Mature Transformer Management Program

MTMProgram™
Introduction

The MTMProgram™ addresses the emerging issue of power transformer aging. While this subject has been a topic of discussion for over two decades, the strength of our transmission infrastructure has allowed transformers to operate beyond their design life.

Deregulation and economic controls have changed the demands of new systems. These transformers that are operating beyond their design life will soon begin to fail in significant numbers.

This issue can be addressed by identifying weak units through an economical approach that deals with the dynamics of the aging process.

As the largest OEM in the world with a unique history, ABB is often entrusted with diagnosing and assessing the condition of various transformers. ABB has detailed historical transformer design knowledge of nearly 75% of the installed base of large power transformers in North America, including Westinghouse, GE, Asea, Brown Boveri, and other predecessor technologies. The ABB assessment processes and technical tools developed are the natural result of our distinctive market position.

ABB has developed a four-step process (Figure A):

- Transformer Fleet Screening
- Transformer Design and Condition Assessment
- Life Assessment/Profiling
- Implementation of Engineering Solutions

Figure A
Steps of the ABB Mature Transformer Management Program

![Diagram of the ABB Mature Transformer Management Program steps]

**STEP ONE**
Transformer Fleet Screening

**STEP TWO**
Transformer Design and Condition Assessment

Rigorous, unit-based design evaluation and condition assessment.

**STEP THREE**
Life Assessment/Profiling

Detailed life assessment, including design and engineering analysis for life extension of each specific transformer.

**STEP FOUR**
Implementation of Engineering Solutions

Replacement  Refurbishment  Cooling Upgrade
Transformer Fleet Screening

The fleet risk assessment process is the first or precursor step in the transformer life management process. This process is used to sort through the readily available analytical and statistical information about each transformer in the fleet. This way, accurate and intelligent action plans can be made regarding the future of each transformer and the fleet as a whole. The goal is to prioritize action plans for the transformers in the fleet and identify transformers that are candidates for detailed design and condition assessments (Figure B). Fleet screening will be performed each year as part of the program.

Transformer Design and Condition Assessment

The transformer design evaluation and condition assessment process is a paramount step in the transformer life assessment and asset management approach. It requires rigorous, state-of-the-art analysis methods/rules typical to the design, testing, and quality assurance tools presently used by ABB designers in the design and manufacture of both core form and shell form transformers.

The assessment combines input from the design assessment, historical loading, operational history, and also routine and advanced diagnostic data (Figure C).

**Figure B**

*Typical results of the transformer fleet risk assessment*

**Figure C**

*Typical results of the short-circuit strength analysis used in a life assessment study.*
Life assessment/profiling is a unit-based ranking that typifies the risk of failure based on results of the design and condition assessment. This is a more detailed and precise risk of failure estimate than a fleet risk assessment since it focuses on specific knowledge of the transformer design and actual condition assessment. The resulting ranking provides an accurate estimate of the risk of failure for the transformer, which can be compared to the expected failure risk of other transformers in the industry.

Once the status of a unit is known, recommendations for maintaining, improving the unit condition, or establishing a contingency can be prioritized. The result is the elimination of high-risk units without increasing budget expenditures.

Implementation of Engineering Solutions

Based on the results of this rigorous analysis program, engineered solutions are prescribed to achieve risk reduction, life extension, and in general, health improvement of the fleet. Such engineering solutions options include:

- Preventative and Corrective Maintenance Activities
- Field Repair and Retrofit Solutions
- Relocation and Transportation
- Testing and Advanced Diagnostics
- Factory Repair Solutions
- Planned Transformer Replacement Solutions

Clearly, capital requirements for wholesale unit replacement are not economically feasible. However, neither is the revenue loss resulting from a doubling or tripling of system failures. Therefore, the logical approach is to continually identify the “weak system units” and replace, remanufacture, retrofit, or reposition these critical assets on the system before they remove themselves from service.

As this system is followed over multiple years, maintenance and operating budget dollars will be directed to the highest risk units. Remaining expenditures can then be directed to medium-risk areas. The result is a dynamic that moves high-risk units into lower risk areas and prevents the migration of low- or medium-risk units into higher risk positions. As the health of your fleet continues to improve annually, ABB anticipates your operations and maintenance budgets will begin to decrease, resulting in over-all savings for your company.

ABB’s MTMProgram is distinctive in the transformer industry. Because we possess nearly 75% of the detailed transformer design database in the industry, only ABB can provide an analysis based not just on statistics, but based on this specific design knowledge. Consequently, our clients get the most accurate, detailed analysis possible. The ABB MTMProgram provides a technical, economic, optimized solution to improve the reliability and availability of your transformer fleet.