

Ceramic RF Power Capacitors  
Synthetic Capacitors  
Vacuum Capacitors

Vacuum Relays  
Vacuum Interrupters  
Vacuum Contactors

**Product Guide**

# Ceramic RF Power Capacitors

Richardson Electronics offers an extensive line of ceramic RF power capacitors ideally suited for high voltage and high current applications. Capacitor configurations include: Plate, Barrel, Feed Through, Tubular and Pot styles. We stock a wide selection of ceramic RF power capacitors with capacitance values extending from the lower picofarad (pF) range up to the nanofarad (nF) range, 5kV to 40kV.

## Key Benefits

- Long Life, Good Reliability
- Variety of Tolerances
- Affordable
- Compact Sizes
- Low Dielectric Loss

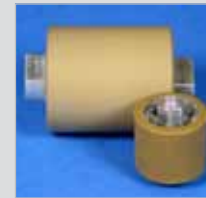
## Common Applications

- Induction and Dielectric Heating
- Broadcast Transmission
- Pulse Power
- Medical
- Laser
- Semiconductor Wafer-Fab
- Plasma

## PRODUCTS



Plate Capacitors



Barrel Capacitors



Feed-Through Capacitors



Tubular Capacitors



Pot Capacitors



Water Cooled Pot Capacitors



HV Caps "Hockey Pucks"



Cascade Capacitor Stacks

Type	Common Applications	Dielectric	Cooling	Categories	Common Series	Capacitance Range	Voltage Range
Plate (Disc)	Broadcast transmitters, RF Heating	Ceramic	Convection/ Forced air	Contoured Rim	PA, PC, PD, PE, PS,10...12,806, 855..858, 831...835, 841...845, 53...57, 907...910, 874	5.6 pF - 27 nF	2.0 - 16 kVpk
				HV	FPE, FPS, FPZ, PEZ, 807, 808, 918	50 pF - 1.5 nF	3.5 - 30 kVpk
				HV Silicone Protected	PEF220, 809, 810,917	160 pF - 10 nF	12 - 20 kVpk
Barrel	Broadcast transmitting/ Antenna Tuning Units, X-Ray, Diathermy, Welding, Dielectric & Induction Heating	Ceramic	Convection/ Forced air	General Purpose	TOS, TOF, 5F, 7F, HT57, HT50, HT58, HH58, HT53, HT54,HT55, 61...74	1.5 pF - 2.5 nF	2.0 -16 kVpk
				HQ	TOSW, TOSZ, HT59, HT67,HH67, SPHH, SPHT	3.0 pF - 1.0 nF	9.0 - 30 kVpk
				HV	TOSZ	1.0 nF	40 kVpk
Feed-Through	RF Heating, Power Transmitters, HV Filters	Ceramic	Convection/ Forced air	General Purpose	DB, DBZ, DF,DGZ,DS,DWB, SPFT, 804, 860	100 pF - 4.7 nF	3.0 - 30 kVpk
				HQ	DB, DBZ,DBF	100 pF - 125 nF	20- 25 kVpk
				HV	DBF	500 pF - 3.0 nF	20 - 40 kVpk
Tubular	EMI Filtering, RFI Suppression	Ceramic	Convection/ Forced air	General Purpose	RA, RB, RC, RD, RE,918, 04...06, 805, 800, 803, 01...03	3.0 pF - 4.7 nF	.0 - 15 kVpk
Pot	High Voltage Filter, Bypass & Coupling Circuits	Ceramic	Convection/ Forced air	General Purpose	TA, TB, TC, TD, TDZ, TE, 25TP...49TP, 27SP..51`SP, 26TS...50TS,811TP,817SP	10 pF - 6.0 nF	6.0 - 15 kVpk
				HQ	TDZ, TDFZ	100 pF - 2.0 nF	12 - 18 kVpk
				HV	TDZ, TDFZ	2.0 pF -15 nF	15 - 40 kVpk
Water-cooled (Pot)	Steel/Pipe (induction Heating) Generators, HF Welding	Ceramic	Water	Internal Cooling	TWX, TWXF, PWC	3.0 pF -1.0 nF	14 - 22.5 kVpk
				External Cooling	TWXFZ, TWIF	1.0 nF - 10 nF	4 - 22.5 kVpk
HV Caps "Hockey Pucks"	Laser, HV DC Power Supplies, Lighting Arrestors	Ceramic	Convection/ Forced air	With Terminals	HPC, HPD, EPSL	350 pf - 5 nF	20 kVdc or 15 KVrms
Cascade Stacks	Voltage Multiplier Circuits, Spray Gun Nozzles	Ceramic	Convection/ Forced air	Stacked Disc Capacitors	GDMQ, GFMM, GFMM	3 x 125 pF- 7 x 2.2 nF	8- 19 kVpk per disc

Please contact Richardson Electronics for specific part numbers and/or data sheets.

# Synthetic High Voltage Capacitors

Richardson Electronics offers a wide selection of high voltage capacitors utilizing synthetic-based dielectrics. Hydrocarbon and polymer technology provides all types of film and paper dielectrics, metalized and discrete foil electrodes, oil-filled and dry construction designs and a wide variety of packaging options, including both metal and plastic casings.

To help satisfy demanding DC, pulse, and high frequency AC applications, a variety of product types are available including: advanced film capacitors, high energy capacitors, high voltage capacitors, metallized capacitors, fast pulse capacitors and high current capacitors.

For large R&D or OEM projects, let our team help design a customized solution for you.

## Key Benefits

- Extreme Long Life, High Reliability
- Able to Target the Most Demanding Applications
- Very High Voltage and Current Capabilities
- Low ESR, Low Inductance
- High Energy Density, High Peak Currents
- Wide Temperature Range
- Wide Variety of Footprint and Casing Options
- High Mechanical Shock

## Common Applications

- Induction Heating
- National Labs & Universities Research & Development
- Defense – Radar
- Pulse Power
- Medical, X-Ray and Heart Defibrillators
- Aerospace Projects
- Circuits – PFN, Filter, Inverter

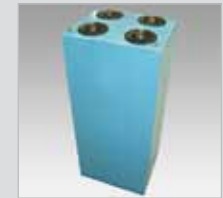
## PRODUCTS



Power Distribution Capacitors



Power Distribution Modular Capacitors



Energy Storage Capacitors



Energy Storage Capacitors



High Voltage Pulse Capacitors



High Voltage Capacitors



Water Cooled Assemblies

Classification	Common Applications	Dielectric	Cooling	Categories	Common Series	Capacitance Range	Voltage Range
Power Distribution & Transmission	Induction Heating, Tank Circuits, Tuning Circuits, Power Correction (Power Factor)	Plastic Film, Oil Impregnated	Convection or Water	Air Cooled - Canisters	16L, NL	0.125 - 5800 $\mu$ F	100 - 1670 VAC
				Water Cooled - Canisters	19L, NL	5 - 300 $\mu$ F	275 - 2200 VAC
		Polypropylene, Mica	Conduction/Water	Conduction Cooled - Assemblies	CSM, C	.1 - 1000 $\mu$ F	Up to 100kVDC
				Water Cooled - Assemblies	CMF	.001 - 9500 $\mu$ F	Up to 30kVDC
Energy Storage	Magnetizing equipment, Laser, Fusion Research, Metal Forming, Defibrillators	Polypropylene - Synthetic Impregnated	Convection/Forced Air	Standard	PL, CMF	55 - 9500 $\mu$ F	5.65 - 26 kVDC
Energy Storage - Discharge	Pulse X-Ray, Laser Pumping, Pulse-Forming Networks	Oil-Filled, Oil Impregnated	Convection/Forced Air	Standard	LK - ND	0.005 - 50 $\mu$ F	3 - 40 kVDC
High Voltage Pulse Discharge	Lasers, Flash Lamps, Other Pulse Circuits	Synthetics & Hydrocarbons	Convection/Forced Air	Standard	DM, DP, DE	0.007 - 750 $\mu$ F	1 - 50 kVDC
High Voltage Capacitors	Lithotrippers, Pulse EMF, Medical, R&D, Industrial	Synthetics & Hydrocarbons	Convection/Forced Air	HV - 1000 pps @ 1 KHz	SE/SSE	0.04 - 0.15 $\mu$ F	30 - 80 kVDC
				HV - 1 pps @ 1 hZ	S/SS	0.04 - 1.0 $\mu$ F	30 - 100 kVDC
				Pulse Discharge and DC	PM/PD	4.5 - 200 nF	25 - 62 kVDC
				Fast Pulse	PDS/PDSS	8 - 100 nF	Up to 100 kVDC

Please contact Richardson Electronics for specific part numbers and/or data sheets.

# Vacuum Capacitors

Vacuum is an ideal dielectric and enables this technology to be considered in many demanding applications.

Richardson Electronics carries a wide variety of vacuum capacitors ranging from 12pF to 5,000pF and covering test voltages of 5kV to 60 kV. Select from a full range of fixed, variable, and water-cooled capacitors for use in wafer-fabrication, plasma, medical, broadcast, and industrial heating applications.

## Key Benefits

- Long Life, High Reliability
- High Voltage Ratings
- High Current Ratings
- High-Speed Tuning
- Wide Tuning Ranges
- Self Healing
- High Altitude Operation
- Compact Sizes / Low Weight

## Common Applications

- RF match, Semiconductor Wafer Fab Equipment, Flat Panel Display
- Power Amplifier Tank Circuits
- Output Pi Networks
- Neutralizing Circuits
- Grid Plate Block Circuits
- Antenna Coupling; Filter/Tap Circuits
- Pulse Shaping Circuits
- Feed-Through for Harmonic Attenuation
- Dielectric Heating Equipment Tank Circuits
- Low Inductance, High Current Bypass Applications
- Non-Magnetic Circuits for MRI and NMR

## PRODUCTS



Fixed Vacuum Capacitors



Variable Vacuum Capacitors



Water Cooled (Variable) Vacuum Capacitors

## Capacitor Hardware

Richardson Electronics supplies important capacitor accessories. In order to mechanically mount certain capacitors, a variety of brackets, flanges, protective caps, and other hardware pieces are necessary. Used properly, the hardware helps to minimize any adverse effects of vibration and ensure a reliable, long-lasting design.

Classification	Common Applications	Dielectric	Cooling	Categories	Common Series	Capacitance Range	Voltage Range
Fixed	Dielectric Heating, Semiconductor Wafer-Fab, Plasma Shortwave Transmission	Vacuum (or Gas)	Convection/Forced Air	Vacuum	1CKT, CKT1, CF2, CFA, CFB, CFC, CFD, CFHD, CFHP, CFED, CFFP, CFDP	25 - 2500 pF	5 - 60 kVpk
				Gas Filled	CGF1	210 - 260 pF	40 - 50 kVpk
Variable	Dielectric Heating, Semiconductor Wafer-Fab, Plasma, Shortwave,	Vacuum (or Gas)	Convection/Forced Air	Vacuum	CADD, CVDD, C/GCS, CACAN, CVCD, CVFP, CVDD, CSV1, CVHP, CVER, MCSVF, CMV1, CMV, CVA, CVB, CVC, CVD	25 - 4000 pF	5 - 60 kVpk
				Gas Filled	CHV	45pF	3.0 - 7.5 kVpk
Variable - Water Cooled	Shortwave, RF Heating, Science	Vacuum	Water	Vacuum	CWV1, CWV5, CWC, CWD	25 - 2050 pF	30 - 65 kVpk

Please contact Richardson Electronics for specific part numbers and/or data sheets.

# Vacuum Relays

Richardson Electronics is proud to offer the highest quality vacuum relays in the marketplace. Our relays are designed to meet or exceed the requirements of MIL-R-83725. Several relays have guaranteed life ratings in the multi-million cycle range. The relays' reliability along with its compact size and high power handling characteristics make them a viable design-in solution for your high voltage, RF switching applications.

## Key Benefits

- Long Life, High Reliability
- Low Contact Resistance
- High Voltage and Current Carry Capabilities
- High Speed Switching
- Compact Design

## Common Applications

- Vapor Deposition Etch Equipment for Semiconductor Fabrication
- RF Broadcast Transmitters for Radio and TV
- Satellite Communications and Deep Space Applications
- Medical, MRI and Heart Defibrillators
- Airborne and Mobile Communications

## PRODUCTS



SPST  
Vacuum-Filled  
Relays



SPDT  
Vacuum-Filled  
Relays



Gas- Filled  
Relays

Classification	Common Applications	Dielectric	Types - Contact Form	Contact Arrangement	Common Series	Voltage	Current
Vacuum	Vapor deposition (Wafer fabs), Transmitter, Receiver Switches, PFN, Ion Implant, MRI Power Supplies, Radar, Security Screening, TWT Power Supplies	Vacuum	Normally Open (Form A)	SPST	RF42, RF6A, RF80, RF51, RF52, RJ8A	4 - 33 kV	12 - 110A
			Normally Closed (Form B)	SPST	RF41, RF5A, RF4A, RF88, RF50, RF52, RF69	4 - 70 kV	12 - 35A
			Form Latching	SPST	RF44, RF43, RF47, RF72, RF73	6 - 14 kV	12 - 50A
			Standard (Form C)	SPDT	RF1E, RJ1H, RJ1C, RJ1D, RF61, RJ1A, RF62, RF65, RF3A, RJ2B, RJ6B, RJ4B, RJ4C, RF10B, RJ9B, RJ5B	4 - 50 kV	3 - 110A
			Form Latching	SPDT	RF60, RF63	4 - 9 kV	3 - 110A
Energy Storage	Magnetizing equipment, Laser, Fusion Research, Metal Forming, Defibrillators	Gas	Normally Closed (Form B)	SPST	RGH3	70 kV	15A
			Standard (Form C)	SPDT	RGH3	50 kV	10A

Please contact Richardson Electronics for specific part numbers and/or data sheets.

# Vacuum Interrupters

Vacuum Interrupters for the utility and industrial markets are available from Richardson Electronics. Interrupter designs handle a wide range of both voltage and current interrupt levels. Utility interrupters are available in operating voltages up to 38 kV RMS and up to 7.2 kV RMS in industrial style interrupters. Custom designs are available for significant OEM requirements.

## Key Benefits

- Long Life, High Reliability
- Fast Interrupting Speed
- Rapid Dielectric Recovery
- High Cycle Withstand Voltages
- Environmentally Friendly
- Compact Design
- Oil-Less Operation

## Common Applications

- Electrical Power Generation & Distribution
- Capacitor Banks
- Line Dropping
- Industrial Motor Controls
- Induction Heating & Electric Furnaces
- Fault Protection of High Power Transmitters

## PRODUCTS



Utility Interrupters



Industrial Interrupters



RF/DC Interrupters



Industrial Interrupters - different mounting configurations

Classification	Common Applications	Dielectric	Mode	Operating Voltage	Continuous Current
Utility	Electric Power Generation/Distribution	Vacuum	Standard	15.5 - 38 kV RMS	200A RMS
Industrial	Industrial, Switchgear	Vacuum	Standard	1.5 - 7.2 kV RMS	300 - 400A RMS
RF/ DC	RF Induction and Electric Furnaces, DC	Vacuum	RF	22 - 50 kV <sub>pk</sub>	35 - 90A up to 300 KHz
			DC	30 - 40 kV dc	200 - 300ADC

Please contact Richardson Electronics for specific part numbers and/or data sheets.

# Vacuum Contactors

Richardson Electronics offers a wide selection of vacuum contactors for utility, industrial as well as RF/DC applications. Our series of contactors are available up to 50 kV and operational current up to 630 amps. Richardson Electronics' engineering support team can also supply vacuum interrupter solutions to meet your unique requirements.

## Key Benefits

- Long Life, High Reliability
- No Contact Maintenance
- Environmental Friendly
- Compact Designs

## Common Applications

- Utility – Electrical Distribution
- Oil Rigs
- Industrial Motor Controls
- Pumps
- Chemical Processing
- Mining Equipment
- Hoists/Conveyors
- Induction Heating
- Primary Control for Power Supplies
- Fault Protection of High Power Transmitters

## PRODUCTS



Three Phase Contactors



SPST HV AC/DC Contactors



SPST High Voltage Contactors



SPDT High Voltage Contactors



RF High Voltage Contactors

Classification	Common Applications	Dielectric	Operating Voltage	Continuous Current
Three Phase	Switch Power Transformers, Voltage Regulation, Power Factor Correction. Mining, Petroleum, Earth Movers, Conveyors, Industrial Loads	Vacuum	600 to 7200 V RMS	200 to 450 A RMS @ 60 Hz
SPST High Voltage AC/DC	High Power Broadcast Transmitters	Vacuum	30 - 50 kV <sub>pk</sub>	100 ADC or 100A - 200A RMS
SPST High Voltage	High Power Broadcast Transmitters	Vacuum	15 - 40 kV <sub>pk</sub>	30 - 100A
SPDT High Voltage	High Power Transmitting & Industrial Process Equipment	Vacuum	20 - 40 kV <sub>pk</sub>	100A
High Voltage	Band Switching of Transmitters, Switching Filter Sections, Antenna Switching, Tap Changing of RF Coils (Induction, Dielectric Heating), Switching of Transmission Lines	Vacuum	2-25 kV @ 32 MHz or 116VACR RMS @ 50/60 Hz	35 - 45A @ 32 MHz or 40A @ 2 MHz

Please contact Richardson Electronics for specific part numbers and/or data sheets.

## Leading Service

For over 50 years, Richardson Electronics has built a reputation of unsurpassed service levels in the industry. This attention to each order regardless of its size separates us from many resellers in the industry.

With over \$27 million worth of components in inventory, we have many standard items in stock to support your timely needs. In fact, many orders can ship the same day as ordered from any one of our regional warehouse hubs.

## Leading Design & Engineering

Richardson Electronics offer a full range of design and engineering capabilities and services to support our customers' needs for design-in components and custom-engineered solutions.

Our global engineering team enables us to provide engineering and technical support from any where in the world. They are ready to assist you in identifying the optimal capacitor whether it be a new design or existing application.

## Leading Brands

Richardson Electronics is proud to be the master distributor for the most prestigious names in the high voltage electronic component industry including:



### RICHARDSON ELECTRONICS SALES LOCATIONS

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<b>NORTH AMERICA</b>			
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Cover photo is Sandia Laboratory's "Z" Machine" utilizing high energy storage capacitors. Photo courtesy of General Atomics.