

POWERSUB™ Medium Voltage  
Substation Circuit Breakers, Type FVR



*First in*  
*reliability,*  
safety, and arc-resistant  
*technology*

# Advanced Technology for Leading Reliability

**For over ninety years, Square D**

**has been providing utility,**

**industrial, and commercial**

**customers with highly reliable**

**products. By combining the**

**latest developments in circuit**

**breaker technology with world-**

**renowned quality, POWERSUB**

**Vacuum Substation Circuit**

**Breakers from Square D are the**

**most advanced medium voltage**

**circuit breakers available.**

## **POWERSUB™ Vacuum Circuit Breaker Type FVR**

Since 1903, Square D has been setting standards in quality for the electric industry and serving the utilities with highly reliable products. The POWERSUB distribution vacuum circuit breaker Type FVR continues this tradition with its arc-resistant construction. The FVR circuit breaker is the first in the industry to provide this additional safety feature which exceeds ANSI standards. All FVR circuit breakers include:

- **Arc-resistant\* construction** — rated 40kA in accordance with EEMAC and IEC standards for Type B enclosures  
\*except 3000A rating

- **Compliance to ANSI standards** — designed and tested to comply with or exceed ANSI standards C37.04, .06 and .09 for outdoor oil-less circuit breakers

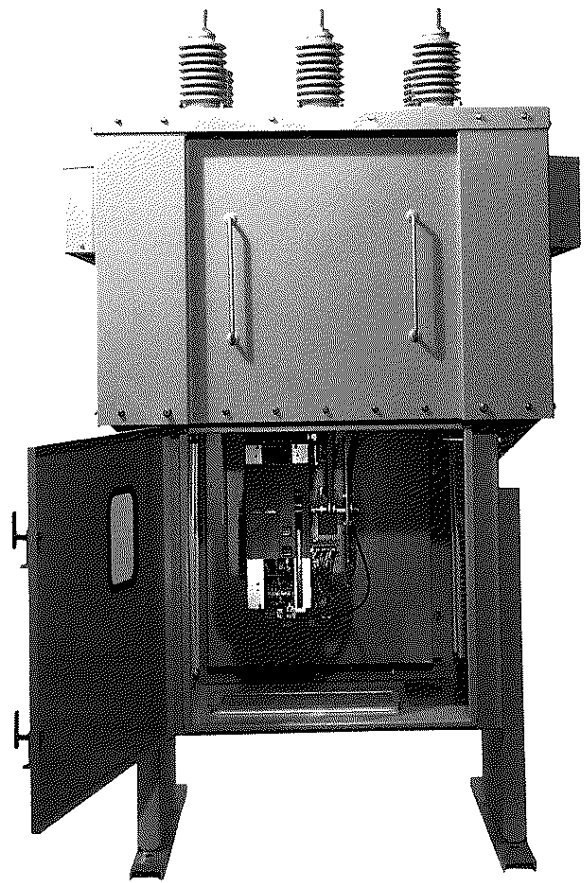
- **ISO 9001 certification** — The Square D POWERSUB distribution circuit breakers are designed and manufactured in a facility that is Quality Systems Registered by Underwriters Laboratories, Inc. to ISO 9001.

POWERSUB Type FVR circuit breakers also provide the following benefits:

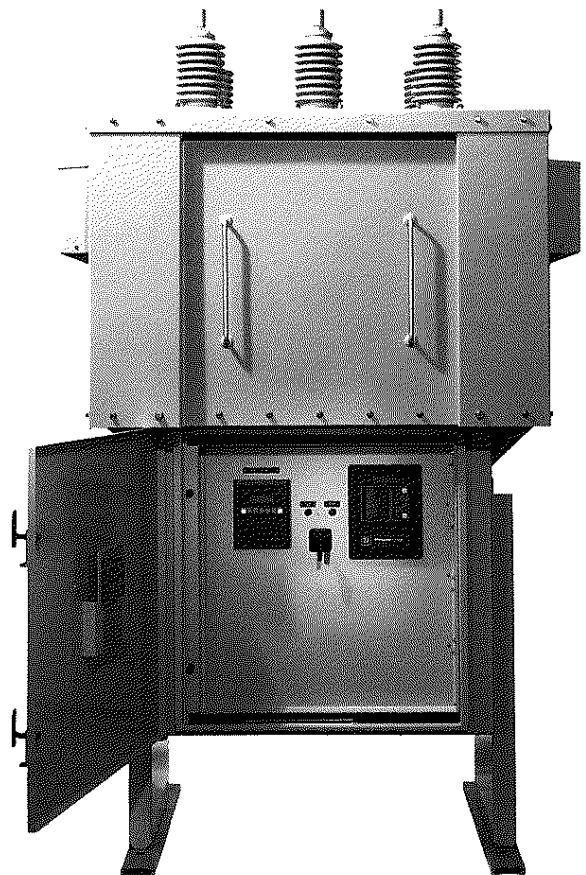
- **High-speed operation** — interrupting time of 3 cycles due to reduced contact travel and high dielectric strength

- **Long life** — hermetically sealed vacuum interrupters to protect contacts from corroding elements and contamination

- **Ease of maintenance** — interrupter assemblies and contact wear indicators accessible via a bolted panel
- **Reliability** — a minimum of moving parts on the motor-driven, spring-charged Type RI mechanism
- **Durability** — proven porcelain apparatus roof bushings
- **Flexibility** — standard adjustable heights and optional stainless steel roofs.



**Type FVR Breaker  
(Front View)**



**Type FVR Breaker  
(Rear View)**

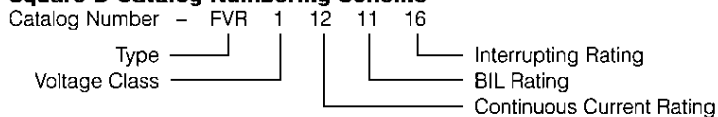
## FVR Vacuum Circuit Breaker Ratings

| Substation<br>Circuit<br>Breaker<br>Catalog<br>Number | Voltage<br>Max.<br>kV rms | Continuous<br>Current<br>at 60 Hz,<br>Amperes,<br>rms | Insulation Level<br>Test Voltage |                     | Short<br>Circuit<br>Current<br>kA rms at<br>Max. kV | Max.<br>Symmetrical<br>Interrupting<br>Capability<br>kA rms | Rated<br>Permissible<br>Tripping<br>Delay<br>Y Seconds | 3 Second<br>Current<br>Carrying<br>Capability<br>kA rms | Close and<br>Latching<br>Capability<br>kA Peak |          |          |          |
|---|---------------------------|---|----------------------------------|---------------------|---|---|--|---|--|----------|----------|----------|
|   |                           |   | Low<br>Frequency<br>kV rms       | Impulse<br>kV Crest |   |   |  |   |  |          |          |          |
| FVR1061112<br>FVR1081116                              | 15.5                      | 600<br>800  | 50                               | 110                 | 12<br>16  | 12<br>16  | 2  | 12<br>16  | 32<br>43                                       |          |          |          |
| FVR1121112<br>FVR1121116                              | 15.5                      | 1200<br>1200  | 50                               | 110                 | 12<br>16  | 12<br>16  | 2  | 12<br>16  | 32<br>43                                       |          |          |          |
| FVR1121120<br>FVR1121125                              |                           | 1200<br>1200  |                                  |                     | 20<br>25  | 20<br>25  |  | 20<br>25  | 54<br>68                                       |          |          |          |
| FVR1121131<br>FVR1121140                              |                           | 1200<br>1200  |                                  |                     | 31.5<br>40  | 31.5<br>40  |  | 31.5<br>40  | 85<br>108                                      |          |          |          |
| FVR1201112<br>FVR1201116                              |                           | 2000<br>2000  |                                  |                     | 50  | 110   |  | 12<br>16  | 12<br>16                                       | 2        | 12<br>16 | 32<br>43 |
| FVR1201120<br>FVR1201125                              |                           | 2000<br>2000  |                                  |                     |   |   |  | 20<br>25  | 20<br>25                                       |          | 20<br>25 | 54<br>68 |
| FVR1201131<br>FVR1201140                              | 2000<br>2000              | 31.5<br>40  | 31.5<br>40                       | 31.5<br>40          |   |   | 85<br>108  |   |  |          |          |          |
| FVR1301112<br>FVR1301116                              | 3000<br>3000              | 50  | 110                              | 12<br>16            |   |   | 12<br>16   | 2   | 12<br>16                                       |          | 32<br>43 |          |
| FVR1301120<br>FVR1301125                              | 3000<br>3000              |   |                                  | 20<br>25            |   |   | 20<br>25   |   | 20<br>25                                       |          | 54<br>68 |          |
| FVR1301131<br>FVR1301140                              | 3000<br>3000              |   |                                  | 31.5<br>40          | 31.5<br>40  | 31.5<br>40  | 85<br>108  |   |  |          |          |          |
| FVR2121212<br>FVR2121216                              | 1200<br>1200              |   |                                  | 60                  | 125<br>(150)  | 12<br>16  | 12<br>16   |   | 2  | 12<br>16 | 32<br>43 |          |
| FVR2121220<br>FVR2121225                              | 1200<br>1200              |   |                                  |                     |   | 20<br>25  | 20<br>25   |   |  | 20<br>25 | 54<br>68 |          |
| FVR2201212<br>FVR2201216                              | 2000<br>2000              | 60  | 125<br>(150)                     |                     |   | 12<br>16  | 12<br>16   | 2   |  | 12<br>16 | 32<br>43 |          |
| FVR2201220<br>FVR2201225                              | 2000<br>2000              |   |                                  |                     |   | 20<br>25  | 20<br>25   |   |  | 20<br>25 | 54<br>68 |          |
| FVR2121531<br>FVR2201531                              | 1200<br>2000              |   |                                  | 80                  | 150   | 31.5  | 31.5   |   | 2  | 31.5     | 85       |          |
| FVR3121512<br>FVR3121516                              | 1200<br>1200              |   |                                  | 80                  | 150   | 12<br>16  | 12<br>16   |   | 2  | 12<br>16 | 32<br>43 |          |
| FVR3121520<br>FVR3121525                              | 1200<br>1200              | 20<br>25  | 20<br>25                         |                     |   | 20<br>25  | 54<br>68   |   |  |          |          |          |
| FVR3121531  | 1200                      | 31.5  | 31.5                             |                     |   | 31.5  | 85   |   |  |          |          |          |
| FVR3201512<br>FVR3201516                              | 2000<br>2000              | 80  | 150                              |                     |   | 12<br>16  | 12<br>16   | 2   |  | 12<br>16 | 32<br>43 |          |
| FVR3201520<br>FVR3201525                              | 2000<br>2000              |   |                                  |                     |   | 20<br>25  | 20<br>25   |   |  | 20<br>25 | 54<br>68 |          |
| FVR3201531  | 2000                      |   |                                  | 31.5                | 31.5  | 31.5  | 85   |   |  |          |          |          |
| FVR3122012<br>FVR3122016                              | 1200<br>1200              |   |                                  | 80                  | 200   | 12<br>16  | 12<br>16   |   | 2  | 12<br>16 | 32<br>43 |          |
| FVR3122020<br>FVR3122025                              | 1200<br>1200              |   |                                  |                     |   | 20<br>25  | 20<br>25   |   |  | 20<br>25 | 54<br>68 |          |

All ratings are based on 3-cycle interrupting time and voltage range factor, k=1.0.

( ) Indicates optional BIL ratings

### Square D Catalog Numbering Scheme

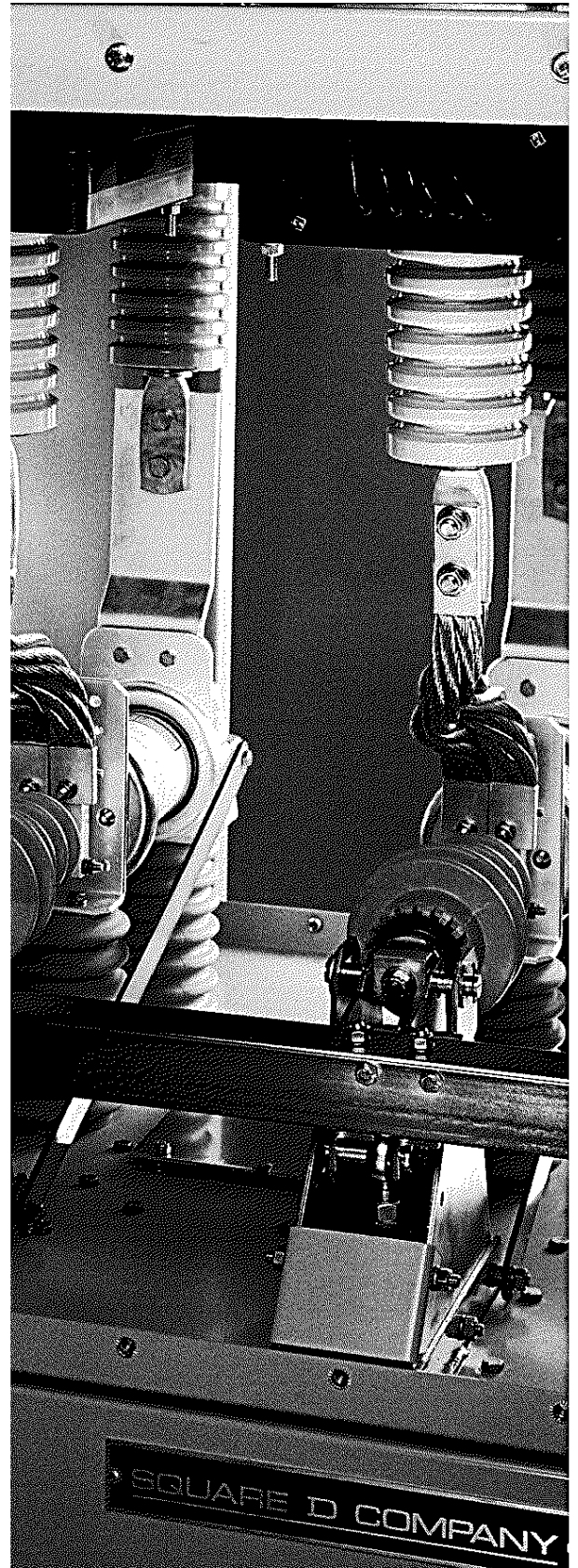
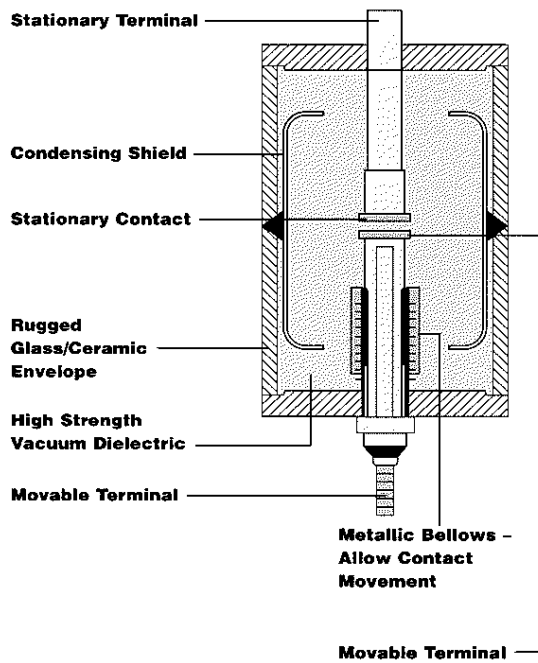


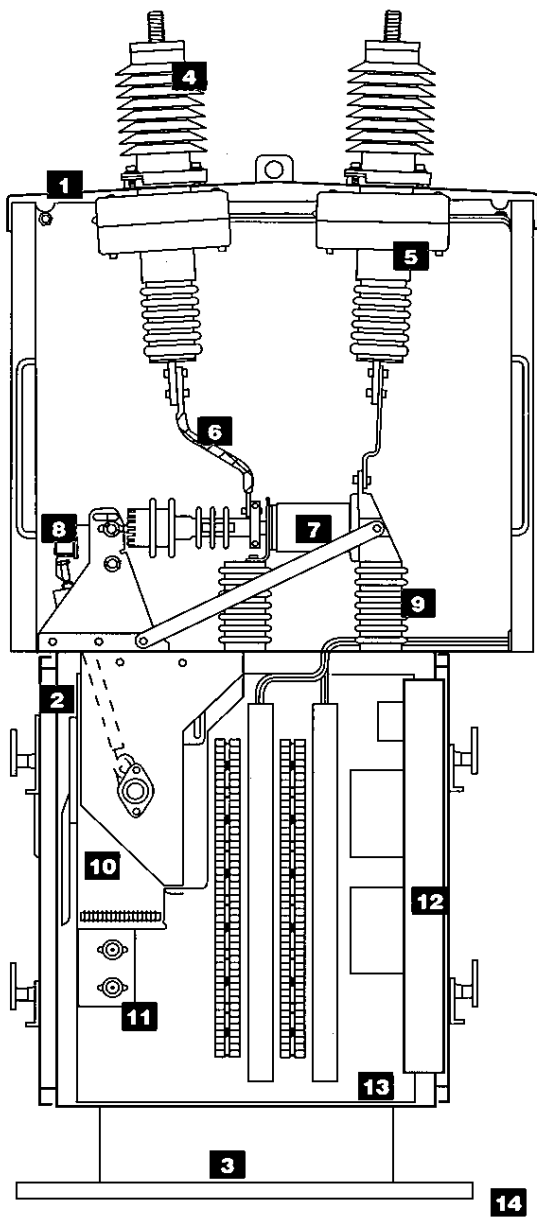
| Type         | Continuous Current Rating  | BIL Rating   | Voltage Class                         | Interrupting Rating  |
|--------------|--|--|---------------------------------------|--|
| FVR - Vacuum | 06 - 600A<br>08 - 800A<br>12 - 1200A<br>20 - 2000A<br>30 - 3000A | 11 - 110 kV<br>12 - 125 kV<br>15 - 150 kV<br>20 - 200 kV | 1 - 15.5 kV<br>2 - 27 kV<br>3 - 38 kV | 12 - 12 kA<br>16 - 16 kA<br>20 - 20 kA<br>25 - 25 kA<br>31 - 31.5 kA<br>40 - 40 kA |

**Vacuum Circuit Breaker Operation (see illustration below)**

- As the contacts part, the arc develops. A plasma of metallic ions is released by the contacts.
- This plasma provides transfer media for the electron flow until the interruption occurs.
- The condensation of the metallic vapor on the condensing shield is rapid, and the dielectric recovery rate is much faster than the rate of rise of the transient recovery voltage (TRV).
- This metallic vapor removes gas molecules from the evacuated space, assisting in maintaining the high vacuum.

**Vacuum Interrupter**





## Breaker Detail

1. High Voltage Compartment
2. Low Voltage Compartment
3. Adjustable Legs
4. Entrance Bushings
5. Current Transformers
6. Flexible Connector
7. Vacuum Interrupter Bottle†
8. Drive Bar Assembly
9. Stand off Insulator
10. Mechanism
11. Auxiliary Switches
12. Relay & Instrument Door
13. Control Wiring Panel
14. Galvanized Base Channel

† Pole detail shown for 110-150 kV BIL. 200kV BIL design has two vacuum interrupters per pole.

**ANNOUNCING...  
ARC-RESISTANT  
CONSTRUCTION**  
POWERSUB, type FVR, takes safety to the "next level" for the first time in outdoor distribution circuit breakers. The concept of "arc-resistant" equipment has been developed. The intent is to provide increased safety for personnel working in the vicinity of a breaker enclosure by ensuring that any arc which may occur

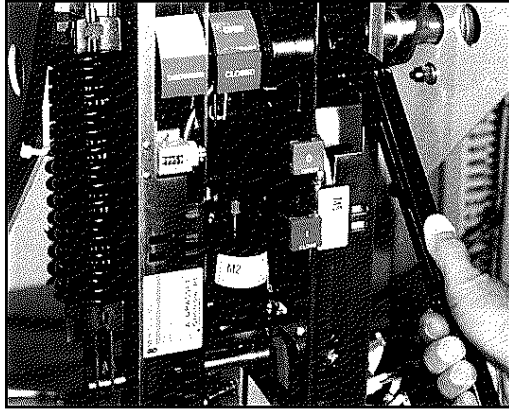
is controlled in its effects. When an arc occurs inside a circuit breaker enclosure, it also causes a sudden, large rise in pressure. The design of the FVR enclosure ensures that high pressures will be vented upward, and all exterior panels will remain intact and in place on the enclosure.\*



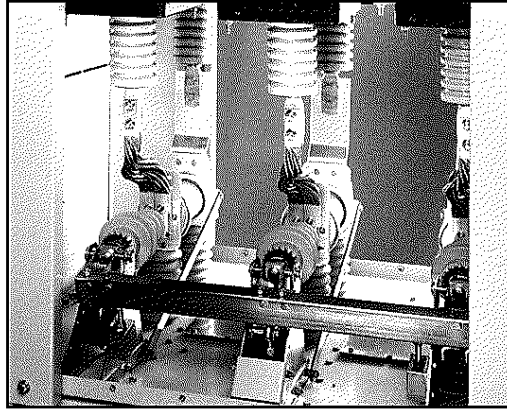
Access panels bolted and interlocked with enclosure to remain secure during high-pressure events.

Access panel interlocking detail (shown without bottom flange for detail clarity).

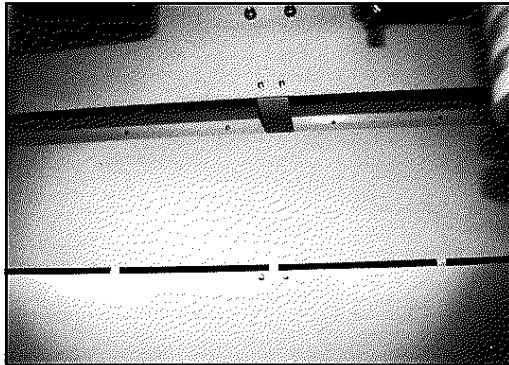
**\*NOTE: The use of arc-resistant enclosures does not preclude the need to follow normal personnel safety procedures.**



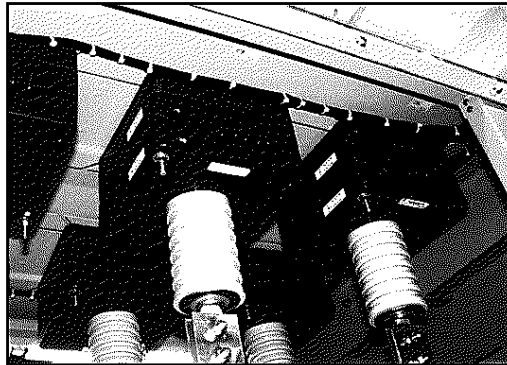
**"RI" mechanism with built-in charging handle.**



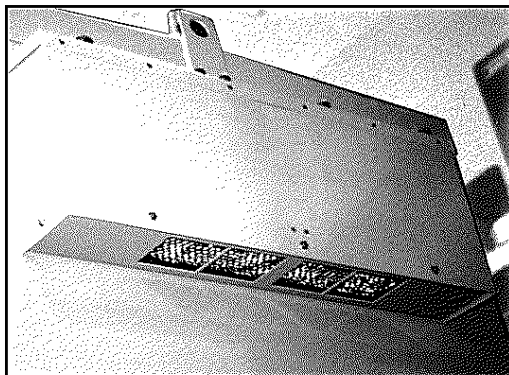
**High voltage compartment (showing 15kV vacuum interrupters).**



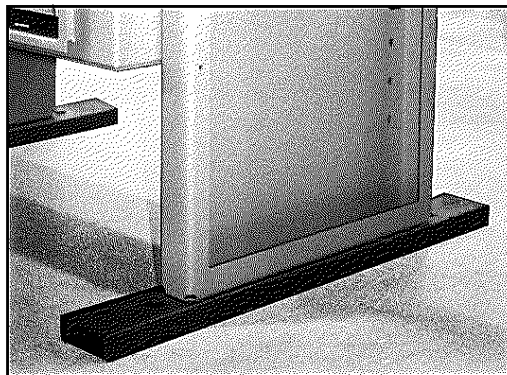
**Arc-resistant design includes interior pressure relief panels behind vent box on each side.**



**Multi-ratio current transformer mounted on roof bushings (space for 1, 2, or 3 on each bushing - varies with relaying accuracy required).**

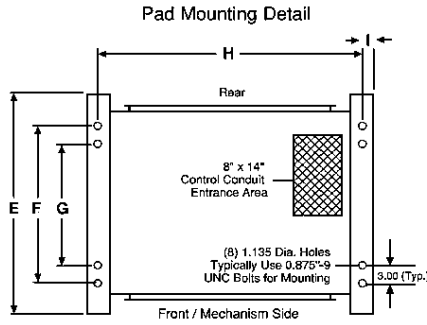
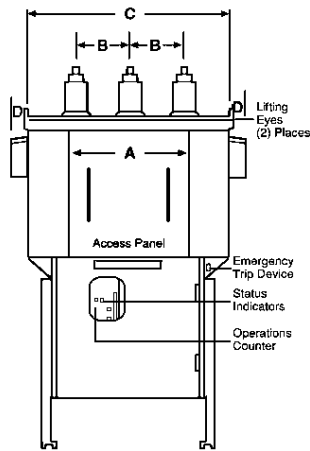


**As part of arc-resistant construction, exterior vents with "pop-up" covers and interior pressure relief panels ensure greater operator safety.**

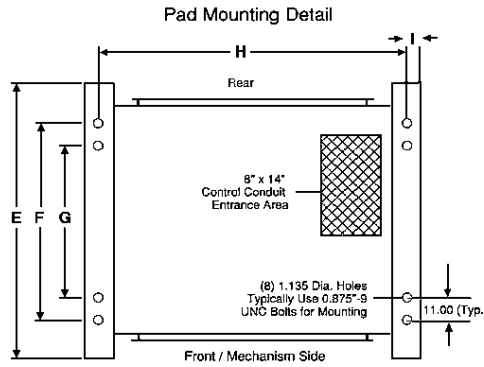
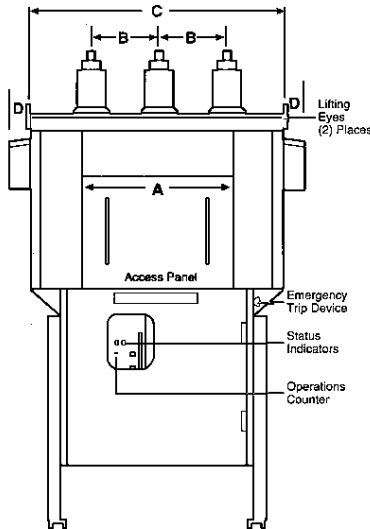
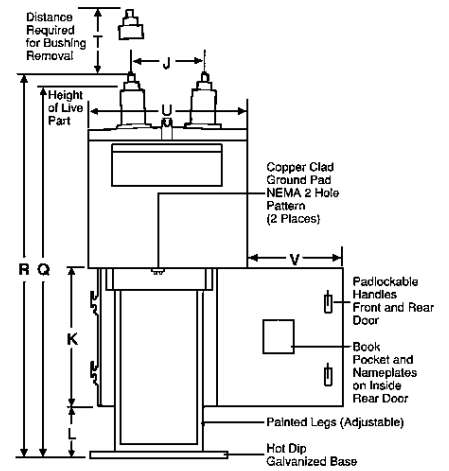


**Standard painted legs provide adjustable height with galvanized base.**

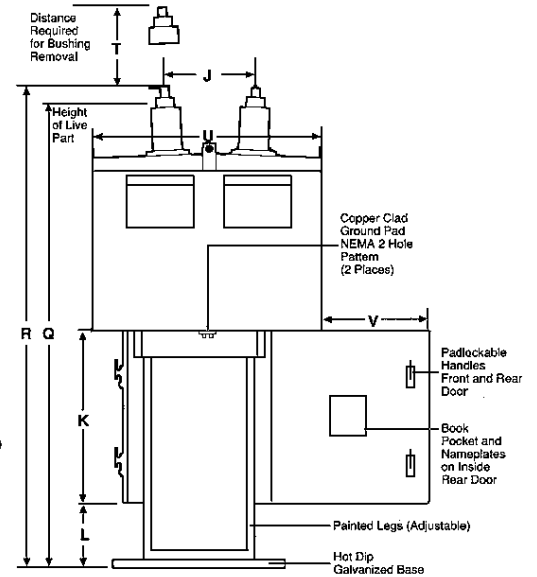
## Dimensions 15, 27 and 38 kV Type FVR



**110 - 125 - 150 kV BIL**




**200 kV BIL**



| FVR       | A     | B     | C     | D*   | E     | F     | G     | H     | I    | J     | K     | L(max) | L(min) | Q(max) | Q(min) | R(max) | R(min) | T     | U     | V     |
|-----------|-------|-------|-------|------|-------|-------|-------|-------|------|-------|-------|--------|--------|--------|--------|--------|--------|-------|-------|-------|
| 110kV BIL | 32.62 | 15.00 | 55.50 | 4.25 | 38.00 | 27.00 | 21.00 | 44.00 | 2.00 | 20.00 | 39.12 | 31.94  | 7.94   | 122.38 | 98.38  | 125.88 | 101.88 | 18.62 | 44.00 | 31.75 |
| 125kV BIL | 32.62 | 15.00 | 55.50 | 4.25 | 38.00 | 27.00 | 21.00 | 44.00 | 2.00 | 20.00 | 39.12 | 31.94  | 7.94   | 122.38 | 98.38  | 125.88 | 101.88 | 18.62 | 44.00 | 31.75 |
| 150kV BIL | 32.62 | 17.00 | 63.50 | 4.25 | 38.00 | 27.00 | 21.00 | 52.50 | 1.75 | 17.25 | 39.12 | 25.94  | 4.94   | 122.75 | 101.75 | 126.25 | 105.25 | 22.00 | 50.75 | 27.00 |
| 200kV BIL | 38.50 | 19.50 | 74.00 | 4.25 | 54.00 | 43.00 | 21.00 | 52.50 | 1.75 | 29.50 | 39.12 | 25.94  | 4.94   | 137.75 | 116.75 | 140.75 | 119.75 | 24.00 | 68.50 | 22.85 |

D\* = 13.00 for 3000A (110kV BIL)

**Note:** Dimensions subject to change and not for construction.  
All dimensions are approximate and are in inches.

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GROUPE SCHNEIDER

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