

Customers and consultants by and large are getting more and more concerned about the subject of installing internal arc-compatible switchgear panels, both in low voltage and medium voltage ranges of equipments

Let us examine the prevailing situations with reference to low voltage and medium voltage range of equipment separately

Low voltage equipment

Support from prevailing standards and the historical evolution of this subject

Looking at Low voltage switchgear panels manufactured as per IEC 61439-1&2, internal arc compatibility testing is not made mandatory under IEC. 61439-1&2

The first document regarding arc fault tests was the German PEHLA guide No.2 issued in the year 1969. This guideline document describes the method of testing switchgear under conditions of internal arcing and gives the criteria for accepting an arc-resistant construction. Under this document, the highest priority was given to prove protection for the operating persons

Since then, this requirement of internal arc compatibility was seriously taken by certain market segments like petrochemical and allied industries, where combustible material either solids, or liquids or gas was handled.

The big international switchgear manufacturing companies and power plants also took this subject seriously and started specifying the same in their switchgear specifications. However, the other lower market segments did not venture in to specifying this requirement because of the involved higher cost considerations

Later on, the IEC sub commission 17D, developed a guide for internal arc testing IEC-TR 61641 naming it as a technical report (TR) which was first issued in the year 1996 as the first edition, which mainly focused on personal protection and later on the second edition of this report was issued in the year 2008, with the addition of assembly protection

This is the theory of technical report (TR). In practice in many cases, the manufacturer applies the TR

Much more generic like it is a standard. The manufacturers are encouraged to do so because many users lack in their way of specifying the internal arc capabilities of the switchgear panel they need.

In the year 2002, National electric code also adopted arc flash labeling requirements. In September 2002, IEEE 1584, “**IEEE guide for performing arc flash hazard calculations**” was released.

Internal arc testing from a user perspective

Employers are responsible for the safety of their employees, but they are also keen on continuity of their production facilities.

Continuity in this case translates in to minimum damage occurring to the switchgear because of an internal arc fault, so that the production could be resumed as soon as possible

From a personal safety perspective, professionals have come to realize that the arc flash hazards, pose a very serious danger with regard to both physical injury which could be fatal to the people around, and significant damage to the switchgear & the surrounding property

This undesirable situation and after effects of an arc fault seriously threatens the equipment reliability and the continuous availability

Merits of internal arc testing

Having gone through the historical evolution of this subject of internal arc resistant panel requirement and also after appreciating the advantages of personal safety, added with reliability and availability of the switchgear, it will be quite evident that employers / owners want to install internal arc compatible switchgear panels and look for maximum safety for their employees and longevity of life and continuous availability of the switchgear panels for the investment they have made

Arc fault testing is reasonably a new phenomenon and less understood by the users and specifiers particularly in India as compared to the other tests like a classic short circuit test or an impulse voltage test

Reasons for this testing being unpopular in India till now

It should be noted that the panels for arc fault testing are of fully equipped switchgear assemblies and are likely to get totally destroyed during the testing. As such the cost of the multiple fully assembled panels added with high cost of testing becomes a serious matter for consideration

Another aspect seen as a major constraint will be the numerous configurations and arrangements available in low voltage area and the major task of matching one's requirement closer to the configuration which has undergone testing.

This matching task could even be proved to be not practicable also under many circumstances. This situation necessitates the end user to be well aware of and verify that his requirement of panels which sufficiently resembles the tested configuration and judge whether the results of the performed tests fully apply to his equipments.

More important will be that, apart from the interpretation of the applicable level of validity of the test results of previously conducted test on some configuration, serious attention to be paid to the protection settings given for the equipment under consideration, which greatly influences the integrity of the entire switchgear assembly which is 100% customer specific

Hence attention of all users / customers is drawn to the most important point stressed here that it will not be enough for insisting for an internal arc tested panel but more importance needs to be given for the protection settings provided for the switchgear assembly to clear the fault & to see that the fault energy

Dissipated at the point of fault is reduced to the bare minimum & a comprehensively integrated effort involving all the related issues needs to be put in place



Classifications of internal arc tested equipments as per IEC62271-200

Basically, there are three different classifications

1. AFLR

2. **BFLR**
3. **CFLR**

Let us examine as to what these classifications mean to the user

1. **AFLR**

A: stands for category A. Category A is for situations where authorized people only

Will be allowed to be around the panel (general public is not allowed).

Distance of indicators

Will be at 300mm from the enclosure under test

F: stands for front that is protection available for people at front of the panel

L: stands for lateral, that means protection available for people at either left or right side of the panel

R: stands for rear that means protection available for people at rear side of the panel

Who are the authorized people?

Those who are trained for the purpose for which they are there with suitable PPE

2. **BFLR**

B: stands for category B. Category B is for situations where unrestricted accessibility is allowed

Including general public. Distance of indicators will be at 100mm from the enclosure under test

F: stands for front that is protection available for people at front of the panel

L: stands for lateral, that means protection available for people at either left Or right side of the panel

R: stands for rear that means protection available for people at rear side of the panel

Please see the picture below to know about free accessibility to everyone including general public

Such equipments which are accessible for public life has to have **BFLR** category

3. **CFLR**

C: Stands for category C which is applicable for pole mounted out of reach equipments

What factors cause arc flashes or internal arcs in switchgear panels?

Panel internal short circuits, are most likely a result of following facts

1. Hot spots
2. Growth of whiskers

3. Growth of fungus
4. Tracking across insulation materials
5. Insulation degradation due to condensation
6. Entry of vermin & entry of small animals
7. Loose metallic parts
8. Human errors

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