HartlandControls

Capacitors 101

Motor Run Capacitors

WHAT YOU NEED TO KNOW

HartlandControls

In this Book

What is a Capacitor?

Regardless of the application, a capacitor's function remains the same: To charge and discharge electrical energy back to the circuit when necessary.

Capacitors come in many different shapes, sizes and materials. They're used in a wide range of applications, including electronics, appliances, transportation and power grids worldwide.

At its core,

a capacitor is a device consisting of two conductors separated by an insulator that stores potential energy in an electric field.

How a Capacitor Works

Capacitors are similar to short-term batteries. However, they're able to release energy much more rapidly—often in less than a few seconds—by storing energy in an electrostatic field. Attached to motors, they send a jolt to start the motor (a "start" capacitor), or a regular series of jolts to keep the motor working (a "run" capacitor).

In an air conditioner or furnace, capacitors work with three different motors: the compressor, the blower and the outside fan.

Motor Run Capacitors

Out of the many different types of capacitors in the world, Hartland Controls focuses on the CBB65 series, also known as a motor run capacitor.

The external structure is made up of a round or oval shaped aluminum canister. The internal construction meets various electrical load requirements for the Heating Ventilation Air Conditioner industry.

Patent History: The first CBB65 can-style construction capacitor patent was filed in the United States in 1934 and issued in 1937. Throughout the years, manufacturers have made refinements as new materials became available, but the basic construction still follows the 1937 patent.

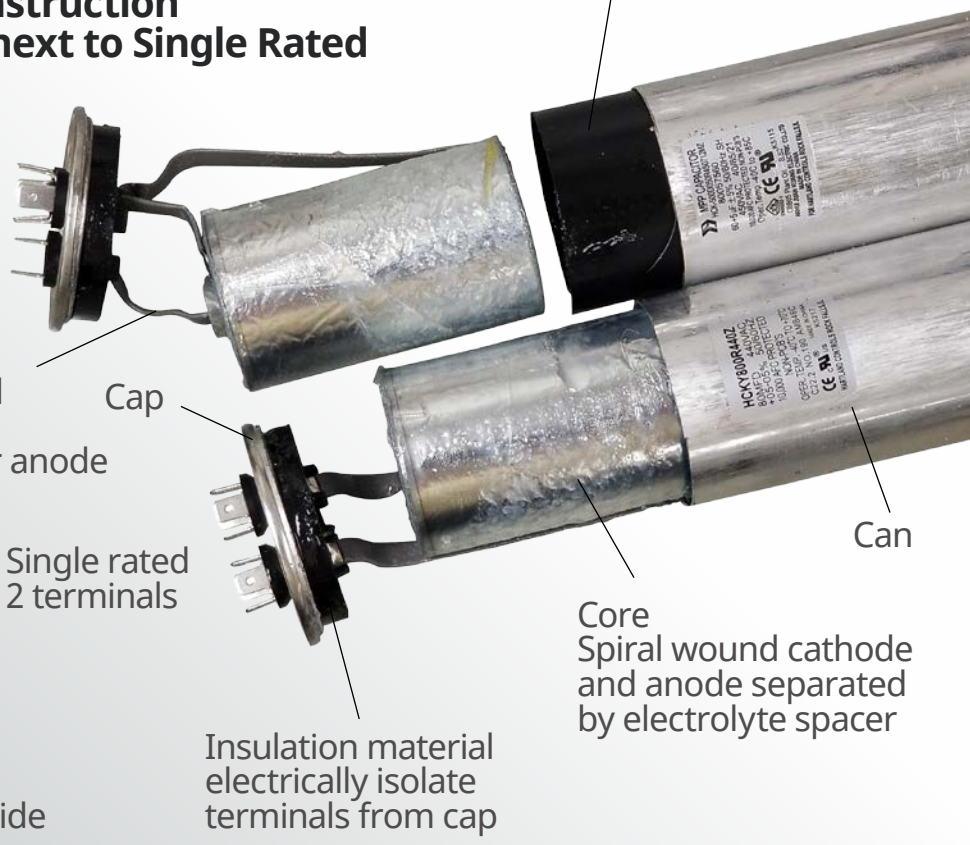
Internal Construction

The *μ* in *μF* isn't an italic letter u. It's the Greek letter *mu*, which is a common abbreviation for *micro*.

Capacitors are constructed to allow for different electrical power distribution methods. Capacitance is their ability to collect and store energy, which is measured in farads (F).

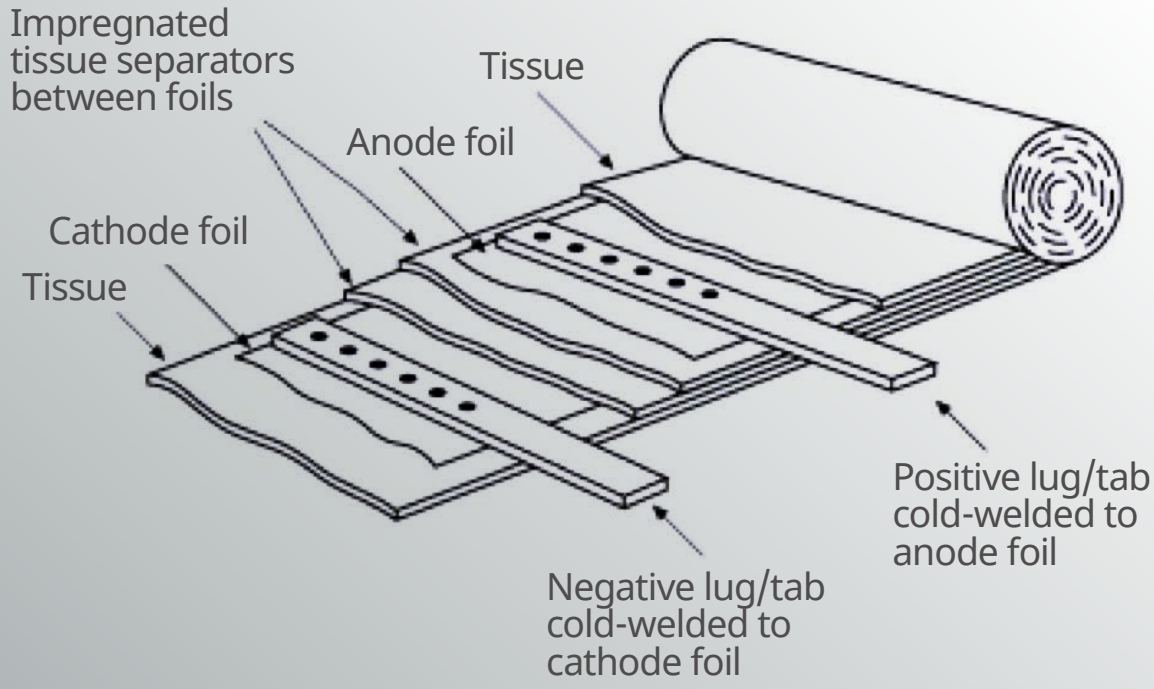
- **Single Rated** (one microfarad—mF or μF) has 2 terminal locations.
- **Dual Rated** (two microfarads—mF or μF) has 3 terminal locations.

Internal Construction
Dual Rated next to Single Rated



Spiral Wound Core Construction

The core's function is to provide the capacitance (storage) of the capacitor. Capacitance is proportional to the surface area of the cathode and anode and inversely proportional to the distance between them.



More surface area = more storage.

Choosing a Quality Capacitor

It's impossible to determine capacitor quality just by looking at it; they all appear to be the same. However, there are some important features that differentiate capacitors from each other—and have an impact on capacitor life.

How to spot an inferior capacitor:

1. No plastic base cup to support the mylar film rolls
2. No Nomex sleeve to protect and insulate the rolls
3. Less than seven micrometer mylar thickness
4. No vacuum sealing to eliminate leaks and contaminants

Checklist for Capacitor Quality

- –40°C to 70°C (–40°F to 158°F) operating temperature
- 60,000 hour life at rated temperature
- Accelerated life test performance: 2000 hours @ 125% rated voltage @ 80°C
- Thick, seven micrometer film for greater reliability and quality
- Vacuum sealed to eliminate leaks and/or contaminates
- 1.5mm plastic cup to support Mylar film rolls
- Nomex sleeve to protect and insulate Mylar film rolls
- Tested per EIA-456-A Standards—Industry BEST +/–3% tolerance
- 10,000 AFC protected
- UL / CSA / VDE approved

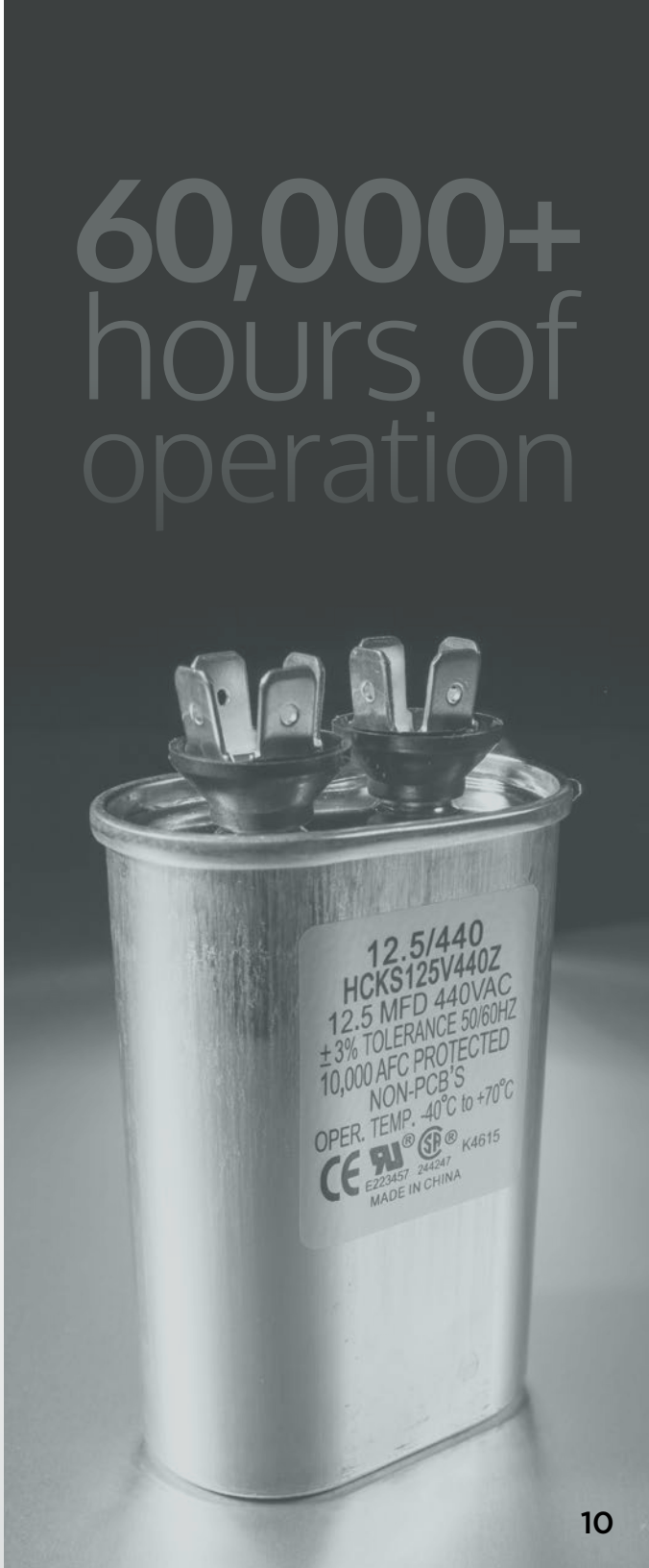
Life Expectancy

Our capacitor designs provide up to 60,000 hours of operation under normal temperature and operating conditions. If your application requires longer operating times, contact us to discuss your needs.

Safe-fail Methods Due to Damage or Misuse

Capacitors typically have one of two safe failure methods designed into them:

1. **A pressure relief vent** that opens to relieve gas buildup, stopping the over discharge or change condition.
2. **A cap designed to bulge** that breaks the internal connections, stopping the over discharge or change condition.



Safety First

WARNING: Never assume a capacitor is discharged!

Hartland Controls CBB65 capacitors are designed to provide high voltages when fully charged. Improper handling means electrical shock can happen.

Follow these safety rules:

- Never ever touch capacitor terminals
- Never short the terminals with a metal object (This can create heavy sparking that can cause fire under the right conditions)
- Discharging should be through a resistance load by an engineering lab specialist

About Hartland Controls

Hartland Controls is a premier manufacturer of custom electrical control solutions and engineered assemblies. Our state-of-the-art facilities are geared for high-volume, ongoing product programs. Located in the heart of the Midwest, our facility is ideally situated to serve customers nationwide through a broad distribution network and associates who are dedicated to outstanding customer service.

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