Underground Distribution Switchgear

Functional Specification Guide

Type MOST, Oil-Insulated Switchgear

PS285003EN

Functional Specification for 15 kV, 25 kV, or 35 kV Underground Distribution Switchgear

1. Scope

1.1. This specification applies to three-phase, [select #] - way [select # -source, select # -tap], 50-60 Hz, fully dead front, sectionalizing underground distribution switchgear; with maximum main bus rating of [select: 200 or 600] amperes continuous current and maximum tap rating of [select: 200 or 600] amperes. Source switching shall be accomplished with under-oil switches.. Tap overcurrent protection shall be accomplished utilizing drawout under-oil current-limiting fuses.

1.2. The unit is to be insulated with [select: E200 less-flammable fluid for operation to minus 30 degrees C, Envirotemp™ FR3™ less-flammable fluid for operation to 0 degrees C (32 degrees F), or mineral oil for operation to minus 30 degrees C,] dielectric, contained in a sealed tank design, so operation is unimpaired by flood conditions or contaminated environments (except control). The unit shall utilize under-oil sectionalizing switches for current loadbreak switching. The unit shall be designed for installation on a concrete or fiberglass pad at ground level.

1.3. This specification shall only cover the purchase and shipment of switchgear. The purchaser and/or user shall be responsible for all site-work, electrical connections, and installation.

2. Applicable Standards

IEEE Std C37.74™-2003 standard – IEEE Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems Up to 38 kV

IEEE Std C57.12.28™-2005 standard – Standard for Pad-Mounted Equipment - Enclosure Integrity

IEEE Std C57.12.29™-2005 standard – IEEE Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments – applicable when stainless steel construction is specified

IEEE Std 386™-2006 standard – Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 V

IEC 801-3 – Radiated Electromagnetic Field Requirements

IEC 68-2-30 – Environmental Testing

3. Ratings

3.1. The switchgear shall be rated as follows:

Nominal Voltage	15 kV	25 kV	35 kV
Maximum Design Voltage……	15.5	27	38
BIL……	95	125	150
1-minute Withstand Switch* and Terminators…	34	40	50
Continuous Current, amps……	600	300	200*
Load Switching, amps……	600	300	200*
Momentary Current 10 Cycles, amps (asym.)…..	16,000	16,000	16,000
2 Sec., Short Time Current, amps (sym.)……	10,000	10,000	10,000
3 Shot Make and Latch amps (asym.)……	16,000	16,000	9,600

* If specified, an alternate 2-position Open-Close switch shall be provided that shall have a 300-amp continuous and load-switching rating and meet the performance of IEEE Std C37.74™-2003 standard.

3.2. The switchgear shall have an ambient operating temperature range of -30 ºC to +40 ºC.

4. Construction

4.1. The underground distribution switchgear shall consist of a 2-sided, sealed insulation tank, and separate front and rear cable compartments. Overall height, width, depth and layout shall conform to the manufacturer's standard construction practices for the configuration, ratings, and voltage class specified. Standard construction shall be of [select: mild steel with stainless steel hardware or 100% 304L stainless steel].

4.2. The liquid-filled unit shall have a tamperproof bolted tank cover design, utilizing Buna-N rubber gaskets. The sealed tank (with deadfront terminators installed) shall be capable of withstanding flood immersion while energized, and shall be impervious to contaminants and animals, so as not to compromise the main insulation structure. The cable compartments shall be located at the front and back of the tank respectively. The main cable compartments may house a combination of source way(s) and load or tap way(s). All switch operating handles shall be located on the same front plate as the ways that they operate, in order to reduce the likelihood of operating an incorrect switch. Recessed lifting provisions for suitable balanced lift shall be provided on the tank ends.

4.3. Cable compartments shall both have a minimum depth of [select: 16, 22, 26 or 30 inches], to provide ease of cable installation and allow for the addition of termination accessories.

4.4. Top-hinged cabinet style doors shall be provided. Top hinged doors will allow access to cable terminations with swing-up type doors with door stays and stainless steel hinges. Units wider than 46 inches shall have split doors to allow easy operation by one person. Both source and tap doors must be able to open fully at the same time. Each door shall have a floating lock pocket with padlock hasp and pentahead stainless steel door bolt.

4.5. Cabinet construction shall meet all NEMA and ANSI security requirements as defined in the IEEE C57.12.28-2005 standard and the construction requirements of the IEEE Std C37.74™-2003 standard.

4.6. Units shall be shipped complete with [select: E200 less-flammable fluid for operation to minus 30 degrees C, Envirotemp™ FR3™ less-flammable fluid for operation to 0 degrees C (32 degrees F), or mineral oil for operation to minus 30 degrees C].

4.7. Select below based on insulation requirements.

4.8. [select: for liquid dielectric switchgear, The unit shall be equipped with a 1-inch oil-fill plug and a 1-inch drain plug with 3/8" sampler. A single automatic pressure relief valve shall be supplied that is hotstick-operable

and located on the source-side front plate above the oil level indicator within the switchgear. The unit shall have sight gages to monitor the dielectric level located on each unit side equipped with an operating handle.]

4.9. [select: A 1/2-13 UNC stainless steel ground nut shall be provided that is welded to the switchgear tank and mounted beneath each bushing, or, The manufacturer shall provide a factory assembled 1/2-inch diameter copper ground rod in each compartment, for use with user's grounded clamps, that shall provide a 3 inch clearance from the ground rod to the front plate of the tank to accommodate grounding of the insulated connectors.]

4.10. A non-corrosive operating diagram (one-line schematic of the unit) shall be affixed to the inside of the right hand, first opening door, on both sides of the unit, if two (2) sided. A single nameplate shall be provided that is mounted on the source side tank front plate in the upper right hand corner. The nameplate shall contain the following information:

- Catalog Number/Model Number
- Serial Number
- Nominal voltage class, kV
- Rated maximum voltage, kV
- BIL, kV
- Manufacturing Date: MM/YYYY
- Rated continuous current, A
- Rated load interrupting rating, A
- Momentary current rating, kA asym.
- Close & latch rating, kA asym.
- Total weight, lbs.
- Liquid dielectric volume (gallons)

4.11. Three (3) Faulted Circuit Indicator mounting provisions shall be provided in the sills beneath the cabinet doors at the position of each way. The provisions shall include a 1-1/16 diameter hole sized for Eaton's Cooper Power series type S.T.A.R. fault indicator small remote display, cover plate, and tamperproof mounting bolts. There shall be provisions for mounting at least one fault indicator for each equipment bushing.

4.12. Bushings

4.12.1. Bushings shall be deadfront type for use with separable connectors conforming to IEEE Std 386™-2006 standard and ANSI Standard C119.2. The source ways shall have a continuous current rating of [select: 600 ampere with bushings, or 200 ampere with wells for bushing inserts]. Tap ways shall have a continuous current rating of [select: 600 ampere with bushings, or 200 ampere with wells for bushing inserts.]

4.12.2. [select: Six hundred (600) ampere bushings, or The two-hundred (200) ampere wells] shall be horizontally configured at 24 inches above the pad and accept molded, separable deadfront connectors. Bushings shall be mounted with minimum spacing of 8.0-inches between centerlines, except between the C-phase bushings which may be a minimum of 7.0-inches. A standoff bracket or parking stand shall be supplied for each bushing and shall be mounted horizontally adjacent to each bushing on a 4.0-inch centerline from the bushing centerline. The standard phasing of the bushings from left to right shall follow the sequence ABC-CBA. Each bushing shall have identification affixed to the front plate identifying its source or tap designation, as shown on the one-line operating diagram, and its phase identification.

4.12.3. Where 35 kV rated switchgear with 200 amp sources or taps are specified, [select: Eaton's Cooper Power series one-piece, loadbreak, large interface, integral bushings shall be supplied, or, bushing wells shall be supplied for use with small interface, user furnished, inserts.]

4.13. Source Switches

4.13.1. Source Switches shall use Eaton's Cooper Power series three-phase gang-operated loadmake/loadbreak oil sectionalizing switches that meet the performance requirements of the IEEE Std C37.74™-2003 standard. The switch mechanism shall use a manually-charged, stored-energy, spring-loaded over-toggle assembly, which is independent of operator speed. The switch shall operate by rotation of the operating handle. The switch shall provide positive latching in each position and shall have positive indication of switch position. A 2-position single-blade Open-Closed type, 3-position single-blade Selector type, 4-position V -blade type, or 4-position T-blade type sectionalizing switch shall be provided as indicated in the one-line diagram given for the switchgear configuration that is required. The operating handles shall be sidemounted and in a separate tamper-resistant compartment that is integral to the tank, externally accessible, and secured with a pentahead bolt that may be padlocked for security. Frontplate mounted switch operating handles shall be available as an option. The switch shall be operable by a hotstick or by an optional "T" handle accessory. Each switch shall have provisions for field installed key interocks.

5. Fusing

5.1. Overcurrent protection shall be provided by Eaton's Cooper Power series types ELSG or SX-Limiter under-oil full-range current-limiting fuses that shall be mounted in Eaton's Cooper Power series type ELSG wet well drawout fuseholders.

5.2. 15 kV rated switchgear shall be provided with fuseholders that accept 8.3 kV maximum rated fuses. 25 kV rated switchgear shall be provided with fuseholders that accept 15.5 kV or 23.0 kV maximum rated fuses. 35 kV rated switchgear shall be provided with fuseholders that accept 23.0 kV maximum rated fuses.
Note: 15 kV delta = use 25 kV rated switchgear

5.3. The switchgear shall be provided with fuseholders only unless otherwise specified.

6. Finish Performance Requirements:

6.1. The switchgear shall be constructed of mild steel with stainless steel details and painted green conforming to Munsell 7GY 3.29/1.5. The coating system employed shall meet or exceed IEEE Std C57.12.28™-2005 standard coating system requirements for underground distribution equipment, including the following performance tests:

- 1500-hour 5% salt spray corrosion test per ASTM B117 / D1654
- 1000-hour humidity test per ASTM D2247 / D1654
- 500-hour ultraviolet accelerated weathering test per ASTM G53 / D523
- Direct impact test with 160 in. lb. falling dart per ASTM D2794
- Tabor abrasion test 3,000 cycles per ASTM D4060
- Crosshatch adhesion per ASTM D3359

6.2. [select (additionally): for stainless steel], The switchgear and its compartments shall be constructed of 100% 304L stainless steel painted green conforming to Munsell 7GY 3.29/1.5. The coating system employed shall meet or exceed IEEE Std C57.12.29™-2005 standard coating system requirements for underground distribution equipment in coastal environments,]

7. [select: Optional Features]

7.1. Interlocks

7.1.1. When specified, mounting provisions for Kirk key interlocks shall be provided on each switched way. The actual interlocking key scheme and the interlocks will be furnished by the purchaser.

7.2. 200 ampere bushing well switch module inserts.

7.3. T-handle (for manual operation of switch handles without using hotstick).

7.4. Fault indicator mounting provisions located on the source and tap compartment door sill.

7.5. Spare fuse storage rack.

8. Certified Design Test Data:

8.1. Certified design test data shall be furnished upon request. The test data shall be available for the following:

- Switch ratings per IEEE Std C37.74™-2003 standard
- Coatings per [select: IEEE Std C57.12.28™-2005 or IEEE Std C57.12.29™-2005 standard]

9. Production Testing - The unit shall be subjected to the following production tests:

- Continuity test to assure correct internal connections.
- Hi-pot test to determine dielectric strength of the unit.
- Pressure test to assure tank is completely sealed.

10. Submittals

10.1. The manufacturer shall furnish a detailed list of ratings and accessories and set of drawings defined as follows [select optional: drawings for approval] :

- Detailed front elevation
- Single Line
- Base Plan
- Schematics

10.2. The manufacturer shall furnish instruction manuals covering the installation of the switchgear and the operation of its various components.

11. Quality Assurance

11.1. The manufacturer shall be a company specializing in medium-voltage underground distribution switchgear with at least fifteen years of documented experience.

11.2. Equipment shall be built in accordance with the industry standards for medium-voltage equipment.

11.3. The manufacturer shall be registered and certified as ISO 9001 compliant by a recognized international and independent body.

12. Warranty

13. The underground distribution switchgear shall be provided with a one-year warranty in-service/18 months maximum from date of shipment.

14. Approved Manufacturers

Eaton

APPENDIX A: MODELS AND WAYS

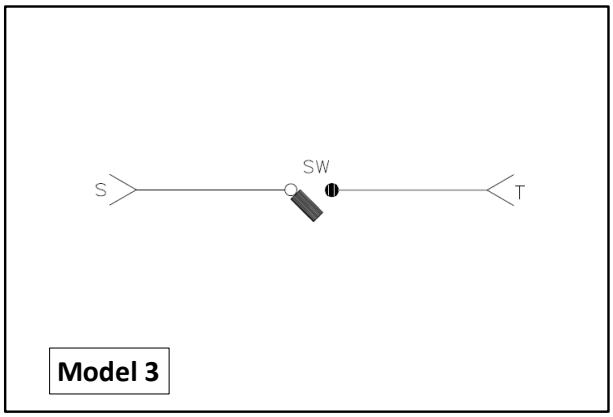
These notes are for the user of this specification guide and are not intended to be a part of the specification.

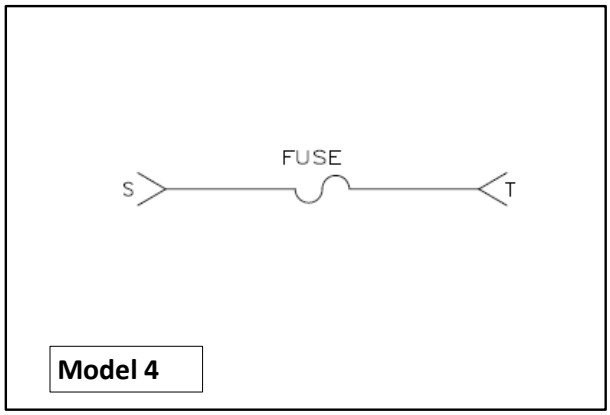
Definitions:

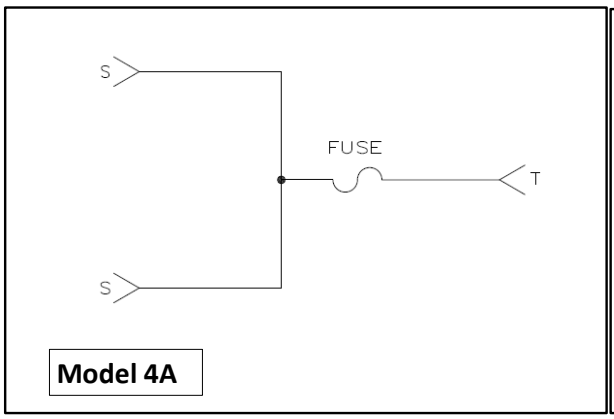
WAY - A “way” is defined as a connection from the exterior (either a source or a tap) to the interior switchgear bus that may be a direct electrical connection or a connection via switch or a fuse. The total number of “ways” is the sum of all sources and taps. An internal bus tie switch is not a way.

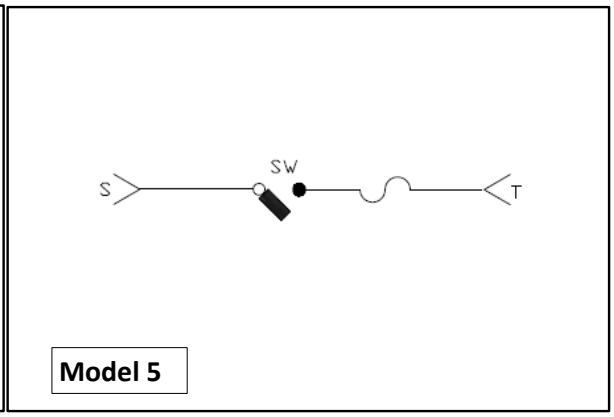
MODEL or MODEL NUMBER – A shorthand method to describe a bus arrangement that includes sources, taps and tie switches that further defines the presence of switches, fuses, and direct connections to the bus. This allows one to describe bus common arrangements without creating or transmitting drawings. Typical model number arrangements follow; these may be modified to accommodate any possible arrangement of the circuit elements.

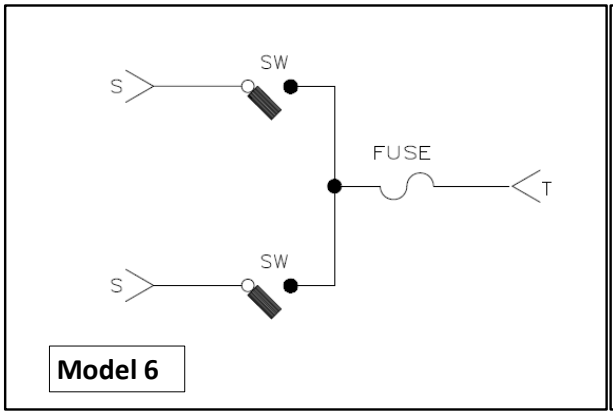
INSERT A MODEL DIAGRAM INTO THE SPECIFICATION FROM THIS LIST OR CREATE A SKETCH (maximum of 6 ways, total):

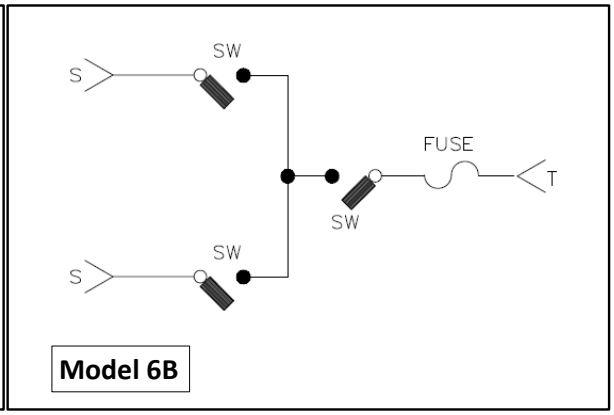


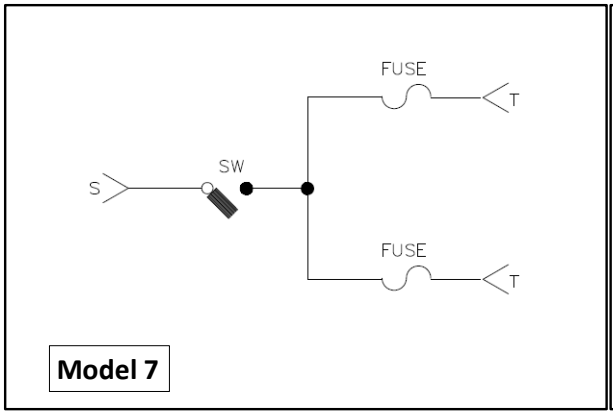


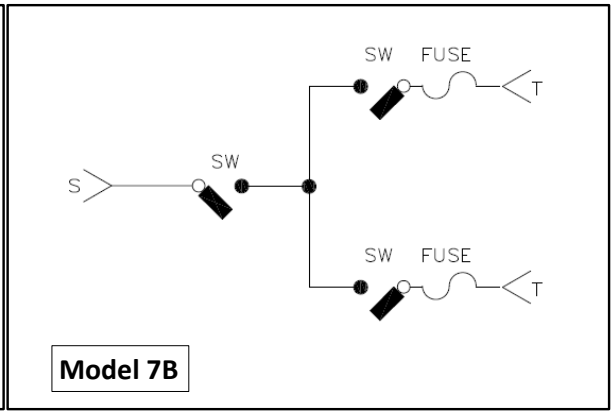


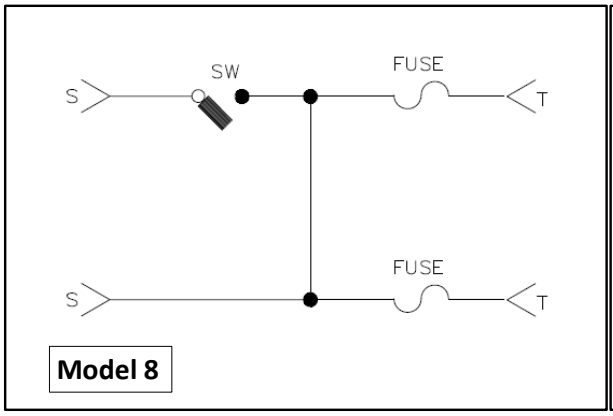


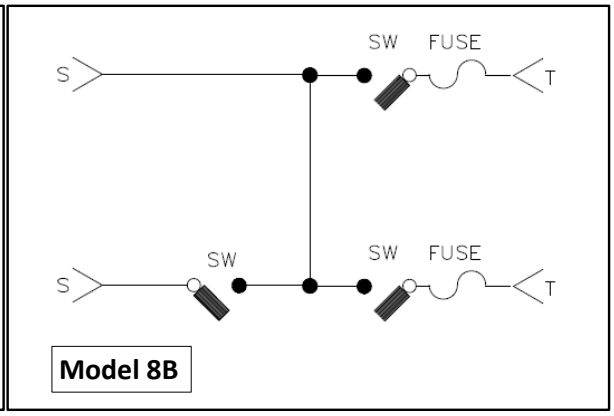


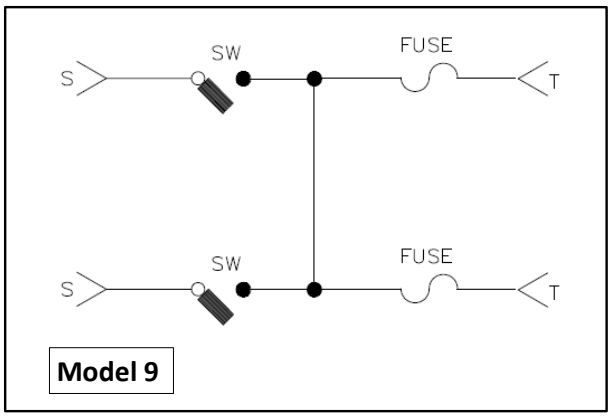


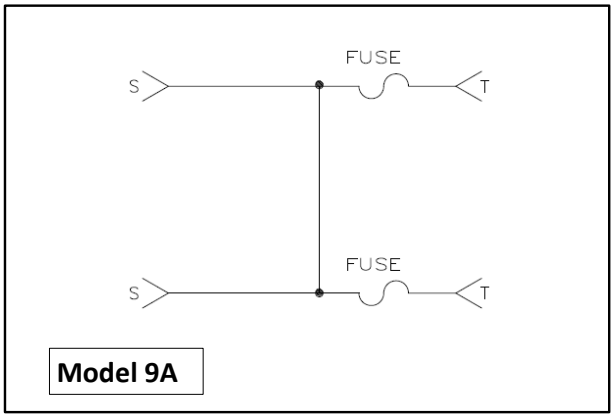


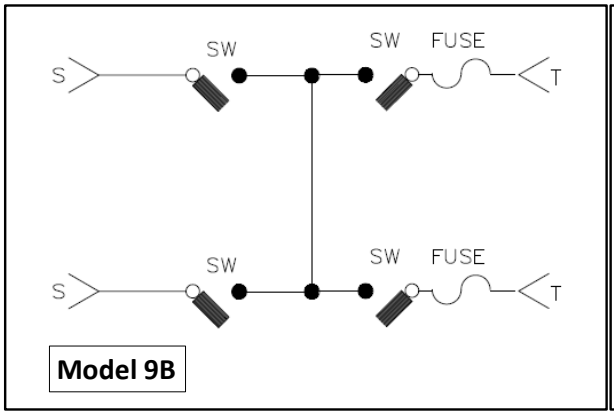


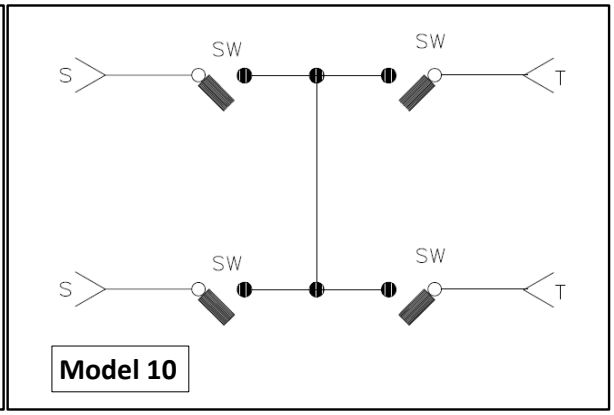


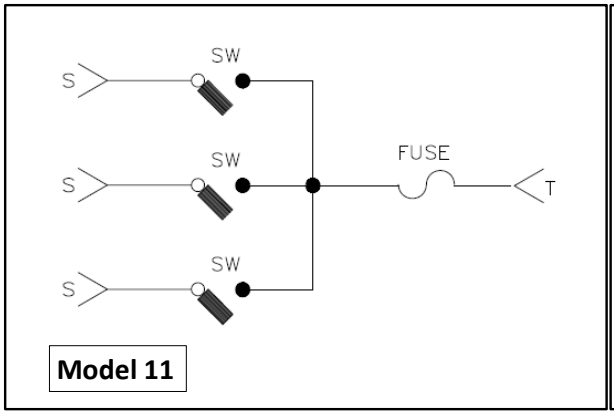


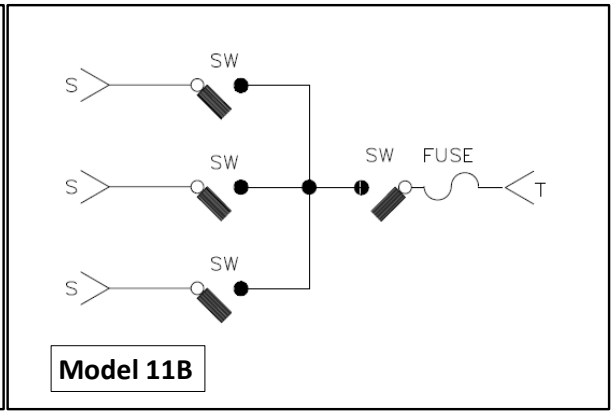


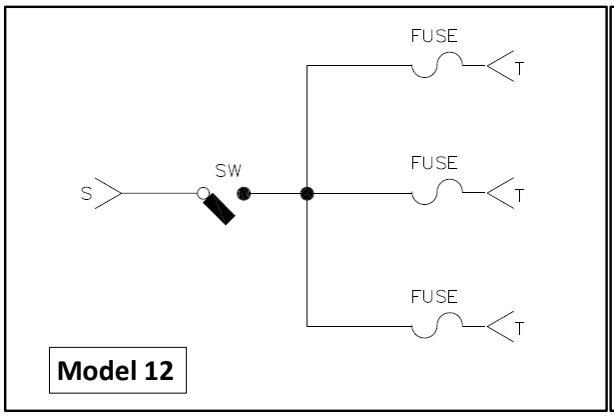


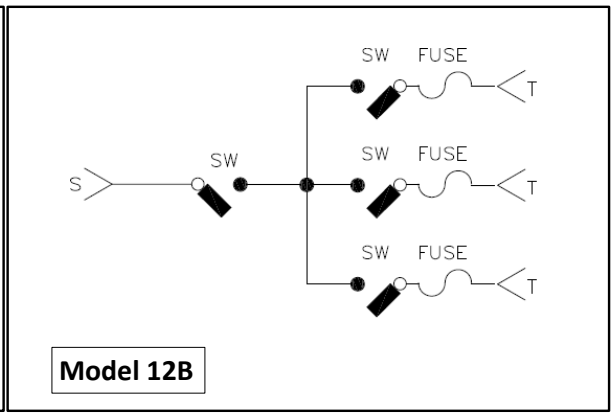


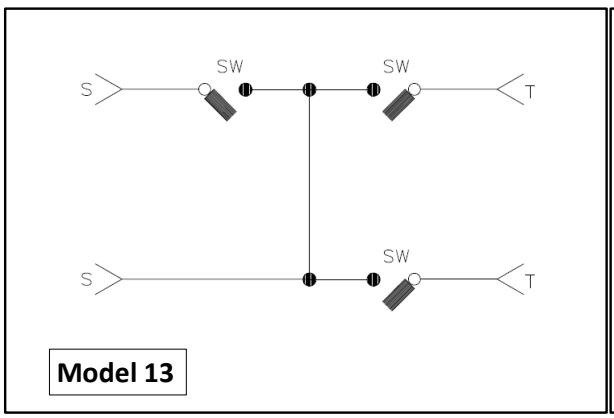


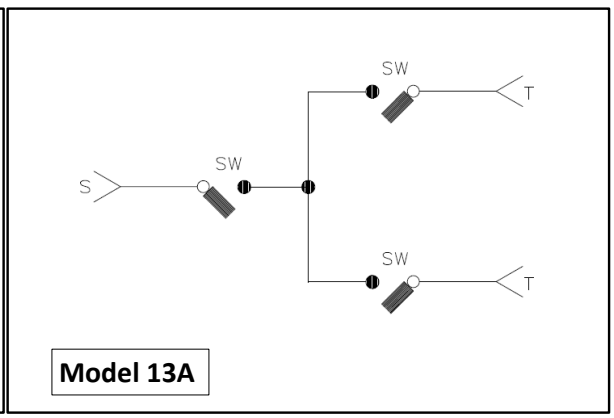


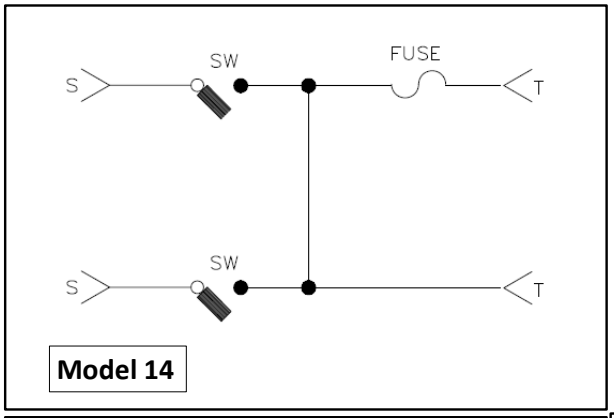




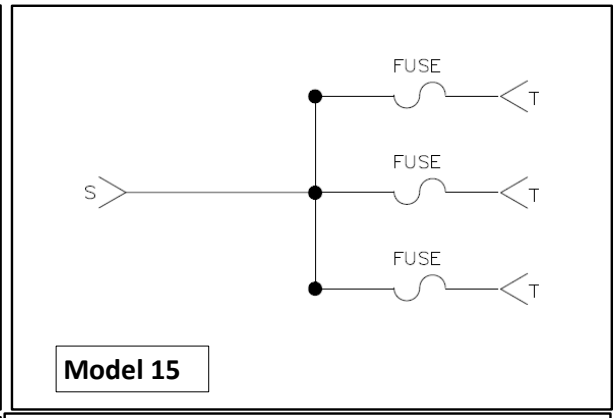




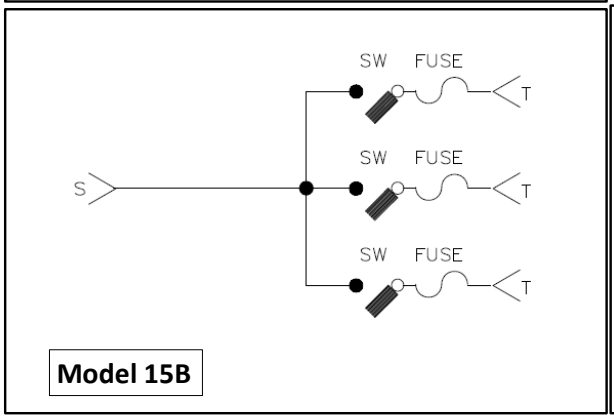




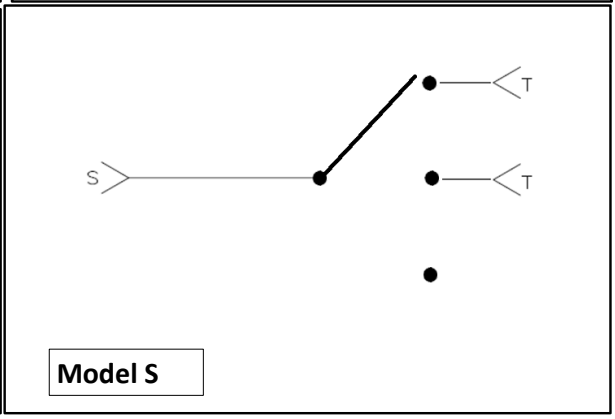
Model 14



Model 15



Model 15B



Model S

Envirotemp™ and FR3™ are licensed trademarks of Cargill, Incorporated.