NORTHLAND POWER

# Burk's Falls East Solar Project

## Noise Assessment Study Report

August 15, 2011

Project Report

August 15, 2011

**Northland Power Inc.**
**Burks Falls East Solar Project**

# Noise Assessment Study Report

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# Executive Summary

This report presents the results of the noise assessment study required for Solar Facilities under Regulation 359/09, as part of the Renewable Energy Approval (REA) Process.

Northland Power Solar Burks Falls East L.P. (hereinafter referred to as "Northland") has retained Hatch Ltd. (Hatch) to prepare a Noise Assessment Study for the Northland Power Burks Falls East Solar-Photovoltaic facility (hereinafter referred to as the "Project"), with an installed capacity of 10 MW (AC). The Project will be located on approximately 80 hectares (ha) of land on Chetwynd Road in the single tier Municipality of Armour Township, Ontario.

This Noise Assessment Study has been prepared based on the document entitled "Basic Comprehensive Certificates of Approval (Air) – User Guide" by the Ontario Ministry of the Environment (MOE). The sound pressure levels at the points of reception (POR) have been estimated using ISO 9613-2, implemented in the CADNA-A computer code. The performance limits used for verification of compliance correspond to the values for rural areas (45 dBA for day time, 40 dBA for night time). The results presented in this report are based on the best available information at this time. It is the intention that, in the detailed engineering phase of the project, certified noise data based on final plans and designs will confirm the conclusions of this noise study.

Based on the results obtained in this study, we believe that the sound pressure levels at POR will not exceed MOE requirements for rural areas. Any noise issues that might arise during commissioning will be manageable and can be resolved by implementing typical remediation measures as described in this report. It is our intention to verify by field measurements taken on completion of installation and during commissioning that the noise levels at the POR are within the limits set by the MOE.

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# 1. Introduction

This report presents the results of the noise assessment study required for Solar Facilities under Regulation 359/09, as part of the Renewable Energy Approval (REA) Process.

Northland Power Solar Burks Falls East L.P. (hereinafter referred to as "Northland") retained Hatch Ltd. (Hatch) to prepare a Noise Assessment Study for the Northland Power Burks Falls East Solar-Photovoltaic (Solar PV) facility (hereinafter referred to as the "Project"), with an installed capacity of 10 MW (AC). The Project will be located on Chetwynd Road in the single tier Municipality of Armour Township, Ontario.

The report was prepared according to publication "Basic Comprehensive Certificates of Approval (Air) – User Guide, 2004" by the Ministry of the Environment (MOE), and includes a general description of the facility, sources and points of reception (POR), assessment of compliance, as well as all the supporting information relevant to the Project.

# 2. Facility Description

The Project will utilize photovoltaic (PV) panels installed on fixed racking structures, mounted on the ground. The PV panels generate DC electricity, which is converted to low-voltage AC electricity by clusters of inverters. The AC power is transformed to 27.6 kV by a transformer located at each inverter cluster. The 27.6-kV power is brought to a single central substation transformer to be stepped up to 44 kV for transmission away from the site.

Since the panels will be ground-mounted and the total nameplate capacity is over 10 kW, the Project is considered to be a Class 3 Solar Facility, according to the classification presented in Regulation 359/09.

A general description of the facility is provided in Table 2.1.

**Table 2.1 General Project Description**

| | |
|---|---|
| Project Description | Ground-mounted Solar PV, Class 3 |
| System Nameplate Capacity | 10 MW AC/10 MVA |
| Local Distribution Company | Hydro One Networks Inc. |
| Approximate Coordinates | Latitude 45°36'39.37"N, Longitude 79°21'16.01"W |

## 2.1 Site Location

The property consists of agricultural land totalling approximately 80 hectares, located about 4 km southeast of Burk's Falls town, in the single tier Municipality of Armour Township, Ontario. Figure 2.1 shows the geographical location of the Project. The detailed scaled Zoning Designation Plan and Area Location Plan drawings are included in Appendix A. A total of 92 receptors are located within 2.0 km from the substation.

For modelling purposes, the vegetation that blocks some of the POR from the sources has not been incorporated, so the predicted sound levels at these locations may be slightly over predicted.

## 2.2 Acoustical Environment

The Project will be surrounded by farmland and forested areas to the north and south. The background noise levels are expected to be typical of rural areas classified as a Class 3 based on Publication NPC-232 by the MOE. Some traffic noise is expected from Chetwynd Road (north of the Project) mainly during day hours. There are no airports within 5 km distance from the Project area and there are no large industrial facilities nearby. The closest town, Burk's Falls, is located about 4 km northwest of the proposed location.

## 2.3 Life of Project

The expected life of the Project is 30 years. The manufacturer's warranty on the PV modules is 25 years and the expected life of solar power plants of this type is 35 to 40 years.

## 2.4 Operating Hours

Solar PV facilities produce electricity during the day hours, when the sun's rays are collected by the panels. After sunset, the plant will not receive solar radiation to generate any electricity. Under these conditions, the inverters will not produce noise and the transformers will be energized, but not in operation (no fans).

## 2.5 Approach to the Study

The sound pressure levels at the POR were predicted using procedures from ISO 9613-2, which is a widely used standard for the evaluation of noise impact in environmental assessments. The sound power levels were estimated from the National Electrical Manufacturers Association (NEMA) standards for the substation transformer. The inverter manufacturer provided the noise data for the inverter clusters, which include the medium-voltage transformer. The software package CADNA-A, which implements ISO 9613-2, was used to predict the noise levels at the closest POR. This numerical modelling software is able to handle the sound sources present in the Project, as well as considering atmospheric and ground attenuation. The height contours for the site were taken from the Ontario Base Maps (OBM).

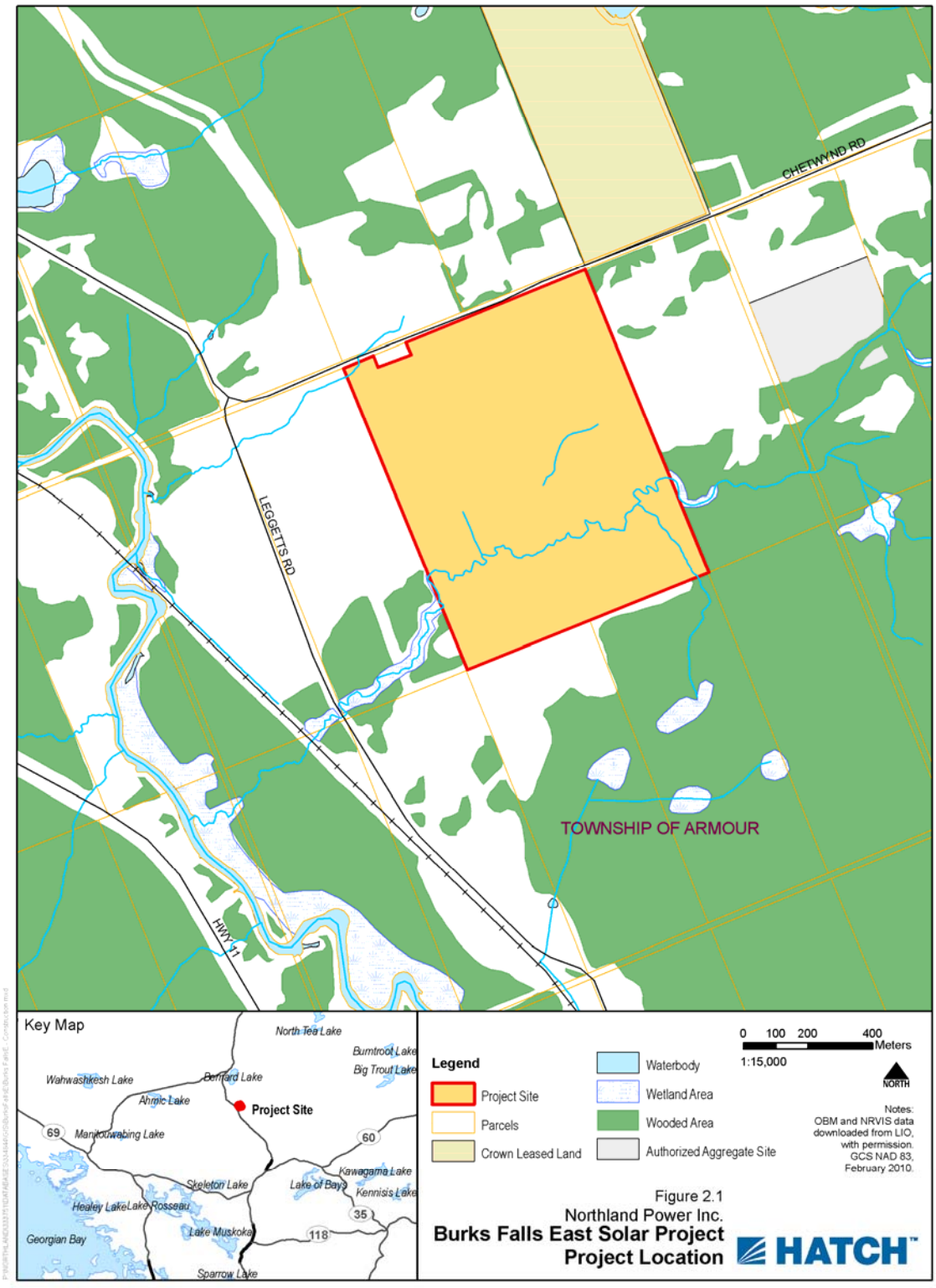


**Figure 2.1 Project Location**

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# 3. Noise Source Summary

The main sources of noise from the Project will be the step-up transformer, located at the substation, and eight inverter clusters which also include medium-voltage transformers. Cogeneration Associates Limited provided a layout of the solar PV facility (see Figure A3, Appendix A). The coordinates of each source are presented in Appendix B.

## 3.1 Substation

At this point, it is anticipated that the step-up power transformer located in the substation will have a capacity of 10 MVA. In addition, the transformer will be oil-filled with air-forced cooling (ONAF). For the purpose of evaluating the potential noise impacts of the transformer, the sound power level was estimated using data from NEMA TR1-1993 (2000). This standard provides maximum sound level values for transformers, and manufacturers routinely meet this specification. Hence, the results based on NEMA slightly overestimate the impact on POR. The NEMA levels were then converted into frequency spectra using empirical correlations for transformer noise (Harris, 1998).

Power transformers are considered by the MOE to be tonal noise sources. A 5-dBA penalty will be added to the sound power spectrum, as recommended by Publication NPC-104, "Sound Level Adjustments," for tonality. Table B2, Appendix B, shows the frequency spectrum used to model the substation transformer.

## 3.2 Inverter Clusters (Pads)

At this stage of the Project, Northland is planning to use inverter clusters manufactured by SMA. Each Sunny Central SC1250MV unit comprises two 630HE inverters (630 kW), contained in an e-house or enclosure (see Appendix B). The main sources of noise are the cooling/ventilation fans for the inverters, the electrical components on the inverters and the medium-voltage transformer.

The installed capacity of each inverter cluster is 1.25 MW, as shown in Table 3.1. SMA provided third-octave noise data for the inverter cluster unit, which includes the medium-voltage transformer (see Appendix B). A 5-dBA penalty was added to the frequency spectrum, as stipulated in Publication NPC-104, "Sound Level Adjustments," to allow for tonality. The frequency spectra used for the inverter clusters and medium-voltage transformers is shown in Table B2, Appendix B.

The "barrier effect" provided by the solar panels surrounding the inverter clusters has not been modelled, which means that the sound pressure levels predicted at the POR can be higher than would be the case if the barrier was accounted for. Note also that, at night time, the facility will not operate. Under these conditions, the inverters do not produce noise. The medium-voltage transformers are energized and make some magnetostrictive noise at a reduced level, but no cooling fans are in operation. Since the noise data provided by SMA combines both inverter and transformer, the CADNA-A model will assume that the cluster will be operating 24 hours.

## 3.3 Noise Summary Table

A summary of the sound sources described above, including sound level, characteristics and potential noise control measures, is presented in Table 3.1.

**Table 3.1 Noise Source Summary**

| Source ID | Source Description | Overall Sound Power Level (dBA) | Source Location | Sound Characteristics | Noise Control Measures |
|---|---|---|---|---|---|
| 1 | Subs. Transformer: 10 MVA | 93.3 | O | S-T | B |
| 2 | Inverter Cluster #1: 1.25 MW | 102.2 | O | S-T | U |
| 3 | Inverter Cluster #2: 1.25 MW | 102.2 | O | S-T | U |
| 4 | Inverter Cluster #3: 1.25 MW | 102.2 | O | S-T | E,S |
| 5 | Inverter Cluster #4: 1.25 MW | 102.2 | O | S-T | E,S |
| 6 | Inverter Cluster #5: 1.25 MW | 102.2 | O | S-T | E,S |
| 7 | Inverter Cluster #6: 1.25 MW | 102.2 | O | S-T | E,S |
| 8 | Inverter Cluster #7: 1.25 MW | 102.2 | O | S-T | E,S |
| 9 | Inverter Cluster #8: 1.25 MW | 102.2 | O | S-T | E,S |

**Notes:**
1. A 5-dBA penalty is included in this table.
2. Location: Inside building (I), Outside building (O).
3. Sound Characteristics: Steady (S), Tonal (T), Impulsive (I), Quasi-Steady Impulsive (QSI).
4. Noise Control: Silencer (S), Acoustic lining (A), Barrier (B), Lagging (L), Enclosure (E), Other (O), Uncontrolled (U).

# 4. Point of Reception Summary

The POR used in this study have been taken from the OBM for the surrounding area. Some additional receptors (residential buildings) were added based on satellite imagery from Google Earth Pro (2007) and consultation with individuals familiar with the Project location. The total number of POR within a 1-km radius from the substation is 29 (see Figure A2). Three of these receptors have been chosen as representative for evaluating the noise impact from the facility, and are presented in Table 4.1 (see Figure A2 in Appendix A). The complete set of results is provided in Appendix C, including a noise map from CADNA-A. For this study, the elevation above ground of the POR is 4.5 m.

**Table 4.1 Point of Reception Noise Impact (Day Time)**

| Source ID | POR 1 | | POR 5 | | POR 11 | |
|---|---|---|---|---|---|---|
| | Distance (m) | $L_{eq}$ Sound Level (dBA) | Distance (m) | $L_{eq}$ Sound Level (dBA) | Distance (m) | $L_{eq}$ Sound Level (dBA) |
| 1 | 139 | 34.0 | 245 | 30.0 | 705 | 20.9 |
| 2 | 627 | 33.7 | 563 | 30 | 548 | 35.1 |
| 3 | 540 | 31.6 | 424 | 33.8 | 459 | 32.8 |
| 4 | 508 | 23.5 | 306 | 28.3 | 404 | 25.1 |
| 5 | 269 | 28.7 | 197 | 32.1 | 580 | 19.8 |
| 6 | 287 | 28.8 | 358 | 25.7 | 663 | 17.0 |
| 7 | 470 | 22.1 | 202 | 31.9 | 375 | 25.8 |
| 8 | 391 | 22.8 | 655 | 20.6 | 974 | 13.2 |
| 9 | 237 | 26.9 | 503 | 22.0 | 871 | 14.4 |

# 5. Impact Assessment

The purpose of the acoustic assessment report is to demonstrate that the facility is in compliance with the noise performance limits. The Project will be located in a Class 3 Area, based on the classification defined in Publication NPC-232 by the MOE. Class 3 area means a rural area with an acoustical environment that is dominated by natural sounds, having little or no traffic, such as an agricultural area.

Table 5.1 shows the performance limits set by the MOE for Class 3 Areas, according to Publication NPC-232.

**Table 5.1 Performance Limits (One-Hour $L_{eq}$) by Time of Day for Class 3 Areas**

| Time of Day | One Hour $L_{eq}$ (dBA) Class 3 Area |
|---|---|
| 07:00 to 19:00 | 45 |
| 19:00 to 23:00 | 40 |
| 23:00 to 07:00 | 40 |

The facility will be operating during the day hours, that is, before 19:00 during most of the year. However, in the summer months, the sun may shine until past 21:00, although the inverters will be well below 100% loading conditions. This means that during the summer the power plant will be operating at the time the applicable performance limit changes from 45 dBA to 40 dBA. At night time, the transformer is still energized, so the resultant sound pressure levels should be compared to the lower limit of 40 dBA. Note that since the frequency spectrum provided by the manufacturer includes the inverters and medium-voltage transformer at 100% loading conditions, it is assumed that both devices are operating during 24 hours. In reality, the only sound that could be perceived at night time is the magnetostrictive noise from the transformers.

For this study, the overall ground attenuation coefficient was assumed to be 0.7, which is commonly used by the MOE for evaluating the noise impact of other renewable energy facilities.

## 5.1 Compliance With Performance Limits

Table 5.2 presents the predicted sound pressure levels for the representative POR. The complete set of results is included in Appendix C. Appendix D includes a detailed calculation log of the representative POR with the highest Sound Pressure Level.

**Table 5.2 Acoustic Assessment Summary (Day and Night Time)**

| POR ID | POR Description | Sound Level at POR ($L_{eq}$) Day/Night* (dBA) | Verified by Acoustic Audit (Yes/No) | Performance Limit ($L_{eq}$) Day/Night (dBA) | Compliance With Performance Limit (Yes/No) |
|---|---|---|---|---|---|
| 1 | House – Northwest | 39.5/39.5 | No | 45.0/40.0 | Yes |
| 5 | House – North | 39.5/39.5 | No | 45.0/40.0 | Yes |
| 11 | House – Northeast | 37.9/37.9 | No | 45.0/40.0 | Yes |

* The night time sound levels assume operation 24 hours a day, in reality the only sound that is emitted at night time is the magnetostrictive noise from the transformers.

The results show that all POR are compliant with MOE guidelines based on the performance limits.

# 6. Mitigation Measures

Mitigation for operation of the facility has been modelled and shown to be feasible in the form of acoustic barriers for the substation, and enclosures with acoustical louvers for six of the inverters. The proposed considerations for these devices must be revisited when the specific dimensions and configuration of the enclosure are made available.

The minimum construction requirements for the proposed noise barriers located next to the substation are presented in Table 6.1, as well as the approximate dimensions. Figure B1 and Table B3 in Appendix B present a diagram of the barrier design and the absorption coefficients used in the noise model. The noise reduction and sound transmission characteristics of the acoustical louvers considered in this report are presented in Table B4, Appendix B.

**Table 6.1 Barrier Description**

| Mitigation ID | Location | Construction Requirements | Approximate Height (m) | Approximate Length (m) | Distance From Source (m) |
|---|---|---|---|---|---|
| BarrierS_1 | See Figure B1 | 20 kg/m$^2$, continuous | 4.0 | 5.0 | 1.5 |
| BarrierS_2 | See Figure B1 | 20 kg/m$^2$, continuous | 4.0 | 5.0 | 1.5 |
| BarrierS_3 | See Figure B1 | 20 kg/m$^2$, continuous | 4.0 | 5.0 | 1.5 |

While analysis indicates that no additional mitigation will be required, the noise levels will be verified at the closest POR after the Project goes into service. If measurements indicate a need to further reduce sound levels to satisfy MOE criteria, additional mitigation measures will be taken at the sources.

# 7. Conclusions and Recommendations

For the Burks Falls East Solar-Photovoltaic facility, the sound pressure levels at the POR have been estimated using the CADNA-A model, based on ISO 9613-2. The performance limits used for comparison correspond to Class 3 areas, with 45 dBA during day time (7:00 a.m. to 7:00 p.m.) and 40 dBA during night time. Mitigation for operation of the Project has been modelled and shown to be feasible.

Based on the results obtained in this study, it is concluded that the sound pressure levels at the POR will be below MOE requirements for Class 3 areas at night time (40 dBA) and day time (45 dBA).

# 8. References

Harris, C. 1998. Acoustical Measurements and Noise Control, Third Edition. Acoustical Society of America.

IEEE. 2006. C57.12.90-2006: Standard Test Code for Liquid-Immersed, Power and Regulating Transformers. pp 64 to 76.

Ministry of the Environment (MOE). 1997. Noise Assessment Criteria in Land Use Planning. Publication LU-131. Ontario Ministry of the Environment. 12 pp + Annex.

MOE. 1995. Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban). Publication NPC-205. Ontario Ministry of the Environment. 6 pp + Annex.

MOE. 1995. Sound Level Limits for Stationary Sources in Class 3 Areas (Rural). Publication NPC-232. Ontario Ministry of the Environment. 8 pp + Annex.

NEMA. 2000. Standards Publication No. TR 1-1993 (R2000): Transformers, Regulators and Reactors. National Electrical Manufacturers Association. 31 pp.

ISO 1996-1 Description, Measurement and Assessment of Environmental Noise – Part 1: Basic Quantities and Assessment Procedures.

# Appendix A

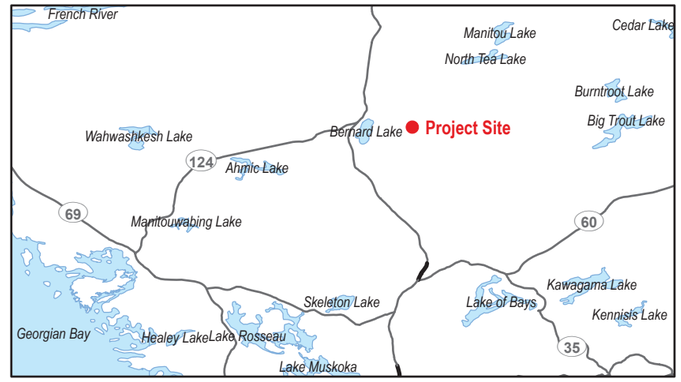
## Land-Use Zoning Designation Plan, Area Location Plan and Plant Layout

627500
628000
628500
629000

5052500
5052000
5051500
5051000

CHETWYND RD
LEGGETTS RD

RU
MX
W




Key Map

Zones

| | |
|---|---|
| RU | Rural |
| MX | Extractive Industrial |
| W | Wetlands Protection |

Project Site

N

0 100 200 400 Metres

1:8,000

Source:
Zoning By Law for Armour Township, Schedule A2

Northland Power Inc.
Burk's Falls East Solar Energy Project

**Land Use**
**Zoning Designation Plan**

Figure A.1

HATCH™

627500 628000 628500 629000

5053000 5052500 5052000 5051500

POR 5

POR 1

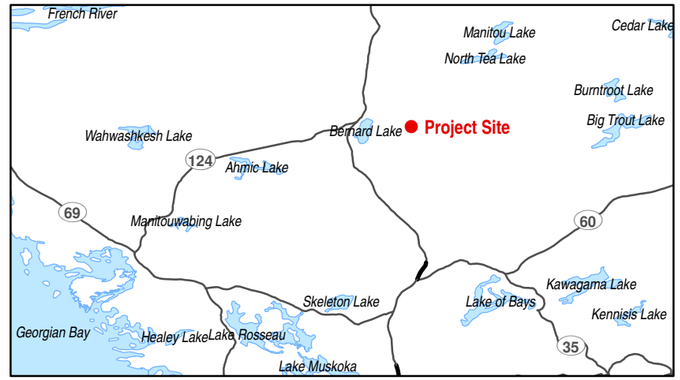
POR 11

CHETWYND RD

LEGGETTS RD

Tributary of Magnetawan River

Tributary of Magnetawan River




Key Map

**Legend**

- Representative POR
- Building
- Roads
- Rail
- Watercourse
- Topographic Contour (5m interval)
- Project Site
- Parcels
- Authorized Aggregate Site
- Crown Leased Land
- Waterbody
- Unevaluated Wetland
- Wooded Area

0 75 150 300 Metres

NORTH

1:8,000

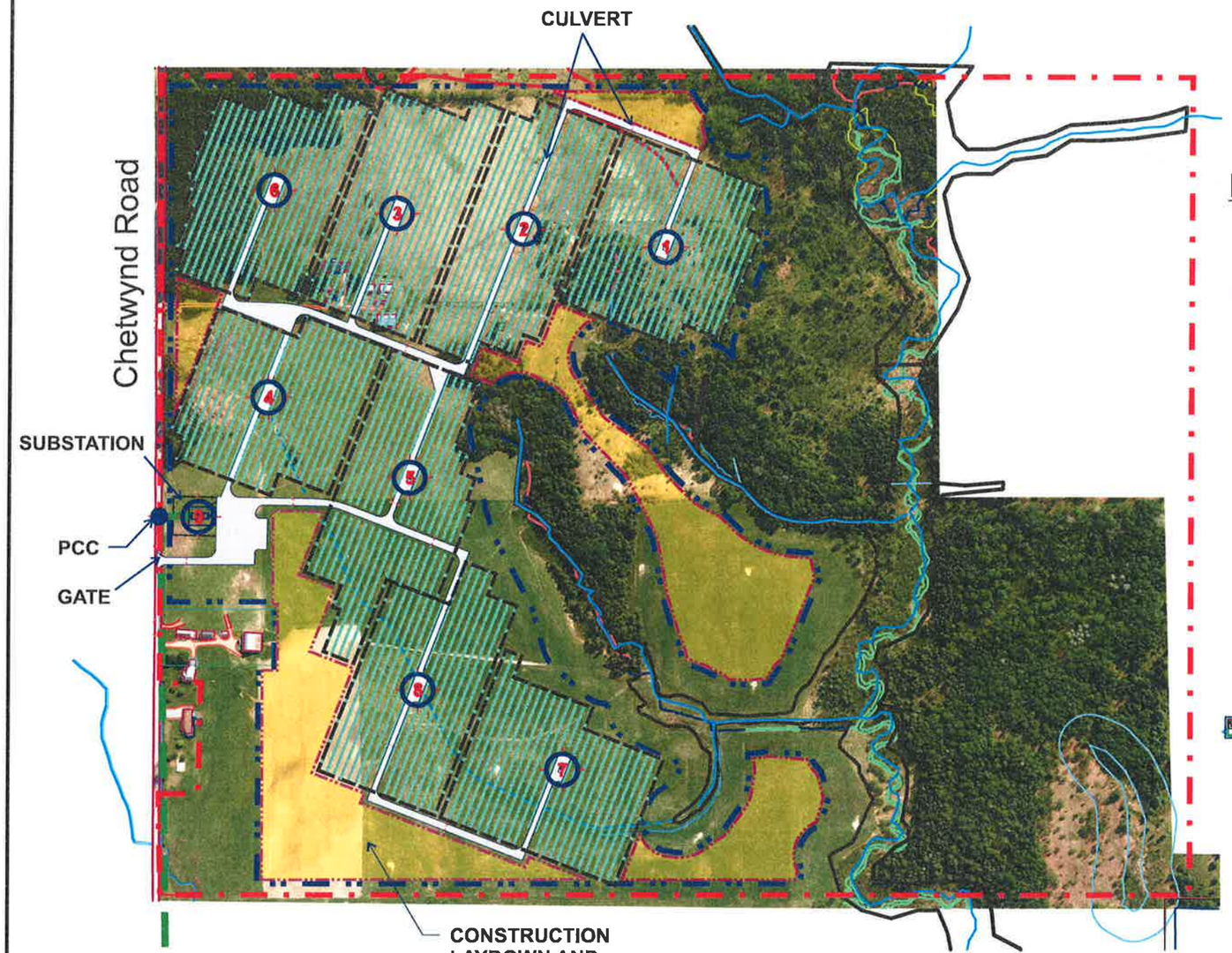
Notes:
1. OBM and NRVIS data downloaded from LIO, with permission.
2. Spatial referencing UTM NAD 83, July 2010.

Northland Power Inc.
Burk's Falls East Solar Energy Project
**Scaled Area Location Plan**

Figure A.2

HATCH™

P:\NORTHLAND\333751\DATABASES\334844\GIS\BurksFallsE\Burks FallsE_A2_Noise.mxd




## LEGEND:

- GRAVEL ACCESS ROAD
- GATE
- OVERHEAD 44 kV LINE
- OVERHEAD 44 kV LINE BY HYDRO ONE
- PROPERTY BOUNDARY
- CULVERT
- AVAILABLE AREA BOUNDARY / FENCE LINE & PROPERTY SETBACK @ 10 m (CONSTRUCTION SILT FENCE)
- CONSTRUCTION LAYDOWN AND POTENTIAL SOLAR MODULE AREA
- PCC (POINT OF COMMON COUPLING)
- 163 RACKS IN ONE GROUP, 3 STRINGS OF 11 PANELS PER RACK (SET @ 30° TILT WITH 7.6 METERS SPACING)
  42,900 PANELS REQUIRED, AND 43,032 PANELS USED FOR LAYOUT.
  NOMINAL CAPACITY: 12 $MW_{DC}$ OR 10 $MW_{AC}$
- 7 — 2 x 625 kVA INVERTER
  1 x 1250 kVA TRANSFORMER

| INVERTER'S TRANSFORMER (UTM Co-ordinate) | | |
|---|---|---|
| 17 T | X (m E) | Y (m N) |
| P1 | 628514.68 | 5051927.96 |
| P2 | 628475.90 | 5052064.11 |
| P3 | 628443.58 | 5052185.16 |
| P4 | 628226.75 | 5052234.58 |
| P5 | 628207.34 | 5052074.62 |
| P6 | 628419.26 | 5052306.36 |
| P7 | 627998.00 | 5051827.73 |
| P8 | 628017.42 | 5051987.69 |

| SUBSTATION'S TRANSFORMER (UTM Co-ordinate) | | |
|---|---|---|
| 17 T | X (m E) | Y (m N) |
| P9 | 628092.96 | 5052248.91 |

0m 50m 100m 150m 200m
1:2000 SCALE

**PRELIMINARY LAYOUT**
**NOT FOR CONSTRUCTION**

**REVISIONS**

| NO | DATE | SYMBOL | REMARKS |
|---|---|---|---|
| P0 | DEC 2010 | | ISSUED FOR NOISE MODELING |
| P1 | JAN 2011 | | LAYOUT & BER SETBACKS AND INVERTERS UTM CO-ORDINATE CHANGED |

STAMP



COGENERATION Associates Limited

PREPARED FOR NORTHLAND POWER

PROJECT

**NORTHLAND POWER SOLAR BURKS FALLS EAST**

| | | | |
|---|---|---|---|
| DRAWN BY | TIEN PHAM | VERIFIED BY | |
| SCALE | N.T.S. | VERIFIED BY | |
| DATE | DEC 2010 | APPROVED BY | |

ISSUED FOR TENDER

PROJECT No.

TITLE: SOLAR FARM PROJECT SITE PLAN

DRAWING No.: SP-01 (BFE) Rev.P1

# Appendix B

## Noise Sources

**Table B1 Point Sources Used in CADNA-A, Includes Tonality Penalty of 5 dBA**

| Name | Result PWL | | Correction | | Height | Coordinates | | |
|---|---|---|---|---|---|---|---|---|
| | Day (dBA) | Night (dBA) | Day (dBA) | Night (dBA) | (m) | X (m) | Y (m) | Z (m) |
| Substation: 10 MVA | 93.3 | 93.3 | 5.0 | 5.0 | 3.2 | 628093 | 5052249 | 326.2 |
| Inverter Cluster #1: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628493 | 5051835 | 326.9 |
| Inverter Cluster #2: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628579 | 5051981 | 329.9 |
| Inverter Cluster #3: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628510 | 5052155 | 338.5 |
| Inverter Cluster #4: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628271 | 5052174 | 328.9 |
| Inverter Cluster #5: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628273 | 5052044 | 320.7 |
| Inverter Cluster #6: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628418 | 5052305 | 335.4 |
| Inverter Cluster #7: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628019 | 5051850 | 310.8 |
| Inverter Cluster #8: 1.25 MW | 102.2 | 102.2 | 5.0 | 5.0 | 3.5 | 628039 | 5051987 | 313.5 |

**Table B2 Frequency Spectra Use for Modelling the Noise Sources, Not Including Tonality Penalty**

| Name | Octave Spectrum (dBA) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | A | lin |
| 10-MVA Subs. Transformer | 45.5 | 64.7 | 76.8 | 79.3 | 84.7 | 81.9 | 78.1 | 72.9 | 63.8 | 88.3 | 96.9 |
| Inverter 1.25 MW | 4.8 | 64.8 | 78.9 | 93.0 | 91.6 | 90.1 | 87.6 | 79.9 | 65.4 | 97.2 | 103.7 |

**Table B3 Absorption Coefficient α for the Barriers**

| Name | Octave Spectrum (dBA) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | Aw |
| **Barrier** | 0.00 | 0.00 | 0.01 | 0.05 | 0.05 | 0.04 | 0.04 | 0.04 | 0.00 | 0.05 |

**Table B4 Noise Reduction and Sound Transmission Characteristics of the Acoustical Louvers**

| Name | Octave Spectrum (dBA) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| **Louver** | 0.0 | 0.0 | 10.0 | 10.0 | 12.0 | 16.0 | 23.0 | 18.0 | 0.0 |

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# SUNNY CENTRAL 800MV / 1000MV / 1250MV

SC 800MV-11 / SC 1000MV-11 / SC 1250MV-11


**Efficient**

- Without low-voltage transformer: greater plant efficiency due to direct connection to the medium-voltage grid

**Turnkey Delivery**

- With medium-voltage transformer and concrete substation for outdoor installation

**Optional**

- Medium-voltage switchgear systems for a flexible structure of large solar parks
- AC transfer station with measurement
- Medium-voltage transformers for other grid voltages (deviating from 20 kV)

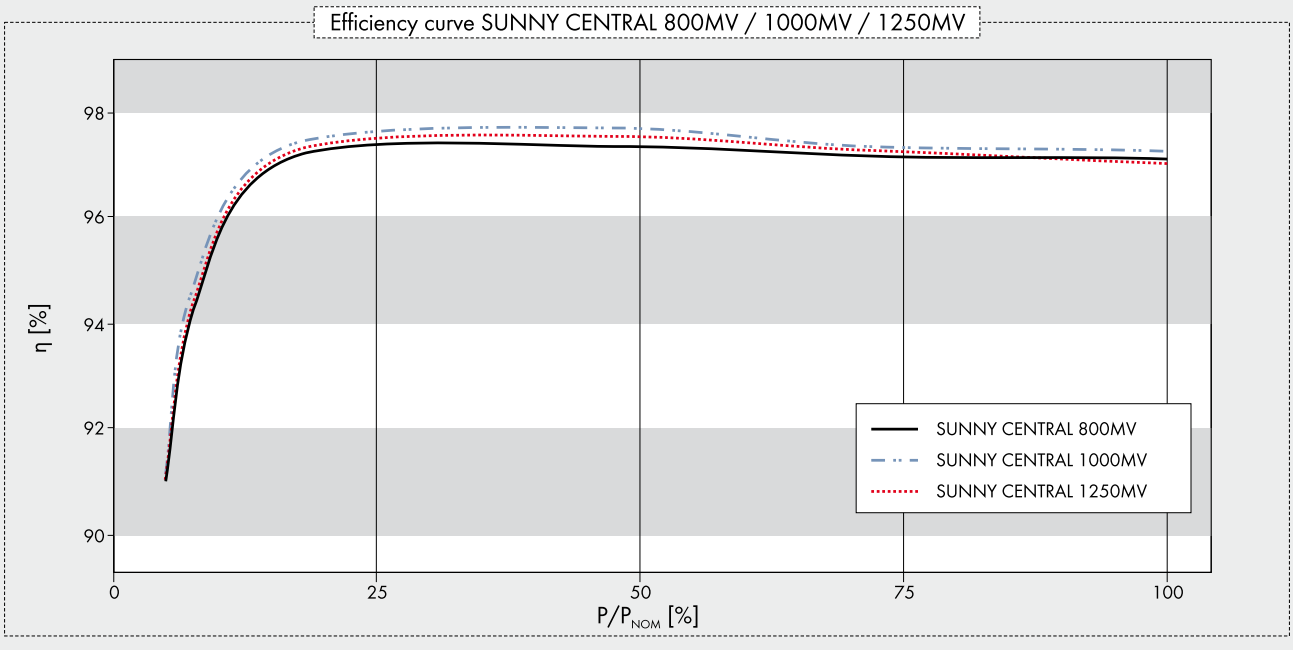
## SUNNY CENTRAL for Direct medium-voltage feed-in 800MV / 1000MV / 1250MV

High-performance medium-voltage station

For even more power: Two powerful Sunny Central HE inverters are components of a medium-voltage station (MV) which feeds directly into a shared medium-voltage transformer. In this way, for example, two Sunny Central 630HE inverters are combined into a powerful Sunny Central 1250MV station. The advantage: By removing the need for the low-voltage transformer, the plant operator realizes greater yields and at the same time lower inverter costs. The Sunny Central MV is delivered as a "turnkey" concrete substation for outside installation. On top of that, the Sunny Central MV actively participates in grid management, and thereby fulfils all requirements of the Medium-Voltage Directive valid as of July 2010.

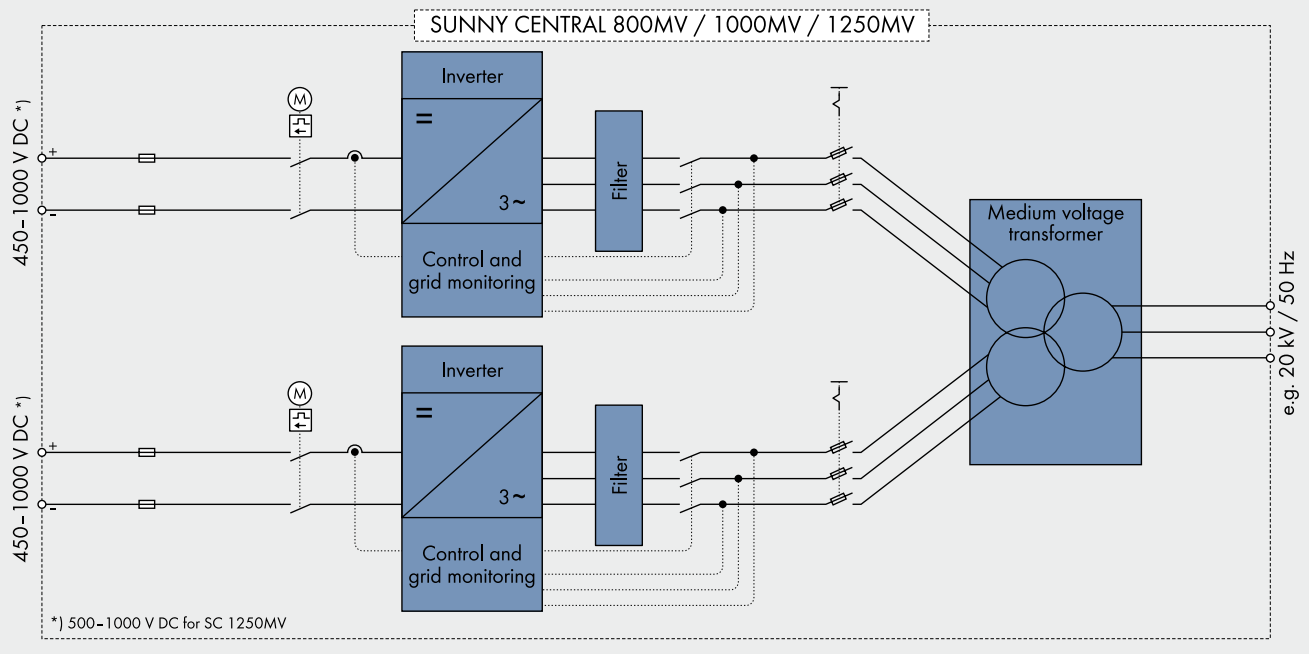
# SUNNY CENTRAL 800MV / 1000MV / 1250MV

| Technical data | Sunny Central 800MV | Sunny Central 1000MV | Sunny Central 1250MV |
|---|---|---|---|
| **Input data** | | | |
| Nominal DC power | 816 kW | 1018 kW | 1284 kW |
| Max. DC power | 900 kWp[1)] | 1120 kWp[1)] | 1410 kWp[1)] |
| MPP voltage range | 450 V – 820 V [5)] | 450 V – 820 V [5)] | 500 V – 820 V [5) 7)] |
| Max. DC voltage | 1000 V | 1000 V | 1000 V |
| Max. DC current | 1986 A | 2484 A | 2844 A |
| Number of DC inputs | (16 + 16) + 4 DCHV | (16 + 16) + 4 DCHV | (16 + 16) + 4 DCHV |
| **Output data** | | | |
| Nominal AC power @ 45 °C | 800 kVA | 1000 kVA | 1250 kVA |
| Continuous AC power @ 25 °C | 880 kVA | 1100 kVA | 1400 kVA |
| Nominal AC voltage | 20000 V | 20000 V | 20000 V |
| Nominal AC current | 23.2 A | 28.8 A | 36.1 A |
| AC grid frequency 50 Hz | ● | ● | ● |
| AC grid frequency 60 Hz | ● | ● | ● |
| Power factor (cos φ) | | 0.9 leading ... 0.9 lagging | |
| Max. THD | < 3 % | < 3 % | < 3 % |
| **Power consumption** | | | |
| Internal consumption in operation | < 3000 W [4)] | < 3000 W [4)] | < 3000 W [4)] |
| Standby consumption | < 180 W + 1100 W | < 180 W + 1100 W | < 180 W + 1350 W |
| External auxiliary supply voltage | 3 x 230 V, 50/60 Hz | 3 x 230 V, 50/60 Hz | 3 x 230 V, 50/60 Hz |
| External back-up fuse for auxiliary supply | B 20 A, 3-pole | B 20 A, 3-pole | B 20 A, 3-pole |
| **Dimensions and weight** | | | |
| Height | 3620 mm | 3620 mm | 3620 mm |
| Width | 5400 mm | 5400 mm | 5400 mm |
| Depth | 3000 mm | 3000 mm | 3000 mm |
| Weight | 35000 kg | 35000 kg | 35000 kg |
| **Efficiency** [2)] | | | |
| Max. efficiency | 97.7 % | 97.9 % | 97.8 % |
| Euro-eta | 97.3 % | 97.5 % | 97.4 % |
| **Protection rating and ambient conditions** | | | |
| Protection rating (as per EN 60529) | IP54 | IP54 | IP54 |
| Operating temperature range | –20 °C ... +45 °C | –20 °C ... +45 °C | –20 °C ... +45 °C |
| Rel. humidity | 15 % ... 95 % | 15 % ... 95 % | 15 % ... 95 % |
| Fresh air consumption | 12400 m³/h | 12400 m³/h | 12400 m³/h |
| Max. altitude (above sea level) | 1000 m | 1000 m | 1000 m |

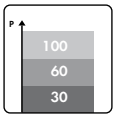


| | Sunny Central 800MV | Sunny Central 1000MV | Sunny Central 1250MV |
|---|---|---|---|
| **Features** | | | |
| Display: text line / graphic | ●/– | ●/– | ●/– |
| Ground fault monitoring | ● | ● | ● |
| Heating | ● | ● | ● |
| Emergency stop | ● | ● | ● |
| Circuit breaker AC side | SI load disconnection switch | SI load disconnection switch | SI load disconnection switch |
| Circuit breaker DC side | Switch-disconnector with motor | Switch-disconnector with motor | Switch-disconnector with motor |
| Monitored overvoltage protectors AC / DC | ●/● | ●/● | ●/● |
| Monitored overvoltage protectors for auxiliary supply | ● | ● | ● |
| **SCC (Sunny Central Control) interfaces** | | | |
| Communication (NET Piggy-Back, optional) | analog, ISDN, Ethernet | analog, ISDN, Ethernet | analog, ISDN, Ethernet |
| Analog inputs | 10 x $A_{in}$ [3] | 10 x $A_{in}$ [3] | 10 x $A_{in}$ [3] |
| Overvoltage protection for analog inputs | O | O | O |
| Sunny String-Monitor connection (COM1) | RS485 | RS485 | RS485 |
| PC connection (COM3) | RS232 | RS232 | RS232 |
| Electrically separated relay (ext. alert signal) | 2 | 2 | 2 |
| **Certificates / listings** | | | |
| EMC | EN 61000-6-2 EN 61000-6-4 | | |
| CE conformity | ● | ● | ● |
| BDEW-MSRL / FGW / TR8 [6] | ● | ● | ● |
| RD 1633 / 2000 | ● | ● | ● |
| Arrêté du 23/04/08 | ● | ● | ● |
| ● standard features O optional features – not available | | | |
| Type designation | SC 800MV-11 | SC 1000MV-11 | SC 1250MV-11 |

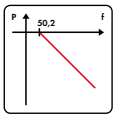
HE: High Efficiency, inverter without galvanic isolation for connection to a medium-voltage transformer (taking into account the SMA specification for the transformer)
1) Specifications apply to irradiation values below STC
2) Efficiency measured without an internal power supply at $U_{DC}$ = 500 V
3) 2x inputs for the external nominal value specification for active power and reactive power, 1x external alarm input, 1x irradiation sensor, 1x pyranometer
4) Internal consumption at nominal power
5) At 1.05 $U_{AC, nom}$ and cos φ = 1
6) With limited dynamic grid support
7) At $f_{grid}$ = 60 Hz: 510 V - 820 V
**Please note:** in certain countries the substations may differ from the substations shown in the images



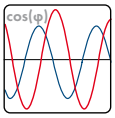
# POWERFUL GRID MANAGEMENT FUNCTIONS



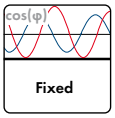

**Remote controlled power reduction in case of grid overload**
In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination with the SMA Power Reducer Box. Typical limit values are 100, 60, 30 or 0 per cent of the nominal power.



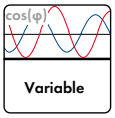

**Frequency-dependent control of active power**
As of a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



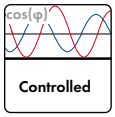

**Static voltage support based on reactive power**
To stabilize the grid voltage, SMA inverters feed reactive power (leading or lagging) into the grid. Three different modes are available:



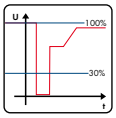

**a) Fixed definition of the reactive power by the grid operator**
The grid operator defines a fixed reactive power value or a fixed displacement factor between $\cos(\varphi)_{leading}$= 0.90 and $\cos(\varphi)_{lagging}$= 0.90.




**b) Definition of a dynamic setpoint of the reactive power by the utility operator**
The grid operator defines a dynamic displacement factor - any value between $\cos(\varphi)_{leading}$= 0.90 und $\cos(\varphi)_{lagging}$= 0.90. It is transmitted either through a communication unit the evaluation can e.g. be evaluated and processed by the SMA Power Reducer Box.

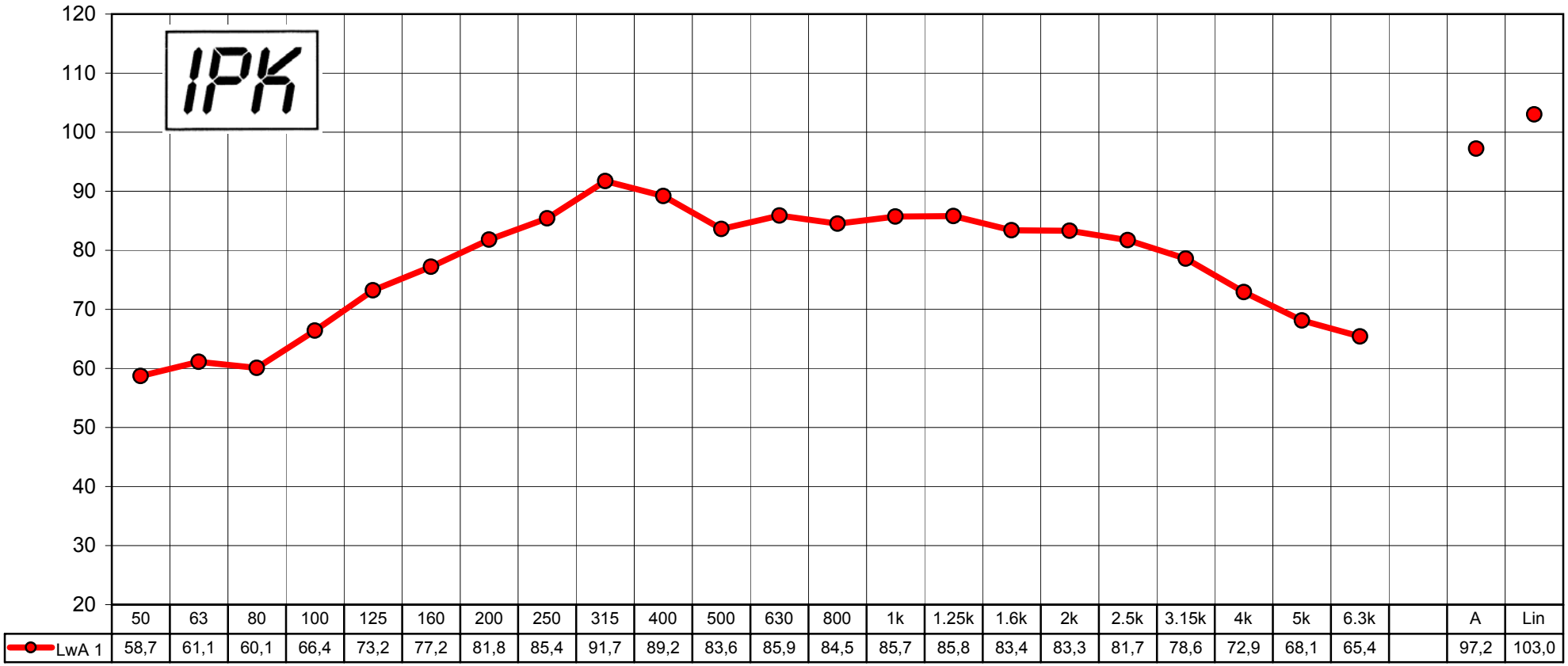



**c) Control of the reactive power over a characteristic curve**
The reactive power or the phase shift is controlled by a pre-defined characteristic curve – depending on the active power fed into the grid or the grid voltage.




**Limited Dynamic Grid Support**
The inverter continues to feed to the grid after short term voltage drops – as long as the grid voltage is within a defined voltage window.

**SMA Solar Technologie Umrichteranlage Sunny Central SC 1000MV**
**Betrieb bei Nennleistung und 50 Hz; 1000 KW**




| | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1k | 1.25k | 1.6k | 2k | 2.5k | 3.15k | 4k | 5k | 6.3k | | A | Lin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LwA 1 | 58,7 | 61,1 | 60,1 | 66,4 | 73,2 | 77,2 | 81,8 | 85,4 | 91,7 | 89,2 | 83,6 | 85,9 | 84,5 | 85,7 | 85,8 | 83,4 | 83,3 | 81,7 | 78,6 | 72,9 | 68,1 | 65,4 | | 97,2 | 103,0 |

**Terz - Mittenfrequenz [Hz]**



INGENIEURBÜRO PETER KAPOLNEK
Waiblinger Str. 69, 70372 Stuttgart, Tel.: (0711) 567911, Telefax: (0711) 561447

**From:** Janos Rajda [mailto:Janos.Rajda@sma-america.com]
**Sent:** Monday, October 18, 2010 9:38 AM
**To:** Moran, Joaquin
**Cc:** Mike Lord; Chris Rytel; Elie Nasr
**Subject:** RE: Noise Levels - U R G E N T

Hi Joaquin,

Yes it will apply as two (2) 625kW, 60Hz are complete mechanical equivalents to two (2) 500kW, 50Hz or to a 1000kW 2-units system. The slight electrical difference between the two units relate to minimum DC voltage rating and grid frequency the units are connected to with no significant impact on levels of unit parts audio noise generation.

Regards,

Janos

---

**From:** Moran, Joaquin [mailto:JMoran@Hatch.ca]
**Sent:** October-18-10 9:13 AM
**To:** Janos Rajda
**Cc:** Mike Lord; Chris Rytel; Elie Nasr
**Subject:** RE: Noise Levels - U R G E N T

Hi Janos,

Thanks for the information. Just to clarify, the sound power levels provided seem to be for a 1000 kW unit, 50 Hz. Will these apply to the units to be deployed in this case (625 kW, 60 Hz)?

Cheers,

Joaquin

**Joaquin E. Moran**
Tel. +1 905 374-0701 x 5236

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**From:** Janos Rajda [mailto:Janos.Rajda@sma-america.com]
**Sent:** Sunday, October 17, 2010 11:22 PM
**To:** Moran, Joaquin
**Cc:** Mike Lord; Chris Rytel; Elie Nasr
**Subject:** RE: Noise Levels - U R G E N T

Hi Joaquin,

Over the weekend we obtained third octave sound power levels for 100% or rated loading case for two SC units as supplied at the time for FirstSolar project in Sarnia.

Thanks again for providing as with sample data, which proved to be helpful in communicating the sound power level format requirement.

Best regards,

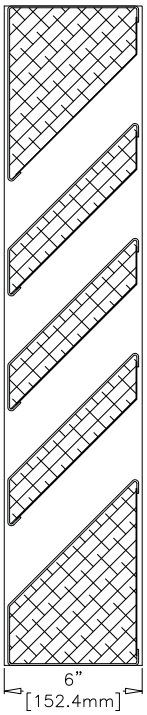
Janos

# GREENHECK AFJ-601

## Acoustical Louver
## J Blade

### Application and Design

AFJ-601 is an acoustical weather louver designed to protect air intake and exhaust openings in building exterior walls. Design incorporates J style insulated acoustical blades and high free area to provide maximum resistance to sound transmission, rain and weather while providing minimum resistance to airflow. The AFJ-601 is an extremely efficient louver with **AMCA LICENSED PERFORMANCE DATA** enabling designers to select and apply with confidence.




amca CERTIFIED RATINGS
WATER PENETRATION
SOUND AND AIR PERFORMANCE
AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

### Standard Construction

**Frame . . . . . .** Heavy gauge formed aluminum, 6 in. x 0.080 in. nominal wall thickness

**Blades. . . . . .** J style, heavy gauge formed aluminum, 0.080 in. nominal wall thickness, positioned at 45° on approximately 5 in. centers

**Construction** . . . Mechanically fastened

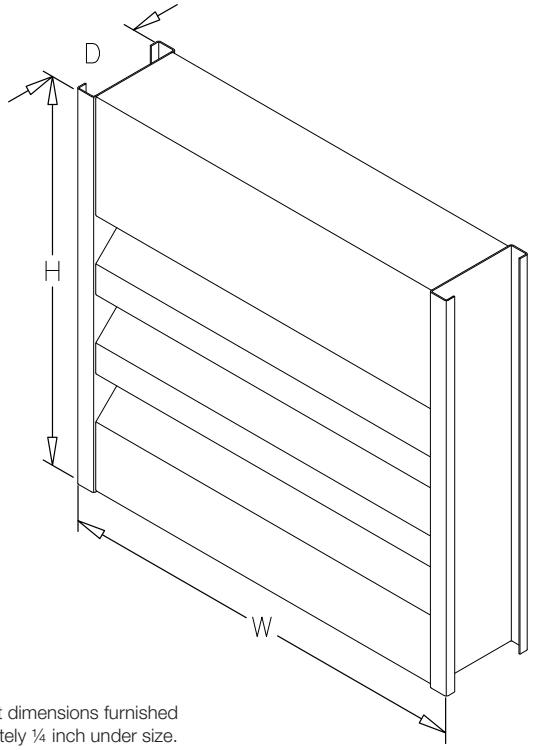
**Acoustical Insulation . . . . .** Fiberglass Insulation

**Birdscreen. . . . .** 3/4 in. x 0.051 flattened expanded aluminum in removable frame, inside mount (rear)

**Finish. . . . . .** Mill

**Minimum Size . .** 12 in. W x 15 in. H

**Maximum Single Section Size . . .** 60 in. W x 120 in. H




*Width and height dimensions furnished approximately ¼ inch under size.

### Options *(at additional cost)*

- A variety of bird and insect screens
- Blank off panels
- Clip angles
- Extended sill
- Filter racks
- Flanged frame
- Galvanized steel frame and blade
- Security bars
- A variety of architectural finishes including:
  - Clear anodize
  - Integral color anodize
  - Baked enamel paint
  - Kynar paint

# PERFORMANCE DATA

# AFJ-601

**J Blade Acoustical Louver**
**Formed Aluminum**

## Free Area Chart (Sq. ft.)

| Louver Height Inches | Louver Width Inches | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 12 | 18 | 24 | 30 | 36 | 42 | **48** | 54 | 60 |
| 15 | 0.12 | 0.21 | 0.29 | 0.37 | 0.45 | 0.53 | 0.61 | 0.69 | 0.77 |
| 18 | 0.25 | 0.41 | 0.57 | 0.74 | 0.90 | 1.06 | 1.22 | 1.38 | 1.55 |
| 24 | 0.37 | 0.62 | 0.86 | 1.10 | 1.35 | 1.59 | 1.83 | 2.08 | 2.32 |
| 30 | 0.50 | 0.82 | 1.15 | 1.47 | 1.80 | 2.12 | 2.44 | 2.77 | 3.09 |
| 36 | 0.62 | 1.03 | 1.43 | 1.84 | 2.24 | 2.65 | 3.05 | 3.46 | 3.86 |
| 42 | 0.75 | 1.24 | 1.72 | 2.21 | 2.69 | 3.18 | 3.67 | 4.15 | 4.64 |
| **48** | 1.00 | 1.65 | 2.30 | 2.94 | 3.59 | 4.24 | **4.89** | 5.54 | 6.18 |
| 54 | 1.12 | 1.85 | 2.58 | 3.31 | 4.04 | 4.77 | 5.50 | 6.23 | 6.96 |
| 60 | 1.25 | 2.06 | 2.87 | 3.68 | 4.49 | 5.30 | 6.11 | 6.92 | 7.73 |
| 66 | 1.37 | 2.26 | 3.16 | 4.05 | 4.94 | 5.83 | 6.72 | 7.61 | 8.50 |
| 72 | 1.50 | 2.47 | 3.44 | 4.41 | 5.39 | 6.36 | 7.33 | 8.30 | 9.27 |
| 78 | 1.75 | 2.88 | 4.02 | 5.15 | 6.28 | 7.42 | 8.55 | 9.69 | 10.82 |
| 84 | 1.87 | 3.09 | 4.30 | 5.52 | 6.73 | 7.95 | 9.16 | 10.38 | 11.59 |
| 90 | 2.00 | 3.29 | 4.59 | 5.89 | 7.18 | 8.48 | 9.77 | 11.07 | 12.37 |
| 96 | 2.12 | 3.50 | 4.88 | 6.25 | 7.63 | 9.01 | 10.38 | 11.76 | 13.14 |
| 102 | 2.25 | 3.71 | 5.16 | 6.62 | 8.08 | 9.54 | 11.00 | 12.45 | 13.91 |
| 108 | 2.50 | 4.12 | 5.74 | 7.36 | 8.98 | 10.60 | 12.22 | 13.84 | 15.46 |
| 114 | 2.62 | 4.32 | 6.02 | 7.73 | 9.43 | 11.13 | 12.83 | 14.53 | 16.23 |
| 120 | 2.75 | 4.53 | 6.31 | 8.09 | 9.88 | 11.66 | 13.44 | 15.22 | 17.00 |

Greenheck Fan Corporation certifies that the AFJ-601 louvers shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to water penetration, air performance and sound ratings.

## Sound Transmission Class

The Sound Transmission Class (STC) is a rating of the effectiveness of an assembly in isolating or reducing airborne sound transmission. STC is a single number that summarizes airborne sound transmission loss data. Assemblies with higher STC ratings are more efficient at reducing sound transmission. STC is determined in accordance with ASTM E413-04.

## Transmission Loss

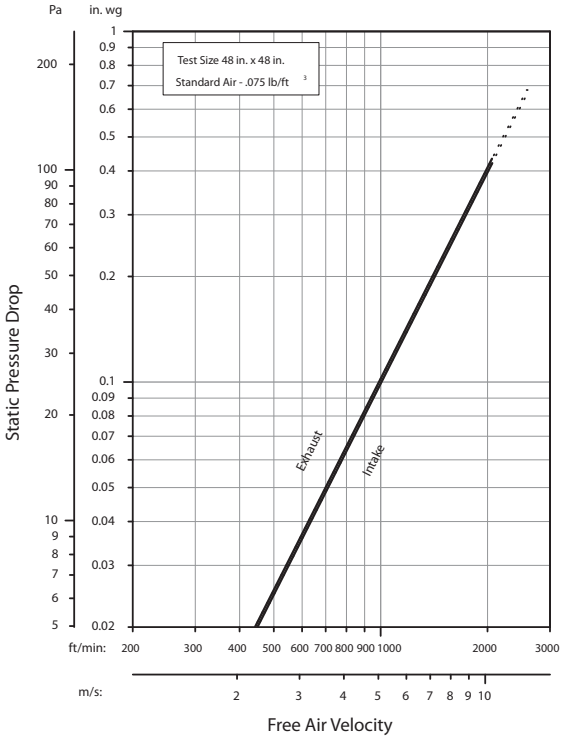
Transmission loss (TL) is a measurement of the reduction of sound power transmission (dB) through an assembly at a given frequency. The more sound power that is reduced, the greater the TL. TL is tested in accordance with ASTM E90-04.

## Free Field Noise Reduction in Decibels

Free Field Noise Reduction is determined by adding 6 dB to the Transmission Loss.

| Octave Band | 2 | 3 | 4 | 5 | 6 | 7 | STC |
|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 63 | 125 | 250 | 500 | 1000 | 2000 | |
| Transmission Loss (dB) | 4 | 4 | 6 | 10 | 17 | 12 | 10 |
| Free Field Noise Reduction (dB) | 10 | 10 | 12 | 16 | 23 | 18 | |

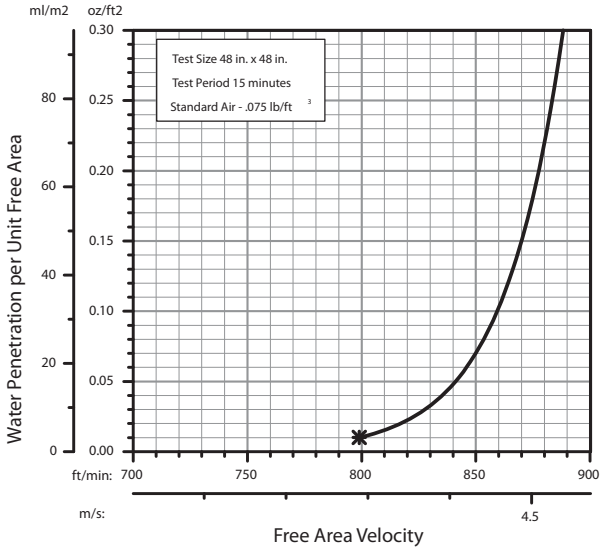
## Airflow Resistance (Standard Air - .075 lb/ft³)




Model AFJ-601 resistance to airflow (pressure drop) varies depending on louver application (air intake or air exhaust). Free area velocities (shown) are higher than average velocity through the overall louver size. See louver selection information.

## Water Penetration (Standard Air - .075 lb/ft³)

***Test size 48 in. x 48 in. Test duration of 15 min.***




The AMCA Water Penetration Test provides a method for comparing various louver models and designs as to their efficiency in resisting the penetration of rainfall under specific laboratory test conditions. The beginning point of water penetration is defined as that velocity where the water penetration curve projects through .01 oz. of water (penetration) per sq. ft. of louver free area. ***The beginning point of water penetration for Model AFJ-601 is 799 fpm free area velocity.** These performance ratings do not guarantee a louver to be weatherproof or stormproof and should be used in combination with other factors including good engineering judgement in selecting louvers.

GREENHECK

# INSTALLATION DETAILS

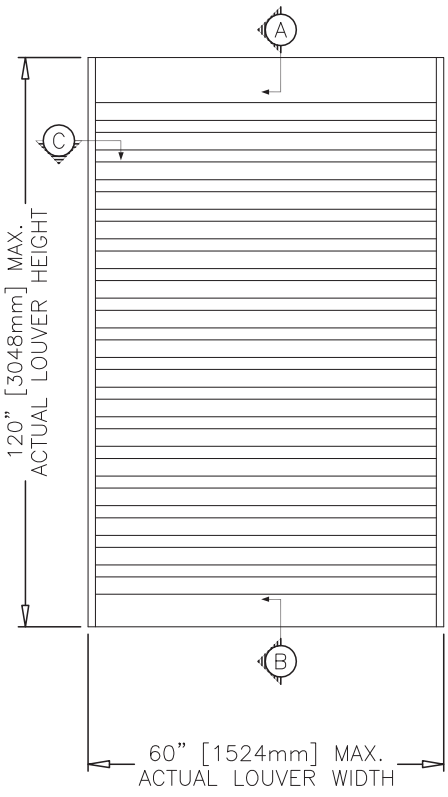
# AFJ-601

**J Blade Acoustical Louver**
**Formed Aluminum**

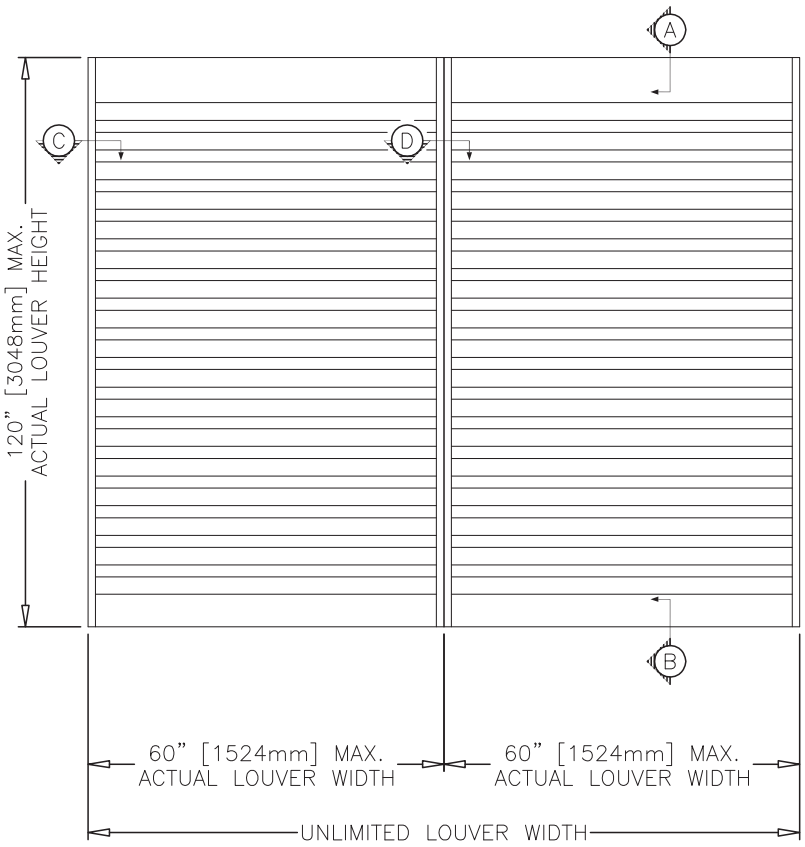
## Maximum Size and Installation Information

Maximum single section size for model AFJ-601 is 60 in. W x 120 in. H. Larger openings require field assembly of multiple louver panels to make up the overall opening size. Individual louver panels are designed to withstand a 25 PSF wind-load (please consult Greenheck if the louvers must withstand higher wind-loads). Structural reinforcing members may be required to adequately support and install multiple louver panels within a large opening. Structural reinforcing members along with any associated installation hardware is not provided by Greenheck unless indicated otherwise by Greenheck. Additional information on louver installation may be found in AMCA Publication #501, Louver Application Manual.

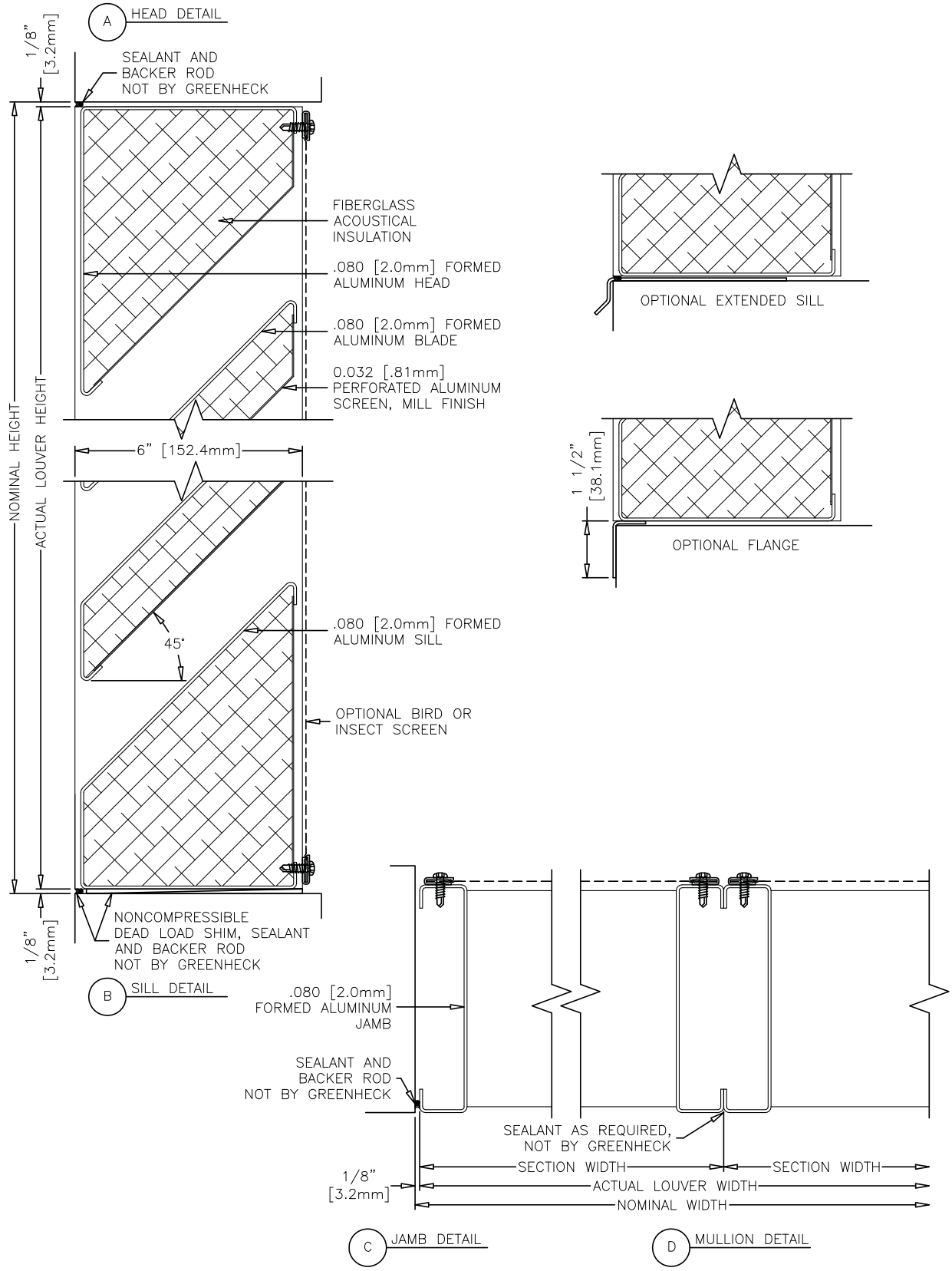
SINGLE SECTION




MULTIPLE SECTION W/ MULLION



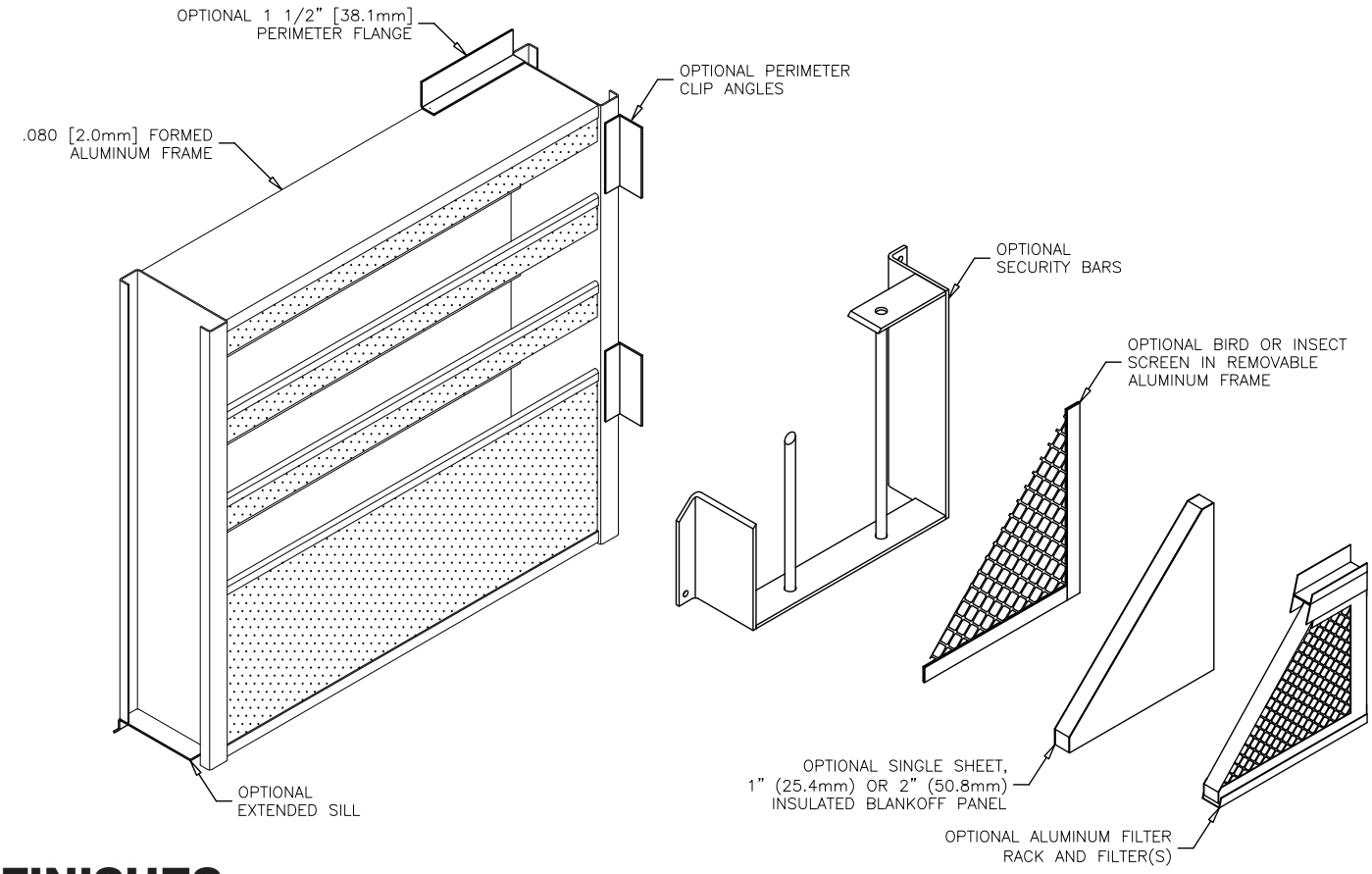

| Minimum Single Section Size | Maximum Single Section Size |
|---|---|
| 12 in. W x 15 in. H | 60 in. W x 120 in. H |


A HEAD DETAIL
1/8" [3.2mm]
SEALANT AND BACKER ROD NOT BY GREENHECK
FIBERGLASS ACOUSTICAL INSULATION
.080 [2.0mm] FORMED ALUMINUM HEAD
.080 [2.0mm] FORMED ALUMINUM BLADE
0.032 [.81mm] PERFORATED ALUMINUM SCREEN, MILL FINISH
NOMINAL HEIGHT
ACTUAL LOUVER HEIGHT
6" [152.4mm]
45°
.080 [2.0mm] FORMED ALUMINUM SILL
OPTIONAL BIRD OR INSECT SCREEN
1/8" [3.2mm]
NONCOMPRESSIBLE DEAD LOAD SHIM, SEALANT AND BACKER ROD NOT BY GREENHECK
B SILL DETAIL
OPTIONAL EXTENDED SILL
1 1/2" [38.1mm]
OPTIONAL FLANGE
.080 [2.0mm] FORMED ALUMINUM JAMB
SEALANT AND BACKER ROD NOT BY GREENHECK
SEALANT AS REQUIRED, NOT BY GREENHECK
SECTION WIDTH
SECTION WIDTH
1/8" [3.2mm]
ACTUAL LOUVER WIDTH
NOMINAL WIDTH
C JAMB DETAIL
D MULLION DETAIL

# OPTION DRAWINGS

# AFJ-601

**J Blade Acoustical Louver**
**Formed Aluminum**




# FINISHES

| Finish Type | Description/Application | Color Selection | Standard Warranty (Aluminum) |
|---|---|---|---|
| **2-coat 70% KYNAR 500®/HYLAR 5000®** AAMA 2605 – Dry film thickness 1.2 mil. (AKA: Duranar®, Fluoropon®, Trinar®, Flouropolymer, Polyvinylidene Fluoride, PVDF2) | ***"Best."*** The premier finish for extruded aluminum. Tough, long-lasting coating has superior color retention and abrasive properties. Resists chalking, fading, chemical abrasion and weathering. | **Standard Colors:** Any of the 24 standard colors shown can be furnished in 70% or 50% KYNAR 500®/HYLAR 5000® or Baked Enamel.<br><br>**2-Coat Mica:** Greenheck offers 9 standard 2-coat Mica colors. Other colors are available. Consult Greenheck for possible extra cost when selecting non-standard colors or special finishes. | 10 Years (Consult Greenheck for availability of extended warranty) |
| **2-coat 50% KYNAR 500®/HYLAR 5000®** AAMA 2604 – Dry film thickness 1.2 mil. (AKA: Acroflur®, Acrynar®) | ***"Better."*** Tough, long-lasting coating has excellent color retention and abrasive properties. Resists chalking, fading, chemical abrasion and weathering. | | 5 Years |
| **Baked Enamel** AAMA 2603 – Dry film thickness 0.8 mil. (AKA: Acrabond Plus®, Duracron®) | ***"Good."*** Provides good adhesion and resistance to weathering, corrosion and chemical stain. | | 1 Year |
| **Integral Color Anodize** AA-M10C22A42 (>0.7 mil) | "Two-step" anodizing is produced by following the normal anodizing step with a second, colorfast process. | Light, Medium or Dark Bronze; Champagne; Black | 5 years |
| **Clear Anodize 215 R-1** AA-M10C22A41 (>0.7 mil) | Clear, colorless and hard oxide aluminum coating that resists weathering and chemical attack. | Clear | 5 years |
| **Clear Anodize 204 R-1** AA-M10C22A31 (0.4-0.7 mil) | Clear, colorless and hard oxide aluminum coating that resists weathering and chemical attack. | Clear | 1 Year |
| **Industrial coatings** | Greenheck offers a number of industrial coatings such as Hi-Pro Polyester, Epoxy, and Permatector®. Consult a Greenheck Product Specialist for complete color and application information. | | Consult Greenheck |
| **Mill** | Materials may be supplied in natural aluminum or galvanized steel finish when normal weathering is acceptable and there is no concern for color or color change. | | n/a |

*Finishes meet or exceed AAMA 2605, AAMA 2604, and AAMA 2603 requirements. Please consult www.greenheck.com for complete information on standard and extended paint warranties. Paint finish warranties are not applicable to steel products.*


GREENHECK®

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AFJ-601
August 2010 Rev. 1

Blank Back


**Figure B1 Location and ID of Proposed Sound Barriers**

# Appendix C

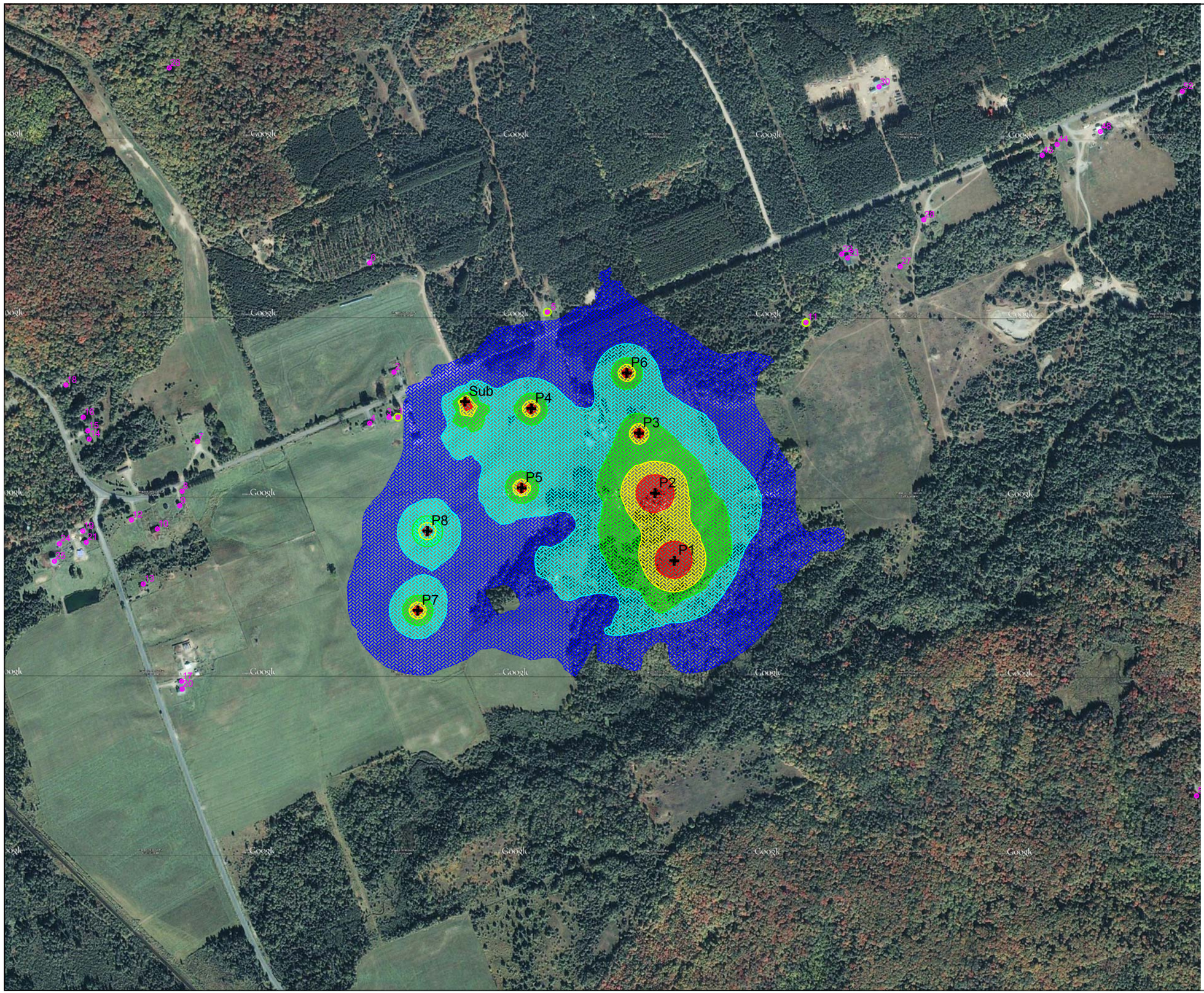
## Sound Pressure Levels for Points of Reception, Noise Maps from CADNA-A

**Table C1 Sound Pressure Levels for POR (shaded rows correspond to representative POR)**

| ID | Level Lp | | Limit. Value | | Noise Type | Height | Coordinates | | |
|---|---|---|---|---|---|---|---|---|---|
| | Day (dBA) | Night (dBA) | Day (dBA) | Night (dBA) | | (m) | X (m) | Y (m) | Z (m) |
| 1 | 39.5 | 39.5 | 45 | 40 | Total | 4 | 627958 | 5052217 | 324.66 |
| 2 | 38 | 38 | 45 | 40 | Total | 4 | 627950 | 5052308 | 329 |
| 3 | 38.9 | 38.9 | 45 | 40 | Total | 4 | 627940 | 5052217 | 324 |
| 4 | 38.1 | 38.1 | 45 | 40 | Total | 4 | 627901 | 5052205 | 323.68 |
| 5 | 39.5 | 39.5 | 45 | 40 | Total | 4 | 628259 | 5052429 | 340.09 |
| 6 | 34.1 | 34.1 | 45 | 40 | Total | 4 | 627901 | 5052528 | 341.98 |
| 7 | 32.2 | 32.2 | 45 | 40 | Total | 4 | 627554 | 5052168 | 317.65 |
| 8 | 32.6 | 32.6 | 45 | 40 | Total | 4 | 627523 | 5052068 | 314 |
| 9 | 32.6 | 32.6 | 45 | 40 | Total | 4 | 627518 | 5052039 | 314 |
| 10 | 31.9 | 31.9 | 45 | 40 | Total | 4 | 627473 | 5051992 | 311.13 |
| 11 | 37.9 | 37.9 | 45 | 40 | Total | 4 | 628780 | 5052408 | 354 |
| 12 | 30.9 | 30.9 | 45 | 40 | Total | 4 | 627421 | 5052010 | 311.55 |
| 13 | 29 | 29 | 45 | 40 | Total | 4 | 627445 | 5051881 | 308.11 |
| 14 | 29.2 | 29.2 | 45 | 40 | Total | 4 | 627336 | 5052173 | 313.98 |
| 15 | 28.8 | 28.8 | 45 | 40 | Total | 4 | 627333 | 5052190 | 314.04 |
| 16 | 28.3 | 28.3 | 45 | 40 | Total | 4 | 627324 | 5052217 | 314.13 |
| 17 | 31.2 | 31.2 | 45 | 40 | Total | 4 | 627522 | 5051685 | 309 |
| 18 | 27.6 | 27.6 | 45 | 40 | Total | 4 | 627289 | 5052282 | 315.88 |
| 19 | 30.3 | 30.3 | 45 | 40 | Total | 4 | 627323 | 5051988 | 309 |
| 20 | 32.3 | 32.3 | 45 | 40 | Total | 4 | 627523 | 5051669 | 308.99 |
| 21 | 29.1 | 29.1 | 45 | 40 | Total | 4 | 627330 | 5051965 | 309 |
| 22 | 33.2 | 33.2 | 45 | 40 | Total | 4 | 628852 | 5052546 | 359 |
| 23 | 33.5 | 33.5 | 45 | 40 | Total | 4 | 628864 | 5052538 | 359 |
| 24 | 29.9 | 29.9 | 45 | 40 | Total | 4 | 627276 | 5051962 | 309 |
| 25 | 30.1 | 30.1 | 45 | 40 | Total | 4 | 627266 | 5051927 | 309 |
| 26 | 25.3 | 25.3 | 45 | 40 | Total | 4 | 627497 | 5052921 | 354.66 |
| 27 | 31.3 | 31.3 | 45 | 40 | Total | 4 | 628970 | 5052521 | 343.26 |
| 28 | 30.1 | 30.1 | 45 | 40 | Total | 4 | 629017 | 5052615 | 350.65 |
| 29 | 26.4 | 26.4 | 45 | 40 | Total | 4 | 628586 | 5053121 | 354 |
| 30 | 28.2 | 28.2 | 45 | 40 | Total | 4 | 628927 | 5052883 | 361.78 |
| 31 | 26 | 26 | 45 | 40 | Total | 4 | 628489 | 5053221 | 354.48 |
| 32 | 25.8 | 25.8 | 45 | 40 | Total | 4 | 628374 | 5053262 | 359 |
| 33 | 26 | 26 | 45 | 40 | Total | 4 | 628457 | 5053236 | 356.94 |
| 34 | 25.8 | 25.8 | 45 | 40 | Total | 4 | 628449 | 5053256 | 356.83 |
| 35 | 26.1 | 26.1 | 45 | 40 | Total | 4 | 628604 | 5053187 | 354 |
| 36 | 25.6 | 25.6 | 45 | 40 | Total | 4 | 628444 | 5053279 | 357.04 |
| 37 | 25.4 | 25.4 | 45 | 40 | Total | 4 | 628440 | 5053305 | 356.95 |
| 38 | 27.1 | 27.1 | 45 | 40 | Total | 4 | 626929 | 5052271 | 325.81 |
| 39 | 27.3 | 27.3 | 45 | 40 | Total | 4 | 626934 | 5052401 | 337.76 |

| ID | Level Lp | | Limit. Value | | Noise Type | Height | Coordinates | | |
|---|---|---|---|---|---|---|---|---|---|
| | Day (dBA) | Night (dBA) | Day (dBA) | Night (dBA) | | (m) | X (m) | Y (m) | Z (m) |
| 40 | 27.1 | 27.1 | 45 | 40 | Total | 4 | 626915 | 5052290 | 329.78 |
| 41 | 24.7 | 24.7 | 45 | 40 | Total | 4 | 628413 | 5053387 | 359 |
| 42 | 23.2 | 23.2 | 45 | 40 | Total | 4 | 626936 | 5052550 | 337.09 |
| 43 | 27.2 | 27.2 | 45 | 40 | Total | 4 | 629256 | 5052745 | 346.73 |
| 44 | 26.8 | 26.8 | 45 | 40 | Total | 4 | 629286 | 5052767 | 347.05 |
| 45 | 26.2 | 26.2 | 45 | 40 | Total | 4 | 626790 | 5052478 | 340.81 |
| 46 | 26 | 26 | 45 | 40 | Total | 4 | 626769 | 5052492 | 340.66 |
| 47 | 31.1 | 31.1 | 45 | 40 | Total | 4 | 628263 | 5050906 | 335.62 |
| 48 | 26.1 | 26.1 | 45 | 40 | Total | 4 | 629373 | 5052793 | 347.76 |
| 49 | 30.6 | 30.6 | 45 | 40 | Total | 4 | 628263 | 5050849 | 339 |
| 50 | 25.1 | 25.1 | 45 | 40 | Total | 4 | 628112 | 5050711 | 317.35 |
| 51 | 24.8 | 24.8 | 45 | 40 | Total | 4 | 628100 | 5050680 | 313.86 |
| 52 | 24.6 | 24.6 | 45 | 40 | Total | 4 | 629538 | 5052874 | 343.11 |
| 53 | 24.6 | 24.6 | 45 | 40 | Total | 4 | 628072 | 5050667 | 311.3 |
| 54 | 23.8 | 23.8 | 45 | 40 | Total | 4 | 629614 | 5052925 | 340.31 |
| 55 | 25.2 | 25.2 | 45 | 40 | Total | 4 | 626994 | 5050994 | 299 |
| 56 | 27.2 | 27.2 | 45 | 40 | Total | 4 | 629567 | 5051454 | 349 |
| 57 | 24.9 | 24.9 | 45 | 40 | Total | 4 | 626959 | 5050971 | 299 |
| 58 | 25.1 | 25.1 | 45 | 40 | Total | 4 | 627191 | 5050793 | 299 |
| 59 | 24.6 | 24.6 | 45 | 40 | Total | 4 | 627010 | 5050876 | 299 |
| 60 | 24.7 | 24.7 | 45 | 40 | Total | 4 | 627045 | 5050849 | 300.12 |
| 61 | 24.7 | 24.7 | 45 | 40 | Total | 4 | 627121 | 5050781 | 302.23 |
| 62 | 22.8 | 22.8 | 45 | 40 | Total | 4 | 629683 | 5053019 | 338.17 |
| 63 | 23.4 | 23.4 | 45 | 40 | Total | 4 | 629792 | 5052749 | 334 |
| 64 | 24.9 | 24.9 | 45 | 40 | Total | 4 | 627175 | 5050726 | 303.57 |
| 65 | 24.4 | 24.4 | 45 | 40 | Total | 4 | 626991 | 5050843 | 300.41 |
| 66 | 24.6 | 24.6 | 45 | 40 | Total | 4 | 627131 | 5050738 | 304.15 |
| 67 | 22.1 | 22.1 | 45 | 40 | Total | 4 | 629526 | 5053335 | 346.82 |
| 68 | 25 | 25 | 45 | 40 | Total | 4 | 627228 | 5050672 | 304 |
| 69 | 24.3 | 24.3 | 45 | 40 | Total | 4 | 626983 | 5050830 | 301.18 |
| 70 | 24.5 | 24.5 | 45 | 40 | Total | 4 | 627076 | 5050755 | 303.94 |
| 71 | 24.9 | 24.9 | 45 | 40 | Total | 4 | 627236 | 5050656 | 304 |
| 72 | 23.1 | 23.1 | 45 | 40 | Total | 4 | 629830 | 5052758 | 334 |
| 73 | 24.9 | 24.9 | 45 | 40 | Total | 4 | 627194 | 5050677 | 305.14 |
| 74 | 23.1 | 23.1 | 45 | 40 | Total | 4 | 629821 | 5052791 | 334 |
| 75 | 24.3 | 24.3 | 45 | 40 | Total | 4 | 627003 | 5050802 | 302.85 |
| 76 | 24.9 | 24.9 | 45 | 40 | Total | 4 | 627180 | 5050683 | 305.47 |
| 77 | 22.5 | 22.5 | 45 | 40 | Total | 4 | 629729 | 5053034 | 336.48 |
| 78 | 24.8 | 24.8 | 45 | 40 | Total | 4 | 627212 | 5050651 | 304.09 |
| 79 | 24.8 | 24.8 | 45 | 40 | Total | 4 | 627235 | 5050636 | 304 |

| ID | Level Lp | | Limit. Value | | Noise Type | Height | Coordinates | | |
|---|---|---|---|---|---|---|---|---|---|
| | Day (dBA) | Night (dBA) | Day (dBA) | Night (dBA) | | (m) | X (m) | Y (m) | Z (m) |
| 80 | 27.2 | 27.2 | 45 | 40 | Total | 4 | 629693 | 5051348 | 354 |
| 81 | 21.3 | 21.3 | 45 | 40 | Total | 4 | 629614 | 5053319 | 339.98 |
| 82 | 21.3 | 21.3 | 45 | 40 | Total | 4 | 629610 | 5053340 | 340.99 |
| 83 | 24.6 | 24.6 | 45 | 40 | Total | 4 | 627295 | 5050553 | 302.81 |
| 84 | 21.3 | 21.3 | 45 | 40 | Total | 4 | 629602 | 5053362 | 341.51 |
| 85 | 24.3 | 24.3 | 45 | 40 | Total | 4 | 627342 | 5050496 | 302.09 |
| 86 | 26.2 | 26.2 | 45 | 40 | Total | 4 | 629791 | 5051283 | 356.28 |
| 87 | 21.6 | 21.6 | 45 | 40 | Total | 4 | 629869 | 5053094 | 334 |
| 88 | 23.6 | 23.6 | 45 | 40 | Total | 4 | 627499 | 5050327 | 299 |
| 89 | 23.2 | 23.2 | 45 | 40 | Total | 4 | 629871 | 5051250 | 355.56 |
| 90 | 19.8 | 19.8 | 45 | 40 | Total | 4 | 627463 | 5050290 | 302.56 |
| 91 | 25.2 | 25.2 | 45 | 40 | Total | 4 | 629907 | 5051239 | 358.32 |
| 92 | 19.9 | 19.9 | 45 | 40 | Total | 4 | 629897 | 5053315 | 337.44 |


P#
Inverter
Sub
Substation
#
Noise receptor
Representative receptor
From 40 to 45 dBA
From 45 to 50 dBA
From 50 to 55 dBA
From 55 to 60 dBA
Over 60 dBA
N
P1
P2
P3
P4
P5
P6
P7
P8
Sub
Northland Power Inc.
Burks Falls East Solar Photovoltaic Facility – Noise map
0 120 240 360 480 600 m
SCALE 1:7500
Figure C1
HATCH™

# Appendix D

## CADNA-A: Sample Calculations

Receiver
Name: POR1
ID: 1.0
X: 627958.00
Y: 5052217.00
Z: 324.66

| Point Source, ISO 9613, Name: "Substation", ID: "Substation" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628092.96 | 5052248.91 | 326.22 | 0 | 32 | 50.5 | 50.5 | 0.0 | 0.0 | 53.8 | 0.0 | -3.0 | 0.0 | 0.0 | 4.5 | 0.0 | -0.0 | -4.8 | -4.8 |
| 2 | 628092.96 | 5052248.91 | 326.22 | 0 | 63 | 69.7 | 69.7 | 0.0 | 0.0 | 53.8 | 0.0 | -3.0 | 0.0 | 0.0 | 5.8 | 0.0 | -0.0 | 13.0 | 13.0 |
| 3 | 628092.96 | 5052248.91 | 326.22 | 0 | 125 | 81.8 | 81.8 | 0.0 | 0.0 | 53.8 | 0.1 | 2.3 | 0.0 | 0.0 | 3.4 | 0.0 | -0.0 | 22.2 | 22.2 |
| 4 | 628092.96 | 5052248.91 | 326.22 | 0 | 250 | 84.3 | 84.3 | 0.0 | 0.0 | 53.8 | 0.1 | 2.7 | 0.0 | 0.0 | 4.4 | 0.0 | -0.0 | 23.2 | 23.2 |
| 5 | 628092.96 | 5052248.91 | 326.22 | 0 | 500 | 89.7 | 89.7 | 0.0 | 0.0 | 53.8 | 0.3 | -0.8 | 0.0 | 0.0 | 9.3 | 0.0 | -0.0 | 27.1 | 27.1 |
| 6 | 628092.96 | 5052248.91 | 326.22 | 0 | 1000 | 86.9 | 86.9 | 0.0 | 0.0 | 53.8 | 0.5 | -0.9 | 0.0 | 0.0 | 11.7 | 0.0 | -0.0 | 21.8 | 21.8 |
| 7 | 628092.96 | 5052248.91 | 326.22 | 0 | 2000 | 83.1 | 83.1 | 0.0 | 0.0 | 53.8 | 1.3 | -0.9 | 0.0 | 0.0 | 14.3 | 0.0 | -0.0 | 14.5 | 14.5 |
| 8 | 628092.96 | 5052248.91 | 326.22 | 0 | 4000 | 77.9 | 77.9 | 0.0 | 0.0 | 53.8 | 4.5 | -0.9 | 0.0 | 0.0 | 17.1 | 0.0 | -0.0 | 3.4 | 3.4 |
| 9 | 628092.96 | 5052248.91 | 326.22 | 0 | 8000 | 68.8 | 68.8 | 0.0 | 0.0 | 53.8 | 16.2 | -0.9 | 0.0 | 0.0 | 19.9 | 0.0 | -0.0 | -20.3 | -20.3 |
| 10 | 628092.96 | 5052248.91 | 326.22 | 1 | 125 | 81.8 | 81.8 | 0.0 | 0.0 | 54.0 | 0.1 | 2.3 | 0.0 | 0.0 | 3.1 | 0.0 | 0.0 | 22.3 | 22.3 |
| 11 | 628092.96 | 5052248.91 | 326.22 | 1 | 250 | 84.3 | 84.3 | 0.0 | 0.0 | 54.0 | 0.2 | 2.7 | 0.0 | 0.0 | 3.3 | 0.0 | 0.2 | 24.0 | 24.0 |
| 12 | 628092.96 | 5052248.91 | 326.22 | 1 | 500 | 89.7 | 89.7 | 0.0 | 0.0 | 54.0 | 0.3 | -0.8 | 0.0 | 0.0 | 7.7 | 0.0 | 0.2 | 28.3 | 28.3 |
| 13 | 628092.96 | 5052248.91 | 326.22 | 1 | 1000 | 86.9 | 86.9 | 0.0 | 0.0 | 54.0 | 0.5 | -0.9 | 0.0 | 0.0 | 9.2 | 0.0 | 0.2 | 23.9 | 23.9 |
| 14 | 628092.96 | 5052248.91 | 326.22 | 1 | 2000 | 83.1 | 83.1 | 0.0 | 0.0 | 54.0 | 1.4 | -0.9 | 0.0 | 0.0 | 11.1 | 0.0 | 0.2 | 17.3 | 17.3 |
| 15 | 628092.96 | 5052248.91 | 326.22 | 1 | 4000 | 77.9 | 77.9 | 0.0 | 0.0 | 54.0 | 4.6 | -0.9 | 0.0 | 0.0 | 13.4 | 0.0 | 0.2 | 6.5 | 6.5 |
| 16 | 628092.96 | 5052248.91 | 326.22 | 1 | 8000 | 68.8 | 68.8 | 0.0 | 0.0 | 54.0 | 16.6 | -0.9 | 0.0 | 0.0 | 16.1 | 0.0 | -0.0 | -16.9 | -16.9 |

| Point Source, ISO 9613, Name: "Inverter1", ID: "Inverter1" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628514.68 | 5051927.96 | 327.63 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 67.0 | 0.0 | -4.9 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | -52.3 | -52.3 |
| 2 | 628514.68 | 5051927.96 | 327.63 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 67.0 | 0.1 | -4.9 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 7.7 | 7.7 |
| 3 | 628514.68 | 5051927.96 | 327.63 | 0 | 125 | 83.9 | 83.9 | 0.0 | 0.0 | 67.0 | 0.3 | 3.5 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 13.2 | 13.2 |
| 4 | 628514.68 | 5051927.96 | 327.63 | 0 | 250 | 98.0 | 98.0 | 0.0 | 0.0 | 67.0 | 0.7 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 28.4 | 28.4 |
| 5 | 628514.68 | 5051927.96 | 327.63 | 0 | 500 | 96.6 | 96.6 | 0.0 | 0.0 | 67.0 | 1.2 | -1.4 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 29.9 | 29.9 |
| 6 | 628514.68 | 5051927.96 | 327.63 | 0 | 1000 | 95.1 | 95.1 | 0.0 | 0.0 | 67.0 | 2.3 | -1.5 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 27.3 | 27.3 |
| 7 | 628514.68 | 5051927.96 | 327.63 | 0 | 2000 | 92.6 | 92.6 | 0.0 | 0.0 | 67.0 | 6.1 | -1.5 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 21.1 | 21.1 |
| 8 | 628514.68 | 5051927.96 | 327.63 | 0 | 4000 | 84.9 | 84.9 | 0.0 | 0.0 | 67.0 | 20.6 | -1.5 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | -1.1 | -1.1 |
| 9 | 628514.68 | 5051927.96 | 327.63 | 0 | 8000 | 70.4 | 70.4 | 0.0 | 0.0 | 67.0 | 73.3 | -1.5 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | -68.4 | -68.4 |

| Point Source, ISO 9613, Name: "Inverter2", ID: "Inverter2" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628475.90 | 5052064.11 | 333.67 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 65.6 | 0.0 | -4.8 | 0.0 | 0.0 | 9.5 | 0.0 | -0.0 | -60.6 | -60.6 |
| 2 | 628475.90 | 5052064.11 | 333.67 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 65.6 | 0.1 | -4.8 | 0.0 | 0.0 | 9.4 | 0.0 | -0.0 | -0.6 | -0.6 |
| 3 | 628475.90 | 5052064.11 | 333.67 | 0 | 125 | 83.9 | 83.9 | 0.0 | 0.0 | 65.6 | 0.2 | 3.3 | 0.0 | 0.0 | 1.2 | 0.0 | -0.0 | 13.5 | 13.5 |
| 4 | 628475.90 | 5052064.11 | 333.67 | 0 | 250 | 98.0 | 98.0 | 0.0 | 0.0 | 65.6 | 0.6 | 2.0 | 0.0 | 0.0 | 2.3 | 0.0 | -0.0 | 27.5 | 27.5 |
| 5 | 628475.90 | 5052064.11 | 333.67 | 0 | 500 | 96.6 | 96.6 | 0.0 | 0.0 | 65.6 | 1.0 | -1.4 | 0.0 | 0.0 | 5.2 | 0.0 | -0.0 | 26.1 | 26.1 |
| 6 | 628475.90 | 5052064.11 | 333.67 | 0 | 1000 | 95.1 | 95.1 | 0.0 | 0.0 | 65.6 | 2.0 | -1.4 | 0.0 | 0.0 | 3.9 | 0.0 | -0.0 | 25.0 | 25.0 |
| 7 | 628475.90 | 5052064.11 | 333.67 | 0 | 2000 | 92.6 | 92.6 | 0.0 | 0.0 | 65.6 | 5.2 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | 21.7 | 21.7 |
| 8 | 628475.90 | 5052064.11 | 333.67 | 0 | 4000 | 84.9 | 84.9 | 0.0 | 0.0 | 65.6 | 17.7 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | 1.6 | 1.6 |
| 9 | 628475.90 | 5052064.11 | 333.67 | 0 | 8000 | 70.4 | 70.4 | 0.0 | 0.0 | 65.6 | 63.1 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | -58.4 | -58.4 |

| Point Source, ISO 9613, Name: "Inverter3", ID: "Inverter3" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628443.58 | 5052185.16 | 338.50 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 64.8 | 0.0 | -4.6 | 0.0 | 0.0 | 4.6 | 0.0 | -0.0 | -55.0 | -55.0 |
| 2 | 628443.58 | 5052185.16 | 338.50 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 64.8 | 0.1 | -4.6 | 0.0 | 0.0 | 4.6 | 0.0 | -0.0 | 5.0 | 5.0 |
| 3 | 628443.58 | 5052185.16 | 338.50 | 0 | 125 | 73.9 | 73.9 | 0.0 | 0.0 | 64.8 | 0.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 5.8 | 5.8 |
| 4 | 628443.58 | 5052185.16 | 338.50 | 0 | 250 | 88.0 | 88.0 | 0.0 | 0.0 | 64.8 | 0.5 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 20.7 | 20.7 |
| 5 | 628443.58 | 5052185.16 | 338.50 | 0 | 500 | 84.6 | 84.6 | 0.0 | 0.0 | 64.8 | 0.9 | -1.3 | 0.0 | 0.0 | 1.3 | 0.0 | -0.0 | 18.9 | 18.9 |
| 6 | 628443.58 | 5052185.16 | 338.50 | 0 | 1000 | 79.1 | 79.1 | 0.0 | 0.0 | 64.8 | 1.8 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | 12.6 | 12.6 |
| 7 | 628443.58 | 5052185.16 | 338.50 | 0 | 2000 | 69.6 | 69.6 | 0.0 | 0.0 | 64.8 | 4.7 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | 0.2 | 0.2 |

| Point Source, ISO 9613, Name: "Inverter3", ID: "Inverter3" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 8 | 628443.58 | 5052185.16 | 338.50 | 0 | 4000 | 66.9 | 66.9 | 0.0 | 0.0 | 64.8 | 16.0 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | -13.8 | -13.8 |

| Point Source, ISO 9613, Name: "Inverter4", ID: "Inverter4" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628226.75 | 5052234.50 | 328.50 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 59.6 | 0.0 | -3.5 | 0.0 | 0.0 | 8.0 | 0.0 | -0.0 | -54.3 | -54.3 |
| 2 | 628226.75 | 5052234.50 | 328.50 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 59.6 | 0.0 | -3.5 | 0.0 | 0.0 | 7.6 | 0.0 | -0.0 | 6.0 | 6.0 |
| 3 | 628226.75 | 5052234.50 | 328.50 | 0 | 125 | 73.9 | 73.9 | 0.0 | 0.0 | 59.6 | 0.1 | 2.8 | 0.0 | 0.0 | 0.6 | 0.0 | -0.0 | 10.8 | 10.8 |
| 4 | 628226.75 | 5052234.50 | 328.50 | 0 | 250 | 88.0 | 88.0 | 0.0 | 0.0 | 59.6 | 0.3 | 2.4 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 25.8 | 25.8 |
| 5 | 628226.75 | 5052234.50 | 328.50 | 0 | 500 | 84.6 | 84.6 | 0.0 | 0.0 | 59.6 | 0.5 | -1.0 | 0.0 | 0.0 | 1.0 | 0.0 | -0.0 | 24.5 | 24.5 |
| 6 | 628226.75 | 5052234.50 | 328.50 | 0 | 1000 | 79.1 | 79.1 | 0.0 | 0.0 | 59.6 | 1.0 | -1.1 | 0.0 | 0.0 | 1.1 | 0.0 | -0.0 | 18.5 | 18.5 |
| 7 | 628226.75 | 5052234.50 | 328.50 | 0 | 2000 | 69.6 | 69.6 | 0.0 | 0.0 | 59.6 | 2.6 | -1.1 | 0.0 | 0.0 | 1.1 | 0.0 | -0.0 | 7.4 | 7.4 |
| 8 | 628226.75 | 5052234.50 | 328.50 | 0 | 4000 | 66.9 | 66.9 | 0.0 | 0.0 | 59.6 | 8.8 | -1.1 | 0.0 | 0.0 | 1.1 | 0.0 | -0.0 | -1.5 | -1.5 |

| Point Source, ISO 9613, Name: "Inverter5", ID: "Inverter5" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628207.34 | 5052074.62 | 323.50 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 60.2 | 0.0 | -3.6 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | -46.7 | -46.7 |
| 2 | 628207.34 | 5052074.62 | 323.50 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 60.2 | 0.0 | -3.6 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 13.3 | 13.3 |
| 3 | 628207.34 | 5052074.62 | 323.50 | 0 | 125 | 73.9 | 73.9 | 0.0 | 0.0 | 60.2 | 0.1 | 2.8 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 10.8 | 10.8 |
| 4 | 628207.34 | 5052074.62 | 323.50 | 0 | 250 | 88.0 | 88.0 | 0.0 | 0.0 | 60.2 | 0.3 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 25.2 | 25.2 |
| 5 | 628207.34 | 5052074.62 | 323.50 | 0 | 500 | 84.6 | 84.6 | 0.0 | 0.0 | 60.2 | 0.6 | -1.1 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 24.9 | 24.9 |
| 6 | 628207.34 | 5052074.62 | 323.50 | 0 | 1000 | 79.1 | 79.1 | 0.0 | 0.0 | 60.2 | 1.1 | -1.1 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 19.0 | 19.0 |
| 7 | 628207.34 | 5052074.62 | 323.50 | 0 | 2000 | 69.6 | 69.6 | 0.0 | 0.0 | 60.2 | 2.8 | -1.1 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 7.8 | 7.8 |
| 8 | 628207.34 | 5052074.62 | 323.50 | 0 | 4000 | 66.9 | 66.9 | 0.0 | 0.0 | 60.2 | 9.4 | -1.1 | 0.0 | 0.0 | 0.0 | 0.0 | -0.0 | -1.6 | -1.6 |

| Point Source, ISO 9613, Name: "Inverter6", ID: "Inverter6" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628419.26 | 5052306.36 | 335.48 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 64.4 | 0.0 | -4.6 | 0.0 | 0.0 | 9.2 | 0.0 | -0.0 | -59.3 | -59.3 |
| 2 | 628419.26 | 5052306.36 | 335.48 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 64.4 | 0.1 | -4.6 | 0.0 | 0.0 | 9.1 | 0.0 | -0.0 | 0.8 | 0.8 |
| 3 | 628419.26 | 5052306.36 | 335.48 | 0 | 125 | 73.9 | 73.9 | 0.0 | 0.0 | 64.4 | 0.2 | 3.1 | 0.0 | 0.0 | 1.1 | 0.0 | -0.0 | 5.0 | 5.0 |
| 4 | 628419.26 | 5052306.36 | 335.48 | 0 | 250 | 88.0 | 88.0 | 0.0 | 0.0 | 64.4 | 0.5 | 2.1 | 0.0 | 0.0 | 1.6 | 0.0 | -0.0 | 19.4 | 19.4 |
| 5 | 628419.26 | 5052306.36 | 335.48 | 0 | 500 | 84.6 | 84.6 | 0.0 | 0.0 | 64.4 | 0.9 | -1.3 | 0.0 | 0.0 | 3.6 | 0.0 | -0.0 | 17.0 | 17.0 |
| 6 | 628419.26 | 5052306.36 | 335.48 | 0 | 1000 | 79.1 | 79.1 | 0.0 | 0.0 | 64.4 | 1.7 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | 12.9 | 12.9 |
| 7 | 628419.26 | 5052306.36 | 335.48 | 0 | 2000 | 69.6 | 69.6 | 0.0 | 0.0 | 64.4 | 4.5 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | 0.6 | 0.6 |
| 8 | 628419.26 | 5052306.36 | 335.48 | 0 | 4000 | 66.9 | 66.9 | 0.0 | 0.0 | 64.4 | 15.4 | -1.4 | 0.0 | 0.0 | 1.4 | 0.0 | -0.0 | -12.9 | -12.9 |

| Point Source, ISO 9613, Name: "Inverter7", ID: "Inverter7" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 627998.00 | 5051827.73 | 309.05 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 62.9 | 0.0 | -4.3 | 0.0 | 0.0 | 9.0 | 0.0 | -0.0 | -57.8 | -57.8 |
| 2 | 627998.00 | 5051827.73 | 309.05 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 62.9 | 0.1 | -4.3 | 0.0 | 0.0 | 8.9 | 0.0 | -0.0 | 2.3 | 2.3 |
| 3 | 627998.00 | 5051827.73 | 309.05 | 0 | 125 | 73.9 | 73.9 | 0.0 | 0.0 | 62.9 | 0.2 | 3.0 | 0.0 | 0.0 | 1.6 | 0.0 | -0.0 | 6.4 | 6.4 |
| 4 | 627998.00 | 5051827.73 | 309.05 | 0 | 250 | 88.0 | 88.0 | 0.0 | 0.0 | 62.9 | 0.4 | 2.1 | 0.0 | 0.0 | 2.1 | 0.0 | -0.0 | 20.5 | 20.5 |
| 5 | 627998.00 | 5051827.73 | 309.05 | 0 | 500 | 84.6 | 84.6 | 0.0 | 0.0 | 62.9 | 0.8 | -1.2 | 0.0 | 0.0 | 4.9 | 0.0 | -0.0 | 17.3 | 17.3 |
| 6 | 627998.00 | 5051827.73 | 309.05 | 0 | 1000 | 79.1 | 79.1 | 0.0 | 0.0 | 62.9 | 1.4 | -1.3 | 0.0 | 0.0 | 3.4 | 0.0 | -0.0 | 12.7 | 12.7 |
| 7 | 627998.00 | 5051827.73 | 309.05 | 0 | 2000 | 69.6 | 69.6 | 0.0 | 0.0 | 62.9 | 3.8 | -1.3 | 0.0 | 0.0 | 1.3 | 0.0 | -0.0 | 3.0 | 3.0 |
| 8 | 627998.00 | 5051827.73 | 309.05 | 0 | 4000 | 66.9 | 66.9 | 0.0 | 0.0 | 62.9 | 12.8 | -1.3 | 0.0 | 0.0 | 1.3 | 0.0 | -0.0 | -8.8 | -8.8 |

| Point Source, ISO 9613, Name: "Inverter8", ID: "Inverter8" | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | X | Y | Z | Refl. | Freq. | LxT | LxN | K0 | Dc | Adiv | Aatm | Agr | Afol | Ahous | Abar | Cmet | RL | LrT | LrN |
| | (m) | (m) | (m) | | (Hz) | dB(A) | dB(A) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | (dB) | dB(A) | dB(A) |
| 1 | 628017.42 | 5051987.69 | 313.50 | 0 | 32 | 9.8 | 9.8 | 0.0 | 0.0 | 58.5 | 0.0 | -3.1 | 0.0 | 0.0 | 7.9 | 0.0 | -0.0 | -53.4 | -53.4 |
| 2 | 628017.42 | 5051987.69 | 313.50 | 0 | 63 | 69.8 | 69.8 | 0.0 | 0.0 | 58.5 | 0.0 | -3.1 | 0.0 | 0.0 | 7.9 | 0.0 | -0.0 | 6.5 | 6.5 |
| 3 | 628017.42 | 5051987.69 | 313.50 | 0 | 125 | 73.9 | 73.9 | 0.0 | 0.0 | 58.5 | 0.1 | 2.8 | 0.0 | 0.0 | 1.9 | 0.0 | -0.0 | 10.6 | 10.6 |
| 4 | 628017.42 | 5051987.69 | 313.50 | 0 | 250 | 88.0 | 88.0 | 0.0 | 0.0 | 58.5 | 0.3 | 2.4 | 0.0 | 0.0 | 2.1 | 0.0 | -0.0 | 24.7 | 24.7 |
| 5 | 628017.42 | 5051987.69 | 313.50 | 0 | 500 | 84.6 | 84.6 | 0.0 | 0.0 | 58.5 | 0.5 | -0.9 | 0.0 | 0.0 | 5.3 | 0.0 | -0.0 | 21.3 | 21.3 |
| 6 | 628017.42 | 5051987.69 | 313.50 | 0 | 1000 | 79.1 | 79.1 | 0.0 | 0.0 | 58.5 | 0.9 | -1.0 | 0.0 | 0.0 | 4.8 | 0.0 | -0.0 | 15.8 | 15.8 |
| 7 | 628017.42 | 5051987.69 | 313.50 | 0 | 2000 | 69.6 | 69.6 | 0.0 | 0.0 | 58.5 | 2.3 | -1.0 | 0.0 | 0.0 | 3.8 | 0.0 | -0.0 | 6.0 | 6.0 |
| 8 | 628017.42 | 5051987.69 | 313.50 | 0 | 4000 | 66.9 | 66.9 | 0.0 | 0.0 | 58.5 | 7.8 | -1.0 | 0.0 | 0.0 | 1.0 | 0.0 | -0.0 | 0.6 | 0.6 |