AC Filter Capacitor Bank
For Wind, Solar and Network Power

Over Half a Century of Expertise

SBE, Inc.
AC Filter Capacitor Technology

AC Filter Capacitor Bank Overview

- Immediately reduce AC Capacitor, associated component and labor costs
- Decrease maintenance costs
- Increase life
- Improve reliability
- Dry film construction
- Eliminate failures which cause collateral damaging using SBE's patented technology
- Simplify supply chain

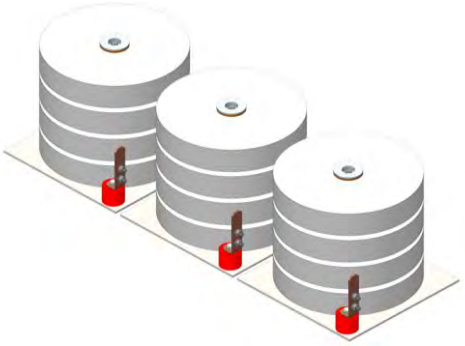
AC Filter Capacitor Bank – Building Blocks

A 3 phase system can easily be realized using the single phase unit as a building block.

Single Phase Building Blocks

3-Phase Horizontal Alignment

3-Phase Vertical Alignment



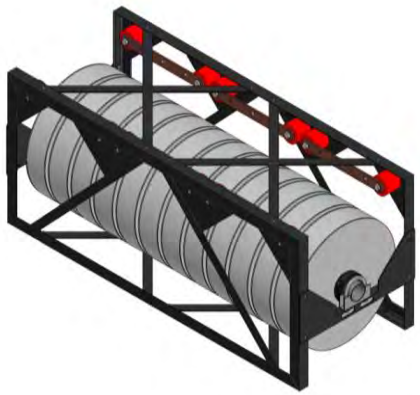
3-phase Horizontal Alignment

The Problem

- Typical, oil filled AC filter capacitors with unreliable pressure interrupters are generally difficult to manage and fail catastrophically, causing collateral damage to systems and system downtime.
- To prevent such failures, costly system maintenance must take place often.

The Solution

- Solution: Combine SBE power ring form factor with patented segmented film technology
  - Reduce hotspot temperature
  - Eliminate catastrophic failure mode



The Meaning of AC Capacitor Life

- How is AC capacitor “life” defined? – Answer: In several ways
  - Catastrophic failure where system is shut down
  - Significant cap loss due to pressure interrupters actuating
    - Benign failure – limit is THD due to change in filter
  - Gradual cap loss over time
    - Benign failure – limit is THD due to change in filter
  - Increase in DF and increasing hot spot temperature
    - Field replacement

More on AC Capacitor Life

- Does a cap bank that is replaced after five years really have a five year life?
  - If ailing cans are replaced at regular service intervals, the answer is no
  - How many of the cans that start out in the bank are there when it is pulled out of service?
- New systems can have improved life with a larger cap bank size, however, the trade-off is reduced power density – not a desired feature

Life and Attributes of SBE AC Capacitor Technology

- SBE dry film with patented segmentation design offers significant improvements…
  - Eliminate catastrophic failure mode
  - Runs up to 20°C cooler than conventional cans
  - DF is much lower and very stable
  - SBE life tests predict > 80,000 hours to reach 10% to 20% reduction of cap from nominal under normal service conditions

Preventing AC Cap Catastrophic Failures

- SBE's patented end connection and segmentation technology
  - allows for safe management of higher current densities
  - prevents "unzipping" failures
- SBE's Power Ring capacitors are not sealed in a can, therefore overpressure and subsequent explosive failures do not occur.
- Finally, the large surface area and short thermal path to the end faces of the Power Ring are ideal for reducing temperature rise, therefore extending life.

AC Filter Capacitor Bank
Supply Chain & Serviceability Enhancement

- Fully integrated unit
- Purchase one “drop-in unit Instead of several components (capacitors, bus structures, housing, terminals, etc…)
- Each unit is easily serviceable by a single individual
- Ease of installation in both the field and the factory

SBE Engineering Expertise

The SBE engineering team can:

- Help you optimize a bank design which can drop in to your existing space,
  - A drop-in solution
    - facilitates a simple path for field testing and system evaluation
    - allows for convenient implementation of second sourcing since the AC capacitor bank is not changed dimensionally – but cost and performance are improved.
- Help you create a leading edge, new design.