# DRAWINGS ON 35MM MICROFILM FOR INSTALLATION AND TELEPHONE COMPANY EQUIPMENT MAINTENANCE



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## 1. GENERAL

**1.01** This section outlines the general plan for the production, distribution, and use of 35mm microfilm of engineering drawings for installation and telephone company equipment maintenance.

**1.02** This section is reissued to include restrictive notice on aperture cards (Fig. 1 and 2) and revise keypunching information to indicate drawing design control location (paragraph 3.06 and 3.07). Revision arrows are used to emphasize the more significant changes.

**1.03** Engineering drawings are the backbone of the operating equipment installed throughout the Bell System and copies of these drawings are required by the various organizations throughout the system. These copies are used by Bell Laboratories in the design and development of equipment; by Western Electric for manufacturing the equipment, for engineering specific telephone company orders, and for installation of the equipment in the field; by the operating telephone companies for engineering, operation, and maintenance of the equipment; and by AT&T for engineering and reference.

**1.04** In 1974, Western Electric began implementation of a program to provide microfilm of the J, ED, H, and T standard drawings, in place of paper prints, to Installation. These drawings are used by the installation forces in installing or modifying telephone equipment. The T standard drawings are subsequently turned over to the telephone company for use in maintaining the equipment. The SDs will continue to be supplied in paper print form.

**1.05** Unitized microfilm, that is, individual 35mm microfilm frames mounted in apertured electrical accounting machine (EAM) cards of engineering drawings, provides an improved method of furnishing drawing information throughout the Bell System. Drawings are photographed at their source on 35mm film or generated directly on 35mm film by a computer-output microfilm (COM) device. A COM device is a recorder that converts digital data from a computer into readable form and records it on microfilm. The provision of legible microfilm is dependent on the preparation of the drawings in accordance with standard drawing practices as covered in "Technical Design Manual—Standards--Bell System Drafting—Product Drawing," CI 97.111, or generation on a COM device in accordance with X-76081 "Standards for 35mm Computer-Output Microfilm (COM) for Engineering Drawings" and "Computer-Output Microfilm (COM) Drawing Standards," Section 15 of the Technical Design Manual. Each microfilm frame is mounted in an apertured EAM card that is keypunched and interpreted (printed) to identify the drawing. The keypunching allows the microfilm cards to be mechanically sorted and filed, if conditions require, while the interpreting permits visual identification of the drawings.

**1.06** Unitized microfilm provides a means of furnishing all drawings on a standard uniform size card. Microfilm offers substantial savings from reduced file cabinet floor space requirements, simplified filing operatings, faster and less costly shipping and mailing, and reduced reproduction costs.

**1.07** Standards ranging from the quality of the raw film and the mounting of the microfilm in the apertured cards through the requirements for the

equipment used to produce and use microfilm have been established to assure a completely coordinated and compatible microfilm system.

## 2. PRODUCTION AND DISTRIBUTION

**2.01** Microfilming of drawings begins with the original drawings being photographed with a precision 35mm camera or generated directly on 35mm film by means of a COM device under controlled conditions that have been established to ensure microfilm of high quality.

**2.02** The exposed microfilm is then processed carefully. Upon completion of processing, the microfilm is inspected to determine that quality requirements are met.

**2.03** Following inspection, each microfilm frame is mounted in an aperture card using a precision mounter. However, before the film is mounted, the aperture card is keypunched and interpreted with drawing identification information.

**2.04** Duplicate copies of the original microfilm are produced in card-to-card printers in the quantity required for distribution.

**2.05** Standard drawings are prepared at Bell Laboratories or Western Electric Product Engineering Control Centers. They are microfilmed at the originating organization location and the resulting silver master aperture cards are sent to the Western Electric Reproduction Center at Hawthorne, Illinois, where a master microfilm file of the latest issues of standard drawings is maintained. At Hawthorne, a duplicate diazo microfilm is produced and sent to the Western Electric Reproduction Center at Kearny, New Jersey, where a duplicate master microfilm file is maintained. Upon receipt of an Engineer Furnish and Install (EF&I) or Telephone Company Engineer (TCE) order from an associated company at a Western Electric Regional Engineering Center, the Western regional engineer prepares a drawing summary. This drawing summary lists all drawings associated with a job. Based on the type of telephone system involved, the drawing summary is data-linked to either the Hawthorne or Kearny reproduction center where duplicate microfilm of the J, ED, H, and T standard drawings and paper prints of the standard SDs are produced. These microfilm and paper prints are sent to the job site for use by the installation forces when modifying or adding to existing central offices or installing new central offices. Upon completion of the installation, the SDs and T standard drawings are turned over to the telephone company maintenance personnel to maintain the equipment.

## 3. APERTURE CARDS

**3.01** The cards used for mounting duplicate microfilm are 3-1/4 by 7-3/8 inch apertured EAM cards that are assigned KS specification numbers as shown in Fig. 1 and 2. These cards are inspected by Western Electric. Special precautions, shelf life, packaging, and ordering information regarding these cards are covered in Section 006-120-100.

**3.02** All aperture cards will have negative images (light lines on a dark background) and will be free of scratches, foreign material, stains, or defects that make drawing information illegible.

**3.03** The identification information, such as drawing number, sheet number, issue number, size, and section number (if a multiple-frame drawing) is entered on the card for use by the installation and maintenance personnel. All other information, such as address, distribution, design, control location, etc, is intended for use by the reproduction organization in producing and distributing the microfilm. See Fig. 1 and 2.

### Keypunching Microfilm Cards

**3.04** The information required to identify the drawing shall be keypunched in columns 1 through 23 of the aperture card, as indicated in Table A. In addition, to facilitate the production and distribution of the aperture cards to the field, the distribution control data shall be keypunched for Hawthorne-produced cards as covered in paragraph 3.06 and for Kearny-produced cards as covered in paragraph 3.07.

**3.05** Where information is not applicable, the fields shall remain blank. Zeros shall be punched only when they are a significant part of the information. Information not requiring all columns of the allotted field shall be punched in the right-hand columns, and unused columns shall be to the left of the punched columns for each particular field.

**3.06** The Hawthorne-produced duplicate aperture cards shall be keypunched as follows:

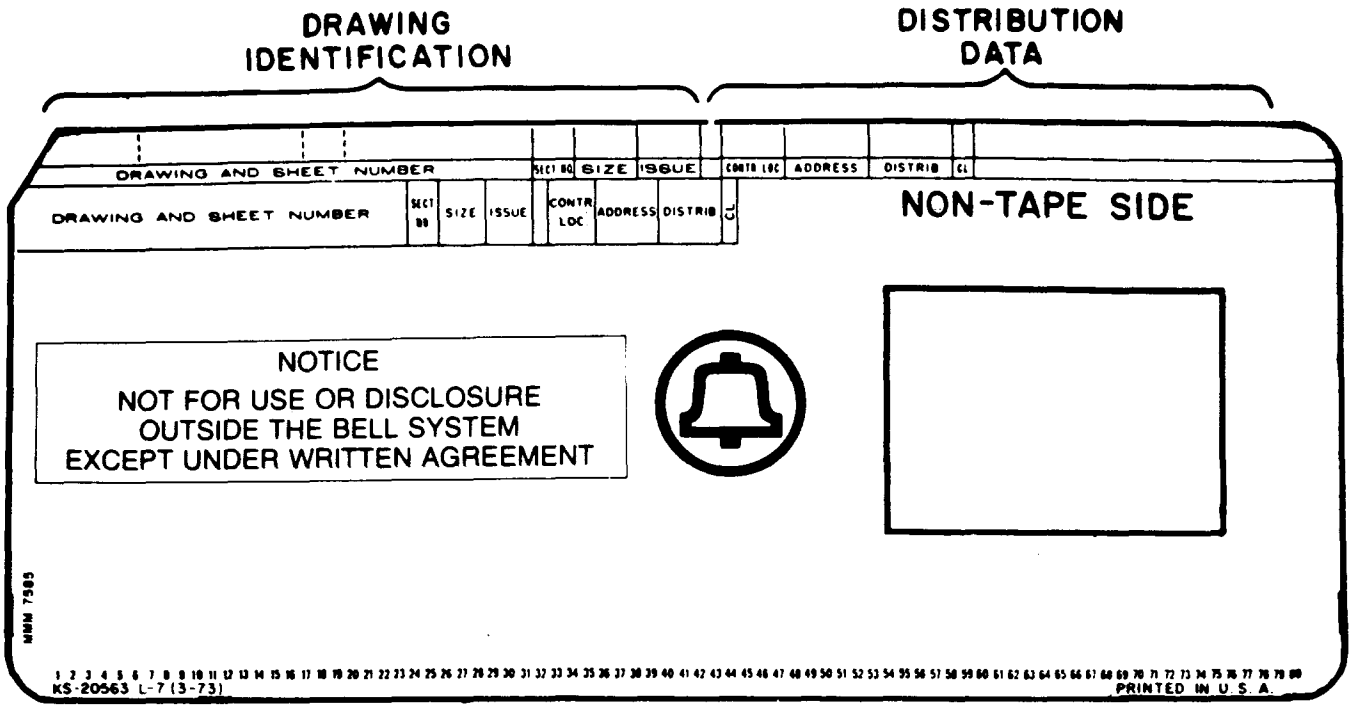


Fig. 1—KS-20563 L-7 Hawthorne Distribution Card (Green) ←

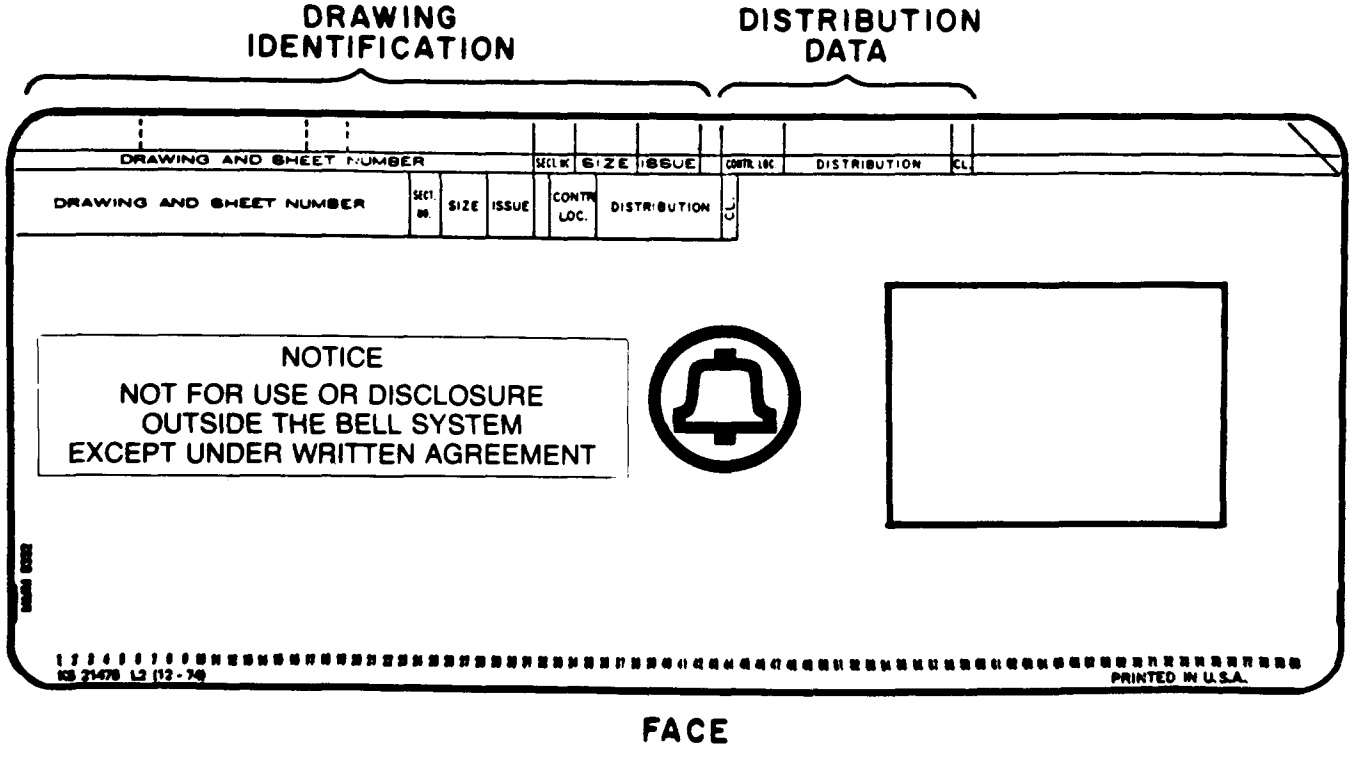


Fig. 2—KS-21478 L2 Kearny Distribution Card (Green) ←

| CARD FIELD COLUMN | INFORMATION | SEE |
|---|---|---|
| 1—23 | Drawing and Sheet Number | Table A |
| 24—25 | Section Number | 3.07(a) |
| 26—28 | Size | 3.07(b) |
| 29—31 | Issue | 3.07(c) |
| 32 | EF&I/TCE Order Service Code | 3.07(d) |
| →33—35 | Design Control Location | 3.07(e) |
| 36—39 | EF&I/TCE Order Schedule Date | 3.07(f) |
| 40—43 | Distribution Code | 3.07(g) |
| 44 | Illegibility Designation | 3.07(h) |
| 45—50 | Production Identification Number | 3.07(i) |

**3.07** The Kearny produced duplicate aperture cards shall be keypunched as follows:

| CARD FIELD COLUMN | INFORMATION | SEE |
|---|---|---|
| 1—23 | Drawing and Sheet Number | Table A |
| 24—25 | Section Number | 3.07(a) |
| 26—28 | Size | 3.07(b) |
| 29—31 | Issue | 3.07(c) |
| →33—35 | Design Control Location | 3.07(e) |
| 40—43 | Distribution Code | 3.07(g) |

(a) ***Section Number (Columns 24-25):*** The alphabetical and numerical information identifying the particular section of a multiple frame drawing.

(b) ***Size (Columns 26-28):*** The alphabetical and/or numerical information shown on the drawing to indicate size.

(c) ***Issue (Columns 29-31):*** The number indicating the issue of the drawing. Suffix letters need not be punched. For drawings refurbished without raising the issue, the issue numbers shall be preceded by an X, which will appear in column 29 or 30, depending upon whether the current issue has one or two digits.

(d) ***EF&I/TCE Order Service Code (Column 32):*** The designation indicating the type of service, either emergency or regular.

→(e) ***Design Control Location (Columns 33-35):*** The design control location for a drawing is indicated by a combination of alphabetical and numerical characters. See Section 006-110-100 for the design control location codes.

(f) ***EF&I/TCE Order Schedule Date (Columns 36-39):*** The month and day the microfilm is scheduled to be shipped.

(g) ***Distribution Code (Columns 40-43):*** The alphabetical and numerical information indicating the distribution of a particular drawing.

(h) ***Illegibility Designation (Column 44):*** On microfilm cards containing class II (refurbishing scheduled for later date) or class III (refurbishing not intended because of low activity) drawings, a numeric 2 or 3, respectively, is punched.

(i) ***Production Identification Number (Columns 45-50):*** A local use number that identifies each drawing in a sequence of drawings for a particular order.

**Interpreting**

**3.08** Cards shall be interpreted on a 64-character per line interpreter on line number one using 80-column punching (less the aperture column area), into 64-character interpreting.

**3.09** In the case of the Hawthorne-produced card, KS-20563 L-7: (1) the production and distribution interpreted data does not, in some instances, relate to the headings shown on the card, (2) the EF&I/TCE order numbers shall be printed in columns 57 through 64.

**Inspection Procedures**

**3.10** The duplicate microfilm produced at Hawthorne and Kearny and distributed to the field shall meet the following general requirements of Section 006-115-500.

(a) General quality

(b) Legibility

(c) Image centering

(d) Drawing identification.

In the case of legibility, the requirement applies to the duplicate microfilm sent to the field rather than the file master duplicate.

## 4. MICROFILM READERS

**4.01** A microfilm reader is a machine that projects an enlarged image from a microfilm card onto a self-contained screen. A reader permits quick and ready reference to drawing information. Two types of readers are available for this program: desk top and portable. Fig. 3 shows the viewing area of the two readers in relation to the size of the standard drawing. The majority of drawings are of the 6S size.

(a) ***Desk Top Reader:*** The reader selected for use by the telephone companies for central office equipment maintenance weighs about 50 pounds. It is 21-1/2 inches high by 16 inches wide by 18 inches deep and is equipped with a nonglare screen 14-3/4 inches wide by 12-1/2 inches high. It is primarily intended for use as a desk top reader since its size and weight prohibit continual moving between offices. However, the narrow width of the reader will allow it to be placed on a rolling cart and be used in the front and rear equipment aisles.

(b) ***Portable Reader:*** This reader weighs about 5 pounds. It is 13 inches high by 8-3/8 inches wide by 10-3/4 inches deep and has a viewing area 7-3/4 inches wide by 5-3/4 inches high. The weight and size makes it extremely portable. Its main disadvantage is a smaller viewing area.

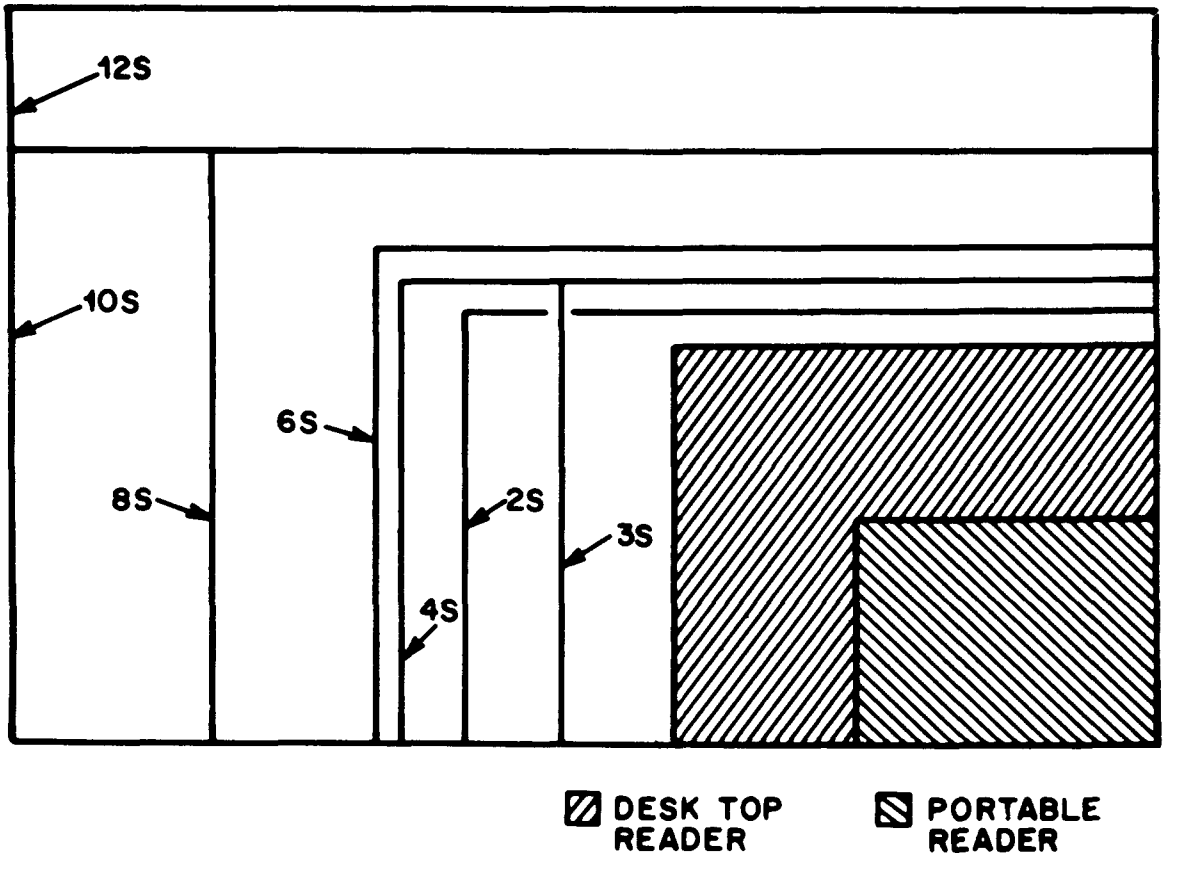


**Fig. 3—Microfilm Readers—Approximate Viewable Area of Standard Drawings**

## 5. RECOMMENDED METHOD OF OPERATING WITH MICROFILM IN TELEPHONE COMPANY CENTRAL OFFICES

**5.01** The Western Electric Reproduction Centers send microfilm of the J, ED, H, and T standard drawings to the job site for use by the installation forces. Upon completion of the installation phase of the job, the microfilm of the T standard drawings will be turned over to the telephone company for use in maintaining the equipment. In a new central office, all T standard drawings associated with the job will be in microfilm form. In the case of modifications or additions, only the T drawings affected by the change will be furnished on microfilm, the T drawings not involved are on hard copy. This will result in a dual file of paper prints and microfilm.

**5.02** Upon receipt of T drawing microfilm from installation, the central office supervisor should proceed as follows:

(a) Designate a location for the microfilm file.

(b) Establish the responsibility for microfilm file maintenance.

(c) Have the microfilm file checked against the shipping list to determine if the file is complete.

(d) Assure the microfilm is filed in numerical sequence.

(e) Ensure that all personnel know how to use the microfilm readers.

(f) Resolve all conflicts in using readers by assigning their use by work priority.

(g) Verify all microfilm readers are turned off when not in use.

### Microfilm File Operations

**5.03** Personnel accessing the microfilm file shall select the aperture cards required and remove them from the file for use in the appropriate microfilm viewing equipment. When removing microfilm, a marker will be helpful in maintaining file integrity. When the microfilm is no longer being used, it shall be returned to the file.

### Aperture Card Handling

**5.04** Care should be exercised in handling the microfilm aperture cards to avoid subjecting the film to fingerprints, scratches, or other damage.

### Microfilm Files

**5.05** Appropriate files shall be provided to store the microfilm aperture cards associated with each central office. The T drawings for an average central office can be contained in file drawers 18 inches long, 8 inches wide, and 4 inches high.

## TABLE A

## KEYPUNCHING DRAWING NUMBER

| NO. AS SHOWN ON DRAWING | APERTURE CARD COLUMNS | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| ED-12346-01-2 | | | E | D | | | | 1 | 2 | 3 | 4 | 6 | | | | 0 | 1 | | | | | 2 | |
| ED-12345-11 | | | E | D | | | | 1 | 2 | 3 | 4 | 5 | | | | 1 | 1 | | | | | | |
| ED-12345-108, Sh 2 | | | E | D | | | | 1 | 2 | 3 | 4 | 5 | | | 1 | 0 | 8 | | | | | 2 | |
| H-816-042, Sh 2 | | | | H | | | | | | 8 | 1 | 6 | | | 0 | 4 | 2 | | | | | 2 | |
| J61563AA-2, Sh 2 | | | | J | | | | 6 | 1 | 5 | 6 | 3 | A | A | | | 2 | | | | | 2 | |
| T-1A123-108, Sh A123 | | | | T | | | | 1 | A | 1 | 2 | 3 | | | 1 | 0 | 8 | A | | 1 | 2 | 3 | |
| T-12345-30, Sh A3 | | | | T | | | | 1 | 2 | 3 | 4 | 5 | | | | 3 | 0 | A | | | | 3 | |
| T-12345-11, Sh A1 | | | | T | * | | | 1 | 2 | 3 | 4 | 5 | | | | 1 | 1 | A | | | | 1 | |

PREFIX — BASE — SUBCODE OR FAMILY — SUFFIX OR CATEGORY — SECTION — SHEET — INSERTED SHEET

*Notes*

A. See 3.06 and 3.07 for additional keypunching information.

B. An asterisk (*) is punched in column 5 to indicate a computer-generated wiring drawing.