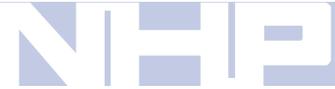




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TECHNICAL NEWS

INDUSTRIAL SWITCHGEAR & AUTOMATION SPECIALISTS



IS YOUR SWITCHBOARD IN GOOD FORM?

The electrical switchboard is the heart of any building and as with the human heart it is usually totally ignored until something goes wrong. It may require a bit of surgery to fix a switchboard problem or a complete transplant may be required. The fix may be simple or the building may be "laid up" for some time waiting for a suitable replacement.

The switchboard is required to meet performance standards to suit the installation. These include such things as short circuit performance and temperature rise. The construction of the switchboard and the degree of separation between parts is optional. The standard for switchboards, AS/NZS 3439.1 provides a wide variety for specifications of switchboard construction but gives little guidance on how to select a suitable specification for a particular application. This was made even more difficult with the year 2002 edition of the standard in that there are now 17 different construction Forms to choose from.

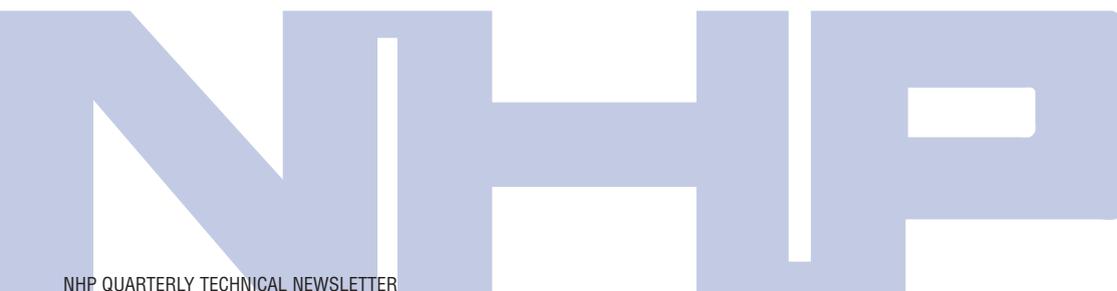


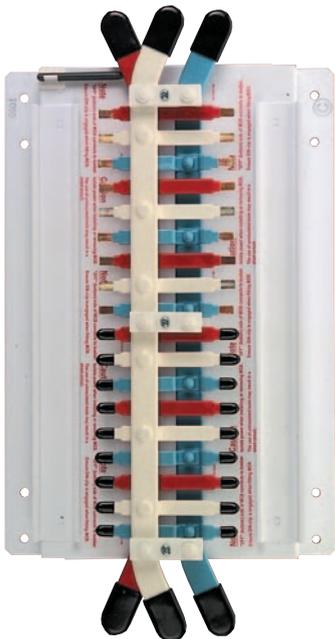
Circuit Breaker assembly complying to Form 4bh. (When load-side terminal covers are fitted).

FEATURES:

- The History.
- What does the user want?
- Safe operation.
- Ability to maintain a functional unit.
- Connect cables.
- Fault containment.
- Cost.
- Selection guide.
- Conclusion.

PLEASE CIRCULATE TO:





Insulation on busbars is one means of providing segregation.

1. THE HISTORY

Initially Australia prepared most of its electrical standards and generally British standards were used as the basis. To some people these older standards reflected a more practical approach than provided in the international or IEC standards that Australia now follows.

Going back to AS1136, first published in 1974 the Forms of segregation of a switchboard were easy to understand and logical. In the 1988 edition one of the main problems concerning the industry was resolved. This issue related to the treatment of moulded case breakers mounted on a chassis system. Could the intent of segregation be achieved by the case of a device instead of providing individual cells. The relevant clause 7.9.2.1 applying to Forms 2A, 2B and 3 read in part, "Where a functional unit comprises a single device, with no provision for internal examination, maintenance or adjustment, two or more such devices may be mounted behind a common removable door or cover, provided that –"

Unfortunately with the introduction of AS/NZS 3439, AS1136 was superseded in 1993. This new standard followed the international IEC 439 very closely with only minor amendment for Australia. The issue of chassis mounted circuit breakers was again unresolved in that the case of the device could not be considered as providing segregation (now called separation). In the terms of the different forms this meant that this type of construction could no longer be considered as achieving Form 3.

Some of the other IEC influenced countries in the world did not accept this and introduced clauses to permit the device case as providing segregation. When Australia adopted IEC 60439.1:1999 as AS/NZS 3439.1:2002 Australian alternatives to the standard Forms of internal separation were added. This resulted in a total of seventeen different Forms. Not only was the case of a device permitted to be considered as separation but insulated busbar were also accepted.

2. WHAT DOES THE USER WANT?

The expanded choice of Form does have a heavy bias towards the manufacturer. It would seem to now endorse all construction styles and at the same time give them a higher numeric rating. For the user there is really only increased confusion as to what it is all about.

3. SAFE OPERATION

Regardless of the internal form of separation the switchboard should be safe to operate. All controls should be accessible without exposure to live parts and this is achieved with the lowest requirement of Form 1.

3.1. ABILITY TO MAINTAIN A FUNCTIONAL UNIT

A switchboard may contain active components. The typical example of this is the switchgear required for motor starting. The components can wear out or become defective and maintenance needs to be considered. To work on the faulty equipment the circuit must be isolated and any parts of the switchboard that remain alive must not be accidentally touched while working on the fault. If isolation is to be by the main incoming isolator then a minimum of Form 2b / 3b construction is required. The incoming conductors must not be exposed. If turning off the whole switchboard is unacceptable then the switchboard can be designed to allow the individual circuit to be isolated and protection provided against touching other live equipment by placing each functional unit in its own cell.



For a single device the housing can be considered as providing separation.

3.2. CONNECT CABLES

The connection or disconnection of outgoing cables can be important for some installations. To perform this operation with power applied to the switchboard it is important that the terminal area is separated from the main conductors and the terminals of other outgoing circuits. This level of safety is achieved with Form 4b construction.

3.3. FAULT CONTAINMENT

Internal faults can develop and AS/NZS 3439.1 provides a test method to evaluate the effects of such a fault. While switchboards tested for internal faults are normally fully separated, separation by itself is no guarantee of fault containment.

4. COST

Higher Form ratings can allow more maintenance activities to be performed on a live switchboard but at additional cost. It is important to understand what the expectations are for the switchboard and not over specify if costs are to be controlled.

5. SELECTION GUIDE

In table 1 the different forms of internal segregation are listed against the requirements for each sub classification. Included in the table are the suggested minimum requirements for safe access to a live board to remove or fit outgoing cables and the requirements to access functional units. The sub Forms meeting the requirements are listed. For the other possible Form arrangements the incoming supply should be isolated. If the isolating switch is in the switchboard the incoming side must be separated from the rest of the switchboard.

6. CONCLUSION

The large range of possible switchboard Forms in the standard are confusing and little help is given in regard to selection. Specifications for switchboards should focus on the functional performance required and the maintenance needs such as likely failure and security of supply. When this is done the selection of Form becomes much easier.

Table 1

| | Form 1 | Form 2 | | | Form 3 | | | | | | Form 4 | | | | | | Suggested minimum for live access to - | | | |
|-----------------------------------|--------|--------|----|-----|--------|-----|----|-----|-----|------|--------|-----|------|----|-----|-----|--|-----------------|---------------------------|-------------------------------------|
| | 1 | 2a | 2b | 2bi | 3a | 3ah | 3b | 3bh | 3bi | 3bih | 4a | 4ah | 4aih | 4b | 4bh | 4bi | 4bih | Outgoing cables | Functional Unit | |
| BUSBARS | | | | | | | | | | | | | | | | | | | | |
| Separated from FU | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | O | |
| Separated from outgoing terminals | | | X | X | | | X | X | X | X | X | X | X | X | X | X | X | O | | |
| Separated by insulation | | | | X | | | | X | X | | | X | | | X | X | | O | O | |
| Separated by compartment | | | X | | X | X | X | | | X | X | | X | X | | | | | | |
| FUNCTIONAL UNITS | | | | | | | | | | | | | | | | | | | | |
| Separated from each other | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | O | |
| Not separated from each other | X | X | | | | | | | | | | | | | | | | | | |
| Separation by housing of device | | | | | X | | X | | X | | X | X | | X | | X | | | | |
| Separation by compartment | | | X | | X | | X | | X | | X | | X | | X | | | | O | |
| TERMINALS | | | | | | | | | | | | | | | | | | | | |
| Not separated from busbars | X | X | | | X | X | | | | | | | | | | | | | | |
| Separated from busbars | | | X | X | | | X | X | X | X | X | X | X | X | X | X | X | O | | |
| Separated from other terminals | | | | | | | | | | | | | X | | X | X | O | | | |
| Separated by insulation | | | | | | | | | | | | | | | X | X | | | | |
| Not separated from others | X | | | | | | X | X | X | X | X | X | | | | | | | | |
| In same compartment as FU | | | | | | | | X | X | X | X | | | | | | | | | |
| Not in same compartment as FU | | | | | X | X | X | X | | | | | X | | | | | | | |
| | | | | | | | | | | | | | | | | | Complying Forms | | 4b, 4bh, 4bi, 4bih | 2b, 3a, 3b, 3bi, 4a, 4b, 4bi |

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