ETAP IEC Short-Circuit

The ETAP V&V process for the IEC Short-Circuit program has over 1100 test case scenarios that are run before each ETAP release. The following cases are excerpts from the Short-Circuit IEC 3-phase and unbalanced short-circuit results.

Short-Circuit IEC Comparison Case # 1

Comparison of ETAP Short-Circuit IEC Calculations against Published Example

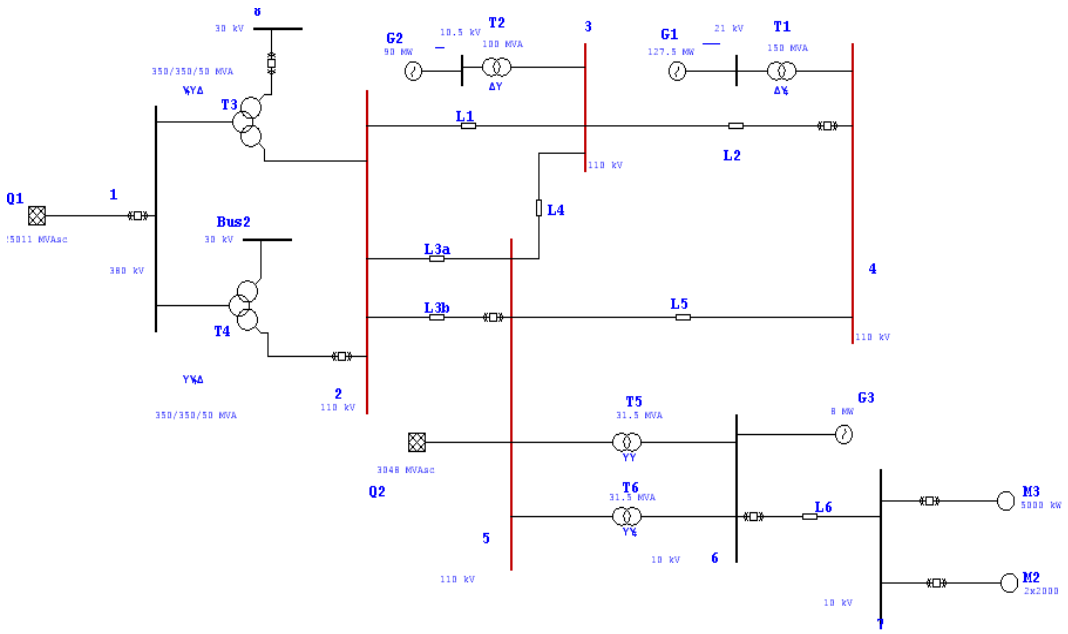
Excerpts from Validation Cases and Comparison Results (TCS-SCIEC-082)

Highlights

- Comparison of ETAP unbalanced fault results against published results in IEC Standard 60909-4 2000 Example 4.
- Compares system results for high and medium voltage systems.
- Compares the initial symmetrical current (I"k).
- Compares the peak current (Ip) for both method B and C.
- Compares the maximum steady state current value (Ik max).
- Compares both balanced 3-phase and unbalanced LG results.

System Description

This is 3-phase system operating at 50Hz. The Utility connection is operating at 380 kV. The utility connection transformers are two 350 MVA (primary winding rating) with 350 MVA 120 kV secondary and 50 MVA 30 kV tertiary windings. The system has two PowerStation units. One is operating at 21 kV and is rated for 150 MVA. The second unit is operating at 10.5 kV and is rated for 100 MVA.



Comparison of Results

The following tables of comparison show the differences between ETAP Results and those published in the IEC Standard example. Please note that the percent difference for the initial symmetrical current (I"k) is less than 0.002 % in most cases. The difference in the peak current values is less than 0.5% in most cases.

	IEC	ETAP		IEC	ETAP		IEC	ETAP		IEC	ETAP		IEC	ETAP	
Bus	I"K (kA)	I"k	%Diff	Ip(b) (kA)	Ip(b)	%Diff	Ip©	Ip©	%Diff	Ib	Ib	%Diff	Ik (kA)	Ik	%Diff
1	40.6447	40.6449	**0.0**	100.577	100.5783	**0.0**	100.568	100.576	**0.0**	40.645	40.64	**-0.0**	40.635	40.635	**0.0**
2	31.7831	31.7817	**-0.0**	80.8249	80.50905	**-0.4**	80.6079	80.6963	**0.1**	31.57	31.576	**0.0**	31.663	31.662	**-0.0**
3	19.673	19.6724	**-0.0**	45.8249	45.82378	**-0.0**	45.8111	45.9764	**0.4**	19.388	19.398	**0.0**	19.623	19.623	**-0.0**
4	16.2277	16.2273	**-0.0**	36.8041	36.80346	**-0.0**	36.8427	37.0397	**0.5**	16.017	16.015	**-0.0**	16.196	16.195	**-0.0**
5	33.1894	33.1873	**-0.0**	83.6266	83.62118	**-0.0**	83.4033	83.5906	**0.2**	32.795	32.807	**0.0**	32.997	32.995	**-0.0**
6	37.5629	37.5626	**-0.0**	99.191	99.19047	**-0.0**	98.1434	99.2752	**1.1**	34.028	34.166	**0.4**	34.356	34.356	**-0.0**
7	25.5895	25.5893	**-0.0**	59.094	59.09395	**0.0**	51.6899	51.8932	**0.4**	23.212	23.305	**0.4**	22.276	22.276	**0.0**
8	13.5778	13.5777	**-0.0**	36.9201	36.92002	**0.0**	36.9227	36.6847	**-0.6**	13.578	13.578	**0.0**	13.573	13.573	**-0.0**

Table 9: Comparison of ETAP 3-phase short-circuit IEC results against IEC Standard example for I"k, Ip and Ik.

	IEC	ETAP		IEC	ETAP	
Bus	I"K LG	I"K LG	%Diff	Ip© LG	Ip© LG	%Diff
2	15.9722	15.972	**-0.0**	40.5086	40.553	**0.1**
3	10.4106	10.41	**-0.0**	24.2424	24.33	**0.4**
4	9.0498	9.049	**-0.0**	20.5463	20.655	**0.5**
5	17.0452	17.045	**-0.0**	42.8337	42.931	**0.2**

Table 10: Comparison of ETAP unbalanced short-circuit IEC results against IEC Standard example for I"k and Ip.

Reference

1. IEC Standard 60909-4 2000, Example 4.
2. ETAP Short Circuit IEC V&V Documents, Case Number TCS-SCIEC-082.