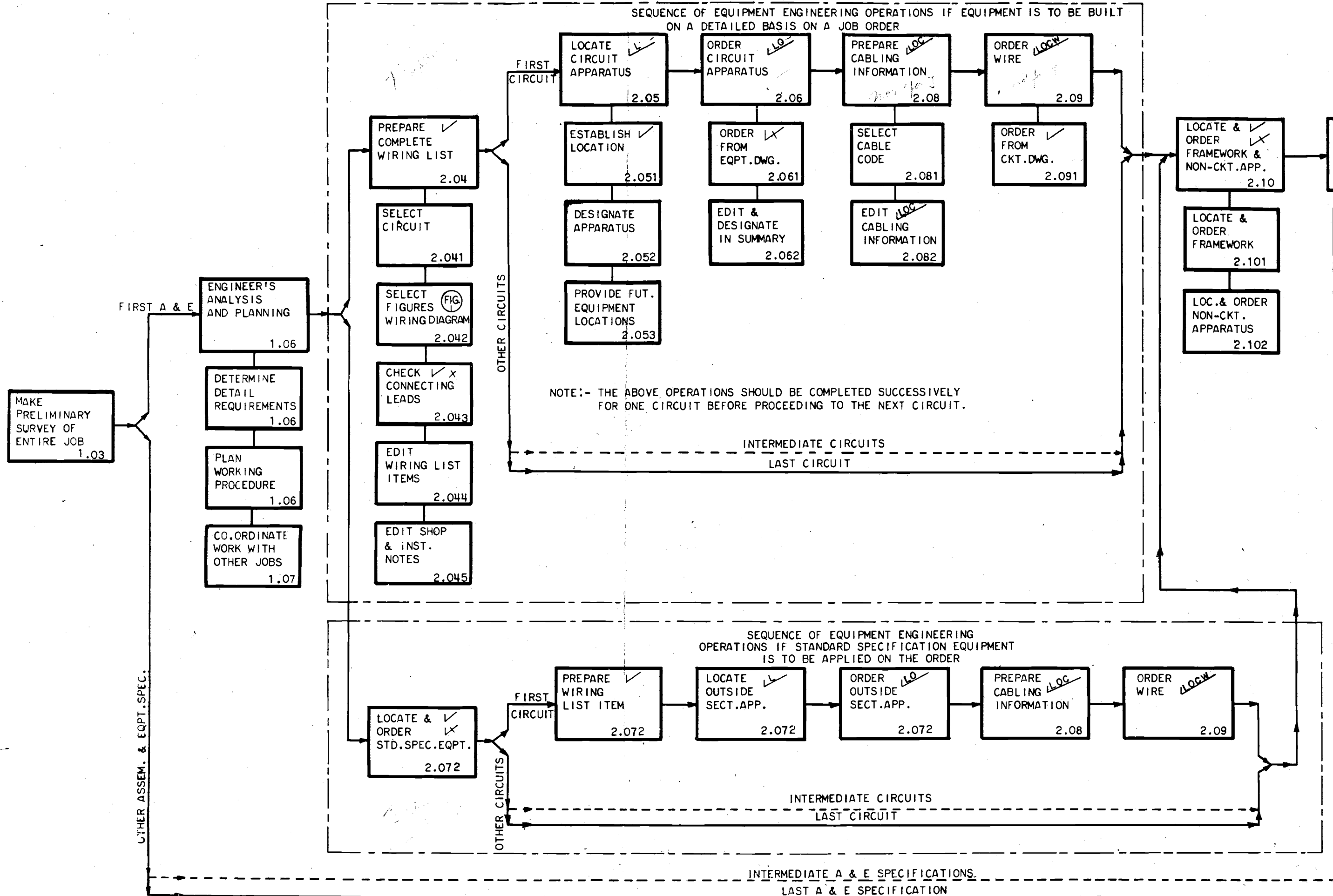
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REFERENCES

Equipment Engineering Handbook

Scheduling of Switchboard Orders	Section 41
List of Engineering Forms	Section 25
Practices Applying to Job Equipment Specifications:	
All Types of Equipment - General Practices	Section 43
Local Manual Equipment	Section 101
Toll Switchboards and Toll Terminal Equipment	Section 102
Power Equipment	Section 108
Cabling	Section 105
Combination Orders (Toll and Local Dial Equipment)	Section 13
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Numbering of Specifications and Drawings	Section 31
Drawing Orders and Supplements	Section 19
Equipment Drawings	Section 204
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Time Ticket Procedures	Section 45
Complaints, J.I.M.'s and Installer's Requisitions	Section 9
Holds, Releases and Cancellations	Section 41
Engineering Information Available to Equipment Engineers	Section 1
Bell System Practices Master Index	X-64200
Keysheet - Master	SD-90250-01
Index of J Specifications	E-1376
Index of PEL's, PEC's, GEC's, etc. (Maintained in the Toll and Local Manual Systems Standards Engineering Department)	
Abbreviations for Stamping Designations on Telephone Equipment	BSP AA613.001



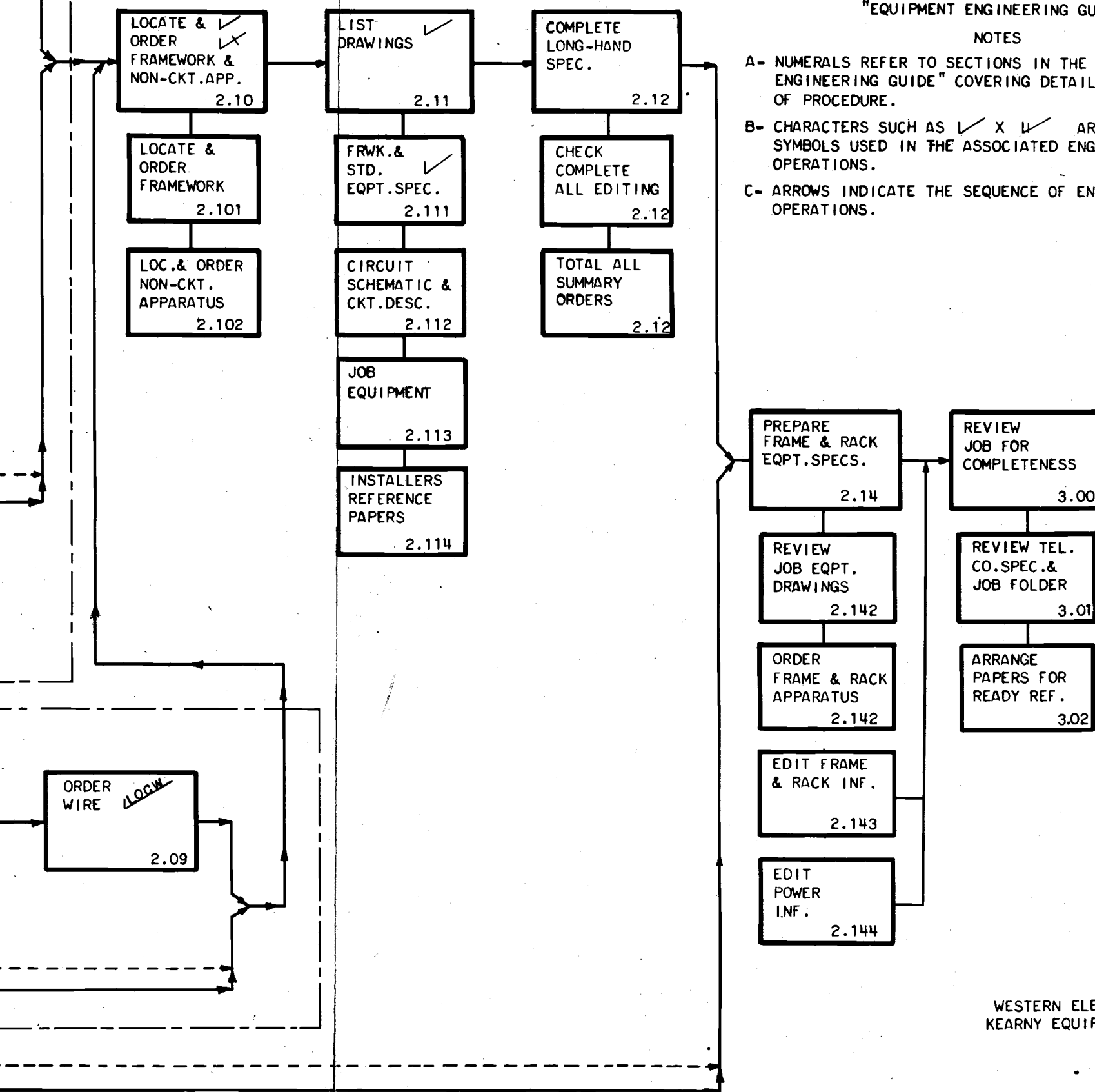
KEYSHEET
FOR
SWITCHBOARD ENGINEERING OPERATIONS
ASSOCIATED WITH THE
"EQUIPMENT ENGINEERING GUIDE"

NOTES

A- NUMERALS REFER TO SECTIONS IN THE "EQUIPMENT ENGINEERING GUIDE" COVERING DETAILED EXPLANATION OF PROCEDURE.

B- CHARACTERS SUCH AS ✓ X ✓ ARE INDICATING SYMBOLS USED IN THE ASSOCIATED ENGINEERING OPERATIONS.

C- ARROWS INDICATE THE SEQUENCE OF ENGINEERING OPERATIONS.



WESTERN ELECTRIC COMPANY
KEARNY EQUIPMENT DEPARTMENT

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1. JOB ANALYSIS

1.01 JOB SCHEDULING

Before a Telephone Company's order and associated specifications and drawings reach the stage of being assigned to an engineer in the Western Electric Company's Equipment Engineering Organization, preparatory steps are taken by the Switchboard Program and Scheduling Division in building up a production program and shop load to arrange for a place for this order in the load.

The Advance Notice of Order issued by the Telephone Company ten months prior to the desired shipping date, and revised as required up to six weeks before the actual order due date, and finally the actual order, give an increasingly accurate load picture for scheduling purposes.

Shortly after the order and the accompanying Telephone Company's specifications and drawings are received in the Engineering Department, the Engineering Section Chief determines from his estimate of the engineering effort involved in the job and the shop loading information what space the job will require on the Engineering Load Chart. The Equipment Engineering Schedule is then prepared showing the various specifications to be written for the order, together with the longhand specification due dates.

1.02 DETAILED JOB ANALYSIS BY ENGINEERING ANALYZER

It is the function of the engineering analyzer to determine what are the principal items of standard equipment and circuits to be furnished on the order. Jobs are analyzed for four reasons:

1. To interpret Telephone Company specification items on individual orders in terms of specific Bell Laboratories standard specifications, keysheets, or schematics to save the time of inexperienced engineers, and to insure uniformity in the application of circuits to similar traffic problems on different orders.
2. To reveal special items which must be referred to the Bell Telephone Laboratories as early as possible for development and recommendations.
3. To determine the major items of equipment to be built by the shop to permit advance ordering or scheduling.
4. To secure the benefit of specialized knowledge of circuits possessed by the analyzers.

The detailed analysis should provide the following information for the engineer:

- a. A recommendation of the standard equipment specifications, keysheets and application schematics that are to be applied on the job.
- b. A recommendation of any circuits that are not listed in the standard specifications, keysheets or application schematics which should be applied on the order. These circuits are to be given in the form of Bell Laboratories schematic numbers.
- c. A recommendation covering the provision of any special features. In case the analyzer is not in a position to provide this information, he would refer the problem to the Bell Laboratories.
- d. In case information required in determining what to furnish on the job is lacking in the customer's specification, the analyzer would take steps to obtain this information from the telephone company.

It is the analyzer's responsibility to be certain that the operating features of the equipment he has recommended meet the traffic requirements of the central office.

Standard manufacturing specification drawings covering the major shop-load equipment items on an order are listed on the Key Item Analysis form (KW15LL) by the Requirements and Stock Maintenance Dept. and this listing should be reviewed critically by the analyzer and corrected as required so that sufficient space in the shop load is reserved for the current order. These forms also constitute an important factor in developing the manufacturing program from which apparatus, piece parts, and raw materials are ordered in advance.

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It is essential that standard specifications be up-to-date at the time they are required for application on an order. Some of these are currently kept up-to-date by the standards engineers because of frequent application, while others are brought up-to-date only at the time they are to be applied. The analyzer or engineer should consult the card file, which is maintained in the Toll and Local Manual Standards Engineering Department, to determine the status of standard specifications he wishes to apply. If a card shows that a standard specification is "up-to-date" the engineer may proceed to apply it; but if the card shows that it is "out-of-date" the analyzer or engineer should issue form KW 159-D to the standards engineering department to serve as notice that the specification should be brought up-to-date for job application. The cards in the file mentioned above show other items of useful information such as: rating, replaced specifications, and a list of the drawings used in the standard specifications.

The correction of the Key Item Analysis form KW-151L, and the issuing of form KW 159-D may be delegated to the engineer. In all cases, however, the engineer is responsible for making corrections on both of these forms after the original analyzation.

1.03 ENGINEER'S PRELIMINARY SURVEY

In starting the engineering of a job, a general understanding of the scope of the work involved should be obtained. This is secured by carefully reading through the telephone company's specification, all correspondence and the analyzer's recommendations; and by studying the floor plan drawings for arrangement, ceiling height, etc., to determine what kind and amount of equipment is to be furnished, how the equipment will fulfill the general traffic requirements, the arrangement of the present and additional equipment and how it will be installed. The order sheet, key item analysis form and schedule sheet give the initial data for fitting the job into the Western Electric load and will govern the engineer's work to a large extent.

During the preliminary survey, all letters, blue prints and other papers required in engineering the job that should accompany the customer's specification are checked in, and the necessary steps taken to procure those that have not been received.

In case the Telephone Company has ordered equipment with which the engineer is unfamiliar, reference may be made to the General Engineering Circulars, New Development Descriptions and Bell System Practices specifications covering this particular type of equipment. The identifying numbers and titles of these papers may be obtained from the general topical index lists which are maintained in the Standards Toll and Local Manual Systems Department.

1.04 JOB FOLDER (ENGINEER'S TEMPORARY FILE)

A job folder should be originated as an aid in preventing the loss or misplacement of letters and papers received with the telephone company's specification, and to establish a definite place for the engineer's carbon copy of all future correspondence, memoranda, and information to and from other organizations. In its preparation, all papers should be arranged in an orderly manner to facilitate reference to any desired information, and the folder designated plainly to distinguish it from those folders that have been prepared on other active orders. Sets of visible index pages are available in each department to divide the folder into its various sections.

Form KL-1946F (JOB ENGINEERING MEMO) is available for recording, from time to time, any unusual features in the job, and those items on which action cannot be completed with the principal engineering work. This form is also used to record all correspondence with the Bell Laboratories.

Original copies of correspondence received on the job order should not be filed in the job folder, but should be sent on to other organizations affected and then to the Clerical Department to be filed in the regular office correspondence folder.

1.05 OFFICE RECORDS AND WORKING PAPERS

After becoming acquainted with the general features of the job, obtain a copy of the office record drawing (-000) and order the job drawings required. If job wiring list drawings are not available, the volumes containing specifications of previous orders must be obtained from file and consulted to ascertain the circuits already in operation in the office.

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In all cases, check the town and office record files for active orders as they may affect the engineering of the present order. Check with the file clerk to determine whether or not there may be unfilled records of other active orders recently received. Obtain volume XII (Misc. and Common) in all cases, and volume XIV (Tel. Co. engineered orders) if there is one on this office. Volume XIV may contain specifications on orders which were engineered in detail by the Telephone Company for which our office records and drawings have not been corrected. (Consult supervisor with regard to correcting the records affecting the job.) Order the office correspondence folder if required to investigate discrepancies in records.

Working papers, consisting of the standard specifications, drawings, and longhand specification forms, should be obtained as completely as possible at this time. It may be necessary to order additional papers in the course of the engineering of the job as more facts regarding the job are revealed. However, efficient engineering requires the anticipation of these needs so that engineering is not held up awaiting papers or drawings at any stage.

1.06 ENGINEER'S ANALYSIS AND PLANNING

In addition to the study made by the analyzer for the purpose of determining what to furnish, it is necessary for the engineer to study the customer's specification to understand what items of equipment are to be furnished, and their relationship to the present office equipment and to other portions of the order. It is also necessary to determine the portion of the job that will be ordered in accordance with the standard specifications and the portion that will be engineered in detail. Consideration should be given at this time to equipment capacities or arrangements which may require such items as non-standard switchboard framework or keyshelves.

It is necessary to study each type of equipment of the job to determine how to properly provide it. This means, for example, that the engineer should decide whether new local cables should be supplied in the case of a modification, or whether the installer should add leads to existing local cables. Another example would be to ascertain whether standard stock equipment might be modified to meet a special job condition or whether the equipment should be built completely on order by the shop.

Having determined what equipment is required and how it relates to existing equipment in the office, it is essential that a forward view be taken of the engineering, manufacturing and installation effort required on the job. The future progress of the engineering work should be visualized to determine whether any interruptions or delays will be encountered due to lack of or faulty engineering information. This visualization of the engineering work should disclose any points which may need to be referred to the telephone company or other organizations for their approval, and which would otherwise delay the progress of engineering. In considering the manufacturing and installation work the engineer should see that the job as a whole is so planned that all phases of it may progress in an orderly and efficient manner, and that no essential portion is liable to be delayed due to engineering.

For the engineer's own benefit, it is advisable to mark the floor plan drawing at this time to show the proposed arrangement of the additional bays, etc., and to mark the present bays, etc., on which work is to be done. In addition, the engineer should form an overall idea of the power and framework requirements of the order.

On the first few jobs, or when in doubt about his judgment, it is advisable for the engineer to discuss his proposed plan of engineering with his group leader or supervisor to make sure that he is proceeding in the most advantageous manner so that needless effort may be avoided.

1.07 CO-ORDINATION

At the time the job is planned, consideration should be given to its possible relationship to other jobs. In case the job is a part of a project, the job completion date should be checked against the overall completion date of the entire project; and the type of equipment being furnished should be studied to insure its conformance to the type of equipment being furnished on the other jobs in the project. (See Item 1.05)

On a combination job (usually Toll and Dial equipment), consideration must be given to the interchange of engineering information between plants, the overall completion date,

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the necessary connections including tie cables between offices, the general cabling scheme, power requirements, and to the possibility of interference of frame and rack equipment locations. A co-ordination questionnaire is originated by the plant controlling the project and is used to specify work to be done by each plant.

With regard to other jobs which may be in process for the same office, a check should be made for interference of equipment locations and other possible installation difficulties that may be encountered due to modifications or relocations.

On orders for new central offices and major additions or rearrangements, it is essential that the Switchboard, Power and Cabling engineers confer on the proposed plan covering their portions of the work.

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2. EQUIPMENT ENGINEERING OPERATIONS

2.00 INTRODUCTION TO DETAILED ENGINEERING

It is desirable that a detailed study of one type of equipment be made and followed through to the completion of the specifications and drawing information covering that phase of the work before undertaking a detailed consideration of another type on the order.

Inexperienced engineers who have questions involving job details, analysis, engineering procedure, and the job application of standard circuits and standard equipment should discuss them with the group leader or supervisor who will supply the information, or refer the engineer to an analyzer, standards engineer or methods engineer.

The above study of a particular type of equipment on an order should include a consideration of the individual circuit requirements from an operative point of view and from the viewpoint of the general location and mounting of the apparatus. A clear conception of the traffic features of a circuit is necessary for an intelligent application of the circuit. This information may be secured from the Bell Laboratories schematic, the associated circuit description and from B. S. P.'s.

Having determined how the circuits and equipment of a particular type are to be provided on the order, as outlined in par. 1.06 (Engineer's Analysis and Planning), the engineer may proceed with the following engineering operations.

2.01 SEQUENCE OF ENGINEERING OPERATIONS

To insure accuracy and completeness in the preparation of job specifications and drawings, a planned sequence in performing the engineering operations is essential. The extent of the various operations will depend on whether standard equipment may be specified, or whether the equipment must be built up on a detailed basis for the order.

The following is the sequence of the engineering operations:

1. Preparation of the wiring list
 2. Locating circuit apparatus
 3. Ordering circuit apparatus
 4. Preparation of cabling information
 5. Ordering wire
 6. Locating and ordering framework and non-circuit apparatus
 7. Listing drawings
 8. Completion of longhand specification
- } applied successively
for each wiring list
item

The above sequence is applicable in all cases; however, an explanation of certain deviations which may be made when standard equipment specifications are used, is covered in the section on the Application of Standard Equipment Specifications.

In the planning of major equipment layouts, it is an essential of good engineering to plan for economical utilization of space, a desirable cabling arrangement, and for efficient central office maintenance. In laying out job equipment drawings the plan and method used on previous jobs in the central office should be considered and followed as far as possible. Consider that the maintenance man will work for years on the equipment as laid out by you and that he will be saved from considerable confusion if like circuits are grouped and numbered uniformly.

2.02 JOB PROGRESS INDICATOR

In order to maintain a planned sequence of engineering operations it is essential that a means of indicating the progress and completion of each of the engineering operations directly associated with each circuit item in the job wiring list be used. The completion of each operation for a particular circuit item is indicated by placing a character opposite this item in the specification wiring list when circuit modifications are to be made, and opposite the item on the wiring list drawing when circuits are being added.

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The characters used are as follows:

- ✓ - Indicates that the circuit meets the job requirements
- L - Indicates that locations for the circuit apparatus have been indicated on equipment drawings
- O - Indicates that the circuit apparatus has been ordered
- C - Indicates that the cabling information has been written
- W - Indicates that the wire has been ordered in the job specification
- / - Indicates that the circuit drawing number has been listed in the job specification.

*I - no wiring
no cabling
T - wiring + cabling*

The preparation of the wiring list for a particular type of equipment to be furnished on an order should be completed before proceeding to the other operations. Each item of the wiring list should be designated by a checkmark at the time that the figures and optional features of the circuit as specified on the wiring list are considered satisfactory for the job. After the complete preparation of the wiring list, the other operations listed above should be applied successively to each item of the wiring list, and the completion of each operation indicated by placing the associated character, that is L for locating, O for ordering, etc. on the checkmark opposite each item.

When all operations for a particular wiring list item have been completed, the Job Progress Indicator will have the following appearance

LOCK

In case a particular operation need not be performed, the associated character should be shown in the regular manner, thereby indicating that consideration has been given to that operation.

Should it become necessary to make a change in the ordering or location of any equipment or apparatus either during the process of engineering the job or after its completion, extreme care should be taken to see that all portions of the job affected are properly changed. Give careful consideration to all aspects of the change. It is recommended that a list of all of the related changes be made on the margin of the specification or on a separate sheet of paper. As each portion of the total change is completed, it may be crossed off the list.

2.03 STATUS OF ITEMS IN TELEPHONE COMPANY'S SPECIFICATION

As an assurance that all portions of the telephone company's specification have been considered and that the necessary action has been taken, and as a means of indicating the authorization for any deviations, the following plan should be used.

The completion of the action required in connection with each paragraph, item, note, or section of the telephone company's specification should be indicated by placing a checkmark before that individual portion of the telephone company's specification.

Notations of changes made by the telephone company in their specification by subsequent letters should be made opposite the particular portions affected indicating the letter, appendix, or other authority for the change.

Explanatory notes covering engineering procedures in connection with questionable items in the Telephone Company's specification which require the telephone company's approval, should be made on the back of the page opposite the questionable portions in the telephone company's specification. In general, items of this kind, and confirmations of verbal information, should be referred to the telephone company immediately, or as soon as the engineering of the job specifications affected is completed, depending upon the importance of the question. By the time the last specification has been completed, all questionable items should have been referred for approval of the action which has been taken.

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2.04 PREPARATION OF THE JOB WIRING LIST

It is of utmost importance that the wiring list be prepared completely and accurately, in order to minimize the necessity of alterations in it at a later stage in the preparation of the specification. The wiring list for any one type of equipment should be completely prepared before proceeding with any other engineering operations applying to this equipment. Before proceeding with the preparation of the wiring list it is necessary to determine the general locations of the apparatus and location of circuit terminations and fusing so that the circuit drawings selected will contain figures and wiring and cabling arrangements which will satisfy the location requirements. Application schematics, if available, will be helpful in the basic engineering and in planning the general locations of the equipment in the central office. Detailed layouts of the apparatus of standard circuits are shown on standard equipment drawings.

The following procedure is essential in connection with the selection of each of the various circuits (Wiring Diagrams) to be included in the wiring list.

2.041 SELECTION OF THE CIRCUITS (Wiring Diagrams)

When standard equipment specifications are recommended by the engineering analyzer the required circuits are obtained from these specifications.

For a job or portion of a job for which standard manufacturing specifications are not available and which must be built up on a detailed basis, the selection of the circuits (Wiring Diagrams) is made from the circuit schematic recommendations given by the analyzer. A careful study of the T-drawings which have been made from a recommended schematic must be made in determining the particular one which will fulfill the specific job need.

A study of the associated circuit description sheets (CD's) will aid in selecting the features desired and in getting a clear understanding of the traffic features of the circuit.

2.042 SELECTION OF THE FIGURES AND OPTIONAL WIRING AND APPARATUS ON WIRING DIAGRAM

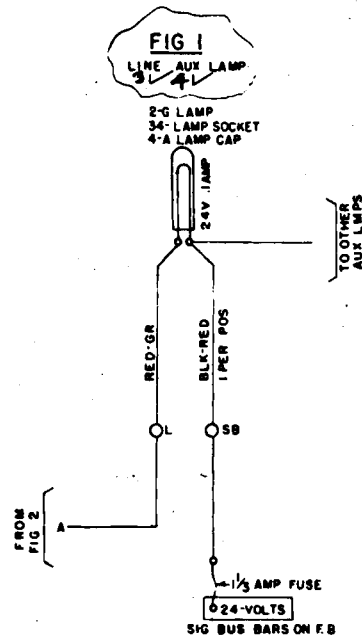
The choice of optional figures and wiring is made by studying the notes of the wiring diagram and from a study of the functions of the figures and optional wiring.

A check mark should be placed opposite the notes which have a bearing on the job being engineered.

In case there are several optional features, a study of the Bell Laboratories schematic is necessary in order to select the proper optional wiring to fill the requirements of the job. In such cases, select the figures and optional wiring conditions of the schematic drawings and mark to indicate use on job. Also select the connecting schematic drawings. (The key sheet and the application schematic, if available, should be used for this purpose.) If several circuits are involved and no application schematic is available, prepare a simple block schematic showing the connections. On complex jobs, block schematic drawings should be prepared.

As the figures and optional wiring features are selected, draw a circle around the numbers of the figures and optional wiring designations that should be specified. A circuit drawing when marked with these circles, provides a systematic basis for writing the job wiring list.

When a circuit figure is being specified for a certain position, bay or unit, and other figures on the same circuit drawing are being specified for other positions, bays or units, the number of the position, bay or unit with which each figure is associated should be written in the circle drawn around the number of the figure. (See sample on this page.) These position, bay or unit numbers will prevent confusion where circuit figures are required in several different locations. When a figure number or optional wiring designation has been entered in the wiring list, place a checkmark opposite the position, bay or unit number which has been written in the circle drawn around the figure number.



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2.043 CHECKING CONNECTING LEADS

A lead, or group of leads to be run from one circuit figure to another on the same circuit drawing, or to a figure on another circuit drawing, should be given careful consideration. Place a checkmark near the ends of the leads if a connection is required and a crossmark if a connection is not required.

If a connection from one circuit to another circuit is required but the number of the other circuit is not shown on the first, the number should be written across the ends of the connecting leads as a reminder of the circuit to which connection is to be made.

If the connecting circuit drawing numbers are shown on a circuit drawing across the ends of the connecting leads, the drawing numbers that are not applicable to the particular wiring list should be crossed out.

Uncolored leads may or may not be required depending upon whether or not the connecting circuit is used. Colored leads, or leads shown in cable, in the figures selected must always be provided for.

2.044 WIRING LIST EDITING

When the proper circuit and its figures and optional features have been determined, as covered in the preceding sections, it should be entered in the wiring list. The wiring list is prepared in either, or both, of two distinct forms; namely, as a wiring list drawing or as a wiring list in the specification. Section 43, Paragraph 14 of the Equipment Engineering Handbook outlines the condition under which each of these forms of wiring lists should be prepared; and Paragraph 14.3 describes the manner in which various circuit items should be entered in a wiring list in a specification.

Supplement "A" (Section 43 of the Equipment Engineering Handbook) illustrates a wiring list drawing, and shows numerous examples of wiring list items entered in this form. Notes on Supplement "A" explain the entries to be made under each of the wiring list columns.

When incorporating the wiring list in the specification, the order of editing each item is as follows:

- a - Description of the work to be done by the shop or installer (add; equip.; mod.; remove).
- b - Quantity of circuits to be equipped.
- c - Name of circuit expressed in terms of the standard abbreviation shown in the circuit drawing title box.
- d - Circuit drawing number, figures and optional apparatus and wiring features.
- e - Numbering of the circuits being equipped where more than one circuit is wired for.
- f - Quantity and numbering of the circuits which are wired for where more circuits are wired for than are being equipped.
- g - Location of the circuit in the switchboard, bay, or other equipment.

An example of a wiring list item in a specification is as follows:

Add: 2 - Toll cds T-62542-30 fig. 1,A,C & F ("X" & "Z" wiring) ckts
7 & 8 wire for 6 ckts 7 to 12 (Pos 3 & 4 only)

Do not duplicate the wiring list of a standard equipment specification in the job specification.

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The wiring list in a job specification should be divided under the following headings.

(a) WIRED EQUIPMENT TO BE PLACED BY THE INSTALLER

The wiring associated with switchboard sections, bays, units, desks, etc. built by the shop or furnished by the Telephone Company should be placed under this heading.

(b) LOCAL CABLES TO BE PLACED BY THE INSTALLER

New Local Cables or supplementary local cables to be made by the shop and placed on existing equipment by the installer should be placed under this heading.

(c) WIRING AND APPARATUS TO BE PLACED BY THE INSTALLER

Under this heading list all additions and changes on existing wiring and equipment which do not require new shop made local cables.

(d) WIRED EQUIPMENT TO BE REMOVED

This heading is to be used only to preserve a permanent record of the wiring list for complete units of equipment, such as switchboard sections, bays, units, etc. which are to be removed from the central office.

The above headings with explanatory notes will be found in the longhand engineering forms. Their uses are further described in Section 43 of the Equipment Engineering Handbook.

Wiring list items detailed out as shown in the preceding example or covered by reference to the wiring list drawings should be grouped under the proper wiring list heading of the job specification to fit the particular job condition.

The wiring list drawing forms for certain types of equipment have been designed to include columns for recording the schematic (SD) figures and options which are equipped in the Central Office. This information is used extensively by the Telephone Office maintenance force and by the Telephone Company's engineering force; it is important, therefore, that it be accurate and complete. The schematic drawing figures and wiring options which correspond with the figures and optional wiring of a Wiring Diagram being applied on an order, may be obtained from a Table on the Wiring Diagram. This Table shows the relation between all figures and options of the Wiring Diagram and the figures and options of the schematic drawing (SD) from which the Wiring Diagram was made.

2.045 NOTES FOR SHOP AND INSTALLER

The preparation of the job wiring list also involves the writing of notes which will completely explain and clearly outline to the shop or to the installer those conditions for which information is not completely shown on the circuit and equipment drawings. It is essential that the procedure to be taken by the shop or the installer be stated clearly.

The following is an example:

M The 24 volt battery lead on T ----- for the one way polar repeaters shall be run in 16 AM blk-red wire.

Notes should not be written which duplicate information that is fully included in the wiring list or in associated information. Notes necessary to provide a permanent record of special conditions, and those which involve information for the maintenance of the equipment after it has been installed should be placed on the wiring list drawing.

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2.046 INDICATION OF COMPLETION OF A WIRING LIST ITEM

When a circuit item in the job wiring list has been completely determined and edited, a checkmark should be placed opposite the item on the wiring list. This checkmark provides the basis for the Job Progress Indicator.

2.05 LOCATING CIRCUIT APPARATUS ON EQUIPMENT DRAWINGS

2.051 ESTABLISHMENT OF APPARATUS LOCATION ON EQUIPMENT DRAWINGS

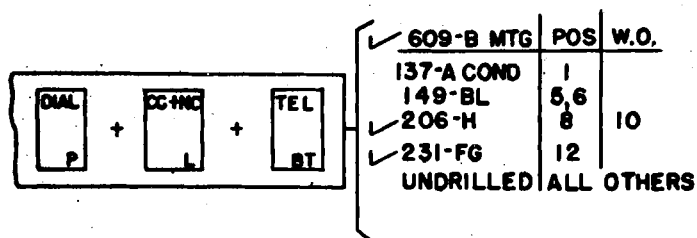
Having completely prepared the wiring list, the location of all apparatus shown in the circuit figures of a particular item of the wiring list is to be established on the Equipment Drawings in the following manner:

Each piece of apparatus on a circuit drawing is shown individually on a standard equipment drawing, or should be shown by the engineer on a job equipment drawing.

In establishing a location for a piece of apparatus, the electrical and maintenance limitations of the apparatus, and the physical requirements of both the apparatus and the mounting plate, panel, or framework must be considered in assigning the location. Bell Laboratories standard layouts (ED drawings) should be followed if available.

The assignment of termination points for ground and tone leads should be made when locating the circuit apparatus.

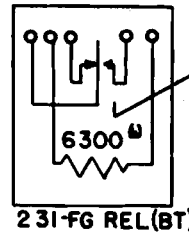
Having established the location of the individual pieces of apparatus on the equipment drawing or sketch, the location thereon should be designated by a checkmark. The following are examples of indications that the location of apparatus has been established.



21 E135 PU CDS	SD 737-B	30	✓
21 B 1087	L(RI) 600A	30	✓
21 139-A CONDSL		30	✓
31	35		
31(RI)	35		✓
31	35		

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On establishing the location of the apparatus on an equipment drawing, the code of the apparatus shown thereon should be compared with that on the circuit drawing and a checkmark placed on the apparatus convention on the circuit drawing if they agree, as illustrated by the sketch on this page.



This checkmark indicates that the apparatus location has been provided for, and that the code of the apparatus has been verified.

Apparatus, such as cords, lamps, vacuum tubes, etc., which is not shown on any equipment drawing should be ordered in the specification directly from the circuit drawing. The ordering of this apparatus should be indicated by placing a checkmark at the apparatus code designation.

When establishing locations for apparatus shown on a circuit, consideration must also be given to locating and designating non-circuit apparatus on the equipment drawings, such as apparatus blanks, key spaces, jack spaces, mounting plates, etc.

2.052 DESIGNATION OF APPARATUS ON EQUIPMENT DRAWINGS

Accurate designation of apparatus on the equipment drawings is equally as important as the assignment of location.

The following designations which are stamped by the shop or installer should be clearly shown on the equipment drawings:

- a - Group designation - the circuit name or its abbreviation, which should be the same wherever any part of the circuit is found on the equipment drawings. The abbreviated circuit name should correspond with the abbreviated name used in the job wiring list item.
- b - Functional designation - the lettered designations shown for the apparatus in the circuit figure.
- c - The office circuit numbering.
- d - The position or bay numbers with which such apparatus as terminal strips, fuses, etc. is associated.
- e - Other designations as required by standard typical equipment drawings.

In addition to the above the engineer should provide the following information which the draftsman will show in a Table or otherwise on the equipment drawing.

- a - The circuit drawing number (T-number).
- b - The dash number of the job specification ordering the equipment.
- c - Code of apparatus.

Note: Section 204 of the Equipment Engineering Handbook covers general information relative to the form in which information should be shown on the different types of equipment drawings, and supplements A, C, D, E, & H show examples of front equipment, fuse board, relay rack and distributing frame types of equipment drawings. In Section 25 of the Equipment Engineering Handbook will be found a list of engineering forms to be used in the preparation of information to send to the Drafting Department to enable it to prepare the job equipment drawings.

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2.053 PROVISIONS FOR FUTURE EQUIPMENT ON EQUIPMENT DRAWINGS

The location of future apparatus for which only wiring is being provided should be shown in the same manner as for apparatus that is being provided; with the exception that the apparatus location should be designated "WO" (complete wiring only), "LCO" (local cable only), or "FCO" (factory cabling only).

If required, space for the ultimate amount of equipment should be provided and designated "future" at all locations. In general, the same ultimates should be planned for at all of the appearances of any one type of circuit.

2.054 INDICATION OF COMPLETION OF "LOCATING" AND "DESIGNATING" OPERATIONS

Having located and designated all apparatus associated with a particular wiring list item, the completion of these operations should be indicated by the addition of the character L in the job progress indicator, thus ✓

2.06 ORDERING CIRCUIT APPARATUS

2.061 ORDERING FROM EQUIPMENT DRAWINGS

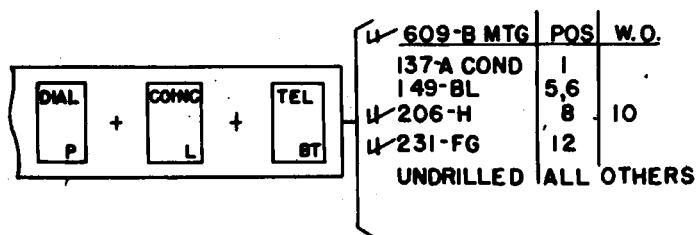
After all apparatus shown on the circuit drawing figures specified in the wiring list has been located on the equipment drawings, the apparatus for this circuit should be ordered in the apparatus summary directly from the equipment drawing. The apparatus of each circuit on the wiring list drawing should be ordered immediately after the locating operation for this circuit has been completed. In case apparatus for several circuits is located close together, such as on a jack field or switchboard rear equipment, it is advisable to order all of this apparatus at the time that the apparatus for the last of the several circuits is located on the equipment drawing.

If a further check is desired, a comparison between the apparatus shown on the circuit and the apparatus ordered will give an excellent cross-check.

It is essential that the Apparatus Card Catalog be consulted for the rating of apparatus (Std., A & M, MD) whenever any equipment is being ordered which is not well known to the engineer.

After entering an individual item of apparatus in the specification summary, the apparatus code as entered in the summary should be compared with that shown on the equipment drawing, and a cross line placed on the checkmark at the apparatus on the equipment drawing if they are the same.

Examples are shown below:



21E135 PU CDS	SL 737-B	30
21B1087	URI 600A	30
21139-A COND SL		30
31	35	
31(RI)	35	
31	35	

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2.062 DESIGNATION OF APPARATUS AND EQUIPMENT IN THE SPECIFICATION SUMMARY (SECTION "B")

In the specification summary, a unit of equipment should be designated with the switchboard position, section, or bay "office-number" by which it will be known when installed. (See Equipment Engineering Handbook Section 43, paragraph 18).

Apparatus which is to be mounted in a unit of equipment by the shop should be listed in the specification summary as a part of the order for the unit following the term "equipped with" (e/w).

The following is an example:

- 1 - J63501Q-1 List 1 and D No. 9 Test Board Teleg. Line Bay (Bay 1001) e/w
- 6 - 63D Jack Spaces (for Jack Fields 2 & 3).

Apparatus which is shown on circuit drawings and ordered in the Specification Summary to be mounted by the installers, shall be designated in the Specification Summary with the circuit number and with the number of the position or bay on which it is to be mounted. This does not apply to fuses, resistance lamps, heat coils and protectors the mounting location of which is self evident.

The following is an example:

- 23 - 141A Cond.
 - 2-T-61395-30 (Pos. 101)
 - 1-T-61387-31 (Pos. 102)
 - 20-T-60963-11 (Pos. 103 to 112)

2.063 INDICATION OF COMPLETION OF "ORDERING" OPERATION

On ordering all apparatus associated with a particular wiring list item, the completion of this operation should be indicated by the addition of the character 0 in the job progress indicator, thus ✓0

2.07 APPLICATION OF STANDARD EQUIPMENT SPECIFICATIONS

If standard equipment specifications are applied on the order, the regular engineering operations consisting of the preparation of the job wiring list, and the locating and ordering of the equipment as covered in the previous sections, are considerably modified.

Standard equipment specifications, as prepared by the Standards Engineering Division, are based on the Bell Laboratories specifications which are designed to provide uniform equipment arrangements and facilitate engineering and manufacturing. The use of these specifications permits standard manufacturing set-ups in the shop, and permits the use of standard shop and field test sets.

2.071 ESTABLISHING FAMILIARITY WITH STANDARD EQUIPMENT SPECIFICATIONS

A successful application of standard equipment specifications requires that they be thoroughly understood. In case an unfamiliar specification is being used, it is essential that a thorough study be made of this specification (Lists, tables, notes, etc.), supplemented by reference to the related Bell Laboratories specification for other notes and for correlation with related equipment.

The correctness of the standard specification and drawings is a functional responsibility of the Standards Engineering Division, and it is not necessary that this information be checked, except to gain an understanding of the standard specification, and to determine which of the apparatus or wiring is provided by the lists of the specification.

2.072 APPLICATION OF STANDARD EQUIPMENT SPECIFICATIONS

In using these standard specifications the engineering information, consisting of the lists, notes, and tables is studied for application to the job at hand. Those notes that apply to the job should be checked, while those that do not apply should be designated by a crossmark.

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The lists required, as determined in this study, should be designated by placing a checkmark, and writing the position, bay, or unit number to which they apply, opposite the list number in Table A on the standard specification drawing.

The job equipment drawing information should now be prepared to show the location of the section, bay, or unit.

The equipment should be ordered in the job specification in accordance with the standard specification lists, and a cross line placed on the checkmark opposite the list numbers in Table A on the standard specification.

Prepare the job wiring list by listing each circuit shown on the wiring list of the standard equipment specification together with the proper options both inside and outside section, bay, or unit, as required to meet the job conditions. The Job wiring list drawing should show all of the figures and options which are wired, as well as such of these which are equipped. The standard specification wiring list shows all figures and options which are wired, while Table A shows which of these are equipped by the stock lists of the standard specification. As each circuit is listed on the job wiring list form the regular engineering operations, that is locating apparatus, ordering apparatus, etc., are successively applied to the apparatus outside the section, bay, or unit equipment, using the job progress indicator in the regular manner to show which steps have been completed.

2.08 PREPARATION OF JOB CABLING INFORMATION

2.081 SELECTION OF CABLE

In selecting the code of cable for a circuit it is necessary to determine a suitable code fulfilling the following requirements: (Refer to Sec. 3, Supplement A of Eqpt. Eng. Handbook)

- (b) Gauge of conductors (as shown on circuit drawing)
- (c) Insulation of conductors (as shown on circuit drawing)
- (d) Arrangement of conductors (paired, tripled, etc. as shown on circuit drawing)
- (e) Design of cable (flat, oval, round, etc.)
- (f) Covering of cable (braided, shielded, lead, etc.)
- (g) Relative arrangement of equipment in the switchboard or on the bays.

If the selection of a cable is made to meet the requirements of only a certain circuit, the code as selected may be entered directly in the cabling information.

If the conductors of several circuits terminate together, making it desirable to run a common cable, the number of conductors of each type for each circuit should be entered in the cabling information. When the total conductor requirements are thus obtained, the proper cable may be selected.

In selecting a cable for miscellaneous conductors for several types of circuits, consideration should be given to the fact that the installing effort is greatly reduced by running one large cable rather than several smaller ones. It is, however, more desirable to use two medium size cables rather than one large and one small cable. This does not eliminate the necessity for proper segregation of the various tone or signal leads as covered in Section 203, paragraph 9.18, (Wiring Segregated for Electrical Reasons) Equipment Engineering Handbook. It is also necessary to select a cable suitable for the arrangement of the equipment on the relay rack and for the terminations on the frames. (See Sec. 3, Supplement A of Eqpt. Eng. Handbook for allowable number of positions or bays which may be served by one cable).

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2.082 METHOD OF EDITING CABLING INFORMATION

See Equipment Engineering Handbook Section 105, Part 1, Supplement C.

2.083 INDICATION OF COMPLETION OF CABLING INFORMATION

Having prepared all the necessary cabling information associated with a particular wiring list item the completion of this operation is indicated by adding the character C in the Job Progress Indicator, thus LOC

2.09 ORDERING WIRE

2.091 METHOD OF ORDERING WIRE

All wire, shown on the circuit figures of a particular item in the wiring list, that is to be run by the installer, should be ordered in the following manner:

Each color of wire shown on a circuit drawing figure should be chosen individually, and the necessary amount as determined from a study of the equipment arrangement should be tabulated in the wire editing form; except that 20 gauge "AM" type wire run on cable racks shall be ordered in the cabling information and restricted to the following colors:

Single - Black-Red
Paired - Black & Black-Red
Triple - Yellow, Yellow-Green & Red-Green
(Refer to Sec. 105, paragraph 17, Equipment Engineering Handbook).

The circuit drawing number for which the individual amount of wire is ordered should be included in the tabulation. To indicate the provision of wire, a checkmark should be placed on the color of wire on the circuit drawing figure.

2.092 INDICATION OF COMPLETION OF ORDERING WIRE

After ordering all the necessary wire associated with a particular wiring list item, the completion of the operation should be indicated by adding the character W in the Job Progress Indicator, thus LOCW

2.10 LOCATING AND ORDERING FRAMEWORK AND NON-CIRCUIT APPARATUS

2.101 ASSEMBLY AND FRAMEWORK PARTS

All supporting assemblies and framework parts must be ordered either in the Assembly & Equipment specifications or the requirements listed in the framework information forms (to be ordered by the Cabling Engineer in the framework specification). Some of these parts such as switchboard section assemblies, keyshelves, rear equipments, roof equipments, test board unit assemblies, etc., must be selected before the sketches showing the apparatus locations can be made. Others, such as framework connecting details, bus bar details, etc., are determined at the time the framework is being specified.

When the engineer has selected the framework parts their location and designation should be entered on the equipment drawings, and a checkmark placed at the location assigned to indicate that the framework as selected meets the job requirements.

2.102 NON-CIRCUIT APPARATUS

Non-circuit apparatus, such as apparatus blanks, jack spaces, key spaces, number plates, etc., should be tentatively determined at the time the circuit apparatus locations are assigned.

When the codes of this apparatus have been chosen, checkmarks should be placed opposite their designations on the equipment drawing. This apparatus should be ordered from the equipment drawing in the same manner as all other apparatus and a cross line placed on the checkmark at its location on the Equipment Drawing to indicate that it has been ordered.

EQUIPMENT ENGINEERING GUIDE

2.11 LISTING DRAWINGS AND REFERENCE PAPERS

All framework drawings, standard specifications, equipment, circuit, schematic and other drawings required in connection with the engineering of the job specification, together with the issue numbers of the drawings used shall be listed in the job specification except those pointed out as exceptions to the rule in "X3" notes of the K.E.F. longhand specification forms.

Issue numbers are listed in order that a permanent record may be made of the issue numbers of drawings from which the equipment was engineered and manufactured.

When equipment is ordered in an advance memorandum, the issue number of the drawing listed on the advance memorandum should be listed in the Job Specification in which the equipment ordered in advance is being specified.

The following procedure is recommended in carrying out the listing of drawings, standard specifications and other reference papers in the Job Specifications.

2.111 LISTING FRAMEWORK AND STANDARD EQUIPMENT SPECIFICATION DRAWINGS

With the job specification summary as a guide, list the framework and standard specification drawings and their associated supplementary drawings under the proper headings and place a checkmark at the left of the summary item to indicate that the drawing and its supplementary drawings have been listed.

2.112 LISTING CIRCUIT DRAWINGS AND SCHEMATICS

With the wiring list as a guide, the circuit drawings should be arranged in numerical order and listed with their associated schematics in the drawing list. The issue number of the schematic should be obtained from Note 51 of the circuit drawing. To indicate that a circuit has been listed, a cross line should be placed on the Job Progress Indicator, thus

2.113 LISTING EQUIPMENT DRAWINGS

All equipment drawings required in connection with the wiring or assembly of equipment covered by the specification should be listed.

2.114 LISTING INSTALLER'S REFERENCE PAPERS

Drawings and specifications required only by the installer in connection with the modification or removal of equipment may be determined in a review of the job specification wiring list, installer's notes, and apparatus summary. These papers which will have a limited distribution, should be listed in the job specification as Installer's Reference Papers.

2.12 COMPLETION OF LONGHAND SPECIFICATION

The title page, having been edited initially in the preparation of the specification, should be checked for correctness at this time.

Under the heading "General," a complete summary of the major items ordered in the specification should be given.

In the installing specification (-92) a "Narrative Story" and Job Summary should be given. (See Equipment Engineering Handbook Section 43, Paragraph 4).

The editing under all headings should be checked for completeness.

Review the summary notes for completeness and proper reference to the items in the summary of material. (See Section 43, Paragraph 17 of the Equipment Engineering Handbook.

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Check the completeness of the editing of all items in the job summary. Those that are at present listed as several quantities should be totaled to form one summary item.

Example: 23 - 141A Cond.
 2-T-61395-30 (Pos. 101)
 1-T-61387-31 (Pos. 102)
 20-T-60963-11 (Pos. 103 to 112)

2.13 PREPARATION OF DRAFTING INFORMATION

2.131 ISSUANCE OF DRAWING ORDERS AND CHANGE SUPPLEMENTS

When any addition or modification in equipment is to be made in a central office, drawing orders for the preparation of new drawings and change supplements calling for changes of existing drawings must be issued.

After issuing the drawing order or supplement, place a checkmark at the left of the corresponding drawing number in the specification drawing list.

When drawing orders or supplements are to be issued by the line engineer on other than job drawings, the order or supplement should be prepared as soon as the need for the change becomes apparent.

If possible, it is advisable to include all information on a drawing order or supplement. If this is not possible, supplementary sketches or marked prints may be supplied to the draftsmen. Standard forms should be used for providing the supplementary sketches.

Office records drawings (000) should be changed if the title or dash number of any office drawing is changed or a new drawing is issued.

The index drawing (T-6000 series) should be changed if a central office base number is changed or added.

2.132 COMPLETENESS OF INFORMATION TO THE DRAFTING ORGANIZATION

Information to the drafting organization must of necessity be complete and accurate to insure a thorough and efficient drafting job. Reference to drawings and other papers that will assist the draftsman should be made in the drafting information. Legible drawing sketches will also materially aid the draftsman.

2.133 APPROVAL OF TRACINGS

The responsibility for the accuracy and completeness of the engineering information, as interpreted and shown on the tracing by the draftsman, rests with the engineer. In the case of minor changes, final approval of the tracing may be delegated to the draftsman by placing a checkmark in the space provided for this purpose on the change supplement. Wiring list drawings must be approved by the Engineer because of the importance of this record.

2.14 PREPARATION OF FRAME AND RACK EQUIPMENT SPECIFICATION

2.141 WIRING LIST

The development of the wiring list, and the locating and ordering of equipment for circuits associated with this specification should be performed in the manner outlined in previous sections.

2.142 FRAME AND RACK EQUIPMENT DRAWINGS

The frame and rack equipment drafting information which has previously been prepared in connection with the locating operation for each of the assembly and equipment specifications should be reviewed for general arrangement, giving special consideration to the provisions for ultimate equipment, maintenance, and cabling conditions.

EQUIPMENT ENGINEERING GUIDE

Summarize such apparatus as fuses, protectors, resistance lamps, terminal strips, etc., from each drawing and enter in the specification.

After ordering the above apparatus place a cross line on the checkmark at the apparatus location.

Having ordered all such apparatus, list the equipment drawing number in the specification. The drawing order or supplement should now be prepared, and a checkmark placed at the left of the drawing number in the specification drawing list to indicate completion of that operation.

As an assurance that all frame and rack equipment drawings have been listed, the floor plans should be reviewed to redetermine all the frames and racks on which work is to be done in connection with the order.

2.143 FRAME AND RACK INFORMATION

As a part of the review of the frame and rack equipment drawing information, consideration should be given to the additional framework required. Study each drawing individually to determine the necessary framework. The Bay frameworks which have been ordered in the assembly and equipment specifications together with all other framework which is to be ordered in the framework specification should be listed in the editing form. The engineer writing the framework specification is responsible for ordering any miscellaneous framework details, junction plates, etc., required in connection with the bay framework listed by the switchboard engineer.

2.144 PREPARATION OF JOB POWER INFORMATION

The various battery voltages, signals and tones that are needed should have been designated on the fuse board equipment drawing in connection with "locating" the apparatus and equipment ordered in the assembly and equipment specifications. These power requirements should now be specified in the information to the power engineer.

A study of the power circuits of the office will aid in furnishing the correct power information, and be a source of information as to the type of power plant and signal current supply equipment available in the office. This study of power circuits is also necessary in furnishing power alarm circuits.

If the power requirement of the order consists only of an addition to fuse panels already supplying the particular voltage, signal or tone, it is not necessary to cover this requirement in the form of information to the power engineer. However, in case there are no terminations of this power supply already indicated on the fuse board, or where the panels being added exceed the ultimate originally provided for, this information should be given in the power form. The switchboard engineer should add a record of the additional power drain required for the present order on the Power Drain Table of the Fuse Board Equipment Drawing.

The questionnaire portion of the power form should be used as a guide in providing the necessary information for any other power requirements.

EQUIPMENT ENGINEERING GUIDE

3. JOB COMPLETION

3.00 GENERAL REVIEW

Having completed the preparation of the specifications, and the drawing information, it is essential that a general review of the job be made to assure its completeness. Any unusual conditions which have had an effect on the engineering performance and which have not as yet been recorded on the Equipment Department Job Engineering Memorandum (KL-1946-F) should be recorded at this time for reference when the job pricing estimate is being prepared.

As an assurance that the job as a whole has been properly coordinated it is advisable on the larger jobs that the switchboard, cabling and power engineers discuss together their respective portions of the job, giving special consideration to the interpretation of the information forms passed among themselves, and to the provisions made for any customer's changes.

3.01 REVIEW OF THE TELEPHONE COMPANY'S SPECIFICATION AND THE JOB FOLDER

The telephone company's specification and the job folder should be reviewed to make sure that proper action has been taken on all items. In case there are any items which cannot be completed, a follow-up record should be made of them to insure their completion at the earliest possible date.

A memorandum to the organization responsible should be written to care for any special distribution of drawings or specifications or to cover any special requirements.

3.02 ARRANGEMENT OF PAPERS FOR FUTURE REFERENCE

The telephone company's specification, the job folder and copies of the typed job specifications and marked copies of job drawings should be accurately labeled and filed in an orderly manner to facilitate ready reference. These should be retained until the time of final billing, when the Job specifications and Telephone Company's specification should be sent to file, and all other papers destroyed, first checking the job folder to remove any original copies of correspondence which may have been filed therein in error. Any such original copies should be sent to the files.

3.03 FINAL CORRECTION OF OFFICE DRAWINGS.

Changes in office drawings and specifications arising during the course of the installation which may affect other jobs in process should be made as soon as possible.

At the time the final marked prints are received from the installer it is important that all of the remaining changes be made in the job drawings and specifications. The prints as received from the installer should be examined closely, to determine whether or not changes in location of equipment affect any later jobs for the central office on which the engineering has been started, or completed.

The active cooperation of both the engineer and the installer is necessary in the use of final marked prints to provide proper engineering records for orderly and efficient engineering on all future orders for the central office.



Superintendent of Equipment Practices

EQUIPMENT ENGINEERING GUIDE

APPENDIX A

A Short Glossary of Terms Commonly Used in Equipment Engineering and Drafting

A & M - The abbreviation for "Addition and Maintenance Only". This is a rating for drawings used in the manufacture of equipment which is no longer rated "Standard" but which may be supplied for additions to existing installations. It is also a rating for apparatus which is no longer standard but which may be supplied for additions and for maintenance purposes.

APPENDIX - Supplementary pages added to a specification to make additions to, or to make changes in the original.

APPENDIX, REQUISITION SERVICE - An appendix, issued to order additional items associated with a certain specification, which is given approximately the same rush service as installer's requisitions, and is used to avoid the necessity of writing both an installer's requisition and a "record only" appendix. (See EEH Sec. 43 Par. 25.65).

AUTOMATIC DISTRIBUTION - A method of distributing blueprints according to a fixed layout to Telephone Company files when job base-numbered T-drawings are raised in issue.

BSP

BELL SYSTEM PRACTICES - These are issued by the Bell Telephone Laboratories and the A. T. & T. Co. in the form of bulletins or specifications supplemented by drawings. They provide standard working information for the engineering, installation, inspection and maintenance forces of the Bell System. Series AA 200 and AA 300, on Equipment Design Requirements, which are of particular interest to an Equipment Engineer, are listed on checking list BSP AA 128,002.

BLUE LINE PRINT - A paper print having blue lines on a white field, made on blue print paper from a Van Dyke negative.

BLUE PRINT - A paper print having white lines on a blue field, made on blue print paper from a regular Tracing.

BROWN SHEET - A firm job schedule (Brown Sheet) for a telephone company's order is issued by the Scheduling Department after an engineering schedule has been established and manufacturing and installing intervals have been set up. The Brown Sheet is a copy of the order sheet which has been reissued to show the following job information:

- a. The Manufacturing Commitment Date (M.C. date)
- b. Shipping Date.
- c. Installation Starting Date.
- d. Installation Completion Date.

These dates are a commitment to the Telephone Company through the medium of the Brown Sheet by the Western Electric Co. through the Distributing House which serves the Telephone Company.

B. T. SHEETS - Typed sheets describing the electrical operation of the older circuits the schematics of which appear on the circuit wiring diagrams.

BULK CABLE - Lengths of switchboard cable, the ends of which are not formed. They are shipped on reels from Merchandise stock.

CARD CATALOGUE - A set of 5 x 8 inch cards, alphabetically arranged, on each card of which appears a brief description, rating, dimensioned illustration and convention of one or more pieces of coded apparatus.

CC

CUSTOMER'S CHANGE - This is an accounting classification term applied to a change in a job made by a Telephone Company and received by the Western Electric Co. before the Job correspondence date has passed (before Job is contracted). (See E.E.H. Sec. 45, par. 2.74).

CD

CIRCUIT DESCRIPTION - Planographed sets of pages describing the electrical operation of a circuit as seen from its schematic drawing (SD). Issued by the Bell Laboratories.

CHANGE IN SCHEDULE FORM - A form originated by the Equipment Engineering Branch to change the dates on which Job specifications and drawings are due the manufacturing organizations.

EQUIPMENT ENGINEERING GUIDE

APPENDIX A

CN

CHANGE NOTICE - A form issued by the Equipment Engineering Branch to the Installation Dept. for the purpose of coordinating all of the information relating to an equipment change to be made on a number of jobs in process of installation, usually resulting from a class A or AR change in a circuit schematic drawing.

CIRCUIT CONVENTION BOOK - A book containing all of the apparatus conventions, together with instructions on the assignment of colored leads on wiring diagrams.

CIRCUIT REQUIREMENTS TABLE - A Table of data on a Bell Laboratories circuit schematic drawing which shows the current values and time intervals to be used in adjusting the relays in the circuit.

COMPLAINT - Report of a difficulty encountered by the shop in the manufacture of Equipment from specifications and drawings produced in the Equipment Engineering Branch.

CONVENTION, APPARATUS - A small sketch, representing a piece of apparatus, drawn to show its electrical components and to suggest its mechanical construction and operation.

CURRENT DRAIN - The number of amperes of electrical current drawn from a Central Office Battery, or through a particular power cable. The busy hour load is the average current drain for the hour of the day in which the greatest number of calls are completed, (for the current drains of individual circuits see the Current Drain Data Books in the Standards Engineering Department).

CURRENT DRAIN TABLE - A table of current drain values for a given fuse board or decentralized filter to be shown generally on the job Fuse Board Equipment Drawing or other appropriate equipment drawing. (See KTN 484.)

DCS

DETAIL CHANGE SHEETS - Typed sheets prepared by the circuit drafting organization which provide detailed installing instructions consisting of lists of leads which are to be added, removed, cut dead, connected or reconnected by the installer to accomplish certain wiring changes in existing equipment. (See Sec. 209 of Equipment Engineering Handbook).

DRAWINGS - PREFIXES - Letter designations applying to various numerical series of drawings for certain types.

A- Usually assigned to drawings covering manufacturing information for coded apparatus and comparable assemblies. A few older types of switchboard drawings were assigned in the "A" prefix series of numbers.

ED- A prefix applied to standard drawings, mainly framework, cabling and equipment drawings.

ES- A prefix used for several types of Bell Laboratories drawings (circuit schematics, equipment, and framework). This prefix has been superseded by the prefix "SD" for new circuit schematics, and by "ED" for new equipment and framework drawings.

H- A prefix for semi-standard drawings of several types, mainly framework and equipment modification drawings, or drawings having moderately repetitive application.

J- A prefix for standard equipment specifications in the form of drawings having equipment views, stocklists, manufacturing notes, and engineering notes.

LC- Local Cable design drawing for the manufacture of a local cable for a standard or non-standard type of equipment. It shows the dimensions and form of a local cable as it appears in one plane on the forming board.

P- Drawing of a "Piece Part". Piece Parts are component parts of apparatus, switchboards, frameworks and related equipment. They have a relatively wide application, and many are carried in stock. Machine tools are usually provided for their manufacture.

SD- A Circuit Schematic drawing: This is a circuit drawing issued by the Bell Telephone Laboratories which shows the fundamental electrical connections between the pieces of apparatus used in the circuit. The electrical operation of a circuit may be readily traced on a schematic.

EQUIPMENT ENGINEERING GUIDE

APPENDIX A

DRAWINGS - PREFIXES (Cont'd)

- SRT- A Soldering Record T drawing which shows the apparatus of a circuit (wiring side) arranged exactly as it is mounted on a unit of equipment, and which shows colored stubs of the circuit leads extending from the apparatus. Used by the shop for connecting and soldering local cables to apparatus. SRT drawings are prepared only for special cases.
- ST- A Circuit Schematic drawing formerly issued by the Western Electric Co. for a Circuit T drawing.
- T- A prefix for several types of drawings such as Wiring Diagrams, and Job Equipment Drawings.
- WRT- A Wiring Record T drawing which is a Table of information on tracing cloth listing the wires and their terminating points (grouped by gauge and color) which appear on a certain circuit T drawing. WRT drawings are used by the shop in placing wires in position on the forming board in the manufacture of local cables.

DRAWINGS - TYPES OF

- ASSEMBLY DRAWING - A drawing showing dimensioned views of an assembled unit of framework (Terminal frame, Relay bay, etc.), and having stocklists of Piece Parts or Details of which the unit is to be made.
- BASE NUMBERED DRAWING - A job drawing, the number of which is composed of the prefix T followed by the four-digit base number of the Central Office and a three-digit or four-digit number which indicates the type of job drawing. A base number has been assigned to each Central Office for the purpose of identifying all associated drawings for the office.
- CIRCUIT SCHEMATIC - See SD drawing prefix.
- DETAIL DRAWING - A drawing showing dimensioned views of parts of a framework assembly. The parts are known as "Details". They are similar to Piece Parts, but have a relatively small application.
- JOB DRAWING - A Drawing showing certain equipment as installed or to be installed in a particular Central Office. (Relay Rack Equipment drawing, Switchboard Front Equipment drawing, etc.)
- LOCAL CABLE DESIGN DRAWING - See LC drawing prefix.
- PIECE PART DRAWING - See P drawing prefix.
- SPECIFICATION DRAWING - See J drawing prefix.
- WIRING DIAGRAM - A circuit drawing which shows the colors, gauges and terminating points of the wires, and which shows the apparatus in conventional form as viewed from the wiring side. This drawing is used for connecting leads in the shop, and for running and connecting leads by the installers. It is a circuit "manufacturing drawing".
- WIRING LIST DRAWING - Tables of information on tracing cloth which list the quantities and drawing numbers of the wiring diagrams and schematics of circuits installed, or to be installed in a Central Office. The figures and optional features of these circuits are also listed.
- WIRING RECORD DRAWING - See WRT drawing prefix.
- DRAWING ORDER - A printed form filled out by an engineer ordering a new drawing to be made by the drafting organization. General and specific information for making the drawing is entered on the form.
- EF OR KEF FORM - Abbreviations for "Engineering form" and "Kearny Engineering form". Many are mimeographed forms consisting of a number of pages used by the Job Engineers in writing specifications. Others are single page forms which expedite the work in equipment engineering and drafting.

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EEH

EQUIPMENT ENGINEERING HANDBOOK - A loose leaf book containing a number of sections each of which prescribes certain procedures of Equipment Engineering or Drafting. This book, supplemented by "Temporary Notices", is the authority for these procedures.

E/W

EQUIPPED WITH - A term used in Equipment Specifications to indicate that the apparatus or material listed as a part of the summary item shall be mounted by the shop on the framework or panel being ordered in the item.

FACTORY CABLE - Switchboard cable which is formed and soldered to jacks, lamp sockets, keys, etc. in the shop before shipment to the Installers.

FLOOR PLAN DATA SHEETS - Printed pages issued by the Bell Telephone Laboratories to the drafting organizations, showing typical floor plans of Central Offices, and dimensioned plan view sketches of all types of switchboards, desks, frames and racks, power equipment, etc. The standard conventions of these equipments to be shown on floor plan drawings are also given on these data sheets.

FORMED CABLE - Switchboard cable which is stripped, butted, formed and sewed in the shop before shipment to the Installers.

FUSE BOARD RECORD SHEETS - Tables of data typed on pages suitable for insertion in a Fuse Record Book, which show the names, office numbering, and drawing numbers of the circuits assigned to the fuses on double row fuse panels. (There is insufficient space to stencil this information on a double row fuse panel and on a lamp panel).

GENERAL ENGINEERING CIRCULARS - Booklets formerly issued by the A. T. & T. Co. describing new developments in telephone equipment together with recommendations on their application. Information of this kind is now issued in booklets known by other titles.

HOLD, RELEASE, OR CANCELLATION - A form issued by the Equipment Engineering Branch which authorizes the shop to hold, release or cancel work in process.

INTERVAL CHARTS - Various charts showing standard intervals for engineering, manufacturing, and shipping equipment specified on regular switchboard orders.

ISSUE FILE - A loose leaf book file containing the Equipment Engineering Branch record of the issue numbers of all drawings (except apparatus drawings), together with a record of the Order Numbers of the Jobs on which the drawings have been specified. This file also shows whether the tracing of a particular drawing is in the drafting dept. and "not in" the Vault (Tracing file), or has been completed and is "in" the Vault.

In this file is also maintained a record of specifications and appendices originated or scheduled, and dates of delivery to the shop. These are recorded by Job Order Number.

JIM

JOB INFORMATION MEMORANDUM - A form filled out by an Installer describing difficulty he is experiencing on the job. The installer mails the JIM to the Field Service organization which refers the matter to the organization responsible and secures a reply for the installer.

K-96 ORDER (OR 9600 ORDER) - A K-96 order is a 5-digit order having the suffix "K-96" to identify it. These orders cover only miscellaneous modifications or additions to equipment existing in a Central Office. They involve a minimum amount of manufacturing work, since most of the work is performed in the field. They may also be used as an order to bring Job Equipment drawings up-to-date with equipment changes made by a Telephone Company. Specifications are not written for K-96 orders as manufacturing and installing information is ordinarily given on a combined order sheet and summary.

K-97 ORDERS

K-98 ORDERS - Orders detail engineered by the Telephone Companies for which our engineering records would normally be brought up-to-date on a running order basis.

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KIA

KEY ITEM ANALYSIS FORM - A form issued by the Requirements and Stock Maintenance Department in connection with a Telephone Company's order, on which is listed the Standard Equipment Specifications covering the major shop-load equipment items. These forms constitute the basis for the shop load.

KIM

KEARNY INFORMATION MEMORANDUM - A mimeographed memorandum or instruction issued by the Equipment Engineering Methods Department covering local equipment engineering, drafting and related clerical routines that do not relate directly to Equipment Engineering Handbook practices.

These memoranda include technical information such as the listing of new standard drawings being available for certain purposes, substitution of material, limitation of stock of cable or wire, etc. Organizational information such as division of responsibilities, temporary service arrangements, etc., is also covered in these memoranda.

KTN

KEARNY TEMPORARY NOTICE - A mimeographed instruction issued by the Equipment Engineering Methods Department which modifies a practice presently contained in the Equipment Engineering Handbook, or institutes a new practice which will be included in the Handbook.

LOCAL CABLE - A handmade cable, not covered by braiding, composed of the leads which connect together the apparatus within a unit of equipment. The leads, placed in position on a forming board, are bound together with lacing twine stitched at regular intervals along every branch of the cable.

LOCAL POWER CABLE - A cable similar in construction to a local cable except that it contains mainly battery and ground leads which run through a lineup of switchboards, desks or frames.

M ORDER - An order issued on the shop by the Merchandise Organization or the Switchboard Program and Scheduling Division for the manufacture of a quantity of standard equipment to be applied on Telephone Company orders, or to be carried in stock.

MC DATE

MANUFACTURING COMMITMENT - A commitment by the Manufacturing Organization to complete the manufacture of certain equipment and to deliver it to the Merchandise Organization by a designated date.

METHOD OF OPERATION SHEETS - See B.T. Sheet.

MD

MFR. DISC.

MANUFACTURE DISCONTINUED - A rating applied to the drawings of certain equipment, and to certain apparatus to indicate that it is no longer manufactured by the usual methods on a production basis. The machine tools for manufacturing such items are no longer available.

NDD

NEW DEVELOPMENT DESCRIPTION - Mimeographed pages issued by the Standards Engineering Division describing a newly developed equipment, and stating its probable annual demand. The numbers of the drawings associated with the new equipment are listed. This is an advance notice to the Manufacturing Department and to the Merchandise Organization regarding new equipment and the present equipment which it replaces.

ORDER SHEET (ON SWITCHBOARD EQUIPMENT ORDERS) - A switchboard equipment order form issued by the Merchandise Organization (Sales Dept.) which authorizes the expenditure of money (time and material) on a Telephone Company's specific job identified by the Western Electric Co. order number which appears on the Order Sheet.

PERIODIC CHANGES - Improvements in design released by the Bell Laboratories periodically (usually once a year) on certain types of equipment.

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PEC

PLANT ENGINEERING CIRCULAR - A numbered pamphlet issued by the A. T. & T. Co. to the Telephone Companies describing newly developed equipment; and major modifications of existing equipment which will have wide application.

PEL

PLANT ENGINEERING LETTER - A numbered general letter issued by the A. T. & T. Co. to the Telephone Companies describing minor improvements in the design of telephone equipment.

POWER DATA SHEETS - Printed pages, issued by the Bell Telephone Laboratories for use by power engineers and draftsmen, showing dimensioned sketches and cross sections of the power equipment and supplies (engines, generators, motor control equipment, etc.) which are obtained from other manufacturers. These sheets also show capacity ratings, shipping data and other information.

POWER PUNCHING LIST - An assignment list associating the numbered punchings (or terminals) of a terminal strip with the lettered "power" punchings of a circuit drawing. This list is prepared by the local cable drafting department, as part of the local cable layout for local cables to be built on a customer's order. These are required only when the older circuit drawings are used since the later drawings show numbered power punchings.

QUESTIONNAIRES - Specification long-hand forms issued by the Standards Engineering Division for use by the Telephone Companies in writing their specifications on Jobs to be engineered by the Western Electric Co. These forms are intended to produce uniformity in the specifications of all Telephone Companies, and to inform the Telephone Companies of the items of engineering information desired by the Western Electric Co.

REQUISITION, INSTALLER'S - A form used by the installers for ordering material and apparatus on a rush basis required on a job in process of installation. Usually used to order material to replace that lost in shipment or found defective; and to order additional material where an insufficient quantity was ordered in a specification. This form is also used by equipment engineers to order certain material for an active order that has been released for shipment on which the installation completion date is very close at hand. (See EEH Section 9, Par. 11).

RGM

RETURNED GOODS MEMORANDUM - A form issued by an installer on which he lists excess material and equipment being returned by him from the job to the Merchandise organization.

REMARK SHEET - A form issued by a local cable draftsman to the shop, which lists the wiring record drawings and the local cable design drawings required for the manufacture of a certain Job local cable. This form is designated by the prefix RS followed by the Job order number, Job specification number and shop order dash number assigned to the local cable to be made.

REPRODUCED TRACING - A tracing cloth reproduction of an original tracing, made by a photographic printing frame process. Drafting changes and additions may be made on the reproduced tracing.

SCHEDULE, ENGINEERING - A form issued by the Equipment Engineering Branch which shows the numbers of the Job specifications scheduled, the dates they are due the manufacturing departments, and coordinates the dates of specifications in the several engineering and drafting departments.

SCHEMATIC - See Circuit Schematic

SOURCE - The shop or storeroom which is designated in an Equipment Specification Summary by the Central Editing Department as being responsible for furnishing an item of apparatus or equipment required for a Telephone Company's order.

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SPECIFICATIONS - TYPES OF

D SPECIFICATION - A manufacturing specification issued by the Engineer of Manufacture organization for a piece of special apparatus to care for a condition for which standard apparatus is not suitable.

JOB SPECIFICATION - A specification issued by the Equipment Engineering Branch for certain items of central office equipment for a particular central office. This specification contains information for the shop and the installer.

KS SPECIFICATION - A manufacturing specification issued by the Bell Telephone Laboratories for a piece of apparatus or equipment to be manufactured by Suppliers.

STANDARD EQUIPMENT SPECIFICATION - A manufacturing specification issued by the Standards Engineering Division for a unit of standard equipment. These are usually in the form of drawings having stock lists, and are known as J specifications (occasionally ED or H).

X SPECIFICATION - Typed specifications issued by the Bell Telephone Laboratories covering a wide variety of subjects, some of which deal with general requirements of apparatus, descriptions of certain types of equipment, periodic plan for the introduction of improvements in design, drafting practices, etc. Only a few X specifications are being currently reissued; most of them have been superseded by B.S.P.'s or J specifications.

SUMMARY OF APPARATUS - The B section of a Job Specification in which the items and quantities of wired equipment and loose apparatus are listed which are to be supplied in accordance with the specification.

SA

SUPPLEMENTAL AUTHORIZATION - A change in a Job authorized by a telephone company at a date later than the Job Correspondence Date (after the contract date). Work on such a change should be designated "SA" on time tickets to insure billing the telephone company at the date of final billing.

SUPPLEMENT, DRAWING - A form issued by an equipment engineer to the drafting organization calling for changes to be made on an existing drawing. Various classifications may be assigned to a Supplement depending upon the urgency and extent of application of the drawing change.

SWITCHBOARD CABLE - Cable used inside a central office, consisting of various combinations of insulated copper wire (single, pair etc.) and various colors; covered with a braided textile covering painted with a grey flameproof paint.

TIM

TEMPORARY INFORMATION MEMORANDUM - A form issued by the Standards Engineering Division authorizing the shop or installer to deviate temporarily from standard requirements in the manufacture or installation of central office equipment.

TC

TRAFFIC CIRCULAR - A numbered pamphlet issued by the A. T. & T. Co. to the Telephone Companies describing new and changed traffic practices of major importance.

TRAFFIC LETTER - A numbered letter issued by the A. T. & T. Co. to the Telephone Companies describing new and changed Traffic Practices of minor importance, and those of temporary application.

VANDYKE - A paper negative print having a brown field and transparent white lines, made from a tracing, for the purpose of making blue prints having blue lines on a white field.