



Guide to Forms of Separation

Low Voltage Switchgear and Controlgear
Assemblies to BS EN 61439-2



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Acknowledgements

BEAMA would like to thank IEC and BSI for allowing references to their standards; Health and Safety Executive (HSE) for reference to their documents.

Guide to Selecting Forms of Separation

Preface

Since 1992 *The BEAMA Installation Guide to Forms of Separation* has become the accepted Industry standard, providing a clearer understanding of the constructional requirement and various ways of meeting the necessary standard internal separation.

The history behind this Guide started with British Standard BS 5486 Part 1:1990 later amended in line with European standards to BS EN 60439-1 in 1994. A *BEAMA Installation* initiative, led to a National Annex being added to the standard in March 1995. The Annex is still there today in the BS EN 61439-2 Standard.

Forms of internal separation in BS EN 61439-2 are subject to agreement between the manufacturer and the user. BEAMA recommends this Guide as an appropriate basis for such an agreement.

This sixth edition of the Guide has been produced to be in line with BS EN 61439-2 and remains essential reading for both specifier's and users. The Guide is intended to assist in selecting the most appropriate form of separation for a given application.

Introduction

For specifiers, one of the most significant choices they face when specifying a low-voltage assembly, is the form of separation. Selection of an inappropriate form of separation will at the very least cause disappointment. As a consequence the assembly may either be much more expensive than necessary or it may be unsuitable for the application.

Useful Definitions

The Standard includes definitions relating to Assemblies. Those particularly relevant to the forms of separation of Assemblies include the following.

Assembly

“Power switchgear and controlgear assembly (PSC-ASSEMBLY)”
“Low-voltage switchgear and controlgear ASSEMBLY used to distribute and control energy for all types of loads, intended for industrial, commercial and similar applications where operation by ordinary persons is not intended.” This includes floor standing or wall mounting distribution switchboards, panel boards, and motor control centres using electromechanical and/or electronic components. It does however specifically exclude individual devices and self-contained components which control a single circuit i.e. wall mounted starters and fuse switches.

Functional Unit

“Part of an ASSEMBLY comprising all the electrical and mechanical elements including switching devices that contribute to the fulfilment of the same function”.
“NOTE Conductors which are connected to a functional unit but which are external to its compartment or enclosed protected space (e.g. auxiliary cables connected to a common compartment) are not considered to form part of the functional unit”
Comprises all parts necessary to form a complete incoming or outgoing circuit. It includes the load current carrying device(s) and associated equipment, cable terminals, and control devices within the assembly, that are necessary to form the complete circuit. It excludes the connections from the unit to the busbars (busbar connections) and any insulation or shrouding with which they may be provided. It may consist of more than one compartment or enclosed protected space.

Section

“Constructional unit of an ASSEMBLY between two successive vertical delineations”.
Usually considered to be a single full height column containing one or more functional units. One or more columns are required to complete an assembly.

Sub-Section

“Constructional unit of an ASSEMBLY between two successive horizontal or vertical delineations within a section”. The area or space within a column identified and bounded by two adjacent and horizontal constructional members e.g. cross members or shelves.

Compartment

“Section or sub-section enclosed except for openings necessary for interconnection, control or ventilation”

Enclosure

“Housing affording the type and degree of protection suitable for the intended application”. Provides protection for equipment against certain external influences from any accessible direction and against direct contact to a degree of protection of at least IP2X.

Partition

“Part of the enclosure of a compartment separating it from other compartments”. A component used to form the top, bottom, sides, front or back of a compartment or enclosure and which can be manufactured from metal or an appropriate synthetic material. A device’s integral housing may also satisfy this requirement.

Barrier

“Part providing protection against direct contact from any usual direction of access”. Used to achieve a form of separation, it must meet the requirement of at least IP2X. It can also take the form of insulating material in direct contact with the live part, e.g. heat shrink sleeving on a busbar. Alternatively it can be rigid insulation, e.g. terminal shields or an earthed metal screen appropriately positioned relative to the live part(s).

Duty Holder

The term used within the Electricity At Work Regulations to refer to the person appointed to be responsible for the electrical equipment, systems and conductors and any work or activities being carried out on or near the electrical equipment. The Duty Holder must be competent and may be the employer, an employee, or a self-employed person.

What are Forms of Separation?

BS EN 61439-2 stipulates:-

Typical arrangements of internal separation by barriers or partitions are described in Table 104 and are classified as forms (for examples, see Annex AA).

The form of separation and higher degrees of protection shall be the subject of an agreement between assembly manufacturer and user.

PSC-ASSEMBLIES can be divided to attain one or more of the following conditions between functional units, separate compartments or enclosed protected spaces:

- Protection against contact with hazardous parts. The degree of protection shall be at least IPXXB,
- Protection against the passage of solid foreign bodies. The degree of protection shall be at least IP2X.

NOTE The degree of protection IP2X covers the degree of protection IPXXB.

These are much less precise requirements than normally expected in a standard. The forms of separation given are only typical and the means by which separation is achieved is subject to agreement between the user and the manufacturer. More fundamentally, no indication is given as to the objectives of separating an assembly. The benefits a particular form of separation may bring are not defined, conversely, nor are the disadvantages if an inappropriate selection is made.

Fundamental Objectives of Separation

The principal reason for separating an assembly is to facilitate access to a part of the assembly whilst other parts may remain energised and in service. Whilst, in general, separation does not improve the electrical performance of the assembly it does provide:

- Protection against contact with live parts belonging to the adjacent functional units,
- Protection against the passage of solid foreign bodies from one unit of an assembly to an adjacent unit.

Verification of separation is by application of the appropriate IP test to BS EN 60529 (IPXXB and/or IP2X).

Legal Obligations

As most National Standards, including the BS EN 61439 series, are derived from International Standards, they reflect good practice but they do not fully encompass the requirements of local legislation. Indeed, the standards may not be legally binding.

In the United Kingdom legal obligations take precedence over standards. For low-voltage assemblies the Low Voltage Directive (LVD) and the Electricity at Work Act are relevant and in particular, Regulation 14 of the latter must be respected.

The Law

Regulation 14

“No person shall be engaged in any work activity on or near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless:-

- (a) it is unreasonable in all the circumstances for it to be dead; and***
- (b) it is reasonable in all the circumstances for him to be at work on or near it while it is live; and***
- (c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury”***

Clearly this regulation is pertinent and onerous when contemplating working within a partially energised assembly. There is no allowance for tolerable risk. If an assembly can reasonably be isolated prior to any covers being removed, it must be isolated.

Where it is impractical to totally isolate an assembly prior to carrying out work within an assembly, the degree of separation, and the way in which the separation is achieved within the assembly should be considered in a risk assessment to be undertaken by the Duty Holder (see definitions). This risk assessment will consider all relevant factors including:

- (i) Work to be carried out,
- (ii) Mechanical protection afforded by any insulation and separation,
- (iii) Possibility of initiating a flashover,
- (iv) Likelihood of an electric shock.

Basics of Separation

[\[Return to FAQs\]](#) ➔

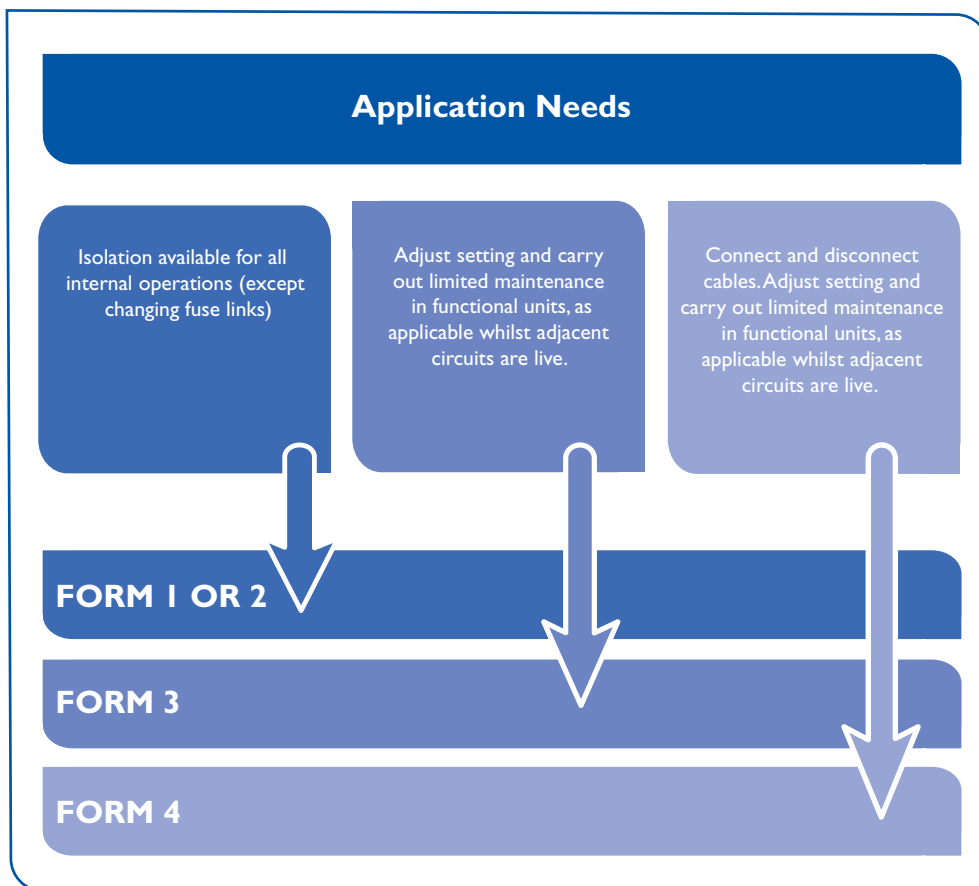
Specifying the most appropriate form of separation for an assembly is not an easy matter. In specifying a form of separation the following should be considered:

- The consequences of isolating the assembly or part of,
- Nature of task to be performed,
- Competence of person undertaking work whilst the remainder of the assembly is energised.

Users and specifiers of assemblies are encouraged to consider in detail the application and then to follow the process outlined in the main considerations section, in order to determine the most appropriate form of separation required.

Main considerations

BS EN 61439-2 identifies four main categories of separation; Forms 1, 2, 3 and 4. As a first step users should consider what operations they need to carry out without fully isolating the assembly. Then using a process generally as outlined in the chart below, identify the main category of separation they require for their application.



Having established the fundamental form for separation needed for an application, specific details must be considered. The IEC and EN versions of 61439-2 divide Forms 2, 3 and 4 into two sub categories. However, within the requirements defined in the standards there are three fundamental ways of providing separation:

- Insulation of live parts,
- Partitions or barriers (metallic or non-metallic),
- Integral housing of a device.

Each has different attributes; clearly much depends on the ‘agreement between user and manufacturer’.

In order to aid the agreement between user and manufacturer, BS EN 61439-2 includes a National Annex which further details the sub categories by type of construction such as describing the location of terminals for external conductors and in some instances, the location of cable glands relative to the associated cable terminals.

In making the appropriate choice the user needs to consider:

- The tasks to be carried out with the assembly partially energised – adjusting relay setting, terminating large power cables, replacing components, etc.
- What tools may be used. Is there a risk of tools slipping and damaging insulation.
- Possibility of mechanical impact causing damage to the integrity of the separation.
- Is there a danger of small components falling from one compartment to another causing a hazard.
- Can temporary barriers be effectively used to supplement the protection provided by separation whilst work is being carried out.
- The additional safety that can be provided by the use of Personal Protective Equipment.
- The anticipated level of skill of those carrying out any work within the assembly.

Detailed selection

Using the considerations listed above and any other relevant application specific needs the user should then refine their separation needs and select the appropriate sub category of the basic form selected.

Forms 1
and 2

Options in the National Annex of BS EN 61439-2			
Main criteria	Sub-criteria	Form	Type of construction
No separation		Form 1	
Separation of busbars from the functional units.	Terminals for external conductors not separated from busbars.	Form 2a	
	Terminals for external conductors separated from busbars.	Form 2b	Type 1 Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings.
			Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions.

With Form 1 all components including busbars and cable termination can, and usually are, in the same compartment. In order to safely work within the assembly it must be isolated upstream.

Form 2 has the busbars separated from the functional units and, depending on whether 2a or 2b is selected the cable terminals may be separated from the busbars. However, as functional units are not separated from each other, Form 2 has little practical advantage over Form 1. In reality a Form 2 assembly without any additional barriers or screens must be isolated prior to the interior of the assembly being accessed.

Form 3

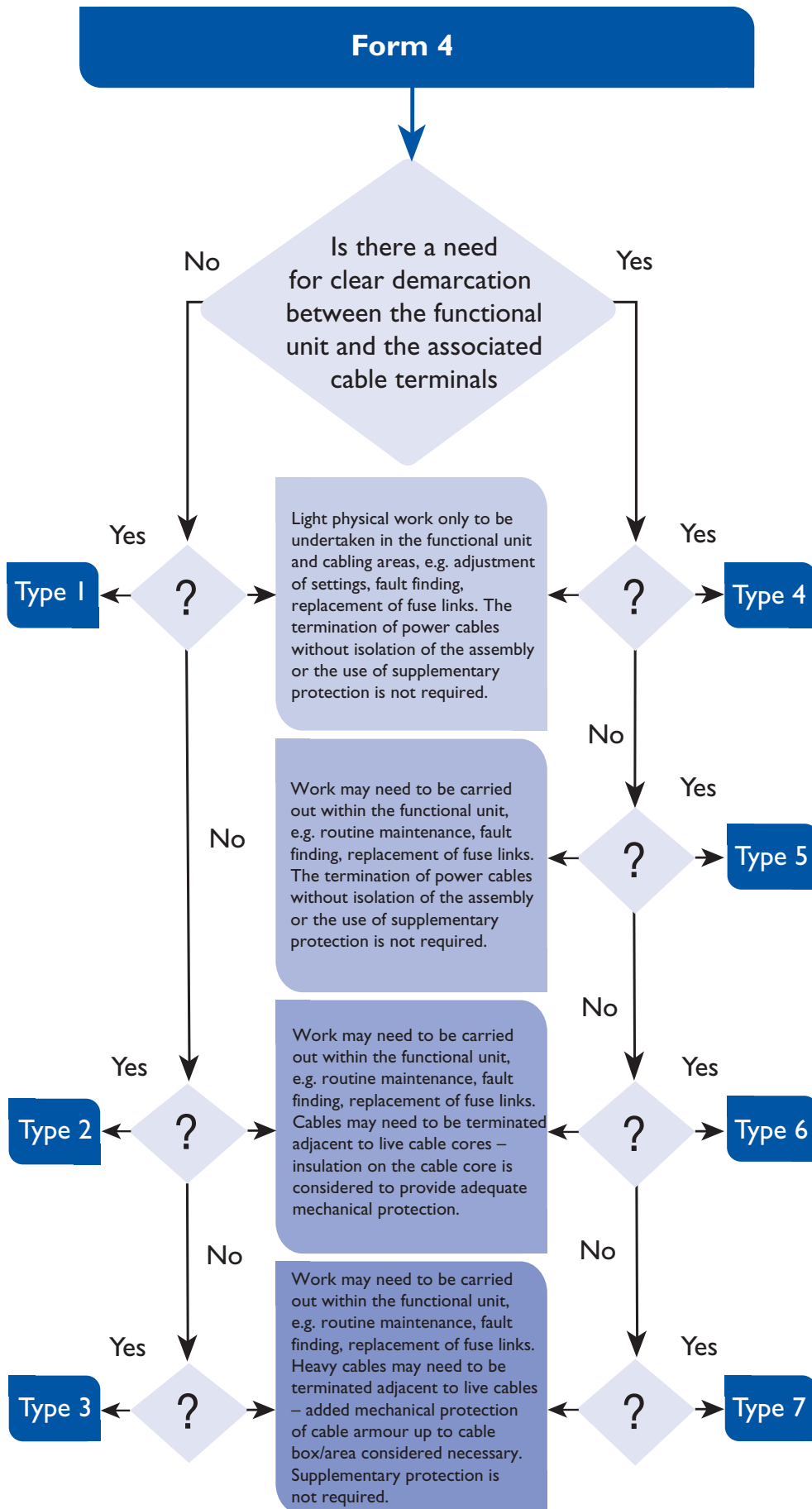
Options in the National Annex of BS EN 61439-2			
Main criteria	Sub-criteria	Form	Type of construction
Separation of busbars from the functional units and separation of all functional units from one another. Separation of the terminals for external conductors from the functional units, but not from each other.	Terminals for external conductors not separated from busbars.	Form 3a	
	Terminals for external conductors separated from busbars.	Form 3b	Type 1 Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings.
			Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions.

Form 3 may permit work to be carried out within the functional unit, for example; routine maintenance, fault finding, replacement of fuse links. In selecting the constructional type the specifier must, bearing in mind there is no requirement for the terminals of one circuit to be separated from adjacent circuits, determine if there is benefit to be gained from separating the busbars from cable terminals. If there is advantage in having the busbars separated, the means of separation, sleeving or similar or rigid barriers must be determined based on the likely mechanical needs of the separation.

Form 4

Options in the National Annex of BS EN 61439-2			
Main criteria	Sub-criteria	Form	Type of construction
Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit.	Terminals for external conductors in the same compartment as the associated functional unit.	Form 4a	Type 1 Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings. Cables may be glanded elsewhere.
			Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Cables may be glanded elsewhere.
			Type 3 Busbar separation is by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility.
	Terminals for external conductors not in the same compartment as the associated functional unit, but in individual, separate, enclosed protected spaces or compartments.	Form 4b	Type 4 Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings. Cables may be glanded elsewhere.
			Type 5 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Terminals may be separated by insulated coverings and glanded in common cabling chamber(s).
			Type 6 All separation requirements are by metallic or non-metallic rigid barriers or partitions. Cables are glanded in common cabling chamber(s).
			Type 7 All separation requirements are by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility.

Form 4 provides many variants which offer different opportunities in use. Selecting the most appropriate needs a very detailed understanding of the application and a logical thought process to arrive at the most suitable solution. The following flow chart may assist in this exercise.



Other considerations

In applications where an extremely high continuity of supply is required there may be an advantage in being able to replace or add a functional unit while the busbars and adjacent circuits remain energised and in service. For these applications an assembly with withdrawable or removable functional units should be specified. The level of protection provided to operators while the functional unit is being removed and when it is removed needs to be agreed with the manufacturer.

BS EN 61439-2 is not definitive in what separation will offer or how it will be achieved. Much is left to agreement between the user and manufacturer. This is intentional as it allows manufacturers to use their initiative, whilst meeting the basic requirements set out in the standard. It also enables the most appropriate assembly to be provided for the particular application, but in so doing, it does make selecting the right assembly all the more difficult.

In addition to the process outlined above the following should be taken into account before reaching a final decision on the form of separation to be specified for a particular application.

1. Method of construction in Form 3 and 4 assemblies

As switching devices such as MCCBs, integrated motor starters and variable speed drives evolve; there is an increasing tendency for them to be enclosed in their own integral housing (group mounted). This provides an opportunity to use the device's integral housing as the means of separation or, alternatively enclose the complete device within a compartment within the assembly (compartmentalised).

The use of the device's integral housing as a means of separation is recognised within BS EN 61439-2. Whichever approach is used, the chosen devices and the assembly as a whole must meet the safety and performance criteria set out in the standard. Generally, use of the integral housing as a means of separation will lead to the most compact assembly, but its suitability will essentially be determined by the way in which the assembly is to be used (operated, maintained, etc.) throughout its anticipated life.

2. Use of multiple forms of separation

Within an assembly it can be acceptable and even advantageous to use more than one form of separation. For example, within a Form 4 assembly it may be acceptable to have a MCB distribution board that may be regarded as one functional unit. Alternatively the Form 4 assembly may include several circuits of different Form 4 types with different cable termination arrangements. Similarly, where there is difficulty isolating an assembly upstream, a Form 1 or 2 assembly may be acceptable providing its incoming cable terminals are separated using a Form 4 construction.

3. Holes in partitions or barriers

The basic requirement for separation is that barriers or partitions should pass an IP2X test. If, based on the anticipated use of the assembly, this will lead to an unacceptable risk of parts or tools accidentally passing into energised functional units, the user should discuss his requirements with the manufacturer.

4. Size

As a general rule the higher the degree of separation then the larger the assembly. Barriers and partitions take up space and may restrict air flow necessitating the use of larger components to achieve the required rating of a circuit within the assembly. Almost certainly a Form 4 Type 3 or 7 specification will increase the size of the assembly compared with a lower form of separation.

5. Changing fuse links

Whilst not specifically covered within BS EN 61439-2, assemblies generally supplied by BEAMA member companies will be arranged such that fuse links within functional units can be replaced by suitably instructed and competent personnel without the need to isolate the whole assembly.

6. Neutral

The risks associated with neutral conductors in a present day distribution system have prompted much debate and at times have led to a more cautious approach than is necessary.

BS 7671 (UK wiring regulations) prescribes that except for a main switch intended for operation by ordinary persons, in a TN-S or TN-C-S system the neutral conductor need not be isolated or switched where it can be regarded as being reliably connected to earth by a suitably low impedance.

The neutral conductor of a circuit may remain connected when the line conductor(s) of that circuit are isolated. This could be a hazard because a voltage difference between a neutral and earth can be present. Prior to undertaking work on the circuit it must be ascertained if the capacity to deliver a harmful electric shock exists.

In a TN-S or TN-C-S system, a harmful touch voltage due to load current in the neutral is unlikely, where the circuit conductors have been sized to comply with the voltage drop constraints in Table 12A of BS 7671. Nevertheless, a competent person must complete a risk assessment and appropriate test(s) to confirm that, the exposed neutral connection within the assembly is not a hazardous live part. In particular, The (UK) Electricity at Work Regulations 1989 including any amendments must be complied with.

7. Safe working with adjacent equipment energised

Switchboard manufacturers cannot give all embracing assurances for safe working, according to the form of separation with parts of the assembly energised. Specifying a particular form of separation will not guarantee this for any given form number. Effectively this means that where live working is being contemplated a risk assessment and judgement must be made for every situation by the Duty Holder.

8. Cost

Higher forms of separation, generally lead to larger and structurally more complex assemblies and therefore higher costs. For the most cost effective solution the lowest level of separation that meets the needs of the application should be specified.



Introduction to Illustrations

The illustrations which follow are interpretations for the various types of construction used to achieve satisfactory forms of separation in accordance with BS EN 61439-2.

Specifiers and users should be aware that the different methods that manufacturers use to achieve various forms of separation can often result in two products which both bear the same overall form type but can be physically and financially different.

The illustrations are in no way intended to be considered as prescriptive.

Although many assemblies are custom built and by nature “unique” the illustrations represent a general indication of typical product offerings of BEAMA member companies.

BS EN 61439-2 also includes panel boards within its scope. This has been reflected in production of these illustrations.

All of the following illustrations exclude the external enclosure.

Overview of the Forms of Separation

Key:



Notes:

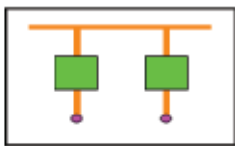
Forms of Separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device

All diagrams from figures AA 1, 2, & 3 from Annex AA
Text from UK National Annex
Both from BS EN 61439-2

Form 1

Form 1

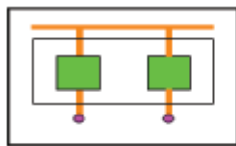


Form 1:

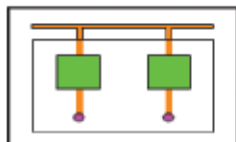
No internal separation is provided.

Form 2

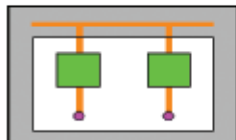
Form 2a



Form 2b Type 1



Form 2b Type 2



Form 2:

Functional unit separate from the busbars

The 'a' designation denotes terminals are not separate from the busbar

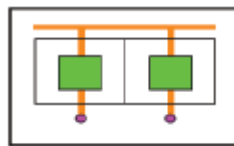
The 'b' designation denotes terminals are separate from the busbar

Type 1 utilises insulated coverings for busbar separation

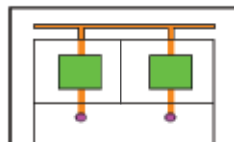
Type 2 utilises insulated partitions and barriers for busbar separation.

Form 3

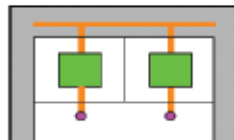
Form 3a



Form 3b Type 1



Form 3b Type 2



Form 3:

As Form 2 plus:

Functional units separate from other functional units

The 'a' designation denotes terminals are not separate from the busbar

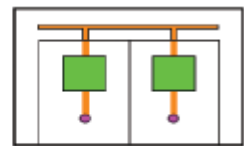
The 'b' designation denotes terminals for external conductors are in a **separate** compartment to the functional unit

Type 1 utilises insulated coverings for busbar separation

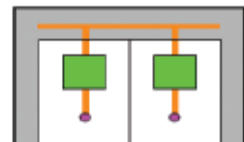
Type 2 utilises insulated partitions and barriers for busbar separation.

Form 4

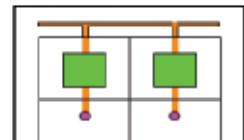
Form 4a Type 1



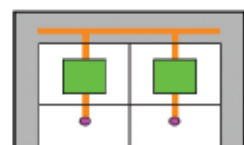
Form 4a Type 2 & Type 3



Form 4b Type 4



Form 4b Type 5, 6 & 7



Form 4:

As Form 3 plus:

Terminals for external conductors separate each other

The 'a' designation denotes terminals within the functional unit

The 'b' designation denotes terminals for external conductors are in a **separate** compartment to the functional unit

Types 1 & 4 utilises insulated coverings for busbar separation

Types 2, 3, 5, 6 & 7 utilise partitions and barriers for busbar separation

Types 3 & 7 feature integral glanding

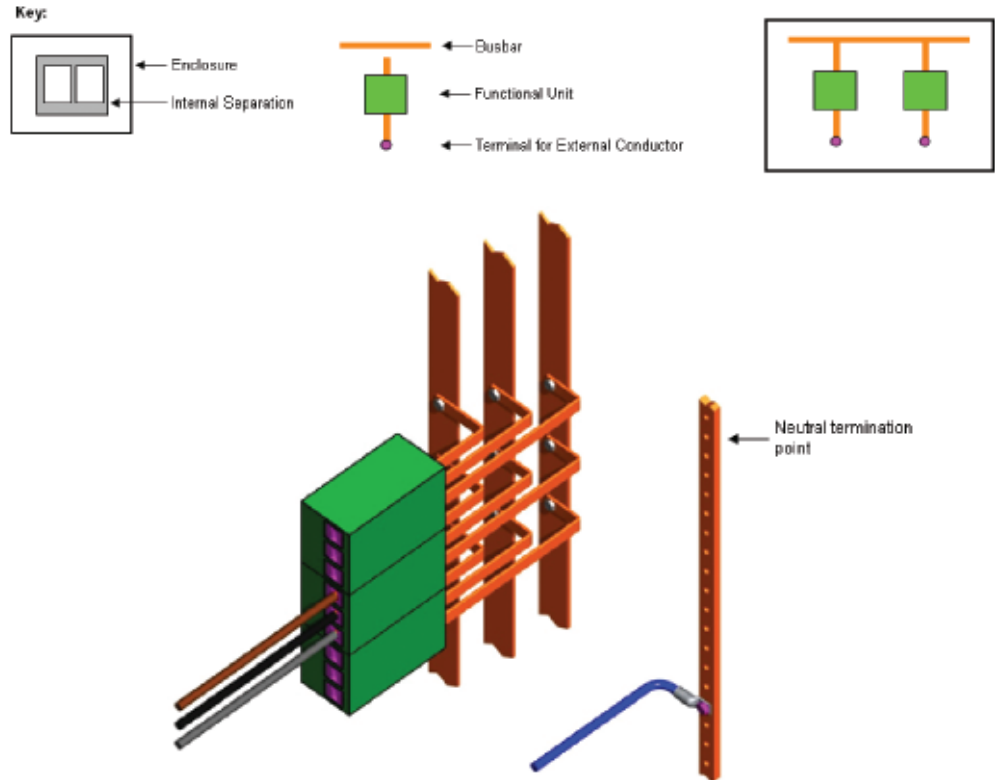
Type 5 utilises insulated coverings for terminals for external conductors.

Form 1

Form 1 assemblies are closed so as to provide protection against contact with internal live parts, or compartments, but where no internal separation is provided for functional units or terminals.

Form 1 requires that;

- (i) Busbars **are not** separated from functional units
- (ii) Busbars **are not** separated from any incoming or outgoing termination
- (iii) Functional units **are not** separated from other functional units
- (iv) Functional units **are not** separated from any incoming or outgoing termination.



Form 2a

All Form 2 assemblies are enclosed so as to provide protection against contact with internal live parts, or compartments and where there is internal separation of the busbar from the functional units.

Form 2a requires that;

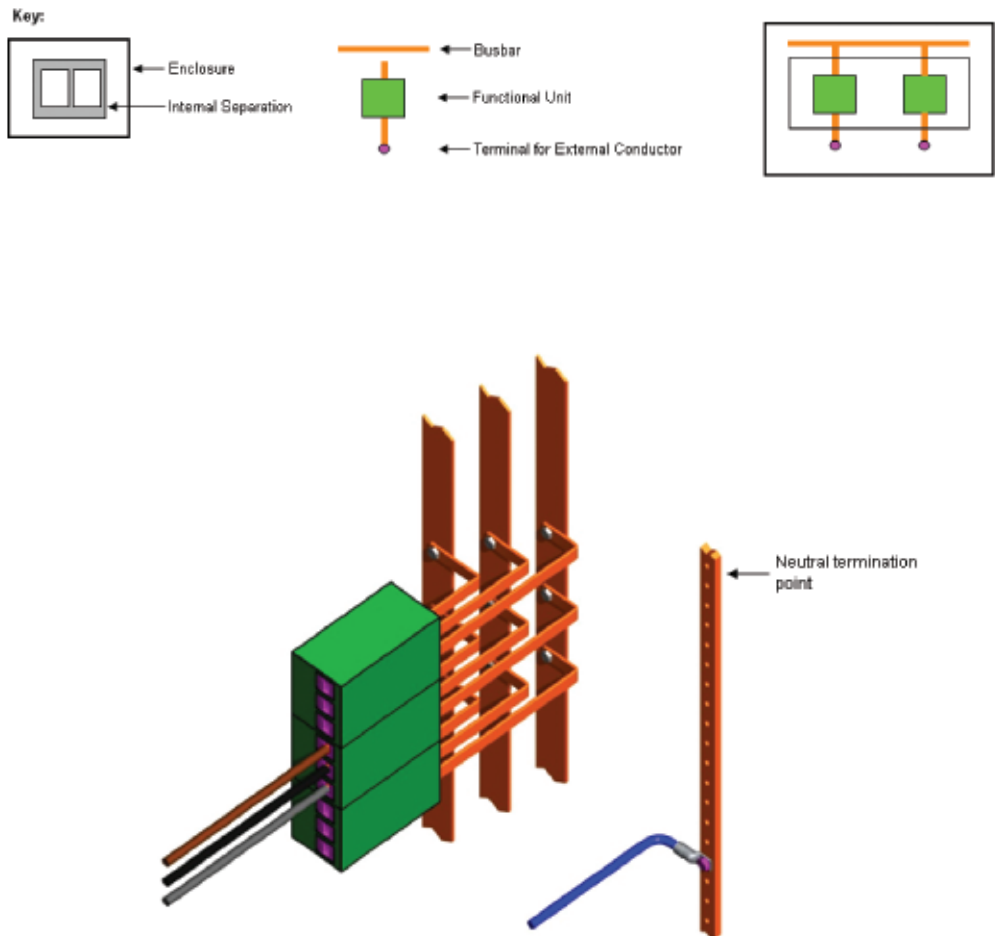
- (i) Busbars **are** separated from functional units
- (ii) Busbars **are not** separated from any incoming or outgoing termination
- (iii) Functional units **are not** separated from other functional units
- (iv) Functional units **are** separated from any incoming or outgoing termination
- (v) Terminals **are not** separate from each other.

Notes:

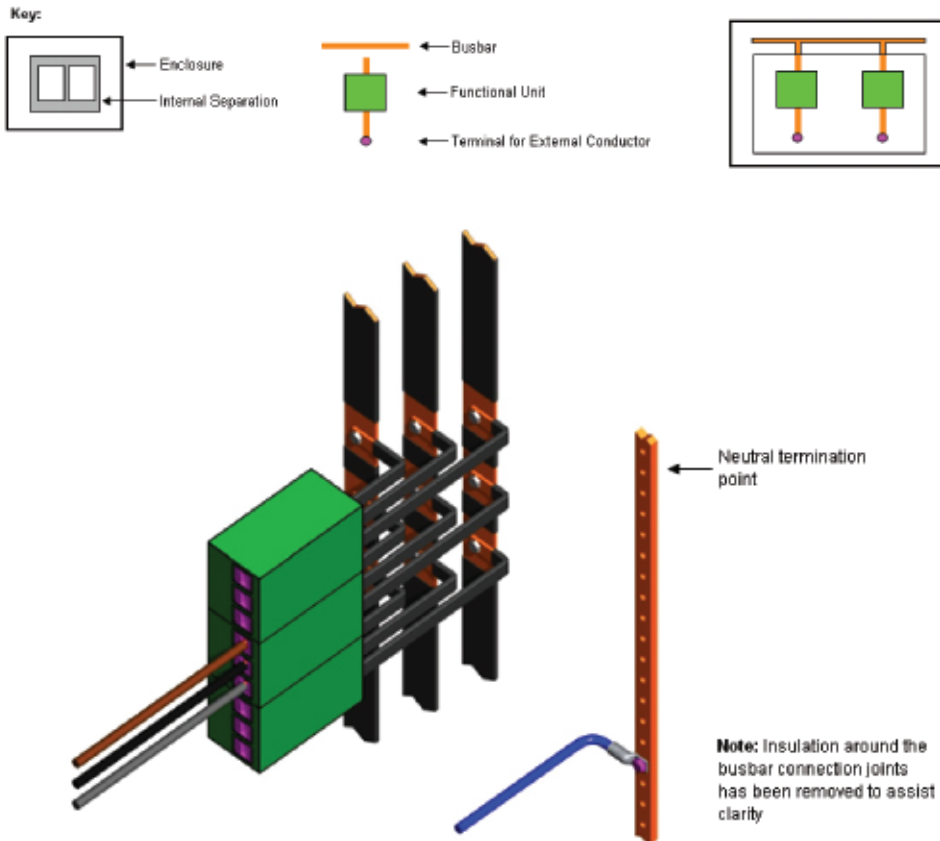
Forms of separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.

The 'a' designation denotes terminals for external conductors are not separate from the busbars.



The above illustration uses the "Integral Housing of the Device" as a means of separation.



The above illustration uses the “Integral Housing of the Device” as a means of separation.
Cable terminations are integral to the device.

Form 2b Type 1

All Form 2 assemblies are enclosed so as to provide protection against contact with internal live parts, or compartments and where there is internal separation of the busbar from the functional units.

Form 2b Type 1 requires that;

- (i) Busbars are separated from functional units

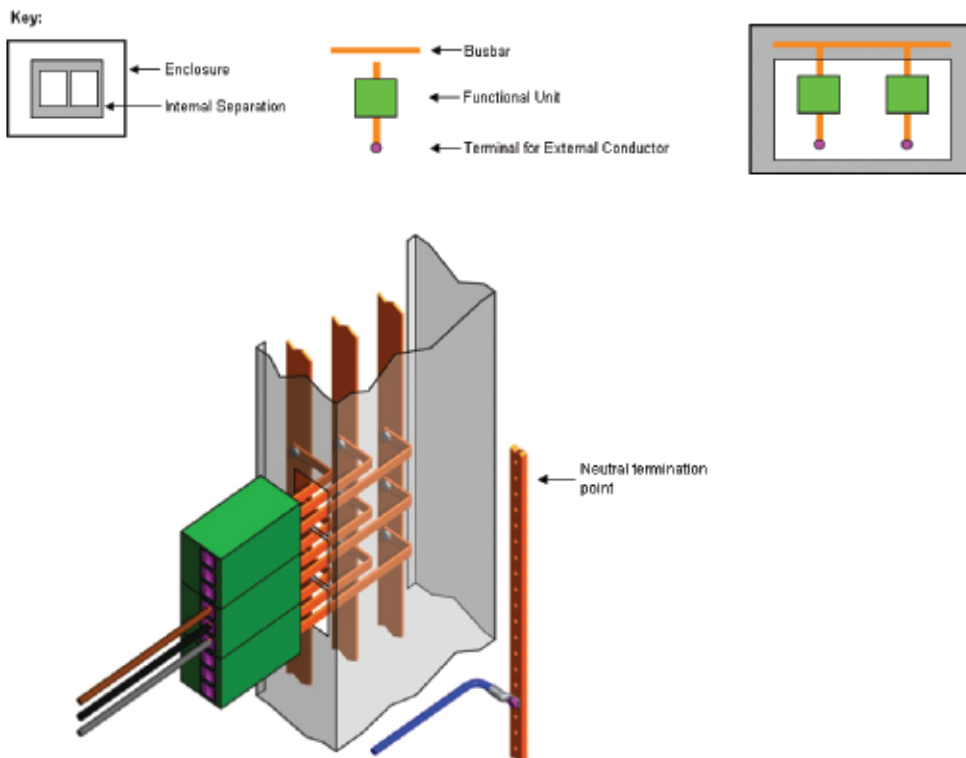
Notes:

Forms of separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral terminations see Other Considerations item 6.

The ‘b’ designation denotes terminals are separate from the busbars.

The ‘Type 1’ designation denotes busbar separation is achieved by insulated coverings – sleeving, wrapping or coating.



Form 2b Type 2

All Form 2 assemblies are enclosed to provide protection against contact with internal live parts, or compartments and where there is internal separation of the busbar from the functional units.

Form 2b Type 2 requires that;

- (i) Busbars are separated from functional units.

Notes:

Forms of separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral terminations see Other Considerations item 6.

The ‘b’ designation denotes terminals are separate from the busbars.

The ‘Type 2’ designation denotes busbar separation by partitions and barriers.

Form 3a

All Form 3 assemblies are enclosed so as to provide protection against contact with internal live parts, or compartments and where there is internal separation of the busbar from the functional units and separation of the functional units from each other. Terminals are separated from functional units but not from each other.

Form 3a requires that;

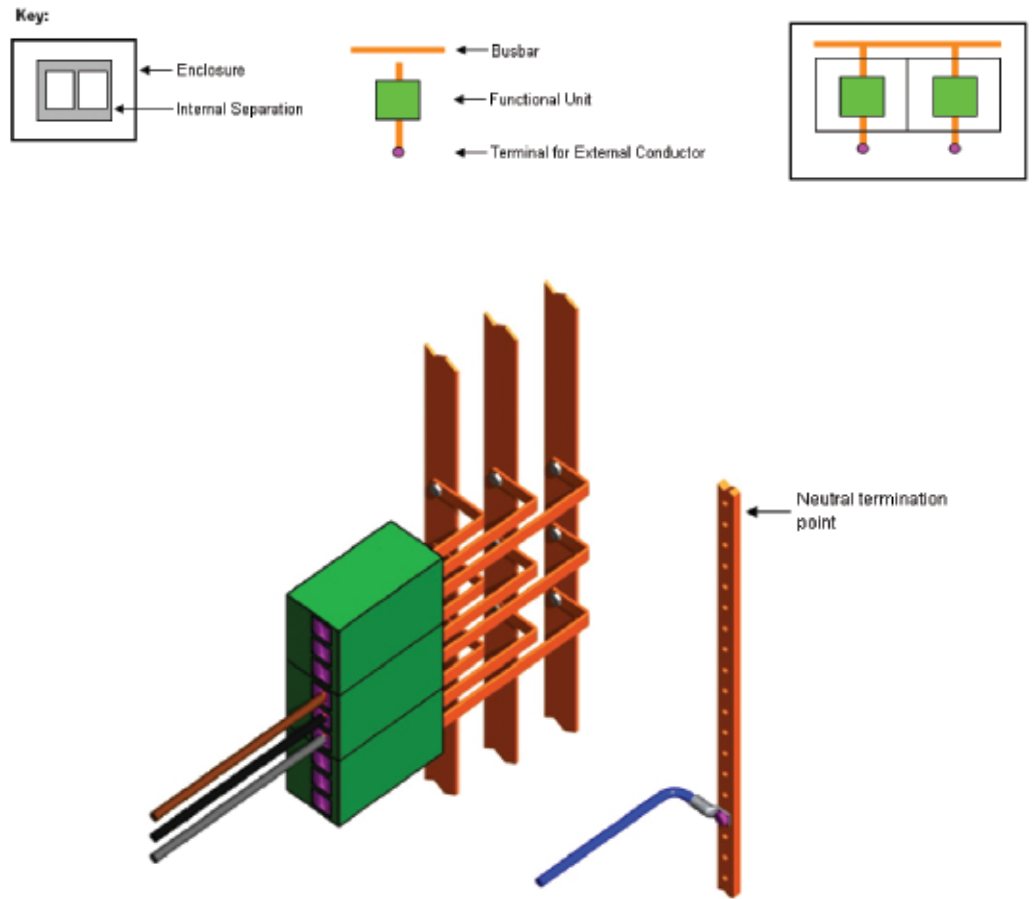
- (i) Busbars **are** separated from functional units
- (ii) Busbars **are not** separated from any incoming or outgoing termination
- (iii) Functional units **are** separated from other functional units
- (iv) Functional units **are** separated from any incoming or outgoing termination
- (v) Terminals **are not** separate from each other.

Notes:

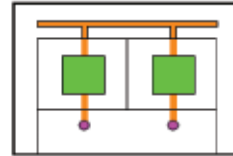
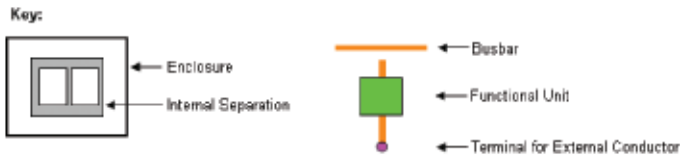
Forms of separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.

The 'a' designation denotes terminals for external conductors are not separate from the busbars.



The illustration above is Form 3a where the Integral Housing of the device is the means of separation and the arrangement is regarded as 'Group Mounted'.



Form 3b Type I

All Form 3 assemblies are enclosed so as to provide protection against contact with internal live parts, or compartments and where there is internal separation of the busbar from the functional units and separation of the functional units from each other. Terminals are separated from functional units but not from each other.

Form 3b Type I also requires that;

- (i) Busbars **are** separated from functional units
- (ii) Functional units **are** separated from other functional units
- (iii) Terminals for external conductors **are** separated from the respective functional unit and the busbars. Terminals are not separated from other terminals for external conductors.

Notes:

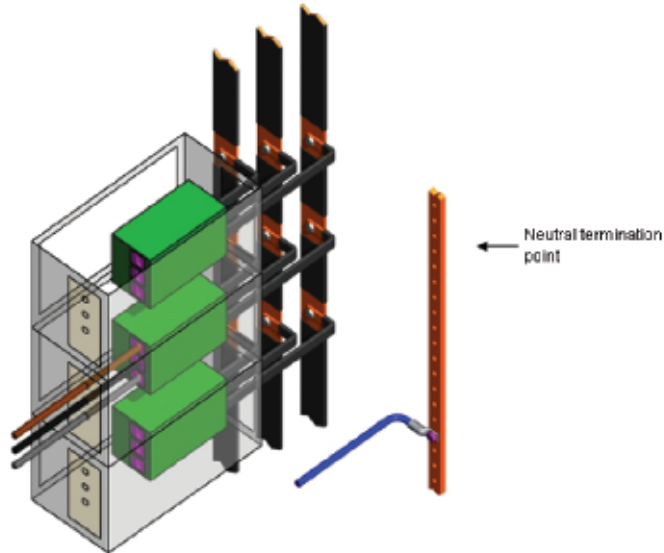
Forms of separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.

The 'b' designation denotes terminals for external conductors are in a **separate** compartment to the functional unit.

The 'Type I' designation denotes busbar separation is achieved by insulated coverings – sleeving, wrapping or coating.

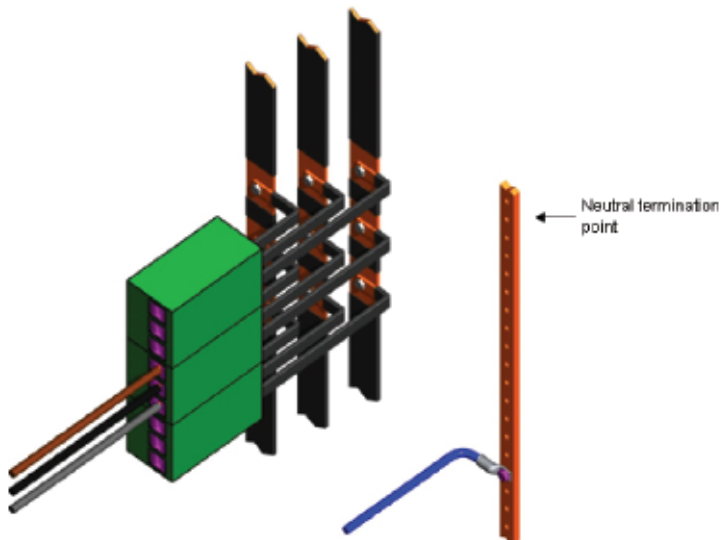
Compartmentalised



The above illustration uses “Partitions and Barriers” as a means of separation and is referred to as **Compartmentalised**.

Note: Insulation around the busbar connection joints has been removed, in both images to assist clarity.

Group Mounted



The above illustration uses the “Integral Housing of the Device” as a means of separation and is referred to as **Group Mounted**.

Where a device's integral housing is the means of separation, the construction of the device shall be such that it has a barrier which prevents access from the terminals for external conductors, to the internal parts of the device.

Form 3b Type 2

All Form 3 assemblies are enclosed so as to provide protection against contact with internal live parts, or compartments and where there is internal separation of the busbar from the functional units and separation of the functional units from each other. Terminals are separated from functional units but not from each other.

Form 3b Type 2 also requires that;

- (i) Busbars **are** separated from functional units
- (ii) Functional units **are** separated from other functional units
- (iii) Terminals for external conductors **are** separated from the respective functional unit and the busbars. Terminals are not separated from other terminals for external conductors.

Notes:

Forms of separation can be achieved by using;

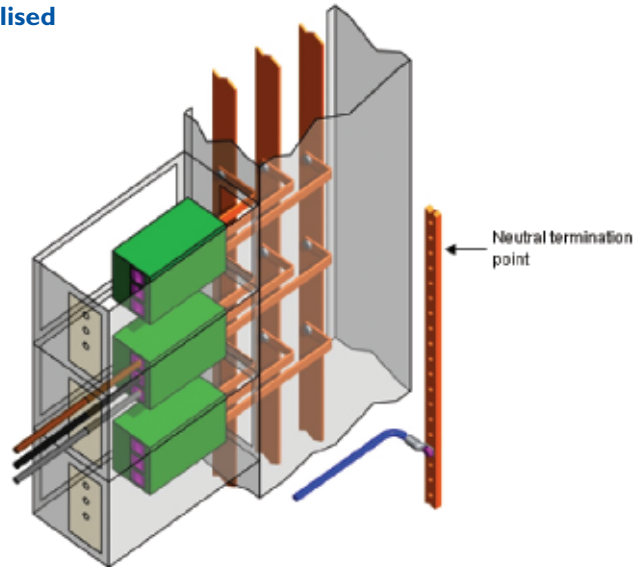
- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.

The 'b' designation denotes terminals for external conductors are in a **separate** compartment to the functional unit.

The 'Type 2' designation denotes busbar separation by partitions and barriers.

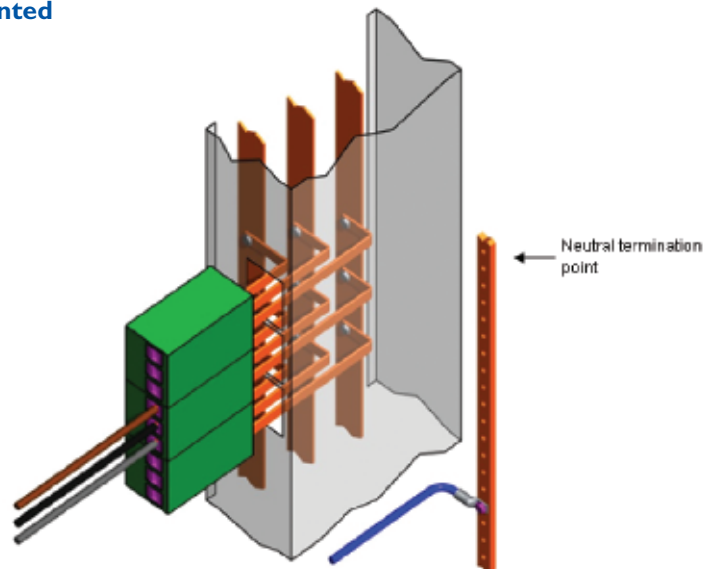


Compartmentalised



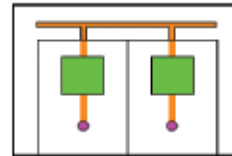
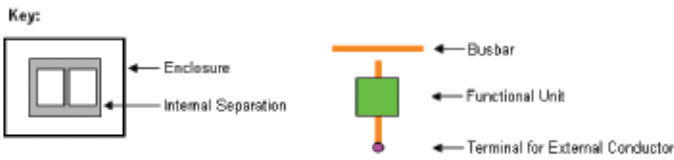
The above illustration uses "Partitions and Barriers" as a means of separation and is referred to as **Compartmentalised**.

Group Mounted



The above illustration uses the "Integral Housing of the Device" as a means of separation and is referred to as **Group Mounted**.

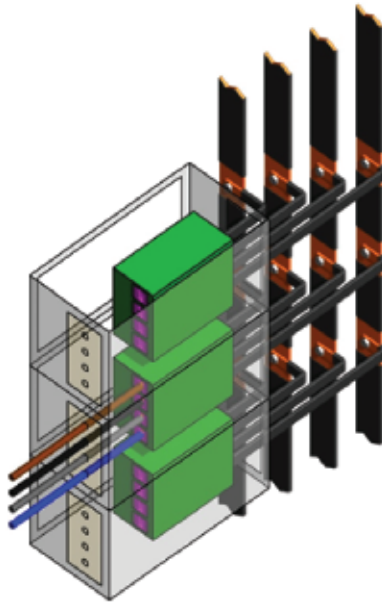
Where a device's integral housing is the means of separation, the construction of the device shall be such that it has a barrier which prevents access from the terminals for external conductors, to the internal parts of the device.



Form 4a Type I

All Form 4a assemblies require the termination of all associated external conductors, both line(s) and neutral within the functional unit. Separate/common neutral bars **do not** fulfil this requirement.

Compartmentalised



The above illustration uses a combination of clauses covering “Partitions and Barriers” and “Insulated Coverings”.

Note: Insulation around the busbar connection joints has been removed, in both images to assist clarity.

- Form 4a Type I also requires the separation of;**
- (i) Busbars from functional units
 - (ii) Functional Units from each other
 - (iii) Terminals for external conductors from other terminals **and** from the busbars.

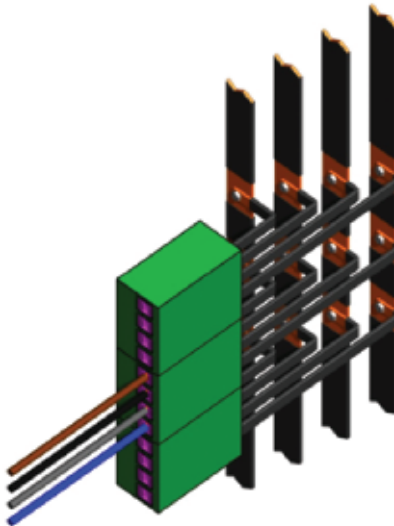
Notes:

- Forms of separation can be achieved by using;**
- (i) Partitions/barriers of metallic or non-metallic material
 - (ii) The integral housing of the device
 - (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
 - (iv) For neutral termination see Other Considerations item 6.

The ‘a’ designation denotes terminals for external conductors are within the **same** compartment as the functional unit.

The ‘Type I’ designation denotes busbar separation is achieved by insulated coverings – sleeving, wrapping or coating.

Group Mounted



The above illustration uses a combination of clauses covering “Integral Housing of the Device” and “Insulated Coverings”.

Form 4a Type 2

All Form 4a assemblies require the termination of all associated external conductors, both line(s) and neutral within the functional unit. Separate/common neutral bars **do not** fulfil this requirement.

Form 4a Type 2 also requires the separation of;

- (i) Busbars from functional units
- (ii) Functional Units from each other
- (iii) Terminals for external conductors from other terminals **and** from the busbars.

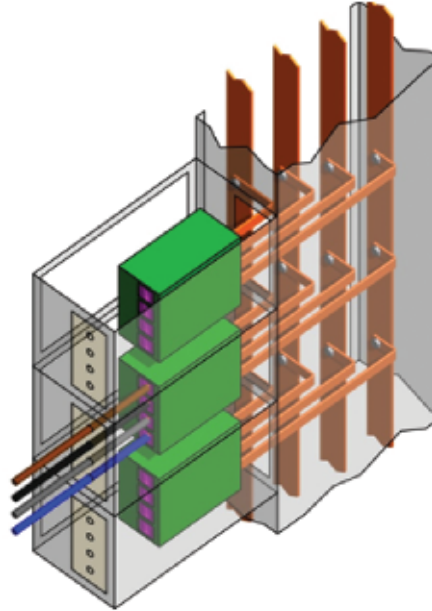
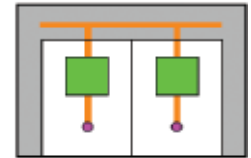
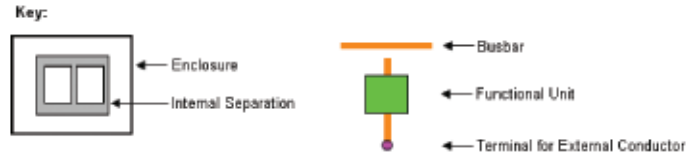
Notes:

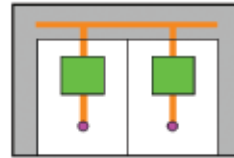
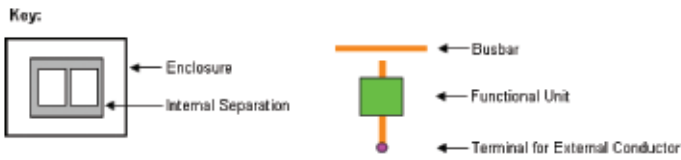
Forms of separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.

The 'a' designation denotes terminals for external conductors are within the **same** compartment to the functional unit.

The 'Type 2' designation denotes busbar separation by partitions and barriers.





Form 4a Type 3

All Form 4a assemblies require the termination of all associated external conductors, both line(s) and neutral within the functional unit. Separate/common neutral bars **do not** fulfil this requirement.

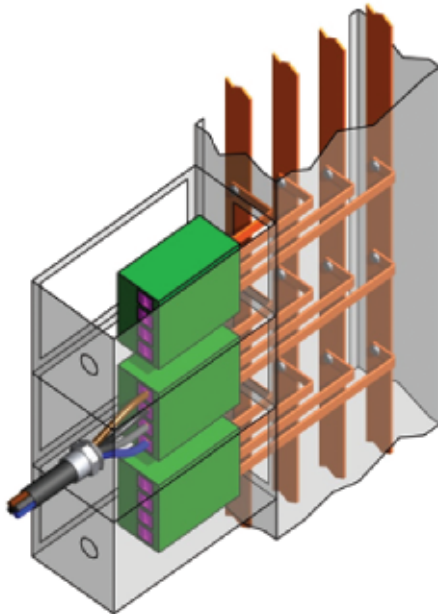
Form 4a Type 3 also requires the separation of:

- (i) Busbars from functional units
- (ii) Functional Units from each other
- (iii) Terminals for external conductors from other terminals **and** from the busbars
- (iv) Individual, integral cable glanding facilities are to be provided for each circuit.

Notes:

Forms of separation can be achieved by using:

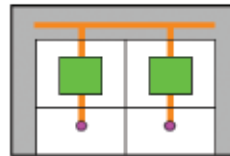
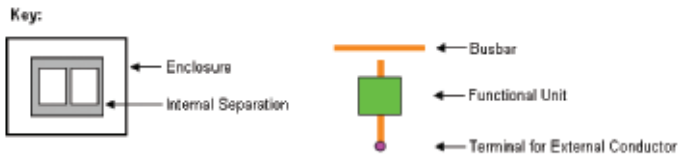
- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.



The above illustration uses "Partitions and Barriers" as a means of separation. Cable terminations are integral to the device.

The 'a' designation denotes terminals for external conductors are within the **same** compartment as the functional unit.

The 'Type 3' designation denotes busbar separation by partitions and barriers.



Form 4b Type 5

All Form 4b assemblies require the termination of all associated external conductors, both line(s) and neutral within a space separate from but associated with the functional unit. Separate/common neutral bars do **not** fulfil this requirement.

Form 4b Type 5 also requires the separation of:

- (i) Busbars from functional units
- (ii) Functional Units from each other
- (iii) Terminals for external conductors from their own functional unit, other sets of terminals **and** from the busbars
- (iv) Separation of terminals for external conductors to be achieved by insulated coverings.

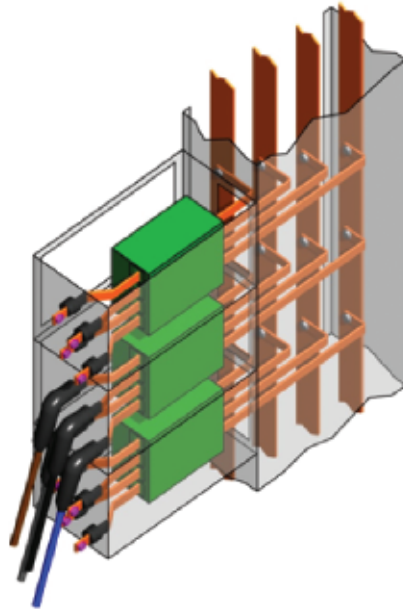
Notes:

Forms of separation can be achieved by using:

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see *Other Considerations* item 6.

The 'b' designation denotes terminals for external conductors are in a **separate** compartment to the functional unit.

The 'Type 5' designation denotes busbar separation by partitions and barriers with outgoing terminals separated by insulated coverings.



The above illustration uses "Partitions and Barriers" as a means of separation and "insulated coverings" for separation of external terminals.

Form 4b Type 6

All Form 4b assemblies require the termination of all associated external conductors, both line(s) and neutral within a space separate from but associated with the functional unit. Separate/common neutral bars **do not** fulfil this requirement.

Form 4b Type 6 also requires the separation of;

- (i) Busbars from functional units
- (ii) Functional Units from each other
- (iii) Terminals for external conductors from other terminals **and** from the busbars.

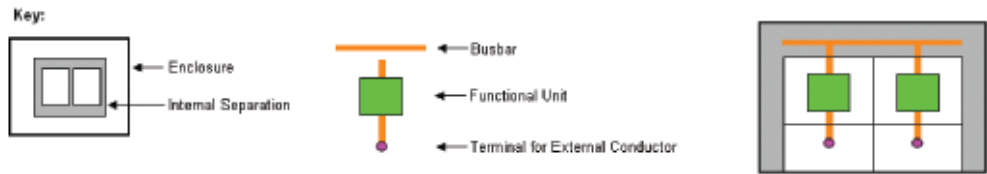
Notes:

Forms of separation can be achieved by using;

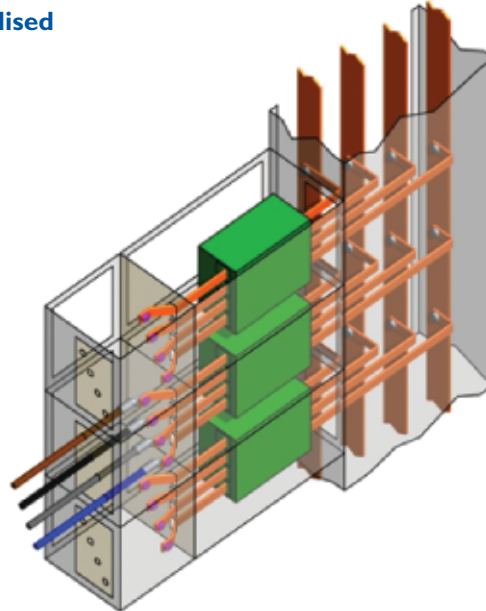
- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.

The 'b' designation denotes terminals for external conductors are in a **separate** compartment to the functional unit.

The 'Type 6' designation denotes busbars and terminals are separated by partitions and barriers.

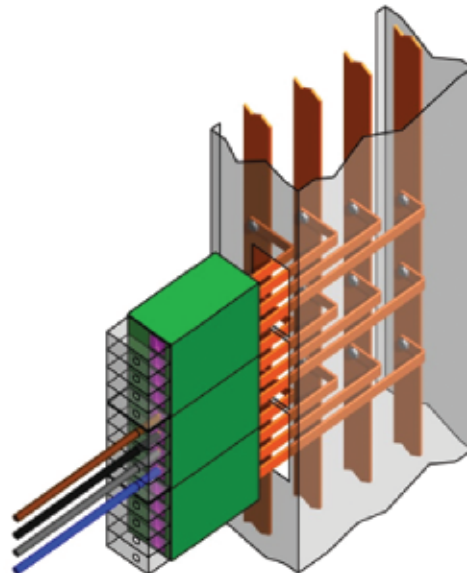


Compartmentalised



The above illustration uses "Partitions and Barriers" as a means of separation and is referred to as **Compartmentalised**. Cable terminations are extended into separate individual compartments.

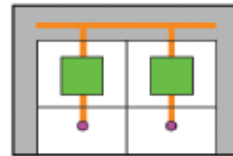
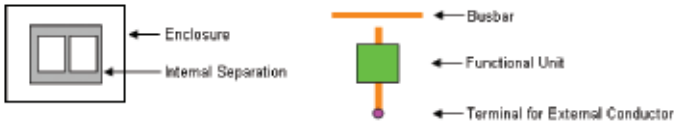
Group Mounted



The above illustration uses the "Integral Housing of the Device" as a means of separation and is referred to as **Group Mounted**. Cable terminations are separated by terminal shields.

Where a device's integral housing is the means of separation, the construction of the device shall be such that it has a barrier which prevents access from the terminals for external conductors, to the internal parts of the device.

Key:



Form 4b Type 7

All Form 4b assemblies require the termination of all associated external conductors, both line(s) and neutral within a space separate from but associated with the functional unit. Separate/common neutral bars **do not** fulfil this requirement.

Form 4b Type 7 also requires the separation of;

- (i) Busbars from functional units
- (ii) Functional Units from each other
- (iii) Terminals for external conductors from other terminals **and** from the busbars
- (iv) Individual, integral cable glanding facilities are to be provided for each circuit.

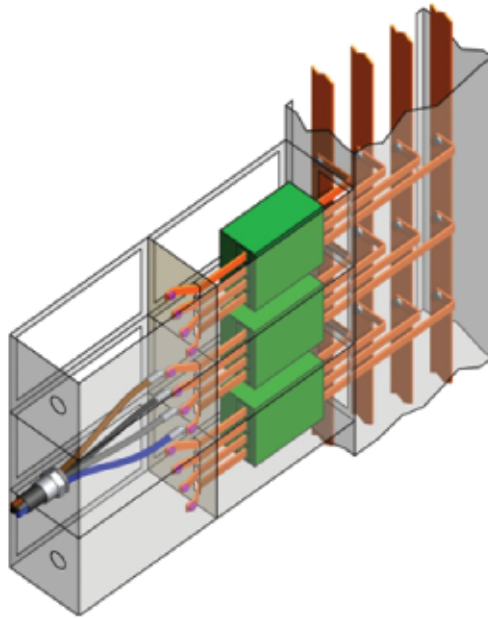
Notes:

Forms of separation can be achieved by using;

- (i) Partitions/barriers of metallic or non-metallic material
- (ii) The integral housing of the device
- (iii) Terminal shrouds, shields and dividers can be used to contribute towards the required degree of separation (IPXXB)
- (iv) For neutral termination see Other Considerations item 6.

The 'b' designation denotes terminals for external conductors are in a **separate** compartment to the functional unit.

The 'Type 7' designation denotes busbars and extended terminals are separated by partitions and barriers.



The above illustration uses "Partitions and Barriers" as a means of separation.

Cable terminations are extended into separate individual compartments.

Frequently Asked Questions

What are the responsibilities of a Duty Holder ?

Are there legal requirements as well as the LVD ?

How do I decide what form of separation is required ?

There are many types of Form 4 how do I decide which is most appropriate to my application ?

Does all of an assembly have to be the same form ?

Where does the Neutral connect in a Form 4 assembly ?

For further details on the neutral connection click here to shortcut to the Form 4 illustrations

Is the Neutral safe to touch ?

What are the technical requirements for the many forms of separation ?

Is there more than one method of achieving a form of separation ?

Does the form of separation affect the size of the assembly ?

Does the form of separation affect the cost of the assembly ?

What form of separation enables safe live working ?

Can the integral housing of the device provide separation ?



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