



DAIRYLAND ELECTRICAL INDUSTRIES

ISOLATE. GROUND. PROTECT.

The Variable Threshold Neutral Isolator (VTNI) Technical Literature

INTRODUCTION

The Variable Threshold Neutral Isolator (VT/NI) is designed to prevent, or reduce to an insignificant level, any voltage entering the user's premises from the electric utility's primary neutral line. At the same time, the VT/NI maintains the safety aspects of solidly connected neutrals.

This utility pole mounted device is installed near the distribution transformer, between the primary neutral of the utility system and the secondary neutral of the customer service, as depicted in Figure 1. It acts as a closed tie switch between the primary and secondary neutrals under abnormal overvoltage conditions, and as an open switch under normal conditions. This product meets the requirement of the National Electric Safety Code (NESC) Rule 97D2, which allows for primary to secondary neutral isolation.

HOW THE VARIABLE THRESHOLD NEUTRAL ISOLATOR FUNCTIONS

Dairyland Electrical Industries' Variable Threshold Neutral Isolator (VT/NI) is normally open, voltage triggered switch which performs two key functions.

FUNCTION 1:

Isolation of the customer's neutral/grounding system under normal operating conditions

When properly installed, the VT/NI is an open switch connected between the power utility primary neutral/grounding system and the customer's secondary neutral/grounding system. This effectively isolates these two systems, thereby preventing neutral-to-earth voltage on the customer's service. The VT/NI is the functional equivalent of an isolation transformer for providing this function.

FUNCTION 2:

Reconnection of neutrals/grounding systems during overvoltage conditions

In addition to providing isolation, another main function of the VT/NI is to reconnect the two neutrals/grounding systems any

time the voltage difference between them attempts to exceed a predetermined value for a predetermined time.

Reconnection of the neutrals is important to prevent unsafe voltage from developing between the two grounding systems and to enable the power utility's over-current protection to function properly in the event of a primary-to-secondary failure of the distribution transformer.

The Variable Threshold Neutral Isolator was designed to prevent transient over-voltages from causing the isolating device to transition to its "shorted mode" unless the transient lasts beyond a predetermined time—as illustrated in Figure 3.

This characteristic effectively increases the switching threshold voltage for short duration over-voltage events, yet retains a lower threshold voltage for 60 Hz steady-state conditions.

FEATURES OF THE VT/NI

Energy Requirements

None. This device does not use or require energy. It is totally autonomous.

Number of Operations

Virtually unlimited under maximum 60 Hz current ratings—provided operations are not immediately repetitive.

Automatic Reset

Following an overvoltage event which causes the isolator to transition to its "shorted mode," the device automatically reverts to its voltage blocking (i.e. switch open) mode whenever the current through the terminals goes through zero.



VTNI
Variable Threshold
Neutral Isolator

Fail-safe

Should the neutral isolator be exposed to current in excess of rating so that failure would result, failure will normally occur in the shorted mode, thereby permanently reconnecting the primary and secondary neutral. Due to this possibility, it is suggested that the utility recommend a suitable voltage monitoring device to the customer and assist in its installation.

Field Testing

VT/NI's can readily be tested to verify operability using a standard DC ohmmeter:

• If R (ohmmeter) > 5,000 ohms between terminals, the unit is likely functional.

• If R (ohmmeter) < 1 ohm, unit is not functional, contact factory for repair.

If the unit is installed, remove one lead before conducting this test. If there is any question on whether a unit is functional, contact Dairyland.

Terminals

The VT/NI has two identical terminals; each will accommodate #8 through 1/0 copper ground conductor.

Neutral Connection

The primary and secondary neutral can be connected to either terminal. The isolator is completely bi-directional.

Enclosure

The VT/NI is cased in a light gray non-conducting, non-corrosive, fiberglass reinforced polyester enclosure which is waterproof and moisture proof. The enclosure is preassembled to a non-metallic bracket suitable for mounting on a wood utility pole. Corrosion resistant lag bolts and washers are provided for mounting.

Weight

(7) Pounds (3.2 kg)

Serial Number

All Variable Threshold Neutral Isolators have a separate label with a serial number.

Compliance

The VT/NI complies with the National Electrical Safety Code (NESC) Rule 97D2 and with the REA rule published in Federal Register March 27, 1984, Vol. 49 No. 60 pg. 11619 and 11620, 7CFR paragraph 1729.10. In addition, the VT/NI complies with the 1996 requirements of the Wisconsin Public Service Commission for an isolating device that will also block transient over-voltage as illustrated in Figure 3. Individual state electrical codes may modify and supercede NESC 97D2, altering such aspects as the ground rod spacing. Reference your state's electrical codes.

Other Considerations

Other utilities serving the location where the VT/NI is to be installed may have a parallel interconnection between the

power company primary neutral and the customer secondary neutral, thereby bypassing the isolator. Therefore, all utilities should be consulted when installing a VT/NI to assure the desired isolation between the neutrals is obtained. Telephone and cable TV companies are prime examples of utilities which must be contacted.

The Neutral Isolator is not recommended for use on the secondary side. It is intended for primary-to-secondary isolation only. It is to be installed and maintained by the local power utility as its use and application comes under the National Electric Safety Code (NESC).

Ratings for VT/NI-170-45		
60 Hz AC-RMS Rating		
Amperes	# Cycles I ² t	(Amp ² sec)
3200	1	170 x 10 ³
2400	3	288 x 10 ³
1900	10	602 x 10 ³
1700	30	1445 x 10 ³
Lightning Surge Current Rating Based on a 8 x 20 micro-second waveform		
30,000 Amperes crest		
60 Hz Voltage Rating		
For use on 15kV, 25kV or 35kV Class Distribution Systems		
Switching Threshold Voltage		
Reference Figures 2 & 3		
Operating Temperature		
-40°F to +140°F (-40°C to +60°C)		

OPERATION UNDER 60 HZ CONDITIONS

Figure 2 shows the peak or absolute voltage at which the Variable Threshold Neutral Isolator (VT/NI) transitions to the shorted mode when AC power frequency (50 or 60 Hz) is impressed across the isolator terminals. The transition to the shorted mode starts at 45 VAC peak and increases as the external voltage increases. The "Prospective Peak AC Voltage Impressed Across Isolator Terminals" on the horizontal axis in Figure 2 refers to the peak AC voltage that the external system may attempt to impress across the isolator terminals. As the voltage from the external system is increased, the voltage at which the VT/NI transitions to its shorted mode is also increased as illustrated.

For example, if the prospective peak voltage is 100 volts, the isolator switching threshold voltage increases from 45 volts to 62 volts. In other words, though the system attempts to impress 100 volts, the VT/NI limits the peak voltage to 62 volts. This characteristic results from modifying the original neutral isolator design in order to block transient over-voltages as illustrated in Figure 3. Should there be a special application where a different 60 HZ threshold voltage is required, please

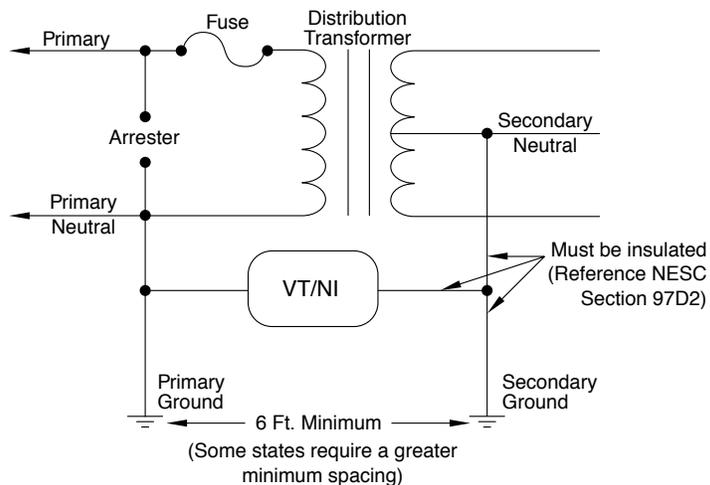
consult Dairyland.

OPERATION UNDER TRANSIENT CONDITIONS

When fast rising voltage (e.g., such as from lightning, an electric fence, etc.) is applied across the isolator terminals, transition to the shorted mode is delayed as illustrated in Figure 3. For example, a voltage transient of 200 microseconds in duration would need to have a magnitude of over 200 volts before the isolator would transition to its “shorted” (i.e. non-blocking) mode. Similarly, a voltage transient of 100 microseconds in duration would have to exceed about 310 volts, and a 1.5 microsecond transient, more than about 530 volts. This characteristic enables the isolator to effectively block short duration transients while maximizing safety for longer duration over-voltage events.

This characteristic, combined with a 60Hz switching threshold voltage of 45 volts peak, increases the range of overvoltage conditions for which the isolator will maintain isolation without sacrificing safety. After the transient event is over, the isolator automatically reverts to its normal, or voltage blocking, mode.

Figure 1: Schematic of VT/NI Installation



Note: Remove bond between secondary neutral and transformer tank.

Figure 2: Switching Threshold Voltage @ 60 Hz

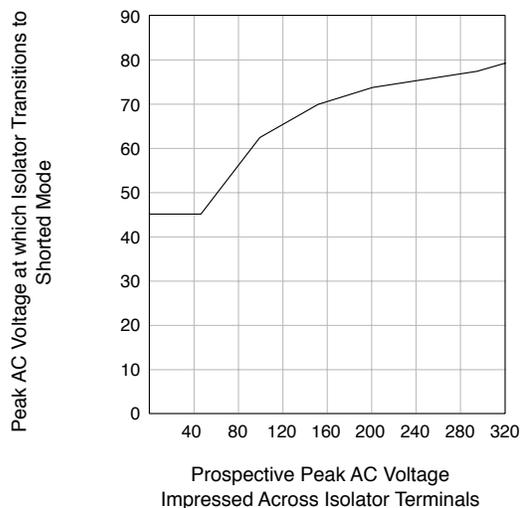


Figure 3: Triggering Characteristics Under Transient Conditions

