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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

(affiliée à l'Organisation Internationale de Normalisation — ISO)

RECOMMANDATION DE LA CEI

INTERNATIONAL ELECTROTECHNICAL COMMISSION

(affiliated to the International Organization for Standardization — ISO)

IEC RECOMMENDATION

**Publication 113-3**

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1974

# Schémas, diagrammes, tableaux

## Troisième partie: Recommandations générales pour l'établissement des schémas

# Diagrams, charts, tables

## Part 3: General recommendations for the preparation of diagrams



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# DIAGRAMS, CHARTS, TABLES

## Part 3: General recommendations for the preparation of diagrams

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendations and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This recommendation has been prepared by Sub-Committee 3B, Preparation of Diagrams, Charts and Tables. Item Designation, of IEC Technical Committee No. 3, Graphical Symbols.

Two drafts were discussed at the meeting held in Paris in 1972. As a result of this meeting, a combined new draft, document 3B(Central Office)8, was submitted to the National Committees for approval under the Six Months' Rule in February 1973.

The following countries voted explicitly in favour of publication of Part 3:

| | |
|---|---|
| Australia | Japan |
| Austria | Netherlands |
| Belgium | Portugal |
| Denmark | Romania |
| Egypt | South Africa (Republic of) |
| Finland | Sweden |
| France | Switzerland |
| Germany | Turkey |
| Israel | United Kingdom |
| Italy | United States of America |

# DIAGRAMS, CHARTS, TABLES

## Part 3: General recommendations for the preparation of diagrams

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### 1. Introduction

The principles given in this recommendation apply to all types of electrical diagrams and are additional to those given for each type of diagram in other parts of the publication.

### 2. Drawing sizes

Preferably drawing sizes according to the international A-series, see ISO Recommendation R 216, should be used.

The choice of drawing sizes shall be decided after taking into account the following points:

- the volume and complexity of the design,
- the level of knowledge of personnel who will use the diagrams,
- the possibility of using a smaller size, but with a larger number of sheets,
- the requirements of filing and handling,
- the requirements of microfilming,
- the requirements of computer-aided design.

All sheets of a multi-sheet document shall be numbered in a manner which will relate them to one another.

### 3. Application of graphical symbols

3.1 *Different kinds of graphical symbols*

In IEC Publication 117, Recommended Graphical Symbols, different kinds of symbols are shown, e.g.:

- for items: block symbols, complete symbols;
- for parts of symbols: general symbols, qualifying symbols, supplementary symbols.

In some cases, symbols of different forms are shown, e.g.:

- preferred form, other forms;
- simplified form, complete form;
- for position or state: closed, latched, engaged;
- for diagrams: single-line, multi-line;
- for both large and small scale maps: planned, in service.

3.2 *Combinations and composition of symbols*

Publication 117 does not give all the possible examples. Any symbol may be composed by combining together the existing symbols in this publication, as well as with the letter symbols of IEC Publication 27, Letter Symbols to be used in Electrical Technology.

The use of qualifying or supplementary symbols given in certain parts of Publication 117 is not limited only to the chapter in which they appear.

If the required parts for building a symbol are not found in IEC publications, graphical or letter symbols established by other sources may be used, but in such a case their meaning should be clearly stated.

3.3 *Choice of symbols for a diagram*

When Publication 117 shows alternative forms, in principle the basic rules for the choice of a symbol should be:

*a)* to use the simplest form of symbol adequate for the particular purpose;

*b)* to use the preferred form wherever possible;

*c)* to use the chosen forms consistently throughout the same set of technical documents.

*Example:*

For a relatively simple explanatory diagram, such as a block diagram, and especially where single-line representation can be used, it is sufficient in many cases to use general or simplified form symbols. Example: for a transformer, see Figure 1.

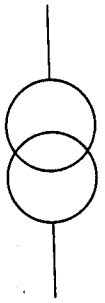


FIGURE 1

For an explanatory diagram intended to facilitate a detailed study, such as a circuit diagram, the general symbol may not be sufficient. For example, for the transformer it may be necessary to use a more detailed symbol including supplementary or qualifying symbols showing the connection of windings and the vector symbol group according to IEC Publication 76, Power Transformers. For example, see Figure 2. The simplified symbol form (Form Ia), however, may still be sufficient.

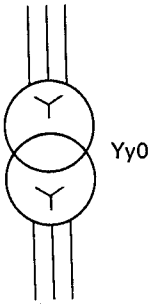



FIGURE 2

For a diagram, in which all the parts, such as windings, terminals and their designations have to be shown in detail, it may be necessary to use the complete form symbol. Example: for a transformer, see Figure 3.

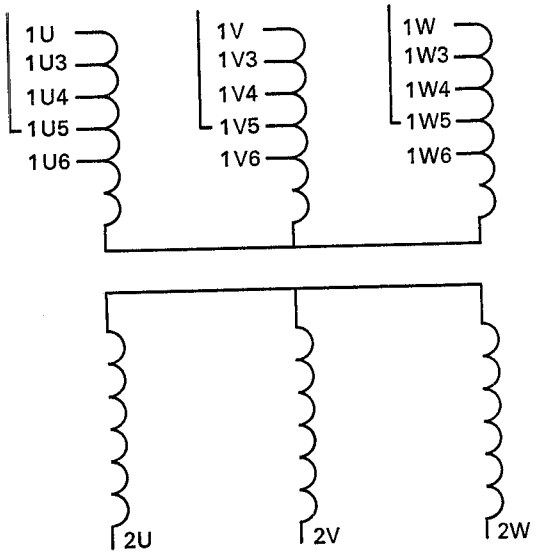



FIGURE 3

3.4 *Symbol size, line thicknesses*

In most cases, the meaning of a symbol is defined by its *form*. The *size* and the *line thickness* do not, as a rule, affect the meaning of the symbol.

In some cases, it may be desirable to use different sizes of symbols:

*a)* to emphasize certain aspects;

*b)* to facilitate the inclusion of additional information.

In Figure 4, a machine set consisting of a 3-phase generator is shown in two different manners. The left-hand variant uses symbol sizes as shown in IEC Publication 117-2, Recommended Graphical Symbols, Part 2: Machines, Transformers, Primary Cells and Accumulators, Transductors and Magnetic Amplifiers, Inductors. The right-hand variant shows the 3-phase generator symbol larger than the exciter symbol.

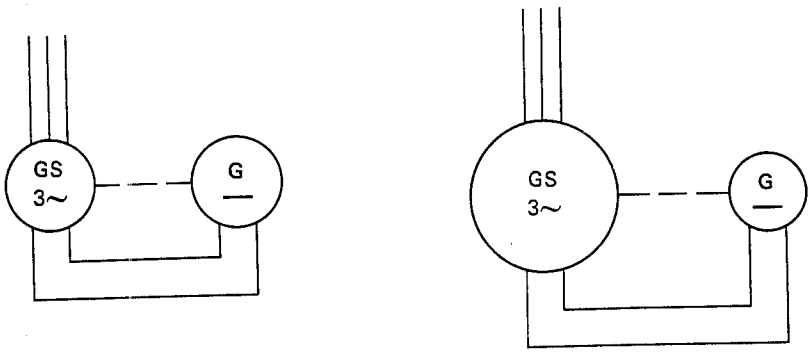



FIGURE 4

In Figure 5, a binary logic AND element is shown to the left as in IEC Publication 117-15, Recommended Graphical Symbols, Part 15: Binary Logic Elements. To the right, the symbol size is increased to make possible the inscription of pin numbers, additional designations and other information.

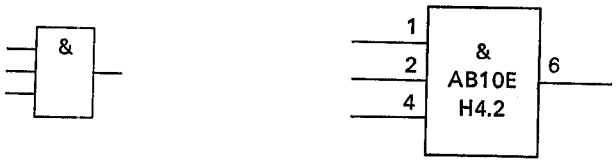



FIGURE 5

To emphasize or distinguish circuits, different line thicknesses may be used for conductor symbols. Figure 6 shows a three-phase transformer with a part of its associated switchgear and controlgear in which the power circuits are represented by heavier lines.

For additional emphasis, thicker lines may be used for other symbols than those of conductors.

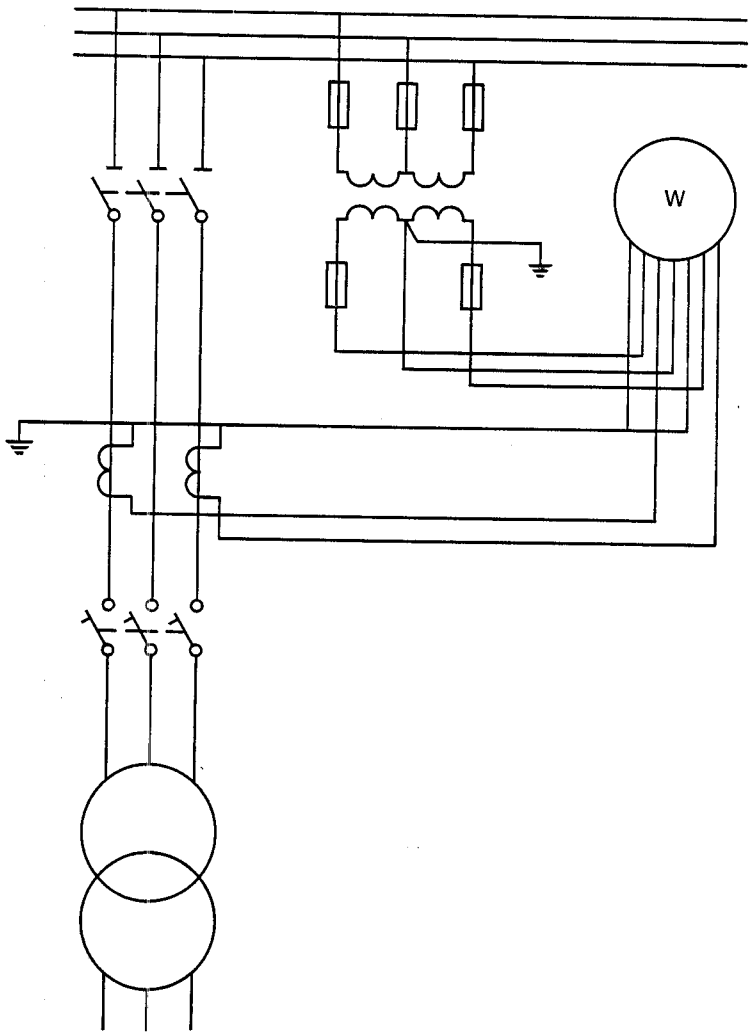



FIGURE 6

3.5 *Orientation of symbols*

The orientation of most symbols as shown in Publication 117 is not mandatory. Unless otherwise indicated, symbols may be turned or mirror-imaged to avoid conductor bends and cross-overs.

When part of a symbol is derived from the characteristic curve of a device, this part of the symbol shall not be turned.

Waveforms or their stylized representations should be shown the way they normally appear on an oscilloscope screen.

3.6 *Representation of terminals*

In Publication 117, terminal symbols are not generally used. In some special cases, the terminal symbols are part of the graphical symbols and must be shown. However, generally it is not necessary to add symbols for terminals brushes, etc., to the symbols for components.

If, for certain types of diagrams, it is necessary to give symbols representing terminals, these should be in accordance with Symbols 64 and 65 of IEC Publication 117-1, Recommended Graphical Symbols, Part 1: Kind of Current, Distribution Systems, Methods of Connection and Circuit Elements. In the same way, if symbols for brushes are necessary, they should be chosen from Publication 117-2, Symbols 107 to 110.

3.7 *Representation of conductors*

In Publication 117, symbols for components, machines etc. are generally shown with conductors. In these cases, the conductor symbols are used as examples only. Other ways of representing the conductors are permissible provided that the meaning of the symbol is not changed.

*Example:*

For a frequency multiplier in single-line representation, Publication 117 shows the symbol as in Figure 7. Other variants are permissible, as for example in Figure 8.

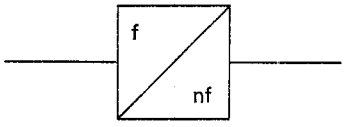



FIGURE 7

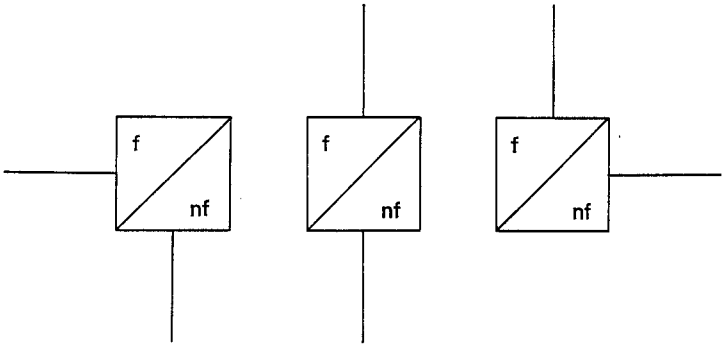



FIGURE 8

On the other hand, in a few cases the conductor symbols affect the meaning of the component symbol and shall therefore be drawn as shown in Publication 117.

*Example:*

Resistor, Figure 9; relay coil, Figure 10.

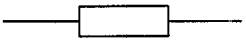


FIGURE 9

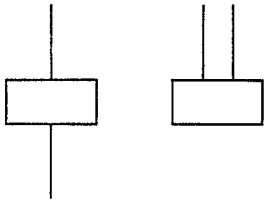


FIGURE 10

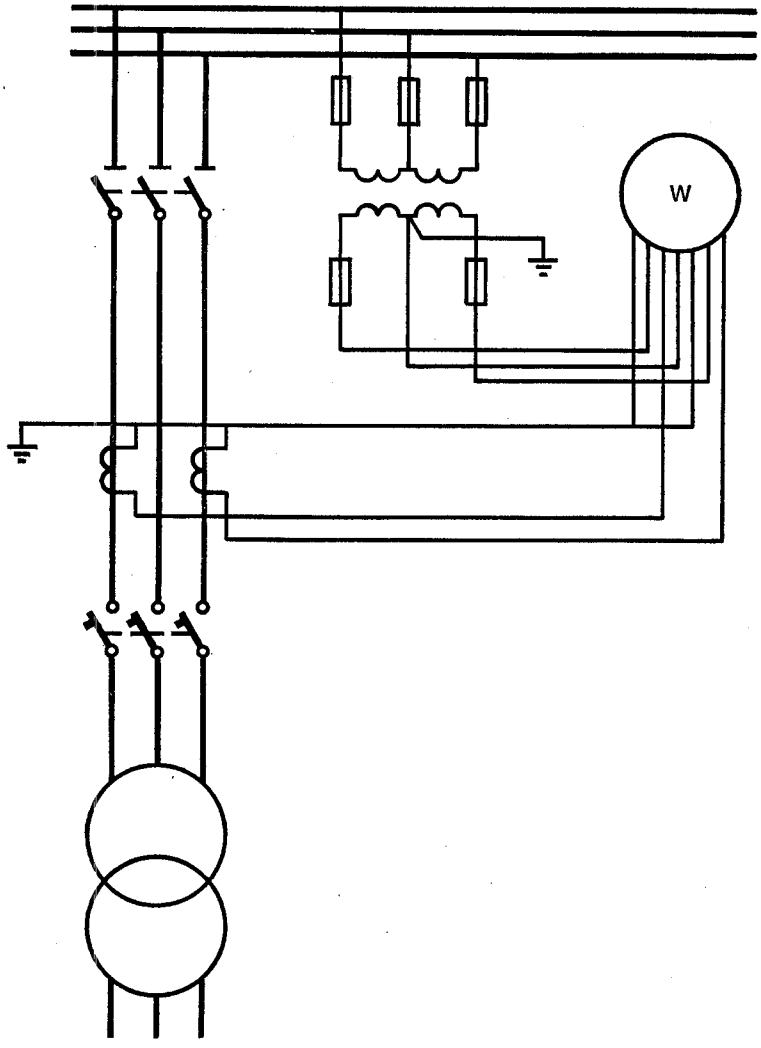
# ERRATUM

**Page 12**

*Remplacer la figure 6 existante par la figure suivante:*

**Page 13**

*Replace the existing figure 6 by the following:*



## 4. **Connecting lines**

### 4.1 *Identification of connecting lines*

Connecting lines, whether single or in groups, shall be identified. This identification, which may be near the line or in a gap in the line, may also serve to indicate destination. For example, see Figure 11.


FIGURE 11

### 4.2 *Multi-line representation*

Where there are a number of parallel lines representing conductors, they shall be arranged according to their function in groups separated from each other by spaces wider than those between the lines of a group.

If grouping according to function is not practicable, it is helpful to arrange the lines in arbitrary groups of not more than three. For example, see Figure 12.

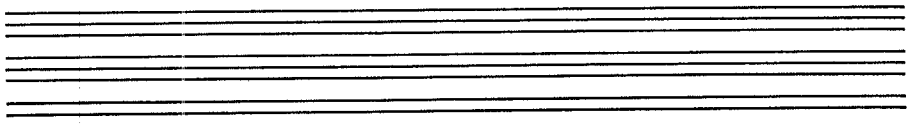


FIGURE 12

### 4.3 *Single-line representation*

Single-line representation, the essential purpose of which is to avoid a multiplicity of parallel lines, may be used in a multi-line diagram. For example, see Figure 13.

FIGURE 13

If the terminations of a group of lines are consecutively numbered at each end, as in Figure 14 (multi-line representation), a simplified representation as shown in Figure 15 may be used.

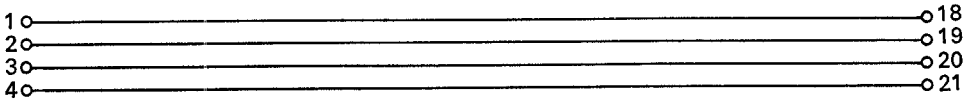



FIGURE 14

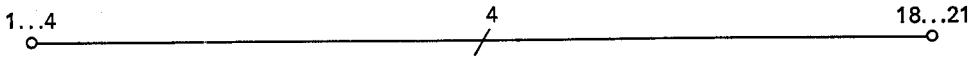



FIGURE 15

If the terminations are not in the same order, they should be designated as shown in Figure 16.


FIGURE 16

The method shown by Symbols 60 to 63 in Publication 117-1 should be used when a single line represents a group of conductors. In this case, it is always necessary to show an identification mark at each conductor symbol. For example, see Figure 17.

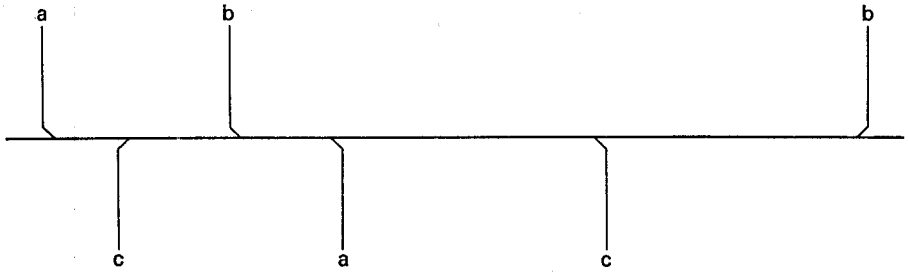



FIGURE 17

4.4 *Omitting lines*

When a line representing a conductor crosses a relatively large part of a diagram, most of the line may be omitted and the connection indicated by references. For example, see Figure 18.

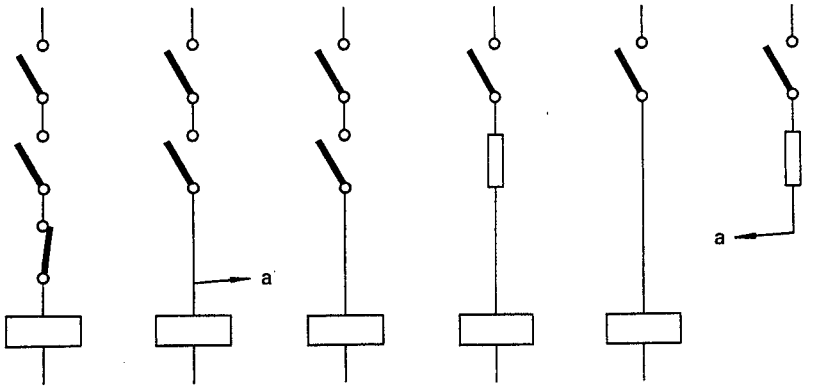



FIGURE 18

Groups of lines on a diagram may be omitted for most of their length, provided their ends are enclosed by suitable referenced brackets (see Figure 19).


FIGURE 19

4.5 *Number of conductors*

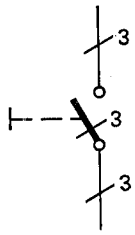
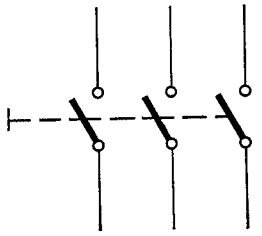
In single-line representation, the number of conductors represented by a single symbol should be indicated where necessary. Publication 117 gives many examples of how this should be done. The following are additional examples.

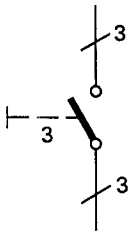
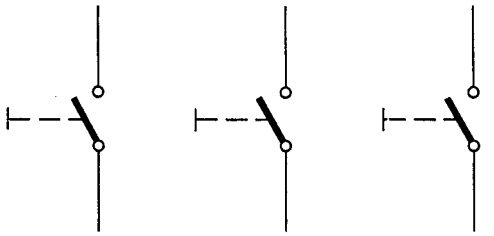
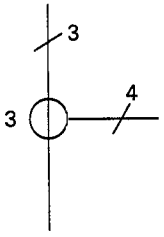
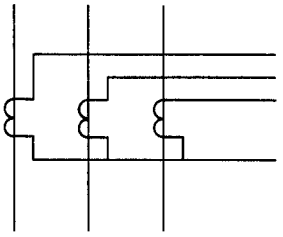
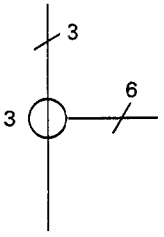
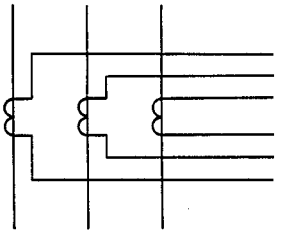
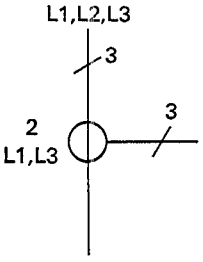
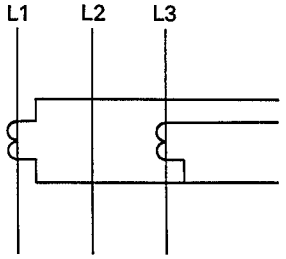
| Figure | Example | Description |
|---|---|---|
| 20.1 |   | One three-conductor cable with sealing end |
| 20.2 |  | One three-conductor cable with sealing end, simplified forms |
| 20.3 |   | |

## 5. Application of single-line representation to apparatus

In single-line representation, the number of devices represented by a single symbol should be indicated where necessary. Publication 117 gives many examples of how this should be done. The following are additional examples.

*Note.* — Single-line representation can give rise to difficulties of interpretation and it should therefore be used with care. In cases of doubt, the number of conductors should be indicated on either side of the symbol for the device.

| Figure | Example | Description |
|---|---|---|
| 21 |   | One three-pole switch, manually operated<br>Multi-line equivalent:  |

| Figure | Example | Description |
|---|---|---|
| 22 |  | Three single-pole switches, each manually operated<br>Multi-line equivalent:<br>  |
| 23 |  | Three conductors, each with a current transformer and a total of four secondary connections brought out<br>Multi-line equivalent:<br>  |
| 24 |  | Three conductors, each with a current transformer and a total of six secondary connections brought out<br>Multi-line equivalent:<br>  |
| 25 |  | Three conductors L1, L2, L3, two of which have a current transformer, with a total of three secondary connections brought out<br>Multi-line equivalent:<br>  |

## 6. Methods of indicating symbol location

There are several satisfactory methods of indicating symbol location. The grid reference system which finds general application is described below.

Some other methods, applicable to circuit diagrams, are described in Publication 113-4 (under consideration).

When the grid reference system is used, each sheet is divided into rectangular zones which are identified, for example, by numbers from left to right (columns) and letters from top to bottom (rows). For example, see Figure 26.

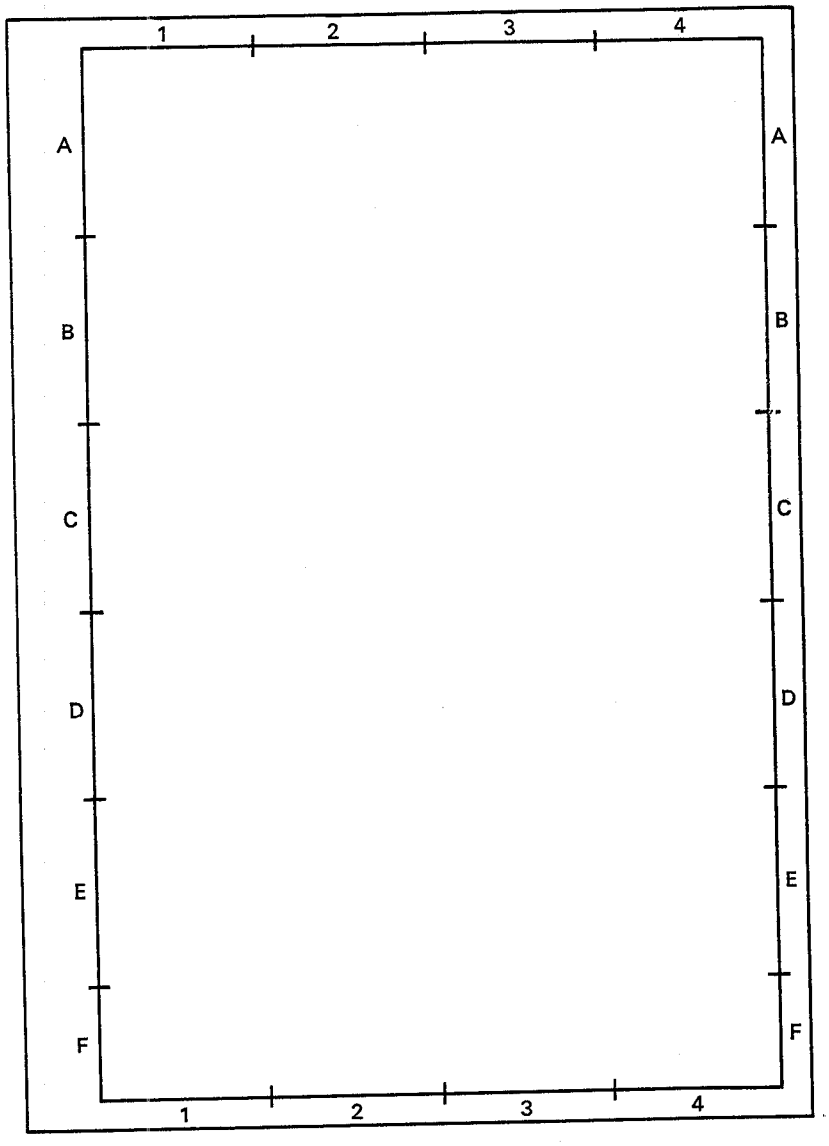



FIGURE 26

The width and height of the zones may depend on the size of the sheet and the complexity of the diagram.

The location of each symbol or circuit in a diagram can be indicated by the number and letter of the zone containing the symbol or circuit. In certain cases, it may be sufficient to use only a column or row designation.

The method of referencing shall be consistent. See Table I.

TABLE I

*Examples*

| For referring to: | Write reference as below: |
|---|---|
| row G on the same sheet | G |
| column 7 on the same sheet | 7 |
| rectangular zone G7 on the same sheet | G7 |
| rectangular zone G7 on sheet 34 of the same diagram (i.e., with the same drawing number) | 34/G7 |
| rectangular zone G7 of single-sheet diagram No. 4568 | Diagram 4568/G7 |
| rectangular zone G7 on sheet 34 of diagram No. 5796 | Diagram 5796/34/G7 |

If there is a risk, when using the diagram, of confusing the grid reference of the symbol with other designations referring to the actual equipment, the grid reference should be written in parenthesis.

## 7. **Operational state to be represented**

Apparatus shall normally be shown in the de-energized or unoperated position or state. For example, relay contacts shall be shown in the de-energized state of the relay.

It is essential that parts of a multi-switching device are shown in a mutually consistent position or state, irrespective of whether the circuit is in the unoperated condition or not.

To avoid ambiguity, a special indication on the diagram (e.g. by a note or a chart) is needed:

*a)* for apparatus which may rest in any one of two or more positions or states;

*b)* if it is essential to show a circuit in a particular operated position or state.

Switches for emergency, standby, alarm, etc., circuits should be shown in the positions which they occupy during normal service of the equipment or in a specific defined condition (e.g. aircraft on the ground).

Test switches and similar devices should be shown in normal position, not in test position.