



Form Of Segregation

IEC 60439-1 / BS EN 60439-1

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19th Sept 2008



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Introduction

- BS EN 60439 Part 1, describes a system for classifying the various forms of separation to be provided principally for:
 - Protection against contact with live parts belonging to the adjacent *functional units*.
 - Limitation of the probability of initiating arc faults.
 - Protection against the passage of solid foreign bodies from one unit of an *Assembly* to an adjacent unit.

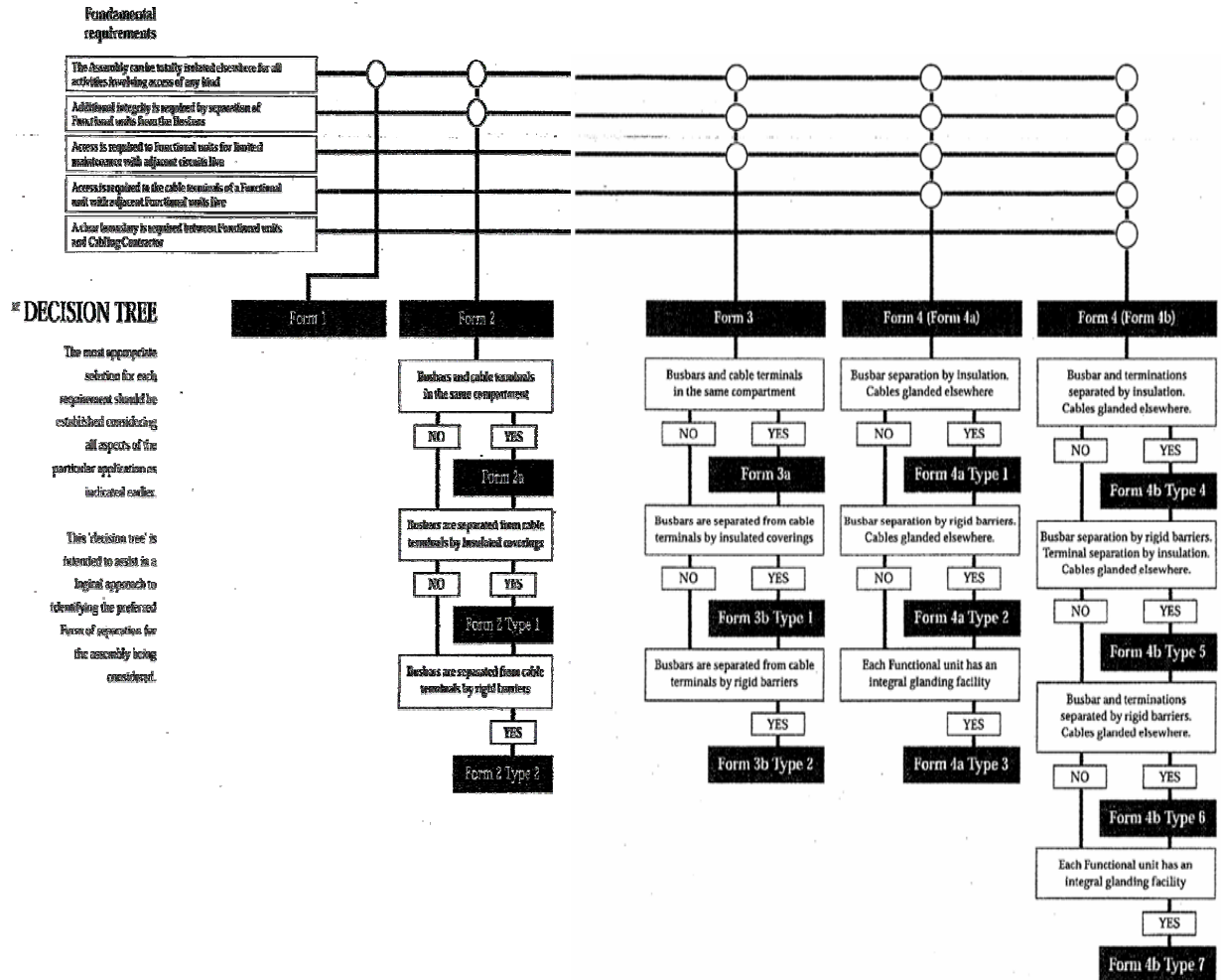
Selecting a Form of Segregation

- In general, the price of an Assembly will increase with increased levels of separation and/or types of construction.

Selecting a Form of Segregation

- To select the most suitable arrangement for each application, the following points are to be considered:-
 - Site and position of switchboard
 - Maintenance requirement of the switchgear.
 - Skill level of personnel having access to the *Assembly*
 - Probability of requiring access to the terminals of a particular circuit with those adjacent live and still in service.
 - Difficulty and/or inconvenience in isolating the complete *Assembly*.
 - Price and benefits of the different forms.
- Refer Decision Tree

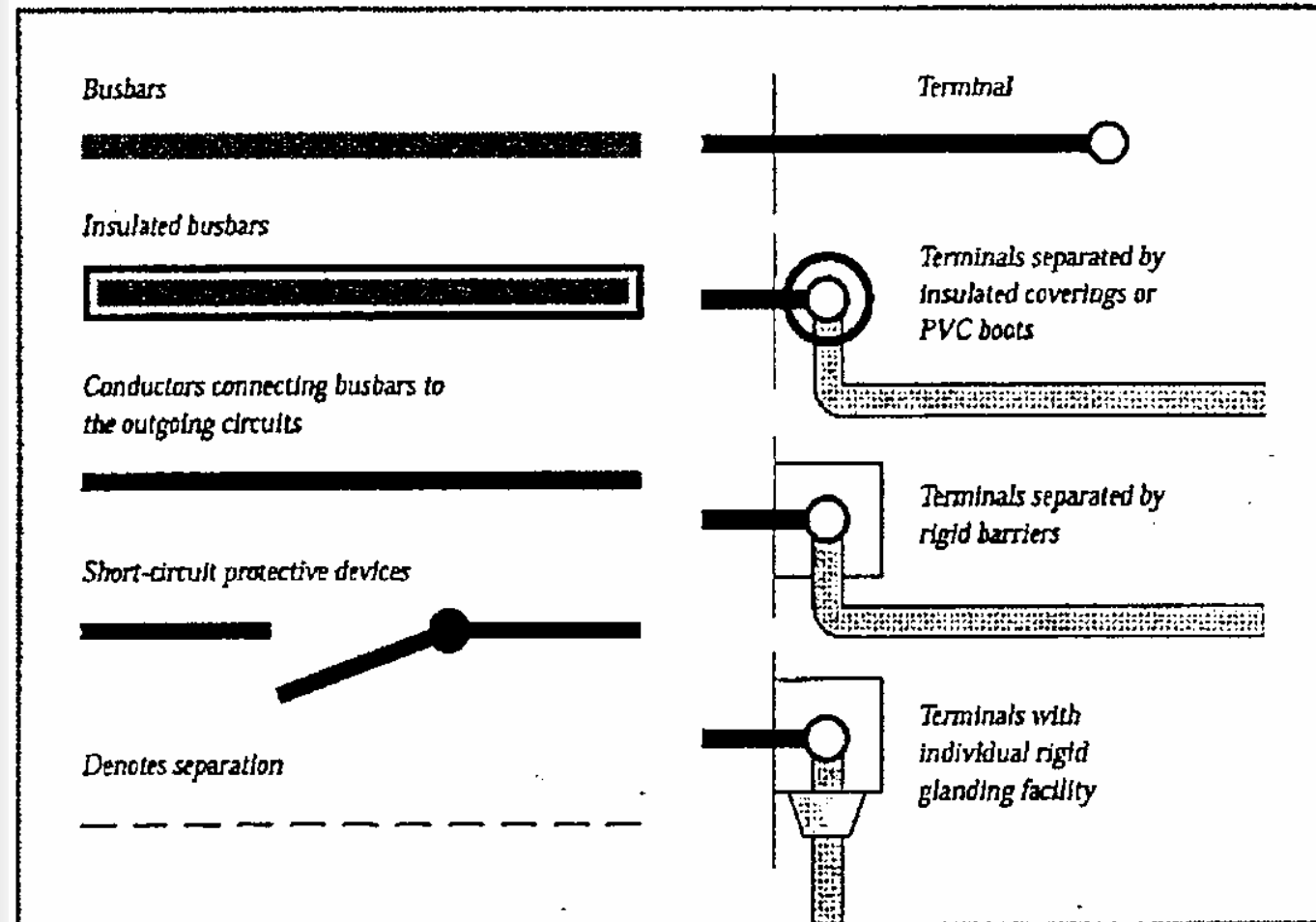
Decision Tree



Overall Form

- Form 1
- Form 2a
- Form 2b
 - Type 1
 - Type 2
- Form 3a
- Form 3b
 - Type 1
 - Type 2
- Form 4a
 - Type 1
 - Type 2
 - Type 3
- Form 4b
 - Type 4
 - Type 5
 - Type 6
 - Type 7

Key Throughout



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Busbars



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Insulated Busbars



■ Insulated Electrical Busbars

- Polypropylene
- Polyethylene
- Nylon
- PVC

■ Flexible Insulated busbars



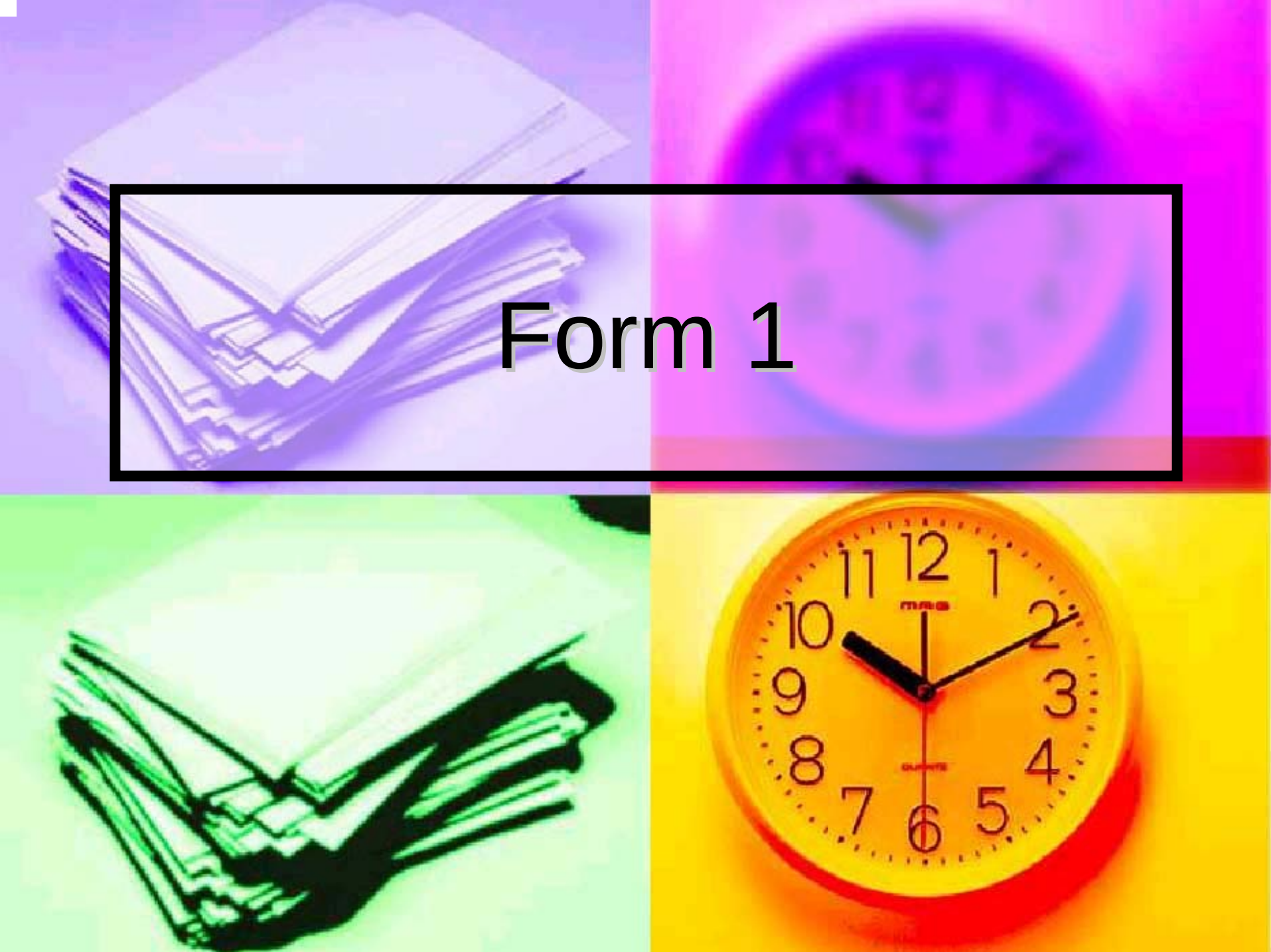
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PVC Boots



- PVC Boots

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The image is a composite of four quadrants. The top-left quadrant shows a stack of papers with a blue tint. The top-right quadrant shows a clock with a red tint. The bottom-left quadrant shows a stack of papers with a green tint. The bottom-right quadrant shows a clock with a yellow tint. A black rectangular border is superimposed over the center of the image, containing the text 'Form 1'.

Form 1

Form 1 Requirements

- Form 1 covers overall *Assemblies* which are enclosed so as to provide protection against contact with any internal live part or components, but where no internal separation is provided for *functional units* or terminations.

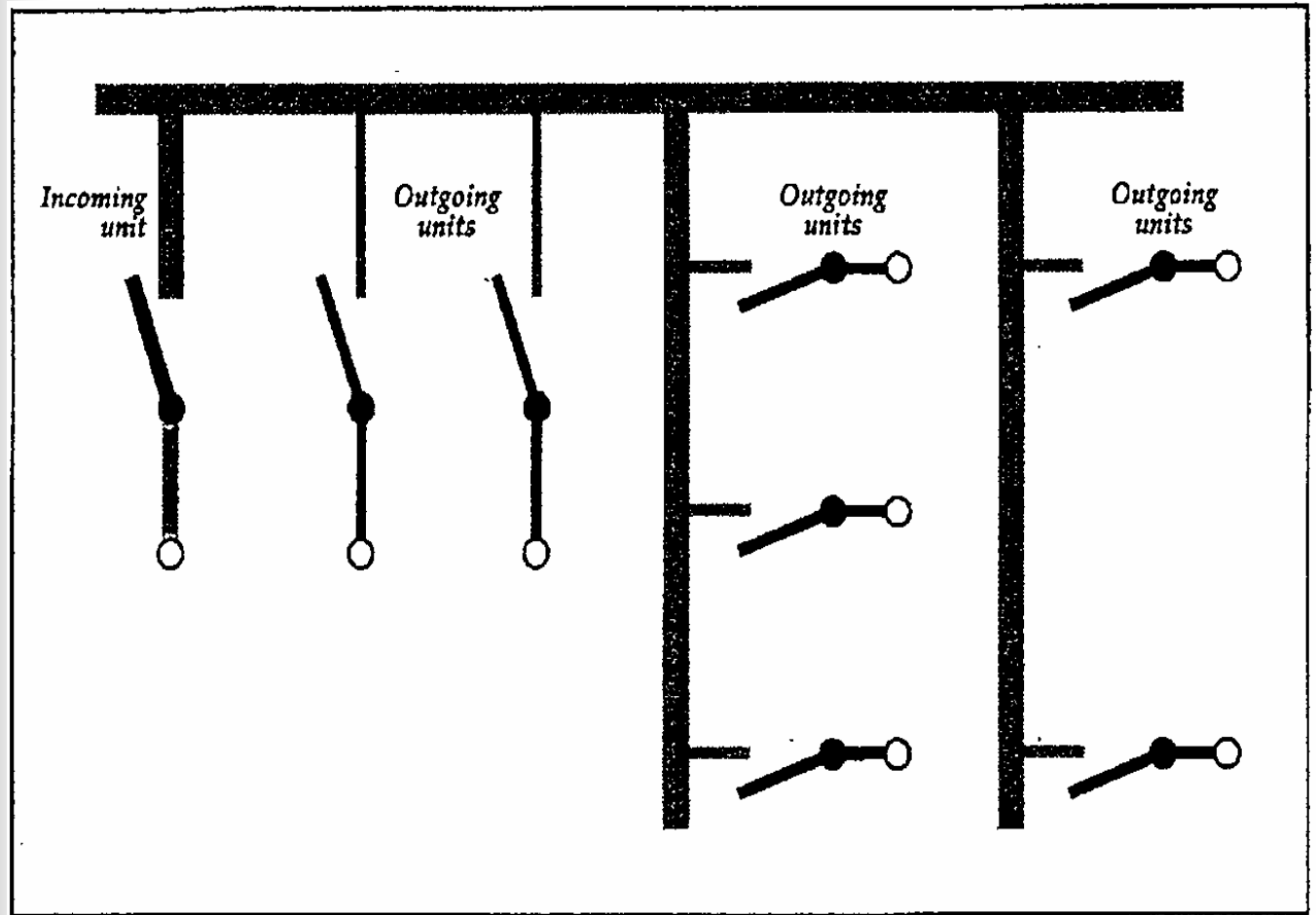
Form 1 Requirements

■ For Form 1:-

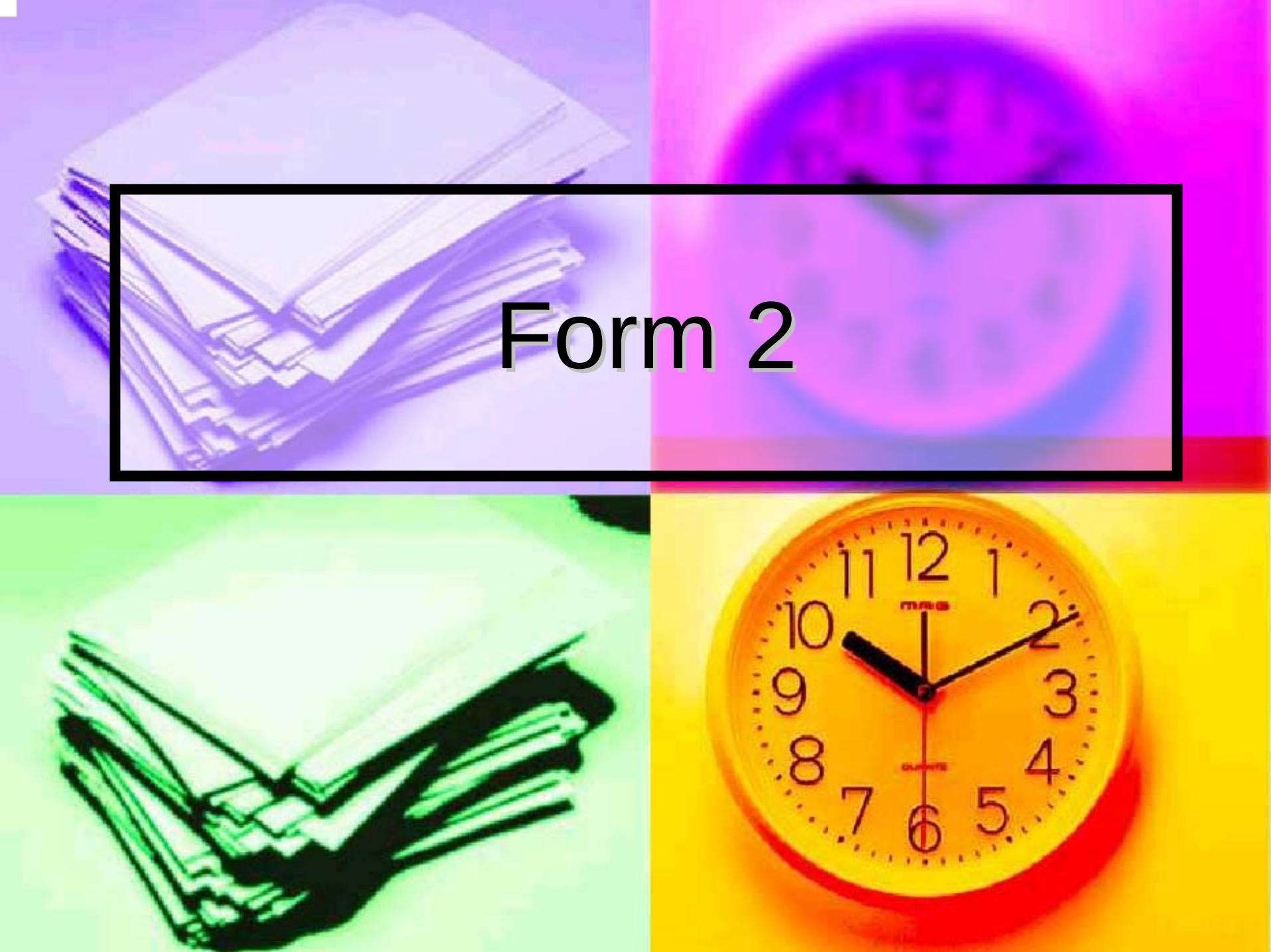
- Busbars ***are not*** separated from the functional units.
- Functional units ***are not*** separated from other functional units.
- Functional units ***are not*** separated from any incoming or outgoing termination.
- Busbars ***are not*** separated from any incoming or outgoing terminations.

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Form 1



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Form 2

Form 2 Requirements

- Form 2 defines overall *Assemblies* which are enclosed to provide protection against contact with any internal live parts or components, and where there is internal separation of the busbars from *the functional units*.

Form 2 Requirements

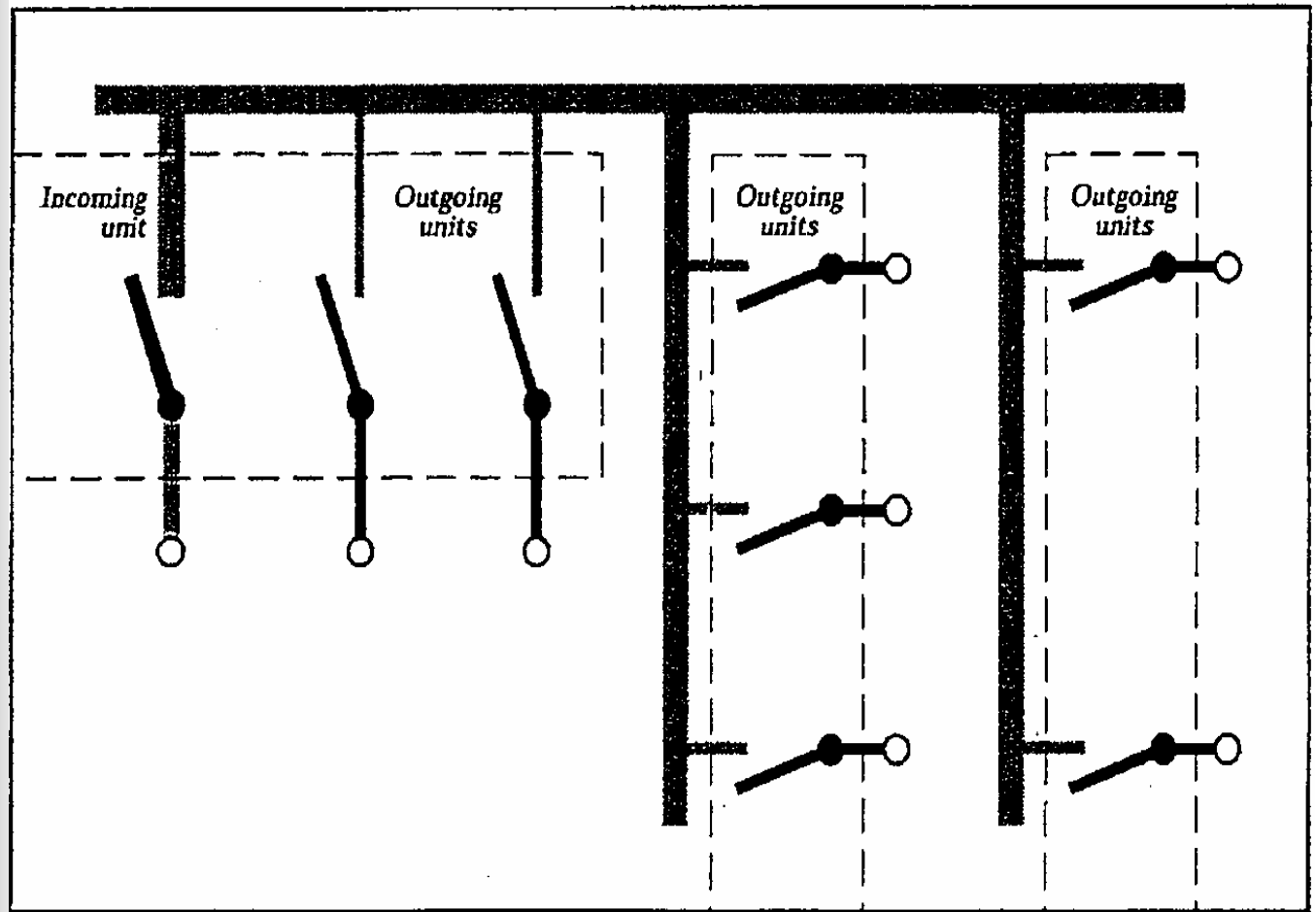
- For Form 2, the general conditions apply:-
 - Busbars **are** separated from functional units.
 - Functional units **are not** separated from other functional units.

Form 2a

- As basic Form 2
- Terminals are not separated from the busbars, or each other.

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Form 2a



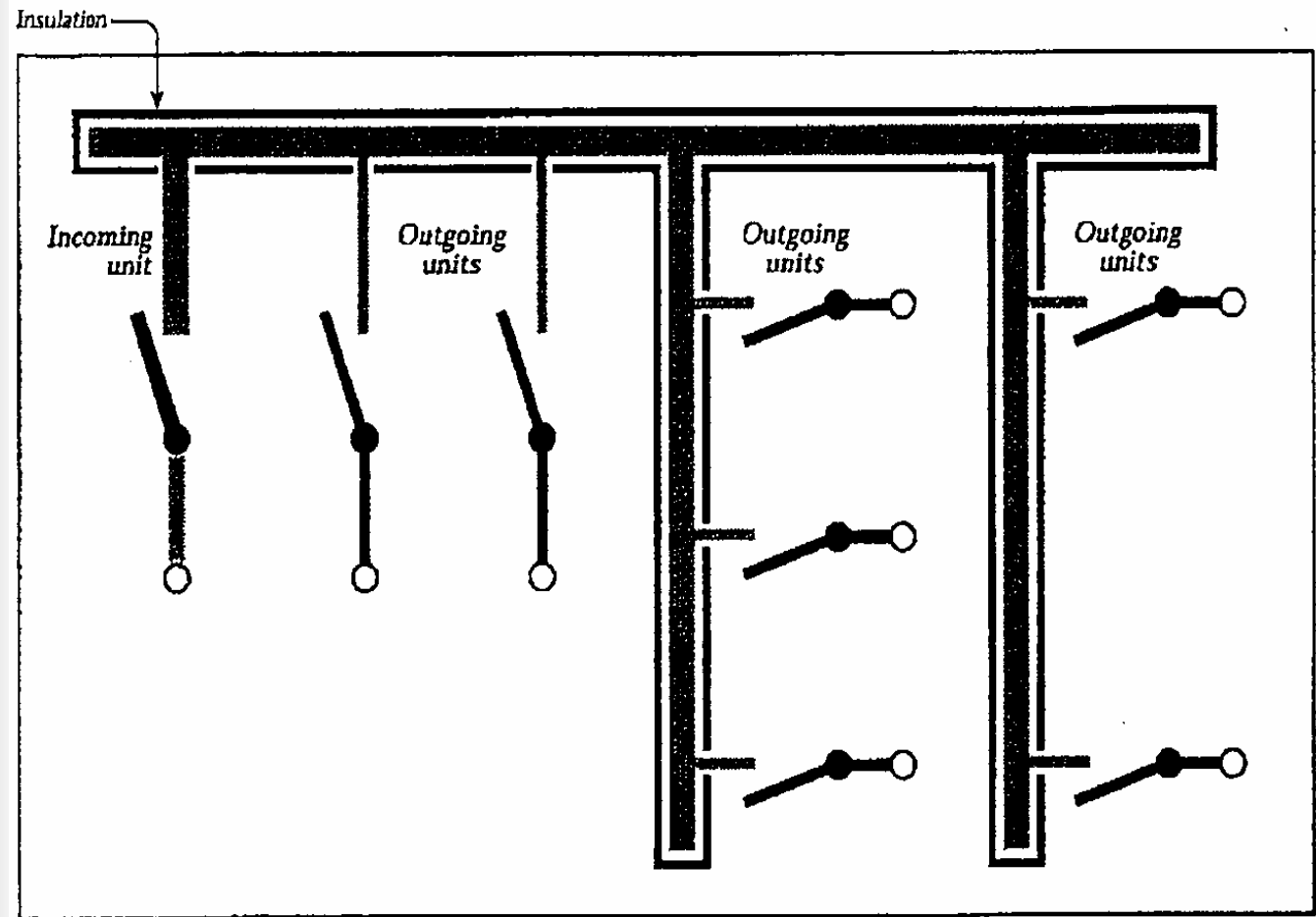
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Form 2b Type 1

- Main criteria as Form 2
- Busbar separation is achieved by insulated coverings, e.g. PVC sleeving, wrapping or coating.
- Terminals are separated from the busbars, but not from *functional units* or each other.

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Form 2b Type 1



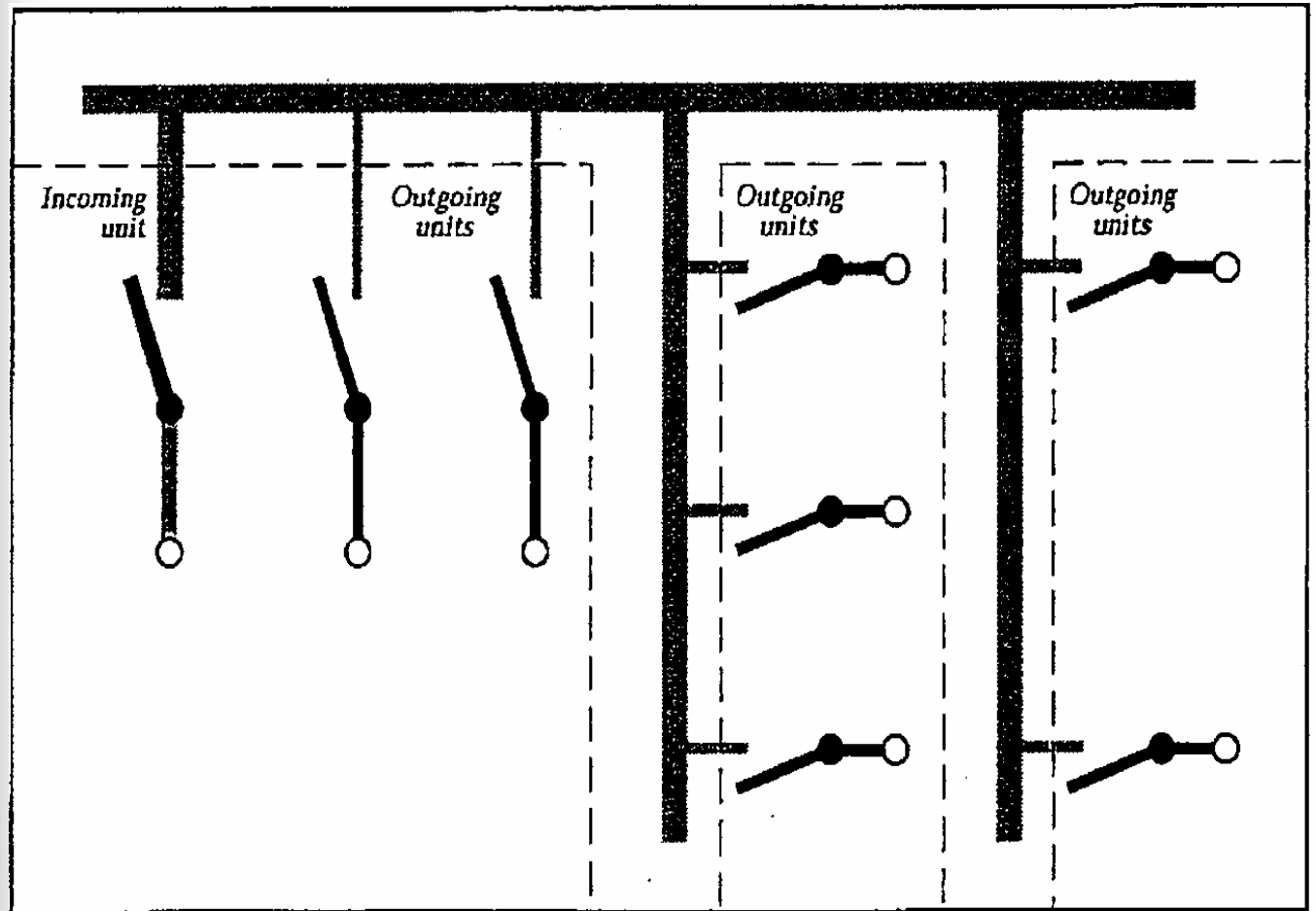
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Form 2b Type 2

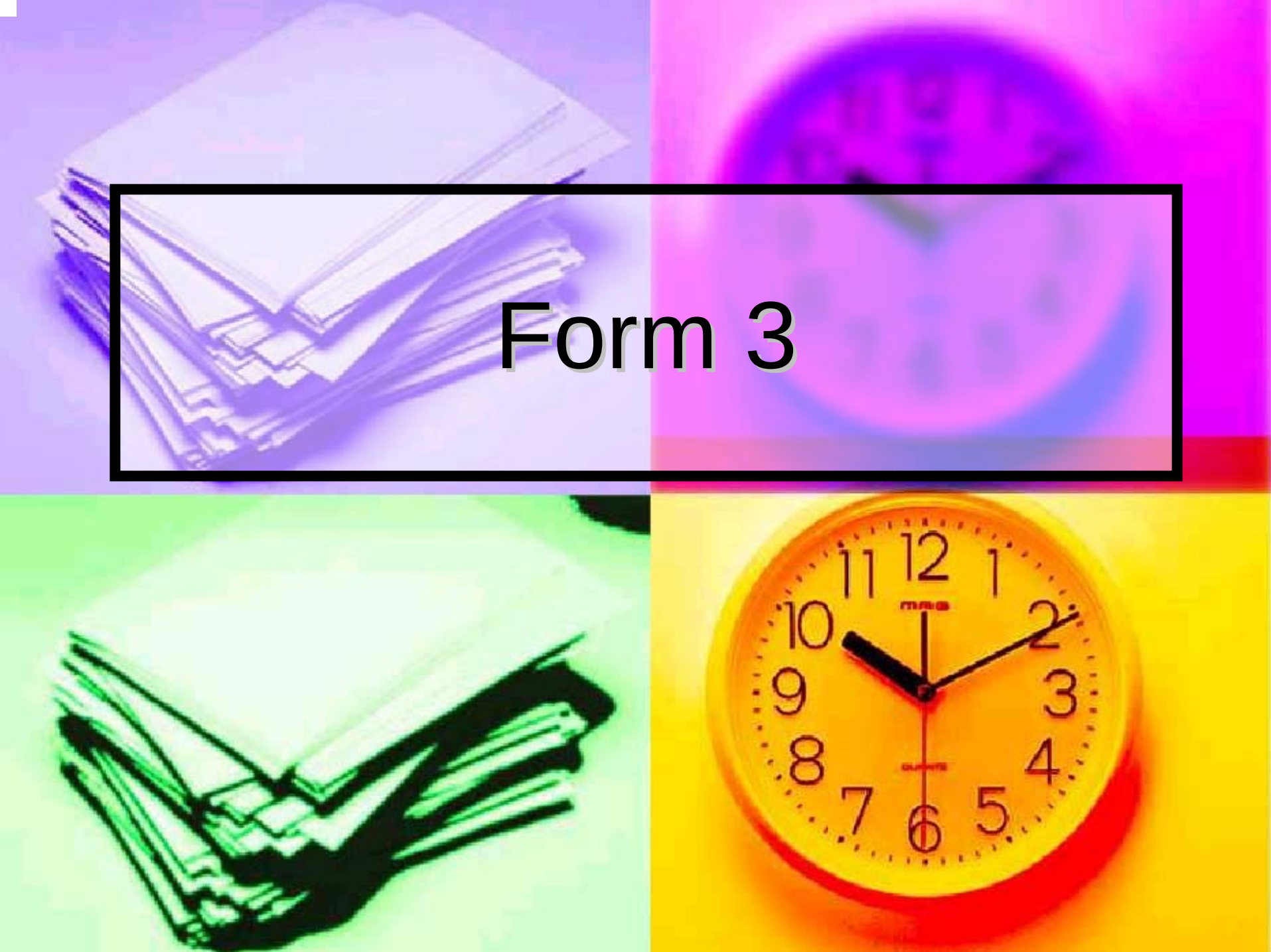
- Main criteria as Form 2
- Busbar separation is achieved by metallic or non-metallic rigid *barriers or partitions*.
- Terminals are separated from the busbars, but not from *functional units* or each other.

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Form 2b Type 2



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Form 3

Form 3 Requirements

- Form 3 defines overall *Assemblies* which are enclosed to provide protection against contact with any internal live parts or components, and in which there is internal separation of the busbars from the *functional units* and separation of all *functional units* from each other.

Form 3 Requirements

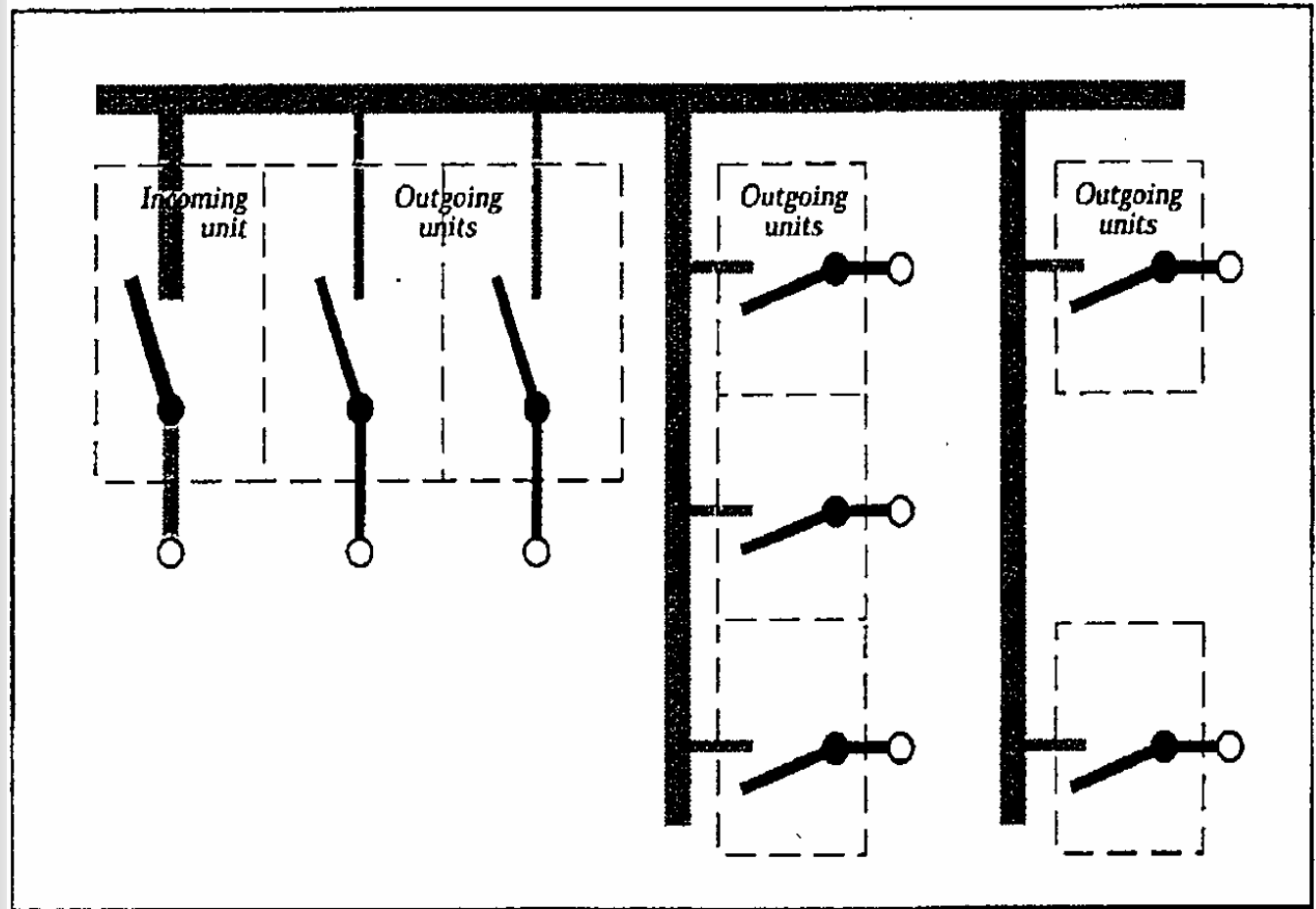
- Form 3 general conditions apply:
 - Busbars **are** separated from functional units
 - Functional units **are** separated from each other
 - Functional units **are** separated from incoming and outgoing terminals
 - Incoming and outgoing terminals **are not** separated from each other.

Form 3a

- As basic Form 3
- Terminals are not separated from the busbars, or each other.

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Form 3a

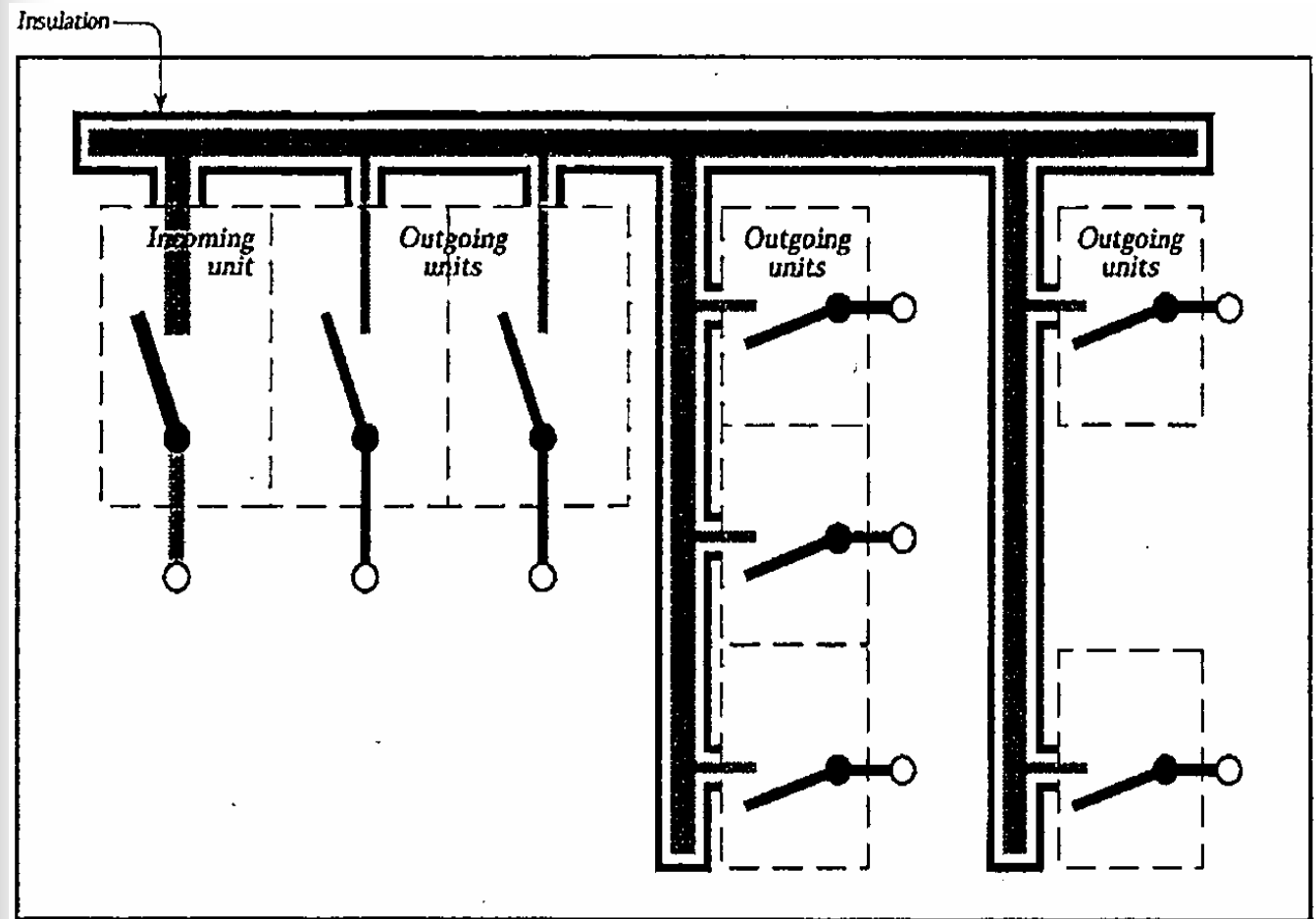


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Form 3b Type 1

- As basic Form 3.
- Busbar separation is achieved by insulated coverings, e.g. PVC sleeving, wrapping or coating.
- Terminals are separated from the busbars, but not from each other.

Form 3b Type 1

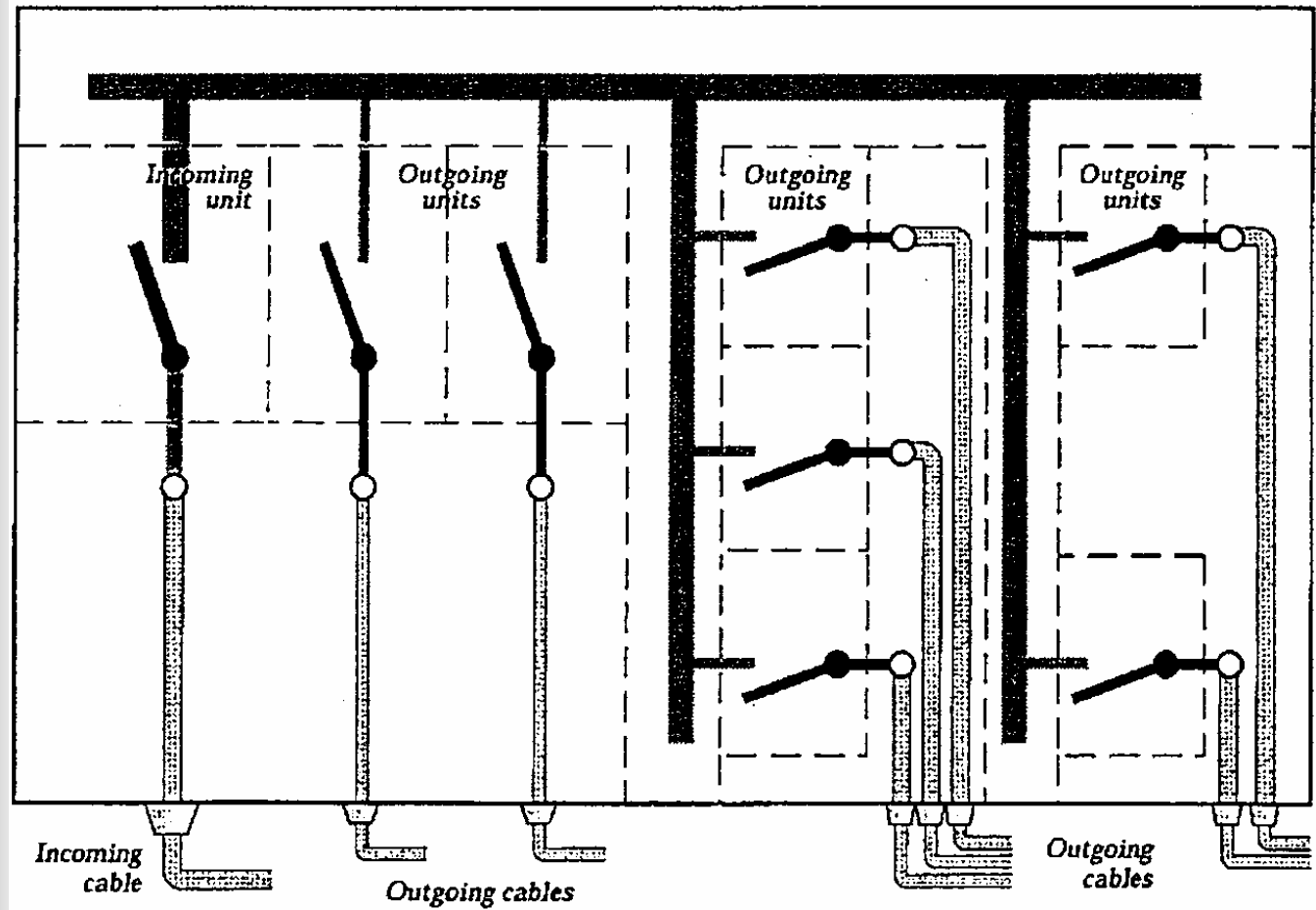


Form 3b Type 2

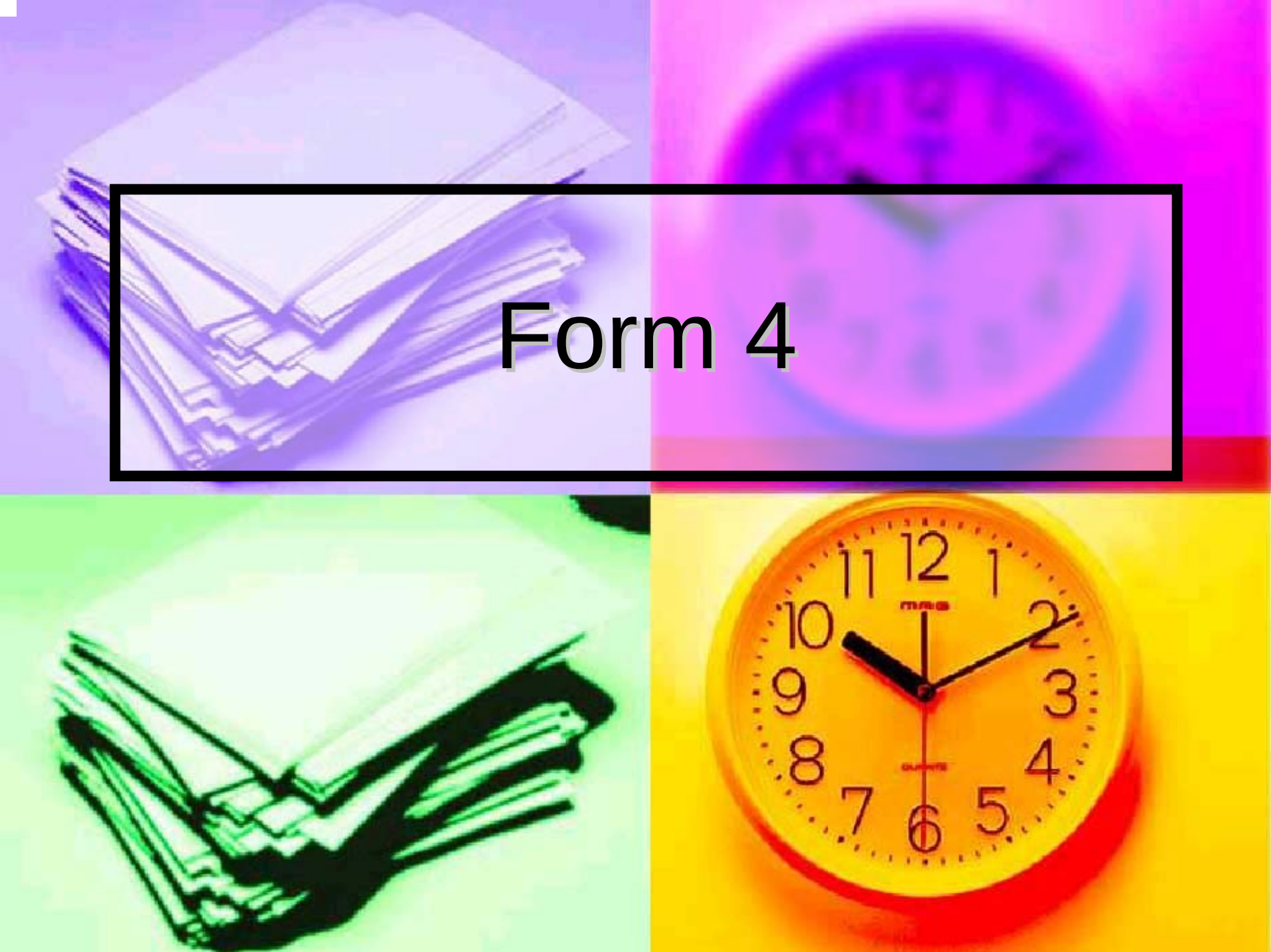
- As basic Form 3.
- Busbar separation is achieved by metallic or non-metallic rigid barriers or partitions.
- Terminals are separated from the busbars, but not from each other.

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Form 3b Type 2



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Form 4

Form 4 Requirements

- Form 4 defines overall *Assemblies* which are enclosed to provide protection against contact with internal live parts or components, and in which there is internal separation of the busbar system from the *functional units*, and separation of all *functional unit* from each other. Incoming and outgoing terminals are also required to be separated from the busbars and from each other.

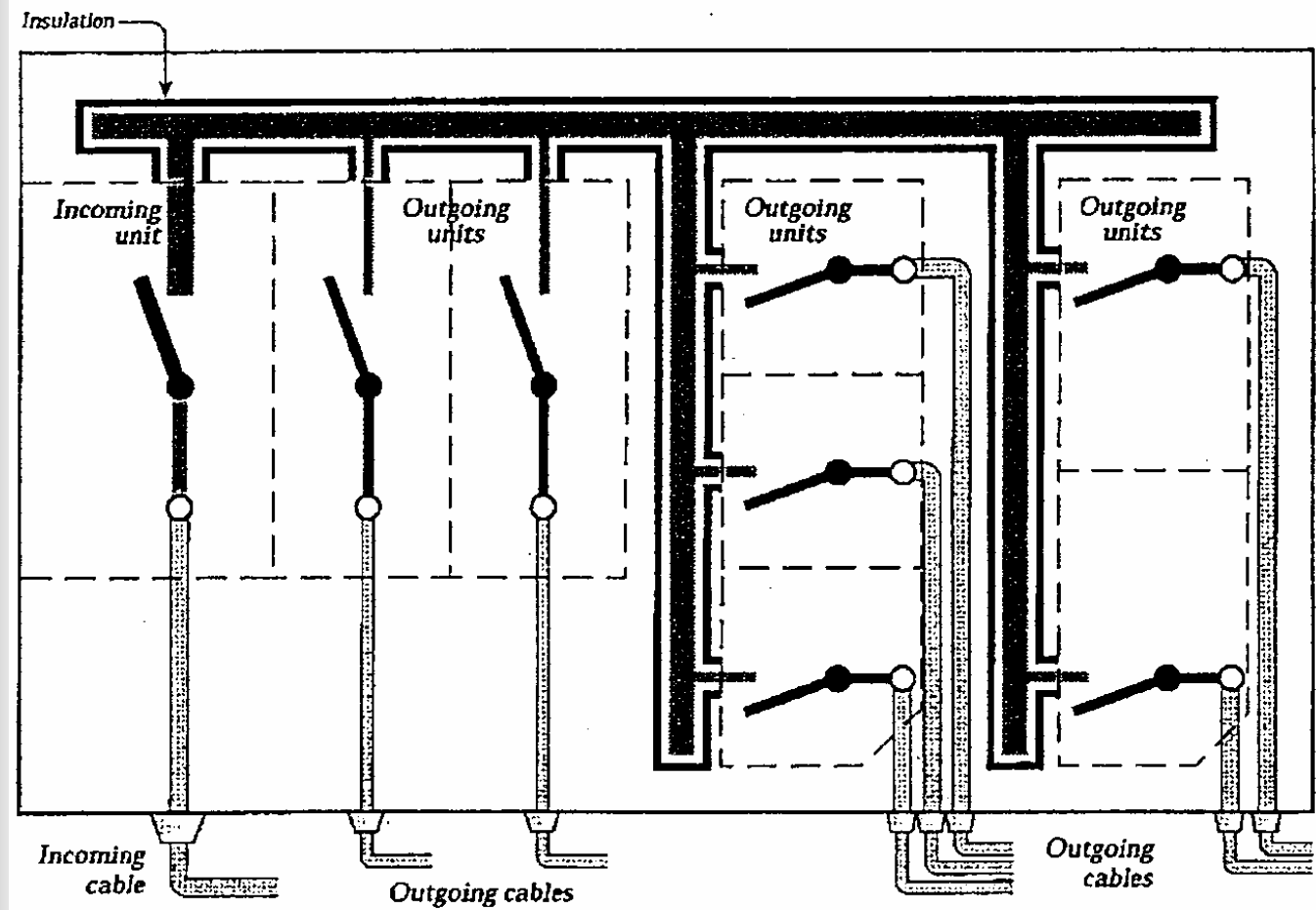
Form 4 Requirements

- Form 4 general conditions apply:-
 - Busbars **are** separated from functional units
 - Functional units **are** separated from each other
 - Terminations to *functional units* **are** separated from each other.

Form 4a Type 1

- As basic Form 4
- Busbar separation is achieved by insulated coverings, e.g. PVC sleeving, wrapping or coating.
- Cables are terminated within same compartments as the associated functional unit.
- Cables may be glanded elsewhere, e.g. in a common cabling chamber.

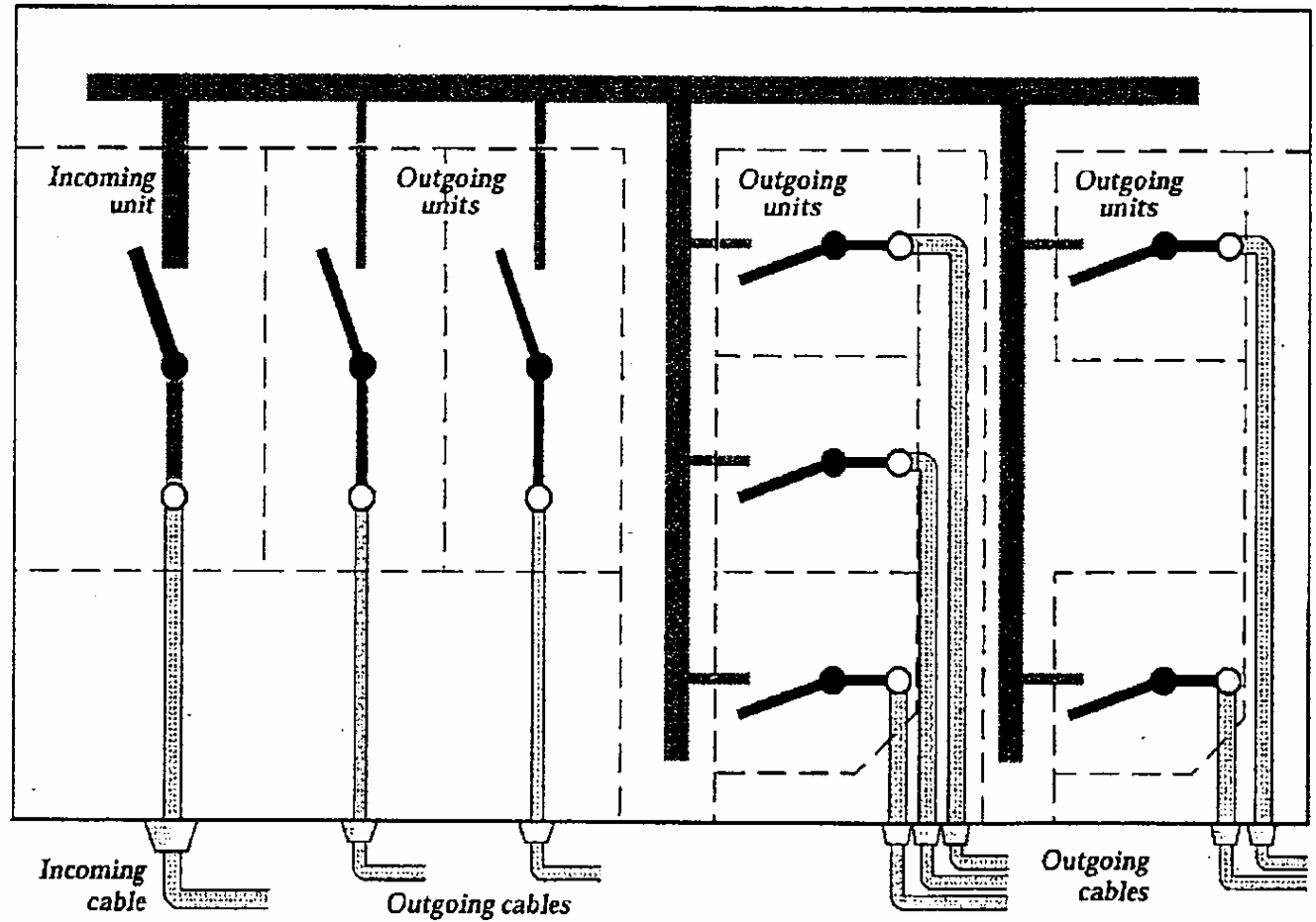
Form 4a Type 1



Form 4a Type 2

- As basic Form 4
- Busbar separation is achieved by metallic or non-metallic rigid *barriers or partitions*.
- Cables are terminated within same compartment as the *functional unit*.
- Cables may be glanded elsewhere, e.g. in a common cabling chamber.

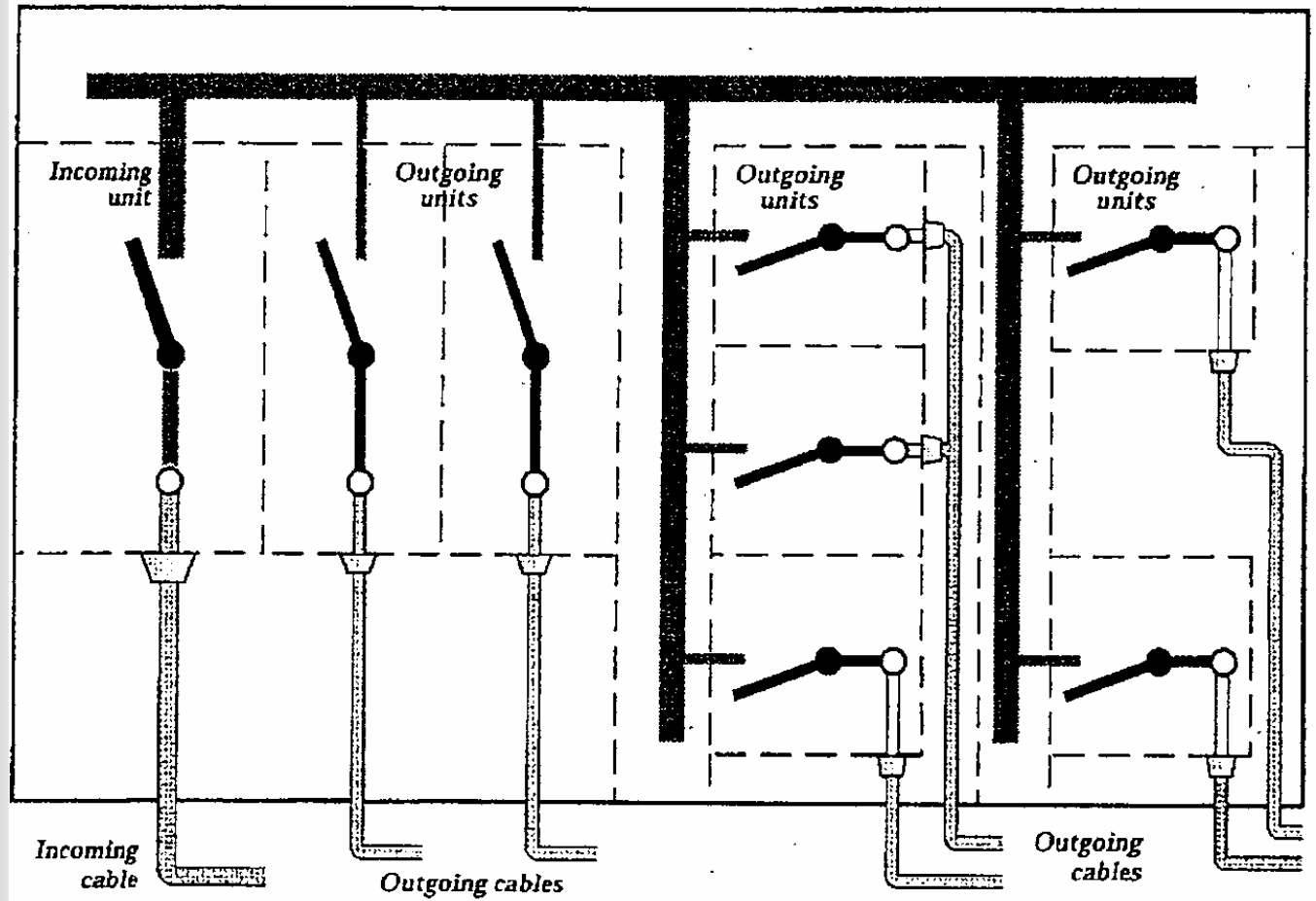
Form 4a Type 2



Form 4a Type 3

- As basic Form 4
- Busbar separation is achieved by metallic or non-metallic rigid *barriers or partitions*.
- Cables are terminated within same compartment as the *functional unit*.
- The terminations for each *functional unit* has its own integral glanding facility.

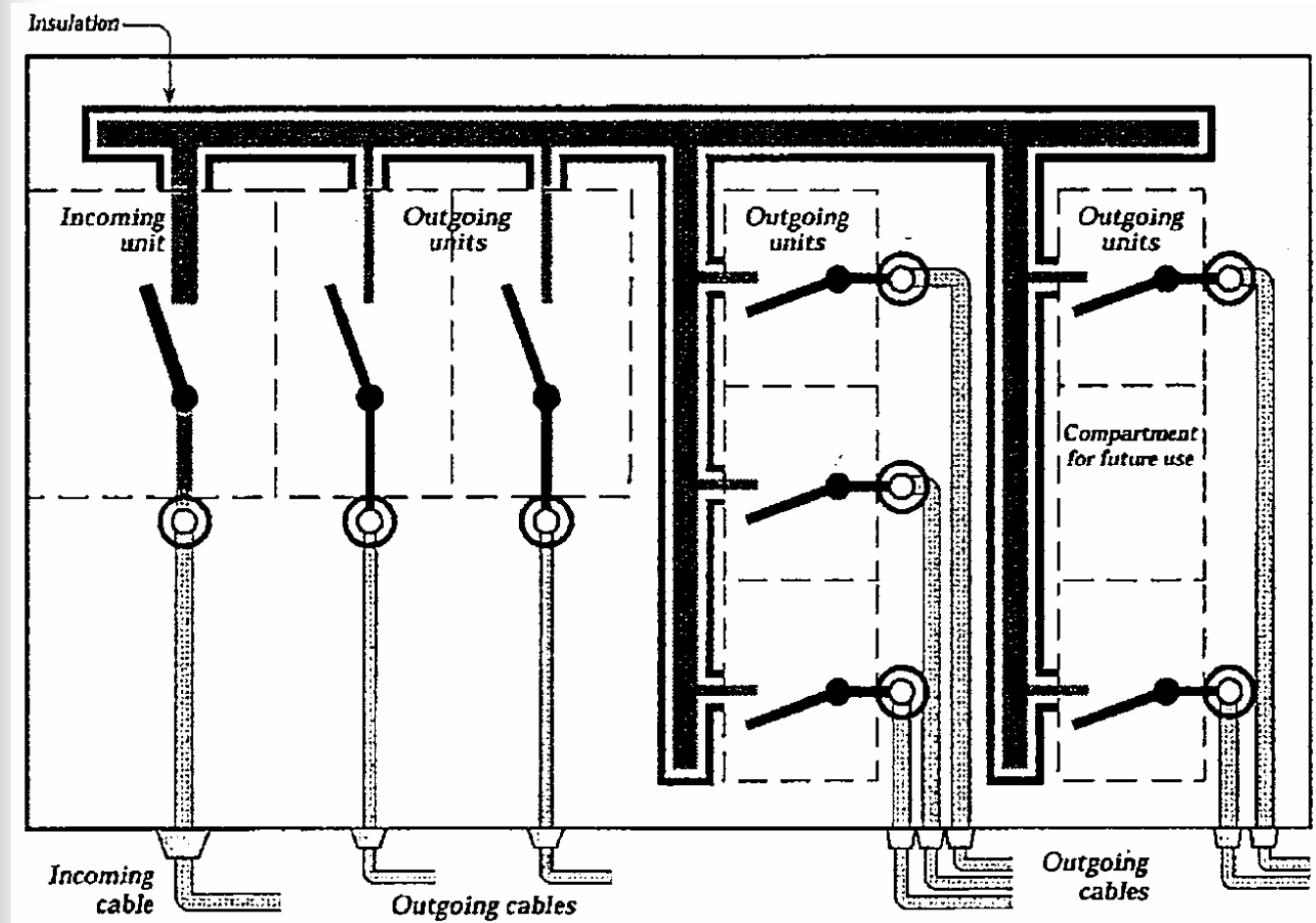
Form 4a Type 3



Form 4b Type 4

- As basic Form 4
- Busbar separation is achieved by insulated coverings, e.g. PVC sleeving, wrapping or coating.
- Terminals are external to the *functional unit* and separated by insulated coverings, e.g. PVC boots.
- Cables may be glanded elsewhere, e.g. in a common cabling chamber.

Form 4b Type 4

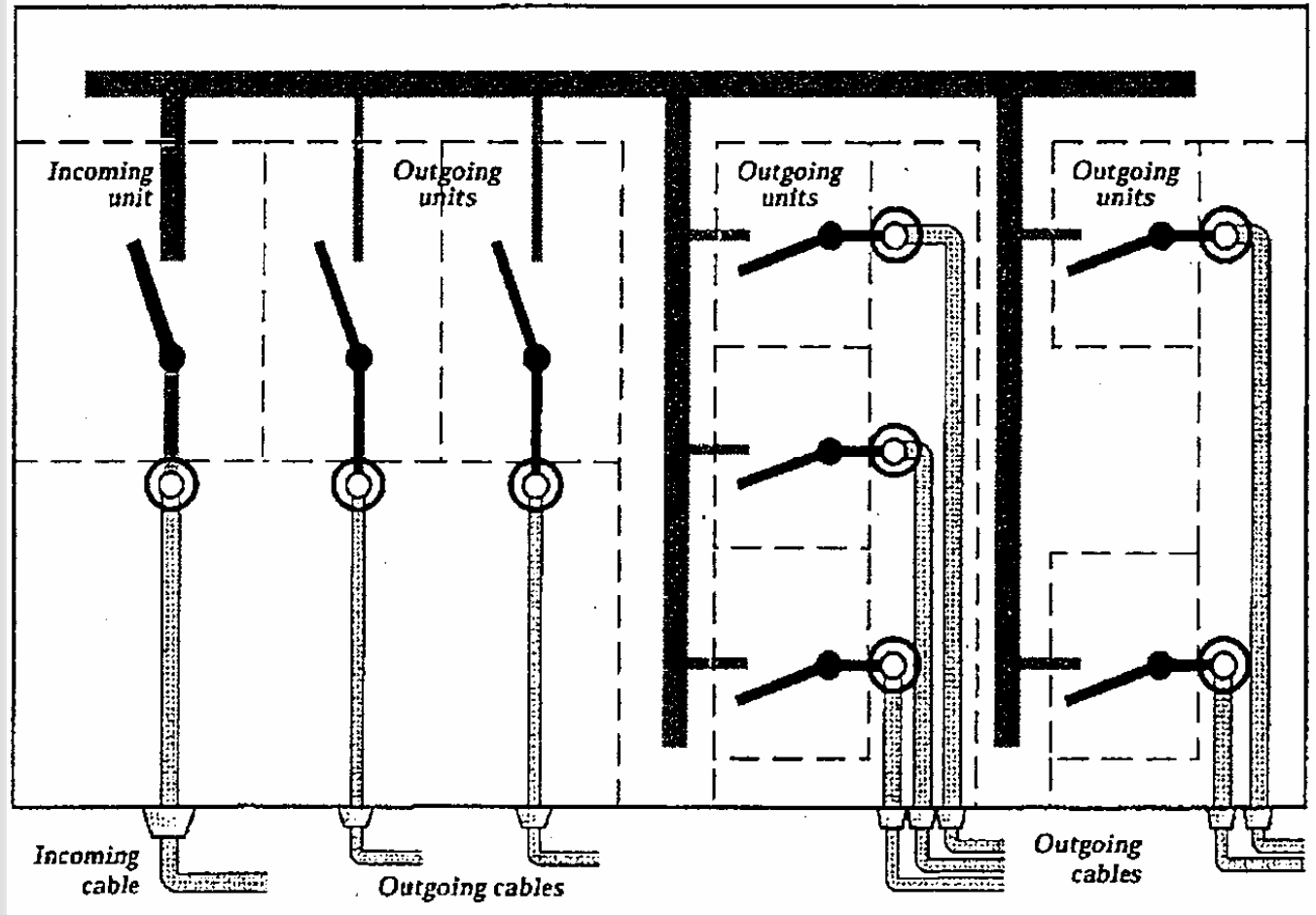


Form 4b Type 5

- As basic Form 4
- Busbar separation is achieved by metallic or non-metallic rigid *barriers or partitions*.
- Terminals are external to the *functional unit* and separated by insulated coverings, e.g. PVC boots.
- Cables may be glanded elsewhere, e.g. in a common cabling chamber.

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Form 4b Type 5

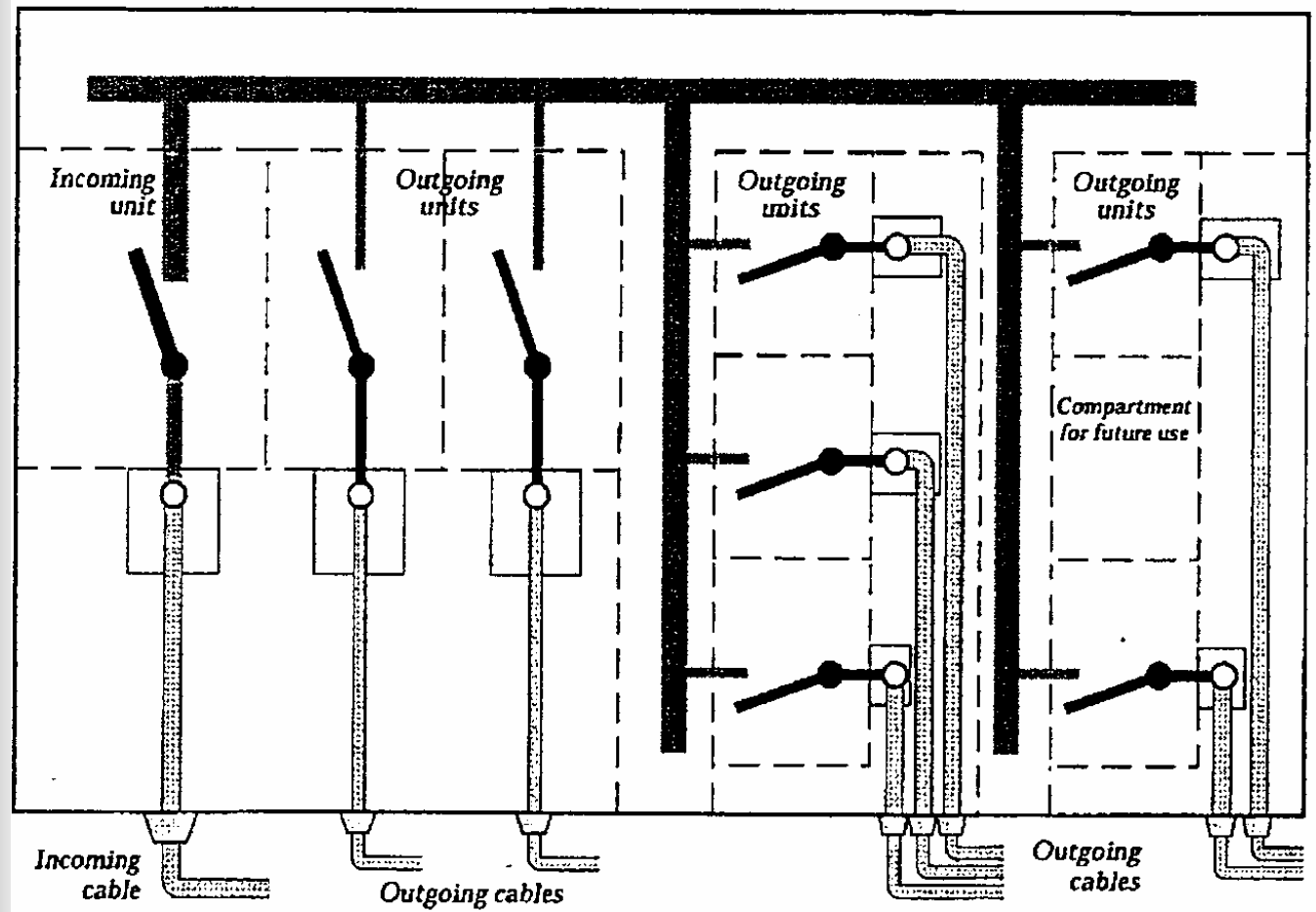


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Form 4b Type 6

- As main criteria for Form 4.
- All separation is achieved by metallic or non-metallic rigid *barriers* or *partitions*.
- Terminals are external to the *functional unit* compartments and enclosed in their own *compartments* by means of rigid *barriers* or *partitions*.
- Cables may be glanded elsewhere, e.g. in a common cabling chamber.

Form 4b Type 6

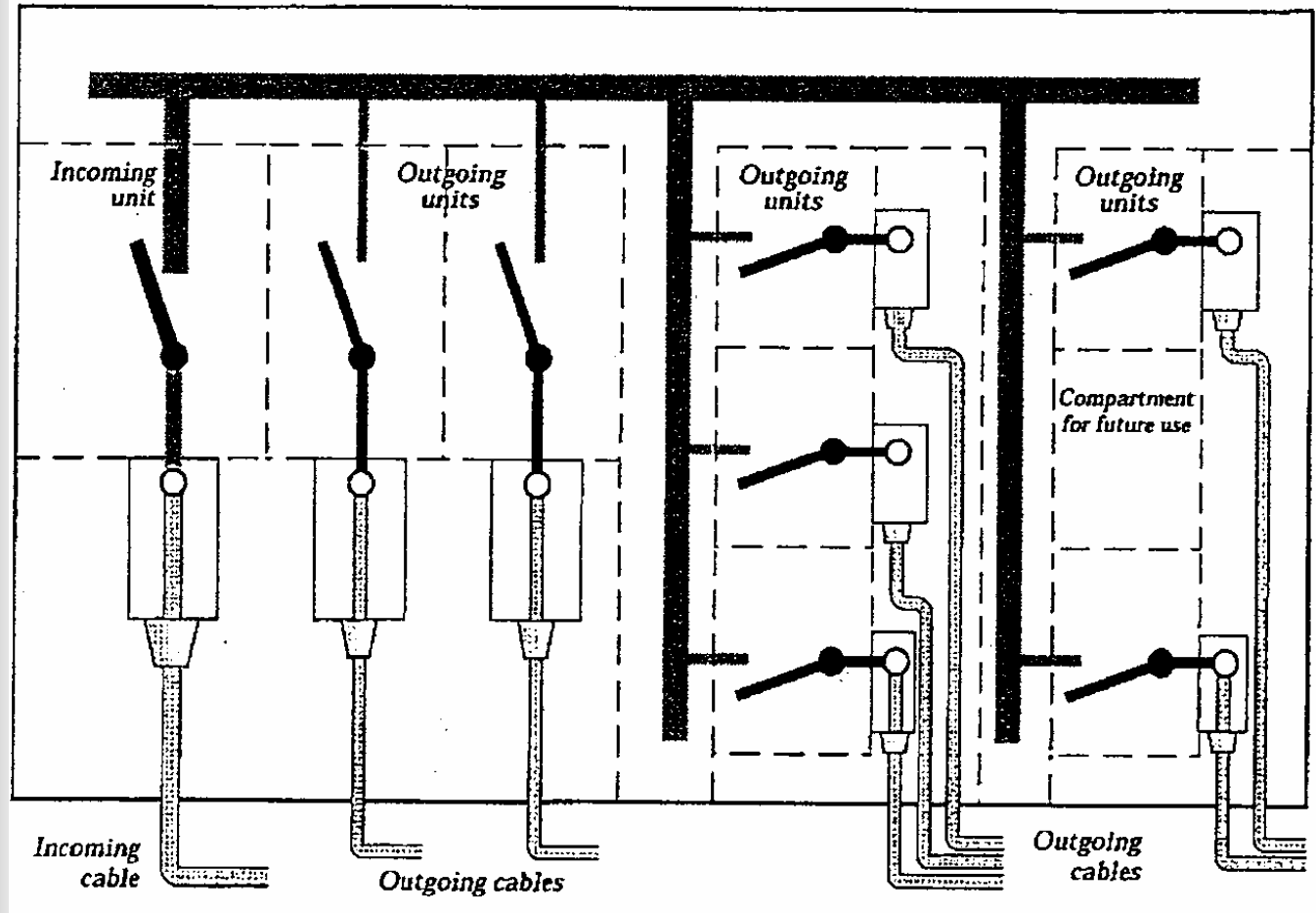


Form 4b Type 7

- As main criteria for Form 4.
- All separation is achieved by metallic or non-metallic rigid *barriers or partitions*.
- Terminals are external to the *functional unit* compartments and enclosed in their own *compartment* by means of rigid *barriers or partitions* complete with integral glanding facility.

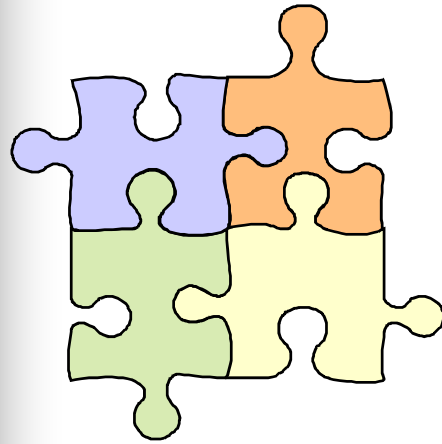
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Form 4b Type 7

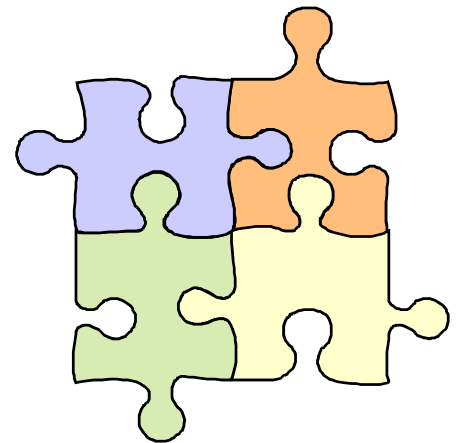


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Q & A Sesi Soal Jawab



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Sesi Soal Jawab (Q1)



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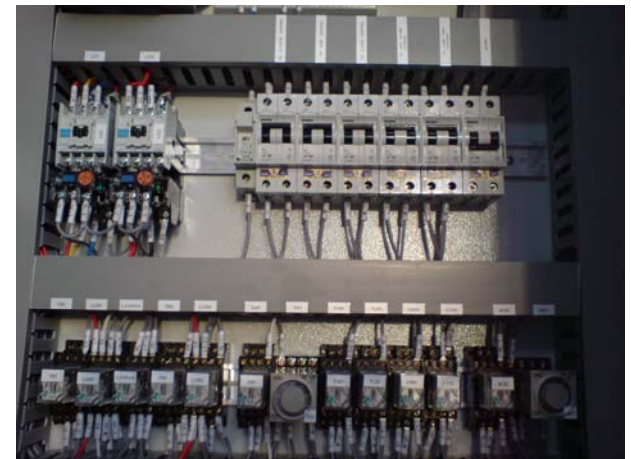
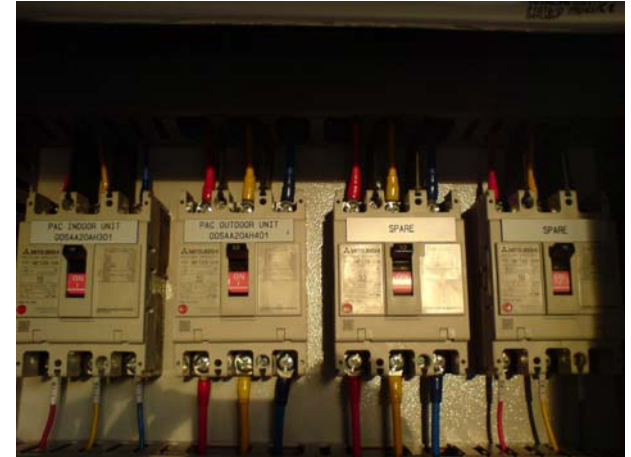
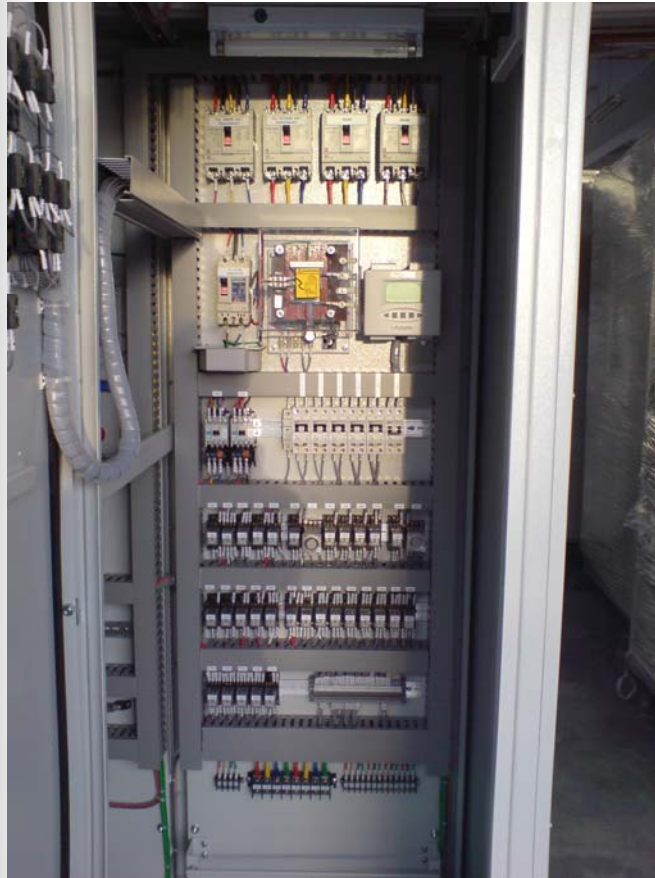
Sesi Soal Jawab (Q1)



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Sesi Soal Jawab (Q1) End

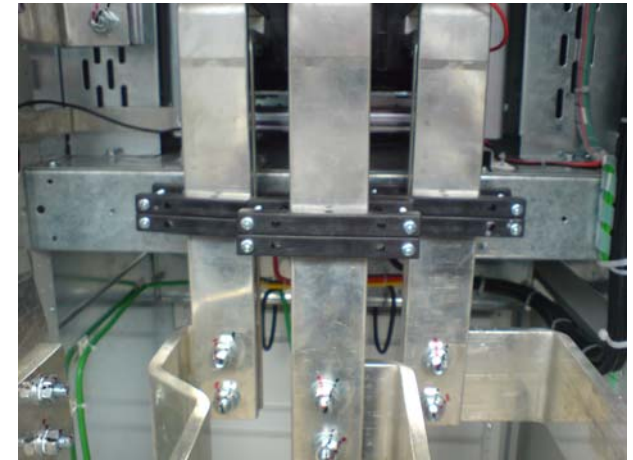


Jawapan: Form 1

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Sesi Soal Jawab (Q2)



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Sesi Soal Jawab (Q2) End

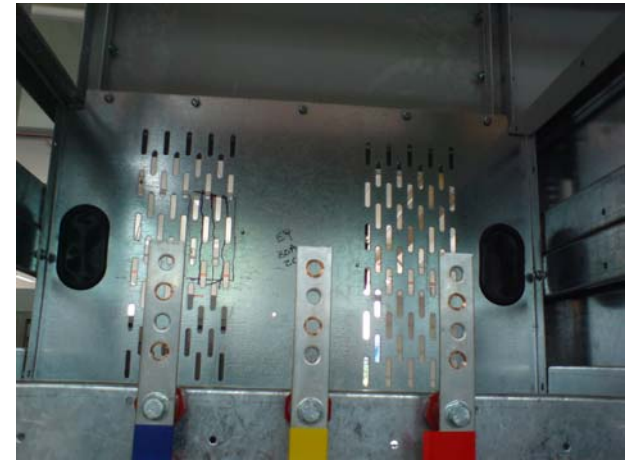


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Jawapan: Form 2b Type 2

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Sesi Soal Jawab (Q3)



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Sesi Soal Jawab (Q3) End



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Jawapan: Form 3b Type 2

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Sesi Soal Jawab (Q4) End



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Jawapan: Form 1

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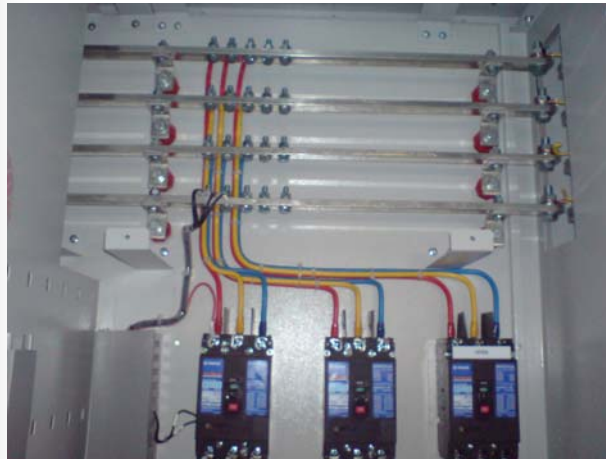
Sesi Soal Jawab (Q5)



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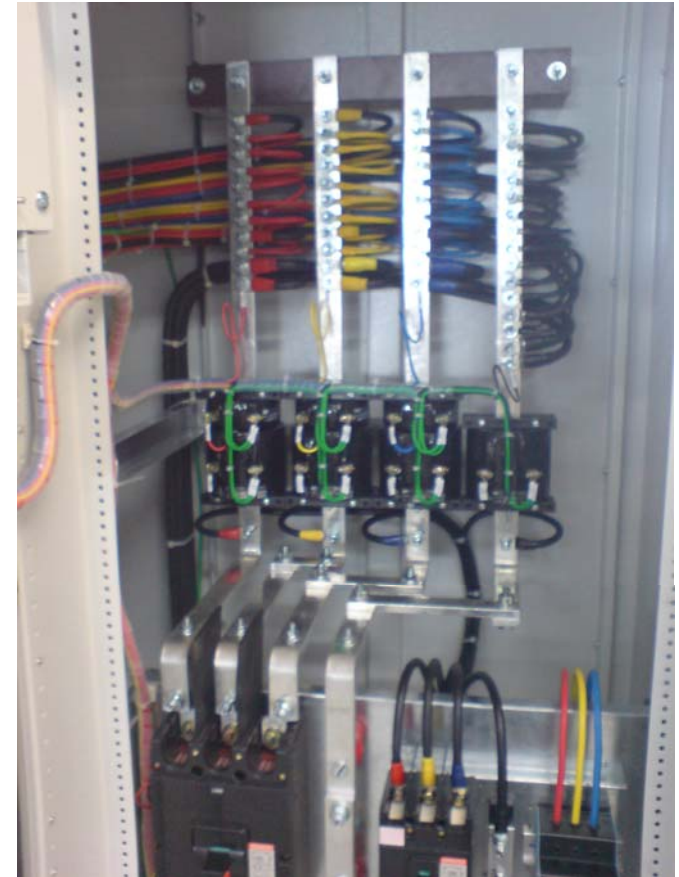
Sesi Soal Jawab (Q5) End



Jawapan: Form 1

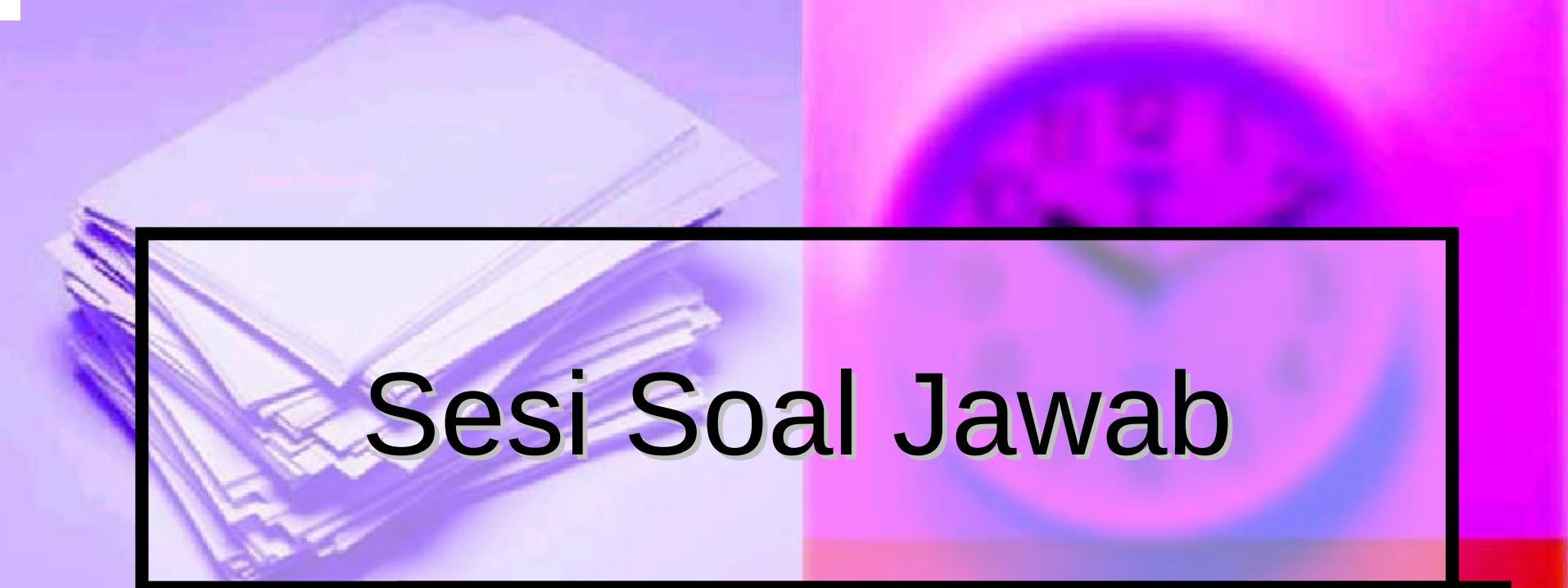
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Sesi Soal Jawab (Q6) End



Jawapan: Form 1

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Sesi Soal Jawab



Thank you