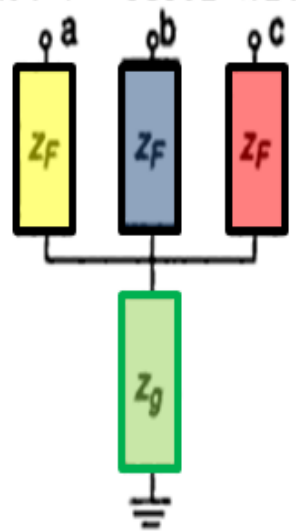



THREE PHASE FAULT WITH & WITHOUT GROUND FAULT

Type of Fault	Three-Phase Components		Symmetrical Components	
	$Z_F^{a,b,c}$	$Y_F^{a,b,c}$	$Z_F^{0,1,2}$	$Y_F^{0,1,2}$
 <p>Three-Phase-to-Ground</p>	$\begin{bmatrix} z_F + z_g & z_g & z_g \\ z_g & z_F + z_g & z_g \\ z_g & z_g & z_F + z_g \end{bmatrix}$	$\frac{1}{3} \begin{bmatrix} y_t + 2y_F & y_t - y_F & y_t - y_F \\ y_t - y_F & y_t + 2y_F & y_t - y_F \\ y_t - y_F & y_t - y_F & y_t + 2y_F \end{bmatrix}$ <p style="text-align: center;">where $y_t = \frac{1}{z_F + 3z_g}$</p>	$\begin{bmatrix} z_F + 3z_g & 0 & 0 \\ 0 & z_F & 0 \\ 0 & 0 & z_F \end{bmatrix}$	$\begin{bmatrix} y_0 & 0 & 0 \\ 0 & y_F & 0 \\ 0 & 0 & y_F \end{bmatrix}$ <p style="text-align: center;">where $y_0 = \frac{1}{z_F + 3z_g}$</p>
 <p>Three-Phase</p>	Not defined	$\frac{y_F}{3} \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix}$	$\begin{bmatrix} \infty & 0 & 0 \\ 0 & z_F & 0 \\ 0 & 0 & z_F \end{bmatrix}$	$y_F \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

As expected for a balanced and symmetrical short-circuit fault, the sum of the three-phase currents $I_R + I_Y + I_B$ is equal to zero hence the net fault current flowing into earth is zero. Similarly, the sum of the three-phase voltages $V_R + V_Y + V_B$ is equal to zero.

The case of a solid or bolted three-phase to earth short-circuit fault is obtained by setting $Z_F = 0$.