

EA-PSM Symmetrical Short Circuit verification validation case

IEC Short Circuit Case 3 validation case

Introduction

Verification validation cases are run before each EA-PSM version release. Calculation results are compared to Published Examples. EA-PSM short circuit conditions are calculated according to IEC 60909 standard. This is case example of IEC60909 part 4, example 3. EA-PSM software validation is performed using 3 phase symmetrical and unbalanced short circuit calculation results. The difference in the results is less than **0.07%** for all bus voltages and short circuit currents.

System Description

A low-voltage system with $U_N = 400\text{ V}$ and $f = 50\text{ Hz}$ is given in Fig. 1. The short-circuit currents I_k shall be determined at the short-circuit locations F1 to F3. Network contains cable lines, overhead lines and 20/0.41 kV transformers. The elements impedances are described in Table 2.

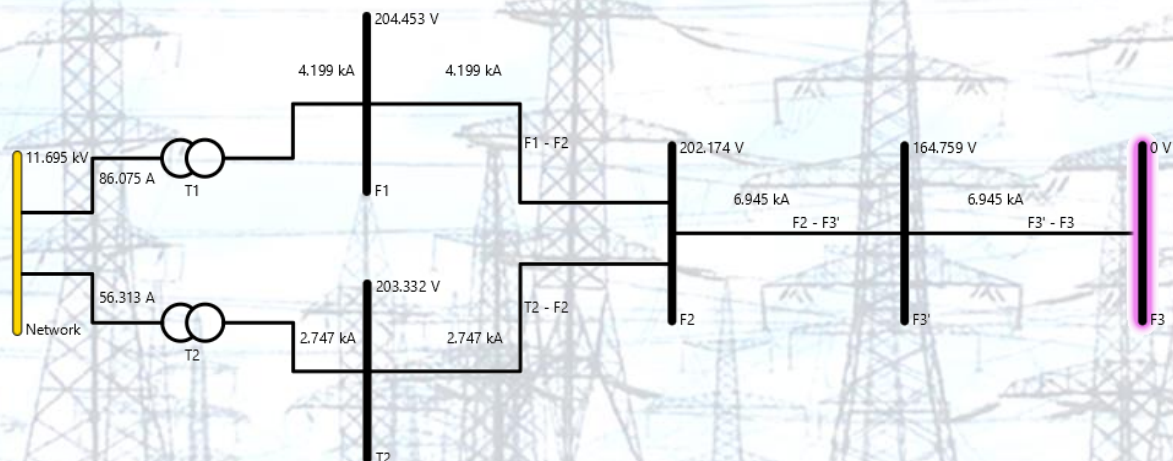


Fig. 1. Case 3 test network diagram

Table 1. Element parameters

Title	Voltage level	Resistance	Reactance
System	20 kV	126.382 mΩ	1.264 Ω
Transformer T1	0.41 kV	2.68 mΩ	10.052 mΩ
Transformer T2	0.41 kV	4.712 mΩ	15.698 mΩ
Cable line F1-F2	0.4 kV	0.385 mΩ	0.395 mΩ
Cable line T2-F2	0.4 kV	0.416 mΩ	0.136 mΩ
Cable line F2-F3'	0.4 kV	5.42 mΩ	1.74 mΩ
Overhead line F3'-F3	0.4 kV	18.5 mΩ	14.85 mΩ

Calculation Results

Symmetrical K3 short circuit calculations were performed at each network point. Voltage factor used in calculations $c = 1.05$. Fault branch current at each point are depicted in Table 2.

Table 2. Fault branch current results comparison with reference

Point	EA-PSM	Reference	Difference
	I, kA	I, kA	ΔI
F1	34.625	34.62	0.01%
F2	34.117	34.12	0.01%
F3	6.945	6.95	0.07%

References

International standard IEC 60909-4, *Short-circuit currents in three-phase A.C. systems*, ch. 3, 2000.