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Wire Size Guide

When remote fixtures and exit signs are connected to emergency lighting units of less than 50 volts, circuit runs must be sufficient size to maintain a proper operating voltage to all lamps. The maximum allowable voltage drop should not exceed 5%. Proper wire size can be selected from the following table or by use of the following formula:



$$CM = \frac{22 \times W \times L}{.05 \times E^2}$$

CM= Wire size in circular mills
W= Emergency load in watts
L= Length of circuit in feet

E= Line Voltage
22= Constant
.05= Factor for max. allowable voltage drop

		Length of Wire Run (in feet)													
		watts													
	wire size	13	18	25	30	35	50	60	75	100	150	200	250	300	400
6 volts	12	41	30	21	18	15	11	9	8	6	4	—	—	—	—
	10	65	47	32	28	24	17	14	11	9	6	—	—	—	—
	8	110	75	54	45	39	27	22	18	14	9	7	—	—	—
	6	165	120	86	71	62	43	36	29	22	15	11	9	—	—
12 volts	12	165	110	85	71	61	42	35	29	21	14	10	8	—	—
	10	260	190	136	112	97	68	52	45	34	23	17	14	11	—
	8	415	300	215	180	154	108	90	72	54	36	27	21	18	—
	6	660	475	340	285	245	170	140	114	86	57	43	34	28	—
	4	1050	760	540	455	390	275	225	182	137	91	68	55	45	—
24 volts	12	660	440	340	284	244	168	140	116	84	56	40	32	26	21
	10	1040	760	544	448	388	272	208	180	136	92	68	52	44	34
	8	1668	1200	860	720	616	432	360	288	216	144	108	84	72	54
	6	2640	1900	1360	1140	980	680	560	456	344	228	172	136	112	85
	4	4200	3040	2160	1810	1560	1100	900	728	548	364	272	220	180	100
32 volts	12	1160	840	600	500	435	300	250	200	150	100	75	60	50	42
	10	—	1340	960	800	690	480	400	320	240	160	120	96	80	63
	8	—	—	1540	1280	1110	770	640	510	385	255	192	154	128	100
	6	—	—	—	—	1740	1220	1020	815	610	405	305	240	200	163
	4	—	—	—	—	—	—	1620	1300	970	650	485	390	325	260
48 volts	12	—	1899	1367	1139	949	680	—	455	341	227	170	136	113	68
	10	—	—	—	1811	1509	1085	—	724	543	362	271	217	181	108
	8	—	—	—	—	—	1729	—	1152	864	576	432	345	288	172
	6	—	—	—	—	—	—	—	1832	1374	916	687	549	458	274
120 volts	12	14964	—	7792	—	—	3896	—	—	1945	1300	977	720	650	608
	10	23787	—	12367	—	—	6193	—	—	3093	2067	1553	1238	1033	966
	8	37810	—	19705	—	—	9852	—	—	4820	3289	2471	1970	1644	1538
	6	60159	—	31327	—	—	15663	—	—	7822	5229	3929	3132	2614	2445



BATTERY UNIT CAPACITY CHART



Battery Unit	Wattage Capacity				
	0.5 hr	1 hr	1.5 hrs	2 hrs	4 hrs
6V - 36W	36	21	15	12	6
6V - 72W	72	42	30	24	12
6V - 108W	108	63	45	36	18
6V - 180W	180	105	75	60	30
12V - 36W	36	21	15	12	6
12V - 72W	72	42	30	24	12
12V - 100W	100	58	42	33	17
12V - 144W	144	84	60	48	24
12V - 200W	200	117	83	67	33
12V - 250W	250	144	100	83	42
12V - 288W	288	168	120	96	48
12V - 360W	360	210	150	120	60
24V - 144W	144	84	60	48	24
24V - 200W	200	117	83	67	33
24V - 288W	288	168	120	96	48
24V - 350W	350	200	144	120	60
24V - 432W	432	250	180	144	72
24V - 550W	550	320	230	180	90
24V - 720W	720	420	300	240	120

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Electrical Code

Extracts from the Canadian Electrical Code



Section 46 – Emergency Systems, Unit Equipment, and Exit Signs

46-000 Scope

- 1) This section applies to the installation, operation, and maintenance of emergency systems and unit equipment intended to supply illumination and to emergency systems intended to supply power, in the event of failure of the normal supply, where required by the National Building Code of Canada.
- 2) The Section applies to the wiring of exit signs.
- 3) The requirements of this section are supplementary to, or amendatory of, the general requirements of this Code..

46-100 Capacity

Emergency systems and unit equipment shall have adequate capacity and rating to ensure the satisfactory operation of all connected equipment when the principal source of power fails.

46-102 Instructions

- 1) Complete instructions for the operation and care of an emergency system or unit equipment which shall specify testing at least once every month to ensure security of operation shall be posted on the premises in a frame under glass.
- 2) The form of instructions and their locations shall be in compliance with the National Building Code of Canada.

46-104 Maintenance

- 1) Where batteries are used as a source of supply, the batteries shall be kept :
 - a) in proper condition, and
 - b) fully charged at all times.

46-106 Arrangement of Lamps

- 1) Emergency lights shall be so arranged that the failure of any one lamps will not leave in total darkness the area normally illuminated by it.
- 2) No appliance or lamp, other than those required for emergency purposes, shall be supplied by the emergency circuits.

ELECTRICAL CODE



46-108 Method of Wiring (See Appendices B and G)

- 1) Except as permitted by Subrule (2) and Rule 46-304(3), all conductors of systems, equipment, and devices installed in accordance with this Section shall be :
 - a) installed in metal raceway of the totally enclosed type or
 - b) incorporated in a cable, having a metal armour or sheath or
 - c) installed in rigid nonmetallic conduit where embedded in at least 50mm of masonry or poured concrete or
 - d) installed in electrical nonmetallic tubing where embedded in at least 50mm of masonry or poured concrete.
- 2) Conductors installed in buildings of combustible construction in accordance with Rules 12-506 to 12-520 shall be permitted to be incorporated in a nonmetallic sheathed cable.
- 3) Conductors of emergency systems and conductors between unit equipment and remote lamps shall be kept entirely independent of all other conductors and equipment and shall not enter a fixture, raceway, box, or cabinet occupied by other conductors except where necessary :
 - a) in transfer switches and
 - b) in exit signs and emergency lighting fixtures supplied from two sources.

46-200 Emergency Systems (See Appendix B)

- 1) Rules 46-202 to 46-210 apply to emergency systems from central standby supplies only.

46-202 Supply (See Appendix G)

- 1) The emergency supply shall be a standby supply consisting of :
 - a) a storage battery of the rechargeable type having sufficient capacity to supply and maintain at not less than 91% of full voltage the total load of the emergency circuits for the time period required by the National Building Code of Canada, but in no case less than 1/2 h, and equipped with a charging means to maintain the battery in a charge condition automatically or
 - b) a generator driven by a dependable prime mover.
- 2) Automobile batteries and lead batteries not of the enclosed glass-jar type are not considered suitable under Subrule (1) and shall only be used where a deviation has been allowed in accordance with Rule 2-030.
- 3) Where a generator is used, it shall be :
 - a) of capacity sufficient to carry the load and
 - b) arranged to start automatically without failure and without undue delay upon the failure of the normal power supply of the equipment connected to this generator.

Electrical Code

Extracts from the Canadian Electrical Code



46-204 Control

- 1) The current supply for emergency systems shall be controlled by automatic transfer equipment that energizes the emergency system upon failure of the normal current supply and that is accessible only to authorized persons.
- 2) An automatic light-actuated device, approved for the purpose, shall be permitted to be used to control separately the lights located in an area that is adequately illuminated during daylight hours without the need for artificial lighting.

46-206 Overcurrent Protection

- 1) No device capable of interrupting the circuit, other than the overcurrent device for the current supply of the emergency system, shall be placed ahead of the branch circuit overcurrent devices.
- 2) The branch circuit overcurrent devices shall be accessible only to authorized persons.

46-208 Audible and Visual Trouble-Signal Devices

- 1) Every emergency system shall be equipped with audible and visual trouble-signal devices that give warning of derangement of the current source or sources and that indicate when the emergency load is supplied from batteries or generators.
- 2) Audible trouble signals shall be permitted to be wired so that :
 - a) they can be silenced, but a red warning or trouble light shall continue to provide the protective function and
 - b) when the system is restored to normal, the audible signal will :
 - (i) sound, thus indicating the necessity of restoring the silencing switch to its normal position or
 - (ii) reset automatically so as to sound for any subsequent operation of the emergency system.

46-210 Remote lamps

Lamps shall be permitted to be mounted at some distance from the current supply that feeds them, but the voltage drop in the wiring feeding such lamps shall not exceed 5% of the applied voltage.

46-300 Unit Equipment (see Appendix B)

Rules 46-302 to 46-306 apply to individual unit equipment for emergency lighting only.

46-302 Mounting of Equipment

Each unit equipment shall be mounted with the bottom of the enclosure not less than 2 m above the floor wherever practicable.

ELECTRICAL CODE



46-304 Supply Connections

- 1) Receptacles to which unit equipment is to be connected shall be not less than 2,5 m above the floor, where practicable, and shall be not more than 1,5 m from the location of the unit equipment.
- 2) Unit equipment shall be permanently connected to the supply if:
 - a) the voltage rating exceeds 250V or
 - b) the marked input rating exceeds 24 A.
- 3) Where the ratings in Subrule (2) are not exceeded, the unit equipment shall be permitted to be connected using the flexible cord and attachment plug supplied with the equipment.
- 4) Unit equipment shall be installed in such a manner that it will be automatically actuated upon failure of the power supply to the normal lighting in the area covered by that unit equipment.

46-306 Remote lamps (see Appendix B)

- 1) The circuit conductors to remote lamps shall be of such size that the voltage drop does not exceed 5% of the marked output voltage of the unit equipment, or such other voltage drop for which the performance of unit equipment is certified when connected to the specific remote lamp being installed.
- 2) Remote lamps shall be suitable for remote connection and shall be included in the list of lamps provided with the unit equipment.
- 3) The number of lamps connected to a single unit equipment shall not result in a load in excess of the watts output rating marked on the equipment for the emergency period required by the National Building Code of Canada, and the load shall be computed from the information in the list of lamps referred to in Subrule (2).

46-400 Exit signs (See Appendices B and G)

- 1) Where exit signs are connected to an electrical circuit, that circuit shall be used for no other purpose.
- 2) Notwithstanding Subrule (1), exit signs shall be permitted to be connected to a circuit supplying emergency lighting in the area where these exit signs are installed.
- 3) Exit signs in Subrule (1) and (2) shall be illuminated by an emergency power supply where emergency lighting is required by the National Building Code of Canada.

Building Code

Extracts from the National Building Code of Canada - 2005



3.2.6. Additional Requirements for High Buildings (see Appendix B)

3.2.6.1. Application

- 1) This Subsection applies to a building
 - a) of Group A, D, E or F major occupancy classification that is more than
 - (i) 36 m high, measured between grade and the floor level of the top storey,
or
 - (ii) 18 m high, measured between grade and the floor level of the top storey, and in which the cumulative or total occupant load on or above any storey above grade, other than the first storey, divided by 1.8 times the width in metres of all exit stairs at that storey, exceeds 300,
 - b) containing a Group B major occupancy in which the floor level of the highest storey of that major occupancy is more than 18 m above grade,
 - c) containing a floor area or part of a floor area located above the third storey designed or intended as a Group B, Division 2 occupancy, and
 - d) containing a Group C major occupancy whose floor level is more than 18 m above grade.

3.2.7. Lighting and Emergency Power Systems

3.2.7.3. Emergency Lighting

- 1) Emergency lighting shall be provided to an average level of illumination not less than 10 lx at floor or tread level in
 - a) exits,
 - b) principal routes providing access to exit in open floor areas and in service rooms,
 - c) corridors used by the public,
 - d) corridors serving patients' sleeping rooms,
 - e) corridors serving classrooms,
 - f) underground walkways,
 - g) public corridors,
 - h) floor areas or parts thereof where the public may congregate
 - i) in Group A, Division 1 occupancies, or
 - ii) in Group A, Division 2 and 3 occupancies having an occupant load of 60 or more,
 - i) floor areas or parts thereof of daycare centres where persons are cared for, and
 - j) food preparation areas in commercial kitchens.
- 2) Emergency lighting to provide an average level of illumination of not less than 10 lx at floor or catwalk level shall be included in a service space referred to in Sentence 3.2.1.1.(8).
- 3) The minimum value of the illumination required by Sentences (1) and (2) shall be not less than 1 lx.
- 4) In addition to the requirements of Sentences (1) to (3), the installation of battery-operated emergency lighting in health care facilities shall conform to the appropriate requirements of CSA Z32, "Electrical Safety and Essential Electrical Systems in Health Care Facilities."

3.2.7.4. Emergency Power for Lighting

- 1) An emergency power supply shall be
 - a) provided to maintain the emergency lighting required by this Subsection from a power source such as batteries or generators that will continue to supply power in the event that the regular power supply to the building is interrupted, and
 - b) so designed and installed that upon failure of the regular power it will assume the electrical load automatically for a period of
 - i) 2 h for a building within the scope of Subsection 3.2.6.,
 - ii) 1 h for a building of Group B major occupancy classification that is not within the scope of Subsection 3.2.6., and
 - iii) 30 min for a building of any other occupancy. (See Appendix A.)
- 2) If self-contained emergency lighting units are used, they shall conform to CSA C22.2 No. 141, "Unit Equipment for Emergency Lighting."

3.4.5. Exits

3.4.5.1. Exit Signs

- 1) Every exit door shall have an exit sign placed over or adjacent to it if the exit serves
 - a) a building more than 2 storeys in building height,
 - b) a building having an occupant load of more than 150, or
 - c) a room or floor area that has a fire escape as part of a required means of egress.
- 2) Every exit sign shall
 - a) be visible from the exit approach,
 - b) have the word EXIT or SORTIE displayed in plain legible letters, and
 - c) be illuminated continuously while the building is occupied.
- 3) Exit signs shall consist of
 - a) red letters on a contrasting background or contrasting letters on a red background, with the letters not less than 114 mm high and having a 19 mm stroke, if the sign is internally illuminated, and
 - b) white letters on a red background or red letters on a contrasting background that is white or a light tint, with letters not less than 150 mm high and having a 19 mm stroke, if the sign is externally illuminated.
- 4) If illumination of an exit sign is provided from an electrical circuit, that circuit shall
 - a) serve no equipment other than emergency equipment, and
 - b) be connected to an emergency power supply as described in Sentence 3.2.7.4.(1).
- 5) If necessary, the direction of egress in public corridors and passageways shall be indicated by a sign conforming to Sentence (3) with a suitable arrow or pointer indicating the direction of egress.
- 6) Except for egress doorways described in Sentence 3.3.2.4.(4), an exit sign conforming to Sentences (2), (3) and (4) shall be placed over or adjacent to every egress doorway from rooms with an occupant load of more than 60 in Group A, Division 1 occupancies, dance halls, licensed beverage establishments, and other similar occupancies that, when occupied, have lighting levels below that which would provide easy identification of the egress doorway.

Building Code

Extracts from the National Building Code of Canada - 2005



3.4.5.2. Signs for Stairs and Ramps at Exit Level

- 1) In a building more than 2 storeys in building height, any part of an exit ramp or stairway that continues up or down past the lowest exit level shall have a posted sign clearly indicating that it does not lead to an exit.

9.9.10. Signage

9.9.10.1. Application

- 1) This Subsection applies to all exits except those serving not more than one dwelling unit.

9.9.10.2. Visibility of Exits

- 1) Exits shall be located so as to be clearly visible or their locations shall be clearly indicated.

9.9.10.3. Required Exit Signs

- 1) Every exit door in a building that is 3 storeys in building height or in a building having an occupant load greater than 150 shall have an exit sign over it or adjacent to it.

9.9.10.4. Exit Direction Signs

- 1) Exit direction signs shall be placed in corridors and passageways where necessary to indicate the direction of exit travel.

9.9.10.5. Visibility of Exit Signs

- 1) Exit signs shall be installed so as to be visible from the exit approach and shall be illuminated continuously while the building is occupied.

9.9.10.6. Lettering

- 1) Exit signs shall have the word EXIT or SORTIE in red letters on a contrasting background or a red background with contrasting letters when the sign is internally lighted, and white letters on a red background or red letters on a white background when the sign is externally lighted.
- 2) Lettering referred to in Sentence (1) shall be made with not less than 19 mm wide strokes and be not less than 150 mm high when the sign is externally lighted, and not less than 114 mm high when the sign is internally lighted.

9.9.10.7. Illumination

- 1) Illumination of exit signs required in Article 9.9.10.3. shall conform to Sentences 9.9.11.3.(2) and (3).
- 2) Where illumination of exit signs required in Article 9.9.10.3. is provided by an electrical circuit, that circuit shall serve no equipment other than emergency equipment.

9.9.10.8. Signs for Stairs and Ramps at Exit Level

- 1) In buildings that are 3 storeys in building height, any part of an exit ramp or stairway that continues up or down past the lowest exit level shall be clearly marked to indicate that it does not lead to an exit, if the portion beyond the exit level may be mistaken as the direction of exit travel.

BUILDING CODE



9.9.11. Lighting

9.9.11.3. Emergency Lighting

- 1) Emergency lighting shall be provided in
 - a) exits,
 - b) principal routes providing access to exit in an open floor area,
 - c) corridors used by the public,
 - d) underground walkways, and
 - e) public corridors.
- 2) Emergency lighting required in Sentence (1) shall be provided from a source of energy separate from the electrical supply for the building.
- 3) Lighting required in Sentence (1) shall be designed to be automatically actuated for a period of at least 30 min when the electric lighting in the affected area is interrupted.
- 4) Illumination from lighting required in Sentence (1) shall be provided to average levels of not less than 10 lx at floor or tread level.
- 5) Where incandescent lighting is provided, lighting equal to 1 W/m² of floor area shall be considered to meet the requirement in Sentence (4).
- 6) Where self-contained emergency lighting units are used, they shall conform to CSA C22.2 No. 141, "Unit Equipment for Emergency Lighting."

Building Code

Extracts from the National Building Code of Canada - 2005



Classification by Group

Examples	Group	Group		
Motion picture theatres	A	1		
Opera houses				
Art Galleries	A	2		
Auditoria				
Bowling alleys				
Churches and similar places of worship				
Club, non-residential				
Community halls				
Court rooms				
Dance halls				
Exhibition halls (other than classified in Group E)				
Gymnasias				
Arenas	A	3		
Rinks	A	4		
Amusement park structures (not elsewhere classified)				
Bleachers	B	1		
Jails				
Penitentiaries	B	2		
Police stations with detention quarters				
Children's custodial homes	C	2		
Convalescent homes				
Hospitals	C			
Infirmaries				
Orphanages				
Apartment Hotels				
Boarding houses				
Clubs, residential				
Colleges, residential				
Convents				
Dormitories				
Banks			D	
Barber and hairdressing shops				
Beauty parlors				
Dental offices				
Dry Cleaning establishments				
Self-service, not using flammable or explosive solvents or cleaners				
Department stores				
Exhibition halls				
Markets				
Bulk plants for flammable liquids	E			
Bulk storage warehouses for hazardous substances				
Television studios admitting a viewing audience				
Theatres, including experimental theatres	A	2		
Lecture halls				
Libraries				
Licensed beverage establishments				
Museums				
Passenger stations and depots				
Recreational piers				
Restaurants				
Schools and colleges, non-residential				
Undertaking premises				
Indoor swimming pools with or without spectator seating	A	3		
Grandstands	A	4		
Reviewing stands				
Stadia	B	1		
Psychiatric hospitals with detention quarters				
Reformatories with detention quarters	B	2		
Prisons				
Psychiatric hospitals without detention quarters	B	2		
Reformatories without detention quarters				
Sanitoria without detention	C			
Nursing homes				
Houses				
Boarding houses				
Monasteries				
Motels				
Schools, residential				
Laundries, self-service			D	
Medical offices				
Offices				
Police stations without detention quarters				
Radio stations				
Small tool and appliance rental and service establishment				
Shops	E			
Stores				
Supermarkets				
Flour mills	E			
Grain elevators				
Lacquer factories				

BUILDING CODE



Examples

	Group	Group
Cereal mills		
Chemicals manufacturing or processing plants		
Distilleries		
Dry Cleaning plants		
Feed Mills		
Aircraft hangars		
Box factories		
Candy plants		
Cold storage plants		
Dry Cleaning establishments not using flammable or explosive solvents for cleaners		
Electrical substations		
Factories		
Freight depots		
Helicopter landing areas on roofs		
Laboratories Workshops		
Creameries		
Factories		
Laboratories		
Power plants		
Salesrooms Workshops		
Mattress factories		
Paint, varnish and pyroxylin product factories	F	1
Rubber processing plants		
Spray painting operations		
Waste paper processing plants		
Mattress factories		
Planning mills		
Printing plants		
Repair garages		
Salesroom		
Services stations	F	2
Storage rooms		
Television studios admitting a viewing audience		
Warehouses		
Wholesale rooms		
Woodworking factories		
Laundries except self-service		
Storage garages including open air		
Parking garages		
Storage rooms	F	3
Warehouses		
Samples display rooms		

FIRE CODE

Extracts from the National Fire Code of Canada - 2005



2.7.3 Safety to Life

2.7.3.1. Installation and Maintenance

- 1) Exit lighting, exit signs and emergency lighting shall be provided in buildings in conformance with the NBC. (See Appendix A.)
- 2) Exit lighting and exit signs shall be illuminated during times when the building is occupied.
- 3) Emergency lighting shall be maintained in operating condition, in conformance with Section 6.5.

Section 6.5 Emergency Power Systems and Unit Equipment for Emergency Lighting

6.5.1.1. Inspection, Testing and Maintenance

- 1) Except as provided in Articles 6.5.1.2. to 6.5.1.5., emergency power systems shall be inspected, tested and maintained in conformance with CAN/CSA-C282, "Emergency Electrical Power Supply for Buildings."
- 2) An emergency electrical power supply system for emergency equipment for health care facilities shall be inspected, tested and maintained in conformance with CAN/CSA-Z32, "Electrical Safety and Essential Electrical Systems in Health Care Facilities." (See Appendix A.)

6.5.1.6. Inspection of Unit Equipment

- 1) Self-contained emergency lighting unit equipment shall be inspected at intervals not greater than one month to ensure that
 - a) pilot lights are functioning and not obviously damaged or obstructed,
 - b) the terminal connections are clean, free of corrosion and lubricated when necessary,
 - c) the terminal clamps are clean and tight as per manufacturer's specifications, and
 - d) the battery surface is kept clean and dry.
- 2) Self-contained emergency lighting unit equipment shall be tested
 - a) at intervals not greater than one month to ensure that the emergency lights will function upon failure of the primary power supply, and
 - b) at intervals not greater than 12 months to ensure that the unit will provide emergency lighting for a duration equal to the design criterion under simulated power failure conditions.
- 3) After completion of the test required in Clause (2)(b), the charging conditions for voltage and current and the recovery period shall be tested to ensure that the charging system is functioning in accordance with the manufacturer's specifications.

6.5.1.7. Inspection of Emergency Lights

- 1) Except as provided in Article 6.5.1.6., emergency lights shall be inspected at intervals not greater than 12 months to ensure that they are functional.

GENERATOR ROOM CODE

Extracts from the
Canadian Standard Association



Section 6.11 Emergency Lighting

6.11.1 General

6.7.1.1. The emergency electrical power supply room and the automatic transfer switch room, where separate, shall be equipped with unit equipment for emergency lighting that complies with CSA C22.2 N^o. 141. Sufficient lamps shall be provided to ensure that a minimum lighting level of 50 lx for 2 h is available at all equipment locations requiring adjustment or service.

Note: This illumination level is significantly greater than that specified in the NBC, which requires 10 lx for egress route emergency lighting.

6.11.2 Emergency lighting units shall be tested in accordance with Table 2 and CSA C22.2 N^o. 141.

6.11.3 The emergency lighting unit shall include

- (a) automatic self-diagnostic circuitry; and
- (b) a transient voltage surge suppressor on the supply side of power to the unit.

