

Open Delta or a Wye Connected Voltage Transformer - Which One Should You Choose?

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There are two different methods of configuring voltage transformers (VT) in a three-phase medium-voltage circuit and this has always caused confusion over which is the correct application. This Technical Brief will explain the advantages and disadvantages of the two designs to provide guidance in making the appropriate selection.

The open delta voltage transformer configuration consists of two (2) double bushing VTs connected as shown in Figure 1. The wye voltage transformer configuration consists of three (3) single bushing VTs and is configured such that one end of the primary bushing is connected to the primary circuit and the other end is tied to the common neutral point; which is then connected to ground. See Figure 2.

Most of the medium voltage applications prefer the wye connected VTs. However there are medium voltage applications with balanced three phase loads where the open delta connected VTs are preferred.

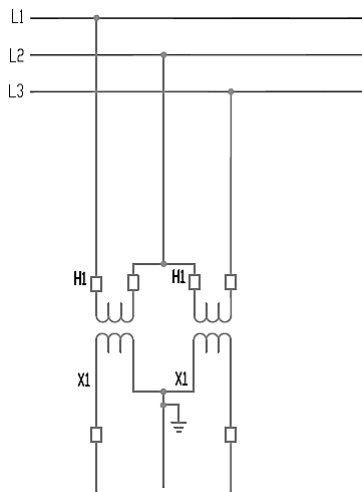


Figure 1: Open Delta VT Connection

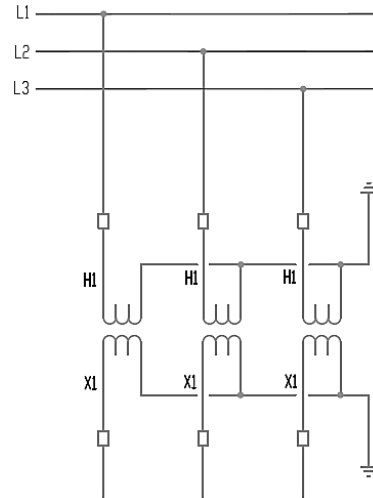


Figure 2: Wye VT Connection

The following Table shows the functional differences between open delta and wye VT connections. This information will determine the appropriate configuration for your application.

Open Delta VTs (2 VTs)	Wye VTs (3 VTs)
VT primary monitors only the line-to-line voltages	VT primary monitors only the line-to-neutral voltages
VT secondary can only monitor line-to-line voltages	VT secondary can monitor line-to-line and line-to-neutral voltages

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VT secondary voltages can only be 120V line-to-line	VT secondary voltages can be 208V or 120V line-to-line and 120V or 69V line-to-neutral respectively depending on the VT ratio.
Only works with 3 phase 3 wire systems	May be applied to 3 phase 3 wire systems or 3 phase 4 wire systems
Does not provide any voltage for ground directional sensing	Provides polarizing voltage for ground directional sensing
Since B phase is grounded on the secondary side of the VT, only A and C phase measurements are in-phase.	Voltages measured on the secondary side of the VT are in-phase with the individual phase voltages.
Very low possibility of ferroresonance.	Possibility of ferroresonance when applied on an ungrounded or high impedance power systems. Ferroresonance may be eliminated by using a single primary wye with dual secondary VTs where one VT secondary set is wye connected and the other VT secondary set is a broken delta
Can only detect line faults.	Can detect both line and ground faults
Allows positive and negative sequence components Blocks the zero sequence components.	Allows all three sequence components (positive, negative and zero). Zero sequence voltage ($3V_0$) is required for directional sensing applications.
Requires line-to-line rated VTs irrespective of the system grounding.	May use line-to-line or line-to-neutral rated VTs depending on the system grounding.



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