Ballard Power Systems Europe A/S
Majsmarken 1
9500 Hobro
Denmark

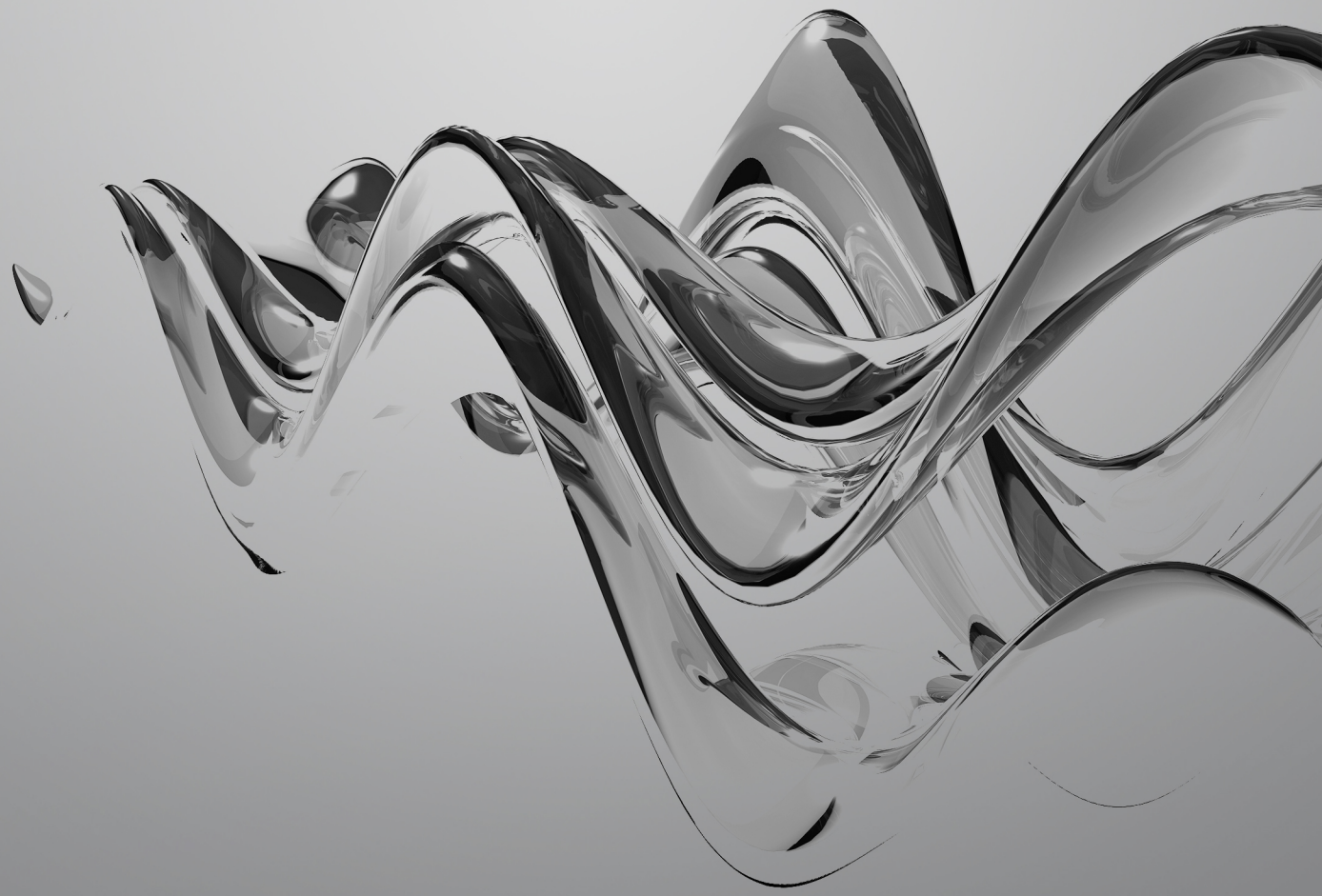
Revision history		
Rev.	**Date.**	**Description**
001	16/10/2023	First Issue

Document Title:	**BLPH Project - Specials: Harmonic Study Report**
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Purchaser Job:	K559-2254
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Code:	E99
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Customer:	CrossWind C.V., Rotterdam, The Netherlands

ENGINEERING
TOMORROW

MyDrive® Harmonics Report

1MW Grid converter



Project name: 1MW Grid converter

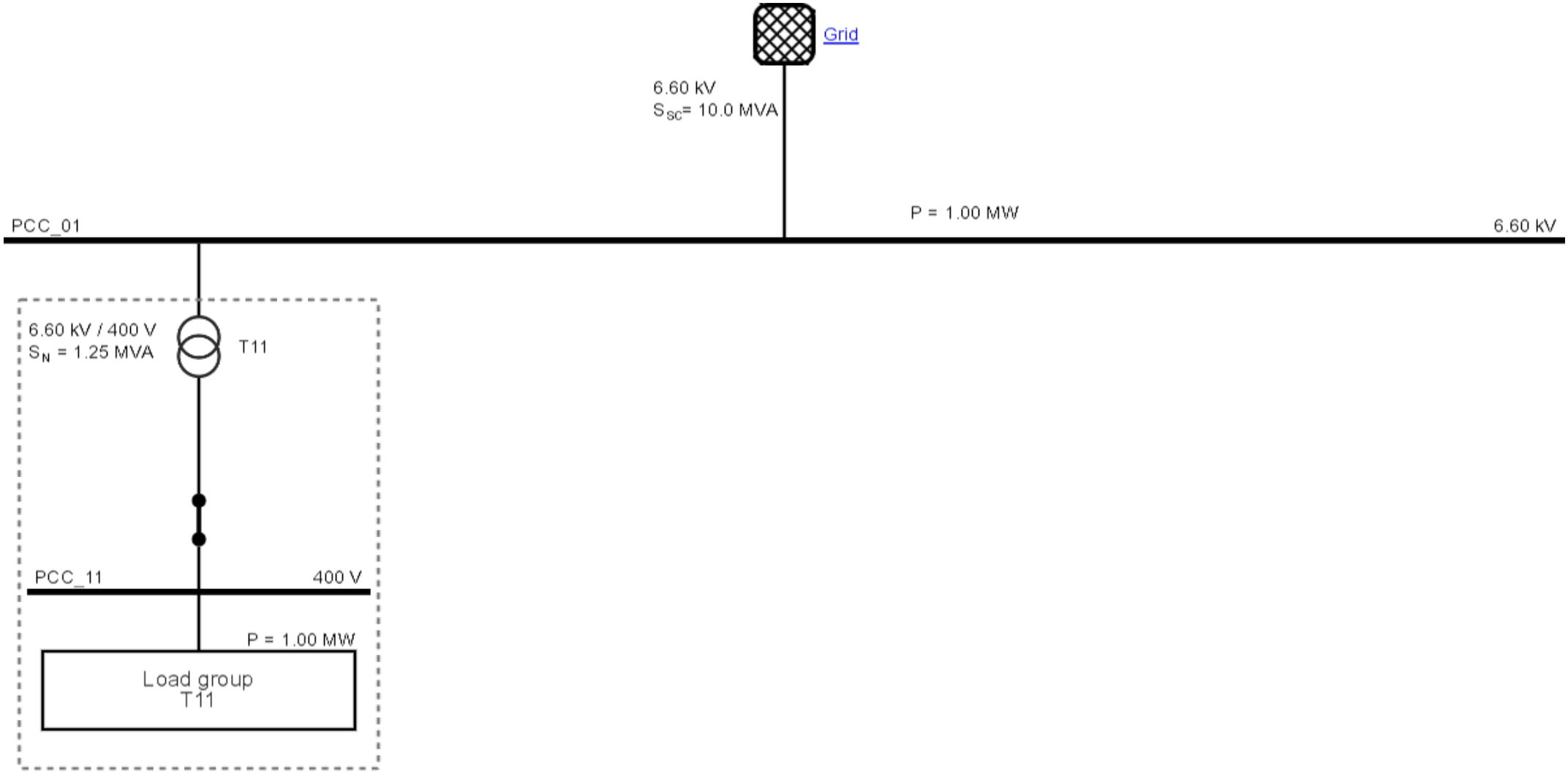
Units	Metric
Frequency	50
Created by	Richard Sørensen
Customer	Ballard
Version	v.1
Date	2023-10-16

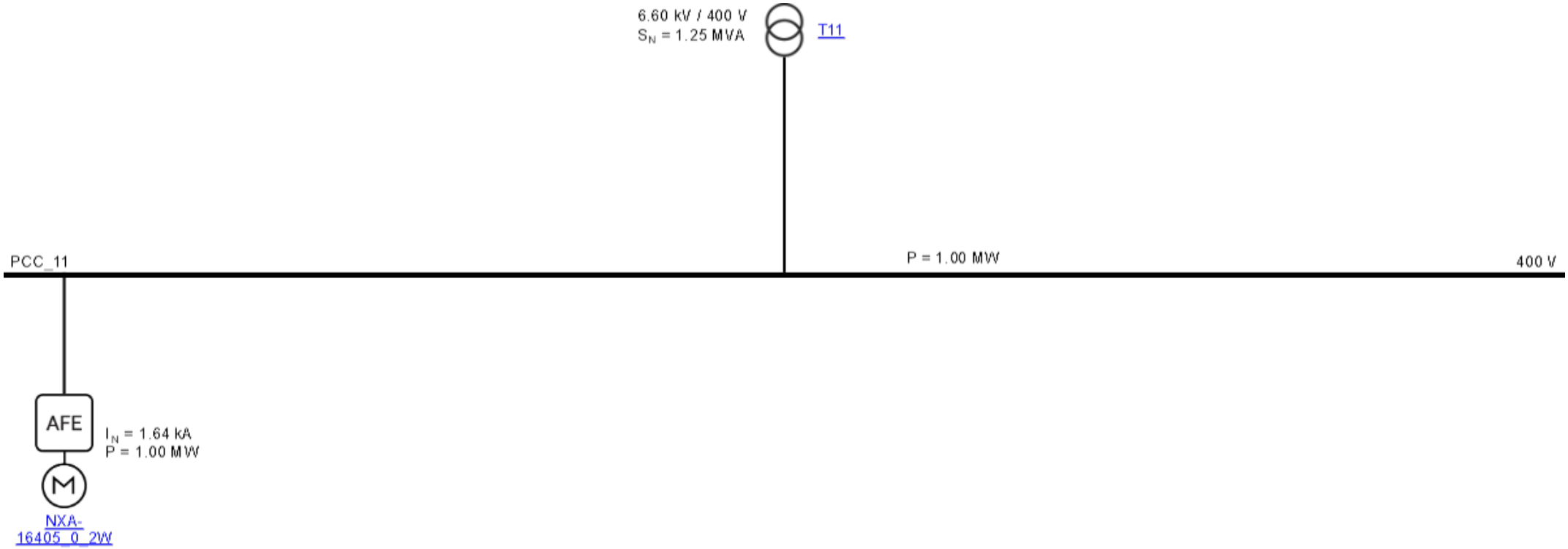
System (1)

Calculation overview

T11 primary side

Voltage THD	0.96 %
Current THD	1.38 %


Grid
6.60 kV
S_{sc}= 10.0 MVA
P = 1.00 MW
PCC_01
6.60 kV
6.60 kV / 400 V
S_N = 1.25 MVA
T11
PCC_11
400 V
P = 1.00 MW
Load group
T11


6.60 kV / 400 V
S_N = 1.25 MVA
T11
PCC_11
P = 1.00 MW
400 V
AFE
I_N = 1.64 kA
P = 1.00 MW
NXA-16405_0_2W

System components

Grid (Grid)

Bus voltage	6.6 kV
Short circuit power	10 MVA
Short circuit X/R ratio	10
Voltage predistortion	0 %
Demand current	80 %

Two winding transformer (T11)

Primary voltage	6.6 kV
Secondary voltage	400 V
Nominal power	1250 kVA
Short circuit voltage	6 %
Ohmic part of short circuit voltage	1.5 %
Primary demand current	80 %
Secondary demand current	80 %

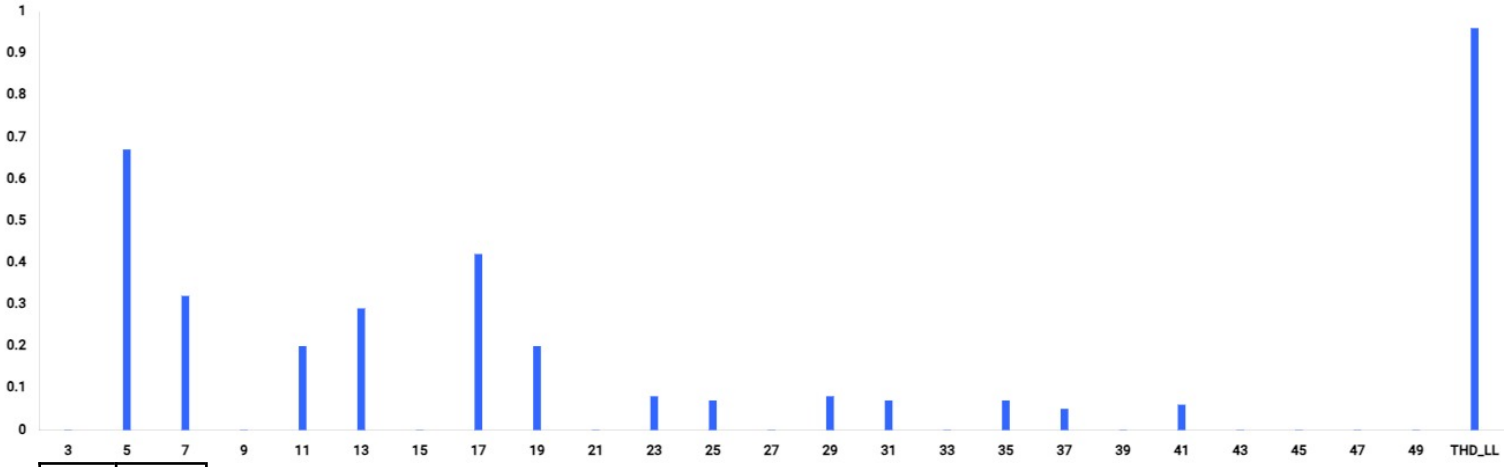
Load group T11

Active front-end (NXA-16405_0_2W)

Quantity	1
Model	NXA-16405_0_2W
Nominal input current	1640 A
DC load power	1000 kW

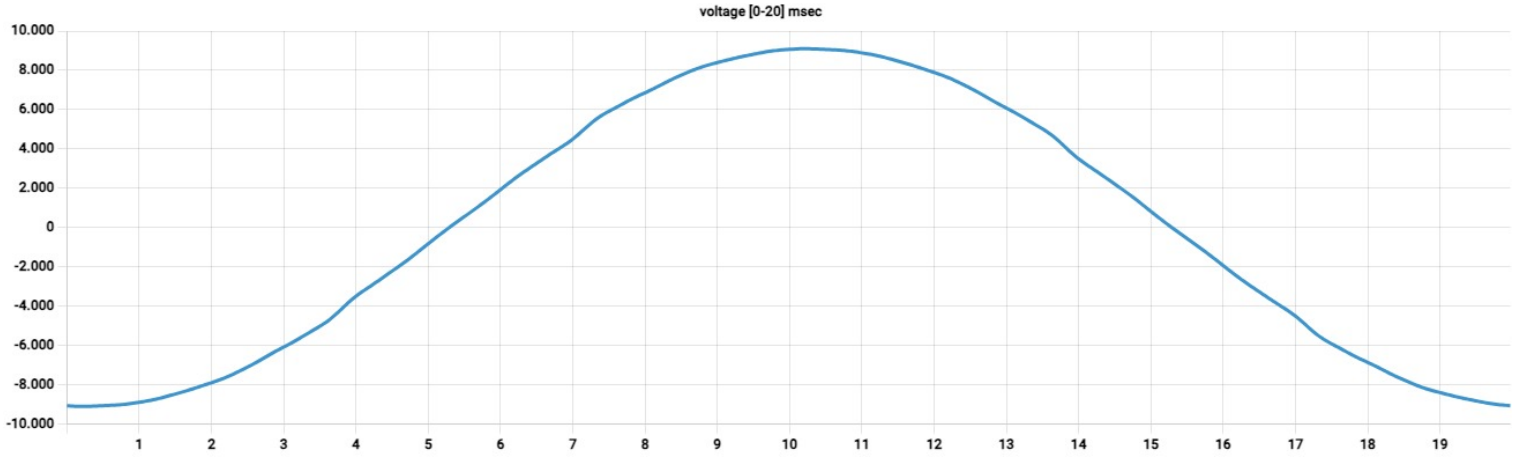
T11 primary side

Volt in % of fundamental



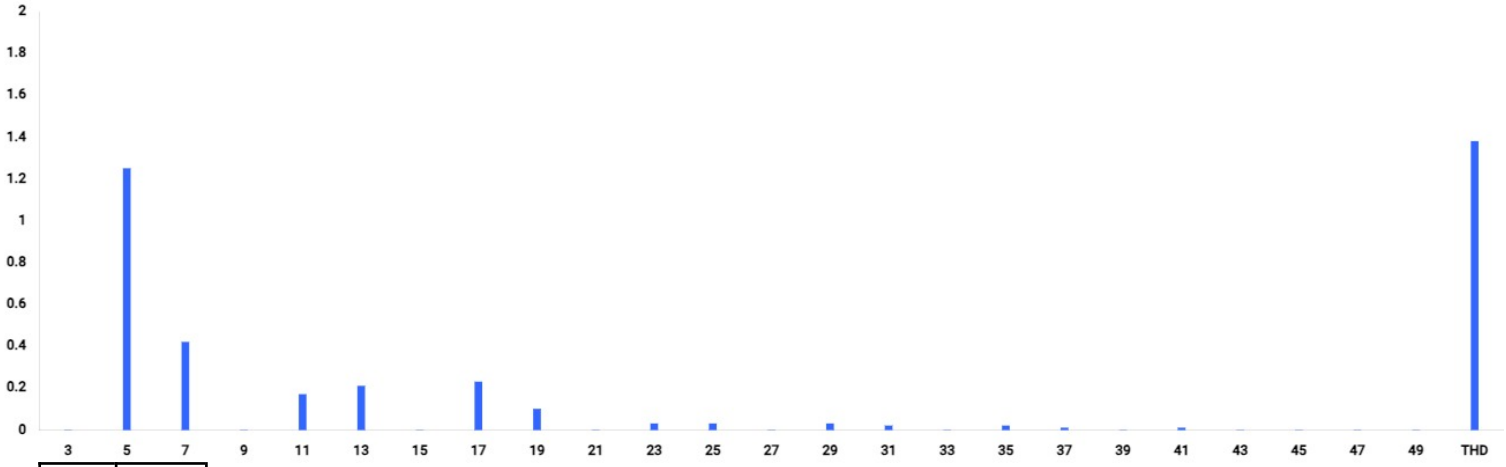
Key	Value
3	0.00
5	0.67
7	0.32
9	0.00
11	0.20
13	0.29
15	0.00
17	0.42
19	0.20
21	0.00
23	0.08
25	0.07
27	0.00
29	0.08
31	0.07
33	0.00
35	0.07
37	0.05
39	0.00
41	0.06
43	0.00
45	0.00
47	0.00
49	0.00
THD	0.96

U_{rms}=3728.22 THD_u=0.96 % (U_{1rms}= 3728.04 V)


voltage [0-20] msec
10.000
8.000
6.000
4.000
2.000
0
-2.000
-4.000
-6.000
-8.000
-10.000
1
2
3
4
5
6
7
8
9
10
11
12
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14
15
16
17
18
19

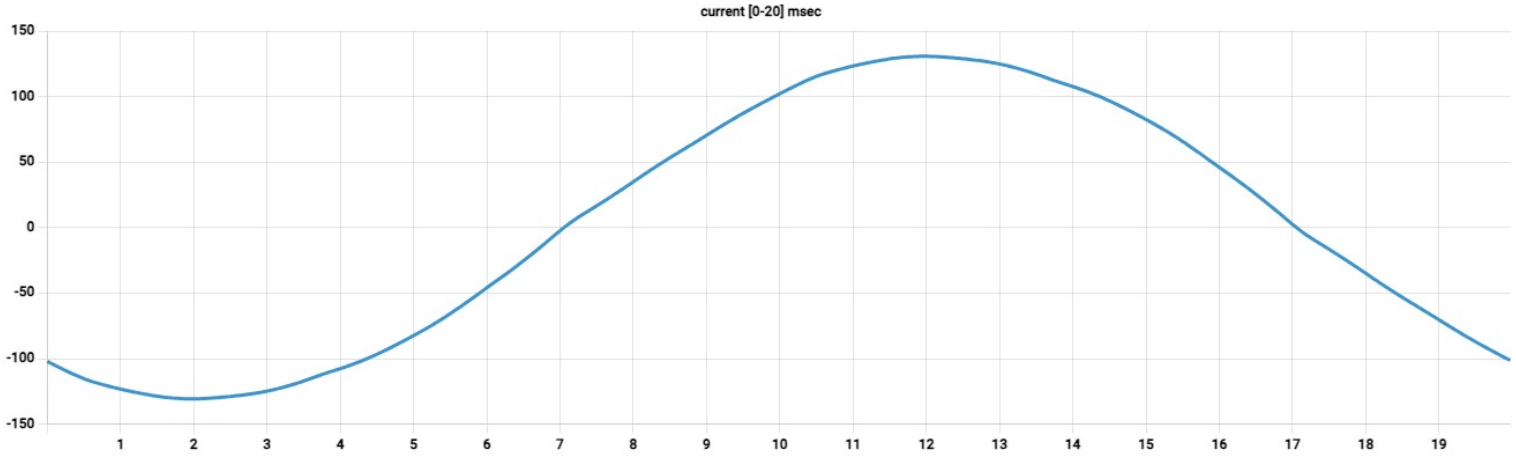
T11 primary side

Current in % of fundamental



Key	Value
3	0.00
5	1.25
7	0.42
9	0.00
11	0.17
13	0.21
15	0.00
17	0.23
19	0.10
21	0.00
23	0.03
25	0.03
27	0.00
29	0.03
31	0.02
33	0.00
35	0.02
37	0.01
39	0.00
41	0.01
43	0.00
45	0.00
47	0.00
49	0.00
THD	1.38

I_{rms}= 92.24THD_i= 1.38 %(I_{1rms}= 92.23 A)



Calculated values at T11 primary side

Displacement Power Factor	1
Fundamental Current RMS	92.23 A
Demand Current RMS	87.48 A
Short Circuit Current/Demand Current RMS ratio	10
Total Harmonic Current RMS	1.27 A
Total Current RMS	92.24 A
Average Active Power	1030.25 kW
Average Apparent Power	1031.7 kVA
Total Harmonic Current Distortion	1.38 %
Total Harmonic Voltage Distortion (Phase)	0.96 %
Total Harmonic Voltage Distortion (Line-to-Line)	0.96 %
True Power Factor (lambda)	1
Fundamental Voltage RMS (Phase)	3728.04 V
Fundamental Voltage RMS (Line-to-Line)	6457.16 V
Total Harmonic Voltage RMS (Phase)	35.92 V
Total Voltage RMS (Phase)	3728.22 V
Total Voltage RMS (Line-to-Line)	6457.46 V
Crest Factor	1.42

The compilation of information in this report (the "Information") relies upon the accuracy of the data entered by the user of MyDrive® Harmonics and of the actual operating and environmental conditions. Several outside factors can influence the harmonics measured on a power system, including other peripheral equipment within the plant and other neighbouring plants. This can include, but is not limited to, frequency converters, variable loads and/or other equipment. The calculated current and voltage harmonics shown may contain inaccuracies and is for estimation purposes only. It is provided "AS IS" without warranty of any kind and does not constitute a guarantee of that the information is complete, current, or correct, and Danfoss accepts no responsibility for unsuitable or inaccurate material that may be encountered. The use of this report does not relieve the user of any obligation or duty that might arise under any legislation covering the activities to which this document has been or is to be applied.

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