Short-Circuit ANSI Comparison Case # 3

Comparison of ETAP 3-Phase Duty Short-Circuit Calculations against Published IEEE Std 399-1997 Example

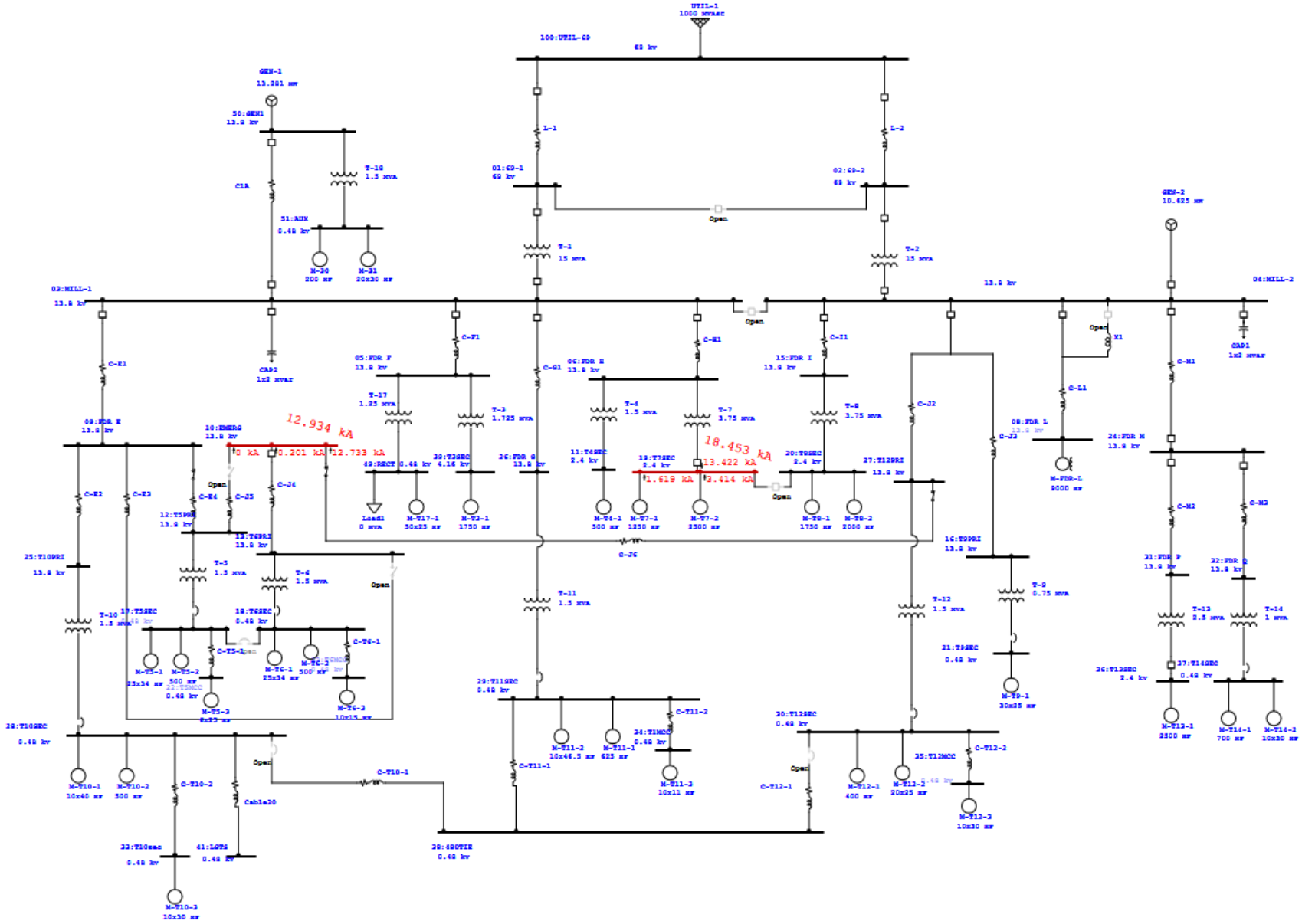
Excerpts from Validation Cases and Comparison Results (TCS-SC-162)

Highlights

- Comparison of ETAP 3-phase Duty Short-circuit results against a published 44-bus example from the IEEE Std. 399-1997, Section 7.7, pages 187-205, [1].
- Comparison of Momentary Fault Currents.
- Comparison of Interrupting Currents.
- Comparison of ANSI C37.010, C37.05 –1979 Multiplying Factors.
- Comparison of calculated individual current contributions and calculated voltages away from the faulted bus.
- Comparison of motor contributions determined according to the reactance values specified in Table 7-2 of IEEE Std. 399-1997.
- Comparison of Asymmetrical Currents.
- Comparison of Peak Currents.
- Comparison of element per-unit impedance representation for motors, generators, cables and lines.

System Description

This is a 44 Bus system with a utility tie and in-plant generators. Both the utility tie and the generators are in service and supplying power to the plant. The system rotating load is typical of a system operating near full capacity. The system contains both induction and synchronous motors. The utility is operating at 69 kV and the generators at 13.8 kV. Several motors, rated less than 50 HP, are modeled as composite motors in ETAP. Motors rated higher than 50 Hp, are modeled individually. This document is an excerpt from TCS-SC-162 [2]



Comparison of Results

The following tables of comparison show the differences between ETAP results and those published in Tables 7-5 and 7-6 of IEEE Std. 399-1997. Please note that the maximum deviation in the results is about 0.11 % due to the accuracy of significant figures in ETAP.

For a fault at Bus 19: T7SEC	IEEE Std 399-1997 Example	ETAP	% Diff
Pre-fault Voltage (kV)	2.40	2.40	**0.00**
Voltage to Ground (at fault location) (%)	0.00	0.00	**0.00**
Total Mom Fault Current (kA)	18.45	18.45	**0.00**
X/R ratio	13.70	13.70	**0.00**
Asymmetrical Momentary Current (kA)	27.76	27.76	**0.00**
Peak Current (kA)	46.88	46.83	**0.11**
Contribution from Bus 6:FDR-H2 (kA)	13.42	13.42	**0.00**
Voltage to Ground (at Bus 6) (%)	82.00	82.00	**0.00**
Contribution from Motor M-T7-1 (kA	1.62	1.62	**0.00**
Contribution from Motor M-T7-2 (kA	3.41	3.41	**0.00**

Table 7: Comparison of ETAP Momentary Short-circuit results against published IEEE Std 399-1997 Section 7.7 Example results for a fault at Bus 19: T7SEC.

For a fault at Bus 10: EMERG	IEEE Std 399-1997 Example	ETAP	% Diff
Pre-fault Voltage (kV)	13.80	13.80	**0.00**
Voltage to Ground (at fault location) (%)	0.00	0.00	**0.00**
Total Inter. Fault Current (kA)	11.62	11.62	**0.00**
X/R ratio	8.95	8.94	**0.11**
MF (ANSI Std C37.010 1979)	1.00	1.00	**0.00**
Adjusted Asymmetrical Current (kA)	11.62	11.62	**0.00**
Contribution from Bus 13:T6 PRI (kA)	0.04	0.04	**0.00**
Voltage to Ground (at Bus 13) (%)	0.00	0.00	**0.00**
Contribution from Bus 27:T12 PRI (kA)	11.58	11.58	**0.00**
Voltage to Ground (at Bus 27) (%)	4.00	4.00	**0.00**

Table 8: Comparison of ETAP Interrupting Short-circuit results against published IEEE Std 399-1997 Section 7.7 Example results for a fault at Bus 10: EMERG.

Reference

1. IEEE Brown Book: IEEE Std. 399-1997, Section 7.7, page 187-205.
2. ETAP Short Circuit ANSI V&V Documents, Case Number TCS-SC-162.