Bulletin 4-5-15
Identification and coloring of insulated conductors and cables
Rules 4-024, 4-026, and 4-032

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Scope

1) Identification of insulated neutral conductors
2) Identification of insulated bonding conductors
3) Identification of a neutral conductor when changing circuit voltage
4) The use of tape to mark or identify conductors
5) Colour of non-metallic sheathed cable outer jackets
6) Changing colour of multi-conductor cable
7) Marking of phase conductors

1) Identification of insulated neutral conductors

Consumer's services
Rule 4-024 1) requires that all insulated neutral conductors up to and including No. 2 AWG, in any location, be identified by a continuous white covering, or by three continuous white strips along the entire length of the conductor.

Rule 4-026 requires that insulated neutral conductors larger than No. 2 AWG to either be continuously identified or be suitably labelled or marked at each end at the time of installation. Marking shall be permitted to be white paint, white sleeving, white tape, or other equivalent means.

Rule 4-024 4) permits insulated neutrals of any size in multi conductor cables to be permanently identified at each accessible point in the circuit by the use of white paint, white sleeving, white tape, or other equivalent means.

Safety Note
There was a near miss reported where the neutral and a phase conductor were interchanged accidentally at the supply connection point to a consumer's service.

Historically, utilities have used white to identify one of the phase conductors in their systems, which can potentially lead to errors when a consumer's service is connected to a supply authority system.

Although not required by the Code, it is considered good practice to bare the consumer's neutral conductor at the weather head on three phase services to reduce the likelihood of a utility worker treating the white conductor as a phase conductor.

2) Identification of insulated bonding conductors

Rule 4-032 requires that insulated bonding or grounding conductors up to and including No. 2 AWG in size to have a continuous outer finish that is either green or green with one or more yellow stripes.

In sizes larger than No. 2 AWG the conductor is permitted to be labelled or marked in a permanent manner with a green colour or green colour with one or more yellow stripes at each end and at each point where the conductor is accessible. Paint, sleeving, tape, or other equivalent means are acceptable.

3) Identification of a neutral conductor when changing circuit voltage

Where equipment operating at 120 V is installed on a circuit converted from 240 V operation, such as may occur where natural gas water heaters replace electric water heaters, one of the unidentified conductors may be re-used as an identified conductor as per Rule 4-024 4) provided that any exposed portion of the conductor is permanently identified at each accessible point in the circuit by white paint, white sleeving, white tape, or equivalent means.

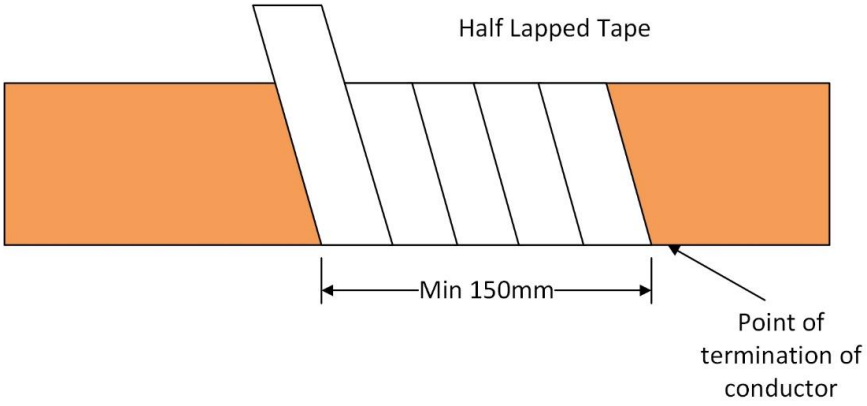
4) The use of tape to mark or identify conductors

Tape is acceptable for identification or marking of conductors if it is applied as per the CSA standard in a half lap wrapped manner. CSA C22.2 No. 197 PVC insulating tape states: “The tape is intended to be applied in layers, each layer being half-lapped...” (See Figure B1)

Note
Where tape is used outdoors for identification of conductors at a supply connection point or similar location, “Weather Resistant” tape shall be used.

Where there are longer lengths of cable at larger enclosures such as switchboards a minimum of 150 mm of conductor shall be identified at the points of connections.

Figure B1 – CSA standard’s requirement for half lap wrapped tape



5) Colour of non-metallic sheathed cable outer jackets

Question
Why are some non metallic sheathed cable (NMSC) jackets coloured blue, some red, some yellow, some white, etc?

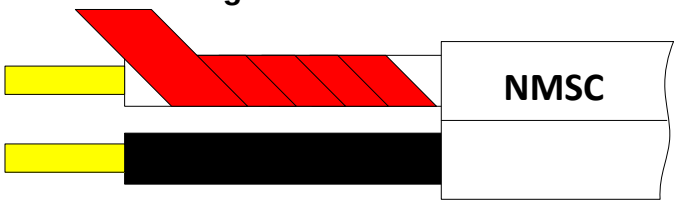
Answer
The colouring of the jacket of non-metallic sheathed cable is not mandated by the Code. Some cable manufacturers are colour coding the jackets of cables intended for different purposes as a marketing tool. White is intended for general purpose circuits, blue is intended for AFCI circuits, yellow for 20 amp kitchen circuits, and red for 240 volt circuits. Inspectors will check the wire size (gauge) rather than the cable jacket colour to ensure the correct wire has been used for the connected load.

6) Changing colour of multi-conductor cable

When installing NMSC or Armoured cable to feed:

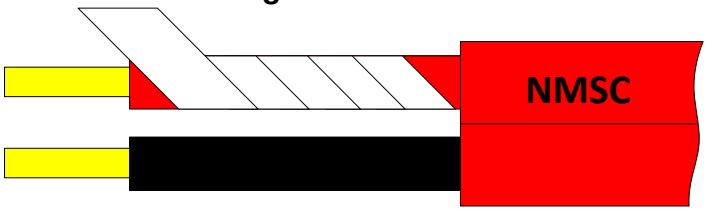
a) 240 V equipment, it is permitted to use a cable with a white and black conductor (OESC Rule 4-032), provided that any exposed portion of the white conductor is permanently changed at each accessible point in the circuit by coloured paint, sleeving, tape, or equivalent means (see Figure B2).

Figure B2



b) 120 V equipment as per OESC 4-032, it is permitted to use a cable with red and black conductor provided that any exposed portion of the coloured conductor is permanently changed at each accessible point in the circuit by white paint, sleeving, tape, or equivalent means (see Figure B3).

Figure B3



Note
When tape is used for marking of conductors it shall be applied as per CSA C22.2 No. 197 PVC insulating tape states: “The tape is intended to be applied in layers, each layer being half-lapped...”

7) Marking of phase conductors

Rule 4-032 3) c) requires that where circuits are colour-coded, 3-phase ac insulated conductors are marked per the following colours:

- Phase A Red
- Phase B Black
- Phase C Blue
- Neutral White

Licensed distributor, licensed transmitter, and licensed generator owned (for high voltage installations) 3-phase ac insulated conductors may be marked per the following colours:

- Phase A Red
- Phase B White or Yellow
- Phase C Blue
- Neutral Bare or Concentric

The difference in marking of phase B increases the probability for marking to be designed or installed incorrectly, especially for portions of installations that contain both consumer and supply authority conductors.

For example, if the low voltage service conductor phase B was incorrectly marked as white and connected to the neutral lug in a service box, there would be risk of shock or failure to equipment.

Rule 4-032 also applies to installations under the scope of Section 36 and Section 75, which may be designed or installed by those that are experienced in work for licensed distributors, licensed transmitters, or licensed generators. Caution should be exercised to ensure that proper marking be applied for compliance with Rule 4-032, with awareness of the different colour marking practices.