Intelli-Firewall – Transformer Bank Modular Firewall

Many of the major transformers in the U.S.A. are at, or beyond, their useful lives which significantly increases the possibility of failure, fire, and catastrophic losses. Transformer replacements are being postponed and utilities are utilizing a variety of maintenance, inspection and monitoring services to optimize reliability and reduce capital investments. Despite this, fires have, and will occur, resulting in significant costs and disruption of power to their customers. The challenge was to develop a solution that would mitigate the impact of losses in the future. Composite Support & Solutions Inc and Southern California Edison collaborated to address this challenge and developed the Intelli-Firewall, a lightweight modular firewall system that protects each transformer and isolates the potential damage associated with catastrophic failures.

Major transformers are grouped in banks of four or more, each containing up to 14,000 gallons of highly refined mineral oil. The fires (Figure 1) that are commonly associated with catastrophic transformer failures can increase the impact of failure beyond the loss of a singular asset (Figure 2)—significantly increasing the severity and duration of power interruptions. While one solution would be to replace all transformers, a single replacement can take up to two years and cost anywhere from $4 million to $6 million.

The spaces between installed transformers are typically narrow making it difficult to install traditional firewalls. However, the typical Intelli-Firewall consists of a 35 feet by 35 feet wall constructed with 28 panels assembled in four vertical sections (Figure 3). The vertical columns (Figure 4) holding these sections are prefabricated, fire-protected steel beams with durable bolt-on covers (Figure 5), making the firewall both easy to assemble and remove, should access be necessary to address a transformer maintenance issue. The lightweight nature of the panels allows lifting with a small crane or man lift (Figure 6), and the cellular panels provide the necessary structural characteristics and fire resistance, while at the same time reducing the overall weight of the system (Figure 7). Walls are customized to address varying height and width requirements as well as unique situations when electrical equipment needs to be connected on both sides of the wall and pass through a panel. The Intelli-Firewall is a proven success and has been installed in a number of large utilities on the west coast including San Diego Gas & Electric, Southern California Edison, Nevada Power, and Pacific Gas & Electric. In addition, to a number of utilities across the nation we are working with several potential customers in the manufacturing industry that see the need to protect critical assets including electrical equipment.

The team used chemically bonded ceramics (CBC's) as a resin and created an advanced composite material by combining that resin with glass and carbon fibers. In essence, the team took the CBC material from a laboratory curiosity to a very demanding infrastructure firewall application in a short time. Pultrusion process technology was advanced to combine CBC material and fibers in unique ways, and the resulting composite material has demonstrated fire resistant characteristics (Figure 8) and a mechanical toughness, which were impossible to achieve with the CBC resin alone. The material and the manufacturing process are 'green'.

Traditional firewall construction methods use block-by-block masonry construction, extending the installation time, but the new system has cut down the time a transformer must be out of operation for firewall installation from several weeks to one day, and it can be installed simultaneously with other construction activities. The rapid installation also provides flexibility to construction scheduling and management.

Intelli-Firewall™ is the recipient of the 2008 Charles Pankow Award for Innovation**.**

Fig 1. Substation Fire disrupting power to 125,000 homes and businesses

Fig 3. Three Intelli-Firewalls, each 35' x 35'

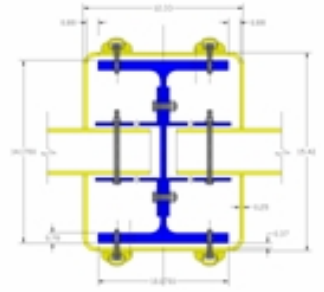

Fig 5 Steel Columns (Blue)
CBC Fire Protection Materials (Yellow)

Fig 7. Overall Weight Comparison

Fig 2. Aftermath of the Substation Fire/ Multiple Assets are lost

Fig 4. Installation of Pre-Fabricated Vertical Columns

Fig 6. Installation of Pre-Fabricated Panels

Fig 8. Fire Performance Testing of Intelli-Firewall