

Specifications

Conditions of Sale

STANDARD: The seller's standard conditions of sale set forth in Price Sheet 150 apply, except as modified under the "Special Warranty Provisions" and "Warranty Qualifications" sections on page 2.

SPECIAL TO THIS PRODUCT:

SPECIFICATION NOTE: The Mark V Circuit-Switcher uses an in-series circuit-breaking interrupter and a circuit-making and isolating disconnect, making it especially suited for switching and protection of transformers, lines, cables, capacitor banks, and line-connected or tertiary-connected shunt reactors. The Mark V Circuit-Switcher is suitable for frequent operation over a long period of time with minimal maintenance. It is capable of closing, carrying, and interrupting fault currents as well as load currents, and it uses interrupters economically tailored for specific applications by using the precise number of interrupting gaps required. These interrupters are unaffected if subjected to sustained system voltage for extended periods resulting from being left open with the disconnect blades closed for any reason. The Mark V Circuit-Switcher is available in three styles—vertical-break, center-break, and integer.

EXCLUSIONS: Mark V Circuit-Switchers do not include connectors. Various connectors are available, as listed in Table 2 on page 3. Specify the quantity and catalog number of the connectors desired.

Circuit-switchers do not include manual operating handles.

Mounting pedestals and anchor bolts, if furnished, are not included and must be ordered separately. For mounting pedestals and anchor bolts, see Table 13 on page 15.

Circuit-switchers do not include the services of an S&C field service specialist for evaluating the condition of the circuit-switcher.

SPECIFICATION DEVIATIONS: When Mark V Circuit-Switchers are to be provided with special connectors (including all expansion, compression, and multi-conductor types), refer to the nearest S&C Sales Office.

Single-, two-, and four-pole vertical-break style and center-break style circuit-switchers are available. Refer to the nearest S&C Sales Office.

POWER OPERATION: High-speed, high-torque power operation of S&C Mark V Circuit-Switchers is required to provide two-time duty-cycle fault-closing ratings of 30,000 amperes, RMS, three-phase symmetrical, 76,500 amperes peak for the vertical-break style and integer-style circuit-switchers; and two-time duty-cycle fault-closing ratings of 40,000 amperes, RMS, three-phase symmetrical, 102,000 amperes peak for the center-break style circuit-switchers. See the "Basis of Fault-Closing Ratings" section below. Power operation of Mark V Circuit-Switchers also provides opening and closing without hesitation under 3/4-inch (19-mm) ice formation for the vertical-break and integer styles, 1 1/2-inch (38-mm) ice formation for the center-break style, close interphase simultaneity, long life of fault-closing contacts under normal operating duties, and avoidance of excessive switching transients caused by prolonged or unstable prestrike arcing. Mark V Circuit-Switchers are provided with high-speed, high-torque power operation by adding Type CS-1A Switch Operators. Refer to S&C Specification Bulletin 719-31 for details on Type CS-1A Switch Operators.

For high-speed tripping of power-operated Mark V Circuit-Switchers, add an S&C Shunt-Trip Device. See Table 8 on page 9. This optional shunt-trip device provides high-speed (8-cycle) circuit interruption. The Type CS-1A Switch Operator is required if the shunt-trip device is specified.

BASIS OF FAULT-CLOSING RATINGS: Two-time duty-cycle fault-closing ratings, as set forth above and on succeeding pages, apply to Mark V Circuit-Switchers when powered by the Type CS-1A Switch Operator and are based on performance as follows:

1. The circuit-switcher is capable of two fault-closing operations consisting of closing against and carrying for three seconds● its rated fault-closing current, after which it can carry and interrupt its rated continuous current and is capable of power operation—either opening or closing.
 2. After each occasion consisting of either one or two fault-closing operations at its rated fault-closing current, the circuit-switcher must be inspected and any necessary repair or replacement of the fault-closing contacts made to restore the device to its original condition.
- 10 cycles for center-break style circuit-switchers.



Conditions of Sale—Continued

MANUAL OPERATION: Integer-style, vertical-break style, and center-break style Mark V Circuit-Switchers (with extruded-aluminum weldment bases)—are all available for manual operation. Manually operated circuit-switchers, however, do not provide the performance features obtainable with power-operated circuit-switchers described in the “Power Operation” section on page 1, such as fault-closing ratings and opening and closing under ice formation, nor can they be furnished with the shunt-trip device. Also, for manually operated Mark V Circuit-Switchers, the degree of simultaneity of opening and closing of the three pole-units depends on the proper installation and adjustment of the operating mechanism—as well as on the speed of cranking at the operating handle—and must be considered in establishing ground-relay settings. If manual operation is desired, specify the S&C Manual Geared Operating Handle listed in Table 9 on page 13.

MOUNTING OF CIRCUIT-SWITCHERS: The high operating speed makes possible many of the Mark-V Circuit-Switcher’s superior performance features when power-operated (described on page 1) and brings about the high dynamic forces for which S&C Mounting Pedestals were specifically designed—and are thus highly recommended. (See Table 13 on page 15.) Alternately, circuit-switchers can be installed on the user’s steel pedestals or supporting structures, which must meet specific static and dynamic deflection limits shown on the data sheets listed in Table 1.

Table 1. Static and Dynamic Deflection Limit Resources

| Circuit-Switcher Style and Rating | Static and Dynamic Loading Specifications |
|---|---|
| Vertical-break, 34.5 through 161 kV | Data Sheet 711-300 |
| Center-break, 230 kV: extruded-aluminum weldment base | Data Sheet 711-301 |
| Center-break, 345 kV: aluminum-sheathed steel weldment base | Data Sheet 711-302 |
| Integer, 34.5 through 69 kV | Data Sheet 711-303 |

USUAL OPERATING CONDITIONS: Mark V Circuit-Switchers will perform as intended at temperatures within the range of -40 °C to + 40°C (-40°F to + 104°F), at altitudes of up to 3300 feet (1000 meters)●, and at wind loadings of up to 100 miles per hour (160 kilometers per hour).

Mark V Circuit-Switchers, when installed with the recommended S&C Mounting Pedestals and anchor bolts (see Table 13 on page 15), are capable of withstanding seismic loading of 0.2-g ground acceleration in any direction, as well as performing as intended during such loading and afterward.

For applications at temperatures not within the specified range, at higher altitudes, at higher wind loadings, or where higher seismic withstand capabilities are required, refer to the nearest S&C Sales Office.

SPECIAL WARRANTY PROVISIONS: The standard warranty contained in the seller’s standard conditions of sale, as set forth in Price Sheet 150, applies to Mark V Circuit-Switchers and accessories and associated switch operators, except the first paragraph of the said warranty is replaced by the following:

- (1) **General:** The seller warrants to the purchaser for a period of five years from the date of shipment that the equipment delivered will be of the kind and quality specified in the contract description and will be free of defects of workmanship and material. Should any failure to conform to this warranty appear under proper and normal use within five years after the date of shipment, the seller agrees, upon prompt notification thereof and confirmation that the equipment has been stored, installed, operated, inspected, and maintained in accordance with recommendations of the seller and standard industry practice, to correct the nonconformity either by repairing any damaged or defective parts of the equipment or (at the seller’s option) by shipment of necessary replacement parts.

Replacement parts provided by the seller under the warranty for the original equipment will be covered by the original-equipment warranty for its duration. Replacement parts purchased separately will be covered by the warranty contained in the seller’s standard conditions of sale, as set forth in Price Sheet 150.

WARRANTY QUALIFICATIONS: Warranty of circuit-switchers is contingent upon each of the following:

- Observance of the static and dynamic deflection limits shown on S&C Data Sheet 711-300, 711-301, 711-302, or 711-303, as applicable
- Power operation of circuit-switchers only by S&C Switch Operators
- Installation and adjustment of circuit-switchers in accordance with S&C’s applicable erection drawings and instruction sheets
- Conformance with the inspection recommendations defined in S&C Instruction Sheet 711-590

● Mark V Circuit-Switchers can be installed at altitudes greater than 3300 feet (1000 meters), but deratings to the BIL voltage will apply. Refer to the nearest S&C Sales Office for details.

How to Order

STEP 1. Obtain the catalog number of the desired circuit-switcher from Tables 4, 5, 6, and 7 on pages 7 and 8.

Catalog Number: 1 5 7 3 1 4

STEP 2. Obtain the suffix letters of optional features, if desired, from Table 8 on pages 9 through 12. Add the indicated suffix letter(s) to the catalog number of the circuit-switcher selected in Step 1.

Catalog Number: 1 5 7 3 1 4

Suffix: T 1

STEP 3. Obtain the catalog number of the mounting pedestal(s), if desired, from Table 13 on page 15. From this same table, obtain the catalog number of the required anchor bolts, taking care to note the quantity of anchor bolts required for the circuit-switcher selected.

Catalog Number: 9 2 4 5 0 R 1 G

Catalog Number: S 8 1 3 6 5 2

STEP 4. Select a manual handle or switch operator.

If manual operation is desired: Order an S&C Manual Geared Operating Handle. Obtain the catalog number for the manual handle from Table 9 on page 13.

If accessories for the manual geared operating handle are desired: Obtain the suffix letters of the desired accessories from Table 10 on page 13. Add the indicated suffix letter(s) to the catalog number of the operating handle.

Catalog Number: 5 2 9 1 F 1

Suffix: F 1

If power operation is desired, order a Type CS-1A Switch Operator. Refer to Specification Bulletin 719-31 for catalog and ordering information.

STEP 5. If connectors are desired, obtain the catalog number of the desired connector from Table 2. Order six connectors for each circuit-switcher.

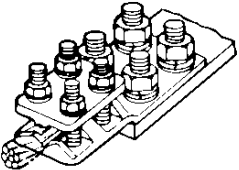
Catalog Number: 4 5 6 8

Example: The final catalog number for a complete order that includes a 138-kV, 1200-A continuous circuit-switcher, two interrupting gaps, with pre-assembly and a 125-Vdc shunt-trip device would be:

1 5 7 3 2 9 A T 2

Note: All Mark V Circuit-Switcher orders must be designed by S&C's Custom Engineering team. Spare or replacement interrupters for Mark V Circuit-Switchers are ordered using the same method outlined above.

Table 2. Connectors^①

| Illustration | Description | Accommodating Conductor | Catalog Number ^② |
|---|---|---|-----------------------------|
|  | Standard bronze pad terminal, four-bolt, tin plated. Includes 1/2-inch galvanized steel hardware for attachment to terminal pads of the circuit-switchers | 2/0 stranded (89.0 mm ²) through 800 kc mil (538.6 mm ²) copper | 4568R1 |
| | | 4/0 stranded (141.3 mm ²) through 1000 kc mil (672.5 mm ²) copper | 4569R1 |
| | Standard aluminum-alloy pad terminal, four-bolt. Includes 1/2-inch galvanized steel hardware for attachment to terminal pads of circuit-switchers | 250 kc mil (167.5 mm ²) through 400 kc mil (268.5 mm ²) copper or aluminum | 5329 |
| | | 350 kc mil (235.0 mm ²) through 600 kc mil (404.1 mm ²) copper or aluminum | 5331 |
| | | 600 kc mil (404.1 mm ²) through 900 kc mil (606.4 mm ²) copper or aluminum | 5333 |
| | | 900 kc mil (606.4 mm ²) through 1250 kc mil (841.9 mm ²) copper or aluminum | 5334 |

^① Connectors listed are suitable only for applications through 161 kV. For connectors for higher voltage applications, contact the nearest S&C Sales Office.

^② Add suffix letter to the catalog number to specify appropriate mounting bolt length as follows:

- “-A” for 1/2–13x1
- “-B” for 1/2–13x1 1/2
- “-C” for 1/2–13x2

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Table 3. Application Classifications

| Class | | Application | | Maximum Amperes, Interrupting, RMS, Symmetrical | Symbol | |
|--------------------------------------|---|---|--|---|---|-------------------|
| | | Qualifications | | | Solidly or Effectively ^① Grounded System | Ungrounded System |
| Transformer Switching and Protection | Parallel switching | Max 60-Hertz recovery voltage: 90 kV, RMS ^⑤ | | 1200/1600/2000● | M | M |
| | | Max 60-Hertz recovery voltage: 150 kV, RMS ^⑤ | | 1200/1600/2000● | M | N |
| | Load dropping and magnetizing current switching | Transformers ^⑥ connected solidly grounded-wye on the primary (circuit-switcher) side and delta on the secondary side | | ■ | E | — |
| | | All other connections of transformers ^⑥ | | ■ | B | B |
| | Fault interrupting ^④ | Primary faults—with the total connected length of all lines on the source side of the circuit-switcher not less than that indicated in footnote ^⑦ | | 7000 or 8000▲◆ | J | J |
| | | Primary faults—with the total connected length of all lines on the source side of the circuit-switcher less than that indicated in footnote ^⑦ | | 4000▲▼ | G | G |
| | | Secondary faults—transformers ^⑥ connected solidly grounded-wye on the primary (circuit-switcher) side and delta on the secondary side | | 4000□▲ | △ | G |
| | | Secondary faults—all other connections of transformers | | 4000□▲ | G | G |
| | | Internal faults—see both primary and secondary faults, above | | | | |
| Line Switching and Protection | Load splitting (parallel or loop switching) | Max 60-Hertz recovery voltage: 90 kV, RMS ^⑤ | | 1200/1600/2000● | M | M |
| | | Max 60-Hertz recovery voltage: 150 kV, RMS ^⑤ | | 1200/1600/2000● | N | N |
| | Load dropping | Circuits with <i>all</i> load-side transformers ^⑥ connected solidly grounded-wye on the primary (circuit-switcher) side and delta on the secondary side ^⑧ | | 1200/1600/2000● | E | — |
| | | Circuits with load-side transformers connected other than as described above | | 1200/1600/2000● | B | B |
| | Line dropping | | | ◇ | K | L |
| | Fault interrupting ^④ | Line or bus faults—with the total connected length of all lines on the source side of the circuit-switcher <i>not less than</i> that indicated in footnote ^⑦ | | 7000 or 8000▲▼ | J | J |
| | | Line or bus faults—with the total connected length of all lines on the source side of the circuit-switcher <i>less than</i> that indicated in footnote ^⑦ | | 4000▲▼ | G | G |

TABLE CONTINUED ►

Table 3. Application Classifications—Continued

| Class | | Application | | Maximum Amperes, Interrupting, RMS, Symmetrical | Symbol | |
|--|---|--|--|---|---|-------------------|
| | | Qualifications | | | Solidly or Effectively ^① Grounded System | Ungrounded System |
| Cable Switching and Protection | Load splitting (parallel or loop switching) | Max 60-Hertz recovery voltage: 90 kV, RMS ^⑤ | | 1200/1600/2000● | M | M |
| | | Max 60-Hertz recovery voltage: 150 kV, RMS ^⑤ | | 1200/1600/2000 ● | N | N |
| | Load dropping | Circuits with all load-side transformers ^⑥ connected solidly grounded-wye on the primary (circuit-switcher) side and delta on the secondary side ^⑧ | | 1200/1600/2000● | E | — |
| | | Circuits with load-side transformers connected other than as described above | | 1200/1600/2000● | B | B |
| | Cable dropping (charging current) | Shielded cable | | 550 | H | L |
| | | Unshielded cable | | 550 | K | L |
| | Fault interrupting ^④ | Cable or bus faults—with any total connected length of cable, and with a total connected length of all overhead lines on the source side of the circuit-switcher not less than that indicated in footnote ^⑦ | | 7000 or 8000▲● | J | J |
| | | Cable or bus faults—with any total connected length of cable, but with a total connected length of all overhead lines on the source side of the circuit-switcher less than that indicated in footnote ^⑦ | | 4000▲▼ | G | G |
| Shunt Capacitor Bank ^② Switching and Protection ^③ | Bank current switching | Grounded capacitor bank | Applications on solidly grounded systems through 69 kV | 1000● | H | — |
| | | | All other applications | 550 | H | L |
| | | Ungrounded capacitor bank | | 550 | L | L |
| | Fault interrupting ^④ | Primary faults—with the total connected length of all lines on the source side of the circuit-switcher <i>not less than</i> that indicated in footnote ^⑦ | | 7000 or 8000▲◆ | ● | L |
| | | Primary faults—with the total connected length of all lines on the source side of the circuit-switcher less than that indicated in footnote ^⑦ | | 4000▲▼ | ● | L |
| Series Reactor Switching | | Refer to the nearest S&C Sales Office | | | | |
| Shunt Reactor Switching and Protection (line-connected or tertiary-connected reactors) | Reactor current switching | Reactor wye-connected with solidly grounded neutral | | 1000▽■ | P | R |
| | | Reactor delta-connected, or wye-connected with ungrounded neutral ^⑨ | | 1000▽■ | R | R |
| | Fault interrupting ^④ | Oil-insulated reactors | | 2800▲ | ◀ | R |
| | | Air-insulated reactors | | 2000▲ | ◀ | R |

① X_G/X_1 from 0 to + 3.0 and R_0/X_1 from 0 to + 1.0.

② Includes both single and multiple (back-to-back) banks.

③ S&C BankGuard Plus[®] Controls, described and listed in S&C Specification Bulletin 1011-31 have the sensitivity to detect the first faulted unit in a capacitor bank or to promptly respond to a shorted-turns fault in a shunt reactor—but with the discrimination to disregard system and bank unbalances as well as spurious transients. For installations of S&C Automatic Control Devices on, or in the same substation with, 345-kV or 500-kV circuits, contact the nearest S&C Sales Office.

④ The interrupting ratings shown are applicable for the following reclosing duty cycle: O + 0 seconds (no intentional delay) + CO + 0 seconds + CO.

⑤ For integer-style circuit-switchers (except catalog numbers 157886 and 157986) the maximum 60-Hertz recovery voltage is 75 kV, RMS.

⑥ Three-phase transformers or three-phase banks of single-phase transformers.

FOOTNOTES CONTINUED ON PAGE 6 ►

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TABLE 3 FOOTNOTES CONTINUED

⑦ Total connected length of all overhead lines (in all directions), including any number of feeders connected to source-side substations, as indicated in table below. Connected cable may reduce or eliminate the line-length requirement. Contact the nearest S&C Sales Office.

| | | | | | |
|----------------------------|-----------------|----------------|------------|------------|------------|
| System Voltage, kV → | 34.5 thru 69 | 115 and 138 | 161 | 230 | 345 |
| Total Length, Miles (km) → | 7 (11) | 15 (24) | 20 (32) | 25 (40) | 40 (64) |

⑧ And *all* single-phase transformers connected phase-to-ground on the primary (circuit-switcher) side.

⑨ For applications involving wye-connected reactor banks with neutral grounded through a fourth reactor, contact the nearest S&C Sales Office.

● Depending upon continuous rating of the circuit-switcher.

■ Circuit-switcher will drop loads through 1200, 1600, or 2000 amperes, depending upon its continuous rating, and will switch magnetizing currents associated with such loads.

▲ Tripping of a circuit-switcher must be coordinated with a series power fuse or with source-side protective equipment for short-circuit currents in excess of this value.

◆ 8000 amperes for all Mark V Circuit-Switcher models rated 34.5 kV through 69 kV, also 2-gap models rated 115 kV and 3-gap models rated 138 kV and 161 kV; 7000 amperes for all other Mark V Circuit-Switchers for which symbol "J" applies.

▼ 3000 amperes for 115-kV single-gap Mark V Circuit-Switchers.

□ The Mark V Circuit-Switcher is suitable for transformer-primary applications where the *inherent* secondary-fault current—the secondary-side fault current as reflected on the primary side of the transformer, assuming an infinite (zero-impedance) source—does not exceed 4000 amperes (3000 amperes in the case of 115-kV single-gap Mark V Circuit-Switchers) for a fault external to the transformer. The *inherent* secondary-fault current may be calculated as follows:

$$I = 57.8P$$

$$(\%Z)E$$

where I = Inherent secondary-fault current, amperes

P = Transformer self-cooled three-phase rating, kVA

E = Primary-side system phase-to-phase voltage, kV

%Z = Percent transformer primary-to-secondary impedance, referred to transformer self-cooled three-phase kVA rating

For applications where the *inherent* secondary-fault current exceeds the above limits but where the maximum expected fault current, based on transformer impedance *plus* source impedance (anticipating future system growth), is within these limits, contact the nearest S&C Sales Office.

△ Symbol "E" for solidly grounded systems; symbol "F" for effectively grounded systems.

◇ Maximum length of line: 300 miles.

▽ For vertical-break and integer style circuit-switcher applications where load in excess of 550 amperes is to be switched frequently, extra-performance closing contacts are recommended for increased contact life; refer to the Table 8 on pages 9 through 12.

● Symbol "K" for solidly grounded capacitor banks applied on solidly grounded systems; symbol "L" for all other applications.

■ For center-break style circuit-switcher reactor switching applications above 500 amperes, contact the nearest S&C Sales Office.

▲ For applications up to 4000 amperes, contact the nearest S&C Sales Office.

◀ Symbol "P" for solidly grounded reactors applied on solidly grounded systems, provided phase-to-phase and ungrounded three-phase faults are cleared by other devices; symbol "R" for all other applications.

Table 4. Circuit-Switchers—Three-Pole Vertical-Break Style^{①②③}

| Ratings | | | | | | | No. of Interrupting Gaps | Applications (see Table 2 on pages 4 and 5) | Insulator T.R. No. | Leakage Distance, Inches (mm) | Catalog Number ^⑤ | Page Reference for Dimensional Information |
|---------|------|-----|--------------|------------|--------|--|--------------------------|---|--------------------|-------------------------------|-----------------------------|--|
| kV | | | Amperes, RMS | | | | | | | | | |
| Nom. | Max. | BIL | Cont. | Short-Time | | Fault-Closing, Duty-Cycle, Two-Time ^④ | | | | | | |
| | | | | Mom. | 3-Sec. | | | | | | | |
| 34.5 | 38 | 200 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLMR | 210 | 37 (940) | 157314 | 16 |
| 46 | 48.3 | 250 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLMR | 214 | 43 (1092) | 157315 | |
| 69 | 72.5 | 350 | 1200 | 61 000 | 40 000 | 30 000 | 1 2 | BEFGHJKMP BEFGHJKLMR | 216 216 | 72 (1829) | 157316 157326 | |
| 115 | 121 | 550 | 1200 | 61 000 | 40 000 | 30 000 | 1 2 | BEFGJM BEFGHJKLMNPR | 286 286 | 99 (2515) | 157318 157328 | |
| 138 | 145 | 650 | 1200 | 61 000 | 40 000 | 30 000 | 2 3 | BEFGHJKMNP BEFGHJKLMNPR | 288 288 | 116 (2946) | 157329 157369 | |
| 161 | 169 | 750 | 1200 | 61 000 | 40 000 | 30 000 | 2 3 | BEFGHJKMNP BEFGHJKMNPR | 291 291 | 132 (3353) | 157320 157360 | |

① Circuit-switchers do not include connectors. Refer to Table 2 page 3. Circuit-switchers are furnished with gray (Munsell Number 5 BG 7.0/014) station post insulators.

② Circuit-switchers do not include manual operating handles. (See Table 9 on page 13.)

③ Shunt-trip device is available with all power-operated Vertical-Break Style Mark V Circuit-Switchers.

④ For complete information refer to the “Basis of Fault-Closing Ratings” section on page 1.

⑤ If the circuit-switcher is to be installed on a structure other than S&C Mounting Pedestals (see Table 13 on page 15), detailed drawings of the user-furnished mounting structure must be supplied at the time of order. Please contact your nearest S&C Sales Office for details.

Table 5. Circuit-Switchers—Three-Pole Center-Break Style, with Extruded-Aluminum Weldment Bases^{①②③④⑤}

| Ratings | | | | | | | No. of Interrupting Gaps | Applications (see Table 2 on pages 4 and 5) | Insulator T.R. No. | Leakage Distance, Inches (mm) | Catalog Number ^⑦ | Page Reference for Dimensional Information |
|---------|------|-----|--------------|------------|--------|--|--------------------------|---|--------------------|-------------------------------|-----------------------------|--|
| kV | | | Amperes, RMS | | | | | | | | | |
| Nom. | Max. | BIL | Cont. | Short-Time | | Fault-Closing, Duty-Cycle, Two-Time ^⑥ | | | | | | |
| | | | | Mom. | 3-Sec. | | | | | | | |
| 230 | 242 | 900 | 1600 | 70 000 | 42 750 | 40 000 | 3 | BEFGHJKMNP | 308 | 165 (4191) | 657361R2 | 18 |
| | | | 2000 | 80 000 | 50 000 | 40 000 | 3 | BEFGHJKMNP | 308 | 165 (4191) | 757361R2 | |

① Circuit-switchers do not include connectors. Refer to Table 2 on page 3. Circuit-switchers are furnished with gray (Munsell Number 5 BG 7.0/014) station post insulators.

② Circuit-switchers do not include manual operating handles. (See Table 9 on page 13.)

③ Shunt-trip device is available with all power-operated center-break style Mark V Circuit-Switchers.

④ For center-break style circuit-switchers, blade opening direction, as viewed from interrupter end, is to the left.

⑤ Flexible-conductor connections are recommended at both ends of all center-break style circuit-switchers with extruded-aluminum weldment bases, except when the bypass accessory (catalog number

suffix “-B2”) is furnished. In this instance, a rigid bus connection is necessary at the rotating-insulator end. To reduce circuit-switcher deflection during opening and closing operations—which can loosen the bus connection—double-acting shock absorbers (catalog number suffix “-H”) are available and are recommended.

⑥ For complete information refer to the “Basis of Fault-Closing Ratings” section on page 1.

⑦ If the circuit-switcher is to be installed on a structure other than S&C Mounting Pedestals (see Table 13 on page 15), detailed drawings of the user-furnished mounting structure must be supplied at the time of order. Please contact your nearest S&C Sales Office for details.

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Table 6. Circuit-Switchers—Three-Pole Center-Break Style, with Aluminum-Sheathed Steel Weldment Bases^{①②③④}

| Ratings | | | | | | | No. of Interrupting Gaps | Applications (see Table 2 on pages 4 and 5) | Insulator T.R. No. | Leakage Distance, Inches (mm) | Catalog Number ^⑥ | Page Reference for Dimensional Information |
|---------|------|------|--------------|------------|--------|--|--------------------------|---|--------------------|-------------------------------|-----------------------------|--|
| kV | | | Amperes, RMS | | | | | | | | | |
| Nom. | Max. | BIL | Cont. | Short-Time | | Fault-Closing, Duty-Cycle, Two-Time ^⑤ | | | | | | |
| | | | | Mom. | 3-Sec. | | | | | | | |
| 345 | 362 | 1300 | 1600 | 70 000 | 43 750 | 40 000 | 3 | E●MN | 368 | 231 (5867) | 357363 | 20 |
| | | | 2000 | 80 000 | 50 000 | 40 000 | 3 | E●MN | 368 | 231 (5867) | 557363 | |

① Circuit-switchers do not include connectors. Refer to Table 2 on page 3. Circuit-switchers are furnished with gray (Munsell Number 5 BG 7.0/014) station post insulators.

② These circuit-switchers cannot be furnished with manual operating handles.

③ Shunt-trip device is available with all power-operated center-break style Mark V Circuit-Switchers.

④ For center-break style circuit-switchers, blade opening direction, as viewed from interrupter end, is to the left.

⑤ For complete information refer to the “Basis of Fault-Closing Ratings” section on page 1.

⑥ If the circuit-switcher is to be installed on a structure other than S&C Mounting Pedestals (see Table 13 on page 15), detailed drawings of the user-furnished mounting structure must be supplied at the time of order. Please contact your nearest S&C Sales Office for details.

● Not applicable for fault-interrupting duty. Also suitable for three-phase transformers and three-phase banks of single-phase transformers connected solidly grounded-wye on the primary (circuit-switcher) side, solidly grounded-wye on the secondary side, with a delta-connected tertiary.

Table 7. Circuit-Switchers—Three-Pole Integer Style^{①②}

| Ratings | | | | | | | No. of Interrupting Gaps | Applications (see Table 2 on pages 4 and 5) | Insulator T.R. No. | Leakage Distance, Inches (mm) | Catalog Number ^④ | | Page Reference for Dimensional Information |
|---------|------|-----|--------------|------------|--------|--|--------------------------|---|--------------------|-------------------------------|----------------------------------|---|--|
| kV | | | Amperes, RMS | | | | | | | | | | |
| Nom. | Max. | BIL | Cont. | Short-Time | | Fault-Closing, Duty-Cycle, Two-Time ^③ | | | | | Vertical Operating Shaft Inboard | Vertical Operating Shaft Outboard ^⑤ on Right | |
| | | | | Mom. | 3-Sec. | | | | | | | | |
| 34.5 | 38 | 200 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLMPPR | 210 | 37 (940) | 157914 | 157814 | 22 |
| 46 | 48.3 | 250 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLMPPR | 214 | 43 (1092) | 157915 | 157815 | |
| 69 | 72.5 | 350 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKMP | 216 | 72 (1829) | 157916 | 157816 | |
| | | | | | | | 2 | BEFGHJKLMPPR | 216 | 72 (1829) | 157926 | 157826 | |

① Circuit-switchers do not include connectors. Refer to Table 2 on page 3. Circuit-switchers are furnished with gray (Munsell Number 5 BG 7.0/014) station post insulators.

② Circuit-switchers do not include manual operating handles. (See Table 9 on page 13).

③ For complete information refer to the “Basis of Fault-Closing Ratings” section on page 1.

④ If the circuit-switcher is to be installed on a structure other than S&C Mounting Pedestals (see Table 13 on page 15), detailed drawings of the user-furnished mounting structure must be supplied at the time of the order. Please contact your nearest S&C Sales Office for details.

⑤ As viewed from interrupter end.

Table 8. Optional Features—For Mark V Circuit-Switchers

| Item | Suffix to be Added to Circuit-Switcher Catalog Number | Applicable to Circuit-Switcher | |
|---|---|--------------------------------|--|
| | | Style | Rating, kV |
| Pre-assembled Mark V Circuit-Switcher—provides three pole-units, each consisting of a brain and interrupter assembly, integral disconnect blade, jaw-contact assembly, terminal adapter, support insulators, channel base, and shunt-trip device (when applicable)—all factory-assembled and adjusted | -A | Vertical-break | 69 thru 161 |
| | | Center-break | 230 |
| Shunt-trip device, 48-Vdc control voltage—provides 8-cycle maximum interrupting time for Mark V Circuit-Switcher operated by a Type CS-1A Switch Operator. Not available with manually operated circuit-switchers①② | -T1 | All | 34.5 thru 69 115 and 138 161 230 345 |
| Shunt-trip device, 125-Vdc control voltage—provides 8-cycle maximum interrupting time for Mark V Circuit-Switcher operated by a Type CS-1A Switch Operator. Not available with manually operated circuit-switchers①② | -T2 | All | 34.5 thru 69 115 and 138 161 230 345 |
| Bypass accessory, single-pole, stick-operated, set of three, 800 amperes continuous, 20,000 amperes momentary rating—permits exercising of the circuit-switcher and checkout of relaying equipment without opening high-voltage circuit | -B1 | Integer and vertical-break | 34.5 46 69 |
| | | Vertical-break | 115 138 |
| Bypass accessory, single-pole, stick-operated, set of three, 1200 amperes continuous, 61,000 amperes momentary rating—permits exercising of the circuit-switcher and checkout of relaying equipment without opening high-voltage circuit | -B2 | Vertical-break | 34.5 46 69 115 138 161 |
| | | Center-break⑤ | 230 |
| Extra-performance closing contacts—provide increased contact life for 34.5-kV through 138-kV vertical-break and integer style circuit-switchers in applications where load in excess of 550 amperes is switched frequently. Each pole-unit set consists of one copper-tungsten arcing-tip assembly in substitution for the standard stainless steel arcing-tip assembly and one carbon arcing-rod assembly with support clamp③④ | -C1 | Integer and vertical-break | 34.5 thru 138 |

① Shunt-trip device control voltage should be the same as switch operator motor and control voltage.

② For shunt-trip insulated operating shafts equipped with resistance-graded (conductive glaze) insulators, refer to your nearest S&C Sales Office.

③ Extra-performance closing contacts (catalog number suffix “-C1”) cannot be used in conjunction with pre-insertion inductors (catalog number suffix “-P5,” “-P51,” “-P6,” or “-P61”), and vice versa.

④ Extra-performance closing contacts can be used on 115-kV and 138-kV circuit-switchers only at installations where the jaw contacts are connected to the source and the interrupters are connected to the load.

⑤ Requires rigid bus connections at rotating-insulator end of the circuit-switcher. To reduce circuit-switcher deflection during opening and closing operations—which can loosen the bus connections—double-acting shock absorbers (catalog number suffix “-H”) are recommended.

TABLE CONTINUED ►

Mark V Circuit-Switchers

Table 8. Optional Features—For Mark V Circuit-Switchers—Continued

| Item | Suffix to be Added to Circuit-Switcher Catalog Number | Applicable to Circuit-Switcher | |
|--|---|---------------------------------|--|
| | | Style | Rating, kV |
| Grounding switch, manual, three-pole, group-operated, 61,000 amperes momentary rating, with flexible straps for current transfer at hinge end of blades, and with 90° opening blades <i>parallel</i> to bases when in open position. Includes manual operating handle ^① | -G2 | All | 34.5 46 69 115 138 161 230 |
| Grounding switch, manual, three-pole, group-operated, 80,000 amperes momentary rating, with flexible straps for current transfer at hinge end of blades, and with 90° opening blades <i>perpendicular</i> to bases when in open position. Includes manual operating handle ^{②③} | -G4 | Center-break | 230 |
| Grounding switch, manual, three-pole, group-operated, 61,000 amperes momentary rating, with flexible straps for current transfer at hinge-end of blades, and with 90° opening blades <i>perpendicular</i> to bases when in open position. Includes manual operating handle | -G22 | Vertical-break and center-break | 34.5 46 69 115 138 161 230 |
| Grounding switch, manual, three-pole, group-operated, 61,000 amperes momentary rating, with braidless current transfer at hinge-end of blades, and with 90° opening blades <i>perpendicular</i> to bases when in open position. Includes manual operating handle | -G23 | Vertical-break and center-break | 34.5 46 69 115 138 161 230 |
| Double-acting shock absorbers—for center-break style circuit-switchers with extruded-aluminum weldment bases. Reduce deflection during opening and closing operations ^④ | -H | Center-break | 230 |
| Key type interlock, for use on grounding switch (catalog number suffix “-G2” or “-G4”), key to be matched with “Key Interlock with Switch” as optionally furnished with S&C Switch Operators and/or other interlocked device(s). See the “Accessories for Switch Operators” table in S&C Specification Bulletin 719-31, catalog number suffix “-L”; or Table 10 on page 13, catalog number suffix “-L” | -L | All | All |
| International crating. Wood used is either hardwood or certified by the supplier as “Heat treated (kiln dried) to a core temperature of 133°F (56°C) for a minimum of 30 minutes” | -L71 | All | All |
| Low-temperature interrupters. For applications where temperature regularly falls below -40°F (-40°C). Includes modified red target indicators | -N2 | All | All |

① Grounding switches opening parallel to bases can only be applied at interrupter end for center-break style circuit-switchers.

② Grounding switches can be applied at rotating-insulator end of center-break style circuit-switchers only by extending bases and adding extra insulator stacks. Refer to your nearest S&C Sales Office.

③ Pre-assembly option “-A” must be specified when ordering ground-ing switch.

④ Recommended for circuit-switchers furnished with bypass acces-sory (catalog number suffix “-B2”). Included as standard equipment on circuit-switchers furnished with standard-duty pre-insertion inductors (catalog number suffix“-P5” or “-P51”).

TABLE CONTINUED ►

Table 8. Optional Features—For Mark V Circuit-Switchers—Continued

| Item | For Capacitor Bank | | Suffix to be Added to Circuit-Switcher Catalog Number | Applicable to Circuit-Switcher | | | |
|--|--|---------------|---|--------------------------------|----------------------------|-------------------|----|
| | | | | Style | Rating, kV | | |
| Pre-insertion inductors—for circuit-switchers in single-bank capacitor switching applications. Limit inrush current, overvoltage, and audible noise at capacitor bank bus. Also limit switching-surge overvoltages at remote transformers. Not available with manually operated circuit-switchers ^{①②③} | 34.5 | 3 to 11 | -P6 | Integer and vertical-break | 34.5 | | |
| | | 12 to 22 | -P61 | | | | |
| | 46 | 4 to 18 | -P6 | | 46 | | |
| | | 19 to 36 | -P61 | | | | |
| | Enhanced-duty pre-insertion inductors ^⑤ | 69 | 5 to 20 | -P6 | Integer (1 gap) | 69 | |
| | | | | | Integer (2 gap) | | |
| | | | | | Vertical-break | | |
| | | 21 to 42 | -P61 | Integer (1 gap)● | 69 | | |
| | | | | Integer (2 gap)● | | | |
| | | | | Vertical-break | | | |
| | 115 | 10 to 60 | -P6 | Vertical-break | 115 | | |
| | 138 | 13 to 75 | -P6 | Vertical-break | 138 | | |
| | Standard-duty pre-insertion inductors ^⑤ | 34.5 | 3 to 33 | -P5 | Integer and vertical-break | 34.5 | |
| | | 46 | 4 to 44 | | | 46 | |
| 69 | | 5 to 65 | -P● | Integer and vertical-break | 69 | | |
| | | | | | -P51● | Integer (1 gap)■▲ | 69 |
| | | | | | | Integer (2 gap)■▲ | |
| Vertical-break▲ | | | | | | | |
| 115 | | 10 to 84 | -P5 | Vertical-break | 115 | | |
| 138 | | 13 to 81 | | | 138 | | |
| 230 | 17 to 198 | Center-break◆ | | | 230 | | |

① Extra-performance closing contacts (catalog number suffix “-C1”) cannot be used in conjunction with pre-insertion inductors (catalog number suffix “-P5”, “-P51”, “-P6”, or “-P61”), and vice versa.

② Circuit-switchers equipped with pre-insertion inductors are not suitable for fault-closing duty.

③ Circuit-switchers equipped with pre-insertion inductors are capable of two consecutive closing operations 5 minutes apart, followed by one closing operation every hour.

④ In some instances, especially for grounded capacitor banks up to 69 kV, larger-size capacitor banks may be accommodated. Refer to your nearest S&C Sales Office.

⑤ For multiple bank (back-to-back) capacitor switching applications or for systems rated above 138 kV, refer to your nearest S&C Sales Office.

● Includes high-strength insulators (T.R. number 278) at jaw-contact end, insulator mounting weldments, and jaw-contact-end mounting brackets.

■ Catalog number suffix “-P5” pre-insertion inductors generally limit, to 2 per unit, overvoltages on unloaded open-ended lines up to 30 miles (48 km) from 5- to 20-MVAC capacitor banks, up to 50 miles (80 km) from 21- to 65-MVAC capacitor banks. For effectiveness up to 50 miles (80 km) from 5- to 20-MVAC capacitor banks, specify catalog number suffix “-P51.”

▲ Includes jaw-contact-end mounting brackets necessary to attain 0.2 ground acceleration seismic loading capability.

◆ Includes double-acting shock absorber on each pole-unit to reduce circuit-switcher deflection during opening and closing operations.

TABLE CONTINUED ►

Mark V Circuit-Switchers

Table 8. Optional Features—For Mark V Circuit-Switchers—Continued

| Item | Suffix to be Added to Circuit-Switcher Catalog Number | Applicable to Circuit-Switcher |
|--|---|---|
| | | Voltage, Nom., kV |
| Mark V Circuit-Switcher furnished less insulators ^① | -Z1 | 34.5 |
| | | 46 |
| | | 69 |
| | | 115 |
| | | 138 |
| | | 161 |
| | | 230 |
| | | 345 |
| | | Voltage, Nom., kV ^② From ➔ To |
| Mark V Circuit-Switcher furnished with insulators of the next <i>lower</i> voltage rating | -Z2 | 46 ➔ 34.5 |
| | | 69 ➔ 46 |
| | | 115 ➔ 69 |
| | | 138 ➔ 115 |
| | | 161 ➔ 138 |
| | | 230 ➔ 161 |
| Mark V Circuit-Switcher furnished with insulators of the next <i>higher</i> voltage rating | -Z3 | 34.5 ➔ 46 |
| | | 46 ➔ 69 |
| | | 69 ➔ 115 |
| | | 115 ➔ 138 |
| | | 138 ➔ 161 |
| | | 161 ➔ 230 |

^① Not available for integer-style switches.

^② In instances where insulators of the next-lower or next-higher voltage rating have different bolt-circle dimensions, adapters are required; refer to your nearest S&C Sales Office.

Table 9. S&C Manual Geared Operating Handle—For Mark V Circuit-Switchers

| Item | Catalog Number |
|--------------------------------|----------------|
| Manual geared operating handle | 5291● |

● Includes appropriate flexible coupling for connection of output shaft of operating handle to vertical operating pipe of the circuit-switcher. For other applications of manual geared operating handle, specify flexible coupling matched to size of vertical operating pipe. See Table 10.

Manual operating handles are available with all integer-style and vertical-break style circuit-switchers, and with all center-break style circuit-switchers with extruded-aluminum weldment bases. Manually

operated circuit-switchers have no fault-closing ratings, and cannot be provided with shunt-trip device.

The degree of simultaneity of opening and closing of the three pole-units of a manually operated circuit-switcher is dependent on the proper installation and adjustment of the operating mechanism—as well as on the speed of cranking at the operating handle—and must be considered in establishing ground-relay settings.

Table 10. Accessories—For Manual Geared Operating Handle

| Item | Suffix to be Added to Operating Handle Catalog Number |
|--|---|
| Flexible coupling—for use with 1½-inch IPS vertical operating pipe (comes standard when manual geared operating handle is ordered with a circuit-switcher) | -F1 |
| Flexible coupling—for use with 2-inch IPS vertical operating pipe (comes standard when manual geared operating handle is ordered with a circuit-switcher) | -F2 |
| Flexible coupling—for use with 2½-inch IPS vertical operating pipe (comes standard when manual geared operating handle is ordered with a circuit-switcher) | -F3 |
| Flexible coupling—for use with 3-inch IPS vertical operating pipe (comes standard when manual geared operating handle is ordered with a circuit-switcher) | -F4 |
| Key interlock, locks circuit-switcher open | -L |
| Auxiliary switch (individually adjustable contacts), 4-PST—coupled to circuit-switcher① | -Q |
| Auxiliary switch (individually adjustable contacts), 8-PST—coupled to circuit-switcher① | -W |

① The 4-PST Auxiliary Switch (catalog number suffix “-Q”) cannot be furnished if the 8-PST version (catalog number suffix “-W”) is specified, and vice versa.

Mark V Circuit-Switchers

Table 11. Spare or Replacement Interrupters—For Mark V Circuit-Switchers

| Item | For Mark V Circuit-Switcher | | Obsolete Catalog Number | Replacement Catalog Number ^{①②} | Replacement Catalog Number (Low-Temperature) ^③ |
|-------------------------|---|--------------------------|-------------------------|--|---|
| | Style | No. of Interrupting Gaps | | | |
| Interrupter, single-gap | Integer | 1 | SA-40315 | SA-43826-A● | SA-43826-1-A |
| | | 1 | SA-40316 | SA-43827-A■ | SA-43827-1-A |
| | Vertical-break and center-break | 1 | SA-40316 | SA-43827-A | SA-43827-1-A |
| Interrupter, 2-gap | Integer vertical-break and center-break | 2 | SA-40317 | SA-43828-A | SA-43828-1-A |
| Interrupter, 3-gap | Vertical-break and center-break | 3 | SA-40318 | SA-43829-A | SA-43829-1-A |

① When ordering, please state mounting position of circuit-switcher, viz., upright or vertical.

② Elastomeric-seal interrupters exhibiting low gas-pressure indication (red target) and having porcelain housing in good condition can be exchanged for new interrupters. Elastomeric-seal interrupters can be identified by the dome-shaped pressure-relief vent cover. To ensure proper handling, refer to the nearest S&C Sales Office and obtain a special serially numbered label to place on the shipping container. Enclose a packing slip showing purchase order or requisition number covering the exchange and ship the replaced interrupter, transportation charges prepaid, to S&C Electric Company, Repair Center, 1800 Devon Avenue, Chicago, Illinois 60660-1010.

③ Low-temperature interrupter intended for circuit-switchers with the “-N2” option.

- For use on circuit-switcher catalog numbers:
157814, 157815, 157816
157914, 157915, 157916
- For use on circuit-switcher catalog numbers:
157886, 157986

Table 12. Parts

| Item | Catalog Number |
|--|----------------|
| SF ₆ reclamation tool—assists reclaiming SF ₆ from discontinued solder-seal interrupters. (Solder-seal interrupters have flat pressure-relief vent cover.) User-furnished SF ₆ reclamation equipment required | SXA-2213 |

Table 13. Mounting Pedestals and Anchor Bolts—For Mark V Circuit-Switchers

| Item | For Circuit-Switcher | | Phase Spacing, Inches (mm) | Column Section, Inches (mm) | Column Height ^① , Feet (mm) | Catalog Number | Anchor Bolts ^{②③} | |
|---|---------------------------------|--|----------------------------|--|---|---|----------------------------|----------------|
| | Style | Rating, kV | | | | | Qty. Req'd. | Catalog Number |
| Mounting pedestals (one per set), single rectangular tubular column, formed steel plate construction, galvanized finish | Integer ^④ | 34.5 thru 69 1 and 2 gaps | ● | 10×18 (254×457) | 8 (2438) 9 (2743) 10 (3048) 11 (3353) 12 (3658) | 92450R1-G 92451R1-G 92452R1-G 92453R1-G 92454R1-G | 4 | S-81365-2 |
| Mounting pedestals, set of two, square steel tube construction, complete with Circuit-Switcher support frame, galvanized finish | Vertical-break and center-break | 69 thru 115 1 and 2 gaps | 96 (2438) | 12×12 (305×305) | 8 (2438) 9 (2743) 10 (3048) 11 (3353) 12 (3658) | 90100R1-G 90101R1-G 90102R1-G 90103R1-G 90104R1-G | 8 | S-81365-1 |
| | Vertical-break | 138 1, 2, and 3 gaps | 96 (2438) | 12×12 (305×305) | 8 (2438) 9 (2743) 10 (3048) 11 (3353) 12 (3658) | 90100R1-G 90101R1-G 90102R1-G 90103R1-G 90104R1-G | | |
| | Center-break ^⑤ | 138 1, 2, and 3 gaps | 108 (2743) | 12×12 (305×305) | 8 (2438) 9 (2743) 10 (3048) 11 (3353) 12 (3658) | 90120R1-G 90121R1-G 90122R1-G 90123R1-G 90124R1-G | | |
| | Vertical-break | 161 2 and 3 gaps | 108 (2743) | 12×12 (305×305) 14×14 (356×356) | 8 (2438) 9 (2743) 10 (3048) 11 (3353) 12 (3658) | 90120R1-G 90121R1-G 90132R1-G 90133R1-G 90134R1-G | 8 | S-81365-2 |
| | Vertical-break and center-break | 161 2 and 3 gaps | 123 (3124) | 12×12 (305×305) 14×14 (356×356) | 8 (2438) 9 (2743) 10 (3048) 11 (3353) 12 (3658) | 90140R1-G 90141R1-G 90152R1-G 90153R1-G 90154R1-G | 8 | S-81365-1 |
| Mounting pedestals, set of six, square steel tube construction galvanized finish | Center-break | 230 3 gaps extruded-aluminum weldment bases | Not applicable | 12×12 (305×305) | 8 (2438) 9 (2743) 10 (3048) 11 (3353) 12 (3658) | 90180R1-G 90181R1-G 90182R1-G 90183R1-G 90184R1-G | 24 | S-81365-2 |
| | | 345 3 gaps aluminum-sheathed steel weldment bases | Not applicable | 16×16 (406×406) | 10 (3048) 11 (3353) 12 (3658) | 90162R3-G 90163R3-G 90164R3-G | 24 | S-81365-3 |

① Mounting pedestals of less than 12-foot (366-cm) column height may be furnished in intermediate heights—in 3-inch (76-mm) increments, as shown in the table below. Add the appropriate suffix to the mounting pedestal set catalog number.

| Additional Column Heights, Inches (mm) | Mounting Pedestal Catalog Number Suffix |
|--|---|
| 3 (76) | -S3 |
| 6 (152) | -S6 |
| 9 (229) | -S9 |

NOTE: Maximum standard column height is 12 feet (366 cm).

② Each anchor bolt is of galvanized steel and is furnished with two hex nuts and two flat washers to facilitate leveling the mounting pedestals.

③ Nominal sizes of anchor bolts are as follows, in inches:

- S-81365-1: 1×33
- S-81365-2: 1¼×44
- S-81365-3: 1½×55

④ If mounting pedestals are to be used with integer-style circuit-switchers that are equipped with the shunt-trip device, add suffix “-T” to the catalog number.

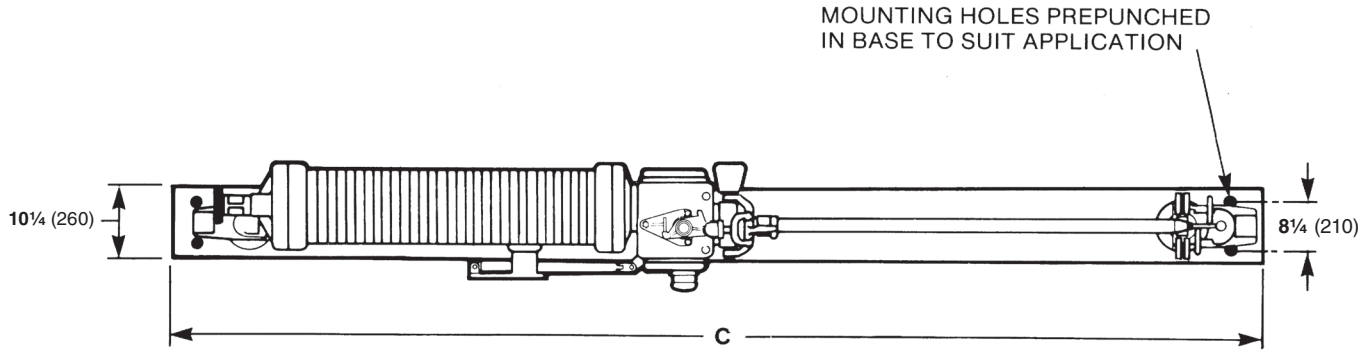
⑤ Vertical-break style circuit-switchers, one, two, or three gaps, rated 138 kV, will also fit these mounting pedestals.

● Phase spacing for integer-style circuit-switchers is fixed by the dimensions of the mounting frame and is 41 inches (104 cm) for circuit-switchers rated 34.5 kV and 46 kV, and 51 inches (130 cm) for circuit-switchers rated 69 kV.

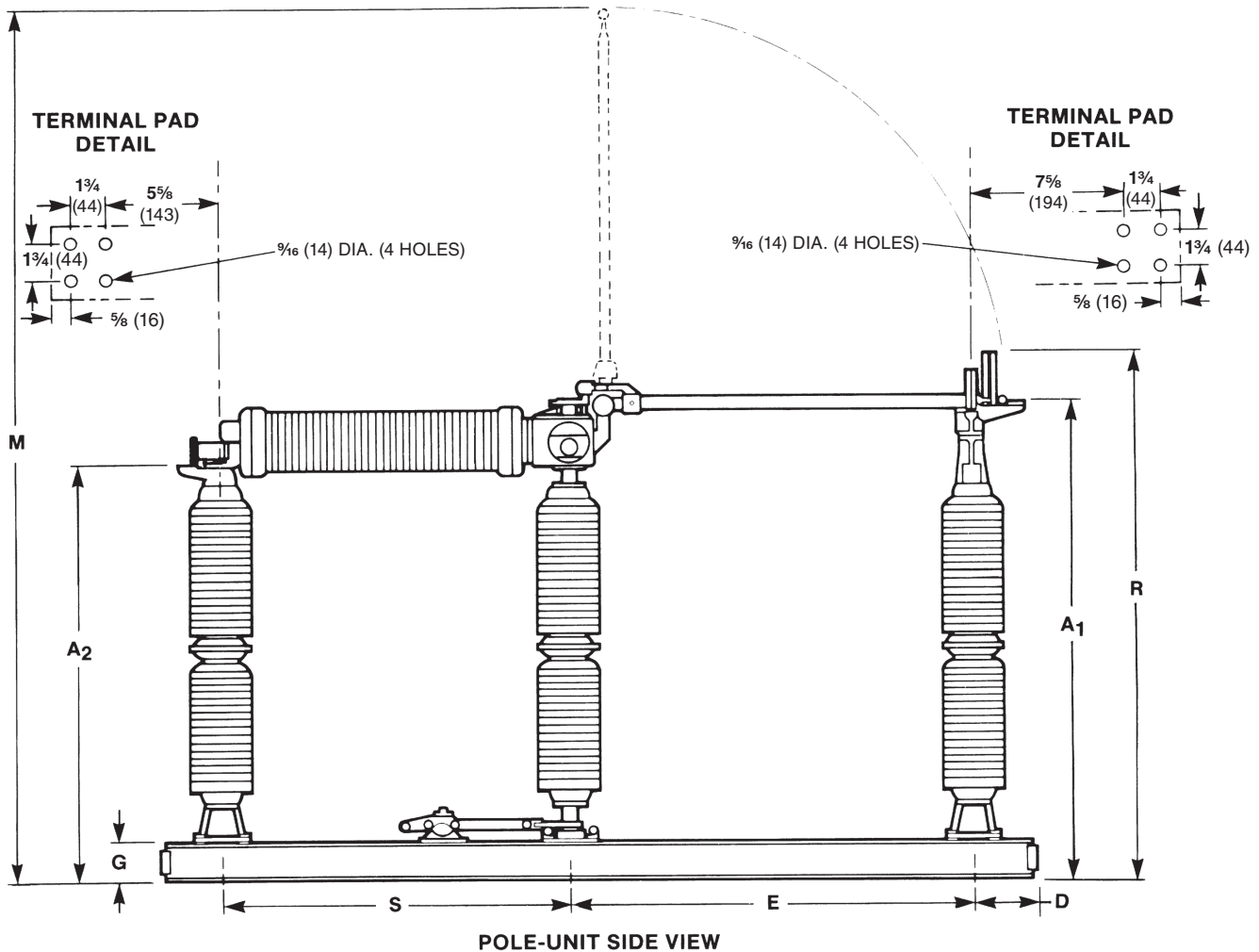
Mark V Circuit-Switchers

Three-Pole Vertical-Break Style 34.5 kV through 161 kV

Dimensions in inches (mm)



POLE-UNIT TOP VIEW



| Rating | | | | | | | No. of Interrupting gaps | Applications (See Table 3 on pages 4 and 5) |
|--------|------|-----|--------------|------------|--------|--|--------------------------|--|
| kV | | | Amperes, RMS | | | | | |
| Nom. | Max | BIL | Cont. | Short-Time | | Fault-Closing Duty-Cycle Two-Time ^① | | |
| | | | | Mom. | 3-Sec. | | | |
| 34.5 | 38 | 200 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLPR |
| 46 | 48.3 | 250 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLMPR |
| 69 | 72.5 | 350 | 1200 | 61 000 | 40 000 | 30 000 | 1 2 | BEFGHJKMP BEFGHJKLMPR |
| 115 | 121 | 550 | 1200 | 61 000 | 40 000 | 30 000 | 1 2 | BEFGJM BEFGHJKLMNPR |
| 138 | 145 | 660 | 1200 | 61 000 | 40 000 | 30 000 | 2 3 | BEFGHJKMNP BEFGHJKLMNPR |
| 161 | 169 | 750 | 1200 | 61 000 | 40 000 | 30 000 | 2 3 | BEFGHJKMNP BEFGHJKLMNPR |

| Insulator T.R. No. | Catalog Number ^{②③④} | Dimensions in Inches (mm) | | | | | | | | | Net Wt. per Pole-Unit, Lbs. (kg) |
|--------------------|-------------------------------|---------------------------|------------|------------|-----------|-----------|---------|-------------|-------------|------------|----------------------------------|
| | | A1 | A2 | C | D | E | G | M | R | S | |
| 210 | 157314 | 46½ (1181) | 34¾ (873) | 96 (2438) | 11½ (283) | 29 (737) | 6 (152) | 74¼ (1886) | 56¼ (1429) | 44¾ (1137) | 680 (308) |
| 214 | 157315 | 50½ (1283) | 38¾ (975) | 104 (2642) | 13½ (333) | 33 (838) | 6 (152) | 82¼ (2089) | 60¼ (1530) | 44¾ (1137) | 740 (336) |
| 216 | 157316 | 58½ (1486) | 46¾ (1178) | 110 (2794) | 11½ (283) | 43 (1092) | 6 (152) | 100¼ (2546) | 68¼ (1734) | 44¾ (1137) | 850 (386) |
| 216 | 157326 | 58½ (1486) | 46¾ (1178) | 118 (2997) | 11½ (283) | 43 (1092) | 6 (152) | 100¼ (2546) | 68¼ (1734) | 52¾ (1343) | 890 (404) |
| 286 | 157318 | 75¾ (1921) | 63½ (1613) | 128 (3251) | 11½ (283) | 61 (1549) | 7 (178) | 136¾ (3464) | 85¾ (2169) | 44¾ (1137) | 1145 (519) |
| 286 | 157328 | 75¾ (1921) | 63½ (1613) | 138 (3505) | 12½ (308) | 61 (1549) | 7 (178) | 136¾ (3464) | 85¾ (2169) | 52¾ (1343) | 1185 (538) |
| 288 | 157329 | 84¾ (2149) | 72½ (1842) | 146 (3708) | 11½ (283) | 71 (1803) | 7 (178) | 155¾ (3947) | 94¾ (2397) | 52¾ (1343) | 1275 (578) |
| 288 | 157369 | 84¾ (2149) | 72½ (1842) | 165 (4191) | 11½ (283) | 71 (1803) | 7 (178) | 155¾ (3947) | 94¾ (2397) | 71½ (1816) | 1390 (630) |
| 291 | 157320 | 92¾ (2353) | 80½ (2045) | 154 (3912) | 11½ (283) | 79 (2007) | 7 (178) | 171¾ (4353) | 102¾ (2600) | 52¾ (1343) | 1375 (624) |
| 291 | 157360 | 92¾ (2353) | 80½ (2045) | 173 (4394) | 11½ (283) | 79 (2007) | 7 (178) | 171¾ (4353) | 102¾ (2600) | 71½ (1816) | 1490 (676) |

① For complete information refer to the "Basis of Fault-Closing Ratings" section on page 1.

② Connectors not included. For available connectors refer to Table 2 on page 3. Circuit-Switchers are furnished with gray (Munsell Number 5 BG 7.0/014) station post insulators.

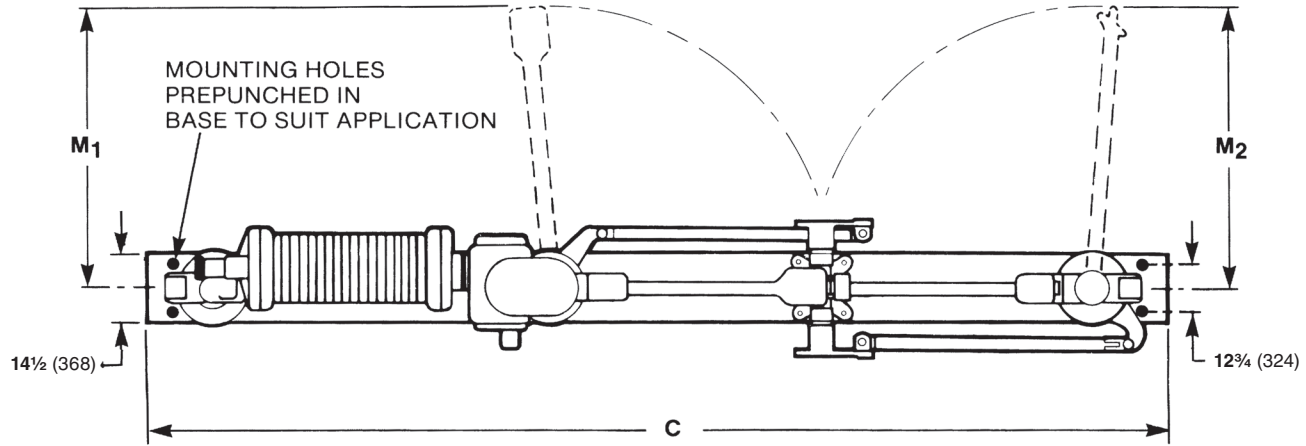
③ Manual operating handle not included. (See Table 9 on page 13.)

④ Shunt-trip device is available with all power-operated vertical-break style Mark V Circuit-Switchers.

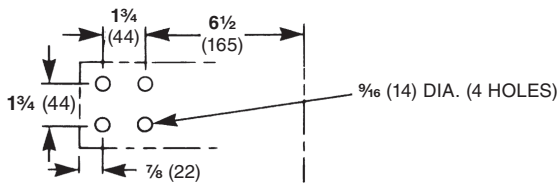
Mark V Circuit-Switchers

Three-Pole Center-Break Style with extruded-aluminum weldment bases 230 kV

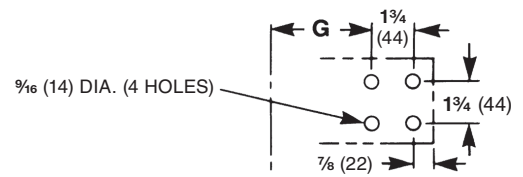
Dimensions in inches (mm)



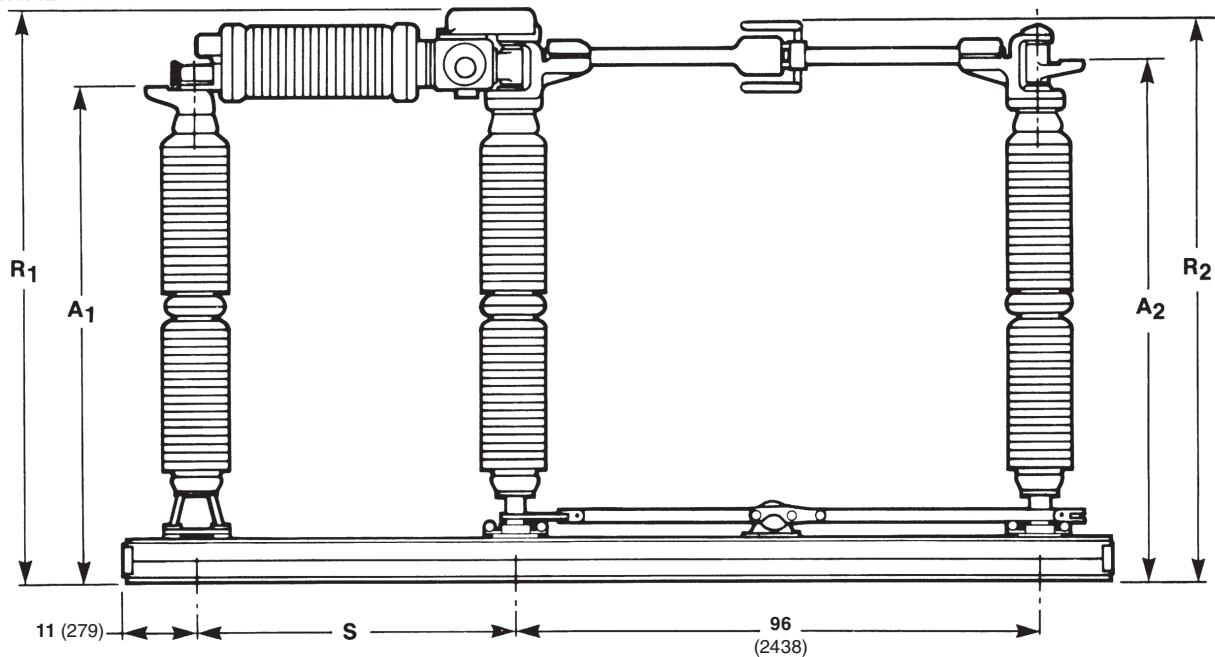
POLE-UNIT TOP VIEW



TERMINAL PAD DETAIL



TERMINAL PAD DETAIL



POLE-UNIT SIDE VIEW

| Rating | | | | | | | No. of Interrupting gaps | Applications (See Table 3 on pages 4 and 5) | Insulator T.R. No. |
|--------|-----|-----|--------------|------------|--------|--|--------------------------|---|--------------------|
| kV | | | Amperes, RMS | | | | | | |
| Nom. | Max | BIL | Cont. | Short-Time | | Fault-Closing Duty-Cycle Two-Time ^① | | | |
| | | | | Mom. | 3-Sec. | | | | |
| 230 | 242 | 900 | 1600 | 70 000 | 43 750 | 40 000 | 3 | BEFGHJKMNP | 308 |
| | | | 2000 | 80 000 | 50 000 | 40 000 | 3 | BEFGHJKMNP | 308 |

| Catalog Number ②③④⑤⑥ | Dimensions in Inches (mm) | | | | | | | | | Net Wt. per Pole-Unit, Lbs. (kg) |
|-------------------------|---------------------------|----------------|---------------|-------------|---------------|---------------|----------------|----------------|---------------|----------------------------------|
| | A1 | A2 | C | G | M1 | M2 | R1 | R2 | S | |
| 657361R2 | 99 (2515) | 103 (2616) | 197 (5004) | 5 (127) | 51¼ (1314) | 54½ (1384) | 112¾ (2864) | 112½ (2858) | 79½ (2019) | 1850 (839) |
| 757361R2 | 100¼ (2546) | 104½ (2654) | 201 (5105) | 7½ (191) | 51¼ (1302) | 56¼ (1429) | 114 (2896) | 114¼ (2902) | 83½ (2121) | 1958 (888) |

① For complete information refer to the “Basis of Fault-Closing Ratings” section on page 1.

② Connectors not included. For available connectors refer to Table 2 on page 3. Circuit-switchers are furnished with gray (Munsell Number 5 BG7.0/014) station post insulators.

③ Manual operating handle not included. (See Table 9 on page 13.)

④ Shunt-trip device is available with all power-operated center-break style Mark V Circuit-Switchers.

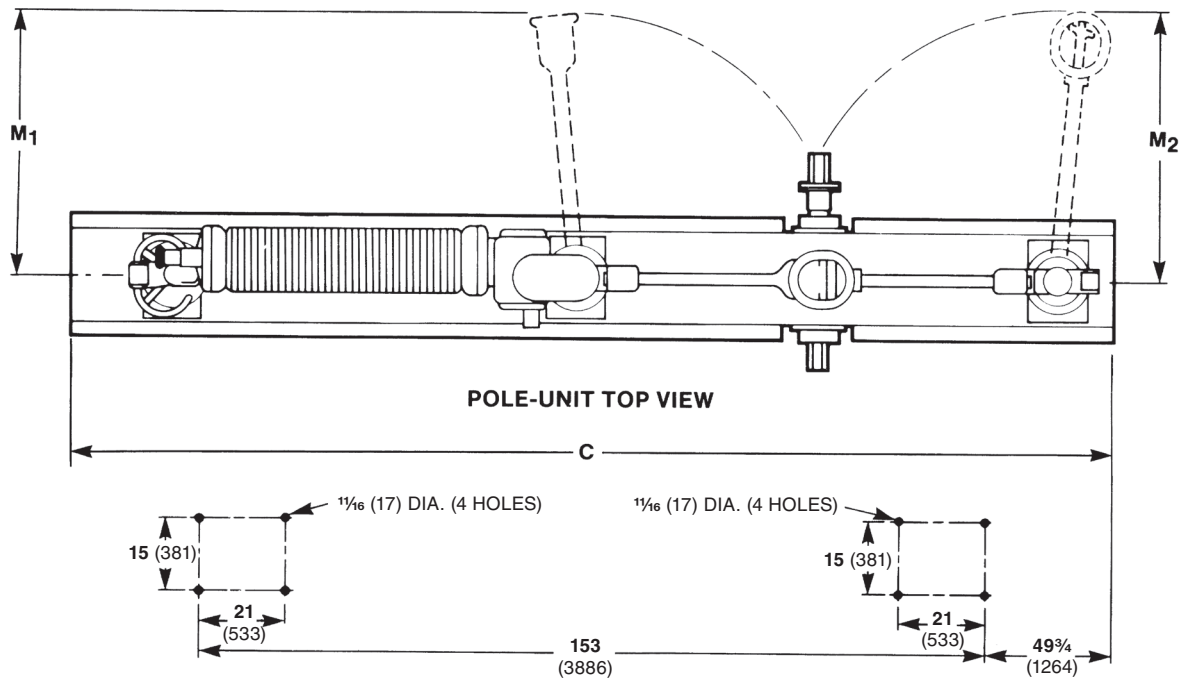
⑤ For center-break style circuit-switchers, blade opening direction, as viewed from interrupter end, is to the left.

⑥ Flexible-conductor connections are recommended at both ends of all center-break style circuit-switchers with extruded-aluminum weldment bases, except when the bypass accessory (catalog number suffix “-B2”) is furnished. In this instance, rigid bus connections are necessary at the rotating-insulator end. To reduce circuit-switcher deflection during opening and closing operations—which can loosen the bus connections—double-acting shock absorbers (catalog number suffix “-H”) are available and are recommended.

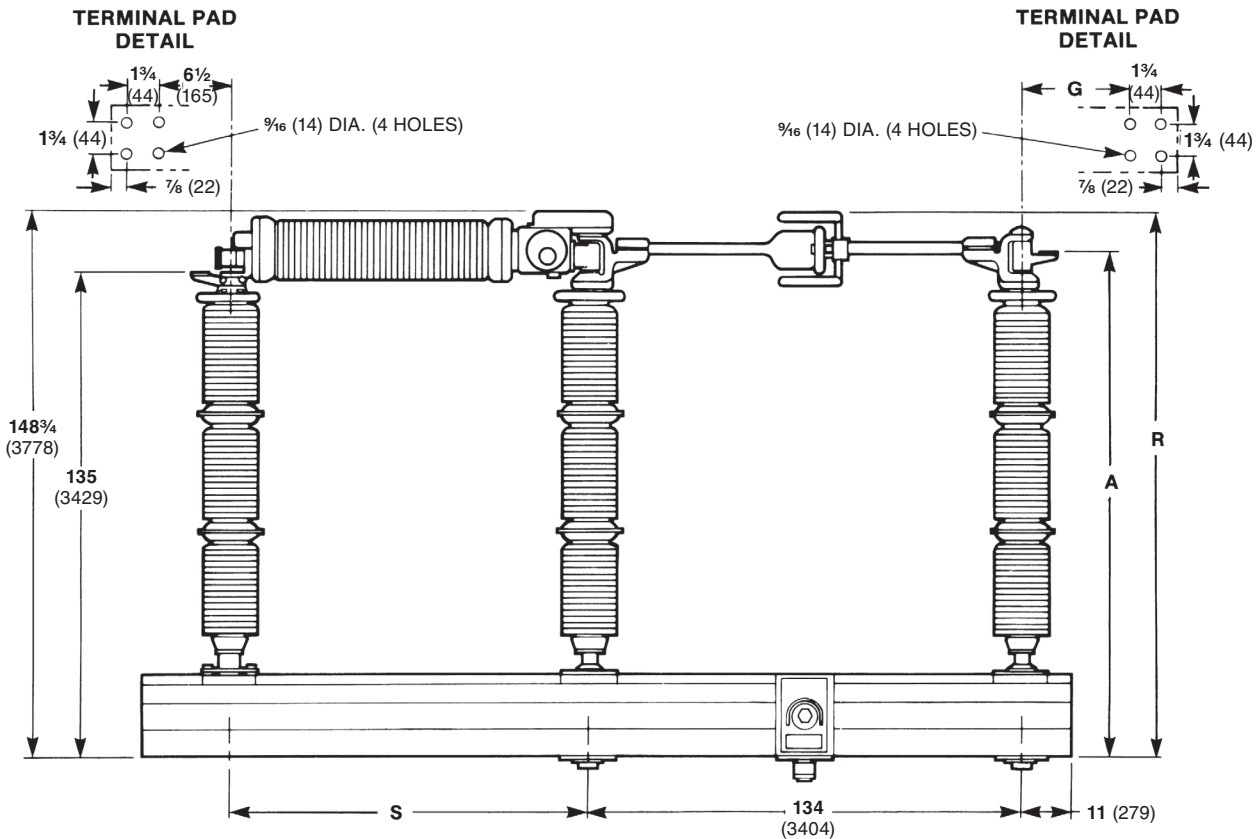
Mark V Circuit-Switchers

Three-Pole Center-Break Style with aluminum-sheathed weldment bases 345 kV

Dimensions in inches (mm)



MOUNTING HOLE DETAIL



POLE-UNIT SIDE VIEW

| Rating | | | | | | | No. of Interrupting Gaps | Applications (See Table 2 on pages 4 and 5) |
|--------|-----|------|--------------|------------|--------|--|--------------------------|---|
| kV | | | Amperes, RMS | | | | | |
| Nom. | Max | BIL | Cont. | Short-Time | | Fault-Closing Duty-Cycle Two-Time ^① | | |
| | | | | Mom. | 3-Sec. | | | |
| 345 | 362 | 1300 | 1600 | 70 000 | 43 750 | 40 000 | 3 | E●MN |
| | | | 2000 | 80 000 | 50 000 | 40 000 | 3 | E●MN |

| Insulator T.R. No. | Catalog Number ^{②③④⑤} | Dimensions in Inches (mm) | | | | | | | Net Wt. per Pole-Unit, Lbs. (kg) |
|--------------------|--------------------------------|---------------------------|------------|----------|------------|------------|-------------|------------|----------------------------------|
| | | A | C | G | M1 | M2 | R | S | |
| 368 | 357363 | 139 (3531) | 231 (5867) | 5 (127) | 70¾ (1797) | 74½ (1892) | 150½ (3823) | 79½ (2019) | 4775 (2166) |
| 368 | 557363 | 140¼ (3562) | 235 (5969) | 7½ (191) | 71¼ (1810) | 78⅞ (2003) | 152 (3861) | 83½ (2121) | 4900 (2223) |

① For complete information refer to the "Basis of Fault-Closing Ratings" section on page 1.

② Connectors not included. For available connectors refer to Table 2 on page 3. Circuit-switchers are furnished with gray (Munsell Number 5 BG7.0/014) station post insulators.

③ These circuit-switchers cannot be furnished with manual operating handle.

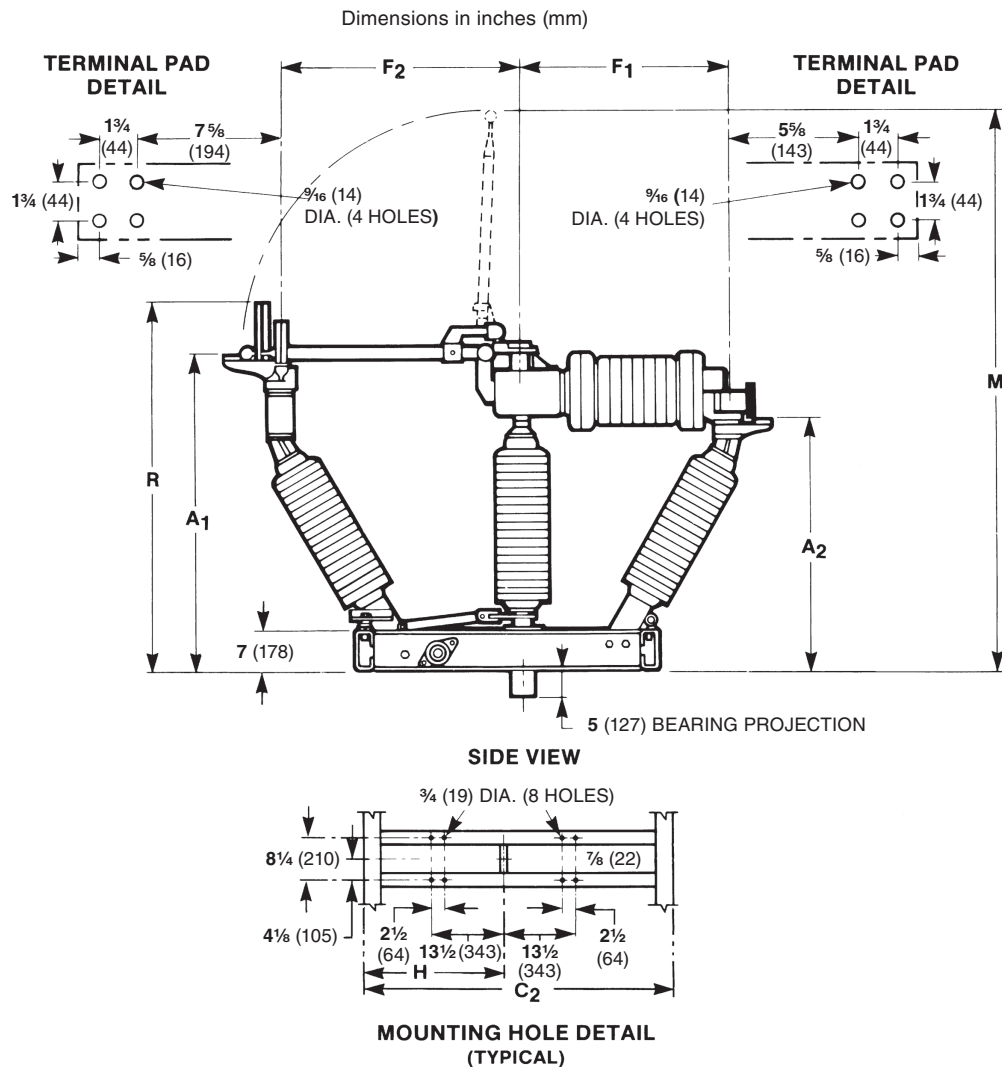
④ Shunt-trip device is available with all power-operated center-break style Mark V Circuit-Switchers.

⑤ For center-break style circuit-switchers, blade opening direction, as viewed from interrupter end, is to the left.

● Not applicable for fault-interrupting duty. Also suitable for three-phase transformers and three-phase banks of single-phase transformers connected solidly grounded-wye on the primary (circuit-switchers) side, solidly grounded-wye on the secondary side, with a delta-connected tertiary.

Mark V Circuit-Switchers

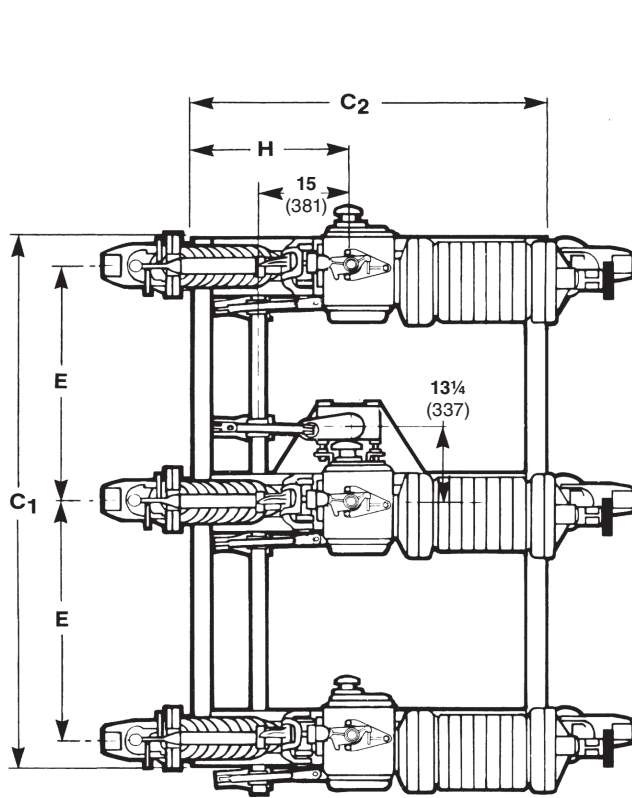
Three-Pole Integer Style 34.5 kV through 69 kV



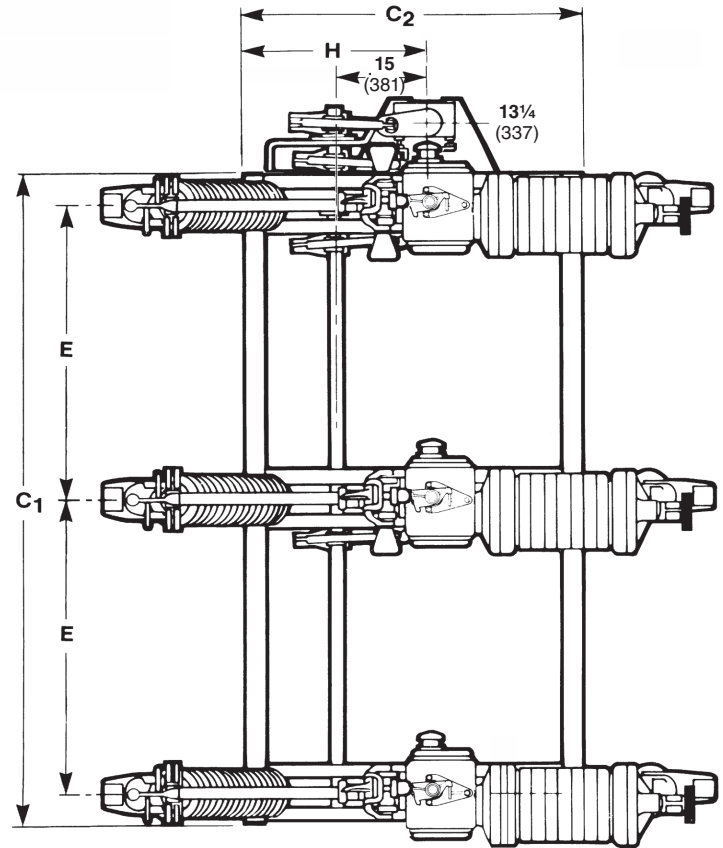
| Rating | | | | | | | No. of Interrupting gaps | Catalog Number (See Table 2 on pages 4 and 5) | Insulator T.R. No. |
|--------|------|-----|--------------|------------|--------|--|--------------------------|--|--------------------|
| kV | | | Amperes, RMS | | | | | | |
| Nom. | Max | BIL | Cont. | Short-Time | | Fault-Closing Duty-Cycle Two-Time ^① | | | |
| | | | | Mom. | 3-Sec. | | | | |
| 34.5 | 38 | 200 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLMPR | 210 |
| 46 | 48.3 | 250 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKLMPR | 214 |
| 69 | 72.5 | 350 | 1200 | 61 000 | 40 000 | 30 000 | 1 | BEFGHJKMP | 216 |
| | | | | | | | 2 | BEFGHJKLMNPR | 216 |

^① For complete information, refer to the "Basis of Fault-Closing Ratings" section on page 1.

TABLE CONTINUED ►



ILLUSTRATED
34.5-kV AND 46-kV
INBOARD OPERATING SHAFT



ILLUSTRATED
69-kV OUTBOARD OPERATING SHAFT

TOP VIEW

| Catalog Number ^{②③④⑤} | | Dimensions in Inches (mm) | | | | | | | | | | Net Wt. per Integer-Unit, Lbs. (kg) |
|----------------------------------|---|--|--|---------------|--|--------------|--|--------------|---|--|--|-------------------------------------|
| Vertical Operating Shaft Inboard | Vertical Operating Shaft Outboard on Right ^⑤ | A1 | A2 | C1 | C2 | E | F1 | F2 | H | R | M | |
| 157914 | 157814 | 44 ³ / ₄ (1137) | 32 ⁵ / ₈ (829) | 92 (2337) | 57 ¹ / ₂ (1461) | 41 (1041) | 37 ¹ / ₄ (946) | 29 (737) | 26 (660) | 54 ¹ / ₂ (1384) | 72 ¹ / ₂ (1842) | 2250 (1021) |
| 157915 | 157815 | 48 ³ / ₄ (1238) | 36 ⁵ / ₈ (930) | 92 (2337) | 57 ¹ / ₂ (1461) | 41 (1041) | 37 ¹ / ₄ (946) | 33 (838) | 26 (660) | 58 ¹ / ₂ (1486) | 80 ¹ / ₂ (2045) | 3040 (1379) |
| 157916 | 157816 | 56 ³ / ₄ (1441) | 44 ⁵ / ₈ (1133) | 112 (2845) | 55 (1397) | 51 (1295) | 37 ¹ / ₄ (946) | 43 (1092) | 30 ¹ / ₂ (775) | 66 ¹ / ₂ (1689) | 98 ¹ / ₂ (2502) | 3250 (1474) |
| 157926 | 157826 | 56 ³ / ₄ (1441) | 44 ⁵ / ₈ (1133) | 112 (2845) | 62 (1575) | 51 (1295) | 52 ¹ / ₈ (1343) | 43 (1092) | 30 ¹ / ₂ (775) | 66 ¹ / ₂ (1689) | 98 ¹ / ₂ (2502) | 3600 (1633) |

② Connectors not included. For available connectors refer to Table 2 on page 3. Circuit-Switchers are furnished with gray (Munsell Number 5 BG7.0/014) station post insulators.

③ Manual operating handle not included. (See Table 9 on page 13.)

④ Shunt-trip device is available with all power-operated vertical-break style Mark V Circuit-Switchers.

⑤ As viewed from interrupter end.