

Vacuum Switches

Type VCS-1S Solenoid-Operated Capacitor Switch Installation and Operation Instructions

S260-15-2

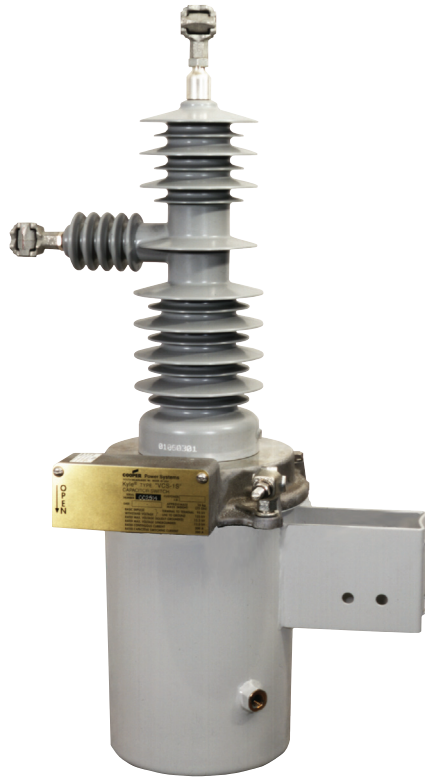


Figure 1.
Kyle Type VCS-1S single-phase vacuum capacitor switch.

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SAFETY FOR LIFE



Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Cooper Power Systems employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high voltage lines and equipment and support our “Safety For Life” mission.

SAFETY INFORMATION

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate, and service it.

A competent technician has these qualifications:

- *Is thoroughly familiar with these instructions.*
- *Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.*
- *Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.*
- *Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, hotstick, etc.*

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.

Safety Instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER: Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

G103.3

WARNING: Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling, or maintenance can result in death, severe personal injury, and equipment damage.

G101.0

WARNING: This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury, and equipment damage.

G102.1

WARNING: Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

G122.3



PRODUCT INFORMATION

Introduction

Service Information S260-15-2 provides installation, operation, and service instructions for Type VCS-1S solenoid-operated vacuum capacitor switches.

Read This Manual First

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional Information

These instructions can not cover all details or variations in the equipment, procedures, or processes described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, please contact your Cooper Power Systems representative.

Acceptance and Initial Inspection

Each switch is completely assembled, tested, inspected, and adjusted at the factory. It is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the switch thoroughly for damage and loss of parts incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.

Handling and Storage

Be careful during handling and storage of the switch to minimize the possibility of damage. If the switch is to be stored for any length of time prior to installation, provide a clean, dry storage area.

Standards

Cooper Power System switches are designed and tested in accordance with IEEE Std C37.66™-2005 standard.

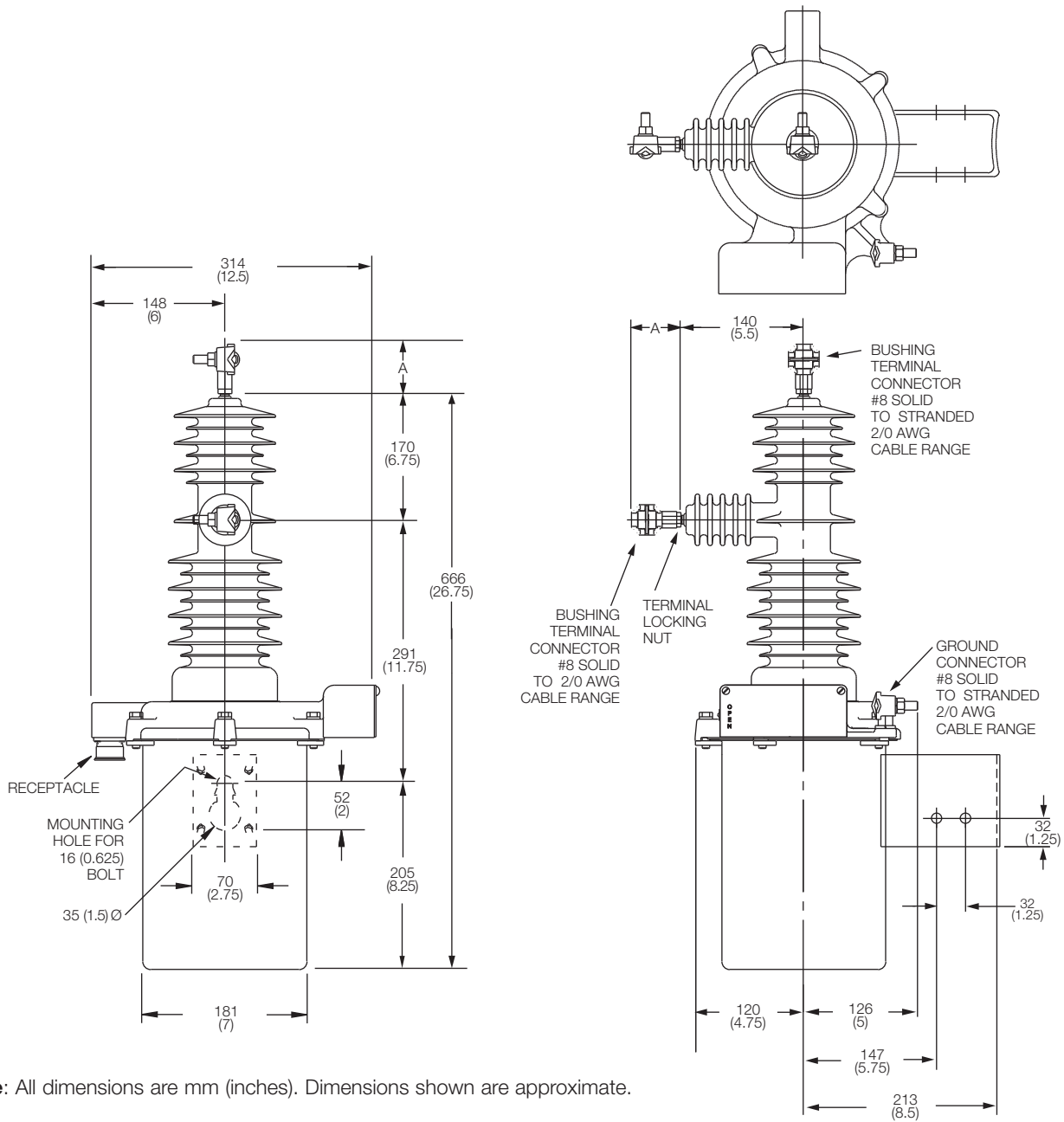
Quality Standards

ISO 9001:2000 Certified Quality Management System

Description

The Kyle Type VCS-1S solenoid-operated vacuum capacitor switch is a single-phase, electrically operated vacuum switch. The solid polymer insulation system does not rely on gas, foam, or liquid dielectrics. Highly resistant to ozone, oxygen, moisture, contamination, and ultraviolet light, it is an environmentally safe capacitor switch. The VCS-1S switch has a single, solid polymer bushing and is suitable for operation through a temperature range of -40 °C to +65 °C.

DIMENSIONS



Note: All dimensions are mm (inches). Dimensions shown are approximate.

Terminal Option	Dimension A
Eyebolt	50 mm (2 in)
Flat Pad, 1-Hole	75 mm (3 in)

Creepage	
Terminal to Terminal	521 mm (20.25 in)
Terminal to Ground	641 mm (25.0 in)

Figure 2.
Dimensions of Type VCS-1S switch.



RATINGS AND SPECIFICATIONS

Check Switch Ratings Prior to Installation

The switch must be applied within its specified ratings. Check data plate ratings and compare with the system characteristics at the point of application prior to installation. Tables 1–5 list the ratings and specifications for the VCS-1S switch.

TABLE 1
General Specifications

Mass (Weight) [kg (lb)]	16 (35)
Operating Temperature Range	-40 °C to +65 °C
Rated Frequency (Hz)	50/60
Mechanical Operations (close/open without maintenance)	25,000

TABLE 2
Duty Cycle (per ANSI C37.66)

Operations at 40 A	400
Operations at 100 A	400
Operations at 200 A	400

TABLE 3
Electrical Specifications

Operating Voltage, Nominal	120 V ac
Operating Voltage Range	95–127 V ac
Current (nominal, ac)	8 A
Nominal Close Time	100 ms
Nominal Open Time	100 ms

TABLE 4
Voltage Ratings

Maximum Voltage	
Solidly grounded capacitor banks, phase-to-ground	15.5 kV
Ungrounded capacitor banks, phase-to-phase	13.0 kV
Basic Insulation Level (BIL)	
Line-to-ground	125 kV
Open contact	95 kV
Max. RIV @ 9.4 kV	100 µV
60 Hz Withstand	
Dry, 1 minute	50 kV
Wet, 10 seconds	45 kV

TABLE 4
Current Ratings

Asymmetrical Making Current	9000 A
Continuous Current	200 A
Load Interrupting Ability (Inductive)	
10 to 100% Power Factor	200 A
Capacitive Current (Max.)	200 A
Short-Time Current	
Momentary Asymmetric (10 cycles)	9000 A
Symmetrical (0.5 second)	6000 A
Symmetric (1 second)	4500 A
Rated High Frequency Peak	
Transient Making Current	6000 A
Rated Transient Inrush Frequency	6000 Hz

INSTALLATION PROCEDURE

Check-out Procedure

CAUTION: Personal Injury. Bushings have sharp edges. Wear protective gloves when handling the unit. Failure to do so can result in cuts and abrasions. T258.0

- 1. Check data plate.** Make sure that ratings on the data plate are correct for the planned installation.
- 2. Reorient switch position if required for installation.** Loosen the head-to-tank mounting bolts only if it is necessary to reorient the position of the switch to make high-voltage line connections. After reorienting the switch, immediately retorque the head-to-tank mounting bolts in an alternating pattern to 13–20 N•m (10–15 ft•lbs).
- 3. Bushing terminals adjustment.** The bushing terminals may also be rotated about their axis for optimum alignment to high-voltage conductors. If terminal rotation is required, use the following procedure:
 - A.** Loosen the terminal locking nut on back of terminal. See Figure 2 for location of terminal locking nuts.
 - B.** Rotate terminal to desired location.
 - C.** Retighten the terminal locking nut. Torque to 12–14 N•m (9–10 ft•lbs).

IMPORTANT: Do not over-torque locking nut.

- 4. Install the switch.** Follow locally approved installation procedures. Mounting hardware is available for pole mounting as an accessory.

High-Voltage Connections

WARNING: Hazardous Voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T223.2

WARNING: This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage. G102.1

- 1. Ground the switch.** Make the ground connection to the ground connector located on the switch as shown in Figure 2.
- 2. Make line connections.** Connect the primary leads to the bushing terminals. The universal clamp-type terminals accommodate AWG No. 8 solid through 2/0 stranded conductor.

Control Wiring

Connections to the solenoid actuating mechanism are made through the standard five-pin (or optional six-pin) receptacle on the head casting.

Mating plugs for the receptacle must be ordered separately. Maximum cable and wire sizes accommodated by the plugs are indicated in Table 6.

Pin orientation diagrams for the receptacles are shown in Figure 3.

TABLE 6
Control Wiring Specifications

Accessory Plugs			
Catalog Number	Number of Pins	Cable Range O.D.	Max. Wire Size AWG
KA48NR	5	11–14 mm (0.437–0.562 in.)	12
KA98NR	6	13–16 mm (0.500–0.625 in.)	16

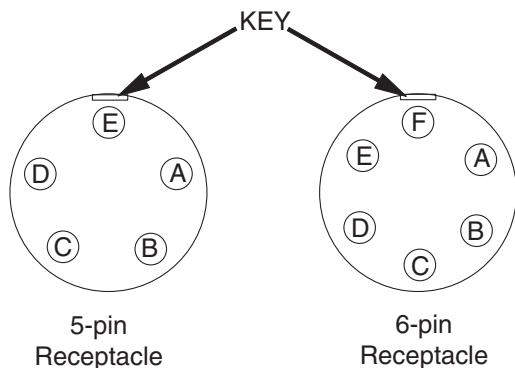


Figure 3.
Receptacle pin orientation.

Three-Wire Control

The basic device for remote control of the VCS-1S switch is a single-pole, double-throw switch (three-wire control) supplied by the customer. Any manual switch, time switch, voltage-, current- or photo-electric-controlled switch, or similar device can be used, provided the control circuit is energized for a minimum of 50 milliseconds for each operation. A connection diagram for a three-wire control is shown in Figure 4.

Two-Wire Control with Relay

The control can also be operated by a single-pole, single-throw (SPST) switch (two-wire control). A factory-installed single-throw, double-throw (SPDT) relay accessory is required for two-wire control operation. A connection diagram for a two-wire control is shown in Figure 4.

OPERATION

Electrical Operation

The switch may be opened and closed electrically by applying rated control voltage to the proper terminals of the actuator receptacle.

Contact Position Indicator

WARNING: Hazardous Voltage. This device is not a substitute for a visible disconnect. Follow all locally approved safety practices. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury. G112.1

The yellow flag is used as the contact position indicator. When the switch is closed, the yellow indicator flag is located behind the data plate. The flag drops down into view when the solenoid operates to open the switch. The indicator flag returns to the position behind the data plate when the switch is subsequently closed.

SERVICE INFORMATION

Service Requirements

The Kyle Type VCS-1S switch has been designed with a minimum mechanical life of 25,000 operations. The switch requires routine inspection to check for physical damage and to verify operation.

Frequency of Inspection

Because these switches are applied under widely varying operation and climatic conditions, maintenance intervals are best determined by the user based upon actual operating experience.

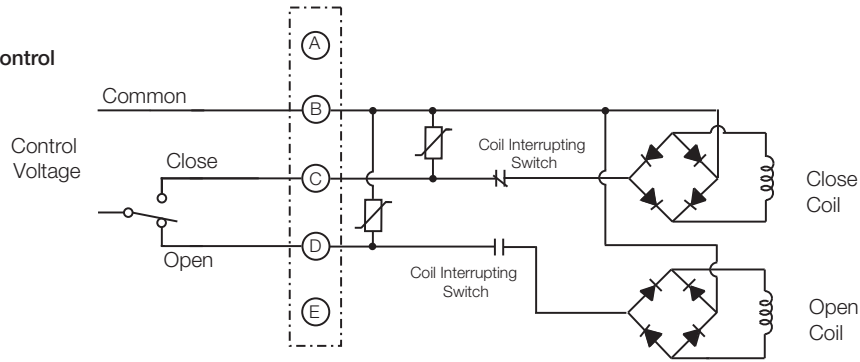
High-Potential Withstand Testing

WARNING: Hazardous Voltage. The switchgear and high-voltage transformer must be in a test cage or similar protective device to prevent accidental contact with the high-voltage parts. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T221.3

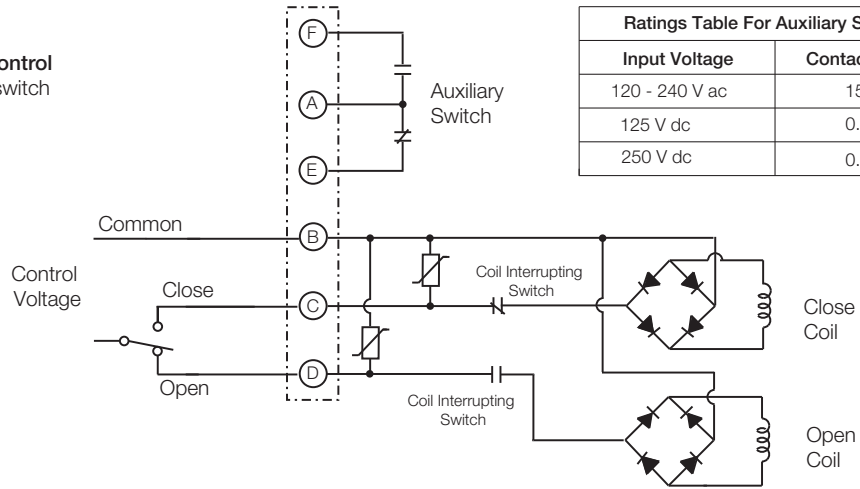
CAUTION: Radiation. At voltages up to the specified test voltages, the radiation emitted by the vacuum interrupter is negligible. However, above these voltages, radiation injurious to personnel can be emitted. See *Service Information S280-90-1, Vacuum Interrupter Withstand Test Voltage Ratings Information* for further information. G109.2

Use the following procedures to perform high-potential withstand tests. The VCS-1S capacitor switch should be tested at 37.5 kV ac.

**5 Pin
Three-wire Control**



**6 Pin
Three-wire Control
with auxiliary switch
accessory**



Ratings Table For Auxiliary Switch	
Input Voltage	Contact Rating
120 - 240 V ac	15 A
125 V dc	0.5 A
250 V dc	0.25 A

**5 Pin
Two-wire Control**

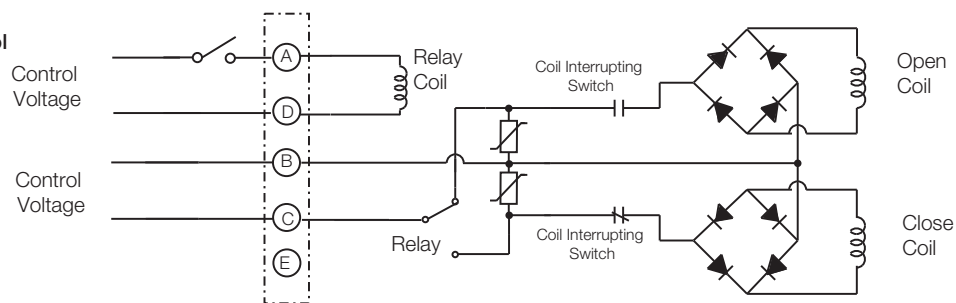


Figure 4.
Typical connection diagrams (switch shown in OPEN position).

Closed Contacts Test

1. Close the switch contacts.
2. Ground the switch.
3. Apply proper test voltage to one of the bushing terminals. The switch should withstand the test voltage for 60 seconds.

Open Contacts Test

1. Open the switch contacts.
2. Ground the switch.
3. Ground the bushing terminal on one side of the switch.
4. Apply proper test voltage to the ungrounded bushing terminal. The switch should withstand the test voltage for 60 seconds.

5. Reverse the test and ground connections to the bushing terminals.
6. Apply proper test voltage to the ungrounded bushing terminal. The switch should withstand the voltage for 60 seconds.

Withstand Test Results

The high-potential withstand tests provide information on the dielectric condition of the switch.

If the switch passes the closed-contacts test and fails the open-contacts test, the cause is likely to be in the interrupter assembly.

If the switch fails the closed-contacts test, the cause is likely to be a diminished electrical clearance or failed insulation.

Inspection of VCS-1S Module

If the VCS-1S module was exposed to an external flashover, an inspection process is recommended to assure proper operation of the switch. Should the VCS-1S exhibit external flashover attributes (carbon tracking or discoloration), the following procedure is recommended to restore the encapsulation back to its original condition:

1. Remove device from service.
2. Inspect module for damage to the terminals. Remove any damaged terminals and replace.
3. Inspect module for damage to the module rods. If there is damage to the module rods, the module must be replaced.
4. Verify through careful inspection that there is no damage to the housing or head casting that could inhibit proper operation.
5. Clean the damaged module with isopropyl alcohol and a scratch-free, nylon scouring pad to remove any carbon deposit.
6. Confirm the dielectric strength of the module by performing high-potential withstand testing. Confirm both phase-to-ground and phase-to-phase conditions. See the High-Potential Withstand Testing section of this manual.

Replacement Parts

Replacement Parts for Kyle Switches are available through the factory Service Department. Only factory-authorized parts are to be used. To order replacement parts, refer to the current Replacement Parts Price List for catalog numbers and pricing. Contact your Cooper Power Systems representative for additional information and ordering procedures.

Factory-Authorized Service Centers

Factory-authorized service centers are located throughout North America to provide maintenance, repair, and testing services for Kyle switches. For further information, contact your Cooper Power Systems representative.



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