Table 6.2 Calculated Sound Pressure Levels at POR (shaded rows correspond to representative POR)
Existing = Existing dwelling

ID	Description	Total Sound Pressure (dBA)	Performance Limit (dBA)	Height (m)	UTM Coordinates NAD83 Zone18			Min dist. to source (m)
					X (m)	Y (m)	Z (m)	
1	Existing	39.7	40.0	4.5	366773	4903320	134.5	126
2	Existing	36.6	40.0	4.5	366859	4903323	134.5	201
3	Existing	35.3	40.0	4.5	366876	4903397	134.5	242
4	Existing	37.9	40.0	4.5	366782	4903432	134.5	153
5	Existing	33.4	40.0	4.5	367019	4903279	134.4	335
6	Existing	33.9	40.0	4.5	366950	4903384	134.5	309
7	Existing	37.7	40.0	4.5	366476	4903421	134.5	161
8	Existing	33.4	40.0	4.5	366973	4903383	134.5	329
9	Existing	32.3	40.0	4.5	367088	4903275	134.3	394
10	Existing	36.3	40.0	4.5	366439	4903427	134.5	198
11	Existing	31.6	40.0	4.5	367172	4903163	133.1	429
12	Existing	34.8	40.0	4.5	366391	4903443	134.5	248
13	Existing	31.5	40.0	4.5	367092	4903373	134.5	436
14	Existing	35.3	40.0	4.5	366449	4903496	134.5	212
15	Existing	30.2	40.0	4.5	367240	4903233	133.5	521
16	Existing	30.0	40.0	4.5	366166	4902770	129.5	508
17	Existing	29.8	40.0	4.5	366157	4902750	129.5	524
18	Existing	29.3	40.0	4.5	366180	4902639	128.5	547
19	Existing	29.1	40.0	4.5	366041	4902939	130.1	563
20	Existing	29.1	40.0	4.5	366034	4902964	130.2	557
21	Existing	29.1	40.0	4.5	366029	4903026	130.7	536
22	Existing	29.0	40.0	4.5	366017	4903032	130.7	545
23	Existing	28.6	40.0	4.5	366018	4902893	129.6	599
24	Existing	28.8	40.0	4.5	365998	4903069	130.9	551
25	Existing	28.7	40.0	4.5	365990	4903082	130.9	555
26	Existing	28.3	40.0	4.5	366304	4902384	126.6	542
27	Existing	28.4	40.0	4.5	366372	4902339	126.3	518
28	Existing	28.2	40.0	4.5	365968	4902982	130.1	609
29	Existing	27.9	40.0	4.5	365963	4902878	129.5	656
30	Existing	28.0	40.0	4.5	365942	4903033	130.4	615
31	Existing	26.9	40.0	4.5	367524	4903182	129.5	761
32	Existing	28.0	40.0	4.5	366039	4903555	134.5	588
33	Existing	27.1	40.0	4.5	365957	4903545	134.1	653
34	Existing	26.6	40.0	4.5	365864	4903408	132.8	687
35	Existing	26.0	40.0	4.5	365769	4903004	129.5	790
36	Existing	25.9	40.0	4.5	365767	4902982	129.5	798
37	Existing	26.4	40.0	4.5	365856	4903450	133.0	707
38	Existing	26.2	40.0	4.5	365899	4903590	134.2	725
39	Existing	25.4	40.0	4.5	366132	4902195	124.5	793
40	Existing	25.8	40.0	4.5	365786	4903405	132.5	762

ID	Description	Total Sound Pressure (dBA)	Performance Limit (dBA)	Height (m)	UTM Coordinates NAD83 Zone18			Min dist. to source (m)
					X (m)	Y (m)	Z (m)	
41	Existing	25.2	40.0	4.5	366115	4902187	124.3	812
42	Existing	26.0	40.0	4.5	365916	4903656	134.5	747
43	Existing	25.6	40.0	4.5	365772	4903432	132.6	782
44	Existing	25.1	40.0	4.5	365675	4903041	129.5	871
45	Existing	24.7	40.0	4.5	366062	4902160	123.6	871
46	Existing	24.7	40.0	4.5	365642	4903198	130.4	885
47	Existing	24.2	40.0	4.5	365751	4902462	124.9	1011
48	Existing	24.8	40.0	4.5	365762	4903627	134.0	863
49	Existing	24.6	40.0	4.5	365686	4903496	132.8	883
50	Existing	23.4	40.0	4.5	367854	4903074	124.5	1023
51	Existing	24.3	40.0	4.5	365602	4903245	130.7	924
52	Existing	24.0	40.0	4.5	365980	4902130	122.8	954
53	Existing	24.5	40.0	4.5	365781	4903713	134.5	890
54	Existing	24.4	40.0	4.5	367146	4904098	138.7	872
55	Existing	23.2	40.0	4.5	367888	4903013	124.5	1035
56	Existing	23.0	40.0	4.5	367909	4903049	124.5	1065
57	Existing	23.5	40.0	4.5	365676	4902425	124.5	1094
58	Existing	24.0	40.0	4.5	365654	4903592	133.4	946
59	Existing	24.0	40.0	4.5	365730	4903727	134.5	941
60	Existing	22.5	40.0	4.5	367926	4903216	124.5	1145
61	Existing	22.7	40.0	4.5	367944	4903078	124.5	1108
62	Existing	23.1	40.0	4.5	365879	4902086	121.9	1061
63	Existing	23.3	40.0	4.5	365489	4903250	130.6	1038
64	Existing	23.3	40.0	4.5	365646	4903743	134.5	1021
65	Existing	23.0	40.0	4.5	367312	4904188	139.5	1046
66	Existing	22.4	40.0	4.5	365807	4902040	121.2	1147
67	Existing	23.0	40.0	4.5	365650	4903811	134.5	1054
68	Existing	22.5	40.0	4.5	366536	4901668	119.3	1046
69	Existing	22.2	40.0	4.5	366382	4901674	119.5	1082
70	Existing	22.6	40.0	4.5	365526	4903684	133.6	1100
71	Existing	22.2	40.0	4.5	366329	4901680	119.5	1096
72	Existing	22.5	40.0	4.5	365500	4903658	133.3	1114
73	Existing	22.2	40.0	4.5	365512	4903779	134.3	1155
74	Existing	21.7	40.0	4.5	366199	4901665	119.1	1166
75	Existing	21.4	40.0	4.5	366245	4901600	117.0	1203
76	Existing	21.3	40.0	4.5	366085	4901666	117.8	1223
77	Existing	21.2	40.0	4.5	366069	4901660	117.4	1237
78	Existing	21.2	40.0	4.5	366190	4901603	116.6	1225
79	Existing	21.5	40.0	4.5	365415	4903793	134.0	1248
80	Existing	21.0	40.0	4.5	366139	4901589	115.5	1261
81	Existing	20.7	40.0	4.5	366016	4901609	115.0	1308
82	Existing	20.8	40.0	4.5	366826	4901429	115.3	1265
83	Existing	20.7	40.0	4.5	365991	4901610	114.8	1322

ID	Description	Total Sound Pressure (dBA)	Performance Limit (dBA)	Height (m)	UTM Coordinates NAD83 Zone18			Min dist. to source (m)
					X (m)	Y (m)	Z (m)	
84	Existing	20.7	40.0	4.5	367679	4901743	114.7	1237
85	Existing	20.4	40.0	4.5	367768	4901816	114.6	1242
86	Existing	20.6	40.0	4.5	366861	4901414	115.5	1282
87	Existing	20.9	40.0	4.5	365339	4903808	134.0	1322
88	Existing	20.3	40.0	4.5	367795	4901814	114.5	1262
89	Existing	20.4	40.0	4.5	367715	4901725	114.0	1274
90	Existing	20.4	40.0	4.5	365815	4901666	115.8	1388
91	Existing	20.4	40.0	4.5	366875	4901385	115.2	1313
92	Existing	20.7	40.0	4.5	365271	4903752	133.5	1361
93	Existing	20.2	40.0	4.5	365766	4901673	116.2	1417
94	Existing	20.6	40.0	4.5	365288	4903813	133.9	1370
95	Existing	20.4	40.0	4.5	365265	4903816	133.9	1393
96	Existing	20.4	40.0	4.5	365270	4903845	134.1	1401
97	Existing	19.4	40.0	4.5	367907	4901809	110.8	1347
98	Existing	20.1	40.0	4.5	365215	4903835	134.0	1446
99	Existing	20.0	40.0	4.5	365213	4903857	134.1	1457
100	Existing	17.9	40.0	4.5	368194	4902084	110.3	1435
101	Existing	19.8	40.0	4.5	365178	4903844	134.0	1483
102	Existing	19.8	40.0	4.5	365123	4903732	133.3	1492
103	Existing	19.6	40.0	4.5	365110	4903782	133.7	1522
104	Existing	18.2	40.0	4.5	368362	4902275	112.2	1523
105	Existing	19.5	40.0	4.5	365135	4903856	134.2	1527
106	Existing	19.4	40.0	4.5	365118	4903868	134.3	1548
107	Existing	17.8	40.0	4.5	368397	4902267	110.8	1559
108	Existing	18.9	40.0	4.5	365041	4903916	134.5	1638
109	Existing	18.7	40.0	4.5	365011	4903913	134.5	1664
110	Existing	18.4	40.0	4.5	364922	4903826	134.2	1713
111	Existing	18.4	40.0	4.5	364942	4903879	134.5	1714
112	Existing	18.2	40.0	4.5	364883	4903837	134.3	1753
113	Existing	18.2	40.0	4.5	364872	4903824	134.2	1759
114	Existing	17.7	40.0	4.5	364823	4903911	134.5	1836
115	Existing	17.7	40.0	4.5	365499	4904756	134.5	1775
116	Existing	17.5	40.0	4.5	364792	4903920	134.5	1868
117	Existing	16.6	40.0	4.5	365182	4904745	134.5	1985
118	Existing	16.6	40.0	4.5	365211	4904781	134.5	1989
119	Existing	16.6	40.0	4.5	364893	4904450	134.5	2037
120	Existing	16.5	40.0	4.5	365148	4904745	134.5	2010
121	Existing	16.4	40.0	4.5	364855	4904442	134.5	2066
122	Existing	16.4	40.0	4.5	364836	4904433	134.5	2077
123	Existing	16.2	40.0	4.5	364677	4904232	134.5	2105
124	Existing	16.2	40.0	4.5	364705	4904280	134.5	2104

In order to account for the potential noise impacts to vacant lots surrounding the Project Location (i.e., those that could have an inhabited building constructed on the lot at a future date), a comparison was made between the Zoning Designation (Figure A.1 in Appendix A), the noise receptors, land parcels surrounding the Project Location and the noise contours shown in Figure C.1 and Figure C.2 in Appendix C. The results from the comparison are summarized in Table 6.3 below and show that the 40-dBA noise contour partially encroaches onto five parcels surrounding the Project Location.

Effect of the noise emissions at the POR was also accessed by intersecting the 40-dBA sound pressure noise contours calculated at 1.5-m above ground with 30-m radius circles placed around the POR (Figure C.2). The results show that none of the 30-m radius zones are affected by the noise emissions.

Table 6.3 Parcels Partially Affected by the Project's noise emission

Parcels ID	PIN	Zoning	Description
PR01	451300047	Rural	Contains an existing noise receptor
PR02	451300049	Rural	Vacant lot
PR03	N/A*	Rural	Contains existing noise receptors
PR04	451300050	Rural	Contains an existing noise receptor
PR05	451300134	Rural	Vacant lot

*(N/A – no parcel PIN information available at time of study)

The noise receptors located on parcels PR01, PR03 and PR04 were included in the CADNA-A model and determined to be compliant with the MOE performance limits.

As described in 1.(4)4. of Ontario Regulation 521/10, a noise receptor on a vacant lot (where no building permit has been issued) is considered to be the location ". . . at which a building would reasonably be expected to be located, having regard to the existing zoning by-law and the typical building pattern in the area . . .". For parcel PR02, a building would reasonably be expected to be located anywhere adjacent to Hwy 2 South outside of the 40-dBA contour line encroachment. Presently there is limited access to the PR05 parcel. However, should more complete access be made available in the future there is sufficient land to build a residence that is unaffected by the 40-dBA contour line. Hence, for both vacant lot parcels, there is sufficient room on the unaffected property for a future dwelling (i.e., noise receptor) to be built on the property, be below 40-dBA and, thus, be compliant with the MOE performance limits.

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

7. Conclusions and Recommendations

For the Kingston Gardiner Hwy 2 South Solar Energy Project, 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 a 40-dBA threshold. Mitigation for operation of the Project has been modeled and shown to be feasible.

Based on the results obtained in this study, it is concluded that the sound pressure levels at the POR resulting from the Project operation will be below MOE requirements for Class 3 areas of 40 dBA at all time.

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Report Reviewed and Approved By

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PROVINCE OF ONTARIO

Jan 26, 2012

Oleg Belashov, M.A.Sc., P.Eng.

8. References

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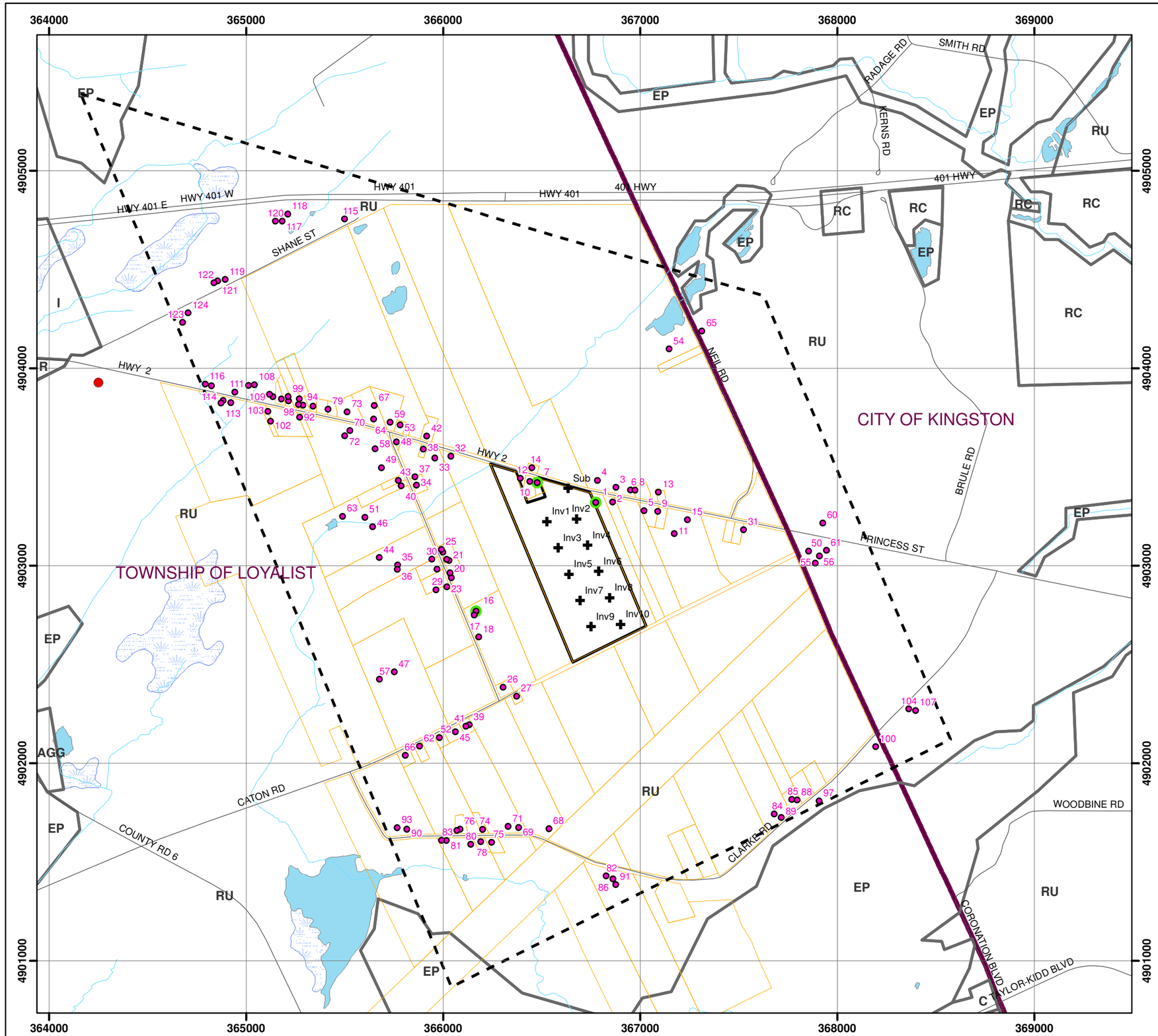
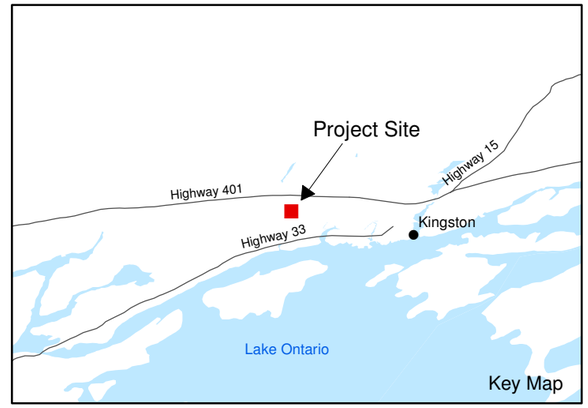
International Organization for Standardization (ISO). Standard 1913-2:Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation.

Appendix A

Land Use Zoning Designation Plan, and Area Location Plan





LEGEND

- Sub Substation Transformer
- Inv# Inverter Unit
- # Noise Receptor
- # Representative Noise Receptor
- Road
- Watercourse
- 1200m Envelope
- Project Site
- Parcel
- Municipality
- Water Body
- Wetland Area
- Zone Boundary

Zones

AGG	Aggregate
C	Commercial
EP	Environmental Protection
FA	Fringe Area
I	Industrial
RC	Rural Commercial
RU	Rural

Notes:
1. OBM and NRVIS data downloaded from LIO, with permission.
2. Spatial Referencing UTM NAD 83.
3. Land use information obtained from the Township of Loyalist and City of Kingston Official Plans.

0 0.25 0.5 1 Km

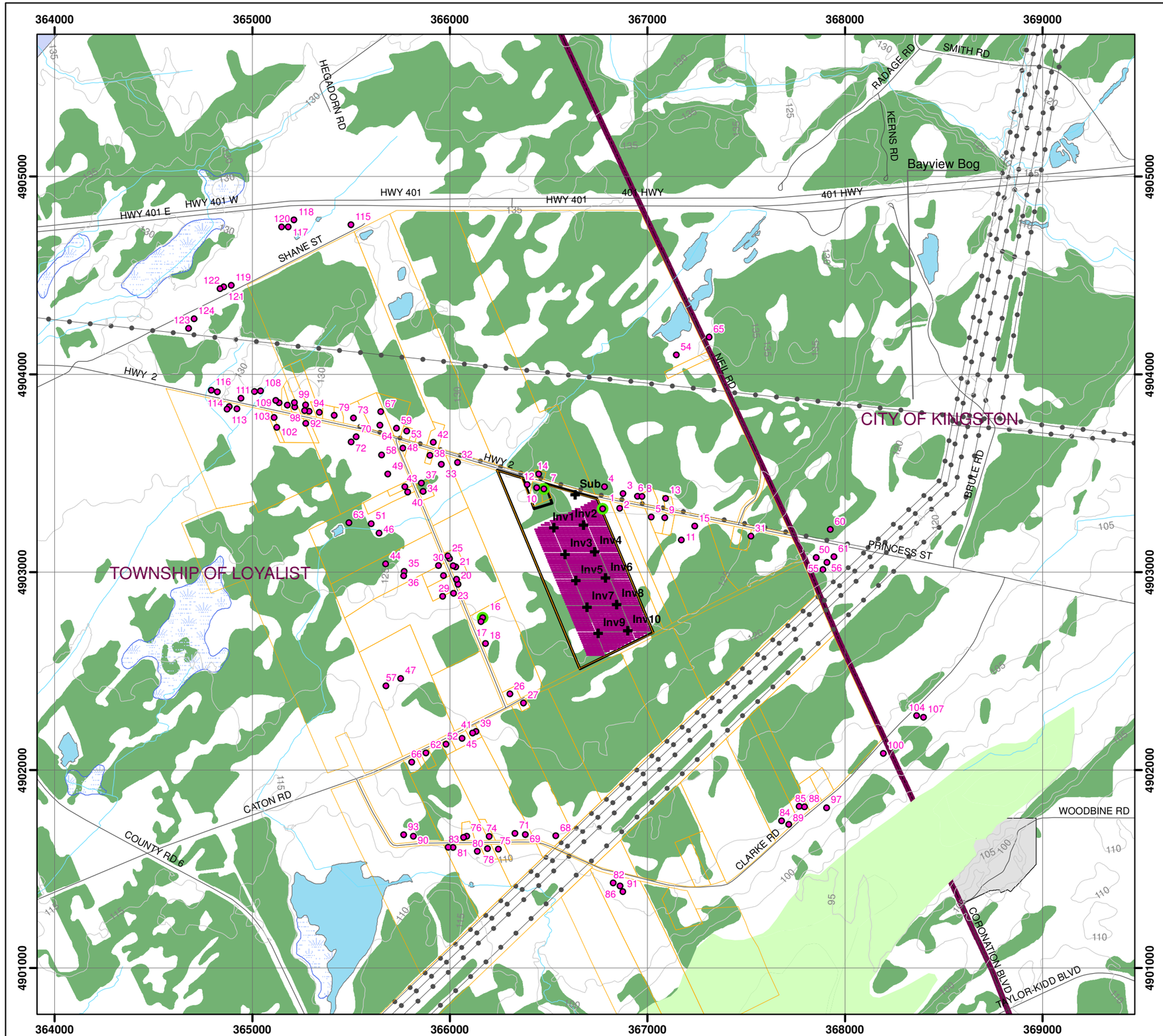
NORTH

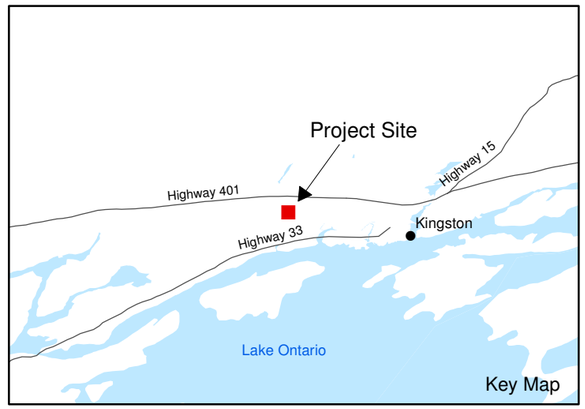
1:20,000

Figure A.1
Axio Power Canada Inc./SunEdison Canada
Kingston Gardiner Hwy 2 South
Land Use Plan

HATCH

Path: P:\CANSOLAR\335467\SPECIALIST_APPS\GIS\Hwy 2_South\Hwy 2 South_Noise_Zoning.mxd Date Saved: 1/19/2012 2:17:47 PM





LEGEND

- Sub — Substation
- Inv# — Inverter Unit
- Noise Receptor
- Represesentative Noise Receptor
- Railway
- Road
- Transmission Line
- Watercourse
- Solar PV Panels
- Project Site
- Parcel
- Municipality
- Water Body
- Wetland
- Provincially Significant Wetland
- Woodland

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

0 0.25 0.5 1 Km

1:20,000

NORTH

Figure A.2

Axio Power Canada Inc./SunEdison Canada

Kingston Gardiner Hwy 2 South

Area Location Plan

HATCH

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Appendix B

Noise Sources

Table B.1 Point Sources Used in CADNA-A, Includes Tonality Penalty of 5.0-dBA. NAD83 Zone18.

Source ID	Description	Spectra ID	Total Sound Power Level - 24 Hours (dBA)	Correction - 24 Hours (dBA)	Height (m)	UTM Coordinates (m)		
						X	Y	Z
Sub	44-kV/10-MVA Substation transformer	Transformer10MVA	90.8	5.0	3.0	366634	4903392	133.0
Inv1	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366526	4903226	132.8
Inv2	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366677	4903239	133.4
Inv3	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366584	4903091	131.9
Inv4	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366733	4903105	132.3
Inv5	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366639	4902958	131.1
Inv6	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366789	4902972	131.1
Inv7	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366695	4902825	129.9
Inv8	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366844	4902839	129.8
Inv9	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366751	4902692	128.8
Inv10	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366901	4902705	128.6

Table B.2 Frequency Spectra Used for Modelling the Noise Sources, Not Including Tonality Penalty.

Spectra ID	Octave Spectrum (dBA)										
	31.5	63	125	250	500	1000	2000	4000	8000	A	lin
Transformer10MVA	43.0	62.2	74.3	76.8	82.2	79.4	75.6	70.4	61.3	85.8	94.4
SC1000MV		64.8	78.9	93	91.6	90.1	87.6	79.9	65.4	97.2	103.7

Table B.3 Noise Reduction and Sound Transmission Characteristics of the Acoustical Louvers.

Name	Octave Spectrum (dB)								
	31.5	63	125	250	500	1000	2000	4000	8000
Greenheck Louver	0	10	10	12	16	23	18	0	0

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)

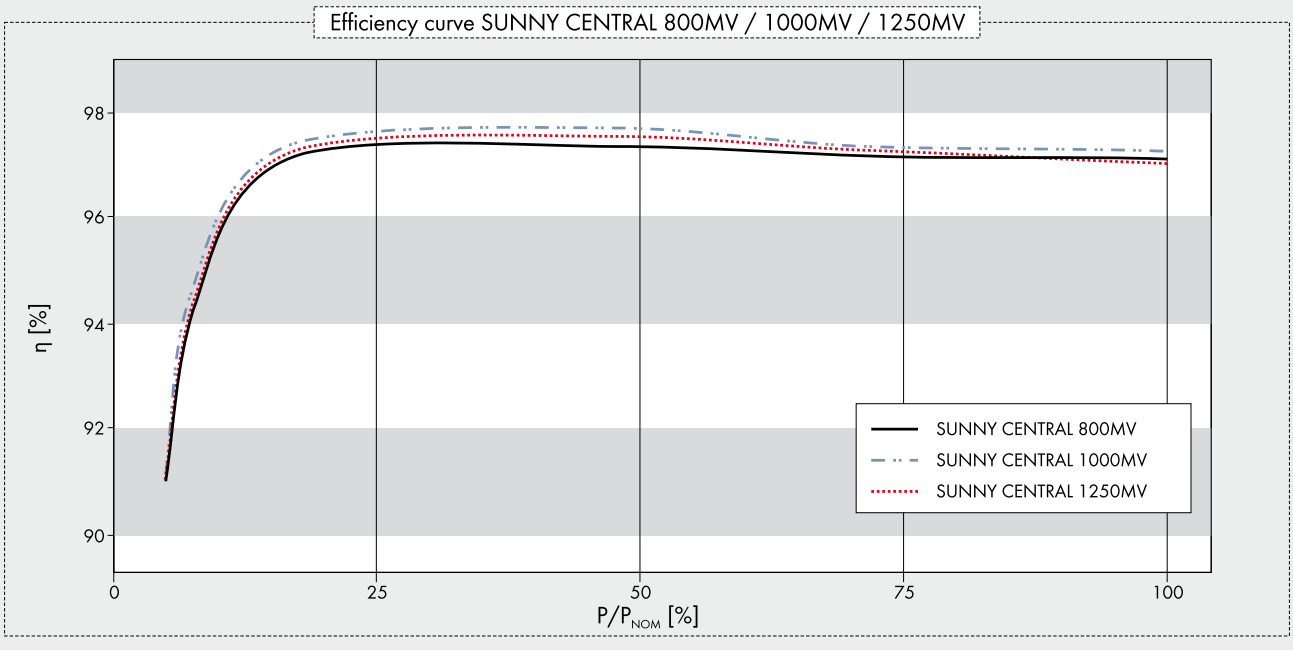
SUNNY CENTRAL for Direct medium-voltage feed-in 800MV / 1000MV / 1250MV

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.

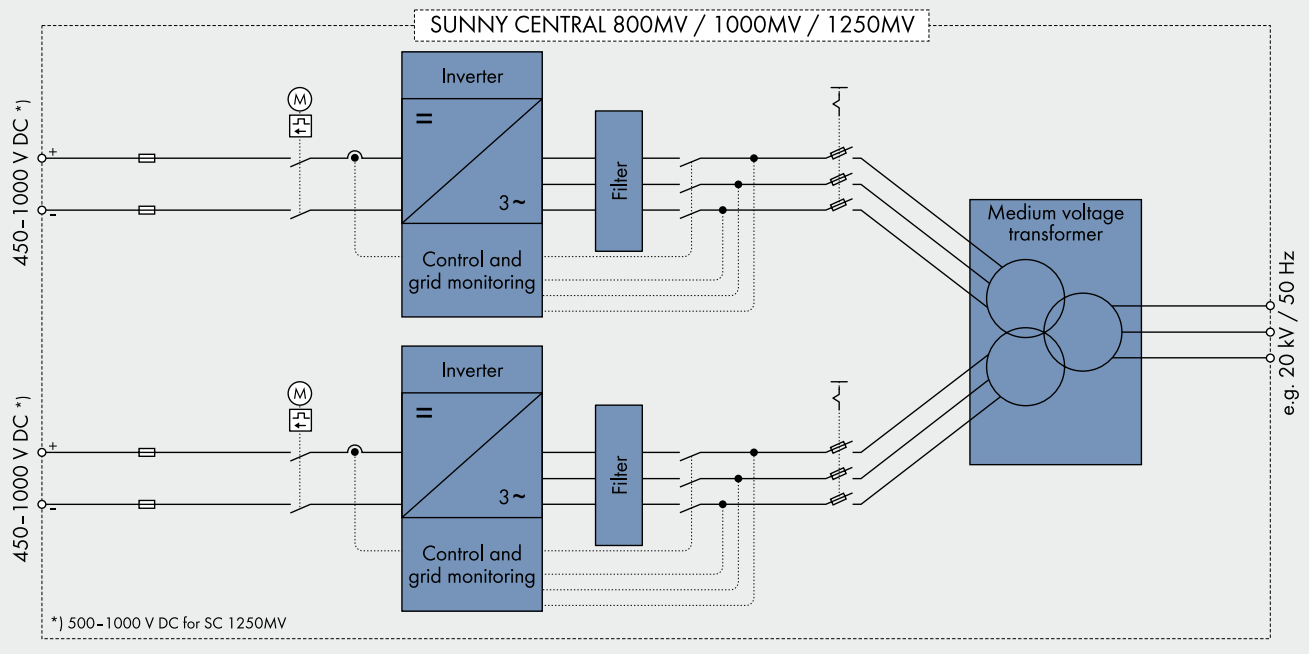
SUNNY CENTRAL 800MV / 1000MV / 1250MV

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

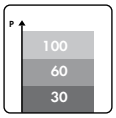


	Sunny Central 800MV	Sunny Central 1000MV	Sunny Central 1250MV
Features			
Display: text line / graphic	●/–	●/–	●/–
Ground fault monitoring	●	●	●
Heating	●	●	●
Emergency stop	●	●	●
Circuit breaker AC side	SI load disconnection switch	SI load disconnection switch	SI load disconnection switch
Circuit breaker 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

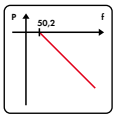
HE: High Efficiency, inverter without galvanic isolation for connection to a medium-voltage transformer (taking into account the SMA specification for the transformer)
1) Specifications apply to irradiation values below STC
2) Efficiency measured without an internal power supply at U_{DC} = 500 V
3) 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



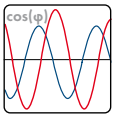
POWERFUL GRID MANAGEMENT FUNCTIONS



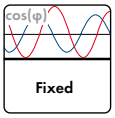
Remote controlled power reduction in case of grid overload
In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination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



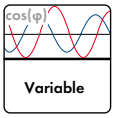
Frequency-dependent control of active power
As of a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



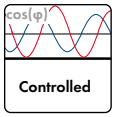
Static voltage support based on reactive power
To stabilize the grid voltage, SMA inverters feed reactive power (leading or lagging) into the grid. Three different modes are available:



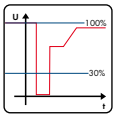
a) Fixed definition of the reactive power by the grid operator
The grid operator defines a fixed reactive power value or a fixed displacement factor between $\cos(\varphi)_{leading}$= 0.90 and $\cos(\varphi)_{lagging}$= 0.90.



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.

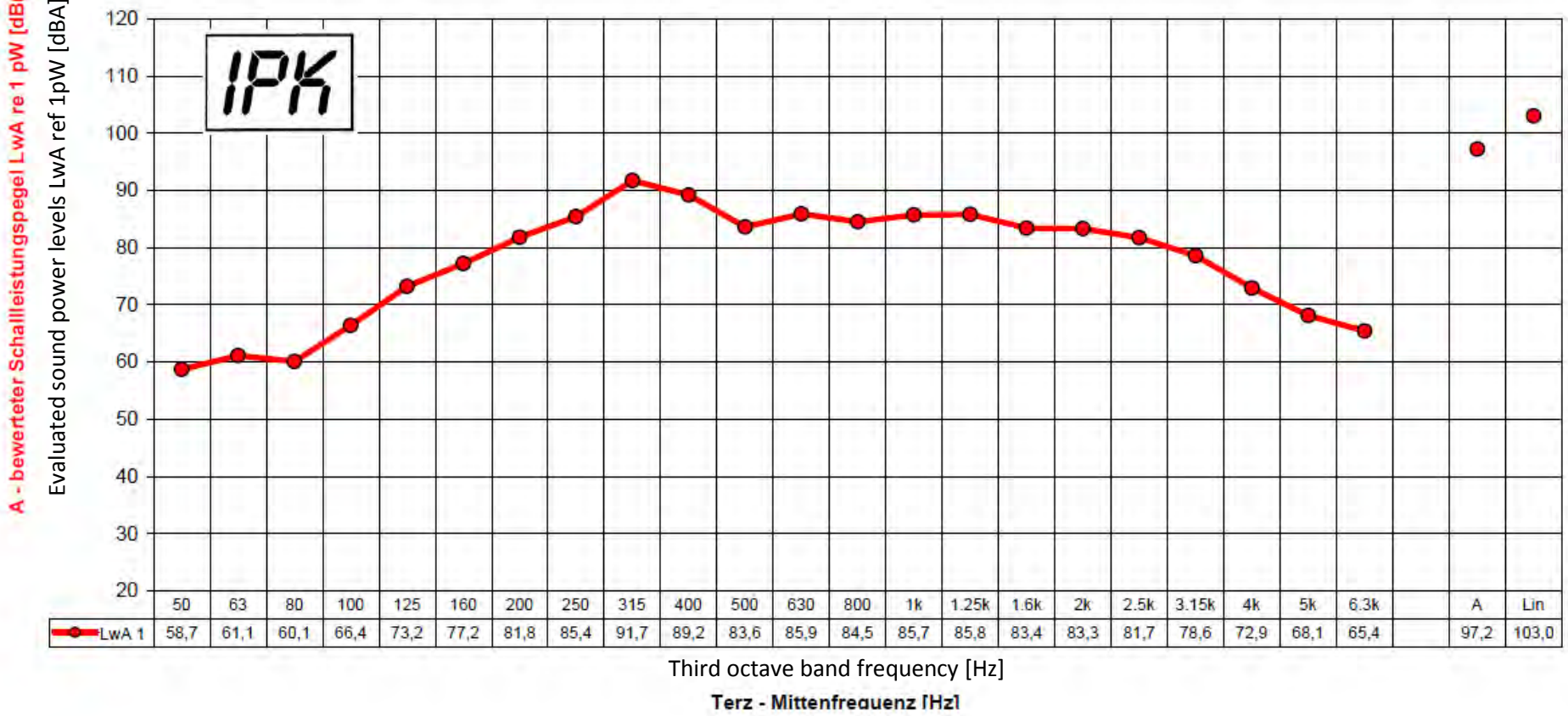


Limited Dynamic Grid Support
The inverter continues to feed to the grid after short term voltage drops – as long as the grid voltage is within a defined voltage window.

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

SMA Solar Technologies Inverter Unit Sunny Central SC 1000MV

Name Plate Capacity 1000 kW at 50 Hz



	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

Third octave band frequency [Hz]

Terz - Mittenfrequenz [Hz]

Estimated Frequency Spectra for Transformers

Transformer - 44kV/10MVA

From Handbook of Noise and Vibration Control (Crocker, 2007, page 1335-1336, Eq. 18 and Table 20) and Beranek's old notes (page 7-19)

Average LpA	68 dBA	Based on NEMA TR1-1993 (R2000), Table 0-2
Estimated surface area	35 m^2	Can be assumed, 25% of change will produce a difference of 1 dB on Lw, try to estimate on the high side

Correction factors are in dB

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Notes
C1	-11.0	-5.0	-3.0	-8.0	-8.0	-14.0	-19.0	-24.0	-31.0	Outdoors, indoors in mechanical room over 140 m^3
C2	-11	-2	3	-2	-2	-11	-19	-24	-31	Indoors
C3	-11	-2	3	2	2	-4	-9	-14	-21	Serious Noise Problems

Sound Power Level calculated as Lw=Average LpA + 10*log(Estimated surface area) + C + 10

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Combined [dB]
C1 based [dB]	82.4	88.4	90.4	85.4	85.4	79.4	74.4	69.4	62.4	**94.5**
C2 based [dB]	82.4	91.4	96.4	91.4	91.4	82.4	74.4	69.4	62.4	**99.5**
C3 based [dB]	82.4	91.4	96.4	95.4	95.4	89.4	84.4	79.4	72.4	**101.5**

Resulting A-weighted sound power level

Freq. (Hz)	A-Weight	C1 based [dBA]	C2 based [dBA]	C2 based [dBA]
31	-39.4	43.0	52.0	57.0
63	-26.2	62.2	65.2	65.2
125	-16.1	74.3	80.3	80.3
250	-8.6	76.8	82.8	86.8
500	-3.2	82.2	88.2	92.2
1000	0	79.4	82.4	89.4
2000	1.2	75.6	75.6	85.6
4000	1	70.4	70.4	80.4
8000	-1.1	61.3	61.3	71.3
LwA [dBA]		**85.8**	**90.8**	**95.6**

Used in the study

Figure B.1 Sound Power Level Calculation for 44-kV/10-MVA Substation Transformer.

Third octave, as provided		
Freq #	Freq (Hz)	LwA (dBA)
1	25	
2	31.5	
3	40	
4	50	58.7
5	63	61.1
6	80	60.1
7	100	66.4
8	125	73.2
9	160	77.2
10	200	81.8
11	250	85.4
12	315	91.7
13	400	89.2
14	500	83.6
15	630	85.9
16	800	84.5
17	1000	85.7
18	1250	85.8
19	1600	83.4
20	2000	83.3
21	2500	81.7
22	3150	78.6
23	4000	72.9
24	5000	68.1
25	6300	65.4
26	8000	
27	10000	
	Total LwA	**97.2**

Full octave, as used in CADNA-A model		
Freq #	Freq (Hz)	LwA (dBA)
	31.5	
5	63	64.8
8	125	78.9
11	250	93.0
14	500	91.6
17	1000	90.1
20	2000	87.6
23	4000	79.9
26	8000	65.4
	Total LwA	**97.2**

$$\rightarrow 10\log\left(10^{\frac{58.7}{10}}+10^{\frac{61.1}{10}}+10^{\frac{60.1}{10}}\right)=64.8dBA$$

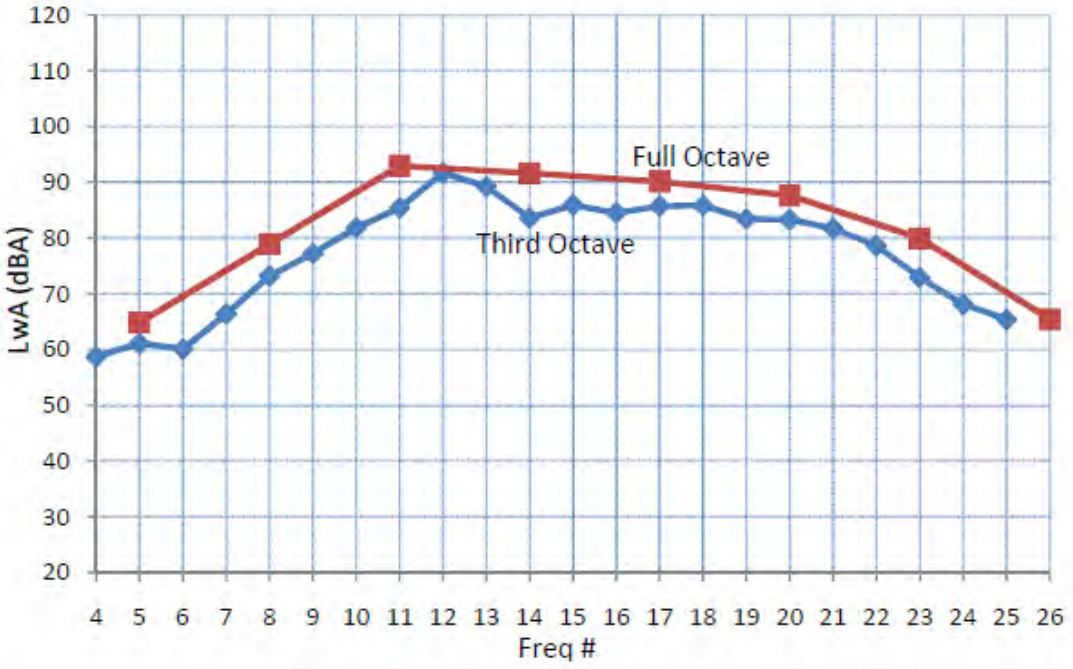


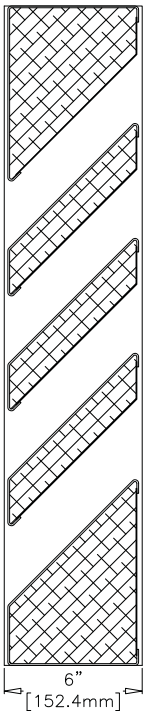
Figure B.2 Sound Power Level Calculation for SMA Sunny Central 1000MV, 100% LOAD.

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

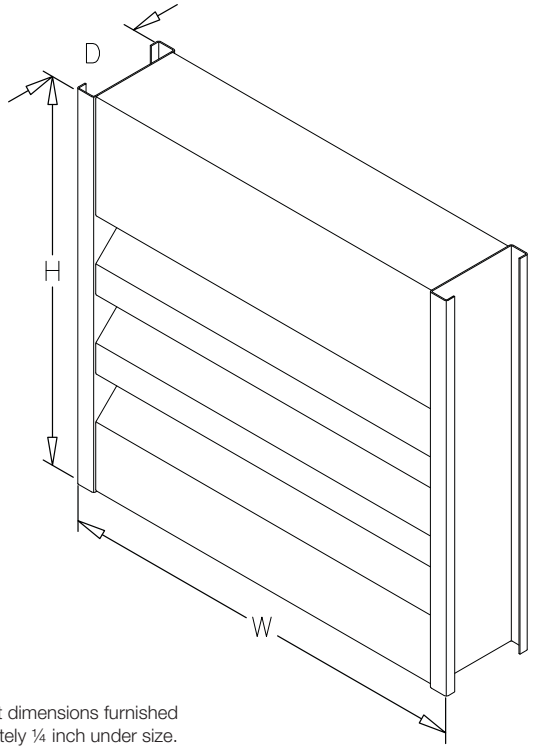
Acoustical Insulation . . . . . Fiberglass Insulation

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

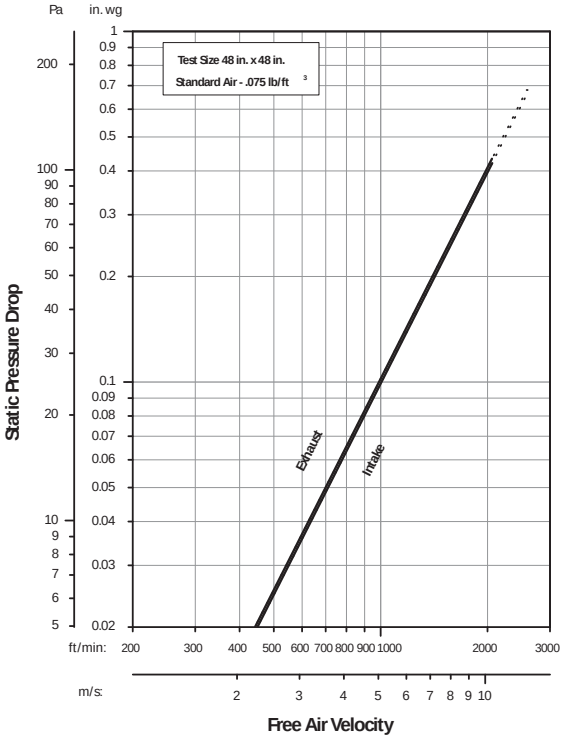
Transmission loss (TL) is a measurement of the reduction of sound power transmission (dB) through an assembly at a given frequency. The more sound power that is reduced, the greater the TL. TL is tested in accordance with ASTM E90-04.

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	

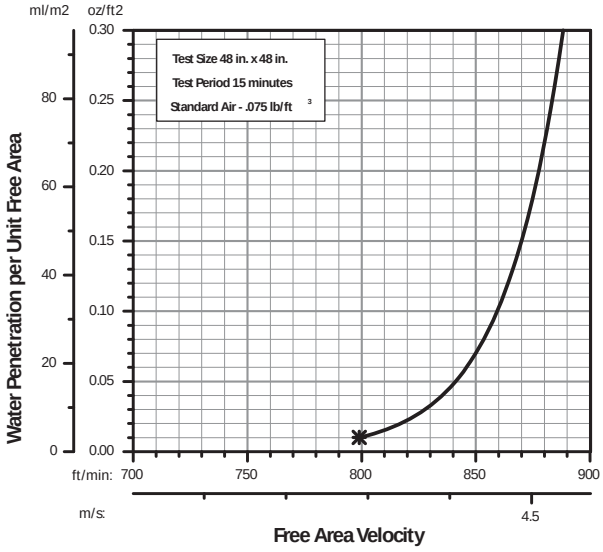
Airflow Resistance (Standard Air - .075 lb/ft³)



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.

INSTALLATION DETAILS

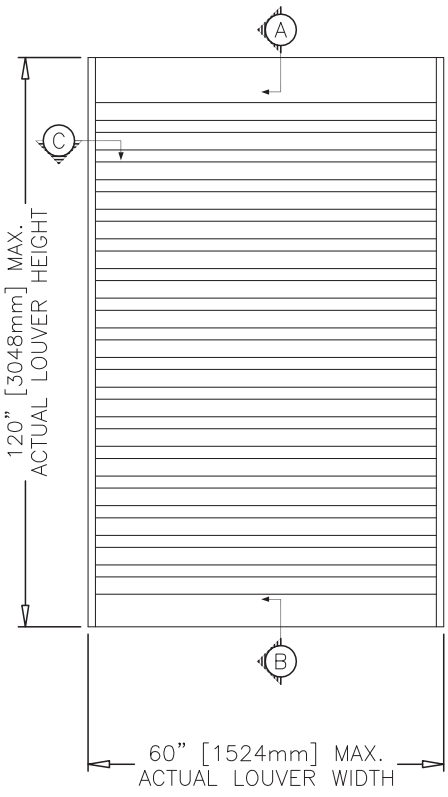
AFJ-601

J Blade Acoustical Louver
Formed Aluminum

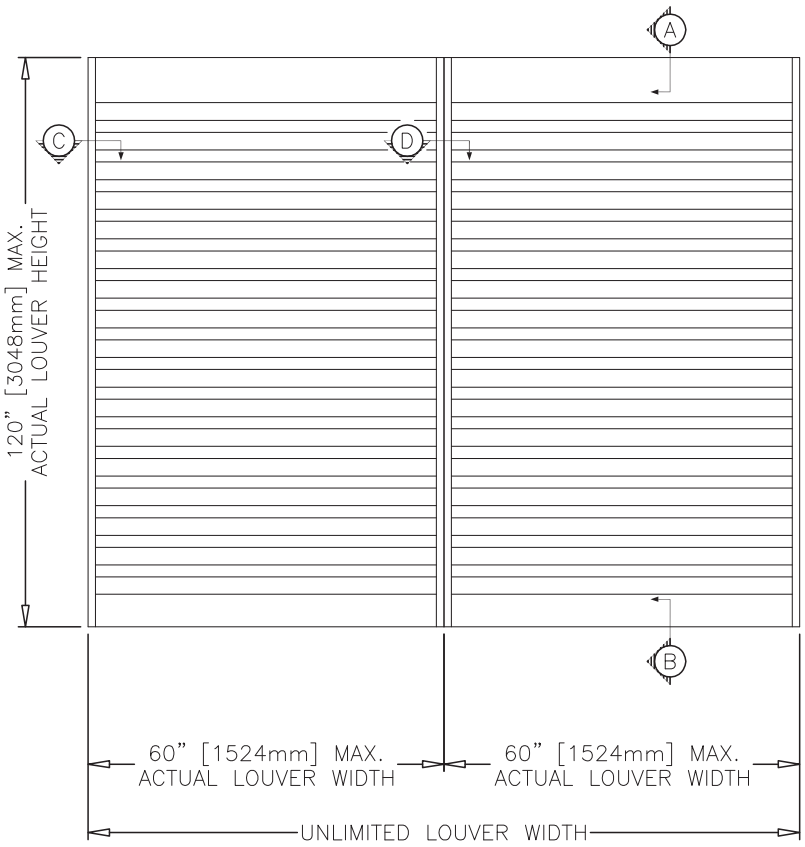
Maximum Size and Installation Information

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.

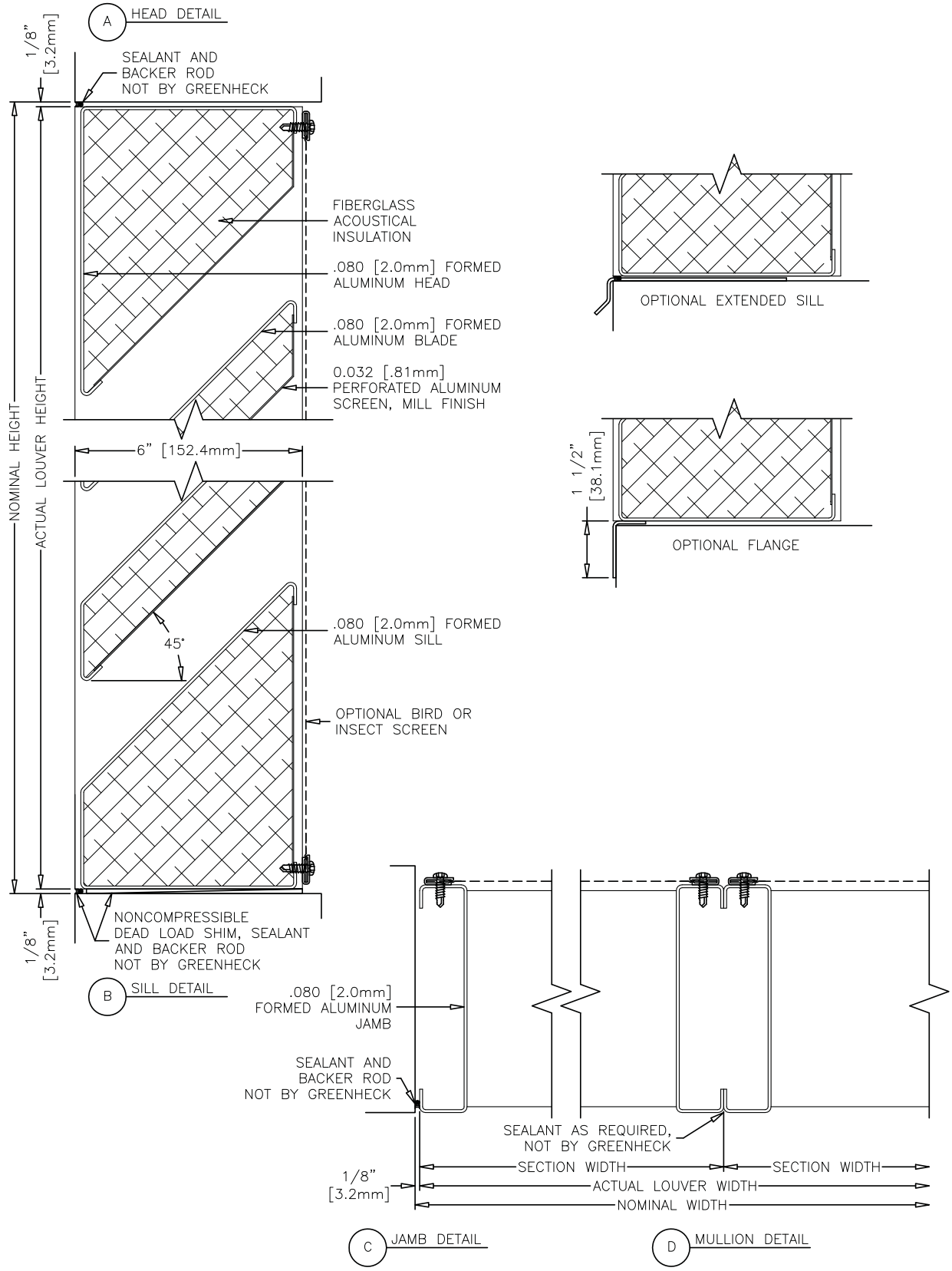
SINGLE SECTION



MULTIPLE SECTION W/ MULLION



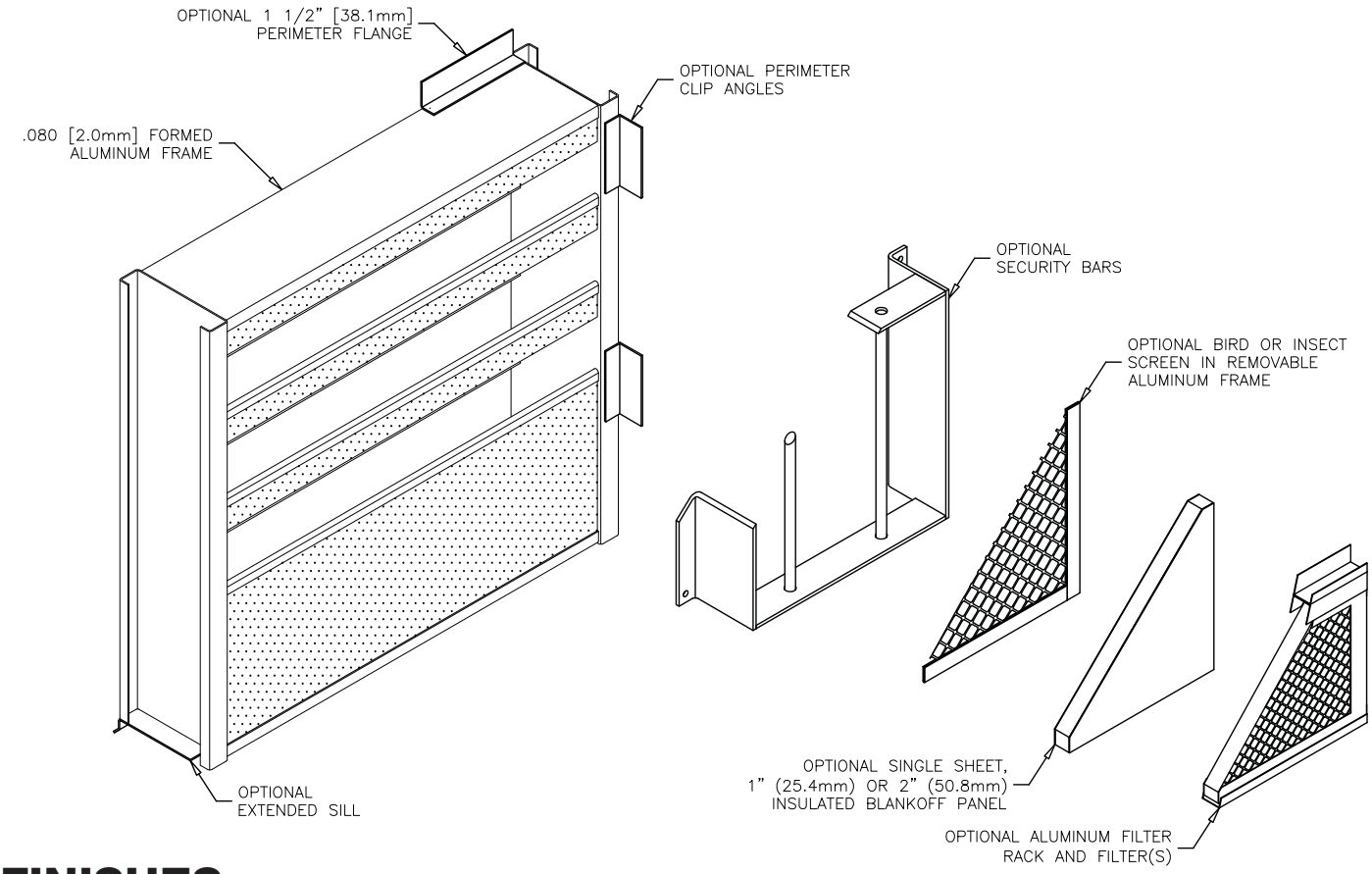
Minimum Single Section Size	Maximum Single Section Size
12 in. W x 15 in. H	60 in. W x 120 in. H


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
NONCOMPRESSIBLE DEAD LOAD SHIM, SEALANT AND BACKER ROD NOT BY GREENHECK
1/8" [3.2mm]
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. **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.

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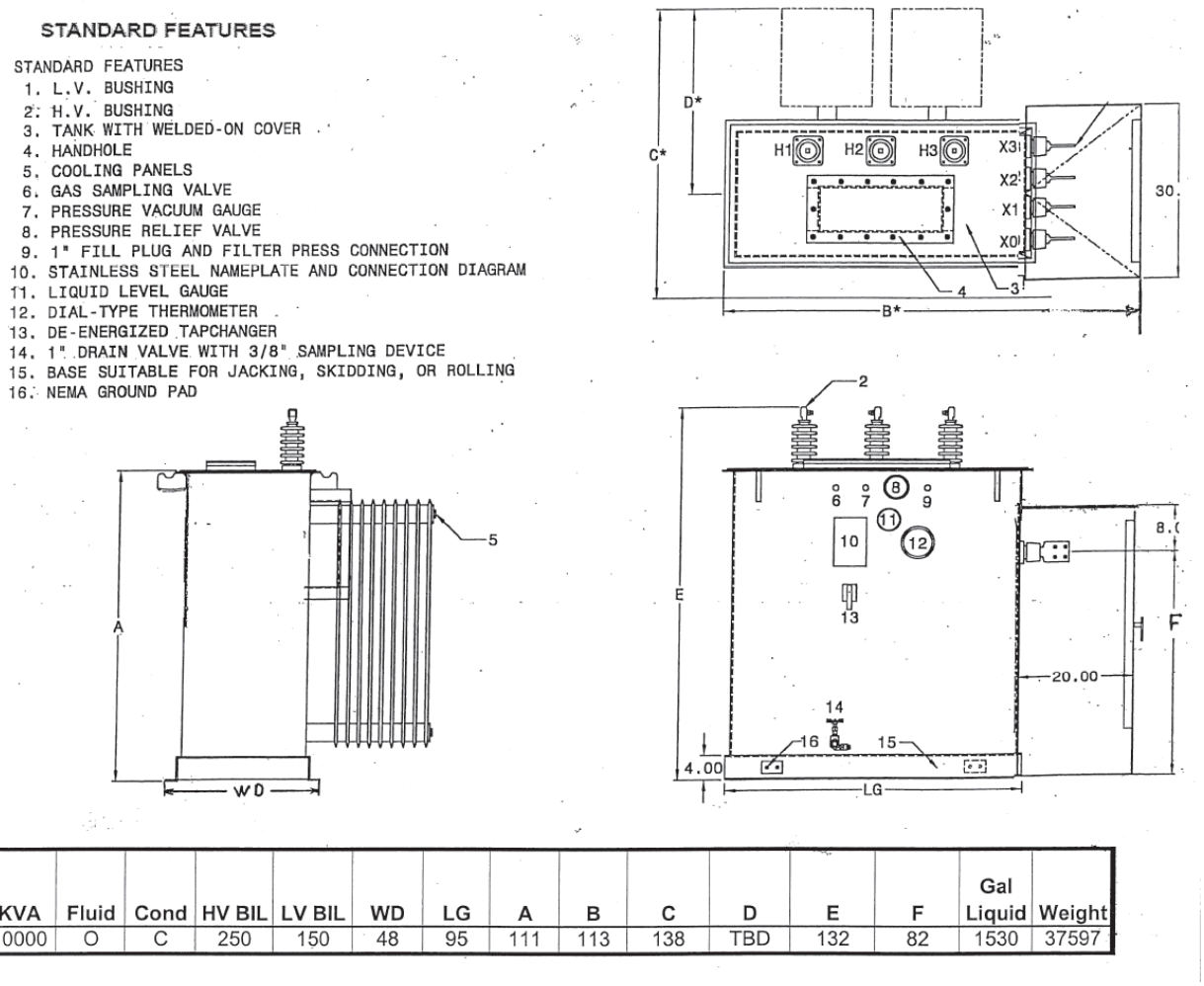

KVA	Fluid	Cond	HV BIL	LV BIL	WD	LG	A	B	C	D	E	F	Gal Liquid	Weight
10000	O	C	250	150	48	95	111	113	138	TBD	132	82	1530	37597

Figure B.3 Catalogue Dimensions (inches) of Substation Transformer, Obtained from Magna Electric Corporation.

Appendix C

Noise Map from CADNA-A