29 kV, Three-Phase, Overhead, SCADA-Controlled Load Interrupter Distribution Switching Systems

1. Scope

This standard covers the requirements for 29 kV, three-phase, overhead, SCADA-controlled, distribution switching systems and related accessories. SCADA stands for supervisory control and data acquisition.

This standard applies to the following Seattle City Light (SCL) stock numbers:

Stock No.	Description
013874	Switch, horizontal, three-phase voltage sensing on jaw side of switch only
014402	Switch, riser style (vertical), three-phase voltage sensing on hinge (bottom) side and three-phase current-sensing on jaw (top) side of switch
013876	Control unit with IntelliTeam SG Automatic Restoration System Software; three current and three voltage sensing inputs
013875	24 Vdc, 8 Ah battery pack
014564	Ground strap, tin-plated copper, flexible, braided, for disconnect handle

A complete switching system (at one site) includes two major components: a switch and a control unit that provides an interface between the switch and the master-station computer or peer-to-peer communication with distributed intelligence.

Switches, control units, and control unit batteries are assigned individual stock numbers, and are ordered separately.

The purpose of this standard is threefold:

1. Promote standardization of equipment and SCADA protocol within the overhead distribution system.
2. Make available a reliable family of SCADA-controlled switches and control components that reduces O&M expenses by sharing common training requirements and operational work practices.
3. Facilitate ordering by providing a cross-reference between SCL stock numbers, common applications, and manufacturer catalog numbers.

2. Application

Overhead distribution switches are intended for use on three-phase, 26.4 kV, 4-wire, solidly grounded, wye-connected, 60 Hz systems.

Horizontal switches are used for sectionalizing feeders.

Riser-style (vertical) switches are installed on terminal poles.

New switches are shipped with the ground strap included. Stock No. 014564 is only used to replace damaged or vandalized disconnect handle grounding jumpers.

Prior to January 2016, SCL procured three different styles of switches and one type of controller. See the Appendix for details.

As of June 2018, two types of switches and one type of controller will be used for the SCL overhead distribution system.

An S&C Electric Scada-Mate switch with a control unit provisioned with IntelliTeam SG Automatic Restoration System Software makes it possible to isolate a fault and restore service (to all but the faulted section of line) without the intervention of a system dispatcher. Multiple switches are required to create a useful system.

Scada-Mate is a proprietary product of the S&C Electric Co.

For more information, distribution engineers are encouraged to consult the S&C Electric extensive online library.

3. Industry Standards

Except as modified by this standard, switching systems shall meet the applicable requirements of the following industry standards:

IEEE 1247; Standard for Interrupter Switches for Alternating Current, Rated Above 1000 V

ANSI/IEEE C37.32; High Voltage Air Switches, Bus Supports, and Switch Accessories – Schedules of Preferred Ratings Manufacturing Specifications, and Application Guide

IEEE C37.34; Standard Test Code for High-Voltage Air Switches

4. Requirements

4.1 General

Each switch, ground-level handle, and control unit shall be integrally designed and produced.

Disconnect handle ground straps shall be tin-plated copper.

Manufacturer shall be solely responsible for the performance of the switch and control unit components as well as the complete integrated assembly.

All components of the switch and control unit shall be factory assembled and tested.

Switches and control units shall be of high quality design and construction providing safe and reliable operation with minimal maintenance over the life of the product.

Manufacturer shall inform SCL in writing of all design changes that could affect the understood or published capabilities of the switch or control unit.

One instruction book shall be securely attached to each switch in a waterproof, ultraviolet light-resistant envelope. Alternatively, one instruction book may be placed inside the control unit cabinet.

4.2 Load Interrupter Switches

Load interrupter switches are used for the monitoring, serving, remote supervisory control, and automatic restoration of the overhead distribution system.

Switches shall have the following basic electrical ratings:

Maximum voltage	29 kV, rms
Number of phases	3
Power frequency	60 Hz
Lightning-impulse withstand voltage	150 kV BIL, crest
Continuous current	600 A, rms
Short-time (1 s) withstand current	16 kA, rms symmetrical

Switches shall be compatible with control units provisioned with Gold License Level Access S&C IntelliTeam SG Automatic Restoration System Software. The control unit is a separate stock number.

Switches shall be designed for wood pole mounting, with horizontal and riser-style (vertical) mounting configurations.

Switch interrupters shall be opened and closed electrically via push-button switch inside the control unit, or remotely via SCADA.

Horizontal switches shall also have the ability to be opened and closed manually using a hookstick through the manual-operation pull-ring at the base of the switch.

Horizontal switches shall include a ground-level disconnect handle, as well as an interlock system that prevents operation of the switch with the disconnect handle while the interrupters are closed. The disconnect handle shall be operable only if the interrupters are open.

Riser-style switches shall also have the ability to be opened manually using the ground-level disconnect handle installed on the pole.

Handles shall be supplied with sufficient operating mechanisms, epoxy insulators, fiberglass rod, galvanized steel rod, ground strap, guides, guide bearings, couplings, and other parts and accessories to allow the operating handle to be mounted 42 inches above the finished grade level.

The requirements for this switch were derived from S&C Descriptive Bulletin 768-30, dated July 13, 2009, S&C Specification Bulletin 768-31, dated March 16, 2015, and S&C Photo Sheet 768-710, dated December 20, 1999. Refer to 768-30, 768-31, and 768-710 for more information.

Stock No.	S&C Electric Catalog No.
013874	148213R2-A1- E3-G35-S121

where:

148213R2 =	horizontal, extra mounting-pole clearance, manual, nonelectrical opening and closing capability
A1 =	wildlife protection
E3 =	three-phase voltage sensing on jaw side of switch
G35=	shielded control cable in liquid-tight flexible metal-wiring conduit, 35ft length
S121 =	ground-level disconnect handle with (2) Cypoxy insulators and (1) fiberglass insulating rod

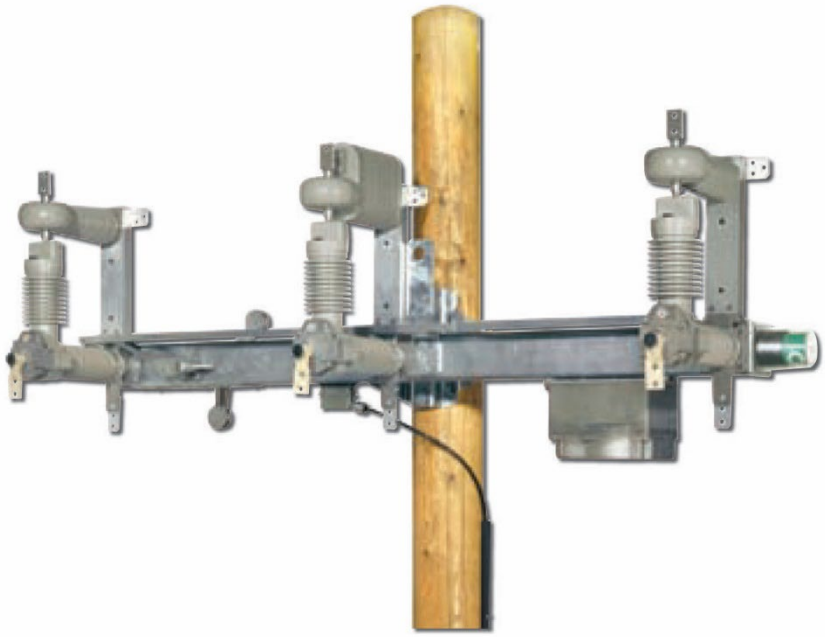
Figure 4.2a. Load Interrupter Switch, Horizontal

Stock No.	S&C Electric Catalog No.
014402	148313R2-A1-G35-H-S113

where:

148313R2 =	riser-style, manual, nonelectrical opening
A1 =	wildlife protection
G35 =	shielded control cable in liquid-tight flexible metal-wiring conduit, 35-ft length
H =	High speed
S113	Ground-level disconnect handle with (2) Cypoxy insulators and (1) fiberglass insulating rod

Figure 4.2b. Load Interrupter Switch, Riser-Style (Vertical)



4.3 Control Unit

The control unit manages distribution switches and can automatically sectionalize a feeder based on such factors as overcurrent, loss of voltage, and phase unbalance.

One control unit can automate one switch, and multiple controls can be programmed to communicate with each other using the IntelliTeam SG Automatic Restoration System.

The IntelliTeam SG Automatic Restoration System allows multiple switch controls to work together in teams by using peer-to-peer communication, and quickly transfer load to minimize the number of customers affected by a fault or outage.

The requirements for this control unit were derived from S&C Descriptive Bulletin 768-30, dated July 13, 2009, S&C Specification Bulletin 768-31, dated March 16, 2015, S&C Specification Bulletin 1044-31, dated March 16, 2015, S&C Specification Bulletin 1045-31, dated November 9, 2015 and from the factory direct. Refer to 768-30, 768-31, 1044-31, 1045-31 and the factory for more information.

Stock No.	S&C Electric Catalog No.
013876	6801GPS-A1-F01-H9-JB1-K1-P0-R248-R98-T9-W2

where:

6801GPS =	6801 automatic switch control with GPS module
A1 =	WiFi module with antenna
F01 =	For use with S&C Scada-Mate switch
H9 =	Voltage sensing on one side of switch
JB1 =	Pole mounting, in padlockable corrosion-resistant aluminum enclosure, 18″ W x 24″ H x 91/2″ D
K1 =	Three voltage sensor/three current sensor input configuration
P0 =	DNP 3.0 communication protocol
R248 =	RuggedCom RS9000 (an Ethernet switch)
R98 =	RS9000 installed by S&C
T9 =	Factory-installed top-mounted GPS antenna
W2 =	Control from power sensors

Figure 4.3. Control Unit

4.4 Battery Pack

Stock No.	Enersys Catalog No.	Energy +
013875	59100019001	4X0859-0012E

Figure 4.4. Battery Pack, 24 Vdc, 8 Ah

4.5 Ground Strap

Stock No.	S&C Electric Catalog No.
014564	SA-30996

5. Packaging

5.1 General

Pallets shall be designed for movement by either pallet jack or forklift.

The two openings for the pallet jack or forklift shall have a minimum width of 21 in and height of 4 in.

Crates and pallets, including slats, blocking, and wedges, shall be unpainted wood.

5.2 Load Interrupter Switch

Each switch (and ground-level disconnect handle, including pipe and all accessories) shall be packaged in its own crate and delivered on its own pallet.

The outside of each switch crate shall be permanently and clearly marked with the following:

- Manufacturer name or symbol
- SCL purchase order number
- SCL stock number, and manufacturer
- Manufacturer equipment serial number, if applicable

5.3 Control Unit

Control units and control unit battery packs shall be packaged separately.

Each control unit shall be packaged in its own crate and delivered on a pallet.

The outside of each control unit crate shall be permanently and clearly marked with the following:

- Manufacturer name or symbol
- SCL purchase order number
- SCL stock number, and manufacturer
- Manufacturer equipment serial number, if applicable

5.4 Battery Pack

Battery packs shall be individually packaged to prevent damage during shipping, inside storage, and handling prior to use.

Each battery package shall be shipped fully charged.

The outside of each battery package shall be permanently and clearly marked with the following:

- SCL purchase order number
- SCL stock number

Each battery shall be permanently and clearly marked with the following:

- Manufacturer name or symbol
- S&C catalog number
- Date of last charge

6. Shipping

Product may be delivered on enclosed, covered, or flatbed trucks. If switches or control units are delivered on a flatbed truck, product shall be side-loaded.

Because Washington State law requires a 10-in minimum side board when driving a forklift or pallet jack onto the bed of a truck or trailer. Most flatbed trucks or trailers must be side-loaded to ease off loading.

7. Issuance

Unit: EA

8. Sources

1044-31; “S&C IntelliTeam SG Automatic Restoration Software, Software Licensing, Specification Bulletin 104431”; dated March 16, 2015

1044-34; “IntelliTeam SG Automatic Restoration System, Descriptive Bulletin 104434”; dated December 7, 2015

1045-30; “S&C 6801 Automatic Switch Control for Outdoor Pole-Mounted Gear, Descriptive Bulletin 104530”; dated June 2, 2014

1045-31; “S&C 6800 Series Automatic Switch Controls, Specification Bulletin 104531”; dated November 9, 2015

768-30; “Scada-Mate Switching Systems, Outdoor Distribution, 14.5 kV through 34.5 kV”; S&C Descriptive Bulletin, dated July 13, 2009

768-31; “Scada-Mate Switching Systems, Outdoor Distribution, 14.5 kV through 34.5 kV Specifications”; S&C Specification Bulletin, dated March 16, 2015

768-710; “Scada-Mate Switching Systems”; S&C Photo Sheet, dated December 20, 1999

Russo, Dave; SCL Engineer, subject matter expert for 4501.55

SCL Material Standard 2501.55 (renumbered to 4501.55); “29 kV, Three-Phase, Overhead, Scada-Controlled, Distribution Switchgear Systems”

Shetab, Muneer; SCL Standards Engineer and subject matter expert for 4501.55

Shipek, John; SCL Standards Engineer, subject matter expert and originator of 4501.55

www.sandc.com; S&C Electric Company

Appendix. Inactive Stock Items

The following stock items are no longer purchased, however, a number of these switches and control units are currently in operation in the field. This table is provided for informational purposes only.

Stock No.	Description
012658	Remote supervisory controlled (capable), load interrupter switch, upright
012697	Remote supervisory controlled (IntelliTeam capable), load interrupter switch, upright
013250	Remote supervisory controlled ((IntelliTeam capable), load interrupter switch, vertical
012663	Control unit with SCADA-Mate switch software
012698	Control unit with IntelliTeam II system software
013272	Control unit with IntelliTeam SG system software