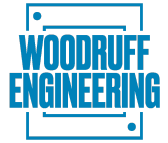


Magnetic Field Coil Capacitor Bank Module

Bipolar Pulsed-Power Bank for Magnetic Field Coil Energization



FIELD-PROVEN · Built, delivered, and in continuous operation at a fusion research customer site since 2016 · 100,000-shot / 10-year design life

The Magnetic Field Coil Capacitor Bank Module is a bipolar, field-proven pulsed-power supply built by Woodruff Engineering to energize magnet coil sets for magnetic reconnection research. Each module discharges a bank of eight parallel high-density metalized-polypropylene capacitors through a phase-control thyristor forward switch, crowbarred at peak current by a diode stack for reliable uni-polar-swing operation. A resistive water-dump provides primary post-shot discharge, backed by passive bleed resistors that safe the bank to below the NFPA 70E 50 V threshold within 12 hours in the event of a dump failure. The module is fully self-contained on two standard 48" x 48" pallets for on-site installation with a minimal connection set (facility power, coil leads, and fiber-optic control/diagnostics), and has been operating in the customer's experimental program on this basis since delivery.

26 kA

PEAK DISCHARGE CURRENT

1,400 V

BANK VOLTAGE

~436 kJ

STORED ENERGY / MODULE

100,000

SHOT DESIGN LIFE

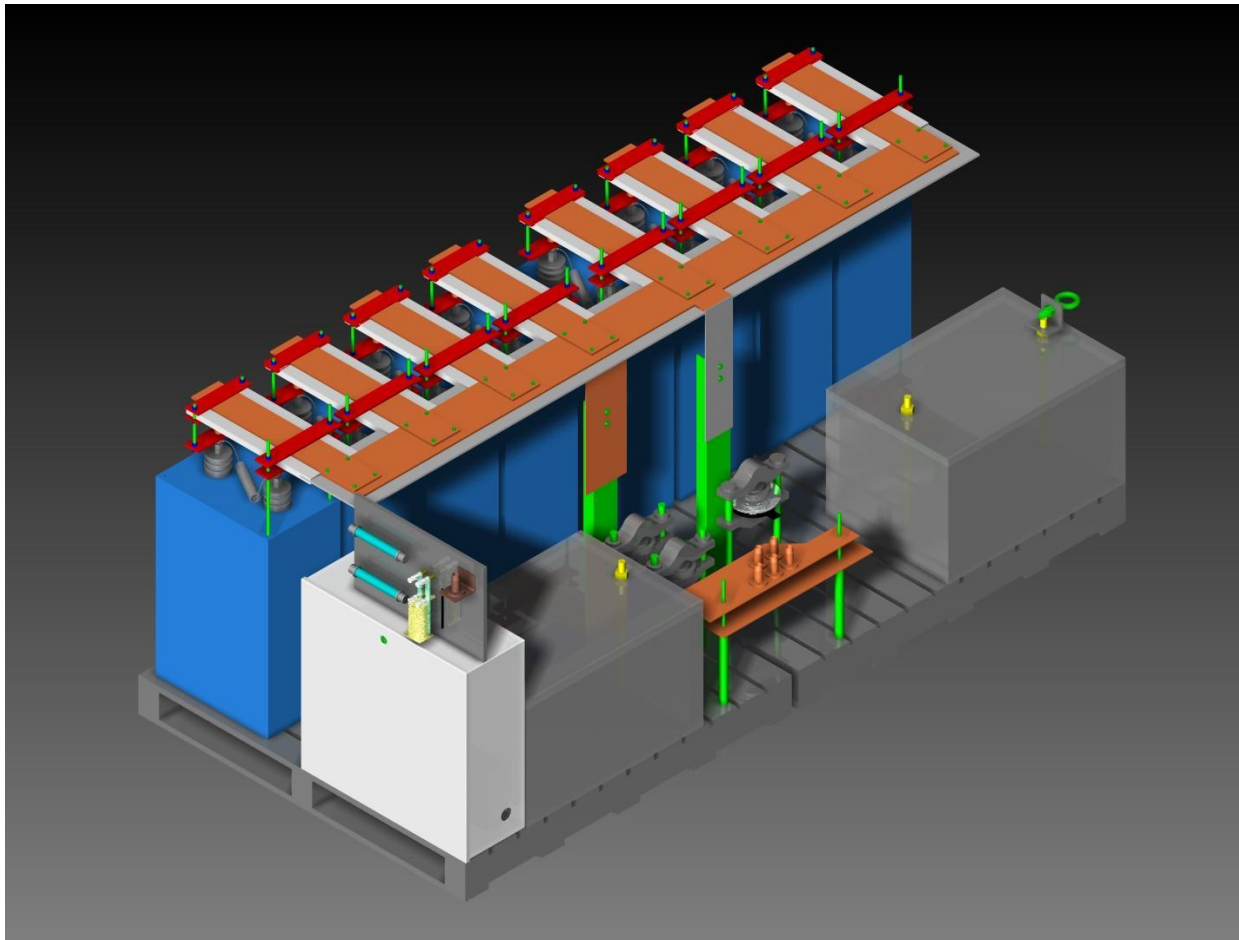


Figure 1: Magnetic Field Coil Capacitor Bank Module — system assembly, dual-pallet configuration

ELECTRICAL SPECIFICATIONS

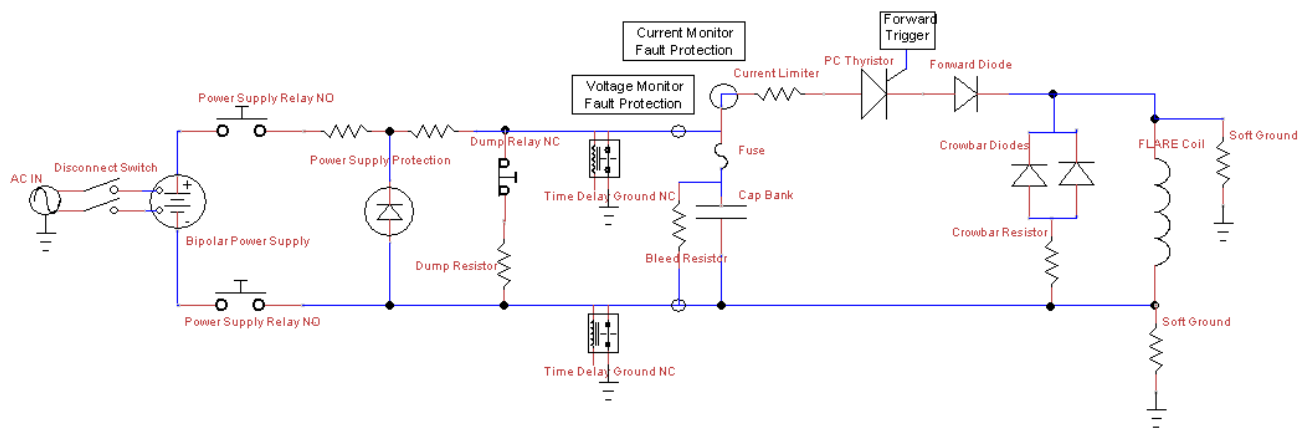


Figure 2: Magnetic Field Coil Circuit Schematic

Sub-Coils Driven	2 per module Magnetic Field Coil (Magnetic Field Coil) coil set
Bank Voltage	1,400 V DC Nominal charge voltage
Peak Discharge Current	26 kA First current swing
Current Rise Time (t-rise)	> 30 ms To peak current
Crowbar Timing	At current peak Diode commutation (uni-polar swing)
First-Swing Polarity	Always positive Uni-polar crowbar switch used (diode commutation); no polarity reversal seen by capacitors
Stored Energy per Module	~436 kJ Calculated: $\frac{1}{2} C V^2$, $C = 8 \times 55,650 \mu F$ parallel, $V = 1,400 V$
Design Life	10 years / 100,000 full-power shots With regular maintenance

CAPACITORS & SWITCHING

Capacitors	8 x 1.4KV 55,650 μF @ 1.4 kVDC each, metalized polypropylene film, dry type
Capacitor Life Rating	500,000 discharges (90% survival) Per manufacturer specification
Capacitor Fusing	4 x 15 AWG bare copper wire per cap Individually fused; blows on over-current event
Forward Switch	Phase-control thyristor TTL-triggered via fiber-optic frequency-to-voltage converter
Crowbar Switch	Parallel stack of 2 diodes Conducts only after current peak, crowbarring at maximum current
Bleed Resistor	25 W, 700 k Ω , Ohmite Mox-G (per capacitor) Passive last-resort safing; discharges bank below 50 V within 12 hours
Buswork	Copper busbar, brass knife-edge adapters Mylar-insulated to 2E+1 stand-off; 1 m Ω over-current protection resistor

CHARGING SYSTEM

Charging Supplies	2 x 10kV (POS + NEG) <i>Wired in series for bipolar charging; see note below on facility rating</i>
Charge Switch	Normally-open DPST <i>Connected only during charging; opens before programmed discharge</i>
Charge Regulation	Series resistor on each output line <i>Improves regulation, limits fault current</i>
Protection Diode	One per module <i>Blocks reverse voltage to charge supply on bank pre-fire</i>

Note: charging supplies are shared facility infrastructure rated to ±10 kV and serve multiple capacitor bank modules across the customer's pulsed-power system; this Magnetic Field Coil module is operated at its 1,400 V design point. If a dedicated, module-specific charging supply rating is required for a future build, please confirm with Woodruff Engineering.

DUMP & SAFETY

Primary Dump	Aqueous copper-sulfate resistive dump (brass electrodes) <i>Discharges bank below 50 V (NFPA 70E) within 30 seconds</i>
Dump Relay	Normally-closed relay <i>De-energizes to engage dump on Kirk-key removal, E-stop, or interlock break</i>
Repeat Dump Rating	Sequential full-energy dumps at 3-minute intervals <i>Resistor temperature monitored remotely, kept below 60°C (ASTM C1055)</i>
Diagnostics	Forward current, bank voltage, resistor & ignitron temperatures <i>Transmitted via fiber-optic connection to DAQ</i>
Interlocks	Kirk-key isolation switch, E-stop, enclosure interlock <i>De-energizes charge relay and engages dump on any break</i>
Enclosure	1/4" steel blast shield between modules <i>Procedures in place to de-energize bank bMagnetic Field Coilore personnel access</i>

MECHANICAL & ENVIRONMENTAL

Footprint	≤ 32 sq ft (64 sq ft max including egress/maintenance clearance)
Mounting	2 x 48" x 48" standard steel pallets <i>Modular, transportable, on-site installation</i>
Total Height	< 50 inches
Weight	1,200 lbs per pallet <i>2,400 lbs total, both pallets</i>
Cooling	None required for capacitor bank; chiller loop for ignitron switch cooling <i>See note below</i>
Electrical Input	208 V three-phase, 110 V
Environmental	Room temperature, seasonal humidity tolerated, dust-free prMagnetic Field Coilerred <i>No special AC required beyond ignitron cooling lines</i>

Note: Supporting engineering drawings for this module rMagnetic Field Coilerence ignitron switch hardware and a shared chiller loop, while the forward-switch specification calls out a solid-state thyristor. Both configurations exist in the delivered CCDPS system across module types; Woodruff Engineering can confirm the as-built switch technology for this specific module serial number on request.

KEY FEATURES

Field-Proven Design Built and delivered to an operating fusion research customer; in continuous service since 2016 under a 100,000-shot, 10-year design life.

Modular, Transportable Package

Fully self-contained on two standard pallets with a minimal facility connection set, enabling straightforward installation and relocation.

Redundant Safety Architecture

Primary resistive water dump, passive bleed-resistor backup, hard-wired interlocks, and Kirk-key isolation provide multiple independent paths to a safe state.

Fiber-Optic Control & Diagnostics

All triggering, timing, and diagnostic signals are transmitted via fiber optics for electrical isolation from the high-voltage bank.

TARGET APPLICATIONS

Fusion & Plasma Research

Magnetic reconnection and external-field coil energization for pulsed-power research machines

National Laboratory Programs

Custom capacitor discharge power supplies for experimental physics facilities

Pulsed Magnet Systems

Repetitive high-current, short-duration coil energization requiring crowbar protection

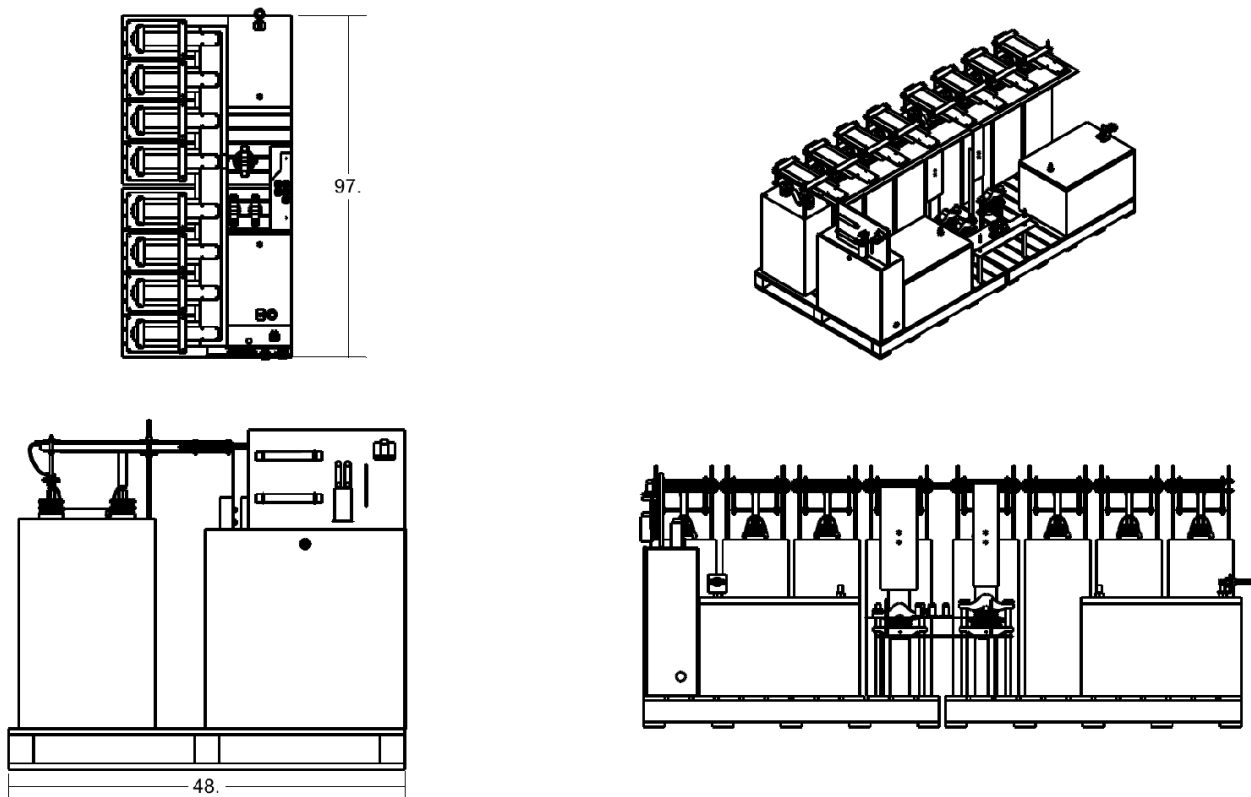


Figure 3: Engineering Drawing — Magnetic Field Coil Capacitor Bank, Drawing No. 0001, Rev A, dim in inches

Customer Information & Order Form

Magnetic Field Coil Capacitor Bank Module · Model WE-CB-Magnetic Field Coil-1P4KV

CUSTOMER / ORGANIZATION DETAILS

Organization:		Department / Program:	
Contact Name:		Title:	
Email:		Phone:	
Billing Address:			
Shipping / Site Address:			

ORDER / INQUIRY DETAILS

Quantity of Modules Requested:		Required Delivery Date:	
Bank Voltage (if different from standard):		Application / Experiment:	
Special Requirements (voltage, footprint, control interface, etc.):			
Additional Notes:			

AUTHORIZATION

Authorized Signature:

Date:

Printed Name:

Purchase Order No. (if applicable):

Please return this form to sales@woodruffeng.com This form does not constitute a binding order; a formal quotation and mutually executed agreement will follow receipt of this information.