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RELAYS, COAXIAL RELAYS and CONTACTORS

HIGH VOLTAGE VACUUM AND
GAS FILLED SWITCHES

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ЦЕНТР ИНЖЕНЕРНО-ТЕХНИЧЕСКИХ РЕШЕНИЙ



The leader in high power



E N G I N E E R I N G T O Y O U R N E E D S

Jennings Technology Company LLC, a wholly owned subsidiary of Thomas & Betts Corporation, offers you the benefit of more than 65 years of expertise in state-of-the-art vacuum technology, producing the world's finest non-thermionic vacuum components for high voltage and high frequency applications. This experience — combined with service, quality and reliability — is why you'll find Jennings components in applications worldwide.

Vacuum & Gas-Filled Relays

A pioneer in the development of the original high voltage vacuum relay, Jennings is still recognized around the world as a leading manufacturer of high voltage relays today. We offer SPST vacuum relays up to 33 kV, SPDT vacuum relays up to 30 kV and gas-filled relays up to 70kV.

Common Applications

- Vapor deposition etch equipment for semiconductor manufacturing
- RF broadcast transmitters for radio and television
- Satellite communications and deep space applications
- Airborne and mobile communications
- Medical MRI and heart defibrillators

Vacuum Coaxial Relays

Jennings offers SPST and SPDT vacuum coaxial relays. Our standard offerings feature power ratings of 90 kW CW, but many other coaxial relays, as well as matrices, are available on request.

Common Applications

- High speed antenna switching
- Transmit/receive switching
- CCTV and CATV
- Microwave telemetry and data acquisition links



vacuum technology

Vacuum Contactors

Jennings vacuum contactors offer one of the most reliable means available today for remotely controlling electric power. Our complete line of vacuum contactors includes three-phase to 7.2 kV, SPST to 50 kV, SPDT to 40 kV and RF to 25 kV and 116 VAC.

Common Applications

- Primary control of power supplies
- Industrial motor controls
- Induction heating equipment
- RF system tap changing
- Fault protection of high power transmitters

Proven reliability

Jennings uses state-of-the-art manufacturing processes and equipment. Even as modernization and increased demands have forced many of our customers to change and update their equipment over the years, they have continued to rely on Jennings for new designs and dependable products that withstand millions of operating cycles and provide them with a competitive edge in their industry.

While rigorous testing has proven the reliability of our products, we feel that successful operation in numerous applications, including RF transmitters, semiconductor processing equipment, industrial motor controls, induction heating systems and MRI equipment, to name just a few, serves as the ultimate testimony to the superiority of Jennings products.

We maintain a quality assurance program in accordance with MIL-I-45208A, and our relays are designed to meet or exceed the requirements of MIL-R-83725. In addition, Jennings Technology is now ISO 9001 certified.

Need something you don't see in our catalog?

Some manufacturers don't want to be bothered with non-standard orders. At Jennings, we welcome your unique applications. Our in-house engineers will work with you to custom design a relay, coaxial relay or vacuum contactor from an original concept, or to modify one of our standard models. This catalog contains a sampling of our standard models, from which a variety of modifications are possible. If none of our standard models meet your needs, our engineers will work with you to design a custom solution that will.

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Relay Selection Guides

Relays by Type

RELAY TYPE	TEST VOLTAGE (kV PEAK @ 60 Hz)	MAX. CONT. CURRENT (AMPS RMS)	MODEL NO.	PAGE NUMBER
SPST Vacuum	4	12	RF41-26S	13
	4	12	RF42-26S	13
	6	12	RF44-26S	13
	9	12	RF43-26S	13
	10	30	RF4A-26S	14
	10	12	RF5A-26S	14
	10	12	RF6A-26S	14
	10	35	RF47-26S	14
	10	50	RF72-26S	15
	10	50	RF72-N1105	15
	10	50	RF72-N1107	15
	10	35	RF80-26S	15
	10	10	RF88-26S	15
	12	12	RF50-26S	16
	12	12	RF51-26S	16
	14	35	RF73-26S	16
	17.5	15	RF52-26S	16
	24	15	RF69-26S	17
	33	110	RJ8A-26S	17
SPDT Vacuum	4	8	RF1E-26S	18
	4	12	RF60-26S	18
	4	10	RF61-26S	18
	5	18	RJ1A-26S	19
	5	3	RJ1H-26S	19
	5	3	RJ1H-26N877	19
	6	18	RJ1C-26S	19
	7	18	RJ1D-15S	19
	9	10	RF62-26S	20
	9	10	RF65-12S	20
	9	10	RF63-26S	20
	10	30	RF3A-26S	20
	10	18	RJ1A-26N969	21
	15	50	RJ2C-26S	21
	15	50	RJ6B-26S	21
	15	50	RJ6B-D3136	21
	15	50	RJ6C-26S	21
	18	50	RJ4B-26S	22
	18	50	RJ4C-26S	22
	20	75	RF10B-26S	22
	20	110	RJ9B-26S	23
	30	10	RJ5B-26S	23
SPST Gas	70	15	RGH3-24D2524	24
SPDT Gas	50	10	RGH5-26S	24

Relays Alpha Listing by Model Number

ALPHA LISTING BY MODEL NO.	
MODEL NO.	PAGE NUMBER
RJ9B-26S	23
RJ8A-26S	17
RJ6C-26S	21
RJ6B-D3136	21
RJ6B-26S	21
RJ5B-26S	23
RJ4C-26S	22
RJ4B-26S	22
RJ2C-26S	21
RJ1H-26S	19
RJ1H-26N877	19
RJ1D-15S	19
RJ1C-26S	19
RJ1A-26S	19
RJ1A-26N969	21
RGH5-26S	24
RGH3-24D2524	24
RF88-26S	15
RF80-26S	15
RF73-26S	16
RF72-N1107	15
RF72-N1105	15
RF72-26S	15
RF6A-26S	14
RF69-26S	17
RF65-12S	20
RF63-26S	20
RF62-26S	20
RF61-26S	18
RF60-26S	18
RF5A-26S	14
RF52-26S	16
RF51-26S	16
RF50-26S	16
RF4A-26S	14
RF47-26S	14
RF44-26S	13
RF43-26S	13
RF42-26S	13
RF41-26S	13
RF3A-26S	20
RF1E-26S	18
RF10B-26S	22

Relays Alpha Listing by Military Drawing

ALPHA LISTING BY MILITARY DRAWING		
MILITARY DRAWING	MODEL NO.	PAGE NUMBER
M83725/3-001	RF1D-26S	18*
M83725/3-002	RF1E-26S	18
M83725/4-001	RJ1H-26N877	19
M83725/4-002	RJ1H-15S	19*
M83725/5-001	RJ1A-26S	19
M83725/6-001	RF40-26S	—†
M83725/7-001	RF41-26S	13
M83725/8-001	RF42-26S	13
M83725/9-001	RF43-26S	13
M83725/10-001	RF50-26S	16
M83725/11-001	RF60-26S	18
M83725/12-001	RF64-26S	—†
M83725/12-002	RF61-26S	18
M83725/13-001	RF63-26S	20
M83725/15-003	RF10B-26S	22
M83725/16-001	RF65-12S	20
M83725/16-002	RF62-26S	20
M83725/17-001	RF51-26S	16
M83725/18-002	RF5A-26S	14
M83725/18-003	RF5A-26N938	—†

* Available as options.

† Please contact factory for more information.

Jennings High-Voltage Vacuum Relays

Jennings vacuum relays are widely used in airborne, mobile and marine communications equipment. Typical applications include antenna coupling, tap changing on radio frequency (RF) coils, transmit / receive switching to an antenna, switching in pulse-forming networks and heavy duty power supplies. Our relays are noted for fast operating speeds and the ability to withstand high voltages and carry heavy currents (at frequencies up to 75 MHz), while maintaining low and stable contact resistance.

Vacuum relays are available in SPST normally open (N/O) and normally closed (N/C) models, as well as SPDT configurations. Latching relays are available in some models.

Vacuum as a Dielectric

Vacuum is the ideal dielectric for high voltage relay switching. It has extremely high voltage breakdown characteristics, a fast recovery rate (up to 10 kV per millisecond) and it provides an absolutely inert and non-reactive environment for switching contacts. Since there is no oxygen in a vacuum, contacts remain oxidation free.

The high dielectric strength of the vacuum permits close contact spacing, on the order of 1000 volts per mil (= 0.0394 inches). The small movement required to operate a vacuum relay permits the use of small, low mass actuators, allowing high operating speeds. Use of refractory metal contacts provides exceptional interrupting ability and ensures long contact life.

If a load is switched, an arc will be formed. At the point where the contacts are getting very close and the current density is getting higher and higher, a breakdown occurs. This arc will have a very low voltage of 18–23 V and be quite stable in comparison to an arc in air, which is another advantage of vacuum (Figure 1). The combination of constant arc voltage acting as a current limiter and short arc time means vacuum relays generally wear less than other types and give stable performance over the life of the relay.

Pressurized Gas as a Dielectric

(at Jennings, a mixture containing primarily SF-6)

Pure high pressure gas allows relays to attain high dielectric strength and to avoid oxidation. This dielectric is ideal for the high in-rush capacitive make and capacitive discharge loads. Typical applications include electrostatic discharge (ESD) test equipment, cable test equipment and heart defibrillators. Gas-filled relays also provide low, stable leakage current in applications sensitive to current fluctuations, especially across open contact sets over long periods of time.

Gas-filled relays, however, should not be used when it is necessary to break a current. As the contacts open, the gas is ionizing and an arc is formed and sustained for much longer than in vacuum.

The contact resistance of Jennings' gas-filled relays is typically measured at 28 V and will be higher than and not as stable as in a vacuum relay.

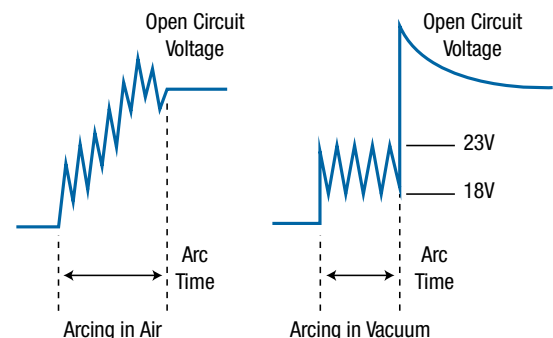


Figure 1



Typical Applications

RF Applications

Jennings vacuum relays play a vital role when high power and low RF losses are required.

- Vapor deposition for semiconductor wafer processing
- Transmitter/receiver switches
- Pulse forming networks
- Ion implant
- MRI power supplies
- Radar systems
- Security screening systems
- TWT power supplies
- Radio antenna tuning matching circuits

Test Equipment and Instrumentation

Jennings gas-filled relays are great for high in-rush and stable leakage current applications, and Jennings vacuum relays are the ideal solution for low leakage and high carry current applications.

- ESD pulse forming equipment
- HiPot testing
- Cable testing
- Motor winding testing
- Mega-ohm testing
- High power lasers
- Power supply testing
- Mass spectrometry
- High voltage power supplies
- Transformer test equipment
- Ballast test equipment

Specialized Applications

Jennings vacuum and gas-filled relays are excellent for:

- Airport lighting systems
- Geosciences down-hole data acquisition
- Scientific instrumentation
- Under-sea power distribution
- Sinusoidal heart defibrillators

Custom Applications

Because Jennings relays and contactors are sealed to support a vacuum, they can also be filled with special gases for custom applications. They can be re-packaged, tailored or tested to specific requirements.

- Super-low nano amperage leakage
- Screw terminals, long flying leads or special connectors
- Special packaging to replace obsolete relays
- Very low temperature applications
- High pressure oceanic applications
- Low out-gassing and Hi-Rel testing with traceability and configuration controls for space and satellites.

Basic Functionality — How Do Jennings Relays Work?

Jennings manufactures two common relay types:

1. Clapper type relay (Figure 2)
2. Diaphragm relay (Figure 3)

The pictures below show both types and their main features.



Figure 2



Figure 3

A Jennings Vacuum Relay primarily consists of two main assemblies. We have the ceramic “switch” assembly, which contains the HV contacts, and the actuator assembly, which holds the actuation coil.

The two types differ in regards to the mechanical actuation. In the diaphragm relay, the actuator is placed outside of the vacuum envelope, whereas in the clapper type relay, we find the actuator inside the vacuum.

The assembly containing the coil is the driving part of the relay and will be connected to your driver circuit. As voltage is applied to the coil, a magnetic field is built up and an electro-magnetic force is created. This force is used to move the mechanism and thus the movable contact inside the vacuum envelope. The contact transfers from the N/C to the N/O position or, in a SPST relay, opens your high voltage circuit.

Basic Relay Terms and Definitions

Arc — An electric discharge between mating relay contacts when an energized circuit is interrupted.

Contact bounce — The intermittent undesirable opening of closed contacts or closing of open contacts.

Break — The opening of closed contacts to interrupt an electrical circuit.

Voltage breakdown — An undesirable condition of arcing within a relay due to overvoltage.

Cold — An unenergized electrical circuit.

Dielectric — An insulating medium capable of recovering, as electric energy, all or part of the energy required to establish an electrical field (voltage stress). The field, or voltage stress, is accompanied by displacement or charging currents. Vacuum is one of the best dielectrics.

Hot — An energized electrical circuit.

Make — The closure of open contacts to complete an electrical circuit.

Peak test voltage — The peak AC voltage (at 60 Hz) that can be applied between external high voltage terminals, or between an open terminal and ground, for up to one minute with no evidence of failure. Peak test voltages must not be exceeded, even for very short pulses.

Rated operating voltage (kV Peak) — The voltage that can safely be applied to the relay for sustained periods of time without failure. This voltage rating decreases as AC frequency increases. Rated operating voltages approach peak test voltage only at lower frequencies.

Continuous current, carry — The current that flows through the closed relay contacts for sustained time periods. This current rating is determined by the relay envelope temperature rise. A ceramic relay is allowed a 100°C rise. Current ratings can be increased by external cooling, such as forced air or heat sinks.

Contact capacitance — The capacitance of the relay measured (a) between open contacts or (b) between contact and ground. Measured at 1 kHz.

Contact resistance — The resistance between closed contacts, measured at 6.0 VDC with a 1.0 amp root mean square (RMS) load.

Operate time — The time in milliseconds between voltage being first applied to the relay coil and final closure of all normally open contacts. This time includes contact bounce.

Release time — The time in milliseconds between removal of power from the relay coil and final closing of all normally closed contacts. This time includes contact bounce.

Ambient temperature range — The range of environmental temperatures in which the relay mounted in the equipment will operate safely. Heat will be generated by the current flowing through the relay, which will elevate the temperature above ambient depending on the current level imposed.

Pull-in voltage — The minimum coil voltage required to operate a relay so that all normally open contacts close.

Dropout voltage — The maximum coil voltage at which an operating relay releases and all normally closed contacts close.

Coil resistance — The DC resistance, in ohms, of the coil — measured at 25°C.

Shock — The number of g's (gravities) a relay can sustain when tested by a $\frac{1}{2}$ sine pulse (calibrated impact) for 11 milliseconds without the closed contacts opening or the open contacts closing.

Vibration Peak — The maximum harmonic motion at rated gravities and frequencies that a relay can sustain without uncontrolled opening of closed contacts or closing of open contacts.

Expected mechanical life — The number of operations for which a relay can be expected to operate reliably. Cold switching applications approach this figure.

Contact arrangement: Jennings relays have the following contact arrangement:

- Single pole single throw (SPST)
- Single pole double throw (SPDT)

Contact form: The code for the relay model (see following page for more information):

- Form A: SPST—Normally Open
- Form B: SPST—Normally Closed
- Form C: SPDT
- Form Latching: SPST
- Form Latching: SPDT

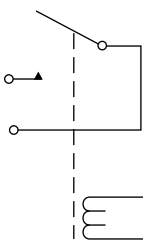
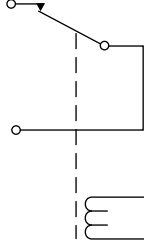
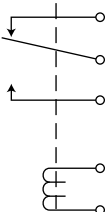
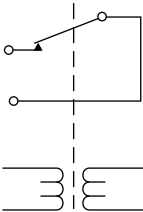
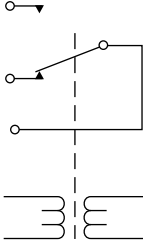
Selection Guide

How to Use this Table

From the diagrams at the top of the table, choose the contact configuration that meets your requirements. Then choose from the list in that column the relay that meets your voltage and current specifications. Please refer to the product information included in this catalog and look for more detailed information on the selected relay.

You can use this table for all continuous current carry applications. For all power switching applications, please refer to the next section.

All relays in bold letters are generally ok to be hot switched.

Form A	Form B	Form C	Latching	Latching
SPST-N/O	SPST-N/C	SPDT	SPST	SPDT
				
RF42-26S, 4kV, 12A RF6A-26S, 10kV, 12A RF80-26S, 10kV, 35A RF51-26S, 12kV, 12A RF53-26S, 17.5kV, 15A RJ8A-26S, 33kV, 110A	RF41-26S, 4kV, 12A RF5A-26S, 10kV, 12A RF4A-26S, 10kV, 30A RF88-26S, 10kV, 35A RF50-26S, 12kV, 12A RF52-26S, 17.5kV, 15A RF69-26S, 24kV, 15A RGH3-24D2524, 70kV, 15A	RF1E-26S, 4kV, 8A RJ1H-26S, 5kV, 3A RJ1H-26N877, 5kV, 3A RJ1C-26S, 6kV, 18A RJ1D-15S, 7kV, 18A RF61-26S, 4kV, 10A RJ1A-26S, 5kV, 18A RF62-26S, 9kV, 10A RF65-12S, 9kV, 10A RJ1A-26N969, 10kV, 30A RF3A-26S, 10kV, 30A RJ2B-26S, 15kV, 50A RJ6B-26S, 15kV, 50A RJ6B-D3136, 15kV, 50A RJ4B-26S, 18kV, 50A RJ4C-26S, 18kV, 50A RF10B-26S, 20kV, 75A RJ9B-26S, 20kV, 110A RJ5B-26S, 30kV, 10A RGH5-26S, 50kV, 10A	RF44-26S, 6kV, 12A RF43-26S, 9kV, 12A RF47-26S, 10kV, 35A RF72-26S, 10kV, 50A RF73-26S, 14kV, 35A	RF60-26S, 4kV, 12A RF63-26S, 9kV, 10A



Non-Power Switching Applications

For applications where the circuit is switched with no load across the relay terminals (non-power switching), a relay performs either as an insulator or a conductor.

In the make mode, the contacts conduct the full current of the load, and contact current handling capacity is limited by heating caused by contact resistance. Special low resistance copper alloys are used for most cold switching relays to assure high current handling capabilities.

In the break mode, the relay must perform as a high voltage insulator. Stand-off voltages are highest at DC and low AC frequencies and decline at higher frequencies due to RF heating of the insulator. Ceramic insulators provide the best withstand capabilities for high RF applications.

RF Applications (at Jennings, typically 2–32 MHz)

Switching RF equipment hot can cause damage to various circuit elements, so RF circuits generally are switched cold. This means the power is completely removed at the time of switching, and the relay never breaks or makes the load.

The primary reasons for using vacuum relays in RF applications are their exceptional insulating qualities and their low RF contact resistance — as low as .03 ohms at 30 MHz. This low RF resistance remains stable throughout the service life of the relay because of the advantages provided by the vacuum environment.

Vacuum relays show a frequency-dependent current and voltage limitation. As frequency increases, the conduction path through the contacts decreases, causing contact surface heating and limiting the maximum RF voltage that can be withstood. Most of our relays have been rated at 2.5 MHz, 16 MHz and 32 MHz.

When a vacuum relay is open, RF voltage is seen across the open contacts or the contacts to ground. The relay in effect behaves as a high voltage capacitor measuring 1–2 pF. Current leakage through the insulator causes heating, which further establishes limits to maximum current ratings.

Figure 4 shows a typical transmitter application for an RJ6B Vacuum Relay. This relay has a set of low voltage sequence contacts as well as high voltage contacts. The high voltage contacts complete the circuit to the antenna before the transmitter is turned on and will delay switching the antenna until power is turned off. This ensures the transmitter is properly loaded when power is applied.

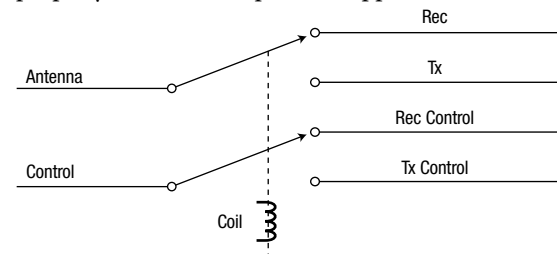


Figure 4 — RJ6B Relay Used as TR Relay and Switching Control

Pulse Applications

Vacuum relays are especially well suited in radar applications for pulse forming networks with pulse lengths from 1 ms to 10 ms (Figure 5). These applications require a relay to withstand the pulse forming network voltage on a repetitive basis, usually from 100 to 500 pulses per second. Higher peak currents can be used in this type of service due to the low duty cycle and short pulse duration. Average energy dissipated in the relay is low, heating minimal, and consequently voltages up to peak ratings and peak currents to 1000 amps can be utilized.

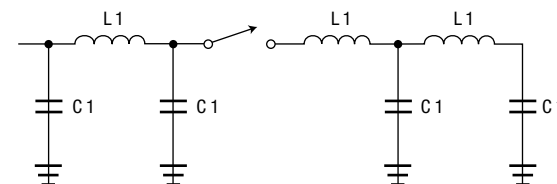


Figure 5 — Pulse Forming Network Typical Duty Cycle — 001

Please contact our technical department to help you determine which relay fits your pulse application.

Power Switching Applications

Direct Power Switching — Make and Break

AC circuits are inherently much easier to switch at high current levels than DC circuits. Current zeroes occur twice per AC cycle, and the high recovery voltage of the vacuum dielectric ensures extinction at the first current zero, reducing arcing and subsequent contact erosion.

The refractory metals used for contacts in relays intended for hot DC switching are selected to withstand arcing by their high melting temperatures and hardness. Vacuum relays have higher switching capabilities than most relays, but above 1 kV, they are generally limited to a maximum of 15 amps. When higher current levels are to be switched, suppression or bucking circuits (Figure 6) should be used to develop artificial current zeroes. This circuit keeps contact differential voltage at a minimum until the contacts fully open.

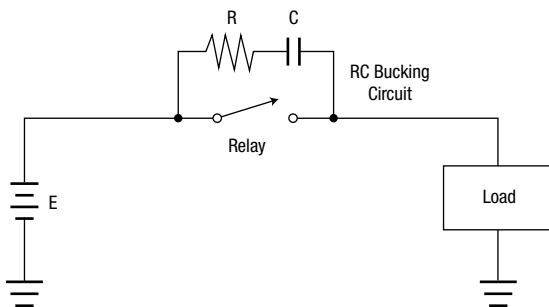


Figure 6

Do not use gas-filled relays for make-and-break power switching, because the relay will draw an arc on opening and sustain the arc. Thus, the relay will not be able to reliably open the contacts.

There are some other considerations when looking at using a vacuum or gas-filled relay in your power switching application.

Which elements dominate the electrical circuit?

Circuit loads can generally be considered as resistive, capacitive or inductive, even though they may consist of both active (tubes and solid-state devices) and passive elements (capacitors, resistors, inductors, etc.). Circuits with significant capacitive or inductive elements are more difficult to switch due to the stored energy. Figures 7A, 7B and 7C show the current for each type of load.

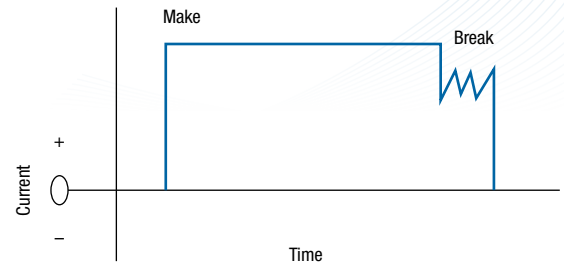


Figure 7A — Resistive Load Profile

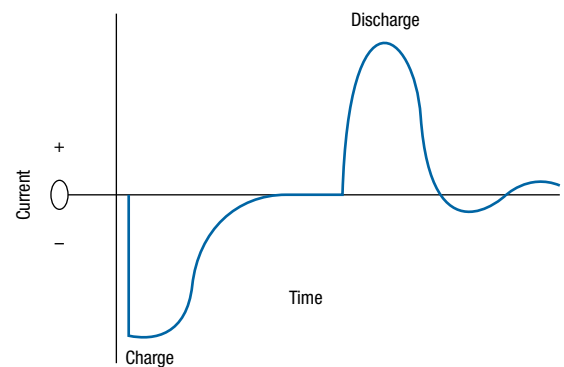


Figure 7B — Capacitive Load Profile

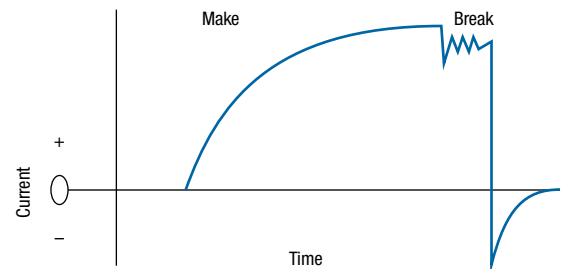


Figure 7C — Inductive Load Profile

Circuits made up primarily of resistive components have little effect upon voltage across HV terminals (Figure 7A). Resistive loads are generally used to generate the power switch rating of a vacuum relay.

When circuits with large capacitive elements break, a negative bias voltage appears equal to the stored energy of the capacitor. This stored energy can cause a momentary high current surge upon make (Figure 7B). As the contacts close, an arc is generated, and there is the danger of contact welding due to that short high energy spike.

With inductive elements present, a high momentary voltage transient occurs when the circuit is broken, which decays rapidly to open line voltage (Figure 7C). This spike can damage any other circuit elements, and we recommend that you clamp the voltage sufficiently in order to protect your circuit.

Is a ground-isolated relay available? Or can the relay be positioned on the ground side of the load?

Jennings has a number of relays available with ground isolation from the vacuum enclosures. Typical types are RF1, RF3, RF4 and RF10, as well as all RF40, 50, 60 and 70 series relays. Ground-isolated relays can be used within their voltage ratings without concern for ground faults, because the switching part of the relay is completely isolated from ground.

If only relays with internal grounds are available for your hot switch application, the relay should always be placed on the ground side of the load to prevent breakdown damage. Otherwise, fault conditions may cause internal arc-over to the grounded housing (Figure 8).

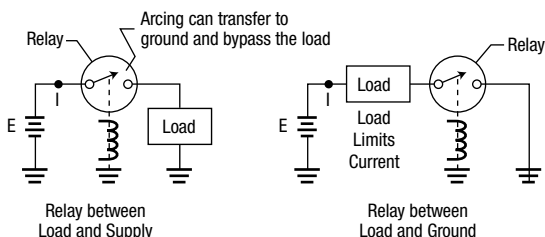


Figure 8

Capacitive Discharge or Make-Only Switching

Gas-filled relays are ideal for the high in-rush capacitive make and capacitive discharge loads found in electrostatic discharge (ESD) test equipment, cable test equipment and heart defibrillators. Typical models are the RGH5-26S or the RGH3-26S.

Gas-filled relays also provide low, stable leakage current in applications sensitive to current fluctuations, especially across open contact sets over long periods of time. However, these relays should not be used when it is necessary to break a current. As the contacts open, the gas will ionize, and an arc will be formed and sustained for much longer than in vacuum.

Vacuum relays are also often used in high voltage circuits to protect personnel by shorting out (bleeding) a capacitive circuit to ground once the high voltage has been removed. The low resistance contacts of a vacuum relay allow very high peak currents to be handled (up to 200 amps for up to 50 milliseconds without contact deterioration or welding). Arc contact welding is a function of arc voltage (a constant 18–23 volts), current and time. Currents of up to 500 amps have been carried for 10 milliseconds without failure.

Most standard relays will handle discharge pulses of 200 joules. In most applications, a series load resistor is used to lengthen capacitor discharge time to reduce peak current carried by the relay (Figure 9).

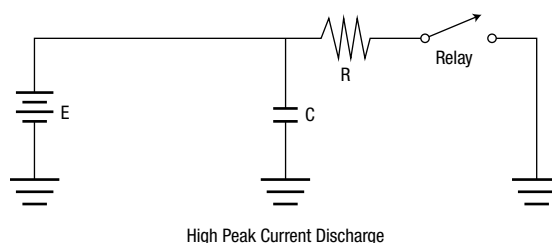


Figure 9

The Relay Driver Circuit

Relay Timing Characteristics

The coil voltage greatly affects relay operating speed, with higher voltages giving higher speeds. With a slightly higher than nominal voltage applied to the coil, the speed will immediately increase. It is important, though, to prevent overheating and be aware of the maximum allowable voltage for the relay that is used. For example, a 26.5 VDC coil should not exceed 32 VDC for continuous duty.

The preferable method is to use an overvoltage pulse that decays to normal operating potential in a few milliseconds (Figure 10). A simple RC network placed between the power supply and the relay will do this.

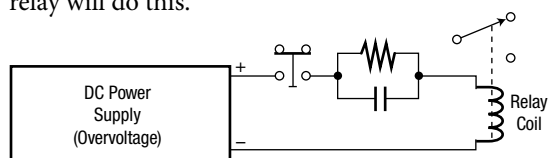


Figure 10

Transients in the Relay Driver Circuit

When the relay coil is turned on, the magnetic field takes a few moments to build up — at the same time energy is being stored in the coil. When the coil is later turned off, the stored energy can cause a voltage spike in the driver circuit and damage other components.

To increase the de-energized time and eliminate voltage transients, a zener-diode or zener-zener combination can be used across the coil (Figure 11). High voltage transients can be eliminated with an inductor/diode combination placed between the power supply and the relay (Figure 12).

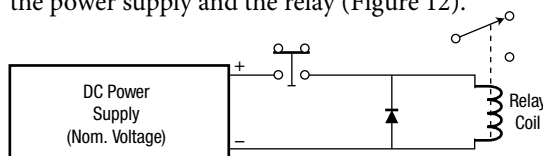


Figure 11

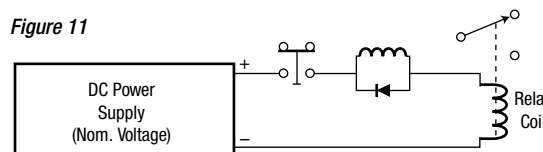


Figure 12

It is important to understand how the method chosen to suppress any transients will affect the relay operating characteristics.

Relay Mounting and Installation

- The relay envelope may become contaminated during transfer or assembly. Keep the envelope surface clean.
- Protect the relay from physical damage while storing and while mounting.
- When soldering wires onto the relay terminals, always make sure to remove excess flux as well as to clean the ceramic surface in order to ensure proper isolation. Please see our website for soldering guidelines for the some common relay types.
- When vacuum relays are mounted, the relay base should be connected to ground (also see Figure 8 on page 10 for more information on positioning of the relay within the circuit).
- The mounting methods shown are a few of the most common methods used by Jennings customers. In addition, Jennings offers a variety of flanges to further meet your needs. Should your application require mounting other than what is shown, we will be happy to discuss alternative methods. (NOTE: All models may be mounted and operated in any position.)
- When mounting relays that are to be used at RF frequency, copper straps are often soldered onto the HV terminals for better heat transfer and cooling.
- Please contact us for additional information on adapters for coil terminals, heat sinks or any other mounting questions.

Maintenance

Under normal operating conditions, relays do not need any maintenance. They should be kept free from dust and in a dry environment.

Safety Information

Vacuum relays may be used to switch high voltages at various frequencies. To avoid the danger of electrical shock, all circuits connected to the relay must be de-energized before connection, disconnection or testing.



WARNING



**DISCONNECT POWER BEFORE
SERVICING. HAZARDOUS
VOLTAGE CAN SHOCK, BURN
OR CAUSE DEATH.**

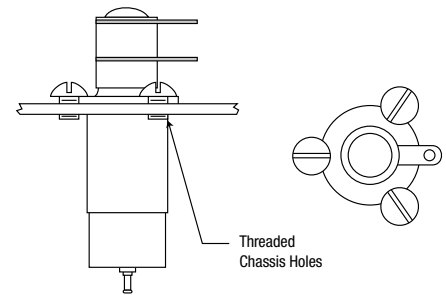


Figure 13A — Typical Screw Mounting

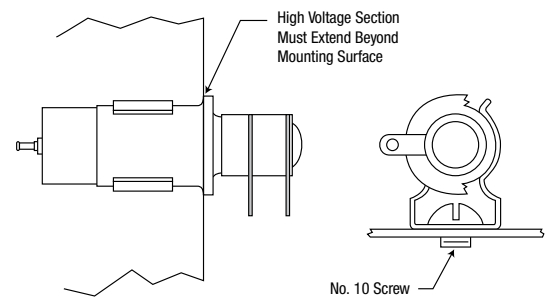


Figure 13B — Flange Mounting
(optional flanges are available on many relays)

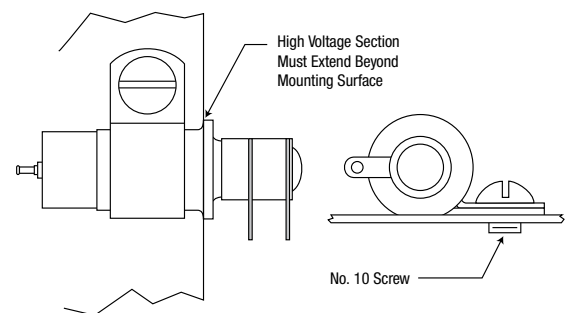


Figure 13C — Clamp Mounting

		RATED OPERATING VOLTAGE (kV PEAK)				12 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT.CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RF41-26S RF42-26S	4	3.6	3.6	3.2	2.5	1.6	1.6	20	10	10	16	1-10	290	50	10 @ 55-2000 Hz	1	1 (28)
RF44-26S	6	3.6	3.6	3.2	2.5	1.6	1.6	12	4	4	16	1-10	80	50	30 @ 95-2000 Hz	1	1 (28)
RF43-26S	9	7	7	6	4	1.6	1.1	20	10	10	16	1-10	47	50	10 @ 55-500 Hz	0.5	1 (28)

RF41-26S

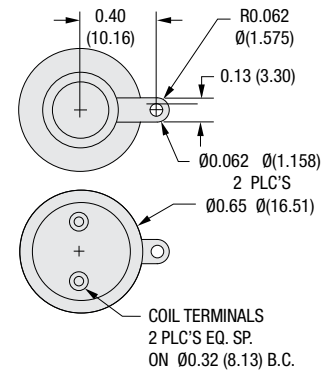
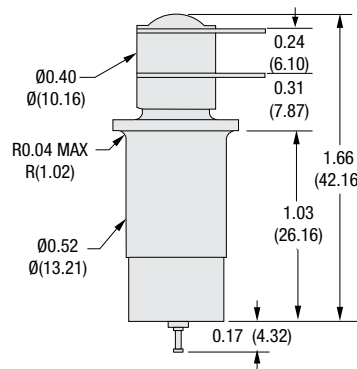
Form:
N/C

Flange Version Available:
RF41D-26S

RF42-26S

Form:
N/O

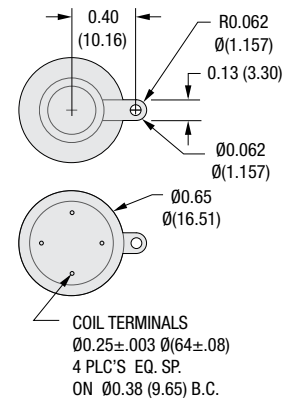
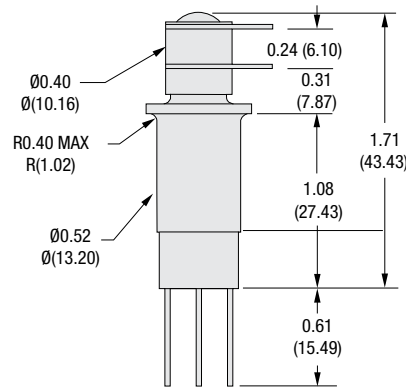
Flange Version Available:
RF42D-26S



RF44-26S

Form:
Latching

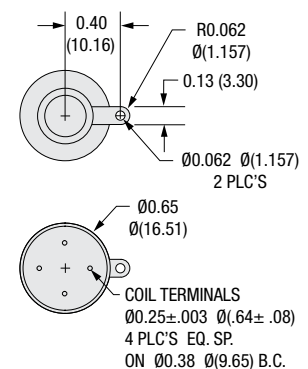
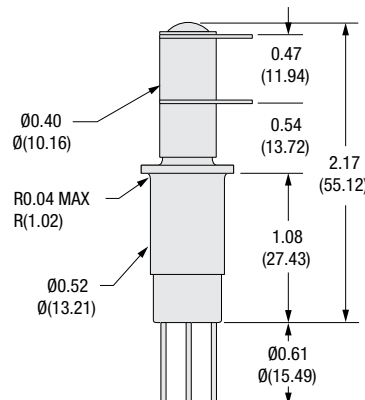
Flange Version Available:
RF44D-26S



RF43-26S

Form:
Latching

Flange Version Available:
RF43D-26S

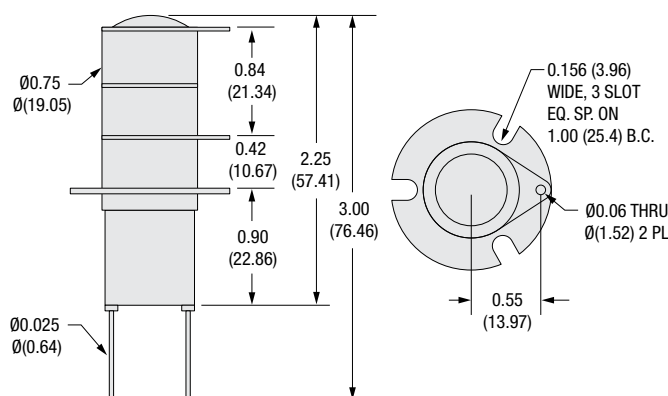


PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	RATED OPERATING VOLTAGE (kV PEAK)				CONTACT CAPACITY (pF)		12 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125".									
		MAX CONT. CURRENT (Amps)				OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
		DC OR 60Hz	2.5 MHz	16 MHz	32 MHz												
RF4A-26S	10	8	7	6	5	2.5	2.5	15	18	18	16	1-10	156	50	10 @ 55-2000 Hz	1	2 (56)
RF5A-26S RF6A-26S	10	8	8	6	5	1.6	1.6	20	8	6	16	1-10	920	30	10 @ 55-1000 Hz	10	.5 (14)
RF47-26S	10	8	8	6	5	1.6	1.6	8*	4	4	16	1-10	80	50	30 @ 55-2000 Hz	1	1 (28)
		30	25	15	10												
		12	10	5	2												
		35	35	18	12												

RF4A-26S

Form:
N/C

Equipped with integral flange



RF5A-26S

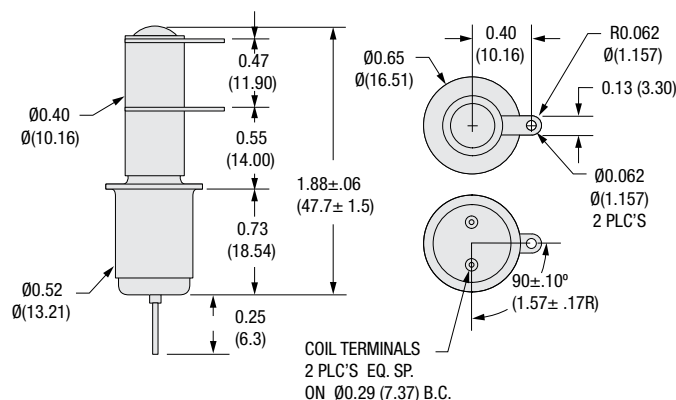
Form:
N/C

Flange Version Available:
RF5AD-26S

RF6A-26S

Form:
N/O

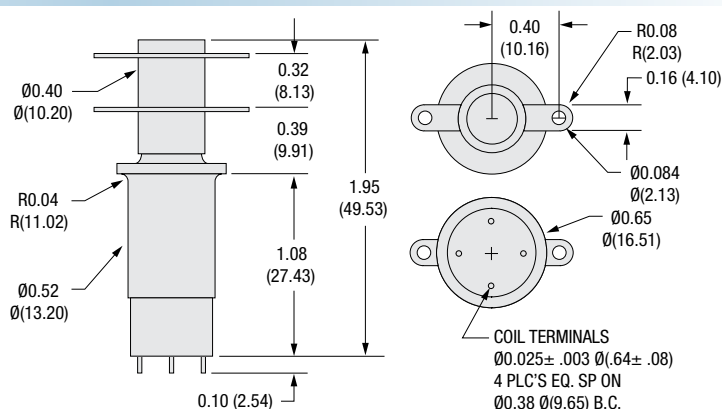
Flange Version Available:
RF6AD-26S



RF47-26S

Form:
Latching

Flange Version Available:
RF47D-26S



* Please contact Jennings Technology for lower/different values.

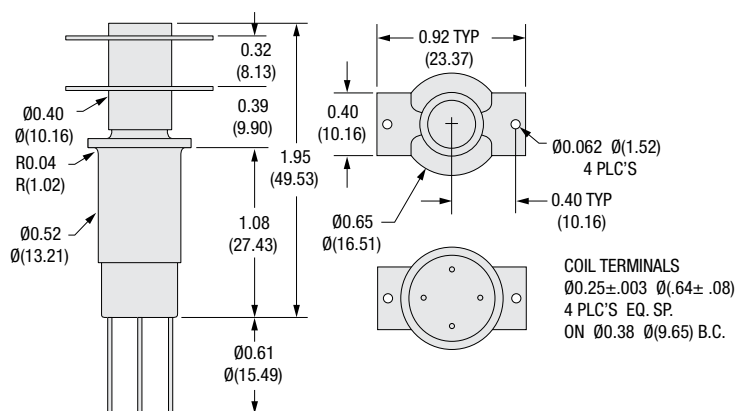
		RATED OPERATING VOLTAGE (kV PEAK)				12 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT.CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RF72-26S RF72-N1105 RF72-N1107	10	8	8	6	5	1.6	1.6	20 8* 20	4 1.5 2.5	4 1.5 2.5	16* 6-12 5-16	1-10* 7-17 6-20	80	50	30 @ 55-2000 Hz	2	1 (28)
RF80-26S	10	8	8	6	4	1.6	1.6	8*	8	3	16	1-10	290	30	10 @ 55-2000 Hz	2	1 (28)
RF88-26S	10	8	8	6	5	1.6	1.6	20	4	4	16	1-10	80	50	10 @ 55-2000 Hz	1	1 (28)

RF72-26S RF72-N1105 RF72-N1107

All three models —

Form:
Latching

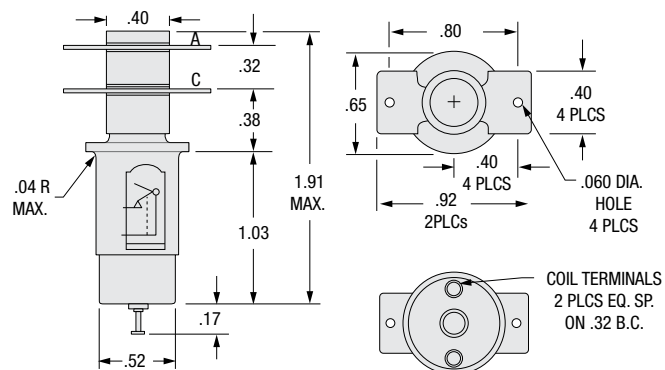
Flange Version Available:
Yes, please call to order



RF80-26S

Form:
N/O

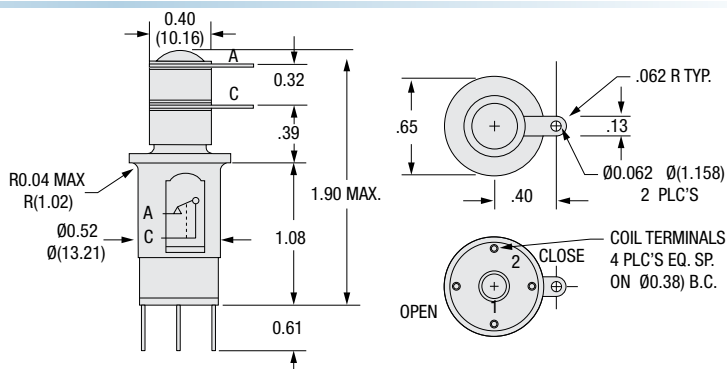
Flange Version Available:
Yes, please call to order



RF88-26S

Form:
N/C

Flange Version Available:
Yes, please call to order



* Please contact Jennings Technology
for lower/different values.

PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	RATED OPERATING VOLTAGE (kV PEAK)				12 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT. CURRENT (Amps)				CONTACT CAPACITY (pF)		MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
		DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND										
RF50-26S [†] RF51-26S [†]	12*	10	7	6	4	1.5	1.5	20	15	15	16	1-10	290	50	10 @ 55-2000 Hz	0.5	1 (28)
RF73-26S	14	12	12	9	7	1.2	1.2	8**	4	4	16*	1-10*	47	30	10 @ 55-2000 Hz	5	1.5 (43)
		35	35	25	15												
RF52-26S RF53-26S	17.5	12	12	9	7	0.8	0.8	20	15	15	16	1-10	290	30	10 @ 55-500 Hz	1	1 (28)
		15	12	6	4												

RF50-26S[†]

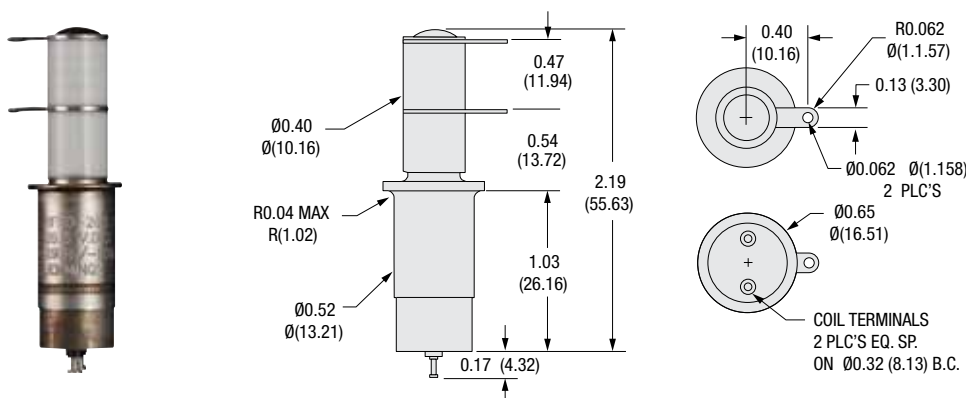
Form:
N/C

Flange Version Available:
RF50D-26S

RF51-26S[†]

Form:
N/O

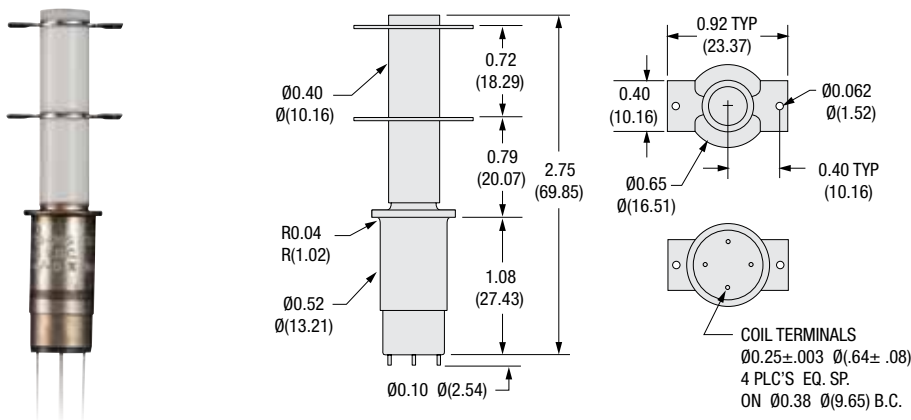
Flange Version Available:
RF51D-26S



RF73-26S

Form:
Latching

Flange Version Available:
Yes, please call to order



RF52-26S

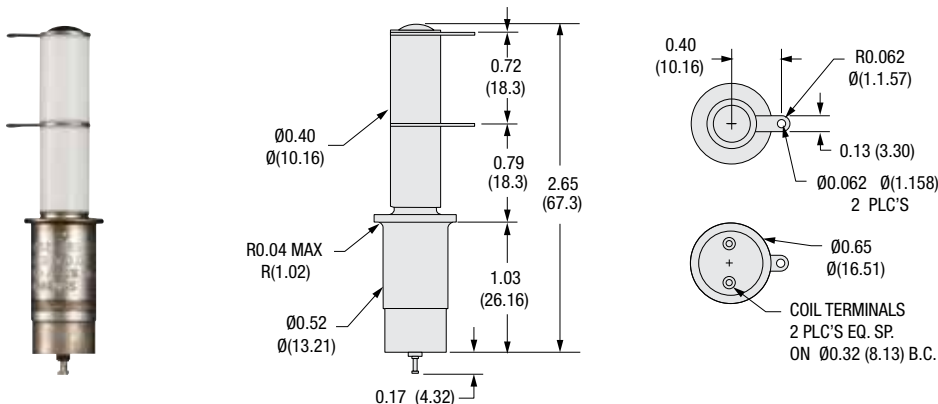
Form:
N/C

Flange Version Available:
RF52D-26S

RF53-26S

Form:
N/O

Flange Version Available:
RF53D-26S



[†] Can be used for hot switch applications.

* 2 kV achieved in insulating medium: fluorocarbon liquid or tightly adherent and void-free encapsulant.

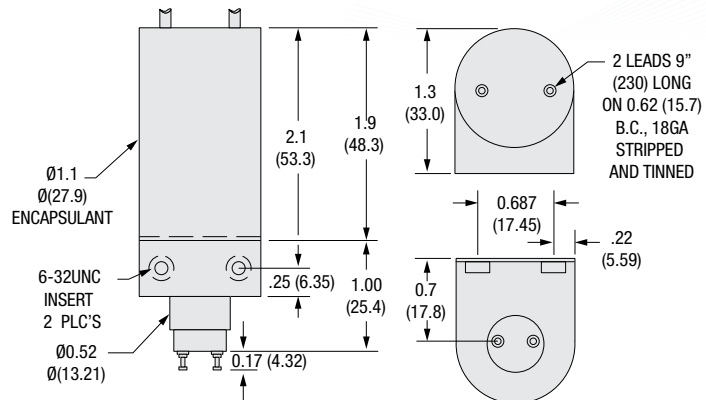
** Please contact Jennings Technology for lower different values.

		RATED OPERATING VOLTAGE (kV PEAK)				12 VDC coil version available for model RF69-26S; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT.CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RF69-26S	24	12	—	—	—	2.5	2.5	40	15	15	18	1-10	290	30	.06 @ 55-500 Hz	2	3 (85)
		15	—	—	—												
RJ8A-26S	33	28	25	12	10	1.3	1	3	18	8	16	1-10	120	30	10 @ 55-500 Hz, 5 @ 500-2000 Hz	2	10 (283)
		110	60	40	30												

RF69-26S

Form:
N/C

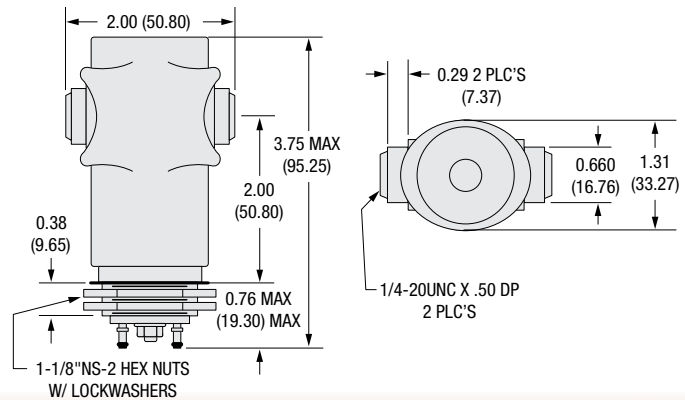
Equipped with integral flange



RJ8A-26S

Form:
N/O

Flange Version Available:
None

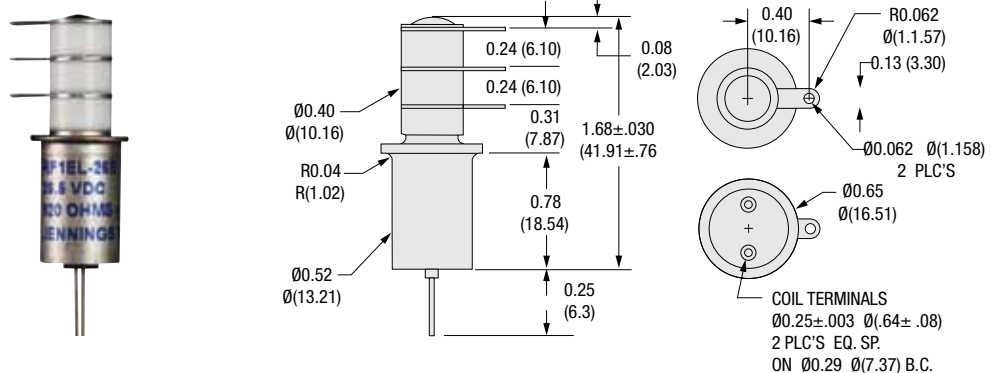


		RATED OPERATING VOLTAGE (kV PEAK)				12 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT. CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RF1E-26S	4	2	2	2	2	1.6	2	30	10	10	16	1-10	920	30	10 @ 55-2000 Hz	10	1 (28)
		8	6	4	2												
RF60-26S	4	3.6	3.6	3.2	2.5	1.6	1.6	20	7	7	18	1-12	47	50	10 @ 55-2000 Hz	0.5	1 (28)
		12	10	6	5												
RF61-26S	4	3.6	3.6	3.2	2.5	1.6	1.6	20	10	10	16	1-10	290	50	10 @ 55-2000 Hz	0.5	1 (28)
		10	8	7	5												

RF1E-26S

Form:
SPDT

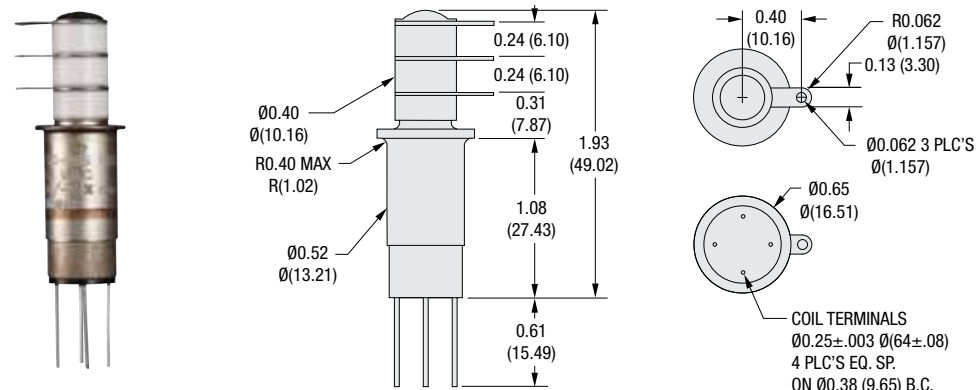
Flange Version Available:
RF1D-26S



RF60-26S

Form:
Latching

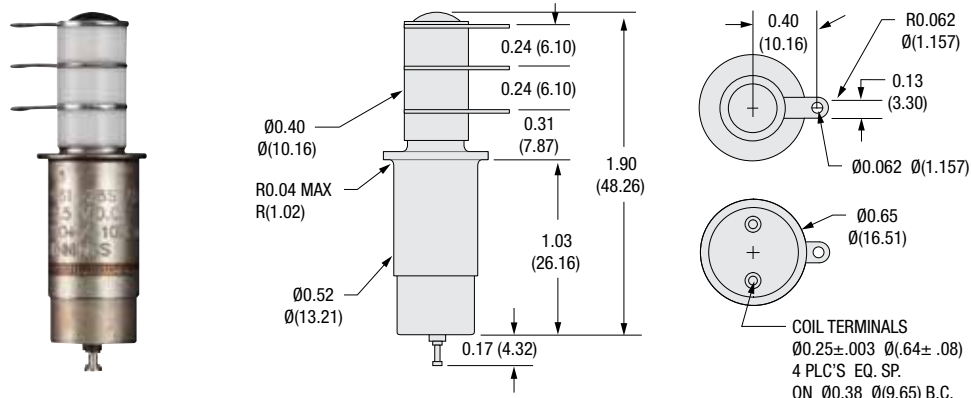
Flange Version Available:
RF6D-26S



RF61-26S

Form:
SPDT

Flange Version Available:
RF6D-26S

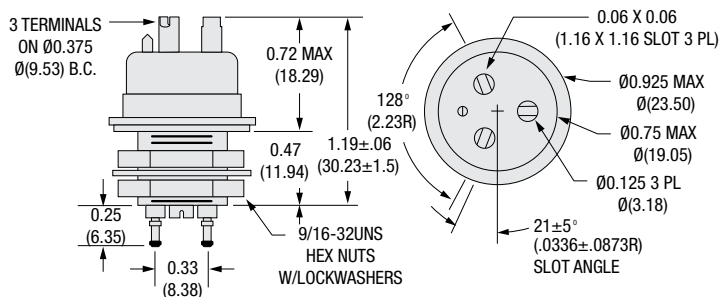


		RATED OPERATING VOLTAGE (kV PEAK)				12 or 115 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT. CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RJ1A-26S	5	3.5	2.5	2	1.5	2	2.5	10	8	8	16	1-10	335	50	10 @ 55-2000 Hz	2	1 (28)
RJ1H-26S [†] RJ1H-26N877 [†]	5	2.5	Hot Break	—	—	2	2.5	30	6	6	16	1-10	335	50	10 @ 55-2000 Hz	2	1 (28)
RJ1C-26S ^{†*} RJ1D-15S ^{†*}	6 7	6 7	Hot Break	—	—	2	2.5	20	6	6	14 10	1-10 0.7-7	335 85	50	20 @ 35-60 Hz, 40 @ 60-125 Hz, 30 @ 125-550 Hz	1	1 (28)

RJ1A-26S

Form:
SPDT

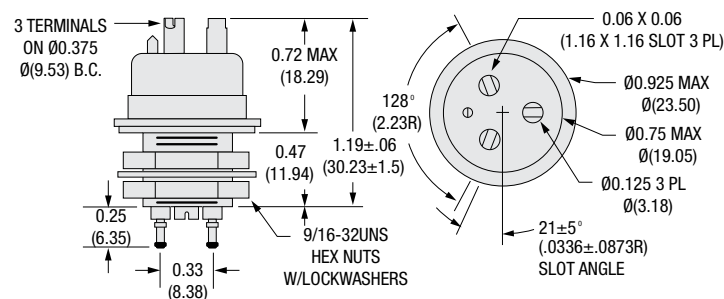
Flange Version Available:
None



RJ1H-26S[†]

Form:
SPDT

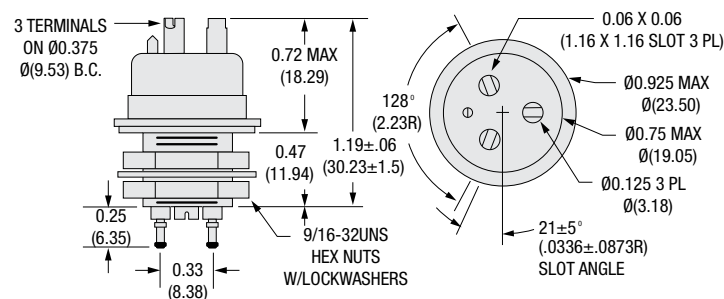
Flange Version Available:
None



RJ1H-26N877[†]

Form:
SPDT

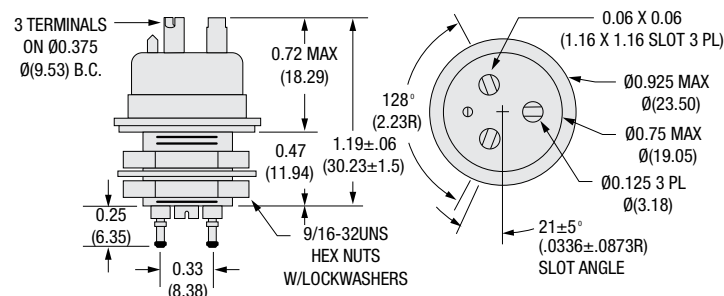
Flange Version Available:
None



RJ1C-26S^{†*}

Form:
SPDT

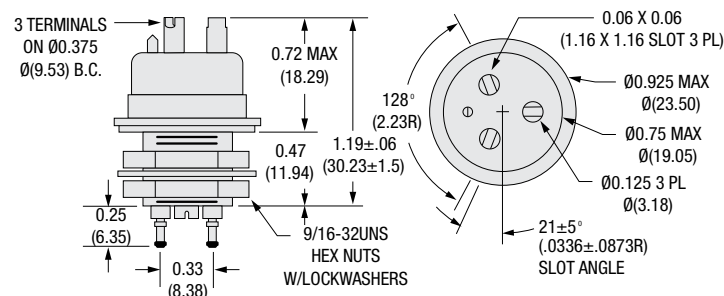
Flange Version Available:
None



RJ1D-15S^{†*}

Form:
SPDT

Flange Version Available:
None



[†] Can be used for hot switch applications.

* Units to be encapsulated by customer, extended vibration profile, HiPot in insulating fluid.

PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	RATED OPERATING VOLTAGE (kV PEAK)				12 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT. CURRENT (Amps)				CONTACT CAPACITY (pF)		MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
		DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND										
RF62-26S RF65-12S	9	7	7	6	4	1.6	1.1	20	10	10	16	1-10 1-5	290 48	50	10 @ 55- 2000 Hz	1	1 (28)
RF63-26S	9	7	7	6	4	1.6	1.1	20	10	10	16	1-10	47	50	10 @ 55- 2000 Hz	1	1 (28)
RF3A-26S	10	8	7	6	5	4	2.5	15	18	18	16	1-10	156	50	10 @ 55- 2000 Hz	1	2 (56)
		30	25	15	10												

RF62-26S

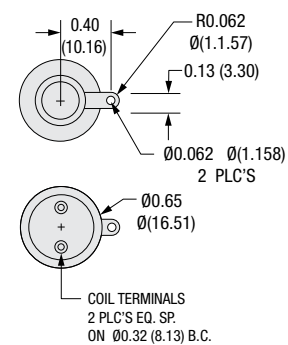
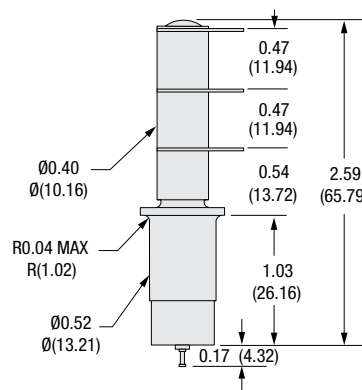
Form:
SPDT

Flange Version Available:
RF62D-26S

RF65-12S

Form:
SPDT

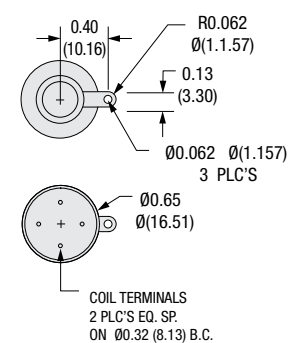
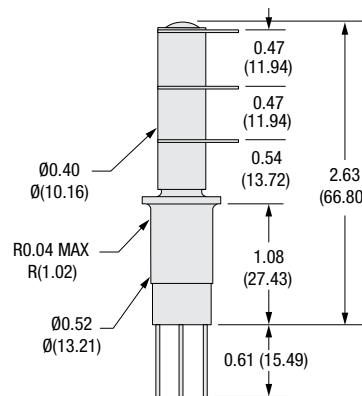
Flange Version Available:
RF65D-12S



RF63-26S

Form:
Latching

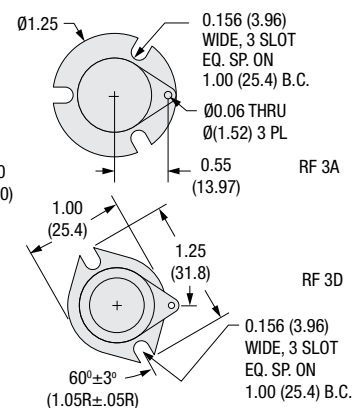
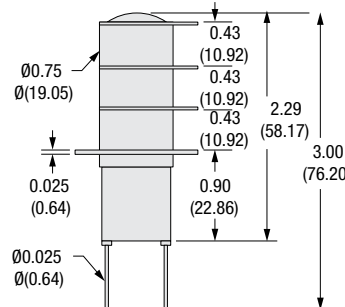
Flange Version Available:
RF63D-26S



RF3A-26S

Form:
SPDT

Equipped with integral flange

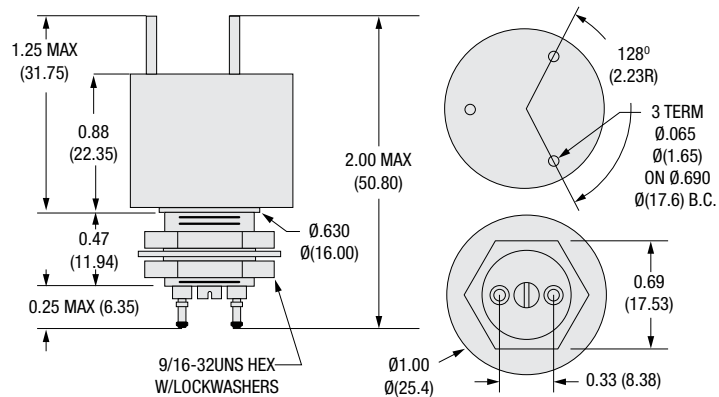


		RATED OPERATING VOLTAGE (kV PEAK)				12 or 115 VDC coil versions available; please contact factory for lead times. For available flange versions, the flange diameter is 1.125".											
		MAX CONT.CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RJ1A-26N696	10	8	—	—	—	2	2.5	10	8	8	16	1-10	335	50	10 @ 55-2000 Hz	2	1 (28)
		18	—	—	—												
RJ2B-26S [†] RJ6B-26S [†]	15	12	10	8	6	0.5 1	1 1.5	12	18	9	16	1-10	270	50	10 @ 55-500 Hz	1 25	3 (85)
		50	30	17	10												
RJ6B-D3136 [†]	15	12	10	8	6	1	1.5	12	18	9	16	1-10	270	50	10 @ 55-500 Hz	25	3 (85)
		50	30	17	10												

RJ1A-26N696

Form:
SPDT

Flange Version Available:
None



RJ2B-26S[†]

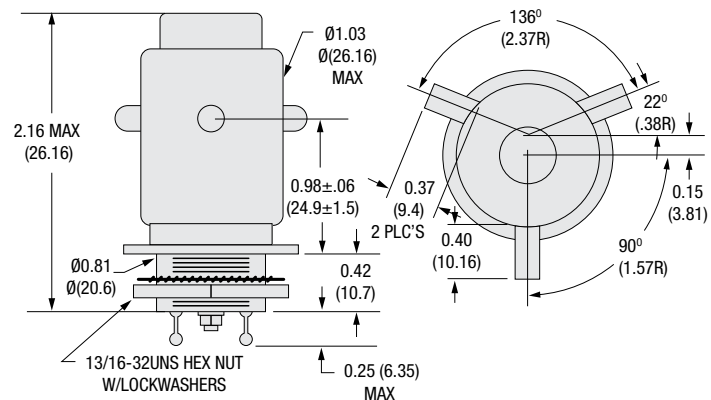
Form:
SPDT

Flange Version Available:
RJ2C-26S

RJ6B-26S[†]

Form:
SPDT

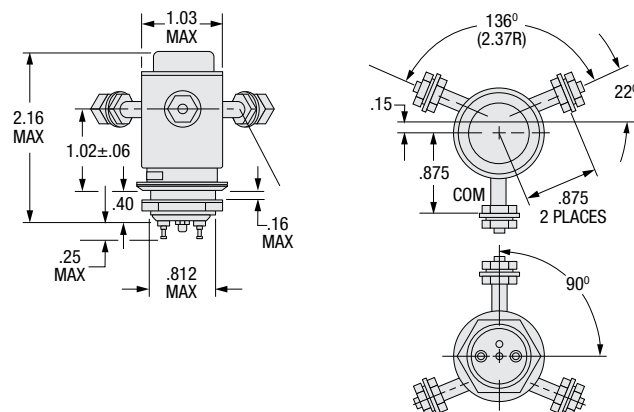
Flange Version Available:
RJ6C-26S



RJ6B-D3136[†]

Form:
SPDT

Flange Version Available:
RJ6C-26D3136



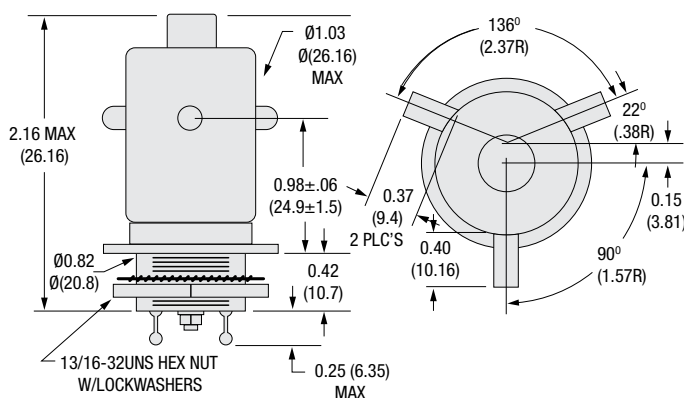
[†] Can be used for hot switch applications.

PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	RATED OPERATING VOLTAGE (kV PEAK)				12 or 115 VDC coil versions available for models RJ4B-26S and RJ4C-26S; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT. CURRENT (Amps)				CONTACT CAPACITY (pF)		MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
		DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND										
RJ4B-26S [†]	18	15	12	10	6	0.5	1	12	18	9	14	1-10	270	30	10 @ 55-500 Hz	1	3 (85)
		50	30	17.5	10												
RJ4C-26S [†]	18	15	12	10	6	0.5	1	12	18	9	14	1-10	270	30	10 @ 55-500 Hz	1	3 (85)
		50	30	17.5	10												
RF10B-26S	20	15	13	10	7.5	1.8	1.5	12	30	12	16	1-10	225	30	5 @ 55-500 Hz	0.1	16 (453)
		75	22	15	12												

RJ4B-26S[†]

Form:
SPDT

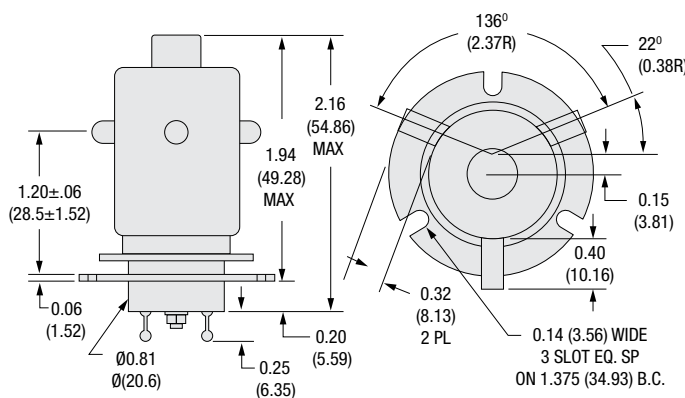
Flange Version Available:
RJ4C-26S



RJ4C-26S[†]

Form:
Latching

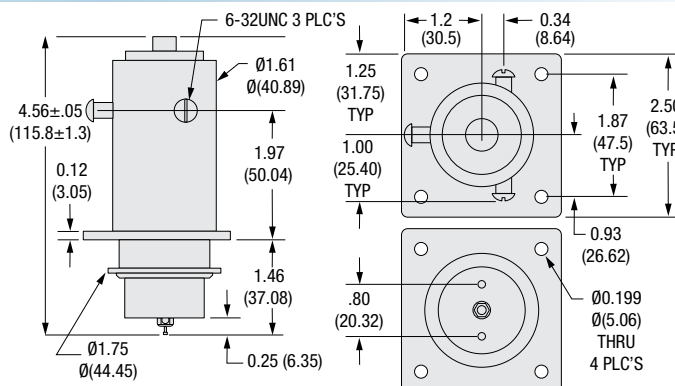
Equipped with integral flange



RF10B-26S

Form:
SPDT

Equipped with integral flange



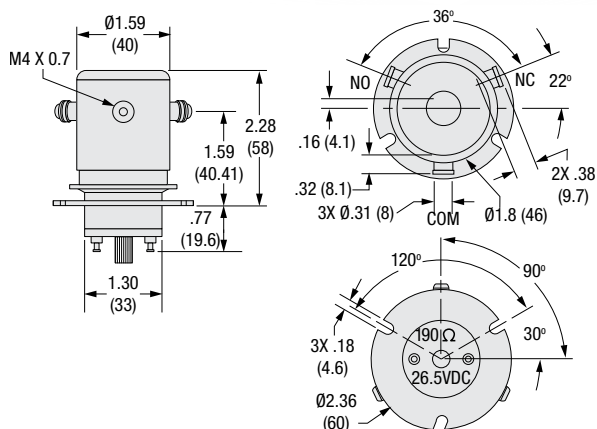
[†] Can be used for hot switch applications.

		RATED OPERATING VOLTAGE (kV PEAK)				12 or 115 VDC coil versions available for model RJ5B-26S; please contact factory for lead times. For available flange versions, the flange diameter is 1.125"											
		MAX CONT. CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RJ9B-26S†	20	15	13	10	—	3	3.5	10	30	8	16	1-10	190	50	10 @ 55-500 Hz	1	11 (312)
		110	50	20	—												
RJ5B-26S	30	25	—	—	—	6	3	50	20	15	18	1-10	167	20	10 @ 55-500 Hz	1	12 (340)
		10	—	—	—												

RJ9B-26S†

Form:
SPDT

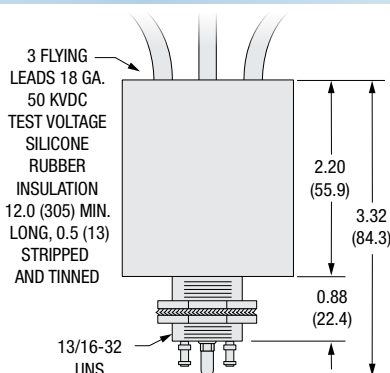
Equipped with integral flange



RJ5B-26S

Form:
SPDT

Flange Version Available:
None



† Can be used for hot switch applications.

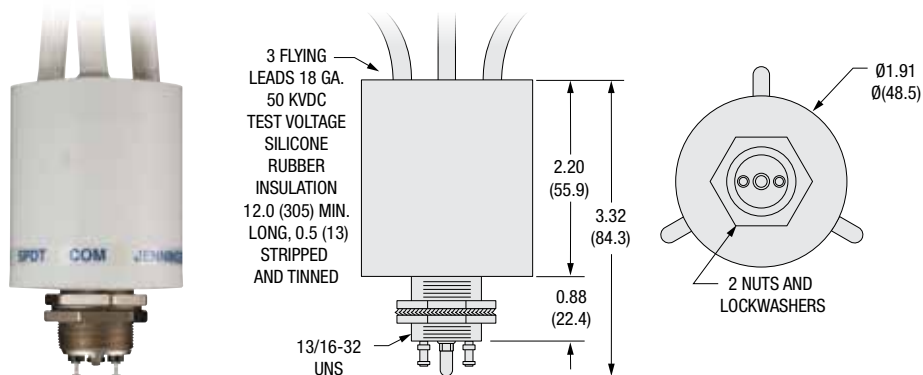


		RATED OPERATING VOLTAGE (kV PEAK)				12 VDC coil versions available for both models. 115 VDC coil version available for model RGH5-26S; please contact factory for lead times.											
		MAX CONT.CURRENT (Amps)				CONTACT CAPACITY (pF)											
PRODUCT NUMBER	TEST VOLTAGE (kV PEAK) 60 Hz	DC OR 60Hz	2.5 MHz	16 MHz	32 MHz	OPEN CONTACT TO OPEN CONTACT	OPEN CONTACTS TO GROUND	MAX CONTACT RESIST. (mΩ)	MAX OPERATE TIME (ms)	MAX RELEASE TIME (ms)	PULL-IN VOLTAGE @ 25°C (Vdc)	DROP-OUT VOLTAGE @ 25°C (Vdc)	COIL RESISTANCE (Ω ±10%)	SHOCK, 11ms ½ SINE (PEAK g's)	VIBRATION PEAK g's @ FREQ.	MECHANICAL LIFE (10 ⁶ CYCLES)	WEIGHT, oz. (grams)
RGH5-26S*	50	40	—	—	—	6	3	500	20	15	18	1–10	167	20	10 @ 55–500 Hz	1	12 (340)
		10	—	—	—												
RGH3-24D2524*	70	70	—	—	—	1.5	1.5	1000	N/A	15	18	16	24	30	10 @ 55–500 Hz	5	16 (454)
		15	← 30 Make →														

RGH5-26S*

Form:
SPDT

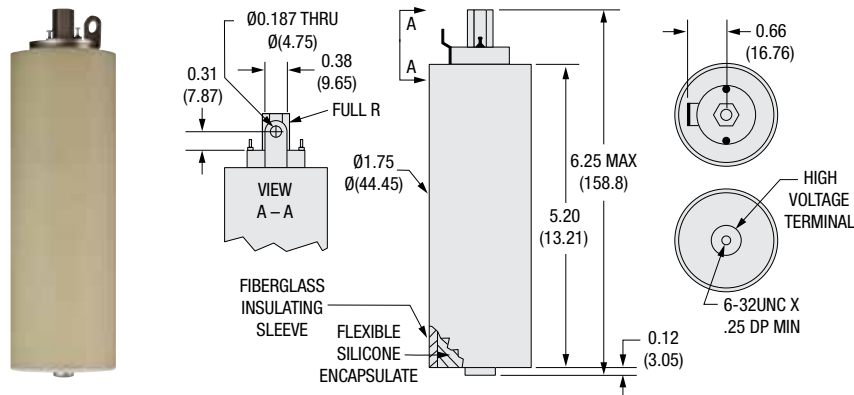
Flange Version Available:
None



RGH3-24D2524*

Form:
SPST N/C

Flange Version Available:
None



* Gas-filled relay, make-only load switching applications (CR measured at 28 VDC/1 Amp).

Vacuum Coaxial Relays

Jennings High-Voltage Vacuum Coaxial Relays

The field of multiple transmitter-antenna matching in the high frequency range entered a new era in the early 1980s, primarily as a result of fast switching requirements by both military and commercial users.

With the trend toward unattended communications equipment, automatic switching over remote circuits became necessary to meet the requirements of new transmitter and receiver equipment. Advancements in speed introduced by missile and newer airplane technology forced early-warning communications systems to operate at higher switching speeds with increased reliability. Switching devices in these applications were exposed to extreme environmental conditions that wreaked havoc on conventional switch contacts. The need to devise new switching methods with far greater circuit efficiency than that exhibited by any previous switching method became obvious.

In the commercial arena as well, higher power requirements and the necessity for continuous operation with the least number of costly traffic delays dictated the need to change to a long-life, maintenance-free, maximum-reliability RF switching device.

Vacuum coaxial relays successfully answered the requirements of both government and commercial needs. The vacuum dielectric enables high speed switching and provides low, stable contact resistance. In addition, the vacuum environment protects the contacts from contamination and oxidation and eliminates the need for contact maintenance.

Vacuum Dielectric Advantages

The high dielectric strength of a vacuum is one of the important features that distinguish Jennings vacuum coaxial relays from other types of coaxial relays. As a rule of thumb, a vacuum device has a dielectric strength of about 1000 volts per mil. Consequently, only a slight contact separation is required to withstand high voltages. Physically, such limited contact movement minimizes the size of the relays, permits the use of a small, simple actuating mechanism and results in faster switching times. Internal grounding minimizes crosstalk.

The use of a vacuum as a contact environment also serves to increase operating reliability and the life of the relay. The absence of oxygen prevents contact corrosion and the formation of oxides and organic materials that can increase circuit resistance. The RF contact resistance in the vacuum relay remains low and stable throughout the rated life of the switch.



50 Ohm Transmission Systems

In addition to long life and high reliability, vacuum coaxial systems also offer assurance of excellent performance for HF and UHF radio systems. The elimination of oxidized contacts eliminates the noise generation and intermodulation distortion that can occur when oxides form and cause rectification of the RF signal.

Because the contact resistance of vacuum coaxial relays is very low and stable, these units offer very low circuit losses. RF insertion loss is typically between 0.02 and 0.1 dB at operating frequencies.

Jennings vacuum relays are distinguished by very low thermal and RF noise generation.

The small relay size made possible by the use of vacuum as a dielectric medium is literally the smallest size possible commensurate with power handling capability and high voltage stand-off rating. Typical operating speeds of between 5 and 50 milliseconds are much faster than that available from conventional coaxial relays.

Application Versatility

Vacuum relays, complete with auxiliary fittings for coaxial systems and custom-designed control systems to ensure safe, reliable switching, are available to meet all power requirements of ship-to-shore, air-to-ground and ground-to-ground radio communications. System flexibility, made possible because of the operating features of these devices, is extremely broad, and you are encouraged to discuss your applications with Jennings engineers, who can make recommendations to assure you of the optimum system at minimum cost.

Examples of the various techniques practical with these relays are:

- **Connector flexibility** — Different connectors can be used as long as the power level rating is not affected.
- **Improved isolation** — Even greater isolation can be obtained by connecting two switches in series.
- **Higher impedance operation** — Although relays are designed for 50 ohm systems, they have been used at higher impedances. Contact us to discuss your application.

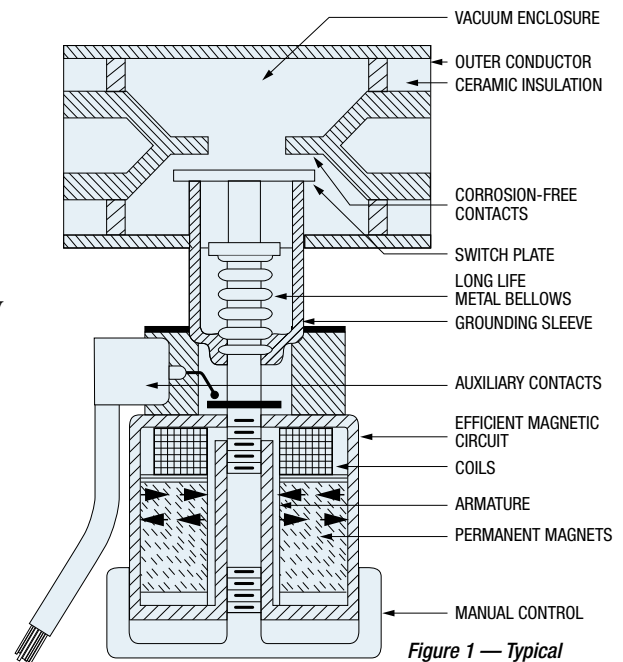
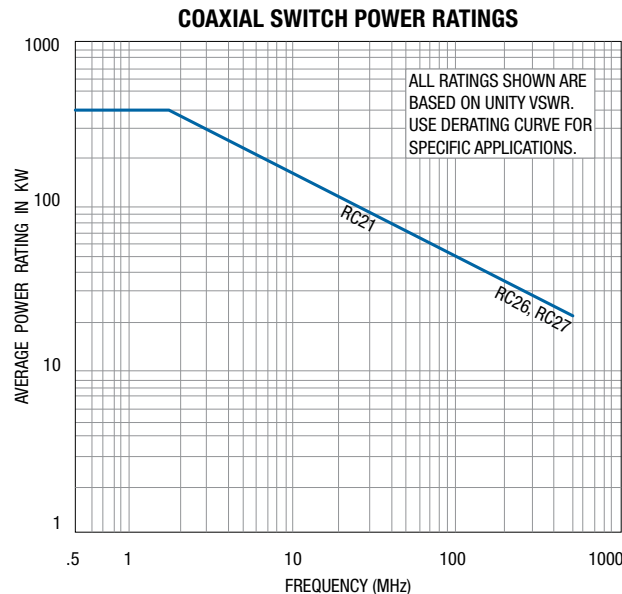


Figure 1 — Typical Jennings Vacuum Coaxial Relay for Rigid Lines

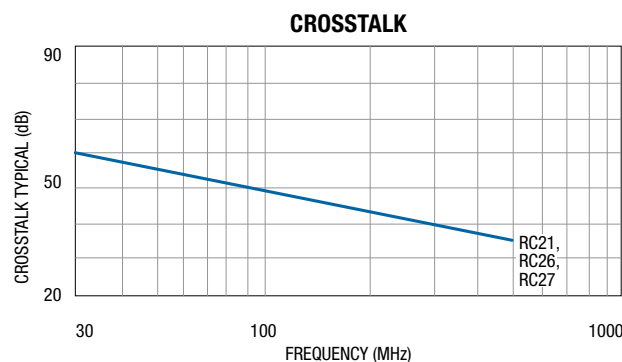
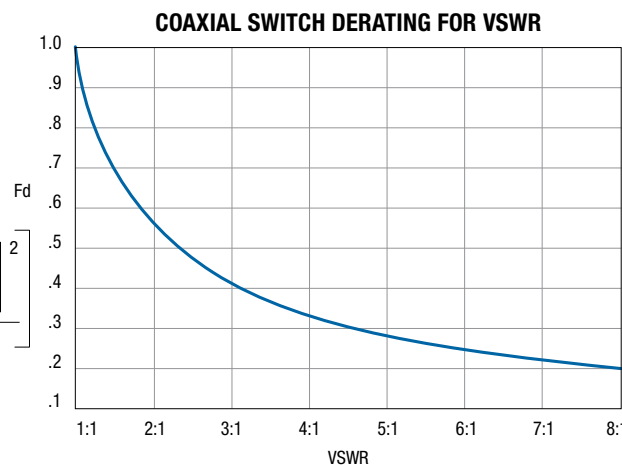
Reliability

Long-term use in large commercial, military and space programs around the world has proven the reliability of Jennings vacuum relays. Applications range from highly complex, multiple antenna transmitter switching systems, which depend upon flawless operation of the control system and individual coaxial relays, to military mobile radio installations on Jeeps or high altitude airborne systems with extreme environmental requirements. Jennings vacuum coaxial relays have a recorded history of dependable, maintenance-free operation. Because of this, they were chosen for ground and airborne applications for the tracking network of the AWACS military program.



R1 – SWITCH RATING AT
UNITY VSWR. (1:1)
R2 – SWITCH RATING AT
KNOWN VSWR. (N:1)
Fd – DERATING FACTOR
FdR1 = R2

$$Fd = \frac{1 + \left[\frac{VSWR - 1}{VSWR + 1} \right]^2}{VSWR}$$



Description

The construction of a typical Jennings vacuum coaxial relay for rigid lines is illustrated by the cutaway view shown on previous page. The material of the relay body is of OFHC copper with the inner conductors sealed into the ends of the housing by vacuum-tight ceramic disk insulators. The inner conductors are electrically connected by means of a switch plate slotted for multiple, positive contact.

A metal bellows on the movable contact allows movement within the vacuum chamber and maintains the vacuum-tight seal. The unique design of the inner conductors provides the necessary compensation to maintain the 50 ohm impedance of the line.

The actuating mechanism is a bi-stable device using permanent magnets, which operate as positive latching devices and aid in the open/close function of the relay. Further drive power for contact movement in either direction is provided by a balanced spring, which also acts to neutralize atmospheric pressure. Small momentary-duty coils transfer the magnetic field of the magnets, thereby releasing their latching hold and initiating contact operation.

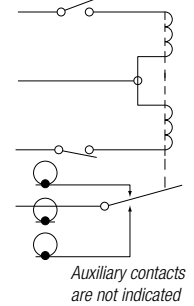
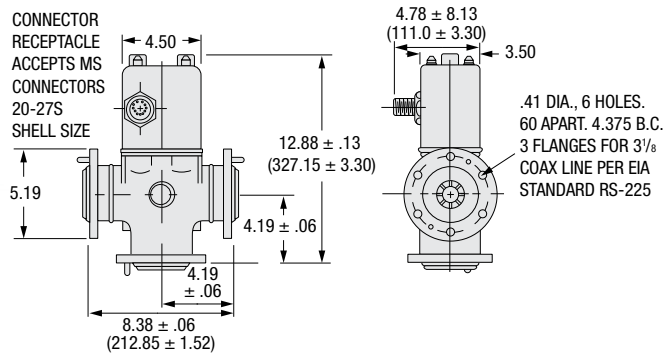
Need a Coaxial Relay You Don't See in this Catalog?

The vacuum coaxial relays featured here represent just a few of our standard models. Many other Jennings vacuum coaxial relays are available on request. *Call us today at 408-292-4025 to discuss your application.*

PRODUCT NUMBER	POWER RATING*	FREQUENCY RANGE	CHARACTERISTIC IMPEDANCE Ω	VSWR	CROSSTALK	INSERTION LOSS	COIL RESISTANCE ($\Omega \pm 10\%$)	ACTUATOR COIL CONNECTION	CONTACT CONFIG.	INPUT/OUTPUT LINE SIZE	ACTUATION	ACTUATING VOLTAGE	POSITION INDICATORS	OPERATE TIME**	WEIGHT lb. (kg)
RC21A5510F14B	90 kW CW @ 30 MHz 2 MW Peak Spec. Order	0-500 MHz	50	1.15:1 Max. @ 500 MHz	Greater than 60 dB isolation @ 30 MHz	0.01 dB Max.	4.8	MS receptacle	SPDT	3.125"	Permanent magnet latching, electrical or manual	26.5 VDC Auto De-energize	DPDT Aux. Contacts and Visual Indicator	50 msec. Max.	14 (6.35)

RC21

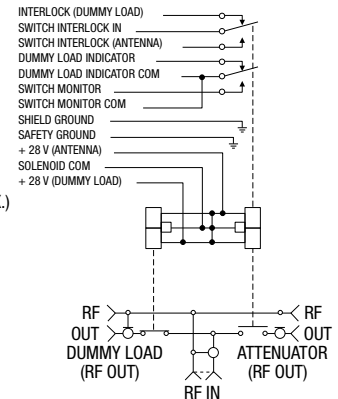
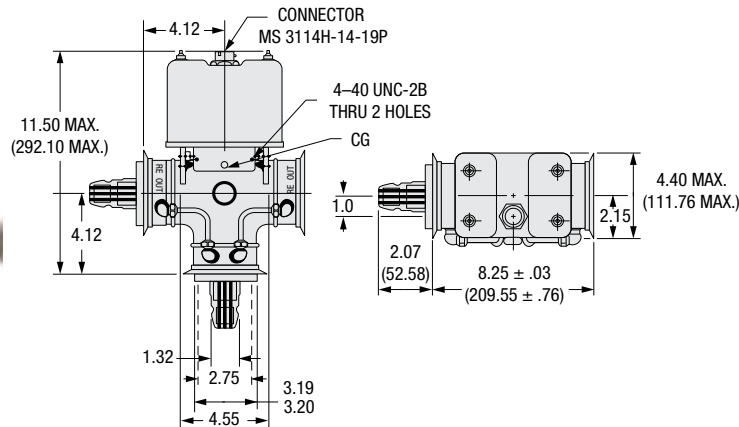
Form:
SPDT



PRODUCT NUMBER	POWER RATING*	FREQUENCY RANGE	CHARACTERISTIC IMPEDANCE Ω	VSWR	CROSSTALK	INSERTION LOSS	SERVICE LIFE	MAX. OPERATING ALTITUDE	COIL VOLTAGE (V $\pm 10\%$)	COIL CURRENT	COIL RESISTANCE	COIL CURRENT DURATION	AUX. SWITCH RATING	AMBIENT TEMP. RANGE	MAX. OPERATE TEMP.	PRESSURIZATION	NORM. OPERATE PRESSURE	WEIGHT lb. (kg)
RC265552G24F	90 kW CW @ 30 MHz 2 MW Peak Spec. Order	0-600 MHz	50	1.1:1 Max. to 400 MHz	Greater than 60 dB isolation @ 30 MHz	0.01 dB Max.	15,000 operating hours min.	35,000 feet	26	5 amps max. per coil	19 Ω nominal	2 sec. max. 22 msec. min.	5 amps resistive	-55° C to +85° C	+71° C	45 PSIA Dry Air	31 ± 1.5 PSIA Dry Nitrogen	14 (6.35)
RC275576G24F																		13 (5.9)

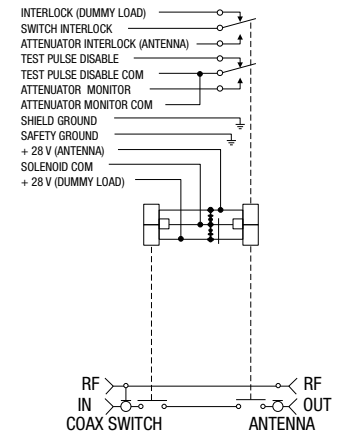
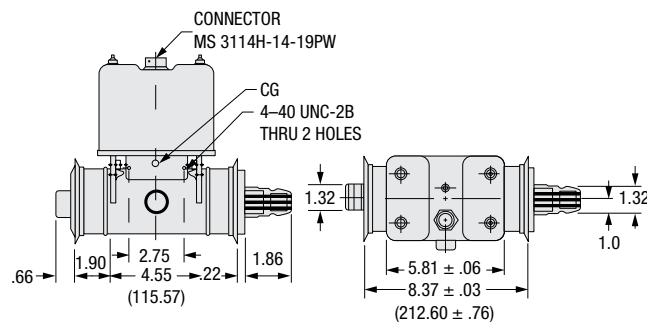
RC26

Switch Assembly
Form:
SPST



RC27

Attenuator
Form:
SPDT



* This power rating is for the frequency at which the relay is most commonly used. The power rating for any point in the frequency range of the unit may be obtained from the power vs. range chart on page 27.
** Faster operating times can be obtained on most units by coil pulse circuits. Please contact us for details.

Vacuum Contactors

Jennings vacuum contactors offer one of the most reliable means available for remotely controlling electric power.

Jennings vacuum contactors provide all the operating advantages of a vacuum interrupter plus the benefits of a matching actuator to meet specific application requirements. These low and medium voltage contactors offer the most reliable means of remotely controlling electric power.

Maintenance-Free Vacuum Contactors Provide Fast Arc Extinction and Rapid Recovery of Dielectric Strength.

Jennings contactors consist of a vacuum interrupter and an actuator linked together by an insulated actuating rod. Linkage and stand-off posts that isolate the high voltage from ground are made of epoxy glass laminate for DC switching. Heavy-duty connectors are provided for the high voltage connection.

Figure 1 illustrates a solenoid-operated vacuum contactor. Its interrupter consists of an evacuated ceramic insulating envelope in which there are two contacts, one stationary and one movable. The movable contact is operated from the outside through a metallic bellows that provides a vacuum-tight seal.

A vacuum has an extremely high dielectric strength — as high as 1000 volts per mil. When the contacts are opened to interrupt current flow, metal vapor is generated by the passage of current through the contacts. The vapor sustains the arc that is created, maintaining it down to or near current zero.

The small arc drawn on the contact opening is quickly extinguished because there are no gases, and there is only a small voltage drop across it. As the arc extinguishes, the metallic vapor rapidly diffuses outward and condenses on the cool surface of the vapor shields. The vapor shields prevent the metallic vapor from depositing on the ceramic insulating surfaces.

Fast arc extinction and rapid recovery of dielectric strength after contact opening are characteristics of vacuum interrupters. A phenomenon with these interrupters is the auto-maintenance of the vacuum. The metallic ions released from the contacts provide a gettering action. Tests have shown that frequent operation of the contacts produces a steady improvement in vacuum level because the released metallic ions actually remove gas molecules from the evacuated space. This ion-pumping action tends to maintain the vacuum near the high initial value.

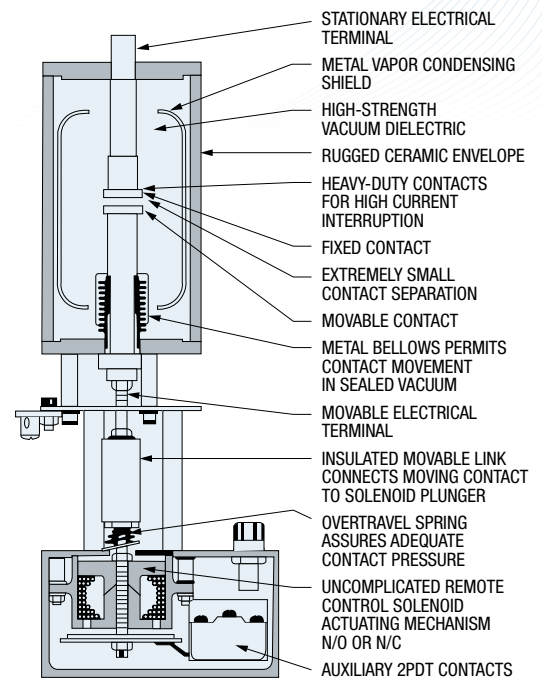


Figure 1 — Typical Jennings Solenoid-Operated Vacuum Contactor



Typical Applications

Jennings vacuum power contactors are used for controlling DC and 50/60/400 Hz circuits. Their principal use is in high power electrical equipment requiring long contact life without maintenance, low-cost, high voltage control or sealed contacts because of environmental conditions.

Switching and protecting transformers used in DC power supplies is one of the most common power frequency applications for contactors. Most transformer switching is done on the primary side for off-on control or to switch out current-limiting resistors or reactors used for reduced-voltage starting of power tubes. It may be necessary to use additional backup fault protection to take care of primary line-side faults. This is sometimes accomplished using a current-limiting fuse or coordinating with a high capacity system breaker already located in the primary side. However, where frequent faults are anticipated, contactors offer a much longer life with no contact maintenance, and they are often less expensive.

Contactors Eliminate Most Chopping Problems

The metal ion plasma in a vacuum interrupter permits current to flow in the circuit for a short period of time after the contacts have been opened. The metallic plasma stabilizes the arc, maintaining it as the current follows the sine wave pattern down to or near current zero.

In highly inductive circuits, this action is essential in preventing a phenomenon known as chopping, which happens with oil, air and vacuum breakers.

Chopping occurs when the arc is suddenly extinguished and the current drops immediately to zero. At high currents, a large amount of energy is stored in the circuit inductance and will resonate at high frequency with the distributed capacitance until dissipated by resistive circuit elements. The transient voltage surges caused by this chopping action can seriously damage the insulation of circuit components. This consideration is especially important in electric power switching because the magnitude of the transient is a function of the rate of change of current across the inductive load.

Because suppression of transient voltages depends on maintaining a stable arc, various steps can be taken to reduce the possibility of chopping. Factors affecting chopping include contact material, contact size, current levels, contact opening speed and external circuitry.

Advantages of Jennings Vacuum Contactors

By employing proven vacuum interrupter technology, Jennings contactors provide reliable, maintenance-free operation in industrial motor controls and other systems using a wide range of currents and voltages. The operation of contacts within a vacuum offers several inherent advantages:

- **No contact maintenance** — Contacts are sealed within a very high vacuum and remain clean permanently. There is no contact oxidation or possibility of foreign matter forming on the contacts and leaving contaminating residues.
- **Long life** — The arc that results as the contact is made or broken is quickly extinguished within a vacuum. The special contact material used erodes at an extremely slow rate to provide reliable operation for tens of thousands of operations.
- **Environmental safety factor** — Vacuum contactors can be used in environments involving corrosive atmospheres because there is no exposed arcing during interruption.
- **Compact, reliable operating mechanism** — The high dielectric strength of a vacuum minimizes the contact-to-contact gap required to interrupt current. This short contact stroke not only provides high operating speed, but also reduces the size and weight of the operating mechanism used.
- **No arc chute replacement** — Ordinary air-break contactors require fragile arc chutes to extinguish the arc that forms when the contact is broken. Arc chutes are damaged with use and ultimately require replacement. The manner in which vacuum contactors operate causes the arc to be extinguished rapidly with minimal damage or wear.
- **Proven operation** — Our vacuum interrupters have been supplied for several decades for use in electrical power generation and distribution systems operating at all voltage levels. The long life and reliability of these devices is such that many of the original units are still in operation!
- **Low contact resistance** — This resistance remains low and stable for the life of the contactor.

AC Current Ratings

Continuous current and maximum interrupting current ratings are all RMS values and should all be considered in selecting the proper contactor. Continuous line current can be calculated by dividing the total three-phase kVA by $\sqrt{3}$ and then by the line-to-line voltage.

When calculating maximum fault currents, consider that the first loops of current flow can always be asymmetrical (see Figure 2 on the following page) by as much as 2.7 times peak instantaneous value or 1.7 times RMS value of the steady state for the first loop. The asymmetry factor (RMS ratio) decays in most practical cases to almost the steady-state value 1 in approximately four cycles (for more information, contact Jennings). Therefore, the faster the contactor opens after the initiation of the short circuit (consider the sum of minimum tripping delay plus contact opening time), the higher the asymmetrical current it has to interrupt. Maximum interrupting currents used in the rating charts assume an asymmetry factor of 1.0.

Maximum steady-state fault current depends upon circuit impedance. In a primary bus fault, the fault current is limited only by source impedance, which may be 2% to 5%, depending on the distance from the power source and the impedance of transformers and line between. Primary bus faults can therefore be as high as 20 to 50 times rated kVA line current of source.

In calculating maximum short circuit currents due to faults in or beyond the transformer secondaries, a knowledge of transformer impedance is necessary, because a transformer with 5% impedance will limit the maximum fault current to a value of 20 times normal line current. Most transformers have impedance of less than 5%, although source impedance and other impedances in the equipment being protected may increase the total impedance to as high as 10%.



Example — A typical 100 kVA three-phase transformer in a DC power supply with 12 kV secondaries and 440 V primaries would have rated kVA line currents of 131 amps RMS in the primaries and 5 amps RMS in the secondaries. If total circuit impedance is 8% (5% in the power supply and 3% in the source and line), the maximum primary fault current due to a short circuit in the high voltage secondaries would be 1640 amps RMS. If interruption occurs within two cycles of fault initiation, this value could be offset by a factor as high as 1.2 times 1640 amps, for a total fault current of 1970 amps RMS. Of course, most fault currents would be less than this value, because maximum offset doesn't always occur, and faults often occur farther along in the circuit, where the impedance of rectifiers and other circuit components help limit the fault current to lower values. (Corresponding fault current in the high voltage secondaries is only 96 amps, which is why the high voltage secondaries are often a desirable place for fault protection when you anticipate a large number of fault operations.)

DC Switching

High voltage vacuum contactors can help the circuit designer solve complex DC switching problems that are otherwise difficult to handle. They can be used to interrupt high voltage, capacitive, resistive or inductive loads without the damaging electrical breakdown so frequently displayed by conventional DC switches.

Vacuum contactors are frequently used in charging capacitor banks, isolating charge banks and safety grounding of power supplies. They are also used to discharge high-energy storage capacitors and for the generation of high current pulses for plasma study, shock waves and metal forming.

DC Switching of Pulse Networks — Vacuum contactors are rated in continuous DC amps. They are used in a broad range of high power radar systems where the peak current is considerably above the continuous current rating of the switch, but where the effective current may be within the switch rating. The effective current in a square pulse = the peak current $\times \sqrt{\text{duty cycle}}$. For example, a typical radar square wave pulse of 2000 amps peak with a .01 duty cycle = 2000 amps $\times \sqrt{.01} = 200$ DC amps effective, which is within the continuous rating of most vacuum contacts.

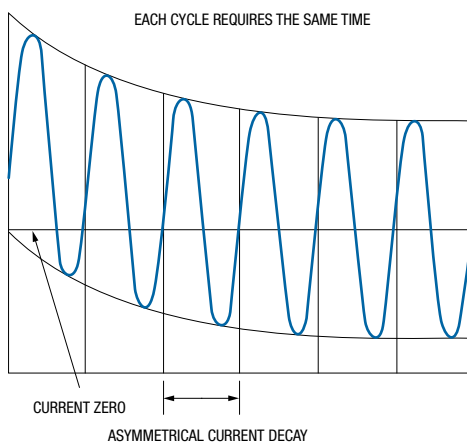


Figure 2

DC Switching of Power Supplies — Vacuum contactors are used for switching current-limiting reactor resistors, switching DC power directly to tubes and modulator loads, interrupting DC currents and isolating DC loads from one common power supply that feeds more than one load. They are also used for DC transfer switching. In switching DC inductive loads, suppression networks are required across the inductances when breaking the circuit and may be required when making the circuit to avoid possible overvoltages. At high voltages, a $\frac{1}{8}$ to 1 MFD capacitor in series with 1 ohm per kV makes an effective suppression network across an inductance. The suppression circuit should be critically damped.

DC Load Switching — In DC load switching, current zeros do not exist as they do in AC circuits. Extremely rapid arc extinction in vacuum switches due to the high velocity radial diffusion of vaporized metal permits vacuum switches to interrupt DC loads more effectively than other types of switchgear.

1. Vacuum switches are rated up to 20 amps at 30 kV DC and 10 amps at up to 50 kV DC resistive loads without arc suppression. (See Figure 3.)
2. Vacuum switches using an R-C suppression across the contacts can interrupt slightly higher currents with less arcing time, which increases contact life. (See Figure 4.)
3. Vacuum switches using a charged capacitor suppression circuit that causes ringing and creates artificial current zeros have been used to interrupt up to 35 kV DC at 150 amps DC resistive loads. (See Figures 5A and 5B.)
4. Inductive loads can be switched like resistive loads when a diode is used in parallel to the load. (See Figure 6.)

Please discuss your high current DC interrupting applications with Jennings application engineers, who will be happy to review your application and make recommendations.

Safety Information

Vacuum contactors may be used to switch high power circuits. All power sources connecting to the vacuum contactor must be isolated to avoid the possibility of electrical shock during inspection and servicing.

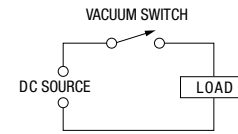


Figure 3 — No Arc Suppression

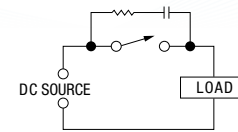


Figure 4 — R-C Suppression ($1 \Omega / \text{kV}$; 0.125–1 MFD)

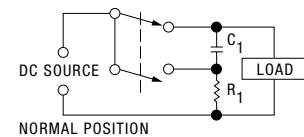


Figure 5A — Charged Capacitor Suppression Circuit in Normal Position

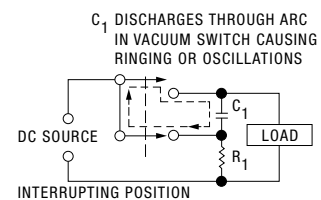


Figure 5B — Charged Capacitor Suppression Circuit in Interrupting Position

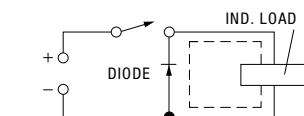


Figure 6 — Inductive Load Switching



WARNING



**DISCONNECT POWER BEFORE
SERVICING. HAZARDOUS
VOLTAGE CAN SHOCK, BURN
OR CAUSE DEATH.**

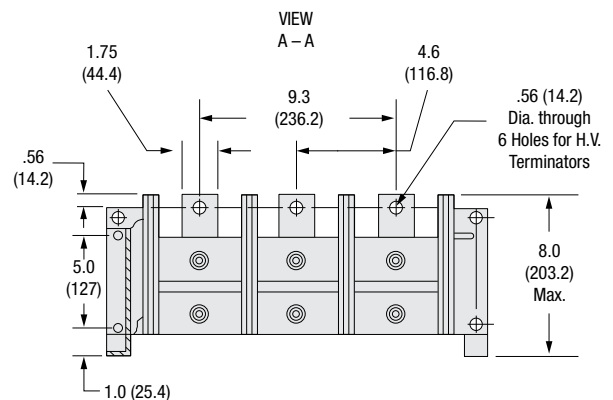
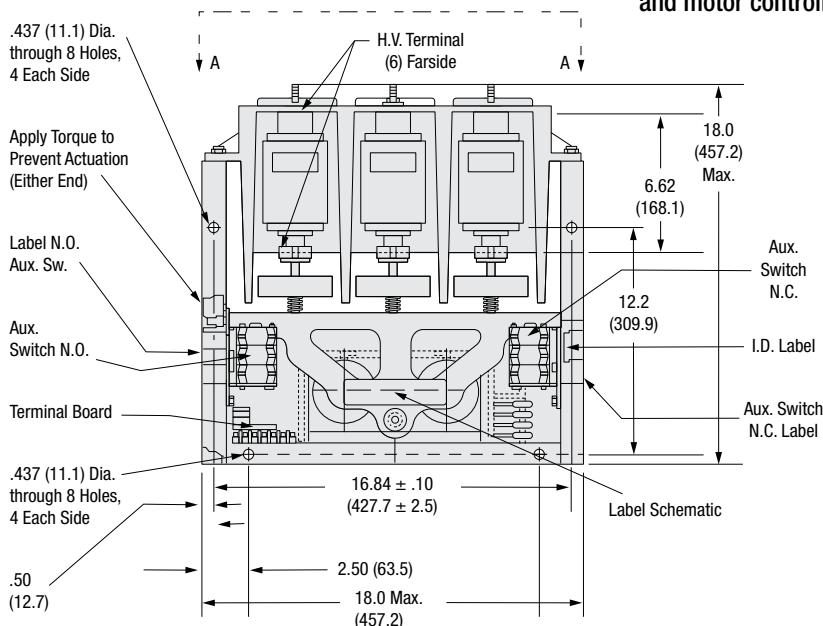
RP173



Measuring 18"H x 18"W x 8"D and weighing less than 67 lbs., the Jennings RP173 Three-Phase Vacuum Contactor is built tough to work in a variety of heavy-duty applications. Able to withstand the frequent switching required to control furnaces and large motors, this contactor can also be used to switch power transformers and capacitor banks for voltage regulation and power factor correction as a means of reducing operating costs. It is ideal for use in motor controllers that operate production and processing equipment, mining and petroleum equipment, earth movers and conveyors, power shovels and all types of industrial loads. Using a trio of vacuum interrupters, the three-phase unit provides a short contact-to-contact gap required to interrupt the circuit for highly reliable operation. The contact materials are rated for 7.2 kV, 600 amp load life and 6000 amp fault current.

Features

- Sealed main contacts provide a minimum of 1 million maintenance-free open and close operations
- Reliable operation in harsh temperature extremes ranging from -20°C to 70°C
- Versatility for use with heavy-duty motors, power equipment and motor controllers



VOLTAGE RATINGS

Maximum Three-Phase Line (kV)	1.5, 2.5, 5.0, 7.2
Dielectrics 50/60/400 Hz, 60-Second Withstand	
— Line-to-Ground (kV RMS)	30
— Line-to-Line (kV RMS)	30
— Across Open Contacts (kV RMS)	30
BIL, 1.2 x 50 μ sec Impulse	
— Line-to-Ground Peak (kV)	20
— Line-to-Line Peak (kV)	20

CURRENT RATING

Continuous (Amps RMS)	450/600
Load-Switching (Amps RMS)	450
— Capacitors (grounded neutral)	2000 KVAR @ 4.16 kV
— Motors	5000 HP @ 7.2 kV
— Transformers	5000 KVA @ 7.2 kV
Making Current (Random Make)	
— 100 Times @ 7.2 kV with 3-Second Backup (kA RMS)	4.5
— 10 Times @ 7.2 kV with Current-Limiting Fuse (kA)	55 peak
— 100 Times @ 5.0 kV with 3-Second Backup (kA RMS)	6
Minimum Load Life @ 600 amps RMS	1 million open/close operations
Interrupt (Amps RMS @ 5.0 kV)	6000

ACTUATOR

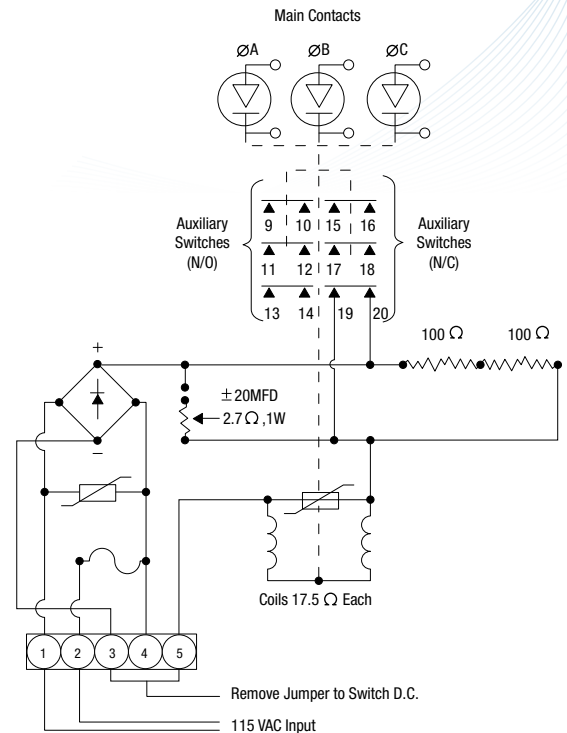
Control Voltage	
— RP173-2310-XX	115 VAC, 50/60 Hz or 110 VDC
— RP173-2311-XX	230 VAC, 50/60 Hz or 220 VDC
Control Current	3.3 pull-in amps, 0.5 hold-in amp
Auxiliary Contacts Configuration	2 N/C, 3 N/O, SPST double break, 10 amps resistive @ 600 VAC

MECHANICAL

Weight (lb.)	67 max.
Release Time (msec.)	100 max.
from Control Switch Off to Separation of Main Contacts	
Mounting	Operates in any position

OPTIONS

Product Number	Mounting Option	Actuator Volts	Line-to-Line Voltage (RMS)
RP173-2310-00	Standard	115 VAC/110 VDC	7200
RP173-2310-01*	Standard	115 VAC/110 VDC	7200
RP173-2311-00	Standard	230 VAC/220 VDC	7200
RP173-2311-01†	Standard	230 VAC/220 VDC	7200
RP173-2314-00	View A-A 180°	115 VAC/110 VDC	7200
RP173-2315-00**	View A-A 180°	115 VAC/110 VDC	7200



Unit Shown in De-Energized Position
RP173-2310-XX Shown



* Includes ruggedized frame.
† Includes contact-wear indicator line.
** Modified for slower release time.

RP133

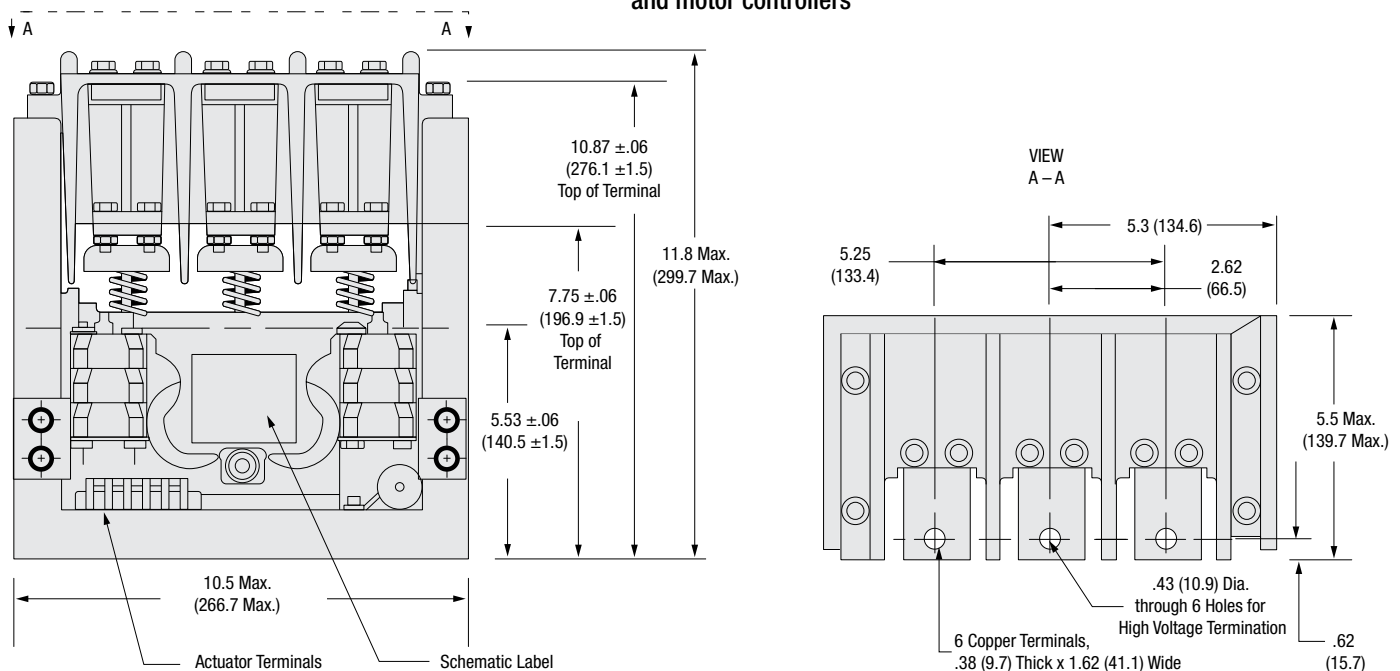


The Jennings RP133 Vacuum Contactor may be small — only 11.8"H x 10.5"W x 5.5"D — and weigh less than 30 lbs., but it can take on requirements of the most demanding equipment. Using a trio of vacuum interrupters, the three-phase unit provides a short contact-to-contact gap required to interrupt the circuit for highly reliable operation. The contact materials are rated for 1.5 kV, 450 amp load life and 4500 amp fault current.

Designed to withstand the frequent switching required to control furnaces and large air conditioning motors, the RP133 is commonly used to protect power transformers and DC power supplies. Use it to switch capacitor banks for voltage regulation and power factor correction as a means of reducing operating costs. Reliable and durable, the RP133 can also be used in motor controllers that operate production and processing equipment, mining and construction equipment, earth movers or carriers, power shovels, rock crushers and conveyors.

Features

- Sealed main contacts provide a minimum of 1 million maintenance-free open and close operations
- Reliable operation in harsh temperature extremes ranging from -20°C to 70°C
- Versatility for use with heavy-duty motors, power equipment and motor controllers



VOLTAGE RATINGS

Maximum Three-Phase Line (V & kV)	600 and 1.5
Dielectrics 50/60/400 Hz, 60-Second Withstand	
— Line-to-Ground (kV RMS)	6.5
— Line-to-Line (kV RMS)	6.5
— Across Open Contacts (kV RMS)	6.5
BIL, 1.2 x 50 μ sec Impulse	
— Line-to-Ground Peak (kV)	20
— Line-to-Line Peak (kV)	20
— Across Open Contacts (kV)	20

CURRENT RATING

Continuous (Amps RMS)	450
Load-Switching (Amps RMS)	450
— Capacitors	750 KVAR @ 1.5 kV
— Motors	750 HP @ 1.1 kV
Making Current (Random Make)	
— 100 Times @ 1.5 kV with 3-Second Backup (kA RMS)	4.5
— 10 Times @ 1.5 kV with Current-Limiting Fuse (kA)	28 peak
— 100 Times @ 1.5 kV with 3-Second Backup (kA RMS)	6
Minimum Load Life @ 450 amps RMS	1 million open/close operations
Interrupt (Amps RMS @ 1.5 kV)	4500

ACTUATOR

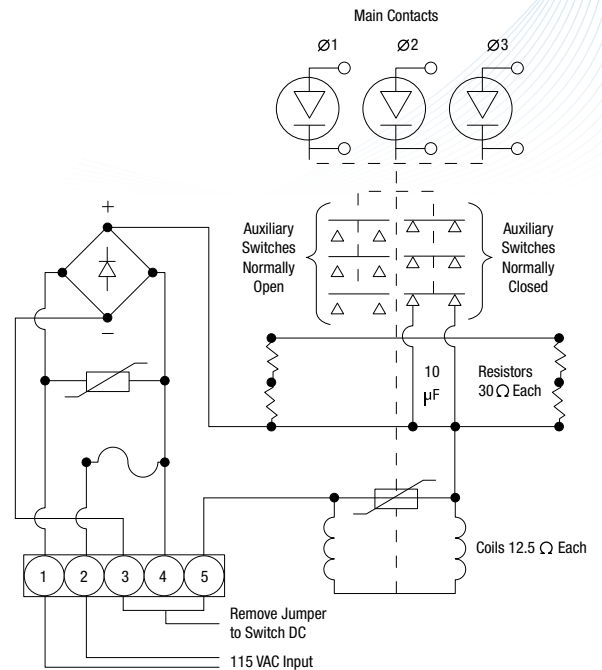
Control Voltage	115 VAC, 50/60 Hz or 110 VDC
Control Current	7.1 pull-in amps, 0.9 hold-in amps
Auxiliary Contacts Configuration	2 N/C, 3 N/O, SPST double break, 10 amps resistive @ 600 VAC

MECHANICAL

Weight (lb.)	30 max.
Release Time (msec.) from Control Switch Off to Separation of Main Contacts	16 max.
Mounting	Operates in any position

OPTIONS

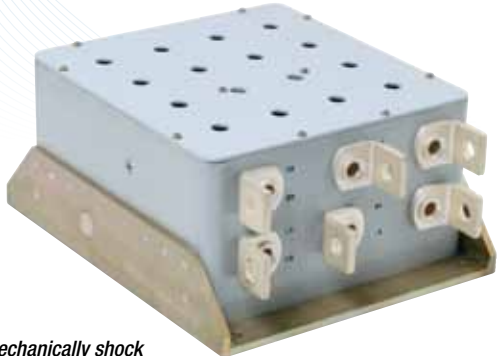
Product Number	Mounting Option	Actuator Volts	Line-to-Line Voltage (RMS)
RP133-2332-00	2332	115 VAC/110 VDC	1500
RP133-2332-01	2332	115 VAC/110 VDC	3300
RP133-2334-00	2334	100 VDC	1500
RP133-2335-00	2335	115 VAC/110 VDC	1500



Unit Shown in De-Energized Position



RP151B



Mechanically shock hardened version available as shown

Features

- Erosion-resistant contacts provide a minimum of 250,000 operations for long, maintenance-free life
- 2000 amps RMS interrupting capacity — ideal for use in an overload interrupter
- Three-phase, normally open operation provides high-speed interrupt

The Jennings RP151B Three-Phase Vacuum Contactor is a compact, normally open, three-phase device for use in equipment that requires a high speed interrupt. It is useful as an overload interrupter to 2000 amps RMS interrupting capacity. Special erosion-resistant contacts provide an operational load life of 250,000 maintenance-free operations at the rated 200 amp current.

VOLTAGE RATINGS

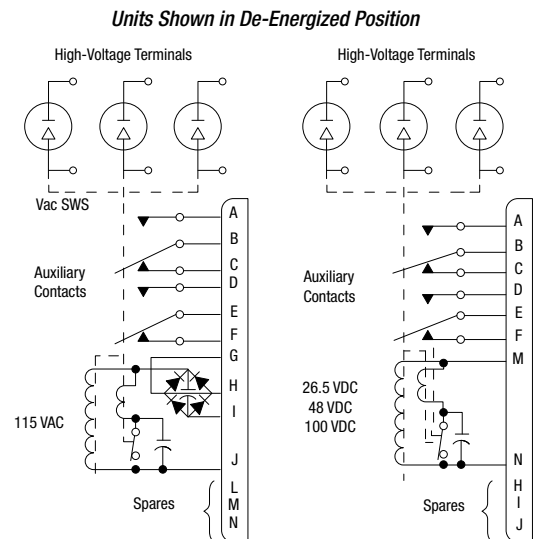
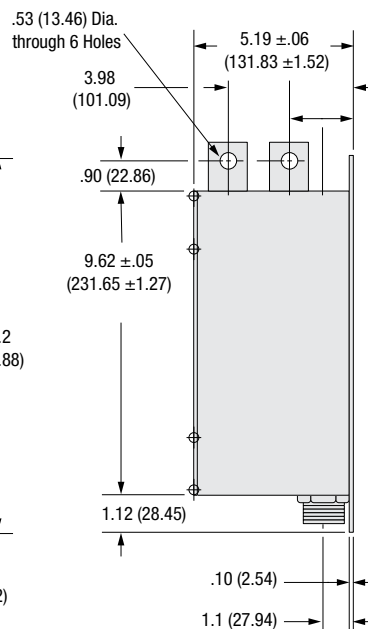
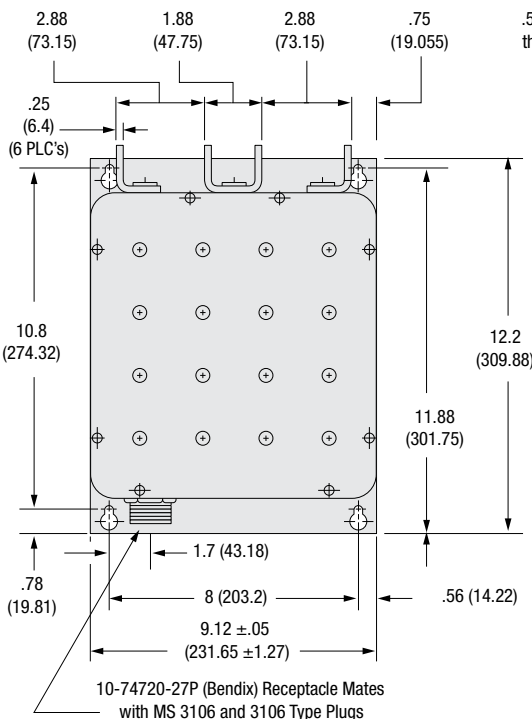
50/60/400 Hz (V)	600
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CURRENT RATING

Continuous (Amps RMS)	200
Maximum Interrupting Current (Amps)	2000
Minimum Load Life	250,000 operations
Interrupt	Less than 2 cycles
Auxiliary Contacts Configuration	DPDT, 115/230 VAC, 8 Amps

OPTIONS

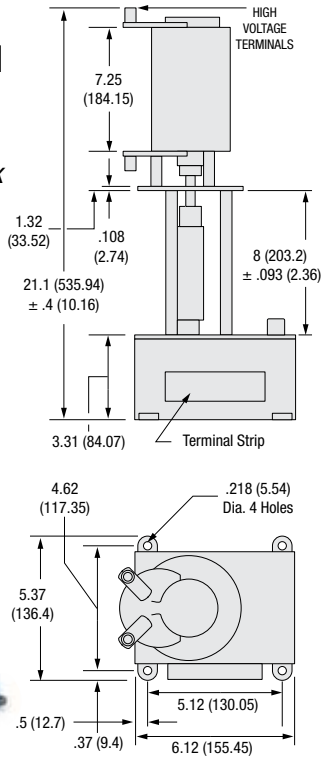
Product Number	Mounting Option	Voltage	Pull-In Current (Amps)	Hold Current (Amps)
RP151B4541X44R20	4541	26.5 VDC	4.0	0.40
RP151B4541X46R20	4541	100 VDC	1.5	0.05
RP151B4541X47R20	4541	115 VAC	1.5	0.05
RP151B4541X4XR20	4541	50 VDC	2.1	0.17
RP151B4548X46R20	4548	100 VDC	1.5	0.05



RP101F, RP901K and RP900K



RP900K



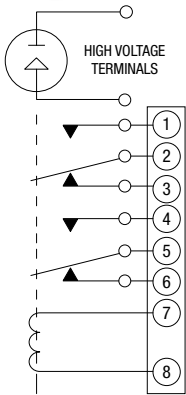
These contactors feature a vacuum interrupter and an actuator linked together by an insulated actuating rod. The contactors provide all of the operating advantages of vacuum interrupting plus the benefits of a matching actuator-solenoid motor. They offer a minimum of 100,000 operations and are ideal for use in high power broadcast transmitters.

	RP101F	RP901K	RP900K
VOLTAGE RATINGS			
Test Voltage (kV Peak)	50	70	70
Rated Voltage (kV Peak)*	30	50	50

CURRENT RATING			
Continuous (Amps RMS)	100 DC	200 DC	200 RMS
Maximum Interrupting Current (Amps)	—	—	4000
Maximum Interrupt DC Power (kW)	500 (10 amps max.)	500 (10 amps max.)	—

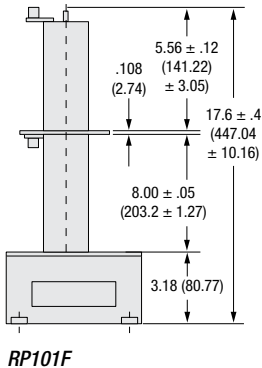
SPECIFICATIONS			
Capacitor Discharge Decaying to 0 in 200μs (kA)	50	100	100
Contact Resistance (Micro Ohms)	200	500	200
Contact Capacity (pF)	4.5	5.5	5.5
Contact Inductance (nH)	32	45	45
Mechanical Life (operations)	100,000	100,000	100,000
Auxiliary Contacts	DPDT	DPDT	DPDT
Auxiliary Contact (Volts AC RMS)	230	230	230
Auxiliary Contact Current (Amps RMS)	15	15	15

* Derate to 15.5 kV RMS for 50/60 Hz cycle power.

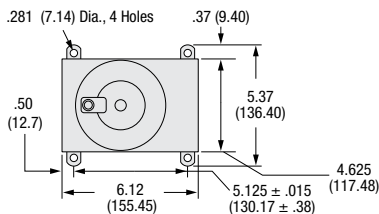


OPTIONS

Product Number	Contact Arrangement	Insulator Length (in.)	Actuator (Volts)	Pull-In Current (Amps)	Hold Current (Amps)	Hold Power (Watts)	Time to Close (msec)	Break Time (msec)
RP101F4903D21B20	N/O	6	115 VAC	5.20 RMS	0.54 RMS	18.0	46	26
RP101F4304D26B20	N/C	6	100 VDC	15.00 DC	0.07 DC	7.0	36	30
RP101F4903A21B20	N/O	2	115 VAC	5.20 RMS	0.54 RMS	18.0	46	26
RP101F4903D2KB20	N/O	6	110 VAC/50 Hz	3.00 RMS	0.30 RMS	17.0	46	26
RP901K4903D21B30	N/O	6	115 VAC/60 Hz	5.20 RMS	0.54 RMS	18.0	60	50
RP900K4903D21B30	N/O	6	115 VAC	5.20 RMS	0.54 RMS	18.0	25	46
RP900K4904D21B30	N/C	6	115 VAC	5.20 RMS	0.54 RMS	18.0	40	70
RP900K4903D2LB30	N/C	6	220 VAC/50 Hz	2.50 RMS	0.35 RMS	12.0	40	70
RP900K4601D26B3C	N/O	6	100 VDC	3.75 DC	0.14 DC	14.3	18	7
RP900K4602D26B30	N/C	6	100 VDC	3.75 DC	0.20 DC	20.0	23	14
RP900K4315E26B30	N/O	8	100 VDC	1.50 DC	0.07 DC	7.0	80	10
RP900K4665XX6B30	N/C	NA	100 VDC	3.75 DC	0.20 DC	20.0	40	12
RP900K4667DX6B30	N/O	6	100 VDC	5.20 DC	0.14 DC	15.9	18	7
RP900K4803D25B30	N/O	6	48 VDC	2.00 DC	0.14 DC	7.0	40	100
RP900K4803D26B30	N/O	6	100 VDC	1.60 DC	0.07 DC	7.0	40	100
RP900K4903C2KB20	N/C	4	115 VAC/50 Hz	5.10 RMS	0.70 RMS	19.0	26	46



RP101F



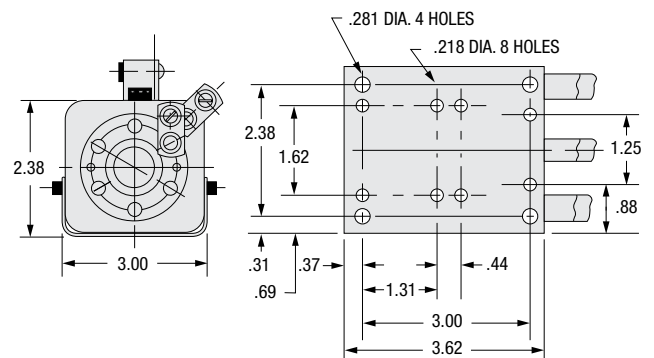
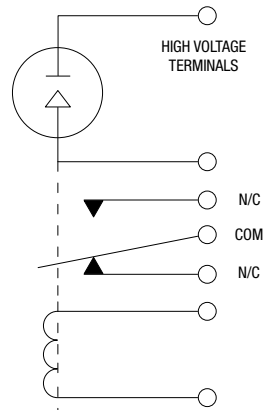
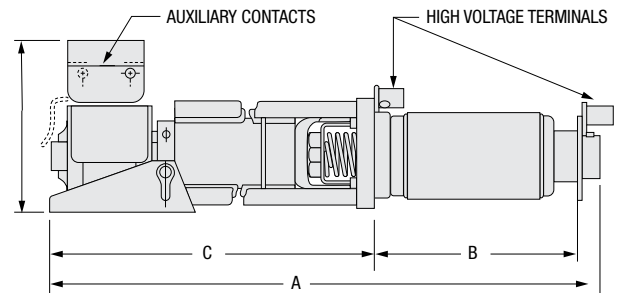
RT1G and RT8A



GENERAL SPECIFICATIONS								
PRODUCT NUMBER	CONTACT ARRANGEMENT	OPERATING VOLTAGE (kV PEAK)	CONTINUOUS CURRENT (AMPS)	MAX. INTERRUPT AC CURRENT (AMPS RMS)	MAX. INTERRUPT DC POWER (kW)	CAPACITOR DISCHARGE 0 IN 200 μ SEC. (AMPS)	MAX. CONTACT RESISTANCE (M Ω)	APPROX. CONTACT CAPACITY (pF)
RT1G4202C21A10	N/C	20	100	500	100	1000	3.00	3.5
RT1G4201C22A10	N/O	20	100	500	100	1000	0.01	3.5
RT8A4201D22A10	N/O	40	100	2000	100	3000	0.30	2.5
RT8A4202D22A10	N/C	40	100	2000	100	3000	0.30	2.5
RT1G4401E21B10*	SPDT	20	100	500	100	1000	3.00	3.5
RT8A4401D21B10*	SPDT	40	100	1000	100	3000	0.30	2.5

Type SPST (N/O and N/C)

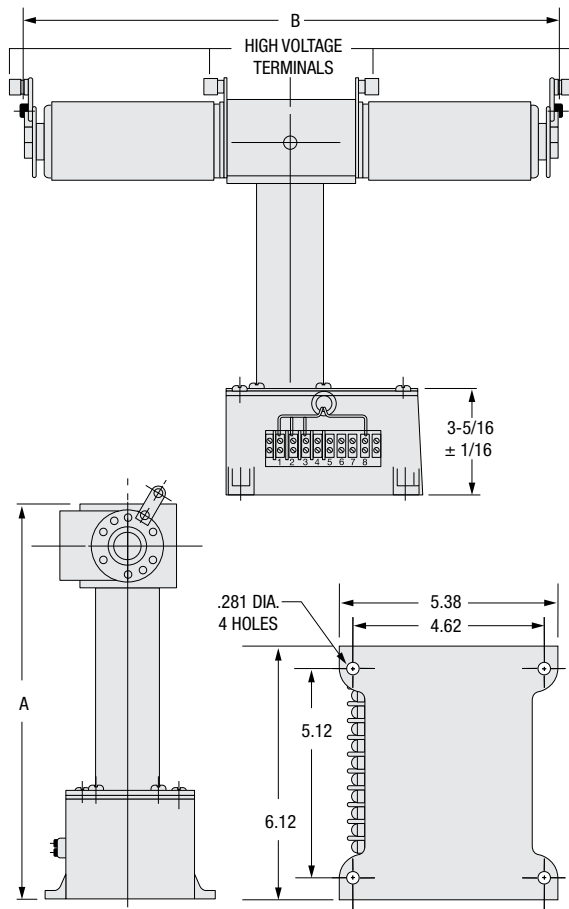
TYPICAL MODEL	RT1G	RT8A
Insulation	4" – 55 kV	6" – 75 kV
Dimension A $\pm$ 0.19	13.53	18.91
Dimension B $\pm$ 0.13	5.00	8.38
Dimension C $\pm$ 0.06	8.03	10.03



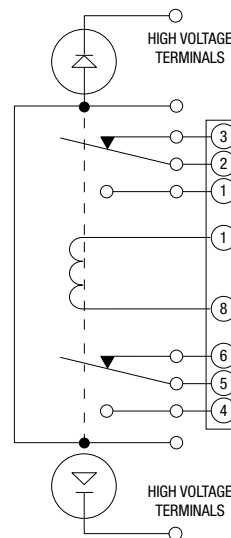
* To order latching models, change 4401 to 4402 in product number.

RT1G and **RT8A**
ACTUATOR SPECIFICATIONS

ACTUATOR VOLTAGE at 50/ 60 Hz (VAC)	PULL-IN CURRENT (AMPS)	HOLD CURRENT (AMPS)	HOLD POWER (WATTS)	TIME TO CLOSE (MSEC)	BREAK TIME (MSEC)	MECH. LIFE (OPERATIONS)	WEIGHT (Lbs.)	AUXILIARY CONTACTS NO. & TYPE	AUXILIARY CONTACT VOLTAGE (VAC RMS)	AUXILIARY CONTACT CURRENT (AMPS RMS)
115	2.5	0.5	17	60	25/30	100,000	2	1 SPDT	115	15
230	1.2	0.2	17	60	25/30	100,000	2	1 SPDT	230	15
230	1.2	0.2	17	60	25/30	100,000	4	1 SPDT	230	15
230	1.2	0.2	17	60	25/30	100,000	4	1 SPDT	230	15
115	2.5	0.5	17	60	25	100,000	8	2 SPDT	115	15
115	2.5	0.5	17	90	90	100,000	10	2 SPDT	115	15


Type SPDT

TYPICAL MODEL	RT1G	RT8A
Insulation	6" – 80 kV	6" – 80 kV
Dimension A ± 0.4	14.8	14.8
Dimension B ± 0.5	16.2	23.0



RF Contactors

Jennings High Voltage Vacuum RF Contactors

RF Switching

The use of a vacuum as a contact environment provides increased operating reliability and ensures long life. Low contact resistance is maintained even when high current causes overheating or arcing occurs.

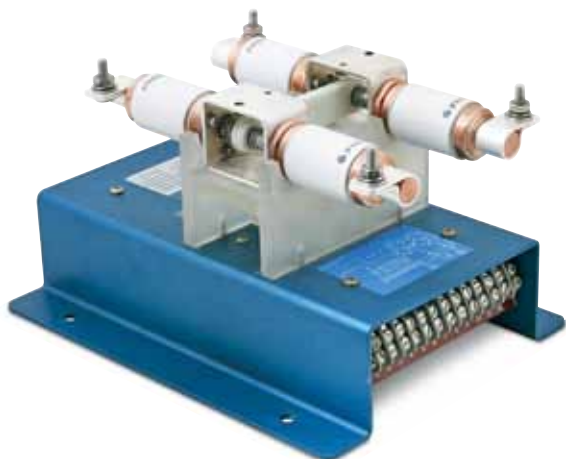
The high dielectric strength of a vacuum and its very fast recovery after arcing are features that manifest themselves in the small size of the vacuum contactor. Only slight contact separation is required to withstand high voltages. The limited contact movement results in a small contactor size. This reduction in overall size makes available RF switchgear with low inductance and low capacitance.

Applications

Vacuum contactors are commonly used in the MF and RF bands to handle currents ranging from 20 to several hundred amps. Typical applications include band switching of transmitters, switching filter sections and antenna multicoupler, antenna reflector switching, tap changing of RF coils used in induction and dielectric heating RF generators and switching of transmission lines.

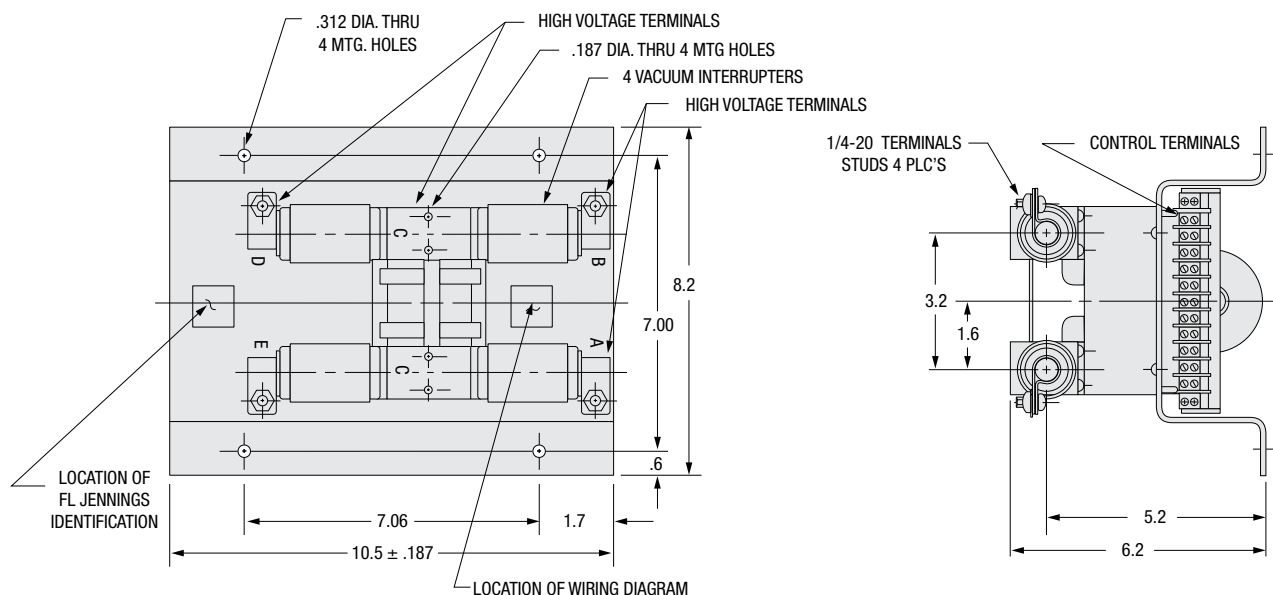


RT22-4070-A31NB and RT22-4070-A317B



RT22-4070-A31NB and RT22-4070-A317B are vacuum contactors with DPDT contact arrangements. These units can also be used as SPDT contactors by wiring the contacts in parallel. These contactors are commonly used in antenna switching for high power RF circuits, such as those encountered in transmitters.

	RT22-4070-A317B	RT22-4070-A31NB
VOLTAGE RATINGS		
Rated Voltage (kV Peak) @ 2 MHz	22	22
Operating Voltage (VACR RMS) @ 50/60 Hz	115	230
CURRENT RATING		
Continuous (Amps RMS) @ 2 MHz	40	40
Max. Contact Resistance (MΩ) @ Rated Continuous Current	500	500
Max. Capacitance Across Open Contacts (pF)	2.5	2.5
Max. Capacitance Contacts to Frame (pF)	1.0	1.0
SPECIFICATIONS		
Max. Opening Time (msec.)	300	300
Max. Closing Time (msec.)	300	300
Actuator Type	Latching	Latching
Actuator Voltage (VACR)	115	230
Max. Pull-In Current (Amps)	0.4	0.3
Dielectric Withstand to Frame (V) @ 60 Hz RMS for 1.0 min.	1250	1250
Max. Weight (lbs.)	12	12
Mechanical Life (operations)	250,000	250,000
Auxiliary Contact Rating @ 115/230 VAC RMS (Amps)	15	15



Jennings Technology is known worldwide as a leader in non-thermionic vacuum components. In addition to relays, coaxial relays and contactors, we offer a full line of vacuum and gas filled capacitors and vacuum interrupters. For more information, contact us today.

Capacitors

- Vacuum Variable (up to 5000 pF)
- Vacuum Fixed (up to 2500 pF)
- Vacuum Trimmable Fixed (up to 1720 pF)
- Vacuum Feed-thru Fixed (up to 25 pF)
- Gas Filled Fixed (up to 1000 pF)
- Gas Filled Variable (up to 45 pF)

Features

Long life, high reliability | High voltage ratings | Wide running ranges | Self-healing | High altitude operation | Compact design

Common Applications

RF matching for semiconductor fab equipment, flat panel display | Power amplifier tank circuits | Pulse shaping circuits | Dielectric heating equipment tank circuits | Low inductance, high current bypass applications | Non-magnetic circuits for MRI and NMR

Relays

- SPST Vacuum Relays (up to 33 kV)
- SPDT Vacuum Relays (up to 30 kV)
- Gas Filled Relays (up to 70 kV)

Features

Long life, high reliability | Low contact resistance | High voltage & current carry capabilities | Fast recovery rates | Fast operating speeds | Compact design | Maintenance free | Military qualified

Common Applications

Vapor deposition etch equipment for semiconductor equipment | RF broadcast transmitters for radio & TV | Satellite communications & deep space applications | Airborne & mobile communications | Medical MRI & heart defibrillators

Interrupters

- Utility Applications (up to 38.0 kV)
- Industrial Applications (up to 7.2 kV)
- RF and dc Applications (up to 50 kV and 40kVDC)

Features

Long life, high reliability | High interrupting speed | Rapid dielectric recovery | High cycle withstand voltages | Freedom from catastrophic failure | Compact design | Economical | Non-flammable, non-toxic | Quiet | Oilless operation | Environmentally friendly

Common Applications

Electrical power generation & distribution systems | Capacitor banks | Line dropping | High power transmitters | RF induction & electric furnaces

Vacuum Contactors

- Three-Phase Contactors (up to 7.2 kV)
- SPST Contactors (up to 50 kV)
- SPDT Contactors (up to 40 kV)
- RF Contactors (up to 25 kV and 116 VAC)

Features

Long life, high reliability | No contact maintenance | Environmentally friendly | Compact design | Eliminates arc chute replacements

Common Applications

Primary control of power supplies | Industrial motor controls | Induction heating equipment | RF system tap changing | Fault protection of high power transmitters

Vacuum Coaxial Relays & Switching Matrices

- SPST Coaxial Relays (up to 90 kW CW)
- SPDT Coaxial Relays (up to 90 kW CW)
- DPDT Coaxial Relays (up to 7.5 kW CW)

Features

Long life, high reliability | High speed switching | Low, stable contact resistance | Maintenance-free operation | Compact design | Application flexibility

Common Applications

High speed antenna switching | Transmit/receive switching | Crossbar matrices | CCTV, CATV | Microwave telemetry & data acquisition links

	Capacitors	Relays	Coaxial Relays	Contactors	Interrupters
Communication	•	•	•	•	•
Transportation	•	•			
Utilities & Power Sources	•	•		•	•
Medical	•	•			•
Military	•	•	•	•	•
Semiconductor	•	•	•		
Space		•	•		
Detection & Test Equipment	•	•	•	•	•
General Industry		•		•	•

Jennings Technology offers a complete line of high voltage vacuum and gas filled components. For specifications, drawings and other technical data, please contact your local sales representative or visit www.jenningstech.com.





CAPACITORS



RELAYS



INTERRUPTERS



CONTACTORS



COAXIAL RELAYS



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