



VarStec Power Solutions, Inc.

PO Box 942

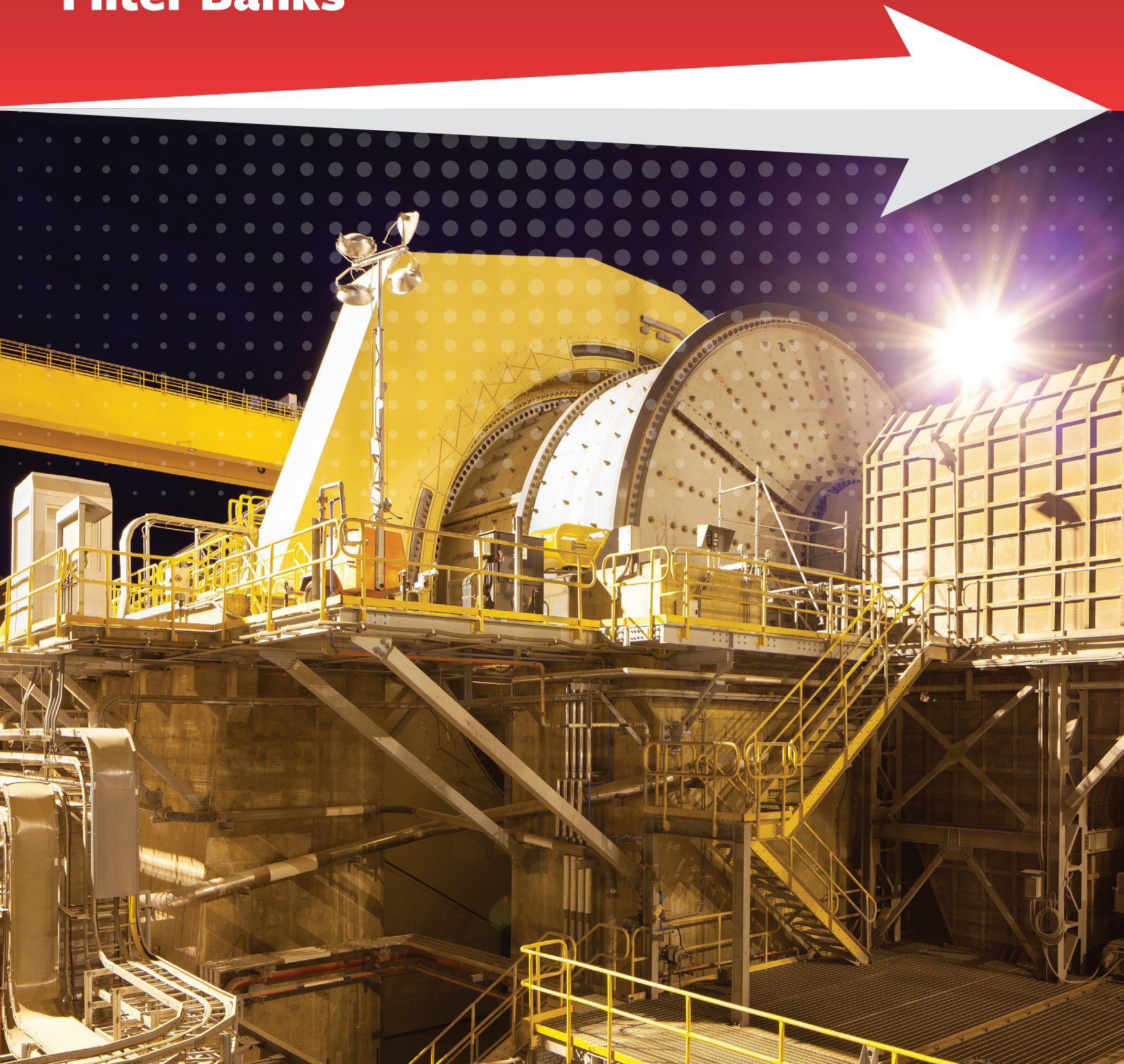
Saratoga Springs, NY 12866

VarStec.com

Info@VarStec.com

518.369.7589

Medium-Voltage Metal-Enclosed Filter Banks



OVERVIEW / KEY FUNCTION

System-fit, medium-voltage metal-enclosed harmonic filter banks designed to provide reliable reactive compensation, power factor correction, and harmonic control for medium-voltage power systems.

In addition to providing the same core reactive compensation and power factor correction functions as capacitor banks, filter banks also prevent harmonic resonance and filter harmonics. One key reason harmonic filters are applied is to prevent harmonic resonance. Conventional capacitor banks create resonance, and this resonance can magnify even small quantities of harmonic current already present on the system to levels that create power quality problems. For this reason, many facilities seeking power factor correction require harmonic filters rather than standard capacitor banks.

Harmonic filters are also installed to filter harmonic current in high harmonic current applications. When high harmonic currents push voltage distortion to unacceptable levels, with or without conventional capacitor banks, filters become a necessity for plant operations. VarStec applies system-fit engineering to deliver fully integrated, factory-tested metal-enclosed harmonic filter banks designed around your specific harmonic environment, resonance concerns, reactive power objectives, and operating requirements of the site.

IMAGE/S HERE TBD

INDUSTRY APPLICATIONS & HARMONIC ENVIRONMENT SOLUTIONS

Our harmonic filter banks are engineered for medium-voltage power systems where power factor correction, harmonic filtering, and resonance control must be addressed together as part of a system-fit solution. VarStec designs their systems around the electrical behavior and operating requirements unique to your industry and application. For example:

- **General Industrial, Commercial, Oil & Gas, & Data Center**

These applications typically require power factor correction and have relatively low harmonic current levels, where filters are needed primarily to prevent resonance rather than to provide harmonic attenuation.

- **Mining Operations**

Mining sites represent some of the most complex harmonic environments in industry. Large VFD drives and cycloconverters produce both integer and non-integer harmonics. These systems require system-fit solutions that combine Notch, High-Pass (HP), and C-High-Pass (C-HP) filters for coordinated harmonic filtering and voltage support.

- **Chemical, Electrowinning & Petrochemical Facilities**

These sites use large rectifier systems that inject significant harmonic current. VarStec evaluates both normal and abnormal (contingency) operating conditions to develop optimized multi-tuned filter solutions.

- **Renewable Energy**

Solar, wind, and battery storage collector systems can present resonance problems even where inverter harmonic output is low. Collector system cable capacitance can further contribute to higher-order resonance, making High-Pass or C-High-Pass filters necessary for damping.

- **Steel Mills & Related Metals Processing**

Facilities using arc furnaces and large AC/DC drives produce ultra-low power factor and highly fluctuating loads. In these applications, hybrid STATCOM and fast-switched harmonic filter banks are coordinated to correct power factor and reduce flicker.

TECHNICAL DETAILS & FILTER DESIGN EXPERIENCE

VarStec applies harmonic analysis expertise and disciplined engineering practices to deliver system-fit harmonic filter solutions aligned with the specific objectives of each project.

Metal-Enclosed Integration (Scope)

VarStec harmonic filter banks are fully compartmentalized, metal-enclosed, and ready-to-install systems that house all switching, all protection, and all control functions within a single integrated package. These systems incorporate the iron-core reactors required for the filter design, while retaining the same core construction, safety, and serviceability advantages offered by our capacitor banks

Application-Specific Filter Design

Each system is engineered around the site's specific harmonic environment and resonance concerns. VarStec evaluates the system as a whole to determine the appropriate filter type and tuning strategy needed to achieve project objectives.

Primary Filter Topologies

- Notch Filters: The simplest design, applied for resonance prevention and precise filtering at individual harmonic frequencies.
- High-Pass Filters (HP): Applied where resonance damping and broader harmonic attenuation are required across a range of frequencies.
- C-High-Pass Filters (C-HP): Offer comparable performance to HP filters but with the advantage of lower fundamental-frequency losses, allowing for highly effective damping.



STRATEGIC BENEFITS OF VARSTEC HARMONIC FILTERS

Reduced Installation Risk & Faster Project Execution

VarStec harmonic filter banks are delivered as fully integrated, factory-assembled systems that reduce field assembly and shift critical testing work away from the job site. This shortens installation schedules and improves project execution.

Safer, More Maintainable Metal-Enclosed Construction

Fully compartmentalized construction provides a higher level of personnel and environmental protection. Ground-level access to key components supports safer inspection and long-term maintenance.

Industry-Leading Harmonic Design Expertise

With more than 30 years of experience, VarStec delivers solutions grounded in deep harmonic analysis. Each system is engineered around the site's harmonic environment, resonance concerns, and long-term performance objectives.

Improved Power Quality & Harmonic Performance

VarStec harmonic filter banks help prevent harmonic resonance, reduce voltage distortion, and support system voltage. For industrial plants, these benefits translate into more reliable operation of plant loads and improved adherence to grid requirements.

Direct Access to Senior Technical Leadership

Proper harmonic filter design requires experience in the selection and coordination of capacitors, reactors, and filter branches. VarStec helps ensure that critical process facilities are not forced offline by improperly designed filter banks.

RATINGS, CONFIGURATION & OPTIONS SYSTEM-FIT TO SPECIFICATIONS

Electrical Ratings & Configuration

- **Filter Bank Type:** Fixed | single-stage | multiple-stage | filter-ready
- **Filter Bank Configuration:** Notch, High-Pass (HP), C-High-Pass (C-HP)
- **Tuning:** As specified or determined from harmonic filter design study
- **Operating Voltage (L-L):** 2.4 kV to 38 kV
- **Reactive Power Output:** 1 MVAR to 100+ MVAR
- **Impulse Withstand Voltage (BIL):** 60 kV to 200 kV

Switching, Protection & Control

- **Switching Devices:** Vacuum contactor | vacuum switch | C2-rated breaker | transient-free switching device
- **Automatic Functions:** Power factor control | kvar control | voltage control | time scheduling
- **Protection Functions:** Overcurrent | overvoltage | unbalance | neutral voltage | direct-fuse sensing | VTHD | ITHD | over-temperature
- **Interlocks:** Mechanical | electrical | key

Communications & Integration

- **Communication Protocols:** Modbus RTU/TCP | DNP3 | IEC 61850 | Ethernet/IP | SEL-specific legacy protocols
- **Local Interface:** Control switches | annunciation | metering display | HMI
- **Utility / Plant Integration:** Coordination with utility interlocks | feeder relaying | substation automation architecture

Power Components & Accessories

- **Filter Reactors:** Iron-core, 1-Phase and 3-Phase, rated per filter design study
- **Capacitor Units:** As specified, by Hitachi Energy, Eaton, GE
- **Power Fuses:** Current-limiting, by SIBA

Connections, Construction & Environment

- **Enclosure Construction:** Compartmentalized metal-enclosed; all-welded structural steel base
- **Coating System:** High-solid epoxy siloxane marine coating (5,500-hour salt-spray resistance)
- **Operating Temperature Range:** -50°C to +55°C (-58°F to +131°F)
- **Seismic Qualification:** Up to Zone 4

Standards, Testing & Documentation

- **Applicable Standards:** IEEE Std 18, IEEE 1036, IEEE 519, IEEE C37.20.2/3 | IEC equivalents
- **Listing / Certification:** UL | NRTL | CSA | CE
- **Documentation:** Drawings, logic documents, relay settings, and harmonic study reports

* Every metal-enclosed harmonic filter bank is engineered and configured to the specific electrical system, site conditions, operating philosophy, and project specification. The ratings, construction features, protection functions, and accessories listed are provided as system-fit, application-specific selections rather than fixed catalog limitations.