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ReliaVac®
Vacuum Interrupter

230 kV ReliaVac®

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CLEAVELAND / PRICE INC.

14000 Rt. 993, Trafford, PA 15085 (724) 864-4177
FAX (724) 864-9040
Email: sales@cleavelandprice.com

ReliaVac® Interrupters

The Cleaveland/Price ReliaVac® is a vacuum interrupter attachment for use with Cleaveland/Price switches in substation and transmission applications. The device is available as a single bottle interrupter for switches rated 15 kV through eight bottle interrupter assemblies for 230 kV switches. Typical switching applications include:

- load switching
- loop switching
- line/cable charging switching

The vacuum interrupter switching capabilities were tested using circuit conditions specified by IEEE Standard 1247-2005 and IEC 62271-103-104. Testing consisted of load interrupting to 2000 A., line/cable capacitance interrupting to 370 A., shunt capacitor switching, and loop splitting. A 1000 operation mechanical endurance test was also performed.

69 kV V2-CAV switch with ReliaVac® interrupters in transmission application

The Cleaveland/Price Difference

While Cleaveland/Price follows the industry practice of stacking vacuum interrupters in a support tube, the similarity between the ReliaVac® and other switch interrupter attachment designs stops there. Cleaveland/Price has taken innovative approaches to address issues relating to vacuum interrupters that customers have shared with us. New design features include:

- The insulating medium in the housing is air that will hold the voltage across the bottles. With the ReliaVac®, there is no gas or oil to leak, and no desiccant to saturate within the interrupter housing. A special vent prevents condensation.
- There are no external mechanisms or bumpers to ice up. Return springs and dampers are enclosed in the housing.
- The vacuum bottle assembly within the interrupter support tube is kept in compression by bias springs to prevent the braze joints of the ceramic bottles from seeing tensile loads that result from the high speed mechanism actuating the contacts.
- The compression system also prevents the vacuum bottles from leaking due to shock loads that could occur during shipping.
- The arc horn has been designed to withstand high closing currents for longer lasting performance.

See Technical Brief No. TB15-001 for additional information.

Interrupter Operating Sequence

15 kV, 2000 A V2-CA with a single bottle ReliaVac® interrupter, shown in the pre-trip position.

Switch Opening

- When the air switch is closed, the interrupting unit is in the closed position and is not in the current path.
- As the switch blade begins its opening motion, a parallel current path is established through the arcing components.
- The moving arc horn contacts the actuating arm and the current is commuted to the closed interrupter.
- The actuating arm is raised high enough to actuate the quick-opening mechanism, which moves all of the vacuum contacts simultaneously to the open position. This causes the vacuum interrupters to break the power circuit.
- The blade and actuating arm separate and the mechanism automatically returns the bottle contacts to the closed position while the air switch provides circuit isolation.

Switch Closing

- When the air switch blade is returned to the closed position, the blade tip pushes past the sprung actuating arm to reset for the next opening stroke. A closing arc is struck between the moving and stationary arcing components.
- Once the air switch is fully closed the interrupter is out of the current path of the disconnect switch.

ReliaVac® Advantages

Air as a Dielectric Medium

Some interrupter systems use oil or gas as a dielectric medium within the interrupter support tube. These systems require seals that must be dependable for the life of the interrupter. Daily variations in ambient air pressure exert a stress on the seals that could lead to leaking. Leaking not only releases the dielectric medium, but may allow the accumulation of moist air within the support tube. The moist air may condense and cause a flashover across bottles within the assembly.

The ReliaVac is unique in that it uses air as a dielectric medium to eliminate the problem of leaking oil or gas. Cleaveland/Price's tested solution to prevent condensing humidity is to establish conditions within the tube that inhibit the air from becoming saturated and condensing.

Through use of a vent with an ePTFE membrane, water particles and contaminants are prevented from passing into the vacuum interrupter support tube. Conversely, the vent membrane allows water vapor to exit the tube. Water vapor is absorbed into, diffused through, and released from the membrane. The combination of controlling humidity within the tube and the thermal insulating properties of air in the tube acts to prevent a rapid change of humidity and temperature that would cause vapor within the interrupter tube to condense. With the special vent, internal and external air pressure is always near equilibrium, eliminating stress on seals.

Protected Trip Mechanism

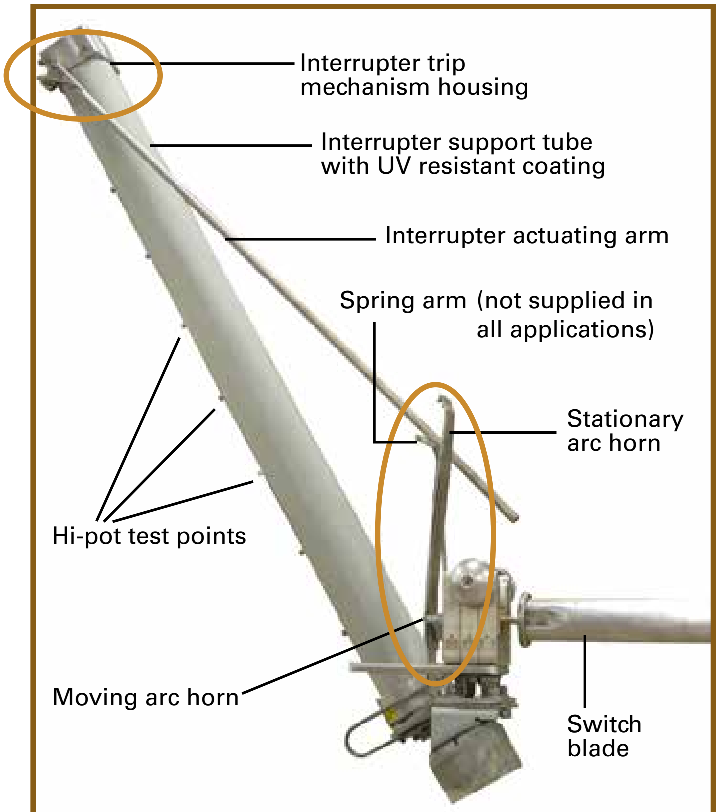
Actuating arm return stroke motion control is integrated into the mechanism design. Return springs and dampers are enclosed in the housing. There are no external mechanisms or bumpers to ice up. The vacuum interrupter assembly is factory adjusted so no field adjustment is needed.

Applications requiring long actuating arms are supplied with a simple external, one-piece spring arm that provides additional motion control along with accurate and repeatable positioning of the arm in the closed position. This is important for dependable engagement with the switch blade at the start of the opening stroke.

Effective Arc Horns

Vertical break switches with ReliaVac attachment feature an advanced arc horn system. The stationary arc horn is specially designed to maintain constant contact with the moving arc horn until the interrupter pickup arm is engaged. This prevents chatter arcing during switch operation.

The moving arc horn, attached to the end of the blade, drives the interrupter actuating arm on switch opening. The arc horn has no moving parts that can go out of adjustment. The design also withstands high closing current values, making frequent replacement of arc horns unnecessary.



Interrupter Routine Testing

At Cleaveland/Price, interrupter attachment routine testing includes recording of interrupter contact stroke and tripping speed. Simultaneous contact opening is verified and recorded on multibreak assemblies. After the interrupter assemblies are installed in the support tubes, the units are subjected to no-load mechanical operations.

Following the mechanical operations test, air is removed from the assembly and the tube is pressurized with argon gas. This argon soaking procedure serves to check the housing's sealing system integrity and exposes breaches in vacuum bottles faster than would occur under standard atmospheric conditions. A damaged vacuum seal will allow argon into the vacuum chamber and produce low AC power frequency withstand values during the subsequent hi-pot test. This procedure verifies that the vacuum interrupter integrity was maintained throughout the assembly process.

ReliaVac®
Interrupter Ratings

This brochure describes standard product and does not show variations in design that are available. Contact the factory for additional details.

Cleaveland/Price reserves the right to make changes or improvements in the product shown in this brochure without notice or obligation.

Capability Ratings and Number of Bottles Required - Ungrounded Neutral System*

		Loop			Full Load		
Nom. kV	Max. kV	No. of Bottles	Loop switching < 30% PF **2000 A.**		Line switching **370 A.**	Load switching ≥ 70%PF **2000 A.**	No. of Bottles
14.4	15.5	1	60.2 kV at 95 μs	TRV Peak		15.9 kV at 100 μs	1
			41 kV	Peak Recovery Voltage	66 kV	22 kV	
23	27	1	60.2 kV at 95 μs	TRV Peak		15.9 kV at 100 μs	1
			41 kV	Peak Recovery Voltage	66 kV	22 kV	
34.5	38	1	60.2 kV at 95 μs	TRV Peak		31.8 kV at 100 μs	2
			41 kV	Peak Recovery Voltage	133 kV	44 kV	
46	48.3	1	60.2 kV at 95 μs	TRV Peak		31.8 kV at 100 μs	2
			41 kV	Peak Recovery Voltage	133 kV	44 kV	
69	72.5	1	60.2 kV at 95 μs	TRV Peak		47.8 kV at 100 μs	3
			41 kV	Peak Recovery Voltage	200 kV	67 kV	
115	123	1	60.2 kV at 95 μs	TRV Peak		72.6 kV at 100 μs	5
			41 kV	Peak Recovery Voltage	303 kV	102 kV	
138	145	1	60.2 kV at 95 μs	TRV Peak		82.7 kV at 100 μs	6
			41 kV	Peak Recovery Voltage	346 kV	116 kV	
161	170	2	120.4 kV at 95 μs	TRV Peak		100 kV at 100 μs	8
			82 kV	Peak Recovery Voltage	418 kV	141 kV	
230	245	2	120.4 kV at 95 μs	TRV Peak		100 kV at 100 μs	8**
			82 kV	Peak Recovery Voltage	418 kV	141 kV	

*contact the factory for solidly grounded neutral system
**solidly grounded neutral system only