Reclosers
Catalog Data
CA280008EN

Effective September 2019
Supersedes January 2016

COOPER POWER SERIES

Types VSA12, VSA12B, VSA16, VSA20, and VSA20A; three-phase; air-insulated; electronically controlled recloser

VSA16 recloser

VSA20A recloser

Powering Business Worldwide

General

Eaton provides reliable and economical overcurrent protection for 15 kV distribution systems with its Cooper Power series VSA-group electronically controlled, three-phase, automatic circuit reclosers with vacuum interrupters.

VSA-group reclosers are available with ratings up to 1200 amps continuous and 20,000 amps interrupting current, for line and substation applications. A choice of electronic recloser controls enables the user to meet a wide variety of application requirements.

The use of vacuum as the interrupting medium and air as the insulating medium, improves safety and substantially reduces long term maintenance costs. The reclosers in this group provide service-proven dependability and long operating life.

Commanded by Eaton's Cooper Power series electronic recloser controls, these automatic circuit reclosers offer superior coordination and application capability, unmatched by other system protection apparatus. The variety of available VSA-group ratings permits the user to select precisely the right recloser for the protection required.

Recloser operations are programmed on the electronic control panel with accurate, preset tripping characteristics and reclosing times, enabling close coordination with other protective devices on the system. When system requirements change, program settings are easily altered with no sacrifice of accuracy or consistency. Recloser and control accessories enable further tailoring of the protective program to achieve maximum system operating flexibility.

When needed, application expertise, backed by world wide recloser application experience, is readily available. Knowledgeable design capability–based on over 50 years of recloser manufacturing experience–has made Eaton the industry leader. Progressive product development programs, using the latest technologies, have resulted in the production of modern, efficient reclosers.

Since the majority of faults are temporary in nature, they can be cleared with only a momentary circuit interruption. Therefore, permanent outages are usually prevented. With outage time kept to a minimum, customer service and system reliability is improved and utility income is maintained.

VSA-group reclosers, like all reclosers from Eaton, are designed and built in accordance with ANSI® C37.60 standard.

Ratings

VSA-group reclosers can be applied in a wide variety of protective schemes on distributions systems ranging from 2.4 through 14.4 kV. Basic ratings are shown in Table 1.

Characteristic features

Fault-sensing information for VSA-group reclosers is supplied to the electronic control by bushing-type current transformers mounted in the recloser. Tripping and closing signals from the control energize operating circuits in the recloser.

Minimum-trip values of the control are independent of the continuous current and interrupting ratings of the recloser. Flexibility in coordination with other protective devices is provided by dual time-current characteristics available from a broad choice of time-current curves, a wide range of minimum-trip values, and a variety of programmable reclosing times.

Energy to operate the vacuum interrupters is provided by a motor-driven operator supplied from a 240 Vac source. The motor operator closes the recloser by charging the closing springs, which in turn provides the force to close the vacuum interrupters and charge the opening springs.

Since their introduction in 1966, Eaton's vacuum interrupters have had an excellent reliability record and have grown to be the most complete line of vacuum switchgear available in the industry.

Mounting equipment

VSA-group reclosers are furnished in standard frames with corner lifting eyes. Mounting equipment is available for either pole or substation installation of the recloser (See Table 6 for mounting accessories).

Surge protection

Best operating results are achieved when reclosers are protected with surge arresters. On line applications, arrester protection is recommended on both sides of a recloser. If protection is to be provided on one side only, it should be on the source side. In substations, arresters should be located on the load side.

Eaton's Cooper Power series distribution-class surge arresters provide excellent protection. See *Catalog Section CA235005EN* for information about the UltraSIL™ Polymer-Housed VariSTAR™ surge arrester and *Catalog Section CA235018EN* for the UltraSIL Polymer-Housed Evolution™ surge arrester.

Table 1. Summary of Ratings

Nominal Voltage (kV)	Maximum Continuous Current (amps)	Maximum Interrupting Rating at Nominal Voltage (sym amps)	Interrupting Medium	Recloser Type
14.4	600	12000	vacuum	VSA12B
14.4	800	12000	vacuum	VSA12
14.4	800	16000	vacuum	VSA16
14.4	800	20000	vacuum	VSA20
14.4	1200	20000	vacuum	VSA20A

Ordering information

A complete electronically controlled VSA-group recloser installation includes:

- Recloser and its accessories.
- Electronic control and its accessories.
- Control cable.
- Mounting equipment.

To order a recloser, electronic control, and control cable:

1. Use Table 2 to specify the catalog number that describes the required recloser.
2. From Tables 3 - 8, specify the catalog numbers that describe the required recloser accessories and mounting equipment.
3. Order the required electronic recloser control. (The control is priced separately from the recloser.)

Table 2. Basic Recloser Catalog Numbers

Recloser Type	Catalog Number
VSA12B	KVS-15-12-600
VSA12	KVS-15-12-800
VSA16	KVS-15-16-800
VSA20	KVS-15-20-800
VSA20A	KVS-15-20-1200

Table 3. Multi-Ratio Bushing Current-Sensing Transformers; Factory-Installed

Description	Catalog Number
Three 600:5 BCTs (accuracy class C100) on bushings 1, 3, and 5	KA65VS1
Three 600:5 BCTs (accuracy class C100) on bushings 2, 4, and 6	KA65VS2
Three 1200:5 BCTs (accuracy class C200) on bushings 1, 3, and 5	KA65VS3
Three 1200:5 BCTs (accuracy class C200) on bushings 2, 4, and 6	KA65VS4

Table 4. Bushings, Terminals; Factory-Installed

Description	Catalog Number
17-in.-creepage bushings, VSA12B, VSA12, VSA16, VSA20	KA59VS
Stud-type terminals, 1-1/8-12 UNF-2A, VSA12, VSA16, VSA20	KA79VS1
4 hole flat-pad terminals, VSA12, VSA16, VSA20	KA79VS2
Stud-type terminals, 1-1/8-12 UNF-2A, VSA12B	KA79VS3
4 hole flat-pad terminals, VSA12B	KA79VS4

Table 5. Service-Related; Factory-Installed

Description	Catalog Number
120 Vac motor operator	KA60VSM2
External spring-charging accessory*	KA59VSM2
External contact-position-indicating accessory	KA61VSM4

* Cannot be used with 2 sets of multi-ratio BCTs.

Table 6. Mounting Equipment

Description	Catalog Number
VSA12B, VSA12, VSA16, VSA20	
Substation mounting frame extension	KA55VS1
Electronic control mounting bracket Double-size cabinet	KA55VS4
Single-pole mounting hanger	KA56VS
VSA20A	
Substation mounting frame extension	KA55VS8
Electronic control mounting bracket Double-size cabinet	KA55VS9
Single-pole mounting hanger	KA52VSM

Table 7. Remote Operation and Indication; Factory-Installed

Description	Catalog Number
Three -stage auxiliary switch	KA55VSM3

Table 8. Form 6 Rack Mount Substation Interface; Factory-Installed

Description	Catalog Number
DC Station Supply Interface*	KVS-SS-XXX**

* Requires a DC source from a substation battery.

** Specify station supply voltage. Replace XXX with 24, 48, or 125 to indicate DC voltage. Contact factory for accessory availability.

Features and detailed description

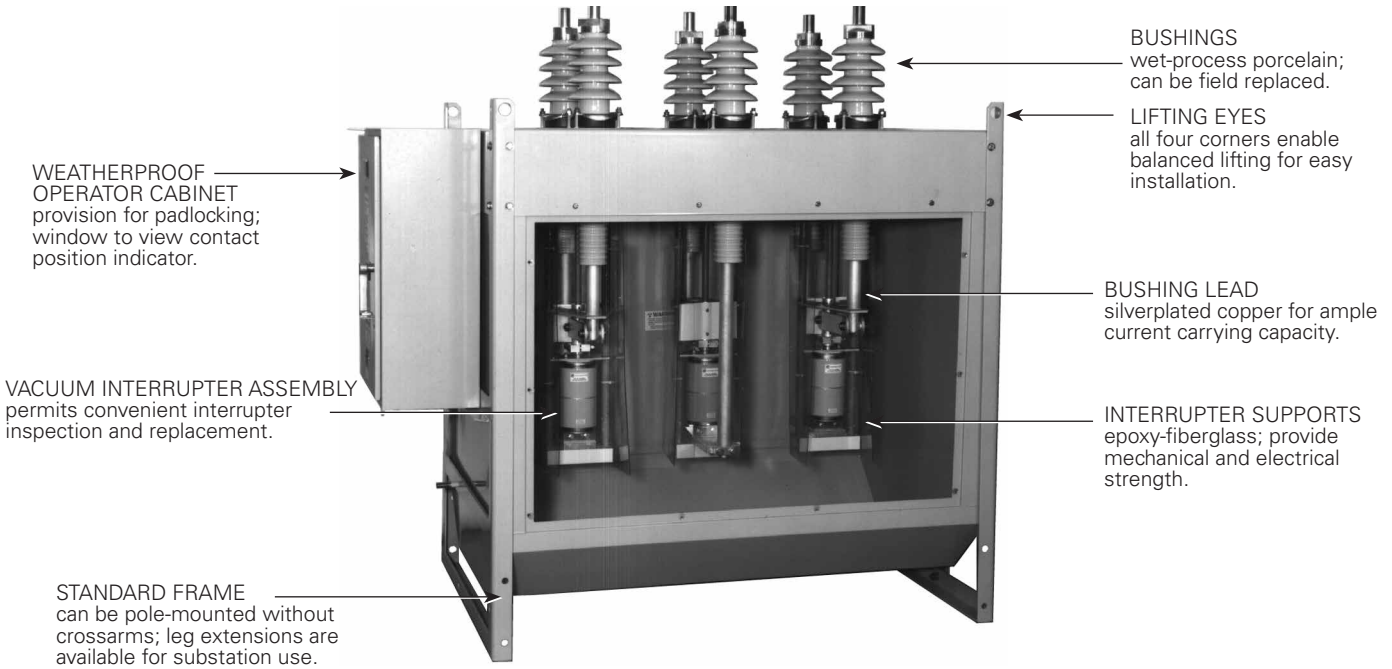


Figure 1. VSA20A three-phase, air-insulated vacuum recloser with inspection cover removed.

Recloser

Eaton's Cooper Power series VSA-group three-phase reclosers feature vacuum interruption with air insulation and low-voltage motor operation. These reclosers are designed for circuit protection on systems operating through 14.4 kV.

Because of the large selection of continuous and interrupting current ratings and the flexibility provided by Eaton's electronic recloser controls; VSA-group reclosers can be applied to meet a wide variety of requirements.

The vacuum interrupters in VSA reclosers provide reliable, shock free fault-current interruption with long interrupter life. The combination of vacuum interruption and air insulation provides longer maintenance intervals and lower maintenance costs than comparable oil-insulated reclosers. Vacuum interruption also provides greater safety for indoor applications than arc interruption in oil.

Closing and tripping operations of the recloser are both powered by springs. The motor-operator loads the closing springs, which charge the opening springs during closing.

An external 240 Vac source supplies power for the motor operator and the cabinet heaters. The 240 Vac supply is not required to trip the recloser.

Fault currents are sensed by 1000:1-ratio bushing current transformers mounted in the recloser (2000:1 current transformers are used in VSA20 and VSA20A reclosers), which provide sensing of both phase and ground (zero sequence) currents. They provide a continuous measurement of line current that is monitored by the recloser control. When the control's programmed minimum trip level is exceeded, the control energizes the trip solenoid in the recloser operating mechanism, opening the recloser.

Construction

Eaton's air-insulated vacuum reclosers offer extra-long service life and require minimal maintenance. Duty cycles are four times those of comparably rated oil-interrupting reclosers. Vacuum interrupter contacts, as well as the entire recloser, require no service other than periodic maintenance inspection.

Housings are fabricated of hot-rolled steel which is phosphatized to resist corrosion, then finished with polyester powder paint. Finish color is light gray, Munsell 5BG 7.0/0.4

Nonferrous alloys are used for mechanism linkages; stainless steel is used for shafts and hardware. Other steel parts are plated. Needle bearing or hard brass bushings are swaged into mechanism plates and linkages to provide long, trouble-free life for moving parts.

All gears and latches are permanently lubricated; sealed ball bearings are used in the motor.

For ease of inspection, all internal parts are readily accessible by removing an inspection panel on either side of the recloser.

Vacuum interrupters are mounted independently of the bushings. The bushing rods clamp to a current transfer member of the interrupter mounting assembly. Therefore, the bushings can be replaced quickly and easily without disturbing the interrupter or requiring any interrupter adjustment.

Insulating supports for the three interrupters are made of filament-wound glass epoxy for high electrical and mechanical strength and moisture resistance.

Cabinet heaters are provided in both the operator mechanism cabinet and the interrupter mechanism cabinet. The heaters are supplied from the 240-Vac auxiliary power source and are connected through a DPST on-off toggle switch and one amp fuses. The mechanism cabinet heater operates at 57 watts. The enclosure heaters operate at 115 watts total.

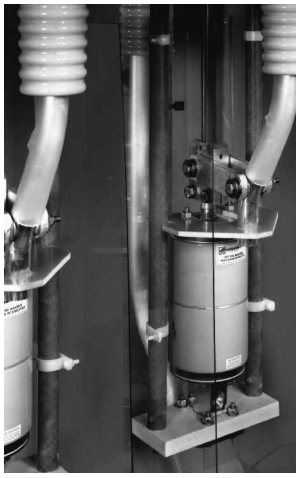


Figure 2. Vacuum interrupter assembly.

Motor operation

VSA-group air-insulated, vacuum reclosers employ a 240 Vac, motor-driven operating mechanism to charge closing and opening springs.

Tripping

Recloser tripping employs stored spring energy. When line current exceeds the programmed minimum-trip value, in one or more phases, the control energizes a trip solenoid in the operating mechanism. The solenoid trips a latch which releases a spring-loaded toggle assembly, opening the recloser contacts and a switch which interrupts the 24-volt signal from the control. Maximum clearing time is 2-1/2 cycles.

Tripping, because it employs stored spring energy released by a 24-volt signal from the control, will occur even if the 240-volt supply is lost.

Closing

Closing energy, as well as the force to charge the opening springs, is supplied by the motor operating mechanism, through motor-loaded closing springs. A 240 Vac motor charges the closing springs through a multi-stage gear drive. When 240 Vac is present, the motor is automatically operated to keep the closing springs in a charged state.

To close the recloser, the control initiates a signal which energizes a solenoid in the recloser operating mechanism. Once actuated, the solenoid releases the closing springs, which close the vacuum interrupters and charge the opening springs.

Stored energy provides multiple operations

Should the recloser's 240 Vac motor supply voltage be lost while the closing spring is charged and contacts are closed, an *Open-Close-Open* sequence remains stored in the recloser operating mechanism. If the recloser trips under these conditions, the stored closing operation allows an immediate reclosing, if required. After such a closing, one additional trip operation then remains stored. Once closed, the recloser always contains energy for at least one trip operation.

Manual operation

A closed recloser can be manually tripped from inside the operator cabinet, using the RESET-TRIP knob, or from outside the cabinet by pulling down the Manual Trip pull-ring. When the recloser is manually tripped, the closing circuit is opened to prevent reclosing. The recloser can be manually restored to service by placing the RESET-TRIP knob at RESET and moving the manual control switch on the recloser control to CLOSE. The manual control switch on the recloser control panel can also be used for tripping.

The recloser can be manually closed by pulling down the Manual Close Pullring located under the operator cabinet.

An emergency means is provided to manually close VSA-group reclosers on a de-energized line in the absence of the 240 Vac power supply.

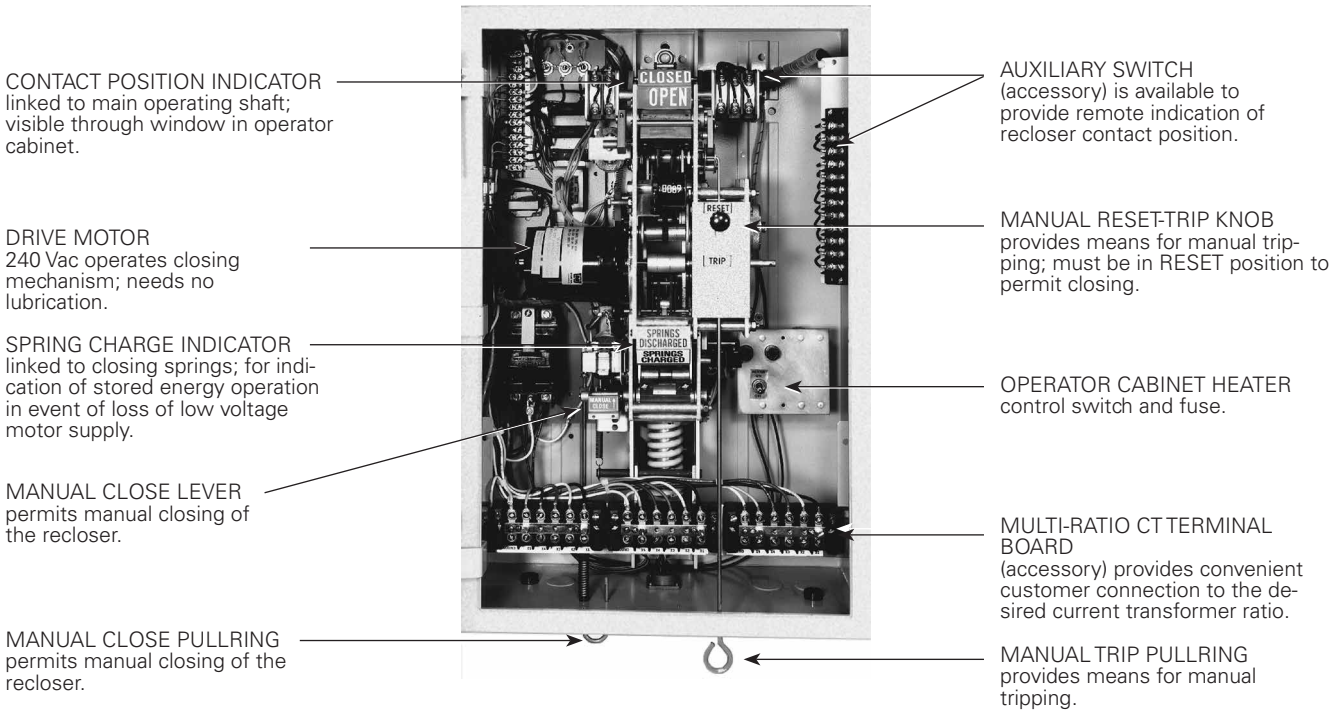


Figure 3. VSA-group recloser operating mechanism components.

A hand crank can be applied to the motor to charge the closing springs. Once charged, the closing springs can be released either from inside or from below the operator mechanism cabinet. As with electrical operations, the opening springs are charged by release of the closing springs, so even a manually closed unit has sufficient stored energy for a trip operation.

Vacuum interrupters

The high quality vacuum interrupters used in VSA-group reclosers are manufactured exclusively at the Distribution Switchgear plant. Eaton's vacuum interrupters are used worldwide in the industry's broadest line of fault protection and switching apparatus, where they have established a proven record of long term reliability.

Vacuum interrupters provide fast, low energy arc interruption with long contact and interrupter life and low mechanical stress. With arc interruption taking place in a vacuum, contact and interrupter life are four times greater than with interruption in oil. At the same time, mechanical stress and wear on the mechanism is substantially reduced. Combined, these factors result in greatly reduced maintenance costs over the life of the recloser.

Eaton's vacuum interrupters are designed with a metal-and-ceramic housing for maximum strength. The high-alumina ceramic used in vacuum interrupters permits a high processing temperature to develop maximum purity of the assembly and is impervious to helium penetration. Metal end closures and the arcing chambers are of high-purity alloys to minimize contamination.

Enclosed in the interrupter is a stationary and a moving contact assembly. The moving contact has a travel of 7/16 in., its shaft passing through a flexible bellows which maintains vacuum integrity. Contacts are made of a special non-welding alloy.

Because even the smallest amount of internal contamination can significantly shorten a vacuum interrupter's life, a state-of-the-art clean-room manufacturing facility is used for vacuum interrupter production. Special care is taken to avoid even minute contamination; whether it be from dust particles, machining oils, or human body salts.

Figure 4. Vacuum interrupters are used in VSA-group reclosers.

Figure 5. Form 6 microprocessor-based recloser control.

Microprocessor-based control for maximum flexibility

Eaton commands the operation of a VSA-group recloser by an electronic recloser control.

The Form 6 control, shown in Figure 4, provides maximum protective hardware design and simple interactive graphical interfaces for complete user customization. All standard control operating parameters including minimum trip levels, time-current curve selection, and sequences of recloser operation are keyboard programmable.

This control utilizes a powerful PC based interface software to configure control settings, record metering information, and establish communication parameters. It also provides analysis tools that include fault locating, event recording, and oscillography functions.

The Form 6 rack mount substation interface accessory enables application of Form 6 rack mount controls and VSA reclosers to substation installations.

Located in the motor operator cabinet, the substation interface accessory allows the Form 6 rack mount control to be located up to 500 ft. from a VSA recloser. (Table 9). The factory-installed interface accessory may be powered by a either a 24, 48, or 125 Vdc substation battery, as specified at time or order. The quiescent battery drain upon the substation is only 40 milliamperes. All VSA reclosers include a 14 pin control cable receptacle to provide convenient connection of the Form 6 rack mount recloser control to either the KA85ME control cable or KME6-1859/ KME6-1811 junction boxes.

For complete descriptive information on the Form 6 control, refer to brochures PA280010EN and PA280009EN.

Table 12. Cable lengths for Form 6 rack mount substation interface accessory

Cable Lengths for 24 Vdc Substation Form 6 Interface Accessory		
Wire Gauge	**Meters**	**Feet**
18 AWG	12	40
16 AWG	18	60
14 AWG	30	100
12 AWG*	50	175
Cable Lengths for 48 Vdc Substation Form 6 Interface Accessory		
Wire Gauge	**Meters**	**Feet**
18 AWG	24	80
16 AWG	36	120
14 AWG	60	200
12 AWG*	100	350
Cable Lengths for 125 Vdc Substation Form 6 Interface Accessory		
Wire Gauge	**Meters**	**Feet**
18 AWG	48	120
16 AWG	54	180
14 AWG	90	300
12 AWG*	150	500

* 12 gauge cable to be used with junction box accessory KME6-1859 or KME6-1181.

Ratings and specifications

Table 9. Voltage Ratings

Maximum Design Voltage (kV)	15.5
Nominal Operating Voltage (kV)	2.4-14.4
Basic Insulation Level (BIL) (kV)	110
60 Hertz Withstand Voltage (kV)	
Dry, one minute	50
Wet, ten seconds	45
Max RIV at 1.0 MHz/9.41 kV (micro-volts)	100

Table 10. Current Ratings

Continuous Current Rating (amps)	
VAS12B	600
VSA12, VSA16, VSA20	800
VSA20A	1,200
Symmetric Interrupting Current (amps)	
VSA12, VSA12B	12,000
VSA16	16,000
VSA20, VSA20A	20,000
Cable Charging Current (amps)	2
Magnetizing Current (amps)	
VSA12,VSA12B VSA16, VSA20	28
VSA20A	42
Three-Second Current, Symmetric (amps)	
VSA12, VSA12B	12,000
VSA16	16,000
VSA20, VSA20A	20,000
Momentary Current, Asymmetric (amps)	
VSA12, VSA12B	20,000
VSA16	25,600
VSA20, VSA20A	32,000
Capacitive Switching, General Purpose, Isolated Bank (amps).	250

Table 11. Electrical Specifications

Trip Solenoid:		
Operating voltage (Vdc)		24
Peak current (A)		12.2
Actuation time (cycles)		1.25
Close Solenoid:		
Operating voltage (Vdc)		24
Peak current (A)		15.5
Actuation time (cycles)		1.5
Spring Charging Motor:	**Standard**	**Accessory**
Operating Voltage (Vac)	240	120
Voltage Range (Vac)	160-257	90-127
Maximum Current, RMS (A)	14	18
Steady State Current (A)	4.1	9
Motor Running Time (cycles)	40	40
Sensing Current Transformers		
VSA12, VSA12B, VSA16		1000:1
VSA20, VSA20A		2000:1
Maximum Arcing Time (cycles)		1.0
Interrupting Time (cycles)		2.5

Table 13. Mechanical Life

Open-Close, no load, operations	2500

Table 14. Bushing Specifications

Bushing creepage distance (in.)	
VSA12, VSA12B, VSA16, VSA20	12*
VSA20A	17
Arcing distance (in.) - phase to ground	
VSA12, VSA12B, VSA16, VSA20	7 1¼2
VSA20A	7 3¼4
Arcing distance (in.) - phase to phase	
VSA12, VSA12B, VSA16, VSA20	9 5⅛8
VSA20A	11

* 17 in. creepage distance available as an accessory.

Table 15. Duty Cycle

Percent of Maximum Circuit Interrupting Rating	Maximum X/R Ratio	Number of Unit Operations
15-20	4	88
45-55	8	112
90-100	15	32
		Total 232

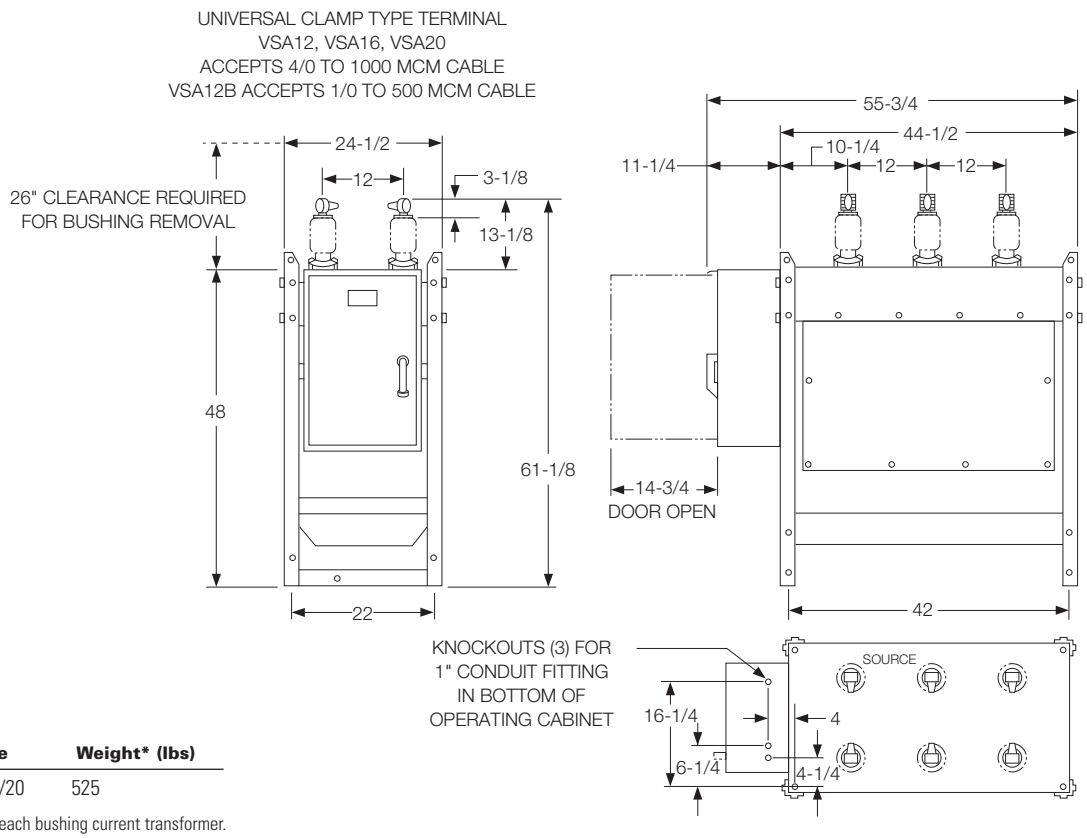
Table 16. Mechanical Specifications

Operating Temperature (°C)	
Minimum	-30
Maximum	
VSA12,VSA12B, VSA16, VSA20	+50
VSA20A	+40
Closing Mechanism	Spring Operated
Opening Mechanism	Spring Operated
Contact Gap (inches)	7/16
Close Contact Travel Time (cycles)	0.5
Open Contact Travel Time (cycles)	0.5
Allowable Contact Erosion (inches)	0.125
Opening Time (24 Vdc solenoid), signal to Contact Part (msec.)	25
Closing Time (24 Vdc solenoid), signal to Contact Make (msec.)	32

Table 17. Auxiliary Switch Interrupting Ratings

Volts	Inductive as (amps)	Non-Inductive as (amps)	Inductive DC (amps)	Non-Inductive DC (amps)
24	–	–	15.0	20.0
48	–	–	7.5	10.0
120	60	80	–	–
125	–	–	1.5	2.0
240	30	60	–	–
250	–	–	0.45	0.5

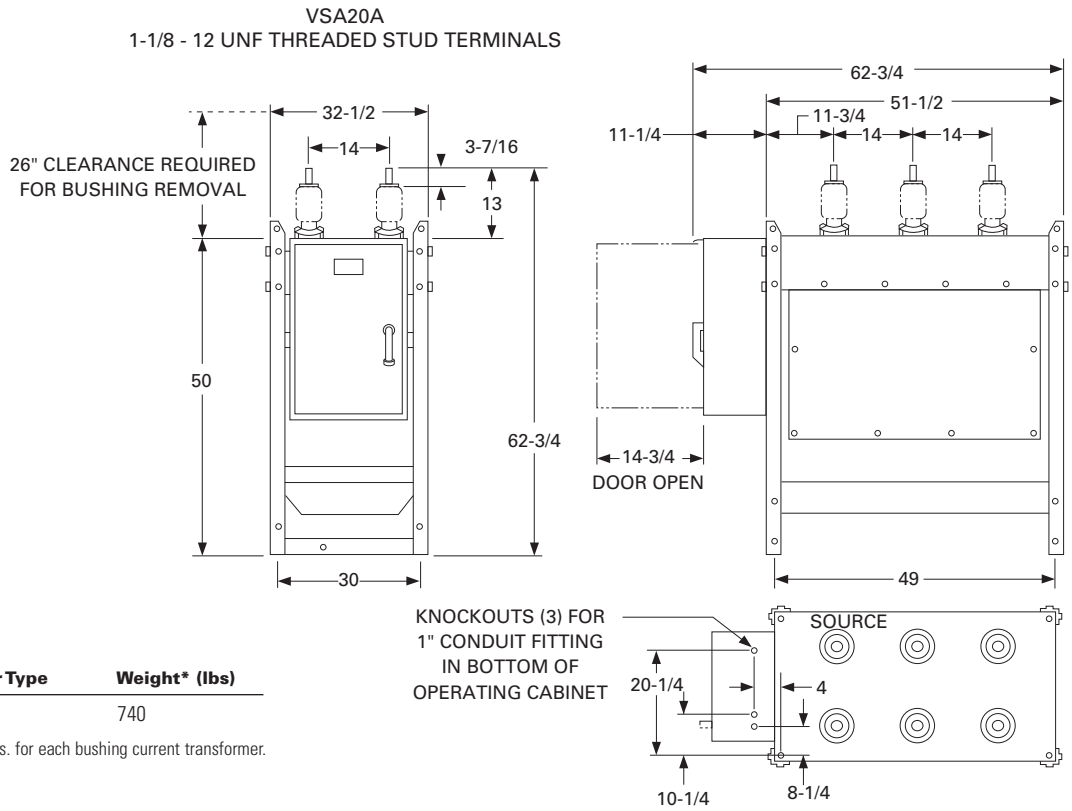
Dimensions and weights



Recloser Type	Weight* (lbs)
VSA12/12B/16/20	525

* Add 25 lbs. for each bushing current transformer.

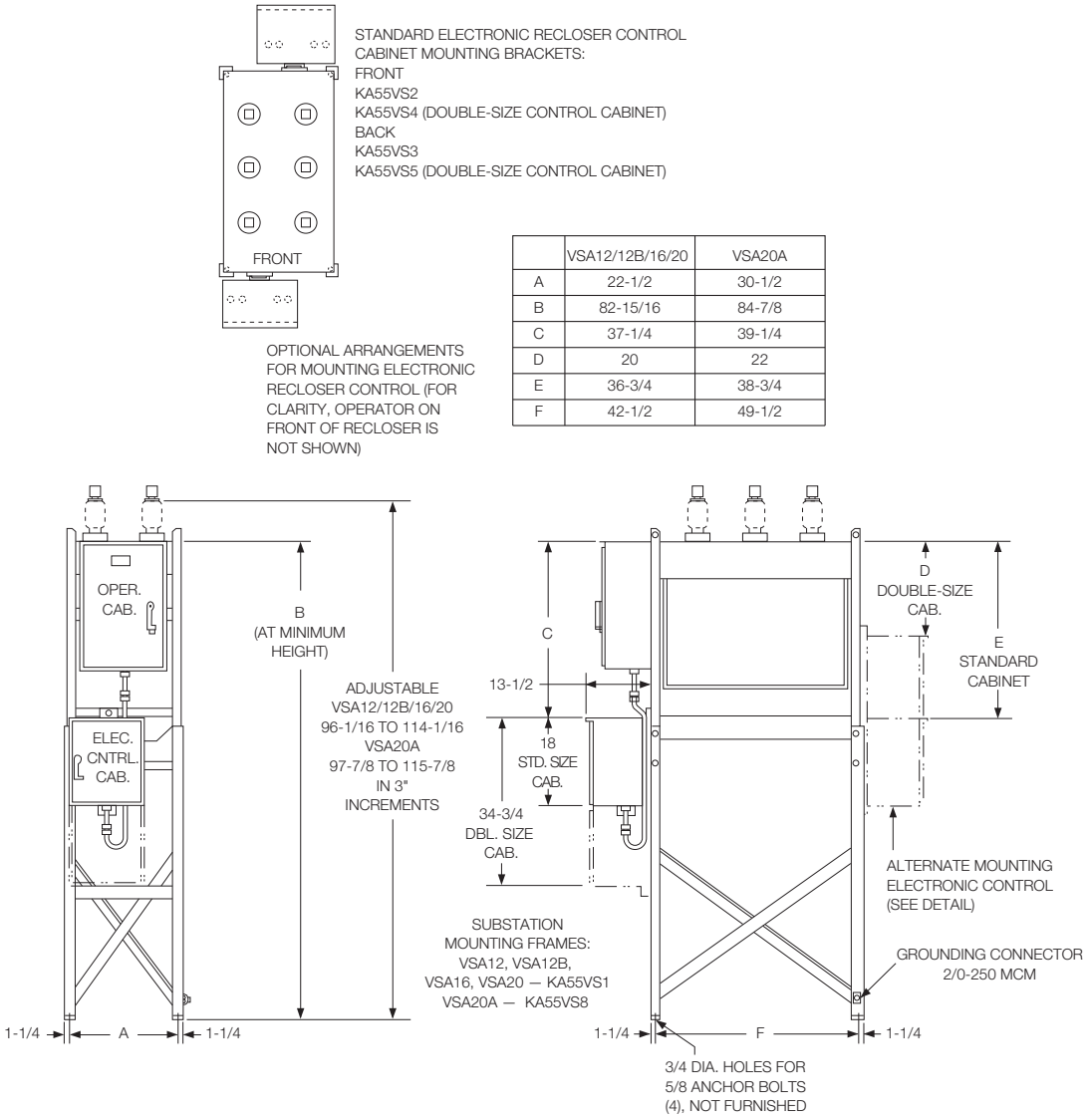
Figure 6. Outline dimensions for Types VSA12, VSA12B, VSA16 and VSA20 reclosers.



Recloser Type	Weight* (lbs)
VSA20A	740

* Add 25 lbs. for each bushing current transformer.

Figure 7. Outline dimensions for Type VSA20A recloser.



	VSA12/12B/16/20	VSA20A
A	22-1/2	30-1/2
B	82-15/16	84-7/8
C	37-1/4	39-1/4
D	20	22
E	36-3/4	38-3/4
F	42-1/2	49-1/2

Recloser Type	Weight* (lbs)
VSA12/12B/16/20	675
VSA20A	890

*Add 25 lbs. for each bushing current transformer.

Figure 8. Outline dimensions and weights for VSA-group reclosers with substation mounting frame accessory (weights shown are for recloser and mounting frame only).

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