

Vacuum capacitors overview

Capacitor selection guides

Capacitor type	Capacity max. (pF)	Test voltage (kV) at 60/50 Hz	Model no. series	Page number
Vacuum fixed	25	35	CKT-25	8
	50	35	CKT-50	8
	100	35	CKT-100	8
	150	30	CKT-150	8
	200	30	CKT-200	8
	250	30	CKT-250	8
	25	25	CKT1-25	9
	50	25	CKT1-50	9
	100	25	CKT1-100	9
	50	15	CF2-50	10
	80	15	CF2-80	10
	100	15	CF2-100	10
	150	15	CF2-150	10
	180	15	CF2-180	10
	210	15	CF2-210	10
	450	45, 50, 55	CFHP-450	11
	500	20, 25, 30	CFED-500	11
	750	40, 45, 50	CFHP-750	12
	750	10, 15, 20, 25	CFED-750	12
	1000	40, 45, 50	CFHP-1000	12
	1000	10, 15, 20, 25, 30	CFED-1000	13
	1500	7.5, 10, 15	CFDP-1500	13
	1500	25, 30, 35	CFFP-1500	13
2000	7.5, 10, 15	CFDP-2000	14	
2000	25, 30, 35	CFFP-2000	14	

Vacuum capacitors overview

Jennings vacuum capacitors

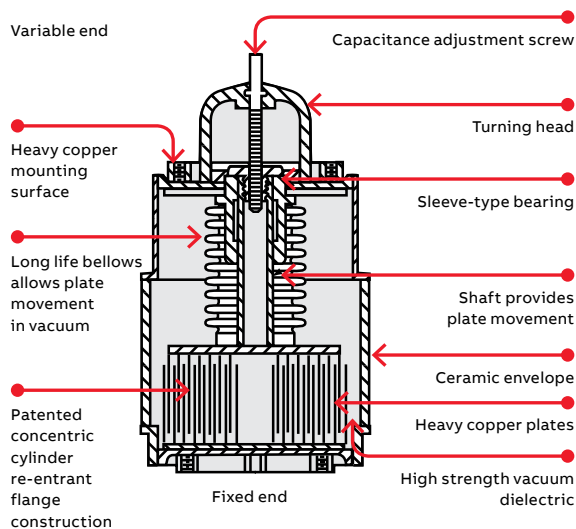
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01 Figure 1 – typical
Jennings variable
vacuum capacitor

Features

- High voltage rating – The dielectric strength of the vacuum permits optimized voltage rating for a given size and capacity, in addition to freedom from contamination, humidity and oxidation.
- High current rating – Low losses and rugged copper construction permit the handling of high RF currents with convection cooling only. Some of our designs offer water and air cooling for extraordinary load conditions.
- Wide tuning ranges – High ratio of maximum to minimum capacity makes Jennings vacuum capacitors desirable for wide tuning ranges.
- Low losses – Losses in a vacuum capacitor are so small that for most applications they can be considered as negligible. Construction materials and the vacuum dielectric permit the handling of large RF currents at high RF frequencies that would destroy capacitors with other dielectrics.
- Self-healing – Jennings vacuum capacitors can withstand momentary overloads that would permanently damage other dielectric materials.
- High altitude operation – Vacuum sealing permits the operation of Jennings vacuum capacitors at high altitudes without the degradation that occurs with other types.

Description and general specification

Figure 1 illustrates the construction of a typical Jennings variable vacuum capacitor. Two sets of



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concentric cylinder plates, one adjustable and the other fixed, are enclosed in an evacuated ceramic envelope with OFHC copper seals at both ends. A flexible metal bellows, attached to a sleeve-type bearing, maintains vacuum while allowing capacitance to vary.

The linear sliding motion required to vary capacitance is converted to rotary tuning via an adjustment screw; in many capacitors, direct pull tuning is an alternative.

Internal breakdown voltage is primarily determined by the spacing of the opposing plates and a high vacuum level.

The following are general specifications pertaining to Jennings vacuum capacitors. Current ratings are for normal convection cooling in ambient temperature of 25 °C unless otherwise specified.

- Maximum allowable operating temperature – 125 °C (257 °F) for ceramic capacitor
- Cooling – Natural convection unless otherwise specified
- Mounting position – Any
- Rotation to increase capacity – Counterclockwise

If none of our standard catalog models meet your needs, our engineers will work with you to design a custom solution to meet your specific needs.

Current/voltage

Maximum operating current for vacuum capacitors is limited by temperature rise and working voltage. At lower frequencies, a capacitor is a current-limiting device as a result of its capacitive reactance. At some frequencies, the internal generation of heat exceeds the device's heat-sinking capabilities, and its current-carrying capacity is limited by thermal considerations. A current vs. frequency chart is provided for each capacitor listed.

Peak voltage is limited by mechanical design of the capacitor. It does not vary with frequency.

Two voltage ratings are provided in our product specifications: AC test voltage and working voltage.

Temperature

Jennings Technology vacuum capacitors are rated for a maximum operating temperature of 125 °C (257 °F) with normal convection cooling at an ambient temperature of 25 °C (72 °F).

Capacitance

Fixed capacitors with a nominal capacitance above 50pF shall be within $\pm 5\%$. Capacitors with a nominal capacitance of 50pF or less shall be within $\pm 10\%$, or 0.5pF, whichever is greater. For variable capacitors, the low end will be equal to or less than minimum rating. The capacitance change is substantially uniform with rotation, and there are no capacitance reversals. Capacitance is within $\pm 10\%$ of the nominal value of the curves shown (capacity vs. turns), in the linear portion of this curve.

Torque/direct pull

In variable capacitors, the linear sliding motion of the moving electrode assembly is converted to rotary tuning via a threaded shaft. The torque values given in the tables are the maximum torque needed to reach minimum capacitance when rotated with a standard lead screw; the torque required to tune away from minimum may be less than half this value.

For most variable capacitors, direct pull tuning is an available option to rotary tuning. Maximum required direct pull force values are also given in the tables.

Capacitance range end-stops are built into every variable capacitor. It is recommended that the user install their own external stops to prevent damage from gear-reduction drives.

Mechanical life

The mechanical life of variable capacitors is related to length of stroke, speed of operation, bellows material and total number of cycles. Extensive mechanical life tests have been run, operating units for complete cycles from maximum to minimum and back to maximum capacity covering 95% of the full stroke of the movable plates. Capacitors with a large bellows and a short stroke will have the greatest life expectancy under cycling operation. Our most recent variable capacitor models are rated for >2 million cycles, ideal for the semiconductor processing industry.

Testing standards**Factory**

All capacitors are tested for dielectric strength on a 100% basis prior to shipment. Upon customer request, certified test reports will be made available.

Dielectric strength is tested using a low current, high potential source at 60 Hz voltage.

Capacitors for applications involving applied DC voltage should be tested on a DC dielectric strength meter for voltage and emission current. Jennings will test capacitors to this measure if specified by the customer.

User

Most users will find the 60 Hz dielectric strength test adequate and relatively inexpensive. Jennings does not recommend DC testing being performed by the user because of safety considerations. If DC testing is performed, care should be taken not to exceed 60% of the peak test voltage rating of the capacitor.



Fixed capacitors

CKT series

CKT series vacuum fixed capacitors, 25–250 pF

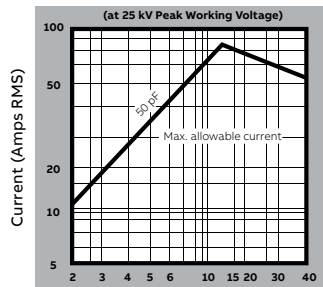
Cat. no.	Capacitance (pF)		Voltage peak (kV)		Current (amps)	Nominal dimensions				Torque in.-lbs.	Weight lb.
	Max.	Min.	Test	Working		Length (in.)	Dia. (in.)	Length (mm)	Dia. (mm)		
CKT-25-0035	25	25	35	25	67	6.42	2.32	163	58.9	–	1.54
CKT-50-0035	50	50	35	25	77	6.42	2.32	163	58.9	–	1.54
CKT-100-0035	100	100	35	25	87	6.42	2.32	163	58.9	–	1.54
CKT-150-0030	150	150	30	20	90	6.46	2.66	164	67.5	–	1.98
CKT-200-0030	200	200	30	20	95	6.46	2.66	164	67.5	–	1.98
CKT-250-0030	250	250	30	20	100	6.46	2.66	164	67.5	–	1.98

01 CKT-50-0035
 CKT-100-0035
 CKT-200-0030
 CKT-250-0030



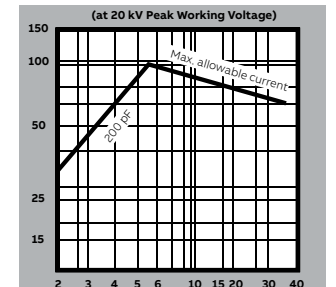
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Continuous RMS amperes vs frequency

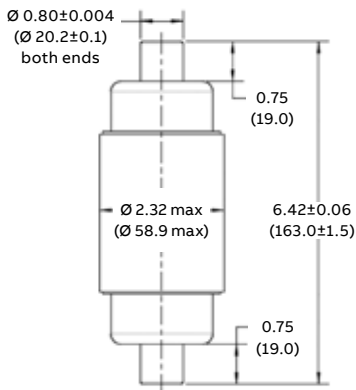


Frequency (MHz)
 CKT-50-0035

Continuous RMS amperes vs frequency

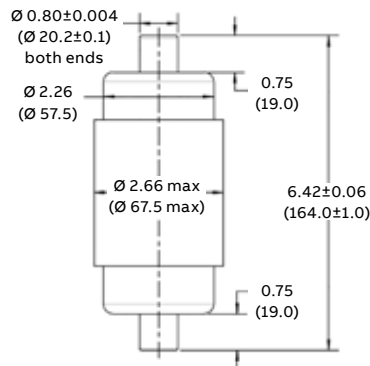


Frequency (MHz)
 CKT-200-0030



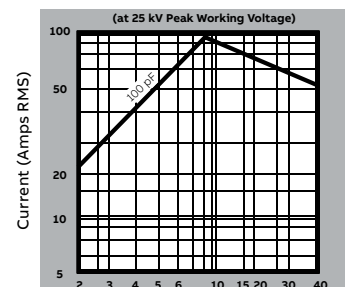
CKT-50-0035
 CKT-100-0035

Dimensions shown are in inches (mm).



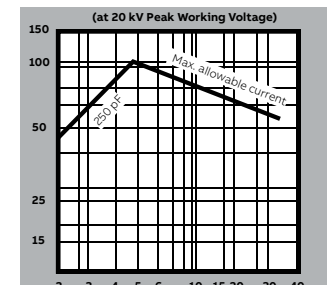
CKT-200-0030
 CKT-250-0030

Continuous RMS amperes vs frequency



Frequency (MHz)
 CKT-100-0035

Continuous RMS amperes vs frequency



Frequency (MHz)
 CKT-250-0030

Fixed capacitors

CKT1 series

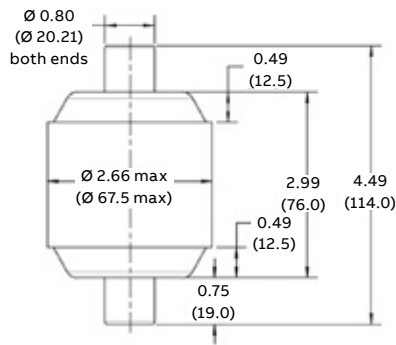
CKT1 series vacuum fixed capacitors, 25–100 pF

Cat. no.	Capacitance (pF)		Voltage peak (kV)		Current (amps)	Nominal dimensions				Torque in.-lbs.	Weight lb
	Max.	Min.	Test	Working		Length (in.)	Dia. (in.)	Length (mm)	Dia. (mm)		
CKT1-25-0025	25	25	25	15	58	4.5	2.68	114	67.5	–	1.32
CKT1-50-0025	50	50	25	15	68	4.5	2.66	114	67.5	–	1.32
CKT1-100-0025	100	100	25	15	80	4.5	2.66	114	67.5	–	1.32

01 CKT1-50-0025
CKT1-100-0025

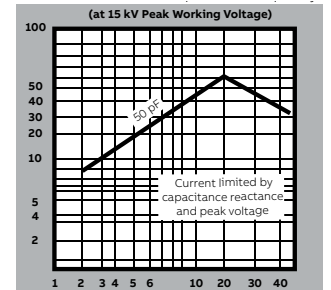


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Dimensions shown are in inches (mm).

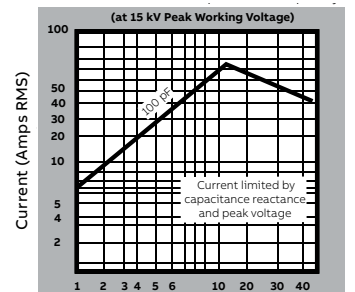
Continuous RMS amperes vs frequency



Frequency (MHz)

CKT1-50-0025

Continuous RMS amperes vs frequency



Frequency (MHz)

CKT1-100-0025

Fixed capacitors

CF2 series

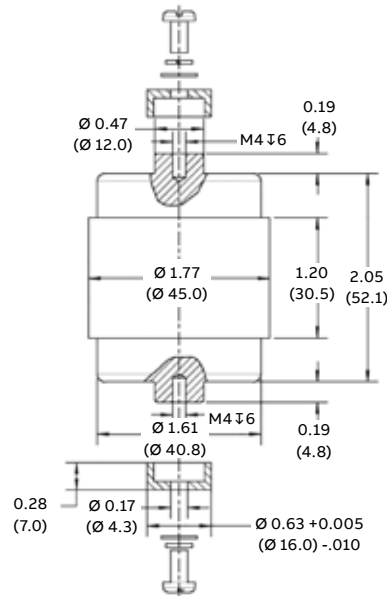
CF2 series compact vacuum fixed capacitors, 50–210 pF

Cat. no.	Capacitance (pF)		Voltage peak (kV)		Current (amps)	Nominal dimensions			Torque in.-lbs.	Weight lb.	
	Max.	Min.	Test	Working		Length (in.)	Dia. (in.)	Length (mm)			Dia. (mm)
CF2-50-0015	50	50	15	9	27	2.44	1.77	62	45	–	0.66
CF2-80-0015	80	80	15	9	76	2.44	1.77	62	45	–	0.66
CF2-100-0015	100	100	15	9	80	2.44	1.77	62	45	–	0.66
CF2-150-0015	150	150	15	9	75	2.44	1.77	62	45	–	0.66
CF2-180-0015	180	180	15	9	90	2.44	1.77	62	45	–	0.66
CF2-210-0015	210	210	15	9	76	2.44	1.77	62	45	–	0.66

- 01 CF2-50-0015
- CF2-80-0015
- CF2-100-0015
- CF2-150-0015
- CF2-180-0015
- CF2-210-0015

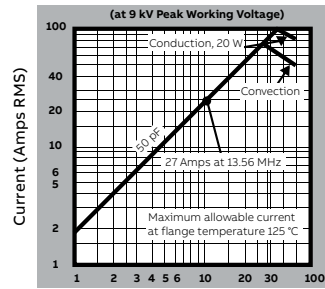


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Dimensions shown are in inches (mm).

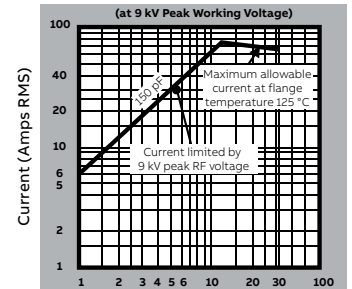
Continuous RMS amperes vs frequency



Frequency (MHz)

CF2-50-0015

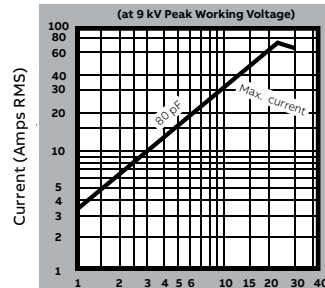
Continuous RMS amperes vs frequency



Frequency (MHz)

CF2-150-0015

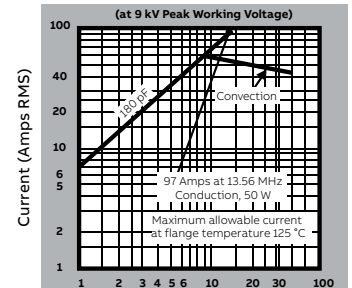
Continuous RMS amperes vs frequency



Frequency (MHz)

CF2-80-0015

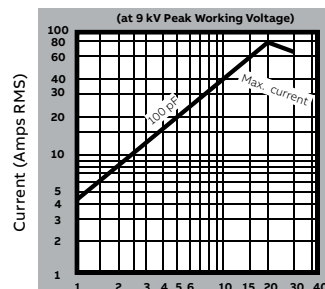
Continuous RMS amperes vs frequency



Frequency (MHz)

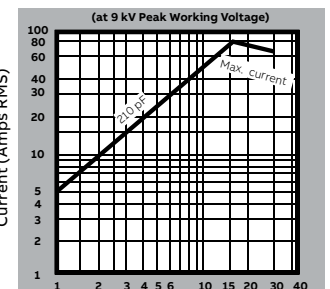
CF2-180-0015

Continuous RMS amperes vs frequency



Frequency (MHz)

CF2-100-0015



Frequency (MHz)

CF2-210-0015

Fixed capacitors

CFHP and CFED series

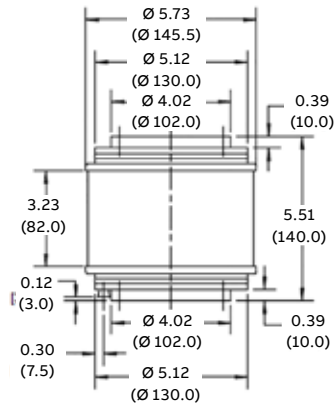
CFHP and CFED series vacuum fixed capacitors, 300–500 pF

Cat. no.	Capacitance (pF)		Voltage peak(kV)		Current (amps)	Nominal dimensions				Torque in.-lbs.	Weight lb.
	Max.	Min.	Test	Working		Length (in.)	Dia. (in.)	Length (mm)	Dia. (mm)		
CFHP-450-45S	450	450	45	27	260	5.51	5.73	140	145.5	–	11
CFHP-450-50S	450	450	50	30	280	5.51	5.73	140	145.5	–	11
CFHP-450-55S	450	450	55	33	300	5.51	5.73	140	145.5	–	11
CFED-500-20S	500	500	20	12	150	3.82	4.76	97	121	–	4
CFED-500-25S	500	500	25	15	160	3.82	4.76	97	121	–	4
CFED-500-30S	500	500	30	18	160	3.82	4.76	97	121	–	4

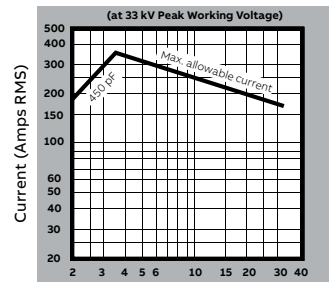
- 01 CFHP-450-45S
- CFHP-450-50S
- CFHP-450-55S
- 02 CFED-500



01



Continuous RMS amperes vs frequency

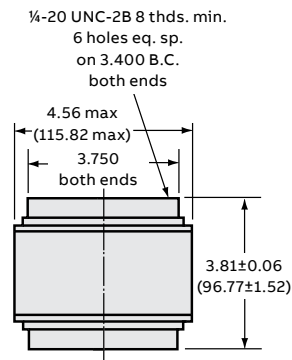


Frequency (MHz)

Mounting: Both ends have tapped holes.

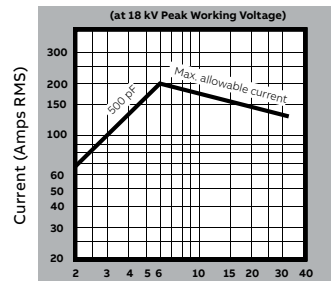


02



Dimensions shown are in inches (mm).

Continuous RMS amperes vs frequency



Frequency (MHz)

Mounting: Both ends have tapped holes.

Fixed capacitors

CFHP and CFED series

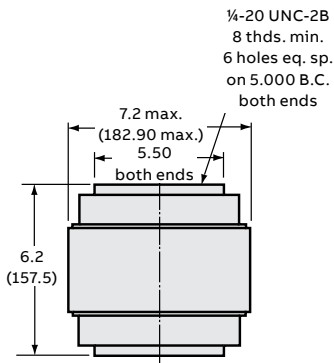
CFHP and CFED series vacuum fixed capacitors, 750–1000 pF

Cat. no.	Capacitance (pF)		Voltage peak (kV)		Current (amps)	Nominal dimensions			Torque in.-lbs.	Weight lb.	
	Max.	Min.	Test	Working		Length (in.)	Dia. (in.)	Length (mm)			Dia. (mm)
CFHP-750-0040	750	750	40	24	340	6.22	7.2	158	183	–	13.0
CFHP-750-0045	750	750	45	24	340	6.22	7.2	158	183	–	13.0
CFHP-750-0050	750	75	50	30	340	6.22	7.2	158	183	–	13.0
CFED-750-10S	750	750	10	6	145	3.82	4.76	97	121	–	5.06
CFED-750-15S	750	750	15	9	150	3.82	4.76	97	121	–	5.06
CFED-750-20S	750	750	20	9	150	3.82	4.76	97	121	–	5.06
CFED-750-25S	750	750	25	15	225	3.82	4.76	97	121	–	5.06
CFHP-1000-40S	1000	1000	40	24	330	6.22	7.2	158	183	–	19.8
CFHP-1000-45S	1000	1000	45	27	340	6.22	7.2	158	183	–	19.8
CFHP-1000-50S	1000	1000	50	30	350	6.22	7.2	158	183	–	19.8

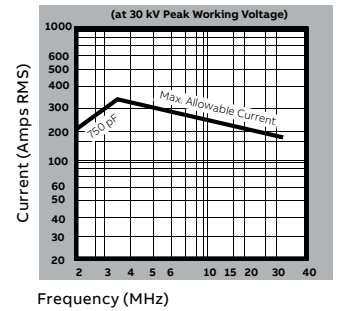
- 01 CFHP-750
- 02 CFED-750
- 03 CFHP-1000-40S
- CFHP-1000-45S
- CFHP-1000-50S



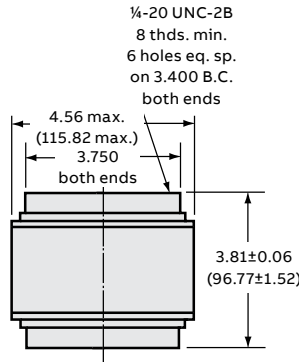
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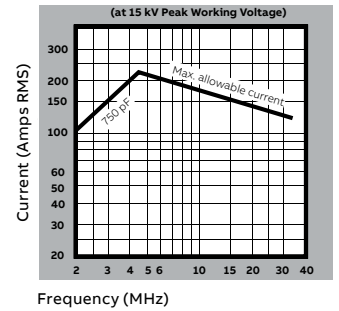
Continuous RMS amperes vs frequency



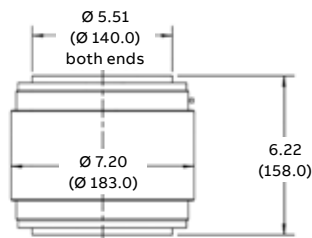
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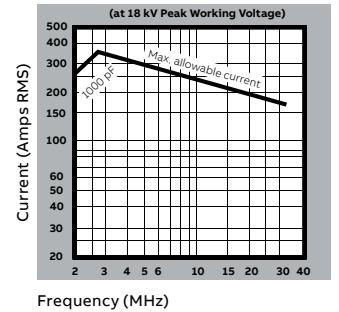
Continuous RMS amperes vs frequency



03



Continuous RMS amperes vs frequency



Dimensions shown are in inches (mm).

Mounting: Both ends have tapped holes.

Fixed capacitors

CFED, CFDP and CFFP series

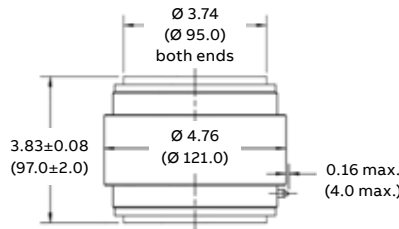
CFED, CFDP and CFFP series vacuum fixed capacitors, 1000–1500 pF

Cat. no.	Capacitance (pF)		Voltage peak (kV)		Current (amps)	Nominal dimensions				Torque in.-lbs.	Weight lb.
	Max.	Min.	Test	Working		Length (in.)	Dia. (in.)	Length (mm)	Dia. (mm)		
CFED-1000-10S	1000	1000	10	6	150	3.82	4.76	97	121	–	7.04
CFED-1000-15S	1000	1000	15	9	155	3.82	4.76	97	121	–	7.04
CFED-1000-20S	1000	1000	20	12	160	3.82	4.76	97	121	–	7.04
CFED-1000-25S	1000	1000	25	15	180	3.82	4.76	97	121	–	7.04
CFED-1000-30S	1000	1000	30	18	180	3.82	4.76	97	121	–	7.04
CFDP-1500-7.5S	1500	1500	7.5	4.5	150	3.31	5.61	84	142.5	–	8.8
CFDP-1500-10S	1500	1500	10	6	170	3.31	5.61	84	142.5	–	8.8
CFDP-1500-15S	1500	1500	15	9	190	3.31	5.61	84	142.5	–	8.8
CFFP-1500-25S	1500	1500	25	15	310	5.83	8.19	148	208	–	22
CFFP-1500-30S	1500	1500	30	18	330	5.83	8.19	148	208	–	22
CFFP-1500-35S	1500	1500	35	21	350	5.83	8.19	148	208	–	22

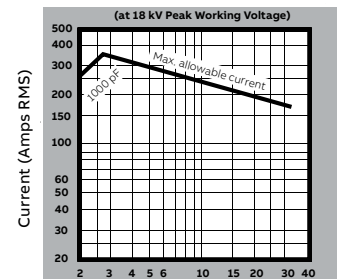
- 01 CFED-1000-10S
- CFED-1000-15S
- CFED-1000-20S
- CFED-1000-25S
- CFED-1000-30S
- 02 CFDP-1500
- 03 CFFP-1500



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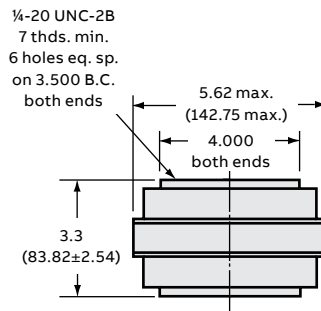
Continuous RMS amperes vs frequency



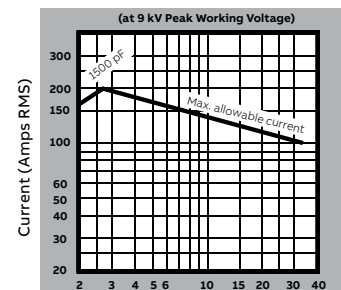
Frequency (MHz)



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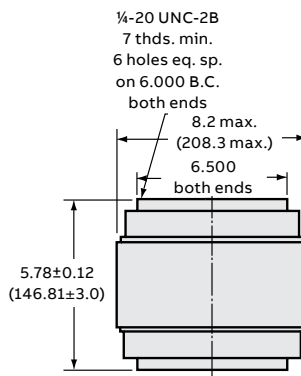
Continuous RMS amperes vs frequency



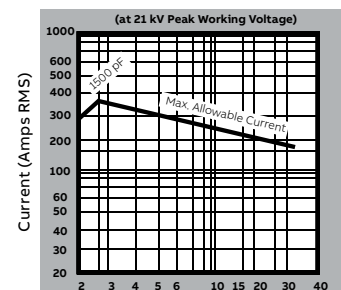
Frequency (MHz)



03



Continuous RMS amperes vs frequency



Frequency (MHz)

Dimensions shown are in inches (mm).

Mounting: Both ends have tapped holes.

Fixed capacitors

CFDP and CFFP series

CFDP and CFFP series vacuum fixed capacitors, 2000 pF

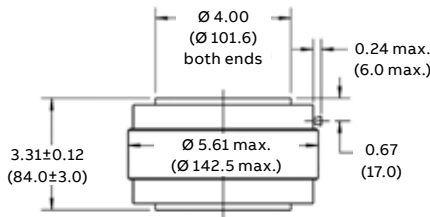
Cat. no.	Capacitance (pF)		Voltage peak (kV)		Current (amps)	Nominal dimensions				Torque in.-lbs.	Weight lb.
	Max.	Min.	Test	Working		Length (in.)	Dia. (in.)	Length (mm)	Dia. (mm)		
CFDP-2000-7.5S	2000	2000	7.5	4.5	160	3.31	5.61	84	142.5	-	9.9
CFDP-2000-10S	2000	2000	10	6	180	3.31	5.61	84	142.5	-	9.9
CFDP-2000-15S	2000	2000	15	9	200	3.31	5.61	84	142.5	-	9.9
CFFP-2000-25S	2000	2000	25	15	350	5.83	8.19	148	208	-	23.32
CFFP-2000-30S	2000	2000	30	18	390	5.83	8.19	148	208	-	23.32
CFFP-2000-35S	2000	2000	35	21	390	5.83	8.19	148	208	-	23.32

01 CFDP-2000-7.5S
CFDP-2000-10S
CFDP-2000-15S

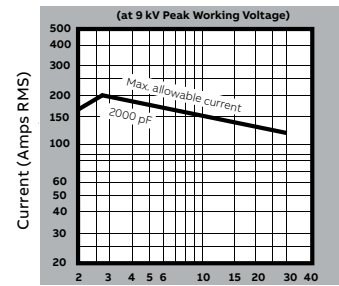
02 CFFP-2000-25S
CFFP-2000-30S
CFFP-2000-35S



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Continuous RMS amperes vs frequency

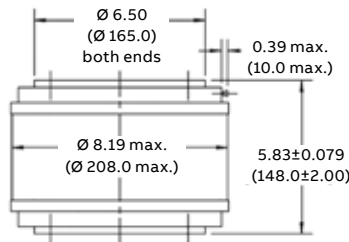


Frequency (MHz)

Mounting: Both ends have tapped holes. CFDM version has additional M6 hole pattern.

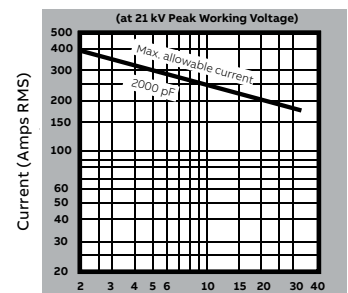


02



Dimensions shown are in inches (mm).

Continuous RMS amperes vs frequency



Frequency (MHz)

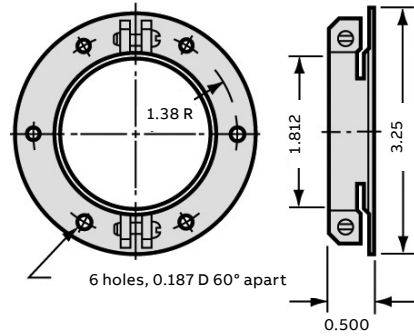
Mounting: Both ends have tapped holes.

Capacitor accessories

Flanges

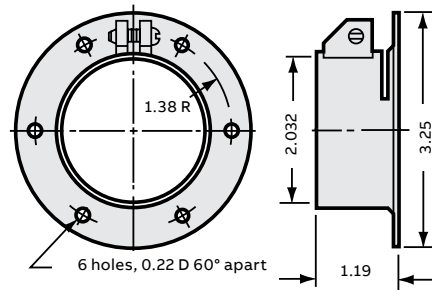
FM1C flange mount

Mat. 0.062 copper/silver



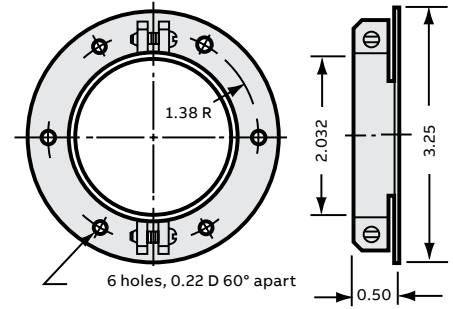
FM2D flange mount

Mat. 0.062 copper/silver



FM2S flange mount

Mat. 0.062 copper/silver



Dimensions shown are in inches.