Base Load Power Hub (BLPH)

Electrical System Study Report - Short Circuit

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

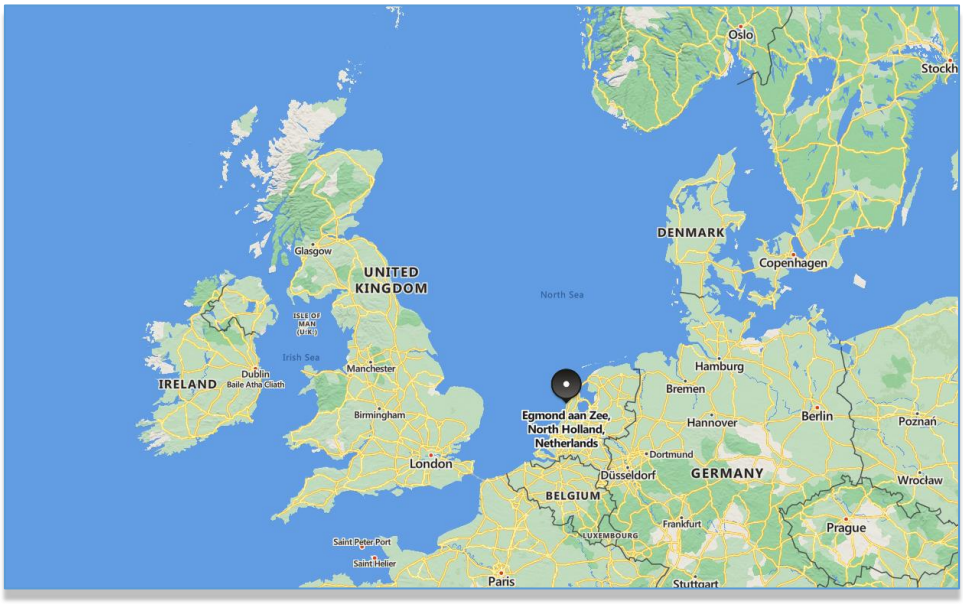


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

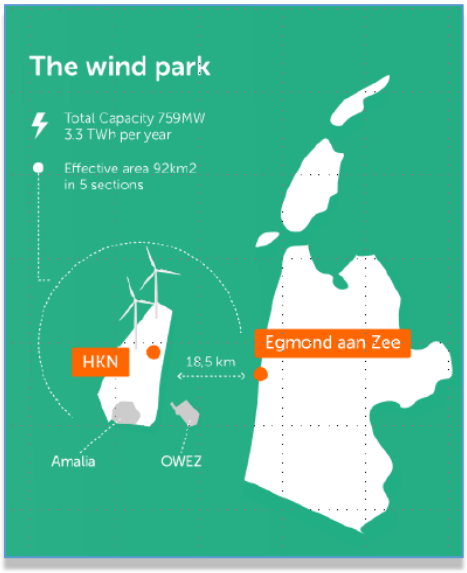


Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

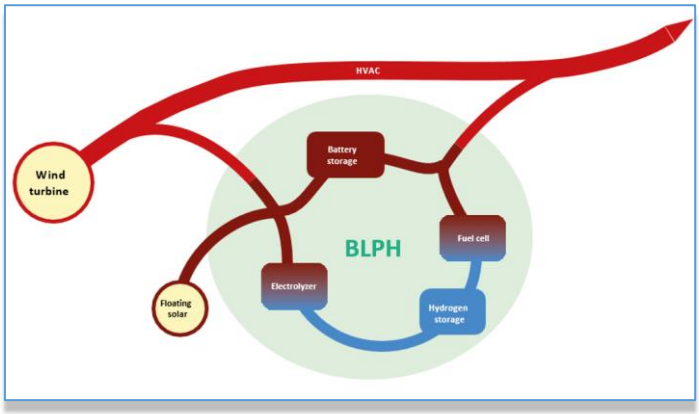


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

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2 DOCUMENT SCOPE

The scope of this study report is to describe the short circuit analysis that will be carried out for the BLPH in the crosswind offshore windfarm. Maximum and minimum fault levels for both 3-phase and 1-phase to earth short circuit conditions are presented in this report.

2.1 REFERENCES

Doc. No.	Description
123A90-DDL-EL-LIS-20148 Rev 00	Electrical Power and Control Cable Schedule
123A90-DDL-EL-LIS-20016 Rev. 2	Electrical Load List & Balance (CCS Mode 'Import)
123A90-PML-PM-TQ-00033	Technical Query – Electrical data of WTG-57
123A90-DDL-EL-RE-20170 Rev. 1	Electrical System Study Report – Load Flow
123A90-DDL-EL-RE-20172 Rev. 1	Electrical System Study Report - Arc Flash Energy Calculation
123A90-DDL-EL-DG-20158 Rev. 1	Overall Single Line Diagram
144671-TKF-IAC-INS-SPE-0001	Technical specification – 66 kV Al 3X400 CONF143350 specification (incl. Drain wire)
IEC-60092-352 (2005-09)	Electrical installations in ships – Part 352: Choice and installation of electrical cables
2XS(FL)2Y HDPE High Voltage 36/60 (72.5) kV Cable	Cable catalogue for HV cable
123A90-PML-PM-TQ-00033_REPLY	Technical Query N. 33
123A90-DDL-EL-LIS-20143_ATT1	CCS MODE 3: HOT STANDBY
123A90-DDL-EL-LIS-20144_ATT1	CCS MODE 2: EXPORT
123A90-DDL-EL-LIS-20145_ATT1	CCS MODE 4: COLD STANDBY
123A90-DDL-EL-LIS-20146_ATT1	CCS MODE 5 : EMERGENCY MODE (Island)
123A90-DDL-EL-LIS-20147_ATT1	CCS MODE 6: POWER OUT (Blackout)
123A90-DDL-EL-LIS-20016_ATT1	CCS MODE 1: Import Charging

Table 1 - Reference Documents

2.2 DEFINITIONS AND ABBREVIATIONS

BESS	Battery Energy Storage System
COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
C_{max}	Maximum voltage factor
C_{min}	Minimum voltage factor
HV	High Voltage
I_{k1}''	Line to earth (LG) initial symmetrical short circuit current (rms)
I_{k2}''	Line to line (LL) initial symmetrical short circuit current (rms)
I_{k3}''	Three phase (LLL) initial symmetrical short circuit current (rms)
I_p	Peak short circuit current
I_{k1}	Line to earth (LG) steady state short circuit current (rms)
I_{k2}	Line to line (LL) steady state short circuit current (rms)
I_{k3}	Three phase (LLL) steady state short circuit current (rms)
kV	kilo Volts
LV	Low Voltage
MV	Medium Voltage
N/A	Not Applicable
NER	Neutral Earthing Resistor
OCTC	Off Circuit Tap Changer
OLTC	On Load Tap Changer
ph	phase
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project
Ref.	Refer to
SLD	Single Line Diagram
U_k	Short circuit impedance
U_n	Nominal system voltage, line-to-line (rms)
WTG	Wind Turbine Generator

Table 2 - Definitions and Abbreviations

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3 DESIGN BASIS

This section presents the details of all the input data, as well as assumptions used for the system studies for BLPH.

3.1 SYSTEM OVERVIEW

The system studied in this report is based on the single line diagram, 123A90-DDL-EL-DG-20158 Rev. 1. The WTG-57 is the wind turbine being connected to the BLPH. It is connected to the rest of the Crosswind offshore windfarm at the end of string A at a 66 kV busbar. The BLPH is also connected to this busbar via a 66/6.9 kV transformer. At the BLPH 6.6 kV BLPH busbar the BESS, electrolyser, fuel cell and solar farm is connected. There is also a 6.6/0.42 kV transformer supplying different loads at the BLPH.

3.2 MODEL OVERVIEW

WTG-57 is connected to the Crosswind offshore windfarm, via string A. WTG-57 is at the end of this string A.

BLPH is connected to the Crosswind offshore windfarm at the common 66 kV busbar with the WTG-57.

At this 66 kV busbar, the rest of the components in the string A is modelled as the supply network. This is termed as “windfarm” in the model.

Other electrical components connected to this 66 kV busbar, 6.6 kV busbar and 400 V busbar are in accordance with the single line diagram in 123A90-DDL-EL-DG-20158 Rev. 1, as well as datasheets of transformers.

Data provided in the single line diagram 123A90-DDL-EL-DG-20158 Rev. 1 were used to model these transformers.

The study has been performed using ETAP (Electrical Transient Analyzer Program) Version 22.0.5.

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3.3 SYSTEM STUDIES BACKGROUND

According to the design philosophy, 9 operation modes are defined. Here under the main 5 operation mode are presented.

These modes of operation are as listed below:

1. CCS MODE 1: Import Charging (corresponding to project IDLE and IMPORT modes)
   - Power generation from WTG-57 is greater than 1 MW. Surplus power is available for import to BLPH from wind farm for charging BESS, running the electrolyser and feeding the BLPH loads.
2. CCS MODE 2: EXPORT
   - Power generation from WTG-57 has dropped below 1 MW, so there is export of power from BLPH from power sources available, i.e. BESS, Fuel Cell and solar farm.
3. CCS MODE 3: Hot standby
   - Power generation from WTG-57 is greater than 1 MW, and either the solar farm, fuel cell or BESS are synchronized and connected to the 6.6 kV power system, ready to generate power. Surplus power is available for import to BLPH from wind farm for feeding the BLPH loads.
4. CCS MODE 4: Cold standby
   - Power generation from WTG-57 has dropped below 1 MW, the solar farm is not generating power, BESS and fuel cell are 'NOT READY'. Power is imported to BLPH from wind farm for feeding the BLPH loads
5. CCS MODE 5: Emergency/Island
   - Windfarm is no longer connected.

3.4 ANALYSIS DESIGN DATA

In the following paragraphs, a brief summary of BLPH Platform main equipment data is presented.

More details are available in the attached ETAP calculations reports.

3.4.1 Supply network

ITEM	3-PH SCC Max [kA]	X/R	3-PH SCC Min [kA]	X/R [pu]
66kV Network 3Ph	15.5	10.0	8.7	10.0
66kV Network 1Ph	7.10	10.0	6.3	10.0

Table 3 - Data for External Network

3.4.2 Power Sources

ITEM	Rated Power [kVA]	Vn [kV]	In [A]	Maximum Generated Active Power [kW]	Sustained SCC [% In]
A-85000 BESS package	1250.0	6.6	109.3	1000.0	150.0
A-80000 Fuel cell package	1250.0	6.6	109.3	1000.0	150.0
PV_Plant	660.0	0.8	476.3	480.0	100.0

Table 4 - Data for Internal Power Sources

3.4.3 Transformers

ITEM	An [kVA]	V1n/V2n [kV]	I1n/I2n [A]	Zcc [%]	X/R [pu]	Vector Group
TR-100AD1	7000.0	66.0+/-8x1.25%/0.69	61.2/585.7	8.0	16.01	Dyn11
TR-200DE1	1600.0	6.6/0.42	139.9/2199.5	6.0	7.94	Dyn11
TR-200ED1	500.0	6.6/0.8	43.7/360.8	6.0	7.63	Dyn11

Table 5 - Data for Main Transformers

3.4.4 Bulk Load 0.4kV

ITEM	An [kVA]	Vn [kV]	In [A]	PF [%]
DC-Battery-System_SWGR	11.5	0.4	16.6	100.0
NAVAID_System	3.16	0.4	4.6	100.0
AC_UPS_F&G	12.5	0.4	18.0	80.0
AC_UPS_PAS	32.5	0.4	46.9	80.0
BL_SG-200N1	982.4	0.4	1418.0	87.78
DB-L&SP-BoP	37.3	0.4	53.8	88.4
DB-L&SP-HVMV	1.7	0.4	2.5	80.0
DB-L&SP-Inst.	1.7	0.4	2.5	80.0
DB-L&SP-LV	1.7	0.4	2.5	80.0
DB-L&SP-UPS	1.7	0.4	2.5	80.0

Table 6 - Data for Bulk Load 0.4kV

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3.4.5 Bulk Load 6.6kV

ITEM	An [kVA]	Vn [kV]	In [A]	PF [%]
A-20000	3.2	6.6	279.9	96.0

Table 7 - Data for Bulk Load 0.4kV

3.4.6 Switchgear Data

ITEM	Rated Voltage [kV]	Rated Ampacity [A]	Short Circuit Rating [kA - s]
HNA6-AFA70	66.0	1250.0	31.5 - 1s
SG-100D1	6.6	630.0	25.0 – 1s
SG-200N1	0.4	2500.0	50.0 – 1s

Table 8 – Data for Main Switchgears

3.4.7 Cables Data

Main cables data are as per 123A90-DDL-EL-LIS-20148 Rev 00 - Electrical Power and Control Cable Schedule.

Cable electrical parameters are as per 123A90-DDL-EL-RE-20151.

3.5 SYSTEM REQUIREMENT

At least 10% margin should be available between the calculated fault level and the specified short circuit rating of the equipment (rms and peak).

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4 SHORT CIRCUIT CURRENT CALCULATION

Purpose of short circuit study is the calculation of maximum expected 3-phase short circuit fault currents on network buses, in order to check adequacy of electrical equipment (bus bars and circuit breakers) in terms of short circuit capability.

Short Circuit Currents have been calculated on the base of the IEC 61363 Standard for Off-shore.

The short circuit unbalance components have been calculated on the base of the IEC 60909 Standard for On-shore.

4.1 ETAP STUDY ASSUMPTIONS

SC Standard:	IEC
X/R for Peak kA Calculation Method:	Method C
Transformer Tap:	Use Nominal Tap
IEC 61363 Prefault Condition:	Prefault Load Flow
cmax for Z adj. (V < 1000V)	1.05%
Protect. Device Duty:	Based on Total Bus Fault Current
Adjustment: Impedance Tolerance	Transformer Impedance +/-10%

4.2 CASE 1: SCCMAX

Short circuit calculation case relevant to normal operation conditions, with minimum source short circuit impedance. This study case leads to the calculation of ultimate maximum 3-phase short circuit fault currents on network buses, in order to check adequacy of electrical equipment in terms of short circuit capability.

- Generation Category: Export
- Loading Category: Export
- Load Diversity Factor: None.
- Power Grid 66kV in service, with maximum short circuit power.
- resistance temperature correction: Global 20°C.
- A-85000 Bess Package in service – in discharging condition.
- A-20000 Electrolyser Package in standby
- A-80000 Fuel Cell Package in service – in discharging condition
- PV Solar Package in service
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" in standby.

4.3 CASE 2: SCCMAX – UNBALANCE – IEC 60909

- Generation Category: Export
- Loading Category: Export
- Load Diversity Factor: None.
- Power Grid 66kV in service, with maximum short circuit power.
- resistance temperature correction: Global 20°C.
- A-85000 Bess Package in service – in discharging condition.
- A-20000 Electrolyser Package in standby
- A-80000 Fuel Cell Package in service – in discharging condition
- PV Solar Package in service
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" in standby.

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4.4 CASE 3: SCCMIN WITH NETWORK – IEC 60909

Short circuit calculation case relevant to minimum operation conditions, with maximum source short circuit impedance. This study case leads to the calculation of minimum 3-phase short circuit fault currents on network buses.

- Generation Category: Hot standby
- Loading Category: Hot standby
- Load Diversity Factor: None.
- Power Grid 66kV in service, with minimum short circuit power.
- resistance temperature correction: Global 90°C.
- A-85000 Bess Package out of service
- A-20000 Electrolyser Package out of service
- A-80000 Fuel Cell Package out of service
- PV Solar Package out of service
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" in standby.

4.5 CASE 4: SCCMAX ISLAND MODE – IEC 60909

Short circuit calculation case relevant to island operation conditions, with minimum source short circuit impedance. This study case leads to the calculation of ultimate maximum 3-phase short circuit fault currents on network buses, in service in island.

- Generation Category: Emergency
- Loading Category: Emergency
- Load Diversity Factor: None.
- Power Grid 66kV out of service.
- resistance temperature correction: Global 90°C.
- A-85000 Bess Package in service – in discharging condition
- A-20000 Electrolyser Package out of service
- A-80000 Fuel Cell Package in service
- PV Solar Package is service
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.

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- LV loads stated as "stand-by operation" in standby.

4.6 CASE 5: SCCMIN ISLAND MODE – IEC 60909

Short circuit calculation case relevant to island operation conditions, with maximum source short circuit impedance. This study case leads to the calculation of minimum 3-phase short circuit fault currents on network buses, in service in island.

- Generation Category: Emergency
- Loading Category: Emergency
- Load Diversity Factor: None.
- Power Grid 66kV out of service.
- resistance temperature correction: Global 90°C.
- A-85000 Bess Package in service – in discharging condition
- A-20000 Electrolyser Package out of service
- A-80000 Fuel Cell Package out of service
- PV Solar Package out of service
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" in standby.

4.7 SCC STUDY RESULTS

Main short circuit calculation results are presented in the following Summary Tables.

Detailed ETAP reports are available in Annexes.

Bus ID	Voltage kV	BUSES DUTY SUMMARY	
		Device Capacity	Calculated SC Current
		Peak [kA]	Peak [kA]
HKN57	66.000	78.75	38.03
HNA6-AFA70	66.000	78.75	34.47
SG-100D1	6.600	62.50	20.54
SG-200N1	0.400	105.00	74.15

Table 9: Short circuit Busbar Peak Capability Verification

Bus ID	Voltage kV	INTERRUPTING DUTY SUMMARY							
		Device Capacity				Calculated SC Currents			
		Making [kA]	Ib sym. [kA]	Ib asym. [kA]	Idc [kA]	Peak [kA]	Ib sym. [kA]	Ib asym. [kA]	Idc [kA]
HKN57	66.000	78.75	31.50	32.39	7.53	38.03	15.54	15.64	1.78
HNA6-AFA70	66.000	78.75	31.50	32.39	7.53	34.47	14.72	14.73	0.72
SG-100D1	6.600	62.50	25.00	25.70	5.98	20.54	8.07	8.30	1.92
SG-200N1	0.400	105.00	50.00			74.15	31.67		

Table 10: Circuit Breaker Capability Verification

Bus ID	Voltage kV	MAXIMUM SHORT CIRCUIT CURRENTS											
		LLL			LG			LL			LLG		
		Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]
HKN57	66.00	15.55	38.38	15.54	7.11	17.55	7.11	13.46	33.24	13.46	13.66	33.72	13.66
HNA6-AFA70	66.00	14.76	35.03	14.75	6.71	15.93	6.71	12.78	30.34	12.78	12.98	30.81	12.98
SG-100D1	6.60	8.11	20.74	8.05	0.40	1.02	0.40	7.03	17.96	7.03	7.13	18.22	7.13
SG-200N1	0.40	31.35	74.08	30.37	33.52	79.23	33.52	27.15	64.16	27.15	32.66	77.19	32.66

Table 11: Results of CASE 2: SCCMAX – Unbalance – IEC 60909

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Bus ID	Voltage kV	MINIMUM SHORT CIRCUIT CURRENTS											
		LLL			LG			LL			LLG		
		Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]
HKN57	66.00	8.70	21.48	8.70	6.30	15.56	6.30	7.53	18.60	7.53	7.93	19.58	7.93
HNA6-AFA70	66.00	8.43	20.16	8.43	5.97	14.28	5.97	7.30	17.46	7.30	7.68	18.38	7.68
SG-100D1	6.60	5.87	15.04	5.87	0.38	0.97	0.38	5.08	13.02	5.08	5.18	13.27	5.18
SG-200N1	0.40	21.66	51.50	21.66	23.49	55.86	23.49	18.76	44.60	18.76	22.85	54.35	22.85

Table 12: Results of CASE 3: SCCMIN with Network – IEC 60909

Bus ID	Voltage kV	MAXIMUM SHORT CIRCUIT CURRENTS											
		LLL			LG			LL			LLG		
		Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]
SG-100D1	6.60	0.45	1.06	0.38	0.00	0.00	0.00	0.39	0.92	0.39	0.39	0.92	0.39
SG-200N1	0.40	5.99	14.11	5.01	8.35	19.65	8.35	5.19	12.22	5.19	8.62	20.30	8.62

Table 13: Results of Case 4: SCCMAX Island Mode – IEC 60909

Bus ID	Voltage kV	MINIMUM SHORT CIRCUIT CURRENTS											
		LLL			LG			LL			LLG		
		Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]	Ik'' [kA]	Ip [kA]	Ik [kA]
SG-100D1	6.60	0.16	0.40	0.16	0.00	0.00	0.00	0.14	0.35	0.14	0.14	0.35	0.14
SG-200N1	0.40	2.16	5.30	2.16	3.12	7.66	3.12	1.87	4.59	1.87	3.38	8.31	3.38

Table 14: Results of Case 5: SCCMIN Island Mode – IEC 60909

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5 CONCLUSION

With reference to the electrical network study calculations results of BLPH Platform electrical network, the following can be pointed out:

SC calculation results

It can be stated that network equipment relevant to BLPH Platform are adequately rated in terms of momentary and interrupting capability: devices SC rating is always above 110 % of calculated short circuit current values.

ATTACHMENTS

Attachment 1 CASE 1: SCCMAX

Electrical Transient Analyzer Program

Short-Circuit Analysis

IEC 61363 Standard

3-Phase Instantaneous Fault Currents

	Swing	V-Control	Load	Total
Number of Buses:	1	0	21	22

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	3	0	0	18	0	0	21

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Inverter	Total
Number of Machines:	0	4	0	0	10	0	14

System Frequency:	50.00
Unit System:	Metric
Project Filename:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\Case1-SCCMax.SI3S

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	20
Cable / Busway Resistance:	Yes	Global	20

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	Load	0.400	0.439	1	99.43	-3.75
Bus4	Load	0.400	0.439	1	99.65	-3.72
Bus7	Load	6.600	6.900	1	99.75	-1.81
Bus62	Load	0.400	0.439	1	99.29	-3.67
Bus63	Load	0.400	0.439	1	99.45	-3.72
Bus64	Load	0.400	0.439	1	98.94	-3.75
Bus66	Load	0.400	0.439	1	99.46	-3.72
Bus67	Load	0.400	0.439	1	99.44	-3.71
Bus68	Load	0.400	0.439	1	99.50	-3.73
Bus69	Load	0.400	0.439	1	99.46	-3.72
Bus84	Load	0.400	0.439	1	99.41	-3.72
Bus92	Load	66.000	66.000	1	99.99	0.00
Bus93	Load	66.000	66.000	1	99.99	0.00
Bus94	Load	6.900	6.900	1	95.46	-1.81
Bus96	Load	6.600	6.900	1	99.75	-1.82
Bus97	Load	6.600	6.900	1	99.80	-1.81
Bus98	Load	0.800	0.836	1	100.42	1.79
Bus99	Load	6.600	6.900	1	99.73	-1.82
HKN57	SWNG	66.000	66.000	1	100.00	0.00
HNA6-AFA70	Load	66.000	66.000	1	99.99	0.00
SG-100D1	Load	6.600	6.900	1	99.79	-1.81
SG-200N1	Load	0.400	0.439	1	99.52	-3.75

22 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

Line/Cable/Busway Input Data

ohms or siemens/1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway			Length						
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R	X	Y
0.4kV_cable	1.0NCUN1	300	10.0	0	5	20	0.06274	0.08900	0.0001854
6.6kV_Cable1	6.6NCUN1	120	25.0	0	2	20	0.15372	0.11300	0.0001400
6.6kV_Cable2	6.6NCUN1	70	44.0	0	1	20	0.26822	0.13000	0.0001100
6.6kV_Cable3	6.6NCUN1	70	78.0	0	1	20	0.26822	0.13000	0.0001100
6.6kV_Cable5	6.6NCUN1	70	55.0	0	1	20	0.26822	0.13000	0.0001100
6.6kV_Cable6	6.6NCUN1	70	25.0	0	1	20	0.26822	0.13000	0.0001100
66kV_Cable1	66NALS1	300	25.0	0	1	20	0.06091	0.12000	0.0000644
66kV_Cable2	66NALS1	300	40.0	0	1	20	0.06091	0.12000	0.0000644
66kV_Cable3	66NALS1	400	1240.0	0	1	20	0.07940	0.09870	0.0000911
AC_UPS-F&G	1.0MCUN4	35	40.0	0	1	20	0.52469	0.08000	0.0001015
AC_UPS-PAS	1.0MCUN4	35	40.0	0	1	20	0.52469	0.08000	0.0001015
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0	1	20	4.60374	0.09300	0.0000575
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0	1	20	4.60374	0.09300	0.0000575
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0	1	20	4.60374	0.09300	0.0000575
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0	1	20	4.60374	0.09300	0.0000575
DB-L&SP_BoP	1.0NCUN4	16	20.0	0	1	20	1.15054	0.08000	0.0000597
DC_Batt_Swgr	1.0MCUN4	16	65.0	0	1	20	1.14505	0.08000	0.0000971
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0	1	20	4.60374	0.09300	0.0000575

Line / Cable / Busway resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z
TR-100AD1	7.000	66.000	6.900	8.00	16.06	0	0	-10.0	3.750	0	7.2000
TR-200DE1	1.600	6.600	0.420	6.00	7.94	0	0	-10.0	2.500	0	5.4000
TR-200ED1	0.500	6.600	0.800	6.00	7.63	0	0	-10.0	0	0	5.4000

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-100AD1	2W XFMR	Bus93	Bus94	6.39	102.66	102.86	
TR-200DE1	2W XFMR	Bus7	Bus4	38.59	306.37	308.79	
TR-200ED1	2W XFMR	Bus97	Bus98	128.41	979.75	988.13	
0.4kV_cable	Cable	Bus4	SG-200N1	6.51	9.23	11.30	0.0000018
6.6kV_Cable1	Cable	Bus94	SG-100D1	0.40	0.30	0.50	0.0003333
6.6kV_Cable2	Cable	SG-100D1	Bus7	2.48	1.20	2.75	0.0002304
6.6kV_Cable3	Cable	SG-100D1	Bus99	4.39	2.13	4.88	0.0004085
6.6kV_Cable5	Cable	SG-100D1	Bus96	3.10	1.50	3.44	0.0002880
6.6kV_Cable6	Cable	SG-100D1	Bus97	1.41	0.68	1.57	0.0001309
66kV_Cable1	Cable	HNA6-AFA70	Bus93	0.00	0.01	0.01	0.0070134
66kV_Cable2	Cable	Bus92	HNA6-AFA70	0.01	0.01	0.01	0.0112215
66kV_Cable3	Cable	HKN57	Bus92	0.23	0.28	0.36	0.4921036
AC_UPS-F&G	Cable	SG-200N1	Bus63	1088.55	165.97	1101.14	0.0000008
AC_UPS-PAS	Cable	SG-200N1	Bus62	1088.55	165.97	1101.14	0.0000008
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	15520.85	313.54	15524.02	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	4775.65	96.47	4776.62	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	11222.77	226.71	11225.06	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	10745.21	217.06	10747.40	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1193.51	82.99	1196.39	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	3860.38	269.71	3869.79	0.0000012
DC_UPS_Navaid	Cable	SG-200N1	Bus64	11939.12	241.18	11941.55	0.0000006

Power Grid Input Data

Power Grid	Connected Bus	Rating		% Impedance 100 MVA Base			Time Constant
ID	ID	MVASC	kV	R	X"	R/X"	Tdc
A-80000	Bus99	1.875	6.600	530.68652	5306.86523	0.10	0.0318
A-85000	Bus96	1.875	6.600	530.68652	5306.86523	0.10	0.0318
SCC_Max	HKN57	1771.888	66.000	0.56157	5.61569	0.10	0.0318
SG-200D2	Bus98	0.660	0.800	1507.63196	15076.32031	0.10	0.0318

Total Connected Power Grids (= 4): 1776.298 MVA

Lumped Load Input Data

Load	Lumped Load						Motor Loads							
	Rating				% Load		Loading		% Imp. (Machine Base)			Time Constant		
ID	kVA	kV	Amp	% PF	MTR	STAT	kW	kvar	R	X"	R/X"	Td'	Tdc	MW/PP
AC_UPS_F&G	12.5	0.400	18.04	80.00	100	0	3.77	2.83	6.46	15.37	0.42	.2000	0.01	0.01
AC_UPS_PAS	32.5	0.400	46.91	80.00	100	0	12.90	9.67	6.46	15.37	0.42	.2000	0.01	0.03
BL_SG-200N1	982.4	0.400	1417.97	87.70	1	99	7.87	4.31	6.46	15.37	0.42	.2000	0.01	0.01
DB-L&SP-BoP	37.3	0.400	53.84	88.40	100	0	6.08	3.22	6.46	15.37	0.42	.2000	0.01	0.03
DB-L&SP-HVMV	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	.2000	0.01	0.00
DB-L&SP-Inst.	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	.2000	0.01	0.00
DB-L&SP-LV	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	.2000	0.01	0.00
DB-L&SP-UPS	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	.2000	0.01	0.00
DC-Battery-System_SWGR	11.5	0.400	16.60	100.00	100	0	1.57	0.00	6.46	15.37	0.42	.2000	0.01	0.01
NAVAID_System	3.2	0.400	4.56	100.00	100	0	3.16	0.00	6.46	15.37	0.42	.2000	0.01	0.00

Total Connected Lumped Loads (= 10): 1086.2 kVA

SHORT-CIRCUIT REPORT

3-Phase fault at bus : **Bus4**

Nominal kV = 0.400

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.000	0.00	-0.092	45.928	91.947	32.541	99.80
0.001	0.05	0.381	44.143	90.156	32.536	95.93
0.002	0.10	5.216	42.438	88.445	32.532	92.24
0.003	0.15	13.766	40.808	86.809	32.528	88.71
0.004	0.20	25.031	39.249	85.244	32.523	85.33
0.005	0.25	37.750	37.757	83.745	32.519	82.10
0.006	0.30	50.529	36.328	82.310	32.514	79.00
0.007	0.35	61.975	34.958	80.934	32.510	76.03
0.008	0.40	70.829	33.645	79.615	32.506	73.19
0.009	0.45	76.096	32.385	78.349	32.501	70.46
0.010	0.50	77.134	31.176	77.134	32.497	67.84
0.011	0.55	73.723	30.016	75.968	32.493	65.32
0.012	0.60	66.081	28.901	74.847	32.489	62.90
0.013	0.65	54.847	27.831	73.771	32.485	60.58
0.014	0.70	41.013	26.802	72.736	32.480	58.35
0.015	0.75	25.832	25.813	71.741	32.476	56.20
0.016	0.80	10.691	24.862	70.785	32.472	54.14
0.017	0.85	-3.023	23.948	69.865	32.468	52.16
0.018	0.90	-14.060	23.069	68.980	32.464	50.25
0.019	0.95	-21.427	22.223	68.128	32.460	48.41
0.020	1.00	-24.490	21.410	67.309	32.456	46.64
0.021	1.05	-23.029	20.627	66.520	32.452	44.94
0.022	1.10	-17.267	19.873	65.761	32.448	43.31
0.023	1.15	-7.845	19.148	65.030	32.444	41.73
0.024	1.20	4.244	18.449	64.326	32.440	40.21
0.025	1.25	17.746	17.777	63.648	32.436	38.75
0.026	1.30	31.272	17.130	62.995	32.432	37.35
0.027	1.35	43.435	16.506	62.366	32.428	35.99
0.028	1.40	52.982	15.906	61.760	32.424	34.69
0.029	1.45	58.922	15.328	61.177	32.420	33.43
0.030	1.50	60.614	14.771	60.614	32.416	32.22
0.031	1.55	57.841	14.235	60.073	32.412	31.05
0.032	1.60	50.820	13.718	59.551	32.409	29.93
0.033	1.65	40.190	13.220	59.047	32.405	28.85
0.034	1.70	26.940	12.741	58.563	32.401	27.81
0.035	1.75	12.322	12.279	58.095	32.397	26.80
0.036	1.80	-2.281	11.834	57.645	32.393	25.83
0.037	1.85	-15.483	11.405	57.211	32.390	24.90
0.038	1.90	-26.034	10.992	56.793	32.386	24.00
0.039	1.95	-32.946	10.594	56.389	32.382	23.13
0.040	2.00	-35.580	10.210	56.001	32.379	22.30
0.041	2.05	-33.719	9.841	55.626	32.375	21.49
0.042	2.10	-27.582	9.485	55.265	32.371	20.72
0.043	2.15	-17.806	9.142	54.916	32.368	19.97
0.044	2.20	-5.383	8.811	54.581	32.364	19.25
0.045	2.25	8.438	8.492	54.257	32.360	18.56
0.046	2.30	22.274	8.185	53.945	32.357	17.89
0.047	2.35	34.738	7.889	53.644	32.353	17.24
0.048	2.40	44.583	7.604	53.353	32.350	16.62
0.049	2.45	50.817	7.329	53.074	32.346	16.02
0.050	2.50	52.804	7.064	52.804	32.343	15.44
0.051	2.55	50.324	6.809	52.544	32.339	14.89
0.052	2.60	43.595	6.563	52.293	32.336	14.35
0.053	2.65	33.252	6.326	52.051	32.332	13.83
0.054	2.70	20.285	6.097	51.817	32.329	13.34
0.055	2.75	5.941	5.877	51.592	32.326	12.86
0.056	2.80	-8.399	5.665	51.375	32.322	12.39
0.057	2.85	-21.352	5.460	51.166	32.319	11.95
0.058	2.90	-31.671	5.263	50.964	32.315	11.52
0.059	2.95	-38.366	5.073	50.769	32.312	11.10
0.060	3.00	-40.802	4.890	50.581	32.309	10.70
0.061	3.05	-38.759	4.713	50.400	32.306	10.32
0.062	3.10	-32.456	4.543	50.225	32.302	9.94
0.063	3.15	-22.528	4.379	50.057	32.299	9.59
0.064	3.20	-9.962	4.221	49.894	32.296	9.24
0.065	3.25	3.995	4.069	49.737	32.292	8.91
0.066	3.30	17.961	3.922	49.586	32.289	8.59
0.067	3.35	30.557	3.780	49.440	32.286	8.28
0.068	3.40	40.534	3.644	49.299	32.283	7.98
0.069	3.45	46.904	3.512	49.163	32.280	7.69
0.070	3.50	49.031	3.386	49.031	32.276	7.42
0.071	3.55	46.696	3.263	48.905	32.273	7.15

(Cont.)

3-Phase fault at bus : **Bus4**

Nominal kV = 0.400

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.072	3.60	40.114	3.146	48.783	32.270	6.89
0.073	3.65	29.920	3.032	48.665	32.267	6.64
0.074	3.70	17.101	2.923	48.551	32.264	6.41
0.075	3.75	2.901	2.817	48.441	32.261	6.18
0.076	3.80	-11.301	2.716	48.335	32.258	5.95
0.077	3.85	-24.125	2.618	48.233	32.255	5.74
0.078	3.90	-34.326	2.523	48.134	32.252	5.53
0.079	3.95	-40.915	2.432	48.039	32.249	5.33
0.080	4.00	-43.257	2.345	47.947	32.246	5.14
0.081	4.05	-41.133	2.260	47.858	32.243	4.96
0.082	4.10	-34.760	2.179	47.773	32.240	4.78
0.083	4.15	-24.770	2.100	47.690	32.237	4.61
0.084	4.20	-12.149	2.024	47.610	32.234	4.44
0.085	4.25	1.859	1.951	47.533	32.231	4.28
0.086	4.30	15.877	1.881	47.458	32.228	4.13
0.087	4.35	28.524	1.813	47.386	32.225	3.98
0.088	4.40	38.558	1.748	47.317	32.222	3.84
0.089	4.45	44.990	1.685	47.250	32.219	3.70
0.090	4.50	47.185	1.624	47.185	32.216	3.56
0.091	4.55	44.923	1.566	47.123	32.214	3.44
0.092	4.60	38.420	1.509	47.062	32.211	3.31
0.093	4.65	28.308	1.455	47.004	32.208	3.19
0.094	4.70	15.572	1.402	46.947	32.205	3.08
0.095	4.75	1.453	1.352	46.893	32.202	2.97
0.096	4.80	-12.672	1.303	46.840	32.199	2.86
0.097	4.85	-25.425	1.256	46.789	32.197	2.76
0.098	4.90	-35.562	1.211	46.740	32.194	2.66
0.099	4.95	-42.098	1.167	46.693	32.191	2.56
0.100	5.00	-44.396	1.125	46.647	32.189	2.47
0.101	5.05	-42.238	1.085	46.602	32.186	2.38

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)

3-Phase fault at bus : **HKN57**

Nominal kV = 66.000

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.000	0.00	-0.001	21.982	43.964	15.544	100.00
0.001	0.05	0.395	21.301	43.284	15.544	96.90
0.002	0.10	2.858	20.642	42.624	15.544	93.90
0.003	0.15	7.082	20.003	41.985	15.544	91.00
0.004	0.20	12.591	19.384	41.366	15.544	88.18
0.005	0.25	18.784	18.784	40.766	15.544	85.45
0.006	0.30	24.995	18.203	40.185	15.544	82.81
0.007	0.35	30.560	17.639	39.621	15.544	80.24
0.008	0.40	34.877	17.093	39.076	15.544	77.76
0.009	0.45	37.471	16.565	38.547	15.544	75.36
0.010	0.50	38.034	16.052	38.034	15.544	73.02
0.011	0.55	36.462	15.556	37.538	15.544	70.76
0.012	0.60	32.858	15.074	37.056	15.544	68.58
0.013	0.65	27.529	14.608	36.590	15.544	66.45
0.014	0.70	20.949	14.156	36.138	15.544	64.40
0.015	0.75	13.718	13.718	35.700	15.544	62.41
0.016	0.80	6.501	13.294	35.276	15.544	60.48
0.017	0.85	-0.038	12.883	34.865	15.544	58.61
0.018	0.90	-5.299	12.484	34.466	15.544	56.79
0.019	0.95	-8.808	12.098	34.080	15.543	55.04
0.020	1.00	-10.258	11.724	33.706	15.543	53.33
0.021	1.05	-9.545	11.361	33.343	15.543	51.68
0.022	1.10	-6.774	11.010	32.992	15.543	50.09
0.023	1.15	-2.251	10.669	32.651	15.543	48.54
0.024	1.20	3.546	10.339	32.321	15.543	47.04
0.025	1.25	10.019	10.020	32.001	15.543	45.58
0.026	1.30	16.502	9.710	31.691	15.543	44.17
0.027	1.35	22.330	9.409	31.391	15.543	42.81
0.028	1.40	26.902	9.118	31.100	15.543	41.48
0.029	1.45	29.742	8.836	30.818	15.543	40.20
0.030	1.50	30.545	8.563	30.545	15.543	38.96
0.031	1.55	29.204	8.298	30.280	15.543	37.75
0.032	1.60	25.825	8.042	30.023	15.543	36.58
0.033	1.65	20.713	7.793	29.774	15.543	35.45
0.034	1.70	14.345	7.552	29.533	15.543	34.36
0.035	1.75	7.319	7.318	29.300	15.543	33.29
0.036	1.80	0.300	7.092	29.073	15.543	32.26
0.037	1.85	-6.047	6.873	28.854	15.543	31.27
0.038	1.90	-11.123	6.660	28.641	15.543	30.30
0.039	1.95	-14.451	6.454	28.435	15.543	29.36
0.040	2.00	-15.727	6.255	28.236	15.543	28.45
0.041	2.05	-14.844	6.061	28.042	15.543	27.57
0.042	2.10	-11.910	5.874	27.855	15.543	26.72
0.043	2.15	-7.228	5.692	27.673	15.543	25.90
0.044	2.20	-1.277	5.516	27.497	15.543	25.09
0.045	2.25	5.345	5.345	27.327	15.543	24.32
0.046	2.30	11.972	5.180	27.161	15.543	23.57
0.047	2.35	17.940	5.020	27.001	15.543	22.84
0.048	2.40	22.648	4.865	26.846	15.543	22.13
0.049	2.45	25.619	4.714	26.695	15.543	21.45
0.050	2.50	26.549	4.568	26.549	15.543	20.78
0.051	2.55	25.332	4.427	26.408	15.543	20.14
0.052	2.60	22.073	4.290	26.271	15.543	19.52
0.053	2.65	17.078	4.158	26.139	15.543	18.91
0.054	2.70	10.822	4.029	26.010	15.543	18.33
0.055	2.75	3.905	3.904	25.885	15.543	17.76
0.056	2.80	-3.008	3.784	25.765	15.543	17.21
0.057	2.85	-9.253	3.667	25.647	15.543	16.68
0.058	2.90	-14.229	3.553	25.534	15.543	16.17
0.059	2.95	-17.461	3.443	25.424	15.543	15.67
0.060	3.00	-18.644	3.337	25.318	15.543	15.18
0.061	3.05	-17.671	3.234	25.214	15.543	14.71
0.062	3.10	-14.649	3.134	25.114	15.543	14.26
0.063	3.15	-9.883	3.037	25.017	15.543	13.82
0.064	3.20	-3.850	2.943	24.924	15.543	13.39
0.065	3.25	2.851	2.852	24.832	15.543	12.97
0.066	3.30	9.556	2.764	24.744	15.543	12.57
0.067	3.35	15.598	2.678	24.659	15.543	12.18
0.068	3.40	20.378	2.595	24.576	15.543	11.81
0.069	3.45	23.420	2.515	24.496	15.543	11.44
0.070	3.50	24.418	2.437	24.418	15.543	11.09
0.071	3.55	23.267	2.362	24.342	15.543	10.75
0.072	3.60	20.072	2.289	24.269	15.543	10.41
0.073	3.65	15.138	2.218	24.199	15.543	10.09
0.074	3.70	8.942	2.150	24.130	15.542	9.78
0.075	3.75	2.084	2.083	24.063	15.542	9.48
0.076	3.80	-4.773	2.019	23.999	15.542	9.18
0.077	3.85	-10.963	1.956	23.937	15.542	8.90

(Cont.)

3-Phase fault at bus : **HKN57**

Nominal kV = 66.000

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.078	3.90	-15.886	1.896	23.876	15.542	8.62
0.079	3.95	-19.067	1.837	23.817	15.542	8.36
0.080	4.00	-20.200	1.780	23.761	15.542	8.10
0.081	4.05	-19.179	1.725	23.705	15.542	7.85
0.082	4.10	-16.111	1.672	23.652	15.542	7.61
0.083	4.15	-11.300	1.620	23.600	15.542	7.37
0.084	4.20	-5.223	1.570	23.550	15.542	7.14
0.085	4.25	1.521	1.522	23.502	15.542	6.92
0.086	4.30	8.266	1.474	23.455	15.542	6.71
0.087	4.35	14.348	1.429	23.409	15.542	6.50
0.088	4.40	19.167	1.385	23.365	15.542	6.30
0.089	4.45	22.246	1.342	23.322	15.542	6.10
0.090	4.50	23.280	1.300	23.280	15.542	5.92
0.091	4.55	22.165	1.260	23.240	15.542	5.73
0.092	4.60	19.004	1.221	23.201	15.542	5.56
0.093	4.65	14.103	1.183	23.163	15.542	5.38
0.094	4.70	7.940	1.147	23.127	15.542	5.22
0.095	4.75	1.112	1.111	23.091	15.542	5.06
0.096	4.80	-5.715	1.077	23.057	15.542	4.90
0.097	4.85	-11.875	1.044	23.024	15.542	4.75
0.098	4.90	-16.770	1.011	22.991	15.542	4.60
0.099	4.95	-19.924	0.980	22.960	15.542	4.46
0.100	5.00	-21.030	0.950	22.930	15.542	4.32
0.101	5.05	-19.984	0.920	22.900	15.542	4.19

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)

3-Phase fault at bus : **HNA6-AFA70**

Nominal kV = 66.000

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.000	0.00	-0.001	20.815	41.631	14.719	100.00
0.001	0.05	0.158	19.955	40.771	14.719	95.87
0.002	0.10	2.291	19.131	39.947	14.719	91.91
0.003	0.15	6.106	18.341	39.156	14.719	88.11
0.004	0.20	11.151	17.583	38.399	14.719	84.47
0.005	0.25	16.857	16.857	37.673	14.719	80.98
0.006	0.30	22.593	16.161	36.977	14.719	77.64
0.007	0.35	27.729	15.494	36.309	14.719	74.43
0.008	0.40	31.694	14.854	35.670	14.719	71.36
0.009	0.45	34.038	14.241	35.056	14.719	68.41
0.010	0.50	34.468	13.653	34.468	14.719	65.59
0.011	0.55	32.886	13.089	33.905	14.719	62.88
0.012	0.60	29.389	12.549	33.364	14.719	60.29
0.013	0.65	24.266	12.031	32.846	14.719	57.80
0.014	0.70	17.967	11.534	32.350	14.719	55.41
0.015	0.75	11.058	11.058	31.874	14.719	53.13
0.016	0.80	4.170	10.602	31.417	14.719	50.93
0.017	0.85	-2.071	10.164	30.980	14.719	48.83
0.018	0.90	-7.095	9.745	30.560	14.719	46.82
0.019	0.95	-10.454	9.343	30.158	14.719	44.88
0.020	1.00	-11.858	8.957	29.772	14.719	43.03
0.021	1.05	-11.209	8.587	29.402	14.719	41.25
0.022	1.10	-8.607	8.233	29.048	14.719	39.55
0.023	1.15	-4.342	7.893	28.708	14.719	37.92
0.024	1.20	1.135	7.567	28.382	14.718	36.36
0.025	1.25	7.255	7.255	28.070	14.718	34.85
0.026	1.30	13.388	6.956	27.771	14.718	33.42
0.027	1.35	18.903	6.669	27.484	14.718	32.04
0.028	1.40	23.233	6.393	27.208	14.718	30.72
0.029	1.45	25.926	6.130	26.945	14.718	29.45
0.030	1.50	26.692	5.877	26.692	14.718	28.23
0.031	1.55	25.430	5.634	26.449	14.718	27.07
0.032	1.60	22.241	5.402	26.217	14.718	25.95
0.033	1.65	17.414	5.179	25.994	14.718	24.88
0.034	1.70	11.397	4.965	25.780	14.718	23.85
0.035	1.75	4.760	4.760	25.575	14.718	22.87
0.036	1.80	-1.868	4.564	25.379	14.718	21.93
0.037	1.85	-7.859	4.376	25.190	14.718	21.02
0.038	1.90	-12.644	4.195	25.010	14.718	20.15
0.039	1.95	-15.774	4.022	24.837	14.718	19.32
0.040	2.00	-16.959	3.856	24.671	14.718	18.53
0.041	2.05	-16.099	3.697	24.512	14.718	17.76
0.042	2.10	-13.295	3.544	24.359	14.718	17.03
0.043	2.15	-8.836	3.398	24.213	14.718	16.33
0.044	2.20	-3.174	3.258	24.073	14.718	15.65
0.045	2.25	3.123	3.124	23.938	14.718	15.01
0.046	2.30	9.427	2.995	23.809	14.718	14.39
0.047	2.35	15.105	2.871	23.686	14.718	13.79
0.048	2.40	19.592	2.753	23.567	14.718	13.23
0.049	2.45	22.435	2.639	23.454	14.718	12.68
0.050	2.50	23.345	2.530	23.345	14.718	12.16
0.051	2.55	22.222	2.426	23.240	14.718	11.66
0.052	2.60	19.165	2.326	23.140	14.718	11.17
0.053	2.65	14.465	2.230	23.044	14.718	10.71
0.054	2.70	8.570	2.138	22.952	14.718	10.27
0.055	2.75	2.050	2.050	22.864	14.718	9.85
0.056	2.80	-4.466	1.965	22.779	14.718	9.44
0.057	2.85	-10.350	1.884	22.698	14.718	9.05
0.058	2.90	-15.032	1.806	22.621	14.718	8.68
0.059	2.95	-18.063	1.732	22.546	14.718	8.32
0.060	3.00	-19.154	1.661	22.475	14.718	7.98
0.061	3.05	-18.203	1.592	22.406	14.718	7.65
0.062	3.10	-15.313	1.526	22.340	14.718	7.33
0.063	3.15	-10.771	1.463	22.277	14.718	7.03
0.064	3.20	-5.029	1.403	22.217	14.718	6.74
0.065	3.25	1.345	1.345	22.159	14.718	6.46
0.066	3.30	7.721	1.290	22.104	14.718	6.20
0.067	3.35	13.470	1.237	22.051	14.718	5.94
0.068	3.40	18.024	1.186	21.999	14.718	5.70
0.069	3.45	20.932	1.137	21.951	14.718	5.46
0.070	3.50	21.904	1.090	21.904	14.718	5.24
0.071	3.55	20.840	1.045	21.859	14.718	5.02
0.072	3.60	17.841	1.002	21.816	14.718	4.81
0.073	3.65	13.195	0.960	21.774	14.718	4.61
0.074	3.70	7.353	0.921	21.735	14.718	4.42
0.075	3.75	0.883	0.883	21.697	14.718	4.24
0.076	3.80	-5.585	0.846	21.660	14.718	4.07
0.077	3.85	-11.422	0.812	21.625	14.718	3.90

(Cont.)

3-Phase fault at bus : **HNA6-AFA70**

Nominal kV = 66.000

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.078	3.90	-16.060	0.778	21.592	14.718	3.74
0.079	3.95	-19.049	0.746	21.560	14.718	3.58
0.080	4.00	-20.098	0.715	21.529	14.717	3.44
0.081	4.05	-19.109	0.686	21.499	14.717	3.29
0.082	4.10	-16.181	0.658	21.471	14.717	3.16
0.083	4.15	-11.604	0.630	21.444	14.717	3.03
0.084	4.20	-5.828	0.604	21.418	14.717	2.90
0.085	4.25	0.579	0.580	21.393	14.717	2.78
0.086	4.30	6.987	0.556	21.369	14.717	2.67
0.087	4.35	12.766	0.533	21.346	14.717	2.56
0.088	4.40	17.349	0.511	21.324	14.717	2.45
0.089	4.45	20.284	0.490	21.303	14.717	2.35
0.090	4.50	21.283	0.470	21.283	14.717	2.26
0.091	4.55	20.245	0.450	21.264	14.717	2.16
0.092	4.60	17.270	0.432	21.245	14.717	2.07
0.093	4.65	12.648	0.414	21.227	14.717	1.99
0.094	4.70	6.829	0.397	21.210	14.717	1.91
0.095	4.75	0.381	0.380	21.194	14.717	1.83
0.096	4.80	-6.067	0.365	21.178	14.717	1.75
0.097	4.85	-11.884	0.350	21.163	14.717	1.68
0.098	4.90	-16.503	0.335	21.149	14.717	1.61
0.099	4.95	-19.473	0.321	21.135	14.717	1.54
0.100	5.00	-20.505	0.308	21.121	14.717	1.48
0.101	5.05	-19.499	0.296	21.109	14.717	1.42

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)

3-Phase fault at bus : **SG-100D1**

Nominal kV = 6.600

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.000	0.00	-0.002	11.439	22.879	8.089	99.99
0.001	0.05	0.297	11.177	22.617	8.089	97.70
0.002	0.10	1.668	10.923	22.362	8.089	95.48
0.003	0.15	3.951	10.675	22.114	8.089	93.32
0.004	0.20	6.898	10.433	21.872	8.088	91.21
0.005	0.25	10.197	10.198	21.636	8.088	89.15
0.006	0.30	13.502	9.968	21.406	8.088	87.15
0.007	0.35	16.466	9.744	21.182	8.088	85.19
0.008	0.40	18.778	9.525	20.963	8.087	83.28
0.009	0.45	20.189	9.312	20.749	8.087	81.42
0.010	0.50	20.540	9.104	20.540	8.087	79.60
0.011	0.55	19.777	8.901	20.337	8.087	77.83
0.012	0.60	17.955	8.702	20.138	8.086	76.10
0.013	0.65	15.231	8.508	19.944	8.086	74.40
0.014	0.70	11.854	8.319	19.754	8.086	72.75
0.015	0.75	8.136	8.134	19.569	8.086	71.14
0.016	0.80	4.422	7.954	19.388	8.085	69.56
0.017	0.85	1.058	7.777	19.211	8.085	68.02
0.018	0.90	-1.644	7.605	19.038	8.085	66.51
0.019	0.95	-3.437	7.436	18.870	8.085	65.04
0.020	1.00	-4.161	7.272	18.705	8.084	63.60
0.021	1.05	-3.763	7.111	18.543	8.084	62.20
0.022	1.10	-2.297	6.953	18.386	8.084	60.82
0.023	1.15	0.079	6.800	18.232	8.084	59.48
0.024	1.20	3.115	6.650	18.081	8.083	58.17
0.025	1.25	6.500	6.503	17.934	8.083	56.89
0.026	1.30	9.889	6.359	17.790	8.083	55.63
0.027	1.35	12.936	6.219	17.649	8.083	54.40
0.028	1.40	15.327	6.082	17.512	8.082	53.21
0.029	1.45	16.817	5.948	17.377	8.082	52.03
0.030	1.50	17.246	5.816	17.246	8.082	50.89
0.031	1.55	16.559	5.688	17.117	8.082	49.77
0.032	1.60	14.811	5.563	16.992	8.081	48.67
0.033	1.65	12.160	5.440	16.869	8.081	47.60
0.034	1.70	8.855	5.321	16.749	8.081	46.56
0.035	1.75	5.207	5.203	16.631	8.081	45.53
0.036	1.80	1.561	5.089	16.517	8.081	44.53
0.037	1.85	-1.737	4.977	16.404	8.080	43.55
0.038	1.90	-4.375	4.867	16.294	8.080	42.60
0.039	1.95	-6.106	4.760	16.187	8.080	41.66
0.040	2.00	-6.771	4.656	16.082	8.080	40.74
0.041	2.05	-6.315	4.553	15.979	8.079	39.85
0.042	2.10	-4.793	4.453	15.879	8.079	38.97
0.043	2.15	-2.364	4.355	15.781	8.079	38.12
0.044	2.20	0.725	4.259	15.685	8.079	37.28
0.045	2.25	4.162	4.166	15.591	8.079	36.46
0.046	2.30	7.601	4.074	15.499	8.078	35.66
0.047	2.35	10.697	3.985	15.409	8.078	34.88
0.048	2.40	13.137	3.897	15.321	8.078	34.12
0.049	2.45	14.675	3.812	15.235	8.078	33.37
0.050	2.50	15.151	3.728	15.151	8.078	32.63
0.051	2.55	14.511	3.646	15.069	8.077	31.92
0.052	2.60	12.810	3.566	14.989	8.077	31.22
0.053	2.65	10.205	3.488	14.910	8.077	30.53
0.054	2.70	6.945	3.411	14.833	8.077	29.87
0.055	2.75	3.341	3.336	14.758	8.076	29.21
0.056	2.80	-0.262	3.263	14.685	8.076	28.57
0.057	2.85	-3.518	3.192	14.613	8.076	27.94
0.058	2.90	-6.115	3.122	14.543	8.076	27.33
0.059	2.95	-7.807	3.053	14.474	8.076	26.73
0.060	3.00	-8.434	2.986	14.407	8.075	26.15
0.061	3.05	-7.942	2.921	14.341	8.075	25.57
0.062	3.10	-6.385	2.857	14.277	8.075	25.01
0.063	3.15	-3.923	2.794	14.214	8.075	24.47
0.064	3.20	-0.801	2.733	14.152	8.075	23.93
0.065	3.25	2.667	2.673	14.092	8.074	23.41
0.066	3.30	6.138	2.614	14.033	8.074	22.89
0.067	3.35	9.264	2.557	13.976	8.074	22.39
0.068	3.40	11.735	2.501	13.919	8.074	21.90
0.069	3.45	13.304	2.446	13.864	8.074	21.42
0.070	3.50	13.810	2.393	13.810	8.074	20.96
0.071	3.55	13.201	2.340	13.758	8.073	20.50
0.072	3.60	11.529	2.289	13.706	8.073	20.05
0.073	3.65	8.954	2.239	13.656	8.073	19.61
0.074	3.70	5.723	2.190	13.606	8.073	19.18
0.075	3.75	2.148	2.142	13.558	8.073	18.76
0.076	3.80	-1.427	2.095	13.511	8.072	18.35
0.077	3.85	-4.656	2.049	13.465	8.072	17.95

(Cont.)

3-Phase fault at bus : **SG-100D1**

Nominal kV = 6.600

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.078	3.90	-7.227	2.004	13.420	8.072	17.56
0.079	3.95	-8.894	1.960	13.376	8.072	17.17
0.080	4.00	-9.498	1.917	13.333	8.072	16.80
0.081	4.05	-8.983	1.876	13.290	8.071	16.43
0.082	4.10	-7.404	1.834	13.249	8.071	16.07
0.083	4.15	-4.920	1.794	13.209	8.071	15.72
0.084	4.20	-1.778	1.755	13.169	8.071	15.38
0.085	4.25	1.710	1.717	13.130	8.071	15.04
0.086	4.30	5.200	1.679	13.093	8.071	14.71
0.087	4.35	8.345	1.642	13.056	8.070	14.39
0.088	4.40	10.836	1.606	13.020	8.070	14.08
0.089	4.45	12.423	1.571	12.984	8.070	13.77
0.090	4.50	12.950	1.537	12.950	8.070	13.47
0.091	4.55	12.359	1.503	12.916	8.070	13.17
0.092	4.60	10.707	1.471	12.883	8.070	12.89
0.093	4.65	8.152	1.438	12.850	8.069	12.60
0.094	4.70	4.940	1.407	12.819	8.069	12.33
0.095	4.75	1.384	1.376	12.788	8.069	12.06
0.096	4.80	-2.173	1.346	12.757	8.069	11.80
0.097	4.85	-5.384	1.317	12.728	8.069	11.54
0.098	4.90	-7.939	1.288	12.699	8.069	11.29
0.099	4.95	-9.590	1.260	12.670	8.068	11.04
0.100	5.00	-10.178	1.232	12.642	8.068	10.80
0.101	5.05	-9.649	1.205	12.615	8.068	10.56

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)

3-Phase fault at bus : **SG-200N1**

Nominal kV = 0.400

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.000	0.00	-0.109	44.864	89.836	31.800	99.76
0.001	0.05	0.182	42.948	87.913	31.796	95.51
0.002	0.10	4.748	41.123	86.082	31.791	91.47
0.003	0.15	12.958	39.384	84.338	31.787	87.61
0.004	0.20	23.833	37.727	82.674	31.782	83.94
0.005	0.25	36.139	36.145	81.086	31.778	80.43
0.006	0.30	48.515	34.636	79.571	31.774	77.08
0.007	0.35	59.596	33.195	78.123	31.769	73.88
0.008	0.40	68.155	31.818	76.740	31.765	70.83
0.009	0.45	73.217	30.502	75.418	31.761	67.91
0.010	0.50	74.154	29.244	74.154	31.756	65.12
0.011	0.55	70.752	28.041	72.945	31.752	62.45
0.012	0.60	63.222	26.890	71.788	31.748	59.89
0.013	0.65	52.188	25.788	70.681	31.744	57.45
0.014	0.70	38.621	24.734	69.620	31.739	55.10
0.015	0.75	23.743	23.725	68.605	31.735	52.86
0.016	0.80	8.909	22.758	67.632	31.731	50.71
0.017	0.85	-4.525	21.832	66.700	31.727	48.66
0.018	0.90	-15.337	20.945	65.807	31.723	46.69
0.019	0.95	-22.560	20.095	64.952	31.719	44.80
0.020	1.00	-25.571	19.280	64.131	31.715	42.99
0.021	1.05	-24.159	18.499	63.345	31.711	41.25
0.022	1.10	-18.541	17.751	62.591	31.706	39.59
0.023	1.15	-9.341	17.033	61.867	31.702	37.99
0.024	1.20	2.466	16.345	61.174	31.698	36.46
0.025	1.25	15.656	15.686	60.509	31.694	35.00
0.026	1.30	28.873	15.053	59.870	31.691	33.59
0.027	1.35	40.760	14.446	59.258	31.687	32.24
0.028	1.40	50.094	13.865	58.671	31.683	30.94
0.029	1.45	55.904	13.306	58.107	31.679	29.70
0.030	1.50	57.566	12.771	57.566	31.675	28.51
0.031	1.55	54.866	12.257	57.047	31.671	27.37
0.032	1.60	48.017	11.764	56.549	31.667	26.27
0.033	1.65	37.643	11.292	56.070	31.663	25.22
0.034	1.70	24.711	10.838	55.611	31.660	24.21
0.035	1.75	10.443	10.403	55.171	31.656	23.24
0.036	1.80	-3.808	9.985	54.748	31.652	22.31
0.037	1.85	-16.689	9.584	54.342	31.648	21.41
0.038	1.90	-26.980	9.200	53.952	31.645	20.56
0.039	1.95	-33.713	8.831	53.577	31.641	19.73
0.040	2.00	-36.265	8.476	53.218	31.637	18.95
0.041	2.05	-34.425	8.136	52.873	31.633	18.19
0.042	2.10	-28.406	7.810	52.542	31.630	17.46
0.043	2.15	-18.831	7.497	52.223	31.626	16.76
0.044	2.20	-6.670	7.197	51.918	31.623	16.09
0.045	2.25	6.858	6.908	51.624	31.619	15.45
0.046	2.30	20.399	6.632	51.342	31.615	14.83
0.047	2.35	32.601	6.366	51.072	31.612	14.24
0.048	2.40	42.243	6.111	50.812	31.608	13.67
0.049	2.45	48.358	5.866	50.562	31.605	13.12
0.050	2.50	50.322	5.631	50.322	31.601	12.60
0.051	2.55	47.922	5.406	50.092	31.598	12.10
0.052	2.60	41.371	5.189	49.871	31.594	11.61
0.053	2.65	31.289	4.982	49.658	31.591	11.15
0.054	2.70	18.643	4.782	49.454	31.587	10.71
0.055	2.75	4.651	4.591	49.257	31.584	10.28
0.056	2.80	-9.336	4.407	49.069	31.581	9.87
0.057	2.85	-21.967	4.231	48.888	31.577	9.47
0.058	2.90	-32.026	4.062	48.714	31.574	9.10
0.059	2.95	-38.543	3.899	48.546	31.570	8.73
0.060	3.00	-40.899	3.743	48.386	31.567	8.38
0.061	3.05	-38.880	3.593	48.231	31.564	8.05
0.062	3.10	-32.699	3.450	48.083	31.560	7.73
0.063	3.15	-22.975	3.312	47.940	31.557	7.42
0.064	3.20	-10.676	3.179	47.803	31.554	7.12
0.065	3.25	2.983	3.052	47.671	31.551	6.84
0.066	3.30	16.650	2.930	47.545	31.547	6.57
0.067	3.35	28.976	2.813	47.423	31.544	6.31
0.068	3.40	38.745	2.700	47.306	31.541	6.05
0.069	3.45	44.988	2.592	47.194	31.538	5.81
0.070	3.50	47.085	2.489	47.085	31.535	5.58
0.071	3.55	44.822	2.389	46.982	31.531	5.36
0.072	3.60	38.411	2.294	46.882	31.528	5.14
0.073	3.65	28.470	2.202	46.785	31.525	4.94
0.074	3.70	15.963	2.114	46.693	31.522	4.74
0.075	3.75	2.108	2.030	46.604	31.519	4.55
0.076	3.80	-11.749	1.949	46.519	31.516	4.37
0.077	3.85	-24.260	1.871	46.436	31.513	4.20

(Cont.)

3-Phase fault at bus : **SG-200N1**

Nominal kV = 0.400

i = total fault current,
Idc = dc component,
ienv = top envelope of current-wave,
Iac(rms) = rms value of ac component,
Idc(%) = percentage value of dc component

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)
0.078	3.90	-34.207	1.796	46.357	31.510	4.03
0.079	3.95	-40.627	1.724	46.281	31.507	3.87
0.080	4.00	-42.898	1.655	46.208	31.504	3.72
0.081	4.05	-40.805	1.589	46.138	31.501	3.57
0.082	4.10	-34.561	1.526	46.070	31.498	3.42
0.083	4.15	-24.784	1.465	46.005	31.495	3.29
0.084	4.20	-12.438	1.406	45.942	31.492	3.16
0.085	4.25	1.263	1.350	45.882	31.489	3.03
0.086	4.30	14.973	1.296	45.824	31.486	2.91
0.087	4.35	27.343	1.244	45.768	31.483	2.79
0.088	4.40	37.159	1.195	45.714	31.480	2.68
0.089	4.45	43.456	1.147	45.662	31.477	2.58
0.090	4.50	45.612	1.101	45.612	31.474	2.47
0.091	4.55	43.414	1.057	45.564	31.471	2.38
0.092	4.60	37.073	1.015	45.518	31.469	2.28
0.093	4.65	27.206	0.974	45.474	31.466	2.19
0.094	4.70	14.775	0.935	45.431	31.463	2.10
0.095	4.75	0.993	0.898	45.389	31.460	2.02
0.096	4.80	-12.794	0.862	45.350	31.457	1.94
0.097	4.85	-25.241	0.828	45.311	31.455	1.86
0.098	4.90	-35.133	0.795	45.274	31.452	1.79
0.099	4.95	-41.505	0.763	45.239	31.449	1.72
0.100	5.00	-43.739	0.733	45.204	31.446	1.65
0.101	5.05	-41.619	0.703	45.171	31.444	1.58

t (s)	t (cycle)	i (kA)	Idc (kA)	ienv (kA)	Iac (kA, rms)	Idc (%)

Short-Circuit Summary Report

3-Phase Fault Currents

Bus		Device		Device Capacity (kA)				Short-Circuit Current (kA)			
				Making							
ID	kV	ID	Type	Peak	Ib sym	Ib asym	Idc	ip	Ib sym	Ib asym	Idc
Bus4	0.400	Bus4	Bus					77.134			
HKN57	66.000	HKN57	SwtchGear	78.750				38.034			
	66.000	CB1	CB	78.750	31.500	32.387	7.529	38.034	15.542	15.644	1.780
	66.000	CB2	CB	78.750	31.500	32.387	7.529	38.034	15.542	15.644	1.780
HNA6-AFA70	66.000	HNA6-AFA70	SwtchGear	78.750				34.468			
	66.000	CB3	CB	78.750	31.500	32.387	7.529	34.468	14.717	14.735	0.715
	66.000	CB4	CB	78.750	31.500	32.387	7.529	34.468	14.717	14.735	0.715
SG-100D1	6.600	SG-100D1	SwtchGear	62.500				20.540			
	6.600	CB6	CB	62.500	25.000	25.704	5.976	20.540	8.072	8.296	1.917
	6.600	CB8	CB	62.500	25.000	25.704	5.976	20.540	8.072	8.296	1.917
	6.600	CB9	CB	62.500	25.000	25.704	5.976	20.540	8.072	8.296	1.917
	6.600	CB12	CB	62.500	25.000	25.704	5.976	20.540	8.072	8.296	1.917
	6.600	CB10	CB	62.500	25.000	25.704	5.976	20.540	8.072	8.296	1.917
SG-200N1	0.400	SG-200N1	SwtchGear	105.000				74.154			
	0.400	CB14	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB7	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB16	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB18	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB19	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB21	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB22	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB23	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB25	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB27	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771
	0.400	CB29	CB	105.000	50.000	50.383		74.154	31.675	34.153	12.771

LV circuit breaker duty determined based on service rating.

* Indicates a device with calculated duty exceeding the device capability.

\# Indicates a device with calculated duty exceeding the device marginal limit. (95 % times device capability)

Attachment 2 CASE 2: SCCMAX – Unbalance – IEC 60909

Electrical Transient Analyzer Program

Short-Circuit Analysis

IEC 60909 Standard

3-Phase, LG, LL, & LLG Fault Currents

	Swing	V-Control	Load	Total
Number of Buses:	1	0	21	22

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	3	0	0	18	0	0	21

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Inverter	Total
Number of Machines:	0	4	0	0	10	0	14

System Frequency:	50.00
Unit System:	Metric
Project Filename:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\Case2_SCCMaxUnb.SI2S

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	20
Cable / Busway Resistance:	Yes	Global	20

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	Load	0.400	0.439	1	99.43	60.00
Bus4	Load	0.400	0.439	1	99.65	60.00
Bus7	Load	6.600	6.900	1	99.75	30.00
Bus62	Load	0.400	0.439	1	99.29	60.00
Bus63	Load	0.400	0.439	1	99.45	60.00
Bus64	Load	0.400	0.439	1	98.94	60.00
Bus66	Load	0.400	0.439	1	99.46	60.00
Bus67	Load	0.400	0.439	1	99.44	60.00
Bus68	Load	0.400	0.439	1	99.50	60.00
Bus69	Load	0.400	0.439	1	99.46	60.00
Bus84	Load	0.400	0.439	1	99.41	60.00
Bus92	Load	66.000	66.000	1	99.99	0.00
Bus93	Load	66.000	66.000	1	99.99	0.00
Bus94	Load	6.900	6.900	1	95.46	30.00
Bus96	Load	6.600	6.900	1	99.75	30.00
Bus97	Load	6.600	6.900	1	99.80	30.00
Bus98	Load	0.800	0.836	1	100.42	60.00
Bus99	Load	6.600	6.900	1	99.73	30.00
HKN57	SWNG	66.000	66.000	1	100.00	0.00
HNA6-AFA70	Load	66.000	66.000	1	99.99	0.00
SG-100D1	Load	6.600	6.900	1	99.79	30.00
SG-200N1	Load	0.400	0.439	1	99.52	60.00

22 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

Line/Cable/Busway Input Data

ohms or siemens per 1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway			Length									
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	20	0.0627427	0.089	0.0001854	0.0997609	0.22606	0.0001854
6.6kV_Cable1	6.6NCUN1	120	25.0	0.0	2	20	0.1537196	0.113	0.00014	0.4156702	0.0506	0.00014
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
6.6kV_Cable3	6.6NCUN1	70	78.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
6.6kV_Cable5	6.6NCUN1	70	55.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
6.6kV_Cable6	6.6NCUN1	70	25.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
66kV_Cable1	66NALS1	300	25.0	0.0	1	20	0.0609136	0.12	0.0000644	0.6468773	0.067	0.0000644
66kV_Cable2	66NALS1	300	40.0	0.0	1	20	0.0609136	0.12	0.0000644	0.6468773	0.067	0.0000644
66kV_Cable3	66NALS1	400	1240.0	0.0	1	20	0.0793982	0.0987	0.0000911	0.275788	0.5429	0.0000911
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	20	0.5246857	0.08	0.0001015	1.6527991	0.1968	
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	20	0.5246857	0.08	0.0001015	1.6527991	0.1968	
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	20	1.1505439	0.08	0.0000597	4.6021757	0.32	
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	20	1.145054	0.08	0.0000971	3.6069198	0.1968	
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	

Line / Cable / Busway resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
TR-100AD1	7.000	66.000	6.900	8.00	16.06	0	0	-10.0	3.750	0	7.20	Dyn	-30.00
TR-200DE1	1.600	6.600	0.420	6.00	7.94	0	0	-10.0	2.500	0	5.40	Dyn	-30.00
TR-200ED1	0.500	6.600	0.800	6.00	7.63	0	0	-10.0	0	0	5.40	Dyn	-30.00

2-Winding Transformer Grounding Input Data

Transformer	Rating			Grounding								
				Conn.	Primary				Secondary			
ID	MVA	Prim. kV	Sec. kV	Type	Type	kV	Amp	ohm	Type	kV	Amp	ohm
TR-100AD1	7.000	66.000	6.900	D/Y					Resistor		400.0	9.95958
TR-200DE1	1.600	6.600	0.420	D/Y					Solid			
TR-200ED1	0.500	6.600	0.800	D/Y					Solid			

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-100AD1	2W XFMR	Bus93	Bus94	6.40	102.84	103.04	
TR-200DE1	2W XFMR	Bus7	Bus4	37.29	296.09	298.42	
TR-200ED1	2W XFMR	Bus97	Bus98	124.10	946.88	954.98	
0.4kV_cable	Cable	Bus4	SG-200N1	6.51	9.23	11.30	0.0000018
6.6kV_Cable1	Cable	Bus94	SG-100D1	0.40	0.30	0.50	0.0003333
6.6kV_Cable2	Cable	SG-100D1	Bus7	2.48	1.20	2.75	0.0002304
6.6kV_Cable3	Cable	SG-100D1	Bus99	4.39	2.13	4.88	0.0004085
6.6kV_Cable5	Cable	SG-100D1	Bus96	3.10	1.50	3.44	0.0002880
6.6kV_Cable6	Cable	SG-100D1	Bus97	1.41	0.68	1.57	0.0001309
66kV_Cable1	Cable	HNA6-AFA70	Bus93	0.00	0.01	0.01	0.0070134
66kV_Cable2	Cable	Bus92	HNA6-AFA70	0.01	0.01	0.01	0.0112215
66kV_Cable3	Cable	HKN57	Bus92	0.23	0.28	0.36	0.4921036
AC_UPS-F&G	Cable	SG-200N1	Bus63	1088.55	165.97	1101.14	0.0000008
AC_UPS-PAS	Cable	SG-200N1	Bus62	1088.55	165.97	1101.14	0.0000008
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	15520.85	313.54	15524.02	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	4775.65	96.47	4776.62	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	11222.77	226.71	11225.06	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	10745.21	217.06	10747.40	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1193.51	82.99	1196.39	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	3860.38	269.71	3869.79	0.0000012
DC_UPS_Navaid	Cable	SG-200N1	Bus64	11939.12	241.18	11941.55	0.0000006

Power Grid Input Data

		Rating		% Impedance 100 MVA Base			Grounding
Power Grid ID	Connected Bus ID	MVASC	kV	R	X"	R/X"	Type
A-80000	Bus99	1.875	6.600	530.68652	5306.86523	0.10	Delta
A-85000	Bus96	1.875	6.600	530.68652	5306.86523	0.10	Delta
SCC_Max	HKN57	1771.888	66.000	0.56157	5.61569	0.10	Wye - Solid
SG-200D2	Bus98	0.660	0.800	1507.63196	15076.32031	0.10	Delta

Total Connected Power Grids (= 4): 1776.298 MVA

Lumped Load Input Data

	Lumped Load						Motor Loads								
	Rating				% Load		Loading		% Impedance (Machine Base)			Grounding			mFact.
Lumped Load ID	kVA	kV	Amp	% PF	MTR	STAT	kW	kvar	R	X"	R/X"	Conn.	Type	Amp	MW/PP
AC_UPS_F&G	12.5	0.400	18.04	80.00	100	0	2.71	2.03	6.46	15.37	0.42	Delta			0.01
AC_UPS_PAS	32.5	0.400	46.91	80.00	100	0	12.90	9.67	6.46	15.37	0.42	Delta			0.03
BL_SG-200N1	982.4	0.400	1417.97	87.70	1	99	4.67	2.56	6.46	15.37	0.42	Delta			0.01
DB-L&SP-BoP	37.3	0.400	53.84	88.40	100	0	6.08	3.22	6.46	15.37	0.42	Delta			0.03
DB-L&SP-HVMV	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DB-L&SP-Inst.	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DB-L&SP-LV	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DB-L&SP-UPS	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DC-Battery-System_SWGR	11.5	0.400	16.60	100.00	100	0	1.57	0.00	6.46	15.37	0.42	Delta			0.01
NAVAID_System	3.2	0.400	4.56	100.00	100	0	3.16	0.00	6.46	15.37	0.42	Delta			0.00

Total Connected Lumped Loads (= 10): 1086.2 kVA

SHORT- CIRCUIT REPORT

Fault at bus: **Bus4**
Nominal kV = 0.400
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
Bus4	Total	0.00	32.092	0.00	100.81	100.74	34.864	34.864	4.94E+001	3.89E+002	3.73E+001	2.96E+002
SG-200N1	Bus4	0.10	1.020	0.07	100.81	100.76	0.739	0.000	5.01E+003	1.13E+004		
Bus7	Bus4	73.83	31.117	86.40	85.96	100.00	34.157	34.864 *	4.72E+001	4.01E+002	3.73E+001	2.96E+002
Bus63	SG-200N1	1.11	0.113	0.80	100.61	101.13	0.082	0.000	4.40E+004	1.02E+005		
Bus62	SG-200N1	2.75	0.291	1.99	100.31	101.72	0.211	0.000	1.76E+004	3.94E+004		
Bus67	SG-200N1	2.04	0.015	1.48	100.36	101.48	0.011	0.000	3.31E+005	7.50E+005		
Bus68	SG-200N1	0.67	0.015	0.49	100.67	100.98	0.011	0.000	3.20E+005	7.50E+005		
Bus69	SG-200N1	1.50	0.015	1.08	100.48	101.28	0.011	0.000	3.26E+005	7.50E+005		
Bus66	SG-200N1	1.44	0.015	1.04	100.50	101.26	0.011	0.000	3.26E+005	7.50E+005		
Bus84	SG-200N1	3.40	0.334	2.46	100.11	101.97	0.242	0.000	1.56E+004	3.43E+004		
Bus1	SG-200N1	3.39	0.103	2.45	100.11	101.96	0.075	0.000	5.04E+004	1.11E+005		
Bus64	SG-200N1	2.89	0.028	2.09	100.17	101.78	0.021	0.000	1.81E+005	4.04E+005		
BL_SG-200N1	SG-200N1	105.00	0.089	105.00	105.00	105.00	0.065	0.000	5.45E+004	1.30E+005		
SG-100D1	Bus7	74.21	1.980	86.79	85.94	100.00	1.242	0.000	1.97E+002	7.52E+001		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	32.092	34.864	27.793	33.723
Peak Current (kA), Method C	:	77.035	83.689	66.715	80.950
Breaking Current (kA, rms, symm)	:		34.864	27.793	33.723
Steady State Current (kA, rms)	:	31.117	34.864	27.793	33.723

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **HKN57**
Nominal kV = 66.000
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
HKN57	Total	0.00	15.546	0.00	142.34	142.33	7.106	7.106	5.89E-001	5.88E+000	2.68E+000	2.68E+001
Bus92	HKN57	0.02	0.046	0.01	142.34	142.34	0.014	0.000	2.82E+002	1.97E+003		
SCC_Max	HKN57	105.00	15.500	105.00	105.00	105.00	7.092	7.106	5.90E-001	5.90E+000	2.68E+000	2.68E+001
HNA6-AFA70	Bus92	0.02	0.046	0.01	142.34	142.34	0.014	0.000	2.82E+002	1.97E+003		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	15.546	7.106	13.463	13.659
Peak Current (kA), Method C	:	38.383	17.546	33.241	33.724
Breaking Current (kA, rms, symm)	:		7.106	13.463	13.659
Steady State Current (kA, rms)	:	15.540	7.106	13.463	13.659

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **HNA6-AFA70**
Nominal kV = 66.000
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
HNA6-AFA70	Total	0.00	14.760	0.00	142.69	142.34	6.714	6.714	8.19E-001	6.17E+000	3.53E+000	2.84E+001
Bus93	HNA6-AFA70	0.00	0.046	0.00	142.69	142.34	0.014	0.000	2.82E+002	1.97E+003		
Bus92	HNA6-AFA70	0.21	14.713	0.19	142.78	142.25	6.700	6.714	8.21E-001	6.19E+000	3.53E+000	2.84E+001
Bus94	Bus93	5.44	0.046	83.55	105.00	83.22	0.014	0.000	2.82E+002	1.97E+003		
HKN57	Bus92	6.27	14.713	6.40	140.85	138.99	6.700	6.714	8.16E-001	6.18E+000	3.47E+000	2.84E+001

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	14.760	6.714	12.782	12.982
Peak Current (kA), Method C	:	35.029	15.935	30.336	30.809
Breaking Current (kA, rms, symm)	:		6.714	12.782	12.982
Steady State Current (kA, rms)	:	14.753	6.714	12.782	12.982

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-100D1**
Nominal kV = 6.600
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-100D1	Total	0.00	8.112	0.00	178.80	183.94	0.400	0.400	7.65E+000	1.03E+002	6.28E+003	1.03E+002
Bus94	SG-100D1	0.46	7.668	0.03	171.01	175.94	0.385	0.400	7.63E+000	1.09E+002	6.28E+003	1.03E+002
Bus7	SG-100D1	0.02	0.067	0.00	178.80	183.95	0.002	0.000	5.05E+003	1.16E+004		
Bus99	SG-100D1	0.10	0.164	0.00	178.80	183.95	0.005	0.000	5.14E+002	5.10E+003		
Bus96	SG-100D1	0.07	0.164	0.00	178.80	183.95	0.005	0.000	5.13E+002	5.10E+003		
Bus97	SG-100D1	0.01	0.054	0.00	178.80	183.95	0.002	0.000	1.57E+003	1.54E+004		
Bus93	Bus94	94.72	7.668	100.49	100.33	100.43	0.385	0.400 *	7.23E+000	1.09E+002	6.28E+003	1.03E+002
Bus4	Bus7	2.62	0.067	108.41	110.25	111.46	0.002	0.000	5.05E+003	1.16E+004		
A-80000	Bus99	105.00	0.164	105.00	105.00	105.00	0.005	0.000	5.10E+002	5.10E+003		
A-85000	Bus96	105.00	0.164	105.00	105.00	105.00	0.005	0.000	5.10E+002	5.10E+003		
Bus98	Bus97	6.47	0.054	103.34	105.00	106.13	0.002	0.000	1.57E+003	1.54E+004		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	8.112	0.400	7.025	7.125
Peak Current (kA), Method C	:	20.740	1.022	17.961	18.216
Breaking Current (kA, rms, symm)	:		0.400	7.025	7.125
Steady State Current (kA, rms)	:	8.049	0.400	7.025	7.125

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-200N1**
Nominal kV = 0.400
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-200N1	Total	0.00	31.348	0.00	101.30	101.80	33.525	33.525	5.57E+001	3.97E+002	4.76E+001	3.20E+002
Bus4	SG-200N1	2.86	30.368	4.41	100.84	101.03	32.826	33.525	5.37E+001	4.11E+002	4.76E+001	3.20E+002
Bus63	SG-200N1	1.04	0.113	0.74	101.11	102.17	0.081	0.000	4.40E+004	1.02E+005		
Bus62	SG-200N1	2.68	0.292	1.91	100.82	102.75	0.208	0.000	1.76E+004	3.94E+004		
Bus67	SG-200N1	1.99	0.015	1.42	100.86	102.51	0.011	0.000	3.31E+005	7.50E+005		
Bus68	SG-200N1	0.61	0.015	0.44	101.16	102.02	0.011	0.000	3.20E+005	7.50E+005		
Bus69	SG-200N1	1.44	0.015	1.03	100.98	102.32	0.011	0.000	3.26E+005	7.50E+005		
Bus66	SG-200N1	1.38	0.015	0.98	100.99	102.29	0.011	0.000	3.26E+005	7.50E+005		
Bus84	SG-200N1	3.34	0.334	2.38	100.62	102.99	0.238	0.000	1.56E+004	3.43E+004		
Bus1	SG-200N1	3.33	0.103	2.37	100.63	102.99	0.073	0.000	5.04E+004	1.11E+005		
Bus64	SG-200N1	2.83	0.028	2.02	100.68	102.81	0.020	0.000	1.81E+005	4.04E+005		
BL_SG-200N1	SG-200N1	105.00	0.089	105.00	105.00	105.00	0.064	0.000	5.45E+004	1.30E+005		
Bus7	Bus4	74.48	30.368	87.06	86.36	100.00	32.826	33.525 *	4.72E+001	4.01E+002	3.73E+001	2.96E+002
AC_UPS_F&G	Bus63	105.00	0.113	105.00	105.00	105.00	0.081	0.000	4.29E+004	1.02E+005		
AC_UPS_PAS	Bus62	105.00	0.292	105.00	105.00	105.00	0.208	0.000	1.65E+004	3.92E+004		
DB-L&SP-HVMV	Bus67	105.00	0.015	105.00	105.00	105.00	0.011	0.000	3.15E+005	7.50E+005		
DB-L&SP-LV	Bus68	105.00	0.015	105.00	105.00	105.00	0.011	0.000	3.15E+005	7.50E+005		
DB-L&SP-UPS	Bus69	105.00	0.015	105.00	105.00	105.00	0.011	0.000	3.15E+005	7.50E+005		
DB-L&SP-Inst.	Bus66	105.00	0.015	105.00	105.00	105.00	0.011	0.000	3.15E+005	7.50E+005		
DB-L&SP-BoP	Bus84	105.00	0.334	105.00	105.00	105.00	0.238	0.000	1.44E+004	3.42E+004		
DC-Battery-System_SWGR	Bus1	105.00	0.103	105.00	105.00	105.00	0.073	0.000	4.66E+004	1.11E+005		
NAVAID_System	Bus64	105.00	0.028	105.00	105.00	105.00	0.020	0.000	1.70E+005	4.04E+005		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	31.348	33.525	27.148	32.661
Peak Current (kA), Method C	:	74.083	79.227	64.158	77.186
Breaking Current (kA, rms, symm)	:		33.525	27.148	32.661
Steady State Current (kA, rms)	:	30.368	33.525	27.148	32.661

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus4	0.400	32.092	77.035	31.117	34.864	83.689	34.864	34.864	27.793	66.715	27.793	27.793	33.723	80.950	33.723	33.723
HKN57	66.000	15.546	38.383	15.540	7.106	17.546	7.106	7.106	13.463	33.241	13.463	13.463	13.659	33.724	13.659	13.659
HNA6-AFA70	66.000	14.760	35.029	14.753	6.714	15.935	6.714	6.714	12.782	30.336	12.782	12.782	12.982	30.809	12.982	12.982
SG-100D1	6.600	8.112	20.740	8.049	0.400	1.022	0.400	0.400	7.025	17.961	7.025	7.025	7.125	18.216	7.125	7.125
SG-200N1	0.400	31.348	74.083	30.368	33.525	79.227	33.525	33.525	27.148	64.158	27.148	27.148	32.661	77.186	32.661	32.661

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus4	0.400	0.00095	0.00750	0.00756	0.00095	0.00750	0.00756	0.00072	0.00571	0.00575	0.00000	0.00000	0.00000
HKN57	66.000	0.25641	2.56084	2.57365	0.25641	2.56084	2.57365	1.16849	11.68488	11.74316	0.00000	0.00000	0.00000
HNA6-AFA70	66.000	0.35671	2.68724	2.71081	0.35671	2.68724	2.71081	1.53634	12.36076	12.45587	0.00000	0.00000	0.00000
SG-100D1	6.600	0.03641	0.49186	0.49321	0.03641	0.49186	0.49321	29.91356	0.49027	29.91758	0.00000	0.00000	0.00000
SG-200N1	0.400	0.00107	0.00766	0.00774	0.00107	0.00766	0.00774	0.00092	0.00616	0.00623	0.00000	0.00000	0.00000

Branch (earth-fault factor) Summary Report

Bus		EFF/Ke (LG)	EFF/Ke (LLG)
ID	kV		
Bus4	0.400	0.84	0.79
HKN57	66.000	1.42	1.42
HNA6-AFA70	66.000	1.43	1.42
SG-100D1	6.600	1.68	1.44
SG-200N1	0.400	0.84	0.81

Attachment 3 CASE 3: SCCMIN with Network – IEC 60909

Electrical Transient Analyzer Program

Short-Circuit Analysis

IEC 60909 Standard

3-Phase, LG, LL, & LLG Fault Currents

	Swing	V-Control	Load	Total
Number of Buses:	1	0	17	18

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	2	0	0	15	0	0	17

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Inverter	Total
Number of Machines:	0	1	0	0	0	0	1

System Frequency:	50.00
Unit System:	Metric
Project Filename:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\Case3_SCCMinNet.SI2S

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	90
Cable / Busway Resistance:	Yes	Global	90

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	Load	0.400	0.439	2	99.43	60.00
Bus4	Load	0.400	0.439	2	99.65	60.00
Bus7	Load	6.600	6.900	2	99.75	30.00
Bus62	Load	0.400	0.439	2	99.29	60.00
Bus63	Load	0.400	0.439	2	99.45	60.00
Bus64	Load	0.400	0.439	2	98.94	60.00
Bus66	Load	0.400	0.439	2	99.46	60.00
Bus67	Load	0.400	0.439	2	99.44	60.00
Bus68	Load	0.400	0.439	2	99.50	60.00
Bus69	Load	0.400	0.439	2	99.46	60.00
Bus84	Load	0.400	0.439	2	99.41	60.00
Bus92	Load	66.000	66.000	2	99.99	0.00
Bus93	Load	66.000	66.000	2	99.99	0.00
Bus94	Load	6.900	6.900	2	95.46	30.00
HKN57	SWNG	66.000	66.000	2	100.00	0.00
HNA6-AFA70	Load	66.000	66.000	2	99.99	0.00
SG-100D1	Load	6.600	6.900	2	99.79	30.00
SG-200N1	Load	0.400	0.439	2	99.52	60.00

18 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

Line/Cable/Busway Input Data

ohms or siemens per 1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway			Length									
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	90	0.08	0.089	0.0001854	0.1272	0.22606	0.0001854
6.6kV_Cable1	6.6NCUN1	120	25.0	0.0	2	90	0.196	0.113	0.00014	0.53	0.0506	0.00014
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	90	0.342	0.13	0.00011	0.68	0.0632	
66kV_Cable1	66NALS1	300	25.0	0.0	1	90	0.0781	0.12	0.0000644	0.8293899	0.067	0.0000644
66kV_Cable2	66NALS1	300	40.0	0.0	1	90	0.0781	0.12	0.0000644	0.8293899	0.067	0.0000644
66kV_Cable3	66NALS1	400	1240.0	0.0	1	90	0.1018	0.0987	0.0000911	0.3536	0.5429	0.0000911
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	90	0.669	0.08	0.0001015	2.1073999	0.1968	
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	90	0.669	0.08	0.0001015	2.1073999	0.1968	
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	90	1.467	0.08	0.0000597	5.868	0.32	
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	90	1.46	0.08	0.0000971	4.599	0.1968	
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	

Line / Cable / Busway resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
TR-100AD1	7.000	66.000	6.900	8.00	16.06	0	0	10.0	3.750	0	8.80	Dyn	-30.00
TR-200DE1	1.600	6.600	0.420	6.00	7.94	0	0	10.0	2.500	0	6.60	Dyn	-30.00

2-Winding Transformer Grounding Input Data

Transformer	Rating			Grounding								
				Conn.	Primary				Secondary			
ID	MVA	Prim. kV	Sec. kV	Type	Type	kV	Amp	ohm	Type	kV	Amp	ohm
TR-100AD1	7.000	66.000	6.900	D/Y					Resistor		400.0	9.95958
TR-200DE1	1.600	6.600	0.420	D/Y					Solid			

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-100AD1	2W XFMR	Bus93	Bus94	7.81	125.47	125.71	
TR-200DE1	2W XFMR	Bus7	Bus4	47.16	374.45	377.41	
0.4kV_cable	Cable	Bus4	SG-200N1	8.30	9.23	12.41	0.0000018
6.6kV_Cable1	Cable	Bus94	SG-100D1	0.51	0.30	0.59	0.0003333
6.6kV_Cable2	Cable	SG-100D1	Bus7	3.16	1.20	3.38	0.0002304
66kV_Cable1	Cable	HNA6-AFA70	Bus93	0.00	0.01	0.01	0.0070134
66kV_Cable2	Cable	Bus92	HNA6-AFA70	0.01	0.01	0.01	0.0112215
66kV_Cable3	Cable	HKN57	Bus92	0.29	0.28	0.40	0.4921036
AC_UPS-F&G	Cable	SG-200N1	Bus63	1387.96	165.97	1397.85	0.0000008
AC_UPS-PAS	Cable	SG-200N1	Bus62	1387.96	165.97	1397.85	0.0000008
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	19789.85	313.54	19792.34	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	6089.19	96.47	6089.95	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	14309.59	226.71	14311.38	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	13700.67	217.06	13702.39	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1521.78	82.99	1524.04	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	4922.18	269.71	4929.56	0.0000012
DC_UPS_Navaid	Cable	SG-200N1	Bus64	15222.96	241.18	15224.87	0.0000006

Power Grid Input Data

		Rating		% Impedance 100 MVA Base			Grounding
Power Grid ID	Connected Bus ID	MVASC	kV	R	X"	R/X"	Type
SCC_Min	HKN57	994.544	66.000	1.00050	10.00496	0.10	Wye - Solid

Total Connected Power Grids (= 1): 994.544 MVA

SHORT- CIRCUIT REPORT

Fault at bus: **Bus4**
Nominal kV = 0.400
Voltage c Factor = 0.95 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
Bus4	Total	0.00	22.086	0.00	90.49	90.93	24.248	24.248	6.00E+001	5.12E+002	4.72E+001	3.74E+002
SG-200N1	Bus4	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus7	Bus4	66.28	22.086	77.80	77.34	90.48	24.248	24.248 *	6.00E+001	5.12E+002	4.72E+001	3.74E+002
Bus63	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus62	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus67	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus68	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus69	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus66	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus84	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus1	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
Bus64	SG-200N1	0.00	0.000	0.00	90.49	90.93	0.000	0.000				
SG-100D1	Bus7	66.56	1.405	78.14	77.29	90.48	0.891	0.000	2.51E+002	9.87E+001		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	22.086	24.248	19.127	23.433
Peak Current (kA), Method C	:	53.398	58.625	46.244	56.655
Breaking Current (kA, rms, symm)	:		24.248	19.127	23.433
Steady State Current (kA, rms)	:	22.086	24.248	19.127	23.433

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **HKN57**
Nominal kV = 66.000
Voltage c Factor = 1.00 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
HKN57	Total	0.00	8.700	0.00	116.27	116.27	6.300	6.300	1.00E+000	1.00E+001	2.14E+000	2.14E+001
Bus92	HKN57	0.00	0.000	0.00	116.27	116.27	0.000	0.000				
SCC_Min	HKN57	100.00	8.700	100.00	100.00	100.00	6.300	6.300	1.00E+000	1.00E+001	2.14E+000	2.14E+001
HNA6-AFA70	Bus92	0.00	0.000	0.00	116.27	116.27	0.000	0.000				

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	8.700	6.300	7.534	7.929
Peak Current (kA), Method C	:	21.482	15.556	18.604	19.578
Breaking Current (kA, rms, symm)	:		6.300	7.534	7.929
Steady State Current (kA, rms)	:	8.700	6.300	7.534	7.929

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **HNA6-AFA70**
Nominal kV = 66.000
Voltage c Factor = 1.00 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
HNA6-AFA70	Total	0.00	8.429	0.00	116.97	117.74	5.968	5.968	1.30E+000	1.03E+001	3.23E+000	2.30E+001
Bus93	HNA6-AFA70	0.00	0.000	0.00	116.97	117.74	0.000	0.000				
Bus92	HNA6-AFA70	0.13	8.429	0.22	117.07	117.62	5.968	5.968	1.30E+000	1.03E+001	3.23E+000	2.30E+001
Bus94	Bus93	0.00	0.000	67.53	100.00	67.98	0.000	0.000				
HKN57	Bus92	4.01	8.429	6.17	115.95	114.65	5.968	5.968	1.29E+000	1.03E+001	3.15E+000	2.30E+001

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	8.429	5.968	7.300	7.682
Peak Current (kA), Method C	:	20.163	14.277	17.462	18.376
Breaking Current (kA, rms, symm)	:		5.968	7.300	7.682
Steady State Current (kA, rms)	:	8.429	5.968	7.300	7.682

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-100D1**
Nominal kV = 6.600
Voltage c Factor = 1.00 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-100D1	Total	0.00	5.867	0.00	169.32	175.77	0.380	0.380	9.63E+000	1.36E+002	6.28E+003	1.26E+002
Bus94	SG-100D1	0.42	5.867	0.04	161.95	168.12	0.380	0.380	9.63E+000	1.36E+002	6.28E+003	1.26E+002
Bus7	SG-100D1	0.00	0.000	0.00	169.32	175.77	0.000	0.000				
Bus93	Bus94	88.38	5.867	95.74	95.47	95.65	0.380	0.380 *	9.11E+000	1.36E+002	6.28E+003	1.25E+002
Bus4	Bus7	0.00	0.000	102.65	105.00	106.55	0.000	0.000				

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	5.867	0.380	5.081	5.176
Peak Current (kA), Method C	:	15.040	0.974	13.025	13.268
Breaking Current (kA, rms, symm)	:		0.380	5.081	5.176
Steady State Current (kA, rms)	:	5.867	0.380	5.081	5.176

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-200N1**
Nominal kV = 0.400
Voltage c Factor = 0.95 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-200N1	Total	0.00	21.658	0.00	90.72	91.77	23.491	23.491	6.82E+001	5.21E+002	6.04E+001	3.98E+002
Bus4	SG-200N1	2.24	21.658	3.36	90.48	91.18	23.491	23.491	6.82E+001	5.21E+002	6.04E+001	3.98E+002
Bus63	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus62	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus67	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus68	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus69	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus66	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus84	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus1	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus64	SG-200N1	0.00	0.000	0.00	90.72	91.77	0.000	0.000				
Bus7	Bus4	66.76	21.658	78.34	77.60	90.48	23.491	23.491 *	6.00E+001	5.12E+002	4.72E+001	3.74E+002

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	21.658	23.491	18.756	22.855
Peak Current (kA), Method C	:	51.503	55.863	44.603	54.349
Breaking Current (kA, rms, symm)	:		23.491	18.756	22.855
Steady State Current (kA, rms)	:	21.658	23.491	18.756	22.855

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus4	0.400	22.086	53.398	22.086	24.248	58.625	24.248	24.248	19.127	46.244	19.127	19.127	23.433	56.655	23.433	23.433
HKN57	66.000	8.700	21.482	8.700	6.300	15.556	6.300	6.300	7.534	18.604	7.534	7.534	7.929	19.578	7.929	7.929
HNA6-AFA70	66.000	8.429	20.163	8.429	5.968	14.277	5.968	5.968	7.300	17.462	7.300	7.300	7.682	18.376	7.682	7.682
SG-100D1	6.600	5.867	15.040	5.867	0.380	0.974	0.380	0.380	5.081	13.025	5.081	5.081	5.176	13.268	5.176	5.176
SG-200N1	0.400	21.658	51.503	21.658	23.491	55.863	23.491	23.491	18.756	44.603	18.756	18.756	22.855	54.349	22.855	22.855

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus4	0.400	0.00116	0.00987	0.00993	0.00116	0.00987	0.00993	0.00091	0.00722	0.00728	0.00000	0.00000	0.00000
HKN57	66.000	0.43582	4.35816	4.37990	0.43582	4.35816	4.37990	0.93389	9.33892	9.38550	0.00000	0.00000	0.00000
HNA6-AFA70	66.000	0.56517	4.48535	4.52082	0.56517	4.48535	4.52082	1.40553	10.01479	10.11294	0.00000	0.00000	0.00000
SG-100D1	6.600	0.04584	0.64784	0.64946	0.04584	0.64784	0.64946	29.92170	0.59800	29.92767	0.00000	0.00000	0.00000
SG-200N1	0.400	0.00132	0.01004	0.01013	0.00132	0.01004	0.01013	0.00116	0.00767	0.00776	0.00000	0.00000	0.00000

Branch (earth-fault factor) Summary Report

Bus		EFF/Ke (LG)	EFF/Ke (LLG)
ID	kV		
Bus4	0.400	0.75	0.70
HKN57	66.000	1.16	1.22
HNA6-AFA70	66.000	1.18	1.23
SG-100D1	6.600	1.61	1.37
SG-200N1	0.400	0.76	0.72

Attachment 4 Case 4: SCCMAX Island Mode – IEC 60909

Electrical Transient Analyzer Program

Short-Circuit Analysis

IEC 60909 Standard

3-Phase, LG, LL, & LLG Fault Currents

	Swing	V-Control	Load	Total
Number of Buses:	1	0	16	17

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	2	0	0	14	0	0	16

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Inverter	Total
Number of Machines:	0	3	0	0	10	0	13

System Frequency:	50.00
Unit System:	Metric
Project Filename:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\Case4_SCCMAX-Isl.SI2S

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	20
Cable / Busway Resistance:	Yes	Global	20

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	Load	0.400	0.420	2	99.57	30.00
Bus4	Load	0.400	0.420	2	99.80	30.00
Bus7	Load	6.600	6.600	2	99.90	0.00
Bus62	Load	0.400	0.420	2	99.43	30.00
Bus63	Load	0.400	0.420	2	99.60	30.00
Bus64	Load	0.400	0.420	2	99.08	30.00
Bus66	Load	0.400	0.420	2	99.61	30.00
Bus67	Load	0.400	0.420	2	99.58	30.00
Bus68	Load	0.400	0.420	2	99.64	30.00
Bus69	Load	0.400	0.420	2	99.60	30.00
Bus84	Load	0.400	0.420	2	99.55	30.00
Bus96	SWNG	6.600	6.600	2	100.00	0.00
Bus97	Load	6.600	6.600	2	99.94	0.00
Bus98	Load	0.800	0.800	2	100.57	30.00
Bus99	Load	6.600	6.600	2	99.87	-0.01
SG-100D1	Load	6.600	6.600	2	99.93	0.00
SG-200N1	Load	0.400	0.420	2	99.67	30.00

17 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

Line/Cable/Busway Input Data

ohms or siemens per 1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway			Length									
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	20	0.0627427	0.089	0.0001854	0.0997609	0.22606	0.0001854
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
6.6kV_Cable3	6.6NCUN1	70	78.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
6.6kV_Cable5	6.6NCUN1	70	55.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
6.6kV_Cable6	6.6NCUN1	70	25.0	0.0	1	20	0.268225	0.13	0.00011	0.5333128	0.0632	
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	20	0.5246857	0.08	0.0001015	1.6527991	0.1968	
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	20	0.5246857	0.08	0.0001015	1.6527991	0.1968	
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	20	1.1505439	0.08	0.0000597	4.6021757	0.32	
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	20	1.145054	0.08	0.0000971	3.6069198	0.1968	
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	20	4.603744	0.093	0.0000575	14.5021868	0.22878	

Line / Cable / Busway resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
TR-200DE1	1.600	6.600	0.420	6.00	7.94	0	0	-10.0	2.500	0	5.40	Dyn	-30.00
TR-200ED1	0.500	6.600	0.800	6.00	7.63	0	0	-10.0	0	0	5.40	Dyn	-30.00

2-Winding Transformer Grounding Input Data

Transformer	Rating			Grounding								
				Conn.	Primary				Secondary			
ID	MVA	Prim. kV	Sec. kV	Type	Type	kV	Amp	ohm	Type	kV	Amp	ohm
TR-200DE1	1.600	6.600	0.420	D/Y					Solid			
TR-200ED1	0.500	6.600	0.800	D/Y					Solid			

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-200DE1	2W XFMR	Bus7	Bus4	40.76	323.61	326.17	
TR-200ED1	2W XFMR	Bus97	Bus98	135.64	1034.92	1043.77	
0.4kV_cable	Cable	Bus4	SG-200N1	7.11	10.09	12.35	0.0000016
6.6kV_Cable2	Cable	SG-100D1	Bus7	2.71	1.31	3.01	0.0002108
6.6kV_Cable3	Cable	SG-100D1	Bus99	4.80	2.33	5.34	0.0003737
6.6kV_Cable5	Cable	SG-100D1	Bus96	3.39	1.64	3.76	0.0002635
6.6kV_Cable6	Cable	SG-100D1	Bus97	1.54	0.75	1.71	0.0001198
AC_UPS-F&G	Cable	SG-200N1	Bus63	1189.76	181.41	1203.51	0.0000007
AC_UPS-PAS	Cable	SG-200N1	Bus62	1189.76	181.41	1203.51	0.0000007
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	16963.91	342.69	16967.37	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	5219.66	105.44	5220.73	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	12266.21	247.79	12268.71	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	11744.25	237.24	11746.64	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1304.47	90.70	1307.62	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	4219.30	294.78	4229.59	0.0000011
DC_UPS_Navaid	Cable	SG-200N1	Bus64	13049.16	263.61	13051.82	0.0000005

Power Grid Input Data

Power Grid ID	Connected Bus ID	Rating MVAsc	Rating kV	% Impedance 100 MVA Base R	% Impedance 100 MVA Base X"	% Impedance 100 MVA Base R/X"	Grounding Type
A-80000	Bus99	1.875	6.600	530.68652	5306.86523	0.10	Delta
A-85000	Bus96	1.875	6.600	530.68652	5306.86523	0.10	Delta
SG-200D2	Bus98	0.660	0.800	1507.63196	15076.32031	0.10	Delta

Total Connected Power Grids (= 3): 4.410 MVA

Lumped Load Input Data

	Lumped Load						Motor Loads								
	Rating				% Load		Loading		% Impedance (Machine Base)			Grounding			mFact.
Lumped Load ID	kVA	kV	Amp	% PF	MTR	STAT	kW	kvar	R	X"	R/X"	Conn.	Type	Amp	MW/PP
AC_UPS_F&G	12.5	0.400	18.04	80.00	100	0	2.71	2.03	6.46	15.37	0.42	Delta			0.01
AC_UPS_PAS	32.5	0.400	46.91	80.00	100	0	12.90	9.67	6.46	15.37	0.42	Delta			0.03
BL_SG-200N1	982.4	0.400	1417.97	87.70	1	99	4.67	2.56	6.46	15.37	0.42	Delta			0.01
DB-L&SP-BoP	37.3	0.400	53.84	88.40	100	0	6.08	3.22	6.46	15.37	0.42	Delta			0.03
DB-L&SP-HVMV	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DB-L&SP-Inst.	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DB-L&SP-LV	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DB-L&SP-UPS	1.7	0.400	2.45	80.00	100	0	0.36	0.27	6.46	15.37	0.42	Delta			0.00
DC-Battery-System_SWGR	11.5	0.400	16.60	100.00	100	0	1.57	0.00	6.46	15.37	0.42	Delta			0.01
NAVAID_System	3.2	0.400	4.56	100.00	100	0	3.16	0.00	6.46	15.37	0.42	Delta			0.00

Total Connected Lumped Loads (= 10): 1086.2 kVA

SHORT- CIRCUIT REPORT

Fault at bus: **Bus4**
Nominal kV = 0.400
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
Bus4	Total	0.00	6.011	0.00	91.84	91.23	8.416	8.416	3.57E+002	2.26E+003	4.08E+001	3.24E+002
SG-200N1	Bus4	0.10	1.020	0.09	91.84	91.24	0.952	0.000	5.48E+003	1.23E+004		
Bus7	Bus4	11.94	5.032	52.37	52.27	100.00	7.500	8.416 *	2.85E+002	2.72E+003	4.08E+001	3.24E+002
Bus63	SG-200N1	1.11	0.113	1.03	91.46	91.68	0.105	0.000	4.80E+004	1.12E+005		
Bus62	SG-200N1	2.75	0.291	2.56	90.87	92.37	0.272	0.000	1.92E+004	4.31E+004		
Bus67	SG-200N1	2.04	0.015	1.91	91.05	92.12	0.014	0.000	3.61E+005	8.20E+005		
Bus68	SG-200N1	0.67	0.015	0.63	91.59	91.51	0.014	0.000	3.50E+005	8.20E+005		
Bus69	SG-200N1	1.50	0.015	1.40	91.26	91.88	0.014	0.000	3.57E+005	8.20E+005		
Bus66	SG-200N1	1.44	0.015	1.34	91.29	91.85	0.014	0.000	3.56E+005	8.20E+005		
Bus84	SG-200N1	3.40	0.334	3.17	90.57	92.69	0.312	0.000	1.70E+004	3.75E+004		
Bus1	SG-200N1	3.39	0.103	3.16	90.57	92.69	0.096	0.000	5.51E+004	1.21E+005		
Bus64	SG-200N1	2.89	0.028	2.70	90.72	92.49	0.026	0.000	1.98E+005	4.41E+005		
BL_SG-200N1	SG-200N1	105.00	0.089	105.00	105.00	105.00	0.083	0.000	5.96E+004	1.42E+005		
SG-100D1	Bus7	12.00	0.320	52.46	52.21	100.00	0.259	0.000	1.15E+003	2.17E+003		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	6.011	8.416	5.205	8.765
Peak Current (kA), Method C	:	14.190	19.868	12.288	20.692
Breaking Current (kA, rms, symm)	:		8.416	5.205	8.765
Steady State Current (kA, rms)	:	5.032	8.416	5.205	8.765

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-100D1**
Nominal kV = 6.600
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-100D1	Total	0.00	0.446	0.00	181.87	181.87	0.000	0.000	3.00E+002	2.04E+003		
Bus7	SG-100D1	0.02	0.067	0.00	181.87	181.87	0.000	0.000	5.52E+003	1.26E+004		
Bus99	SG-100D1	0.10	0.164	0.00	181.87	181.87	0.000	0.000	5.62E+002	5.57E+003		
Bus96	SG-100D1	0.07	0.164	0.00	181.87	181.87	0.000	0.000	5.61E+002	5.57E+003		
Bus97	SG-100D1	0.01	0.054	0.00	181.87	181.87	0.000	0.000	1.72E+003	1.69E+004		
Bus4	Bus7	2.62	0.067	110.25	110.25	110.25	0.000	0.000	5.52E+003	1.26E+004		
A-80000	Bus99	105.00	0.164	0.00	181.87	181.87	0.000	0.000	5.57E+002	5.57E+003		
A-85000	Bus96	105.00	0.164	0.00	181.87	181.87	0.000	0.000	5.57E+002	5.57E+003		
Bus98	Bus97	6.47	0.054	105.00	105.00	105.00	0.000	0.000	1.72E+003	1.69E+004		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	0.446	0.000	0.386	0.386
Peak Current (kA), Method C	:	1.063	0.000	0.920	0.920
Breaking Current (kA, rms, symm)	:		0.000	0.386	0.386
Steady State Current (kA, rms)	:	0.382	0.000	0.386	0.386

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-200N1**
Nominal kV = 0.400
Voltage c Factor = 1.05 (User-Defined)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-200N1	Total	0.00	5.992	0.00	91.74	91.51	8.346	8.346	3.63E+002	2.27E+003	5.21E+001	3.49E+002
Bus4	SG-200N1	0.47	5.012	1.03	91.74	91.42	7.434	8.346	2.92E+002	2.73E+003	5.21E+001	3.49E+002
Bus63	SG-200N1	1.04	0.113	0.97	91.37	91.95	0.105	0.000	4.80E+004	1.12E+005		
Bus62	SG-200N1	2.68	0.292	2.49	90.79	92.64	0.271	0.000	1.92E+004	4.31E+004		
Bus67	SG-200N1	1.99	0.015	1.85	90.96	92.39	0.014	0.000	3.61E+005	8.20E+005		
Bus68	SG-200N1	0.61	0.015	0.57	91.50	91.79	0.014	0.000	3.50E+005	8.20E+005		
Bus69	SG-200N1	1.44	0.015	1.34	91.17	92.15	0.014	0.000	3.57E+005	8.20E+005		
Bus66	SG-200N1	1.38	0.015	1.28	91.20	92.12	0.014	0.000	3.56E+005	8.20E+005		
Bus84	SG-200N1	3.34	0.334	3.10	90.48	92.96	0.310	0.000	1.70E+004	3.75E+004		
Bus1	SG-200N1	3.33	0.103	3.09	90.48	92.95	0.096	0.000	5.51E+004	1.21E+005		
Bus64	SG-200N1	2.83	0.028	2.63	90.63	92.76	0.026	0.000	1.98E+005	4.41E+005		
BL_SG-200N1	SG-200N1	105.00	0.089	105.00	105.00	105.00	0.083	0.000	5.96E+004	1.42E+005		
Bus7	Bus4	12.29	5.012	52.80	52.23	100.00	7.434	8.346 *	2.85E+002	2.72E+003	4.08E+001	3.24E+002
AC_UPS_F&G	Bus63	105.00	0.113	105.00	105.00	105.00	0.105	0.000	4.68E+004	1.11E+005		
AC_UPS_PAS	Bus62	105.00	0.292	105.00	105.00	105.00	0.271	0.000	1.80E+004	4.29E+004		
DB-L&SP-HVMV	Bus67	105.00	0.015	105.00	105.00	105.00	0.014	0.000	3.44E+005	8.20E+005		
DB-L&SP-LV	Bus68	105.00	0.015	105.00	105.00	105.00	0.014	0.000	3.44E+005	8.20E+005		
DB-L&SP-UPS	Bus69	105.00	0.015	105.00	105.00	105.00	0.014	0.000	3.44E+005	8.20E+005		
DB-L&SP-Inst.	Bus66	105.00	0.015	105.00	105.00	105.00	0.014	0.000	3.44E+005	8.20E+005		
DB-L&SP-BoP	Bus84	105.00	0.334	105.00	105.00	105.00	0.310	0.000	1.57E+004	3.74E+004		
DC-Battery-System_SWGR	Bus1	105.00	0.103	105.00	105.00	105.00	0.096	0.000	5.09E+004	1.21E+005		
NAVAID_System	Bus64	105.00	0.028	105.00	105.00	105.00	0.026	0.000	1.85E+005	4.41E+005		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	5.992	8.346	5.190	8.623
Peak Current (kA), Method C	:	14.110	19.652	12.220	20.303
Breaking Current (kA, rms, symm)	:		8.346	5.190	8.623
Steady State Current (kA, rms)	:	5.012	8.346	5.190	8.623

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus4	0.400	6.011	14.190	5.032	8.416	19.868	8.416	8.416	5.205	12.288	5.205	5.205	8.765	20.692	8.765	8.765
SG-100D1	6.600	0.446	1.063	0.382	0.000	0.000	0.000	0.000	0.386	0.920	0.386	0.386	0.386	0.920	0.386	0.386
SG-200N1	0.400	5.992	14.110	5.012	8.346	19.652	8.346	8.346	5.190	12.220	5.190	5.190	8.623	20.303	8.623	8.623

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus4	0.400	0.00630	0.03985	0.04034	0.00630	0.03985	0.04034	0.00072	0.00571	0.00575	0.00000	0.00000	0.00000
SG-100D1	6.600	1.30810	8.87610	8.97197	1.30810	8.87610	8.97197				0.00000	0.00000	0.00000
SG-200N1	0.400	0.00640	0.03996	0.04047	0.00640	0.03996	0.04047	0.00092	0.00616	0.00623	0.00000	0.00000	0.00000

Branch (earth-fault factor) Summary Report

Bus		EFF/Ke (LG)	EFF/Ke (LLG)
ID	kV		
Bus4	0.400	0.83	0.32
SG-100D1	6.600	1.82	1.57
SG-200N1	0.400	0.83	0.34

Attachment 5 Case 5: SCCMIN Island Mode – IEC 60909

Electrical Transient Analyzer Program

Short-Circuit Analysis

IEC 60909 Standard

3-Phase, LG, LL, & LLG Fault Currents

	Swing	V-Control	Load	Total
Number of Buses:	1	0	13	14

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	1	0	0	12	0	0	13

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Inverter	Total
Number of Machines:	0	1	0	0	0	0	1

System Frequency:	50.00
Unit System:	Metric
Project Filename:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\Case5_SCCMin-Island.SI2S

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	90
Cable / Busway Resistance:	Yes	Global	90

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	Load	0.400	0.420	2	99.57	30.00
Bus4	Load	0.400	0.420	2	99.80	30.00
Bus7	Load	6.600	6.600	2	99.90	0.00
Bus62	Load	0.400	0.420	2	99.43	30.00
Bus63	Load	0.400	0.420	2	99.60	30.00
Bus64	Load	0.400	0.420	2	99.08	30.00
Bus66	Load	0.400	0.420	2	99.61	30.00
Bus67	Load	0.400	0.420	2	99.58	30.00
Bus68	Load	0.400	0.420	2	99.64	30.00
Bus69	Load	0.400	0.420	2	99.60	30.00
Bus84	Load	0.400	0.420	2	99.55	30.00
Bus96	SWNG	6.600	6.600	2	100.00	0.00
SG-100D1	Load	6.600	6.600	2	99.93	0.00
SG-200N1	Load	0.400	0.420	2	99.67	30.00

14 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

Line/Cable/Busway Input Data

ohms or siemens per 1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway			Length									
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	90	0.08	0.089	0.0001854	0.1272	0.22606	0.0001854
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	90	0.342	0.13	0.00011	0.68	0.0632	
6.6kV_Cable5	6.6NCUN1	70	55.0	0.0	1	90	0.342	0.13	0.00011	0.68	0.0632	
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	90	0.669	0.08	0.0001015	2.1073999	0.1968	
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	90	0.669	0.08	0.0001015	2.1073999	0.1968	
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	90	1.467	0.08	0.0000597	5.868	0.32	
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	90	1.46	0.08	0.0000971	4.599	0.1968	
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	90	5.8699999	0.093	0.0000575	18.4909992	0.22878	

Line / Cable / Busway resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
TR-200DE1	1.600	6.600	0.420	6.00	7.94	0	0	10.0	2.500	0	6.60	Dyn	-30.00

2-Winding Transformer Grounding Input Data

Transformer	Rating			Conn.	Grounding							
					Primary				Secondary			
ID	MVA	Prim. kV	Sec. kV	Type	Type	kV	Amp	ohm	Type	kV	Amp	ohm
TR-200DE1	1.600	6.600	0.420	D/Y					Solid			

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-200DE1	2W XFMR	Bus7	Bus4	51.54	409.27	412.50	
0.4kV_cable	Cable	Bus4	SG-200N1	9.07	10.09	13.57	0.0000016
6.6kV_Cable2	Cable	SG-100D1	Bus7	3.45	1.31	3.70	0.0002108
6.6kV_Cable5	Cable	SG-100D1	Bus96	4.32	1.64	4.62	0.0002635
AC_UPS-F&G	Cable	SG-200N1	Bus63	1517.01	181.41	1527.81	0.0000007
AC_UPS-PAS	Cable	SG-200N1	Bus62	1517.01	181.41	1527.81	0.0000007
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	21629.82	342.69	21632.53	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	6655.33	105.44	6656.16	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	15640.02	247.79	15641.99	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	14974.49	237.24	14976.37	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1663.27	90.70	1665.74	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	5379.82	294.78	5387.89	0.0000011
DC_UPS_Navaid	Cable	SG-200N1	Bus64	16638.32	263.61	16640.41	0.0000005

Power Grid Input Data

		Rating		% Impedance 100 MVA Base			Grounding
Power Grid ID	Connected Bus ID	MVASC	kV	R	X"	R/X"	Type
A-85000	Bus96	1.875	6.600	530.68652	5306.86523	0.10	Delta

Total Connected Power Grids (= 1): 1.875 MVA

SHORT- CIRCUIT REPORT

Fault at bus: **Bus4**
Nominal kV = 0.400
Voltage c Factor = 0.95 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
Bus4	Total	0.00	2.163	0.00	82.31	82.53	3.132	3.132	5.90E+002	5.72E+003	5.15E+001	4.09E+002
SG-200N1	Bus4	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus7	Bus4	6.49	2.163	46.14	45.79	90.48	3.132	3.132 *	5.90E+002	5.72E+003	5.15E+001	4.09E+002
Bus63	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus62	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus67	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus68	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus69	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus66	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus84	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus1	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
Bus64	SG-200N1	0.00	0.000	0.00	82.31	82.53	0.000	0.000				
SG-100D1	Bus7	6.52	0.138	46.18	45.75	90.48	0.115	0.000	2.40E+003	4.84E+003		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	2.163	3.132	1.873	3.405
Peak Current (kA), Method C	:	5.320	7.704	4.608	8.374
Breaking Current (kA, rms, symm)	:		3.132	1.873	3.405
Steady State Current (kA, rms)	:	2.163	3.132	1.873	3.405

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-100D1**
Nominal kV = 6.600
Voltage c Factor = 1.00 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-100D1	Total	0.00	0.164	0.00	173.21	173.21	0.000	0.000	5.35E+002	5.31E+003		
Bus7	SG-100D1	0.00	0.000	0.00	173.21	173.21	0.000	0.000				
Bus96	SG-100D1	0.09	0.164	0.00	173.21	173.21	0.000	0.000	5.35E+002	5.31E+003		
Bus4	Bus7	0.00	0.000	105.00	105.00	105.00	0.000	0.000				
A-85000	Bus96	100.00	0.164	0.00	173.21	173.21	0.000	0.000	5.31E+002	5.31E+003		

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	0.164	0.000	0.142	0.142
Peak Current (kA), Method C	:	0.404	0.000	0.350	0.350
Breaking Current (kA, rms, symm)	:		0.000	0.142	0.142
Steady State Current (kA, rms)	:	0.164	0.000	0.142	0.142

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Fault at bus: **SG-200N1**
Nominal kV = 0.400
Voltage c Factor = 0.95 (Minimum If)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus	To Bus	% V	kA	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
ID	ID	From Bus	Symm. rms	Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
SG-200N1	Total	0.00	2.159	0.00	82.21	82.67	3.120	3.120	5.99E+002	5.73E+003	6.60E+001	4.35E+002
Bus4	SG-200N1	0.22	2.159	0.45	82.23	82.64	3.120	3.120	5.99E+002	5.73E+003	6.60E+001	4.35E+002
Bus63	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus62	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus67	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus68	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus69	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus66	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus84	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus1	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus64	SG-200N1	0.00	0.000	0.00	82.21	82.67	0.000	0.000				
Bus7	Bus4	6.66	2.159	46.35	45.68	90.48	3.120	3.120 *	5.90E+002	5.72E+003	5.15E+001	4.09E+002

		3-Phase	L-G	L-L	L-L-G
Initial Symmetrical Current (kA, rms)	:	2.159	3.120	1.870	3.385
Peak Current (kA), Method C	:	5.301	7.660	4.591	8.310
Breaking Current (kA, rms, symm)	:		3.120	1.870	3.385
Steady State Current (kA, rms)	:	2.159	3.120	1.870	3.385

\# Indicates a fault current contribution from a three-winding transformer.
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer.

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus4	0.400	2.163	5.320	2.163	3.132	7.704	3.132	3.132	1.873	4.608	1.873	1.873	3.405	8.374	3.405	3.405
SG-100D1	6.600	0.164	0.404	0.164	0.000	0.000	0.000	0.000	0.142	0.350	0.142	0.142	0.142	0.350	0.142	0.142
SG-200N1	0.400	2.159	5.301	2.159	3.120	7.660	3.120	3.120	1.870	4.591	1.870	1.870	3.385	8.310	3.385	3.385

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus4	0.400	0.01041	0.10088	0.10142	0.01041	0.10088	0.10142	0.00091	0.00722	0.00728	0.00000	0.00000	0.00000
SG-100D1	6.600	2.33048	23.12385	23.24099	2.33048	23.12385	23.24099				0.00000	0.00000	0.00000
SG-200N1	0.400	0.01057	0.10106	0.10161	0.01057	0.10106	0.10161	0.00116	0.00767	0.00776	0.00000	0.00000	0.00000

Branch (earth-fault factor) Summary Report

Bus		EFF/Ke (LG)	EFF/Ke (LLG)
ID	kV		
Bus4	0.400	0.75	0.16
SG-100D1	6.600	1.73	1.50
SG-200N1	0.400	0.75	0.17