

INTRODUCING MODERN TRANSFORMER ISOLATION BARRIER



IEEE Transformer Rupture Mitigation Task Group Presentation:



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An Overview of Proposed new Requirements for Transformer Isolation Barriers for hazard containment

Introduction

Proposed IEEE Specification for Transformer Isolation Barriers

- Overview
- Scope
- Purpose
- IEEE Proposed Specification
- Product Description
- TIB Modular Construction Video
- Summary and Questions



Objective

- To initiate a new work item within IEEE Transformer Tank Rupture and Mitigation working group to begin the development of an IEEE Standard or Guide for performance requirements for Transformer Isolation Barriers for Interior and Exterior Transformer Sites

Industry Issues & Known Facts Regarding Transformer Tank Rupture

Introduction:

- Transformer tank rupture occurs when an internal arcing fault vaporizes insulating fluid and generates an expanding gas bubble.
- Expanding gas causes a pressure rise in the transformer tank
- The location, duration, and magnitude of the arcing fault will greatly influence the size of the pressure rise in the transformer tank.
- Dynamic amplification by the pressure wave generated during an internal arcing fault also plays a very important part in tank rupture.
- The dynamic effects of internal arcing faults can result in very high and short lived local overpressures that are many orders of magnitude higher than the longer duration static overpressure that results from the expanding gas bubble.
- Result Tank Rupture Occurs

Overview

Due to the aging of the transmission and distribution grid in North America there is an increased risk of fire & safety hazards due to the potential for tank rupture at transformer stations which can result in :

- Property damage,
- Loss of transformer and possibly other transformers in the station
- Loss of life,
- Loss of revenue (due to downtime)
- Lack availability of new equipment
- Community disruption & evacuations
- Poor public relations



Transformer Isolation Barriers

- A TIB Barrier can potentially contain the fire at the first transformer, saving the second, third and subsequent transformers from damage
- In a typical case the, estimated cost to replace 3, 4 or 5 transformers and repair the damage could be in the vicinity of \$30 million
- In addition, loss of power to the grid and business disruptions costs will accrue



Estimated loss to a Utility could be in the millions

Design Criteria

Performance Objectives

- In most applications, Oil insulated transformers are required to be separated from adjacent structures and from each other by fire barriers having minimum 2 hr. fire integrity.
- The proximity of the fire barriers to the transformers being isolated should be sufficient to ensure that the line-of-sight between any transformer and the adjacent structure or transformers being protected will limit the damage and spread of fire from a transformer failure by shielding the adjacent structures. As a minimum, the fire barrier should extend at least 1 ft. above the top of transformer casing and oil conservator tank, and at least 2 ft. beyond the width of the transformer and cooling radiators.



Purpose

- To provide performance requirements for fire and explosion resistant Transformation Isolation Barriers for critical equipment or personnel protection to preserve and prolong the integrity of a facilities critical features and to protect life, property, community and environment in the event of transformer tank rupture. These barriers are intended provide protection to mitigate damage to adjacent equipment and structures



Common Practice

- Concrete Barriers
- Precast Barriers
- Block Barriers
- Steel Structure
- Ceramic Barriers



Proposed TIB Properties & Performance

- Constructed of Non combustible materials.
- Modular, demountable, and easy to field assemble
- Capable of disassembly and reassembly for maintenance or replacement of the equipment protected and to facilitate repair or relocation
- Impact Strength (Gardiner Impact)
- Hard Body Impact Test (ASTM C1629, Level 3)
- Sound Absorption (min. STC 35)
- Blast Resistance (up to 200 kPa)
- Surface flammability tests
- Fire resistance (up to 4 hours per ASTM E119)
- Corrosion resistance for all structural elements and fasteners (galvanized to ASTM A123).



Proposed TIB Properties & Performance

- Information on Installation requirements
- Separation Distances and Spatial Separations from Buildings and Property Lines
- Specific requirements for containment of spills
- Any other aspects of installation within buildings or outside



Barrier Between AC/DC Transformers & Cable Tray

