Greener Ideas Ltd
C/O Bord Gáis Energy Ltd
No1 Warrington Place
Dublin
D02 HH27
Ireland

Land Use, Planning & Transportation Dept.
South Dublin County Council
County Hall
Tallaght
Dublin 24
D24 A3XC

Ref: SD21A/0167/C3(3)

Subject: Greener Ideas Ltd (GIL): Planning Compliance Update
Construction of a Gas Fired Power Plant at Profile Park, Baldonnell, Dublin D22 C7W4
Register Reference SD21A/0167

Dear Sir/Madam,

With regard to South Dublin County Council's (SDCC) Grant of Permission SD21A/0167 giving approval with conditions for the construction of a gas fired power plant at Profile Park, Baldonnell, Dublin D22 C7W4.

Greener Ideas Ltd (GIL) refer to your letter of 23rd October 2024 regarding compliance submission SD21A/0167/C3(3) which states the following:

SDCC Public Lighting have reviewed the compliance submission and state in their report that *'what has been submitted is not a lighting design and, therefore, does not comply. A light level calculation and electrical calculations are required'*.

In response to the request, we provide the documentation listed in Table 1 below.

File Name	Description
PRF-EL-CR-00-YP-0006	Outdoor Lighting Calculation report
PRF-EL-CR-00-YP-0010(1)	LV Cable Sizing Calculation report
PRF-EL-TS-00-YP-005	Lighting System Technical Specification

Should you have any comments or queries, please do not hesitate to contact the undersigned.

Yours sincerely

p.p.

Thomas Lawlor
Bord Gáis Energy | Upstream Lead
Greener Ideas | Planning & Consents Manager

CLIENT

CONTRACTOR

SITE / PROJECT

100 MW PROFILE PARK RECIPROCATING POWER PLANT PROJECT

1	21.02.2024	For Construction	BS	AG	CK
0	25.09.2023	For Review	BS	AG	CK
REV	***DATE***	***DESCRIPTION***	***DONE***	***CHECKED***	***APPROVED***

STATUS			*ISSUE OWNER*	SIGN	DATE
	FOR INFORMATION	☐	YÜKSEL PROJE		21.02.2024
	FOR REVIEW	☐			
	FOR APPROVAL	☐			
	FOR TENDER	☐			
	FOR COORDINATION	☐			
	FOR CONSTRUCTION	☒			

DOCUMENT NUMBER

PRF-EL-CR-00-YP-0006

DOCUMENT NAME

OUTDOOR LIGHTING CALCULATION REPORT

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1. INDRODUCTION

1.1. General

Centrica Business Solutions (CBS) is a provider of energy insights, optimisation, and on-site generation solutions for its customers, as well as owning and operating energy solutions across the UK, Ireland and North America while continually in the process of identifying new sites for development.

CBS is currently in the process of supporting the development of a circa 100 MW dualfuel generation asset (Athlone Power Project) in Monksland, Athlone and Profile Park, Baldonnel, Ireland. CBS are delivering the project on an Engineering, Procurement and Construction (EPC) basis on behalf of Greener Ideas Ltd.

The Project will consist of five (5) gas reciprocating engines exporting power to the grid via an adjacent 110 kV connection. The Project will use natural gas as its primary fuel with gas oil as a back-up in the event of interruption to the gas supply.

1.2. The Aim and Scope of The Project

The purpose of this document is to specify the design and calculations of the Lighting System of Outdoor Lighting of the 100 MW PROFILE PARK RECIPROCATING POWER PLANT PROJECT to be located near Dublin, Ireland.

In this document are defined the minimum requirements for the lighting and building services design to ensure efficient construction, proper functionality, and high reliability of the production plant.

1.3. Definitions

Project	:100 MW Profile Park Reciprocating Power Plant
Employer	: GIL
Contractor	: GCIL

1.4. Abbreviations

EN	: European Norm
IEC	: International Electrotechnical Commission
W	: Watt
LED	: Light Emitting Diode
UV	: Ultraviolet
cm	: Centimeter
K	: Kelvin

2. CODES AND STANDARTS

As a minimum, the following codes and standards shall be considered:

I.S. 10101:2020	National Rules for Electrical Installations
EN 12464-1	Light and lighting - Lighting of workplaces - Part 1: Indoor workplaces
EN 12464-2	Light and lighting - Lighting of workplaces - Part 2: Outdoor workplaces
EN 50172	Emergency escape lighting systems
EN 60079	Electrical apparatus for explosive gas atmospheres
EN 15193	Energy performance of buildings - Energy requirements for lighting
EN 1838	Lighting applications- Emergency lighting
EN 50262	Metric cable glands for electrical installations
EN ISO 9001	Quality Management System
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60598	Luminaires General requirements and tests
IEC 60079	Explosive atmospheres
IEC 62612	Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements
IEC 60423	Conduit systems for cable management - Outside diameters of conduits for Electrical installations and threads for conduits and fittings
IEC 60502	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV)
IEC 60669	Switches for household and similar fixed electrical installations
ATEX certifications	Hazardous Area Classification

Equipment shall be supplied in accordance with all applicable European Union Directives. Particular attention should be paid to:

- Safety
- Electromagnetic Compatibility
- Machinery
- CE marking

Therefore, the Supplier shall be responsible for supplying the product with its CE marking and all the corresponding documentation."

The units of measure shall be the SI unit of measure.

All arrangement drawings, schematics, wiring diagrams, instructions and operating and maintenance manuals, etc. shall designate systems, equipment, piping, instruments, etc. using the power plant idenfication system.

3. REFERENCE DOCUMENTS

PRF-EL-DW-00-YP-0001	Overall Single Line Diagram
PRF-EL-DW-00-YP-0004	LV Distribution Layout
PRF-EL-LS-00-YP-0002	Overall Electrical Cable List
PRF-EL-DW-00-YP-0007	Outdoor Lighting Layout
PRF-EL-CR-00-YP-0010	LV Cable Sizing Calculation Report
PRF-EL-DW-00-YP-0008	Outdoor/Site Cable Routing Layouts (Incl. Cable Tray and Conduits)
PRF-EL-LS-00-YP-0003	Outdoor/site Cable Schedule
PRF-EL-CR-00-YP-0008	Outdoor Cable Tray Capacity Calculation Report
PRF-EL-TS-00-YP-0005	Lighting System Technical Specification

4. DESIGN CONDITIONS

Ambient Air Conditions: Statistical Data

Minimum Recorded (°C)	-7.6
Mean Recorded (°C)	10.0
Maximum Recorded (°C)	27.5
Mean Wet Bulb Temperature (°C)	8.6
Maximum Wet Bulb Temperature (°C)	21.5
Minimum Humidity	20%
Average Humidity	82%
Maximum Humidity	100%

Ambient Air Temperature: Design Data

Winterisation Temperature (°C)	-10
Max Ambient Design Temperature (°C)	30
Max Wet Bulb Temperature (°C)	22

Wind, Rainfall and Snowfall Data

Average Wind Velocity km/h (m/s)	18.1 (5)
Maximum Wind Velocity km/h (m/s)	74.1 (20.6)
Average Daily Rainfall (mm)	2.1
Maximum Daily Rainfall (mm)	45.4

Site Conditions

Altitude above sea level (m)	69
Maximum wet bulb temperature (°C)	21.5
Minimum ambient air temperature (°C)	-10
Maximum ambient air temperature (°C)	30

Performance Data Reference Conditions

Parameter	Unit	Value
Air inlet temperature (before air inlet filter)	°C	15
Air inlet pressure (before air inlet filter)	mbar	1005
Wet Bulb Temperature	°C	7
Relative Humidity	%	28
Charge Air Temperature Before Cylinder:		
Gas Operation	°C	50
Diesel Operatin	°C	45
Exhaust Gas Bask Pressure	mbar	<=50
Intake Air Pressure Loss	mbar	<=20

5. PROFILE PARK POWER PLANT UNIT LISTS

- ENGINE HALL
- ELECTRICAL ANNEX
- WORKSHOP & STOREROOM
- TANK FARM BUILDING
- SECURITY HUT BUILDING

6. LIGHTING CALCULATIONS OF OUTDOOR LIGHTING

In this document,

- The lighting fixtures have been placed according to the architectural layout plans.
- The lighting design have made based on safety, comfort, working areas and the difference of luminous intensity which is decreased.
- LED fixtures which are convenient for Lighting Technical Specification according to safety, energy efficiency have been used in room and environmental lighting.

6.1. Lighting Values

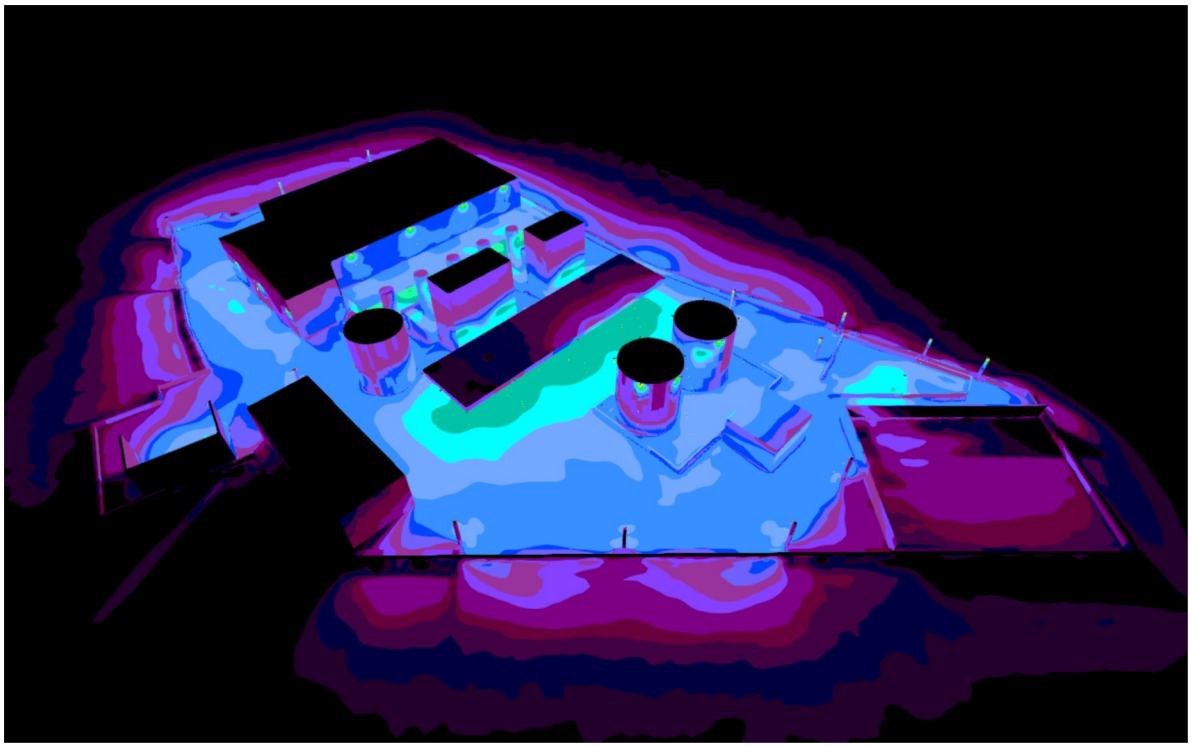
The essential factors of lighting design are specified as the size and qualification of surfaces, preserves of colors, the needs of luminousness. Besides that, the elements that are suitability for architecture, safe, ease of maintenance repair and providing were based on design. The luminousness levels were determined with EN 12464-1, EN 12464-2, Electrical Installation in Buildings standards and the values of them given below.

6.2. Average Illumination Levels

NAME OF LOCATION	STANDART Em (lx)	SIMULATION RESULTS Em (lx)	FIXTURE HEIGHT (m)	FIXTURE TYPE
GENERAL AREA	20	21.2	6	38 W LIGHTING POLE, 6000 Lumen, 4000K
OUTSIDE AREA	15	16.9	6	41 W PROJEKTOR, 7000 Lumen, 4000K
PLATFORM AREA	50	71.6	4,2	15 W LINEER LED LIGHTING FIXTURE, 2300 Lumen, 4000K
RADIATOR PLATFORM	50	60.5	8,5	25 W LINEER LED LIGHTING FIXTURE, 4200 Lumen, 4000K
TANK AREA	20	25.2	13	41 W PROJEKTOR, 7000 Lumen, 4000K
UPPER PLATFORM AREA	20	34.5	7	41 W PROJEKTOR, 7000 Lumen, 4000K
TRANSFORMATION AREA	20	32	7,5	41 W PROJEKTOR, 7000 Lumen, 4000K

The fixtures used in lighting calculations are not binding on product selection in the application phase.

7. SIMULATION RESULTS



PROFILE PARK OUTDOOR LIGHTING CALCULATION REPORT

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Images

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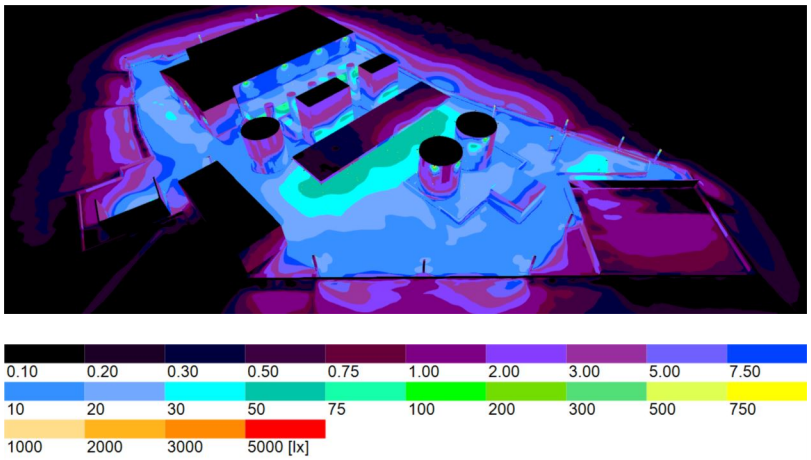
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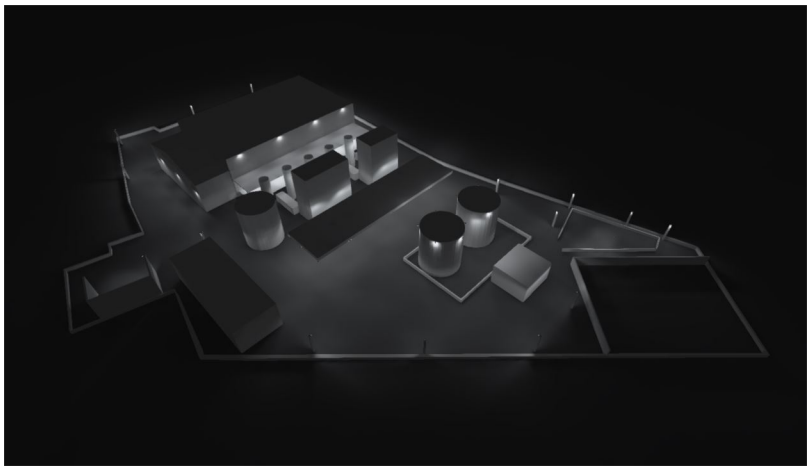

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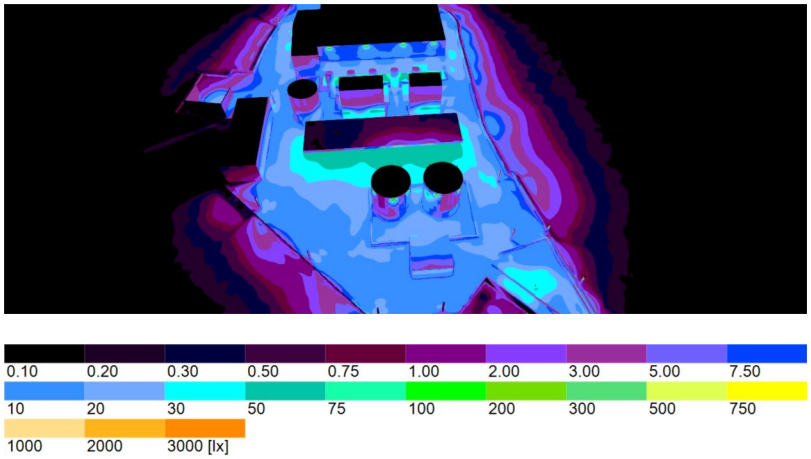
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Images

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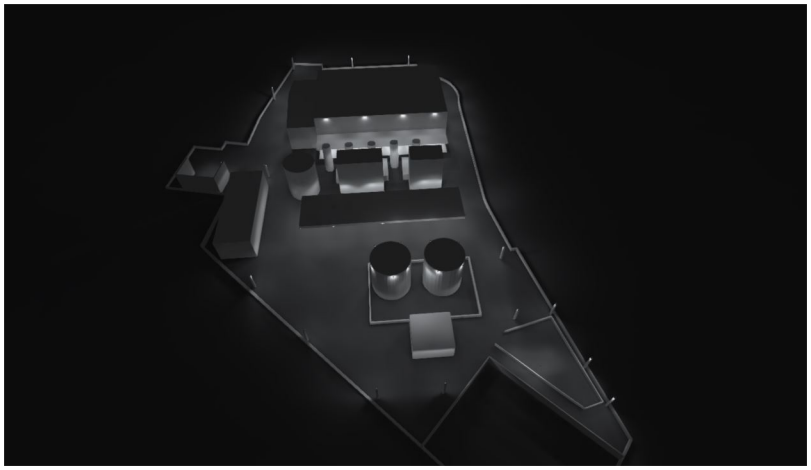

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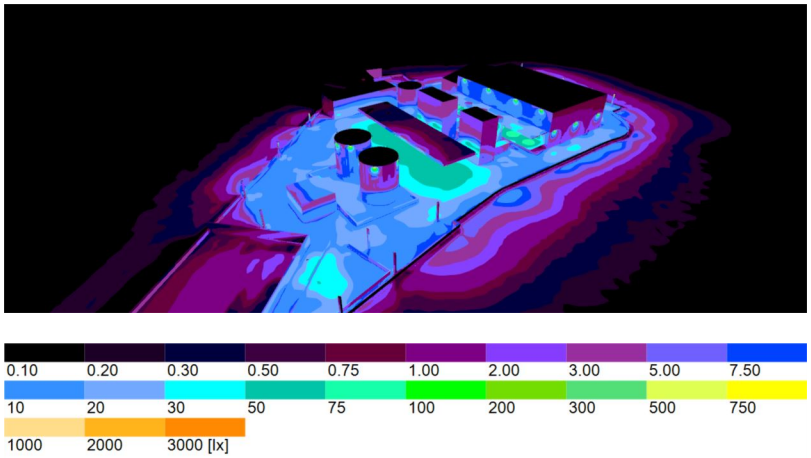
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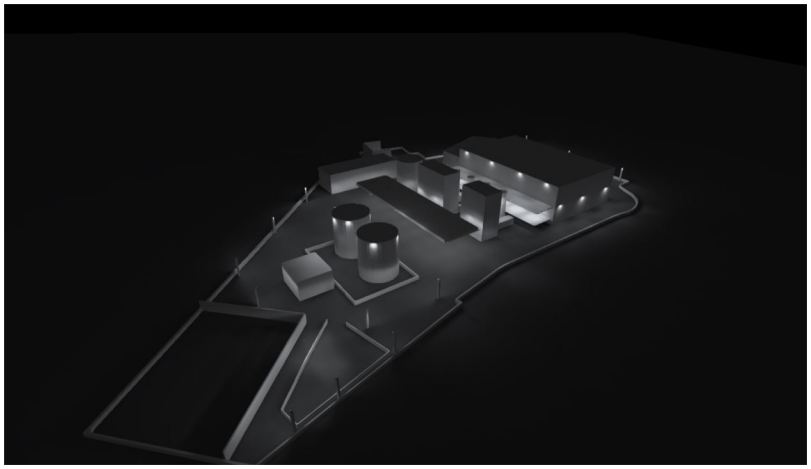

Images

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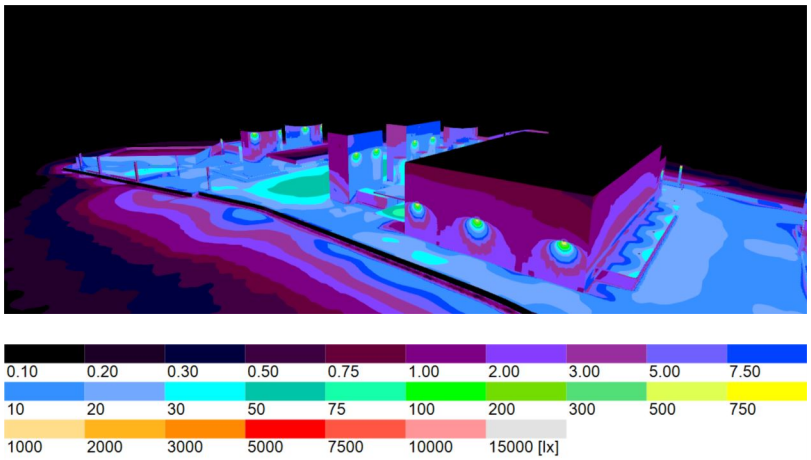
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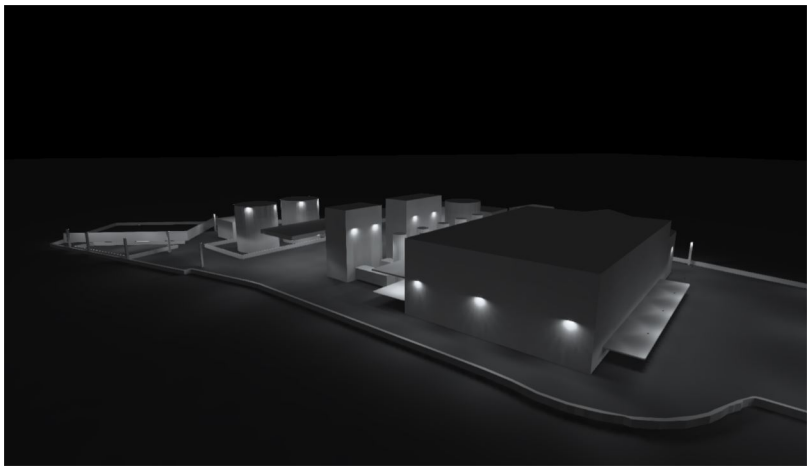

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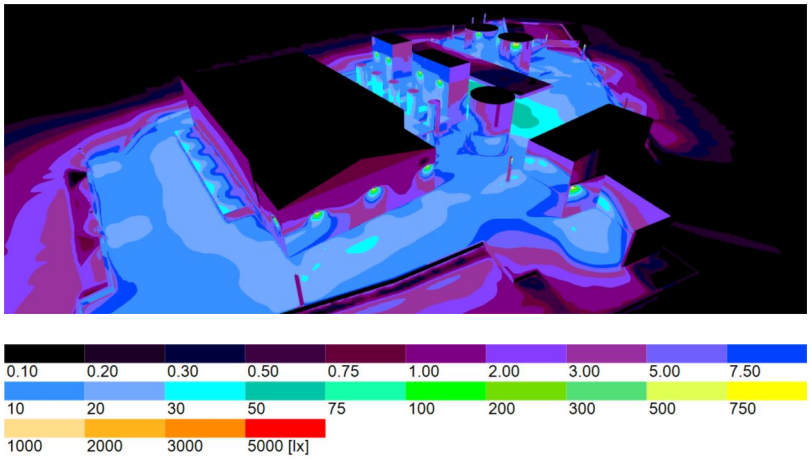
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Images

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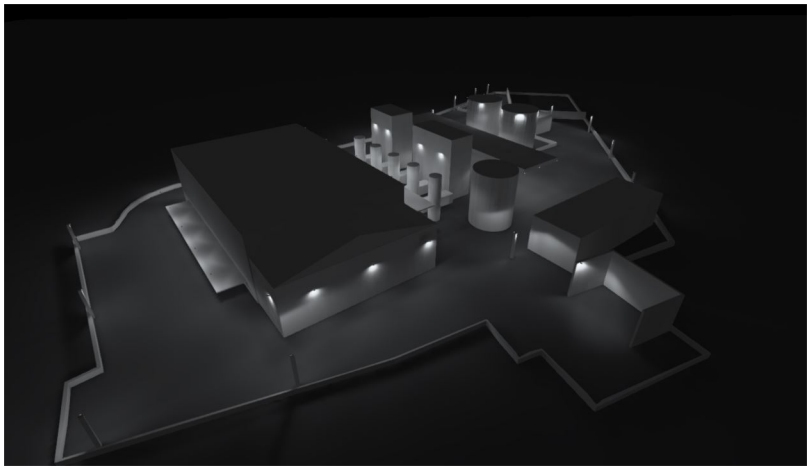

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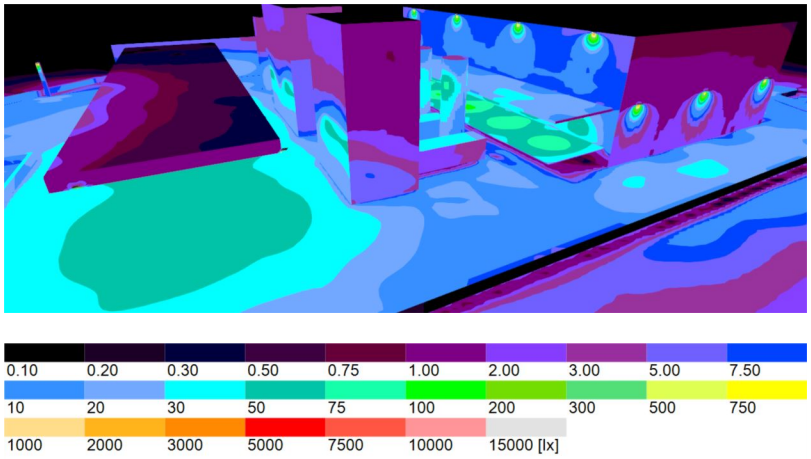

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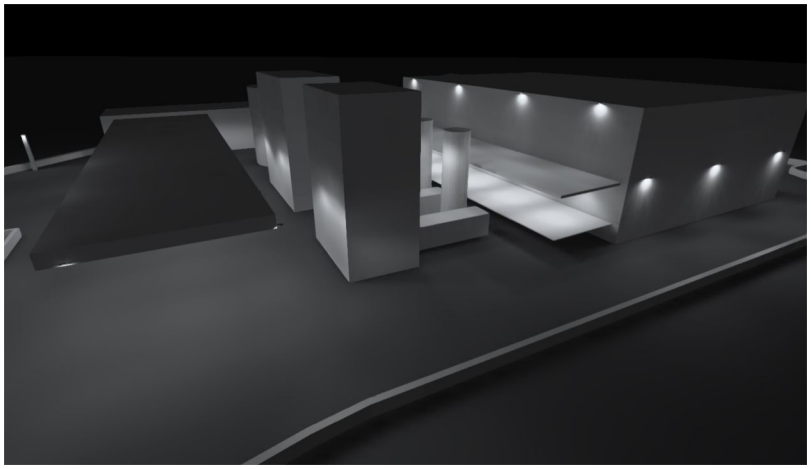

Images

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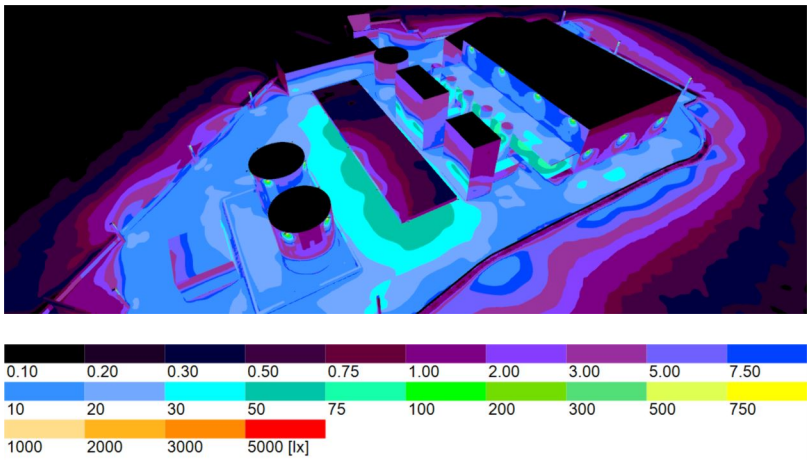
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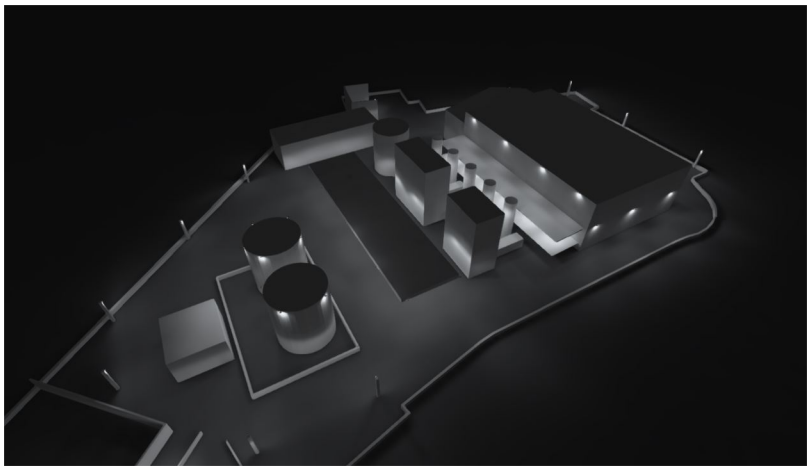
5000 [lx]

14



Luminaire list

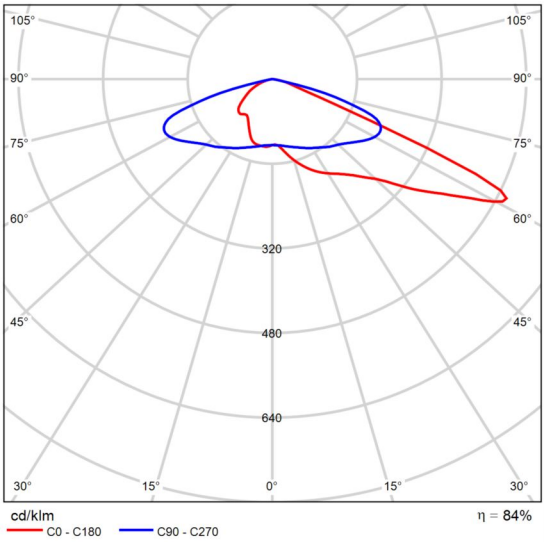
Φ_{total}	P_{total}	Luminous efficacy
433177 lm	2956.4 W	146.5 lm/W

pcs.	Manufacturer	Article No.	Article name	P	Φ	Luminous efficacy
28	Philips		BGP292 T25 1 xLED60-4S/740 DX10	38.0 W	5061 lm	133.2 lm/W
33	Philips		BVP650 T25 1 xLED70-4S/740 OFA52	41.0 W	6213 lm	151.5 lm/W
14	Philips		WT490C PSU L1200 1 xLED42S/840 WB	25.5 W	4202 lm	164.8 lm/W
12	Philips		WT490C PSU L700 1 xLED23S/840 WB	15.2 W	2301 lm	151.4 lm/W

Product data sheet

Philips - BGP292 T25 1 xLED60-4S/740 DX10

P	38.0 W
Φ_{Lamp}	6000 lm
$\Phi_{Luminaire}$	5061 lm
η	84.34 %
Luminous efficacy	133.2 lm/W
CCT	3000 K
CRI	100

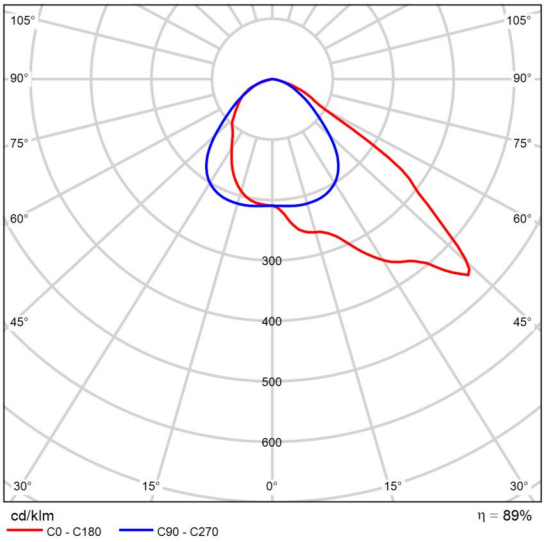


Polar LDC

Product data sheet

Philips - BVP650 T25 1 xLED70-4S/740 OFA52

P	41.0 W
Φ_{Lamp}	7000 lm
$\Phi_{Luminaire}$	6213 lm
η	88.75 %
Luminous efficacy	151.5 lm/W
CCT	3000 K
CRI	100

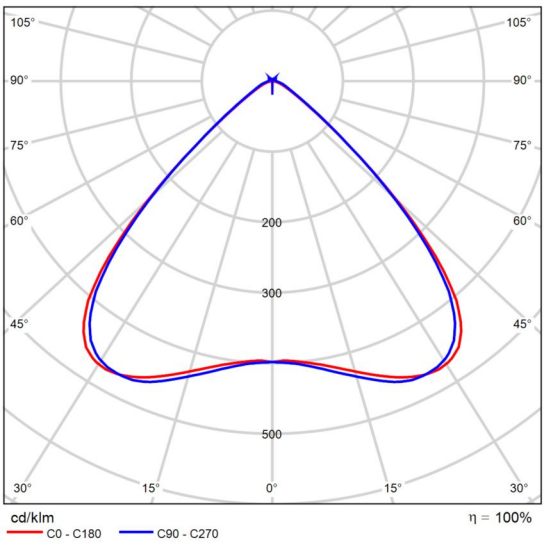


Polar LDC

Product data sheet

Philips - WT490C PSU L700 1 xLED23S/840 WB

P	15.2 W
Φ_{Lamp}	2300 lm
$\Phi_{Luminaire}$	2301 lm
η	100.04 %
Luminous efficacy	151.4 lm/W
CCT	3000 K
CRI	100



Polar LDC

Glare evaluation according to UGR

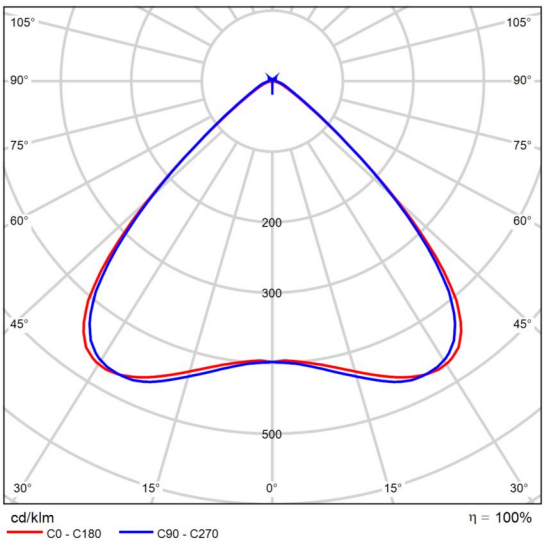
ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	19.0	20.0	19.3	20.3	20.5	18.6	19.7	18.9	19.9	20.2
	3H	19.0	19.9	19.3	20.2	20.5	18.6	19.6	19.0	19.8	20.1
	4H	18.9	19.8	19.3	20.1	20.4	18.6	19.5	19.0	19.8	20.1
	6H	18.9	19.7	19.2	20.0	20.3	18.6	19.5	19.0	19.8	20.1
	8H	18.8	19.6	19.2	19.9	20.3	18.6	19.4	19.0	19.7	20.1
	12H	18.8	19.5	19.2	19.9	20.2	18.6	19.4	19.0	19.7	20.1
4H	2H	18.9	19.7	19.2	20.0	20.4	18.5	19.4	18.9	19.7	20.0
	3H	18.9	19.6	19.3	20.0	20.3	18.6	19.3	19.0	19.7	20.0
	4H	18.9	19.5	19.3	19.9	20.3	18.6	19.3	19.1	19.7	20.1
	6H	18.8	19.4	19.3	19.8	20.2	18.7	19.3	19.1	19.7	20.1
	8H	18.8	19.3	19.3	19.8	20.2	18.7	19.2	19.2	19.7	20.1
	12H	18.8	19.3	19.2	19.7	20.2	18.7	19.2	19.2	19.7	20.1
8H	4H	18.8	19.3	19.3	19.8	20.2	18.6	19.1	19.0	19.5	20.0
	6H	18.8	19.2	19.3	19.7	20.2	18.7	19.1	19.2	19.6	20.1
	8H	18.8	19.2	19.3	19.6	20.2	18.7	19.1	19.2	19.6	20.1
	12H	18.8	19.1	19.3	19.6	20.1	18.8	19.1	19.3	19.6	20.1
12H	4H	18.8	19.3	19.2	19.7	20.2	18.5	19.0	19.0	19.5	19.9
	6H	18.8	19.2	19.3	19.6	20.1	18.7	19.0	19.2	19.5	20.0
	8H	18.8	19.1	19.3	19.6	20.1	18.7	19.0	19.2	19.5	20.1
Variation of the observer position for the luminaire distances S											
S = 1.0H		+1.7 / -3.8					+1.5 / -3.0				
S = 1.5H		+3.8 / -5.7					+3.3 / -4.4				
S = 2.0H		+5.7 / -6.6					+5.1 / -5.1				
Standard table		BK00					BK01				
Correction summand		0.7					0.8				
Corrected glare indices referring to 2300lm Total luminous flux											

UGR diagram (SHR: 0.25)

Product data sheet

Philips - WT490C PSU L1200 1 xLED42S/840 WB

P	25.5 W
Φ_{Lamp}	4200 lm
$\Phi_{Luminaire}$	4202 lm
η	100.04 %
Luminous efficacy	164.8 lm/W
CCT	3000 K
CRI	100



Polar LDC

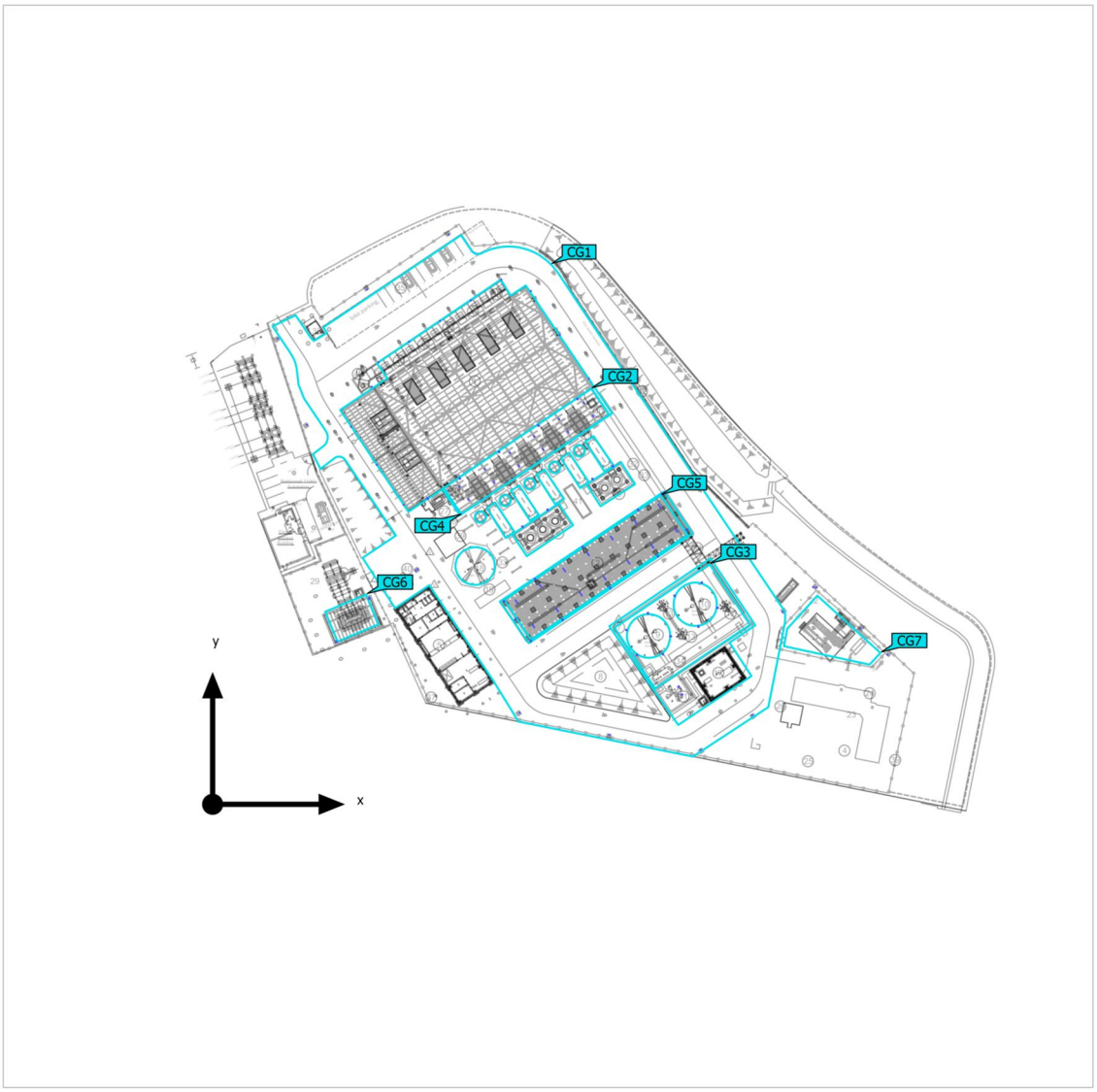
Glare evaluation according to UGR

ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	18.6	19.6	18.9	19.9	20.1	18.2	19.2	18.5	19.5	19.7
	3H	18.5	19.5	18.9	19.7	20.0	18.2	19.1	18.5	19.4	19.7
	4H	18.5	19.4	18.8	19.7	20.0	18.2	19.1	18.5	19.4	19.7
	6H	18.4	19.3	18.8	19.6	19.9	18.2	19.0	18.6	19.3	19.6
	8H	18.4	19.2	18.8	19.5	19.9	18.2	19.0	18.6	19.3	19.6
	12H	18.4	19.1	18.8	19.5	19.8	18.2	18.9	18.6	19.3	19.6
4H	2H	18.4	19.3	18.8	19.6	19.9	18.1	18.9	18.4	19.2	19.5
	3H	18.5	19.2	18.8	19.5	19.9	18.1	18.9	18.5	19.2	19.6
	4H	18.4	19.1	18.9	19.5	19.9	18.2	18.8	18.6	19.2	19.6
	6H	18.4	19.0	18.9	19.4	19.8	18.2	18.8	18.7	19.2	19.6
	8H	18.4	18.9	18.8	19.3	19.8	18.3	18.8	18.7	19.2	19.7
	12H	18.3	18.8	18.8	19.3	19.7	18.3	18.8	18.7	19.2	19.7
8H	4H	18.4	18.9	18.8	19.3	19.8	18.1	18.7	18.6	19.1	19.5
	6H	18.4	18.8	18.9	19.3	19.8	18.2	18.7	18.7	19.1	19.6
	8H	18.4	18.8	18.9	19.2	19.7	18.3	18.7	18.8	19.1	19.6
	12H	18.3	18.7	18.9	19.2	19.7	18.3	18.7	18.9	19.2	19.7
12H	4H	18.3	18.8	18.8	19.3	19.7	18.1	18.6	18.6	19.0	19.5
	6H	18.4	18.7	18.9	19.2	19.7	18.2	18.6	18.7	19.1	19.6
	8H	18.4	18.7	18.9	19.2	19.7	18.3	18.6	18.8	19.1	19.6
Variation of the observer position for the luminaire distances S											
S = 1.0H		+1.6 / -3.8					+1.5 / -3.0				
S = 1.5H		+3.8 / -5.6					+3.3 / -4.4				
S = 2.0H		+5.7 / -6.6					+5.1 / -5.1				
Standard table		BK00					BK01				
Correction summand		0.3					0.4				
Corrected glare indices referring to 4200lm Total luminous flux											

UGR diagram (SHR: 0.25)

Site 1 (Light scene 1)

Calculation objects



Site 1 (Light scene 1)

Calculation objects

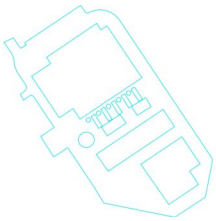
Calculation surfaces

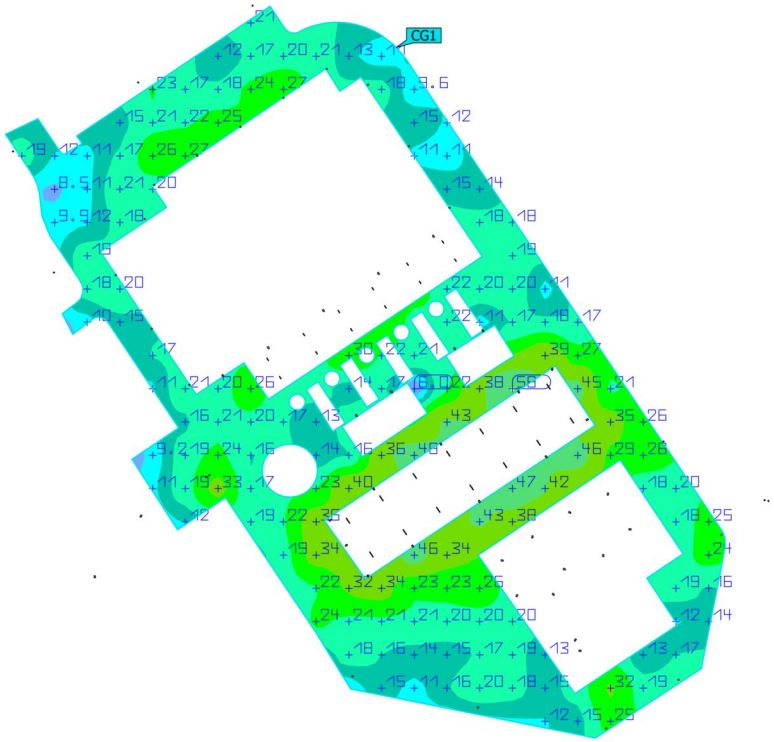
Properties	$\bar{E}$	E_{min}	E_{max}	g_1	g_2	Index
GENERAL AREA Perpendicular illuminance Height: 0.000 m	21.2 lx	6.00 lx	58.2 lx	0.28	0.10	CG1
PLATFORM AREA Perpendicular illuminance Height: 2.300 m	71.6 lx	34.0 lx	106 lx	0.47	0.32	CG2
TANK AREA Perpendicular illuminance Height: 0.000 m	25.2 lx	10.4 lx	47.1 lx	0.41	0.22	CG3
UPPER PLATFORM AREA Perpendicular illuminance Height: 6.600 m	34.5 lx	23.6 lx	44.4 lx	0.68	0.53	CG4
RADYATOR PLATFORM Perpendicular illuminance Height: 0.000 m	60.5 lx	45.5 lx	73.4 lx	0.75	0.62	CG5
TRANSFORMATION AREA Perpendicular illuminance Height: 0.000 m	32.0 lx	20.3 lx	41.0 lx	0.63	0.50	CG6
OUTSIDE AREA Perpendicular illuminance Height: 0.000 m	16.9 lx	11.0 lx	30.1 lx	0.65	0.37	CG7

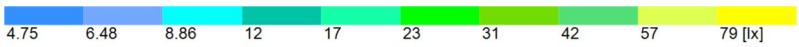
Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Site 1 (Light scene 1)

GENERAL AREA





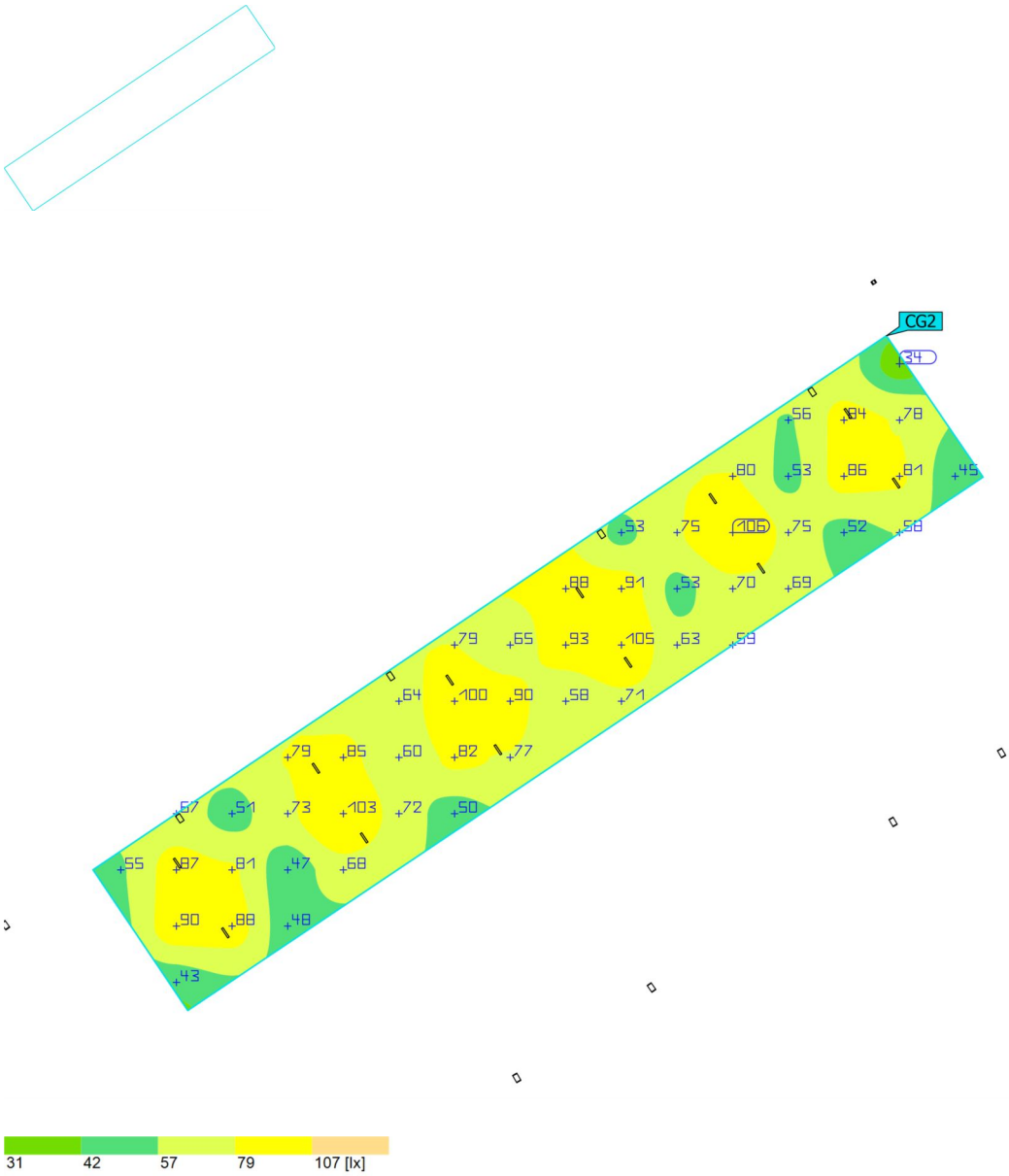


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
GENERAL AREA Perpendicular illuminance Height: 0.000 m	21.2 lx	6.00 lx	58.2 lx	0.28	0.10	CG1

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Site 1 (Light scene 1)

PLATFORM AREA

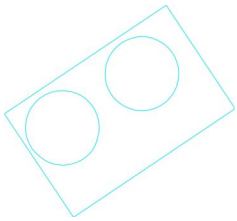


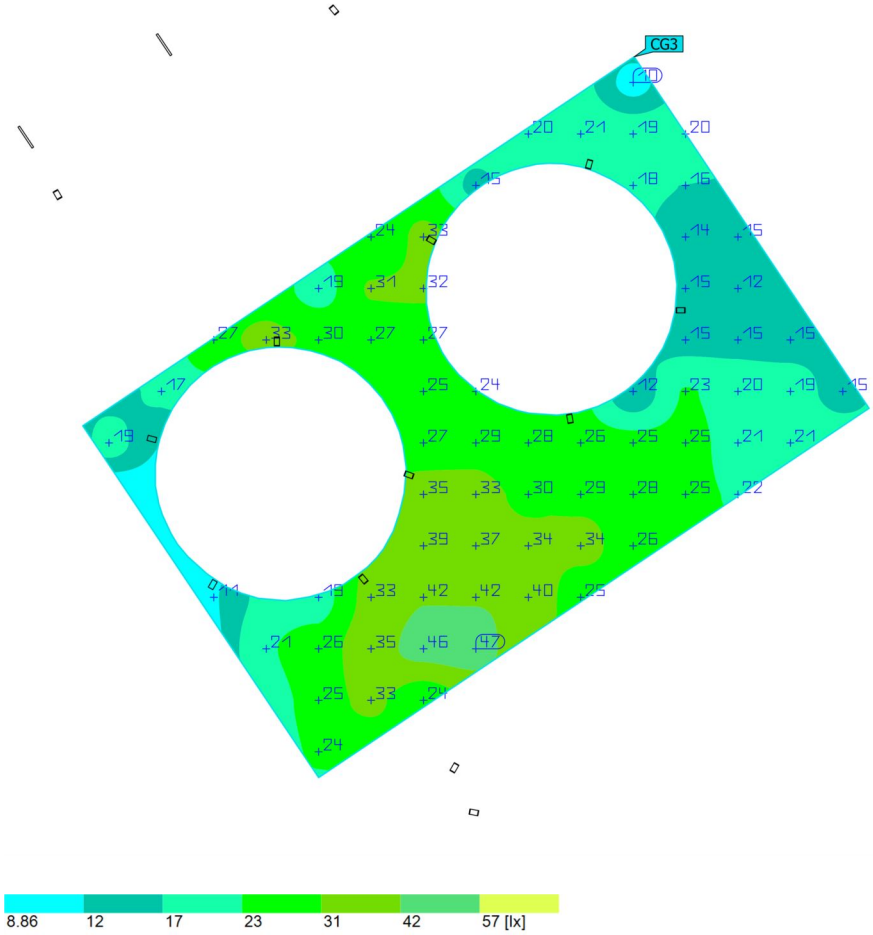
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
PLATFORM AREA Perpendicular illuminance Height: 2.300 m	71.6 lx	34.0 lx	106 lx	0.47	0.32	CG2

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Site 1 (Light scene 1)

TANK AREA



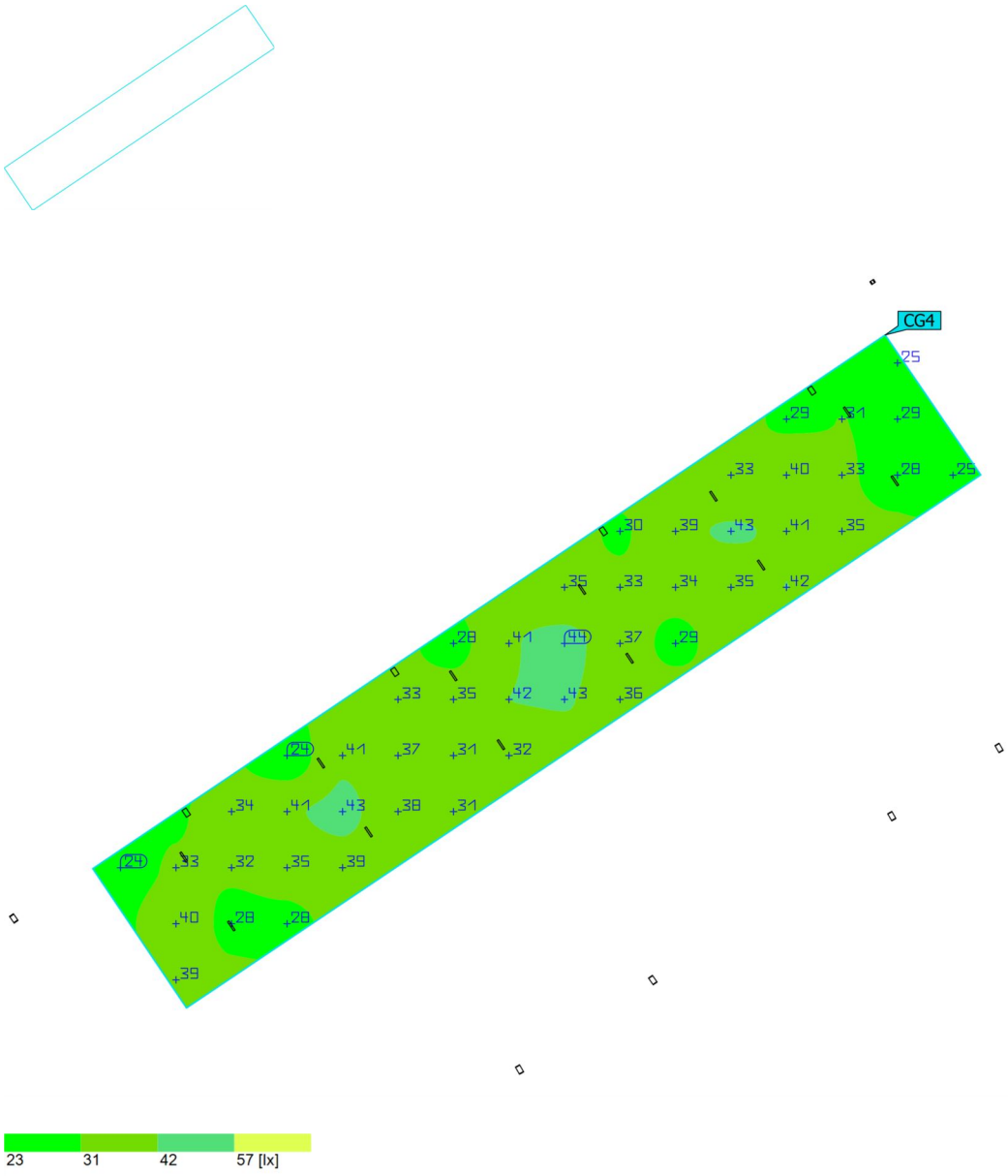


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
TANK AREA Perpendicular illuminance Height: 0.000 m	25.2 lx	10.4 lx	47.1 lx	0.41	0.22	CG3

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Site 1 (Light scene 1)

UPPER PLATFORM AREA

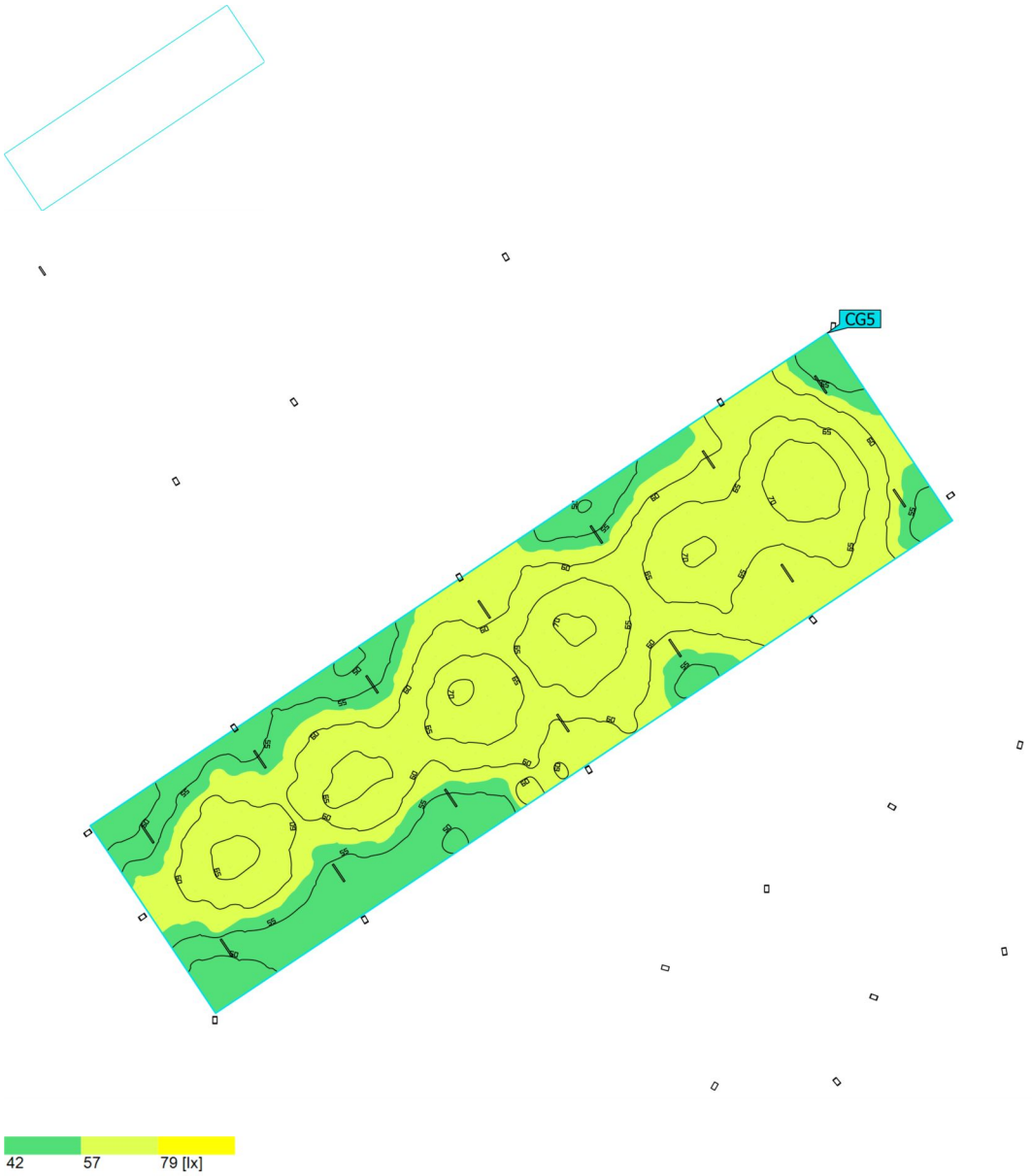


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
UPPER PLATFORM AREA Perpendicular illuminance Height: 6.600 m	34.5 lx	23.6 lx	44.4 lx	0.68	0.53	CG4

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Site 1 (Light scene 1)

RADYATOR PLATFORM

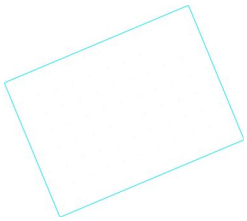


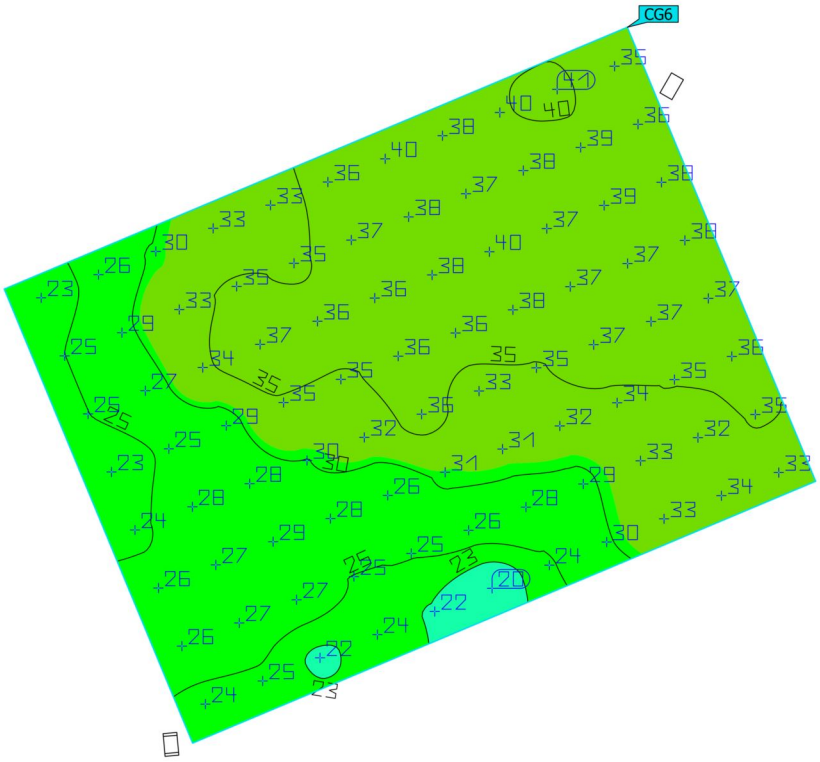
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
RADYATOR PLATFORM Perpendicular illuminance Height: 0.000 m	60.5 lx	45.5 lx	73.4 lx	0.75	0.62	CG5

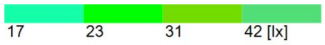
Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Site 1 (Light scene 1)

TRANSFORMATION AREA





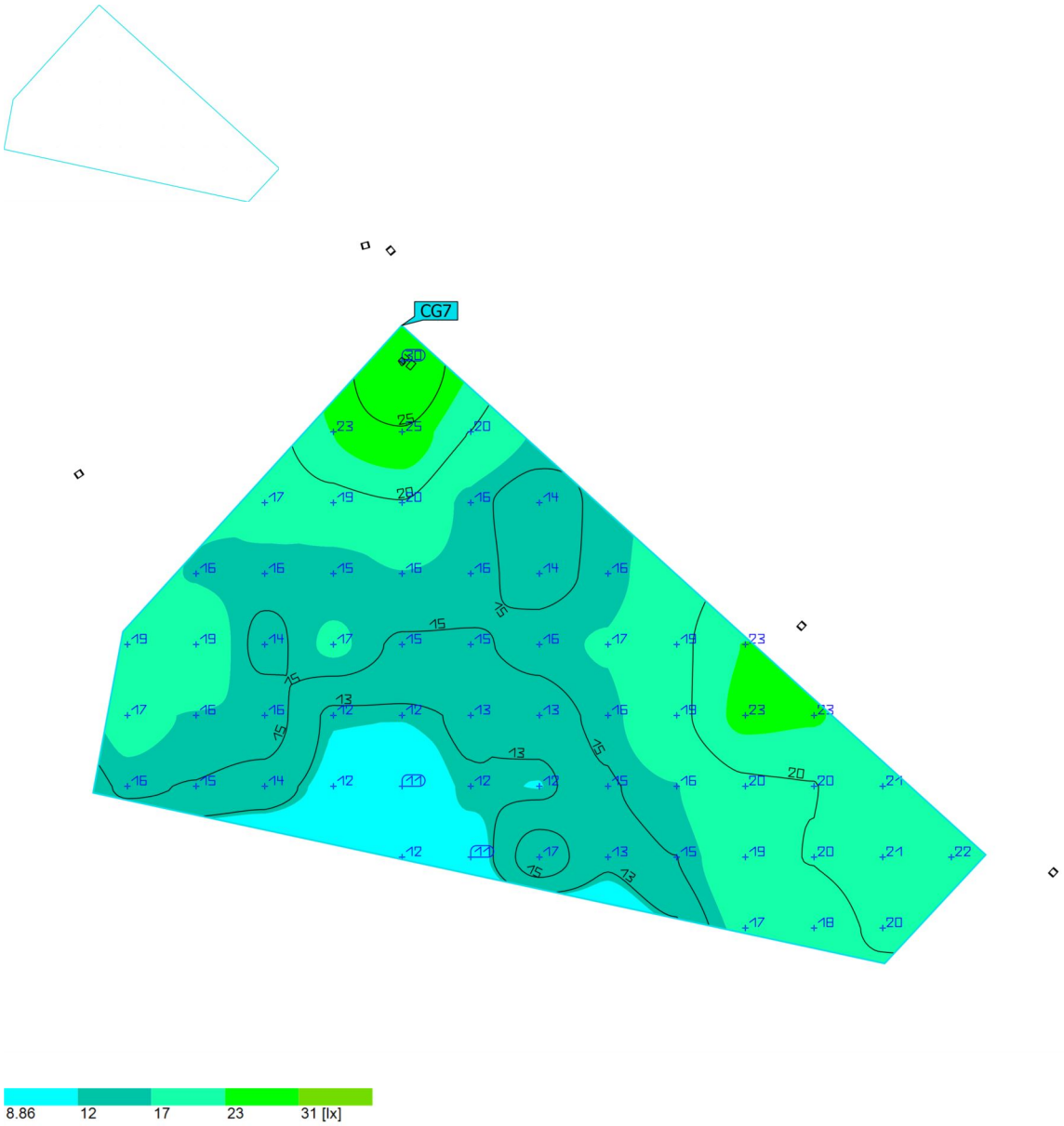


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
TRANSFORMATION AREA Perpendicular illuminance Height: 0.000 m	32.0 lx	20.3 lx	41.0 lx	0.63	0.50	CG6

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Site 1 (Light scene 1)

OUTSIDE AREA



Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
OUTSIDE AREA Perpendicular illuminance Height: 0.000 m	16.9 lx	11.0 lx	30.1 lx	0.65	0.37	CG7

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

CLIENT

CONTRACTOR

SITE / PROJECT

100 MW PROFILE PARK RECIPROCATING POWER PLANT PROJECT

REV	DATE	DESCRIPTION	DONE	CHECKED	APPROVED
0	14.03.2024	For Construction	BS	AG	CK

STATUS		
	FOR INFORMATION	☐
	FOR REVIEW	☐
	FOR APPROVAL	☐
	FOR TENDER	☐
	FOR COORDINATION	☐
	FOR CONSTRUCTION	☒

ISSUE OWNER

YÜKSEL PROJE

SIGN	DATE
	14.03.2024

DOCUMENT NUMBER

PRF-EL-CR-00-YP-0010

DOCUMENT NAME

LV CABLE SIZING CALCULATION REPORT

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1. INDRODUCTION

1.1. General

Centrica Business Solutions (CBS) is a provider of energy insights, optimisation, and on-site generation solutions for its customers, as well as owning and operating energy solutions across the UK, Ireland and North America while continually in the process of identifying new sites for development.

CBS is currently in the process of supporting the development of a circa 100 MW dualfuel generation asset (Athlone Power Project) in Monksland, Athlone and Profile Park, Baldonnel, Ireland. CBS are delivering the project on an Engineering, Procurement and Construction (EPC) basis on behalf of Greener Ideas Ltd.

The Project will consist of five (5) gas reciprocating engines exporting power to the grid via an adjacent 110 kV connection. The Project will use natural gas as its primary fuel with gas oil as a back-up in the event of interruption to the gas supply.

1.2. The Aim and Scope of The Project

The aim of the present document is to define the low voltage cable selection criteria that have to be fulfilled in the design and calculations of all electrical design and building services works for the 100 MW PROFILE PARK RECIPROCATING POWER PLANT PROJECT that is going to be constructed in near Dublin, Ireland.

In this document are defined the minimum requirements for the electrical design to ensure efficient construction, proper functionality and high reliability of the production plant.

1.3. Definitions

Project	:100 MW Profile Park Reciprocating Power Plant
Employer	: GIL
Contractor	: GCIL
Shall	: Indicates a mandatory requirement
Should	: Indicates a strong recommendation

1.4. Abbreviations

AC	: Alternative Current
XLPE	: Cross-linked polyethylene
PVC	: Polyvinyl chloride
LSZH	: Low Smoke Zore Halogen
EN	: European Norm
V	: Voltage
A	: Current
W	: Active Power
VAR	: Reactive Power
VA	: Apparent Power
m	: Meters
cm	: Centimeters
mm	: Millimeters
IEC	: International Electromechanical Commission
IEEE	: Institute of Electrical and Electronics Engineers
ISO	: International Organization for Standardization
HV	: High Voltage
LV	: Low Voltage
MV	: Medium Voltage
MV SWGR	: Medium Voltage Switchgear
LV SWGR	: Low Voltage Switchgear

2. CODES AND STANDARTS

As a minimum, the following codes and standards shall be considered:

I.S. 10101:2020	National Rules for Electrical Installations
IEC 60364-5-52	Low-voltage electrical installations-Selection and erection of electrical equipment-Wiring systems
IEC 63364-4-43	Low-voltage electrical installations-Protection for safety-Protection against overcurrent
IEC 60909	Short-circuit currents in three-phase a.c. systems
IEC 60947-2	Low voltage switchgear and controlgear
IEC 60947-4-1	Low voltage switchgear and controlgear contactors and motor starters electromechanical contactors and motor starters
DIN VDE 0271	Power cables-specifications for power cables 0.6/1kV and above for special applications

3. REFERENCE DOCUMENTS

PRF-EL-DW-00-YP-0001	Overall Single Line Diagram
PRF-EL-DW-00-YP-0002	MV/LV Electrical Equipment Arrangement Layout (Consumer Layout)
PRF-EL-DW-00-YP-0004	LV Distribution Layout
PRF-EL-DW-00-YP-0008	Outdoor/Site Cable Routing Layouts (Incl. Cable Tray and Conduits)
PRF-EL-DW-01-YP-0003	Engine Hall LV Distribution Layout
PRF-EL-DW-02-YP-0003	Electrical Annex LV Distribution Layout
PRF-EL-DW-05-YP-0002	Workshop & Stora Room LV Distribution Layout
PRF-EL-DW-17-YP-0002	Tank Farm Building LV Distribution Layout
PRF-EL-DW-38-YP-0002	Security Hut LV Distribution Layout
PRF-EL-CR-00-YP-0001	Load Flow Study Report
PRF-EL-CR-00-YP-0002	Short Circuit Study Report
PRF-EL-CR-00-YP-0003	GSUT Sizing Calculation Report
PRF-EL-LS-00-YP-0001	Electrical Consumer List
PRF-EL-LS-00-YP-0002	Overall Electrical Cable List
PRF-EL-LS-00-YP-0003	Outdoor/site Cable Schedule
PRF-EL-TS-00-YP-0004	Low Voltage Cable Technical Specification
PRF-EL-TS-00-YP-0011	Low Voltage Busduct Technical Specification
5305170_5305446_FA 0	Overview_Single Line Diagram_RevE
O129074-P00-EP-XX-RP-E-1001	Electrical Basis of Design Report
5305170_5305446	Consumer List_AFC_RevC_Cust

4. DESIGN CONDITIONS

Ambient Air Conditions: Statistical Data

Minimum Recorded (°C)	-7.6
Mean Recorded (°C)	10.0
Maximum Recorded (°C)	27.5
Mean Wet Bulb Temperature (°C)	8.6
Maximum Wet Bulb Temperature (°C)	21.5
Minimum Humidity	20%
Average Humidity	82%
Maximum Humidity	100%

Ambient Air Temperature: Design Data

Winterisation Temperature (°C)	-10
Max Ambient Design Temperature (°C)	30
Max Wet Bulb Temperature (°C)	22

Wind, Rainfall and Snowfall Data

Average Wind Velocity km/h (m/s)	18.1 (5)
Maximum Wind Velocity km/h (m/s)	74.1 (20.6)
Average Daily Rainfall (mm)	2.1
Maximum Daily Rainfall (mm)	45.4

Site Conditions

Altitude above sea level (m)	69
Maximum wet bulb temperature (°C)	21.5
Minimum ambient air temperature (°C)	-10
Maximum ambient air temperature (°C)	30

Performance Data Reference Conditions

Parameter	Unit	Value
Air inlet temperature (before air inlet filter)	°C	15
Air inlet pressure (before air inlet filter)	mbar	1005
Wet Bulb Temperature	°C	7
Relative Humidity	%	28
Charge Air Temperature Before Cylinder:		
Gas Operation	°C	50
Diesel Operatin	°C	45
Exhaust Gas Bask Pressure	mbar	<=50
Intake Air Pressure Loss	mbar	<=20

5. PROFILE PARK POWER PLANT UNIT LISTS

- ENGINE HALL
- ELECTRICAL ANNEX
- WORKSHOP & STOREROOM
- TANK FARM BUILDING
- SECURITY HUT BUILDING

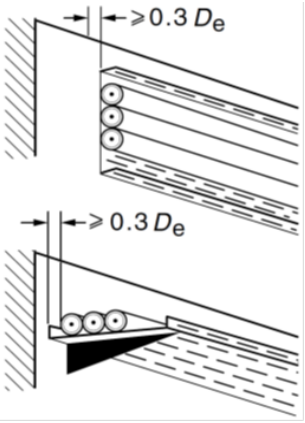
6. MAIN LOW VOLTAGE CABLES SELECTION

6.1. Low Voltage Power Distribution Installation

The result of the calculations which are made referring to the criteria and methods given below, are given in enclosure section ''6.4'' Appendix.

6.2. Conversition Factor Selection According To In Cable Tray&Ladder

Cables that are used in the system are operating temperature 90°C. The current carrying capacity and reduction factors are given in IEC 60364-5-52. Installation methods E and F are to be used in the system.



Single or multi core cables:

In corrugated trays&ladders installed horizontal or vertical

IEC 60364-5-52 Table 52-3

Current carrying capacity of the cables will be referred to the Table B.52.1/B.52-2 of the mentioned standard, for Method D,E and F, at 90°C cable operating temperature and 30°C ambient temperature.

Table B.52-1 (A.52-1) – **Current-carrying capacity in amperes**

Reference methods in table A.52-1	Number of loaded conductors and type of insulation											
A1		Three PVC	Two PVC		Three XLPE	Two XLPE						
A2	Three PVC	Two PVC		Three XLPE	Two XLPE							
B1				Three PVC	Two PVC		Three XLPE		Two XLPE			
B2			Three PVC	Two PVC		Three XLPE	Two XLPE					
C					Three PVC		Two PVC	Three XLPE		Two XLPE		
E						Three PVC		Two PVC	Three XLPE		Two XLPE	
F							Three PVC		Two PVC	Three XLPE		Two XLPE
1	2	3	4	5	6	7	8	9	10	11	12	13
Size (mm^2) Copper												
1,5	13	13,5	14,5	15,5	17	18,5	19,5	22	23	24	26	–
2,5	17,5	18	19,5	21	23	25	27	30	31	33	36	–
4	23	24	26	28	31	34	36	40	42	45	49	–
6	29	31	34	36	40	43	46	51	54	58	63	–
10	39	42	46	50	54	60	63	70	75	80	86	–
16	52	56	61	68	73	80	85	94	100	107	115	–
25	68	73	80	89	95	101	110	119	127	135	149	161
35	–	–	–	110	117	126	137	147	158	169	185	200
50	–	–	–	134	141	153	167	179	192	207	225	242
70	–	–	–	171	179	196	213	229	246	268	289	310
95	–	–	–	207	216	238	258	278	298	328	352	377
120	–	–	–	239	249	276	299	322	346	382	410	437
150	–	–	–	–	285	318	344	371	395	441	473	504
185	–	–	–	–	324	362	392	424	450	506	542	575
240	–	–	–	–	380	424	461	500	538	599	641	679
Aluminium												
2,5	13,5	14	15	16,5	18,5	19,5	21	23	24	26	28	–
4	17,5	18,5	20	22	25	26	28	31	32	35	38	–
6	23	24	26	28	32	33	36	39	42	45	49	–
10	31	32	36	39	44	46	49	54	58	62	67	–
16	41	43	48	53	58	61	66	73	77	84	91	–
25	53	57	63	70	73	78	83	90	97	101	108	121
35	–	–	–	86	90	96	103	112	120	126	135	150
50	–	–	–	104	110	117	125	136	146	154	164	184
70	–	–	–	133	140	150	160	174	187	198	211	237
95	–	–	–	161	170	183	195	211	227	241	257	289
120	–	–	–	186	197	212	226	245	263	280	300	337
150	–	–	–	–	226	245	261	283	304	324	346	389
185	–	–	–	–	256	280	298	323	347	371	397	447
240	–	–	–	–	300	330	352	382	409	439	470	530

NOTE Tables B.52-2 to B.52-3 must be consulted to determine the range of conductor sizes for which the above current-carrying capacities are applicable, for each installation method.

Table B.52-2 (A.52-2) – **Current-carrying capacities (in amperes)**

Installation method	Size mm²	Number of loaded conductors and type of insulation			
		Two PVC	Three PVC	Two XLPE	Three XLPE
D	Copper				
	1,5	22	18	26	22
	2,5	29	24	34	29
	4	38	31	44	37
	6	47	39	56	46
	10	63	52	73	61
	16	81	67	95	79
	25	104	86	121	101
	35	125	103	146	122
	50	148	122	173	144
	70	183	151	213	178
	95	216	179	252	211
	120	246	203	287	240
	150	278	230	324	271
	185	312	258	363	304
	240	361	297	419	351
	300	408	336	474	396
D	Aluminium				
	2,5	22	18,5	26	22
	4	29	24	34	29
	6	36	30	42	36
	10	48	40	56	47
	16	62	52	73	61
	25	80	66	93	78
	35	96	80	112	94
	50	113	94	132	112
	70	140	117	163	138
	95	166	138	193	164
	120	189	157	220	186
	150	213	178	249	210
	185	240	200	279	236
	240	277	230	322	272
	300	313	260	364	308

Conversation Factor Selection:

- **For XLPE Insulation Cables:**

F_1 : Conversion factor = **0.91** (According to IEC 60364-5-52 Table A.52-14)

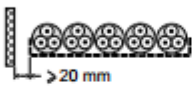
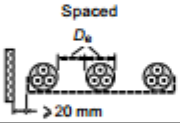
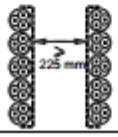
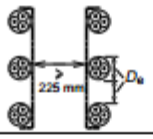
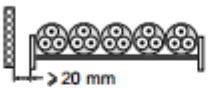
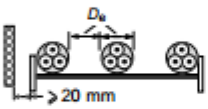
Table A.52-14 (52-D1) – **Correction factor for ambient air temperatures other than 30 °C to be applied to the current-carrying capacities for cables in the air**

Ambient temperature [a] °C	Insulation			
	PVC	XLPE and EPR	Mineral [a]	
			PVC covered or bare and exposed to touch 70 °C	Bare not exposed to touch 105 °C
10	1,22	1,15	1,26	1,14
15	1,17	1,12	1,20	1,11
20	1,12	1,08	1,14	1,07
25	1,06	1,04	1,07	1,04
35	0,94	0,96	0,93	0,96
40	0,87	0,91	0,85	0,92
45	0,79	0,87	0,87	0,88
50	0,71	0,82	0,67	0,84
55	0,61	0,76	0,57	0,80
60	0,50	0,71	0,45	0,75
65	–	0,65	–	0,70
70	–	0,58	–	0,65
75	–	0,50	–	0,60
80	–	0,41	–	0,54
85	–	–	–	0,47
90	–	–	–	0,40
95	–	–	–	0,32

[a] For higher ambient temperatures, consult manufacturer.

F2 : Conversion factor = **0.66** (According to IEC 60364-5-52-Table A.52-20)

Table A.52-20 (52-E4) – Reduction factors for group of more than one multi-core cable to be applied to reference ratings for multi-core cables in free air – Method of installation E in tables A.52-8 (52-C7) to A.52-13 (52-C12)

Method of installation in table 52-B2			Number of trays	Number of cables					
				1	2	3	4	6	9
Perforated trays (note 3)	31	Touching 	1	1,00	0,88	0,82	0,79	0,76	0,73
			2	1,00	0,87	0,80	0,77	0,73	0,68
			3	1,00	0,86	0,79	0,76	0,71	0,66
		Spaced 	1	1,00	1,00	0,98	0,95	0,91	-
			2	1,00	0,99	0,96	0,92	0,87	-
			3	1,00	0,98	0,95	0,91	0,85	-
Vertical perforated trays (note 4)	31	Touching 	1	1,00	0,88	0,82	0,78	0,73	0,72
			2	1,00	0,88	0,81	0,76	0,71	0,70
		Spaced 	1	1,00	0,91	0,89	0,88	0,87	-
			2	1,00	0,91	0,88	0,87	0,85	-
Ladder supports, cleats, etc. (note 3)	32 33 34	Touching 	1	1,00	0,87	0,82	0,80	0,79	0,78
			2	1,00	0,86	0,80	0,78	0,76	0,73
			3	1,00	0,85	0,79	0,76	0,73	0,70
		Spaced 	1	1,00	1,00	1,00	1,00	1,00	-
			2	1,00	0,99	0,98	0,97	0,96	-
			3	1,00	0,98	0,97	0,96	0,93	-

NOTE 1 Values given are averages for the cable types and range of conductor sizes considered in tables A.52-8 to A.52-13. The spread of values is generally less than 5 %.

NOTE 2 Factors apply to single layer groups of cables as shown above and do not apply when cables are installed in more than one layer touching each other. Values for such installations may be significantly lower and must be determined by an appropriate method.

NOTE 3 Values are given for vertical spacings between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing the factors should be reduced.

NOTE 4 Values are given for horizontal spacing between trays of 225 mm with trays mounted back to back. For closer spacing the factors should be reduced.

Thus the conversion factor is calculated as; (For XLPE Insulation Cables)

Conversion Factors:

$F_{1=}$ 0.91 as per Table A.52-14

$F_{2=}$ 0.66 as per Table A.52-20

$F_{overall=}$ $F_1 \times F_2$ =0.91x0.66=**0.60**

6.3. Cable Cross Section Determination According To The Voltage Drop

System voltage drop will be calculated from the transformer L.V. terminal to the end user. The percentage distribution of this voltage drop with respect to the system sections is given in the Maximum Voltage Drop Criteria Table.

The relative voltage drop (expressed as a percentage of the line to neutral voltage) is calculated using the following equation:

$$\Delta u = 100 \,.\, \frac{b \,.\, \left(R_{1\,\mathrm{ph}} \,.\cos\varphi + X_{\mathrm{ph}} \,.\sin\varphi\right) .\, I_{\mathrm{B}} .\, 10^{-3}}{U_0} \,\%$$

b = being equal to 1 for three phase circuits, equal to 2 for single phase circuits

U_0 = Facilities line to neutral nominal voltage [V]

$$\mathrm{U}_0 = \frac{\mathrm{U}_\mathrm{n}}{\sqrt{3}}$$

U_n = Facilities line to neutral nominal voltage [V]

I_B = Design current of the circuit [A]

$R_{1\,\mathrm{ph}}$ = Resistance of the line [mΩ] at operating temperature (90°C)

For insulated conductors and cables $\mathrm{R}_{1\,\mathrm{ph}} = \mathrm{R}_{\mathrm{c1\,ph}} \,.\, l_1$

$\mathrm{R}_{\mathrm{c1\,ph}}$ = cable/conductor resistance per meter [mΩ/m] at conductor operating temperature (90°C)

l_1 = length of the line (cable/conductor) [m]

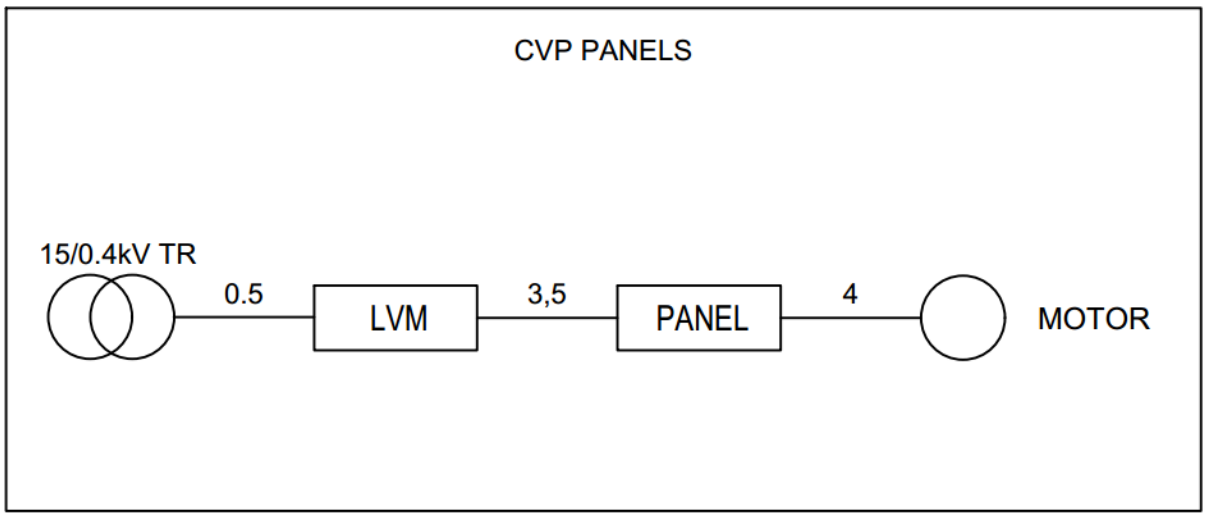
X_{ph} = Line reactance [mΩ]

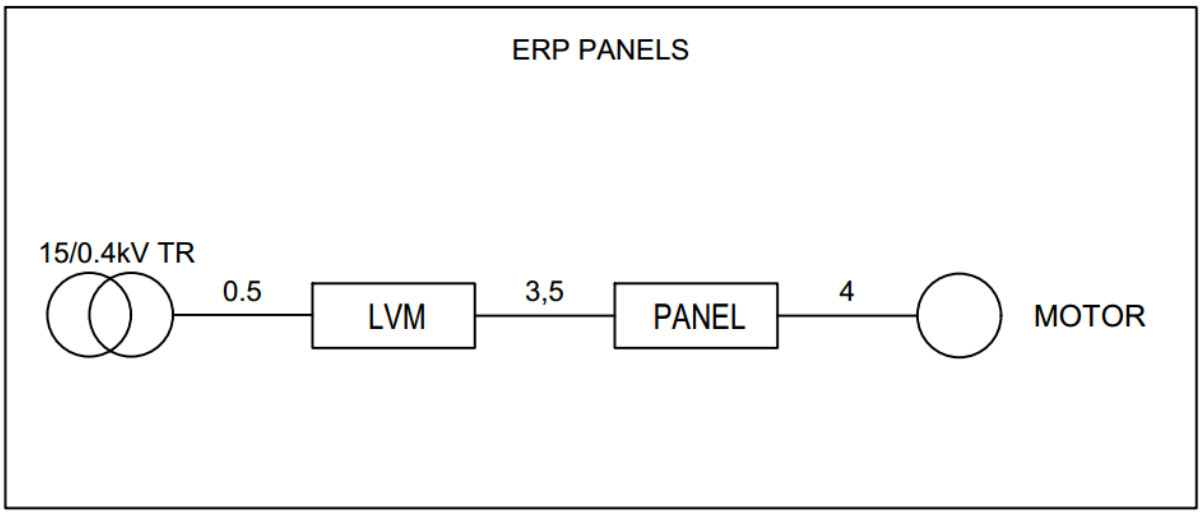
For insulated conductors and cables $\mathrm{X}_{\mathrm{ph}} = \mathrm{X}_{\mathrm{c\,ph}} \,.\, l_1$

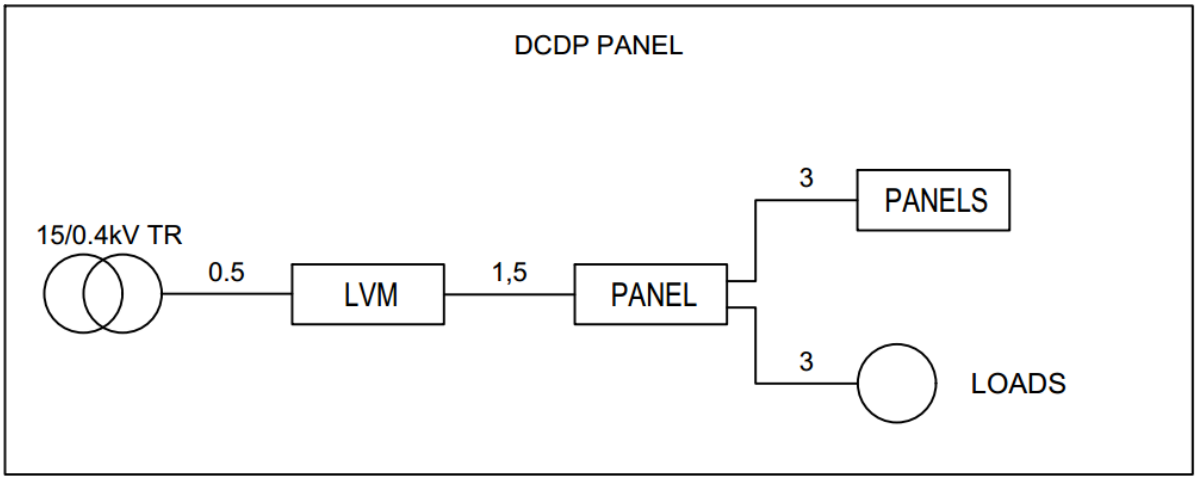
$\mathrm{X}_{\mathrm{c\,ph}}$ = cable/conductor reactance per meter [mΩ/m]

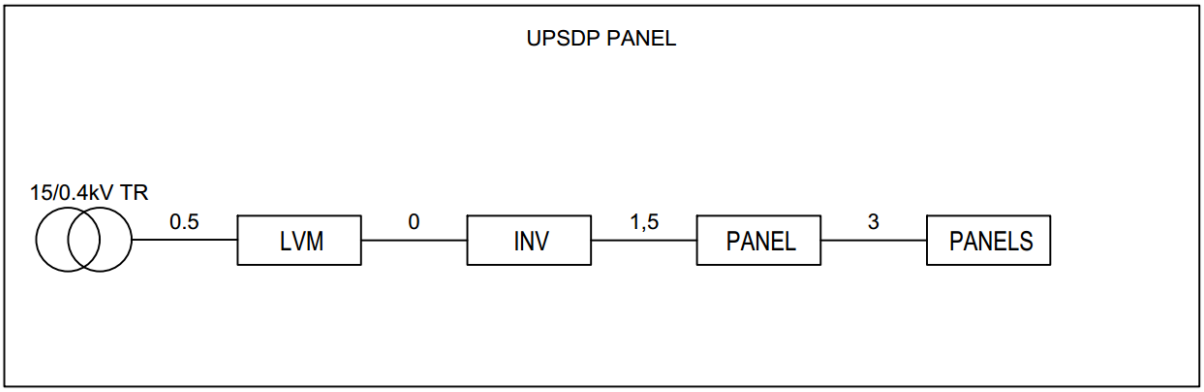
l_1 = length of the line (cable/conductor) [m]

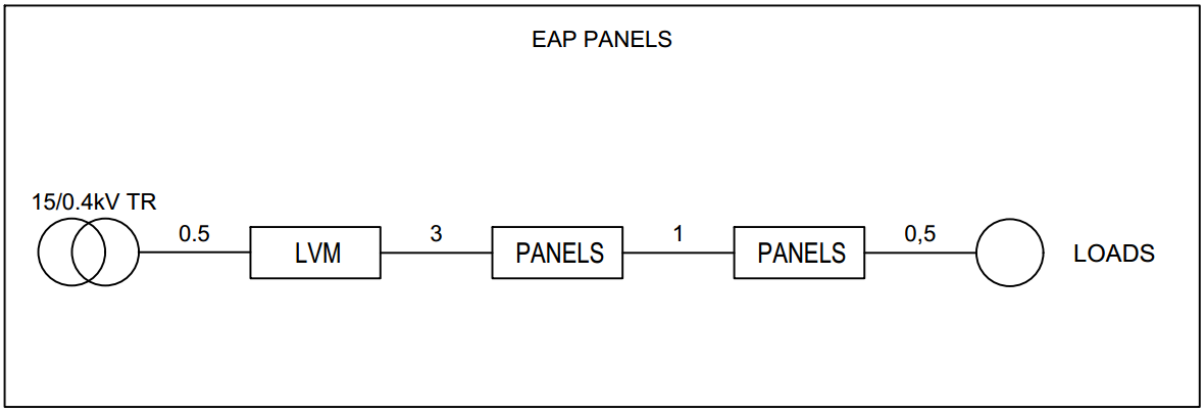
Voltage Drop Limit Selection:

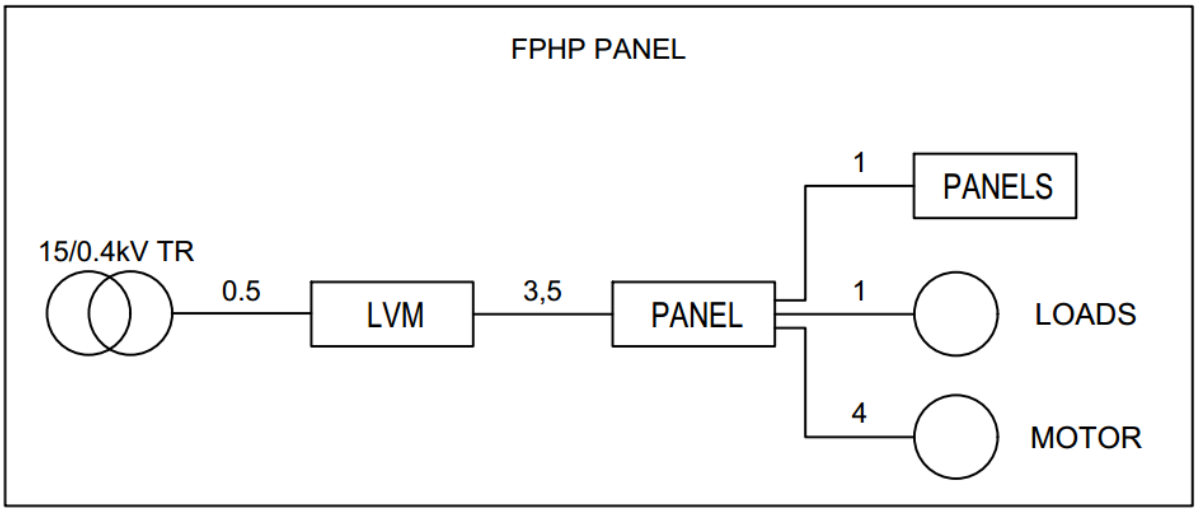


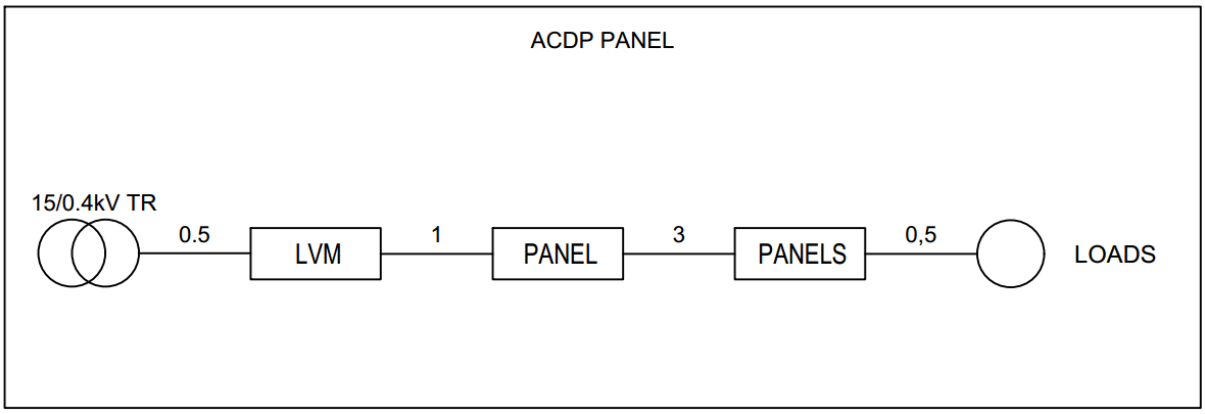


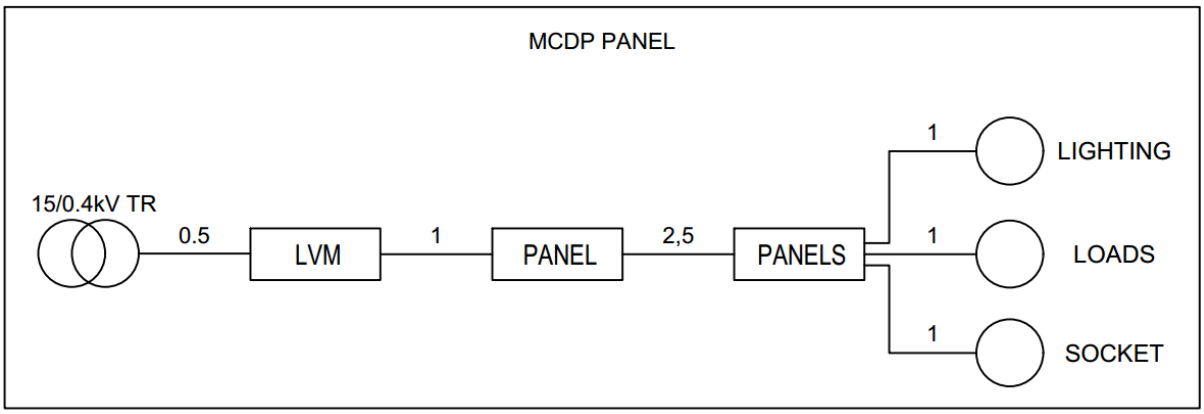


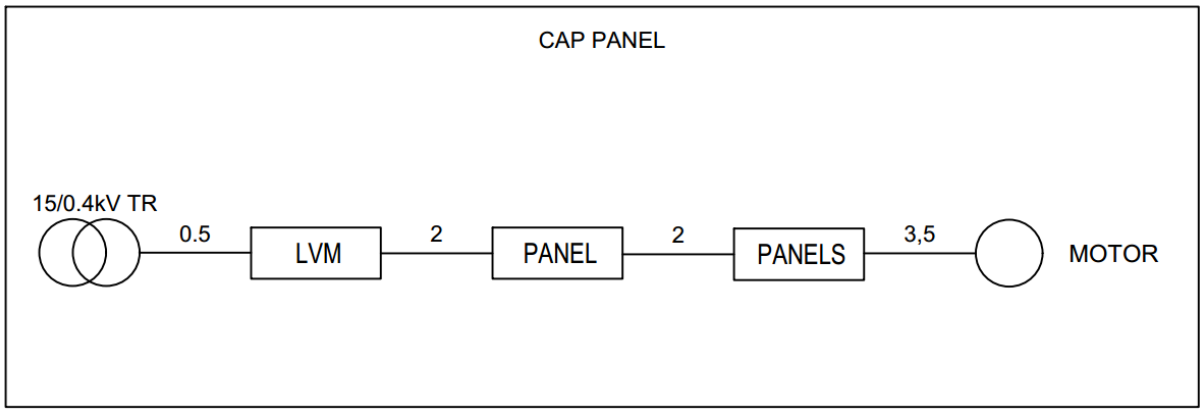

UPSDP PANEL
15/0.4kV TR
0.5
LVM
0
INV
1,5
PANEL
3
PANELS

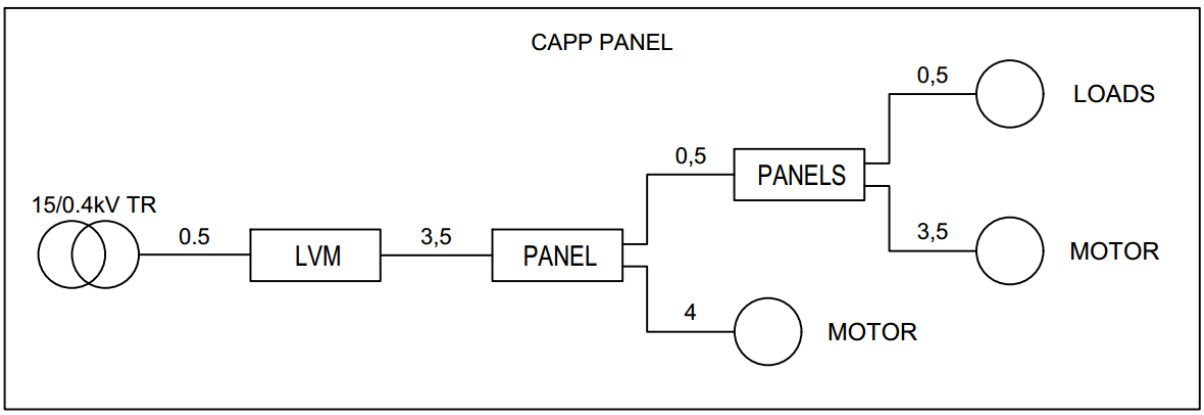

EAP PANELS
15/0.4kV TR
0.5
LVM
3
PANELS
1
PANELS
0,5
LOADS

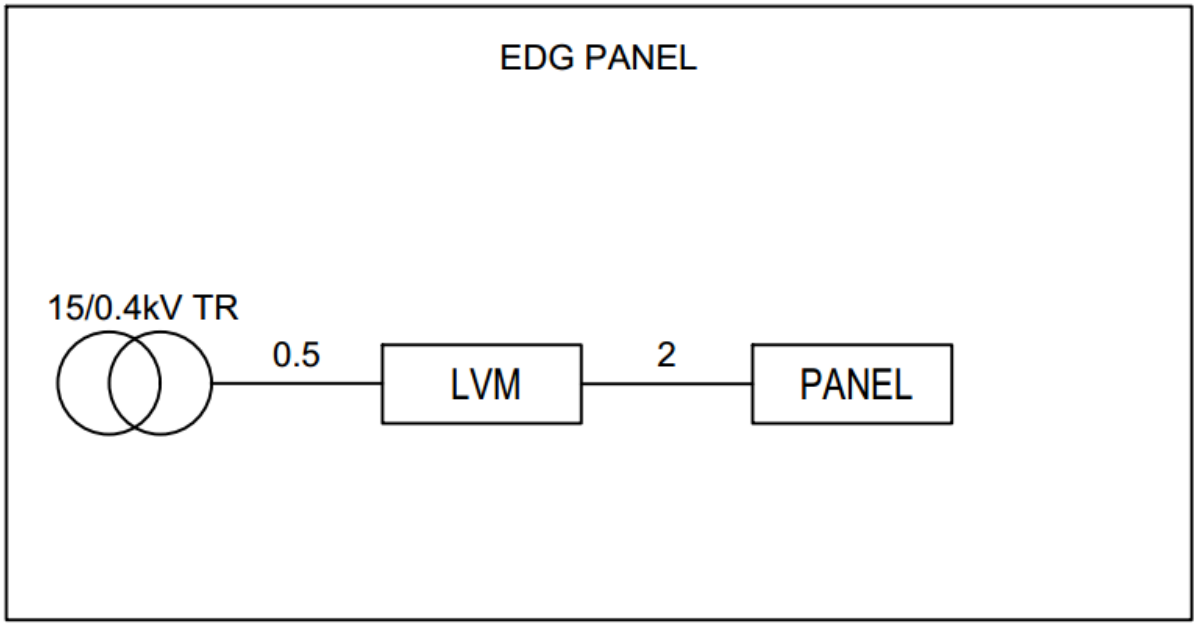

FPHP PANEL
15/0.4kV TR
0.5
LVM
3,5
PANEL
1
PANELS
1
LOADS
4
MOTOR

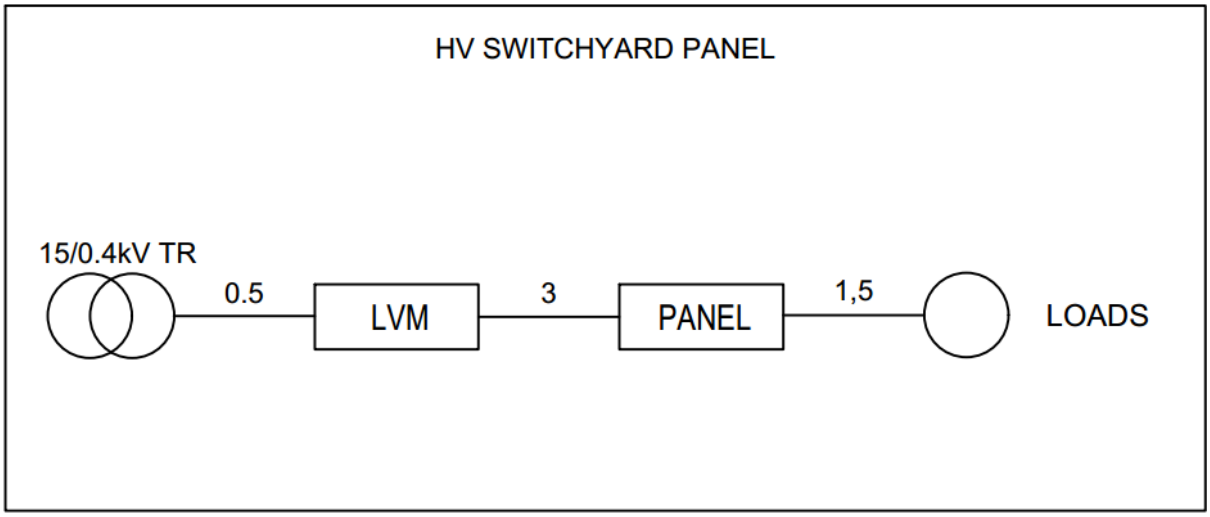

ACDP PANEL
15/0.4kV TR
0.5
LVM
1
PANEL
3
PANELS
0,5
LOADS

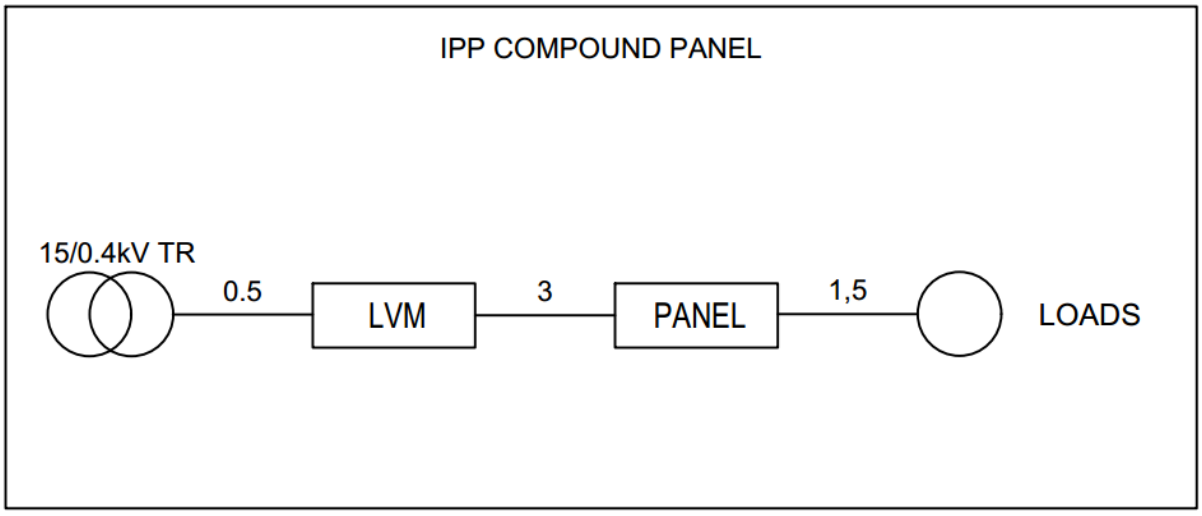

MCDP PANEL
15/0.4kV TR
0.5
LVM
1
PANEL
2,5
PANELS
1
LIGHTING
1
LOADS
1
SOCKET

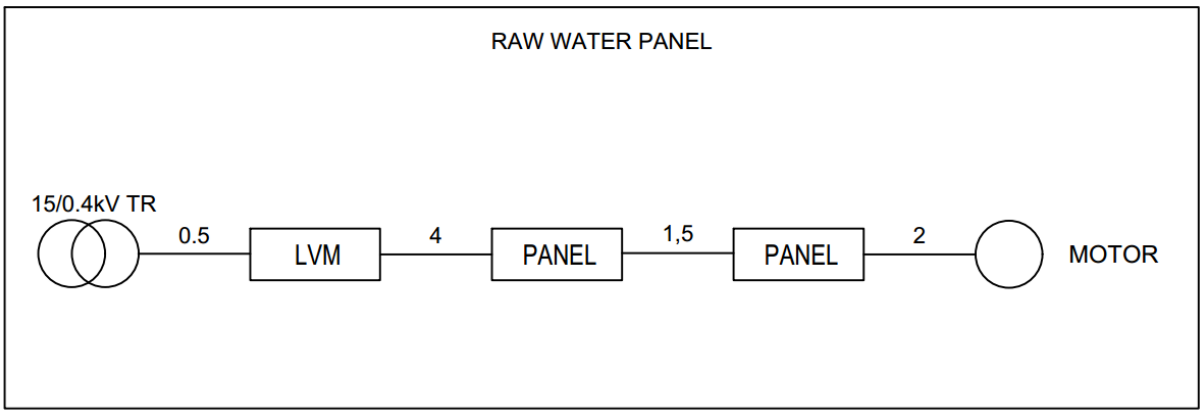

CAP PANEL
15/0.4kV TR
0.5
LVM
2
PANEL
2
PANELS
3,5
MOTOR

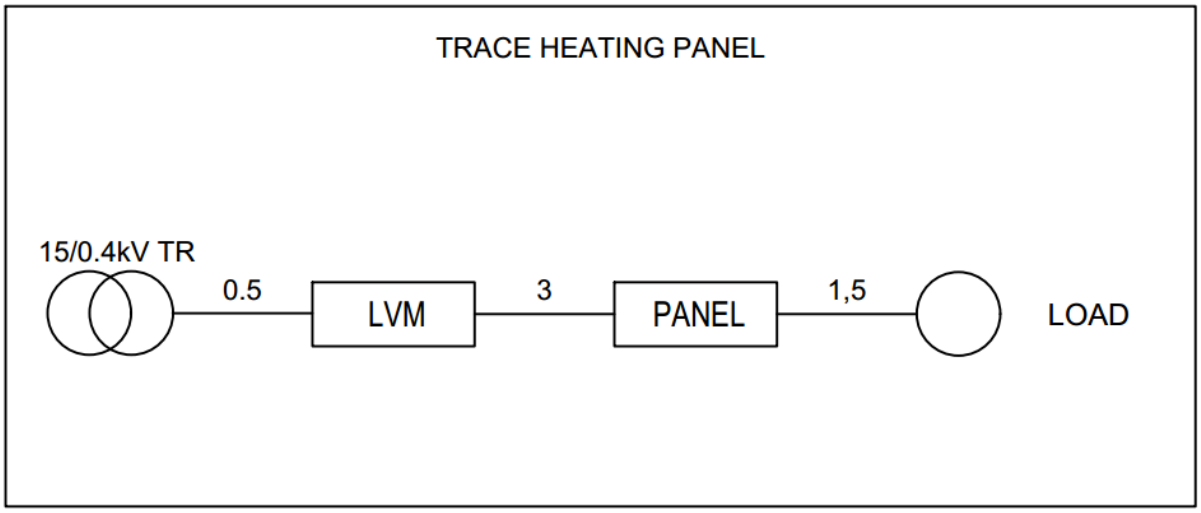

CAPP PANEL
15/0.4kV TR
0.5
LVM
3,5
PANEL
0,5
PANELS
0,5
LOADS
3,5
MOTOR
4
MOTOR

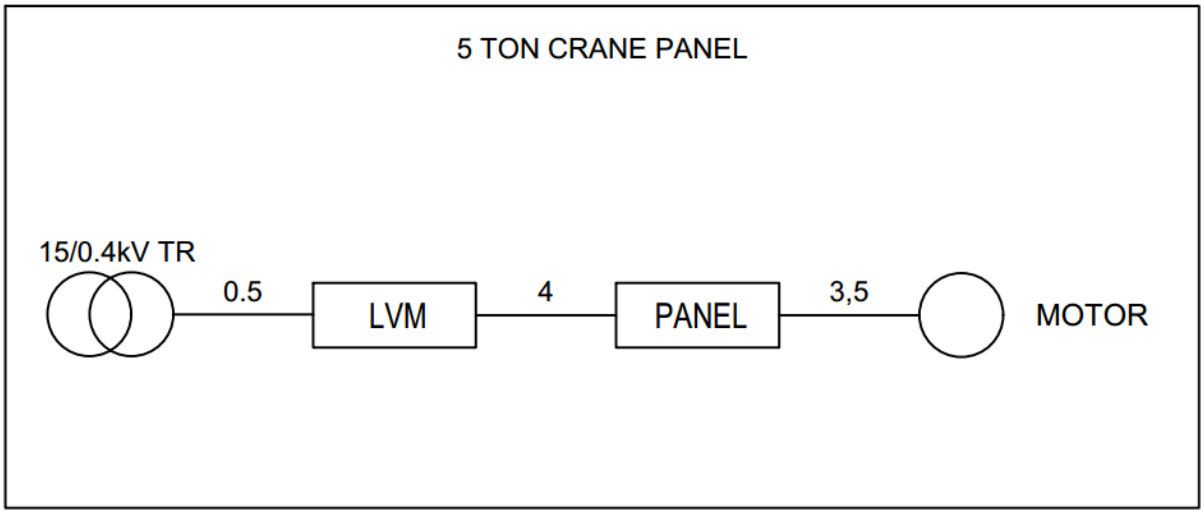

EDG PANEL
15/0.4kV TR
0.5
LVM
2
PANEL

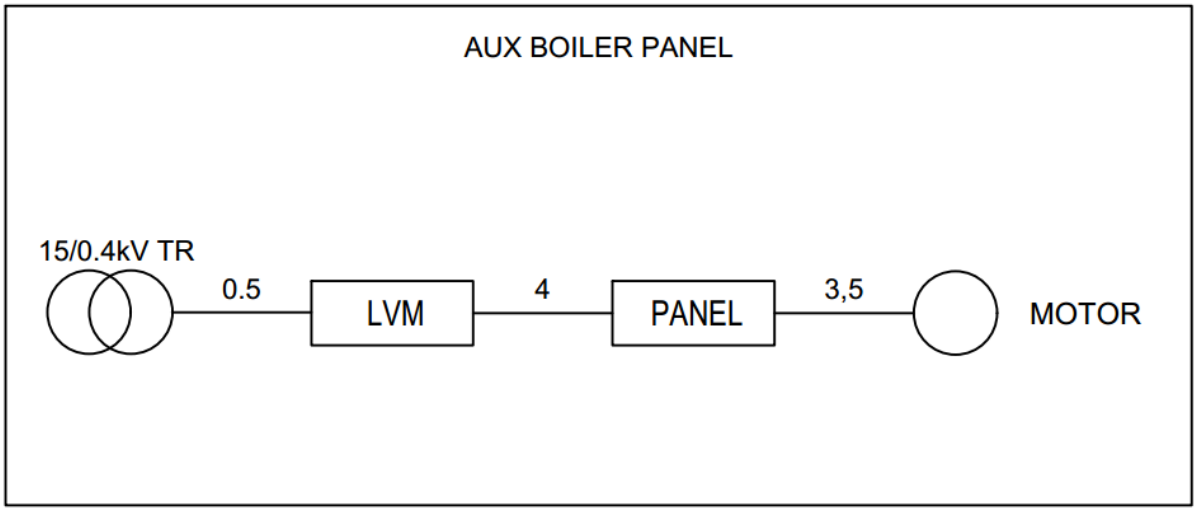

HV SWITCHYARD PANEL
15/0.4kV TR
0.5
LVM
3
PANEL
1,5
LOADS

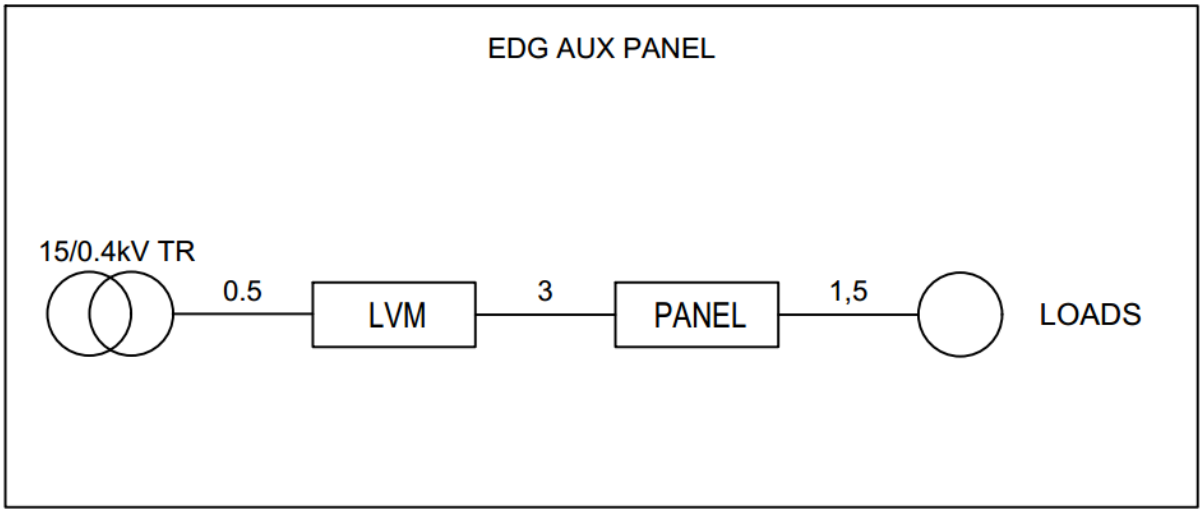

IPP COMPOUND PANEL
15/0.4kV TR
0.5
LVM
3
PANEL
1,5
LOADS

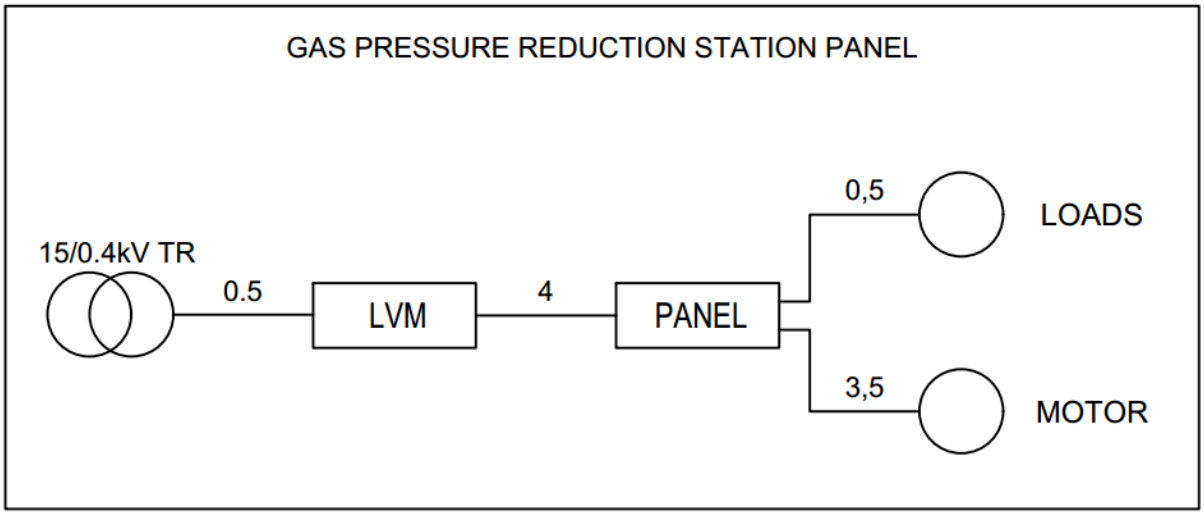

RAW WATER PANEL
15/0.4kV TR
0.5
LVM
4
PANEL
1,5
PANEL
2
MOTOR


TRACE HEATING PANEL
15/0.4kV TR
0.5
LVM
3
PANEL
1,5
LOAD


5 TON CRANE PANEL
15/0.4kV TR
0.5
LVM
4
PANEL
3,5
MOTOR


AUX BOILER PANEL
15/0.4kV TR
0.5
LVM
4
PANEL
3,5
MOTOR


EDG AUX PANEL
15/0.4kV TR
0.5
LVM
3
PANEL
1,5
LOADS


GAS PRESSURE REDUCTION STATION PANEL
15/0.4kV TR
0.5
LVM
4
PANEL
0,5
LOADS
3,5
MOTOR

6.4. Appendix

- 00BFA01 (LV Main Busbar 1) Cable Selection Calculation
- 00BFB01 (LV Main Busbar 2) Cable Selection Calculation
- 00BHA01 (LV Main Common Busbar) Cable Selection Calculation

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1
Ref mark	LV BUSBAR-1

	Normal	Standby
I Total	1872.38 A	
I installed	4546.63 A	
I Avail	2674.25 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT	Circuit OK	Circuit OK	Circuit OK
	IN [X] DU [X] IC [X] SC [X]	IN [X] DU [X] IC [X] SC [X]	IN [X] DU [X] IC [X] SC [X]
Upstream	LV BUSBAR-1	LV BUSBAR-1	LV BUSBAR-1
Ref mark	00CDP01GS011	01CDG01GS011	02CDG01GS011
Upstream BB / D.origin			
Style	Board	Board	Board
Content / ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation			

CABLES INFORMATIONS/EQUIPM.	CVP-1	ERP1	ERP2
N° / Consump / K Coincid / Geog.location	1 / 90kW / 1	1 / 190kW / 1	1 / 190kW / 1
Downst BB / Modif.	A	A	A
Cos φ / K Use / UL	0.85 / 1	0.85 / 1	0.85 / 1
Cos φ Start. / ID/IN / ΔU Start			
η / Supply	1.00 / Normal	1.00 / Normal	1.00 / Normal
Equip. Pole / Type	3P+N	3P+N	3P+N

CABLE	00CDP01GS011	01CDG01GS011	02CDG01GS011
Type	N2XRH (90°C) Dca	N2XRH (90°C) Dca	N2XRH (90°C) Dca
Install. method / Core / Pole	31 / Copper / Single Trefoil	31 / Copper / Single Trefoil	31 / Copper / Single Trefoil
Length / 1st equipt. / L. Max	61 m / 598 m (DU)	85 m / 165 m (DU)	95 m / 165 m (DU)
ΔU Max / ΔU Circuit / ΔU Total	4 % / 0.36 % / 0.86 %	4 % / 1.79 % / 2.30 %	4 % / 2 % / 2.51 %
K T° / K prox / K Add / Fs / K Cumul	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60	1.00 (30°C) / 0.61 / 1.00 / 1.00 / 0.61	1.00 (30°C) / 0.61 / 1.00 / 1.00 / 0.61

PROTECTION	No check on Thermal stress [X] Icu CB checked	No check on Thermal stress [X] Icu CB checked	No check on Thermal stress [X] Icu CB checked
Type / Prot. IC	MCCB / Basis Prot	MCCB / Basis Prot	MCCB / Basis Prot

RESULTS FIXING			
fixed [X] N° / Phase	fixed [X] 2 / 150 mm²	fixed [X] 1 X / 185 mm²	fixed [X] 1 / 185 mm²
N° / Neutral	1 / 150 mm²	1 / 185 mm²	1 / 185 mm²
N° / PE/PEN	1 / 150 mm²	1 / 185 mm²	1 / 185 mm²
Harm. Rate / Loaded N	HR <= 15% / No	HR <= 15% / No	HR <= 15% / No
Protection	NSX630H Micrologic 2.3 4P4T	NSX630H Micrologic 2.3 4P4T	NSX630H Micrologic 2.3 4P4T
Rating / Ir / Im/Isd/IN Fus.	630 A / 252 A / 756 A	630 A / 325.5 A / 1627.5 A	630 A / 325.5 A / 1627.5 A
K on rating. / Tr / Tempo	1 / 16 s / 20 ms	1 / 16 s / 20 ms	1 / 16 s / 20 ms
Magnetic / Li off / IΔn	Electronic	Electronic	Electronic
Downs.Ther. / Li / Δt	On circuit / 6930 A	On circuit / 6930 A	On circuit / 6930 A

RESULTS			
Cable / Neutral / PE/PEN	2X3X(1x150) / 1x150 / 1x150	3X(1x185) / 1x185 / 1x185	3X(1x185) / 1x185 / 1x185
Criteria / IB	IMPOS / 152.83 A	IMPOS / 322.64 A	IMPOS / 322.64 A
S Th. / Iz	48.576 mm² / 532.17 A	198.284 mm² / 310.87 A	198.284 mm² / 310.87 A
Im / Isd Max / Ik Up/Dn	9031 A / 55.1 kA / 31.3 kA	6287 A / 55.1 kA / 17.7 kA	5744 A / 55.1 kA / 16.3 kA
Discrimination / Backup	Total / Without	Total / Without	Total / Without

IK INFORMATIONS / PROTECTION			
Icu / Icm / Icu Backup / Ip	70 kA / 70 kA / 29.65 kA	70 kA / 70 kA / 21.68 kA	70 kA / 70 kA / 20.72 kA
Icu S-pole / Icu S-pole backup			
Tmax. Prot. / Release	157 ms / 4P4T	231 ms / 4P4T	231 ms / 4P4T
Contactor / Thermal relay			
Manufacturer	mg19in1.dug	mg19in1.dug	mg19in1.dug

DISCRIMINATION							
Limit / From							
Thermal / Differential	With	Not Applicable	With	Not Applicable	With	Not Applicable	
Logical Discrim.	☐		☐		☐		
T1 / T2							

IK END									
Ik3 Max / Ik2 Min / If	31309 A	20104 A	9934 A	17661 A	11410 A	6916 A	16252 A	10491 A	6318 A
Ik2 Max / Ik1 Min / Ik1 Max	27114.7 A	11105 A	15084 A	15295.0 A	7462 A	10029 A	14074.9 A	6773 A	9114 A

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV BUSBAR-1|00CDP01GS011..02CDG01GS0

PROJECT: 2304

DRAWING:

Folio 1 / 3

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1
Ref mark	LV BUSBAR-1

	Normal	Standby
I Total	1872.38 A	
I installed	4546.63 A	
I Avail	2674.25 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV BUSBAR-1	LV BUSBAR-1	LV BUSBAR-1
Ref mark		00BTW01GS011	00BRU01GS011	01CDC01GS011
Upstream BB	D.origin			
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+PE	3P+N+PE
Designation				

CABLES INFORMATIONS/EQUIPM.				DCDP				UPSDP-1				EAP1			
N°	Consump	K Coincid	Geog.location	1	8kW	1		1	40kW	1		1	225kW	1	
Downst BB			Modif.				A				A				A
Cos φ		K Use	UL	0.95		1		0.95		1		0.9		1	
Cos φ Start.		ID/IN	ΔU Start												
η		Supply		1.00	Normal			1.00	Normal			1.00	Normal		
Equip. Pole		Type		3P+N				3P				3P+N			

CABLE				00BTW01GS011				00BRU01GS011				01CDC01GS011			
Type				N2XRH (90°C) Dca				N2XRH (90°C) Dca				N2XRH (90°C) Dca			
Install. method		Core	Pole	31		Copper	Multicore	31		Copper	Multicore	31		Copper	Single Trefoil
Length	1st equipt.		L. Max	65 m			122 m (IC)	58 m			84 m (DU)	85 m			180 m (DU)
ΔU Max		ΔU Circuit	ΔU Total	2 %		0.49 %	1.00 %	2 %		1.02 %	1.53 %	3.5 %		1.41 %	1.92 %
K T°	K prox	K Add	Fs	K Cumul	1.00 (30°C)	0.60	1.00	1.00	0.60	1.00 (30°C)	0.60	1.00	1.00	0.60	1.00 (30°C)	0.60	1.00	1.00	0.60

PROTECTION		[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked
Type	Prot. IC	MCCB Basis Prot	MCCB Basis Prot	MCCB Basis Prot

RESULTS FIXING															
fixed [X]	N°	Phase	fixed [X]	1	16 mm²			fixed [X]	1 X	35 mm²		fixed [X]	2	120 mm²	
	N°	Neutral		1	16 mm²								1	120 mm²	
	N°	PE/PEN		1	16 mm²				1	35 mm²			1	120 mm²	
Harm. Rate	Loaded N		HR <= 15%		No					No		HR <= 15%		No	
Protection			NSX100H TM63D 4P4T					NSX100H Micrologic 2.2 3P3T				NSX630H Micrologic 2.3 4P3T+N/2			
Rating	Ir	Im/Isd/IN Fus.	63 A	44.1 A	500 A			100 A	70 A	105 A		630 A	400 A	600 A	
K on rating.	Tr	Tempo	1	15 s				1	16 s	20 ms		1	16 s	20 ms	
Magnetic	Li off	IΔn	Standard (C)					Electronic				Electronic			
Downs.Ther.	Li	Δt	On circuit					On circuit	1500 A			On circuit	6930 A		

RESULTS															
Cable	Neutral	PE/PEN	5G16					4G35				2X3X(1x120)	1x120	1x120	
Criteria	IB		IMPOS	12.15 A				IMPOS	60.77 A			IMPOS	360.84 A		
S Th.	Iz		9.740 mm²	60.08 A				21.761 mm²	94.75 A			97.517 mm²	458.98 A		
Im / Isd Max	Ik Up/Dn		932 A	55.1 kA	/ 3.3 kA			2407 A	55.1 kA	/ 7.9 kA		6123 A	55.1 kA	/ 24.2 kA	
Discrimination	Backup		Total	Without				Total	Without			Total	Without		

IK INFORMATIONS / PROTECTION															
Icu / Icm	Icu Backup	Ip	70 kA	70 kA	5.01 kA			70 kA	70 kA	7.22 kA		70 kA	70 kA	25.73 kA	
Icu S-pole	Icu S-pole backup														
Tmax. Prot.	Release		2 ms	4P4T				8 ms	3P3T			100 ms	4P3T+N/2		
Contactor	Thermal relay														
Manufacturer			mg19in1.dug					mg19in1.dug				mg19in1.dug			

DISCRIMINATION											
Limit	From										
Thermal	Differential	With	Not Applicable			With	Not Applicable			With	Not Applicable
Logical Discrim.		☐				☐				☐	
T1	T2										

IK END											
Ik3 Max	Ik2 Min	If	3339 A	1954 A	1118 A			7869 A	4642 A	2648 A			24163 A	15237 A	6735 A
Ik2 Max	Ik1 Min	Ik1 Max	2891.4 A	1132 A	1675 A			6814.6 A					20925.8 A	7261 A	10126 A

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV BUSBAR-1|00BTW01GS011..01CDC01GS0

PROJECT: 2304

DRAWING:

Folio 2/3

File : PRF Overall Caneco BB1.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1
Ref mark	LV BUSBAR-1

	Normal	Standby
I Total	1872.38 A	
I installed	4546.63 A	
I Avail	2674.25 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	IN [ ] DU [ ] IC [ ] SC [ ]
Upstream		LV BUSBAR-1	LV BUSBAR-1	
Ref mark		02CDC01GS011	00SGA10GH011	
Upstream BB	D.origin			
Style		Board	Board	
Content	ΔU Regulator	3P+N+PE	3P+N+PE	
Designation				

CABLES INFORMATIONS/EQUIPM.				EAP2				FPHP			
N°	Consump	K Coincid	Geog.location	1	225kW	1		1	186kW	1	
Downst BB			Modif.				A				A
Cos φ		K Use	UL	0.9	1			0.94	1		
Cos φ Start.		ID/IN	ΔU Start								
η		Supply		1.00	Normal			1.00	Normal		
Equip. Pole		Type		3P+N				3P+N			

CABLE				02CDC01GS011					00SGA10GH011				
Type				N2XRH (90°C) Dca					N2XRH (90°C) Dca				
Install. method		Core	Pole	31		Copper		Single Trefoil	31		Copper		Single Trefoil
Length	1st equipt.		L. Max	88 m			180 m (DU)		95 m			191 m (DU)	
ΔU Max		ΔU Circuit	ΔU Total	3.5 %		1.46 %		1.97 %	4 %		1.74 %		2.24 %
K T°	K prox	K Add	Fs	K Cumul	1.00 (30°C)	0.60	1.00	1.00	0.60	1.00 (30°C)	0.60	1.00	1.00	0.60

PROTECTION		[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [ ] Icu CB checked
Type	Prot. IC	MCCB Basis Prot	MCCB Basis Prot	

RESULTS FIXING														
fixed [X]	N°	Phase	fixed [X]	2	120 mm²				fixed [X]	1	185 mm²			
	N°	Neutral		1	120 mm²					1	185 mm²			
	N°	PE/PEN		1	120 mm²					1	185 mm²			
Harm. Rate	Loaded N		HR <= 15%		No				HR <= 15%		No			
Protection			NSX630H Micrologic 2.3 4P3T+N/2						NSX400H Micrologic 2.3 4P4T					
Rating	Ir	Im/Isd/IN Fus.	630 A	400 A	600 A				400 A	288 A	2880 A			
K on rating.	Tr	Tempo	1	16 s	20 ms				1	16 s	20 ms			
Magnetic	Li off	IΔn	Electronic						Electronic					
Downs.Ther.	Li	Δt	On circuit	6930 A					On circuit	4800 A				

RESULTS														
Cable	Neutral	PE/PEN	2X3X(1x120)	1x120	1x120				3X(1x185)	1x185	1x185			
Criteria	IB		IMPOS	360.84 A					IMPOS	285.60 A				
S Th.	Iz		97.517 mm²	458.98 A					169.019 mm²	305.78 A				
Im / Isd Max	Ik Up/Dn		5950 A	55.1 kA	/ 23.6 kA				5744 A	55.1 kA	/ 16.3 kA			/
Discrimination	Backup		Total	Without					Total	Without				

IK INFORMATIONS / PROTECTION														
Icu / Icm	Icu Backup	Ip	70 kA	70 kA	25.42 kA				70 kA	70 kA	17.90 kA			
Icu S-pole	Icu S-pole backup													
Tmax. Prot.	Release		100 ms	4P3T+N/2					231 ms	4P4T				
Contactor	Thermal relay													
Manufacturer			mg19in1.dug						mg19in1.dug					

DISCRIMINATION														
Limit	From													
Thermal	Differential		With	Not Applicable					With	Not Applicable				
Logical Discrim.			[ ]						[ ]				[ ]	
T1	T2													

IK END														
Ik3 Max	Ik2 Min	If	23620 A	14885 A	6545 A				16252 A	10491 A	6318 A			
Ik2 Max	Ik1 Min	Ik1 Max	20455.4 A	7040 A	9823 A				14074.9 A	6773 A	9114 A			

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV BUSBAR-1|02CDC01GS011..00SGA10GH0

PROJECT: 2304

DRAWING:

Folio 3 / 3

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-2
Ref mark	LV BUSBAR-2

	Normal	Standby
I Total	2363.78 A	
I installed	4546.63 A	
I Avail	2182.85 A	
Ik3 max	55494 A	
ΔU	0.38 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV BUSBAR-2	LV BUSBAR-2	LV BUSBAR-2
Ref mark		00BTW02GS011	00BRU02GS011	03CDC01GS011
Upstream BB	D.origin			
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+PE	3P+N+PE
Designation				

CABLES INFORMATIONS/EQUIPM.				DCDP	UPSDP-2	EAP3
N°	Consump	K Coincid	Geog.location	1 8kW 1	1 40kW 1	1 225kW 1
Downst BB		Modif.		A	A	A
Cos φ	K Use	UL		0.95 1	0.95 1	0.9 1
Cos φ Start.	ID/IN	ΔU Start				
η	Supply			1.00 Normal	1.00 Normal	1.00 Normal
Equip. Pole	Type			3P+N	3P	3P+N

CABLE				00BTW02GS011	00BRU02GS011	03CDC01GS011
Type				N2XRH (90°C) Dca	N2XRH (90°C) Dca	N2XRH (90°C) Dca
Install. method	Core	Pole		31 Copper Multicore	31 Copper Multicore	31 Copper Single Trefoil
Length	1st equipt.	L. Max		55 m 122 m (IC)	58 m 92 m (DU)	97 m 187 m (DU)
ΔU Max	ΔU Circuit	ΔU Total		2 % 0.41 % 0.79 %	2 % 1.02 % 1.40 %	3.5 % 1.61 % 1.99 %
K T°	K prox	K Add	Fs K Cumul	1.00 (30°C) 0.60 1.00 1.00 0.60	1.00 (30°C) 0.60 1.00 1.00 0.60	1.00 (30°C) 0.60 1.00 1.00 0.60

PROTECTION			No check on Thermal stress [X] Icu CB checked	No check on Thermal stress [X] Icu CB checked	No check on Thermal stress [X] Icu CB checked
Type	Prot. IC		MCCB Basis Prot	MCCB Basis Prot	MCCB Basis Prot

RESULTS FIXING						
fixed [X]	N°	Phase	fixed [X] 1	16 mm²	fixed [X] 1 X	35 mm²	fixed [X] 2	120 mm²
	N°	Neutral	1	16 mm²			1	120 mm²
	N°	PE/PEN	1	16 mm²	1	35 mm²	1	120 mm²
Harm. Rate	Loaded N		HR <= 15%	No		No	HR <= 15%	No
Protection			NSX100H TM63D 4P4T		NSX100H Micrologic 2.2 3P3T		NSX630H Micrologic 2.3 4P3T+N/2	
Rating	Ir	Im/Isd/IN Fus.	63 A	44.1 A	500 A	100 A	70 A	140 A	630 A	400 A	600 A
K on rating.	Tr	Tempo	1	15 s		1	16 s	20 ms	1	16 s	20 ms
Magnetic	Li off	IΔn	Standard (C)			Electronic			Electronic		
Downs.Ther.	Li	Δt	On circuit			On circuit	1500 A		On circuit	6930 A	

RESULTS											
Cable	Neutral	PE/PEN	5G16			4G35			2X3X(1x120)	1x120	1x120
Criteria	IB		IMPOS	12.15 A		IMPOS	60.77 A		IMPOS	360.84 A	
S Th.	Iz		9.740 mm²	60.08 A		21.761 mm²	94.75 A		97.517 mm²	458.98 A	
Im / Isd Max	Ik Up/Dn		1103 A	55.5 kA	/ 3.9 kA	2428 A	55.5 kA	/ 7.9 kA	5603 A	55.5 kA	/ 22.2 kA
Discrimination	Backup		Total	Without		Total	Without		Total	Without	

IK INFORMATIONS / PROTECTION											
Icu / Icm	Icu Backup	Ip	70 kA	70 kA	5.91 kA	70 kA	70 kA	7.23 kA	70 kA	70 kA	24.58 kA
Icu S-pole	Icu S-pole backup										
Tmax. Prot.	Release		2 ms	4P4T		8 ms	3P3T		97 ms	4P3T+N/2	
Contactor	Thermal relay										
Manufacturer			mg19in1.dug			mg19in1.dug			mg19in1.dug		

DISCRIMINATION								
Limit	From							
Thermal	Differential	With	Not Applicable	With	Not Applicable	With	Not Applicable
Logical Discrim.		☐		☐		☐	
T1	T2						

IK END											
Ik3 Max	Ik2 Min	If	3940 A	2306 A	1324 A	7880 A	4649 A	2671 A	22218 A	13972 A	6163 A
Ik2 Max	Ik1 Min	Ik1 Max	3412.2 A	1337 A	1979 A	6824.5 A			19241.0 A	6486 A	9059 A

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV BUSBAR-2|00BTW02GS011..03CDC01GS0

PROJECT: 2304

DRAWING:

Folio 1 / 4

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-2
Ref mark	LV BUSBAR-2

	Normal	Standby
I Total	2363.78 A	
I installed	4546.63 A	
I Avail	2182.85 A	
Ik3 max	55494 A	
ΔU	0.38 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV BUSBAR-2	LV BUSBAR-2	LV BUSBAR-2
Ref mark		04CDC01GS011	05CDC01GS011	03CDG01GS011
Upstream BB	D.origin			
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation				

CABLES INFORMATIONS/EQUIPM.				EAP4			EAP5			ERP3		
N°	Consump	K Coincid	Geog.location	1	225kW	1	1	225kW	1	1	190kW	1
Downst BB		Modif.				A			A			A
Cos φ	K Use	UL		0.9	1		0.9	1		0.85	1	
Cos φ Start.	ID/IN	ΔU Start										
η	Supply			1.00	Normal		1.00	Normal		1.00	Normal	
Equip. Pole	Type			3P+N			3P+N			3P+N		

CABLE				04CDC01GS011			05CDC01GS011			03CDG01GS011		
Type				N2XRH (90°C) Dca			N2XRH (90°C) Dca			N2XRH (90°C) Dca		
Install. method	Core	Pole		31	Copper	Single Trefoil	31	Copper	Single Trefoil	31	Copper	Single Trefoil
Length	1st equipt.	L. Max		107 m		187 m (DU)	117 m		187 m (DU)	135 m		171 m (DU)
ΔU Max	ΔU Circuit	ΔU Total		3.5 %	1.78 %	2.16 %	3.5 %	1.94 %	2.32 %	4 %	2.85 %	3.23 %
K T°	K prox	K Add	Fs	K Cumul	1.00 (30°C)	0.60	1.00	1.00	0.60	1.00 (30°C)	0.60	1.00	1.00	0.60	1.00 (30°C)	0.61	1.00	1.00	0.61

PROTECTION				No check on Thermal stress [X] Icu CB checked		No check on Thermal stress [X] Icu CB checked		No check on Thermal stress [X] Icu CB checked	
Type	Prot. IC			MCCB	Basis Prot	MCCB	Basis Prot	MCCB	Basis Prot

RESULTS FIXING												
fixed [X]	N°	Phase		fixed [X] 2	120 mm²		fixed [X] 2 X	120 mm²		fixed [X] 1	185 mm²	
	N°	Neutral		1	120 mm²		1	120 mm²		1	185 mm²	
	N°	PE/PEN		1	120 mm²		1	120 mm²		1	185 mm²	
Harm. Rate	Loaded N			HR <= 15%	No		HR <= 15%	No		HR <= 15%	No	
Protection				NSX630H Micrologic 2.3 4P3T+N/2			NSX400H Micrologic 2.3 4P3T+N/2			NSX630H Micrologic 2.3 4P4T		
Rating	Ir	Im/Isd/IN Fus.		630 A	400 A	600 A	400 A	400 A	2400 A	630 A	325.5 A	1627.5 A
K on rating.	Tr	Tempo		1	16 s	20 ms	1	16 s	20 ms	1	16 s	20 ms
Magnetic	Li off	IΔn		Electronic			Electronic			Electronic		
Downs.Ther.	Li	Δt		On circuit	6930 A		On circuit	4800 A		On circuit	6930 A	

RESULTS												
Cable	Neutral	PE/PEN		2X3X(1x120)	1x120	1x120	2X3X(1x120)	1x120	1x120	3X(1x185)	1x185	1x185
Criteria	IB			IMPOS	360.84 A		IMPOS	360.84 A		IMPOS	322.64 A	
S Th.	Iz			97.517 mm²	458.98 A		97.517 mm²	458.98 A		198.284 mm²	310.87 A	
Im / Isd Max	Ik Up/Dn			5145 A	55.5 kA	/ 20.7 kA	4755 A	55.5 kA	/ 19.4 kA	4337 A	55.5 kA	/ 12.3 kA
Discrimination	Backup			Total	Without		Total	Without		Total	Without	

IK INFORMATIONS / PROTECTION												
Icu / Icm	Icu Backup	Ip		70 kA	70 kA	23.67 kA	70 kA	70 kA	19.63 kA	70 kA	70 kA	17.81 kA
Icu S-pole	Icu S-pole backup											
Tmax. Prot.	Release			97 ms	4P3T+N/2		97 ms	4P3T+N/2		227 ms	4P4T	
Contactor	Thermal relay											
Manufacturer				mg19in1.dug			mg19in1.dug			mg19in1.dug		

DISCRIMINATION											
Limit	From										
Thermal	Differential	With	Not Applicable		With	Not Applicable		With	Not Applicable		
Logical Discrim.		☐			☐			☐			
T1	T2										

IK END												
Ik3 Max	Ik2 Min	If		20733 A	13016 A	5660 A	19425 A	12175 A	5231 A	12327 A	7930 A	4771 A
Ik2 Max	Ik1 Min	Ik1 Max		17955.2 A	5930 A	8295 A	16822.2 A	5462 A	7649 A	10675.1 A	4961 A	6698 A

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV BUSBAR-2|04CDC01GS011..03CDG01GS0

PROJECT: 2304

DRAWING:

Folio 2 / 4

File : PRF Overall Caneco BB2.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-2
Ref mark	LV BUSBAR-2

	Normal	Standby
I Total	2363.78 A	
I installed	4546.63 A	
I Avail	2182.85 A	
Ik3 max	55494 A	
ΔU	0.38 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV BUSBAR-2	LV BUSBAR-2	LV BUSBAR-2
Ref mark		00CDP02GS011	04CDG01GS011	05CDG01GS011
Upstream BB	D.origin			
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation				

CABLES INFORMATIONS/EQUIPM.				CVP2				ERP4				ERP5			
N°	Consump	K Coincid	Geog.location	1	125kW	1		1	190kW	1		1	190kW	1	
Downst BB			Modif.				A				A				A
Cos φ	K Use		UL	0.85	1			0.85	1			0.85	1		
Cos φ Start.	ID/IN		ΔU Start												
η	Supply			1.00	Normal			1.00	Normal			1.00	Normal		
Equip. Pole	Type			3P+N				3P+N				3P+N			

CABLE				00CDP02GS011				04CDG01GS011				05CDG01GS011			
Type				N2XRH (90°C) Dca				N2XRH (90°C) Dca				N2XRH (90°C) Dca			
Install. method	Core	Pole		31	Copper	Single Trefoil		31	Copper	Single Trefoil		31	Copper	Single Trefoil	
Length	1st equipt.	L. Max		80 m		446 m (DU)		145 m		171 m (DU)		155 m		171 m (DU)	
ΔU Max	ΔU Circuit	ΔU Total		4 %	0.65 %	1.03 %		4 %	3.06 %	3.44 %		4 %	3.27 %	3.65 %	
K T°	K prox	K Add	Fs K Cumul	1.00 (30°C)	0.60	1.00	1.00 0.60	1.00 (30°C)	0.61	1.00	1.00 0.61	1.00 (30°C)	0.61	1.00	1.00 0.61

PROTECTION		[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked
Type	Prot. IC	MCCB Basis Prot	MCCB Basis Prot	MCCB Basis Prot

RESULTS FIXING															
fixed [X]	N°	Phase		fixed [X]	2	150 mm²		fixed [X]	1 X	185 mm²		fixed [X]	1	185 mm²	
	N°	Neutral			1	150 mm²			1	185 mm²			1	185 mm²	
	N°	PE/PEN			1	150 mm²			1	185 mm²			1	185 mm²	
Harm. Rate	Loaded N			HR <= 15%		No		HR <= 15%		No		HR <= 15%		No	
Protection				NSX630H Micrologic 2.3 4P4T				NSX630H Micrologic 2.3 4P4T				NSX630H Micrologic 2.3 4P4T			
Rating	Ir	Im/Isd/IN Fus.		630 A	252 A	756 A		630 A	325.5 A	1627.5 A		630 A	325.5 A	1627.5 A	
K on rating.	Tr	Tempo		1	16 s	20 ms		1	16 s	20 ms		1	16 s	20 ms	
Magnetic	Li off	IΔn		Electronic				Electronic				Electronic			
Downs.Ther.	Li	Δt		On circuit	6930 A			On circuit	6930 A			On circuit	6930 A		

RESULTS															
Cable	Neutral	PE/PEN		2X3X(1x150)	1x150	1x150		3X(1x185)	1x185	1x185		3X(1x185)	1x185	1x185	
Criteria	IB			IMPOS	212.26 A			IMPOS	322.64 A			IMPOS	322.64 A		
S Th.	Iz			48.576 mm²	532.17 A			198.284 mm²	310.87 A			198.284 mm²	310.87 A		
Im / Isd Max	Ik Up/Dn			7588 A	55.5 kA	/ 27.2 kA		4071 A	55.5 kA	/ 11.6 kA		3835 A	55.5 kA	/ 11.0 kA	
Discrimination	Backup			Total	Without			Total	Without			Total	Without		

IK INFORMATIONS / PROTECTION															
Icu / Icm	Icu Backup	Ip		70 kA	70 kA	27.48 kA		70 kA	70 kA	17.24 kA		70 kA	70 kA	16.72 kA	
Icu S-pole	Icu S-pole backup														
Tmax. Prot.	Release			151 ms	4P4T			227 ms	4P4T			227 ms	4P4T		
Contactor	Thermal relay														
Manufacturer				mg19in1.dug				mg19in1.dug				mg19in1.dug			

DISCRIMINATION									
Limit	From								
Thermal	Differential	With	Not Applicable	With	Not Applicable	With	Not Applicable		
Logical Discrim.		☐		☐		☐			
T1	T2								

IK END											
Ik3 Max	Ik2 Min	If	27238 A	17443 A	8347 A	11614 A	7467 A	4478 A	10979 A	7054 A	4219 A
Ik2 Max	Ik1 Min	Ik1 Max	23588.7 A	8945 A	12204 A	10058.1 A	4644 A	6275 A	9507.8 A	4366 A	5903 A

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV BUSBAR-2|00CDP02GS011..05CDG01GS0

PROJECT: 2304

DRAWING:

Folio 3/4

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-2
Ref mark	LV BUSBAR-2

	Normal	Standby
I Total	2363.78 A	
I installed	4546.63 A	
I Avail	2182.85 A	
Ik3 max	55494 A	
ΔU	0.38 %	

CIRCUIT

Circuit OK — IN [X] DU [X] IC [X] SC [X]

IN [ ] DU [ ] IC [ ] SC [ ]

IN [ ] DU [ ] IC [ ] SC [ ]

Upstream		LV BUSBAR-2			
Ref mark		00SGA11GH011			
Upstream BB	D.origin				
Style		Board			
Content	ΔU Regulator	3P+N+PE			
Designation					

CABLES INFORMATIONS/EQUIPM.

FPHP

N°	Consump	K Coincid	Geog.location	1	21.36kW	1													
Downst BB			Modif.				A												
Cos φ		K Use	UL	0.94		1													
Cos φ Start.		ID/IN	ΔU Start																
η		Supply		1.00	Normal														
Equip. Pole		Type		3P+N															

CABLE

00SGA11GH011

Type				N2XRH (90°C) Dca															
Install. method		Core	Pole	31		Copper		Multicore											
Length	1st equipt.		L. Max	145 m				167 m (IC)											
ΔU Max		ΔU Circuit	ΔU Total	4 %		2.93 %		3.31 %											
K T°	K prox	K Add	Fs	K Cumul	1.00 (30°C)	0.60		1.00		1.00		0.60							

PROTECTION

[ ] No check on Thermal stress [X] Icu CB checked		[ ] No check on Thermal stress [ ] Icu CB checked		[ ] No check on Thermal stress [ ] Icu CB checked	
Type	Prot. IC	MCCB	Basis Prot		

RESULTS FIXING

fixed [X]	N°	Phase	fixed [X]	1	16 mm²				fixed [ ]						fixed [ ]				
	N°	Neutral		1	16 mm²														
	N°	PE/PEN		1	16 mm²														
Harm. Rate	Loaded N		HR <= 15%		No														
Protection			NSX100H Micrologic 2.2 4P4T																
Rating	Ir	Im/Isd/IN Fus.	40 A	40 A	400 A														
K on rating.	Tr	Tempo	1	16 s	20 ms														
Magnetic	Li off	IΔn	Electronic																
Downs.Ther.	Li	Δt	On circuit	600 A															

RESULTS

Cable	Neutral	PE/PEN	5G16																
Criteria	IB		IMPOS	32.80 A															
S Th.	Iz		8.328 mm²	60.08 A															
Im / Isd Max	Ik Up/Dn		461 A	55.5 kA / 1.5 kA					/						/				
Discrimination	Backup		Total	Without															

IK INFORMATIONS / PROTECTION

Icu / Icm	Icu Backup	Ip	70 kA	70 kA	2.26 kA														
Icu S-pole	Icu S-pole backup																		
Tmax. Prot.	Release		2 ms	4P4T															
Contactor	Thermal relay																		
Manufacturer			mg19in1.dug																

DISCRIMINATION

Limit	From																		
Thermal	Differential		With	Not Applicable															
Logical Discrim.			[ ]						[ ]						[ ]				
T1	T2																		

IK END

Ik3 Max	Ik2 Min	If	1505 A	881 A	507 A														
Ik2 Max	Ik1 Min	Ik1 Max	1303.8 A	509 A	754 A														

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV BUSBAR-2|00SGA11GH011

PROJECT: 2304

DRAWING:

Folio 4/4

File : PRF Overall Caneco BB2.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1&2
Ref mark	LV COMMON BUSBAR

	Normal	Standby
I Total	2644.61 A	
I installed	4546.63 A	
I Avail	2346.99 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV COMMON BUSBAR	LV COMMON BUSBAR	LV COMMON BUSBAR
Ref mark		LV COMMON BUSBAR_	00BJB01GS011	00BJA01GS011
Upstream BB	D.origin		LV COMMON BUSBAR_	LV COMMON BUSBAR_
Style		Busbar	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation				

CABLES INFORMATIONS/EQUIPM.				LV COMMON BUSBAR_				ACDP				MCDP			
N°	Consump	K Coincid	Geog.location	1	1363.5kW	1		1	40kW	1		1	400kW	1	
Downst BB		Modif.		LV COMMON BUSBAR_		A				A				A	
Cos φ	K Use	UL		0.87	1			0.85	1			0.9	1		
Cos φ Start.	ID/IN	ΔU Start													
η	Supply			1.00	Normal			1.00	Normal			1.00	Normal		
Equip. Pole	Type			3P+N				3P+N				3P+N			

CABLE															
Type				Dca				N2XRH (90°C) Dca				N2XRH (90°C) Dca			
Install. method	Core	Pole		31		Multi+PE		31	Copper	Single Trefoil		31	Copper	Single Trefoil	
Length	1st equipt.	L. Max						30 m		160 m (DU)		30 m		57 m (DU)	
ΔU Max	ΔU Circuit	ΔU Total			0 %	0.51 %		1.5 %	0.19 %	0.69 %		1.5 %	0.52 %	1.02 %	
K T°	K prox	K Add	Fs	K Cumul	1.00 (30°C)			1.00	1.00 (30°C)	0.60	1.00	1.00	1.00 (30°C)	0.60	1.00	1.00	0.60

PROTECTION		[ ] No check on Thermal stress [X] Icu CB checked		[ ] No check on Thermal stress [X] Icu CB checked		[ ] No check on Thermal stress [X] Icu CB checked	
Type	Prot. IC	MCCB	Basis Prot	MCCB	Basis Prot	MCCB	Basis Prot

RESULTS FIXING															
fixed [X]	N°	Phase		fixed [X]	5	185 mm²		fixed [X]	1 X	120 mm²		fixed [X]	2	240 mm²	
	N°	Neutral			5	185 mm²			1	70 mm²			1	240 mm²	
	N°	PE/PEN			1	185 mm²			1	70 mm²			1	240 mm²	
Harm. Rate	Loaded N			HR <= 15%		No		HR <= 15%		No		HR <= 15%		No	
Protection				NS2500N Micrologic 2.0 4P4T				NSX250H Micrologic 2.2 4P4T				NS1250H Micrologic 2.0 4P3T+N/2			
Rating	Ir	Im/Isd/IN Fus.		2500 A	2375 A	23750 A		250 A	100 A	300 A		1250 A	750 A	1500 A	
K on rating.	Tr	Tempo		1	24 s	20 ms		1	16 s	20 ms		1	24 s	20 ms	
Magnetic	Li off	IΔn		Electronic				Electronic				Electronic			
Downs.Ther.	Li	Δt		On circuit	25000 A			On circuit	3000 A			On circuit	12500 A		

RESULTS															
Cable	Neutral	PE/PEN						3X(1x120)	1x70	1x70		2X3X(1x240)	1x240	1x240	
Criteria	IB			IMPOS	2256.38 A			IMPOS	67.92 A			IMPOS	641.50 A		
S Th.	Iz			197.196 mm²				34.280 mm²	229.49 A			251.678 mm²	726.74 A		
Im / Isd Max	Ik Up/Dn			28451 A	55.1 kA / 55.1 kA			9067 A	55.1 kA / 29.7 kA			16110 A	55.1 kA / 42.5 kA		
Discrimination	Backup			Total	Without			Total	Without			I<25.00kA	Without		

IK INFORMATIONS / PROTECTION															
Icu / Icm	Icu Backup	Ip		70 kA	70 kA	121.11 kA		70 kA	70 kA	18.04 kA		70 kA	70 kA	89.25 kA	
Icu S-pole	Icu S-pole backup														
Tmax. Prot.	Release			680 ms	4P4T			34 ms	4P4T			402 ms	4P3T+N/2		
Contactor	Thermal relay														
Manufacturer				mg19in1.dug				mg19in1.dug				mg19in1.dug			

DISCRIMINATION															
Limit	From											25000 A			
Thermal	Differential			With	Not Applicable			With	Not Applicable			With	Not Applicable		
Logical Discrim.				☐				☐				☐			
T1	T2														

IK END															
Ik3 Max	Ik2 Min	If		55050 A	34862 A	31296 A		29740 A	18862 A	9974 A		42502 A	27543 A	17721 A	
Ik2 Max	Ik1 Min	Ik1 Max		47675.0 A	41390 A	54137 A		25755.8 A	11173 A	15716 A		36807.6 A	21348 A	27657 A	

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV COMMON BUSBAR

PROJECT: 2304

DRAWING:

Folio 1 / 6

File : PRF Overall Caneco Commen BB.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1&2
Ref mark	LV COMMON BUSBAR

	Normal	Standby
I Total	2644.61 A	
I installed	4546.63 A	
I Avail	2346.99 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV COMMON BUSBAR	LV COMMON BUSBAR	LV COMMON BUSBAR
Ref mark		00CDD01GS011	00CDE01GS011	00BRV01GS001
Upstream BB	D.origin	LV COMMON BUSBAR_	LV COMMON BUSBAR_	LV COMMON BUSBAR_
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation				
CABLES INFORMATIONS/EQUIPM.		CAP	CAPP	EDG
N° / Consump / K Coincid / Geog.location		1 / 300kW / 1	1 / 220kW / 1	1 / 250kW / 1
Downst BB / Modif.		A	A	A
Cos φ / K Use / UL		0.85 / 1	0.9 / 1	0.8 / 1
Cos φ Start. / ID/IN / ΔU Start				
η / Supply		1.00 / Normal	1.00 / Normal	1.00 / Normal
Equip. Pole / Type		3P+N	3P+N	3P+N
CABLE		00CDD01GS011	00CDE01GS011	00BRV01GS001
Type		N2XRH (90°C) Dca	N2XRH (90°C) Dca	N2XRH (90°C) Dca
Install. method / Core / Pole		31 / Copper / Single Trefoil	31 / Copper / Single Trefoil	31 / Copper / Single Trefoil
Length / 1st equipt. / L. Max		30 m / 102 m (DU)	208 m / 215 m (DU)	60 m / 117 m (DU)
ΔU Max / ΔU Circuit / ΔU Total		2.5 % / 0.58 % / 1.09 %	4 % / 3.38 % / 3.88 %	2.5 % / 1.02 % / 1.53 %
K T° / K prox / K Add / Fs / K Cumul		1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60
PROTECTION		[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked
Type / Prot. IC		MCCB / Basis Prot	MCCB / Basis Prot	MCCB / Basis Prot
RESULTS FIXING				
fixed [X] N° / Phase		fixed [X] 2 / 150 mm²	fixed [X] 2 X / 120 mm²	fixed [X] 2 / 150 mm²
N° / Neutral		1 / 150 mm²	1 / 120 mm²	1 / 150 mm²
N° / PE/PEN		1 / 150 mm²	1 / 120 mm²	1 / 150 mm²
Harm. Rate / Loaded N		HR <= 15% / No	HR <= 15% / No	HR <= 15% / No
Protection		NSX630H Micrologic 2.3 4P3T+N/2	NSX630H Micrologic 2.3 4P3T+N/2	NS1000H Micrologic 2.0 4P3T+N/2
Rating / Ir / Im/Isd/IN Fus.		630 A / 513 A / 5130 A	630 A / 400 A / 600 A	1000 A / 500 A / 1000 A
K on rating. / Tr / Tempo		1 / 16 s / 20 ms	1 / 16 s / 20 ms	1 / 15 s / 20 ms
Magnetic / Li off / IΔn		Electronic	Electronic	Electronic
Downs.Ther. / Li / Δt		On circuit / 6930 A	On circuit / 6930 A	On circuit / 10000 A
RESULTS				
Cable / Neutral / PE/PEN		2X3X(1x150) / 1x150 / 1x150	2X3X(1x120) / 1x120 / 1x120	2X3X(1x150) / 1x150 / 1x150
Criteria / IB		IMPOS / 509.43 A	IMPOS / 352.83 A	IMPOS / 451.05 A
S Th. / Iz		141.926 mm² / 532.17 A	97.517 mm² / 458.98 A	136.536 mm² / 532.17 A
Im / Isd Max / Ik Up/Dn		14129 A / 55.1 kA / 41.1 kA	2783 A / 55.1 kA / 12.2 kA	9138 A / 55.1 kA / 31.6 kA
Discrimination / Backup		Total / Without	Total / Without	I<25.00kA / Without
IK INFORMATIONS / PROTECTION				
Icu / Icm / Icu Backup / Ip		70 kA / 70 kA / 34.30 kA	70 kA / 70 kA / 17.72 kA	70 kA / 70 kA / 66.28 kA
Icu S-pole / Icu S-pole backup				
Tmax. Prot. / Release		157 ms / 4P3T+N/2	100 ms / 4P3T+N/2	157 ms / 4P3T+N/2
Contactor / Thermal relay				
Manufacturer		mg19in1.dug	mg19in1.dug	mg19in1.dug
DISCRIMINATION				
Limit / From				25000 A
Thermal / Differential		With / Not Applicable	With / Not Applicable	With / Not Applicable
Logical Discrim.		☐	☐	☐
T1 / T2				
IK END				
Ik3 Max / Ik2 Min / If		41118 A / 26415 A / 15542 A	12211 A / 7583 A / 3061 A	31563 A / 20269 A / 10052 A
Ik2 Max / Ik1 Min / Ik1 Max		35609.4 A / 18498 A / 24741 A	10575.3 A / 3165 A / 4459 A	27334.6 A / 11252 A / 15279 A

LOGO Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV COMMON BUSBAR|00CDD01GS011|00BR

PROJECT: 2304

DRAWING:

Folio 2/6

File : PRF Overall Caneco Commen BB.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1&2
Ref mark	LV COMMON BUSBAR

	Normal	Standby
I Total	2644.61 A	
I installed	4546.63 A	
I Avail	2346.99 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV COMMON BUSBAR	LV COMMON BUSBAR	LV COMMON BUSBAR
Ref mark		00AEG01GH011	00AEG01GH012	00AEG01GH013
Upstream BB	D.origin	LV COMMON BUSBAR_	LV COMMON BUSBAR_	LV COMMON BUSBAR_
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation				

CABLES INFORMATIONS/EQUIPM.				HV SWITCH YARD PANEL-1				HV SWITCH YARD PANEL-2				110KV IPP COMPOUND			
N°	Consump	K Coincid	Geog.location	1	65kW	1		1	65kW	1		1	65kW	1	
Downst BB		Modif.					A				A				A
Cos φ	K Use	UL		0.9	1			0.9	1			0.9	1		
Cos φ Start.	ID/IN	ΔU Start													
η	Supply			1.00	Normal			1.00	Normal			1.00	Normal		
Equip. Pole	Type			3P+N				3P+N				3P+N			

CABLE				00AEG01GH011				00AEG01GH012				00AEG01GH013			
Type				N2XRH (90°C) Dca				N2XRH (90°C) Dca				N2XRH (90°C) Dca			
Install. method	Core	Pole		31	Copper	Multi+PE		31	Copper	Multi+PE		31	Copper	Multi+PE	
Length	1st equipt.	L. Max		133 m		136 m (DU)		133 m		136 m (DU)		113 m		136 m (DU)	
ΔU Max	ΔU Circuit	ΔU Total		3.5 %	2.91 %	3.41 %		3.5 %	2.91 %	3.41 %		3.5 %	2.47 %	2.98 %	
K T°	K prox	K Add	Fs	K Cumul	1.00 (30°C)	0.60	1.00	1.00	0.60	1.00 (30°C)	0.60	1.00	1.00	0.60	1.00 (30°C)	0.60	1.00	1.00	0.60

PROTECTION		[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked
Type	Prot. IC	MCCB Basis Prot	MCCB Basis Prot	MCCB Basis Prot

RESULTS FIXING															
fixed [X]	N°	Phase		fixed [X]	1	50 mm²		fixed [X]	1 X	50 mm²		fixed [X]	1	50 mm²	
	N°	Neutral			1	50 mm²			1	50 mm²			1	50 mm²	
	N°	PE/PEN			1	50 mm²			1	50 mm²			1	50 mm²	
Harm. Rate	Loaded N			HR <= 15%	No			HR <= 15%	No			HR <= 15%	No		
Protection				NSXmH TM125D 4P4T				NSXmH TM125D 4P4T				NSXmH TM160D 4P4T			
Rating	Ir	Im/Isd/IN Fus.		125 A	112.5 A	1250 A		125 A	112.5 A	1250 A		160 A	112 A	1250 A	
K on rating.	Tr	Tempo		1	15 s			1	15 s			1	15 s		
Magnetic	Li off	IΔn		Standard (C)				Standard (C)				Standard (C)			
Downs.Ther.	Li	Δt		On circuit				On circuit				On circuit			

RESULTS															
Cable	Neutral	PE/PEN		4X50		1X50		4X50		1X50		4X50		1X50	
Criteria	IB			IMPOS	104.24 A			IMPOS	104.24 A			IMPOS	104.24 A		
S Th.	Iz			45.831 mm²	115.09 A			45.831 mm²	115.09 A			45.511 mm²	115.09 A		
Im / Isd Max	Ik Up/Dn			1319 A	55.1 kA / 4.7 kA			1319 A	55.1 kA / 4.7 kA			1544 A	55.1 kA / 5.5 kA		
Discrimination	Backup			Total	Without			Total	Without			Total	Without		

IK INFORMATIONS / PROTECTION															
Icu / Icm	Icu Backup	Ip		70 kA	70 kA	5.23 kA		70 kA	70 kA	5.23 kA		70 kA	70 kA	5.76 kA	
Icu S-pole	Icu S-pole backup														
Tmax. Prot.	Release			15 ms	4P4T			15 ms	4P4T			15 ms	4P4T		
Contactor	Thermal relay														
Manufacturer				mg19in1.dug				mg19in1.dug				mg19in1.dug			

DISCRIMINATION									
Limit	From								
Thermal	Differential	With	Not Applicable	With	Not Applicable	With	Not Applicable		
Logical Discrim.		☐		☐		☐			
T1	T2								

IK END											
Ik3 Max	Ik2 Min	If	4681 A	2767 A	1583 A	4681 A	2767 A	1583 A	5481 A	3242 A	1853 A
Ik2 Max	Ik1 Min	Ik1 Max	4053.7 A	1612 A	2366 A	4053.7 A	1612 A	2366 A	4746.9 A	1892 A	2777 A

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV COMMON BUSBAR|00AEG01GH011|00AE

PROJECT: 2304

DRAWING:

Folio 3/6

File : PRF Overall Caneco Commen BB.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1&2
Ref mark	LV COMMON BUSBAR

	Normal	Standby
I Total	2644.61 A	
I installed	4546.63 A	
I Avail	2346.99 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV COMMON BUSBAR	LV COMMON BUSBAR	LV COMMON BUSBAR
Ref mark		00GAF10GS011	00EGB01AC011	00EGB02AC011
Upstream BB	D.origin	LV COMMON BUSBAR_	LV COMMON BUSBAR_	LV COMMON BUSBAR_
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation				

CABLES INFORMATIONS/EQUIPM.			RAW WATER STATION	TRACE HEATING-1	TRACE HEATING-2
N°	Consump	K Coincid / Geog.location	1 / 17kW / 1	1 / 40kW / 1	1 / 35kW / 1
Downst BB		Modif.	A	A	A
Cos φ	K Use	UL	0.85 / 1	1 / 1	1 / 1
Cos φ Start.	ID/IN	ΔU Start			
η	Supply		1.00 / Normal	1.00 / Normal	1.00 / Normal
Equip. Pole	Type		3P+N	3P+N	3P+N

CABLE				00GAF10GS011	00EGB01AC011	00EGB02AC011
Type				N2XRH (90°C) Dca	N2XRH (90°C) Dca	N2XRH (90°C) Dca
Install. method	Core	Pole		31 / Copper / Multicore	31 / Copper / Multicore	31 / Copper / Multicore
Length	1st equipt.	L. Max		105 m / 122 m (IC)	80 m / 126 m (DU)	80 m / 92 m (DU)
ΔU Max	ΔU Circuit	ΔU Total		4.5 % / 1.71 % / 2.22 %	3.5 % / 1.9 % / 2.40 %	3.5 % / 2.59 % / 3.10 %
K T°	K prox	K Add	Fs / K Cumul	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60

PROTECTION		No check on Thermal stress [X] Icu CB checked	No check on Thermal stress [X] Icu CB checked	No check on Thermal stress [X] Icu CB checked
Type	Prot. IC	MCCB / Basis Prot	MCCB / Basis Prot	MCCB / Basis Prot

RESULTS FIXING						
fixed [X]	N°	Phase	fixed [X] 1	16 mm²	1 X	25 mm²	fixed [X] 1	16 mm²
	N°	Neutral	1	16 mm²	1	25 mm²	1	16 mm²
	N°	PE/PEN	1	16 mm²	1	25 mm²	1	16 mm²
Harm. Rate	Loaded N		HR <= 15% / No		HR <= 15% / No		HR <= 15% / No	
Protection			NSX100H TM63D 4P4T		NSX100H TM63D 4P4T		NSX100H TM63D 4P4T	
Rating	Ir	Im/Isd/IN Fus.	63 A	44.1 A	500 A	63 A	63 A	500 A	63 A	56.7 A	500 A
K on rating.	Tr	Tempo	1	15 s		1	15 s		1	15 s	
Magnetic	Li off	IΔn	Standard (C)			Standard (C)			Standard (C)		
Downs.Ther.	Li	Δt	On circuit			On circuit			On circuit		

RESULTS											
Cable	Neutral	PE/PEN	5G16			5G25			5G16		
Criteria	IB		IMPOS	28.87 A		IMPOS	57.74 A		IMPOS	50.52 A	
S Th.	Iz		9.740 mm²	60.08 A		18.444 mm²	76.47 A		14.580 mm²	60.08 A	
Im / Isd Max	Ik Up/Dn		581 A	55.1 kA	/ 2.1 kA	1174 A	55.1 kA	/ 4.2 kA	760 A	55.1 kA	/ 2.7 kA
Discrimination	Backup		Total	Without		Total	Without		Total	Without	

IK INFORMATIONS / PROTECTION											
Icu / Icm	Icu Backup	Ip	70 kA	70 kA	3.11 kA	70 kA	70 kA	5.13 kA	70 kA	70 kA	4.08 kA
Icu S-pole	Icu S-pole backup										
Tmax. Prot.	Release		2 ms	4P4T		4 ms	4P4T		2 ms	4P4T	
Contactor	Thermal relay										
Manufacturer			mg19in1.dug			mg19in1.dug			mg19in1.dug		

DISCRIMINATION								
Limit	From							
Thermal	Differential	With	Not Applicable	With	Not Applicable	With	Not Applicable
Logical Discrim.		☐		☐		☐	
T1	T2						

IK END										
Ik3 Max	Ik2 Min	If	2075 A	1214 A	697 A	4199 A	2464 A	1409 A	2718 A	1590 A	912 A
Ik2 Max	Ik1 Min	Ik1 Max	1797.1 A	702 A	1039 A	3636.4 A	1429 A	2112 A	2354.0 A	920 A	1362 A

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV COMMON BUSBAR|00GAF10GS01 0EG

PROJECT: 2304

DRAWING:

Folio 4 / 6

File : PRF Overall Caneco Commen BB.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1&2
Ref mark	LV COMMON BUSBAR

	Normal	Standby
I Total	2644.61 A	
I installed	4546.63 A	
I Avail	2346.99 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT		Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]	Circuit OK IN [X] DU [X] IC [X] SC [X]
Upstream		LV COMMON BUSBAR	LV COMMON BUSBAR	LV COMMON BUSBAR
Ref mark		00SMM11GH011	00QHA01GH001	EDG AUX
Upstream BB	D.origin	LV COMMON BUSBAR_	LV COMMON BUSBAR_	LV COMMON BUSBAR_
Style		Board	Board	Board
Content	ΔU Regulator	3P+N+PE	3P+N+PE	3P+N+PE
Designation				
CABLES INFORMATIONS/EQUIPM.		POWER HOUSE CRANE	AUX BOILER-1	EDG AUX
N° / Consump / K Coincid / Geog.location		1 / 30kW / 1	1 / 34kW / 1	1 / 2.5kW / 1
Downst BB	Modif.	A	A	A
Cos φ	K Use / UL	0.85 / 1	0.85 / 1	0.95 / 1
Cos φ Start.	ID/IN / ΔU Start			
η	Supply	1.00 Normal	1.00 Normal	1.00 Normal
Equip. Pole	Type	3P+N	3P+N	3P+N
CABLE		00SMM11GH011	00QHA01GH001	EDG AUX
Type		N2XRH (90°C) Dca	N2XRH (90°C) Dca	N2XRH (90°C) Dca
Install. method / Core / Pole		31 / Copper / Multicore	31 / Copper / Multi+PE	31 / Copper / Multicore
Length / 1st equipt. / L. Max		58 m / 122 m (IC)	72 m / 140 m (IC)	60 m / 76 m (IC)
ΔU Max / ΔU Circuit / ΔU Total		4.5 % / 1.67 % / 2.18 %	4.5 % / 0.84 % / 1.35 %	3.5 % / 0.22 % / 0.73 %
K T° / K prox / K Add / Fs / K Cumul		1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60	1.00 (30°C) / 0.60 / 1.00 / 1.00 / 0.60
PROTECTION		[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked	[ ] No check on Thermal stress [X] Icu CB checked
Type	Prot. IC	MCCB / Basis Prot	MCCB / Basis Prot	MCCB / Basis Prot
RESULTS FIXING				
fixed [X]	N° / Phase	1 / 16 mm²	1 X / 50 mm²	1 / 10 mm²
	N° / Neutral	1 / 16 mm²	1 / 50 mm²	1 / 10 mm²
	N° / PE/PEN	1 / 16 mm²	1 / 50 mm²	1 / 10 mm²
Harm. Rate	Loaded N	HR <= 15% / No	HR <= 15% / No	HR <= 15% / No
Protection		NSX100H TM63D 4P4T	NSXmH TM160D 4P4T	NSX100H TM63D 4P4T
Rating	Ir / Im/Isd/IN Fus.	63 A / 56.7 A / 500 A	160 A / 112 A / 1250 A	63 A / 44.1 A / 500 A
K on rating.	Tr / Tempo	1 / 15 s	1 / 15 s	1 / 15 s
Magnetic	Li off / IΔn	Standard (C)	Standard (C)	Standard (C)
Downs.Ther.	Li / Δt	On circuit	On circuit	On circuit
RESULTS				
Cable	Neutral / PE/PEN	5G16	4X50 / 1X50	5G10
Criteria	IB	IMPOS / 50.94 A	IMPOS / 57.74 A	IMPOS / 3.80 A
S Th.	Iz	14.580 mm² / 60.08 A	45.511 mm² / 115.09 A	9.740 mm² / 44.83 A
Im / Isd Max	Ik Up/Dn	1043 A / 55.1 kA / 3.7 kA	2375 A / 55.1 kA / 8.4 kA	636 A / 55.1 kA / 2.3 kA
Discrimination	Backup	Total / Without	Total / Without	Total / Without
IK INFORMATIONS / PROTECTION				
Icu / Icm / Icu Backup / Ip		70 kA / 70 kA / 5.60 kA	70 kA / 70 kA / 7.47 kA	70 kA / 70 kA / 3.41 kA
Icu S-pole	Icu S-pole backup			
Tmax. Prot.	Release	2 ms / 4P4T	15 ms / 4P4T	1 ms / 4P4T
Contactor	Thermal relay			
Manufacturer		mg19in1.dug	mg19in1.dug	mg19in1.dug
DISCRIMINATION				
Limit	From			
Thermal	Differential	With / Not Applicable	With / Not Applicable	With / Not Applicable
Logical Discrim.		[ ]	[ ]	[ ]
T1	T2			
IK END				
Ik3 Max / Ik2 Min / If		3736 A / 2186 A / 1252 A	8425 A / 4999 A / 2850 A	2274 A / 1330 A / 763 A
Ik2 Max	Ik1 Min / Ik1 Max	3235.9 A / 1267 A / 1875 A	7296.2 A / 2944 A / 4311 A	1969.3 A / 768 A / 1139 A

LOGO
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Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV COMMON BUSBAR|00SMM11GH011|EDG

PROJECT: 2304

DRAWING:

Folio 5/6

File : PRF Overall Caneco Commen BB.afr

CALCULATION SHEET 3C

NETWORK	
Earthing Syst	TN
Voltage	400 V

DISTRIBUTION	
Upstream N Upstream S	TRANSFORMER-1&2
Ref mark	LV COMMON BUSBAR

	Normal	Standby
I Total	2644.61 A	
I installed	4546.63 A	
I Avail	2346.99 A	
Ik3 max	55050 A	
ΔU	0.51 %	

CIRCUIT

Circuit OK

IN [X] DU [X] IC [X] SC [X] | IN [ ] DU [ ] IC [ ] SC [ ] | IN [ ] DU [ ] IC [ ] SC [ ]

Upstream			LV COMMON BUSBAR								
Ref mark			00EKG20GH001								
Upstream BB	D.origin		LV COMMON BUSBAR_								
Style			Board								
Content	ΔU Regulator		3P+N+PE								
Designation											

CABLES INFORMATIONS/EQUIPM.

GAS CONDITIONING STATION

N°	Consump	K Coincid	Geog.location	1	50kW	1													
Downst BB			Modif.				A												
Cos φ		K Use	UL	0.9		1													
Cos φ Start.		ID/IN	ΔU Start																
η		Supply		1.00	Normal														
Equip. Pole		Type		3P+N															

CABLE

00EKG20GH001

Type				N2XRH (90°C) Dca															
Install. method		Core	Pole	31			Copper		Multi+PE										
Length	1st equipt.		L. Max	215 m				237 m (DU)											
ΔU Max		ΔU Circuit	ΔU Total	4.5 %			3.62 %		4.12 %										
K T°	K prox	K Add	Fs	K Cumul	1.00 (30°C)	0.60		1.00		1.00		0.60							

PROTECTION

		[ ] No check on Thermal stress [X] Icu CB checked			[ ] No check on Thermal stress [ ] Icu CB checked			[ ] No check on Thermal stress [ ] Icu CB checked	
Type	Prot. IC	MCCB	Basis Prot						

RESULTS FIXING

fixed [X]	N°	Phase	fixed [X]	1	50 mm²				fixed [ ]						fixed [ ]				
	N°	Neutral		1	50 mm²														
	N°	PE/PEN		1	50 mm²														
Harm. Rate	Loaded N		HR <= 15%		No														
Protection			NSX250H Micrologic 2.2 4P4T																
Rating	Ir	Im/Isd/IN Fus.	250 A	100 A	300 A														
K on rating.	Tr	Tempo	1	16 s	20 ms														
Magnetic	Li off	IΔn	Electronic																
Downs.Ther.	Li	Δt	On circuit	3000 A															

RESULTS

Cable	Neutral	PE/PEN	4X50		1X50														
Criteria	IB		IMPOS	80.19 A															
S Th.	Iz		38.094 mm²	115.09 A															
Im / Isd Max	Ik Up/Dn		900 A	55.1 kA / 2.9 kA			/								/				
Discrimination	Backup		Total	Without															

IK INFORMATIONS / PROTECTION

Icu / Icm	Icu Backup	Ip	70 kA	70 kA	4.39 kA														
Icu S-pole	Icu S-pole backup																		
Tmax. Prot.	Release		15 ms	4P4T															
Contactor	Thermal relay																		
Manufacturer			mg19in1.dug																

DISCRIMINATION

Limit	From																		
Thermal	Differential		With	Not Applicable															
Logical Discrim.			[ ]				[ ]								[ ]				
T1	T2																		

IK END

Ik3 Max	Ik2 Min	If	2926 A	1727 A	990 A														
Ik2 Max	Ik1 Min	Ik1 Max	2533.9 A	1002 A	1472 A														

LOGO
Entreprise

Ind.	MODIFICATIONS
A	
	EA Caneco

Date: 11/08/2023 Standard: IEC364-17

Calculation sheet 3 circuits LV COMMON BUSBAR|00EKG20GH00

PROJECT: 2304

DRAWING:

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CLIENT

CONTRACTOR

SITE / PROJECT

100 MW PROFILE PARK RECIPROCATING POWER PLANT PROJECT

1	18.03.2024	For Construction	BS	AG	CK
0	16.06.2023	For Review	BS	AG	CK
REV	***DATE***	***DESCRIPTION***	***DONE***	***CHECKED***	***APPROVED***

STATUS		
	FOR INFORMATION	☐
	FOR REVIEW	☐
	FOR APPROVAL	☐
	FOR TENDER	☐
	FOR COORDINATION	☐
	FOR CONSTRUCTION	☒

ISSUE OWNER

YÜKSEL PROJE

SIGN	DATE
	18.03.2024

DOCUMENT NUMBER

PRF-EL-TS-00-YP-0005

DOCUMENT NAME

LIGHTING SYSTEM TECHNICAL SPECIFICATION

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1. INDRODUCTION

1.1. General

Centrica Business Solutions (CBS) is a provider of energy insights, optimisation and on-site generation solutions for its customers, as well as owning and operating energy solutions across the UK, Ireland and North America while continually in the process of identifying new sites for development.

CBS is currently in the process of supporting the development of a circa 100 MW dualfuel generation asset (Athlone Power Project) in Monksland, Athlone and Profile Park, Baldonnel, Ireland. CBS are delivering the project on an Engineering, Procurement and Construction (EPC) basis on behalf of Greener Ideas Ltd.

The Project will consist of five (5) gas reciprocating engines exporting power to the grid via an adjacent 110 kV connection. The Project will use natural gas as its primary fuel with gas oil as a back-up in the event of interruption to the gas supply.

1.2. Scope

The purpose of this Specification is to define the scope and minimum technical requirements for the Lighting System associated with the proposed 100 MW PROFILE PARK RECIPROCATING POWER PLANT PROJECT to be located near Dublin, Ireland.

1.3. Definitions

Project	:100 MW Profile Park Reciprocating Power Plant
Employer	: GIL
Contractor	: GCIL
Shall	: Indicates a mandatory requirement
Should	: Indicates a strong recommendation

1.4. Abbreviations

BS	: British Standarts
CIBSE	: Chartered Institution of Building Services Engineers
RoI	: Return of Investment
LED	: Light Emitting Diode
UV	: Ultraviolet
EN	: European Norm
IEC	: International Electrotechnical Commission

MCB	: Miniature Circuit Breaker
LV	: Low Voltage
MV	: Medium Voltage
IP	: Ingress Protection
V	: Volt
K	: Kelvin
IIC	: The International Code Council
ISO	: International Organization for Standardization

2. CODES AND STANDARTS

As a minimum, the following codes and standards shall be considered:

I.S. 10101:2020	National Rules for Electrical Installations
EN 12464-1	Light and lighting - Lighting of work places - Part 1: Indoor work places
EN 12464-2	Light and lighting - Lighting of work places - Part 2: Outdoor work places
EN 50172	Emergency escape lighting systems
EN 60079	Electrical apparatus for explosive gas atmospheres
EN 15193	Energy performance of buildings - Energy requirements for lighting
EN 1838	Lighting applications- Emergency lighting
EN 50262	Metric cable glands for electrical installations
EN ISO 9001	Quality Management System
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60598	Luminaires General requirements and tests
IEC 60079	Explosive atmospheres
IEC 62612	Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements
IEC 60423	Conduit systems for cable management - Outside diameters of conduits for Electrical installations and threads for conduits and fittings
IEC 60502	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV)
IEC 60669	Switches for household and similar fixed electrical installations
IEC 60228	Conductor of insulated cables
BS EN 8138	Emergency Lighting Applications
BS 5266	Code of practice for the emergency lighting of premises
CIBSE codes	Chartered Institution of Building Services Engineers
ATEX certifications	Hazardous Area Classification
RoI standards	Return of Investment

Equipment shall be supplied in accordance with all applicable European Union Directives. Particular attention should be paid to:

- Safety
- Electromagnetic Compatibility
- Machinery
- CE marking

Therefore, the Supplier shall be responsible for supplying the product with its CE marking and all the corresponding documentation."

The units of measure shall be the SI unit of measure.

3. REFERENCE DOCUMENTS

PRF-EL-DW-00-YP-0007	Outdoor Lighting Layout
PRF-EL-CR-00-YP-0006	Outdoor Lighting Calculation Report
PRF-EL-DW-00-YP-0011	Engine Hall and Electrical Annex Basement Lighting Plan
PRF-EL-DW-01-YP-0004	Engine Hall Lighting System Drawings
PRF-EL-DW-01-YP-0005	Engine Hall Lighting System Details
PRF-EL-CR-01-YP-0001	Engine Hall Lighting System Calculation Report
PRF-EL-DW-02-YP-0004	Electrical Annex Lighting System Drawings
PRF-EL-DW-02-YP-0005	Electrical Annex Lighting System Details
PRF-EL-CR-02-YP-0001	Electrical Annex Lighting System Calculation Report
PRF-EL-DW-05-YP-0003	Workshop & Store Room Lighting System Drawings
PRF-EL-DW-05-YP-0004	Workshop & Store Room Lighting System Details
PRF-EL-CR-05-YP-0001	Workshop & Store Room Lighting System Calculation Report
PRF-EL-DW-17-YP-0003	Tank Farm Building Lighting System Drawings
PRF-EL-DW-17-YP-0004	Tank Farm Building Lighting System Details
PRF-EL-CR-17-YP-0001	Tank Farm Building Lighting System Calculation Report
PRF-EL-DW-38-YP-0003	Security Hut Lighting System Drawings
PRF-EL-DW-38-YP-0004	Security Hut Lighting System Details
PRF-EL-CR-38-YP-0001	Security Hut Lighting System Calculation Report
O129074-P00-EP-XX-SP-E-1014	Lighting and Small Power Specification

4. DESIGN CONDITIONS

Ambient Air Conditions: Statistical Data

Minimum Recorded (°C)	-7.6
Mean Recorded (°C)	10.0
Maximum Recorded (°C)	27.5
Mean Wet Bulb Temperature (°C)	8.6
Maximum Wet Bulb Temperature (°C)	21.5
Minimum Humidity	20%
Average Humidity	82%
Maximum Humidity	100%

Ambient Air Temperature: Design Data

Winterisation Temperature (°C)	-10[1]
Max Ambient Design Temperature (°C)	30[1]
Max Wet Bulb Temperature (°C)	22

Wind, Rainfall and Snowfall Data

Average Wind Velocity km/h (m/s)	18.1 (5.0)
Maximum Wind Velocity km/h (m/s)	74.1 (20.6)
Average Daily Rainfall (mm)	2.1
Maximum Daily Rainfall (mm)	45.4

Site Conditions

Parameter	Value [Ref 1]
Altitude above sea level (m)	69
Maximum wet bulb temperature (°C)	21.5
Minimum ambient air temperature (°C)	-10
Maximum ambient air temperature (°C)	30

Performance Data Reference Conditions

Parameter	Unit	Value
Air inlet temperature (before air inlet filter)	°C	15
Air inlet pressure (before air inlet filter)	mbar	1005[1]
Wet Bulb Temperature	°C	7[2]
Relative Humidity	%	28
Charge Air Temperature Before Cylinder:		
Gas Operation	°C	50
Diesel Operatin	°C	45
Exhaust Gas Bask Pressure	mbar	<=50
Intake Air Pressure Loss	mbar	<=20

5. PROFILE PARK POWER PLANT UNIT LISTS

- ENGINE HALL
- ELECTRICAL ANNEX
- WORKSHOP & STOREROOM
- TANK FARM BUILDING
- SECURITY HUT BUILDING

6. LIGHTING REQUIREMENTS

6.1. General Requirements

All lighting fittings shall be supplied ready for connection to the rated voltage, frequency, and prevailing environmental conditions as specified.

The design of lighting fittings shall be considered so that cleaning requirements are minimized. Lighting fixtures shall be easy to replace, and no loose parts which could be lost, shall be used.

The equipment shall be flame-retardant.

Special tools or equipment for installation and maintenance of the lighting equipment shall be avoided.

All lighting fittings for installation in non-classified areas shall be of the industrial type as required. These types of fittings shall be suitable for "two-pin" advanced and LED technology.

Depending on the application, safety glass covers (resistant to thermal shock) or special polycarbonate diffusers (increased thermal and mechanical resistance) with internal prism with light directing shall be used. The diffuser shall be made in one piece, with excellent UV stabilization against discoloration.

Any angular limitation upon the mounting position of the lighting fittings shall be stated. Floodlights shall be suitable for mounting at any angle.

Normal and emergency lighting shall be provided in all buildings and structures (plant areas, switcrooms, offices etc). All lighting fixtures and associated circuits shall be installed as indicated in the drawings. However, where necessary, the fixtures may be repositioned with the prior approval of the Employer, without affecting light distribution, and avoiding interference with other process equipment or station piping.

Lighting fixtures should generally be arranged to allow cables to be looped from one fixture to another. Junction boxes may be used to minimize the voltage drop in the circuits.

Normal indoor lighting shall not have any special duty. They shall be fed by the Sub-Distribution Panel. Also, all outdoor lighting shall be fed from the Sub-Distribution Panel in the Guard House.

Corrosion resistant LED fixture will be used in all over the plant.

The lighting design shall be provided with appropriate arrangements for maintenance and suitable access. Maintenance factors for all luminaries will be provided as part of the design. Interior lighting will be in accordance with national and local standards.

Normal and emergency lighting are switched on at the same time and must provide the required standard lighting.

Lighting system power supplies consisting of 400/230 Volt, three- phase / five wire, one-phase / three-wire or four-wire shall be acceptable. Four wire cable will be used for only lighting fixture with own battery kit for reference phase application. The choice of voltage and distribution

system for lighting installations shall depend on the area to be supplied and the required lighting load.

The elements of the lighting equipment should be ensured protection against the penetration of dust or humidity, which is characteristic for the environment in question. In a chemically hazardous environment, endurance against chemical effects will be ensured.

6.2. Indoor Lighting

The illumination level and the lay-out of the lighting fixture in the various rooms shall ensure correct and well distributed illumination according to the requirements and considering the equipment layout of the respective room.

All lighting fixtures shall be a light similar to daylight. LED fixtures for use in offices, control rooms, switchrooms, and similar rooms should be wall/ceiling/cable tray mounted.

Operating voltage level shall be between 220V and 240V.

The minimum power factor shall be greater than 0.95.

The color temperature shall be 4000K.

All lighting fixtures shall be supplied and fitted with the appropriate lamping, starters, louvres and covers. The selected lighting fixtures should have at least a guaranteed period before replacement of 5 years or at least 5000 hours of use. Suitable suppliers shall be approved by the Contractor.

Suitable lighting shall be provided on the roof floor of the electrical annex building.

The Atex zone class of the equipment in the battery room shall be Zone 2 IIC Eex d T6.

For technical area Luminaires selection shall have appropriate IP ratings, considering the environmental and hazardous area requirements. For non-tech areas lighting fixtures shall be IP20.

6.3. Outdoor lighting

All outdoor lighting fixtures shall be similar to daylight. The lighting sources shall be LED fixtures.

Operating voltage level shall be between 220V and 240V.

The color temperature shall be 4000K.

All lighting fixtures shall be supplied and fitted with the appropriate lamping, starters, louvres and covers. The selected lighting fixtures should have at least a guaranteed period before replacement of 5 years or at least 5000 hours of use. Suitable suppliers shall be approved by the Contractor.

Outdoor area lighting fixtures shall be installed on poles with a height of 4-6 m or building surface. The poles and all other steel construction elements provided for outdoor lighting shall be hot dip galvanized.

Each outdoor lighting circuit shall be fed with a magnetic circuit breaker and can be triggered by a push button impulse current switch. Each pole shall have embedded junction boxes and MCB. The outdoor lighting circuit shall be 3-phase system and shall be controlled by a single photocell relay switch.

All lighting circuits and lines will have grounding wire.

There shall be wall-mounted lighting fixtures on the exterior doors of the buildings and and shall be controlled by photocell relay switches.

Security cameras around the fence should have night vision capability. In this way, there will be no need for security lighting.

Outdoor luminaires shall be at least IP 65.

6.4. Emergency Lighting

Emergency (task area) lighting shall be provided throughout the plant where required. In order to reach the appropriate emergency lux value in the areas, sufficient number of fixtures should have own battery kit.

When the AC power line is energized, the batteries must be continuously charged and have a rated service capacity of at least 60 minutes when AC power is turned off.

6.5. Illumination Levels

General lighting values throughout the facilities should be designed according to the lighting (lux) values given in the table below. The lighting measurements of all rooms shall be at ground level except for meeting room, control room etc. In places such as meeting rooms and control rooms, the lighting measurements should be at the task/activity level. Illumination levels have been made according to the requirements of the EN 12464-1/ EN 12464-2 standards.

Class	Areas	Lighting Level (Lux)	
		Normal	Emergency
1	Control rooms, Desks	500	As per EN 12464
2	Engine Hall	200	As per EN 12464
3	Generator Room	200	As per EN 12464
4	MV Rooms	200	As per EN 12464
5	LV Rooms	200	As per EN 12464
6	Electrical Rooms	200	As per EN 12464

7	Transformer Area	200	As per EN 12464
8	Battery Room	200	As per EN 12464
9	Server Room	200	As per EN 12464
10	Gallery Room	100	As per EN 12464
11	Corridors and Stairwells	100	As per EN 12464
12	Offices, Desks	500	As per EN 12464
13	Meeting Room	500	As per EN 12464
14	Toilets, WC	200	As per EN 12464
15	Rest&Locker Room	200	As per EN 12464
16	Laboratories	500	As per EN 12464
17	First Aid	500	As per EN 12464
18	Workshop	300	As per EN 12464
19	Storehouse	100	As per EN 12464
20	Storage Room	200	As per EN 12464
21	Entrance Room	100	As per EN 12464
22	Changing Area and Facilities	200	As per EN 12464
23	Compressor Room	200	As per EN 12464
24	Road Lighting	10	NA
25	Car Parking	20	NA
26	General Outdoor Lighting	10	NA

6.6. Control of Lighting System

All normal indoor lighting in industrial areas shall be controlled by wall mounted pushbuttons located indoors, near the entrance doors.

Outdoor lighting shall be controlled by photocell relay switches.

All outdoor lighting shall be remotely controlled from guard house or controlled from each dedicated panel and indoor lighting shall be controlled from each dedicated panel.

In rooms with multiple exits, the lighting shall be controlled by all wall mounted pushbuttons located near the entrance doors.

For technical area lighting switches selection shall have appropriate IP ratings, considering the environmental and hazardous area requirements. In non-technical areas, (Office, Rest&Locker Room etc.) IP20 shall be selected.

6.7. Junction Boxes

Junction boxes shall be installed at the locations shown in the drawings. Junction boxes shall be made of PVC with appropriate ingress protection (IP) levels as per installation type. For indoor and outdoor areas junction boxes shall have appropriate IP ratings, considering the environmental and hazardous area requirements.

The boxes shall be securely mounted and easily accessible.

6.8. Electrical Protection

All electrical equipment shall be protected against direct contact, indirect contact, over voltage, over current and short circuit in normal service and in case of a fault in accordance with the IEC.

Installations up to 1000 V shall be protected by use of protective multiple earthing and (neutral conductor and separate protective conductor). The connection between neutral conductor and the protective conductor is allowed in the main LV distribution boards only. Electric installations in housing compounds shall be protected by means of faulty current switches.

6.9. Cable Requirements

The power cables shall generally comply with the requirements of IEC 60502, IEC 60228, and IEC 60183. The indoor lighting cables shall have stranded copper conductors with XLPE insulation, armoured cable, and low smoke zero halogen. Some lighting circuit cable shall only be installed outdoor (they will not be accessed in building). They will be PVC insulated, armoured, and UV radiation resistant (for only outdoor cable). The conductor's cross section shall be adequate for carrying the prospective faults current. Thus, sizing calculations will be done to determine the cable size of each circuit.

6.10. Cable Gland

Cable glands shall be of the compression type with screwed ISO metric threads according to EN 50262. For metal enclosures, the glands shall be made of metallic type. For enclosures of nonconductive materials, the glands shall be of non-conductive materials.

Cable glands shall be selected according to related cable dimensions.

7. TESTS

7.1. Workshop Tests

All electrical equipment and systems shall be tested completely and detailed in Contractor's workshop. All tests required by the codes and standards as well as all manufactures tests need to be performed.

Detailed test protocols of all tests performed should be submitted prior to installation.

7.2. Site Tests

The site tests include,

- pre-installation testing,
- pre-commissioning (including "Loop Testing"),
- commissioning with test on completion.

With the tests the proper and reliable function of the complete scope according to the requirements shall be proven.