Cutler-Hammer
Westinghouse &
Cutler-Hammer Products
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Sumter, South Carolina, U.S.A. 29154

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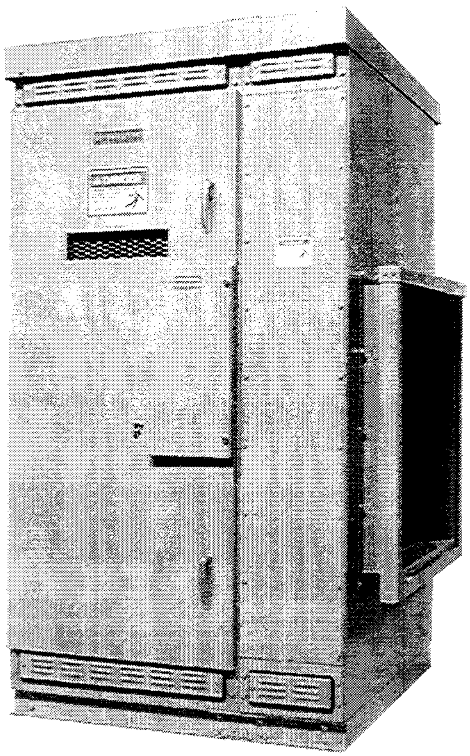
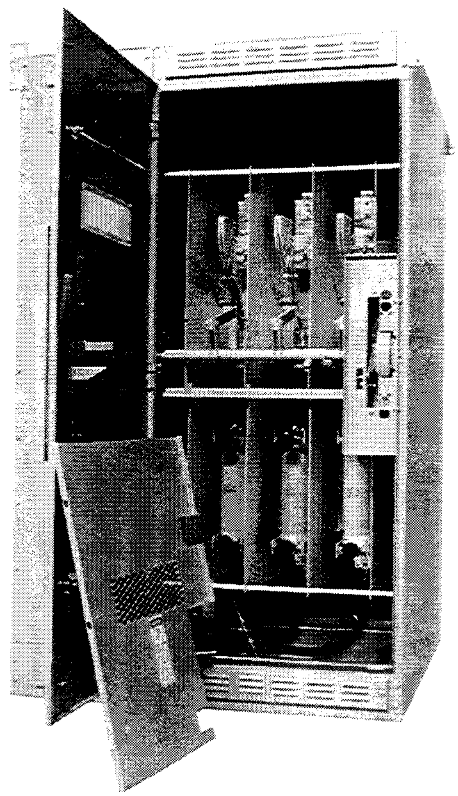
5, 15, 27 and 38 kV Voltage Classes,
600 and 1200 Ampere Manual and Motor
Operated, and Automatic Transfer

Westinghouse WLI Metal-Enclosed Switchgear





Typical Outdoor and Indoor Units

In this publication

Westinghouse WLI Metal-Enclosed Switchgear

Description

WLI Metal-Enclosed Switchgear is an integrated assembly of switches, bus, and fuses which are coordinated electrically and mechanically for medium-voltage circuit protection. All major components are manufactured by Cutler-Hammer, establishing one source of responsibility for the equipment performance and assuring high standards in quality, coordination, reliability, and service.

A complete line of Westinghouse switch and fuse products is available, as follows①:

- 5, 15, 27, and 38 kV voltage classes.
- 600 or 1200 ampere continuous and interrupting ratings.
- Non-fused or fused with current limiting or boric acid-type fuses.
- Manual, motor operated, or electro-mechanical stored energy release.
- Indoor, outdoor, or outdoor walk-in enclosures.
- Single switches and transformer primary switches.
- Duplex load break switch arrangements for selection of alternate feeds.
- Two-position, manual no-load selector switches for selection of alternate feeds.
- Lineups with main bus.
- Standard two- or three-switch motor-operated automatic transfer schemes.
- Designs that include potheads, roof bushings, special terminators, lightning arresters, instrument transformers, meters, and other auxiliary equipment.
- Custom-built units that offer unlimited possibilities of electrical circuitry design.
- Utility Metering Compartments. (Contact your local Cutler-Hammer representative for availability for your particular utility.)
- Complete aftermarket support.

Application
Westinghouse Load Interrupter (WLI) metal-enclosed switchgear provides safe, reliable switching and fault protection for medium-voltage circuits 2.4 kV through 38 kV. The WLI is ideal for applications that do not require automatic reclosing after a transient high current fault or where high duty cycle operation is not needed.

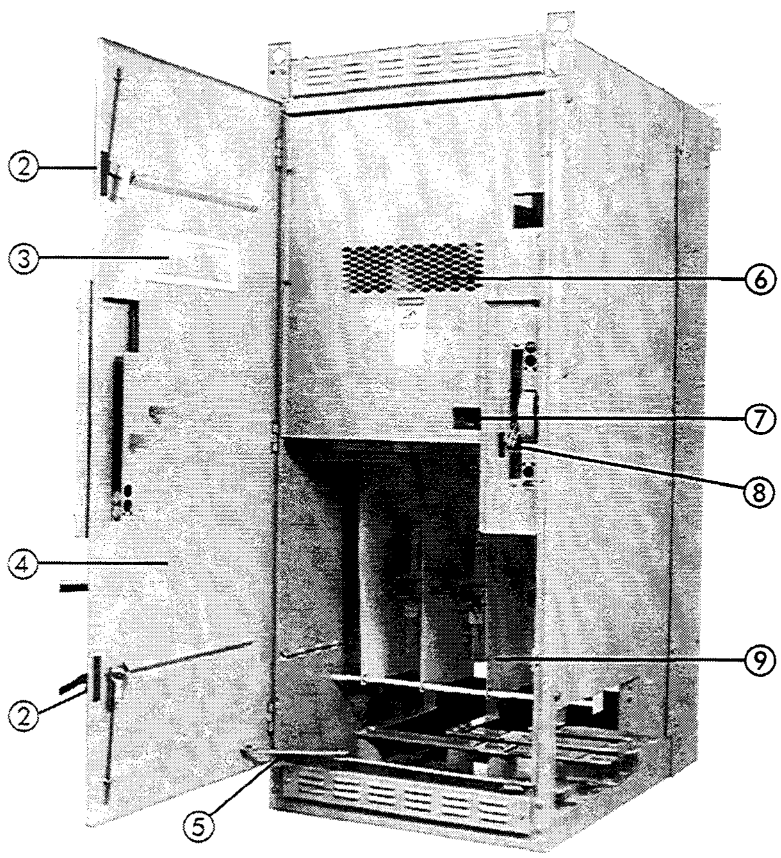
WLI switchgear has the advantage of low initial cost inherent in switch designs while offering the characteristics most vital to safety and coordination.

The switch's quick-make, quick-break mechanism will interrupt full-load current while fuses provide accurate, permanently calibrated short circuit detection and interruption. Visibility of actual blade position without opening the enclosure door improves safety by giving positive assurance of circuit de-energization.

WLI switchgear meets or exceeds the following industry standards: ANSI/IEEE C37.20.3 & C37.20.4; ANSI C37.57 & C37.58; NEMA SG-5.

Certain WLI configurations are available to meet Underwriters Laboratories, Inc., and/or CSA standards. Contact your local Cutler-Hammer Sales Engineer for further information regarding UL or CSA labeling for your particular application.

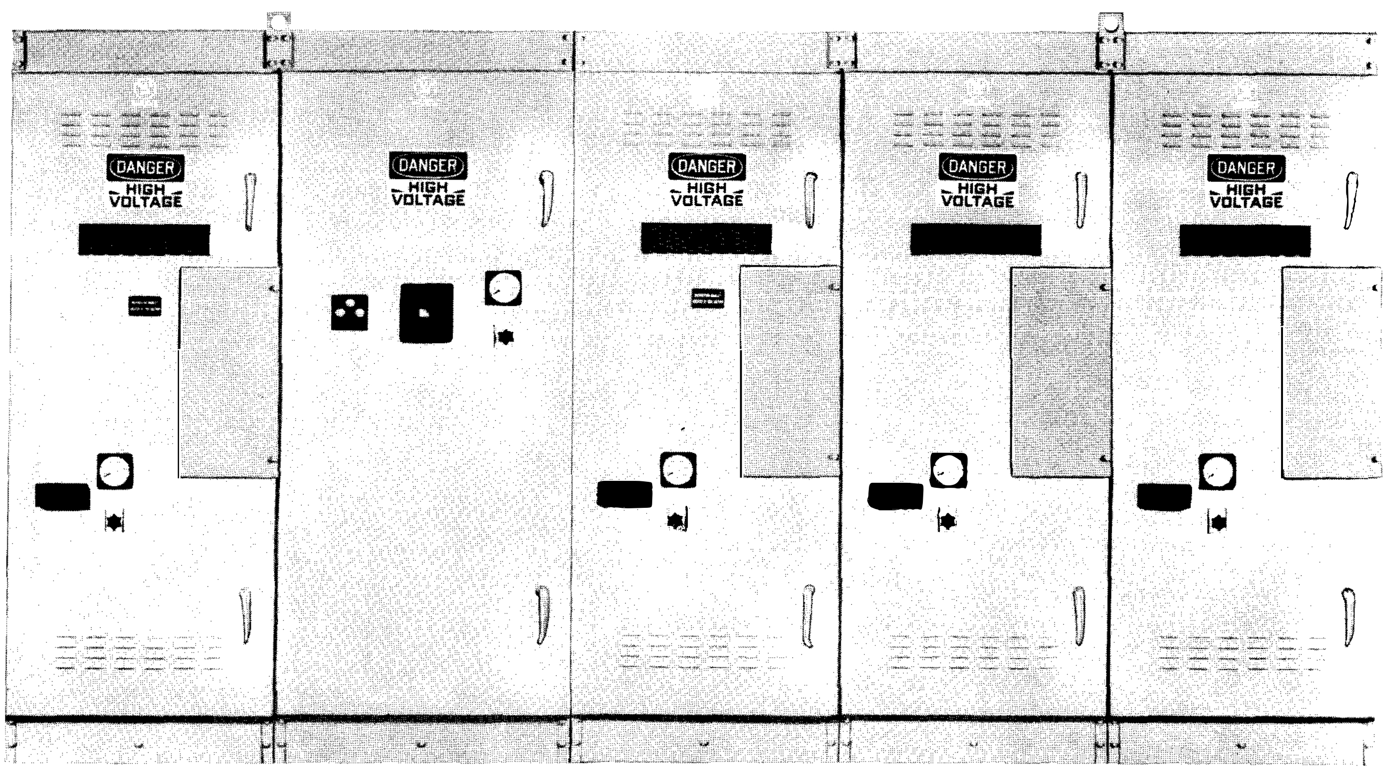
Manually Operated WLI Fused Switch
For description, see page 3.



① For applications requiring switch and breaker type construction, see Descriptive Bulletin 31-960, WVB Vacuum Breaker Metal-Enclosed Switchgear, and Descriptive Bulletin 32-255, VacClad-W MV Metal-Clad Switchgear.

WLI
Metal Enclosed Switchgear

In this publication



Main Switch **Metering Compartment** **Feeder Switch** **Feeder Switch** **Feeder Switch**

Description

WLI switchgear is an integrated assembly of switches, bus and fuses which are coordinated electrically and mechanically for high voltage circuit protection. All major components are manufactured by Westinghouse, establishing one source of responsibility for the equipment performance and assuring high standards in quality, coordination, reliability, and service.

A complete line of Westinghouse switches and fuses is available, as follows:

5, 15, 25, and 35 KV voltage classes.

600 or 1200 ampere interrupting ratings.

Non-fused or fused with current limiting or boric acid-type fuses.

Manual, motor operated, and/or electro-mechanical stored energy release.

Indoor, outdoor, or outdoor walk-in enclosures.

Single switches and transformer primary switches.

Duplex load break selector switch arrangements.

Two-position, manual no-load selector switches.

Lineups with main bus.

Standard two or three switch motor operated automatic transfer schemes.

Standardized designs that include potheads, roof bushings, special terminators, lightning arresters, instrument transformers, meters, and other auxiliary equipment.

Custom built units that offer unlimited possibilities of electrical circuitry design.

Application

Westinghouse Load Interrupter (WLI) metal enclosed switchgear provides safe, reliable switching and fault protection for high voltage circuits 2.4 KV thru 34.5 KV. The WLI is ideal for applications that do not require automatic reclosing after a transient high current fault or where high duty cycle operation is not needed.

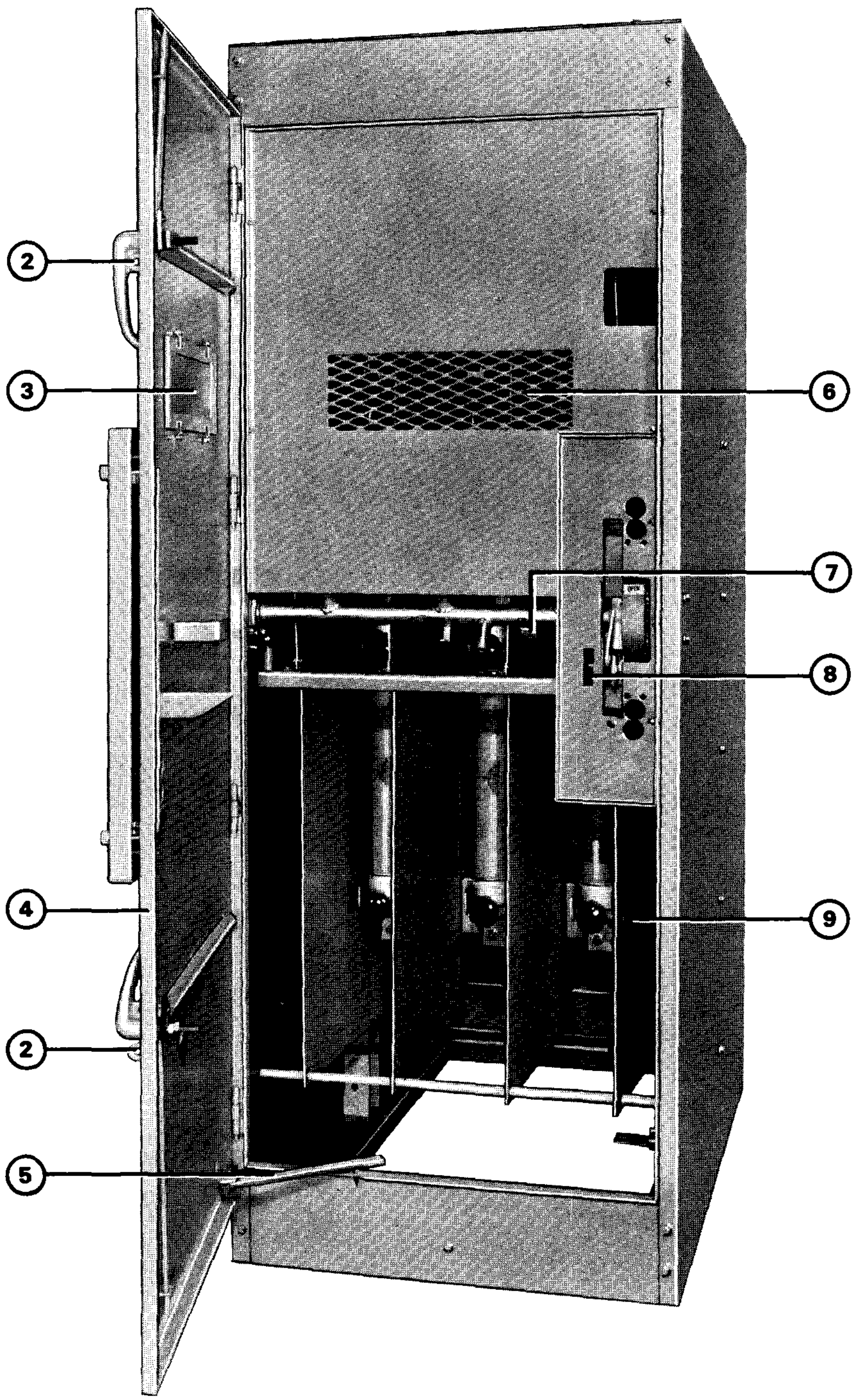
WLI switchgear has the advantage of low initial cost inherent in switch designs while offering the characteristics most vital to safety and coordination.

The switch's quick-make, quick-break mechanism will interrupt full-load current while fuses provide accurate, permanently calibrated short circuit detection and interruption. Visibility of actual blade position improves safety by giving positive assurance of circuit de-energization.

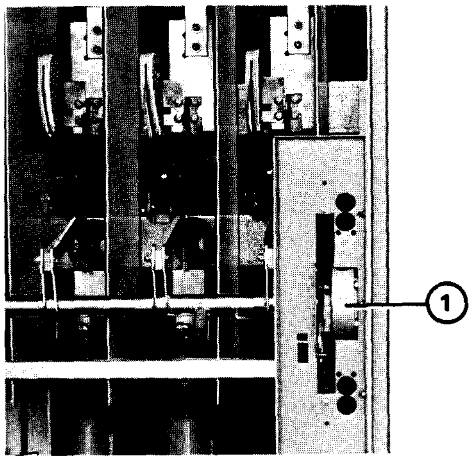
WLI switchgear meets or exceeds ANSI C37.20, NEMA SG-6, and IEEE standards as they apply to metal enclosed switchgear.

Design Features of a Standard Manually Operated Fused Switch

For description, see page 3.



Design Features, *Continued*



① Switch Mechanism Features

Quick-make, quick-break stored energy operation.

The speed and force of opening and closing the switch blades is constant and independent of the operator.

The switch blades cannot be teased to any intermediate positions. During the closing operation, full clearance between blades and Stationary Contacts is maintained until the switch mechanism goes over toggle.

The switch mechanism has only metal-to-metal linkage – no chains or cables to adjust or fail.

Arc interruption takes place between silver-tungsten tipped auxiliary (flicker) blades and high pressure contacts within a DE-ION® arc chute; no arcing takes place between the main blades and the stationary contacts.

Blow out forces cannot be transmitted to the operating handle.

② Provisions for Padlocking Door

③ Inspection Window
A single gasketed, rectangular, high impact viewing window permits full view of the position of all three switch blades through the closed door.

④ Full Height Main Door
The door has a return flange, is re-inforced and has two rotory latch-type handles to provide four latching members held in shear. It closes over a projecting frame and has concealed hinges.

⑤ Foot Operated Door Stop

⑥ Grounded Metal Safety Barrier
A steel barrier punched with a diamond pattern is provided in front of every switch. This barrier prevents inadvertent contact with any live part, yet allows for a full-view inspection of the switch blade position of all three phases.

⑦ Door Interlock
This interlock prevents the door of the enclosure from being opened when the switch is closed. On opening the switch, the interlock disengages automatically from a bracket provided on the back of the door, so that the door can be opened.

⑧ Switch Interlock
This interlock prevents inadvertent closure of the switch if the door of the enclosure is open. When the door is closed, the interlock is automatically defeated and the switch is free to be closed.

⑨ High Quality Insulation
Bus and switch insulators, switch drive rods, barriers between phases, and barriers between outer phases and the housing, are of high strength, non-hygroscopic, track resistant porcelain or glass polyester.

⑩ Permanent Switch Position Indicators

⑪ Provisions for Padlocking Switch
The load interrupter switch may be padlocked in either the open or closed position.

⑫ Provisions for Kirk Key Interlocks

⑬ Operating Handle
The switch operating handle is conveniently located behind the small access door. Because the handle is not in plain sight, the structure has a smooth homogenous appearance and does not provide a challenge to the curious.

⑭ Permanent Nameplates

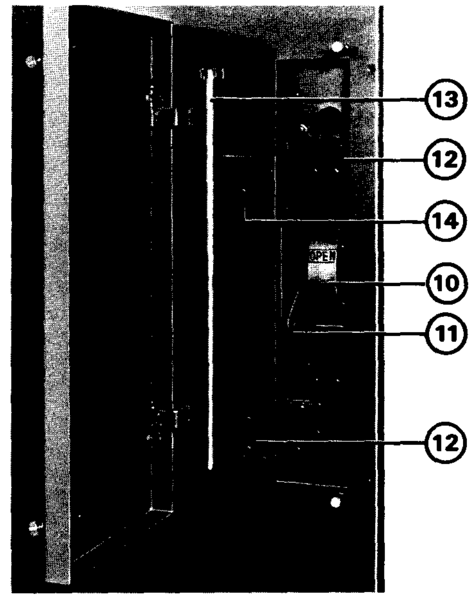
Features Not Illustrated

Ground Bus or Ground Lug

Fuse Mounting
Mountings are of a proven, tested design which positively clamp the fuses into place, yet permit easy replacement of the fuses without special tools. Fuse mountings are available for a wide variety of silver-sand current limiting fuses (CX, CXN or CLE) or boric acid expulsion type fuses (RBA).

Bus Bar
Aluminum tin-plated, air-insulated bus is standard. Braced for 80,000 amperes asymmetrical.

Enclosure
Construction is of a universal frame type design using die-formed, welded and bolted



members. Each unit is substantially braced to prevent cubicle distortion under normal conditions as well as during interruption of short circuit currents. The enclosure material is not less than 11 gage sheet steel. All external and internal painted steel surfaces are thoroughly cleaned and phosphatized prior to application of paint. They are then primed with a corrosion-resisting coating and after assembly, receive a finish coat of a high quality air-dry acrylic enamel. Standard colors are ANSI-61 light gray (indoor) and ANSI-24 dark gray (outdoor). In addition, the undersurfaces of outdoor units receive a corrosion resistive protective coating.

Outdoor enclosures are provided with a 120 volt 250 watt space heater as standard. Control power for these can be supplied as an option.

Generous Cable Termination Area
Because the WLI switch is supported by channel steel uprights (instead of mounting on the rear panel), cable termination can be accomplished easily and conveniently in the rear of the enclosure. Also, appropriate bus and lugs are provided to facilitate cable terminations (as specified) without the necessity of extensive cable training or severe cable bends.

Design Details

Switch Mechanism

The quick-make, quick-break mechanism utilizes a heavy duty coil spring which provides powerful opening and closing action. To close the switch, the handle is inserted into the spring charging cam which is then rotated upward through an angle of 120°. This charges the compression spring which is held by a spring lever. As the spring lever goes over toggle, the stored energy of the spring is released and transferred to the shaft which snaps the switch closed.

As a result of this over-toggle action, the blades move at a predetermined speed which is independent of the operator. It is impossible to tease the switch into any intermediate position.

To open the switch, the spring charging cam is rotated downward resulting in compression of the spring and releasing its stored energy in a similar sequence.

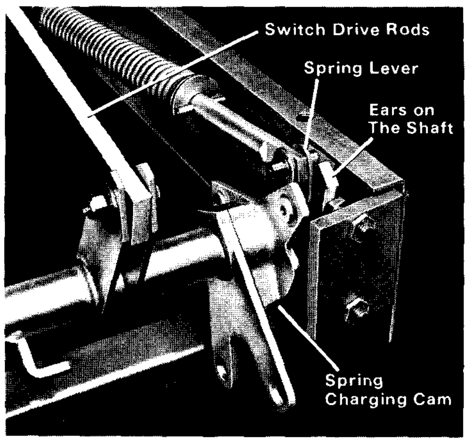


Fig. 1: Switch in Open Position

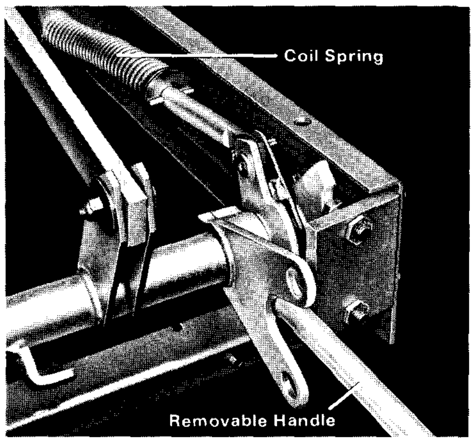


Fig. 2: Spring Being Charged

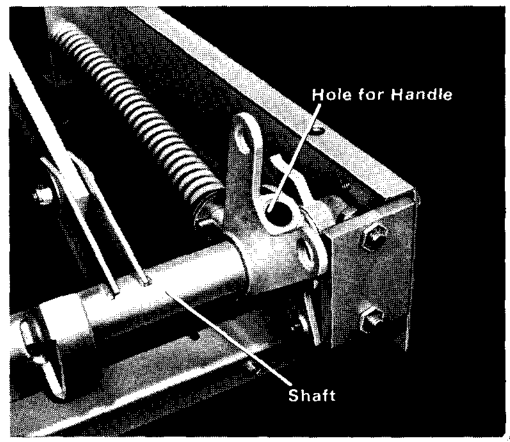


Fig. 3: Switch in Closed Position

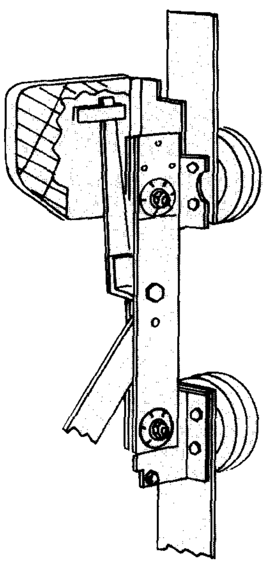
Quick-Break DE-ION® Arc Interruption

With the switch closed, both main and auxiliary (flicker) blades are closed, and practically all of the current flows through the main blades.

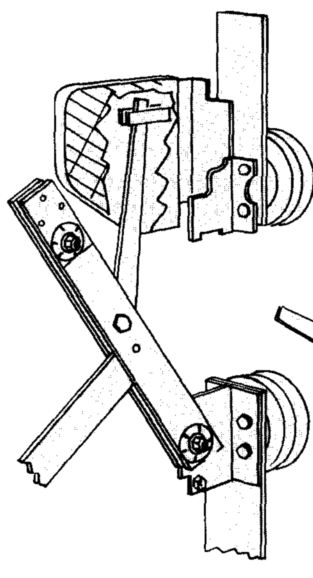
As the main blades open, current is transferred momentarily to the flicker blade, which is held in the arc chute by high pressure contact fingers. There is no arcing at the main blades.

When the main blades reach a pre-determined angle of opening, a stop post on the main blade prevents further angular movement between the main and flicker blades. This starts the flicker blade out of the high pressure contacts in the arc chamber and as contact is broken, the flicker blade is snapped into position by a torsion spring.

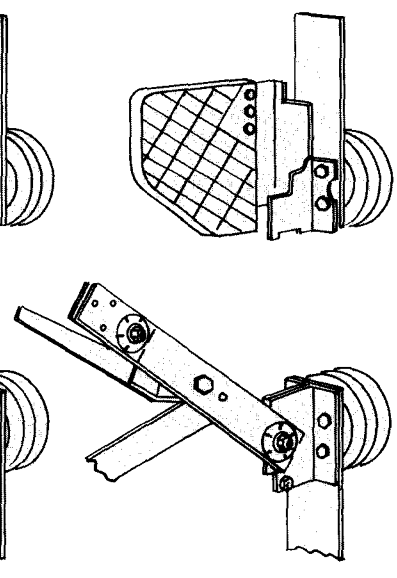
The heat of the arc, meanwhile, releases a blast of de-ionizing gas from the gas-generating material of the arc chute. This combination of quick-break and DE-ION action quickly extinguishes the arc and the circuit is safely de-energized.



Main, Flicker Blade Engaged



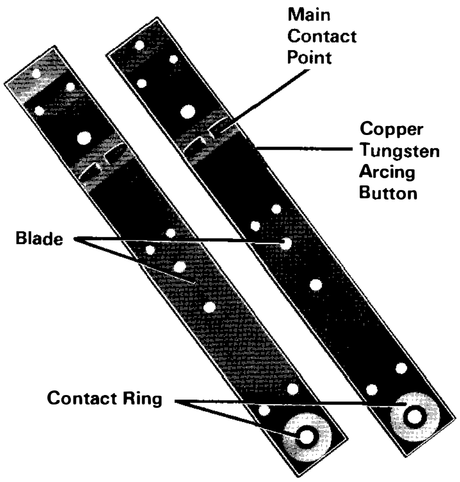
Main Blade Disengaged, Flicker Blade Engaged



Both Blades Disengaged

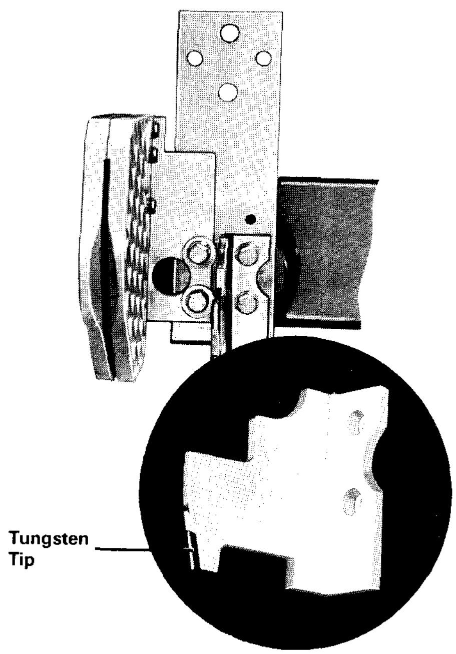
Main Blades

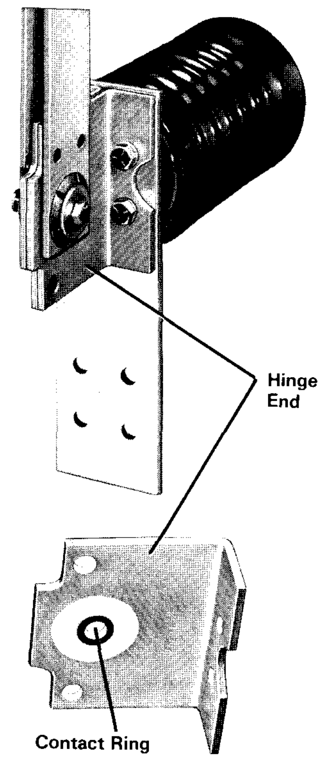
The blade consists of two high conductivity, hard drawn copper bars in parallel. The electrical contact point for 600 amperes is plated copper, the blades are provided with a silver ring at the hinge end and a copper embossed silver plated main contact point. On 40,000 and 61,000 ampere fault close ratings, copper tungsten alloy arcing buttons are provided to prevent damage to main break contact.

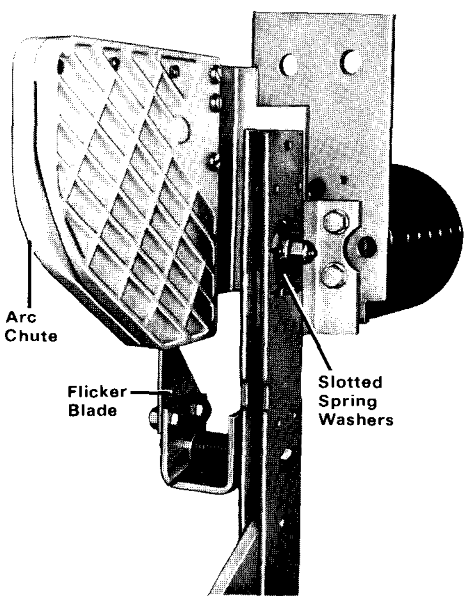


Main Contacts

The main contacts, break and hinge end, are made of high conductivity hard drawn copper. For 40,000 and 61,000 ampere fault closing, the break end is provided with a copper tungsten alloy arcing tip.







The two bars are fastened together to form the single blade at the hinge and break end. To assure permanent high contact pressure, self-adjusting slotted spring washers of phosphorus bronze are drawn tight over machined spacers to provide flexibility to maintain proper contact pressure and blade alignment.

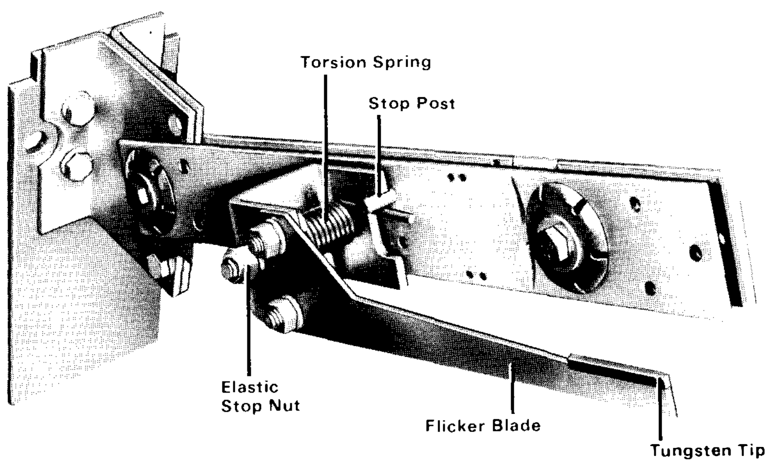
The stationary hinge end consists of two pieces of copper fastened together and proper electrical contact is maintained where the blade is attached to the hinge contact with a bolt and spring washers. To further assure good electrical contact at 1200 amperes, the hinge end is provided with plated contact rings at the moving point.

Arc Chutes

The arc chutes are molded of urea formaldehyde which, under high current conditions, produces de-ionizing gas to extinguish the arc. Contacts within the arc chute restrain the flicker blade assembly until the torsion spring is charged prior to opening.

Flicker Blades

The flicker blade is connected to the side and parallel to the main blade. It is constructed of hard drawn copper with an arc resisting tungsten alloy tip.



Fuses
Current Limiting Type
Westinghouse CX, CXN or CLE

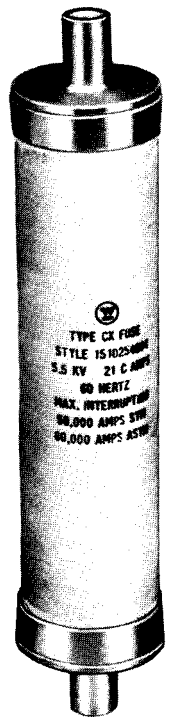
The CX and CXN general purpose current limiting fuses were designed specifically to provide complete fault protection on high capacity indoor and underground distribution systems. They provide excellent protection for all types of transformers.

Type CX and CXN are constructed with pure silver fuse elements, a high-purity silica sand filler, an inorganic core with spaced arc guards, and a glass melamine outer casing.

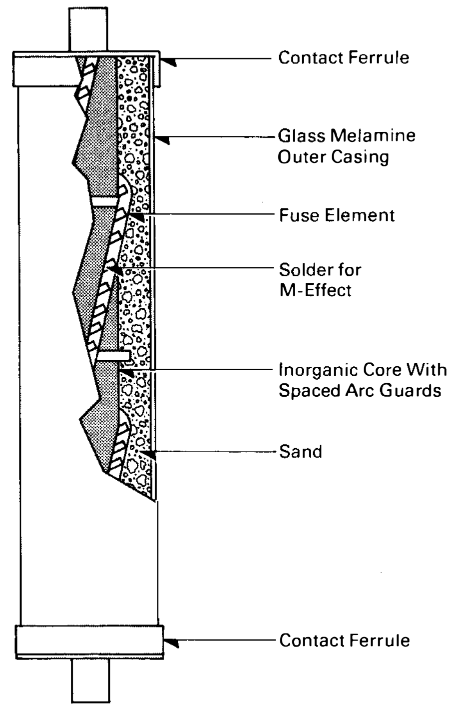
During a high fault current the silver element melts almost instantly losing energy to the surrounding sand. The energy melts the sand forming a glass-like substance called fulgurite. The arc voltage rapidly increases to about three times the fuse voltage rating forcing the current to zero. The fault is interrupted in one-half cycle or less without noise or expulsion of gases.

Low level currents are cleared by the melting of a solder drop on the fuse element which melts the silver element.

The CLE fuse is also a silver-sand constructed fuse with the added feature being blown fuse indication.



CX Fuse



Cross Section Showing Component Parts of a CX Fuse

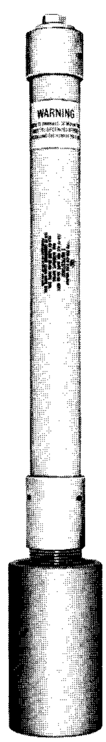
23 Thru 38KV Class

McGraw NX or G.E. EJO-1 current limiting fuses are recommended for use on circuits, above 15KV. Because of their small relative length, the switch units can be reduced in size and shipped as complete assemblies. When RBA Fuses are used, switches will be shipped in two (2) sections.

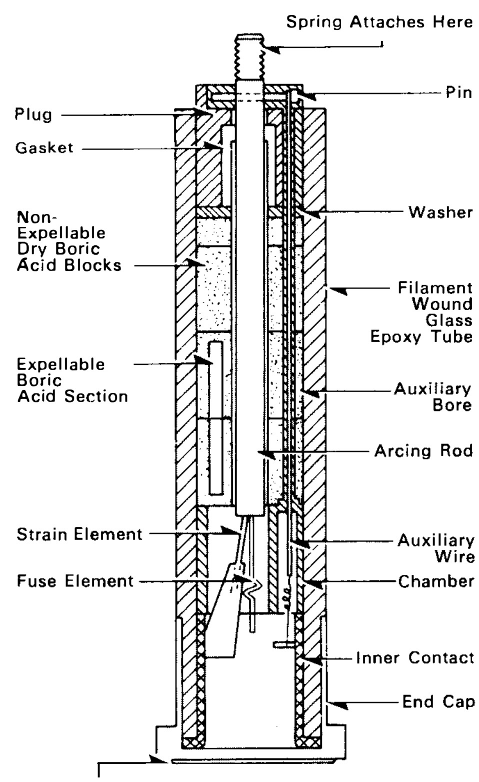
Boric Acid Type
Westinghouse RBA

The boric acid refill is probably the most important component of the RBA fuse. It is designed to interrupt currents of short circuit magnitude within ½ cycle, and through its two de-ionizing chambers in parallel, have selective operation and interruption for both low-current and high-current faults. This is achieved by movement of the arc through the boric acid cylinder by a helical spring and rod. Intense heat from the arc, as it strikes, decomposes the dry boric acid. On decomposition the boric acid forms water vapor and inert boric oxide. The electrical interruption is caused by the steam de-ionizing the arc as it is drawn through the cylinder by the action of the spring and rod. The high particle turbulence of boric acid causes the rate of de-ionization in the cylinder to exceed the ionization rate of the electrical arc. This action prevents the arc from restriking.

After operation of the fuse, the fuse holder is taken from its mountings, the fuse refill removed and replaced with a new refill.



RBA-400 Fuse With Discharge Filter



RBA-400 Fuse Refill

Two-Position, No-Load Selector Switch

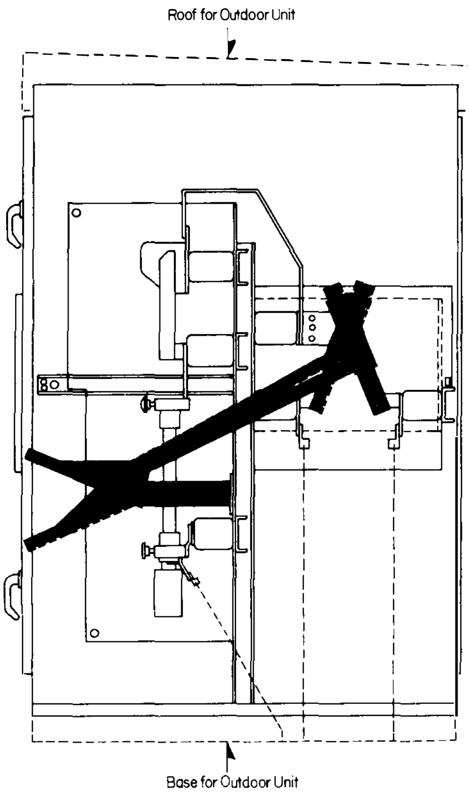
The WLI load interrupter switch can be provided with a two-position non-load break selector switch. This selector switch is mechanically interlocked such that operation can be performed only when the load interrupter switch is in the open position. Also, neither the WLI switch nor the main door can be closed without the selector switch being positively locked in one of the two feeder positions.

Blown Fuse Indication or Trip

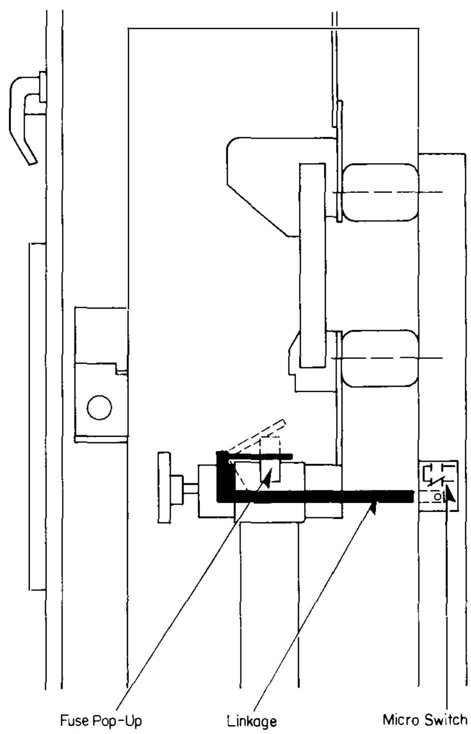
This feature is available when CLE fuses are used. An insulated linkage is moved by the red pop-up button on the fuse and it, in turn, actuates a micro switch. The contacts on this micro switch can be used for remote indication or to open the WLI when used in conjunction with the electro-mechanical stored energy release mechanism.

Grounding Switch

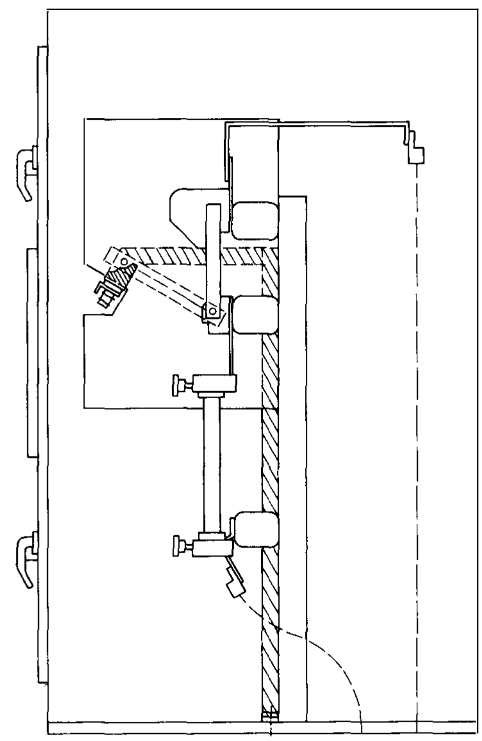
When specified, a grounding feature can be added to any WLI switch. This feature consists of an extra set of main contacts that are directly connected to the ground bus. The blades are always directly connected to ground when the switch is opened.



Typical Two Position Selector Switch for Bottom Cable Entrance

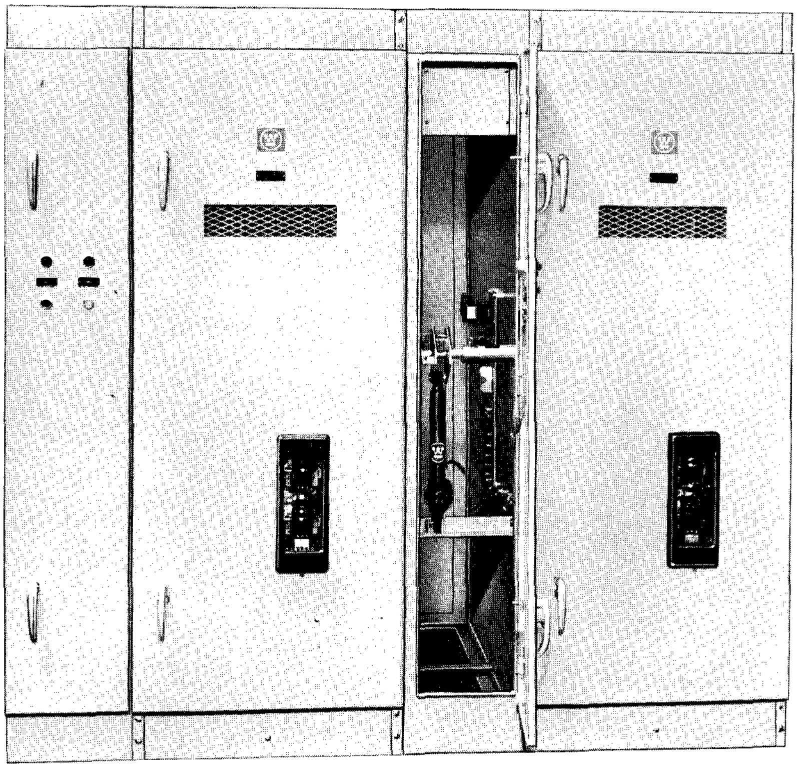


Blown Fuse Mechanism



Section View of Switch that Grounds in the Open Position

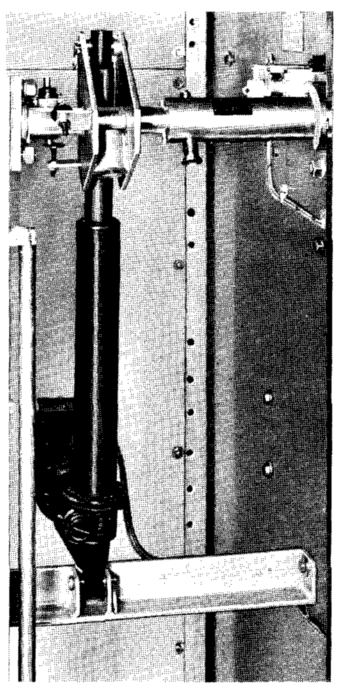
Motor Operated WLI Switches



Application
The WLI Pow-R-Drive motor operator makes possible the safety, convenience, and coordination inherent in remote switch operation. It is also an integral component of WLI automatic transfer switchgear.

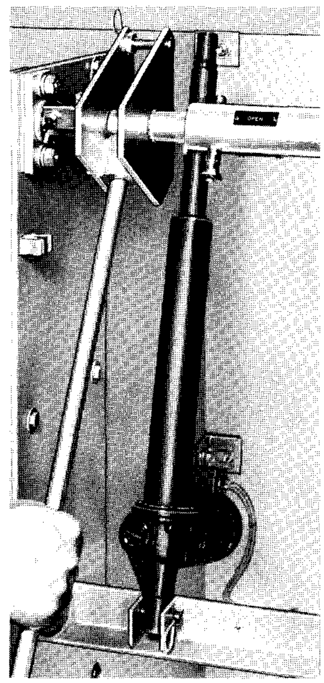
Description
A WLI Pow-R-Drive motor operated switch is a standard, manually-operated switch in combination with a heavy duty electric motor-driven linear actuator which charges the spring. The linear actuator is located in a separate isolated low voltage compartment. During electrical operation, it smoothly and quietly extends or retracts the proper distance to cause the switch mechanism to travel over toggle.

As the switch mechanism goes over toggle, actuating levers on the shaft operate a maintained contact, SPDT, limit switch. This limit switch sequences indicating lights and energizes relays which supply power to the motor – one for each direction of travel. These relays have electrically interlocked coils which prevent simultaneous energization and are supplied with holding circuit contacts.



WLI Pow-R-Drive Motor Operator

Manual Operation
A steel clevis pin connects the linear actuator to the spring charging mechanism which provides a reliable direct drive system. This pin can be removed by hand, and the linear actuator pivoted to the rear of the operator compartment. The switch can then be manually operated.



Pow-R-Drive Motor Operator Standard Features
Rugged, smooth and quiet operation.

Completely sealed and weather protected.

No maintenance required; lubricated and adjusted for normal life.

Load and current limiting clutch.

Automatically reset, thermal overload protector.

Fail-safe motor holding brake.

Electrical interlock disables motor operation with the switch door open.

Manually operable.

De-coupling feature.

Open-close pushbuttons.

Red and green position indicating lights.

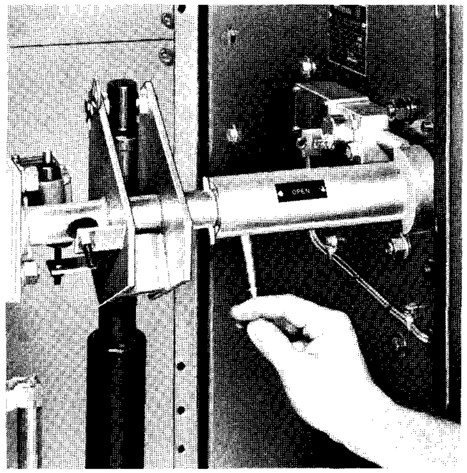
Options
Auxiliary switch position contacts.

Kirk key interlocks to electrically and mechanically lock switch open when the main switch door is open.

Ten cycle operation (electro-mechanical stored energy release).

De-coupling Feature
This feature allows sequencing of the linear actuator and all associated electrical and mechanical components for test purposes, without affecting the WLI switch position.

De-coupling is accomplished simply and quickly by hand removal of a pushbutton stainless steel hitch pin. When this pin is removed, the motor operated shaft is disengaged from the switch spring charging mechanism and rotates freely within a bronze bearing. The pin can only be replaced when the linear actuator has been sequenced thru a complete open-close cycle and has returned to its original position.



Ratings
Motor Operation is available for all published switch ratings. Test data for standard switches also applies to motor operated switches.

The motor operator has the following ratings:

Rated Operating Voltage:
120 Volts Ac, Single Phase
or 125 Volts Dc.

Full Load Current:
Four (4) Amps

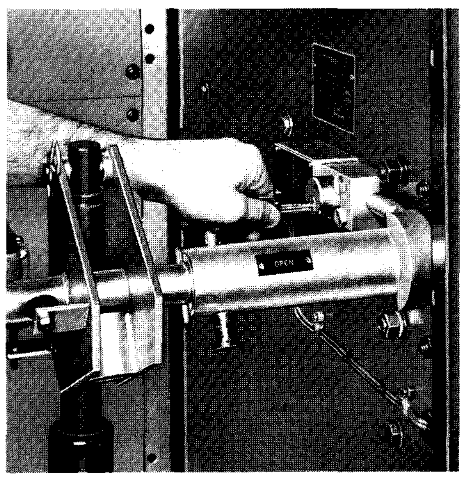
Spring Charging Time:
Three (3) Seconds

Minimum Operating Voltage:
70% of Rated Voltage

The control voltage is supplied by the user.

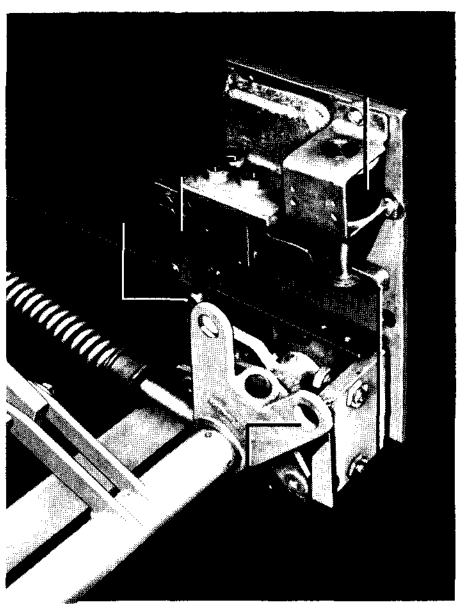
Kirk Key to Lock Switch Open
The Kirk key locking bolt can only be extended when the switch is in the open position. When the switch is closed, the shaft interlock cam prohibits full extension of the bolt.

Extending the bolt not only locks the switch in the open position, but also breaks electrical motor contacts integral to the Kirk key and permits the key to be removed. With the key, the operator can then open the lock on the main switch door. This scheme gives positive assurance that the switch is open and cannot be closed with the main door open.



Electro-Mechanical Stored Energy Release
This feature can be added to either manual or motor operated switches The unit is a mechanical linkage consisting of a teeter bar, a double toggle assembly and a spring release coil. Closing the switch is accomplished by charging the spring (either manually or with the motor operator). When the spring lever reaches the over toggle position, the spring tends to release its energy and tries to move the operating shaft. All movement, however, is restrained by a linkage which transfers the force to the double toggle assembly. The switch can now be closed by tripping the double toggle assembly with the spring release coil or manual lever.

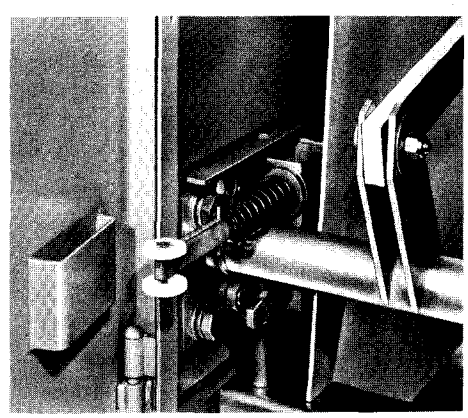
Once the switch is closed, the opening cycle is made ready by recharging the spring and the spring lever traveling over toggle. The double toggle assembly resets after each open or close cycle and allows the mechanical sequence to repeat. The switch can now be opened by the spring release coil or manual lever.



Electro-Mechanical Stored Energy Release

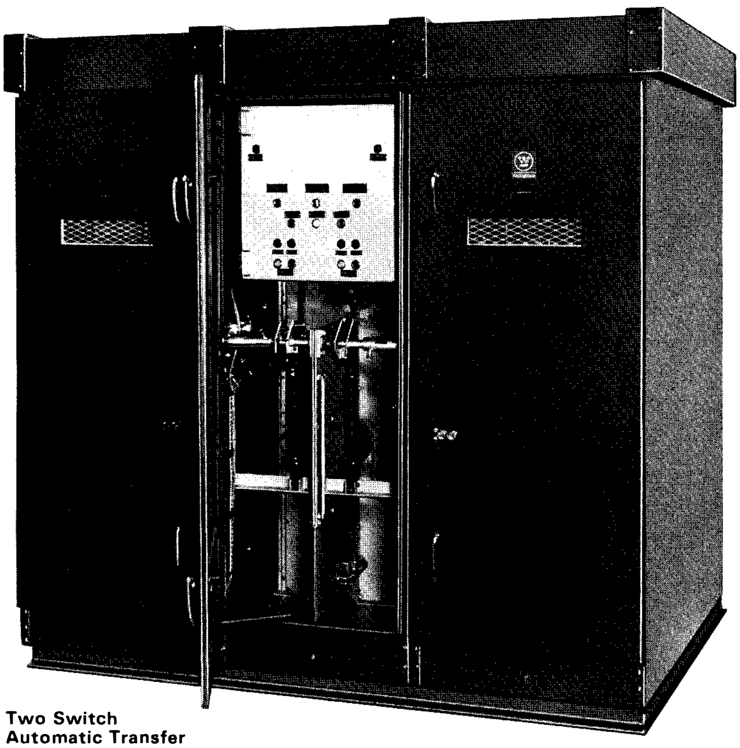
For safety purposes, a shaft lock assembly is provided on the side opposite the spring to prevent the switch from operating when the door is opened and the switch is charged for operation.

Kirk keys are not available with this option.



Shaft Lock Mechanism

WLI Automatic Transfer



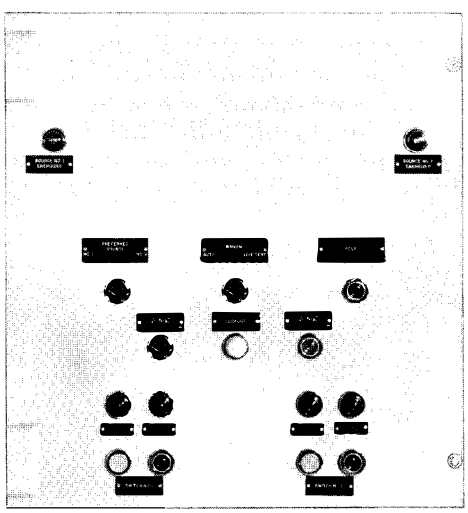
Two Switch
Automatic Transfer

Application
WLI automatic transfer switchgear is an integrated assembly of motor operated WLI switches, sensing devices and control components.

It is typically applied on primary selective service in either a two switch or three switch configuration, and assures high continuity of service for critical loads.

WLI automatic transfer switchgear is applicable to automatic throwover schemes having a wide variety of operational sequences and many standard control panels.

Typical Two Switch Operation
The WLI automatic transfer controller continuously monitors all three phases on both sources for correct voltage. Should the voltage of the normal source be lost, control power will automatically switch to the live standby source. Simultaneously, a signal is sent to start the "OFF DELAY" timer. When the timer times out, the normal will open and the standby switch will close.



Typical Transfer Control Panel

Typical Three Switch Operation
The WLI automatic transfer controller continuously monitors all three phases of both sources for correct voltage. Should the voltage of either source be lost, control power will automatically switch to the other source (unless control power was already being drawn from the other source). Simultaneously, a signal is sent to start the failed sources "OFF DELAY" timer. When the timer times out, the failed source main switch will open and the tie switch will close. Both load busses are now being fed from the single source, remaining at normal voltage.

When the failed source's voltage returns, a signal is sent to start its "ON DELAY" timer. When the timer has timed out, the tie switch will open and the main switch will close. Each load bus is now being fed by its' respective source.

The typical operations described above cover open transition operation including electronic non-paralleling interlocks.

Standard Features
Three phase voltage sensing on both sources.

Automatic control power switching.

Switch position indication lights.

Motor operator de-coupling device: Allows sequencing of motors and associated circuitry without affecting switch positions.

Electrical interlocking to prevent paralleling of sources.

Automatic or manual operation.

Adjustable time delays on both sources, "OFF DELAY" and "ON DELAY".

Single-source responsibility: All basic components manufactured by Westinghouse.

Optional Features
Three switch (two mains and tie) operation.

Closed transition on return to normal.

Choice of automatic or manual return to normal.

Choice of normal source (two switch only)

Lockout on phase and/or ground overcurrents and/or internal bus faults.

Typical Switch Arrangements *Not to be used for construction purposes unless approved.*
Dimensions in Inches – For Metric Dimensions, Multiply by 25.4

The sketches in this section represent the most common switch arrangements. Many other configurations and combinations are available. **Depth of units will vary** due to cable entrance and exit requirements, the addition of lightning arresters, instrument transformers, special cable terminators, etc.

Figure A1:
Single Switch, 5 or 15 Kv, Bottom Entrance, Top or Bottom Exit

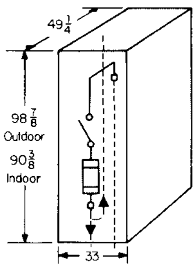


Figure A2:
Single Switch, 5 Kv Only, Top Entrance, Top or Bottom Exit

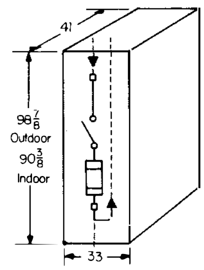


Figure A3:
Single Switch, 5 or 15 Kv, Top Entrance with Pothead, Bottom Exit

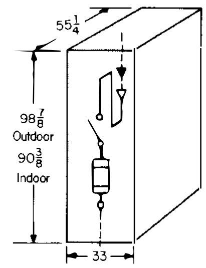


Figure A4:
Single Switch With Main Bus, 5 or 15 Kv, Top Entrance, Bottom Exit

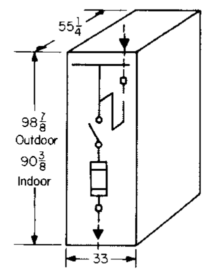


Figure A5:
Single Switch, 25 or 34.5 Kv, Top Entrance, Top Exit

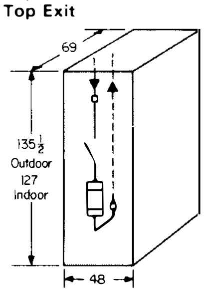


Figure A6:
Single Unit, Load Break Switch, With Selector Switch, 5 or 15 Kv, Top Entrance, Bottom Exit

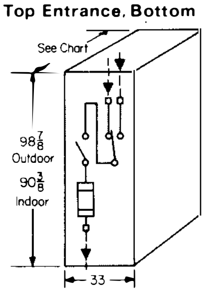


Figure A7:
Single Unit, Load Break Switch, With Selector Switch, 5 or 15 Kv, Bottom Entrance, Bottom Exit

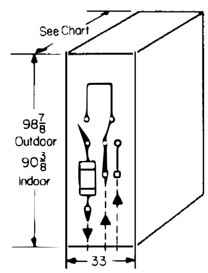


Table for A6 and A7

Voltage 5 Kv	15 Kv	Cable Top	Entrance Bottom	Minimum Depth
X		X		62
X			X	62
	X	X		70
	X		X	62

WLI Switches for Transformer Primary Switching

All necessary cable, lugs, bus and hardware for close coupling the switch to the transformer are supplied with the switch.

Figure B1: **Indoor Switch, 5 or 15 Kv, Cable Connected to Dry Type Transformer, In Most Cases Switch Depth (Minus Front Door) Will Match The Transformer Depth**

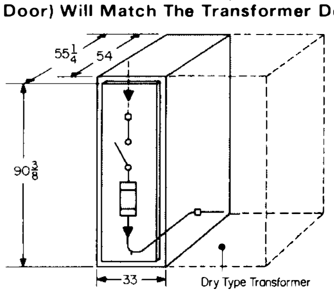


Figure B2:
Indoor Switch, 5 or 15 Kv, Cable Connected to Indoor Liquid Filled Transformer

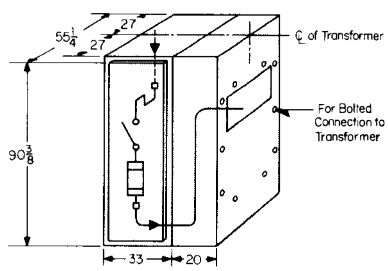


Figure B3:
Outdoor Switch: 5 or 15 Kv, Cable Connected to Outdoor Liquid Filled Transformer

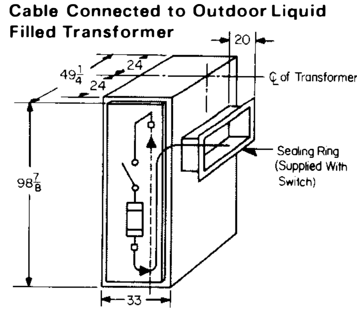
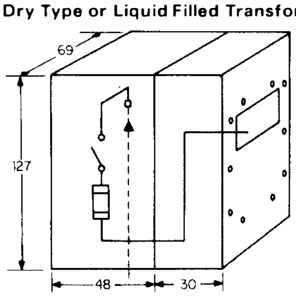
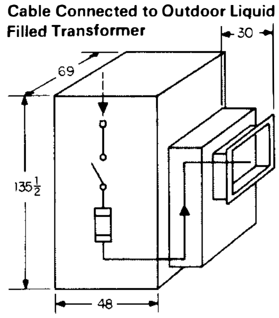


Figure B4:
Indoor Switch 25 or 34.5 Kv, Bus Connected to Indoor Dry Type or Liquid Filled Transformer



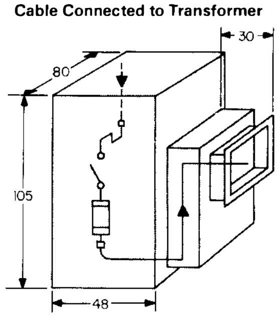
With RBA Fuses

Figure B5:
Outdoor Switch, 25 or 34.5 Kv, Cable Connected to Outdoor Liquid Filled Transformer



With RBA Fuses

Figure B6:
Outdoor Switch, 25 or 34.5 Kv, Cable Connected to Transformer



Non-Fused or With Current Limiting Fuses

Typical Switch Arrangements *Not to be used for construction purposes unless approved.*
Dimensions in Inches – For Metric Dimensions, Multiply by 25.4

The sketches in this section represent the most common switch arrangements. Many other configurations and combinations are available. **Depth of units will vary** due to cable entrance and exit requirements, the addition of lightning arresters, instrument transformers, special cable terminators, etc.

Switch Lineups and Connections to Other Apparatus

Figure C1:
Lineup With Main Switch,
5 or 15 Kv, Bottom Entrance,
Top or Bottom Exit

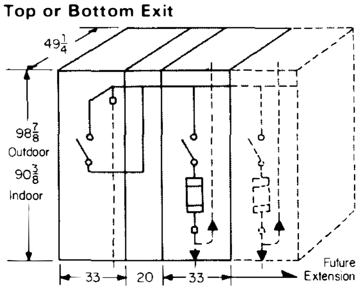


Figure C2:
Duplex Switch Arrangement,
5 Kv, Top Entrance,
Top or Bottom Exit

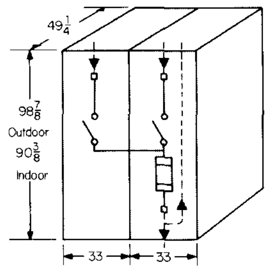


Figure C3:
Duplex Switch Arrangement,
5 or 15 Kv, Bottom Entrance,
Top or Bottom Exit

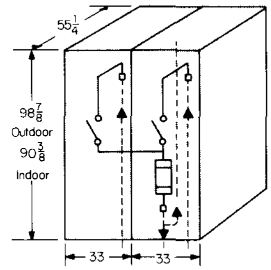


Figure C4:
Lineup With Main Switch,
25 or 34.5 Kv, Bottom Entrance,
Bottom Exit

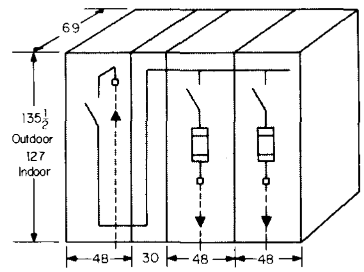


Figure C5:
Outdoor Walk-in With
Main Bus Only, 5 or 15 Kv,
Bottom Entrance, Bottom Exit

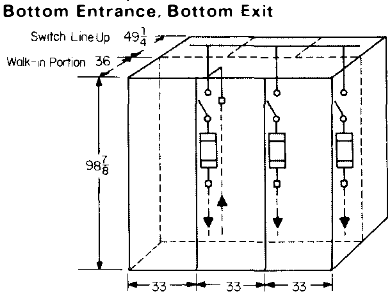


Figure C6:
Connection to High Voltage Starter
5 Kv, Indoor Only,
Top or Bottom Exit

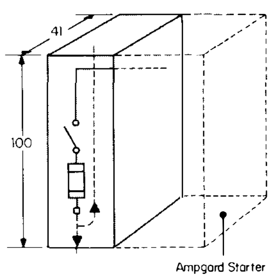
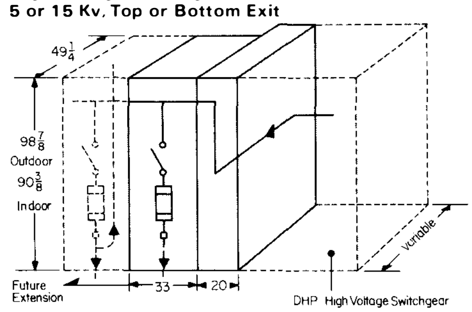


Figure C7:
Indoor Connection to
High Voltage Switchgear,
5 or 15 Kv, Top or Bottom Exit



WLI Pow-R-Drive™ Motor Operated and Automatic Transfer Switch Arrangements

Figure D1:
Motor Operated Switch,
5 or 15 Kv, Bottom Entrance,
Bottom Exit

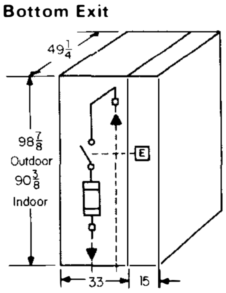


Figure D2:
Lineup With Main Switch,
Motor Operated, 5 or 15 Kv,
Top Entrance, Top Exit

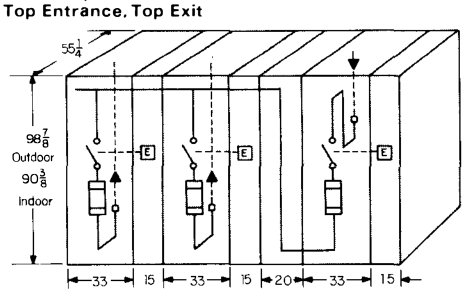


Figure D3:
Two Switch Motor Operated
Automatic Transfer, 5 or 15 Kv,
Bottom Entrance, Bottom Exit

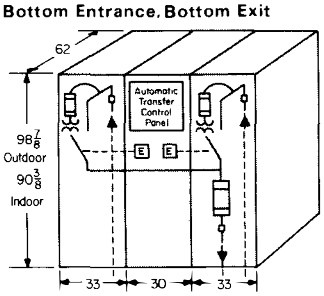
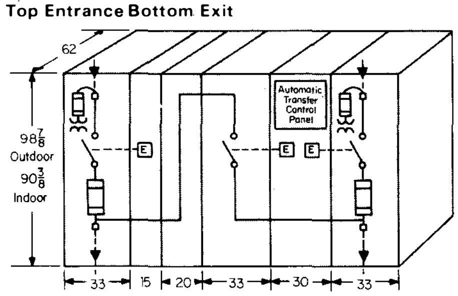
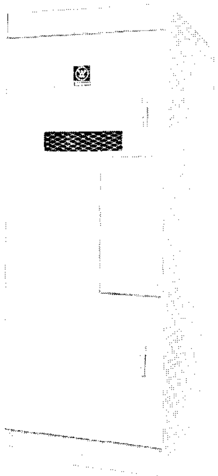


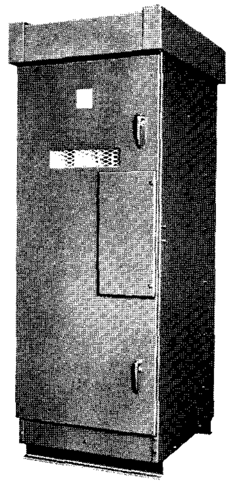
Figure D4:
Three Switch Motor Operated
Automatic Transfer, 5 or 15 Kv,
Top Entrance Bottom Exit



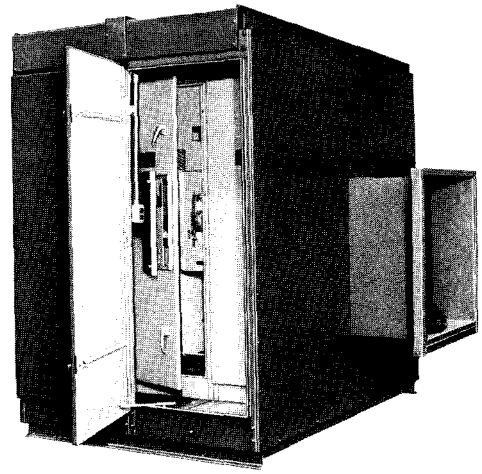
Typical WLI Switch Arrangements



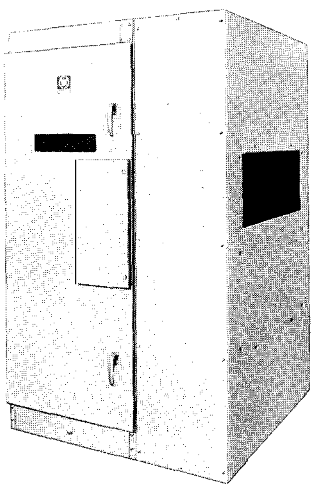
Indoor Single



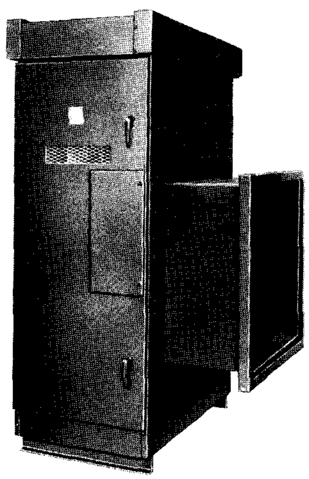
Outdoor Single



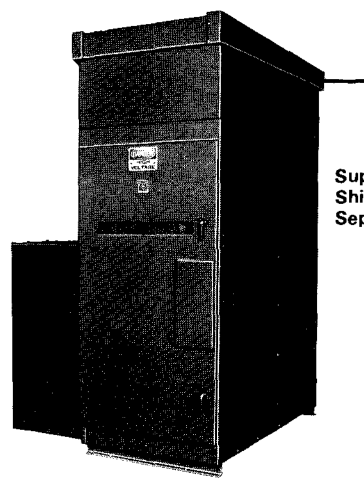
Walk-in Outdoor Structure



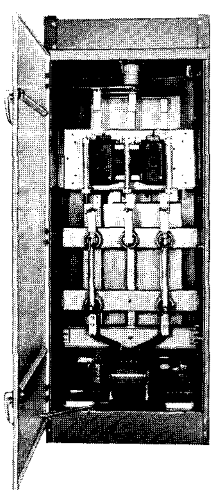
Indoor 5 or 15 Kv Switch with Transition for Connection to Liquid Filled Transformer



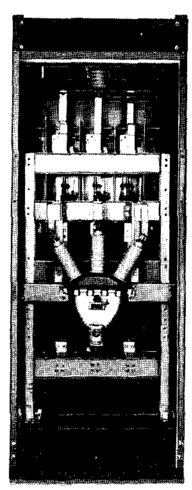
Outdoor 5 or 15 Kv Switch with Throat for Connection to Liquid Filled Transformer



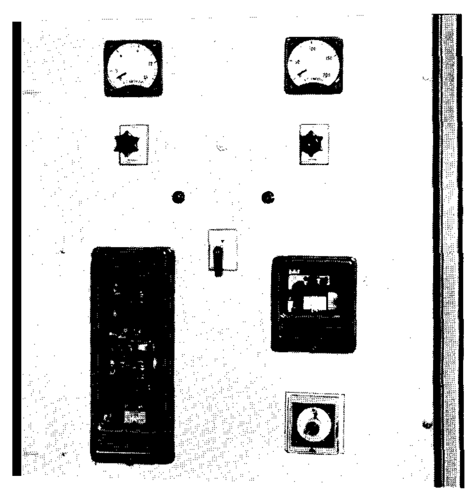
Outdoor 25 or 34.5 Kv Switch with RBA Fuses and Throat for Connection to Liquid Filled Transformer



Rear View of Switch with Potential Transformers and Control Power Transformer



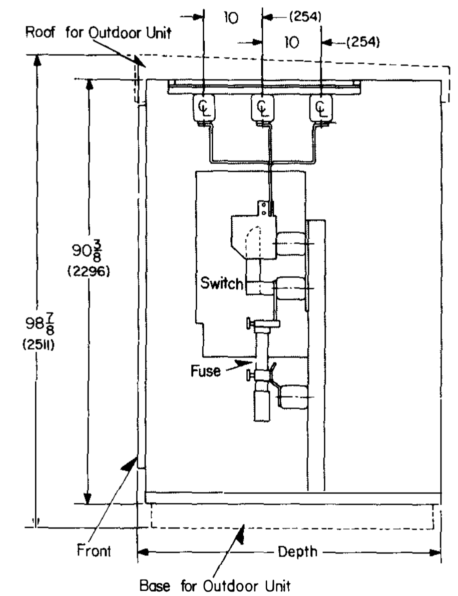
Rear View of Switch with a Three Conductor Pothead



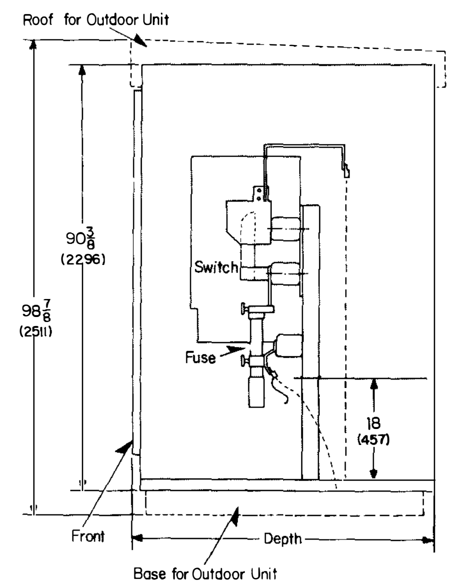
Typical Meter and Control Panel

Dimensions, Inches and (Millimeters) *Not to be used for construction purposes unless approved.*

5, 15 Kv Switches With Main Bus

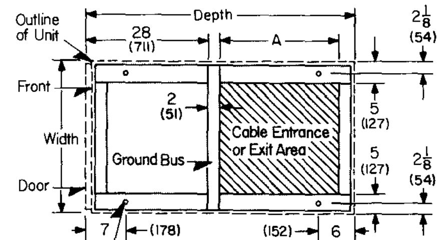


Without Main Bus



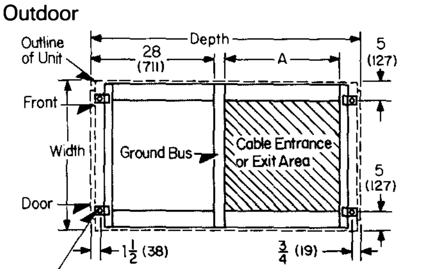
Floor Plans, 5 and 15 Kv (Dimensions)

Indoor



5/8 (16) Diameter Hole (4) For 1/2 (13) Inch Anchor Bolts

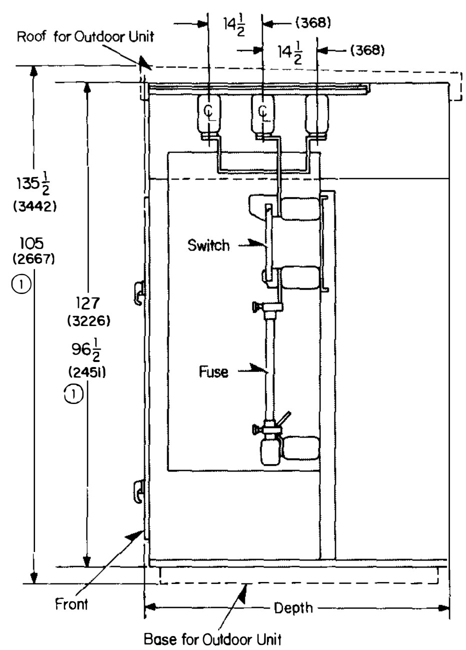
Outdoor



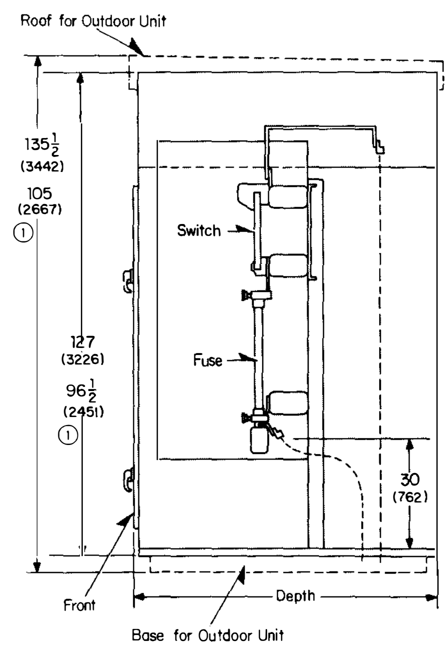
3/4 (19) Diameter Hole (4) For 5/8 (16) Inch Anchor Bolts

Width	Depth	Dim. A
33 (838)	41 (1041)	7 (178)
36 (914)	49¼ (1251)	15 (381)
42 (1067)	55¼ (1403)	21 (533)
48 (1219)	62 (1575)	28 (711)
	70 (1778)	36 (914)
	80 (2032)	46 (1168)

25, 35 Kv Switches With Main Bus

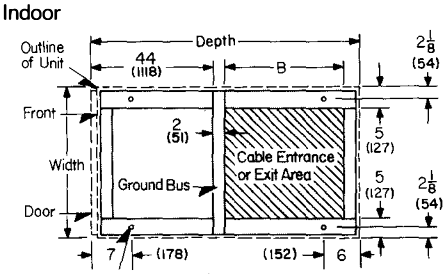


Without Main Bus



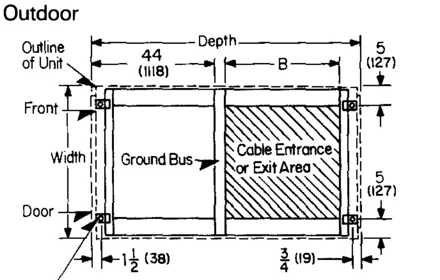
Floor Plans, 25 and 35 Kv (Dimensions)

Indoor



5/8 (16) Diameter Hole (4) For 1/2 (13) Inch. Anchor Bolts

Outdoor



3/4 (19) Diameter Hole (4) 5/8 (16) Inch Anchor Bolts

Width	Depth	Dim. B
48 (1219)	69 (1753)	20 (508)
54 (1372)	80 (2032)	31 (787)
60 (1524)	90 (2286)	41 (1041)
	100 (2540)	51 (1295)

① 105 and 96½ inch dimensions are for non-fused switches, or switches with current limiting fuses. When RBA fuses are used, the switches will be shipped in two sections.

Test Data

All WLI switch ratings have been thoroughly tested in the Westinghouse High Power Laboratory. Tests were performed to substantiate all published ratings in accordance with ANSI and NEMA standards.

The testing program included tests of:

- Basic Impulse Levels
- Momentary Withstand
- Short Time Withstand
- Fault Closing
- Load Interrupting at various loads, various power factors
- Mechanical Life Tests

These tests verfied not only the performance of the switch and integrated switch-fuse assembly, but also the suitability of the enclosure venting, rigidity, and bus spacing.

The mechanical life test subjected the WLI switch mechanism to more than 500 mechanical operating cycles under no load conditions. No failures resulted to the moving or current carrying parts.

Approximate Weights

Switch Description	Indoor Lbs.	Indoor Kg.	Outdoor Lbs.	Outdoor Kg.
5 or 15 KV Class				
Non-fused Switch	1500	675	1800	815
Fuses (3), Add	200	90	200	90
Indoor Transition	300	135	....	....
Outdoor Throat	....	...	200	90
25 or 35 KV Class				
Non-fused Switch	2000	900	2400	1080
Fuses (3), Add	300	135	300	135
Indoor Transition	1100	495	....	....
Outdoor Throat	....	...	900	405
Motor Operator Adder .	400	180	400	180

Further Information

Prices: Price List 31-930
Instruction Leaflet: I.L. 31-930
Power Centers: DB 31-750

Typical Specification

The metal enclosed switchgear shall consist of an assembly of dead front, free standing, structures containing interrupter switches and fuses of the number, rating and type noted on the drawings or specified herein.

The complete metal enclosed switchgear assembly shall have the following ratings:

Maximum Design Voltage ____KV
(5, 15, 25.8 or 38KV)
System Voltage ____KV
Momentary Short Circuit Rating ____MVA
Main Bus Rating ____AMP.

The switchgear assembly shall be integrally designed and produced by the manufacturer of the interrupter switches, fuses, enclosures, and operators to assure a completely coordinated design and establish one source of responsibility for the equipment's performance.

Interrupter Switches

The load interrupter switches shall be quick-make, quick-break with stored energy operation.

Switches shall have the following minimum ratings:

Amperes Continuous . ____Amperes
Amperes Interrupting ____Amperes
Momentary (Switch Closed, 10 Cycle) ____Amps. Asym.
Fault Close ____Amps. Asym.

Each switch or switch and fuse assembly shall have glass polyester insulating barriers between phases and between the outer phases and the enclosure.

Switch Operation

A quick-make, quick-break manual operating mechanism shall be supplied which utilizes a heavy duty coil spring to provide powerful opening and closing action of the switch. To assure reliable operation, the spring charging mechanism shall consist of a rigid metal-to-metal linkage and shall not depend on chains or cables which are subject to failure.

Switch Ratings

Max. KV	Nom. KV	Impulse Withstand KV	Amperes Continuous	Amperes Interrupting	Momentary (Switch Closed) Asym. (10 Cy.)①	Fault Close Asym.
5.0	4.8	60	600	600	40,000	40,000
			1200	600	80,000	61,000
			1200	1200	80,000	61,000
15.0	13.8	95	600	600	40,000	40,000
			1200	600	80,000	40,000
			1200	1200	80,000	40,000
			1200	600	80,000	61,000②
			1200	1200	80,000	61,000②
			600	600	40,000	20,000
25.8	23	125	600	600	40,000	40,000
		or	1200	600	40,000	40,000
		150	1200	600	60,000	60,000
			600	600	40,000	20,000
38.0	34.5	150	600	600	40,000	30,000
			1200	600	40,000	30,000
			1200	600	60,000	30,000

① Four second symmetrical KA ratings:
40KA momentary switch is 25 KA;
60 and 80 KA momentary switches are 38 KA.

② Requires 36 inch wide unit.

Fuse Ratings

Type Fuse	Max. Amps	Amperes Interrupting 4.8 KV Sym.	4.8 KV Asym.	7.2 KV Sym.	7.2 KV Asym.	14.4 KV Sym.	14.4 KV Asym.	23 KV② Sym	23 KV② Asym.	27 KV② Sym.	27 KV② Asym.	34.5 KV② Sym.	34.5 KV② Asym.
Boric Acid Type②													
RBA-200	200E	19,000	30,000	16,600	26,500	14,400	23,000	10,500	16,800	6,900	11,000	6,900	11,000
RBA-400	400E	37,500	60,000	29,400①	47,000	29,400①	47,000	......	......	......	......	......	......
RBA-400	300E	......	......	......	......	......	......	21,000	33,500	16,800	26,800	16,800	26,800
RBA-800	720E	37,500	60,000	29,400①	47,000	29,400①	47,000	......	......	......	......	......	......
RBA-800	540E	......	......	......	......	......	....	21,000	33,500	16,800	26,800	16,800	26,800
Current Limiting Type													
CX	75C	50,000	80,000	......	......	......	....	......	......	......	......	......	......
CX	40C	......	......	50,000	80,000	50,000	80,000	......	......	......	......	......	......
CXN	300C	50,000	80,000	50,000	80,000	......	....	......	......	......	......	......	......
CXN	200C	......	......	......	......	50,000	80,000	......	......	......	......	......	......
CLE-1, 2	450X	50,000	80,000	......	......	......	....	......	......	......	......	......	......
CLE-1, 2	125X	......	......	......	......	85,000	135,000	......	......	......	......	......	......
CLE-1	125E	......	......	50,000	80,000	......	....	......	......	......	......	......	......
CLE-2	200E	......	......	40,000	63,000	......	....	......	......	......	......	......	......
CLE-3	200X	......	......	......	......	50,000	80,000	......	......	......	......	......	......
CLE-750	750E	40,000	63,000	......	......	......	....	......	......	......	......	......	......
NX	80E	......	......	......	......	......	....	50,000	80,000	......	......	......	......
NX	100E	......	......	......	......	......	....	......	......	35,000	56,000	......	......
EJO	80E	......	......	......	......	......	....	......	......	......	......	12,500	20,000

For further fuse data and coordination curves refer to: RBA Fuses AD 36-616 and AD 36-635; CX, CXN and CLE Fuses AD 36-686, AD 36-733, and AD 36-715.

① With 591C607G02 discharge filter, interrupting ratings increase to 34,800 sym. and 55,100 Asym.

② When boric acid fuses are applied above 15KV, the height of the switch is increased. Each switch will be shipped in 2 sections.

Switch Operation, *Continued*
The speed of opening and closing of the switch shall be independent of the operator. With the handle inserted in the spring charging cam, the switch shall be closed by an upward movement to charge the compression spring. At a predetermined point in the charging cycle, the mechanism shall go over toggle, releasing the stored energy of the spring to the switch, snapping the switch closed. As a result of this action, the blades move at a speed independent of the charging motion. It shall be impossible to tease the switch into any intermediate position. Switch opening shall be accomplished by a downward motion of the handle resulting in compression of the spring and releasing its' stored energy in a similar sequence.

The interrupter switch will have separate main, make and break contacts to provide maximum endurance for fault close and load interrupting duty. Arcing contacts shall be spring loaded on make and break and shall be so designed as to be last in and last out. Arc interruption shall take place within urea formaldehyde arc chutes which produce a high dielectric gas to assist interruption.

The operating mechanism shall be designed to provide sufficient power to overcome the blow-out forces when closing the switch into a fault.

Safety Interlocking
The full height door shall be hinged and interlocked with the switch shaft so that the switch must be opened before access to the fuses is possible and the door must be closed before the switch can be closed.

Insulation
All insulation supporting current carrying parts will be procelain or flame retardant, non-tracking glass polyester.

Power Fuses
Fault protection shall be furnished by fuses of one of the two types specified below as indicated on the contract drawings.

Fuses shall be:

A. Current limiting type of the self-contained design to provide fast clean interruption with minimum let-through current. Fuses will operate during the first half cycle on maximum fault conditions with no expulsion of gases or vapor, and shall be Westinghouse Type CX, CXN or equal, or

B. Boric acid type which expel gases and vapor, but are readily refusible with low-cost refill units and shall be Westinghouse Type RBA or equal.

All fuses shall be positively locked in position with provision for easy removal and replacement from the front without the use of special tools.

Main Bus and Connections
The main bus shall consist of electro tin-plated aluminum bus bar mounted on NEMA rated glass polyester or porcelain insulators for the voltage class and BIL specified.

The design of the busses, connections and supports shall be consistent with the mechanical stresses produced by short circuit current equivalent to the interrupting current rating of the associated switch and fuse at service voltage. All hardware used on conductors shall have a high tensile strength and anti-corrosive plating.

A ground lug shall be furnished, firmly secured to the structure for a single cubicle. For line-ups, a ground bus shall be furnished to extend the entire length of the switchgear. Lugs shall be provided for copper ground cable at each end of the bus. All lugs shall be of the solderless type suitable for copper or aluminum cable of sizes indicated on drawings.

Low Voltage Devices
Meters, instruments and relays shall be isolated from high voltage by grounded metal barriers. Small wiring, fuse blocks and terminal blocks within the switchgear shall be furnished as indicated on the drawings. All wiring shall be furnished with wire markers.

Enclosure Construction
Construction shall be on the universal frame type using die-formed, welded and bolted members. To facilitate installation and maintenance of cables and bus, the top and rear covers shall be removable. All enclosing covers and doors shall be fabricated from not less than 11 gauge steel.

Each switch cubicle shall have a single, full length, flanged front door over the switch and/or fuse assembly. The flanged door shall close over a projecting door frame. The door shall be equipped with two rotary latch type handles to provide four latching members held in shear. Provision shall be made for operating the switch and storing the removable handle without opening the full length door. A rectangular, high impact type contact viewing window shall be provided in the door over the switch, and backed up by a grounded metal barrier punched with a diamond pattern to assure safety but still allow full view of the switch blades.

Switchgear assemblies comprising cubicles shall be group mounted with at least 11 gauge steel side sheets between adjacent sections. Each unit shall be adequately braced to prevent distortion of the cubicle under normal operating conditions as well as during interruption of short circuit currents.

Outdoor units shall have a sloped drip-proof roof. All openings shall be screened to prevent the entrance of small animals, and barriered to inhibit the entrance of snow, sand, etc. One space heater shall be provided in each cubicle. Power for the space heater shall be furnished by others.

The structure shall be provided with adequate lifting means and shall be capable of being rolled or lifted into installation position and bolted to the floor.

Adequate conduit space shall be provided to meet the N.E.C. requirements.

Paint and Finish
External and internal steel surfaces to be painted shall be throughly cleaned and phosphatized prior to application of paint. They shall then be primed with a corrosion-resisting coating and, after assembly, receive a finish coat of a high quality air-dry acrylic enamel. Colors should be ANSI-61 light gray for indoor enclosures and ANSI-24 dark gray for outdoor enclosures. In addition, the undersurfaces of outdoor units are to receive a corrosion resistant protective coating.

Motor Operators
Switches shall be supplied with motor operators where shown on the drawings. All motor operated switches shall consist of a standard manually operated switch in combination with an electric motor driven linear actuator which charges the spring. Connection between the linear actuator and switch mechanism shall be by reliable rigid metal-to-metal linkages, not chains or cables. The linear actuator and all associated low voltage wiring shall be located in an isolated low voltage compartment to separate it from the high voltage.

Operating voltage shall be 120 volts 60 Hz. The switch shall be capable of manual operation should a loss of control power be encountered.

The linear actuator shall be a highly repetitively manufactured item, completely sealed and weather protected, and designed for rugged Industrial application. No lubrication or adjustments should be necessary for its normal operating life. The motor shall be equipped with an automatically reset thermal overload protector.

The motor operated switch shall be the WLI Pow-R-Drive motor operated switch or equal.

Testing
The manufacturer shall supply, upon request, test results to conform that the switch has been tested in a high power laboratory to substantiate designs according to applicable ANSI and NEMA Standards. The tests shall verify not only the performance of the switch and integrated switch-fuse assembly, but also the suitability of the enclosure venting, rigidity and bus bracing. In addition, the switchgear shall be factory tested in accordance with ANSI standards.

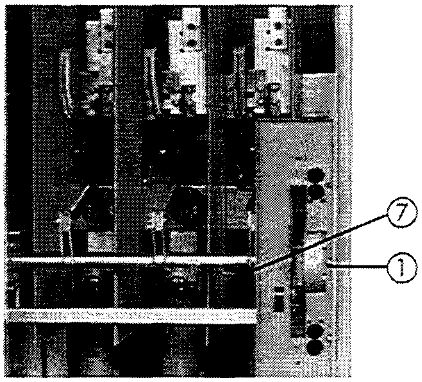
Switchgear shall be Westinghouse Type WLI or approved equal.

Drawings
Record drawings shall be furnished providing the following information: Assembly Voltage/Current Rating; Overall outline dimensions, including available conduit space; Switching and protective device ampere ratings; (Bus) Conductor ratings; and One-line diagram.

Printed in USA

Westinghouse WLI Metal-Enclosed Switchgear

Design Features



Illustrated Design Features

(1) Switch Mechanism Features
Quick-make, quick-break stored energy operation.

The speed and force of opening and closing the switch blades is constant and independent of the speed with which the operator handle is moved.

The switch blades cannot be teased to an intermediate position. During the closing operation, full clearance between blades and stationary contacts is maintained until the switch mechanism goes over toggle.

The WLI time-proven switch mechanism has only metal-to-metal linkages eliminating the need for unreliable chains or cables that require difficult adjustments or fail during operation.

Arc interruption takes place between copper-tungsten tipped auxiliary (flicker) blades and engaging contact fingers within a DE-ION® arc chute; no arcing takes place between the main blades and the stationary contacts.

Blow-out forces cannot be transmitted to the operating handle, thus enhancing operator safety.

(2) Provisions for Padlocking Door

(3) Inspection Window
A single gasketed, rectangular, high impact viewing window permits full view of the position of all three switch blades through the closed door.

(4) Full Height Main Door
The reinforced door is equipped with a return flange. When current limiting fuses are used, there are two latching members. When boric acid fuses are used, there are four latching members. The door closes over a projecting frame and has concealed hinges.

(5) Foot Operated Door Stop

(6) Grounded Metal Safety Barrier
A steel barrier punched with a diamond pattern is provided in front of every switch. This barrier prevents inadvertent contact with any live part, yet allows for a full-view inspection of the switch blade position of all three phases.

(7) Door Interlock
This interlock prevents the door of the enclosure from being opened when the switch is closed. On opening the switch, the interlock disengages automatically from a bracket provided on the back of the door, so that the door can be opened.

(8) Switch Interlock
This interlock prevents inadvertent closure of the switch if the door of the enclosure is open. When the door is closed, the interlock is automatically defeated and the switch is free to be closed.

(9) High Quality Insulation
Bus and switch insulators, switch drive rods, barriers between phases, and barriers between outer phases and the housing, are of high strength, track resistant glass polyester. Porcelain and Polysil® insulation systems are also available.

(10) Permanent Switch Position Indicators

(11) Provisions for Padlocking Switch
The load interrupter switch may be padlocked in either the open or closed position.

(12) Provisions for Key Interlocks

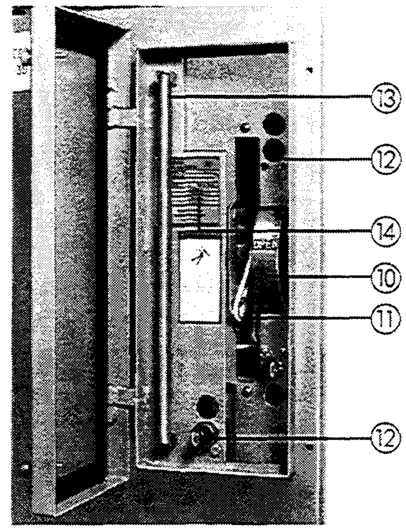
(13) Operating Handle
The switch operating handle is conveniently located behind the small access door. Because the handle is not in plain sight, the structure has a smooth homogenous appearance. When specified, provisions for padlocking the access door can be provided to prevent tampering or unauthorized operation of the switch.

(14) Permanent Nameplates

Design Features Not Illustrated

Ground Bus or Ground Lug

Fuse Mountings
Mountings are of a proven, tested design which positively clamp the fuses into place, yet permit easy replacement of the fuses without special tools. Fuse mountings are available for a wide variety of silver-sand current limiting fuses (CX, CXN, CLE, or HLE) or boric acid expulsion type fuses (RBA).



Bus Bar

Aluminum tin-plated, air-insulated bus is standard. Tin-plated copper, silver-plated copper, and/or insulated bus is also available.

Enclosure
Construction is of a universal frame type design using die-formed, bolted members. Each unit is braced to prevent cubicle distortion under normal conditions as well as during interruption of short circuit currents (seismic braced construction is also available). Enclosures are made of 11 gauge steel that is painted with a baked-on polyester powder coat paint system resulting in a very durable finish with uniform thickness and gloss. This cosmetically pleasing finish minimizes the risk of problems in harsh environments. The standard color is ANSI-61 light gray, and special paint colors are available.

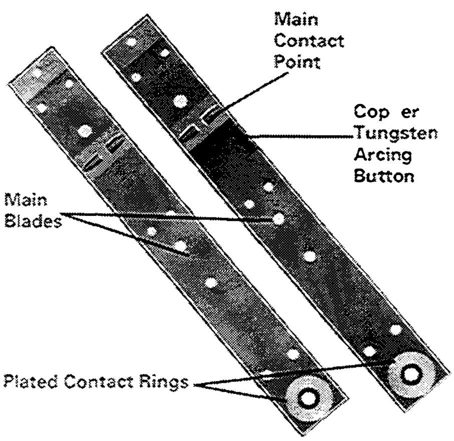
Outdoor enclosures are provided with a 120-volt space heater as standard. (Power for the heater can be supplied as an option.)

Generous Cable Termination Area
Because the WLI switch is supported by channel steel uprights (instead of mounting on the rear panel), cable termination can be accomplished easily and conveniently in the rear of the enclosure. Also, appropriate bus and lugs are provided to facilitate cable terminations (as specified) without the necessity of extensive cable training or severe cable bends. Some switchgear is available with front-access cable terminations. Contact your local Cutler-Hammer representative for availability on your particular application.

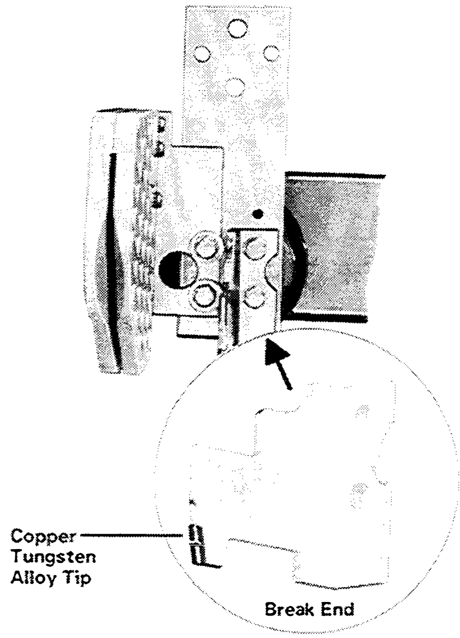
Westinghouse WLI Metal-Enclosed Switchgear

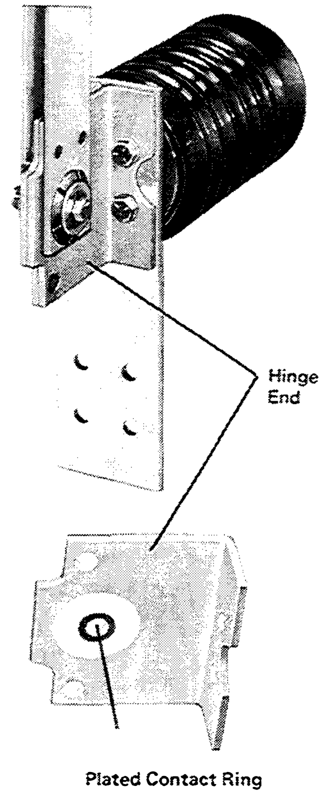
Design Details

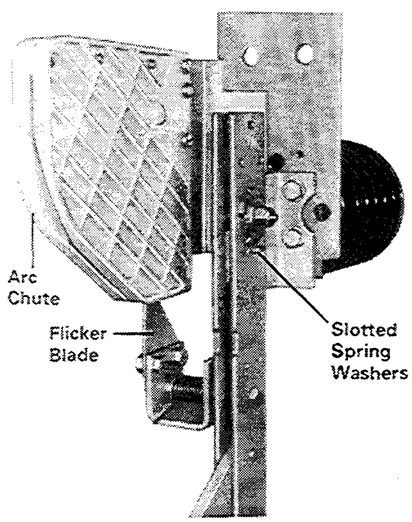
Main Blades
The main blade assembly consists of two high-conductivity, hard drawn copper bars in parallel. The blades are provided with a silver ring at the hinge end and a copper embossed silver-plated main contact point. On 40 kA and 61 kA fault close ratings, copper tungsten alloy arcing buttons are provided to prevent damage to main blades, thus extending contact life and reducing maintenance expenses and downtime.



Main Stationary Contacts
The main contacts, break and hinge end, are made of high-conductivity hard drawn copper. For 40 kA and 61 kA fault closing, the break end is provided with a copper tungsten alloy arcing tip.





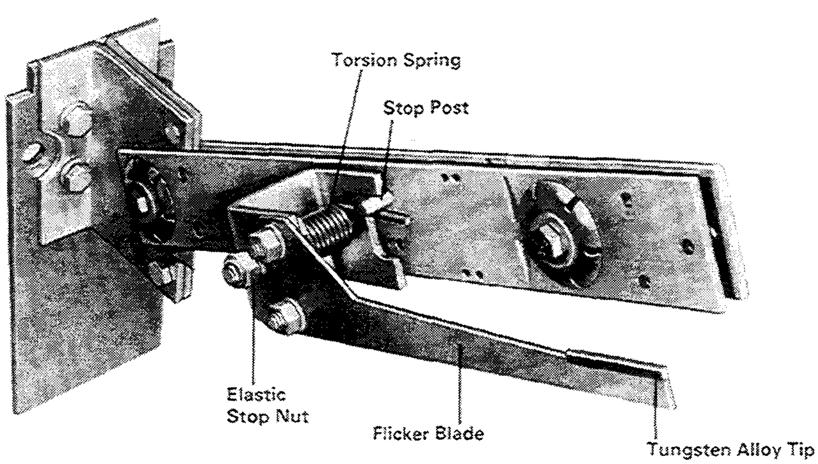


The two bars are fastened together to form a single blade at the hinge and break ends. Self-adjusting slotted spring washers of phosphorus bronze assure that constant high contact pressure and proper blade alignment is maintained.

The stationary hinge end consists of two pieces of copper fastened together. Proper electrical contact is maintained where the blade is attached to the hinge contact with bolt and spring washer construction. To further assure good electrical contact at 1200 amperes, the hinge end is provided with plated contact rings at the moving point.

Arc Chutes
The arc chutes are molded of urea formaldehyde. When the switch is opened under load current conditions, de-ionizing gas is produced and the arc is extinguished. Contacts within the arc chute restrain the flicker blade assembly until the torsion spring is charged prior to opening.

Flicker Blades
A flicker blade is connected to the side of and parallel to, each of the main blade assemblies. It is constructed of a high strength bronze alloy with an arc resisting tungsten alloy tip.



Westinghouse WLI Metal-Enclosed Switchgear

Design Details, *continued*

Switch Mechanism
The quick-make, quick-break mechanism utilizes a heavy-duty coil spring which provides powerful opening and closing action. To close the switch, the handle is inserted into the spring charging cam which is then rotated upward through an angle of 120°. This charges the compression spring which is held by a spring lever. As the spring lever goes over toggle, the stored energy of the spring is released and transferred to the shaft which snaps the switch closed.

As a result of this over-toggle action, the blades move at a predetermined speed which is independent of the operator. It is impossible to tease the switch into any intermediate position.

To open the switch, the spring charging cam is rotated downward resulting in compression of the spring and releasing its stored energy in a similar sequence.

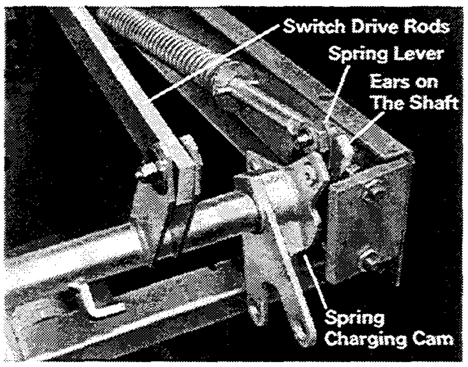


Fig. 1: Switch in Open Position

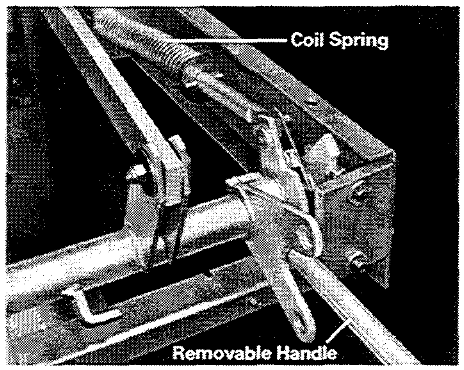


Fig. 2: Spring Being Charged

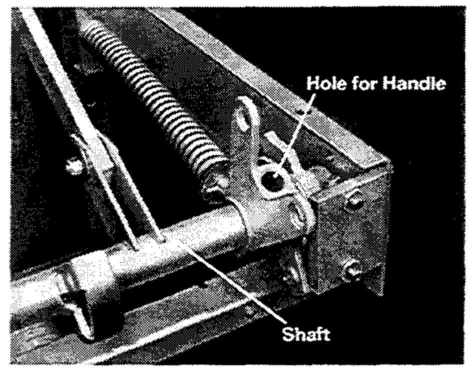


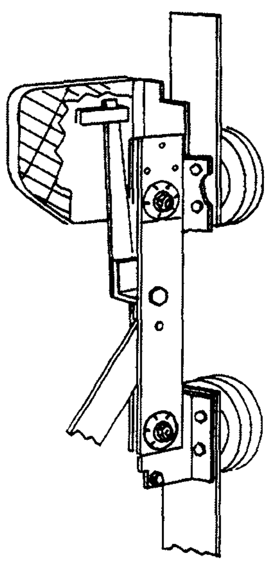
Fig. 3: Switch in Closed Position

Quick-Break DE-ION® Arc Interruption
With the switch closed, both main and auxiliary (flicker) blades are closed. The primary current path is through the main blades.

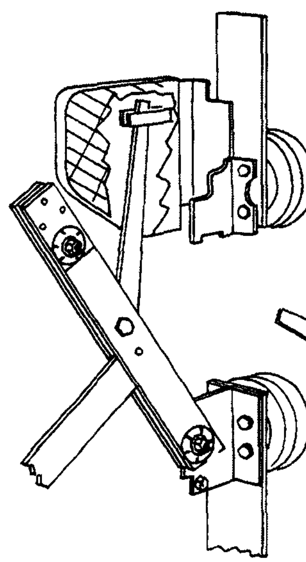
As the main blades open, current is transferred momentarily to the flicker blades, which are held in the arc chute by contact fingers. There is no arcing at the main blades.

When the main blades reach a pre-determined angle of opening, a stop post on the main blade prevents further angular movement between the main and flicker blades. This starts the flicker blade out of the contact fingers in the arc chute. As contact is disengaged, the flicker blade is snapped into position by a torsion spring.

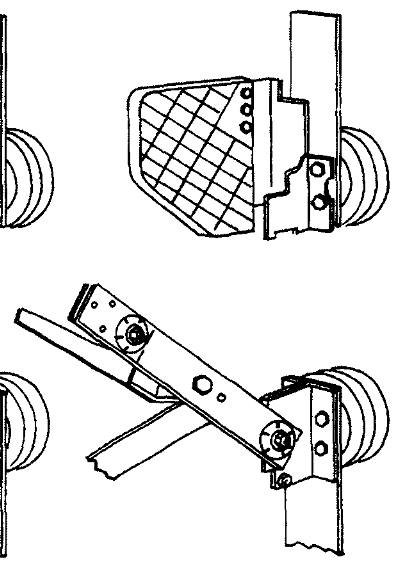
The heat of the arc, meanwhile, releases a blast of de-ionizing gas from the gas-generating material of the arc chute. This combination of quick-break and DE-ION® action quickly extinguishes the arc and the circuit is safely de-energized.



Both Blades Engaged



Main Blade Disengaged, Flicker Blade Engaged



Both Blades Disengaged

Westinghouse WLI Metal-Enclosed Switchgear

Current Limiting Fuses

5 - 15 kV Classes
Westinghouse CX, CXN, CLE, and HLE

The CX and CXN general purpose current limiting fuses were designed specifically to provide complete fault protection on high capacity indoor and underground distribution systems. They provide excellent protection for all types of transformers.

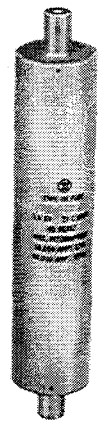
Types CX and CXN fuses are constructed with pure silver fuse elements, a high-purity silica sand filler, an inorganic core with spaced arc guards, and a glass melamine outer casing.

Under high fault current conditions, the silver element melts almost instantaneously losing its energy into the surrounding sand. The energy melts the sand forming a glass-like substance called fulgurite. The arc voltage rapidly increases to about three times the fuse voltage rating forcing the current to zero. The fault is interrupted in one-half cycle or less without noise or expulsion of gases.

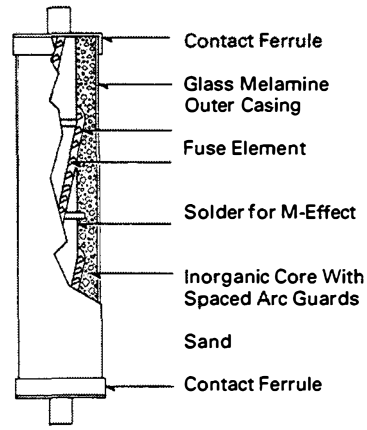
Low-level fault currents are cleared by the melting of a solder drop on the fuse element which melts the silver element.

CLE and HLE fuses are also silver-sand constructed fuses with the added feature of blown fuse indication. In addition, HLE fuses deliver the advantages of optimized energy exchange, improved arc control, lower temperature rise, reduced I^2t let-through, limited arc voltage, and improved time-current characteristics.

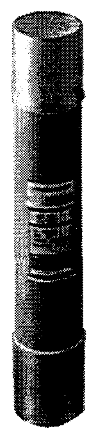
27 - 38 kV Classes
Cooper NX or GE EJO-1 current limiting fuses are recommended for use on circuits above 15 kV. Because of their short relative length, the switch units can be reduced in height.



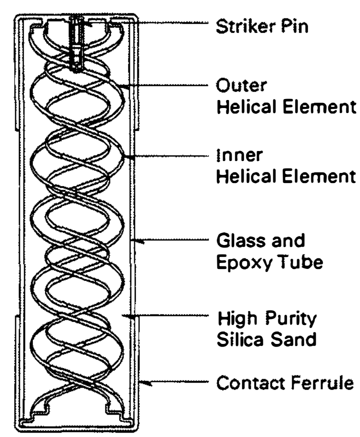
CX Fuse



Cross Section Showing Component Parts of a CX Fuse



HLE Fuse

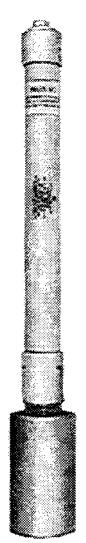


HLE Cross Section Illustrating Double Helix Configuration and Major Components

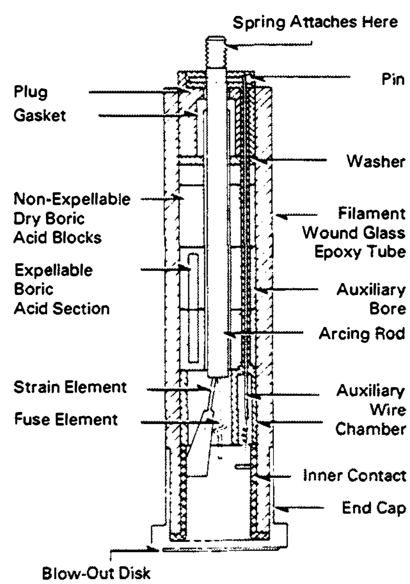
Boric Acid Fuses

Westinghouse RBA
The boric acid refill is probably the most important component of the RBA fuse. It is designed to interrupt currents of short circuit magnitude within ½ cycle, and through its two de-ionizing chambers in parallel, have selective operation and interruption for both low-current and high-current faults. This is achieved by movement of the arc through the boric acid cylinder by a helical spring and rod. As the arc strikes, intense heat decomposes the dry boric acid. On decomposition the boric acid forms water vapor and inert boric oxide. The electrical interruption is caused by the steam de-ionizing the arc as it is drawn through the cylinder by the action of the spring and rod. The high particle turbulence of boric acid causes the rate of de-ionization in the cylinder to exceed the ionization rate of the electrical arc. This action prevents the arc from restriking.

After operation of the fuse, the fuse holder is taken from its mountings, the fuse refill removed and replaced with a new refill.



RBA-400 Fuse with Discharge Filter



RBA-400 Fuse Refill

Westinghouse WLI Metal-Enclosed Switchgear

Blown Fuse LV Contact

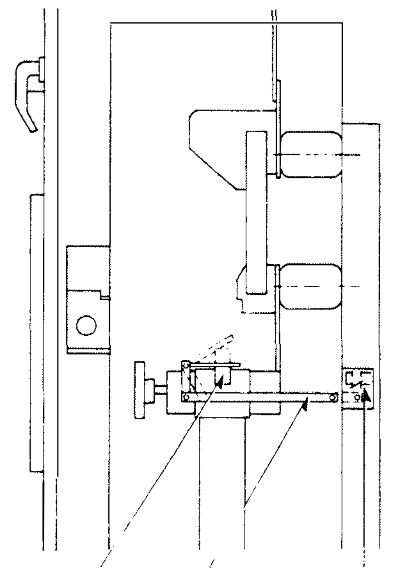
This feature is available when CLE, HLE, or RBA fuses are used. An insulated linkage is moved by the pop-up button (CLE), striker pin (HLE), or indicator (RBA) on the fuse, and it in turn actuates a micro switch. The contacts on this micro switch can be used for remote blown fuse indication or to open the WLI when used in conjunction with motor-operated switches or the electro-mechanical stored energy release mechanism.

Two-Position, No-Load Selector Switch

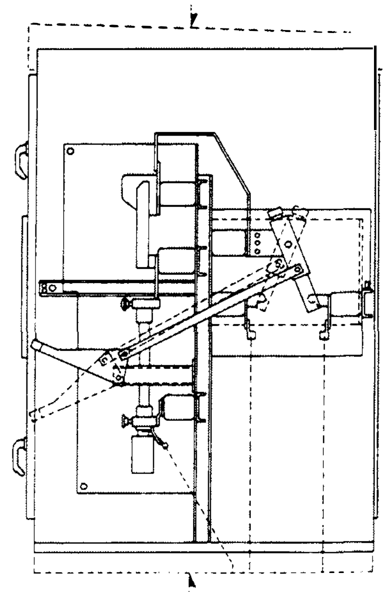
The WLI load interrupter switch can be provided with a two-position non-load break selector switch. This selector switch is mechanically interlocked such that operation can be performed only when the load interrupter switch is in the open position.

Switch Grounding

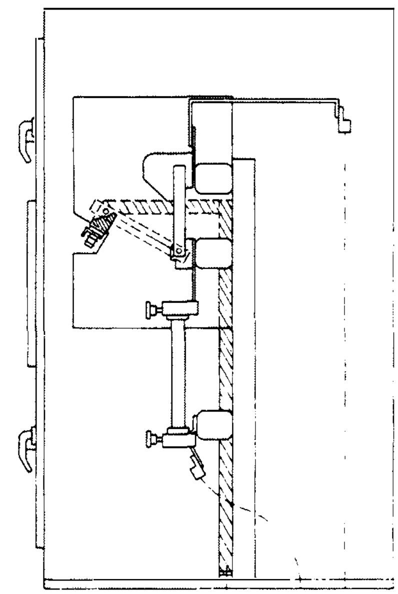
When specified, a grounding feature can be added to any WLI switch. This feature consists of an extra set of main contacts that are directly connected to the ground bus. The blades are always directly connected to ground when the switch is opened.



Blown Fuse Mechanism Operation



Typical Two-Position Selector Switch for Bottom Cable Entrance

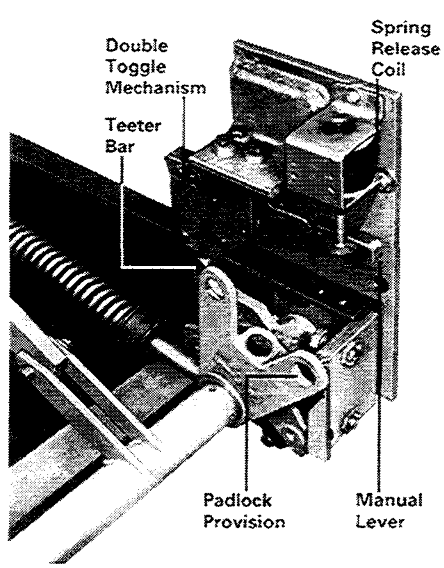


Section View of Switch that Grounds in the Open Position

Electro-Mechanical Stored Energy Release

The unit is a mechanical linkage consisting of a teeter bar, a double toggle assembly, and a spring release coil. Closing the switch is accomplished by charging the spring manually. When the spring lever reaches the over toggle position, the spring attempts to release its energy and move the operating shaft. All movement, however, is restrained by a linkage which transfers the force to the double toggle assembly. The switch can now be closed by tripping the double toggle assembly with the spring release coil or manual lever.

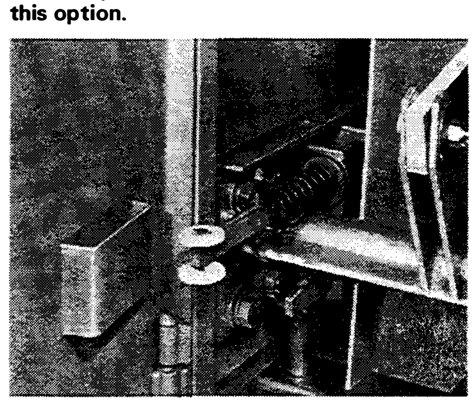
Once the switch is closed, the opening cycle is made ready by recharging the spring and the spring lever traveling over the toggle. The double toggle assembly resets after each open or close cycle and allows the mechanical sequence to repeat. The switch can now be opened by the spring release coil or manual lever.



Electro-Mechanical Stored Energy Release

For safety purposes, a shaft lock assembly is provided on the side opposite the spring to prevent the switch from operating when the door is opened and the switch is charged for operation.

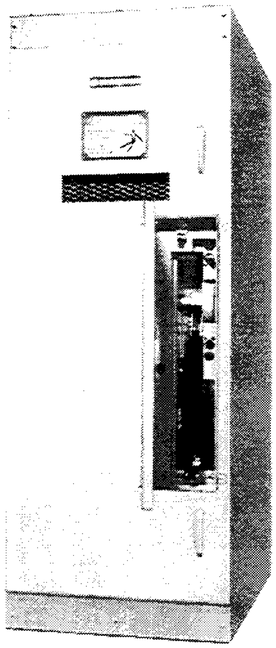
Note: Key interlocks are not available with this option.



Shaft Lock Mechanism

Westinghouse WLI Metal-Enclosed Switchgear

Motor-Operated WLI Switches



WLI Motor Operator

Application

The WLI motor operator makes possible the safety, convenience, and coordination inherent in remote switch operation. It is also an integral component of WLI automatic transfer switchgear.

Description

A WLI motor-operated switch is a standard, manually operated switch in combination with a heavy-duty electric motor-driven linear actuator which charges the spring. The linear actuator is located in a separate isolated low-voltage compartment. During electrical operation, it smoothly and quietly extends or retracts the proper distance to cause the switch mechanism to travel over toggle.

As the switch mechanism goes over toggle, actuating levers on the shaft operate limit switches. The limit switches sequence indicating lights and energize relays which supply power to the motor – one for each direction of travel. These relays have electrically interlocked coils which prevent simultaneous energization and are supplied with holding circuit contacts. Standard motor operators are mounted in the switch enclosure. This eliminates the separate motor compartment, thus conserving floorspace.

Manual Operation

A steel clevis pin connects the linear actuator to the spring charging mechanism. The pin can be removed by hand and the linear actuator pivoted away from the mechanism allowing manual operation when necessary.

Ratings for Motor Operators

Motor Operation is available for all published switch ratings. Test data for standard switches also applies to motor-operated switches.

The motor operator has the following ratings:

Rated Operating Voltage:
120 VAC or 125 VDC (Specify).
Full Load Current:
Four (4) Amps
Spring Charging Time:
Five (5) to Nine (9) Seconds
Minimum Operating Voltage:
90% of Rated Voltage

The Control Voltage for the Motor Operator is Supplied by the User except in Automatic Transfer Control applications where it is supplied by Cutler-Hammer.

Motor Operator Standard Features

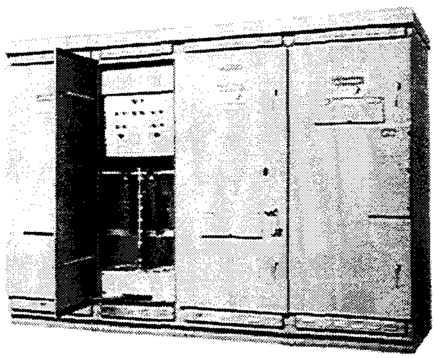
- Rugged, smooth and quiet operation.
- Completely sealed and weather protected.
- No maintenance required; lubricated and adjusted for normal life.
- Load and current limiting clutch.
- Automatically reset, thermal overload protector.
- Fail-safe motor holding brake.
- Electrical interlock that disables motor operation with the switch door open.
- Manually operable.
- De-coupling feature.
- Open-close controls.

Optional Features

- Red and green position indicating lights.
- Switch position auxiliary contacts.
- Key interlocks to electrically and mechanically lock switch open when the main switch door is open.
- Ten-cycle operation (electro-mechanical stored energy release).

Westinghouse WLI Metal-Enclosed Switchgear

WLI Switchgear With Automatic Transfer Control



Two Switch Automatic Transfer

Application
WLI switchgear with automatic transfer control is an integrated assembly of motor-operated WLI switches, sensing devices and control components and is available for 5 – 38 kV classes. It is typically applied on primary selective service in either a two-switch or three-switch configuration, and assures high continuity of service for critical loads. WLI automatic transfer switchgear is applicable to automatic throwover schemes having a wide variety of operational sequences and many standard control panels.

Typical Control Panel for Two-Switch Configuration:
Qty.
4 – Amber lights for "hot" line.
2 – Test pushbuttons.
2 – Red lights for "switch closed".
2 – Green lights for "switch open".
1 – Blue light for "Automatic" mode.
2 – Control switches for manual electrical open and close operations.
1 – Toggle switch for ON/OFF control of Automatic Return to Normal Source operation.
1 – Toggle switch for choice of open or closed transition.
1 – Toggle switch for preferred source selection.

Typical Two-Switch Operation
The WLI automatic transfer controller continuously monitors all three phases on both sources for correct voltage. Should the voltage of the normal source be lost, the voltage sensing relay will activate an "OFF DELAY" timer. If the voltage of the normal source is not restored when the timer completes its timing sequence, the normal source switch will open and the alternate source switch will close in an open transition sequence, thus restoring power to the connected load.

Typical Three-Switch Operation
The WLI automatic transfer controller continuously monitors all three phases of both sources for correct voltage. Should the voltage of either source be lost, control power will automatically switch to the other source (unless control power was already being drawn from the other source). Simultaneously, a signal is sent to start the failed source's "OFF DELAY" timer. When the timer times out, the failed source main switch will open and the tie switch will close. Both load busses are now being fed from the single source remaining at normal voltage.

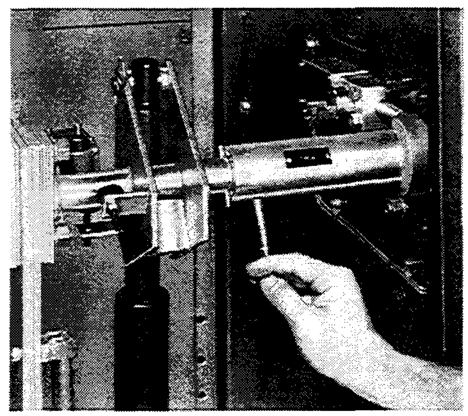
When the failed source's voltage returns, a signal is sent to start its "ON DELAY" timer. When the timer has timed out, the tie switch will open and the main switch will close. Each load bus is now being fed by its respective source.

(The typical operations described above cover open transition operation including electronic non-paralleling interlocks.)

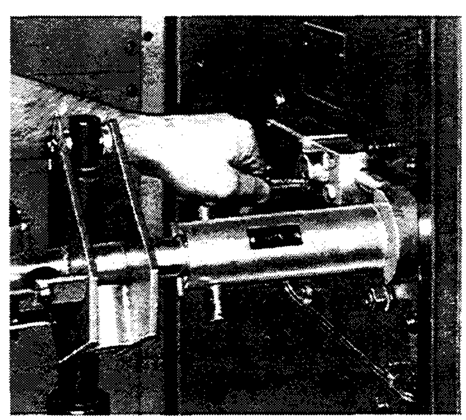
Standard Features
- Three-phase voltage sensing on both sources.
- Automatic transfer controller utilizing PLC logic. (Control power for ATC is derived from supplied VTs.)
- Switch position indication lights.
- Electrical interlocking to prevent paralleling of sources.
- Automatic or manual operation.
- Adjustable time delays on both sources, "OFF DELAY" and "ON DELAY".
- Single-source responsibility: All basic components are manufactured by Cutler-Hammer.

Optional Features
- Three-switch (two mains and tie) operation.
- Closed transition on return to normal.
- Choice of automatic or manual return to normal.
- Choice of normal source (two-switch only).
- Lockout on phase and/or ground overcurrents and/or internal bus faults.
- Motor operator de-coupling device to allow sequencing of motors and associated circuitry without affecting switch positions.

De-coupling Feature
This feature allows sequencing of the linear actuator and all associated electrical and mechanical components for test purposes, without affecting the WLI switch position. Decoupling is accomplished simply and quickly by hand removal of a stainless steel pushbutton hitch pin. When this pin is removed, the motor-operated shaft is disengaged from the switch spring charging mechanism and rotates freely within a bronze bearing. The pin can only be replaced when the linear actuator has been sequenced through a complete open-close cycle and has returned to its original position.



Key Interlock to Lock Switch Open
The key locking bolt can only be extended when the switch is in the open position. When the switch is closed, the shaft interlock cam prohibits full extension of the bolt. Extending the bolt not only locks the switch in the open position, but also breaks electrical motor contacts integral to the key lock and permits the key to be removed. With the key, the operator can then open the lock on the main switch door. This scheme gives the positive assurance that the switch is open and cannot be closed with the main door open, thus enhancing the safety of operating and maintenance personnel.



Westinghouse WLI Metal-Enclosed Switchgear

Typical Switch Arrangements *Not to be used for construction purposes unless approved.*

Dimensions in Inches – For Millimeters, Multiply by 25.4

The sketches in this section represent the most common switch arrangements. Many other configurations and combinations are available. **Depth of units will vary** due to cable entrance and exit requirements, the addition of lightning arresters, instrument transformers, special cable terminators, etc.

Figure A1: Single Switch, 5 or 15 kV, Bottom Entrance, Top or Bottom Exit

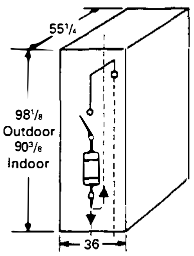


Figure A2: Single Switch, 5 kV Only, Top Entrance, Top or Bottom Exit

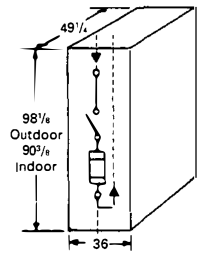


Figure A3: Single Switch, 5 or 15 kV, Top Entrance with Pothead, Bottom Exit

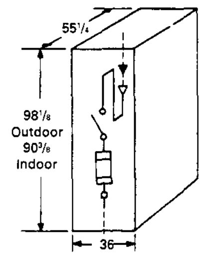


Figure A4: Single Switch with Main Bus, 5 or 15 kV Top Entrance, Bottom Exit

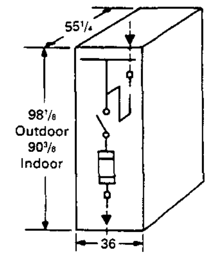


Figure A5: Single Switch, 27 or 38 kV, Top Entrance, Top Exit

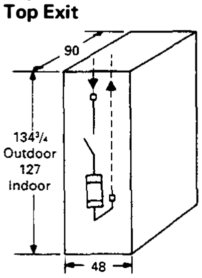


Figure A6: Single Unit, Load Break Switch, With Selector Switch, 5 or 15 kV, Top Entrance, Bottom Exit

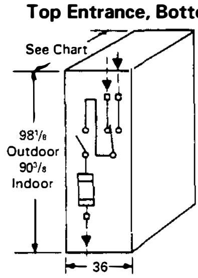


Figure A7: Single Unit, Load Break Switch, With Selector Switch, 5 or 15 kV, Bottom Entrance, Bottom Exit

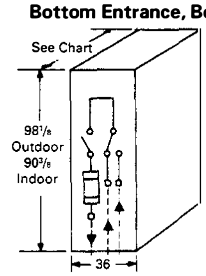


Table for A6 and A7

Voltage		Incoming Cable Entrance		Outgoing Cable Exit		Minimum Depth
5 kV	15 kV	Top	Bottom	Top	Bottom	
X		X		X		70
X		X			X	62
X			X		X	62
	X	X		X		80
	X	X			X	70
	X		X		X	62

WLI Switches for Transformer Primary Switching

All necessary cable, lugs, bus and hardware for close coupling the switch to the transformer are supplied with the switch.

Figure B1: Indoor Switch, 5 or 15 kV, Cable or Bus Connected to Dry-Type Transformer, In Most Cases Switch Depth (Minus Front Door) Will Match The Transformer Depth

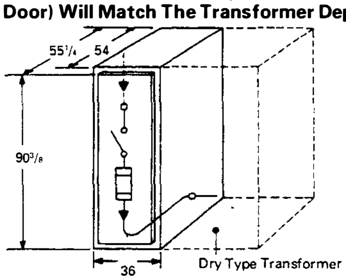


Figure B2: Indoor Switch, 5 or 15 kV, Cable or Bus Connected to Liquid-Filled Transformer

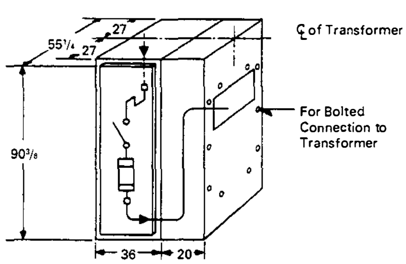


Figure B3: Outdoor Switch, 5 or 15 kV, Cable or Bus Connected to Liquid-Filled Transformer

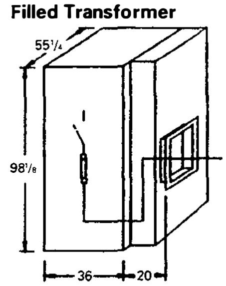
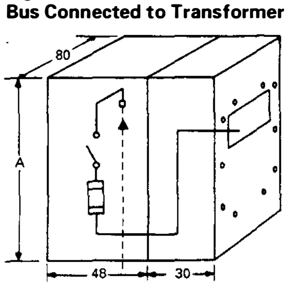
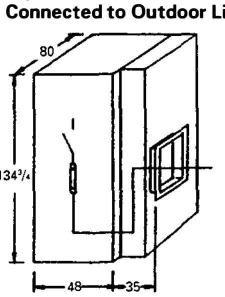


Figure B4: Indoor Switch: 27 or 38 kV, Bus Connected to Transformer



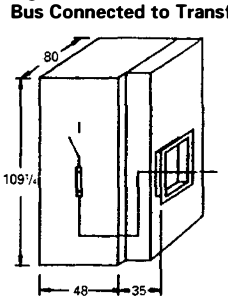
A- 127 With RBA Fuses or 101½ Nonfused or With Current Limiting Fuses

Figure B5: Outdoor Switch, 27 or 38 kV, Bus Connected to Outdoor Liquid-Filled Transformer



With RBA Fuses

Figure B6: Outdoor Switch, 27 or 38 kV, Bus Connected to Transformer



Non-Fused or With Current Limiting Fuses

Westinghouse WLI Metal-Enclosed Switchgear

Typical Switch Arrangements *Not to be used for construction purposes unless approved.*

Dimensions in Inches – For Millimeters, Multiply by 25.4

The sketches in this section represent the most common switch arrangements. Many other configurations and combinations are available. **Depth of units will vary** due to cable entrance and exit requirements, the addition of lightning arresters, instrument transformers, special cable terminators, etc.

Switch Lineups and Connections to Other Apparatus

**Figure C1:
Lineup With Main Switch,
5 or 15 kV, Bottom Entrance,
Top or Bottom Exit**

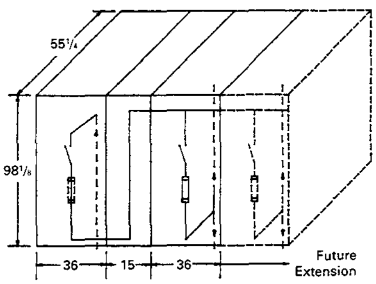


**Figure C2:
Duplex Switch Arrangement,
5 kV, Top Entrance,
Top or Bottom Exit**

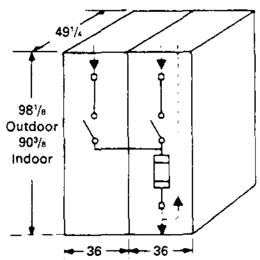


**Figure C3:
Duplex Switch Arrangement,
5 or 15 kV, Bottom Entrance,
Top or Bottom Exit**

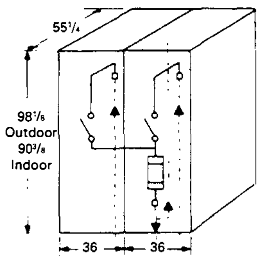


**Figure C4:
Lineup With Main Switch,
27 or 38 kV, Bottom Entrance,
Bottom Exit**

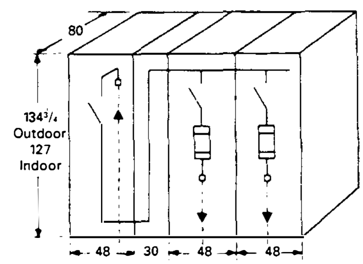


**Figure C5:
Outdoor Walk-in With Main Bus Only,
5 or 15 kV, Bottom Entrance, Bottom Exit**

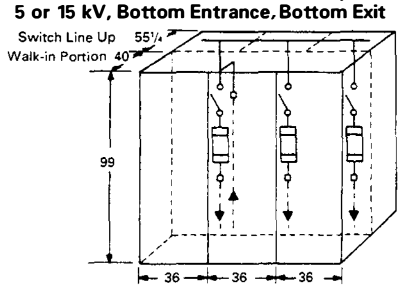


**Figure C6: Connection to
Ampgard Starter, 5 or 7.2 kV,
Indoor Only, Top or Bottom Exit**

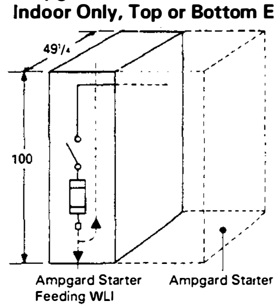


**Figure C7: Connection to
Ampgard Starter, 5 or 7.2 kV,
Indoor Only, Top or Bottom Entrance**

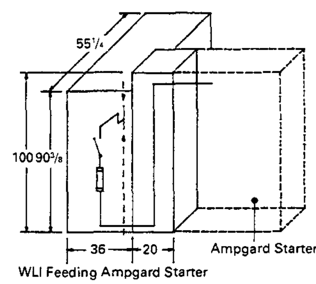
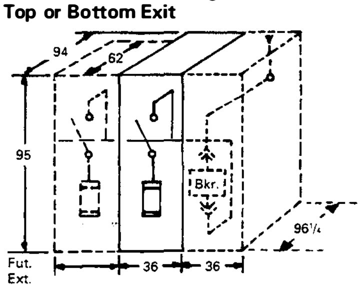


**Figure C8: Indoor Connection to
VacClad-W MV Switchgear, 5 or 15 kV,
Top or Bottom Exit**



WLI Motor-Operated and Automatic Transfer Switch Arrangments

**Figure D1:
Motor-Operated Switch, 5 or 15 kV,
Bottom Entrance, Bottom Exit**

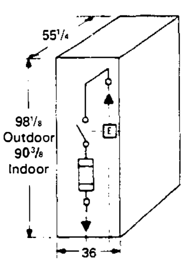


**Figure D2:
Lineup With Main Switch, Motor-Operated,①
5 or 15 kV, Top Entrance, Top Exit**

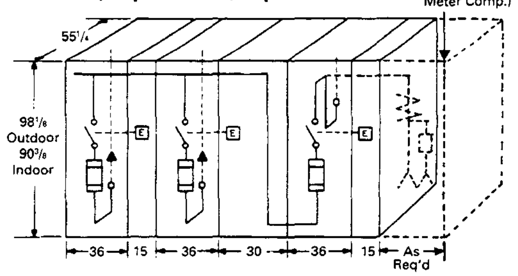


**Figure D3:
Two-Switch Motor-Operated,
Automatic Transfer, 5 or 15 kV,
Bottom Entrance, Bottom Exit**

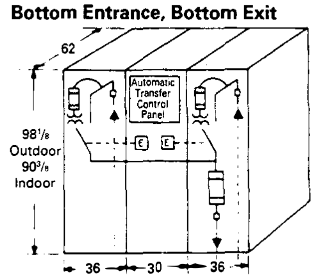
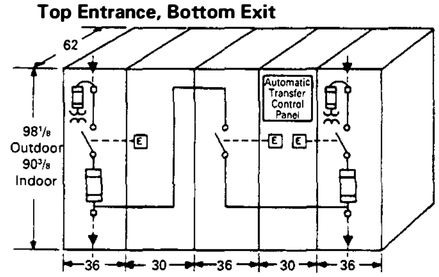


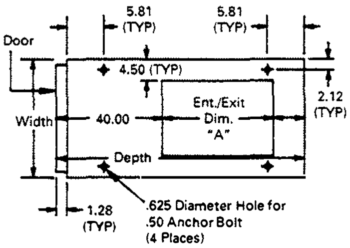
**Figure D4:
Three-Switch Motor Operated,
Automatic Transfer, 5 or 15 kV,
Top Entrance, Bottom Exit**



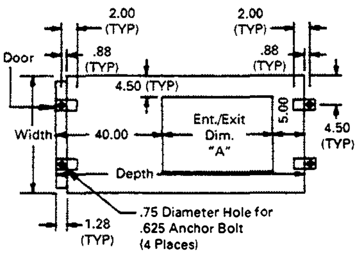
① Motor operators are available mounted in the switch enclosure for many applications. This may eliminate the separate motor compartment.

Westinghouse WLI Metal-Enclosed Switchgear

Floor Plans, 5 and 15 kV (Dimensions) Indoor

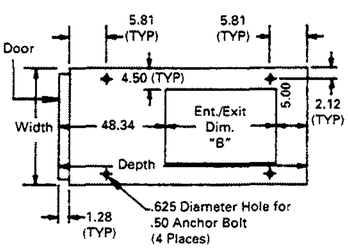


Outdoor

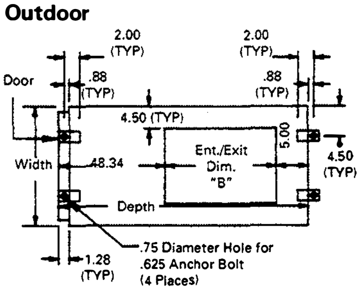


Width	Depth	Dim. A
36, 42, 48	49¹/₄	4¹/₄
	55¹/₄	10¹/₄
	62	17
	70	25
	80	35

Floor Plans, 27 and 38 kV (Dimensions) Indoor

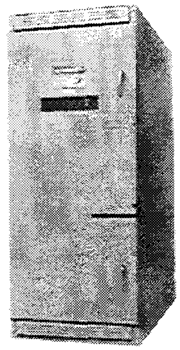


Outdoor

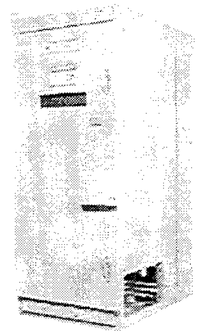


Width	Depth	Dim. B
48, 54, 60	69	15⁵/₈
	80	26⁵/₈
	90	36⁵/₈
	100	46⁵/₈

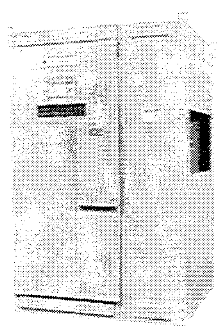
Typical WLI Switch Arrangements



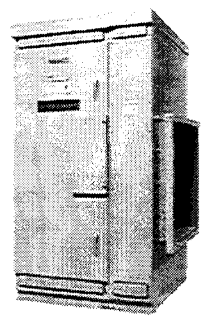
Indoor Single



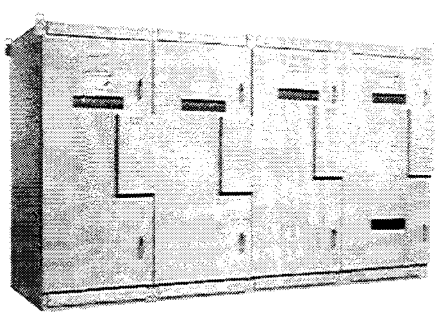
Indoor 5 or 15 kV Switch for Connection to Dry-Type Transformer



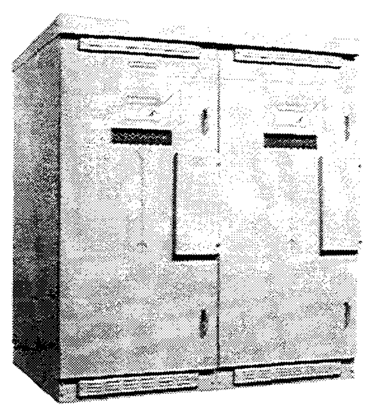
Indoor 5 or 15 kV Switch With Transition for Connection to Liquid-Filled Transformer



Outdoor 5 or 15 kV Switch With Throat for Connection to Liquid-Filled Transformer



Indoor Lineup



Outdoor Lineup

Westinghouse WLI Metal-Enclosed Switchgear

Test Data

All WLI switch ratings have been thoroughly tested in the Westinghouse and/or KEMA High-Power Laboratories. Tests were performed to substantiate all published ratings in accordance with ANSI/IEEE and NEMA standards. The testing program included tests of:

- Basic Impulse Levels
- Momentary Withstand
- Short Time Withstand
- Fault Closing
- Load Interrupting at various loads, various power factors
- Mechanical Life Tests

These tests verified not only the performance of the switch and integrated switch-fuse assembly, but also the suitability of the enclosure venting, rigidity, and bus spacing. The mechanical life test subjected the WLI switch mechanism to more than 500 mechanical operating cycles under no load conditions. No failures resulted to the moving or current carrying parts.

For Further Information on Specific Topics, Please Consult:

WLI Pricing and Ordering Information			PL 31-930
WLI and WVB Instruction Leaflet			IL 31-930
WLI Renewal Parts		RPD 31-935	Catalog 26-000
WLI Sales Aid			SA-11797
WLIGHTNING FAST Program			Form 65514
WVB Vacuum Breaker Metal-Enclosed Switchgear			DB 31-960
VacClad-W MV Metal-Clad Switchgear			DB 32-255
Unit Substation Sales Aid			SA-11730
IMPACC Sales Aid			SA-11998
RBA Fuses	SA-11888	DB 36-630	AD 36-616, AD 36-635
CX Fuses	SA-11888	DB 36-713	AD 36-686
CXN Fuses	SA-11888	DB 36-713	AD 36-733
CLE Fuses	SA-11888	DB 36-711	AD 36-715
HLE Fuses	SA-12059	DB 36-700	AD 36-611
WFS OEM Load Interrupter Switches		IL 31-391	PL 31-931
Unitized Dry-Type Power Centers	SA-11458	DB 31-950	
General Information			Catalog 25-000
Consulting Application Guide			Catalog 55-000

Approximate Weights (Lbs.)

Switch Description	Indoor	Outdoor
5 or 15 kV Class		
Non-fused Switch	1500	1800
Fuses (3), Add	200	200
Indoor Transition	300	135
Outdoor Throat	....	200
27 or 38 kV Class		
Non-fused Switch	2000	2400
Fuses (3), Add	300	300
Indoor Transition	1100	....
Outdoor Throat	....	900
Motor Operator Adder .	400	400

① Two-second symmetrical kA ratings:
- 40 kA momentary switch is 25 kA;
- 60 and 80 kA momentary switches are 38 kA.

② 80 kA rating available on switch and current-limiting fuse switchgear only.

Switch Ratings

Max. kV	Impulse Withstand kV	Amperes Continuous Interrupting	Momentary (Switch Closed) Asym. (10 Cy.)①	Fault Close Asym.
5	60	600	40,000	40,000
		600	61,000	61,000
		600	80,000②	61,000
		1200	61,000	61,000
		1200	80,000②	61,000
15	95	600	40,000	40,000
		600	61,000	61,000
		600	80,000②	61,000
		1200	40,000	40,000
		1200	61,000	61,000
		1200	80,000②	61,000
27	125	600	40,000	40,000
		600	60,000	60,000
38	150	600	40,000	30,000

Fuse Ratings

Type Fuse	Max. Amps	Amperes Interrupting 5 kV Sym.	Asym.	7.2 kV Sym.	Asym.	15 kV Sym.	Asym.	24.5 kV Sym.	Asym.	27 kV Sym.	Asym.	38 kV Sym.	Asym.
Boric Acid Type													
RBA-200	200E	19,000	30,000	16,600	26,500	14,400	23,000	10,500	16,800	6,900	11,000	6,900	11,000
RBA-400	400E	37,500	60,000	29,400①	47,000	29,400③	47,000	......	......	......	......	.....	.....
RBA-400	300E	......	......	......	......	....	......	21,000	33,500	16,800	26,800	16,800	26,800
RBA-800	720E	37,500	60,000	29,400①	47,000	29,400③	47,000	......	......	......	......	.....	.....
RBA-800	540E	......	......	......	......	....	......	21,000	33,500	16,800	26,800	16,800	26,800
Current Limiting Type													
CX	75C	50,000	80,000	......	......	......	......	......	......	......	......	......	......
CX	40C	......	......	50,000	80,000	50,000	80,000	......	......	......	......	......	......
CXN	300C	50,000	80,000	50,000	80,000	......	......	......	......	......	......	......	......
CXN	200C	......	......	......	......	50,000	80,000	......	......	......	......	......	......
CLE-1, 2	450X	50,000	80,000	......	......	......	......	......	......	......	......	......	......
CLE-1, 2	125X	......	......	......	......	85,000	135,000	......	......	......	......	......	......
CLE-1	125E	......	......	50,000	80,000	......	......	......	......	......	......	......	......
CLE-2	200E	......	......	40,000	63,000	......	......	......	......	......	......	......	......
CLE-3	200X	......	......	......	......	50,000	80,000	......	......	......	......	......	......
CLE-750	750E	40,000	63,000	......	......	......	......	......	......	......	......	......	......
HLE	450E	63,000	100,000	......	......	......	......	......	......	......	......	......	......
HLE	350E	50,000	80,000	50,000	80,000	......	......	......	......	......	......	......	......
HLE	250E	......	......	50,000	80,000	50,000	80,000	......	......	......	......	......	......
NX	80E	......	......	......	......	......	......	50,000	80,000	......	......	......	......
NX	100E	......	......	......	......	......	......	35,000	56,000	35,000	56,000	35,000	56,000
EJO	80E	......	......	......	......	......	......	......	......	......	......	12,500	20,000

③ With 591C607G02 high capacity discharge filter, interrupting ratings increase to 37,800 sym and 55,100 asym.

Westinghouse WLI Metal-Enclosed Switchgear

IMPACC

Distribution System Equipment Can Be Tied Together in One Central Location With Networking Capabilities to Remote Stations

Some Significant Features

- **Centralized Data Collection**
  An IMPACC System collects, processes, and stores distribution system operational data. Trend data can help analyze overall electrical distribution system operation or a specific load's historical performance.
- **Early Warning**
  Constant monitoring can alert an operator to potential problems before they occur, thus minimizing costly downtime while keeping the distribution system running smoothly.
- **Troubleshooting**
  Time and date stamped event data is provided to efficiently help troubleshoot problems within a distribution system.
- **Network Integration**
  IMPACC can be integrated with other area networks through an approved personal computer or PLC.
- **Scheduled Maintenance**
  Preventive maintenance schedules can be developed easily from the stored database to improve equipment performance and prevent downtime.
- **Time Savings**
  An IMPACC System eleiminates the necessity to individually read, record, and compile data from electrical distributions assemblies and equipment.
- **Energy Consumption**
  Inexpensive monitoring of energy consumption can be performed at desired locations in the electrical distribution providing for energy cost reductions and/or allocation of energy costs to specific departments or functions.
- **Password Protection**
  Password flexibility allows maximum system utilization and integrity. Up to 30 different passwords can be assigned and can be based on equipment function and/or location.
- **Ease of Installation**
  IMPACC compatible devices are daisy chain connected with a shielded twisted pair wire. Since INCOM is a high frequency-based system, wiring is simplified because there are no polarity considerations.

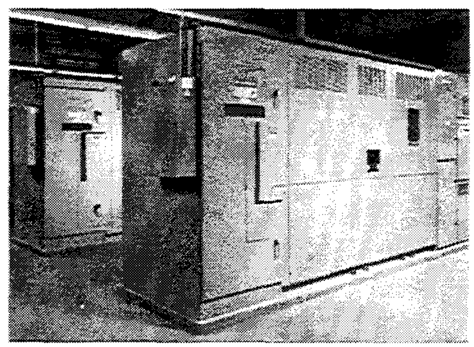
Monitoring, Controlling, and Communicating from a Central Location

From a master control PC, either on-site or off-site, the plant operator, facilities engineer, and/or maintenance engineer can monitor and/or control the entire power distribution system. Information can be made available to other PCs at different locations within a facility.

Shielded twisted pair communications wire in an IMPACC System can extend 7,500 feet without the use of repeaters. Phone lines and modems may be used to extend an IMPACC System to monitor and control off-site locations that may be hundreds or thousands of miles from the master control unit.

IMPACC Capabilities for WLI Switchgear

- Metering Values via IQ Analyzer, IQ Data Plus II, IQ Data, IQ Central Energy Display
- Switch Position via Addressable Relay II
- Blown Fuse Indication via Addressable Relay II
- Switch Control on Motor-Operated and Automatic Transfer Switchgear (Open/Close, Manual/Automatic) via Addressable Relay II



Westinghouse WLI Metal-Enclosed Switchgear

Seismic Qualified Switchgear

Continuing Our Commitment to Industry
The Cutler-Hammer family of Westinghouse distribution system equipment is seismically tested, seismically qualified, and exceeds requirements of both the Uniform Building Code (UBC) and California Code Title 24. These achievements – an industry first – are consistent with our long time commitment to produce equipment that meets the present and future requirements of electrical distribution systems and installations.

Cutler-Hammer is highly experienced in the design and manufacture of distribution equipment that meets the most rigorous seismic standards. Our engineers, scientists, and technicians have worked closely for many years with the Westinghouse Nuclear and Advanced Technology Division in qualifying distribution equipment for service in nuclear power generating stations per IEEE-344.

All equipment is designed and manufactured within the Total Quality concept. This reflects our continuing commitment to produce equipment that provides flexibility, reliability, and ease of installation. Additionally, the equipment is designed and engineered as part of a system as well as stand-alone gear...everything fits and works together.

The capabilities of Westinghouse seismically qualified distribution equipment can be enhanced by the IMPACC communications system that helps provide the status and control immediacy necessary during a seismic event. IMPACC is a unique high frequency-based communications system specifically designed for electrical distribution and control systems.

Seismic Testing Qualification Procedures
Testing procedures are conducted in accordance with ANSI C37.81, guide for application of switchgear in nuclear power plants for "Class 1E" critical applications (reactor shutdown). Cutler-Hammer is the only known manufacturer that uses these testing procedures to seismically qualify a full family of electrical distribution equipment.①

The requirements of ANSI C37.81 include:

- Quantifying actual earthquake conditions (requirements) as well as equipment seismic capability through use of the acceleration vs. frequency response spectrum.
- Verification of structural integrity, relative motion, and hold down requirements by repeatedly exciting the equipment at all of its natural frequencies.

Tests were conducted on shake tables at the Wyle Seismic Test Laboratory, Huntsville, Alabama and the Westinghouse Advanced Energy Systems Division, Pittsburgh, Pennsylvania. Tested equipment was energized before the seismic test to verify operation according to factory specifications; continuity of selected circuits was monitored and verified during the test; and the equipment was re-energized after the test to reverify operation according to factory specifications.

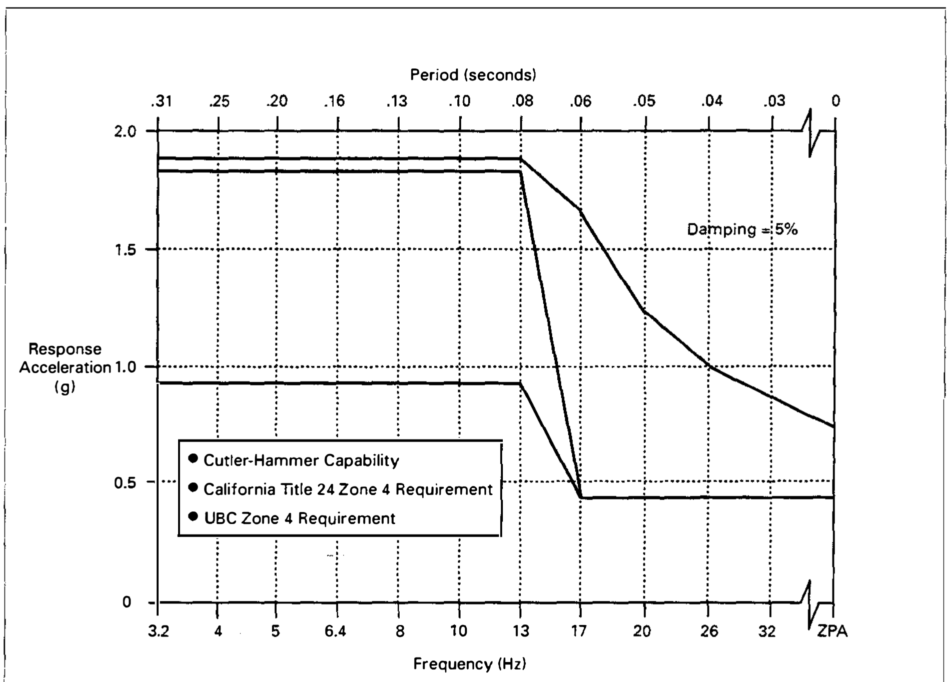
Three 0.2g sine sweep single axis resonance search tests and three triaxial multifrequency seismic tests were performed on each piece of equipment at increasing levels of severity, up to equipment fragility levels. **Summaries of these tests are available from your Cutler-Hammer representative.**

Successful test and analysis to response spectra documents the fact that Westinghouse distribution equipment exceeds the minimum requirements of California Code Title 24 by an ample margin. (Refer to the California Code Title 24 Response Curve chart.) In addition, it exceeds the UBC seismic qualification requirements for application in Zone 4 areas. This means our Cutler-Hammer equipment is also seismically qualified for application in Zones 3, 2A, 2B, 1, and 0.

Many of the tested standard products meet the nuclear seismic values recommended by ANSI C37.81. In order for Cutler-Hammer equipment to be seismic-certified, requirements to that effect must be given at the time of specification and must be included on the ensuing RFQ and order write-up. **For additional information on nuclear requirements, contact your Cutler-Hammer representative.**

Additional Seismic Qualification Information

The White Paper "Seismic Qualification" by Dr. Mostafa Amhed, William Long, and David Roybal is available from your Cutler-Hammer representative.



California Code Title 24 Response Curve

① ANSI C37.81 provides specific requirements and guidance for seismic qualification of metal-enclosed power switchgear assemblies. The testing procedures specified are considered acceptable for seismically qualifying all distribution equipment.

Westinghouse WLI Metal-Enclosed Switchgear

Typical Specification
(The specification as outlined below is an abbreviated specification for a typical Load Interrupter Switch application. For more detailed specifications, please see Catalog 55-000, The Cutler-Hammer Consultant Application Guide, or contact your local Cutler-Hammer representative.)

The metal-enclosed switchgear specified herein shall consist of an assembly of dead front, free standing structures containing interrupter switches and fuses of the number, rating, and type noted on the drawings or specified herein.

The complete metal-enclosed switchgear assembly shall have the following ratings:

Maximum Design Voltage	_____	kV
Nominal System Voltage	_____	kV
Basic Impulse Level	_____	kV
Mom. (Asym) Current	_____	kA
Two-Second Current (Sym)	_____	kA
Bus Continuous Current	_____	A

The switchgear assembly shall be integrally designed and produced by the manufacturer of the interrupter switches, fuses, enclosures, and operators to assure a completely coordinated design and establish one source of responsibility for the equipment's performance.

Interrupter Switch(es)
The load interrupter switch(es) shall be quick-make, quick-break with stored energy operation. The complete assemblies shall have the following minimum ratings:

Maximum Design Voltage	_____	kV
Basic Impulse Level	_____	kV
Amps Continuous and Interrupting	_____	A
Momen. (10 cycles closed, Asym)	_____	kA
Fault Close (Asym)	_____	kA
Two-Second Current (Sym)	_____	kA

Each switch or switch and fuse assembly shall have insulating barriers between phases and between the outer phases and the enclosure.

Switch Operation
All switches shall be three-pole gang operated. A manual quick-make, quick-break over toggle type operating mechanism shall be supplied which utilizes a heavy-duty coil spring to provide powerful opening and closing action of the switch. To ensure reliable operation, the spring charging mechanism shall consist of a rigid metal-to-metal linkage and shall not depend on chains or cables which are subject to failure.

The speed of opening and closing of the switch shall be independent of the operator, and it shall be impossible to tease the switch into any intermediate position under normal operation.

The interrupter switch will have separate main, make and break contacts to provide maximum endurance for fault close and load interrupting duty. Arc interruption shall take place within urea formaldehyde arc chutes which produce a high dielectric gas to assist interruption.

The operating mechanism shall be designed to provide sufficient power to overcome the blow-out forces when closing the switch into a fault.

Safety Interlocking
The full height door shall be hinged and interlocked with the switch shaft so that the switch must be opened before access to the fuses is possible and the door must be closed before the switch can be closed.

Insulation
All insulation supporting current carrying parts will be [glass polyester] [porcelain] [polysil].

Power Fuses
Fault protection shall be furnished by fuses of one of the two types specified below as indicated on the contract drawings. Fuses shall be:

Westinghouse [Current Limiting Type] [CX] [CXN] [CLE] [HLE] or equal, or [Boric Acid Type] [RBA] or equal.

All fuses shall be positively locked in position with provision for easy removal and replacement from the front without the use of special tools.

Main Bus and Connections
The main bus shall consist of [tin-plated aluminum] [silver-plated copper] [tin-plated copper] bus bar mounted on NEMA class insulators.

Ground bus conductors shall be [tin-plated aluminum] [silver-plated copper] [tin-plated copper] and be directly fastened to a bare metal surface of each vertical section, and be of a size sufficient to carry the rated two-second current of the switchgear assembly.

A neutral bus shall be provided only when indicated on the plans. It shall be insulated for 1000 VAC to ground. The current rating of the neutral bus shall be 600A.

One terminal pad per phase shall be provided for attaching contractor supplied cable terminal lugs for a maximum of two conductors per phase of the sizes indicated on the plans. Sufficient space shall be supplied for contractor supplied electrical stress relief termination devices.

Low Voltage Devices
Meters, instruments, and relays shall be isolated from high voltage by grounded metal barriers. Small wiring, fuse blocks, and terminal blocks within the switchgear shall be furnished as indicated on the drawings. All wiring shall be furnished with wire markers.

Enclosure Construction
Construction shall be of the universal frame type using die-formed and bolted members. To facilitate installation and maintenance of cables and bus, the top and rear covers shall be removable. All enclosing covers and doors shall be not less than 11-gauge steel.

Each switch cubicle shall have a single, full length, flanged front door and shall be equipped with two rotary latch type padlockable handles. Provision shall be made for operating the switch and storing the removable handle without opening the full length door. A rectangular, high impact type contact viewing window shall be provided in the door over the switch, and backed up by a grounded metal barrier punched with a diamond pattern to ensure safety but still allow full view of the switch blades.

Outdoor units shall have a sloped weatherproof roof. All openings shall be screened to prevent the entrance of small animals, and barriered to inhibit the entrance of snow, sand, etc. One space heater shall be provided in each outdoor cubicle. Power for the space heater shall be [provided by the manufacturer] [furnished by others]. The design shall be non-walk-in type.

Paint and Finish
External and internal steel surfaces to be painted shall be thoroughly cleaned and phosphatized. A polyester powder coating shall be applied electrostatically and then baked on to provide a uniform thickness and gloss. Color shall be ANSI-61 light gray.

Testing
The manufacturer shall supply, upon request, test results to confirm that the switch has been tested in a high power laboratory to substantiate designs according to applicable ANSI, IEEE, NEMA, UL and CSA standards. The tests shall verify not only the performance of the switch and integrated switch-fuse assembly, but also the suitability of the enclosure venting, rigidity, and bus bracing. In addition, the switchgear shall be factory tested in accordance with the latest version of ANSI/IEEE/NEMA/UL/CSA standards.

Switchgear as provided under this contract shall be Westinghouse Type WLI as manufactured by Cutler-Hammer, or approved equal.

Cutler-Hammer
Westinghouse &
Cutler-Hammer Products
11 Corporate Circle
Sumter, South Carolina, U.S.A. 29154

EATON

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January 1995

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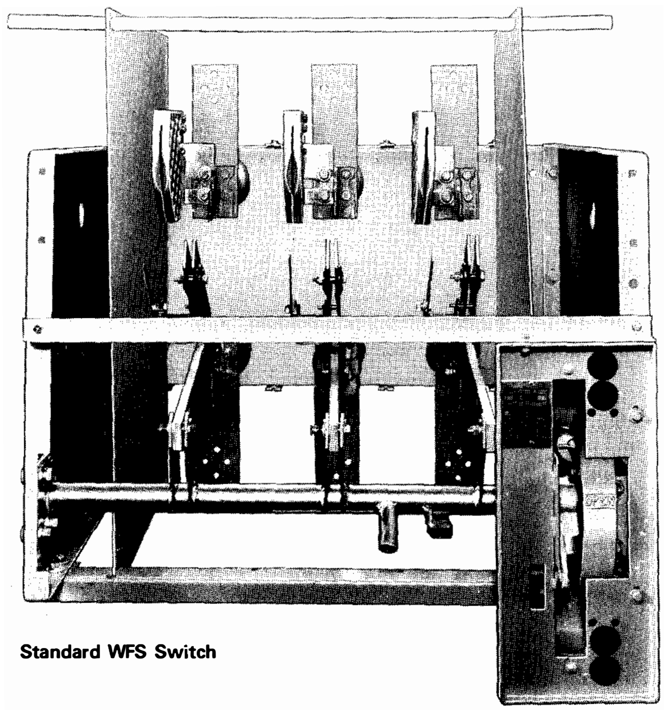
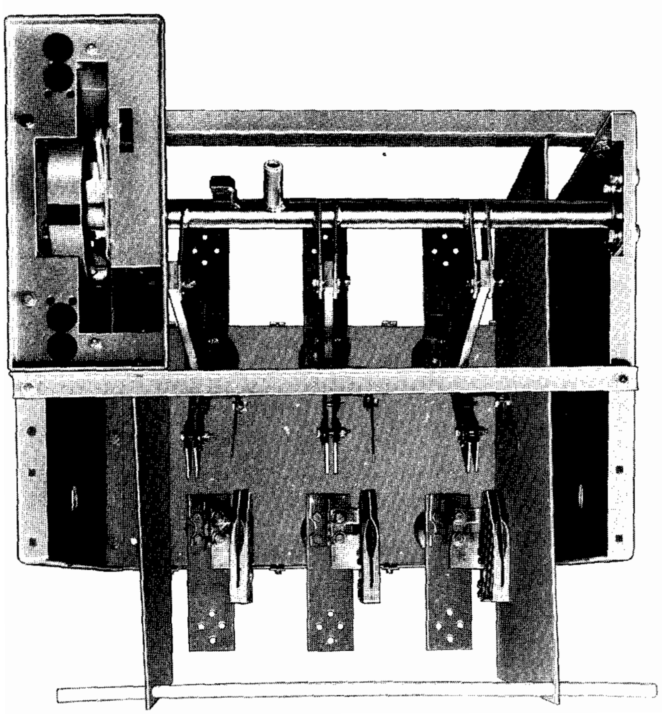
Resale prices suggested only
Mailed to: E, D, C/31-900A

Indoor, Frame-Mounted 2.4 Kv through 38 Kv

Type WFS Load Interrupter Switch



Standard WFS Switch



Inverted WFS Switch

Description

The Type WFS frame-mounted load interrupter switch, is a fully rated quick-make, quick-break spring-operated stored energy switch that provides fast, reliable protection for high voltage circuits 2.4 Kv through 38 Kv. The WFS switches are available in unitized, three-pole configuration for mounting in enclosures or assemblies. They utilize the same DE-ION® arc interruption principal that has made Westinghouse a leader in circuit interruption.

Type WFS switches may be inverted (see cover photo), thus eliminating the need for costly bus transition sections.

Ease of Installation

Type WFS switches are supplied with both rear and side mounting holes for ease of mounting and allowing for flexibility of enclosure design.

The operating handle is cast as an integral part of the switch, eliminating the need for separate parts to be mounted on the enclosure. This design maximizes enclosure space and eliminates alignment problems.

High Power Laboratory Tested

The Type WFS switch meets or exceeds all applicable ANSI, NEMA and IEEE standards. Verification of the switches ratings have been substantiated by a complete set of tests made at the Westinghouse High Power Laboratory.

Type WFS Load Interrupter Switch

List Prices

List prices include three-pole, single throw, group operated Type WFS switch with pole units, interphase barriers and manual operating mechanism on a common frame.

Max. kV	Cont./ Int. Amps. ④	Mom./ F.C. Amps. ①	Width, Inches	Manually Operated: Porcelain Insulator: Style Number ●	List Price	Manually Operated: Glass Poly. Insulators: Style Number ●	List Price	Shunt Trip② ●: Porcelain Insulator: Style Number	List Price	Shunt Trip② ●: Glass Poly. Insulators: Style Number	List Price	Motor Operated② ●: Porcelain Insulator: Style Number	List Price	Motor Operated② ●: Glass Poly. Insulators: Style Number	List Price
Standard Type WFS Frame Mounted Switches – 5 kV (60 kV BIL) thru 15 kV (95 kV BIL)															
Aluminum															
5	600/600	40/20	30	9078A40G01	**$2410**	9078A41G01	**$2310**	9078A42G01	**$3460**	9078A43G01	**$3360**	9078A44G01	**$4185**	9078A45G01	**$4085**
5	600/600	40/40	30	9078A40G02	**2435**	9078A41G02	**2335**	9078A42G02	**3485**	9078A43G02	**3385**	9078A44G02	**4210**	9078A45G02	**4110**
5	1200/600	80/61	30	9078A40G03	**2760**	9078A41G03	**2660**	9078A42G03	**3810**	9078A43G03	**3710**	9078A44G03	**4535**	9078A45G03	**4435**
5	1200/600	80/61	30	9078A40G04	**3910**	9078A41G04	**2425**	9078A42G04	**3575**	9078A43G04	**4860**	9078A44G04	**5685**	9078A45G04	**5585**
15	600/600	40/20	33	9078A40G05	**2525**	9078A41G05	**2425**	9078A42G05	**3575**	9078A43G05	**3475**	9078A44G05	**4300**	9078A45G05	**4200**
15	600/600	40/40	33	9078A40G06	**2550**	9078A41G06	**2450**	9078A42G06	**3600**	9078A43G06	**3500**	9078A44G06	**4325**	9078A45G06	**4225**
15	1200/600	80/40	33	9078A40G07	**2930**	9078A41G07	**2830**	9078A42G07	**3980**	9078A43G07	**3880**	9078A44G07	**4705**	9078A45G07	**4605**
15	1200/1200	80/40	33	9078A40G08	**4195**	9078A41G08	**4095**	9078A42G08	**5245**	9078A43G08	**5145**	9078A44G08	**5970**	9078A45G08	**5870**
15	1200/600	80/61	36	9078A40G09	**3010**	9078A41G09	**2910**	9078A42G09	**4060**	9078A43G09	**3960**	9078A44G09	**4785**	9078A45G09	**4685**
15	1200/1200	80/61	36	9078A40G10	**4275**	9078A41G10	**4175**	9078A42G10	**5325**	9078A43G10	**5225**	9078A44G10	**6050**	9078A45G10	**5950**
Copper															
5	600/600	40/20	30	9078A40G11	**2460**	9078A41G11	**2360**	9078A42G11	**3510**	9078A43G11	**3410**	9078A44G11	**4235**	9078A45G11	**4135**
5	600/600	40/40	30	9078A40G12	**2485**	9078A41G12	**2385**	9078A42G12	**3535**	9078A43G12	**3435**	9078A44G12	**4260**	9078A45G12	**4160**
5	1200/600	80/61	30	9078A40G13	**2810**	9078A41G13	**2710**	9078A42G13	**3860**	9078A43G13	**3760**	9078A44G13	**4585**	9078A45G13	**4485**
5	1200/1200	80/61	30	9078A40G14	**3960**	9078A41G14	**3860**	9078A42G14	**5010**	9078A43G14	**4910**	9078A44G14	**5735**	9078A45G14	**5635**
15	600/600	40/20	33	9078A40G15	**2575**	9078A41G15	**2475**	9078A42G15	**3625**	9078A43G15	**3525**	9078A44G15	**4350**	9078A45G15	**4250**
15	600/600	40/40	33	9078A40G16	**2600**	9078A41G16	**2500**	9078A42G16	**3650**	9078A43G16	**3550**	9078A44G16	**4375**	9078A45G16	**4275**
15	1200/600	80/40	33	9078A40G17	**2980**	9078A41G17	**2880**	9078A42G17	**4030**	9078A43G17	**3930**	9078A44G17	**4755**	9078A45G17	**4655**
15	1200/200	80/40	33	9078A40G18	**4245**	9078A41G18	**4145**	9078A42G18	**5295**	9078A43G18	**5195**	9078A44G18	**6020**	9078A45G18	**5920**
15	1200/600	80/61	36	9078A40G19	**3060**	9078A41G19	**2960**	9078A42G19	**4110**	9078A43G19	**4010**	9078A44G19	**4835**	9078A45G19	**4735**
15	1200/1200	80/61	36	9078A40G20	**4325**	9078A41G20	**4225**	9078A42G20	**5375**	9078A43G20	**5275**	9078A44G20	**6100**	9078A45G20	**6000**
Standard Type WFS Frame Mounted Switches – 25.8 kV thru 38 kV (150 kV BIL)															
Aluminum															
25.8	600/600	40/20	48	9078A46G01	**$3795**										
25.8	600/600	40/40	48	9078A46G02	**3820**										
25.8	1200/600	40/40	48	9078A46G03	**4200**										
25.8	1200/600	61/60	48	9078A46G04	**4280**										
38	600/600	40/20	48	9078A46G05	**4180**										
38	600/600	40/30	48	9078A46G06	**4205**										
38	1200/600	40/30	48	9078A46G07	**4585**										
38	1200/600	61/30	48	9078A46G08	**4665**										
Copper															
25.8	600/600	40/20	48	9078A46G09	**3845**										
25.8	600/600	40/40	48	9078A46G10	**3870**										
25.8	1200/600	40/40	48	9078A46G11	**4250**										
25.8	1200/600	61/60	48	9078A46G12	**4330**										
38	600/600	40/20	48	9078A46G13	**4230**										
38	600/600	40/30	48	9078A46G14	**4255**										
38	1200/600	40/30	48	9078A46G15	**4635**										
38	1200/600	61/30	48	9078A46G16	**4715**										
Inverted Type WFS Frame Mounted Switch – 5 kV (60 kV BIL) thru 15 kV (95 kV BIL)															
Aluminum															
5	600/600	40/20	30	9078A47G01	**$2570**	9078A48G01	**$2470**								
5	600/600	40/40	30	9078A47G02	**2595**	9078A48G02	**2495**								
5	1200/600	80/61	30	9078A47G03	**2920**	9078A48G03	**2820**								
15	600/600	40/20	33	9078A47G05	**2685**	9078A48G05	**2585**								
15	600/600	40/40	33	9078A47G06	**2710**	9078A48G06	**2610**								
15	1200/600	80/40	33	9078A47G07	**3090**	9078A48G07	**2990**								
15	1200/600	80/61	36	9078A47G09	**3170**	9078A48G09	**3070**								
Copper															
5	600/600	40/20	30	9078A47G11	**2620**	9078A48G11	**2520**								
5	600/600	40/40	30	9078A47G12	**2645**	9078A48G12	**2545**								
5	1200/600	80/61	30	9078A47G13	**2970**	9078A48G13	**2870**								
15	600/600	40/20	33	9078A47G15	**2735**	9078A48G15	**2635**								
15	600/600	40/40	33	9078A47G16	**2760**	9078A48G16	**2660**								
15	1200/600	80/40	33	9078A47G17	**3140**	9078A48G17	**3040**								
15	1200/600	80/61	36	9078A47G19	**3220**	9078A48G19	**3120**								

Switch Accessories

Description	Style Number	List Price
Access Door	221C192G01	**$130**
Aux. Switch (2 NO, 2NC Contacts)③		
Standard Type	221C083G02	**280**
Inverted Type	221C083G03	**280**

① Mom.: Momentary Asym. 10 cycle rating; F.C.: Fault Close Asym. rating. All fault closing tests done with non-fused switch and at maximum rated voltage.
② Rated 120 volt Ac, provided by others.
③ Cannot be added to shunt trip and motor operated switches. Already included with 1 NO and 1 NC contacts available for customer use.
④ Cont.: Continuous Amps; Int.: Interrupting Amps.
● Changed or added since previous issue.