

PRODUCT SHEET



Type Z e-Rated® I₀Filter™

Ultra-Efficient, Low Voltage, Zero-Sequence Harmonic Filter for High K-Factor, Phase-to-Neutral Connected Nonlinear Loads

Ultra-High Efficiency

Zero-sequence harmonic filters are not included in the efficiency requirements of NEMA, CSA or DOE standards. However, since these electro-magnetic devices also provide phase-current balancing at their fundamental frequency, I₀Filters™ have been designed to the same standards as PQI's other low voltage transformer products.

- Exceeds NEMA TP 1-2002 and CSA C802.2-12 efficiency requirements
- Exceeds NEMA Premium® Efficiency Transformer Program qualification requirements
- 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 zero-sequence loading, provide high efficiency, and reduce temperature rise and A/C loading during periods of heavier loading (>15% FL)

Additional Benefits

- Reduces 'penalty losses' due to zero-sequence currents
- Reduces apparatus heating and A/C loading
- Reduces energy & lifecycle costs
- Provides the most attractive payback & ROI in the industry
- Financial benefits increase with rising energy costs
- Reduces environmental impact consistent with Green Building™ initiatives
- Reduces voltage distortion to <4% THD_V at electronic loads
- Reduces neutral-to-ground voltages to <4V at phase-to-neutral connected nonlinear loads
- Restores switch-mode power supply's 'ride-through' capability
- Provides phase-current balancing at all positive-, negative- and zero-sequence frequencies
- Increases four- & six-wire branch and feeder circuit capacity
- Protects upstream neutral conductor
- Increases conventional (K-1) transformer capacity by up to 54%
- Assures system compatibility with sensitive electronic loads

Product Description

Type Z e-Rated® I₀Filters™ are highly effective, three-phase, four-wire, passive electromagnetic filters with ultra-low zero-sequence impedances. These filters have been specifically designed to provide a parallel path for all zero-sequence harmonic currents that are generated by phase-to-neutral connected nonlinear electronic loads. Power quality benefits are optimized when filters are installed as close as possible to these electronic loads.

Type Z filters are normally installed at all sub-panels that supply single-phase nonlinear electronic loads via a three-phase circuit breaker. Whether specified at the design stage for new construction or applied in an existing sub-system, these filters are normally sized for potential zero-sequence harmonic current levels. This application philosophy eliminates the need to increase filter capacity as zero-sequence loading increases over time.



Type Z filters alone will normally achieve the recommendations and requirements of IEEE Std. 519-1992 in single-phase, nonlinear load environments. When it becomes necessary to also mitigate the power quality problems associated with positive- and negative-sequence harmonic currents, zero-sequence harmonic filters may be applied in combination with Type DY or DV Distribution TransFilters™.

Type YV directional I₀Filters™ are normally applied in series with sub-panels that supply single-phase nonlinear electronic loads. Whether specified at the design stage for new construction or applied in an existing sub-system, these filters are normally sized for connected kVA loading. Type YV filters may also be used to mitigate positive- and negative-sequence harmonic currents.

The application of zero-sequence harmonic filters will reduce the power quality limitations on branch circuit length and/or loading. These limitations are graphically detailed in two PQI publications entitled: (i) 'Neutral-to-Ground Voltage vs. Branch Circuit Length & Loading for Typical Nonlinear Electronic Workstation Loads' and (ii) 'Neutral-to-Ground Voltage vs. Branch Circuit Length & Loading for Typical 120V Nonlinear Electronic Gaming Machine Loads'.

Type Mini-Z® e-Rated® I₀Filters™

When branch circuits' neutral-to-ground voltages and voltage distortions cannot be economically controlled by other means, Mini-Z® zero-sequence harmonic filters may be applied at the load-end of three-phase, four-wire 'shared neutral' branch circuits or three-phase, six-wire branch circuits.



In 'landscaped' office environments, filters may be conveniently connected to pre-wired partitions via the partition manufacturer's standard wire-way connection cable as shown. Where the partitions are not pre-wired or in private office applications, filters may be connected at branch circuits' 'home run' junction boxes.

The application of Mini-Z® filters in new distribution systems eliminates the need to oversize 'shared neutral' conductors or install separate neutral conductors for each phase in the branch circuit. Similarly, the application of filters in existing systems eliminates the need to replace branch circuits with undersized 'shared neutrals'. In either case, Mini-Z®s will eliminate the need to de-rate circuits or panels. The de-rating of conventional distribution transformers can be reduced from approximately 45% to less than 15%. As a result, filters significantly reduce capital costs and power costs while providing significant performance and power quality improvements.

Mini-Z® filters alone will normally achieve the recommendations and requirements of IEEE Std. 519-1992 in single-phase, nonlinear load environments. When it becomes necessary to mitigate the power quality problems associated with positive- and negative-sequence harmonic currents, these filters may also be applied in combination with Type 'DY' or 'DV' Distribution TransFilters.

Type Z & Mini-Z® e-Rated® Ultra-Efficient, Low Voltage, Zero-Sequence Harmonic Filters

Weights & Dimensions

Neutral Amps.	KVA	Enclosure Size (Inches)	Weight (lbs.) *
25	3	15.50W x 11.00D x 14.25H	85
40	5	15.75W x 15.50D x 21.00H	120
60	7	15.75W x 15.50D x 21.00H	135
75	9	20.25W x 13.50D x 18.25H	165
100	12	20.25W x 13.50D x 18.25H	210
150	18	20.25W x 18.25D x 18.25H	240
175	21	20.25W x 18.25D x 26.50H	300
225	27	20.25W x 18.25D x 26.50H	310
250	30	20.25W x 18.25D x 26.50H	340
300	36	24.50W x 21.50D x 31.50H	375
350	42	24.50W x 21.50D x 31.50H	400
500	60	24.50W x 21.50D x 31.50H	525
600	72	30.75W x 27.75D x 30.75H	690
800	97	30.75W x 27.75D x 30.75H	860
1000	120	30.75W x 27.75D x 30.75H	900
Other	TBD	TBD	*Approximate

Notes:

The weights & dimensions apply to filters up to 600V with NEMA 1 enclosures and with standard temperature rise (115°). Multiple output units and some options may change the enclosure size and weights. Consult PQI for detailed product information for these and other configurations. Mini-Z filters are 7.5"W x 15"D x 12"H and weigh 98lbs.

Technical Specifications

Type:

Z – Wye Equivalent, YV & ZV – Wye:Wye Equivalents

Primary-Secondary Phase-Shift:

YV 0°, 15°, 20°, 30°, 40°, 45°, other

Voltage Class:

1.2kV

Insulation Class:

R (220°C) Nomex

BIL Rating:

10kV (Std. for Class)

Cooling:

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

Seismic Withstand:

Per IBC & CBC requirements with OSHPD Seismic Certification (S_{DS} = 2.1g)

Certifications:

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

Related Standards:

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

Listings:

UL Listed and CSA Approved

Warranty:

10 Years Pro-rated

Product Selection

Frequency:

60Hz, 50Hz, 400Hz, Other

Rating:

3 – 120 kVA, Other

IoFilter™ Application

Type Z & Mini-Z® IoFilters™, with ultra-low zero-sequence impedance flux cancellation windings, effectively reduce voltage distortion (THD_v) at their circuits' loads, the principal cause of reduced load efficiency. IoFilters™ are ideally suited for new construction or as part of a power system optimization and energy reduction plan.

Efficiency Confirmation

IoFilters™'Excitation Losses are confirmed using NEMA TP 2-2005 (Standard Test Method for Measuring the Energy Consumption of Distribution Transformers).

Zero-Sequence Impedance

IoFilters™' zero-sequence impedances are confirmed using a three-phases-to-neutral (H₁-H₂-H₃ – N₀) short-circuit measurement.

The PQI Solution™

Power Quality International's Application Engineers use IEEE Std. C57.110 and CSA C802.5 compliant engineering software (*The PQI Calculator™*) to quickly and accurately determine and compare the losses and efficiencies of any two transformers, with and without the application of Type Z or Mini-Z IoFilters™, 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

Primary Voltage:

208/120, 400/231, 480/277, Other

Secondary Voltage:

208/120, 400/231, 480/277, Other

Temperature Rise:

115°C ^[1], 105°C, 80°C, Other

K-Factor:

K-30

Low Sound:

3dB below NEMA ST 20 ^[1]

Enclosure:

NEMA 3R ^[1]

NEMA 3R w/ Weather Shield (N3R),

NEMA 4 (N4), 4X (N4X)

Enclosure Color:

PQI White ^[1]

ANSI 61 Gray (61), Other

Winding Material:

Copper ^[1]

Efficiency:

All exceed NEMA TP 1, NEMA Premium, DOE 2016 ^[1]

Options

1. Thermal Sensors (TS)

2. Analog Ammeter (AM)

3. TVSS:

50kA Mode (TVSS50),

100kA Mode (TVSS100), Other

Model Number Sequencing

Type-Hz-kVA-PV:SV-Temp. Rise-[Enclosure-Enclosure Color-Winding Material ^[1]]-Options (1 – 3)

Sample Model Number

Z-60-075-208/120:208/120-AL

Product Selection Note ^[1]

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

e-Rated®



All Specifications are subject to change without notice.

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