



# Neutral Directional Overcurrent Element Polarization in the F60

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## DESCRIPTION

The Neutral Directional Overcurrent element uses zero-sequence current ( $I_0$ ) for fault direction discrimination and zero-sequence voltage ( $V_0$ ) or ground current ( $I_G$ ), or both, for polarizing. The ground current transformer must be connected between the ground and neutral point of an adequate local source of ground current. An adequate source of ground current is a ground connection through which the ground current flows always from ground to the neutral point of the system when the current flows to the fault.

## EXAMPLES

1. The current in the neutral of a wye-grounded-delta power transformer can be used as a polarizing source, as the current is always flowing toward the transformer neutral when there is a fault in the system on the wye side of the transformer. The reliability of a single transformer bank as a polarizing source should be considered, since it will be out of service occasionally. Polarizing current for paralleled CTs in the grounded neutrals of two or more transformer banks can be considered sufficiently reliable if the banks have separate circuit breakers so that one bank will always be in service.



NOTE

When the system includes paralleling transmission lines mutually coupled the mutual impedance affects the magnitude of ground fault currents and can result in incorrect directional sensing. In these situations a thorough analysis of the system is necessary to determine the suitability of the ground source for directional polarization.

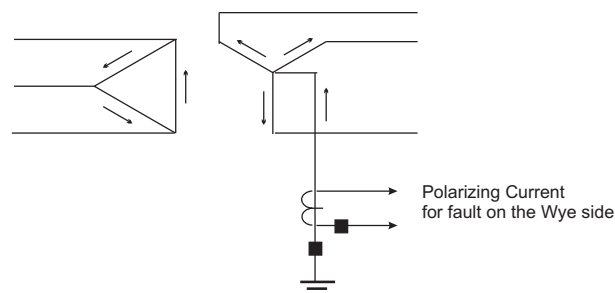
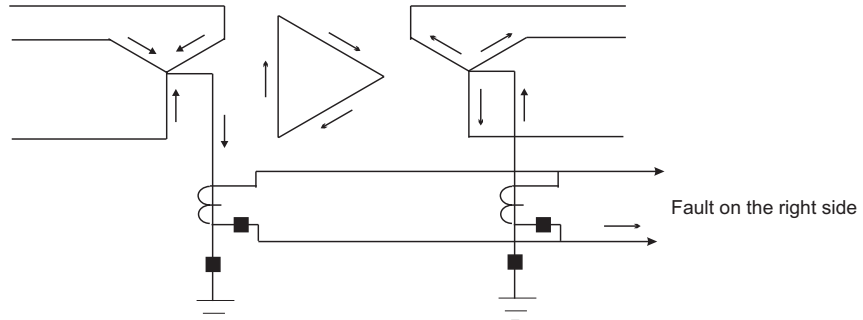


FIGURE 1. Polarizing Current for Paralleled CTs Example 1

2. With a three winding wye-delta-wye power transformer, polarizing CTs should be put in the grounded neutrals of both wye windings and paralleled. The ratios of these two CTs should be inversely proportional to the voltage ratings of the wye windings (if only one wye winding is grounded, the CT installed on the grounded neutral can be used for polarizing).



**FIGURE 2. Polarizing Current for Paralleled CTs Example 2**

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3. As an alternative to the neutral CTs with either two or three winding transformers, a single CT located in the delta winding may be used if these windings do not supply external load or are not connected to a generating source. If there are external connections to the delta, three CTs are required, one in each of the three windings. These CTs should be paralleled in such a way that their output is proportional to 3 times the zero (phase) sequence component of current circulating in the delta when a ground fault occurs (the positive and negative sequence currents will cancel out).
4. Autotransformers should not be used for current polarizing without thorough analysis because the neutral current for a low voltage fault may be reversed from the neutral current for a high voltage fault. Infrequently, the distribution of fault currents is such that a neutral CT may be used. However the conditions might change as system changes are made.

Autotransformer banks with a delta tertiary can use CT's in delta winding for polarizing, as outlined in the previous case (#3).