
WHAT YOU NEED TO KNOW ABOUT

Switchgear retrofitting and upgrades

Why engineering & testing matters



Retrofitting and upgrading older switchgear assemblies can be a cost-effective method to extend the life of your electrical distribution capital and reduce maintenance costs while improving reliability and safety. Failure to invest in quality retrofit solutions can have the opposite effect.

What you need to know

A quality retrofit solution rests on three fundamental pillars:

- **expertise**
- **testing**
- **Implementation**

Expertise takes the form of both knowledge and experience. Testing confirms that the expertise was properly transferred to the retrofit design, but it is not a substitute for a fundamentally good design. Finally, the design must be implemented by building the retrofit circuit breakers under an internal process that is set by the organization and it is a part of everything they do.



Hard learned lessons in design & application

Many third party service organizations began the process of retrofitting circuit breakers once considered unrepairable and returning them to service. The old circuit breaker was stripped, and new circuit breaker installed.

This “retrofit as repair” concept, left in the hands of third party organizations, has led to several serious accidents. Failures in interlocking designs in which inadequate consideration of possible failure modes have resulted fatal accidents in some cases and in product recalls.

A more subtle, but similarly disastrous failure results from failing to account for the electro-dynamic force under short-circuit conditions. What may appear to the technician to be “strong enough” without actual fullpower type testing it is impossible to know.

Other design failures resulting in dielectric breakdown and overheating exist, but because these types of failures occur in all aging switchgear it is more difficult to assign the root cause of the problem to the design and testing – often because these deficiencies take years to manifest themselves.

Proper application of the circuit breaker is also important. The application issues may be as simple as properly interpreting old circuit breaker nameplate information to select the proper replacement rated under current standards or may require a deeper understanding of the system.

Retrofitting & product/system standards

IEEE Standard C37.59™-1991 “Standard Requirements for MV and LV Conversion of Power Switchgear” was created in response to the deficiencies in design and testing.

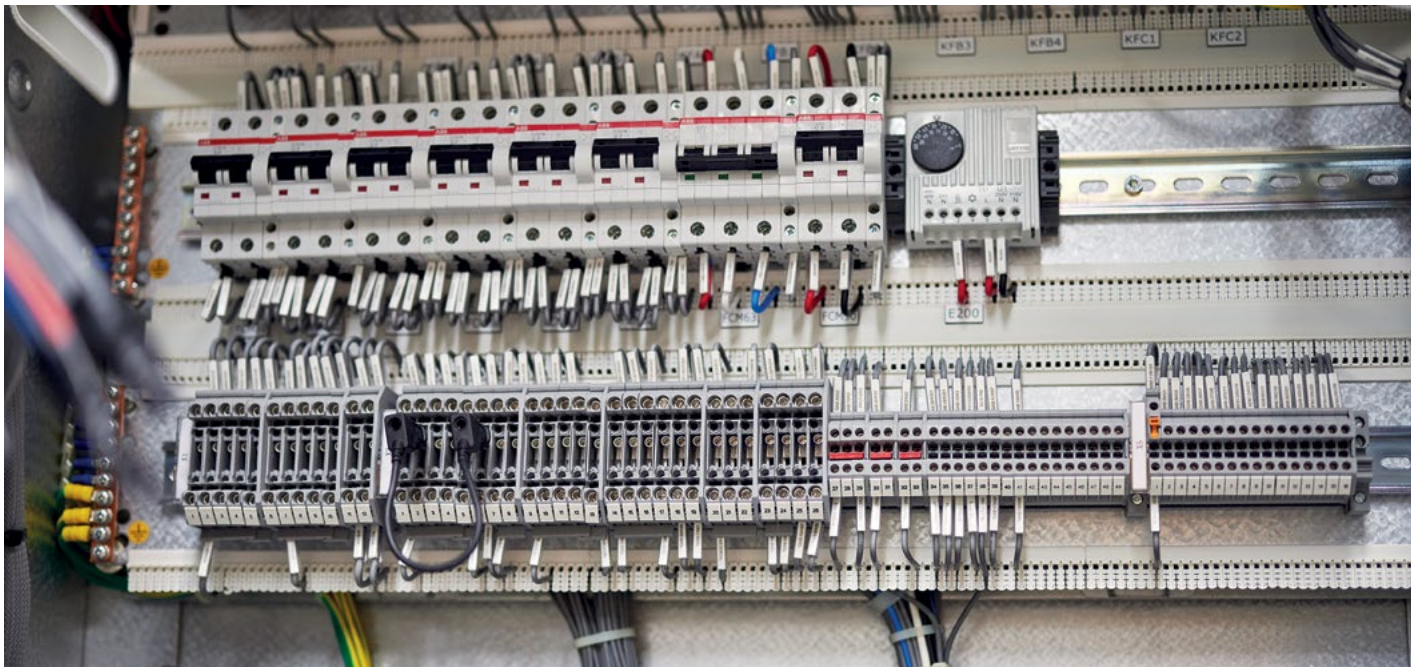
IEC 62271-307 provides extensive guidance for applying type tests from one MV circuit breaker or switchgear design to another.

While IEC 60947-2 and IEC 61439-1 & -2 apply to LV IEC circuit breakers and Switchgear

The applicable IEEE standards for circuit breakers C37.04 & C37.09 work with the switchgear standards C37.20.2 and C37.20.3 to ensure safe and effective medium voltage systems.

For low voltage installation, IEEE C37.13, C37.17 & NEMA C37.50 along with IEEE C37.20.1 are used in the ANSI market.

These documents are essential references for experienced designers to use in designing their type test plans but are often misunderstood to be a ‘cookbook’ for the newcomer to the business.



Type testing applicability and extension in ABB

In both low-voltage and medium-voltage equipment, the circuit breakers work as a system and were designed and tested as such according to the available Switchgear and Circuit Breaker IEEE/NEMA and IEC standards.

ABB internal “Retrofit Design Policy” adopts the requirements of IEEE C37.59 plus specific checklists, reviews, and oversight to ensure that the knowledge and experience of the entire organization is disseminated to every project team and applied to each new design.

In a similar manner, while type testing is essential, it is not a substitute for good design. Type testing is the final quality check which confirms the calculations, simulations, design reviews and engineering expertise which support the design.

To compensate for the inherent uncertainties of performing a limited set of type tests on a single sample, an organizational structure that combines the experience (and previous testing) of many designs with a documented history of successful – and the occasional unsuccessful – retrofit projects in disparate applications supports the expertise necessary to justify confidence that the mandatory type testing is sufficient.

Many of our service centers are colocated with our manufacturing facilities to draw not only on their knowledge and experience, but also access to sophisticated

measurement and analysis tools and extensive internal test laboratories up to and including short-circuit test facilities. All the tools, processes and resources employed in our large product development efforts are also available as needed for our retrofit projects. The involvement of all company departments and organization of processes have lead our production facilities to develop, implement and certify management systems in compliance with international Standards, Like ISO 9001 on quality management, ISO 14001 on environmental management, OHSAS for health and safety of employees in the workplace, etc.

Some 3rd party certifiers, such as Underwrites Laboratories (UL) and China Quality Certification (CQC) have recognized that retrofitting new circuit breakers into existing panels is a valid method of not just extending the life of, but also improving the reliability and safety of these old switchgear assemblies and offer review and certification of retrofit designs. That organizations also require follow up visit to revise quality and production process to maintain the certification and same level quality on the solutions along the entire production life. ABB can therefore even offer certified solutions for their legacy apparatus replacements.

ABB’s internal policies and procedures embody our culture of excellence as a choice, not an accident.



The value of ABB Experience

ABB's engineers understand the challenges associated with retrofitting. We recognize that even small retrofit projects are new designs and require the same tools and expertise which are used for products planned for thousands of production units. ABB has a global network of experts that give us a 'deep bench' of talent plus the procedural, computational and infrastructure resources to ensure not only compliance, but excellence in developing switchgear life extension solutions in defined and certified technology centers.

ABB has a broad network of technical experts available for consultation; these include dedicated field application engineers with many years of experience across a broad range of industries.

Also, highly trained specialists are employed to perform detailed system studies.

For the above reasons, and many others, it is important to work with a capable partner from the beginning of a contemplated retrofit project.



Top 10 misconceptions that you should avoid when you plan to replace your old circuit breaker

1. Type tests guarantee a quality design

Yes, Type testing is the final check that the design was done correctly to withstand the needed performances. But type testing does not, and cannot, check every aspect of the design and the quality of processing during the long term performance of the projects and production of the solutions.

ABB implements strict processes to ensure performances, safety and quality of retrofit solutions.

2. Type tests are not needed if not requested

False, type tests are never optional.

3. Duplicating a part substitutes for type testing

Duplicating a part, or more accurately attempting to duplicate a part is not a substitute for type testing. First, part design extends well beyond what can be measured with a micrometer; also, how the part interacts with the rest of the system is as important as the design of the part itself and type testing is often the only way to verify this.

4. An old working retrofit must be a good design

Unfortunately, some of the most serious accidents which have occurred with retrofit designs have root causes stemming from infrequent operations. Only in extreme circumstances — when it matters most — are the limitations of a poor design exposed.

5. The original fault current study is sufficient

Electrical systems grow and evolve over time, changes in the system may necessitate different types or ratings of circuit breakers. Even if the underlying fault current has not changed, advances in our understanding of circuit breaker application may guide the user to better replacement selections.

6. Matching the old nameplate is always best

Original nameplates values may not convey the same capabilities as are reflected by current standards. Also, even on an apples-to-apples basis, the original ratings may not be a good fit for the current system.

7. A proper retrofit will always fit flawlessl.

This often happens, and is more likely with mature retrofit designs, recognize that the panel into which the retrofit circuit breaker is being installed is just as old as the no-longer-fit-for-service circuit breaker — and has likely been serviced less. Service should always accompany a new retrofit installation, and subsequent installations in different locations.

8. Using a quality vacuum module in MV or the latest LV Breakers, is all that matters

A chain is only as strong as its weakest link. While using MV quality vacuum circuit breakers or LV latest circuit breakers is essential, they are high quality because they are produced in large quantities by top tier manufacturers. Top tier manufacturers employ diverse teams of experienced engineers and designers with access to sophisticated tools and techniques to ensure that quality extends to the entire retrofit project.

9. A local supplier is always best

While having someone close by is comforting if things go wrong, local suppliers may not have the resources to avoid the problems in the first place. ABB can offer it global full knowledge and experience through network of experts distributed locally close to our customers

10. A supplier asking many questions is a “Red Flag”

It’s the quality of questions, not the number that matter. Asking detailed questions is how we ensure that our solutions fulfill customer needs and provide long term value.





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