

## PRODUCT SHEET



### Type PV Power TransFilter™ Medium Voltage, Dry-Type & Cast Coil Transformers for High K-Factor, Phase-to-Neutral Connected Nonlinear Loads with an integrated Type TPM Transformer Performance Meter™



*Dry-Type Coils*



*Type PV Power TransFilter™*

#### Ultra-High Efficiency

- Exceeds US DOE 2016 efficiency requirements
- Exceeds NEMA TP 1-2002 and CSA C802.2-12 efficiency requirements
- Exceeds NEMA Premium® Efficiency Transformer Program qualification requirements
- Exceeds pre-2016 [10 CFR §431.196 (c)(1)] and post- Jan 1, 2016 [10 CFR §431.196 (c)(2)] U.S. DOE efficiency legislation
- Meets or exceeds previously proposed U.S. DOE efficiency legislation including Candidate Standard Level / Trial Standard Level (CSL/TSL) 3 and 4 efficiencies
- Ultra-low Excitation (no-load) Losses provide high efficiency during periods of light-loading (<15% FL)
- Significantly lower Impedance (load) Losses, under nonlinear loading, provide high efficiency, and reduce temperature rise and A/C loading during periods of heavier loading (>15% FL)
- Peak efficiency can be matched to anticipated or measured average loading above 50% full load

#### Additional Benefits

- Reduces 'penalty losses' due to harmonic currents
- Reduces apparatus heating and A/C loading
- Reduces THD<sub>v</sub> to less than 5% at the system's loads
- Assures system compatibility with sensitive electronic loads
- Provides the most attractive payback & ROI in the industry
- Reduces energy & lifecycle costs
- Financial benefits increase with rising energy costs
- Transformer kVA ratings can be matched to anticipated or measured peak loading
- Designs can be optimized to limit inrush, short-circuit and arc flash levels
- Reduces environmental impact consistent with Green Building™ initiatives
- Enclosure size can be altered to match available space
- Dry-Type & Cast Coil transformers are UL Certified & CSA Approved

#### Product Description

Type PV harmonic mitigating Power TransFilters™ exceed all existing and pending energy efficiency requirements under nonlinear loading.

Type PV transformers' ultra-low Excitation (no-load) Losses provide high efficiency during periods of light-loading (<15% FL). This benefit is achieved by using higher quality, grain oriented silicon core steel and full and step-lap miter-cut cores with reduced laminations per group.

Unlike Excitation Losses, which are constant from no-load to full-load, Impedance (load) Losses become significant at approximately 15% FL.

Excitation and Impedance Losses are approximately equal at 50% FL under linear loading. Type PV Power TransFilters™ exceed the efficiency requirements of DOE 2016 under linear loading. Optional e-Rated® units exceed these efficiency requirements under moderate nonlinear loading ( $\leq K-13$ ). Type PV transformers' published efficiencies can be matched to anticipated or measured average loading above 50% FL, when required.

Type PV Power TransFilters™ are three-phase, single or multi-output power transformers that have been specifically designed to supply three-phase and single-phase-to-neutral connected, nonlinear electronic loads. When properly applied, these harmonic mitigating transformers reduce voltage distortion to less than 5% THD<sub>v</sub> at their loads.

Type PV transformers cancel positive- and negative-sequence harmonic currents at their common primary bus or within their multi-output secondary windings. They are available in a number of standard primary-to-secondary phase-shifts so that they may be used to create twelve-, eighteen- or twenty-four-pulse systems. In addition, Type PV transformer's secondary windings are configured to cause the cancellation of all load-generated third-order zero-sequence flux in the core's magnetic circuit.

Type PV Power TransFilters™ may be used as 'stand-alone' mitigation solutions (i.e. without zero-sequence harmonic filters) if THD<sub>i</sub> levels are less than 40% or transformer loading is  $\leq 40\%$ FL.

Alternatively, Type PV units may be used at higher THD<sub>i</sub> and load levels if *IoFilters*™ zero-sequence harmonic filters are used to shunt zero-sequence harmonic currents at remote switchboards and/or panels. The application of *IoFilters*™ will improve any limitations on circuit length and/or loading. These limitations are graphically detailed in two PQI Publications entitled: 'Neutral-to-Ground Voltage vs. Branch Circuit Length & Loading for Typical Nonlinear Electronic Workstation Loads' and: 'Neutral-to-Ground Voltage vs. Branch Circuit Length & Loading for Typical Nonlinear Electronic Gaming Machine Loads'.

Type PV units are cost-effective alternatives to K-Rated power transformers, which are only intended to survive in a harmonic environment, and de-rated power transformers. These conventional transformers cannot reduce harmonic related 'penalty losses' or voltage distortion. Type PV harmonic mitigating Power TransFilters™ provide the most attractive 'payback' and 'return-on-investment' in the industry.

# Type PV Ultra-Efficient, Medium Voltage, Dry-Type & Cast Coil Power TransFilter™

15kV Class, 60kV B.I.L Example		
kVA	Enclosure Size (Inches)	Weight (lbs.) *
750	80.00W x 48.00D x 91.50H	6050
1000	80.00W x 48.00D x 91.50H	7250
1500	90.00W x 60.00D x 91.50H	9250
2000	90.00W x 60.00D x 91.50H	10750
2500	100.00W x 60.00D x 110.00H	11950
3000	100.00W x 60.00D x 110.00H	13550
3750	110.00W x 72.00D x 110.00H	18600
5000	120.00W x 72.00D x 120.00H	21400
Other kV Classes Available		*Approx

## Notes:

The above weights and measures apply to Dry-Type, 15kV Class, 60kV B.I.L. single output configurations with a NEMA 1 enclosure and a standard temperature rise (150°). Other kV Classes (up to 25kV, 125kV B.I.L.), multiple output units and some options will change the enclosure size and weights. Consult PQI for detailed product information for these and other configurations. Enclosure provided will be determined by PQI unless otherwise specified.

## Transformer Application

Type PV Power TransFilters effectively reduce voltage distortion (THD<sub>v</sub>) at their subsystem's loads, the principal cause of reduced load efficiency. Type PV Power TransFilters are ideally suited for new construction or when replacing older transformers with historically low efficiencies as part of a power system optimization and energy reduction plan.

## Efficiency Confirmation

The efficiencies of Type PV Power TransFilters are confirmed using NEMA TP 2-2005 (*Standard Test Method for Measuring the Energy Consumption of Distribution Transformers*).

## The PQI Solution™

Power Quality International's Application Engineers use IEEE Std. C57.110 compliant engineering software (*The PQI Calculator™*) to quickly and accurately determine and compare the losses and efficiencies of any two transformers under any anticipated or measured load profile. The software can also be used to compare an existing and proposed transformer in a replacement scenario.

Given the cost of each transformer or a single transformer in a replacement scenario and the utility rates, the software calculates the annual energy savings, including A/C costs, payback on incremental or replacement costs, return-on-investment and EPA environmental benefits. PQI offers these analytical services, with recommendations, on a 'no charge' basis.

## Technical Specifications

### Type:

PV – Delta:Wye Equivalent

### Primary-Secondary Phase-Shift:

0°, -15°, -20°, -30°, -40°, -45° Std. (-7.5° & -10° increments also available at no additional cost)

### Voltage Class:

5kV to 35kV

### Insulation Class:

R (220°C) Nomex

### BIL Rating:

Std. for Class

### Cooling:

ANN (Air, Internal/External Circ., Natural)

### Seismic Withstand:

Per IBC & CBC requirements with OSHPD Seismic Certification ( $S_{DS} = 2.1g$  &  $2.5g$ ,  $z/h = 1.0$ ,  $I_p = 1.5$ )

### Certifications:

Manufactured in an ISO 9001 facility, qualified by CSA International as a Testing Facility based on ISO/IEC 17025-2005.

### Related Standards:

UL-506, ANSI C57.110, NEMA ST 20, NEMA TP 1-2002, CSA C9-M1981, CSA 22.2 No.47-1977, CSA C802.2-00 OSHPD Seismic Pre-Certification

### Listings & Approvals:

UL Listed and CSA Approved

### Warranty:

10 Years Pro-rated

### Product Selection

#### Frequency:

60Hz, 50Hz, 400Hz, Other

#### Rating:

750 – 5000kVA

#### Primary Voltage:

5kV Class through 35kV Class

#### Secondary Voltage:

600/346, 480/277, 208/120, Other

#### Temperature Rise:

150°C <sup>[1]</sup>, 115°C, 105°C, 80°C, Other

#### K-Factor:

K13

### Taps:

4 Taps, ±2.5%, ±5% <sup>[1]</sup>

6 Taps, ±2.5%, ±5%, +7.5%, +10% (6T)

### Enclosure:

NEMA 1 <sup>[1]</sup>

NEMA 3R w/ Weather Shield (N3R),

### Enclosure Color:

PQI White <sup>[1]</sup>

ANSI 61 Gray (61), Other

### Winding Material:

Copper <sup>[1]</sup>, Aluminum (AL)

### Efficiency:

Exceeds DOE 2016 (ES) <sup>[1]</sup>, Z3, Z3+, Z4

### Transformer Performance Meter:

(TM)

### Options

#### 1. Electrostatic Shield:

Single (ES), Dual (2ES), Triple (3ES)

#### 2. Low Inrush:

Four times Full Load Current (4xIR)

#### 3. Thermal Sensors

(TS)

### 4. TVSS:

50kA Mode (TVSS50),

100kA Mode (TVSS100), Other



### 5. Cast Coil (CC)

### Model Number Sequencing

Type-Hz-kVA-PV:SV-Temp. Rise-[Taps-Low Sound-Enclosure-Enclosure Color-Winding Material <sup>[1]</sup>]-Options (2 – 4)-Efficiency-Option (4 & 5)

### Sample Model Number

PV0-60-1500-12470:480/277-150-ES-6T-AL-ZS

### Product Selection Note <sup>[1]</sup>

Selections that are identified as 'standard' are not required when creating a Model Number.



All Specifications are subject to change without notice.

All contents © 2016, Power Quality International, LLC, All Rights Reserved