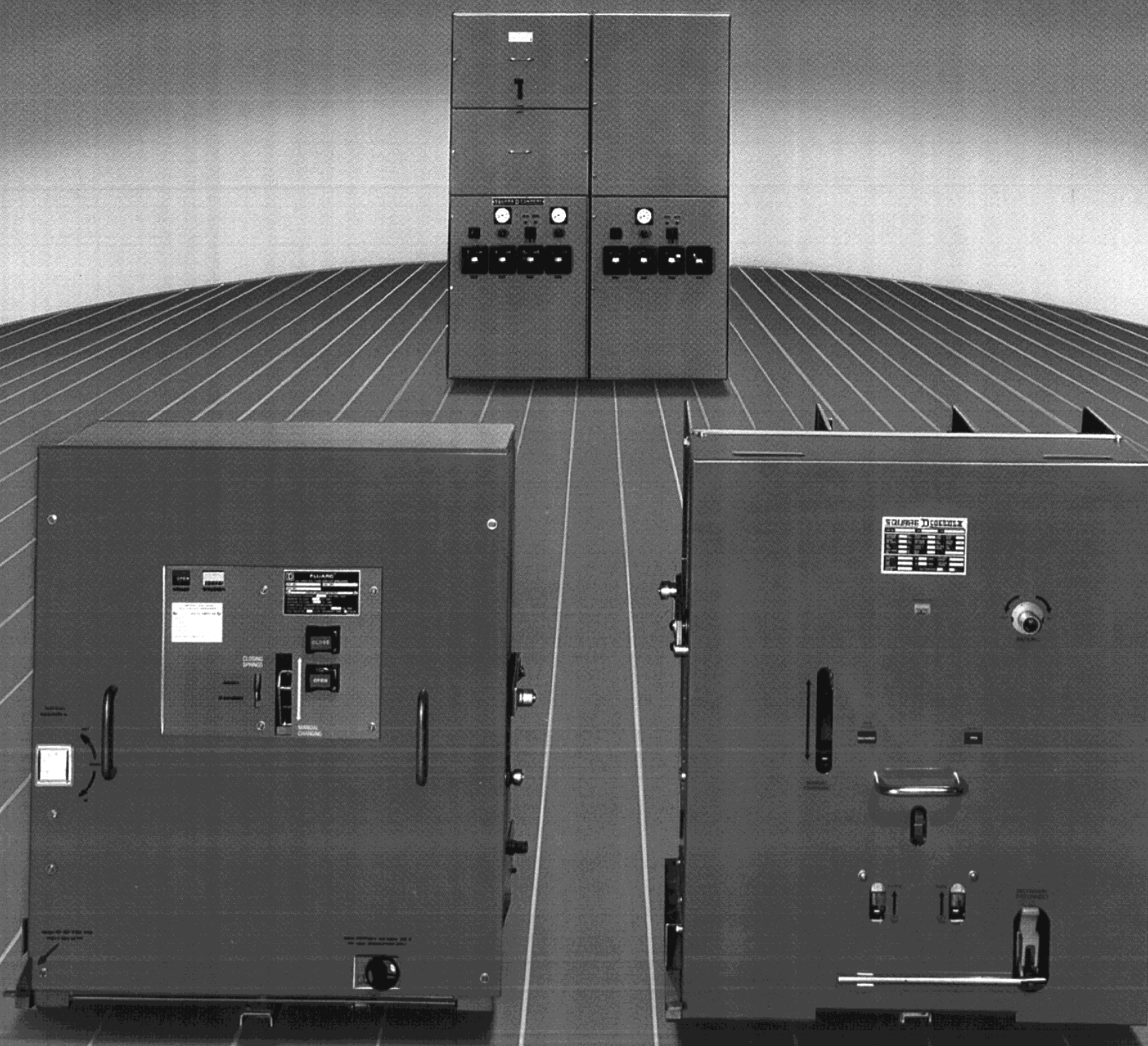




Class 6055

Moving ahead in circuit protection

Metal-Clad Switchgear with SF6 or Vacuum Circuit Breakers



SQUARE D®

Two modern technology circuit breakers now available in metal-clad switchgear construction – SF6 and Vacuum

Square D's Metal-Clad Switchgear utilizing FG-2 (sulphur hexafluoride – SF6) and/or VAD-2 (vacuum) circuit breakers is designed for use on electrical distribution systems rated from 2300 volts to 17,000 volts.

SF6 and vacuum interruption technologies have been proven over the past quarter century and are being used in various types of applications today. The evolution of SF6 and vacuum interruption techniques represent years of development, testing, and engineering experience.

COMPREHENSIVE TEST PROGRAM – A comprehensive design and conformance testing program has been performed by Square D Company development engineers. The switchgear and breakers are tested in accordance with the latest applicable ANSI Standards C37.04, C37.06, C37.09, and C37.20, 1979. The switchgear and breakers meet or exceed the requirements of ANSI, IEEE and NEMA.

FG-2 (SF6) and VAD-2 (vacuum) circuit breakers are used in a wide variety of switching, control and protective circuits. Two-High Metal-Clad Switchgear is typically used in electric utility systems, industrial plants, commercial buildings, hospitals,

municipal pumping stations, wastewater treatment plants, transportation systems and pipeline stations. Transformers, motors, generators, capacitors, transmission and distribution lines, and feeder circuits are protected by this class of switchgear.

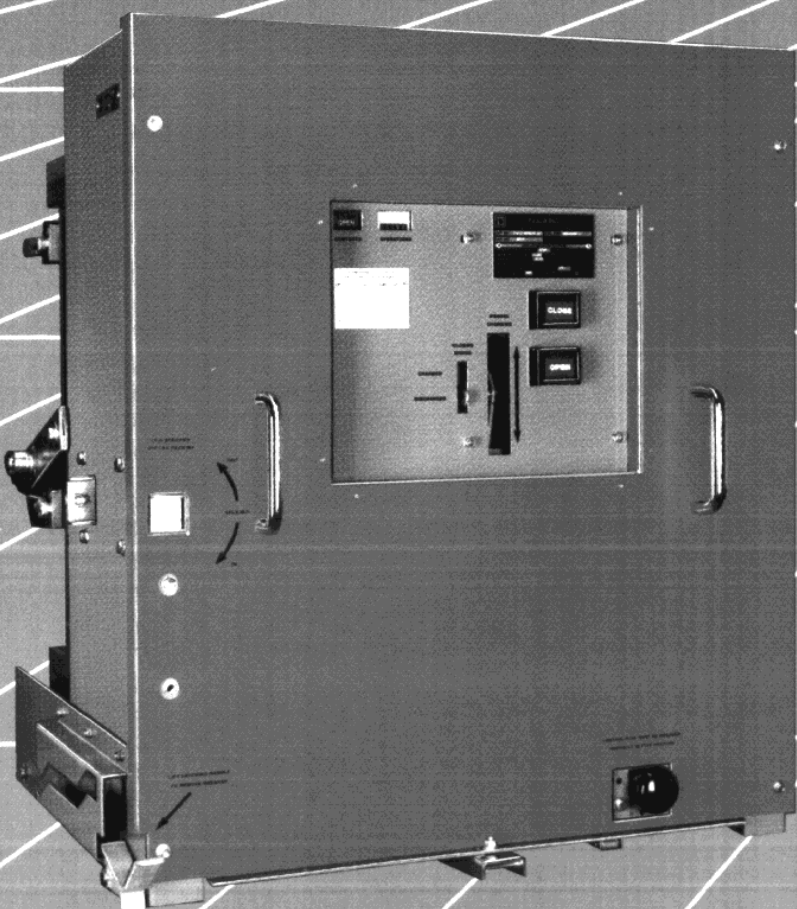
STANDARD FEATURES – Metal-Clad Switchgear is characterized by these necessary features as required by ANSI Standard C37.20:

- Removable Type Breaker
- Grounded Metal Barriers
- Automatic Shutters
- Insulated Bus
- Grounded Breaker Truck Between Test and Connected Positions
- Mechanical Interlocks
- Disconnect Type Voltage Transformers
- Low Voltage Control Compartment

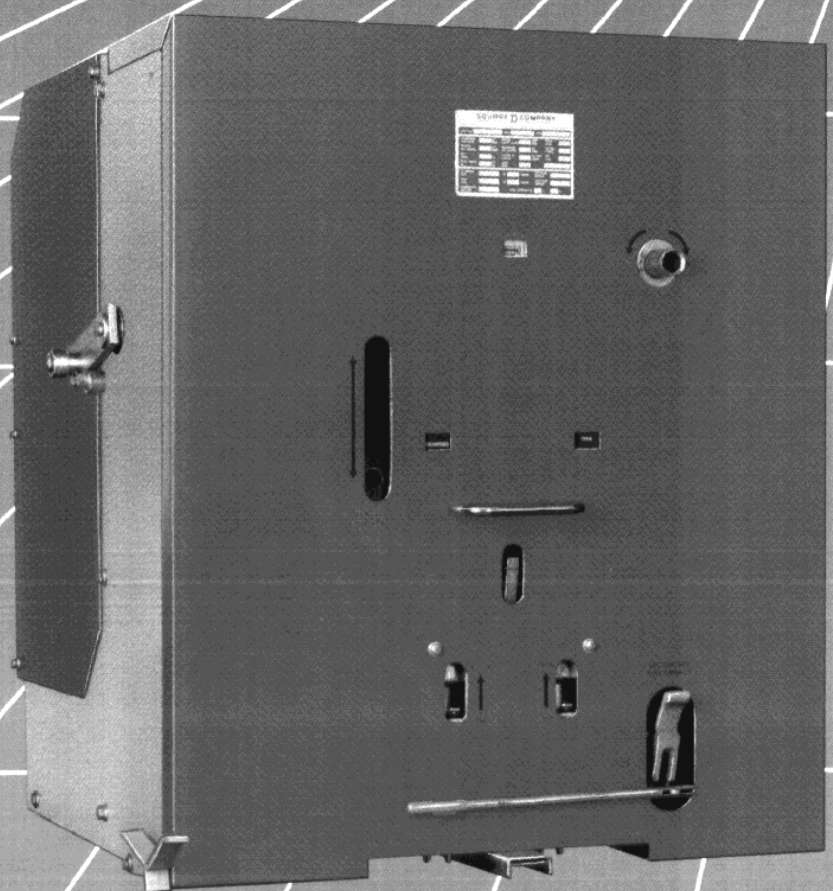
Some of the benefits and features of this ruggedly constructed switchgear are as follows:

- High Performance
- Versatility – SF6 or Vacuum (Interchangeable)
- Floor Space Economy
- Long Life
- Minimum Maintenance
- Fast and Quiet Operation
- Reduced Size and Weight

**Type FG-2
SF6 Circuit Breaker**



**Type VAD-2
Vacuum Circuit Breaker**



© Square D Co., 1986

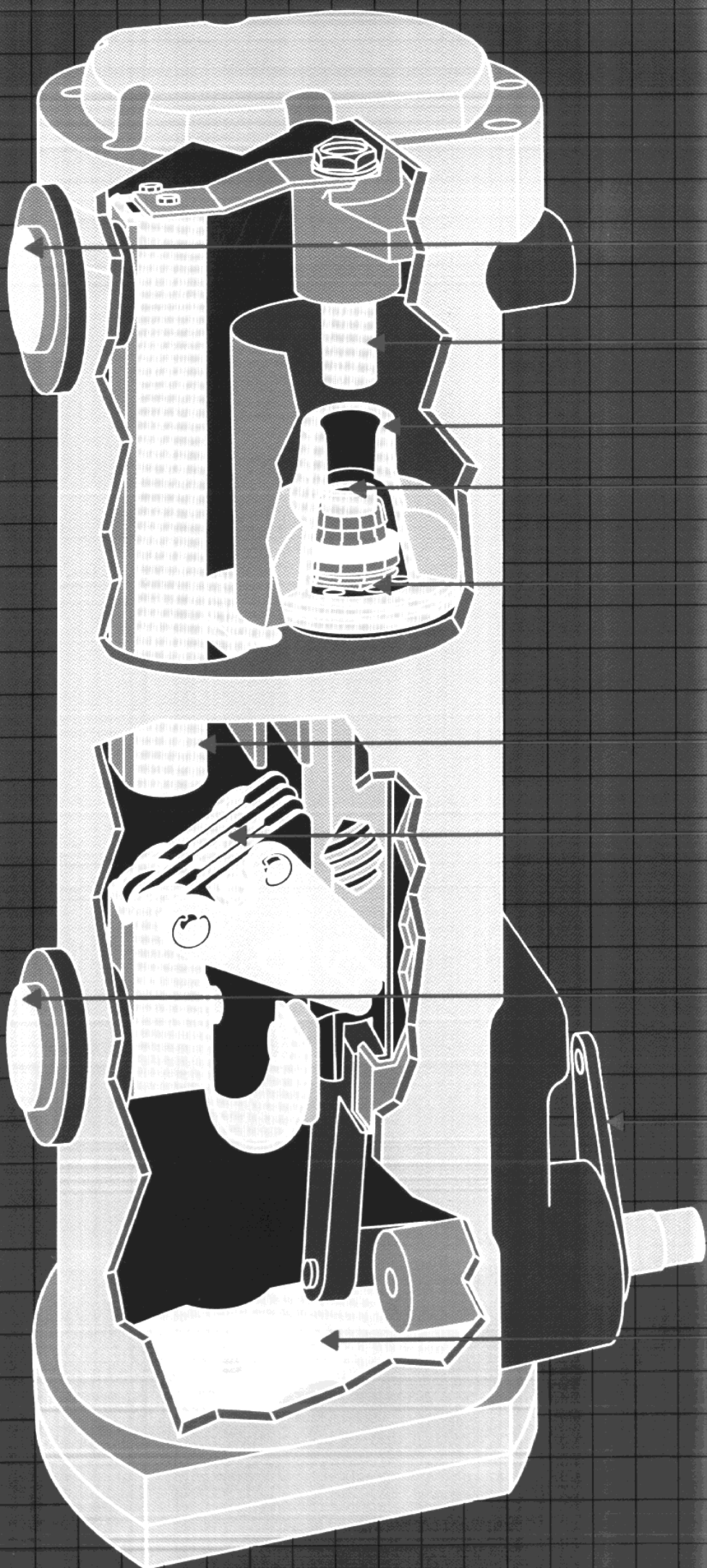
It's your choice
for true
cost-effectiveness

- ①. **HINGED FRONT DOOR**
Relays, instruments and meters are mounted on the door space in a standardized arrangement.
- ②. **HORIZONTAL DRAWOUT CIRCUIT BREAKER**
The FLUARC FG-2 (SF₆) and VACARC VAD-2 (vacuum) circuit breakers are horizontal draw-out design. Disconnect, test, and connect positions are provided.
- ③. **MAIN BUS BARRIERS (not shown)**
Main bus barriers between bays are track resistant, flame retardant glass polyester, with porcelain inserts at 8.25kV and 15kV ratings.
- ④. **CURRENT TRANSFORMERS**
Space is available for four front accessible bushing type current transformers per phase. Two of these current transformers may be placed on the line side and two on the load side of the breaker on each phase.
- ⑤. **CABLE SPACE**
Top or bottom cable entry with adequate space for cables, potheads, cable supports, and surge arresters is provided.
- ⑥. **AUTOMATIC SHUTTERS**
When the circuit breaker is withdrawn from the connected position, the breaker forces the steel shutter to rotate automatically into a position which covers the energized components.
- ⑦. **MAIN BUS AND SUPPORTS**
Insulated bus is provided with fluidized bed epoxy insulation, and with a special design combination of porcelain and main bus supports. Porcelain or glass polyester bus supports and insulators as specified are provided in the cable and auxiliary compartments.
- ⑧. **INSULATING TUBES**
Porcelain insulating tubes are used to insulate the primary stationary contacts and breaker runbacks at both 5 and 15kV ratings.
- ⑨. **COMPARTMENT BARRIERS**
All main compartments are separated by grounded metal barriers.
- ⑩. **RACKING MECHANISM**
The gear driven racking system incorporates safety interlocks.
- ⑪. **FRAME AND HOUSING**
Steel frames provide a strong rigid structure. The structure is engineered for flexibility to allow modifications and future addition of equipment.
- ⑫. **VOLTAGE TRANSFORMERS**
Front accessible drawer mounted voltage transformers can be completely withdrawn through the use of rollers and drawer mounted cantilever rails. For safety, the voltage transformers are grounded during moving to the withdrawn position.
- ⑬. **CONTROL POWER TRANSFORMERS**
Control power transformers rated up to 15 kVA are drawer mounted and can be completely withdrawn from the front for ease of accessibility.



Principal Components ▲





CUTAWAY VIEW OF FG-2 INTERRUPTER SHOWING MAIN COMPONENTS

UPPER TERMINAL

STATIONARY ARCING
CONTACT

NOZZLE

MOVABLE ARCING
CONTACT

PISTON

STATIONARY MAIN
CONTACT

MOVABLE MAIN
CONTACT

LOWER
TERMINAL

OPERATING
LEVER

ALUMINA SILICATE

Type FG-2 (SF6) FLUARC® Circuit Breaker Ratings Data

Type of Breaker	Nominal Rating		Rated Cont. Current 60 Hertz Amps.— RMS	Rated Voltages			Insulation Level Rated Withstand		Interrupting Ratings† Amps.—Symmetrical			Asym-metrical Rating Factor*	Short Time Rating 3 Sec. Amps.— RMS	Close & Latch Rating Amps.— RMS	Inter-rupting Time Cycles
	Three Phase MVA	Voltage kV— RMS		Maximum Voltage kV— RMS	K-Factor Max. kV Min. kV	Minimum Voltage kV— RMS	Low Frequency kV- RMS	ΔImpulse 1.2x5MS kV- CREST	Maximum kV Amps.— RMS	Nominal kV Amps.— RMS	Minimum kV Amps.— RMS				
FG-2-05025-12	250	4.16	1200	4.76	1.24	3.85	19	60	29,000	33,200	36,000	1.1	36,000	58,000	5
FG-2-05025-20	250	4.16	2000	4.76	1.24	3.85	19	60	29,000	33,200	36,000	1.1	36,000	58,000	5
FG-2-05025-30	250	4.16	3000■	4.76	1.24	3.85	19	60	29,000	33,200	36,000	1.1	36,000	58,000	5
FG-2-05035-12	350	4.16	1200■	4.76	1.24	3.85	19	60	41,000	46,900	49,000	1.1	49,000	78,000	5
FG-2-05035-20	350	4.16	2000■	4.76	1.24	3.85	19	60	41,000	46,900	49,000	1.1	49,000	78,000	5
FG-2-05035-30	350	4.16	3000■	4.76	1.24	3.85	19	60	41,000	46,900	49,000	1.1	49,000	78,000	5
FG-2-08050-12	500	7.20	1200	8.25	1.25	6.6	36	95	33,000	37,800	41,000	1.1	41,000	66,000	5
FG-2-08050-20	500	7.20	2000	8.25	1.25	6.6	36	95	33,000	37,800	41,000	1.1	41,000	66,000	5
FG-2-08050-30	500	7.20	3000■	8.25	1.25	6.6	36	95	33,000	37,800	41,000	1.1	41,000	66,000	5
FG-2-15050-12	500	13.8	1200	15.0	1.30	11.5	36	95	18,000	19,500	23,000	1.1	23,000	37,000	5
FG-2-15050-20	500	13.8	2000	15.0	1.30	11.5	36	95	18,000	19,500	23,000	1.1	23,000	37,000	5
FG-2-15050-30	500	13.8	3000■	15.0	1.30	11.5	36	95	18,000	19,500	23,000	1.1	23,000	37,000	5
FG-2-15075-12	750	13.8	1200	15.0	1.30	11.5	36	95	28,000	30,400	36,000	1.1	36,000	58,000	5
FG-2-15075-20	750	13.8	2000	15.0	1.30	11.5	36	95	28,000	30,400	36,000	1.1	36,000	58,000	5
FG-2-15075-30	750	13.8	3000■	15.0	1.30	11.5	36	95	28,000	30,400	36,000	1.1	36,000	58,000	5
FG-2-15100-12	1000	13.8	1200■	15.0	1.30	11.5	36	95	37,000	40,200	48,000	1.1	48,000	77,000	5
FG-2-15100-20	1000	13.8	2000■	15.0	1.30	11.5	36	95	37,000	40,200	48,000	1.1	48,000	77,000	5
FG-2-15100-30	1000	13.8	3000■	15.0	1.30	11.5	36	95	37,000	40,200	48,000	1.1	48,000	77,000	5

†—For interrupting current ratings at operating voltages other than those listed, use the following formula:

Iop = (Vmax / Vop) x I Vmax

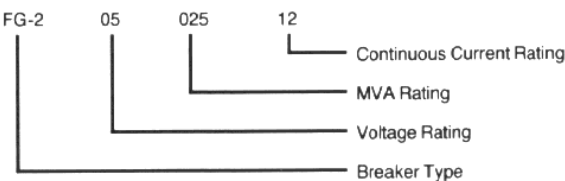
The calculated current should not exceed the maximum interrupting current rating.

I max = K x I Vmax

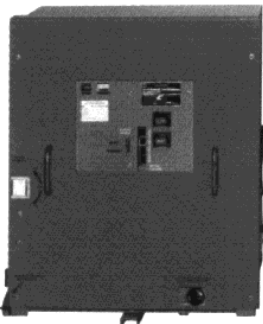
*—Rating factor is based on breaker speed from initiation of trip signal to contact parting, allowing for 1/2 cycle relay time. To obtain the asymmetrical current interrupting capability of the breaker, multiply the symmetrical current by 1.1.

■—Availability to be announced.

BREAKER IDENTIFICATION:



Δ—These values apply with circuit breaker in or out of enclosure.



The FLUARC system of arc interruption provides a soft high speed interruption with quiet operation.

Sulphur hexafluoride gas used in the FG-2 circuit breaker is a nonflammable, colorless, odorless, nontoxic gas which is extremely stable and has a dielectric strength of 2.5 times that of air at atmospheric pressure.

The gas maintenance is assisted by a molecular sieve of dehydrated alumina silicate located at the bottom of each interrupter.

- The arcing contacts and main contacts provide a parallel path for the current. On closing, the arcing contacts make first. On opening, the arcing contacts break last.
- As the arcing contacts part, gas is compressed by the piston and

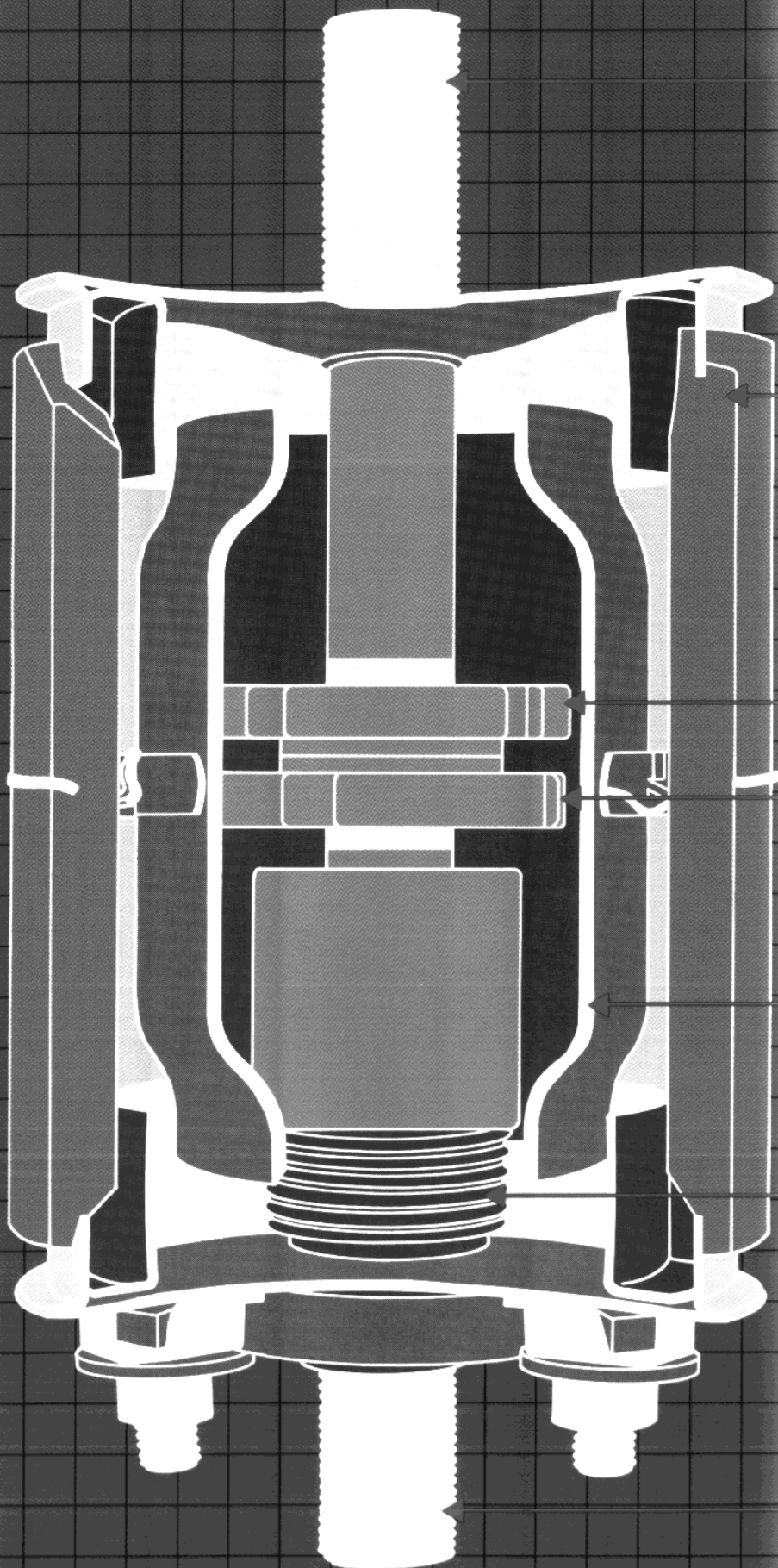
is forced through the nozzle into the arc region and across the arc.

- During the arcing and ionization of the gas, a great amount of arc energy is absorbed and evacuated due to the high specific heat rating of SF6.
- As the arc is cooled radially, the action of the fluorine becomes more dominant, absorbing electrons from the arc and aiding the dielectric recovery across the contacts.
- Due to special chemical property and high heat transfer characteristics of the SF6, the gas rapidly cools and de-ionizes the arc reducing its conductance to practically zero, allowing total extinction at first current zero.

The gas that is forced through the nozzle also serves to damp out the physical motion of the breaker, providing a highly reliable mechanism that lends itself well to the minimum maintenance concept of these breakers.



CUTAWAY VIEW OF VAD-2 VACUUM INTERRUPTER SHOWING MAIN COMPONENTS



STATIONARY
TERMINAL

RUGGED GLASS/
CERAMIC ENVELOPE

STATIONARY
CONTACT
MOVABLE
CONTACT

CONDENSING
SHIELD

FLEXIBLE METALLIC
BELLOWS

MOVABLE
TERMINAL

Type VAD-2 VACARC® (Vacuum) Circuit Breaker Ratings Data

Type of Breaker	Nominal Rating		Rated Cont. Current 60 Hertz Amps.—RMS	Rated Voltages			Insulation Level Rated Withstand		Interrupting Ratings† Amps.—Symmetrical			Asym-metrical Rating Factor*	Short Time Rating 3 Sec. Amps.—RMS	Close & Latch Rating Amps.—RMS	Inter-rupting Time Cycles
	Three Phase MVA	Voltage kV—RMS		Maximum Voltage kV—RMS	K-Factor Max. kV Min. kV	Minimum Voltage kV—RMS	Low Frequency kV-RMS	ΔImpulse 1.2x5MS kV-CREST	Maximum kV Amps.—RMS	Nominal kV Amps.—RMS	Minimum kV Amps.—RMS				
VAD-2-05025-12	250	4.16	1200	4.76	1.24	3.85	19	60	29,000	33,200	36,000	1.2	36,000	58,000	3
VAD-2-05025-20	250	4.16	2000	4.76	1.24	3.85	19	60	29,000	33,200	36,000	1.2	36,000	58,000	3
VAD-2-05025-30	250	4.16	3000	4.76	1.24	3.85	19	60	29,000	33,200	36,000	1.2	36,000	58,000	3
VAD-2-05035-12	350	4.16	1200	4.76	1.24	3.85	19	60	41,000	46,900	49,000	1.2	49,000	78,000	3
VAD-2-05035-20	350	4.16	2000	4.76	1.24	3.85	19	60	41,000	46,900	49,000	1.2	49,000	78,000	3
VAD-2-05035-30	350	4.16	3000	4.76	1.24	3.85	19	60	41,000	46,900	49,000	1.2	49,000	78,000	3
VAD-2-08035-12	500	7.20	1200	8.25	1.25	6.6	36	95	33,000	37,800	41,000	1.1	41,000	66,000	3
VAD-2-08035-20	500	7.20	2000	8.25	1.25	6.6	36	95	33,000	37,800	41,000	1.1	41,000	66,000	3
VAD-2-08035-30	500	7.20	3000	8.25	1.25	6.6	36	95	33,000	37,800	41,000	1.1	41,000	66,000	3
VAD-2-15050-12	500	13.8	1200	15.0	1.30	11.5	36	95	18,000	19,500	23,000	1.2	23,000	37,000	3
VAD-2-15050-20	500	13.8	2000	15.0	1.30	11.5	36	95	18,000	19,500	23,000	1.2	23,000	37,000	3
VAD-2-15050-30	500	13.8	3000	15.0	1.30	11.5	36	95	18,000	19,500	23,000	1.2	23,000	37,000	3
VAD-2-15075-12	750	13.8	1200	15.0	1.30	11.5	36	95	28,000	30,400	36,000	1.2	36,000	58,000	3
VAD-2-15075-20	750	13.8	2000	15.0	1.30	11.5	36	95	28,000	30,400	36,000	1.2	36,000	58,000	3
VAD-2-15075-30	750	13.8	3000	15.0	1.30	11.5	36	95	28,000	30,400	36,000	1.2	36,000	58,000	3
VAD-2-15100-12	1000	13.8	1200	15.0	1.30	11.5	36	95	37,000	40,200	48,000	1.2	48,000	77,000	3
VAD-2-15100-20	1000	13.8	2000	15.0	1.30	11.5	36	95	37,000	40,200	48,000	1.2	48,000	77,000	3
VAD-2-15100-30	1000	13.8	3000	15.0	1.30	11.5	36	95	37,000	40,200	48,000	1.2	48,000	77,000	3

†—For interrupting current ratings at operating voltages other than those listed, use the following formula:

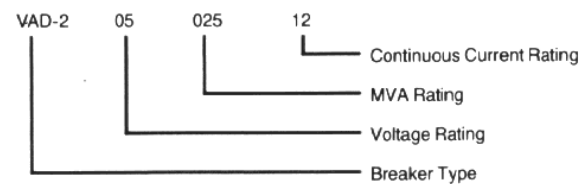
$$I_{op} = \frac{V_{max}}{V_{op}} \times I_{Vmax}$$

The calculated current should not exceed the maximum interrupting current rating.

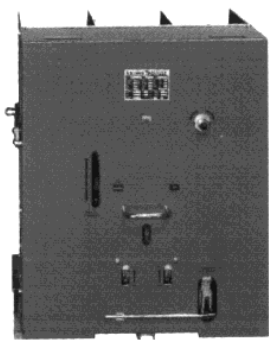
$$I_{max} = K \times I_{Vmax}$$

*—Rating factor is based on breaker speed from initiation of trip signal to contact parting, allowing for 1 / 2 cycle relay time. To obtain the asymmetrical current interrupting capability of the breaker, multiply the symmetrical current by 1.2.

BREAKER IDENTIFICATION:



Δ—These values apply with circuit breaker in or out of enclosure.



The modern vacuum interrupters utilized in VAD-2 circuit breakers are designed for high speed operation, rapid dielectric recovery, quiet operation, minimum maintenance and long life.

- As the contacts part, the arc develops a plasma of metallic ions released by the contacts.

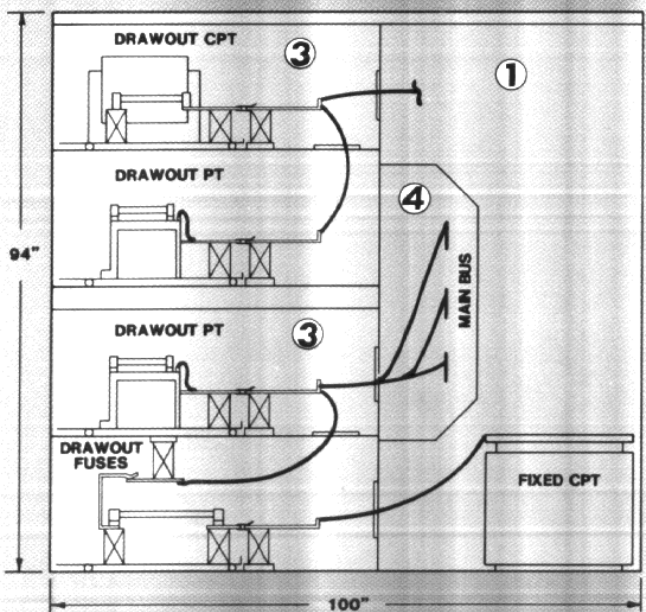
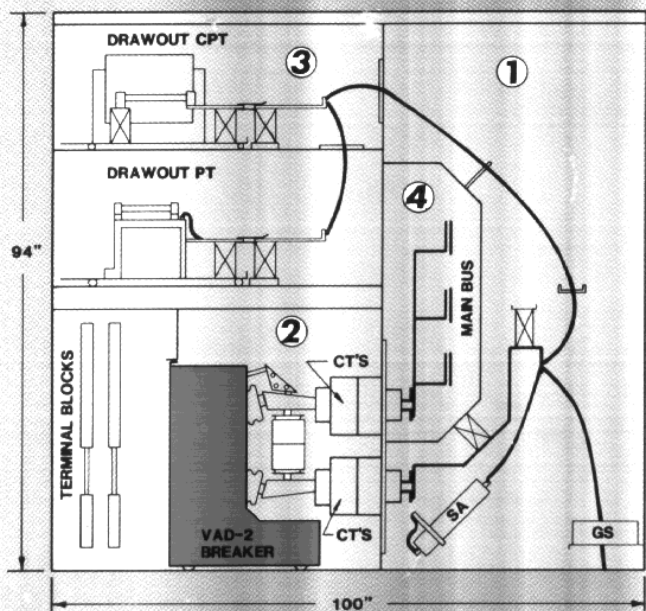
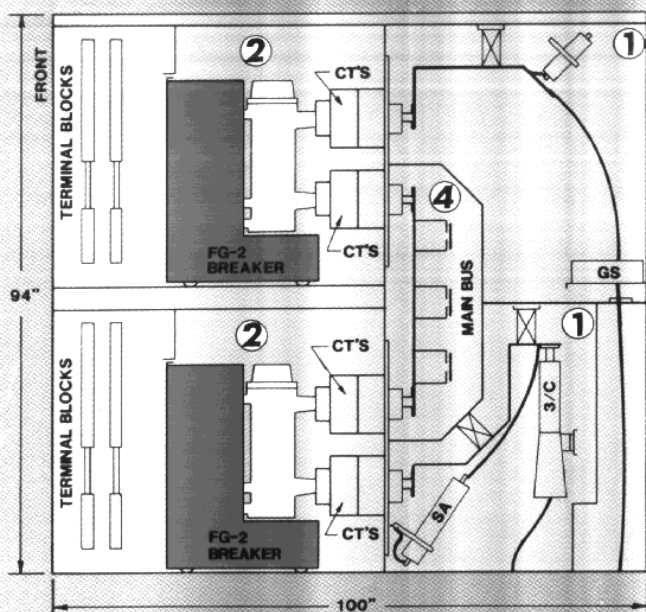
• This plasma provides transfer media for electron flow until the arrival of the first current zero.

- 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 provides a gettering action which removes gas molecules from the evacuated space, therefore assisting in maintaining the high vacuum.

Because the vacuum interrupters are small in size and weight and utilize short operating stroke, there is minimum physical shock to the mechanical system during operation. This makes an ideal situation for long life and low maintenance.

DIMENSIONS

TYPICAL SECTION VIEWS (36" WIDE)



OPTIONS AVAILABLE

1 CABLE COMPARTMENT

- Bottom or top cable entry
- Ground sensor current transformer (zero sequence)
- Space for stress cone termination
- Potheads
- Surge arresters, if required
- Fixed mounted CPT (no cable entry at the bottom)

2 BREAKER COMPARTMENT

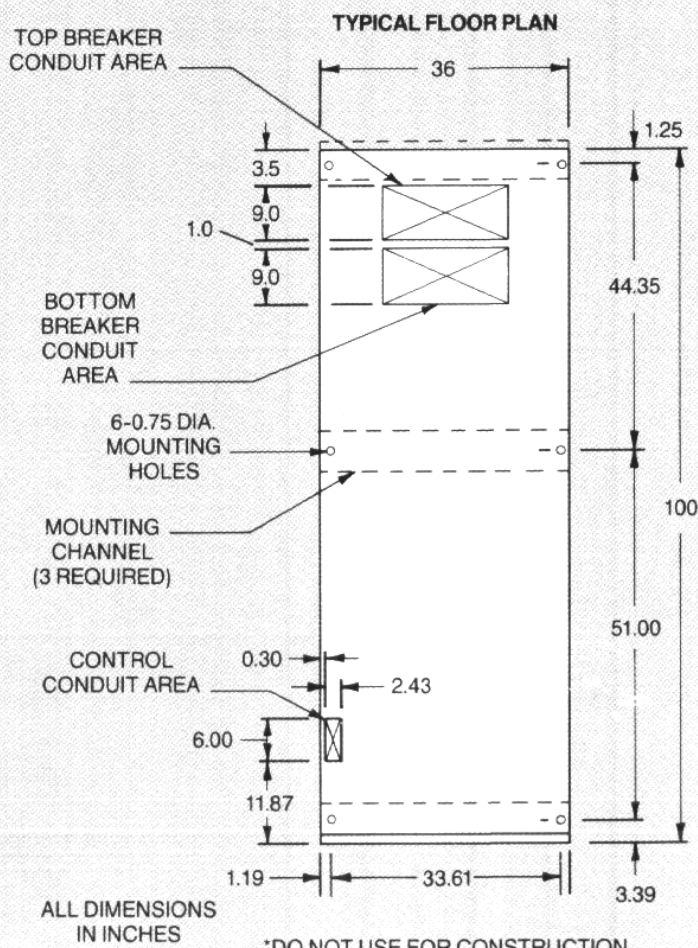
- SF₆ or Vacuum circuit breaker in two high construction
- Side space available for terminal block connections
- Maximum 4 CT's per phase (two on either side of breaker pole)

3 AUXILIARY COMPARTMENT

- Fused drawout PT's or single phase CPT (15 kVA maximum)
- Drawout fuses

4 MAIN BUS COMPARTMENT

- 1200/2000/3000 ampere insulated aluminum (copper optional) main bus



FLOOR PLAN—Metal-Clad Breaker Vertical Section (SHOWN FOR BOTTOM ENTRY)

For further information about Square D Metal-Clad Switchgear with SF₆ or Vacuum Circuit Breakers - contact your nearby Square D sales office. They are conveniently located in over 240 cities throughout the U.S. and abroad to serve you. Or, write to Square D Co., MVDO Marketing Section, 330 Weakley Rd., Smyrna, TN 37167.



SQUARE D®