# Base Load Power Hub (BLPH)

## LV-Cable Sizing Calculation Report

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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.

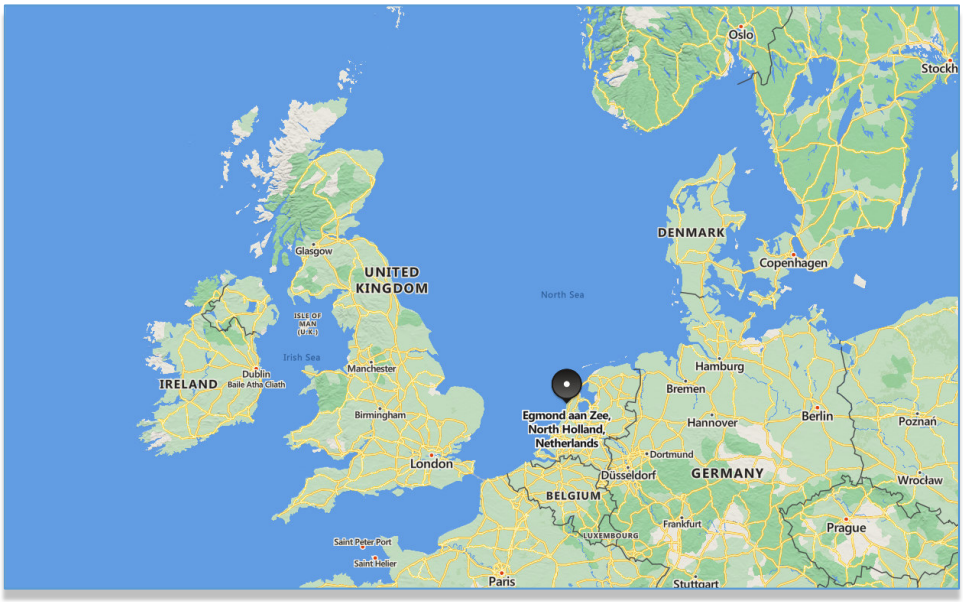



*Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map*

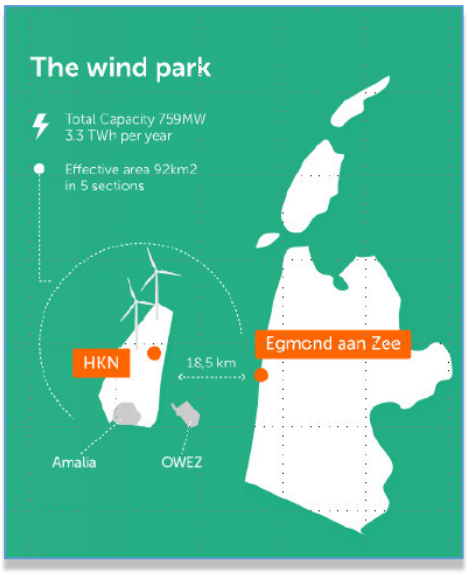



*Figure 2 - Wind Park Details*

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.

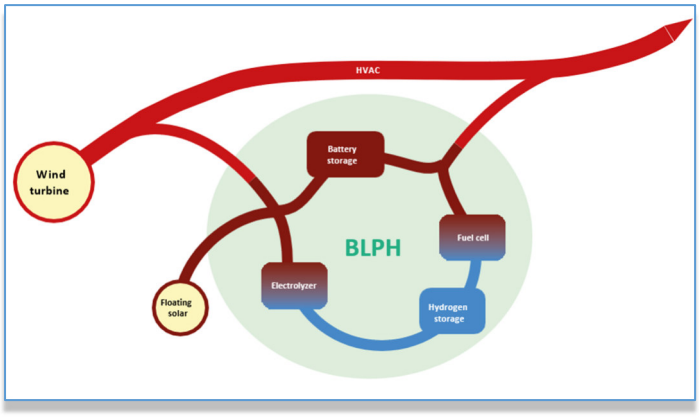



*Figure 3 – BLPH Concept*

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.

# 2 DOCUMENT SCOPE

The scope of this document is to present the method used in dimensioning the LV power cables in BLPH.

## 2.1 REFERENCES

| Doc. No. | Description |
|---|---|
| 123A90-DDL-EL-SP-20180 | LV-Cable Sizing Calculation Criteria |
| K559-2254-EL-REP-004 | Power Cable Schedule |
| 123A90-DDL-EL-DG-20159 | Electrical Single Line Diagram LV Systems |
| 123A90-DDL-EL-DG-20015 | Electrical Single Line Diagram HV & MV Systems |
| K559-2254-EL-LAY-001 | BLPH Base Load Power Hub Cable Routing Layout |
| 123A90-DDL-EL-LIS-20016 | Electrical Load List & Balance (CCS MODE 'IMPORT') Rev-1 |
| 123A90-DDL-EL-RE-20171 | Electrical System Study Report – Short Circuit |
| Cable Parameters – FLEI Cables | Voltage drop parameters of LV cables |
| DEP 33.64.10.10 | DEP Specification - Electrical Engineering Design |

*Table 1 - Reference Documents*

## 2.2 DEFINITIONS AND ABBREVIATIONS

| | |
|---|---|
| COMPANY or Client (CPY): | CROSSWIND |
| CONTRACTOR (CTR): | ROSETTI MARINO S.p.A. |
| PROJECT: | HOLLANDSE KUST NOORD WIND PARK Project |
| AC | Alternating Current |
| Cu | Copper |
| DC | Direct Current |
| LV | Low Voltage |
| LSZH | Low Smoke Zero Halogen |
| N/A | Not Applicable |
| SWA | Steel wire armoured |
| UPS | Uninterrupted Power Supply |
| XLPE | Cross-linked Poly Ethylene |
| EPR | Ethylene Propylene Rubber |

*Table 2 - Definitions and Abbreviations*

# 3 APPLICABLE CODES AND STANDARDS

IEC - International Electro technical Committee (latest edition shall be applied).

| | |
|---|---|
| IEC 60228 | Conductors of Insulated Cables |
| IEC 60287-1 | Electric Cables-Calculation of the current rating |
| IEC 61892-4 | Mobile and fixed offshore units - Electrical installations - Part 4: Cables |
| IEC 60909 | Short-circuit currents in three-phase a.c. systems |

# 4 CABLE SIZING

## 4.1 CRITERIA

Refer to Document 123A90-DDL-EL-SP-20180 for LV cable sizing criteria.

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# 5 SHORT CIRCUIT CURRENT CALCULATION BY ETAP SOFTWARE

## 5.1 DESIGN BASIS

This section provides the details of all the input data and assumptions used for the short circuit study of Base Load Power Hub (BLPH).

### 5.1.1 System Overview

The Low Voltage power system studied in this report is based on Overall/key single line diagram 123A90-DDL-EL-DG-20158 for all the LV loads listed in the Electrical Load List & Balance (CCS MODE 'IMPORT') 123A90-DDL-EL-LIS-20016.

From the 6.6kV BLPH Busbar, the Transformer TR-200DE1, 6.6/0.42 kV supplies various Low Voltage loads connected to the LV Switchgear SG-200N1.

### 5.1.2 Model Overview

The 6.6kV Busbar in BLPH is considered as supply network. This is termed as “Source” in the ETAP model. Source MVA is calculated as = S3 x 6.6kV x 8.37kA = 95.68MVA.

The 1600kVA, 6.6/0.4kV transformer TR-200DE1 is connected to BLPH 6.6kV busbar and feeding the Low voltage loads of the BLPH, through LV Switchgear SG-200N1.

The loads rated power are taken from Doc.no. 123A90-DDL-EL-LIS-20016 - Electrical Load List & Balance (CCS MODE 'IMPORT').

The power cables’ resistance, reactance (positive sequence, negative sequence and zero sequence) values are used from ETAP software library for Cu. EPR cables. The details are attached in the following sections of this document.

### 5.1.3 Short Circuit Study Background

The short circuit study is based on the worst case BLPH loading condition, defined by (CCS MODE 'IMPORT'). From the power system short circuit study, the maximum short circuit current is used as input for selection & verification of short circuit current withstand capacity of various electrical equipment and cables in the power distribution system. The minimum short circuit current is used as input for protection co-ordination study (i.e. graded protection).

Three phase faults (L1-L2-L3) and Single phase-to-Ground (L-G) fault are calculated for maximum short circuit current and minimum short circuit current conditions in the power distribution system.

ETAP software (version 22.0.2) is used for modelling the electrical power distribution system. The results of the short circuit current study are used for verification of LV Power cable’s short circuit withstand capacity in this document refer Annexes-I, 6.1 LV cables verified table.

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### 5.1.4 Basis of Calculation

The following considerations are made to the ETAP model for short circuit study:

- Positive and negative sequence impedances are assumed equal.
- Short circuit calculations are based on nominal impedance values of the equipment.
- The cables resistance & reactance data (positive sequence, negative sequence and zero sequence) are utilized from the ETAP software's standard library for Cu. EPR cables. These details are summarized and attached in following sections of this document.
- Calculation method: IEC 60909
    - The impedance of the transformer is referred to the tap-changer in nominal position, Tap 0.
    - Voltage factor c = $c_{max}$, for the calculation of maximum short circuit current and c=$c_{min}$ for the calculation of minimum short circuit current.

| Nominal system voltage | $c_{max}$ | $c_{min}$ |
|---|---|---|
| <= 1 kV | 1.05 | 0.95 |
| > 1 kV and <= 230 kV | 1.10 | 1.00 |

*Table 3 - Voltage factor values*

# 6 ANNEXES - I

## 6.1 LV CABLES VERIFIED TABLE

| Unit<br>(Tag \| Description) | Ib ≤ In ≤ Iz | Verified<br>Ib ≤ In ≤ Iz | Verified<br>$Isc^2 \cdot T$ | Percentage (%) of Voltage drop from TR-200DE1 Transformer VDTot |
|---|---|---|---|---|
| SG-200N1 \| LV Switchboard | 2309.4<=2560<=3065.1 | OK | Verified | 0.1%<5% |
| SG-200D2 \| LV SWBD 800/460V | 360.84<=500<=613.02 | OK | Verified | 0.24%<5% |
| JB-200E2 \| Temporary Generator / Mobile Battery Pack | 199.91<=256<=298.86 | OK | Verified | 0.55%<5% |
| CP-850E3 \| BESS PCS Cabinet | 18.31<=40<=51 | OK | Verified | 0.57%<5% |
| A-80000 \| Fuel Cell Auxiliary Load | 32.8<=63<=68.34 | OK | Verified | 0.62%<5% |
| A-20000 \| Electrolyser Auxiliary load | 497.84<=500<=613.02 | OK | Verified | 1.04%<5% |
| CP-850E1 \| BESS LV1 Cabinet (+DISTR 1) | 19.05<=40<=51 | OK | Verified | 0.58%<5% |
| CP-850E2 \| BESS LV2 Cabinet (+DISTR 2) | 19.05<=40<=51 | OK | Verified | 0.61%<5% |
| JB-500E8 \| Water Package | 112.48<=160<=172.38 | OK | Verified | 0.43%<5% |
| K-63001-A \| Instrument Air Package | 118.17<=160<=172.38 | OK | Verified | 0.35%<5% |
| K-63001-B \| Instrument Air Package | 118.17<=160<=172.38 | OK | Verified | 0.52%<5% |
| PM-50001 A \| Sea water intake pump A | 13.37<=20<=28.56 | OK | Verified | 0.9%<5% |
| PM-50001 B \| Sea water intake pump B | 13.37<=20<=28.56 | OK | Verified | 0.9%<5% |
| JB-200E3 \| Crane | 47.17<=63<=68.34 | OK | Verified | 0.75%<5% |
| ESW-200N1 \| Welding Sockets (Top Deck) | 124.49<=128<=139.74 | OK | Verified | 1.63%<5% |
| ESW-200N2 \| Welding Sockets (Lower Deck) | 124.49<=128<=139.74 | OK | Verified | 1.76%<5% |
| B100-HSB-001 \| HVAC Panels - HV Room | 34.19<=63<=68.34 | OK | Verified | 0.86%<5% |
| B200-HSB-001 \| HVAC panels - LV Room | 34.19<=63<=68.34 | OK | Verified | 0.34%<5% |
| B300-HSB-001 \| HVAC panels - UPS Room | 62.58<=63<=68.34 | OK | Verified | 0.93%<5% |

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| | | | | |
|---|---|---|---|---|
| B400-HSB-001 \| HVAC panels - ITER | 62.58<=63<=68.34 | OK | Verified | 1.2%<5% |
| CN-200N1 \| Impressed Current Cathodic Protection (ICCP) System | 27.97<=40<=68.34 | OK | Verified | 0.28%<5% |
| UP-200F3 \| AC UPS PAS - 30min - Line A | 103.27<=112<=112.2 | OK | Verified | 0.68%<5% |
| UP-200F3 \| AC UPS PAS - 30min - Line B | 103.27<=112<=112.2 | OK | Verified | 0.62%<5% |
| UP-200F3 \| AC UPS PAS - Bypass | 103.27<=112<=112.2 | OK | Verified | 0.59%<5% |
| UP-200F4 \| AC UPS F&G - 8h - Line A | 103.27<=112<=112.2 | OK | Verified | 0.51%<5% |
| UP-200F4 \| AC UPS F&G - 8h - Line B | 103.27<=112<=112.2 | OK | Verified | 0.66%<5% |
| UP-200F4 \| AC UPS F&G - Bypass | 103.27<=112<=112.2 | OK | Verified | 0.64%<5% |
| UP-200F1 \| DC Battery System - Switchgears Control - Feeder A | 35.66<=63<=68.34 | OK | Verified | 0.77%<5% |
| UP-200F1 \| DC Battery System - Switchgears Control - Feeder B | 35.66<=63<=68.34 | OK | Verified | 0.77%<5% |
| UP-200F2 \| DC UPS NAVAID System - Feeder A | 14.62<=63<=68.34 | OK | Verified | 0.26%<5% |
| UP-200F2 \| DC UPS - NAVAID System - Feeder B | 14.62<=63<=68.34 | OK | Verified | 0.26%<5% |
| DP-200N1 \| DB - Lighting & Small Power - BoP | 24.38<=100<=139.74 | OK | Verified | 0.17%<5% |

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## 6.2 CABLE SIZING FOR ALL LV CABLES

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| SL. No. | From (Tag \| Description) | To (Tag \| Description) | Equipment Rating | Unit (kVA or KW) | Phase | Voltage (Vs) | Load Power Factor $\cos\Phi_{FL}$ | $\sin\Phi_{FL}$ | Power Factor Motor Starting $\cos\Phi_{ST}$ | $\sin\Phi_{ST}$ | Efficiency | Load Current ($I_b$) m = a*1000/(√c*d*e*i) | Selected Cable Details (Cu/XLPE/LSZH/PVC) No. of Cores | Copper cable Size in mm2 (S) | No. of runs per phase | Ampacity as per IEC 61892-4 | As per IEC - 60228 Resistance (R) Ohms/km | As per FLEI Catalogue Reactance (X) Ohms/km | Route Length in Meters (L) | Derating Factors Air Temp. 25°C (K1) | Group (K2) | Overall (K= K1 x K2) | Ampacity of total cables (Iz) u=n*t*m | Voltage drop (VD) at Steady State Voltage (V) | Percentage (%) | Percentage (%) of Voltage drop from TR-200DE1 Transformer | X times Motor Starting Current (Kst) | Voltage drop (VD) during Motor Starting Voltage (V) | Percentage (%) | Spare current capactiy in Cable aa=1-i/u | Load Current ($I_b$) | Breake size ($I_n$) | Cable Ampacity after derating ($I_z$) | $I_b \le I_n \le I_z$ | Verified Ib ≤ In ≤ Iz | Constant for XLPE insulated Copper Conductor (K) | Cable Size in mm² (S) | Calculated Maximum 3phase short circuit current as per ETAP report kA ($I_{sc}$) | Short Circuit withstand time in seconds (T) | $K^2 \cdot S^2$ | $Isc^2 \cdot T$ | $K^2 \cdot S^2 \ge Isc^2 \cdot T$ | Verified $Isc^2 \cdot T$ | Percentage (%) of Voltage drop from TR-200DE1 Transformer | Voltage drop allowable limit | Voltage drop $V_D$Tot | Verified VDTot | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | s | t | u | v | w | | x | y | z | aa | | | | | | | | | | | | | | | | | | |
| | 400V LV Switchboard / Breaker | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | TR200DE1 \| 6.6/0.415 kV Transformer | SG-200N1 \| LV Switchboard | 1600 | kVA | 3 | 400 | 1.00 | 0.00 | | | 1.00 | 2309.40 | 1C | 300 | 5 | 601 | 0.060 | 0.080 | 8 | 1.2 | 0.85 | 1.02 | 3065.10 | 0.38 | 0.10% | 0.10% | | | | 24.65% | 2309.4 | 3200 | 3065.10 | 2309.4<=2560<=3065.1 | OK | 0.143 | 300 | 30.73 | 1 | 1840.41 | 944.33 | 1840.41>944.33 | Verified | 0.10% | 5% | 0.1%<5% | Verified | |
| 2 | TR200ED1 \| 6.6/0.8 kV Transformer | SG-200D2 \| LV SWBD 800/460V | 500 | kVA | 3 | 800 | 1.00 | 0.00 | | | 1.00 | 360.84 | 1C | 300 | 1 | 601 | 0.060 | 0.080 | 52 | 1.2 | 0.85 | 1.02 | 613.02 | 1.95 | 0.24% | NA | | | | 41.14% | 360.84 | 1250 | 613.02 | 360.84<=500<=613.02 | OK | 0.143 | 300 | 6.014 | 1 | 1840.41 | 36.17 | 1840.41>36.17 | Verified | 0.24% | 5% | 0.24%<5% | Verified | |
| | LV Switchboard SG-200N1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | SG-200N1 \| LV Switchboard | JB-200E2 \| Temporary Generator / Mobile Battery Pack | 138.5 | kW | 3 | 400 | 0.95 | 0.31 | | | 0.95 | 199.91 | 1C | 95 | 1 | 293 | 0.193 | 0.085 | 25 | 1.2 | 0.85 | 1.02 | 298.86 | 1.82 | 0.45% | 0.55% | | | | 33.11% | 199.91 | 320 | 298.86 | 199.91<=256<=298.86 | OK | 0.143 | 95 | 1.665 | 0.5 | 184.55 | 1.39 | 184.55>1.39 | Verified | 0.55% | 5% | 0.55%<5% | Verified | |
| 2 | SG-200N1 \| LV Switchboard | CP-850E3 \| BESS PCS Cabinet | 11.09 | kW | 3 | 400 | 0.92 | 0.39 | | | 0.95 | 18.31 | 4C | 10 | 1 | 50 | 1.830 | 0.084 | 35 | 1.2 | 0.85 | 1.02 | 51.00 | 1.91 | 0.48% | 0.57% | | | | 64.09% | 18.31 | 40 | 51.00 | 18.31<=40<=51 | OK | 0.143 | 10 | 3.677 | 0.1 | 2.04 | 1.35 | 2.04>1.35 | Verified | 0.57% | 5% | 0.57%<5% | Verified | |
| 3 | SG-200N1 \| LV Switchboard | A-80000 \| Fuel Cell Auxiliary Load | 20 | kW | 3 | 400 | 0.88 | 0.47 | | | 1.00 | 32.80 | 5G | 16 | 1 | 67 | 1.150 | 0.080 | 35 | 1.2 | 0.85 | 1.02 | 68.34 | 2.09 | 0.52% | 0.62% | | | | 52.00% | 32.8 | 63 | 68.34 | 32.8<=63<=68.34 | OK | 0.143 | 16 | 5.677 | 0.1 | 5.23 | 3.22 | 5.23>3.22 | Verified | 0.62% | 5% | 0.62%<5% | Verified | |
| 4 | SG-200N1 \| LV Switchboard | A-20000 \| Electrolyser Auxiliary load | 278.52 | kW | 3 | 400 | 0.85 | 0.53 | | | 0.95 | 497.84 | 1C | 300 | 1 | 601 | 0.060 | 0.080 | 47 | 1.2 | 0.85 | 1.02 | 613.02 | 3.79 | 0.95% | 1.04% | | | | 18.79% | 497.84 | 1250 | 613.02 | 497.84<=500<=613.02 | OK | 0.143 | 300 | 19.786 | 0.5 | 1840.41 | 195.74 | 1840.41>195.74 | Verified | 1.04% | 5% | 1.04%<5% | Verified | |
| 5 | SG-200N1 \| LV Switchboard | CP-850E1 \| BESS LV1 Cabinet (+DISTR 1) | 11.284 | kW | 3 | 400 | 0.90 | 0.44 | | | 0.95 | 19.05 | 4C | 10 | 1 | 50 | 1.830 | 0.084 | 35 | 1.2 | 0.85 | 1.02 | 51.00 | 1.94 | 0.49% | 0.58% | | | | 62.65% | 19.05 | 40 | 51.00 | 19.05<=40<=51 | OK | 0.143 | 10 | 3.677 | 0.1 | 2.04 | 1.35 | 2.04>1.35 | Verified | 0.58% | 5% | 0.58%<5% | Verified | |
| 6 | SG-200N1 \| LV Switchboard | CP-850E2 \| BESS LV2 Cabinet (+DISTR 2) | 11.284 | kW | 3 | 400 | 0.90 | 0.44 | | | 0.95 | 19.05 | 4C | 10 | 1 | 50 | 1.830 | 0.084 | 37 | 1.2 | 0.85 | 1.02 | 51.00 | 2.06 | 0.51% | 0.61% | | | | 62.65% | 19.05 | 40 | 51.00 | 19.05<=40<=51 | OK | 0.143 | 10 | 3.485 | 0.1 | 2.04 | 1.21 | 2.04>1.21 | Verified | 0.61% | 5% | 0.61%<5% | Verified | |
| 7 | SG-200N1 \| LV Switchboard | JB-500E8 \| Water Package | 66.63 | kW | 3 | 400 | 0.90 | 0.44 | | | 0.95 | 112.48 | 5G | 70 | 1 | 169 | 0.268 | 0.074 | 25 | 1.2 | 0.85 | 1.02 | 172.38 | 1.33 | 0.33% | 0.43% | | | | 34.75% | 112.48 | 160 | 172.38 | 112.48<=160<=172.38 | OK | 0.143 | 70 | 19.514 | 0.2 | 100.2 | 76.16 | 100.2>76.16 | Verified | 0.43% | 5% | 0.43%<5% | Verified | |
| 8 | SG-200N1 \| LV Switchboard | K-63001-A \| Instrument Air Package | 70 | kW | 3 | 400 | 0.90 | 0.44 | | | 0.95 | 118.17 | 5G | 70 | 1 | 169 | 0.268 | 0.074 | 25 | 1.2 | 0.85 | 1.02 | 172.38 | 1.40 | 0.35% | 0.35% | | | | 31.45% | 118.17 | 160 | 172.38 | 118.17<=160<=172.38 | OK | 0.143 | 70 | 19.514 | 0.2 | 100.2 | 76.16 | 100.2>76.16 | Verified | 0.35% | 5% | 0.35%<5% | Verified | |
| 9 | SG-200N1 \| LV Switchboard | K-63001-B \| Instrument Air Package | 70 | kW | 3 | 400 | 0.90 | 0.44 | | | 0.95 | 118.17 | 5G | 70 | 1 | 169 | 0.268 | 0.074 | 30 | 1.2 | 0.85 | 1.02 | 172.38 | 1.68 | 0.42% | 0.52% | | | | 31.45% | 118.17 | 160 | 172.38 | 118.17<=160<=172.38 | OK | 0.143 | 70 | 17.855 | 0.2 | 100.2 | 63.76 | 100.2>63.76 | Verified | 0.52% | 5% | 0.52%<5% | Verified | |
| 10 | SG-200N1 \| LV Switchboard | PM-50001 A \| Sea water intake pump A | 6.1 | kW | 3 | 400 | 0.74 | 0.67 | 0.30 | 0.95 | 0.89 | 13.37 | 4G | 4 | 1 | 28 | 4.610 | 0.096 | 40 | 1.2 | 0.85 | 1.02 | 28.56 | 3.22 | 0.80% | 0.90% | 7.6 | 10.76 | 2.69% | 53.19% | 13.37 | 20 | 28.56 | 13.37<=20<=28.56 | OK | 0.143 | 4 | 1.358 | 0.1 | 0.33 | 0.18 | 0.33>0.18 | Verified | 0.90% | 5% | 0.9%<5% | Verified | |
| 11 | SG-200N1 \| LV Switchboard | PM-50001 B \| Sea water intake pump B | 6.1 | kW | 3 | 400 | 0.74 | 0.67 | 0.30 | 0.95 | 0.89 | 13.37 | 4G | 4 | 1 | 28 | 4.610 | 0.096 | 40 | 1.2 | 0.85 | 1.02 | 28.56 | 3.22 | 0.80% | 0.90% | 7.6 | 10.76 | 2.69% | 53.19% | 13.37 | 20 | 28.56 | 13.37<=20<=28.56 | OK | 0.143 | 4 | 1.358 | 0.05 | 0.33 | 0.09 | 0.33>0.09 | Verified | 0.90% | 5% | 0.9%<5% | Verified | |
| 12 | SG-200N1 \| LV Switchboard | JB-200E3 \| Crane | 25 | kW | 3 | 400 | 0.90 | 0.44 | | | 0.85 | 47.17 | 5G | 16 | 1 | 67 | 1.150 | 0.080 | 30 | 1.2 | 0.85 | 1.02 | 68.34 | 2.62 | 0.66% | 0.75% | | | | 30.98% | 47.17 | 63 | 68.34 | 47.17<=63<=68.34 | OK | 0.143 | 16 | 6.543 | 0.1 | 5.23 | 4.28 | 5.23>4.28 | Verified | 0.75% | 5% | 0.75%<5% | Verified | |
| 13 | SG-200N1 \| LV Switchboard | ESW-200N1\| Welding Sockets (Top Deck) | 69 | kW | 3 | 400 | 0.80 | 0.60 | | | 1.00 | 124.49 | 5G | 50 | 1 | 137 | 0.387 | 0.076 | 80 | 1.2 | 0.85 | 1.02 | 139.74 | 6.13 | 1.53% | 1.63% | | | | 10.91% | 124.49 | 160 | 139.74 | 124.49<=128<=139.74 | OK | 0.143 | 50 | 6.932 | 0.5 | 51.12 | 24.03 | 51.12>24.03 | Verified | 1.63% | 5% | 1.63%<5% | Verified | 125A Power Socket rating considered |
| 14 | SG-200N1 \| LV Switchboard | ESW-200N2 \| Welding Sockets (Lower Deck) | 69 | kW | 3 | 400 | 0.80 | 0.60 | | | 1.00 | 124.49 | 5G | 50 | 1 | 137 | 0.387 | 0.076 | 87 | 1.2 | 0.85 | 1.02 | 139.74 | 6.66 | 1.67% | 1.76% | | | | 10.91% | 124.49 | 160 | 139.74 | 124.49<=128<=139.74 | OK | 0.143 | 50 | 6.435 | 0.5 | 51.12 | 20.7 | 51.12>20.7 | Verified | 1.76% | 5% | 1.76%<5% | Verified | 125A Power Socket rating considered |
| 15 | SG-200N1 \| LV Switchboard | B100-HSB-001 \| HVAC Panels - HV Room | 18 | kW | 3 | 400 | 0.80 | 0.60 | | | 0.95 | 34.19 | 5G | 16 | 1 | 67 | 1.150 | 0.080 | 53 | 1.2 | 0.85 | 1.02 | 68.34 | 3.04 | 0.76% | 0.86% | | | | 49.98% | 34.19 | 63 | 68.34 | 34.19<=63<=68.34 | OK | 0.143 | 16 | 3.834 | 0.2 | 5.23 | 2.94 | 5.23>2.94 | Verified | 0.86% | 5% | 0.86%<5% | Verified | |
| 16 | SG-200N1 \| LV Switchboard | B200-HSB-001 \| HVAC panels - LV Room | 18 | kW | 3 | 400 | 0.80 | 0.60 | | | 0.95 | 34.19 | 5G | 16 | 1 | 67 | 1.150 | 0.080 | 17 | 1.2 | 0.85 | 1.02 | 68.34 | 0.97 | 0.24% | 0.34% | | | | 49.98% | 34.19 | 63 | 68.34 | 34.19<=63<=68.34 | OK | 0.143 | 16 | 10.725 | 0.02 | 5.23 | 2.3 | 5.23>2.3 | Verified | 0.34% | 5% | 0.34%<5% | Verified | |
| 17 | SG-200N1 \| LV Switchboard | B300-HSB-001 \| HVAC panels - UPS Room | 35.75 | kW | 3 | 400 | 0.85 | 0.53 | | | 0.97 | 62.58 | 5G | 16 | 1 | 67 | 1.150 | 0.080 | 30 | 1.2 | 0.85 | 1.02 | 68.34 | 3.32 | 0.83% | 0.93% | | | | 8.42% | 62.58 | 63 | 68.34 | 62.58<=63<=68.34 | OK | 0.143 | 16 | 6.543 | 0.1 | 5.23 | 4.28 | 5.23>4.28 | Verified | 0.93% | 5% | 0.93%<5% | Verified | |
| 18 | SG-200N1 \| LV Switchboard | B400-HSB-001 \| HVAC panels - ITER | 35.75 | kW | 3 | 400 | 0.85 | 0.53 | | | 0.97 | 62.58 | 5G | 16 | 1 | 67 | 1.150 | 0.080 | 40 | 1.2 | 0.85 | 1.02 | 68.34 | 4.42 | 1.11% | 1.20% | | | | 8.42% | 62.58 | 63 | 68.34 | 62.58<=63<=68.34 | OK | 0.143 | 16 | 5.01 | 0.1 | 5.23 | 2.51 | 5.23>2.51 | Verified | 1.20% | 5% | 1.2%<5% | Verified | |
| 19 | SG-200N1 \| LV Switchboard | CN-200N1 \| Impressed Current Cathodic Protection (ICCP) System | 14 | KVA | 3 | 400 | 0.85 | 0.53 | | | 0.85 | 27.97 | 5G | 16 | 1 | 67 | 1.150 | 0.080 | 15 | 1.2 | 0.85 | 1.02 | 68.34 | 0.74 | 0.19% | 0.28% | | | | 59.07% | 27.97 | 40 | 68.34 | 27.97<=40<=68.34 | OK | 0.143 | 16 | 11.853 | 0.02 | 5.23 | 2.81 | 5.23>2.81 | Verified | 0.28% | 5% | 0.28%<5% | Verified | |
| 20 | SG-200N1 \| LV Switchboard | UP-200F3 \| AC UPS PAS - 30min - Line A | 53 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.93 | 103.27 | 4G | 35 | 1 | 110 | 0.524 | 0.076 | 28 | 1.2 | 0.85 | 1.02 | 112.20 | 2.33 | 0.58% | 0.68% | | | | 7.96% | 103.27 | 160 | 112.20 | 103.27<=112<=112.2 | OK | 0.143 | 35 | 13.004 | 0.1 | 25.05 | 16.91 | 25.05>16.91 | Verified | 0.68% | 5% | 0.68%<5% | Verified | Current rating considered as per AEG Vendor |
| 21 | SG-200N1 \| LV Switchboard | UP-200F3 \| AC UPS PAS - 30min - Line B | 53 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.93 | 103.27 | 4G | 35 | 1 | 110 | 0.524 | 0.076 | 25 | 1.2 | 0.85 | 1.02 | 112.20 | 2.08 | 0.52% | 0.62% | | | | 7.96% | 103.27 | 160 | 112.20 | 103.27<=112<=112.2 | OK | 0.143 | 35 | 14.092 | 0.1 | 25.05 | 19.86 | 25.05>19.86 | Verified | 0.62% | 5% | 0.62%<5% | Verified | Current rating considered as per AEG Vendor |
| 22 | SG-200N1 \| LV Switchboard | UP-200F3 \| AC UPS PAS - Bypass | 53 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.93 | 103.27 | 4G | 35 | 1 | 110 | 0.524 | 0.076 | 24 | 1.2 | 0.85 | 1.02 | 112.20 | 2.00 | 0.50% | 0.59% | | | | 7.96% | 103.27 | 160 | 112.20 | 103.27<=112<=112.2 | OK | 0.143 | 35 | 14.491 | 0.1 | 25.05 | 21 | 25.05>21 | Verified | 0.59% | 5% | 0.59%<5% | Verified | Current rating considered as per AEG Vendor |
| 23 | SG-200N1 \| LV Switchboard | UP-200F4 \| AC UPS F&G - 8h - Line A | 53 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.93 | 103.27 | 4G | 35 | 1 | 110 | 0.524 | 0.076 | 20 | 1.2 | 0.85 | 1.02 | 112.20 | 1.66 | 0.42% | 0.51% | | | | 7.96% | 103.27 | 160 | 112.20 | 103.27<=112<=112.2 | OK | 0.143 | 35 | 16.3 | 0.05 | 25.05 | 13.28 | 25.05>13.28 | Verified | 0.51% | 5% | 0.51%<5% | Verified | Current rating considered as per AEG Vendor |
| 24 | SG-200N1 \| LV Switchboard | UP-200F4 \| AC UPS F&G - 8h - Line B | 53 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.93 | 103.27 | 4G | 35 | 1 | 110 | 0.524 | 0.076 | 27 | 1.2 | 0.85 | 1.02 | 112.20 | 2.24 | 0.56% | 0.66% | | | | 7.96% | 103.27 | 160 | 112.20 | 103.27<=112<=112.2 | OK | 0.143 | 35 | 13.349 | 0.05 | 25.05 | 8.91 | 25.05>8.91 | Verified | 0.66% | 5% | 0.66%<5% | Verified | Current rating considered as per AEG Vendor |
| 25 | SG-200N1 \| LV Switchboard | UP-200F4 \| AC UPS F&G - Bypass | 53 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.93 | 103.27 | 4G | 35 | 1 | 110 | 0.524 | 0.076 | 26 | 1.2 | 0.85 | 1.02 | 112.20 | 2.16 | 0.54% | 0.64% | | | | 7.96% | 103.27 | 160 | 112.20 | 103.27<=112<=112.2 | OK | 0.143 | 35 | 13.712 | 0.05 | 25.05 | 9.4 | 25.05>9.4 | Verified | 0.64% | 5% | 0.64%<5% | Verified | Current rating considered as per AEG Vendor |
| 26 | SG-200N1 \| LV Switchboard | UP-200F1 \| DC Battery System - Switchgears Control - Feeder A | 17 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.86 | 35.66 | 4G | 16 | 1 | 67 | 1.150 | 0.080 | 45 | 1.2 | 0.85 | 1.02 | 68.34 | 2.69 | 0.67% | 0.77% | | | | 47.81% | 35.66 | 63 | 68.34 | 35.66<=63<=68.34 | OK | 0.143 | 16 | 4.482 | 0.2 | 5.23 | 4.02 | 5.23>4.02 | Verified | 0.77% | 5% | 0.77%<5% | Verified | Current rating considered as per AEG Vendor |
| 27 | SG-200N1 \| LV Switchboard | UP-200F1 \| DC Battery System - Switchgears Control - Feeder B | 17 | KW | 3 | 400 | 0.80 | 0.60 | | | 0.86 | 35.66 | 4G | 16 | 1 | 67 | 1.150 | 0.080 | 45 | 1.2 | 0.85 | 1.02 | 68.34 | 2.69 | 0.67% | 0.77% | | | | 47.81% | 35.66 | 63 | 68.34 | 35.66<=63<=68.34 | OK | 0.143 | 16 | 4.482 | 0.2 | 5.23 | 4.02 | 5.23>4.02 | Verified | 0.77% | 5% | 0.77%<5% | Verified | Current rating considered as per AEG Vendor |
| 28 | SG-200N1 \| LV Switchboard | UP-200F2 \| DC UPS NAVAID System - Feeder A | 3 | kW | 1 | 230 | 0.97 | 0.24 | | | 0.92 | 14.62 | 3G | 16 | 1 | 67 | 1.150 | 0.080 | 23 | 1.2 | 0.85 | 1.02 | 68.34 | 0.38 | 0.17% | 0.26% | | | | 78.61% | 14.62 | 63 | 68.34 | 14.62<=63<=68.34 | OK | 0.143 | 16 | 4.595 | 0.05 | 5.23 | 1.06 | 5.23>1.06 | Verified | 0.26% | 5% | 0.26%<5% | Verified | |
| 29 | SG-200N1 \| LV Switchboard | UP-200F2 \| DC UPS - NAVAID System - Feeder B | 3 | kW | 1 | 230 | 0.97 | 0.24 | | | 0.92 | 14.62 | 3G | 16 | 1 | 67 | 1.150 | 0.080 | 23 | 1.2 | 0.85 | 1.02 | 68.34 | 0.38 | 0.17% | 0.26% | | | | 78.61% | 14.62 | 63 | 68.34 | 14.62<=63<=68.34 | OK | 0.143 | 16 | 4.595 | 0.05 | 5.23 | 1.06 | 5.23>1.06 | Verified | 0.26% | 5% | 0.26%<5% | Verified | |
| 30 | SG-200N1 \| LV Switchboard | DP-200N1 \| DB - Lighting & Small Power - BoP | 15.71 | kW | 3 | 400 | 0.93 | 0.37 | | | 1.00 | 24.38 | 5G | 50 | 1 | 137 | 0.387 | 0.076 | 18 | 1.2 | 0.85 | 1.02 | 139.74 | 0.29 | 0.07% | 0.17% | | | | 82.55% | 24.38 | 100 | 139.74 | 24.38<=100<=139.74 | OK | 0.143 | 50 | 19.826 | 0.1 | 51.12 | 39.31 | 51.12>39.31 | Verified | 0.17% | 5% | 0.17%<5% | Verified | Minimum Length is 15m, the Cable cannot be shorter |
| | DC UPS DB - Switchgears Control | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | DP-200F1 \| DC UPS DB | CP-100E1 \| DC control for 66 kV GIS Line-1 | 5.2 | kW | | 110 | | | | | 1.00 | 47.27 | 3G | 16 | 1 | 67 | 1.150 | | 13 | 1.2 | 0.85 | 1.02 | 68.34 | 1.41 | 1.28% | 2.05% | | | | 30.83% | 47.27 | 50 | 68.34 | 47.27<=50<=68.34 | OK | 0.143 | 16 | | | | | | | 2.05% | 5% | 2.05%<5% | Verified | |
| 2 | DP-200F1 \| DC UPS DB | CP-100E1 \| DC control for 66 kV GIS Line-2 | 2 | kW | | 110 | | | | | 1.00 | 18.18 | 3G | 16 | 1 | 67 | 1.150 | | 13 | 1.2 | 0.85 | 1.02 | 68.34 | 0.54 | 0.49% | 1.26% | | | | 73.40% | 18.18 | 20 | 68.34 | 18.18<=20<=68.34 | OK | 0.143 | 16 | | | | | | | 1.26% | 5% | 1.26%<5% | Verified | |
| 3 | DP-200F1 \| DC UPS DB | SG-100D1 \| DC Control for 6,6 kV Switchgear Line-A | 1 | kW | | 110 | | | | | 1.00 | 9.09 | 3G | 16 | 1 | 67 | 1.150 | | 20 | 1.2 | 0.85 | 1.02 | 68.34 | 0.42 | 0.38% | 1.15% | | | | 86.70% | 9.09 | 20 | 68.34 | 9.09<=20<=68.34 | OK | 0.143 | 16 | | | | | | | 1.15% | 5% | 1.15%<5% | Verified | |
| 4 | DP-200F1 \| DC UPS DB | SG-100D1 \| DC Control for 6,6 kV Switchgear-Line-B | 1 | kW | | 110 | | | | | 1.00 | 9.09 | 3G | 16 | 1 | 67 | 1.150 | | 20 | 1.2 | 0.85 | 1.02 | 68.34 | 0.42 | 0.38% | 1.15% | | | | 86.70% | 9.09 | 20 | 68.34 | 9.09<=20<=68.34 | OK | 0.143 | 16 | | | | | | | 1.15% | 5% | 1.15%<5% | Verified | |
| | AC UPS - PAS DB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | DP-200F3 \| AC UPS - PAS DB | B400-SIS-001 \| SIS -Controller and I/O Cabinet - Line A | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 35 | 1.2 | 0.85 | 1.02 | 21.42 | 1.14 | 0.50% | 1.17% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.17% | 5% | 1.17%<5% | Verified | |
| 2 | DP-200F3 \| AC UPS - PAS DB | B400-SIS-001 \| SIS -Controller and I/O Cabinet - Line B | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 35 | 1.2 | 0.85 | 1.02 | 21.42 | 1.14 | 0.50% | 1.17% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.17% | 5% | 1.17%<5% | Verified | |
| 3 | DP-200F3 \| AC UPS - PAS DB | B400-PCS-001 \| PCS -Controller and I/O Cabinet - Line A | 1.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 8.15 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 37 | 1.2 | 0.85 | 1.02 | 21.42 | 1.81 | 0.79% | 1.46% | | | | 61.94% | 8.15 | 10 | 21.42 | 8.15<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.46% | 5% | 1.46%<5% | Verified | |
| 4 | DP-200F3 \| AC UPS - PAS DB | B400-PCS-001 \| PCS -Controller and I/O Cabinet - Line B | 1.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 8.15 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 37 | 1.2 | 0.85 | 1.02 | 21.42 | 1.81 | 0.79% | 1.46% | | | | 61.94% | 8.15 | 10 | 21.42 | 8.15<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.46% | 5% | 1.46%<5% | Verified | |
| 5 | DP-200F3 \| AC UPS - PAS DB | B400-EMCS-001 \| EMCS -Controller and I/O Cabinet - Line A | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 38 | 1.2 | 0.85 | 1.02 | 21.42 | 1.24 | 0.54% | 1.22% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.22% | 5% | 1.22%<5% | Verified | |
| 6 | DP-200F3 \| AC UPS - PAS DB | B400-EMCS-001 \| EMCS -Controller and I/O Cabinet - Line B | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 38 | 1.2 | 0.85 | 1.02 | 21.42 | 1.24 | 0.54% | 1.22% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.22% | 5% | 1.22%<5% | Verified | |
| 7 | DP-200F3 \| AC UPS - PAS DB | B400-SRV-001 \| Server Cabinet ITER - Line A | 5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 27.17 | 3G | 6 | 1 | 36 | 3.080 | 0.094 | 40 | 1.2 | 0.85 | 1.02 | 36.72 | 2.74 | 1.19% | 1.83% | | | | 26.00% | 27.17 | 32 | 36.72 | 27.17<=32<=36.72 | OK | 0.143 | 6 | | | | | | | 1.83% | 5% | 1.83%<5% | Verified | |
| 8 | DP-200F3 \| AC UPS - PAS DB | B400-SRV-001 \| Server Cabinet ITER - Line B | 5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 27.17 | 3G | 6 | 1 | 36 | 3.080 | 0.094 | 40 | 1.2 | 0.85 | 1.02 | 36.72 | 2.74 | 1.19% | 1.96% | | | | 26.00% | 27.17 | 32 | 36.72 | 27.17<=32<=36.72 | OK | 0.143 | 6 | | | | | | | 1.96% | 5% | 1.96%<5% | Verified | |
| 9 | DP-200F3 \| AC UPS - PAS DB | CP-630E1 \| UCP - Instrument Air Package | 1.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 8.15 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 30 | 1.2 | 0.85 | 1.02 | 21.42 | 1.47 | 0.64% | 1.32% | | | | 61.94% | 8.15 | 16 | 21.42 | 8.15<=16<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.32% | 5% | 1.32%<5% | Verified | |
| 10 | DP-200F3 \| AC UPS - PAS DB | CP-640E1 \| UCP - N2 Package | 1.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 8.15 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 50 | 1.2 | 0.85 | 1.02 | 21.42 | 2.44 | 1.06% | 1.74% | | | | 61.94% | 8.15 | 16 | 21.42 | 8.15<=16<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.74% | 5% | 1.74%<5% | Verified | |
| 11 | DP-200F3 \| AC UPS - PAS DB | JB-500F8 \| UCP - Water Package | 2 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 10.87 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 27 | 1.2 | 0.85 | 1.02 | 21.42 | 1.76 | 0.76% | 1.44% | | | | 49.26% | 10.87 | 16 | 21.42 | 10.87<=16<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.44% | 5% | 1.44%<5% | Verified | |
| 12 | DP-200F3 \| AC UPS - PAS DB | B100-HSB-001 \| UCP - HVAC HV Room | 0.7 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 3.80 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 63 | 1.2 | 0.85 | 1.02 | 21.42 | 1.44 | 0.62% | 1.30% | | | | 82.24% | 3.8 | 10 | 21.42 | 3.8<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.30% | 5% | 1.3%<5% | Verified | |
| 13 | DP-200F3 \| AC UPS - PAS DB | B200-HSB-001 \| UCP - HVAC LV Room | 0.7 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 3.80 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 23 | 1.2 | 0.85 | 1.02 | 21.42 | 0.52 | 0.23% | 0.91% | | | | 82.24% | 3.8 | 10 | 21.42 | 3.8<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 0.91% | 5% | 0.91%<5% | Verified | |
| 14 | DP-200F3 \| AC UPS - PAS DB | B300-HSB-001 \| UCP - HVAC UPS Room | 0.7 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 3.80 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 19 | 1.2 | 0.85 | 1.02 | 21.42 | 0.43 | 0.19% | 0.87% | | | | 82.24% | 3.8 | 10 | 21.42 | 3.8<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 0.87% | 5% | 0.87%<5% | Verified | |
| 15 | DP-200F3 \| AC UPS - PAS DB | B400-HSB-001 \| UCP - HVAC ITER | 0.7 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 3.80 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 32 | 1.2 | 0.85 | 1.02 | 21.42 | 0.73 | 0.32% | 1.00% | | | | 82.24% | 3.8 | 10 | 21.42 | 3.8<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.00% | 5% | 1.%<5% | Verified | |
| 16 | DP-200F3 \| AC UPS - PAS DB | SG-200N1 \| LV Switchboard Auxiliary | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 22 | 1.2 | 0.85 | 1.02 | 21.42 | 0.72 | 0.31% | 0.31% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 0.31% | 5% | 0.31%<5% | Verified | |
| 17 | DP-200F3 \| AC UPS - PAS DB | SG-200D2 \| LV SWBD 800/460V Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 19 | 1.2 | 0.85 | 1.02 | 21.42 | 0.31 | 0.13% | 1.31% | | | | 87.31% | 2.72 | 10 | 21.42 | 2.72<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.31% | 5% | 1.31%<5% | Verified | |
| | AC UPS - F&G DB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | DP-200F4 \| AC UPS - F&G DB | B400-FGS-001 \| FGS Fire & Gas Panel - Line A | 2 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 10.87 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 33 | 1.2 | 0.85 | 1.02 | 21.42 | 2.15 | 0.93% | 1.45% | | | | 49.26% | 10.87 | 16 | 21.42 | 10.87<=16<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.45% | 5% | 1.45%<5% | Verified | |
| 2 | DP-200F4 \| AC UPS - F&G DB | B400-FGS-001 \| FGS Fire & Gas Panel - Line B | 2 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 10.87 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 33 | 1.2 | 0.85 | 1.02 | 21.42 | 2.15 | 0.93% | 1.45% | | | | 49.26% | 10.87 | 16 | 21.42 | 10.87<=16<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.45% | 5% | 1.45%<5% | Verified | |
| 3 | DP-200F4 \| AC UPS - F&G DB | B400-NET-001 \| System Server / Network Cabinet -Line-A | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 36 | 1.2 | 0.85 | 1.02 | 21.42 | 1.17 | 0.51% | 1.02% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.02% | 5% | 1.02%<5% | Verified | |
| 4 | DP-200F4 \| AC UPS - F&G DB | B400-NET-001 \| System Server / Network Cabinet_Line-B | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | 3G | 2.5 | 1 | 21 | 7.410 | 0.107 | 36 | 1.2 | 0.85 | 1.02 | 21.42 | 1.17 | 0.51% | 1.02% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | 1.02% | 5% | 1.02%<5% | Verified | |

| SL. No. | From (Tag \| Description) | To (Tag \| Description) | Equipment Rating | Unit (kVA or (kW) | Phase | Voltage (Vs) | Load Power Factor | | Power Factor Motor Starting | | Efficiency | Load Current ($I_b$) m =1.1(OL) (AC Servo) | Selected Cable Details (Cu/XLPE/LSZH/ PVC ) | | | As per IEC - 60228 | As per FLEI Catalogue | | Derating Factors | | | Ampacity of total cables (Iz) | Voltage drop (Vo) at Steady State | | Percentage (%) of Voltage drop from TR-200DE1 Transformer | X times Motor Starting Current (Kst) | Voltage drop (Vo) during Motor Starting | | Spare current capectiy in Cable | Load Current ($I_b$) | Breaks size ($I_n$) | Cable Ampacity after derating ($I_z$) | $I_b \le I_n \le I_z$ | Verified $I_b \le I_n \le I_z$ | Constant for XLPE insulated Copper Conductor (K) | Cable Size in $mm^2$ (S) | Calculated Maximum 3phase short circuit current as per ETAP report kA ($I_{sc}$) | Short Circuit withstand time in seconds (T) | $K^2S^2$ | $Isc^2.T$ | $K^2S^2 \ge Isc^2.T$ | Verified $Isc^2.T$ | Percentage (%) of Voltage drop from TR-200DE1 Transformer | Voltage drop allowable limit | Voltage drop $V_DTot$ | Verified VDTot | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Cos ϕ$_1$ | Sin ϕ$_1$ | Cos ϕ$_2$ | Sin ϕ$_2$ | | | No. of Cores | Copper cable Size in mm2 (S) | No. of runs per phase | Ampacity as per IEC 61892-4 | Resistance (R) Ohms/km | Reactance (X) Ohms/km | Route Length in Meters (L) | Air Temp. 25°C (K1) | Group (K2) | Overall (K= K1 x K2) | u=n*t*m | Voltage (V) | Percentage (%) | | | Voltage (V) | Percentage (%) | aa=1-i/u | | | | | | | | | | | | | | | | | | | | |
| | | | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | s | t | u | v | w | | x | y | z | aa | | | | | | | | | | | | | | | | | |
| | | **DB - Lighting & Small Power BoP** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | DP-200N1 \| L& SP DB BoP | EJB-200N1-02-L1-01 \| Normal Lighting Upper Deck | 1.09 | kW | 1 | 230 | 0.93 | 0.37 | | | 0.90 | 5.65 | **3G** | **4** | 1 | 28 | 4.610 | 0.096 | 177 | 1.2 | 0.85 | 1.02 | 28.56 | 4.32 | 1.88% | 2.05% | | | | 80.22% | 5.65 | 16 | 28.56 | 5.65<=16<=28.56 | OK | 0.143 | 4 | | | | | | | | 2.05% | 5% | 2.05%<5% | Verified | to be conservative, the calculation of the voltage drop was verified considering the total power at the end of the line |
| 2 | DP-200N1 \| L& SP DB BoP | EJB-200N1-03-L2-01 \| Normal Lighting Lower Deck | 0.70 | kW | 1 | 230 | 0.93 | 0.37 | | | 0.90 | 3.62 | **3G** | **4** | 1 | 28 | 4.610 | 0.096 | 229 | 1.2 | 0.85 | 1.02 | 28.56 | 3.58 | 1.56% | 1.73% | | | | 87.34% | 3.62 | 16 | 28.56 | 3.62<=16<=28.56 | OK | 0.143 | 4 | | | | | | | | 1.73% | 5% | 1.73%<5% | Verified | to be conservative, the calculation of the voltage drop was verified considering the total power at the end of the line |
| 3 | DP-200N1 \| L& SP DB BoP | EJB-200N1-04-L3-01 \| Normal Lighting stairs | 0.09 | kW | 1 | 230 | 0.93 | 0.37 | | | 0.90 | 0.45 | **3G** | **4** | 1 | 28 | 4.610 | 0.096 | 73 | 1.2 | 0.85 | 1.02 | 28.56 | 0.14 | 0.06% | 0.23% | | | | 98.42% | 0.45 | 16 | 28.56 | 0.45<=16<=28.56 | OK | 0.143 | 4 | | | | | | | | 0.23% | 5% | 0.23%<5% | Verified | to be conservative, the calculation of the voltage drop was verified considering the total power at the end of the line |
| 4 | DP-200N1 \| L& SP DB BoP | EJB-200N1-05-L1-01 \| Small Power Socket (Upper Deck) | 2.50 | kW | 1 | 230 | 0.80 | 0.60 | | | 0.90 | 15.10 | **3G** | **10** | 1 | 50 | 1.830 | 0.084 | 80 | 1.2 | 0.85 | 1.02 | 51.00 | 1.83 | 0.80% | 0.97% | | | | 70.40% | 15.1 | 16 | 51.00 | 15.1<=16<=51 | OK | 0.143 | 10 | | | | | | | | 0.97% | 5% | 0.97%<5% | Verified | Current rating 16A considered |
| 5 | DP-200N1 \| L& SP DB BoP | EJB-200N1-06-L2-01 \| Small Power Socket (Lower Deck) | 2.50 | kW | 1 | 230 | 0.80 | 0.60 | | | 0.90 | 15.10 | **3G** | **10** | 1 | 50 | 1.830 | 0.084 | 89 | 1.2 | 0.85 | 1.02 | 51.00 | 2.03 | 0.88% | 1.05% | | | | 70.40% | 15.1 | 16 | 51.00 | 15.1<=16<=51 | OK | 0.143 | 10 | | | | | | | | 1.05% | 5% | 1.05%<5% | Verified | Current rating 16A considered |
| 6 | DP-200N1 \| L& SP DB BoP | EJB-200N1-08-L1-01 \| Emergency Lighting Upper Deck | 1.28 | kW | 1 | 230 | 0.96 | 0.28 | | | 0.90 | 6.45 | **4G** | **4** | 1 | 28 | 4.610 | 0.096 | 107 | 1.2 | 0.85 | 1.02 | 28.56 | 3.07 | 1.34% | 1.51% | | | | 77.43% | 6.45 | 16 | 28.56 | 6.45<=16<=28.56 | OK | 0.143 | 4 | | | | | | | | 1.51% | 5% | 1.51%<5% | Verified | to be conservative, the calculation of the voltage drop was verified considering the total power at the end of the line |
| 7 | DP-200N1 \| L& SP DB BoP | EJB-200N1-09-L2-01 \| Emergency Lighting Lower Deck | 1.39 | kW | 1 | 230 | 0.96 | 0.28 | | | 0.90 | 7.01 | **4G** | **4** | 1 | 28 | 4.610 | 0.096 | 160 | 1.2 | 0.85 | 1.02 | 28.56 | 4.99 | 2.17% | 2.34% | | | | 75.46% | 7.01 | 16 | 28.56 | 7.01<=16<=28.56 | OK | 0.143 | 4 | | | | | | | | 2.34% | 5% | 2.34%<5% | Verified | to be conservative, the calculation of the voltage drop was verified considering the total power at the end of the line |
| 8 | DP-200N1 \| L& SP DB BoP | EJB-200N1-10-L3-01 \| Emergency Lighting stairs | 0.78 | kW | 1 | 230 | 0.96 | 0.28 | | | 0.90 | 3.92 | **4G** | **4** | 1 | 21 | 4.610 | 0.096 | 129 | 1.2 | 0.85 | 1.02 | 21.42 | 2.25 | 0.98% | 1.15% | | | | 81.68% | 3.92 | 16 | 21.42 | 3.92<=16<=21.42 | OK | 0.143 | 4 | | | | | | | | 1.15% | 5% | 1.15%<5% | Verified | to be conservative, the calculation of the voltage drop was verified considering the total power at the end of the line |
| 9 | DP-200N1 \| L& SP DB BoP | ETB-200N1-14-L1-01 \| TRACE HEATING - PROCESS LINES - FEEDER 1 (SWS LINES) | 3.5 | kW | 1 | 230 | 1.00 | 0.00 | | | 0.95 | 16.02 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 130 | 1.2 | 0.85 | 1.02 | 36.72 | 6.41 | 2.79% | 2.96% | | | | 56.38% | 16.02 | 20 | 36.72 | 16.02<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 2.96% | 5% | 2.96%<5% | Verified | |
| 10 | DP-200N1 \| L& SP DB BoP | ETB-200N1-15-L2-01 \| TRACE HEATING - PROCESS LINES - FEEDER 2 (CI LINES) | 3.5 | kW | 1 | 230 | 1.00 | 0.00 | | | 0.95 | 16.02 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 130 | 1.2 | 0.85 | 1.02 | 36.72 | 6.41 | 2.79% | 2.96% | | | | 56.38% | 16.02 | 20 | 36.72 | 16.02<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 2.96% | 5% | 2.96%<5% | Verified | |
| 11 | DP-200N1 \| L& SP DB BoP | ETB-200N1-16-L3-01 \| TRACE HEATING - PROCESS LINES - FEEDER 3 (DM LINE) | 3.5 | kW | 1 | 230 | 1.00 | 0.00 | | | 0.95 | 16.02 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 130 | 1.2 | 0.85 | 1.02 | 36.72 | 6.41 | 2.79% | 2.96% | | | | 56.38% | 16.02 | 20 | 36.72 | 16.02<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 2.96% | 5% | 2.96%<5% | Verified | |
| 12 | DP-200N1 \| L& SP DB BoP | ETB-200N1-17-L1-01 \| TRACE HEATING - PROCESS LINES - FEEDER 4 (WW LINES) | 3.5 | kW | 1 | 230 | 1.00 | 0.00 | | | 0.95 | 16.02 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 130 | 1.2 | 0.85 | 1.02 | 36.72 | 6.41 | 2.79% | 2.96% | | | | 56.38% | 16.02 | 20 | 36.72 | 16.02<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 2.96% | 5% | 2.96%<5% | Verified | |
| 13 | DP-200N1 \| L& SP DB BoP | ETB-200N1-18-L2-01 \| TRACE HEATING - PROCESS LINES - FEEDER 5 (VESSEL KO | 3.5 | kW | 1 | 230 | 1.00 | 0.00 | | | 0.95 | 16.02 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 130 | 1.2 | 0.85 | 1.02 | 36.72 | 6.41 | 2.79% | 2.96% | | | | 56.38% | 16.02 | 20 | 36.72 | 16.02<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 2.96% | 5% | 2.96%<5% | Verified | |
| 14 | DP-200N1 \| L& SP DB BoP | ETB-200N1-19-L3-01 \| TRACE HEATING - PROCESS LINES - FEEDER 6 (H2 VENT) | 2.5 | kW | 1 | 230 | 1.00 | 0.00 | | | 0.95 | 11.44 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 130 | 1.2 | 0.85 | 1.02 | 36.72 | 4.58 | 1.99% | 2.16% | | | | 68.84% | 11.44 | 20 | 36.72 | 11.44<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 2.16% | 5% | 2.16%<5% | Verified | |
| 15 | DP-200N1 \| L& SP DB BoP | ETB-200N1-20-L1-01 \| TRACE HEATING - PROCESS LINES - FEEDER 7 (SEA WATER | 2.5 | kW | 1 | 230 | 1.00 | 0.00 | | | 0.95 | 11.44 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 127 | 1.2 | 0.85 | 1.02 | 36.72 | 4.48 | 1.95% | 2.12% | | | | 68.84% | 11.44 | 20 | 36.72 | 11.44<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 2.12% | 5% | 2.12%<5% | Verified | |
| 16 | DP-200N1 \| L& SP DB BoP | B400-SIS-001 \| SIS -Controller and I/O Cabinet - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 22 | 1.2 | 0.85 | 1.02 | 21.42 | 0.36 | 0.16% | 0.33% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.33% | 5% | 0.33%<5% | Verified | |
| 17 | DP-200N1 \| L& SP DB BoP | B400-PCS-001 \| PCS -Controller and I/O Cabinet - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 27 | 1.2 | 0.85 | 1.02 | 21.42 | 0.44 | 0.19% | 0.36% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.36% | 5% | 0.36%<5% | Verified | |
| 18 | DP-200N1 \| L& SP DB BoP | B400-EMCS-001 \| EMCS -Controller and I/O Cabinet - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 28 | 1.2 | 0.85 | 1.02 | 21.42 | 0.46 | 0.20% | 0.37% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.37% | 5% | 0.37%<5% | Verified | |
| 19 | DP-200N1 \| L& SP DB BoP | B400-FGS-001 \| FGS Fire & Gas Panel - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 26 | 1.2 | 0.85 | 1.02 | 21.42 | 0.42 | 0.18% | 0.35% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.35% | 5% | 0.35%<5% | Verified | |
| 20 | DP-200N1 \| L& SP DB BoP | B400-NET-001 \| System Server / Network Cabinet - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 29 | 1.2 | 0.85 | 1.02 | 21.42 | 0.47 | 0.21% | 0.38% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.38% | 5% | 0.38%<5% | Verified | |
| 21 | DP-200N1 \| L& SP DB BoP | B400-SRV-001 \| Server cabiner ITER - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 30 | 1.2 | 0.85 | 1.02 | 21.42 | 0.49 | 0.21% | 1.48% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 1.48% | 5% | 1.48%<5% | Verified | |
| 22 | DP-200N1 \| L& SP DB BoP | CP-630E1 \| UCP - Instrument Air Package -A-63000 - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 31 | 1.2 | 0.85 | 1.02 | 21.42 | 0.50 | 0.22% | 0.39% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.39% | 5% | 0.39%<5% | Verified | |
| 23 | DP-200N1 \| L& SP DB BoP | CP-640E1 \| UCP - N2 Package - Auxiliary | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 46 | 1.2 | 0.85 | 1.02 | 21.42 | 0.75 | 0.33% | 0.50% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.50% | 5% | 0.5%<5% | Verified | |
| 24 | DP-200N1 \| L& SP DB BoP | CP-100E2 \| Auxiliary Trafo OLTC | 1 | kW | 3 | 400 | 0.80 | 0.60 | | | 1.00 | 1.80 | **5G** | **4** | 1 | 28 | 4.610 | 0.096 | 59 | 1.2 | 0.85 | 1.02 | 28.56 | 0.69 | 0.17% | 0.34% | | | | 93.68% | 1.8 | 10 | 28.56 | 1.8<=10<=28.56 | OK | 0.143 | 4 | | | | | | | | 0.34% | 5% | 0.34%<5% | Verified | |
| 25 | DP-200N1 \| L& SP DB BoP | CP-100E3 \| Auxiliary Trafo AVR | 0.2 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 1.09 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 52 | 1.2 | 0.85 | 1.02 | 21.42 | 0.34 | 0.15% | 0.32% | | | | 94.93% | 1.09 | 6 | 21.42 | 1.09<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.32% | 5% | 0.32%<5% | Verified | |
| 26 | DP-200N1 \| L& SP DB BoP | CP-100E4 \| Auxiliary Trafo 7MVA | 0.3 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 1.63 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 52 | 1.2 | 0.85 | 1.02 | 21.42 | 0.51 | 0.22% | 0.39% | | | | 92.39% | 1.63 | 6 | 21.42 | 1.63<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.39% | 5% | 0.39%<5% | Verified | |
| 27 | DP-200N1 \| L& SP DB BoP | RR-100D1 \| Auxiliary NER | 0.2 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 1.09 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 60 | 1.2 | 0.85 | 1.02 | 21.42 | 0.39 | 0.17% | 0.34% | | | | 94.93% | 1.09 | 6 | 21.42 | 1.09<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.34% | 5% | 0.34%<5% | Verified | |
| 28 | DP-200N1 \| L& SP DB BoP | CP-200E1 \| Auxiliary Trafo 1,6MVA | 0.3 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 1.63 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 23 | 1.2 | 0.85 | 1.02 | 21.42 | 0.22 | 0.10% | 0.27% | | | | 92.39% | 1.63 | 6 | 21.42 | 1.63<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.27% | 5% | 0.27%<5% | Verified | |
| 29 | DP-200N1 \| L& SP DB BoP | CP-200E2 \| Auxiliary Trafo SOLAR 0,5MVA | 0.3 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 1.63 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 38 | 1.2 | 0.85 | 1.02 | 21.42 | 0.37 | 0.16% | 0.33% | | | | 92.39% | 1.63 | 6 | 21.42 | 1.63<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.33% | 5% | 0.33%<5% | Verified | |
| 30 | DP-200N1 \| L& SP DB BoP | CP-100E1 \| Auxiliary GIS | 3 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 16.30 | **3G** | **6** | 1 | 36 | 3.080 | 0.090 | 59 | 1.2 | 0.85 | 1.02 | 36.72 | 2.42 | 1.05% | 1.22% | | | | 55.60% | 16.3 | 20 | 36.72 | 16.3<=20<=36.72 | OK | 0.143 | 6 | | | | | | | | 1.22% | 5% | 1.22%<5% | Verified | |
| 31 | DP-200N1 \| L& SP DB BoP | 5G-100D1 \| Auxiliary 6.6kV Switchboard | 1.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 8.15 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 71 | 1.2 | 0.85 | 1.02 | 21.42 | 3.47 | 1.51% | 1.68% | | | | 61.94% | 8.15 | 10 | 21.42 | 8.15<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 1.68% | 5% | 1.68%<5% | Verified | |
| 32 | DP-200N1 \| L& SP DB BoP | 5G-200N1 \| LV Switchboard Auxiliary | 1 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 5.43 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 22 | 1.2 | 0.85 | 1.02 | 21.42 | 0.72 | 0.31% | 0.48% | | | | 74.63% | 5.43 | 10 | 21.42 | 5.43<=10<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.48% | 5% | 0.48%<5% | Verified | |
| 33 | DP-200N1 \| L& SP DB BoP | 5G-200D2\| LV SWBD 800/460V Auxiliary | 0.2 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 1.09 | **3G** | **2.5** | 1 | 21 | 7.410 | 0.103 | 12 | 1.2 | 0.85 | 1.02 | 21.42 | 0.08 | 0.03% | 0.20% | | | | 94.93% | 1.09 | 6 | 21.42 | 1.09<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.20% | 5% | 0.2%<5% | Verified | |
| 34 | DP-200N1 \| L& SP DB BoP | UP-200F3 \| AC UPS PAS AUXILIARY | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 9.450 | 0.103 | 24 | 1.2 | 0.85 | 1.02 | 21.42 | 0.50 | 0.22% | 0.39% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.39% | 5% | 0.39%<5% | Verified | |
| 35 | DP-200N1 \| L& SP DB BoP | UP-200F4 \| AC UPS F&G AUXILIARY | 0.5 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 2.72 | **3G** | **2.5** | 1 | 21 | 9.450 | 0.103 | 20 | 1.2 | 0.85 | 1.02 | 21.42 | 0.41 | 0.18% | 0.35% | | | | 87.31% | 2.72 | 6 | 21.42 | 2.72<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.35% | 5% | 0.35%<5% | Verified | |
| 36 | DP-200N1 \| L& SP DB BoP | UP-200F1 \| DC BATTERY SYSTEM AUXILIARY | 0.3 | kW | 1 | 230 | 0.80 | 0.60 | | | 1.00 | 1.63 | **3G** | **2.5** | 1 | 21 | 9.450 | 0.103 | 55 | 1.2 | 0.85 | 1.02 | 21.42 | 0.68 | 0.30% | 0.30% | | | | 92.39% | 1.63 | 6 | 21.42 | 1.63<=6<=21.42 | OK | 0.143 | 2.5 | | | | | | | | 0.30% | 5% | 0.3%<5% | Verified | |
| | | **Battery Cables** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | BC-200F3 \| AC UPS PAS - Charger | BA-200F3 \| AC UPS PAS - Battery | 35 | KW | 1 | 216 | 1.00 | 0.00 | | | 1.00 | 162.04 | **1C** | **70** | 1 | 242 | 0.268 | | 21 | 1.2 | 0.85 | 1.02 | 246.84 | 1.82 | 0.84% | 1.52% | | | | 34.36% | 162.04 | 200 | 246.84 | 162.04<=200<=246.84 | OK | 0.143 | 70 | | | | | | | | 1.52% | 5% | 1.52%<5% | Verified | |
| 2 | BC-200F4 \| AC UPS F&G - Charger | BA-200F4 \| AC UPS F&G - Battery | 15 | KW | 1 | 120 | 1.00 | 0.00 | | | 1.00 | 125.00 | **1C** | **70** | 1 | 242 | 0.268 | | 22 | 1.2 | 0.85 | 1.02 | 246.84 | 1.47 | 1.23% | 1.74% | | | | 49.36% | 125 | 200 | 246.84 | 125<=200<=246.84 | OK | 0.143 | 70 | | | | | | | | 1.74% | 5% | 1.74%<5% | Verified | |
| 3 | BC-200F1 \| DC UPS - Charger | BA-200F1 \| DC UPS - Battery | 10 | KW | 1 | 132 | 1.00 | 0.00 | | | 1.00 | 75.76 | **1C** | **25** | 1 | 127 | 0.727 | | 12 | 1.2 | 0.85 | 1.02 | 129.54 | 1.32 | 1.00% | 1.64% | | | | 41.52% | 75.76 | 125 | 129.54 | 75.76<=125<=129.54 | OK | 0.143 | 25 | | | | | | | | 1.64% | 5% | 1.64%<5% | Verified | |
| 4 | BC-200F2 \| DC UPS - Charger | BA-200F2 \| NAVAID UPS - Battery | 6.6 | KW | 1 | 132 | 1.00 | 0.00 | | | 1.00 | 50.00 | **1C** | **70** | 1 | 242 | 0.268 | | 11 | 1.2 | 0.85 | 1.02 | 246.84 | 0.29 | 0.22% | 0.99% | | | | 79.74% | 50 | 100 | 246.84 | 50<=100<=246.84 | OK | 0.143 | 70 | | | | | | | | 0.99% | 5% | 0.99%<5% | Verified | Current rating 50 A considered as per vendor document |

## 6.3 CABLE PARAMETERS

Cable Reactance value given by FLEI cables vendor. Cable Resistance Value taken from IEC 60228.

| TIPO | Reactance at 50Hz, Ohm/km |
|---|---|
| Cu Cl.2/EPR/LSZH 0,6/1 KV 1CX300 | 0.080 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 1CX95 | 0.085 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 3G10 | 0.084 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 3G2,5 | 0.103 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 3G4 | 0.096 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 3G6 | 0.090 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 4X10 | 0.084 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 4G16 | 0.080 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 4G2,5 | 0.103 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 4G35 | 0.076 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 4G4 | 0.096 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 5G16 | 0.080 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 5G4 | 0.096 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 5G50 | 0.076 |
| Cu Cl.2/EPR/LSZH 0,6/1 KV 5G70 | 0.074 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 1X25 | 0.114 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 1X70 | 0.100 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 2X2,5 | 0.107 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 3G16 | 0.082 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 3G2,5 | 0.107 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 3G6 | 0.094 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 4G2,5 | 0.107 |
| Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 4G4 | 0.100 |
| Cu Cl.2/XLPE/LSZH 0,6/1 KV 7X1,5 | 0.110 |
| Cu Cl.2/XLPE/LSZH/CWB/LSZH 0,6/1 KV 4X4 | 0.096 |

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**Table 2 – Class 2 stranded conductors for single-core and multi-core cables**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Nominal cross-sectional area | Minimum number of wires in the conductor | | | | | | Maximum resistance of conductor at 20°C | | |
| | Circular | | Circular compacted | | Shaped | | Annealed copper conductor | | Aluminium or aluminium alloy conductor[c] |
| | Cu | Al | Cu | Al | Cu | Al | Plain wires | Metal-coated wires | |
| mm² | | | | | | | Ω/km | Ω/km | Ω/km |
| 0,5 | 7 | - | - | - | - | - | 36,0 | 36,7 | - |
| 0,75 | 7 | - | - | - | - | - | 24,5 | 24,8 | - |
| 1,0 | 7 | - | - | - | - | - | 18,1 | 18,2 | - |
| 1,5 | 7 | - | 6 | - | - | - | 12,1 | 12,2 | - |
| 2,5 | 7 | - | 6 | - | - | - | 7,41 | 7,56 | - |
| 4 | 7 | - | 6 | - | - | - | 4,61 | 4,70 | - |
| 6 | 7 | - | 6 | - | - | - | 3,08 | 3,11 | - |
| 10 | 7 | 7 | 6 | 6 | - | - | 1,83 | 1,84 | 3,08 |
| 16 | 7 | 7 | 6 | 6 | - | - | 1,15 | 1,16 | 1,91 |
| 25 | 7 | 7 | 6 | 6 | 6 | 6 | 0,727 | 0,734 | 1,20 |
| 35 | 7 | 7 | 6 | 6 | 6 | 6 | 0,524 | 0,529 | 0,868 |
| 50 | 19 | 19 | 6 | 6 | 6 | 6 | 0,387 | 0,391 | 0,641 |
| 70 | 19 | 19 | 12 | 12 | 12 | 12 | 0,268 | 0,270 | 0,443 |
| 95 | 19 | 19 | 15 | 15 | 15 | 15 | 0,193 | 0,195 | 0,320 |
| 120 | 37 | 37 | 18 | 15 | 18 | 15 | 0,153 | 0,154 | 0,253 |
| 150 | 37 | 37 | 18 | 15 | 18 | 15 | 0,124 | 0,126 | 0,206 |
| 185 | 37 | 37 | 30 | 30 | 30 | 30 | 0,0991 | 0,100 | 0,164 |
| 240 | 37 | 37 | 34 | 30 | 34 | 30 | 0,0754 | 0,0762 | 0,125 |
| 300 | 61 | 61 | 34 | 30 | 34 | 30 | 0,0601 | 0,0607 | 0,100 |
| 400 | 61 | 61 | 53 | 53 | 53 | 53 | 0,0470 | 0,0475 | 0,0778 |
| 500 | 61 | 61 | 53 | 53 | 53 | 53 | 0,0366 | 0,0369 | 0,0605 |
| 630 | 91 | 91 | 53 | 53 | 53 | 53 | 0,0283 | 0,0286 | 0,0469 |
| 800 | 91 | 91 | 53 | 53 | - | - | 0,0221 | 0,0224 | 0,0367 |
| 1 000 | 91 | 91 | 53 | 53 | - | - | 0,0176 | 0,0177 | 0,0291 |
| 1 200 | [b] | | | | | | 0,0151 | 0,0151 | 0,0247 |
| 1 400 [a] | [b] | | | | | | 0,0129 | 0,0129 | 0,0212 |
| 1 600 | [b] | | | | | | 0,0113 | 0,0113 | 0,0186 |
| 1 800 [a] | [b] | | | | | | 0,0101 | 0,0101 | 0,0165 |
| 2 000 | [b] | | | | | | 0,0090 | 0,0090 | 0,0149 |
| 2 500 | [b] | | | | | | 0,0072 | 0,0072 | 0,0127 |

[a] These sizes are non-preferred. Other non-preferred sizes are recognized for some specialized applications but are not within the scope of this standard.

[b] The minimum number of wires for these sizes is not specified. These sizes may be constructed from 4, 5 or 6 equal segments (Milliken).

[c] For stranded aluminium alloy conductors having the same nominal cross-sectional area as an aluminium conductor the resistance value should be agreed between the manufacturer and the purchaser.

# 7 ANNEXES – II

## 7.1 INPUT DATA USED FOR ETAP SHORT CIRCUIT STUDY

| Sl. | Description | Values | Reference |
|---|---|---|---|
| 1 | Source fault current at 6.6kV busbar of BLPH | Max. fault current = 8.37 kA,<br>Source MVA = √3 x 6.6kV x 8.37kA<br>95.67MVA | Table-6 of Doc.no. 123A90-DDL-RE-20171, Electrical system study report-Shirt circuit |
| 2 | Transformer TR-200DE1 data | 1600 kVA,<br>6.6/0.42kV (± 5%)<br>Dyn11<br>LV Solid grounding<br>6% impedance (at tap 0, OCTC) | Overall / Key single line diagram Doc.no. 123A90-DDL-EL-DG-20158 |
| 3 | 6.6kV cables from BLPH 6.6kV busbar to Transformer TR-200DE1 | 3x1Cx70mm² Cu. EPR unarmoured | Table 16 of Doc.no. 123A90-DDL-EL-RE-20151- 'Cable sizing calculation report' |
| 4 | LV cable from Transformer TR-200DE1 to LV Switchgear SG-200N1 | 5x1Cx300 mm² Cu. EPR cable | Refer Annexes -I, 6.2 Cable sizing for all LV cables of this document. |
| 5 | LV Loads from LV Switchgear SG-200N1 | All LV Equipment loads in kW & kVA | Electrical Load List & Balance (CCS MODE 'IMPORT') Doc. No. 123A90-DDL-EL-LIS-20016 |
| 6 | Cables data | Cables' Resistance, Reactance (positive, negative & zero sequence) impedance values are used from ETAP software library | Refer ANNEX-II for all cable data used in ETAP Model |

*Table 4 - Input Data used for short circuit study*

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## 7.2 CALCULATION MODES

Following short-circuit calculation modes are performed for the Low Voltage power distribution of BLPH model:

Maximum short circuit current calculation:

- Maximum three phase fault contribution from BLPH 6.6kV Busbar.
- Maximum single phase fault contribution from BLPH 6.6kV Busbar.
- Voltage factor Cmax according to Table 3 is applied for the calculation of maximum short circuit currents
- Resistance of cables introduced at a conductor temperature of 20°C.

Minimum short circuit current calculation:

- Minimum three phase fault contribution from BLPH 6.6kV Busbar.
- Minimum single phase fault contribution from BLPH 6.6kV Busbar.
- Voltage factor Cmin according to Table 3 is applied for the calculation of minimum short circuit currents
- Resistance of cables introduced at a conductor temperature of 90°C.

## 7.3 RESULTS OF SHORT CIRCUIT CURRENT CALCULATION

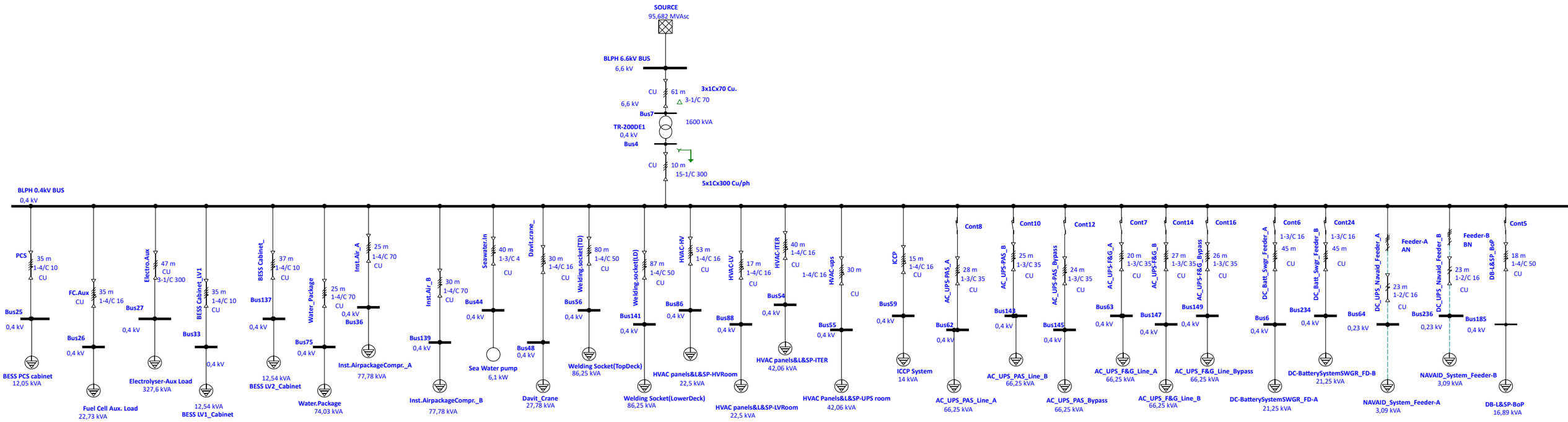
The 3-phase & 1-phase, maximum and minimum short circuit currents calculated using ETAP software are summarized in the following pages of this document.

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## 7.4 SINGLE LINE DIAGRAM

The Single line diagram is modelled in ETAP software based on the load list. For identical cable size & same length of cable, one typical load is modelled for short circuit study.

BASELOAD POWER HUB (BLPH) - LV SHORT CIRCUIT STUDY



## 7.5 CABLE DATA AND MAXIMUM SHORT CIRCUIT CURRENT SUMMARY

From the ETAP software library the Cables' resistance, reactance values at 20°C are used as input for Maximum short circuit condition.

The Summary report shows the Maximum short circuit current for faults such as 3-phase faults, Single phase-to-Ground faults.

# SG-200N1 LV SWGR

| | | | | | |
|---|---|---|---|---|---|
| Project: | BLPH- LV Short Circuit Current | **ETAP** | | Page: | 1 |
| Location: | | 22.0.2C | | Date: | 12-07-2024 |
| Contract: | | **MAXIMUM_SC** | | SN: | INCICOSPA |
| Engineer: | | Study Case: SC_Maximum | | Revision: | Base |
| Filename: | BLPH-LVSC13 12July24Sub System | | | Config.: | BHLP |

## at 0.4kV BUS

### 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 |
| BLPH 0.4kV BUS | 0.400 | 30.730 | 72.240 | 30.659 | 33.041 | 77.673 | 33.041 | 33.041 | 26.602 | 62.536 | 26.602 | 26.602 | 32.130 | 75.532 | 32.130 | 32.130 |
| Bus4 | 0.400 | 31.496 | 75.193 | 31.426 | 34.383 | 82.085 | 34.383 | 34.383 | 27.266 | 65.094 | 27.266 | 27.266 | 33.219 | 79.305 | 33.219 | 33.219 |
| Bus6 | 0.400 | 4.482 | 6.466 | 4.483 | 2.297 | 3.313 | 2.297 | 2.297 | 3.882 | 5.600 | 3.882 | 3.882 | 4.033 | 5.818 | 4.033 | 4.033 |
| Bus25 | 0.400 | 3.677 | 5.304 | 3.677 | 2.176 | 3.139 | 2.176 | 2.176 | 3.184 | 4.594 | 3.184 | 3.184 | 3.339 | 4.817 | 3.339 | 3.339 |
| Bus26 | 0.400 | 5.677 | 8.189 | 5.677 | 2.936 | 4.235 | 2.936 | 2.936 | 4.917 | 7.092 | 4.917 | 4.917 | 5.137 | 7.410 | 5.137 | 5.137 |
| Bus27 | 0.400 | 19.786 | 38.197 | 19.760 | 14.864 | 28.696 | 14.864 | 14.864 | 17.131 | 33.073 | 17.131 | 17.131 | 19.010 | 36.701 | 19.010 | 19.010 |
| Bus33 | 0.400 | 3.677 | 5.304 | 3.677 | 2.176 | 3.139 | 2.176 | 2.176 | 3.184 | 4.594 | 3.184 | 3.184 | 3.339 | 4.817 | 3.339 | 3.339 |
| Bus36 | 0.400 | 19.514 | 30.549 | 19.498 | 17.880 | 27.991 | 17.880 | 17.880 | 16.899 | 26.455 | 16.899 | 16.899 | 19.505 | 30.534 | 19.505 | 19.505 |
| Bus44 | 0.400 | 1.358 | 2.019 | 1.305 | 0.661 | 0.983 | 0.661 | 0.661 | 1.161 | 1.726 | 1.161 | 1.161 | 1.197 | 1.779 | 1.197 | 1.197 |
| Bus48 | 0.400 | 6.543 | 9.439 | 6.544 | 3.410 | 4.919 | 3.410 | 3.410 | 5.667 | 8.175 | 5.667 | 5.667 | 5.945 | 8.576 | 5.945 | 5.945 |
| Bus54 | 0.400 | 5.010 | 7.227 | 5.011 | 2.577 | 3.718 | 2.577 | 2.577 | 4.339 | 6.259 | 4.339 | 4.339 | 4.519 | 6.519 | 4.519 | 4.519 |
| Bus55 | 0.400 | 6.543 | 9.439 | 6.544 | 3.410 | 4.919 | 3.410 | 3.410 | 5.667 | 8.175 | 5.667 | 5.667 | 5.945 | 8.576 | 5.945 | 5.945 |
| Bus56 | 0.400 | 6.932 | 10.009 | 6.932 | 3.687 | 5.323 | 3.687 | 3.687 | 6.004 | 8.669 | 6.004 | 6.004 | 6.327 | 9.135 | 6.327 | 6.327 |
| Bus59 | 0.400 | 11.853 | 17.135 | 11.852 | 6.581 | 9.513 | 6.581 | 6.581 | 10.266 | 14.840 | 10.266 | 10.266 | 11.070 | 16.002 | 11.070 | 11.070 |
| Bus62 | 0.400 | 13.004 | 18.913 | 13.001 | 7.481 | 10.881 | 7.481 | 7.481 | 11.262 | 16.380 | 11.262 | 11.262 | 12.256 | 17.825 | 12.256 | 12.256 |
| Bus63 | 0.400 | 16.300 | 24.060 | 16.293 | 10.010 | 14.776 | 10.010 | 10.010 | 14.116 | 20.837 | 14.116 | 14.116 | 15.697 | 23.170 | 15.697 | 15.697 |
| Bus75 | 0.400 | 19.514 | 30.549 | 19.498 | 13.426 | 21.018 | 13.426 | 13.426 | 16.899 | 26.455 | 16.899 | 16.899 | 19.295 | 30.206 | 19.295 | 19.295 |
| Bus86 | 0.400 | 3.834 | 5.531 | 3.834 | 1.955 | 2.821 | 1.955 | 1.955 | 3.321 | 4.790 | 3.321 | 3.321 | 3.440 | 4.962 | 3.440 | 3.440 |
| Bus88 | 0.400 | 10.725 | 15.487 | 10.724 | 5.860 | 8.462 | 5.860 | 5.860 | 9.288 | 13.413 | 9.288 | 9.288 | 9.953 | 14.374 | 9.953 | 9.953 |
| Bus137 | 0.400 | 3.485 | 5.027 | 3.485 | 2.060 | 2.972 | 2.060 | 2.060 | 3.018 | 4.354 | 3.018 | 3.018 | 3.162 | 4.561 | 3.162 | 3.162 |
| Bus139 | 0.400 | 17.855 | 27.363 | 17.842 | 11.736 | 17.986 | 11.736 | 11.736 | 15.462 | 23.696 | 15.462 | 15.462 | 17.411 | 26.684 | 17.411 | 17.411 |
| Bus141 | 0.400 | 6.435 | 9.289 | 6.435 | 3.403 | 4.912 | 3.403 | 3.403 | 5.573 | 8.044 | 5.573 | 5.573 | 5.859 | 8.457 | 5.859 | 5.859 |
| Bus143 | 0.400 | 14.092 | 20.571 | 14.088 | 8.269 | 12.072 | 8.269 | 8.269 | 12.204 | 17.816 | 12.204 | 12.204 | 13.370 | 19.518 | 13.370 | 13.370 |
| Bus145 | 0.400 | 14.491 | 21.188 | 14.486 | 8.569 | 12.529 | 8.569 | 8.569 | 12.550 | 18.350 | 12.550 | 12.550 | 13.784 | 20.155 | 13.784 | 13.784 |
| Bus147 | 0.400 | 13.349 | 19.436 | 13.346 | 7.727 | 11.250 | 7.727 | 7.727 | 11.561 | 16.833 | 11.561 | 11.561 | 12.608 | 18.356 | 12.608 | 12.608 |
| Bus149 | 0.400 | 13.712 | 19.988 | 13.708 | 7.989 | 11.646 | 7.989 | 7.989 | 11.875 | 17.311 | 11.875 | 11.875 | 12.979 | 18.920 | 12.979 | 12.979 |
| Bus185 | 0.400 | 19.826 | 30.566 | 19.810 | 13.517 | 20.839 | 13.517 | 13.517 | 17.169 | 26.470 | 17.169 | 17.169 | 19.663 | 30.315 | 19.663 | 19.663 |
| Bus234 | 0.400 | 4.482 | 6.466 | 4.483 | 2.297 | 3.313 | 2.297 | 2.297 | 3.882 | 5.600 | 3.882 | 3.882 | 4.033 | 5.818 | 4.033 | 4.033 |

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.

# SG-200N1 LV SWGR

| | | | | | |
|---|---|---|---|---|---|
| Project: | BLPH- LV Short Circuit Current | ETAP | | Page: | 1 |
| Location: | | 22.0.2C | | Date: | 12-07-2024 |
| Contract: | | MAXIMUM_SC | | SN: | INCICOSPA |
| Engineer: | | Study Case: SC_Maximum | | Revision: | Base |
| Filename: | BLPH-LVSC13 12July24Sub System | | | Config.: | BHLP |

## at 0.23kV BUS

### Short-Circuit Summary Report

3-Phase & 1-Phase Fault Currents

| Bus | | Device | | | Device Capacity (kA) | | | | Short-Circuit Current (kA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | kV | ID | Ckt # | Type | Making Peak | Ib sym | Ib asym | Idc | I"k | ip | Ib sym | Ib asym | Idc | Ik |
| BLPH 0.4kV BUS | 0.400 | BLPH 0.4kV BUS | | Bus | | | | | 32.193 | 75.606 | | | | 32.119 |
| Bus64 | 0.230 | Bus64 | | Bus | | | | | 4.595 | 6.628 | | | | 4.595 |
| Bus236 | 0.230 | Bus236 | | Bus | | | | | 4.595 | 6.628 | | | | 4.595 |

ip is calculated using method C
Ib does not include decay of non-terminal faulted induction motors
Ik is the maximum steady state fault current
Idc is based on X/R from Method C and Ib as specified above

For 1-Phase 3-Wire systems (fed from center-tap transformers), the calculated duty for panel's main and feeder protective devices are based on maximum of 1-pole and 2-pole faults.

LV CB duty determined based on service rating.

Total through current is used for device duty.

* 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)

## 7.6 CABLE DATA AND MINIMUM SHORT CIRCUIT CURRENT SUMMARY

From the ETAP software library the Cables' resistance, reactance values at 90°C are used as input for Minimum short circuit condition.

The Summary report shows the Minimum short circuit current for faults such as 3-phase faults, Single phase-to-Ground faults.

# SG-200N1 LV SWGR

| | | | | | |
|---|---|---|---|---|---|
| Project: | BLPH- LV Short Circuit Current | **ETAP** | | Page: | 1 |
| Location: | | 22.0.2C | | Date: | 12-07-2024 |
| Contract: | | **MINIMUM_SC** | | SN: | INCICOSPA |
| Engineer: | | Study Case: SC_Minimum | | Revision: | Base |
| Filename: | BLPH-LVSC13 12July24Sub System | | | Config.: | BHLP |

# at 0.4kV BUS

## 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 |
| BLPH 0.4kV BUS | 0.400 | 23.683 | 55.443 | 23.683 | 25.038 | 58.617 | 25.038 | 25.038 | 20.510 | 48.015 | 20.510 | 20.510 | 24.483 | 57.317 | 24.483 | 24.483 |
| Bus4 | 0.400 | 24.200 | 57.651 | 24.200 | 25.904 | 61.711 | 25.904 | 25.904 | 20.958 | 49.927 | 20.958 | 20.958 | 25.192 | 60.014 | 25.192 | 25.192 |
| Bus6 | 0.400 | 3.201 | 4.617 | 3.201 | 1.634 | 2.357 | 1.634 | 1.634 | 2.772 | 3.999 | 2.772 | 2.772 | 2.875 | 4.147 | 2.875 | 2.875 |
| Bus25 | 0.400 | 2.619 | 3.779 | 2.619 | 1.546 | 2.231 | 1.546 | 1.546 | 2.269 | 3.272 | 2.269 | 2.269 | 2.374 | 3.424 | 2.374 | 2.374 |
| Bus26 | 0.400 | 4.062 | 5.859 | 4.062 | 2.091 | 3.016 | 2.091 | 2.091 | 3.518 | 5.074 | 3.518 | 3.518 | 3.667 | 5.289 | 3.667 | 3.667 |
| Bus27 | 0.400 | 15.804 | 29.573 | 15.804 | 11.926 | 22.318 | 11.926 | 11.926 | 13.687 | 25.611 | 13.687 | 13.687 | 15.335 | 28.696 | 15.335 | 15.335 |
| Bus33 | 0.400 | 2.619 | 3.779 | 2.619 | 1.546 | 2.231 | 1.546 | 1.546 | 2.269 | 3.272 | 2.269 | 2.269 | 2.374 | 3.424 | 2.374 | 2.374 |
| Bus36 | 0.400 | 14.828 | 22.787 | 14.828 | 13.494 | 20.737 | 13.494 | 13.494 | 12.842 | 19.734 | 12.842 | 12.842 | 14.801 | 22.745 | 14.801 | 14.801 |
| Bus44 | 0.400 | 0.926 | 1.336 | 0.926 | 0.465 | 0.671 | 0.465 | 0.465 | 0.802 | 1.157 | 0.802 | 0.802 | 0.821 | 1.185 | 0.821 | 0.821 |
| Bus48 | 0.400 | 4.689 | 6.764 | 4.689 | 2.430 | 3.505 | 2.430 | 2.430 | 4.061 | 5.858 | 4.061 | 4.061 | 4.249 | 6.129 | 4.249 | 4.249 |
| Bus54 | 0.400 | 3.581 | 5.166 | 3.581 | 1.835 | 2.646 | 1.835 | 1.835 | 3.101 | 4.474 | 3.101 | 3.101 | 3.223 | 4.650 | 3.223 | 3.223 |
| Bus55 | 0.400 | 4.689 | 6.764 | 4.689 | 2.430 | 3.505 | 2.430 | 2.430 | 4.061 | 5.858 | 4.061 | 4.061 | 4.249 | 6.129 | 4.249 | 4.249 |
| Bus56 | 0.400 | 5.032 | 7.261 | 5.032 | 2.649 | 3.823 | 2.649 | 2.649 | 4.358 | 6.288 | 4.358 | 4.358 | 4.579 | 6.607 | 4.579 | 4.579 |
| Bus59 | 0.400 | 8.594 | 12.410 | 8.594 | 4.707 | 6.797 | 4.707 | 4.707 | 7.442 | 10.748 | 7.442 | 7.442 | 7.986 | 11.532 | 7.986 | 7.986 |
| Bus62 | 0.400 | 9.541 | 13.828 | 9.541 | 5.389 | 7.810 | 5.389 | 5.389 | 8.263 | 11.975 | 8.263 | 8.263 | 8.943 | 12.962 | 8.943 | 8.943 |
| Bus63 | 0.400 | 12.079 | 17.696 | 12.079 | 7.245 | 10.614 | 7.245 | 7.245 | 10.461 | 15.325 | 10.461 | 10.461 | 11.555 | 16.928 | 11.555 | 11.555 |
| Bus75 | 0.400 | 14.828 | 22.787 | 14.828 | 9.939 | 15.274 | 9.939 | 9.939 | 12.842 | 19.734 | 12.842 | 12.842 | 14.583 | 22.409 | 14.583 | 14.583 |
| Bus86 | 0.400 | 2.735 | 3.946 | 2.735 | 1.391 | 2.007 | 1.391 | 1.391 | 2.369 | 3.417 | 2.369 | 2.369 | 2.450 | 3.534 | 2.450 | 2.450 |
| Bus88 | 0.400 | 7.754 | 11.191 | 7.754 | 4.187 | 6.043 | 4.187 | 4.187 | 6.715 | 9.692 | 6.715 | 6.715 | 7.164 | 10.340 | 7.164 | 7.164 |
| Bus137 | 0.400 | 2.482 | 3.580 | 2.482 | 1.464 | 2.112 | 1.464 | 1.464 | 2.150 | 3.101 | 2.150 | 2.150 | 2.247 | 3.241 | 2.247 | 2.247 |
| Bus139 | 0.400 | 13.505 | 20.367 | 13.505 | 8.655 | 13.052 | 8.655 | 8.655 | 11.696 | 17.638 | 11.696 | 11.696 | 13.102 | 19.758 | 13.102 | 13.102 |
| Bus141 | 0.400 | 4.665 | 6.731 | 4.665 | 2.444 | 3.526 | 2.444 | 2.444 | 4.040 | 5.829 | 4.040 | 4.040 | 4.235 | 6.111 | 4.235 | 4.235 |
| Bus143 | 0.400 | 10.372 | 15.071 | 10.372 | 5.965 | 8.668 | 5.965 | 5.965 | 8.983 | 13.052 | 8.983 | 8.983 | 9.784 | 14.216 | 9.784 | 9.784 |
| Bus145 | 0.400 | 10.679 | 15.534 | 10.679 | 6.185 | 8.997 | 6.185 | 6.185 | 9.248 | 13.453 | 9.248 | 9.248 | 10.097 | 14.688 | 10.097 | 10.097 |
| Bus147 | 0.400 | 9.804 | 14.220 | 9.804 | 5.569 | 8.076 | 5.569 | 5.569 | 8.491 | 12.315 | 8.491 | 8.491 | 9.208 | 13.355 | 9.208 | 9.208 |
| Bus149 | 0.400 | 10.081 | 14.633 | 10.081 | 5.760 | 8.361 | 5.760 | 5.760 | 8.731 | 12.673 | 8.731 | 8.731 | 9.488 | 13.773 | 9.488 | 9.488 |
| Bus185 | 0.400 | 14.949 | 22.694 | 14.949 | 9.912 | 15.047 | 9.912 | 9.912 | 12.946 | 19.653 | 12.946 | 12.946 | 14.719 | 22.345 | 14.719 | 14.719 |
| Bus234 | 0.400 | 3.201 | 4.617 | 3.201 | 1.634 | 2.357 | 1.634 | 1.634 | 2.772 | 3.999 | 2.772 | 2.772 | 2.875 | 4.147 | 2.875 | 2.875 |

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.