

TYPE VLB LOAD INTERRUPTER SWITCHES are designed to interrupt transformer magnetizing currents, line charging currents, and load currents at locations where the cost of a circuit breaker having fault interrupting ability may not be justified, and the use of air break switches is hazardous because the resulting unconfined electric arcs may develop into system faults.

The Type VLB combines the functions of circuit interrupter and disconnecting switch. It will break load or charging currents without the danger of an unconfined arc, while providing the disconnecting switch advantage of positive, visible air-gap isolation of the de-energized equipment. It requires but little more space than a disconnecting switch, and is economical, since the same insulators which support the switch provide line-to-ground insulation for the interrupter.

The VLB load interrupter switch consists of a standard disconnecting switch to which is added a device capable of interrupting currents up to the continuous rating of the switch. The interrupter is a parallel-connected unit which carries current only during the interrupting interval, providing a light-weight, easy-to-operate device without subtracting from the continuous or momentary capacity of the air switch. It is porcelain-clad, gas-sealed, and requires no external supply of gas or other auxiliary apparatus for operation.

The basic disconnecting switch is the Type V, a modern vertical-break unit with ice-breaking ability, full continuous and short-time current-carrying capacity. It is easy to operate and requires minimum maintenance. (See Descriptive Bulletin 36-160 for complete details.)

WESTINGHOUSE SPECIAL FEATURES

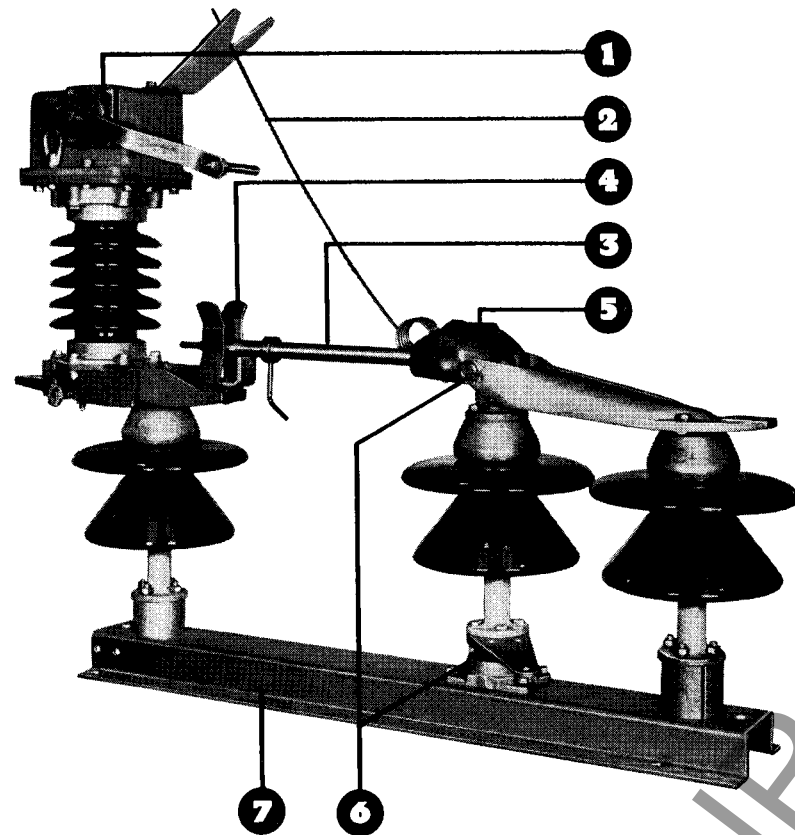
LIGHT-WEIGHT LOAD INTERRUPTER will interrupt currents up to the continuous rating of the switch.

- ▶ **High Dielectric Strength Gas, SF₆**, provides effective interruption of line charging, magnetizing and load currents, yet is not consumed and does not deteriorate appreciably during circuit interruption.
- ▶ **Parallel-Type Construction** requires the interrupter to carry load current only during the interrupting interval.

STANDARD TYPE V DISCONNECTING SWITCH provides visible air gap separating the isolated portion of the system from the energized portion.

- ▶ **High Pressure Contacts** assures good contact in spite of dirt and corrosion. There are no shunts at the hinge end.
- ▶ **Totally-Enclosed Operating Parts** provide protection against weather, affording smooth operation under severe conditions.
- ▶ **Oilite-Bushed Bearings** on live side of switch provide easy operation and permanent lubrication.

Construction



The Type VLB interrupter switch consists of a Type V vertical-break switch using three insulator stacks per pole, one of which rotates to open and close the switch blades. Attached to the switch is a gas-filled, permanently-sealed interrupter unit.

The interrupter is of the parallel-type which carries the load current only during the interrupting interval. It does not subtract from the continuous or momentary ratings of the switch, and at the same time its operating parts are small and light in weight for high speed and ease of operation.

The use of a high dielectric strength gas, SF₆, together with parallel-type design, provides a light, easily-operable, yet very effective unit for the interruption of line charging, transformer magnetizing, and load currents up to 600 amperes (50 percent power factor or above) for any voltage from 15 to 115 kv ungrounded and 138 kv effectively grounded. Each unit is a NEMA Class A device and will interrupt its rating for 500 times without maintenance or repair.

Each interrupter is equipped with a pressure gauge located so as to be visible from the ground to detect accidental loss of pressure. A filling valve is provided to allow replenishing gas in the event of a slow rate of leakage. The use of a gaseous dielectric eliminates maintenance of the filling medium and all fire hazard. In the open position, full visible air-gap isolation is provided for maximum safety for personnel.

Gas-Filled Interrupter Unit

The interrupter consists of a sealed gas-filled chamber containing an axial-flow interrupting unit. The contacts are actuated by a toggle-type spring mechanism which causes them to open and close at a speed which is substantially independent of the speed of operation of the main switch. This mechanism is located in the housing on the top of the porcelain casing which contains the contacts. A shaft passing through the wall of the housing supports the lever which the main switch blade engages to actuate the mechanism.

The interrupter contacts operate in an atmosphere of sulfur hexafluoride (SF₆), which has excellent arc-extinguishing characteristics. Only six inches of contact separation are required in this medium at atmospheric pressure to interrupt 115 kv circuits, making possible the small, light-weight interrupter which can be mounted on a conventional disconnecting switch structure.

To increase the current interrupting ability of SF₆ at high voltages, the moving contact carries a piston and orifice designed to force un-ionized gas through the arc formed by contact separation. The piston compresses gas above it as the contacts separate. When the arc is formed in the teflon orifice which also moves upward with the moving contact, the compressed gas flows down through this orifice to aid in de-ionization.

The entire interrupter unit, including the toggle mechanism housing, is filled with gas. A pressure gauge, visible from the ground, indicates any leakage from the interrupter. The chamber is filled at 30 psi and will interrupt its full rating at 15 psi. The chamber is permanently sealed and will not normally need recharging with gas during the life of the switch.

Interrupter Isolating Blade

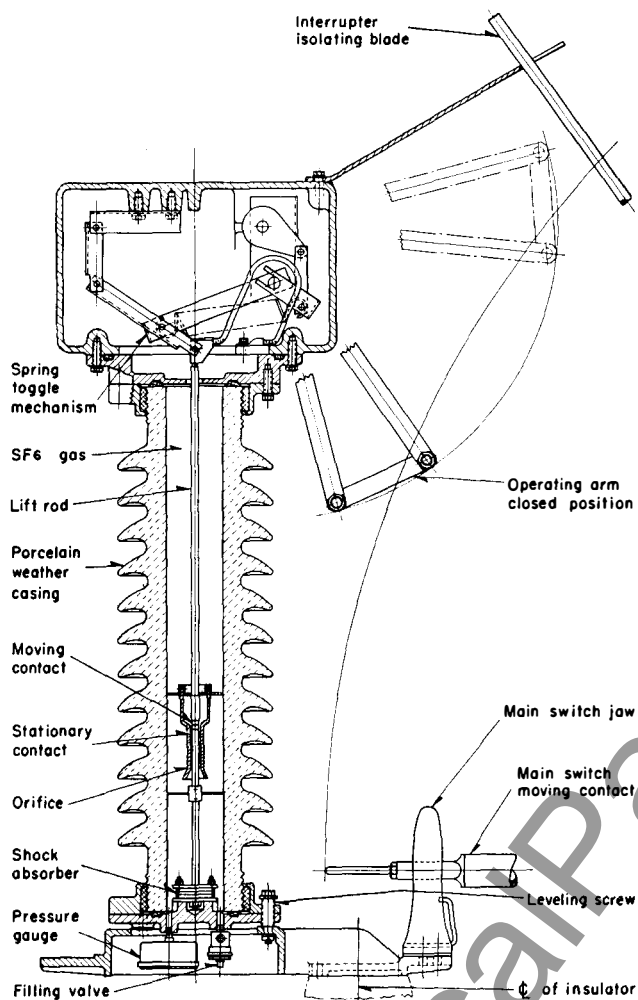
The interrupter isolating blade, which carries current only during the interrupting interval, is opened by an arm on the main switch blade. After the main blade engages the operating lever and releases the over-center toggle of the interrupter contact mechanism, further rotation of the main blade causes the arm to engage the interrupter isolating blade and raise it to the same clearly open position as the main blade.

Main Switch Blade

Main switch blade is of hard drawn copper tubing for carrying extreme fault currents. An arm on the blade is located so that it will engage the interrupter isolating blade and open it after the interrupter moving contacts have separated.

Main Switch Jaw

One-piece, beryllium-cobalt-copper, high-pressure jaw grips the main blade tightly under all loads.



● Cam Housing

The blade actuating parts of the switch are completely enclosed from the weather by the copper-alloy mechanism housing. There are only three moving parts—the rotating insulator and operating arm, blade and fork, and housing—insuring ease of operation and minimum maintenance.

● Oilite-Bushed Bearings

All moving parts on the live side of the switch are equipped with Oilite bearings to provide easy operation and permanent lubrication. The rotating insulator bushings are Oilite-bushed up to 23 kv; above 23 kv, they are equipped with dry-type stainless steel ball bearings.

● Rigid Flanged Mounting Base

The mounting base is hot-dipped galvanized bent plate steel. There are no projections below the mounting surface . . . the rotating insulator shaft extension for direct-connected mechanism is contained entirely within the base.

Application

Application of the Type VLB switch is limited to:

- **LINE SECTIONALIZING**
- **LOAD SWITCHING** up to 600 amperes at 50 to 100 percent power factor
- **TRANSFORMER MAGNETIZING CURRENT SWITCHING** on transformer banks limited to these capacities:

SWITCH RATING—KV	TRANSFORMER BANK—KVA
15, 23, 34.5, 46	35,000
69	70,000
115	100,000

- **CAPACITOR SWITCHING**, manual control only, using either manual or motor operating mechanisms with bank size limited to capacities listed below. No switching of one bank against another; no automatic switching by means of relays; and no specification as to non-restrike performance.

SWITCH RATING—KV	CAPACITOR BANK—KVA
15, 23, 34.5, 46	5,000
69	7,500
115	10,000

List Prices

Three-pole, with manual mechanism

LIST PRICE INCLUDES three-pole, single-throw, manually-gang-operated interrupter switch with manual mechanism. Price includes interphase pipe and vertical operating pipe. It also includes single-conductor, clamp-type terminals when size of cable or tubing is specified on order.

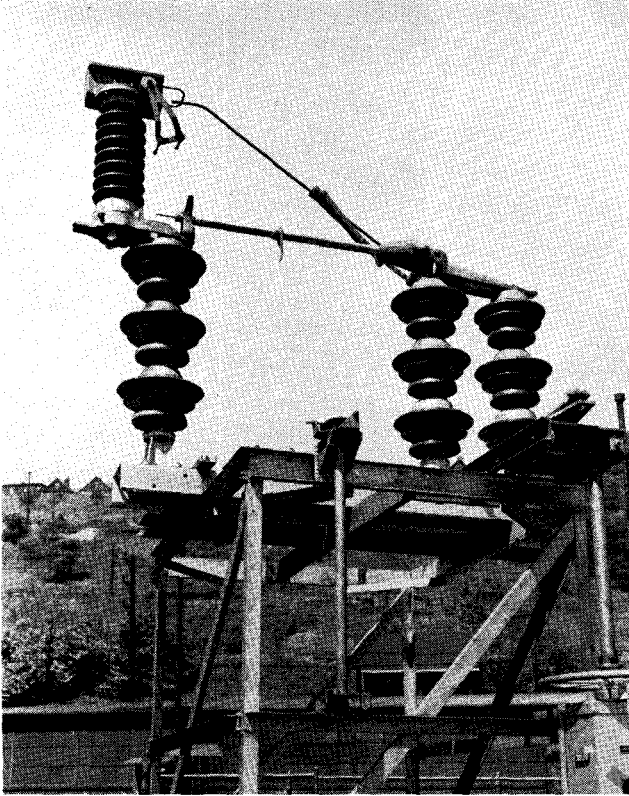
MOTOR OPERATING MECHANISM is available for use with any Type VLB switch. Refer to Catalog Section 36-164 for description, dimensions, and prices.

KV	INSULATOR TECHNICAL REFERENCE NUMBER	CONTINUOUS CURRENT RATING —AMPS	MOUNTING *	LIST PRICE
7.5 or 15	4	400	H-V-I	\$1535
7.5 or 15	4	600	H-V-I	1590
23	7	400	H-V-I	1590
23	7	600	H-V-I	1660
34.5	10	400	H-V-I	1865
34.5	10	600	H-V-I	1940
46	13	600	H-V-I	2365
69 Std. Duty	16	600	H	3260
69 Heavy Duty	56	600	H	3965
115	18	600	H	5550
138†	25	600	H	6615

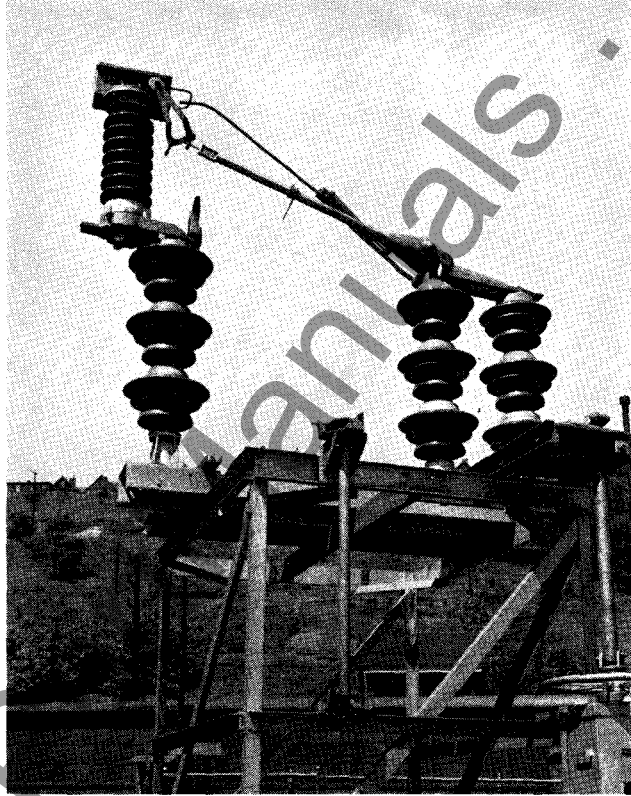
* H = Horizontal; V = Vertical Base; I = Inverted

† Switch has standard 161-kv insulators but interrupters are limited to use on 138-kv effectively grounded systems.

Operation



115-kv load interrupter switch in the closed position.



115-kv load interrupter switch after 60-degree rotation of the center insulator column.

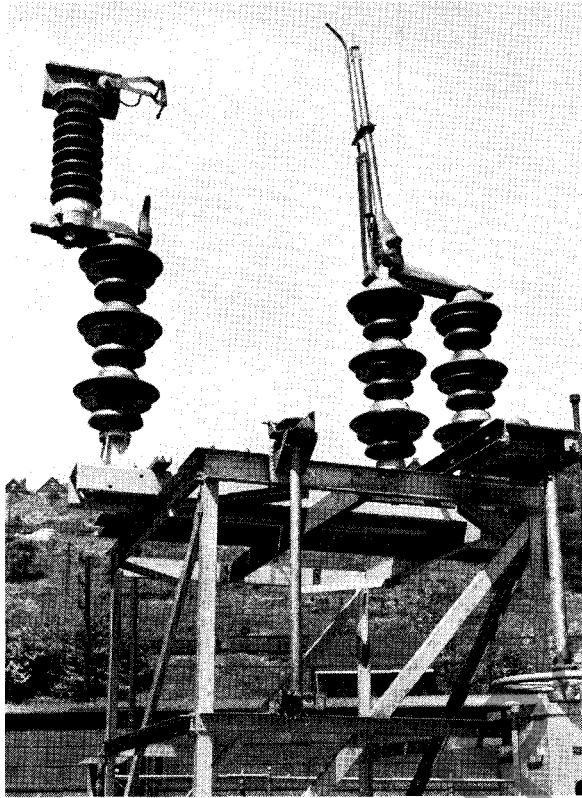
Opening Sequence

The center insulator column rotates to open the switch and interrupter in this sequence:

1. The first 30 angular degrees of rotation of the driving insulator causes the blade to rotate about its axis to give a contact-wiping and powerful ice-breaking action while releasing the pressure on the stationary contact jaws.
2. The second 30 degrees of insulator rotation causes the blade to rise from the stationary contact, thus diverting the current flow through the interrupter unit and the interrupter isolating blade.
3. After the insulator has been rotated a total of 60 degrees, the main switch blade engages the lever on the interrupter mechanism housing, tripping the over-center toggle to cause the contacts to part at high speed within the interrupter. The flow of current is thus interrupted without any external arc.
4. After tripping the interrupter mechanism, further rise of the main blade causes an arm on this blade to engage the interrupter isolating blade. The two blades then rise together during the final 40 degrees of rotation of the driving insulator to establish the full visible air gap required in the disconnecting switch.

In the closed position, the main switch contacts are closed and the separable contacts inside the interrupter are also closed. The normal current path is through the main switch blade, which by-passes the interrupter unit.

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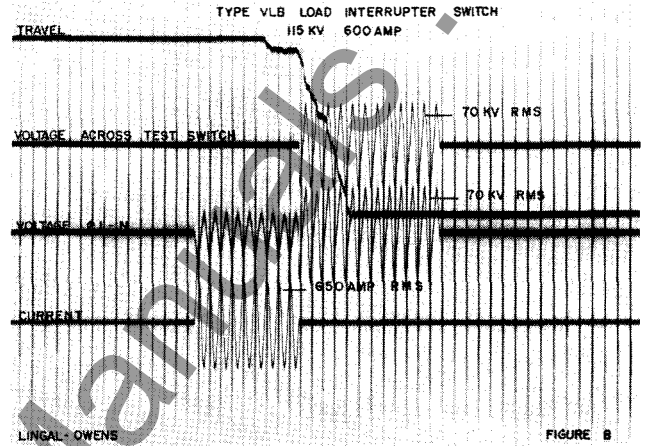


115-kv load interrupter in the full open position.

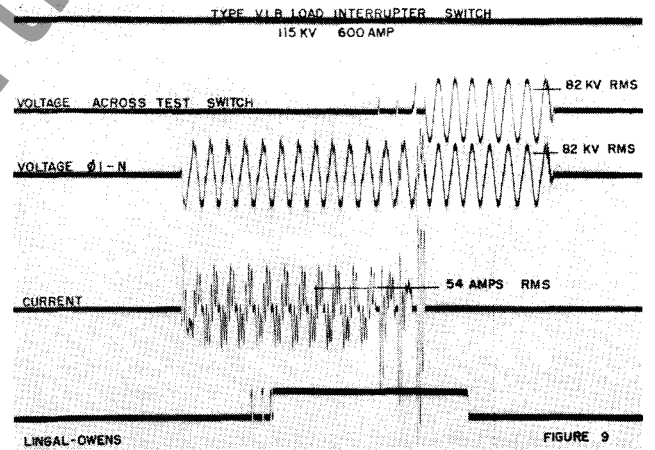
Closing Sequence

The closing sequence is the reverse of the opening sequence, so that the isolating blade is closed and the interrupter contacts made before the main switch contacts are closed. This prevents pre-striking or burning of the main switch contacts while energizing a loaded circuit.

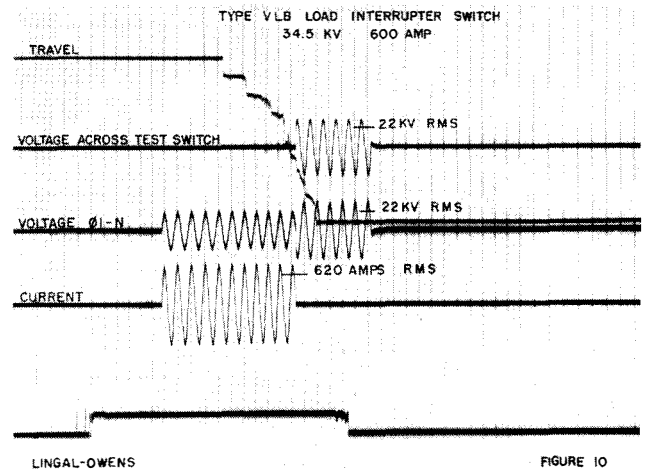
Oscillograms



115-kv load interrupter switch interrupting load current



115-kv load interrupter switch interrupting capacitor current



34.5-kv load interrupter switch interrupting load current.

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Dimensions in inches

Approximate Only. Do Not Use for Construction Purposes.

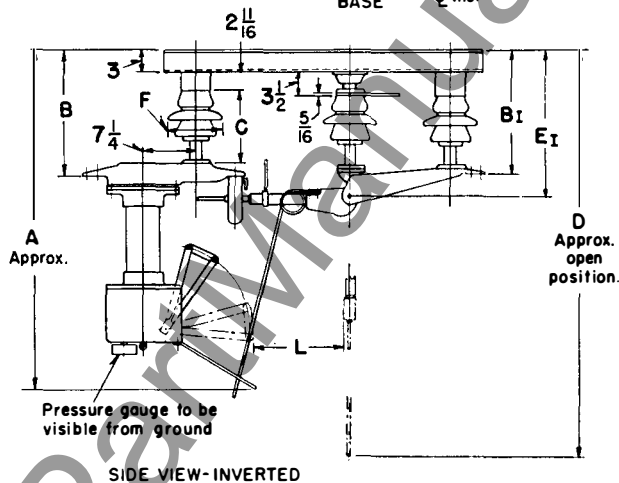
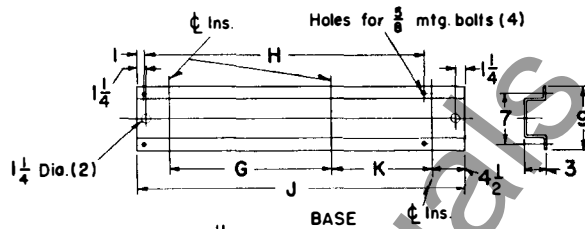
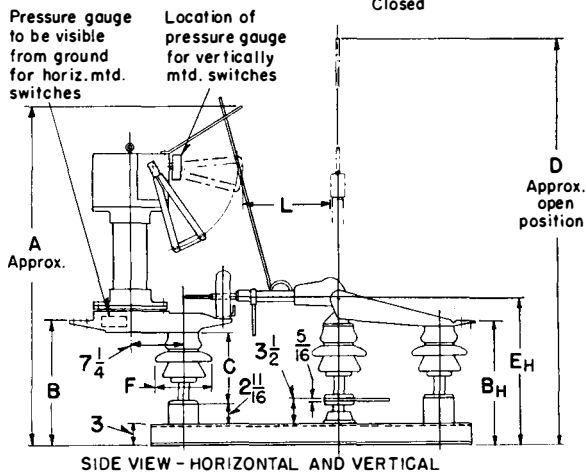
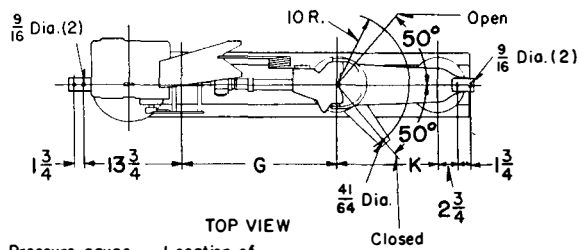


Fig. 1—15 and 23 Kv

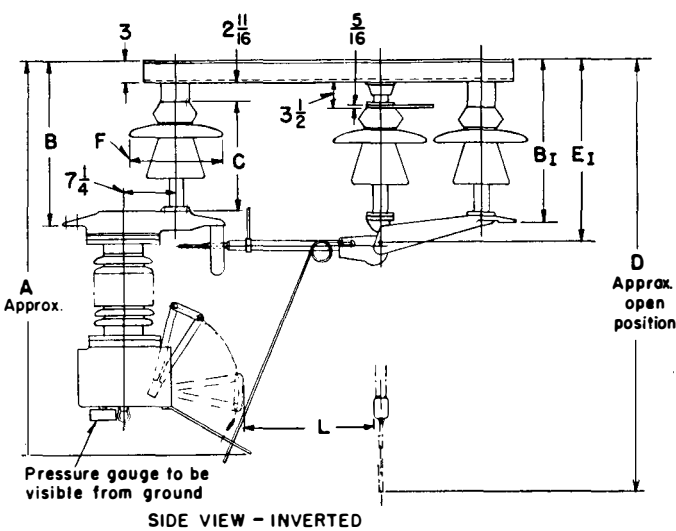
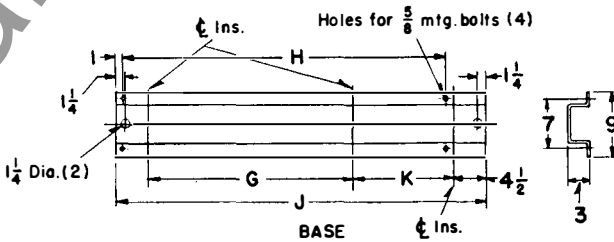
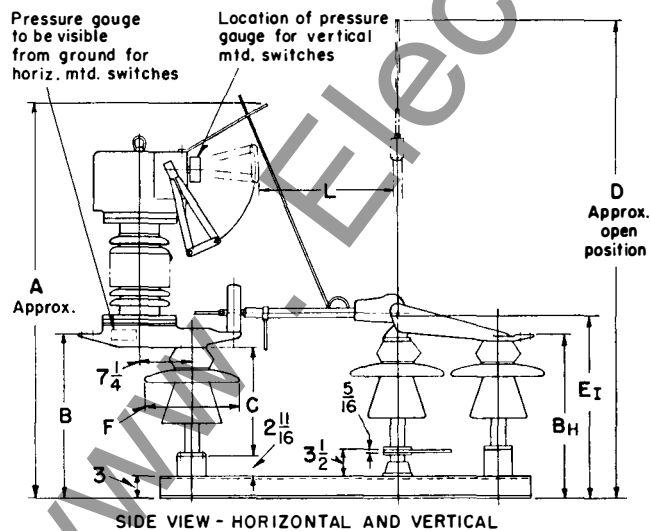
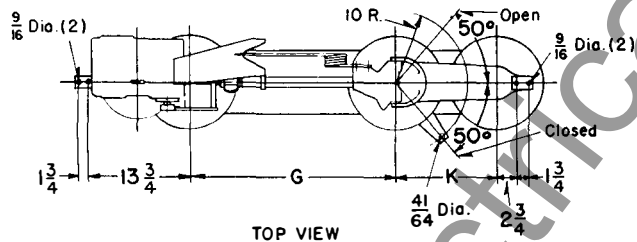


Fig. 2—34.5, 46, and 69 Kv heavy duty

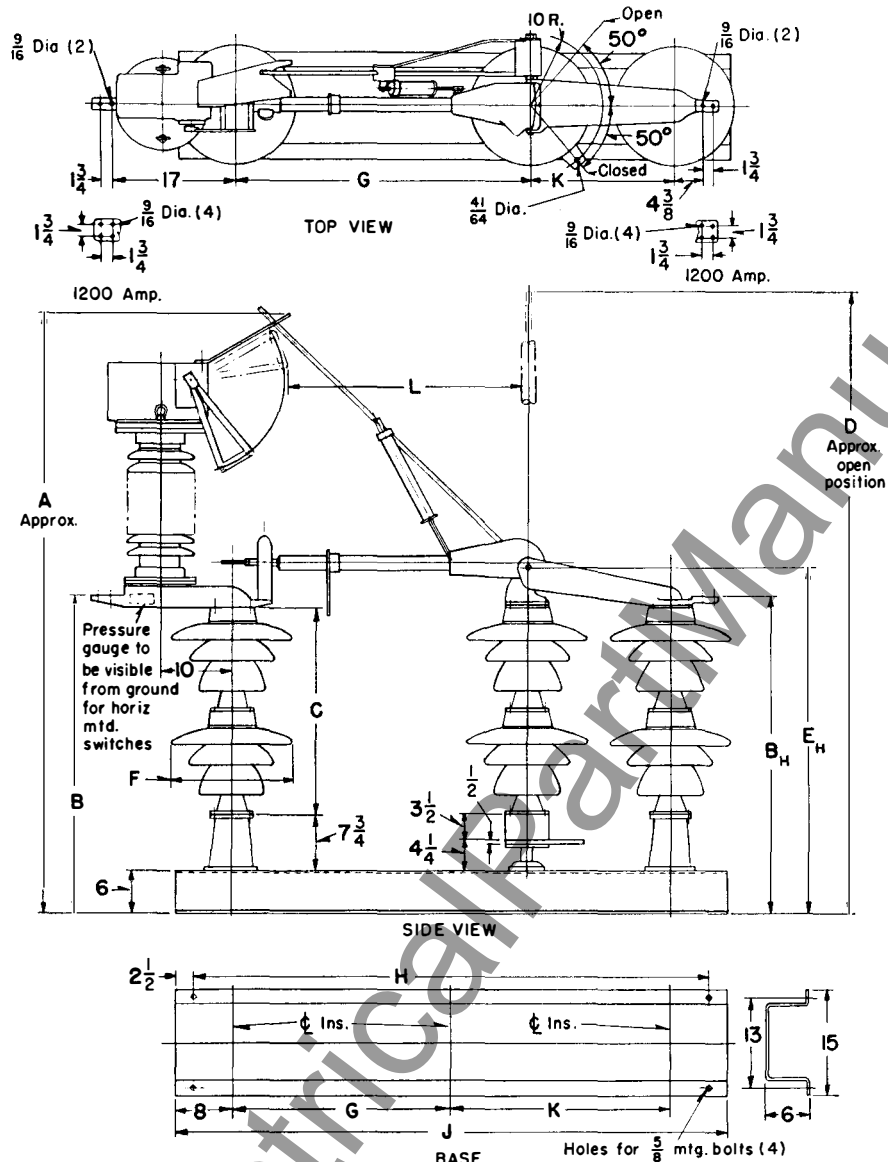


Fig. 3—69 Kv (heavy duty), 115, and 138 Kv

Dimensions in inches Approximate only. Do not use for construction purposes.

KV	AMPS. CONTINUOUS	DIMENSIONS IN INCHES											
		A	B _H	B _I	C	D	E _{II}	E _I	F	G	H	J	K

Fig. 1—15 and 23 Kv

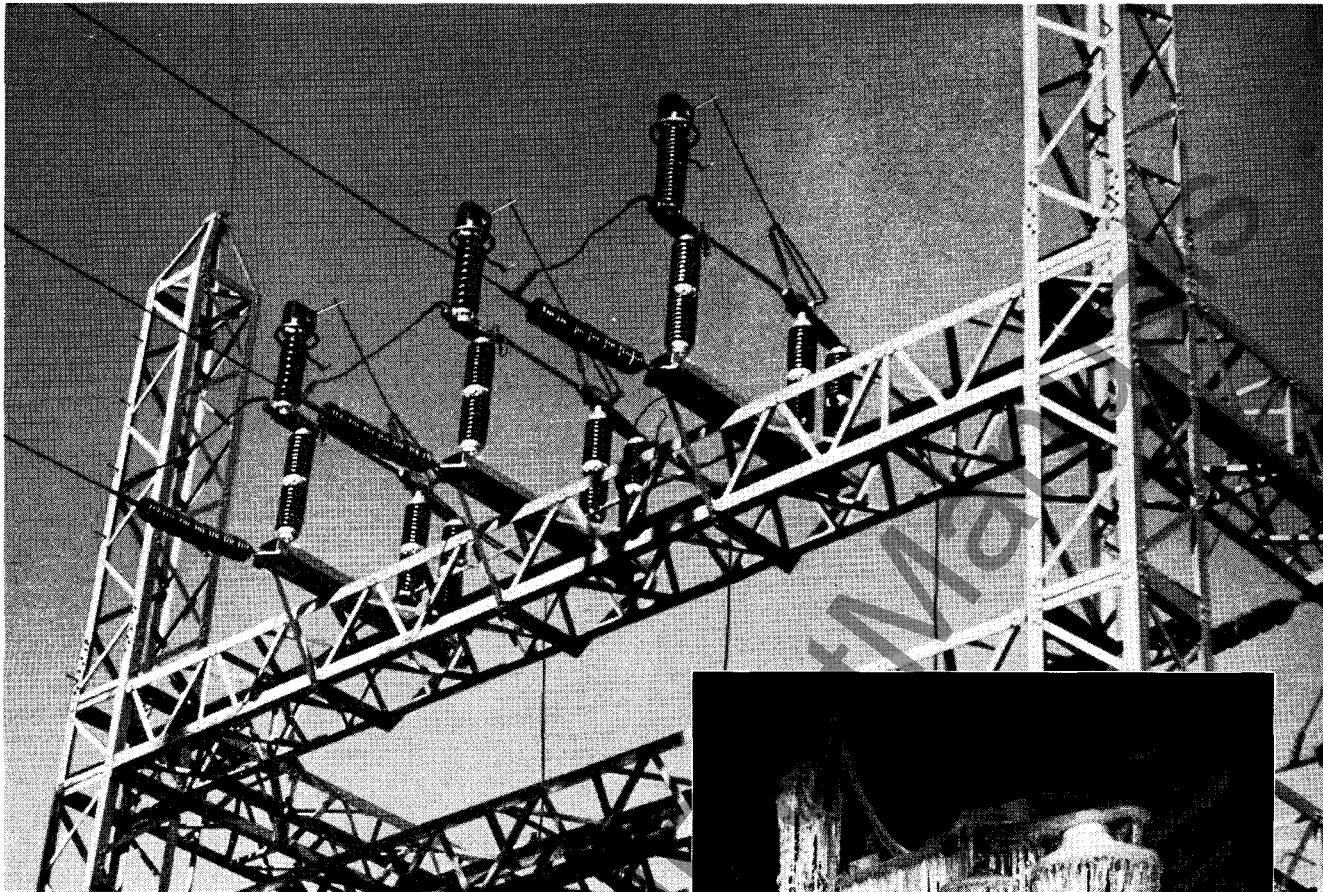
15	600	47 3/4	17 3/8	17 3/8	10	55	20 1/8	20 1/8	8 1/4	22 1/2	39	45 1/2	14	13 1/2
23	600	47 3/4	19 3/8	19 3/8	12	57	22 1/8	22 1/8	10 3/8	22 1/2	39	45 1/2	14	13 1/2

Fig. 2—34.5, 46, and 69 Kv heavy duty

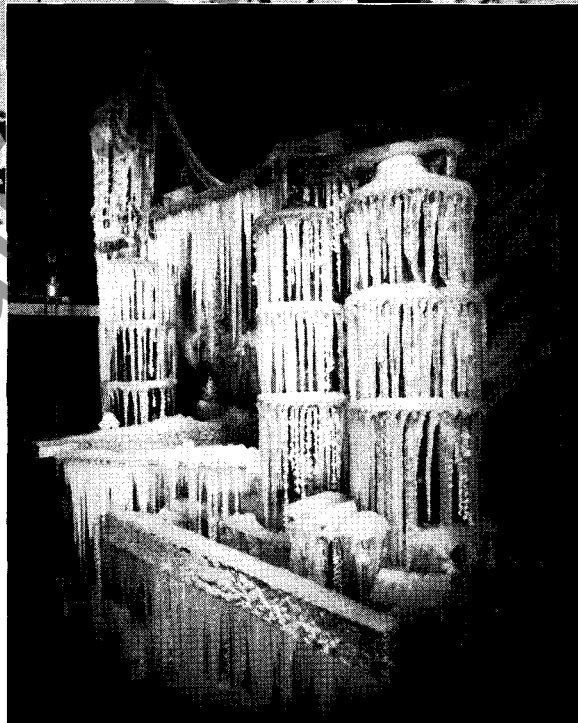
34.5	600	54	22 3/8	22 3/8	15	65 1/2	25 1/8	25 1/8	13 1/8	28 1/2	45	51 1/2	14	18 1/2
46	600	62	25 3/8	25 3/8	18	75	29	29 1/8	14 1/8	34 1/2	55	61 1/2	18	23 1/2
69 std.	600	75 1/2	36 3/8	...	29	95 1/2	40	...	14 1/8	46 1/2	67	73 1/2	18	35 1/2

Fig. 3—69 Kv (heavy duty), 115, and 138 Kv

69 hvy.	600	84	43 3/8	...	29	105 1/2	48 3/16	...	17	48	79	84	20	39 1/2
115	600	114 1/2	58 3/8	...	43 1/2	137	63 1/16	...	17	60	91	96	20	50
123	600	129	72 3/8	...	58	169 1/2	77 3/16	...	17	84	115	120	20	68



▲ *Type VLB switch with station post insulators mounted on steel substation structure.*



▶ *Operation of the Type VLB load interrupter switch has been checked under adverse atmospheric conditions.*

Literature Reference

- TYPE V OUTDOOR DISCONNECTING SWITCH—Refer to Descriptive Bulletin 36-160
- TYPE T-3 MOTOR OPERATING MECHANISM—Refer to Catalog Section 36-164



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DESCRIPTION . INSTALLATION . MAINTENANCE
INSTRUCTIONS

LOAD INTERRUPTER SWITCH
Type VLB

DESCRIPTION

The Type VLB interrupter is an addition to the Type V switch line which enables the switch to open transformer magnetizing currents, line charging currents, and load currents up to 600 amperes (at 50% power factor or better); and voltages of 15 kv to 115 kv ungrounded and 138 kv effectively grounded. It is a NEMA Class A device capable of more than 500 operations without maintenance. The interrupter is located in a current path which parallels the Type V switch. This secondary current path is a higher resistance path than the main switch, and it carries a negligible amount of current when the switch is closed. The switch blade is used to actuate the interrupter and to isolate it after interruption when the switch is opened. In a closing operation, the circuit is first established through the interrupter and the paralleling path prior to closing on the main switch contacts.

The interruption of current is accomplished by separable contacts enclosed in a gas filled porcelain housing. A piston and orifice assembly is attached to the moving contact rod which is driven by a modified toggle linkage mounted at the top of the porcelain. This toggle linkage is actuated by the main switch blade as previously mentioned. When the interrupter is tripped, the moving contact rod including the piston and orifice move so as to create a gas flow through the orifice where the arc is drawn. The gas has high dielectric strength and this characteristic together with the de-ionizing effect of flow through the orifice combine to extinguish the arc drawn between the separated contacts.

The coordination of the switch and interrupter is such that as the V switch blade breaks contact the current is diverted momentarily through the parallel interrupter circuit. As the V switch blade opens, the blade tip engages the interrupter trip lever and actuates the interrupter contacts. The arc is drawn internally and extinguished with no visible display, thereby eliminating the damage of long arcs in air being blown together or into grounded structures creating system faults. Final opening motion of the switch blade picks up the paralleling auxiliary blade thus isolating the interrupter. In the open position the switch provides the full visible air gap required for the rated voltage.

INSTALLATION AND ADJUSTMENT

The adjustment of the VLB pole unit and operating mechanism should be made as described in Instruction Book I.B. 36-160-1A after the interrupter has been mounted and coordinated with the pole unit. The longitudinal axis of the interrupter support casting should parallel the V switch blade so that the stud on the blade will engage the midpoints of the studs on the trip lever. This is a feature related particularly to switches with stacked insulator columns. If the studs do not engage as outlined, it is a sign that the interrupter assembly or the break jaw insulator units need to be re-aligned by loosening the bolts, twisting the units, and re-tightening the hardware. The engagement of the auxiliary blade with the V notched support at the top of the interrupter assembly is also dependent upon the same alignment.

LOAD INTERRUPTER SWITCH

In some ratings the auxiliary blades are biased with a spring tube assembly. It is important that this blade assembly pivots easily. If it is necessary in any case to remove this blade or it is apparent that friction is excessive, the assembly should be thoroughly lubricated at the hinge. This may be done by removing the castle nut and cup washer at the pivot casting. A graphite grease, preferably a silicone, should be used to lubricate the bearing areas. When reassembling, the castle nut should be drawn up finger tight against the cup washer and then turned one half turn for locking with the cotter pin.

The adjustments for coordination of the interrupter trip lever and the switch blade are detailed on the field assembly outlines which accompany the equipment. There should be at least one inch engagement between the stud on the switch blade and the trip lever studs at the time the blade "picks up" the trip lever. As noted on the field assembly outline the position of the trip lever gives an indication of whether the interrupter is open or closed. If the lever is horizontal, the interrupter is open and if it is down, the interrupter is closed. As an additional check on operation a sharp metallic sound is audible when the contacts make or break.

The functioning of the interrupter may be checked positively by "lighting out" with a flashlight or "ringing out" by a bell circuit instead of depending on audible sounds and trip lever position. If such a check is made, the auxiliary blade or paralleled current path must be lifted from the interrupter when the main switch is closed, otherwise the test circuit is shorted.

When the interrupters have been completely adjusted, the switch blade and break jaw should be aligned. With the break jaw mounting bolts loosened, the switch blade should be closed into the jaw and rotated several times in order to allow the jaw to align itself with the blade contact tip. With the blade still closed tighten the bolts which mount the break jaw.

MAINTENANCE

The interrupters are vacuum and pressure tested at the factory and filled to 30 pounds per square inch gauge pressure with sulphur hexafluoride. They should hold gas pressure indefinitely, however, a periodic check every 3 or 4 months is recommended as an operating safeguard. After the units have been in service some time, this period may be increased if experience so indicates.

Each interrupter is equipped with a pressure gauge so arranged that it is readable from ground level. While the interrupters are filled to 30 PSIG at the factory, the pressure readings in service will vary with the ambient temperature. The readings may be as high as 35 PSIG in the summer and as low as 20 PSIG in the winter.

The interrupters will function properly with the pressure as low as 15 pounds per square inch gauge. If the pressure should drop below 15 pounds, but not to zero, the unit may be recharged to 30 pounds by attaching a bottle of sulphur hexafluoride with pressure regulator and hose to the filling valve at the bottom of the interrupter. The valves on the bottle and regulator should be "cracked" slightly in order to purge the connecting hose immediately before attaching the hose to the filling valve. After attaching the hose to the valve, the regulator should be set at 30 PSIG. The filling valve should then be opened until the pressure in the interrupter reaches 30 pounds. The valve should then be closed tightly to assure positive seal.

LOAD INTERRUPTER SWITCH

If the gas pressure in an interrupter should drop to zero, the unit should be returned to the factory for repair.

In the event that an interrupter should be dismantled in the field, the filling valve should be opened when the interrupter is outdoors or under a ventilating hood indoors. Sulphur hexafluoride is an extremely stable and harmless gas in the pure state. After it has been subjected to arcing there is a slight amount of decomposition with some of the products of decomposition being irritating to the nasal passages if inhaled. For this reason, it is recommended that personnel avoid breathing the arced gas and the interrupter be emptied as suggested above.

The deterioration of the sulphur hexafluoride upon repeated arc interruptions is negligible and it is not necessary to recharge a unit after a series of operations. The gas itself has an indefinite life independent of the number of arc interruptions to which it is exposed.



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