Bulletin 8-6-2
Voltage drop in dwelling units
Rule 8-102

Issued May 2016
Supersedes Bulletin 8-6-1

Scope

(1) Background
(2) Application of voltage drop for branch circuits in dwelling units
  (a) Location of “Supply side of the consumer service”
  (b) Wiring lighting and general use circuits with different wire sizes
  (c) Demand load and voltage drop

(1) Background

Rule 8-102 of the Ontario Electrical Safety Code sets out the maximum voltage drop limits on all types of electrical installations including residential.

New Subrule (3) permits wiring for **lighting and general-use** branch circuits (rated not more than 20 A or 120 V) in **dwelling** units with the conductor length measured from the supply side of the consumer’s service to the furthest point of utilization in accordance with the values in Table 68. The maximum conductor lengths are determined based on a typical distributed residential load on lighting and general-use branch circuits.

This bulletin is addressing the application of the Rule for the most typical installations.

(2) Application of voltage drop for branch circuits in dwelling units

(a) Location of “Supply side of the consumer’s service”

The meter base is considered as the supply connection (demarcation) point when determining voltage drop for feeders and branch circuits within the dwelling unit.

Where the consumer’s distribution panel is located remotely from the meter base, the voltage drop in the feeder between them needs to be considered. Rule 8-102 shall be applied to both the feeder and the branch circuits. The voltage drop in either the feeder from the meter base to the panel or a branch circuit from the panel to the furthest outlet on the circuit cannot exceed 3% and the total voltage drop of the two portions combined cannot exceed 5%, as shown in Diagrams B1 and B2.

Diagram B1 - Where the consumer’s distribution panel is located remote from the meter base

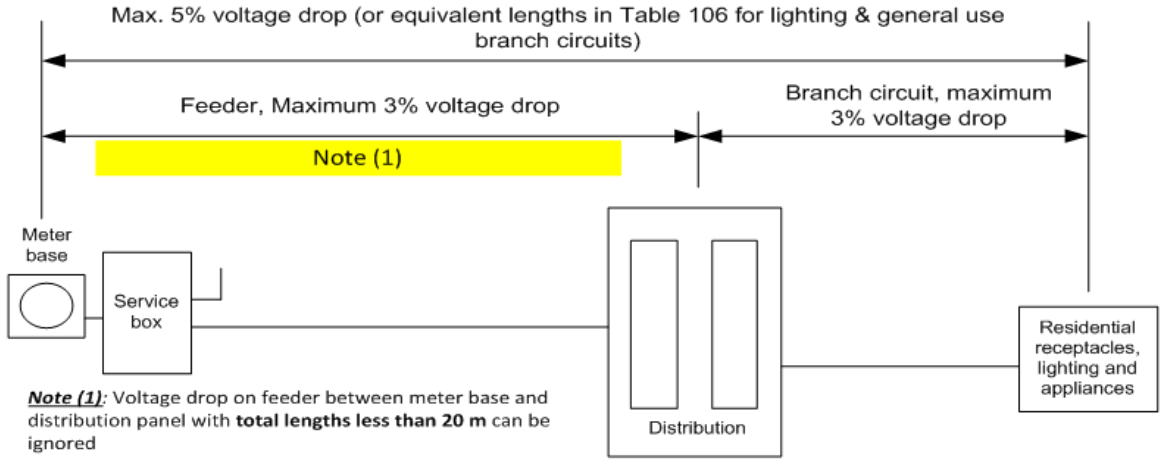
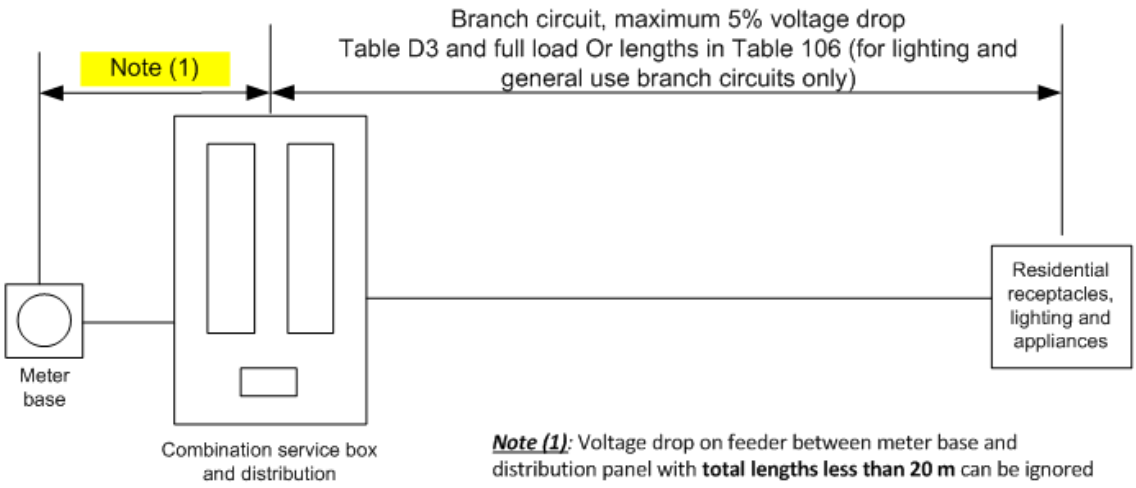
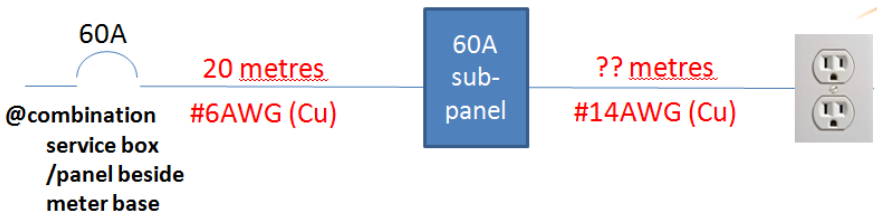


Diagram B2 – Combination service panel



Example 1



Maximum distance from sub-panel to the furthest general use outlet is 38 m.

Answer 1: As the main combination panel is beside the meterbase, and the distance from the combination panel to the sub-panel is 20 m, then lengths in Table 68 can be applied directly to branch circuits from the sub-panel

(b) Wiring lighting and general use circuits with different wire sizes

In some cases, conductors for branch circuits originate from the main consumer's service panel with larger size conductor, and tapped-off to smaller size to feed utilization outlets.

An example for that scenario is the wiring of lighting or a general-use branch circuit with #12 AWG to a junction box, then tap-off from that junction box with #14 AWG to outlets on the circuit. In such cases, and to facilitate complying with the maximum permitted lengths provided in Table 68, the tables below provide guidance to the maximum permitted length with a smaller conductor.

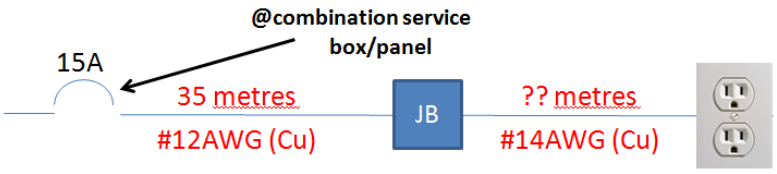
Table B1 – Conductor maximum lengths (m) for lighting and general-use branch circuits with different wire sizes

Length of #12AWG (Cu)	#14 AWG Protected by 15A OC
5	34.9
10	31.7
15	28.6
20	25.4
25	22.3
30	19.1
35	16.0
40	12.9

Length of #10AWG (Cu)	#12 AWG Protected by 20A OC
5	46.9
10	43.7
15	40.6
20	37.4
25	34.3
30	31.1
35	28.0
40	24.8

Length of #10AWG (Cu)	#14 AWG Protected by 15A OC
5	36.0
10	34.0
15	32.1
20	30.1
25	28.1
30	26.1
35	24.2
40	22.2

Example 2:



Answer 2: From Table B1 above, the maximum distance from the junction box to the outlet with #14AWG is **16 m.**

(c) Demand load and voltage drop

Subrule 8-102(1) had been amended to require the voltage drop calculation to be based on the connected load, if known, or the 80% of the rating of the overcurrent protection device protecting the branch circuit or feeder.

As per Appendix B note, new Subrule 8-102(3) and Table 68 are not applicable to the following:

- Household appliances (such as a refrigerator, washing machine, central vacuum, and other receptacles as per Rule 26-722);
- Kitchen receptacles (Rule 26-724(b) and (e));
- Electrical heating and cooking appliances (Rule 26-744); and
- Other specific receptacles installed in dwellings, such as those dedicated for medical devices.

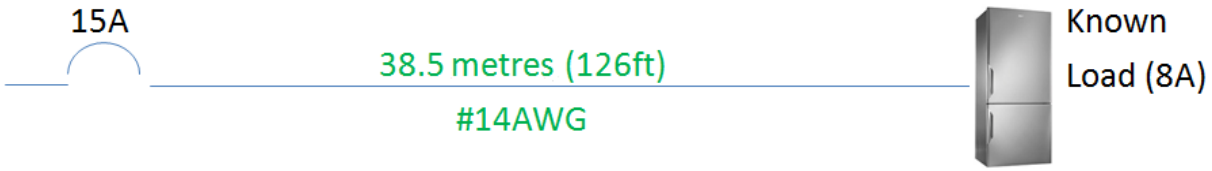
For these branch circuits, Rule 8-102 and Table D3 as set out under the OESC are applicable.

As explained above in item (a) of this bulletin, for applications where distance between meter base and distribution panel < 20 m, a maximum of 5% voltage drop is permitted to be applied for branch circuits.

Table B2 - Maximum conductor length (m) for 120 V branch circuits, for a maximum of 5% voltage drop as obtained from Table D3 for a load located at the end of the circuit and equal to 80% of overcurrent protection rating

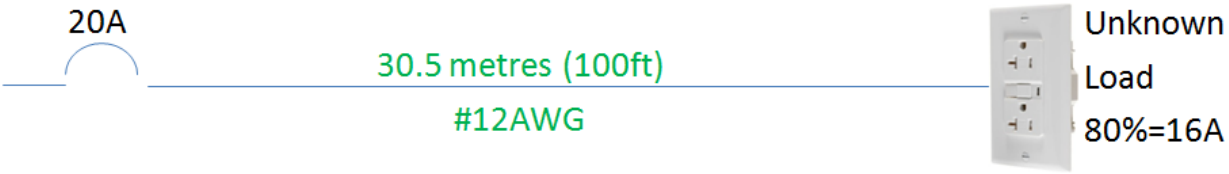
Size AWG (Cu), Rated 90˚C	Overcurrent Protection Setting/Rating			
	15A	**20A**	**25A**	**30A**
	80% Loading of overcurrent protection			
	12A	**16A**	**20A**	**24A**
	Maximum conductor length in meters			
14	26			
12	42	31		
10	67	52	41	32

Example 3:
A 15 A branch circuit wired with #14 AWG copper NMD90 and receptacle supplies a fridge that draws 8.0 A (known load).



Using Table D3 and conductor temperature correction factors:
Maximum conductor length for 5% voltage drop is (7.7 m x 5 x 1.08) = 41.6 m (136.5 ft)

Example 4:
A 20 A branch circuit, wired with #12 AWG copper NMD90, supplies kitchen counter T-slot receptacle, the load is unknown.



Using Table D3 and conductor temperature correction factors:
Maximum conductor length for 5% voltage drop is (6.1 m x 5 x 1.04) = 31.7 m (104 ft)