

# FAQ'S

## Guide to Form of Separation



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## Guide to Form of Separation

### Q: Why are internal separation of assemblies used?

Forms of internal separation are aimed at providing a base to:

- Protect the operator against contact with live parts belonging to adjacent functional units, busbars and terminals.
- Limit the probability of initiating an arc fault.
- Protect passage of solid foreign objects from one unit of assembly to another (achieved by using IP2X separation between each unit).

### Q: Will internal separation guarantee the integrity of the assembly (switchboard) in the event of an arcing fault?

- No. This will only limit the probability of an arcing fault and extra measures are to be taken as per section 2.5.5 of AS/NZS 3000:2007 and annex ZC of AS/NZS 3439.1

### Q: How is internal separation achieved?

There are two methods of achieving this:

- Standard construction
  - By barriers or partitions (these can be metallic or non-metallic);
  - Form 1, 2a, 2b, 3a, 3b, 4a, 4b.
- Alternative construction.
- By using integral housing (IP2X) of functional units denoted by 'h'. Applicable forms are 3ah, 3bh, 4ah and 4bh.
- Insulation of busbars or shrouds denoted by 'i'. Applicable forms are 2bi, 3bi & 4bi.
- The combination of housing (h) and insulation (i). Applicable forms are 3bih, 4aih and 4bih.



## Q: Who decides the appropriate form of separation?

Internal separation is agreed upon by the manufacturer (e.g., Dara Switchboards) and user (e.g., BHP Billiton) as per section 7.7 of AS/NZS 3439.1.

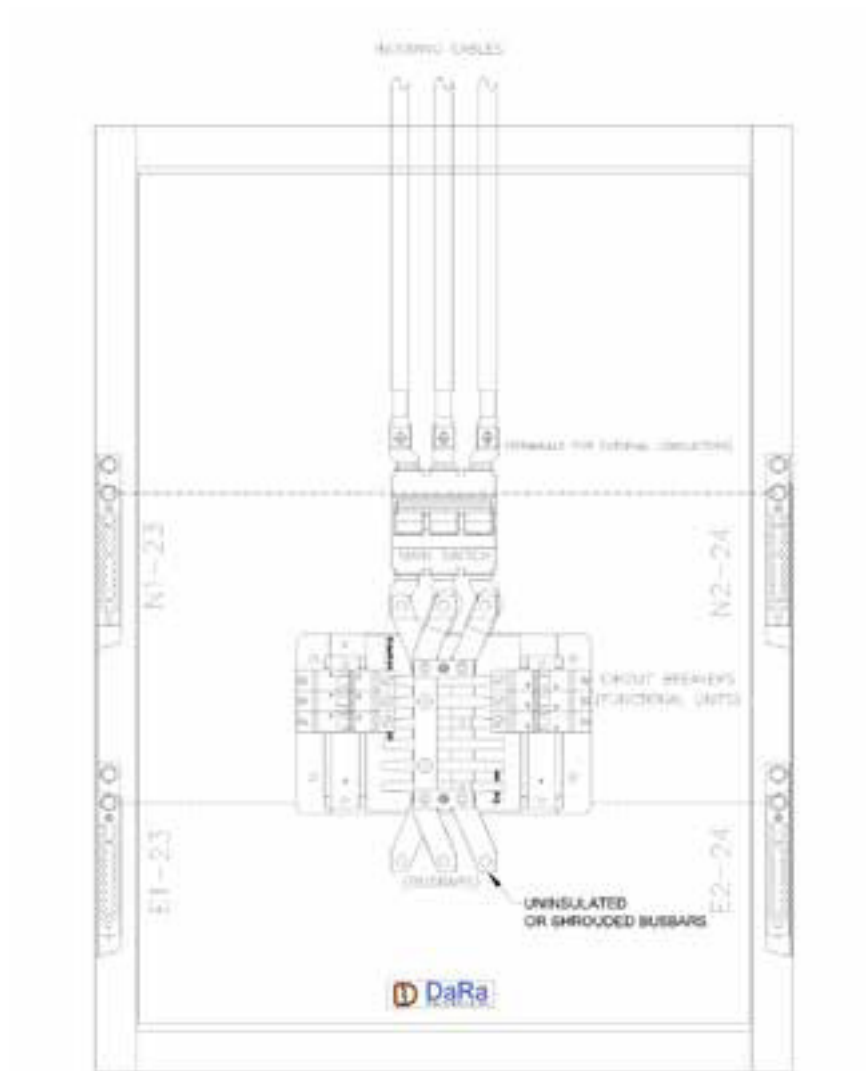
The following points are considered in deciding on the appropriate internal separation by the user, or in absence of specification by the switchboard manufacturer?

- Is the rated current of the switchboard less than 800A? If YES, you are free to select any form of separation (e.g., forms 1, 2a, 2b, 3a, 3b, 4a, 4b, etc.)
- Is the rated current of the switchboard more than 800A? If YES, you are restricted to use one of the prescribed forms of separation as per section 2.5.5.2 of
- AS3000:2007 to reduce the probability of initiating an arcing fault. (e.g., forms 3b, 3bi, 3bih, 4a, 4ah, 4aih, 4b, 4bi, 4bh and 4bih.)
- Can the assembly be isolated elsewhere before removing covers etc? If the answer is YES, you may decide to use the lowest form of separation [form 1] without adding pressure on the switchboard price.
- Do you require additional integrity by having separation between functional units and busbars where the access of busbars in live conditions results in risk of contact with live busbars? If the answer is YES, you will need to use, as a minimum, form 2 construction.
- Do you require access to functional units (e.g., circuit breakers) for limited maintenance (e.g., changing the settings) with adjacent circuits live? If the answer is YES, you will need to use, as a minimum, form 3 construction and also provide separation between functional units.
- Do you require access to cable terminals (e.g., connecting cables to a spare circuit breaker in future while the switchboard is live) of a functional unit with adjacent functional units live? If the answer is YES, you will need to use the maximum form of separation, form 4.



**Q: What are the typical switchboard arrangements for each internal separation?**

### **Form 1 Construction**



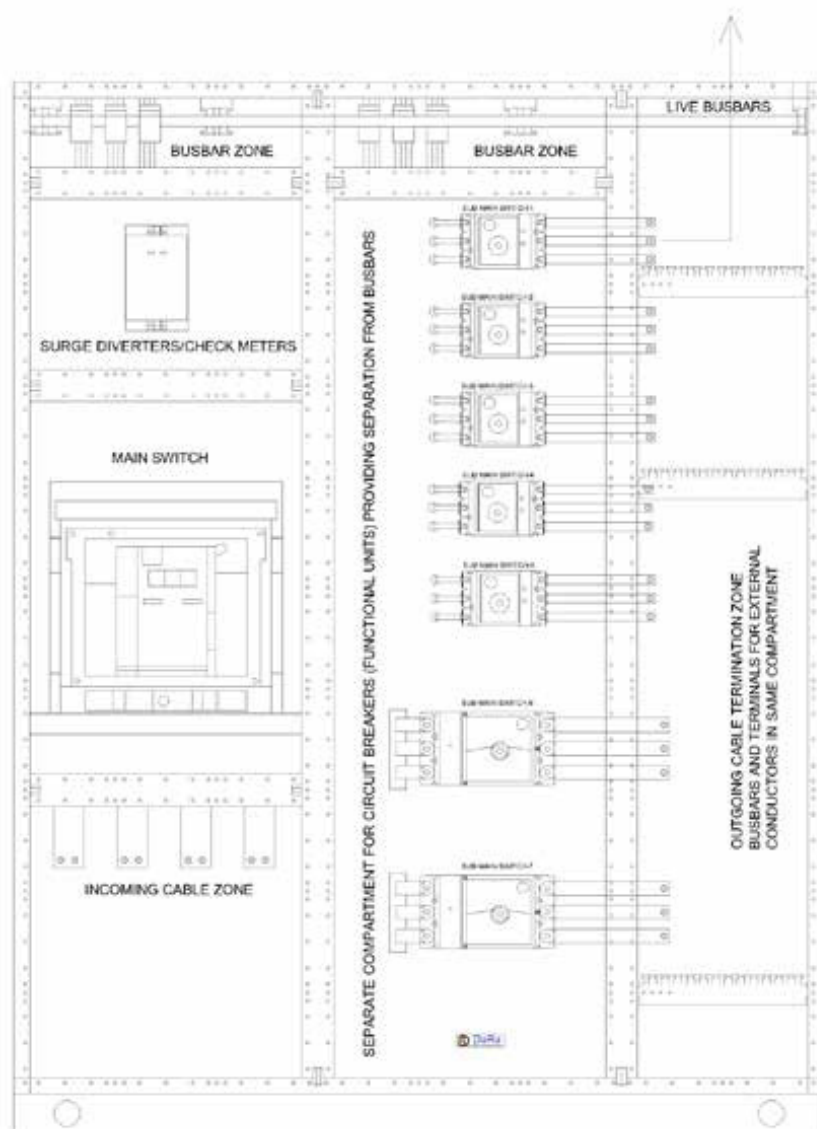
**FORM 1 CONSTRUCTION**  
Escutcheon and Door Removed in the Switchboard

**As illustrated in the above general arrangement, there is no internal separation between busbars, functional units and terminals for external conductors.**

- Generally used for load centres, distribution boards, meter panels, and main switchboards up to 800A.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 1 construction is at 1.

## Form 2 Construction

### Form 2A construction



#### FORM - 2A CONSTRUCTION

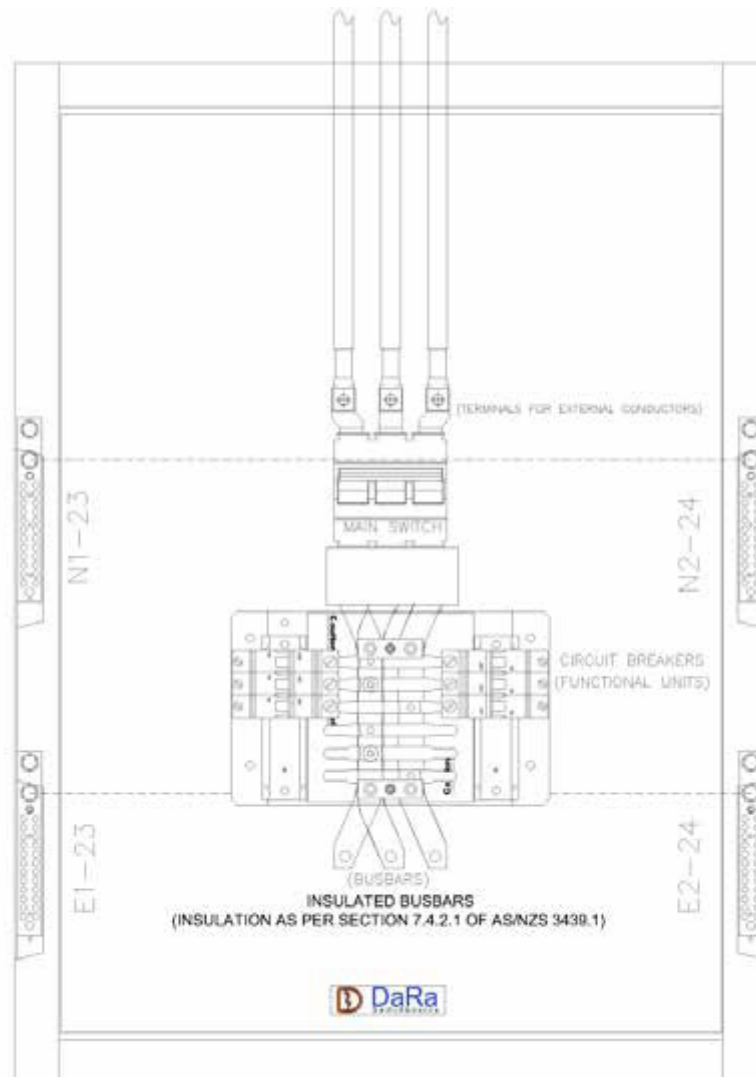
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 2a construction the busbars are separated from functional units but the terminals for external conductors are in the same compartment as the live busbars.

- Generally used for distribution switchboards up to 800A where access to the cable zone is not required once all the cables are terminated. This construction also provides safe access to functional units separated from the live busbars. However this construction is not commonly used in Australia.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 1 construction is at 1.

## Form 2 Construction

### Form 2Bi construction



#### FORM - 2Bi CONSTRUCTION

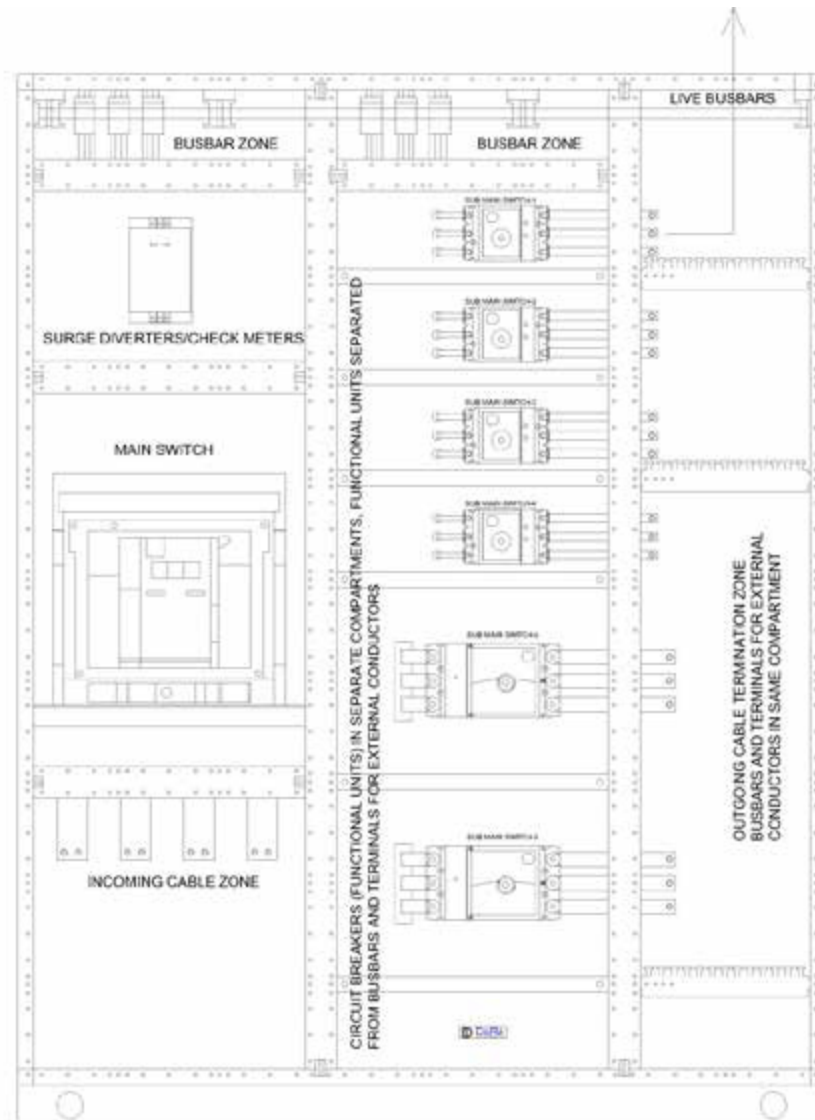
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 2bi construction the separation between busbars and both functional units and terminals for external conductors is achieved by insulation of busbars. This insulation however, needs to fully comply with section 7.4.2.1 of AS/NZS 3439.1.

- Generally used for small light and power distribution switchboards and main distribution boards up to 800A.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 2bi construction is at 2.

## Form 3 Construction

### Form 3A construction



#### FORM - 3A CONSTRUCTION

Doors/Covers Removed in the Switchboard

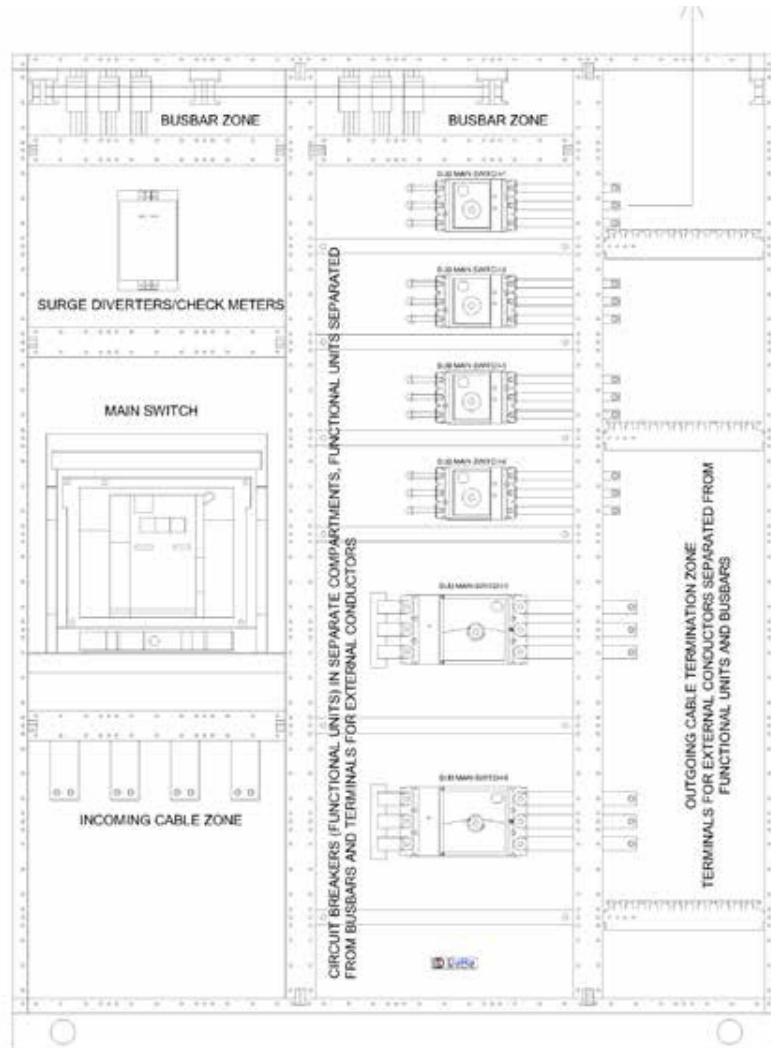
As illustrated in the above general arrangement, in form 3a construction the functional units are separated from each other allowing maintenance of such a functional unit without being exposed to other functional units adjacent to each other. The functional units are separated from busbars and terminals for external conductors. However, the busbars and functional units can be in the same compartment.

- Generally used for distribution switchboards up to 800A. Not commonly used in Australia though.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 3a construction is at 4.



## Form 3 Construction

### Form 3B construction



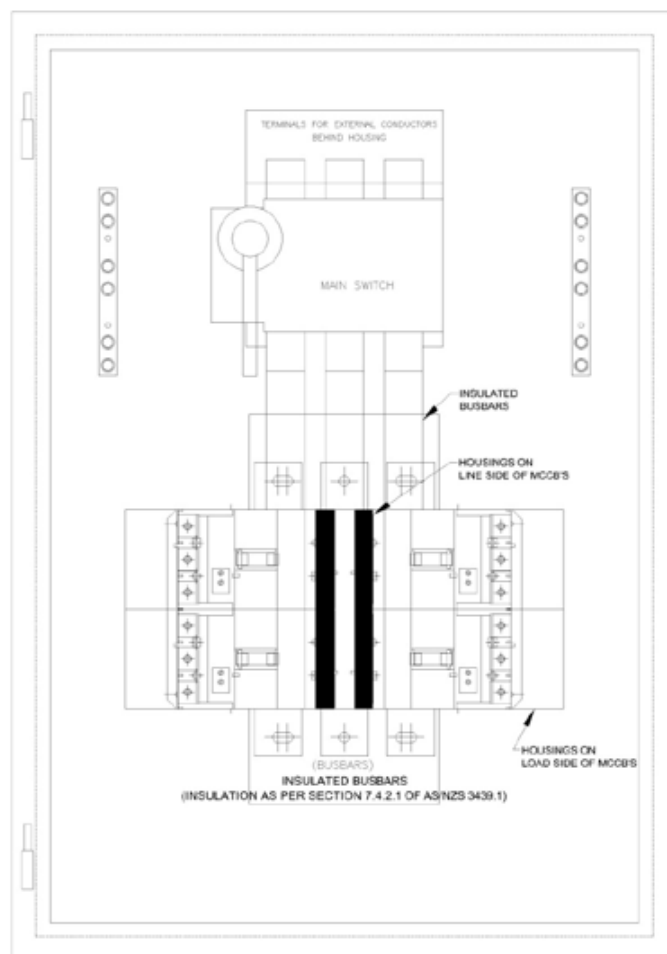
**FORM - 3B CONSTRUCTION**  
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 3b construction the functional units are separated from each other allowing maintenance of functional units without being exposed to adjacent functional units. The functional units are separated from busbars and terminals for external conductors. This construction also separates the busbars from the terminals for external conductors.

- Generally used for distribution switchboards above 800A and is the most commonly used construction for high current switchboards.
- Used where maintenance of functional units (e.g., changing the trip settings of the circuit breaker) is possible while the adjacent functional units are live.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 3b construction is at 7.

## Form 3 Construction

### Form 3Bih construction



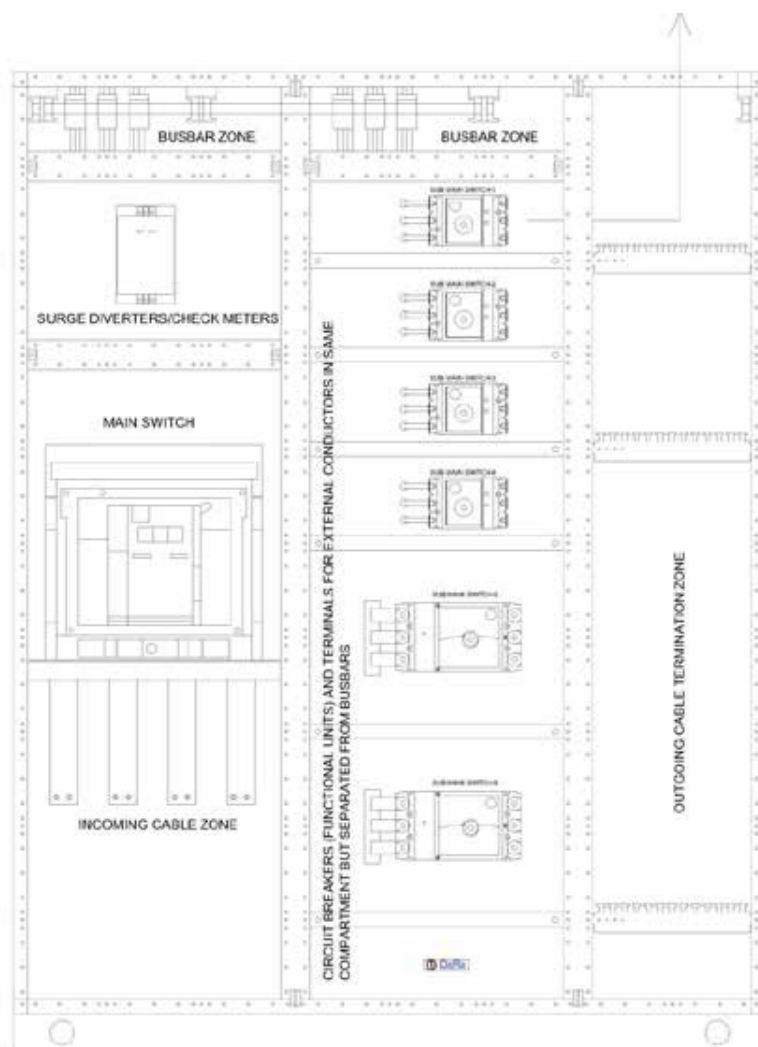
**FORM - 3Bih CONSTRUCTION**  
Escutcheon and Door Removed in the Switchboard

As illustrated in the above general arrangement, in form 3bih construction the separation between functional units and busbars, and busbars and terminals for external conductors is achieved by insulating the busbars and housings of circuit breakers.

- Most commonly used construction for main switchboards above 800A with busbar chassis. This construction is however, limited up to the current rating of the suitable busbar chassis by the manufacturer with insulation in compliance with AS/NZS 3439.1.
- Used in main switchboard applications where there are strict constraints on budget.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 3bih construction is at 4.

## Form 4 Construction

### Form 4A Construction



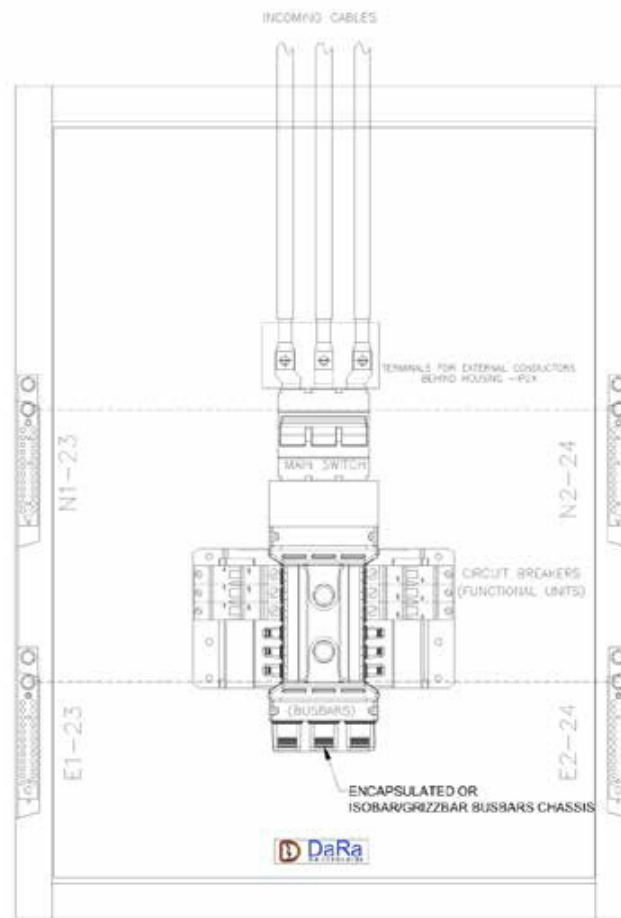
**FORM - 4A CONSTRUCTION**  
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 4a construction the busbars are separated from functional units and terminals for external conductors. However, functional units and terminals for external conductors can be in their own compartment.

- Another commonly used construction for main switchboards above 800A. Used in main switchboard applications where there are strict constraints on budget.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 4a construction is at 6.

## Form 4 Construction

### Form 4AH construction



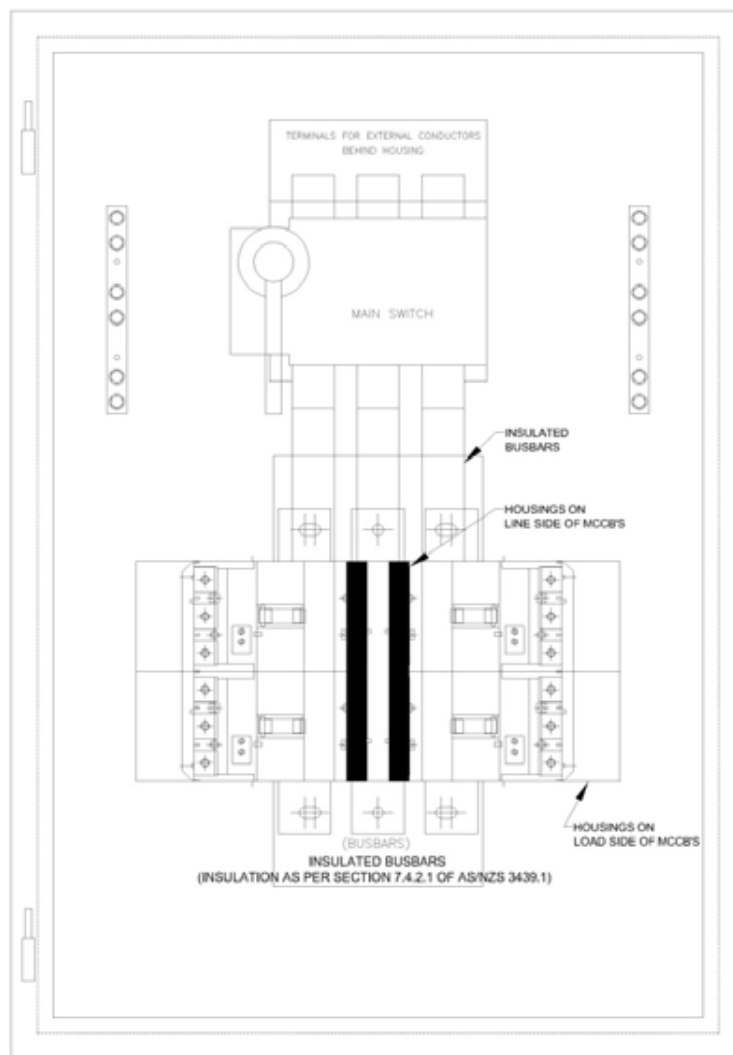
**FORM - 4AH CONSTRUCTION**  
Escutcheon and Door Removed in the Switchboard

**As illustrated in the above general arrangement, in form 4ah construction the busbars are separated from functional units and terminals for external conductors. However, functional units and terminals for external conductors can be in their own compartment.**

- Another commonly used construction for main switchboards above 800A. Used in main switchboard applications where there are strict constraints on budget.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 4a construction is at 5.

## Form 4 Construction

### Form 4IA Construction



#### FORM - 4IA CONSTRUCTION

Escutcheon and Door Removed in the Switchboard

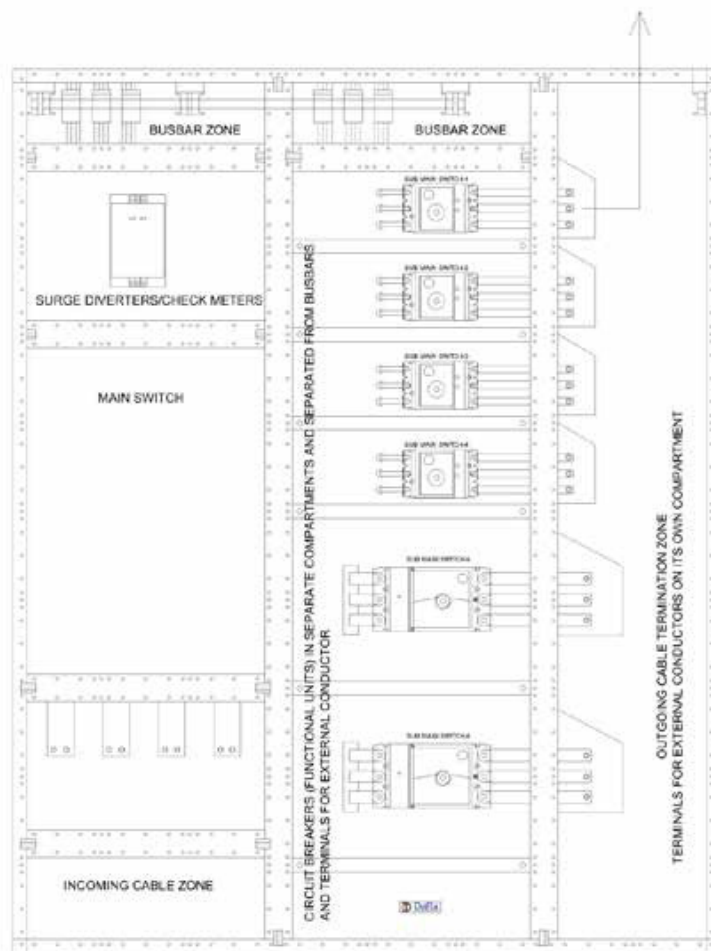
As illustrated in the above general arrangement, in form 4ia construction the separation between busbars and both functional units and terminals for external conductors is achieved by using insulated busbars. The separation between busbars is achieved by use of the functional units own integral IP2X rated housings.

- Used in some main switchboard applications and is limited by the available insulated busbar chassis that will be provide to the required rating.
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 4ia construction is at 6.



## Form 4 Construction

### Form 4B Construction



**FORM - 4B CONSTRUCTION**  
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 4b construction the busbars are separated from functional units and terminals for external conductors. Functional units are separated from each other and the terminals for external conductors are also separated from each other providing the highest level of separation that will maximise the possibility of initiating an arcing fault in a switchboard. In the unlikely event of a fault, the effect of the fault is more contained to the zone where it originated without affecting the other parts of the assembly.

- Used in switchboards rated above 800A and is installed when supplying critical applications. (e.g., hospitals, mines, etc.).
- On a scale of 10 (1 for the lowest price and 10 for the highest price) form 4b construction is at 10.

There are more variations of form of separation that are not illustrated above. These however are not commonly used switchboard constructions.

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The company provides more than 50 opportunities per year for young engineering and IT graduates to carry out their internship. The company's transformation is in using the latest technology in design and engineering switchboards to our clients special needs in mining, industrial, petrochemical, utility, solar and commercial sectors.

