



Cable Specification for Class 2 Circuits

7.4.39.14 Rev. 1

Date: 2007-03-21

Copyright 2007, Canadian Light Source Inc. This document is the property of Canadian Light Source Inc. (CLSI). No exploitation or transfer of any information contained herein is permitted in the absence of an agreement with CLSI, and neither the document nor any such information may be released without the written consent of CLSI.

Canadian Light Source Inc.
101 Perimeter Road
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 0X4 Canada

Signature

Date

Original on File – Signed by:

Author

Neil Johnson

Reviewer #1

Neil Hovdestad

Reviewer #2

Glenn Judkins

Approver

Elder Matias

BLANK PAGE

REVISION HISTORY

<i>Revision</i>	<i>Date</i>	<i>Description</i>	<i>Author</i>
A	2006 Mar 22	Original Draft	Neil Johnson
0	2006-04-06	Issued for use.	Neil Johnson
0A	2007-03-09	Twisted pairs, individual conductors	Neil Johnson
0B	2007-03-21	Comments from Glen Judkins	Neil Johnson
1	2007-03-21	Issued for use.	Neil Johnson

BLANK PAGE

TABLE OF CONTENTS

1.0 Purpose..... 1

2.0 Cable Requirements for class 2 circuits 1

 2.1 General Cable Specification 1

 2.2 Individual conductors..... 1

 2.3 Standard Conductor Insulation Color 2

 2.4 Standard Cable Configurations and Part Numbers 3

 2.5 Standard Single Conductor Size, Color, and Part Numbers..... 4

BLANK PAGE

1.0 PURPOSE

This document provides specifications for Class 2 circuit wiring as defined in the Canadian Electrical Code Part 1 "Safety Standard for Electrical Installations". It is intended as a guideline to facilitate standardization at the Canadian Light Source. There may be cases where different configurations are more suitable, in which case the technically superior cable, which still meets the requirements of the Canadian Electrical Code, should be used.

2.0 CABLE REQUIREMENTS FOR CLASS 2 CIRCUITS

The Canadian Electrical Code (CEC) provides regulations for electrical installations. CEC Section 16 outlines the requirements for Class 2 Circuits. In general, for voltages less than 30 V this involves circuits with a maximum supply of 100 VA. CEC Table 19 lists the types of cable deemed suitable for class 2 circuits. CEC Table 57 lists the allowable ampacities for copper conductors in class 2 circuits, and specifies derating factors which generally need to be applied.

To minimize the need to analyze cable fill and appropriate derating factors, the standard practice at CLS is to assume the maximum derating of 50%. 24 V control circuits are protected by 2 A fuses, which then require #18 AWG conductors.

2.1 GENERAL CABLE SPECIFICATION

- CSA or equivalent approval
- CSA rated CM, CMG, CMX, CMR, CMP, CMH or CLS approved alternate
- CSA rated FT4
- PVC insulation
- Minimum 300 V rated insulation (600 preferable)
- Minimum 60 °C rated insulation
- No. 18 AWG and larger minimum 16 strands/conductor
- No. 19 AWG and smaller minimum 7 strands/conductor
- Tinned conductors
- Gray PVC jacket
- Shielded conductors/cables: aluminized mylar or equivalent shield with drain wire

2.2 INDIVIDUAL CONDUCTORS

- CSA or equivalent approval
- CSA rated TEW or CLS approved alternate
- PVC insulation
- Minimum 300 V CSA rated insulation (600 preferable)
- Minimum 90 °C insulation rating (105 preferable)
- No. 18 AWG and larger minimum 16 strands/conductor
- No. 19 AWG and smaller minimum 7 strands/conductor
- Tinned conductors

2.3 STANDARD CONDUCTOR INSULATION COLORS

For multiconductor cables, conductor colors according to Insulated Cable Engineers Association (ICEA) Color Code Chart 1 and 2/2R in Table 1, depending on the number of conductors, should be used.

Individual conductors are readily available with the first ten colors of Chart 1. If additional colors are required a modified version of chart 2R should be used. Some distributors have striping machines that apply colored bands (typically white or black) to the insulation, providing up to eighteen more combinations. These are listed as the Modified ICEA 2R colors in Table 1.

Twisted pairs should use ICEA Chart 3 colors listed in Table 1..

Table 1: ICEA Based Color Code Charts

ICEA 1	ICEA 2/2R	Modified ICEA 2R	ICEA 3
1 – Black	1 – Black	1 – Black	1 – Black & Red
2 – White	2 – White	2 – White	2 – Black & White
3 – Red	3 – Red	3 – Red	3 – Black & Green
4 – Green	4 – Green	4 – Green	4 – Black & Blue
5 – Brown	5 – Orange	5 – Brown	5 – Black & Yellow
6 – Blue	6 – Blue	6 – Blue	6 – Black & Brown
7 – Orange	7 – White/Black	7 – Orange	7 – Black & Orange
8 – Yellow	8 – Red/Black	8 – Yellow	8 – Red & White
9 – Purple	9 – Green/Black	9 – Purple	9 – Red & Green
10 – Gray	10 – Orange/Black	10 – Gray	10 – Red & Blue
11 – Pink	11 – Blue/Black	11 – Black/White	
12 – Tan	12 – Black/White	12 – Red/White	
	13 – Red/White	13 – Green/White	
	14 – Green/White	14 – Brown/White	
	15 – Blue/White	15 – Blue/White	
	16 – Black/Red	16 – Orange/White	
	17 – White/Red	17 – Yellow/White	
	18 – Orange/Red	18 – Purple/White	
	19 – Blue/Red	19 – Gray/White	
	20 – Red/Green	20 – White/Black	
	21 – Orange/Green	21 – Red/Black	
	22 – Black/White/Red	22 – Green/Black	
	23 – White/Black/Red	23 – Brown/Black	
	24 – Red/Black/White	24 – Blue/Black	
	25 – Green/Black/White	25 – Orange/Black	
		26 – Yellow/Black	
		27 – Purple/Black	
		28 – Gray/Black	

For some purposes the following colors may be used:

- 1 – Black
- 2 – Red
- 3 – Green

2.4 STANDARD CABLE CONFIGURATIONS AND PART NUMBERS

Texcan TXL Cable part numbers are listed. Other equivalent cables are acceptable.

Table 2: CLSI Standard Texcan Multiconductor Cables

Gauge	Conductors	Part Number	Color Code	Voltage	Shield
14	5	52-442-1405	1	600	Y
16	2	52-224-1602	1	600	N
18	2	52-224-1802	1	600	N
18	3	52-224-1803	1	600	N
18	4	52-224-1804	1	600	N
18	5	52-224-1805	1	600	N
18	6	52-224-1806	1	600	N
18	9	52-224-1809	1	600	N
18	15	52-224-1815	2	600	N
18	25	52-224-1825	2	600	N
18	2	52-442-1802	1	600	Y
18	3	52-442-1803	1	600	Y
18	4	52-442-1804	1	600	Y
18	5	52-442-1805	1	600	Y
18	7	52-442-1807	1	600	Y
18	9	52-442-1809	1	600	Y
18	15	52-442-1815	2	600	Y
18	25	52-442-1825	2	600	Y
18	4 pair	52-602-1804	3	600	Y (individual)
20	2	52-224-2002	1	600	N
20	3	52-224-2003	1	600	N
20	5	52-224-2005	1	600	N
20	9	52-224-2009	1	600	N
20	15	52-224-2015	2	600	N
20	25	52-224-2025	2	600	N
20	2	52-442-2002	1	600	Y
20	3	52-442-2003	1	600	Y
20	5	52-442-2005	1	600	Y
20	9	52-442-2009	1	600	Y
20	15	52-442-2015	2	600	Y
20	25	52-442-2025	2	600	Y
22	2	52-224-2202	Blk/Rd	600	N
22	3	52-224-2203	Blk/Rd/Grn	600	N

2.5 STANDARD SINGLE CONDUCTOR SIZE, COLOR, AND PART NUMBERS

General Cable Carol Brand numbers are listed. Other equivalent cables are acceptable. These can be marked with a striping machine to give the additional color combinations listed as Modified IECA 2R in Table 1. White and Black stripes are commonly available.

Table 3: CLSI Standard Solid Color Single Conductor Wire

Color	18 AWG	20 AWG	22 AWG
Black	C2103-01	C2102-01	C2101-01
White	C2103-02	C2102-02	C2101-02
Red	C2103-03	C2102-03	C2101-03
Green	C2103-06	C2102-06	C2101-06
Brown	C2103-08	C2102-08	C2101-08
Blue	C2103-07	C2102-07	C2101-07
Orange	C2103-04	C2102-04	C2101-04
Yellow	C2103-05	C2102-05	C2101-05
Purple	C2103-19	C2102-19	C2101-19
Gray	C2103-10	C2102-10	C2101-10