Bulletin 10-22-7

Requirements for converting a delta service to a grounded wye service

Rules *4-022*, 4-024, *4-026,10-210, 10-114, 10-604*, 14-012 and 14-102

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Scope

1) Background
2) Prior to conversion
3) Requirements when converting from a delta ungrounded supply to a wye grounded supply
    a) Specific requirements where the neutral is used for metering purposes only
    b) Specific requirements where phase-to-neutral loads are served

1) Background

Supply authorities may decide to convert from a delta ungrounded supply (3 phase, 3 wire) to a wye grounded supply (3 phase, 4 wire). Generally, the customer has no immediate need for *the* supply *authority to provid*e a *4-*w*ire* grounded system and they do not need to increase their capacity. *However, installing a 4 wire system will provide protection against single phase faults that may be within the building by facilitating* t*he overcurrent protection to trip. Another advantage would be that the 4-wire system would allow the customer to utilize equipment that requires phase to neutral voltage such as 347-volt lighting*.

Rule 10-210 requires that the new 3 phase, 4 wire system be connected to a system bonding jumper and a grounding conductor at each individual service. In most cases, with a delta ungrounded supply there will be no system grounded conductor (neutral) run to each consumer's service, as no neutral conductor is installed as part of the existing delta connected consumer's service.

The *supply authorit*y and the customer both generally wish to use the existing installation with as little change as possible. Questions arise about installing the neutral, grounding and overcurrent protection. The following information has been developed as a guide for implementing such conversions. Please note that some of the requirements where the metering is changed and neutral loads are to be installed differ from those where the neutral is used for metering purposes only.

2) Prior to conversion

- Inspect the electrical system being converted, paying particular attention to the status of *any ground fault indication lights* and make sure that they are functioning properly.
- If the *indicating lights show* a fault (indicators of different brightness could be a sign of partial faults), further tests should be conducted to find the source of the

fault. The fault may be further inside the building, outside the building or in another building on the same system.

- *Where indicating lights have not been installed, measuring the voltage of each phase to the non-current carrying conductive parts of the system can be alternatively applied. When the facility is operational, follow established procedures for testing energized equipment in a safe and controlled manner at a point as close to the existing service switch as possible and record the results from the tests. When no faults are present, the three values should be very similar to each other. Any significant differences between the measurements may indicate a problem and should be investigated further.*
- ALL FAULTS MUST BE CLEARED BEFORE THE CONVERSION IS ATTEMPTED.

3) Requirements when converting from a delta ungrounded supply to a wye grounded supply

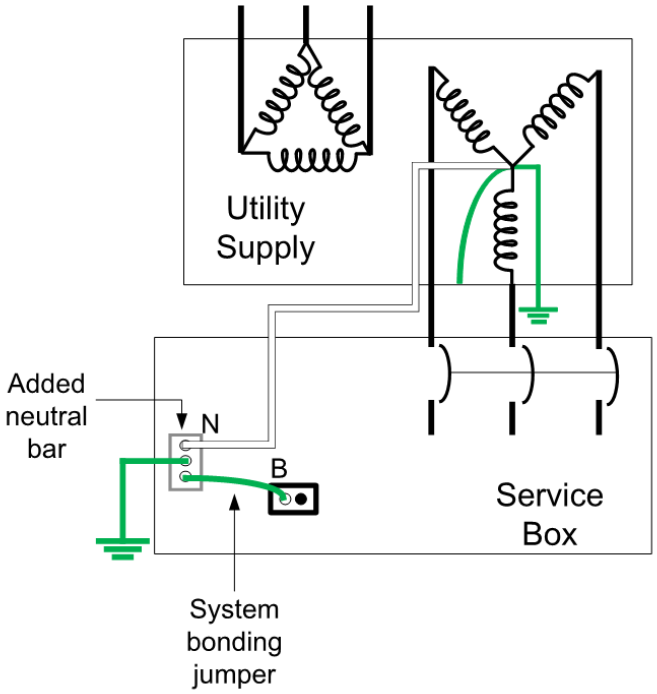
General requirements:

- Where the *supply authority* and customer are agreeable, conversions should be preceded by review of the condition of equipment, grounding and overcurrent protection. In particular, any pre-existing phase to ground faults shall be rectified. Bonding of existing equipment at the main service shall meet the requirements of Rule 10-604
- A new grounded (neutral) conductor must be installed and brought to the building, *whether* the customer has an immediate or perceived need for a neutral *or* not. This connection is essential for clearing faults on the system.
    - The grounded conductor shall not be smaller than that permitted by Rule 10-210, which means sized per Rule 10-616 and Table 16.
    - Adequate provisions shall be made to ensure that the grounded conductor is connected to the service box enclosure by a system bonding jumper and to the grounding conductor, as per Rule 10-210.
    - *There must be space and provision in the service box (main disconnect switch) for the termination and grounding of the neutral conductor see Diagram B1.*
- All ground fault indicators are to be removed and all openings filled.
- The overcurrent protection must be adequate for the available fault current it must withstand *as per Rule 14-012*. HRC fuses are to be used where the available fault current of the system is not known.
- Where the existing service equipment grounding conductor meets the requirements of Rule 10-114 for a system grounding conductor, it can be re-used and shall be terminated so as to ground the new system grounded conductor, as per Rule 10-210.
- Ground fault protection shall be provided as required by Rule 14-102, for solidly grounded systems as follows:
    - Services rated more than 150 V to ground, less than 750 V phase-to-phase and 1000 A or more; OR
    - Services rated 150 V or less to ground and 2000 A or more.
- Where Delta-Wye conversions are completed on facilities that have external

buildings/ structures fed with no continuous bonding back to the main service distribution, Code compliant bonding is required to be installed to ensure that overcurrent protection operates as required (with phases now referenced to ground and no fault return path, a fire hazard could be present where fault current tries to find an alternate path i.e. metallic gas *piping,* communication cable *shielding* etc.).

Note
A notification must be filed and a connection authorization issued by ESA prior to re-energizing the system

Diagram B1 – Termination of the grounded conductor



a) Specific requirements where the neutral is used for metering purposes only

Where the neutral is used for metering purposes only, the following additional requirements apply in addition to "General requirements":

- Service equipment is to be marked in a permanent and conspicuous manner to indicate that no phase to neutral loads are permitted.
- Notwithstanding the requirements of Rules 12-106 and 12-904, the grounded conductor (neutral) is permitted to be installed external to the raceway containing the ungrounded conductors and *should* terminate on the *inside* of the main service box, provided the grounded conductor;
    a) is as close as practical to the raceway containing the ungrounded conductors;
    b) is an aluminum sheathed cable, armoured cable with a non-ferrous

sheath, MI cable or an insulated conductor in a non-metallic raceway; and

c) is installed in compliance with other applicable rules of the code.

- Neutral conductors installed for metering purposes only shall *not extend to any distribution equipment and shall* be permanently identified white in the service box, as per *Rule 4-024 for conductors up to and including No. 2 AWG CU or AL and Rule 4-026 for conductors larger than No. 2 AWG CU or AL.*

b) Specific requirements where phase-to-neutral loads will be served

Where the *service* is changed to a four wire system and phase-to-neutral loads (other than the metering) are to be connected, the following additional requirements apply in addition to “General requirements”:

- A new system bonding jumper shall be installed to bond the grounded conductor to the service box enclosure inside the service box, as per Rule 10-210.
- The *service neutral* grounded conductor shall be installed in the same manner as the ungrounded service conductors. A grounded conductor installed external to the service raceway is not permitted where phase to neutral loads, other than the metering, are installed.