Control Cable, Multi-Conductor, 600 V

1. Scope

This standard covers the requirements for 600 V, multi-conductor, control cable.

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

Stock No.	Conductor Size (AWG)	Number of Conductors	Common Application
640442	12	2	Control and DC supply circuits
640443	12	3	–
640444	12	4	PT circuits
640447	12	7	Control circuits
640449	12	9	Control circuits
640462	10	2	DC supply circuits
640464	10	4	CT circuits
640467	10	7	–
640469	10	9	Control circuits (long runs)

2. Application

Control cable is suitable for use in AC or DC circuits, in wet or dry locations, for direct burial or in conduit, at a temperature not exceeding 90 degrees C.

Control cable is used in a variety of applications inside substations. See Section 1 for some common applications. Unless there are no other options, design engineers should avoid specifying Stock Nos. 640443 and 640467.

Contact Substation Engineering for “Color Coding Standard on Relay and Control Drawings.” This standard identifies the application for individual conductors within an assembly.

3. Industry Standards

Control cable shall meet the applicable requirements of the following industry standards:

ANSI/NEMA WC 57-2004/ICEA S-73-532; "Standard for Control, Thermocouple Extension and Instrumentation Cables"; December 20, 2004

ASTM B8–04; "Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft"

ASTM B33-04; "Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes"

NEMA WC 26-2008 (EEMAC 201-2008); "Binational Wire and Cable Packaging Standard"

ICEA T-29-520; "Vertical Cable Tray Flame Tests @ 210,000 BTU"; January 1, 1986

UL Standard 44; "Standard for Safety - Thermoset-Insulated Wires and Cables"; Underwriters Laboratories Inc.; May 13, 2002

UL Standard 1277; "Standard for Safety - Electrical Power and Control Tray Cables with Optional-Fiber Members"; 4th Edition; Underwriters Laboratories Inc.; November 14, 2001

UL Standard 1685; "Standard for Safety – Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables," 3rd Edition; Underwriters Laboratories Inc.; April 25, 2007

4. Construction

4.1 General

Unless indicated otherwise, all values cited below should be consistent with industry standards; they are repeated here for the convenience of the reader.

4.2 Conductor

Conductor shall have the following attributes:

Attribute	Requirements	Reference
Metal	Tinned copper	ASTM B33
Stranding	Concentric or unilay	ASTM B8
Stranding subtype	Compressed	ASTM B8, Section 11
Class	B or C	ASTM B8, Table 1
Number of strands	7 or 19	ASTM B8, Table 1
Temper	Soft drawn	ASTM B8
Lay	Left-hand	ASTM B8, Section 5

Number and size of conductors shall be according to Section 1 of this standard.

4.3 Insulation

Insulation shall be flame retardant.

Insulation shall have the following attributes:

Attribute	Requirements	Reference
Material	Crosslinked polyethylene (XLPE) type II (thermoset)	ICEA S-73-532, Table 3-2
Type	XHHW-2	UL 44, Table 5.1
Operating temperature, maximum	90°C	UL 44, Table 5.1
Voltage rating	600 V	ICEA S-73-532, Table 3-1 and UL 44, Table 5.1
Thickness		
Minimum	0.027 in	ICEA S-73-532, section 3.3 and UL 44, Table 15.3
Nominal	0.030 in	ICEA S-73-532, Table 3-1 and UL 44, Table 15.3

4.4 Shielding and Covering

Metallic shielding is not required or desired.

Jacket shall be a low-smoke, halogen-free extruded material meeting the requirements of ICEA S-73-532, Section 7.1.6 for Thermoset Type II (moisture resistant) and UL 1685.

Jacket shall be flame retardant.

Jacket shall be moisture resistant.

Jacket for Stock Nos. 640442, 640443, 640444, and 640462 shall have the following attributes:

Requirements		Reference
Thickness:		
Minimum average	0.045 in	ICEA S-73-532, section 4.2.1 and UL 1277, Table 11.3
Minimum point	0.036 in	ICEA S-73-532, section 4.2.1 and UL 1277, Table 11.3

Jacket for Stock Nos. 640447, 640449, 640464, 640467, and 640469 shall have the following attributes:

Requirements		Reference
Thickness:		
Minimum average	0.060 in	ICEA S-73-532, section 4.2.1 and UL 1277, Table 11.3
Minimum point	0.048 in	ICEA S-73-532, section 4.2.1 and UL 1277, Table 11.3

4.5 Assembly, Fillers, and Identification

Individual conductors shall be cabled concentrically with the outer layer having a left-hand lay.

Fillers shall be flame resistant, nonfibrous, and nonhygroscopic.

Cable assembly shall be enclosed in a Mylar binder tape.

A ripcord shall be placed underneath the jacket layer to facilitate stripping.

Identification method shall use base colors with tracers according to the requirements of ICEA S-73-532, Appendix E, section E.3.1., Method 1, Table E-1.

Table 4.5 below conforms to the ICEA S-73-532, Appendix E, section E.3.1., Method 1, Table E-1 and is provided here for the convenience of the reader.

Table 4.5. Conductor Color Identification

Conductor No.	Background or Base Color	First Tracer Color
1	Black	–
2	White	–
3	Red	–
4	Green	–
5	Orange	–
6	Blue	–
7	White	Black
8	Red	Black
9	Green	Black

4.6 Testing and Test Methods

Control cable shall be tested at the factory according to the requirements of ICEA S-73-532, section 6.

Control cable shall be flame tested according to the requirements of ICEA T-29-520.

Control cable shall be listed as Type TC, Sunlight Resistant, and Oil Resistant II according to the requirements of UL 1277.

Control cable shall be listed as Type LS according to the requirements of UL 1685.

5. Tests and Test Reports

Data that establishes compliance with the requirements of ICEA S-73-532, ICEA T-29-520, UL 44, UL 1277, UL 1685, and this standard shall be provided upon request.

6. Marking

The control cable outer surface shall be durably and legibly marked with a print legend throughout its length at a maximum interval of 24 in.

The print legend shall include, but not be limited to, the following information:

- Manufacturer name or symbol
- Number and size of conductors
- Temperature rating, maximum
- Voltage rating
- Year of manufacture
- Type XHHW-2 (UL)
- Type TC-LS (UL)
- Sun Res & Oil Res II (UL)

7. Packaging

Control cable shall be packaged on Class 1, wood reels according to the requirements of NEMA WC 26, Section 2.2.1.

Cable shall be dry when shipped.

Cable ends shall be sealed to prevent the entrance of moisture.

The inner end of the cable shall be brought to the outside of the reel flange and securely fastened.

The inner end shall not be brought out through the reel arbor.

The outer end shall be securely fastened to the inner side of the flange; it is acceptable to use plastic wrap for this purpose.

Control cable shall be packaged according to Table 7.

Each reel shall consist of one continuous, unspliced length.

Each reel shall be legibly marked with the following information:

- Manufacturer identification
- Product description
- Shipping length of cable on reel
- Gross weight
- Tare weight
- Net weight
- Date of manufacture
- SCL purchase order number
- SCL stock number

Cable shall be covered with a layer of protective plastic wrap.

Table 7. Control Cable Packaging

Stock No.	Conductor Size, AWG	Number Conductors	Nominal Length per Reel (ft)	Maximum Reel Diameter (in)	Maximum Reel Traverse (in)
640442	12	2	2,500	30	17
640443	12	3	2,500	30	17
640444	12	4	2,500	30	23
640447	12	7	2,500	36	23
640449	12	9	2,500	40	28
640462	10	2	2,500	30	23
640464	10	4	2,500	36	23
640467	10	7	2,500	40	28
640469	10	9	2,500	40	28

8. Issuance

Stock Unit: FT

9. Approved Manufacturers

			Part Nos.		
Stock No.	**Conductor Size (AWG)**	**Number of Conductors**	**Prysmian (formerly Draka Cableteq USA)**	**Omni Cable/ Houston Wire**	**Service Wire Co.**
640442	12	2	400375	12-02LSE1/HW170 01202	TCNH12/2K1T
640443	12	3	400419	12-03LSE1/HW170 01203	TCNH12/3K1T
640444	12	4	400269	12-04LSE1/HW170 01204	TCNH12/4K1T
640447	12	7	400270	12-07LSE1/HW170 01207	TCNH12/7K1T
640449	12	9	400278	12-09LSE1/HW170 01209	TCNH12/9K1T
640462	10	2	400427	10-02LSE1/HW170 01002	TCNH10/2K1T
640464	10	4	400252	10-04LSE1/HW170 01004	TCNH10/4K1T
640467	10	7	400428	10-07LSE1/HW170 01007	TCNH10/7K1T
640469	10	9	400429	10-09LSE1/HW170 01009	TCNH10/9K1T

10. References

Shipek, John; SCL Standards Supervisor and originator of 6404.11

“Color Coding Standard on Relay and Control Drawings”; Seattle City Light; Engineering Services Division; Drafting Standards and Design Guidelines; 5/29/98