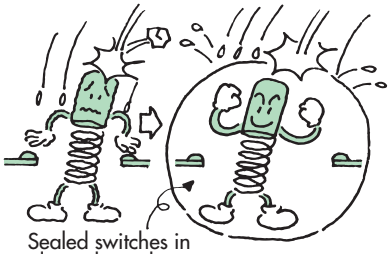
YASKAWA

Q&A

Hermetically Sealed Power Contact

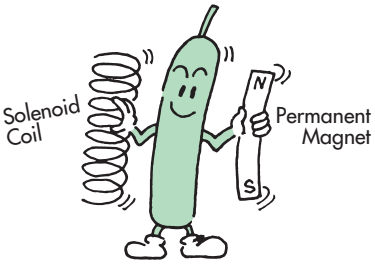
Bestact®

What is Bestact?


Sealed switches in glass tube with inert gas

Q: What is Bestact?

A : Briefly, it is a hermetically sealed contact in a glass tube that can be used in circuits up to 240VAC or 230VDC. This means it remains entirely unaffected by external factors such as gas, dust, water and oil, and maintains extremely high reliability and function over a long period of time. We call it "Bestact", our abbreviation for Best Contact".



Q: How does Bestact open and close?

A : Just like conventional reed switches, a permanent magnet or solenoid coil is used.

Q: How different is it from conventional reed switches in terms of performance?

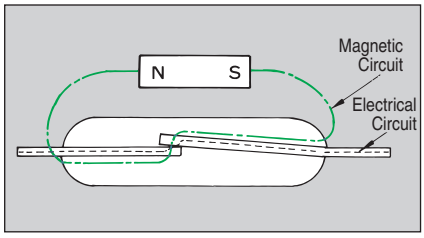
A : The major differences can be summarized as follows;

	Conventional Reed Switches	Bestact (R15)	Bestact (R25)
Applicable Circuit Voltage	100VAC max 50VDC max	240VAC max 230VDC max	240VAC max 115VDC max
Max. Continuous Current	0.5A	5A	3A
Max. Making Current	100VAC 1A max	240VAC 30A ($\cos\phi$=0.3～0.4)	240VAC 15A ($\cos\phi$=0.3～0.4)
Max. Breaking Current	100VAC 0.2A (Contact Protection circuit required)	240VAC 30A ($\cos\phi$=0.3～0.4) 115VDC 0.6A (τ=L/R=100ms)	240VAC 15A ($\cos\phi$=0.3～0.4) 115VDC 0.5A (τ=L/R=40ms)
Contact Resistance	100mohms	500mohms max	500mohms max
Withstand Voltage Across Contacts	500VDC	800VAC	500VAC

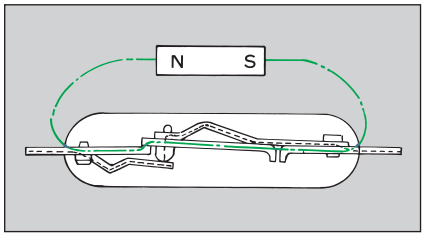
Q: Is its structure the same as conventional reed switches'?

A : No, it is completely different. The basic principle of operation is the same, but the structure is completely different. In conventional reed switches, the current flow path is common with the magnetic flow path. Bestact uses a dual contact structure, consisting of an electrical circuit section and a magnetic circuit section. This unique structure characterizes excellent performance and reliability in Bestact.

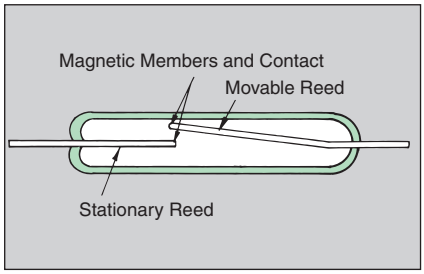
● Magnetic and Electrical Circuits of Conventional Reed Switches



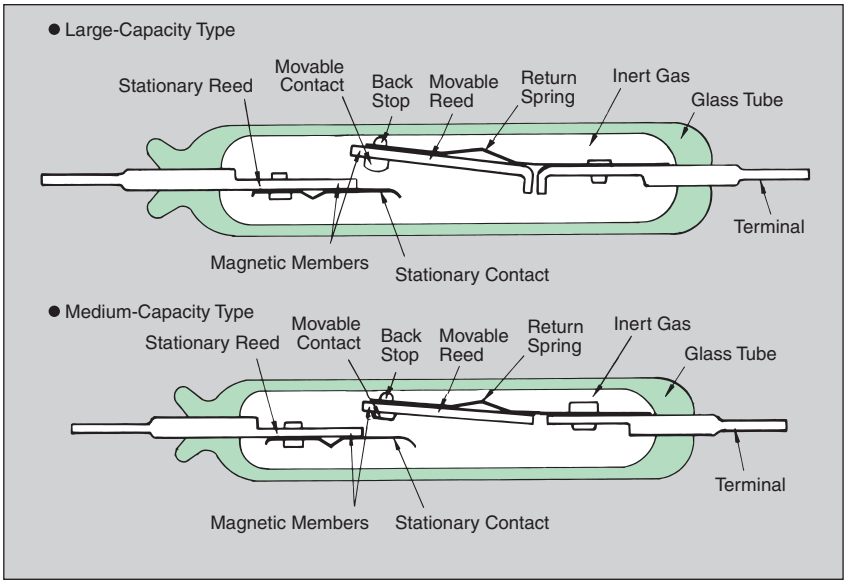
● Magnetic and Electrical Circuits of Bestact



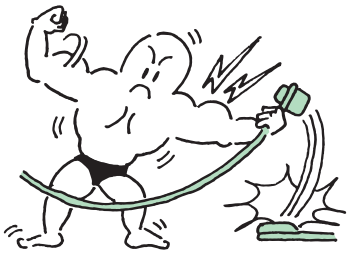
● Structure of Conventional Reed Switches



● Structure of Bestact



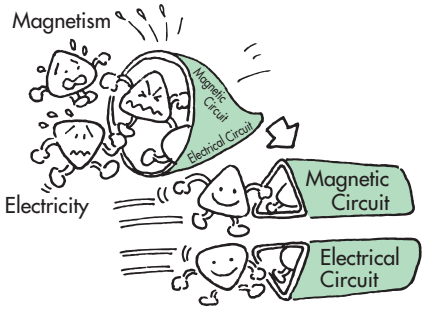
Why is Bestact free from contact sticking?



Q-1: According to the chart above, Bestact has a large switching capacity, doesn't it?

A : That's right. As compared with conventional reed switches, Bestact has approximately hundred times larger switching capacity. But this is not all. Bestact also has the following advantageous features;

* Low contact resistance and high stability
* Little or no switching surge
* Free from sticking even without contact protection circuits
* Large DC breaking capacity available
* Excellent resistance to vibration and shock

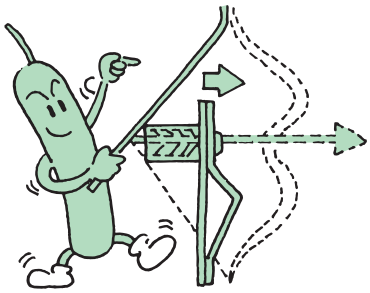


Q-2: Why does the dual contact construction provide Bestact with such large capacity?

A : Because the optimum materials and mechanism are used in both electrical circuit section and magnetic circuit section. And in design, we gave consideration to contact shape, contact pressure, breaking speed and over current capacity.

Q-3: Why is the Bestact free from contact welding and sticking?

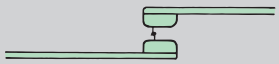
A : In a word, it is because Bestact has a very large switching capacity. Conventional reed switches have a switching capacity of only around 50VA (resistive) at the most. Consequently they frequently suffer from contact welding - due to the electrostatic storage (capacitive) capacity of long cable runs or contact sticking the inrush current of inductive loads, which is due to insufficient repulsive force when the circuit is closed. That's why conventional reed switches normally need contact protection circuits to prevent these faults.
Bestact mechanically charges the return spring and imparts a hammering effect to open the contacts with a large separating force and at high speeds. Made of newly developed heat-resistant material, Bestact will not contact weld or stick, even without contact protection circuitry such as R/C snubbers and diodes, making it possible to use it like a normal contact.



Q-4: What is hammering effect?

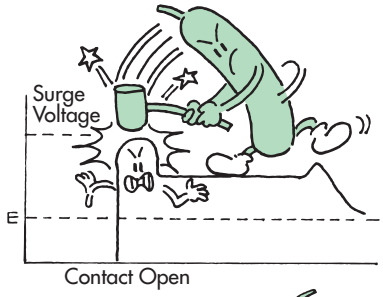
A : It exhibits the function of a bow and arrow. When the armature loses pull force, the movable contact is instantaneously snapped away by the repulsive energy of the armature return spring and stationary contact (contact spring). This helps in breaking small molten contact bridges that often happen in DC circuits.

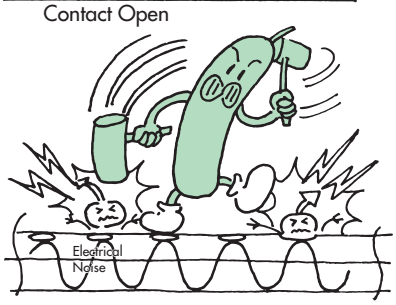
〈Contact Bridge〉



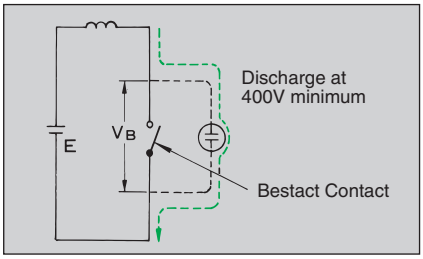
Arc heat from breaking current causes the coating on the contact to peel off. A whisker-like piece, called a contact bridge, can connect the contacts and keep electricity flowing through them although the circuit is essentially set to open. Contact bridges are mostly invisible to the naked eye.

Is there really no surge or noise?

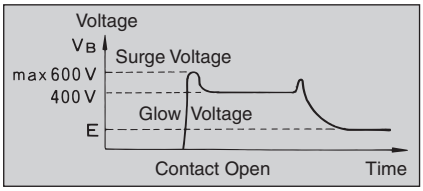


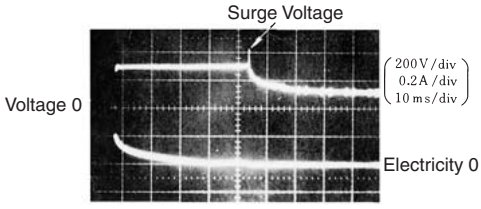


● Equivalent Circuit With Bestact Opened

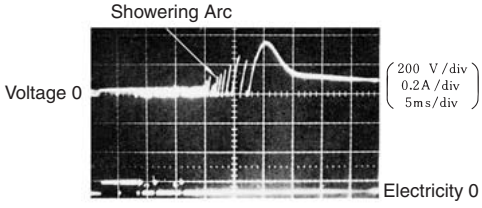


● Voltage Between Contacts With Bestact Opened





(a) DC Breaking Characteristics of Bestact



(b) DC Breaking Characteristics of Conventional Power Relays

Q-1: Doesn't Bestact need contact protection circuits even for inductive load circuits?

A : Not at all. Contact protection circuits are mainly provided to avoid contact welding from the breaking of inductive load circuits and to control surge voltage. Designed to meet or exceed JEM-1230 solenoid relay standards for control use, Bestact switches break inductive load completely. By restraining surge voltages, Bestact requires no contact protection systems when used within the range of rated current.

Q-2: The absence of switching surge helps in preventing noise for electronic circuits, doesn't it?

A : Absolutely.

Q-3: Why isn't there any switching surge?

A : Unlike conventional reed switches, Bestact uses glow discharge before high surge voltages occur, providing operational characteristics that are similar to a circuit with a glow lamp in parallel with the contacts. Although it is not true that Bestact does not produce any surge, it can limit its switching surge smaller than 600V in both AC and DC circuits.

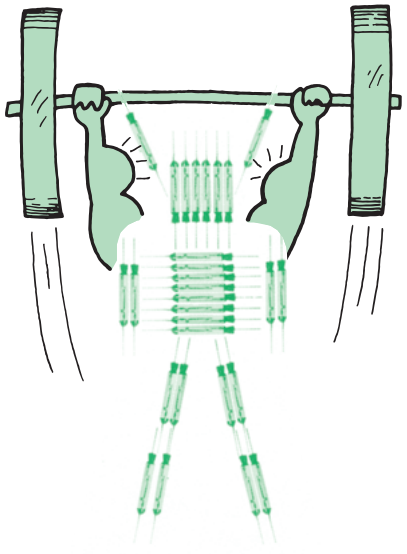
Q-4: Does Bestact's good DC breaking performance come from glow discharge?

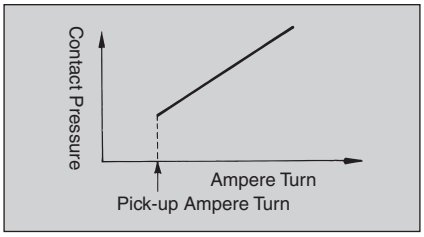
A : Correct. DC inductive loads are normally broken by a long time of arc discharge. This means they normally require contact capacity sufficient to withstand the resulting heat, and a gap between the contacts to remove the arc. Bestact, however, breaks inductive loads while reducing current in the region of the glow discharge. Consequently Bestact switches produce little heat and very low contact damage. A comparison of Bestact and conventional large plug-in relays for DC breaking performance showcases the difference. Bestact has better DC breaking performance than mechanical power relays.

● Bestact is stronger than power relays in DC breaking performance

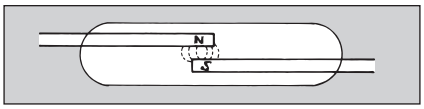
	RAP-6G (Yaskawa Product)	Bestact (R15)	Bestact (R25)
Rated Continuous Current	8A	5A	3A
Rated Operational Current 240VAC(cos ϕ =0.3~0.4) 115VDC(L/R=100ms)	3A 0.2A	1A 0.5A	0.5A 0.3A(L/R=40ms)
Electrical Life	200,000 times at 115VDC (L/R=100ms) 0.2A	300,000 times at 115VDC (L/R=100ms) 0.5A	300,000 times at 115VDC (L/R=40ms) 0.3A

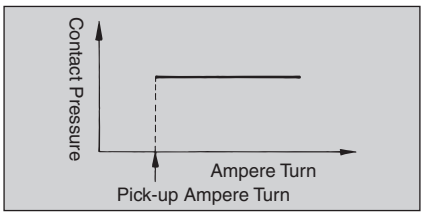
Q Can it be used for both magnetic control applications and electronic circuits?



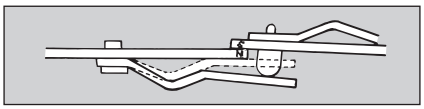


● Conventional Reed Switches





● Bestact



Q-1: Can it directly open and close DC solenoids?

A : Yes, R15 can do it up to about 50VA directly and is the most suitable for valve switches such as DC solenoids.

Q-2: Do you mean that Bestact can perform functions of both conventional reed switches and mechanical power relays?

A : That's right, but that is not all. By using a single Bestact, the reliability rises significantly; circuit wiring becomes simpler eliminating the need of contact protection circuitry or interposing relays.

Q-3: Can Bestact be also used in electronics component circuits?

A : Yes it can. Because of the dual contact structure and the wiping effect, it provides excellent reliability for both analog circuits and dry circuits. According to our field failure data, reliability is significantly better than both mercury relays and semiconductor relays.

Q-4: So can Bestact be used with circuits at any level?

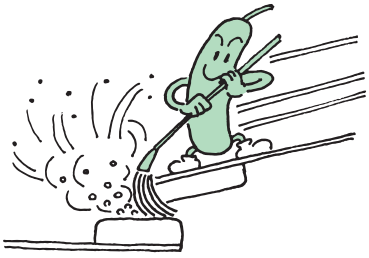
A : It can be used in circuits from 24VDC 1mA up to about 240VAC 1A (inductive load), which makes it ideals as the output contact for controllers. There is no need to worry about load voltage or current levels.

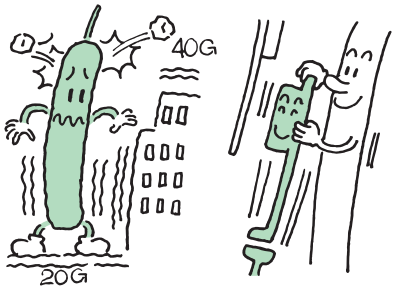
Q-5: Why is the contact resistance so low, and performance so stable?

A : Contact pressure is fixed, and furthermore the movable contact makes contact by a wiping action. In conventional reed switches, the electrical contact and magnet contact parts are common, so contact pressure changes with magnetic contact. And because it is a simple contact, changes in contact pressure cause large changes in contact resistance.

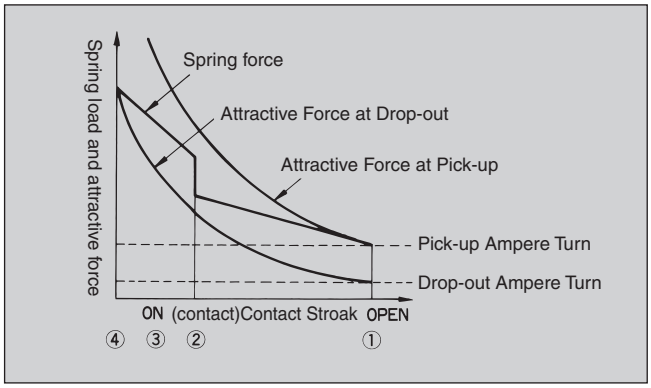
Q-6: How well does Bestact resist against vibration and shock?

A : In the weakest axis, 20G against vibration, 40G against shock. Its movable contact, which is small, compared to that of the conventional reed switches, and the spring-assisted return presses it against the glass tube (back stop mechanism) to make it strong against vibration and shock even when non-energized.





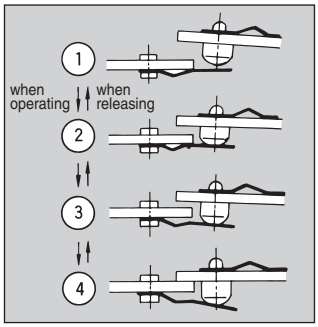
● Operational Characteristics of Bestact



Q-7: Explain the operating principles of the Bestact.

A : Let's take a look at the key points on comparison with conventional reed switches.

● Contact movement of Bestact



● When Operating

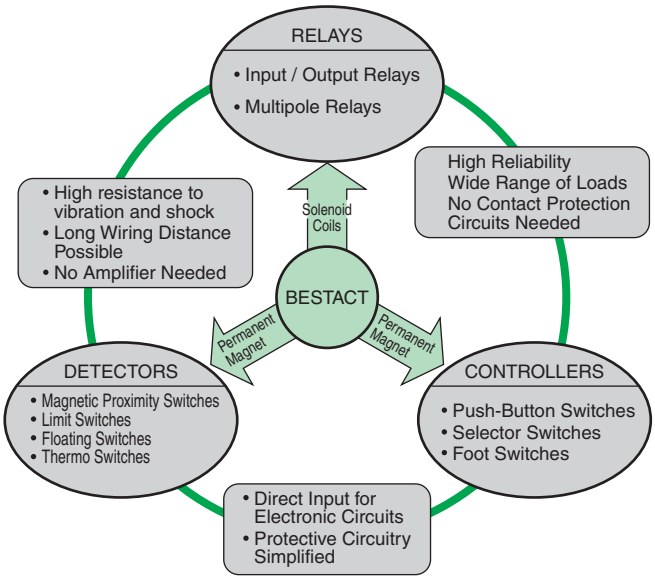
	Bestact	Conventional Reed Switches	Bestact Features
1	Upon closure the ampere turns magnetic (closing) pull force defeats the armature return spring force, causing the armature to move.	Magnetic pull force defeats armature force and moves armature.	—
2	When the armature is moved, the movable contact defeats the stationary contact spring force, and moves the stationary reed as well.	Contact is common with magnetic part, so there is no movements here.	
3	As pull force increases the movable contact defeats the stationary contact spring force, and moves the stationary reed as well.		• Wiping effect
4	The stationary reed touches the armature. The contact force is determined by the difference between the stationary reed spring force and the return spring force, and is not related to magnetic force.	Stationary reed and armature touch, breaking the contact. Contact force varies with magnetic force.	• Contact force is constant for stable contact resistance.

● When releasing

	Bestact	Conventional Reed Switches	Bestact Features
4	At the drop-out ampere-turn level the magnetic members break contact.	At the drop-out ampere turn level, the magnetic members break contact, and the contact is broken at the same time, causing it to gradually leave contact at zero contact pressure. This makes contact sticking.	—
3	Pull force decreases, and the stationary contact spring force and return spring force combine to return movable contact. Even so, the contact remains closed with a certain degree of pressure.		
2	When the stationary contact returns to its rest position the contact opens. At this time, the stationary contact spring force (hammering energy) causes the movable contact to fly off.		• Hammering effect • Destruction of contact bridges • Excellent breaking effect
1	The armature comes to its rest position inside the glass tube, through the backstop mechanism.	The armature returns to its rest position, but because there is no stop mechanism, it continues to move, which makes sticking and re-striking of the contact possible.	• Strong resistance against vibrations and shocks.

Q-7: How can Bestact be used?

A : It can be used in conjunction with a solenoid relay, the energization of a coil, or limit switches and float switches when used with a permanent magnet. Bestact has excellent resistance to environmental conditions, and because it has large capacity and low contact resistance, it produces low surge and noise. This means it can be used in a wide rang of application from solenoid control circuits to electronic circuits with superb cost performance capabilities.



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