



FAQ's

Guide to forms of
Separation

Guide to forms of Separation

Q: Why is internal separation of assemblies used?

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

- Protect 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 measure 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 unit 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 form are 3bih, 4aih and 4bih

Q: Who decides the appropriate form of separation?

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

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

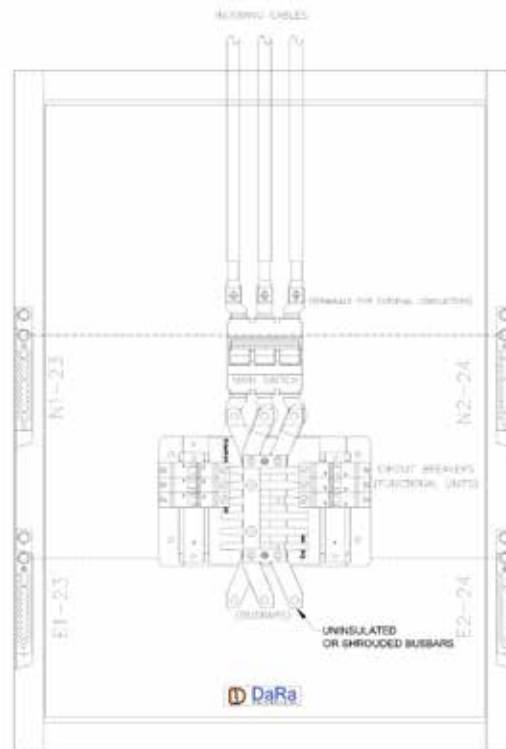
- Is the rated current of the switchboard less than 800A? If YES, you are free to select any form of separation (eg. Form 1, 2a, 2b, 3a, 3b, 4a, 4b etc)
- Is the rated current of the switchboard more than 800A? If YES, you are restricted to use one of the prescribed forms of separations as per section 2.5.5.2 of AS3000:2007 to reduce the probability of initiating an arcing fault. (eg. Form 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 go with 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 result in risk of contact with live busbars? (If the answer is YES, you will need to go with minimum form 2 construction)

- Do you require access to functional units (eg. Circuit breakers) for limited maintenance (eg. Changing the settings) with adjacent circuits live? (If the answer is YES, you will need to go with minimum form 3 construction providing also separation between functional units)
- Do you require access to cable terminals (eg. 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 go with the maximum form of separation-form 4)

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

- Form 1 construction



FORM - 1 CONSTRUCTION

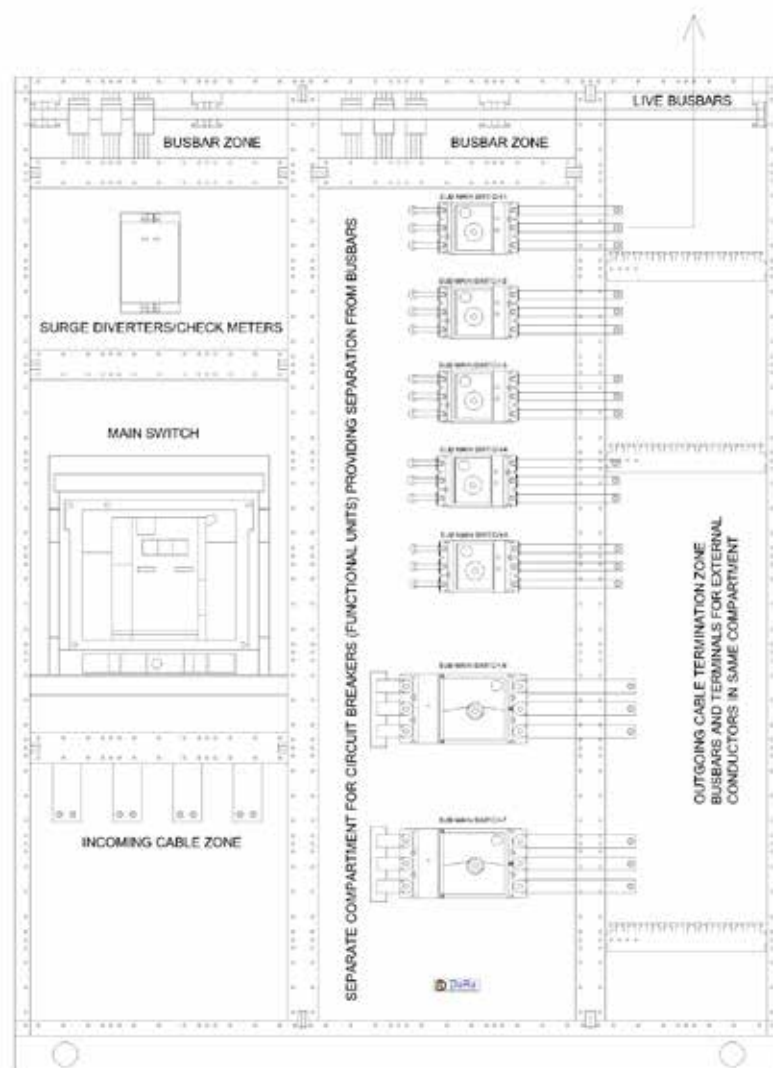
Escutcheon and Door Removed in the Switchboard

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, Main switchboards upto 800A
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 1 construction is at 1 in price.

Form 2 Construction

• Form 2A construction



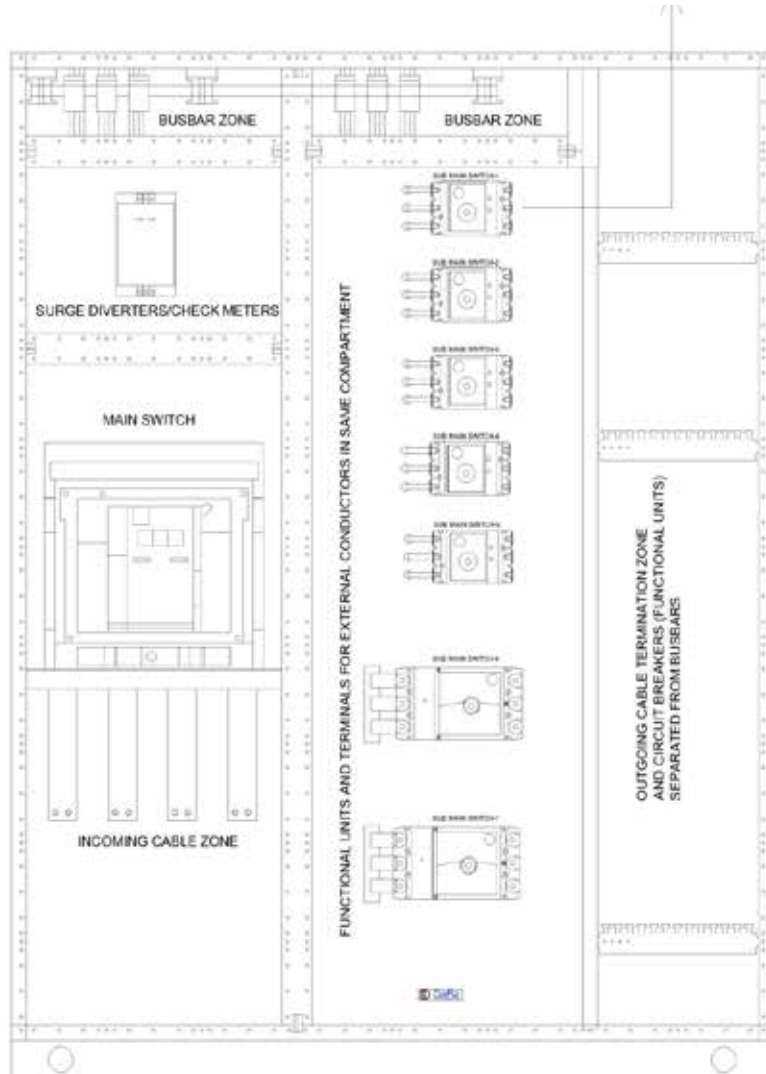
FORM - 2A CONSTRUCTION
Doors/Covers Removed in the Switchboard

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 upto 800A where the access to the cable zone is not is 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
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 2a construction is at 3 in price

Form 2 Construction

• Form 2B construction



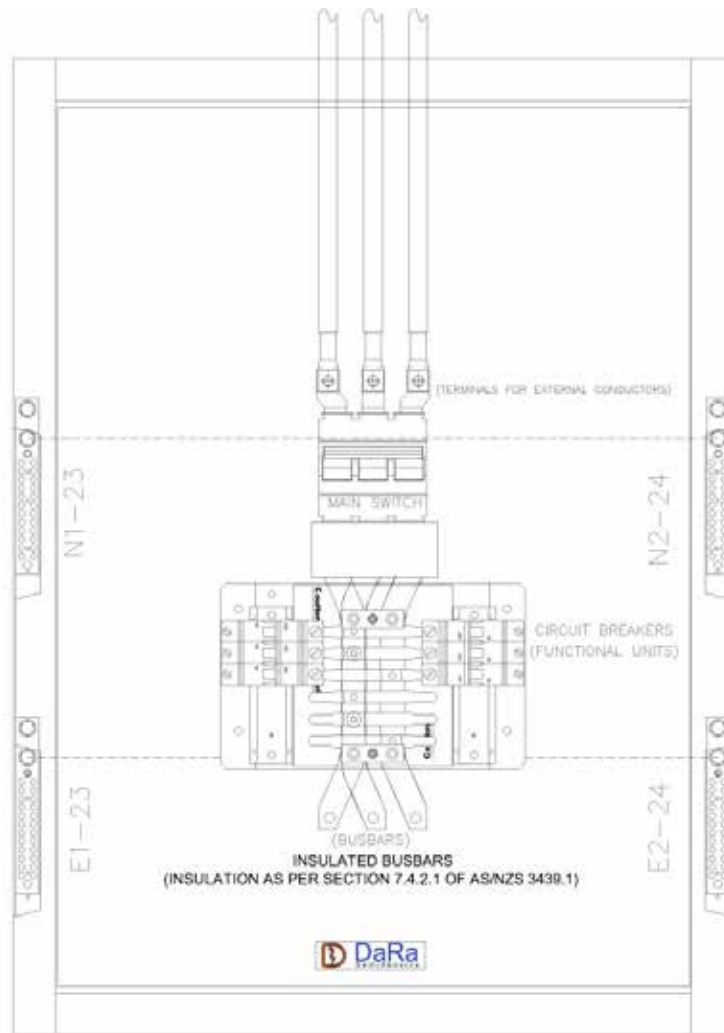
FORM - 2B CONSTRUCTION
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 2b construction the busbars are separated from functional units and the terminals for external conductors. However the functional units and its terminals for external conductors can be in the same compartment.

- Generally used for distribution switchboards upto 800A where opening the cable zone or the functional unit compartment will not expose the live busbars. This construction is used in Main Distribution boards in Australia.
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 2b construction is at 3 in price.
- This construction is also possible for smaller Distribution boards in Australia using encapsulated busbar chassis

Form 2 Construction

• Form 2Bi construction



FORM - 2B CONSTRUCTION

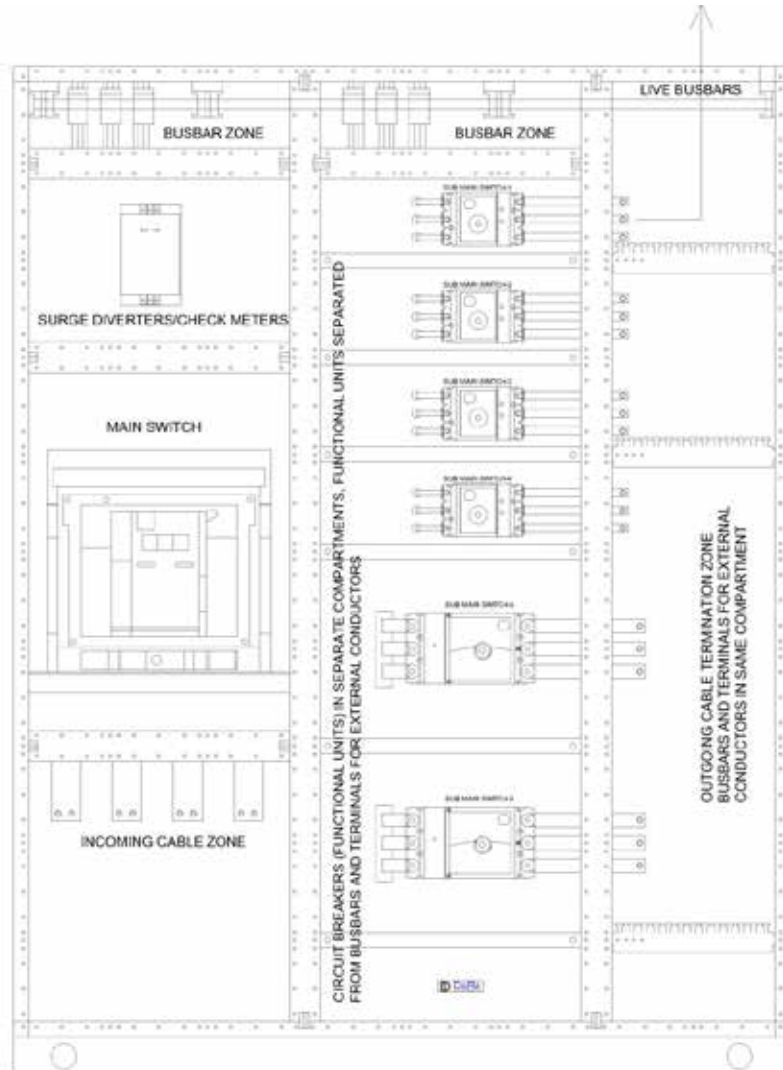
Escutcheon and Door Removed in the Switchboard

As illustrated in the above general arrangement, in form 2bi construction the separation between busbars and both functional units and terminals for external conductors achieved by insulation of busbars. This insulation however needs to fully comply as per 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
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 2bi construction is at 2 in price.

Form 3 Construction

• Form 3A construction



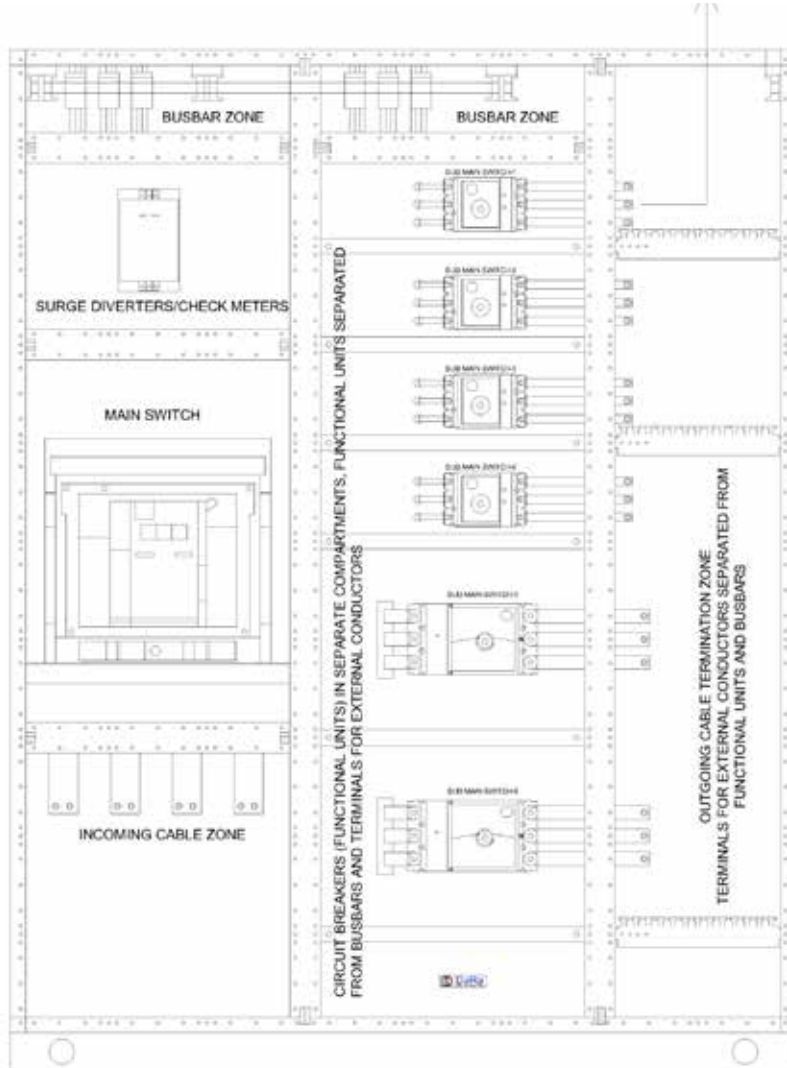
FORM - 3A CONSTRUCTION
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 3a construction the functional units are separated from each other allowing maintenance of such functional unit without been 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 upto 800A. Not commonly used in Australia though.
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 3a construction is at 4 in price.

Form 3 Construction

• Form 3B construction



FORM - 3B CONSTRUCTION

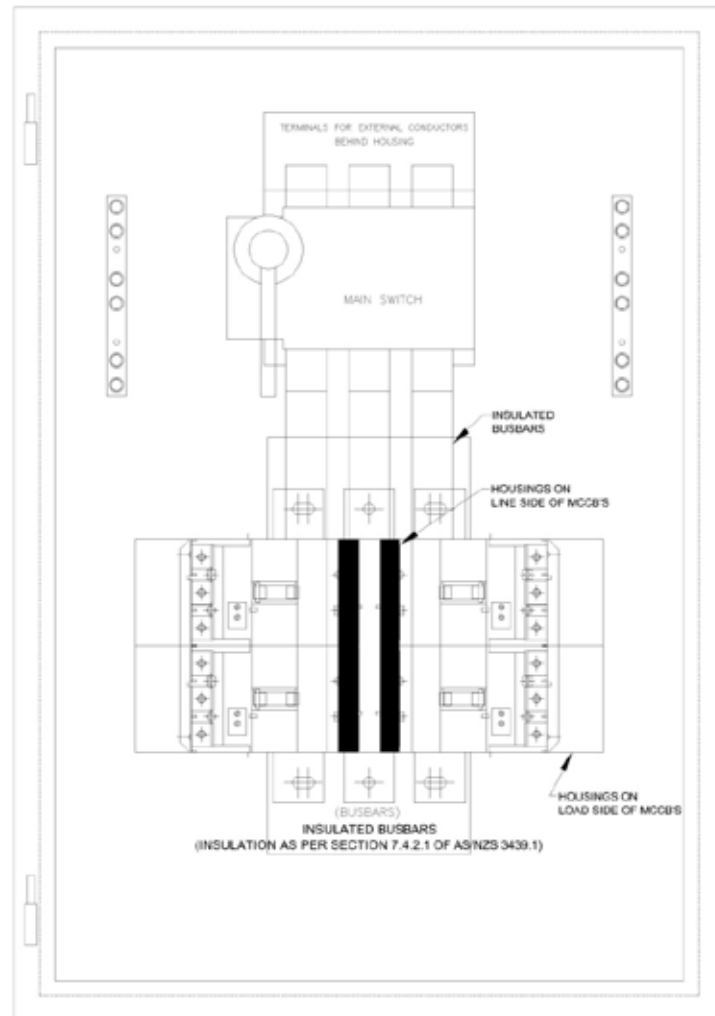
Doors/Covers Removed in the Switchboard

As illustrated in the above general arrangement, in form 3b construction the functional units are separated from each other allowing maintenance of such functional unit without been exposed to other functional units adjacent to each other. The functional units are separated from busbars and terminals for external conductors. Also this construction 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 (eg. Changing the trip settings of the circuit breaker) is possible while the adjacent functional units are live.
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 3b construction is at 7 in price.

Form 3 Construction

• Form 3Bih construction



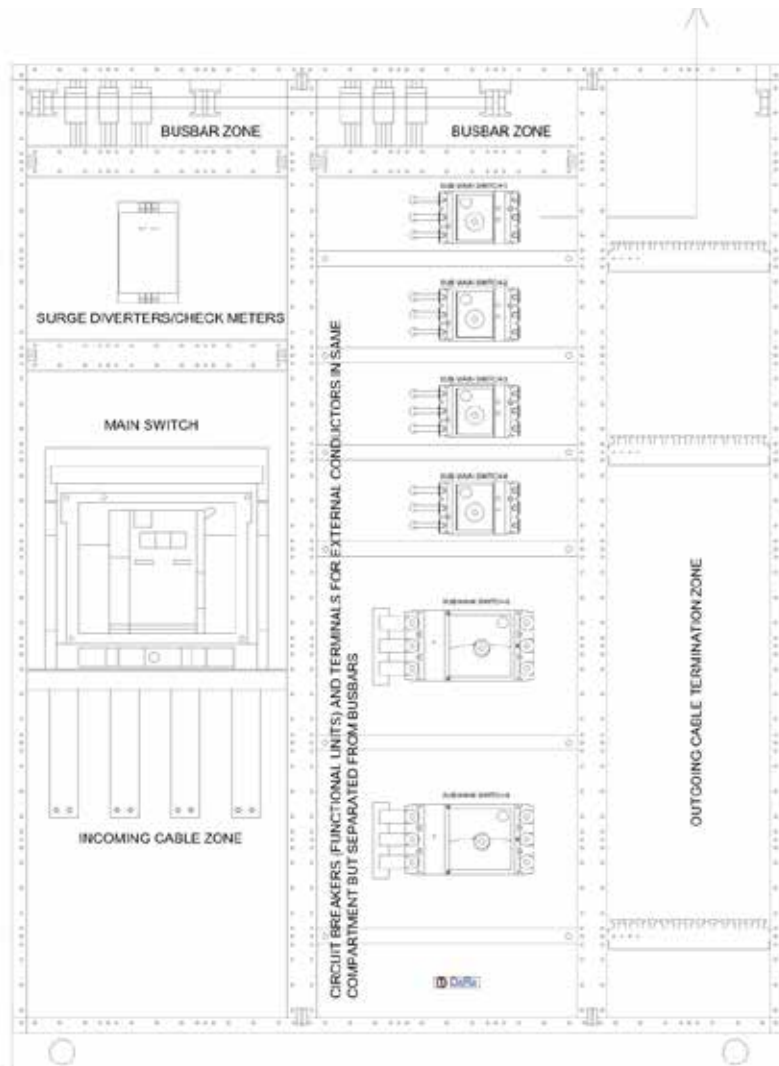
FORM - 3Bih CONSTRUCTION
Escutcheon and Door Remove in the Switchboard

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 the use of insulation of busbars and housings of circuit breakers.

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

Form 4 Construction

• Form 4A construction



FORM - 4A CONSTRUCTION

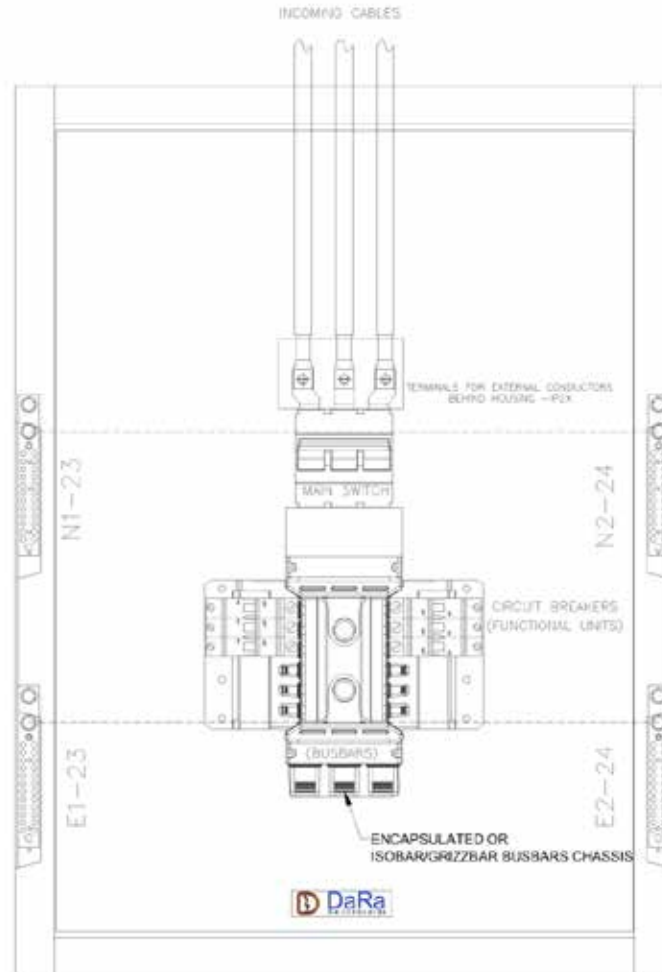
Doors/Covers Removed in the Switchboard

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 on its own compartment

- Another most commonly used construction for Main Switchboards above 800A. Used in Main switchboard applications where there is straight constraints on budget.
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 4a construction is at 6 in price.

Form 4 Construction

• Form 4AH construction



FORM - 4AH CONSTRUCTION

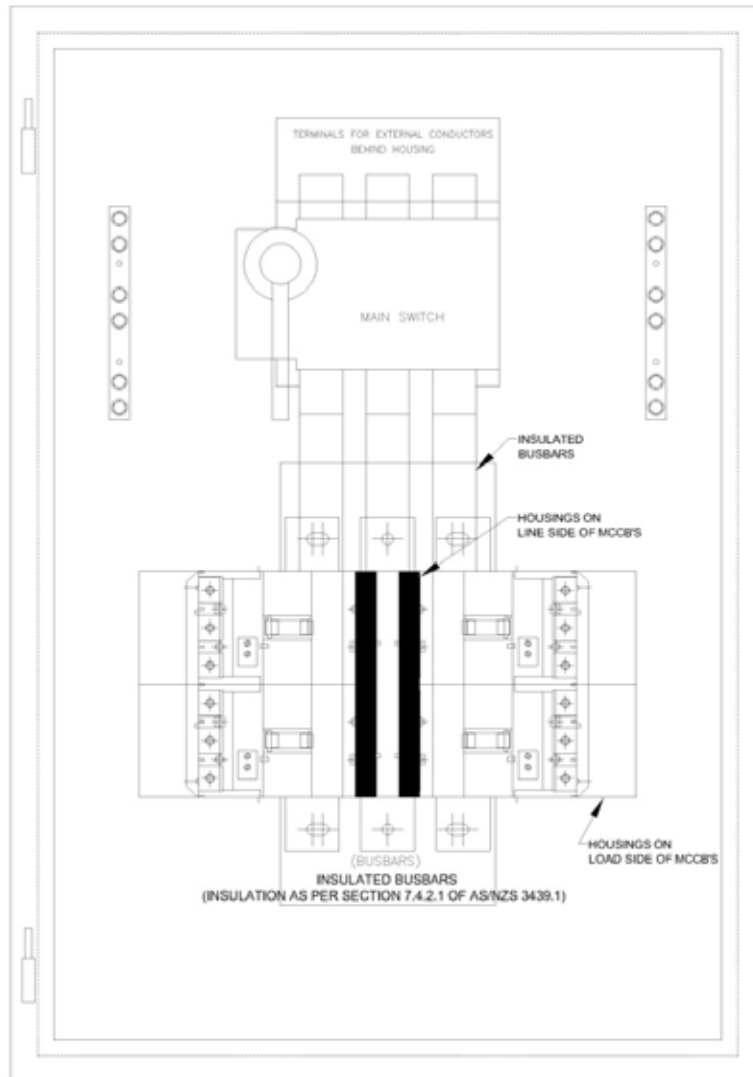
Escutcheon and Door Remove in the Switchboard

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 on its own compartment

- Another most commonly used construction for Main Switchboards above 800A. Used in Main switchboard applications where there is straight constraints on budget.
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 4a construction is at 5 in price.

Form 4 Construction

• Form 4IA construction



FORM - 4IA CONSTRUCTION

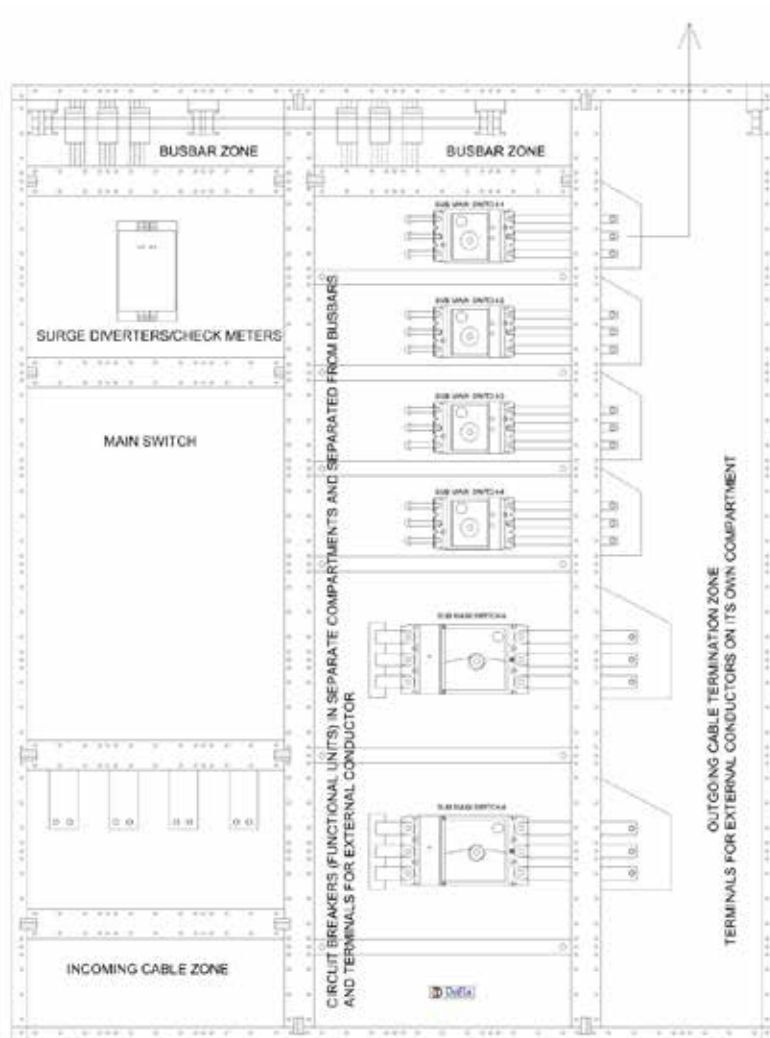
Escutcheon and Door Remove in the Switchboard

As illustrated in the above general arrangement, in form 4aih construction the separation between busbars and both functional units and terminals for external conductors is achieved by using insulated busbars. The separation between busbars 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.
- In a scale of 10 (1 for the lowest price and 10 for the highest price) form 4aih construction is at 6 in price.

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 bus bars 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 maximize the possibility of initiating an arcing fault in a switchboard. In an unlikely event of a fault, the effect of fault is more contained to its zone where it was originated without affecting the other parts of the assembly.

- • Used in switchboards rated above 800A and is installed in supplying critical applications. (eg. Hospitals, mines etc)
- • In a scale of 10 (1 for the lowest price and 10 for the highest price) form 4b construction is at 10 in price.

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

Reference: AS/NZS 3439.1:2002 and AS/NZS 3000:2007

Prepared By:

Shanaka Unantenne Bsc. Eng (Hons), MIEAust, MIET, MIEEEE, MAICD
Engineering Division- Dara Switchboards

DARA SWITCHBOARDS.

5 Faigh Street
Mulgrave, VIC 3170
Australia

info@dara-switchboards.com.au
+61 3 8544 3300

