

## Smart Low-Voltage Distribution Systems

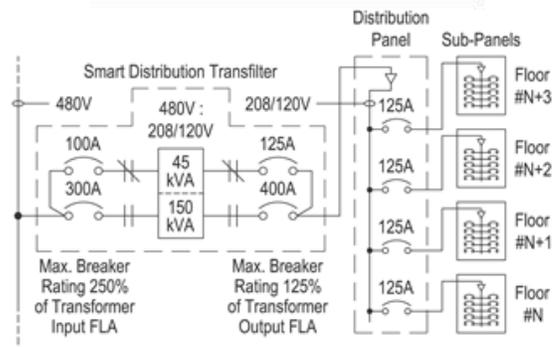
A Load Factor survey undertaken by The Cadmus Group Inc. in 1999 found that the loading of low voltage, dry-type, distribution transformers in commercial, industrial and public buildings was in a range between 9% and 17% of their full load (FL) ratings. More recent surveys have shown even lower Load Factors, the result of upgrading to more energy efficient loads and load management. California's 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, *Section 130.5 – Electrical Power Distribution Systems* compliance reduces transformer average Load Factors even further.

Transformer oversizing is a typical outcome when meeting the requirements of the National Electrical Code (NEC). To maximize energy efficiency and reduce operating costs, the optimum kVA rating of a distribution transformer can be determined by referring to CSA C802.4-2013 – *A Guide for kVA Sizing of Dry-Type Transformers* and the [nationalgrid® Transformer Replacement Program Recommendations for Low Voltage Dry-Type Transformers](#). However, the CSA guide and [nationalgrid®](#) recommendations conflict with the NEC for new construction.

**Smart Distribution Transformers™** - To improve transformer efficiency and resolve the NEC problem, Power Quality International has developed ultra-efficient, variable kVA rated Type SEY – Smart Distribution Transformers™ that, while meeting the code's kVA requirements, will automatically 'right size' to a lower kVA rating to optimize energy efficiency. Smart Distribution Transformers™ include code compliant primary and secondary circuit breaker protection and self-contained fail-safe control systems.

**Smart Distribution TransFilters™** - Smart solutions are also available with harmonic mitigating Type SDV – Smart Distribution TransFilters™ that meet IEEE Std. 519 voltage distortion recommendations at the distribution systems' loads, assuring maximum load efficiency.

*New Construction* – We anticipate the capital cost of Smart Distribution TransFilters™ for new construction will be approximately equal to or less than conventional distribution system configurations. Based on our experience with transformer replacements in existing



45/150kVA Type SDV Smart Distribution TransFilter™

buildings, we conservatively estimate that new construction installations will reduce a subsystem's electrical energy costs in a range between 6% and 12%.

*Transformer Replacement* – The capital cost of Smart Distribution TransFilters™ for transformer replacement would normally be less than those used for new construction, since the Smart transformers' higher kVA ratings would be based on measured Load Factors, as allowed by the NEC. Installations to date have reduced electrical energy costs in a range between 5.8% and 21.3%.

For both new construction and transformer replacement projects, the estimated and confirmed reductions in electrical energy cost are based on improved transformer efficiency, reduced transformer losses due to 'downsizing' and harmonic related 'penalty loss' reductions in the circuitry and loads.