



POWER TECH

Power System Services

Marcin Ruta
Power System Consultant

Our Services

Power Solutions



What we do

We provide
unique support for
your business

Arc Flash Analysis

We are focusing to
provide A to Z solution for
our customer.

Short Circuit Study

Used To design and rate
electrical components of
your system.

Load Flow Study

Used for load predicition
and system design.

Selectivity Study

Utilise possibilities of your
electrical system to
protect your assets.

Harmonics Analysis

Used to assess power
quality and distortion from
higher frequencies

Consulting Services

design recommendations,
what-if scenarios, kick-off
meetings

Short Circuit Study

What?

Basic Analysis used for system design, equipment rating and protection analysis.

Why?

It is important to properly design system, cable sizes, equipment rating eg. switchgears, breakers, generators etc. It provides numerical input for CAPEX/OPEX decisions

Standards?

- IEC 60909 – AC systems
- IEC 60363 – AC marine/offshore
- IEC 60660 – DC systems
- IEEE 946 – DC systems
- ANSI /Comprehensive

Bus	Scenario	lk"	ip	idc	lb	lk	Sk"	Sk	lb _{asym}	SLG lk"	SLG ip	SLG idc
BUS-MVA	SC6	14,35	38,18	7,68	14,35	14,35	273.324	273.324	16,27	4,32	10,03	2,36
	SC7	14,31	33,05	7,58	14,31	14,31	272.665	272.665	16,20	4,31	10,01	2,35
	SC8	8,34	23,59	7,55	7,35	3,29	158.897	62.601	10,53	0,29	0,56	0,04
	SC9	8,31	23,50	7,37	7,32	3,28	158.271	62.561	10,39	0,29	0,56	0,04
	SC10	1,67	4,73	1,53	1,47	0,66	31.844	12.524	2,12	0,27	0,52	0,05
BUS-MVB	SC6	14,35	38,18	7,68	14,35	14,35	273.324	273.324	16,27	4,32	10,03	2,36
	SC7	14,21	32,63	7,29	14,21	14,21	270.704	270.704	15,97	4,30	9,96	2,31
	SC8	8,34	23,59	7,55	7,35	3,29	158.898	62.601	10,53	0,29	0,56	0,04
	SC9	8,34	23,59	7,55	7,35	3,29	158.897	62.601	10,53	0,29	0,56	0,04
	SC10	1,67	4,73	1,53	1,47	0,66	31.844	12.524	2,12	0,27	0,52	0,05

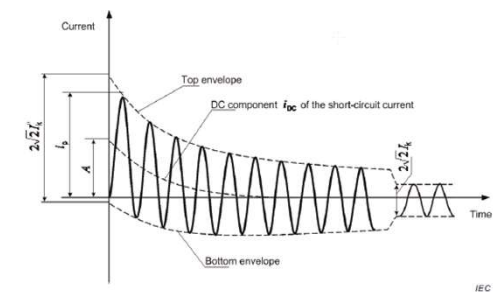
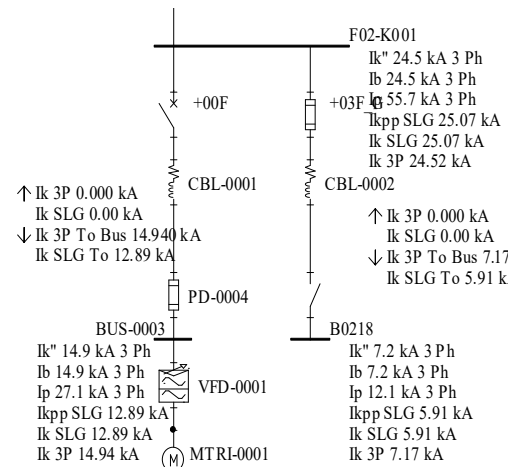


Figure 2 – Short-circuit current of a near-to-generator short-circuit with decaying AC component (schematic diagram)

Load Flow Analysis

What?

common analysis, it predicts loading conditions, power factor, equipment sizing for design, expansion etc

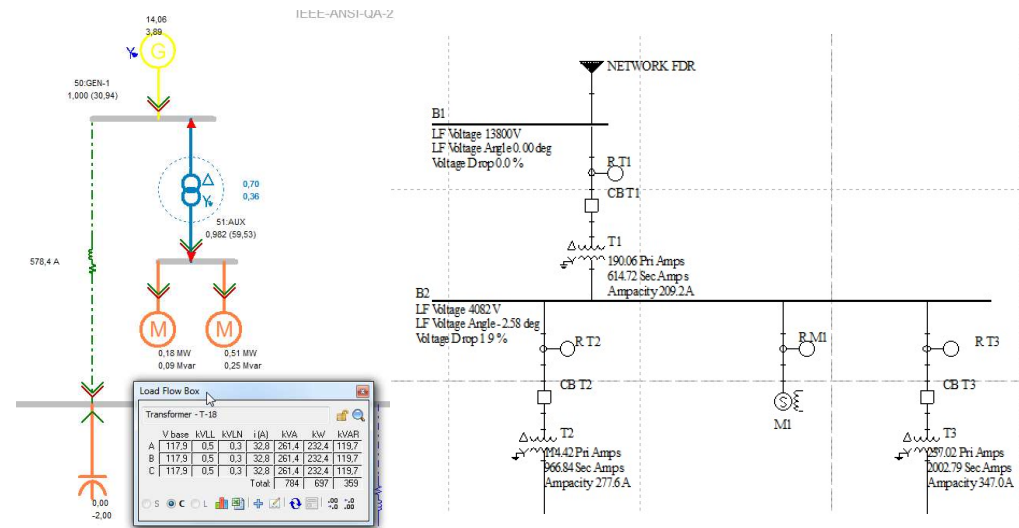
Why?

It allows for proper equipment sizing, validates possible extensions and allows for right design decisions.

How?

Newton Raphson
Multiple scenarios
Power, current, voltage

	Feeder Id	Section Id	Equipment Id	Code	Loading A (%)	Thru Power A (kW)	Thru Power A (kvar)	VA (%)
1	LF-TN	T2	T-2_TXFIX	Two-Winding Transformer	46,4	2159,0	843,7	98,34
2	LF-TN	T-8	T-8_TXFIX	Two-Winding Transformer	95,1	1044,2	567,4	95,42
3	LF-TN	M-T8-1	M-T8-1	Induction Motor	100,0	498,8	241,6	95,42
4	LF-TN	M-T8-2	M-T8-2	Induction Motor	100,0	540,1	261,6	95,42
5	LF-TN	T-6	T-6_TXFIX	Two-Winding Transformer	139,3	601,6	350,5	93,33
6	LF-TN	M-T6-3	M-T6-3	Induction Motor	100,0	42,7	20,7	93,28
7	LF-TN	M-T6-2	M-T6-2	Induction Motor	100,0	150,0	72,7	93,33



Arc Flash Analysis

What?

Arc Flash Analysis is used to quantify hazard with ATPV values (cal/cm²) acc.IEEE1584

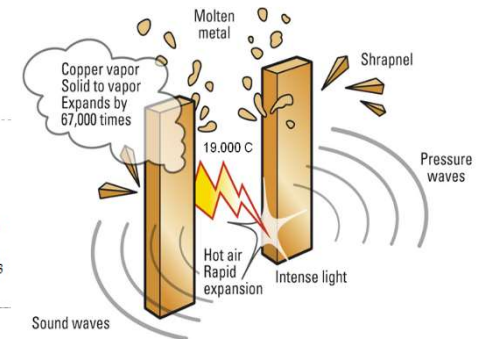
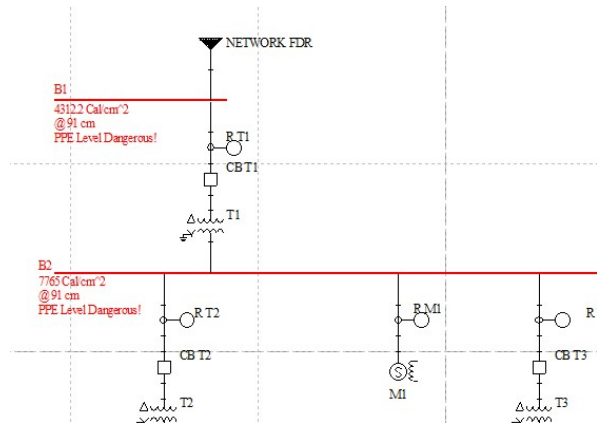
Why?

Arc Flash incident are serious and can lead to fatality. It allows to adress proper elimination, mitigations techniques and proper PPE selection based on ATPV cal.cm2 values

Standards?

IEEE 1584/ NFPA70E
ArcPro /EPRI for networks>15kV
Stokes&Oppenlander for DC
DGUV Information 203-077

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time/Tol (sec.)	Ground	Equip Type	Gap (mm)	Arc Flash Boundary (cm)	Working Distance (cm)	Incident Energy (cal/cm ²)
B1	MaxTripTime @1000.0s	13.80	3.94	3.92	3.59	3.54	1000	0.0000	Yes	SWG	152	414165	91	4312.2
B2	MaxTripTime @1000.0s	4.16	8.35	8.40	6.78	6.62	1000	0.0000	Yes	SWG	102	758053	91	7765.0
B3	R T2	0.48	29.10	20.10	24.79	13.91	4.061	0.1000	Yes	PNL	25	1141	46	234.7
B4	R T2	0.48	23.21	15.81	19.78	11.47	6.601	0.1000	Yes	PNL	25	1344	46	306.7
B5	R T3	0.48	36.91	24.29	23.98	13.00	4.816	0.1000	Yes	PNL	25	1157	46	239.9



Selectivity Study

What?

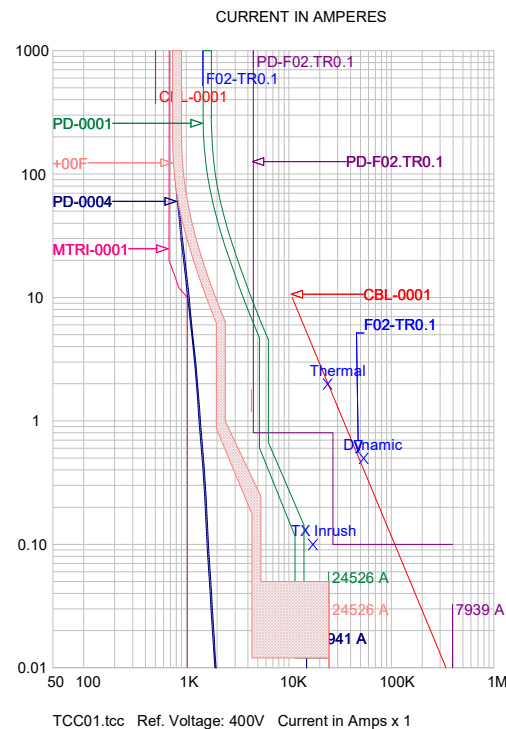
Protective device grading, mandatory by electrical regulations. Used to provide protection for electrical assets eg. motors, cables, generators, transformers etc.

Why?

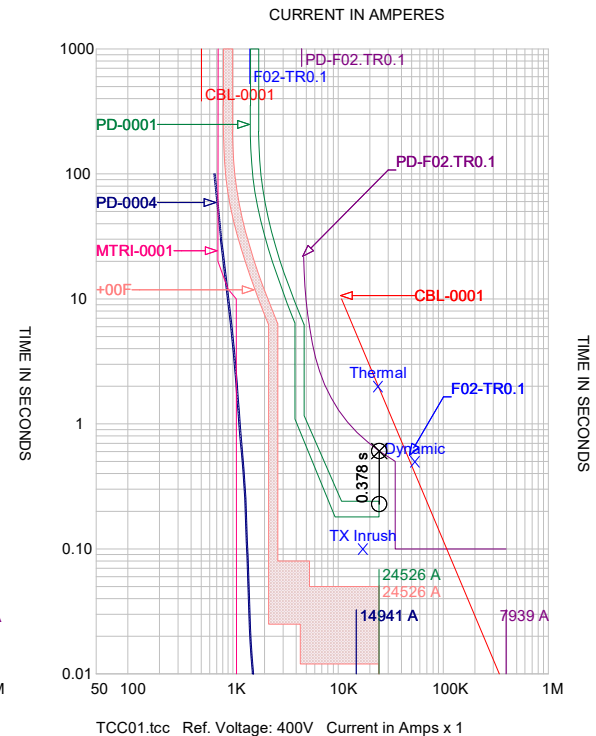
To avoid costly system damages, allow for continuous operation and limit power outages to faulted area.

How?

IEC/IEEE publications
Best Practice industry specific
IEC 60364
IEC 60502
IEC 61439



Not selective



vs Selective

Harmonics Analysis

What?

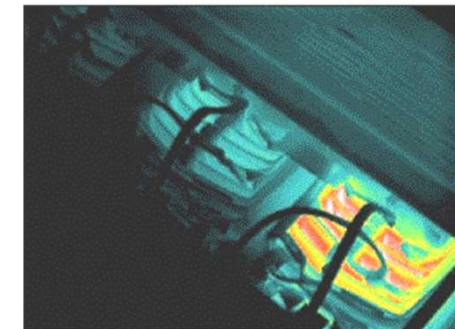
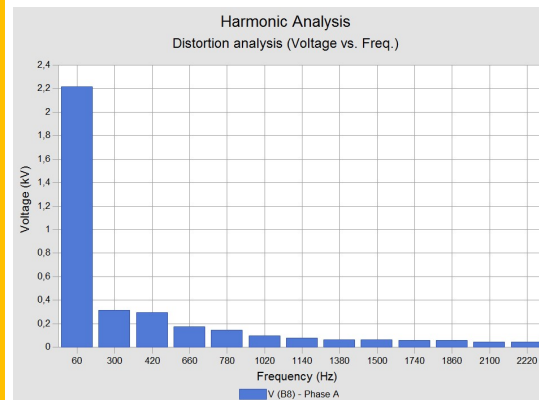
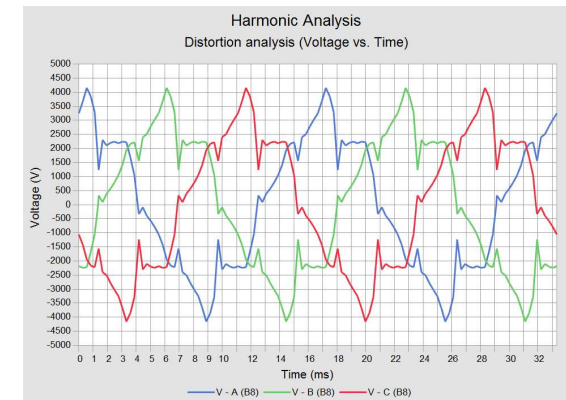
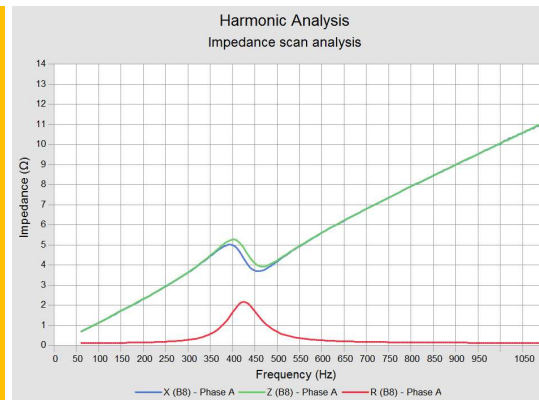
Harmonics Analysis provides input for power quality. It allows for design improvements like filters, predicts behaviour in early design phase and allows to keep system within limits

Why?

Excessive harmonics in the system leads to equipment overheating, resonance and can lead to damage and fire

How?

IEEE 519-2014
61000-3-6

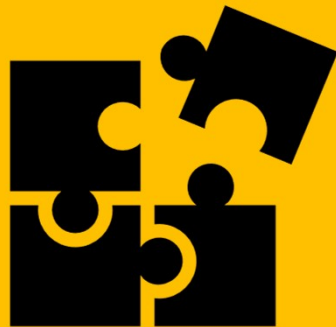


Above thermal image shows overheated windings on a step-down transformer, possibly caused by harmonics.

Additional services

Additional services?

Every customer is different and has specific requirements.



- Cable sizing for low, medium voltage systems
- DC systems short circuit, load flow and arc flash
- Renewable sector PV, WIND, Battery Storage
- Protection scheme recommendations
- System one line diagram mapping service
- Site visit for data collection
- Fault investigations
- Arc Flash trainings & introduction
- Presentations and kick-off meetings
- Technical support for design phase



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Thank you