SRI LANKA STANDARD 690 : PART 4 1985
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# GRAPHICAL SYMBOLS USED IN ELECTROTECHNOLOGY

## PART 4 – MACHINES, TRANSFORMERS, PRIMARY CELLS AND ACCUMULATORS

SRI LANKA STANDARDS INSTITUTION

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## PART 4 : MACHINES, TRANSFORMERS, PRIMARY CELLS AND ACCUMULATORS

SLS 690:Part 4:1985

Gr. 13



SRI LANKA STANDARDS INSTITUTION
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Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

# SRI LANKA STANDARD
# GRAPHICAL SYMBOLS USED IN ELECTROTECHNOLOGY
## PART 4 : MACHINES, TRANSFORMERS, PRIMARY CELLS AND ACCUMULATORS

**FOREWORD**

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1985-10-11, after the draft finalized by the Drafting Committee on Graphical Symbols used in Electrotechnology has been approved by the Electrical Engineering Divisional Committee.

This standard is one of the series of Sri Lanka Standards for Graphical Symbols used in electrotechnology.

It is common in electrical engineering practice to employ graphical symbols to denote the various means and devices used when making diagrams of connections. With the object of making these diagrams easy to understand and universal in meaning, it has become necessary to standardize the basic symbols for various devices commonly come across in the field of electrical engineering.

In selecting and devising these symbols the object has been to ensure that symbols, as far as possible, are self explanatory and easy to draw in general use. It may be necessary in detailed diagrams to indicate the physical structure of the appratus, the actual position of the terminals and so forth, but where possible the principle of the standard symbols should be followed.

In the preparation of this standard the assistance derived from the publications of the International Electrotechnical Commission, the British Standards Institution and the Indian Standards Institution is gratefully acknowledged.

**1.0 SCOPE**

This standard lays down different forms and elements of symbols to represent Rotating Machines, Transformers, Primary Cells and accumulators.

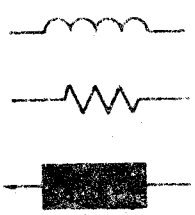
## 2.0 FORMS OF SYMBOLS

**2.1** In this Standard, more than one symbol have been used to designate the same type of rotating machine or transformer depending on the type and class of drawing involved. For same type of rotating machines, is simplified as well as the complete, multi-lone symbols have been specified. In the case of transformers, symbols for single-line and multi-line representation have been given separately.

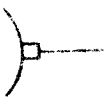
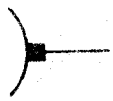
2.2 Symbols of machines for single-line representation may be derived from that for multi-line representation.

2.3 The relative dimensions of the different symbols and of their elements used in the Standard are not obligatory.

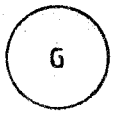
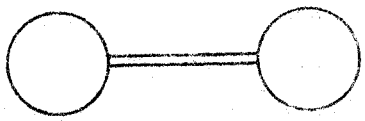
## 3.0 ELEMENTS OF SYMBOLS

| No. | Symbol | Description |
|---|---|---|
| 3.1 | preferred  | Winding<br>*Note 1 :Symbols same as SLSI Publication (....) Part 2 Symbols No.51.0, 51.1, 51.2. However, in this standard only the preferred from is used for simplicity.*<br>*Note 2 : When this form of symbol is used the number of half-circles is not fixed but, if desired, a distinction might be made for the different windings of a machine as specified below:* |
| 3.1.1 |  | Commutating or compensating winding. |
| 3.1.2 |  | Series winding. |
| 3.1.3 |  | Shunt winding or separate winding. |

| No. | Symbol | Description |
|---|---|---|
| 3.2 | | Terminals |
| 3.2.1 |  | *Note 1 : Terminals are drawn in the symbols only if this is essential. In this case symbols No.* **42.0** or **42.1** of SLSI Publication (....) Part 2 are used. |
| 3.2.2 | | |
| 3.2.3 |  | *Note 2 : It is recommended that the centres of symbols* **42.0** *or* **42.1** *should be placed on the line of the main symbol.* |
| 3.3 | | Junctions of Conductors |
| 3.3.1 |  | *Note 1 : Symbols No.* **43.0** *to* **44.2** *of SLSI Publication (....) Part 2 are used for this purpose.* |
| 3.3.2 |  | |
| 3.3.3 |  | *Note 2 : The symbols of connection of conductors (42.0 or 42.1) may be omitted for a simple junction ; it must always be used for a double junction.* |
| 3.3.4 |  | |
| 3.3.5 |  | |
| 3.3.6 |  | |

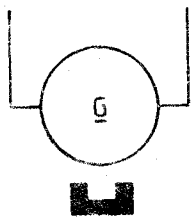
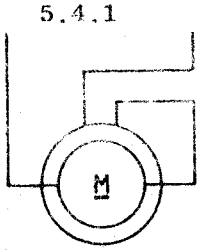
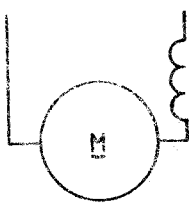
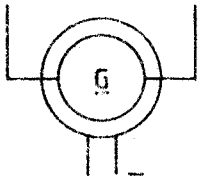
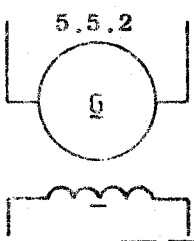
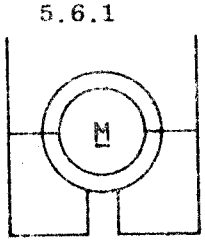
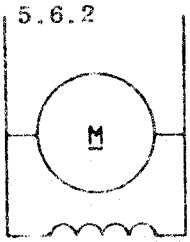
| No. | Symbol | Description |
|---|---|---|
| 3.4 | | Brushed<br><br>*NOTE - Brushes are shown only if this is necessary.* |
| 3.4.1 |  | |
| | or | |
| 3.4.2 |  | Brush on slip-ring |
| 3.4.3 |  | |
| | or | |
| 3.4.4 |  | Brush on Commulator |
| 3.5 | | Supplementary indications, Numberical data<br><br>*NOTE - Supplementary indications (method of connecting windings, letters M, G or C for motor generator or controller) and numerical data are given only if this is necessary; numerical data are shown only on one symbol for each class of machines, as an example.* |

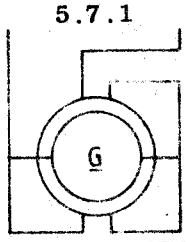
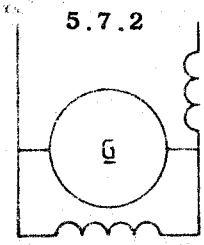
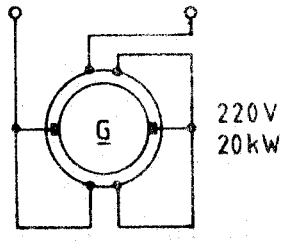
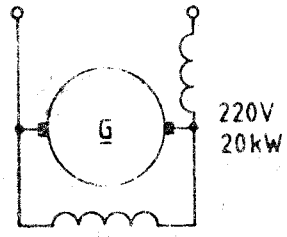
## 4.0 GENERAL SYMBOLS FOR MACHINES

| No. | Symbol | Description |
|---|---|---|
| 4.1 |   | Generator |
| 4.2 |   | Motor |
| 4.3 |   | Machine capable of use as generator or motor |
| 4.4 |  | Mechanically coupled machines |

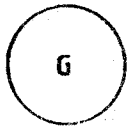
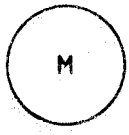
## 5.0 DIRECT CURRENT MACHINES

| No. | Symbol | Description |
|---|---|---|
| 5.1 |   | Direct current generator (General symbol) |
| 5.2 |   | Direct current motor (General symbol) |

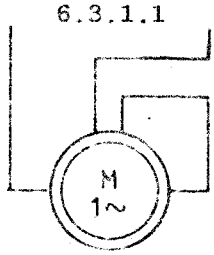
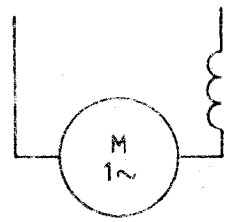
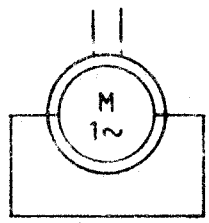
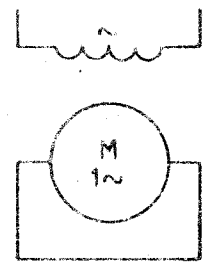
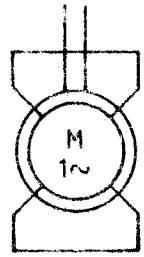
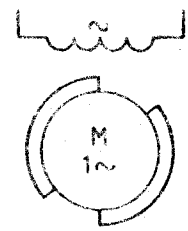
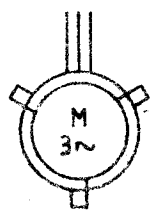
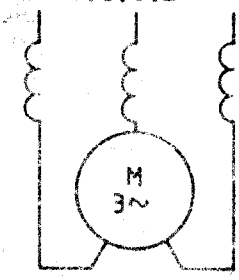
| No. | Symbol | | Description |
|---|---|---|---|
| | Multi-line Representation | | |
| | Simplified Form | Complete Form | |
| 5.3 | |   | D.C. 2-wire permanent magnet generator (G) or motor (M). |
| 5.4 | 5.4.1   | 5.4.2   | D.C. 2-wire series generator (C) or motor (M). |
| 5.5 | 5.5.1   | 5.5.2   | D.C. 2-wire generator (G) or motor (M) separately excited. |
| 5.6 | 5.6.1   | 5.6.2   | D.C. 2-wire shunt generator (G) or motor (M). |

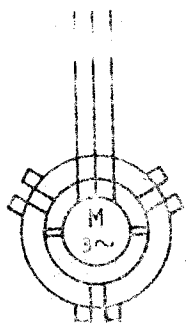
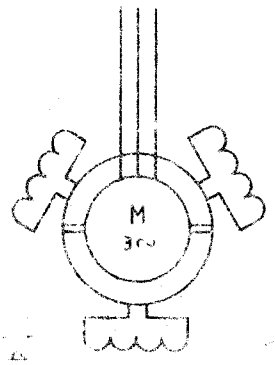
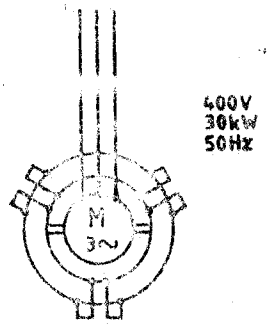
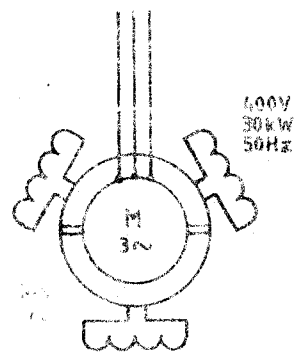
| No. | Symbol | | Description |
|---|---|---|---|
| | Multi-line Representation | | |
| | Simplified Form | Complete Form | |
| 5.7 | 5.7.1   | 5.7.2   | D.C. 2-wire generator (G) or motor (M) compound excited short shunt. |
| 5.8 | 5.8.1   | 5.8.2   | D.C. 2-wire generator compound excited, short shunt, 220V, 20 kW. |

## 6.0 ALTERNATING CURRENT MACHINES

| No. | Symbol | Description |
|---|---|---|
| 6.1 |   | A.C. generator (General symbol) |
| 6.2 |   | A.C. motor (General symbol) |

## 6.3 Alternating current commutator machines

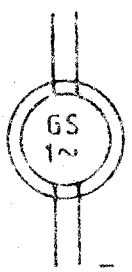
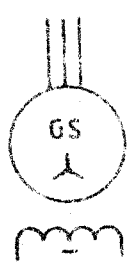
| No. | Symbol | | Description |
|---|---|---|---|
| | Multi-line Representation | | |
| | Simplified Form | Complete Form | |
| 6.3.1 | 6.3.1.1   | 6.3.1.2   | A.C. series motor single phase |
| 6.3.2 | 6.3.2.1   | 6.3.2.2   | Repulsion motor, single phase |
| 6.3.3 | 6.3.3.1   | 6.3.2.2   | A.C. series motor, single phase "Deri" type. |
| 6.3.4 | 6.3.4.1   | 6.3.4.2   | A.C. series motor, three phase. |

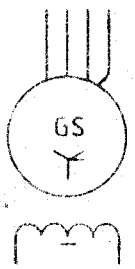
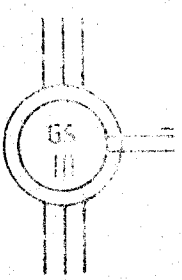
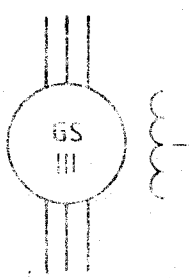
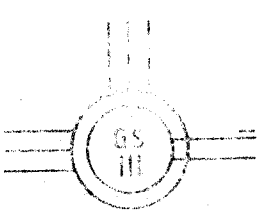
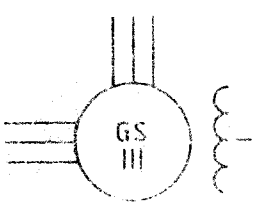
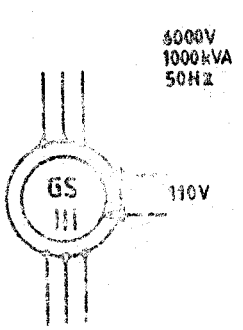
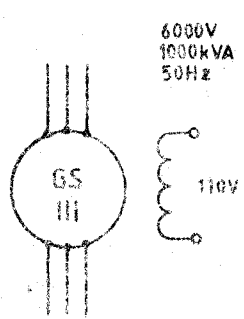
| No. | Symbol | | Description |
|---|---|---|---|
| | Multi-line Representation | | |
| | Simplified Form | Complete Form | |
| 6.3.5 | 6.3.5.1   | 6.3.5.2   | Shunt characteristic brush shifting motor, three phase, rotor fed (Scharge) with double set of brushes.<br><br>The two circles connected by little parallel strokes represent two windings of the same rotor. |
| 6.3.6 | 6.3.6.1   | 6.3.6.2   | Example of a symbol showing terminals, brushes and numerical data:<br><br>Shunt characteristic brush shifting motor, three phase, rotor fed (Scharge) with 400 V double set of brushes 30 kW 50 HZ.<br><br>The two circles connected by little parallel strokes represent two windings of the same rotor. |

## 7.0 SYNCHRONOUS MACHINES

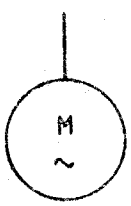
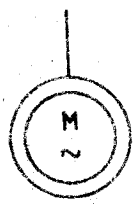
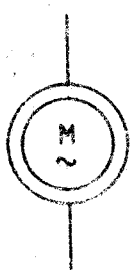
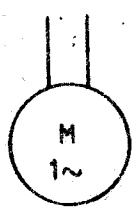
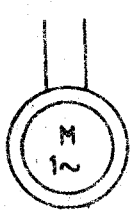
| No. | Symbol | Description |
|---|---|---|
| 7.1 |   | Synchronous generator (General symbol) |
| 7.2 |   | Synchronous motor (General symbol) |

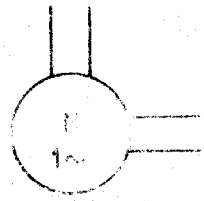
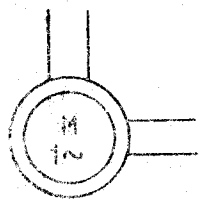
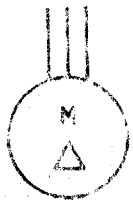
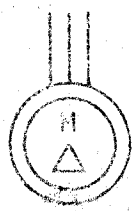
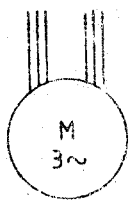
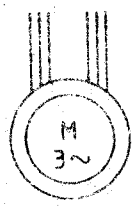
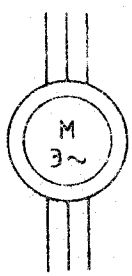
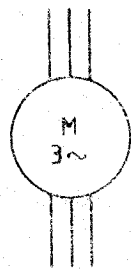
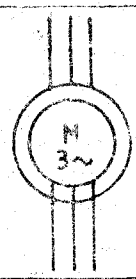
*NOTE - In Symbols 7.3 to 7.7 groups of conductors may be placed in another manner than shown below:*

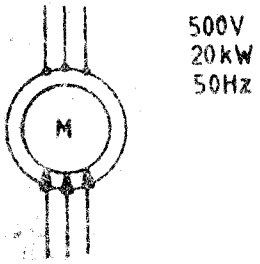
| | Multi-line representation | | |
|---|---|---|---|
| | Simplified Form | Complete Form | |
| 7.3 | |   | Permanent magnet synchronous generator (GS) or synchronous motor (MS) three-phase. |
| 7.4 | 7.4.1   | 7.4.2   | Synchronous generator (GS) or synchronous motor (MS) single phase. |
| 7.5 | 7.5.1   | 7.5.2   | Synchronous generator (GS) or synchronous motor (MS) three-phase star-connected, neutral not brought out. |

| No. | Symbol | | Description |
|---|---|---|---|
| | Multi-line representation | | |
| | Simplified Form | Complete Form | |
| 7.6 | 7.6.1   | 7.6.2   | Synchronous generator (GS) or synchronous motor (MS) three-phase star-connected with neutral brought out. |
| 7.7 | 7.7.1   | 7.7.2   | Synchronous generator (GS) or synchronous motor (MS) three-phase both leads of each phase brought out. |
| | 7.7.5   | 7.7.6   | |
| |   |   | Example:<br><br>2 variants of<br>No. 7.7.1 and 7.7.2 |
| |   |   | Example of a symbol showing terminals, brushes and num numerical data:<br><br>Synchronous generator (GS) or synchronous motor (MS) three phase both leads of each phase brought out,<br>6000 V, 1000 kVA, 50 Hz<br>110V- |

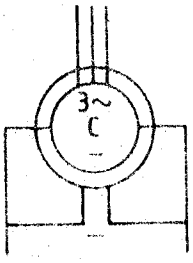
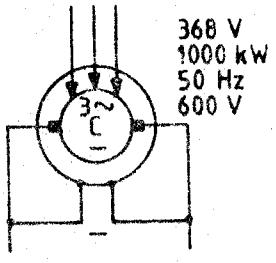
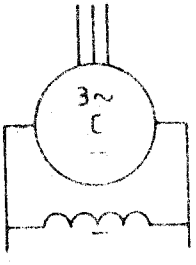
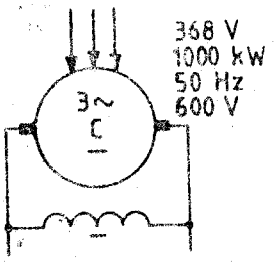
## 8.0 INDUCTION MACHINES

| No. | Symbol | Description |
|---|---|---|
| *NOTE - In symbols* **8.1** *to* **8.9** *groups of conductors may be placed in another manner than generally shown below:*<br>*e.g. symbol* **8.6** | | |
| 8.1 | 8.1.1   8.1.2   | Induction motor, with short-circuited rotor (General symbol) |
| 8.2 |   | Induction motor, with wound rotor (General symbol) |
| 8.3 | 8.3.1   8.3.2   | Induction motor, single phase, squirrel-cage. |

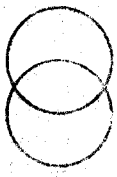
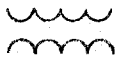
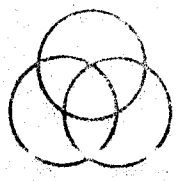
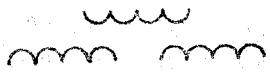
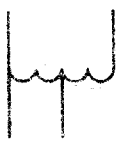
| No. | Symbol | Description |
|---|---|---|
| 8.4 | 8.4.1   8.4.2   | Induction motor, single phase, squirrel-cage, leads of split phase brought out. |
| 8.5 | 8.5.1   8.5.2   | Induction motor, three-phase squirrel-cage. |
| 8.6 | 8.6.1   8.6.2   8.6.3   8.6.4   | Induction motor, three-phase, squirrel-cage, both leads of each phase brought out. |
| 8.7 |   | Induction motor, three-phase, with wound rotor. |

| No. | Symbol | Description |
|---|---|---|
| 8.8 |  | Induction motor, three-phase star-connected, with automatic starter in rotor. |
| | Multi-line Representation | |
| 8.9 |  | Example of a symbol showing terminals, brushes and numerical data:<br>Induction motor, three-phase, with wound rotor 500V 20kW 50Hz. |

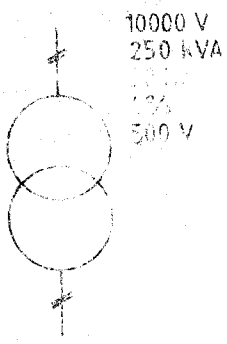
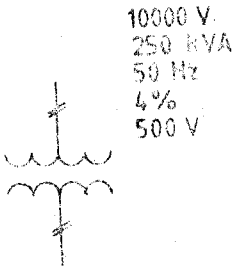
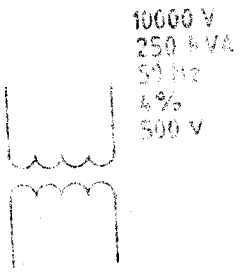
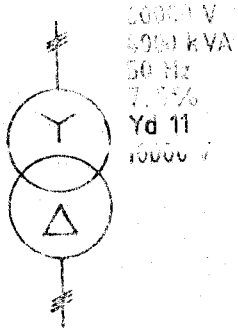
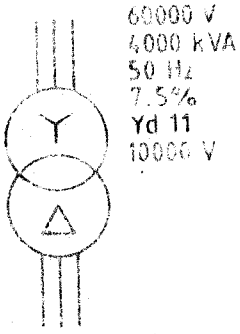
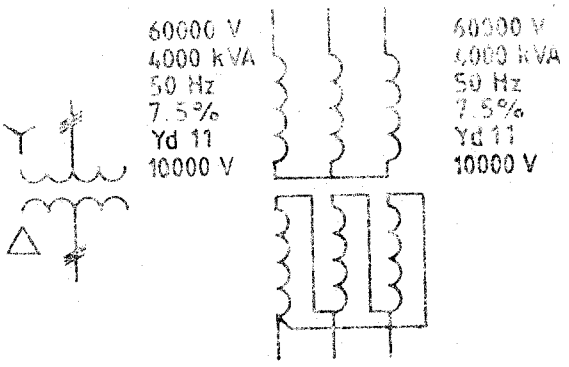
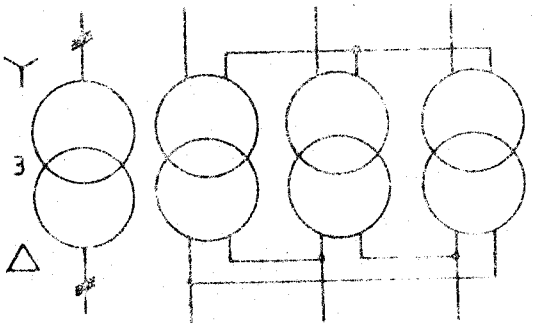
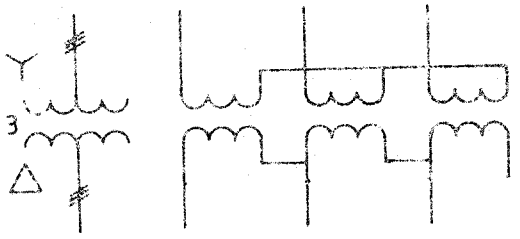
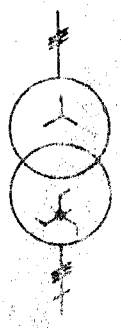
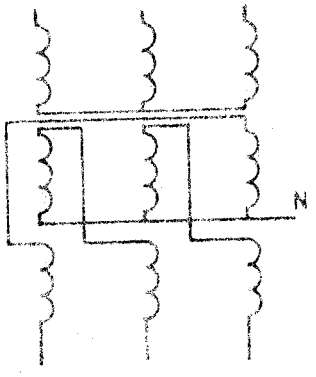
## 9.0 SYNCHRONOUS CONVERTERS

| No. | Symbol | | Description |
|---|---|---|---|
| 9.1 |  | | Synchronous converter<br>(General symbol) |
| | Multi-line Representation | | |
| | Simplified Form | Complete Form | |
| 9.2 | 9.2.1<br>  <br>  | 9.2.2<br>  <br>  | Three-phase synchronous converter, shunt excited<br><br>Example of a symbol showing terminals, brushes and numerical data:<br><br>Three-phase synchronous converter, shunt excited 600V, 1000kW, 50Hz |

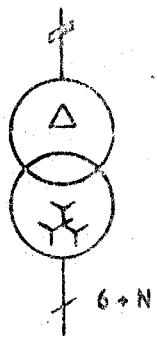
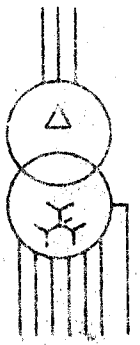
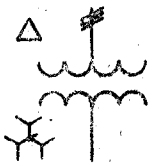
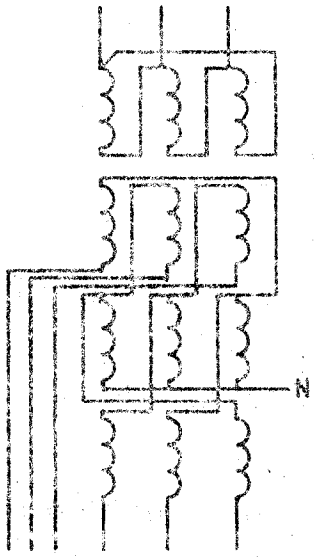
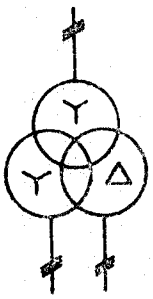
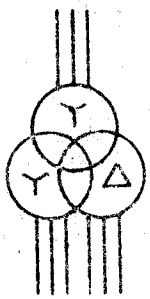
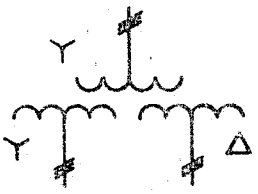
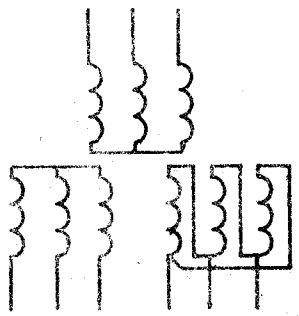
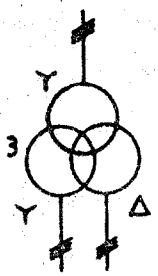
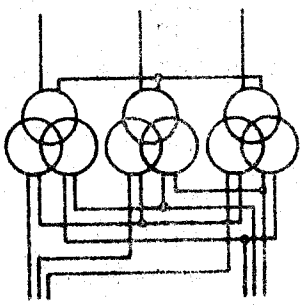
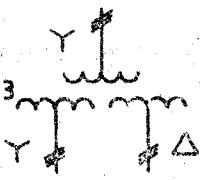
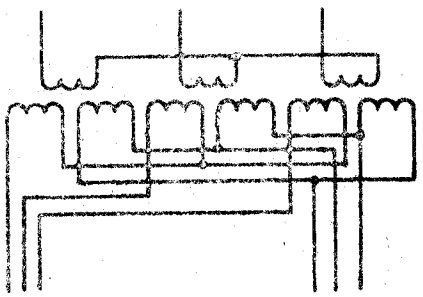
## 10.0 TRANSFORMERS

| No. | Symbols | | Description |
|---|---|---|---|
| | Multi-line Representation | | |
| | Simplified Form | Complete Form | |
| 10.1 | 10.1.1  | 10.1.2  | Transformer with two separate windings. |
| 10.2 | 10.2.1  | 10.2.2  | Transformer with three separate winding. |
| 10.3 | 10.3.1  | 10.3.2  | Auto Transformer. |

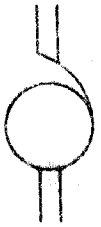
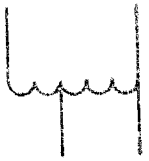
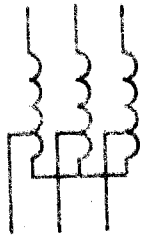
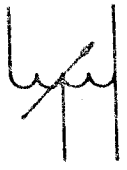
## 11.0 TRANSFORMERS WITH 2 OR 3 WINDING

| No. | Symbols | | | |
|---|---|---|---|---|
| | Simplified Form | | Complete Form | |
| | Single line | Multi line | Single line | Multi line |
| 11.1 | 11.1.1 | 11.1.2 | 11.1.3 | 11.1.4 |
| |  |  |  |  |
| 11.2 | 11.2.1 | 11.2.2 | 11.2.3 | 11.2.4 |
| |  |  |  | |
| 11.3 | 11.3.1 | 11.3.2 | 11.3.3 | 11.3.4 |
| |  | |  | |
| 11.4 | 11.4.1 | 11.4.2 | 11.4.3 | 11.4.4 |
| |  |  |  |  |

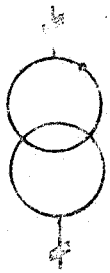
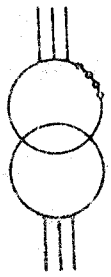
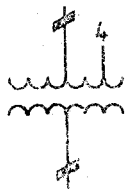
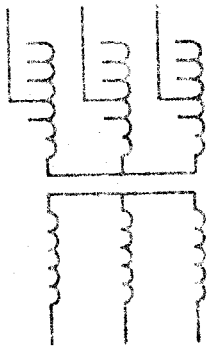
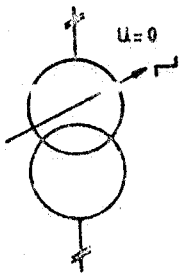
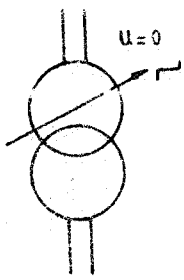
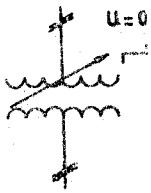
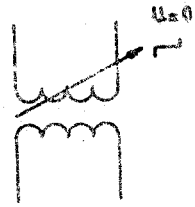
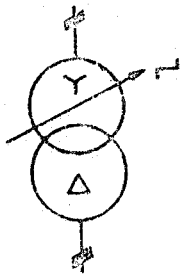
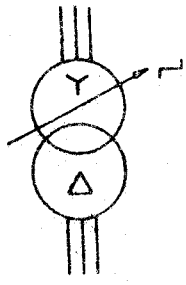
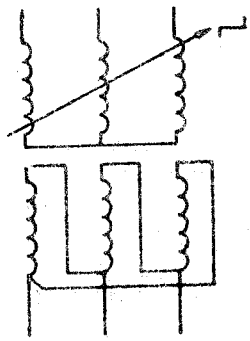
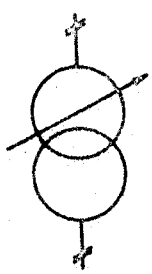
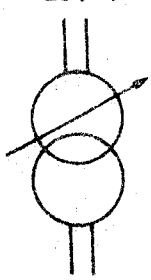
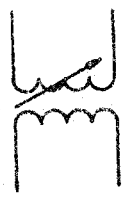
| NO. | Description |
|---|---|
| 11.1 | Single-phase transformer with two separate windings.<br><br>Example:<br><br>10000/500V<br>250 kVA 50Hz<br>short-circuit voltage : 4% |
| 11.2 | Three-phase transformer with two separate windings.<br><br>Example:<br><br>Star-delta<br>60000/10000V<br>4000kVA 50Hz<br>Connection: Yd 11<br>Short-circuit voltage : 7.5%<br><br>(If necessary, the phase-angles may be indicated by vector symbols or hour-numbers as (defined in I.E.C. Publication 76). |
| 11.3 | Three-phase-bank of single-phase transformers with two separate windings.<br><br>Connection: star-delta. |
| 11.4 | Three-phase transformer with two separate windings.<br><br>Connection: star -Zig-Zag. |

| No. | Symbol | | | |
|---|---|---|---|---|
| | Simplified Form | | Complete Form | |
| | Single line | Multi line | Single line | Multi line |
| 11.5 | 11.5.1 | 11.5.2 | 11.5.3 | 11.5.4 |
| |   |  |  |   |
| 11.6 | 11.6.1 | 11.6.2 | 11.6.3 | 11.6.4 |
| |  |  |  |  |
| 11.7 | 11.7.1 | 11.7.2 | 11.7.3 | 11.7.4 |
| |   |  |   |  |

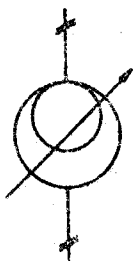
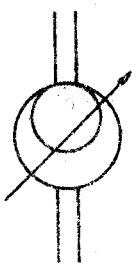
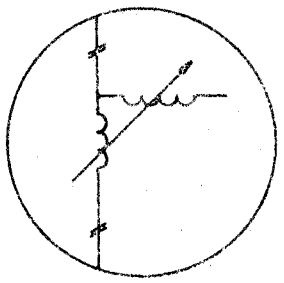
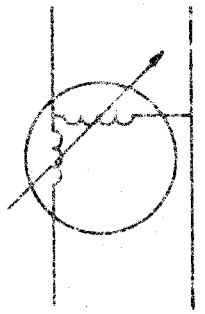
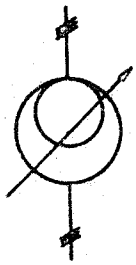
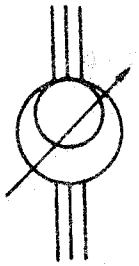
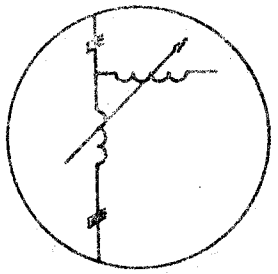
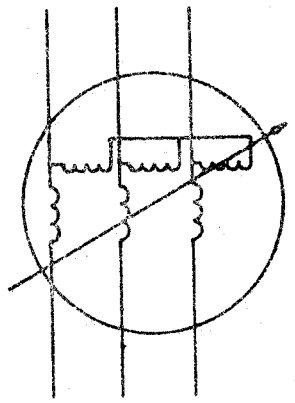
| NO. | Description |
|---|---|
| 11.5 | Three-phase transformer with two separate windings.<br><br>Connection : delta -6-phase fork. |
| 11.6 | Three-phase transformer with three separate windings.<br><br>Connection : star-star-delta. |
| 11.7 | Three-phase-bank of single-phase transformers with three separate windings.<br><br>Connection : star-star-delta. |

| No. | Symbol | | | |
|---|---|---|---|---|
| | Simplified Form | | Complete Form | |
| | Single line | Multi line | Single line | Multi line |
| 12.1 | 12.1.1  | 12.1.2  | 12.1.3  | 12.1.4  |
| 12.2 | 12.2.1  | 12.2.2  | 12.2.3  | 12.2.4  |
| 12.3 | 12.3.1  | 12.3.2  | 12.3.3  | 12.3.4  |

| NO. | Description |
|---|---|
| 12.1 | Auto-transformer, single-phase |
| 12.2 | Auto-transformer, three-phase<br><br>Connection : star. |
| 12.3 | Single-phase auto-transformer with continuous voltage regulation. |

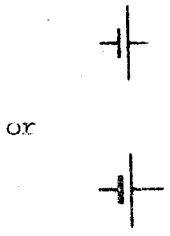
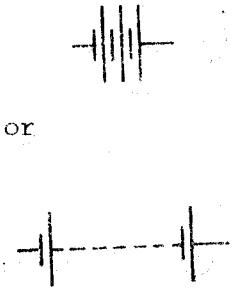
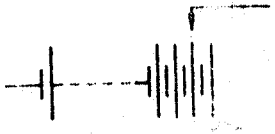
| No. | Symbol | | | |
|---|---|---|---|---|
| | Simplified Form | | Complete Form | |
| | Single line | Multi line | Single line | Multi line |
| 13.1 | 13.1.1  | 13.1.2  | 13.1.3  | 13.1.4  |
| 13.2 | 13.2.1   | 13.2.2   | 13.2.3   | 13.2.4   |
| 13.3 | 13.3.1  | 13.3.2  | 13.3.3  | 13.3.4  |
| 13.4 | 13.4.1  | 13.4.2  | 13.4.3  | 13.4.4  |

| No. | Description |
|---|---|
| 13.1 | Three-phase transformer with 4 tappings. |
| 13.2 | Single-phase transformer with off-voltage tap changer. |
| 13.3 | Three-phase transformer with on-load tap changer. |
| 13.4 | Single-phase transformer with continuous voltage regulation. |

| No. | Symbol | | | |
|---|---|---|---|---|
| | Simplified Form | | Complete Form | |
| | Single line | Multi line | Single line | Multi line |
| 14.1 | 14.1.1  | 14.1.2  | 14.1.3  | 14.1.4  |
| 14.2 | 14.2.1  | 14.2.2  | 14.2.3  | 14.2.4  |

| No. | Description |
|---|---|
| 14.1 | Single-phase induction regulator |
| 14.2 | Three-phase induction regulator. |

## 15.0 PRIMARY CELLS AND ACCUMULATORS

| No. | Symbol | Description |
|---|---|---|
| 15.1 |  | Primary cell or accumulator<br><br>(The long line represents the positive pole, the short line the negative pole). |
| 15.2 |  | Battery of accumulators or primary cells.<br><br>(Symbol No. 15.1 Primary cell or accumulator may also be used to indicate a batter, if there is no risk of confusion; otherwise the voltage or the number and kind of cells should be indicated). |
| 15.3 |  | Battery with tappings |
| 15.4 |  | Variable voltage battery. |
| 15.5 |  | Battery with single end-cell switch. |

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