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TECHNICAL BULLETIN

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UNDERSTANDING INFLUENCES AFFECTING TEMPERATURES WITHIN LV ASSEMBLIES

Temperature rise within LV assemblies has always been a significant performance criterion. Its importance has grown as commercial and environmental pressures increase.

The pursuit of more compact assemblies, optimisation of components and conservation of raw materials all lead to higher temperatures within assemblies.

Quality manufacturers appreciate and manage this complex issue. Yet users and specifiers must also be fully aware of the intended capability and environment for the assemblies they specify/purchase.

To ensure different obligations are harmonised, that all parties have the same expectations and recognise respective responsibilities, a robust, pragmatic international standard is essential.

The international standard for assemblies must accurately define performance capability. Manufacturers need a series of verification methods enabling them to confirm compliance with the standard's determined performance capability. The defined performance capability standard must relate to anticipated service conditions. The standard must recognise means of construction and detail verification methods.

Due to the changes described, the LV Assembly Standard IEC 60439-1 is deficient in areas relating to temperature rise verification of modern assembly systems.

BEAMA*Installation's* Engineered Systems Product Group (ESPG) is addressing the issues, calling for change. Highlighting testing considerations, it is urging more clarity of understanding and means of temperature rise performance verification, plus consistency in approach.

Tighter definition will enable all those involved with assemblies to have the same expectations of loading capability, while users will be assured of defined performance.

Modern LV Assemblies

Rarely are two assemblies identical. In construction, modern LV assemblies tend to be modular. Designs accommodate an almost infinite array of arrangements, constructed from a limited number of well-defined 'blocks'.
Often, busbar systems of essentially the same construction use different numbers of laminations for alternative ratings. Frequently, frame sizes for functional units cover more than one rating.

Temperature rise verification of assemblies is more involved than testing individual, well-defined, mass-produced products. It is impracticable to temperature rise test every different arrangement within a modular system. However, differing interactions occur due to connections to other assembly components. The position and loading of adjacent circuits for all arrangements within the assembly should be considered in the verification. Manufacturers must have a practical method of verifying the capability of a modular system. Where applicable any limitations must be established.

IEC 60439-1

Designs have advanced, but over 30 years the International Standard for LV Assemblies, IEC 60439-1, has hardly changed its approach to temperature rise testing. Its method for temperature rise testing is geared towards a specific assembly, similar to that for single circuit devices.

Therefore manufacturers' designs have to consider the system configured for each potential application. There is lack of clarity around the de-rating of components due to their enclosure conditions, diversity and the working temperature limits of an assembly and its component parts.

The present IEC Standard is not clear and lacks the means of verification of temperature rise performance, as required by the manufacturers and users of a modern LV assembly.

Subsequently, to overcome its limitations, responsible manufacturers have adapted the test procedures within the standard. Lack of confidence in the standard means there are users insisting upon – and paying the price for – testing each purchased assembly.

Progress

What can be done? ESPG is pressing IEC for significant advances in temperature rise testing of assemblies. The outcome is not yet assured, but there is significant support for change within the IEC Committee. Informed representatives of other national committees have identified the same shortcomings resulting in similar approaches to those of UK manufacturers in overcoming the standard's weaknesses.

Proposals for change are progressing within the Radical Restructure of the IEC 60439 series of standards. It is anticipated the future IEC Standard for Power Switchgear and Controlgear Assemblies will take a more enlightened approach to temperature rise verification. The proposal includes an unambiguous definition of diversity and comprehensive temperature rise verification of a modular system.

So that designers can use their initiative and components can be used to their maximum capability, the proposed changes to the standard are still performance-based for matters within the assembly. Responsibility for the thermal performance of an assembly relating to the defined criteria within the proposed IEC Standard, rests with the assembly designer and manufacturer.

A more analytical approach is proposed where customisation is essential and testing undesirable due to cost/time constraints. Safety margins ensure an equivalent performance to tested units.

The proposals outlined relate to power switchgear and controlgear assemblies (general assemblies as complying with IEC 60439-1) of a modular construction. Elements of the restructured IEC 60439 series covering specific products (eg consumer units in accordance with IEC 60439-3) have yet to have their requirements reviewed.

The standards for specific products may continue calling for testing of a particular arrangement as the only means of temperature rise verification.

User Assurance

Assuming the IEC adopts it, the proposed new approach will overcome the present limitations in the standard. It will provide a means of temperature rise verification consistent with the design/application needs of modular assemblies. Significantly, proposed procedures will enable verification of all makes of the modular system in the same manner and within the standard's scope.

Proposed temperature rise verification will enable design optimisation without compromising the standard's defined performance. The tighter definition of diversity factor will enable all those involved with assemblies to have the same expectations of loading capability. Users can rest assured that their assemblies are capable of a defined performance in service.

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