Environmental Noise Analysis

North Summit Cellular Facility

Santa Cruz County, California

BAC Job # 2014-230

Prepared For:

Complete Wireless Consulting

Attn: Kim Le
2009 V Street
Sacramento, CA 95818

Prepared By:

Bollard Acoustical Consultants, Inc.

Paul Bollard, President

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3551 Bankhead Road • Loomis, CA 95650 • Phone: (916) 663-0500 • Fax: (916) 663-0501 • BACNOISE.COM

Introduction

The North Summit Verizon Wireless Unmanned Telecommunications Facility Project (project) proposes the construction of a monopine cell tower and the installation of outdoor equipment cabinets and an emergency diesel standby generator inside a fenced area located approximately 260 feet south of Loma Prieta Avenue in Los Gatos (Santa Cruz County), California. The outdoor equipment cabinets and the emergency diesel standby generator have been identified as primary noise sources associated with the project. Please see Figure 1 for the general site location. The studied site design is dated September 15, 2015.

Bollard Acoustical Consultants, Inc. has been contracted by Complete Wireless Consulting, Inc. to complete an environmental noise assessment regarding the proposed project cellular equipment operations. Specifically, the following addresses daily noise production and exposure associated with operation of the project emergency generator and outdoor equipment cabinets.

Please refer to Appendix A for definitions of acoustical terminology used in this report. Appendix B illustrates common noise levels associated with various sources.

Criteria for Acceptable Noise Exposure

Santa Cruz County General Plan Noise Element

The Santa Cruz County General Plan Noise Element provides regulations regarding noise levels produced by stationary (non-transportation) noise sources. The primary objective of the Noise Element is to prescribe policies that lead to the preservation and enhancement of the quality of life for the residents of Santa Cruz County by securing and maintaining an environment free from hazardous and annoying noise. These standards are summarized below in Table 1.

Table 1
Maximum Allowable Noise Exposure for Stationary Noise Sources
Santa Cruz County Noise Element of the General Plan

Noise Level Descriptor	Daytime 7 a.m. to 10 p.m.	Nighttime 10 p.m. to 7 a.m.
Hourly L_{eq}, dB	50	45
Maximum Level (L_{max}), dB	70	65

Source: Santa Cruz County Noise Element of the General Plan

Figure 1

Project Area and Nearest Noise-Sensitive Receivers
North Summit Cellular Facility - Santa Cruz County, California

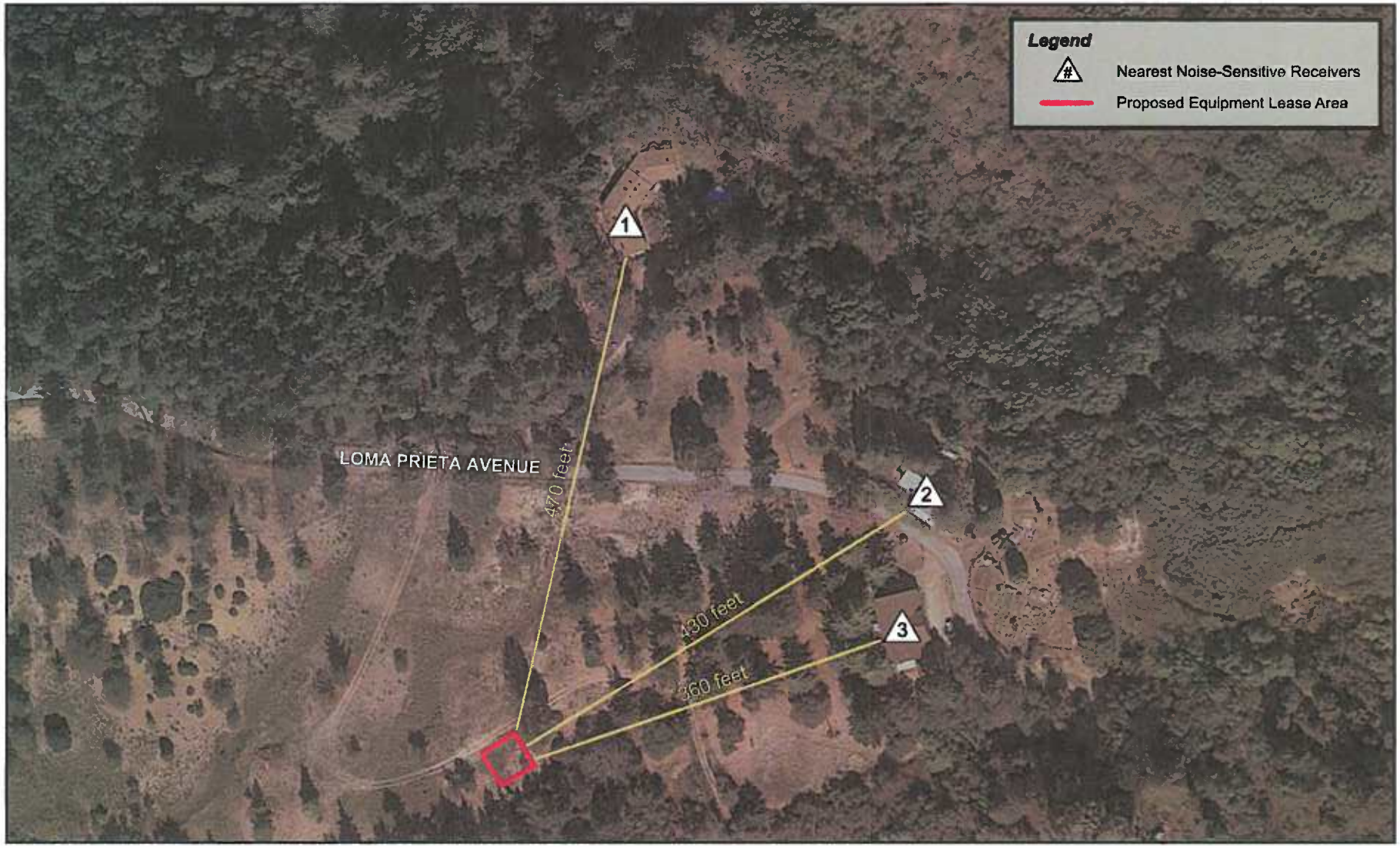

EXHIBIT 11

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Santa Cruz County Code

Section 13.10.663 of the Santa Cruz County Code states that backup generators shall only be operated during power outages and for testing and maintenance purposes. If the facility is located within 100 feet of a residential dwelling unit, noise attenuation measures shall be included to reduce noise levels at the facility to a maximum exterior noise level of 60 dB L_{dn} at the property line and a maximum interior noise level of 45 L_{dn} within the nearby residence.

As shown in Figure 1, the proposed cellular facility is located approximately 360 feet away from the nearest residence. Because the proposed cellular facility would be located over 100 feet away from the nearest residence, the noise level criteria presented in Section 13.10.663 of the Santa Cruz County Code would not be applicable to this project. However, the project noise emissions would still be required to comply with the County of Santa Cruz General Plan Noise Element noise level criteria, presented previously in Table 1.

Discussion of Noise Standard Interpretation Relative to Cellular Facility Projects

Both the County General Plan Noise Element and Noise Ordinance apply the County's noise standards at the property line of the noise-sensitive receiving use. In cases where there are residences located in close proximity to the property lines, application of the noise standards at the project property lines ensures that adequate protection will be in place to ensure the residents are not adversely affected by noise.

Cellular projects are different than most noise-generating projects in that the cellular companies make efforts to locate their proposed equipment as far away from residences as practical, including the residence on the property being leased for the cellular equipment. The result is frequently that the cellular equipment is located far from residences but very close to residential property lines.

The high-frequency noise generated by cellular equipment cabinet cooling fans (the only source of noise associated with the equipment cabinets), dissipates rapidly over distance. As a result, if equipment cabinets are located adjacent to a property line, it's not uncommon for the fan noise to exceed property line noise standards even though the noise has dissipated rapidly within 50 to 100 feet from the cabinets. In addition, cellular cabinet fans frequently cycle off when temperatures drop during nighttime hours and cooling requirements are greatly diminished.

The other noise source associated with cellular projects is the emergency generator. The generator's function is to maintain communications during power outages. As a result, the only time the generator operates is during relatively infrequent power outages and for a period of 15 minutes during daytime hours twice a month to ensure the generator will be functional should a power outage occur.

With a level 2 acoustic enclosure, a typical cellular facility generator emits a noise level of 68 dB at a reference distance of 23 feet. If the generator is located within 10 feet of a residential property line, a condition which is not uncommon, the noise level while operating is approximately 75 dB at that property line. A level of 75 dB will exceed most nighttime property line noise standards even though the nearest residences may be hundreds of feet away and there is no noise-sensitivity at the property line.

Because the noise generation of outdoor equipment cabinet fans is low and dissipates rapidly, and because cellular facility generators would only operate during nighttime hours to maintain vital communications during power outages, it is BAC's professional opinion that noise impacts associated with cellular facilities are more appropriately evaluated in the immediate vicinity of residences rather than at property lines. In addition, because cellular facility generators operate for extended periods at night only during emergency power outages, the noise created by emergency generator operations would appropriately be exempted from local noise provisions. Finally, it is BAC's professional opinion that noise generated during routine, twice-monthly, daytime generator testing should be evaluated relative to local daytime maximum noise level standards.

BAC does not dictate noise policy, or interpretation of noise policy, to city or county planning departments. As a result, this analysis assesses noise impacts at residential property lines as required by the local noise standards. However, noise impacts are also evaluated in the immediate vicinity of existing residences where the actual noise sensitivity is greatest. The preceding discussion is provided to encourage planning departments to consider latitude in interpreting their noise standards in cases where cellular facilities are proposed near residential property lines but considerable distances from the nearest residences.

Project Noise Generation

As discussed previously, there are two project noise sources which are considered in this evaluation; the equipment cabinet cooling systems and the emergency generator. The evaluation of potential noise impacts associated with the operation of each noise source is evaluated separately as follows:

Equipment Cabinet Noise Sources and Reference Noise Levels

The project proposes the installation of four equipment cabinets within the lease area illustrated on Figure 1. Specifically, the cabinets assumed for the project are as follows: two Ericsson eNB RBS6101, one Charles Industries 48V Power Plant and one miscellaneous cabinet cooled by a McLean Model T-20 air conditioner. The cabinets and their respective reference noise levels are provided below in Table 2. The manufacturer's noise level data specification sheets for the proposed equipment cabinets are provided as Appendix C.

Table 2
Reference Noise Level Data of Proposed Equipment Cabinets

Equipment	Number of Cabinets	Reference Noise Level, dB	Reference Distance, feet
Ericsson eNB RBS6101	2	53	5
Charles Industries 48V Power Plant	1	60	5
McLean T-20	1	66	5

Notes: Manufacturer specification sheets provided as Appendix C.

Generator Noise Sources and Reference Noise Levels

A Generac Industrial Power Systems Model SD030 is proposed for use at this facility to maintain cellular service during emergency power outages. The site plans indicate that the generator, located within the same lease area as the equipment cabinets, will be equipped with the Level 2 Acoustic Enclosure resulting in a reference noise level of 68 dB at 23 feet. The manufacturer's noise level data specification sheet for the proposed generator is provided as Appendix D.

The generator which is proposed at this site would only operate during emergencies (power outages) and brief daytime periods for periodic maintenance/lubrication. According to the project applicant, testing of the generator would occur twice per month, during daytime hours, for a duration of approximately 15 minutes. The emergency generator would only operate at night during power outages.

Predicted Facility Noise Levels at Nearby Sensitive Receptors

As indicated in Figure 1, the cellular facility maintains a separation of 360-470 feet from the nearest existing residences, identified as receivers 1-3. The residence identified as receiver 3 is located within the same parcel as the proposed facility (APN: 098-021-06). The nearest off-site residence is identified as receiver 2 on Figure 1. In addition, the nearest property line containing a residence (receiver 1) is located approximately 260 feet north of the proposed project equipment.

Assuming standard spherical spreading loss (-6 dB per doubling of distance), project-equipment noise exposure at the closest receivers was calculated and the results of those calculations are presented in Table 3.

Table 3
Summary of Project-Related Noise Exposure at Nearest Residences and Property Line
North Summit Verizon Wireless Telecommunications Facility Project

Nearest Receiver[1]	Distance from Cellular Equipment (feet)	Predicted Noise Levels (dBA)	
		Outdoor Cabinets[2]	Generator
1	470	28	42
2	430	28	43
3	360	30	44
Property Line	260	33	47

Notes:
1 Receiver locations are shown on Figure 1.
2 The four equipment cabinets were conservatively assumed to be in operation concurrently.

Outdoor Equipment Cabinet Noise Assessment

Because the proposed outdoor equipment cabinets could potentially be in operation during nighttime hours, the operation of the equipment cabinets would be subject to the County's hourly average nighttime noise level standard of 45 dB L_{eq}. As indicated in Table 3, predicted outdoor equipment noise levels of 28-30 dB L_{eq} at the nearest existing residences would satisfy the Santa Cruz County 45 dB L_{eq} nighttime noise level standard. In addition, at the nearest residential property line to the northwest, predicted outdoor equipment noise levels of 33 dB L_{eq} would also satisfy the County's nighttime noise level standard. As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project.

Generator Noise Assessment Relative to County's Daytime Maximum (70 dB L_{max}) Standard

Because the project generator would only operate during daytime hours for brief periods required for testing and maintenance, and assuming generator noise would be considered exempt during emergency operations, noise from the generator could be subject to the County's maximum daytime noise level standard of 70 dB L_{max}. As indicated in Table 3, predicted generator noise levels of 42-44 dB L_{max} would satisfy the Santa Cruz County maximum daytime noise level standard of 70 dB L_{max}. In addition, at the nearest residential property line to the northwest, predicted generator noise levels of 47 dB L_{max} would also satisfy the County's daytime noise level standard. As a result, no additional noise mitigation measures would be warranted for this aspect of the project if the County's maximum daytime noise standard is applicable.

Generator Noise Assessment Relative to County's Nighttime Average (45 dB L_{eq}) Standard

The County has indicated that they prefer generator noise be assessed relative to their nighttime average noise level standard of 45 dB L_{eq}. As shown in Table 3, the predicted generator noise levels of 42-44 dB L_{eq} at the nearest residences would satisfy the Santa Cruz County average nighttime noise level standard of 45 dB L_{eq}. However, at the nearest property line to the northwest, predicted generator noise levels of 47 dB L_{eq} would exceed the County's nighttime criteria. A discussion of potential mitigation measures to meet the County's property line noise level standard can be found in the mitigation section of this report.

Impacts at Property Line and Associated Mitigation

The proposed project equipment is located approximately 260 feet south of the nearest residential property line. As discussed previously, application of the County's noise level standards at the nearest property line would result in an exceedance of the Santa Cruz County General Plan noise level standards.

Generator Mitigation

If the County applies the property line hourly average nighttime noise level standard of 45 dB L_{eq} to the proposed generator, mitigation would be required. To mitigate this identified exceedance to a state of compliance with the County's noise level standard, the effectiveness of constructing a noise barrier was considered. The project site plans indicate the construction of a 6-foot tall wood fence along the lease area perimeter. The wood fence would provide the necessary generator noise attenuation provided the slats overlap by a minimum of 2 inches and are screwed into the framing. The purpose of overlapping slats and using screws rather than nails is to ensure that prolonged exposure to the elements does not result in visible gaps through the slats which would result in reduced noise barrier effectiveness. A 6-foot tall wood fence with overlapping slats would reduce project generator noise exposure to 41 dB L_{eq} at the nearest property line. An 8-foot tall wood fence with overlapping slats would reduce project generator noise exposure to 38 dB L_{eq} at the nearest property line. Both fence heights would reduce project generator noise to a state of compliance with the Santa Cruz County noise level standards.

Conclusions

Predicted Noise Levels at Residences

Based on the equipment noise level data and analyses presented above, project-related equipment noise exposure is expected to satisfy the recommended interpretation of the Santa Cruz County noise exposure limits at the closest residential receivers. Specifically, the proposed outdoor equipment cabinets would be in compliance with the nighttime 45 dB L_{eq} noise level standard and the generator (Generac SD030 equipped with level 2 acoustic enclosure) would be in compliance with the daytime 70 dB L_{max} noise level standard. As a result, no additional consideration of noise mitigation measures would be warranted for the project.

Predicted Noise Levels at Nearest Property Line

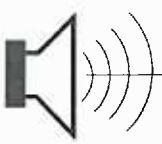
Project-related equipment noise exposure is expected to satisfy the Santa Cruz County nighttime 45 dB L_{eq} noise level standard at the nearest property line provided that the proposed lease area perimeter wood fence slats overlap by a minimum of 2 inches and that the slats are screwed to the framing rather than nailed. Predicted generator noise levels at the nearest property line would be 41 dB L_{eq} and 38 dB L_{eq} with 6 and 8-foot wood fence heights, respectively.

This concludes our environmental noise assessment for the proposed North Summit Cellular Facility in Santa Cruz County, California. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions or requests for additional information.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.



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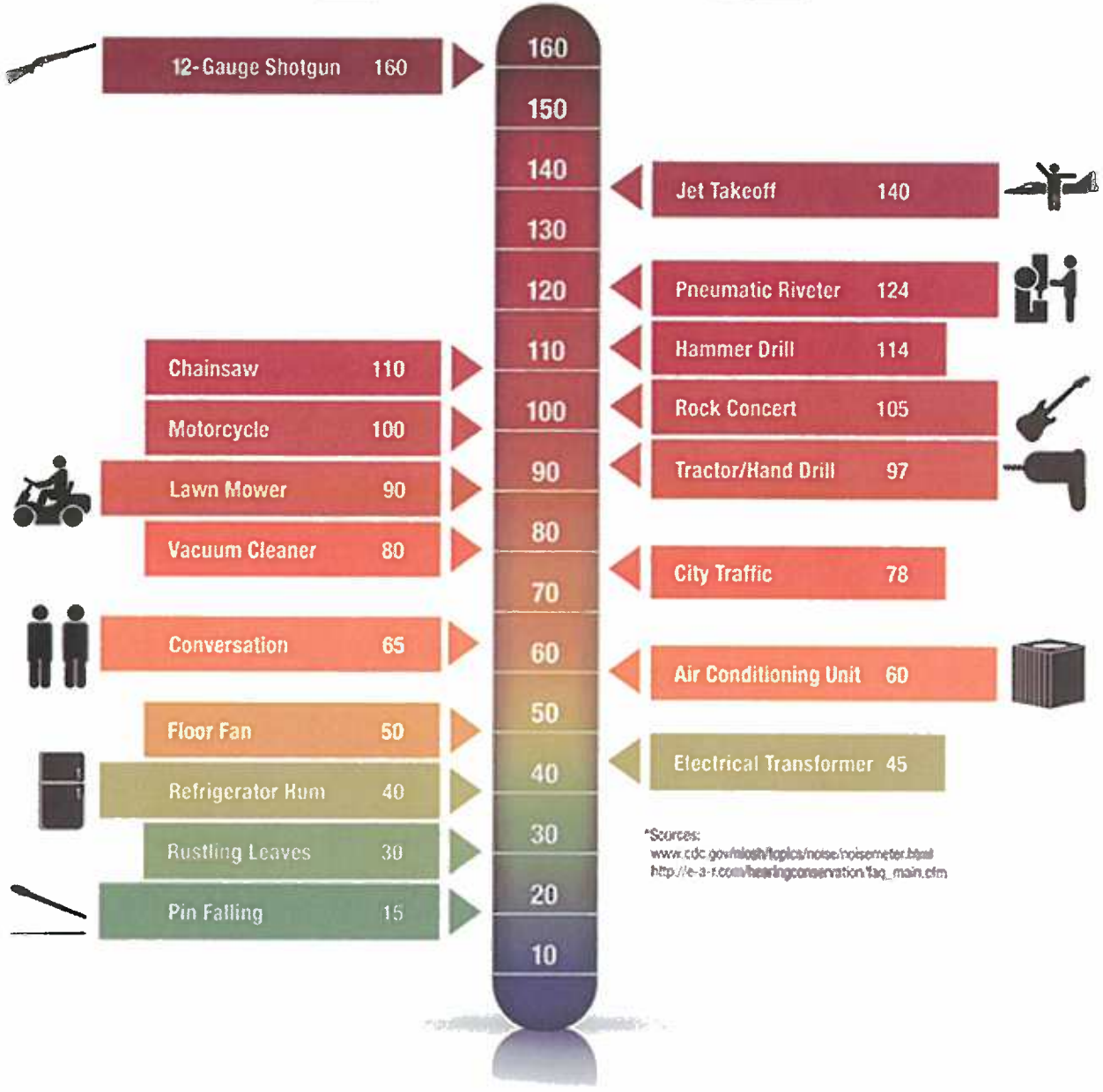
Appendix B

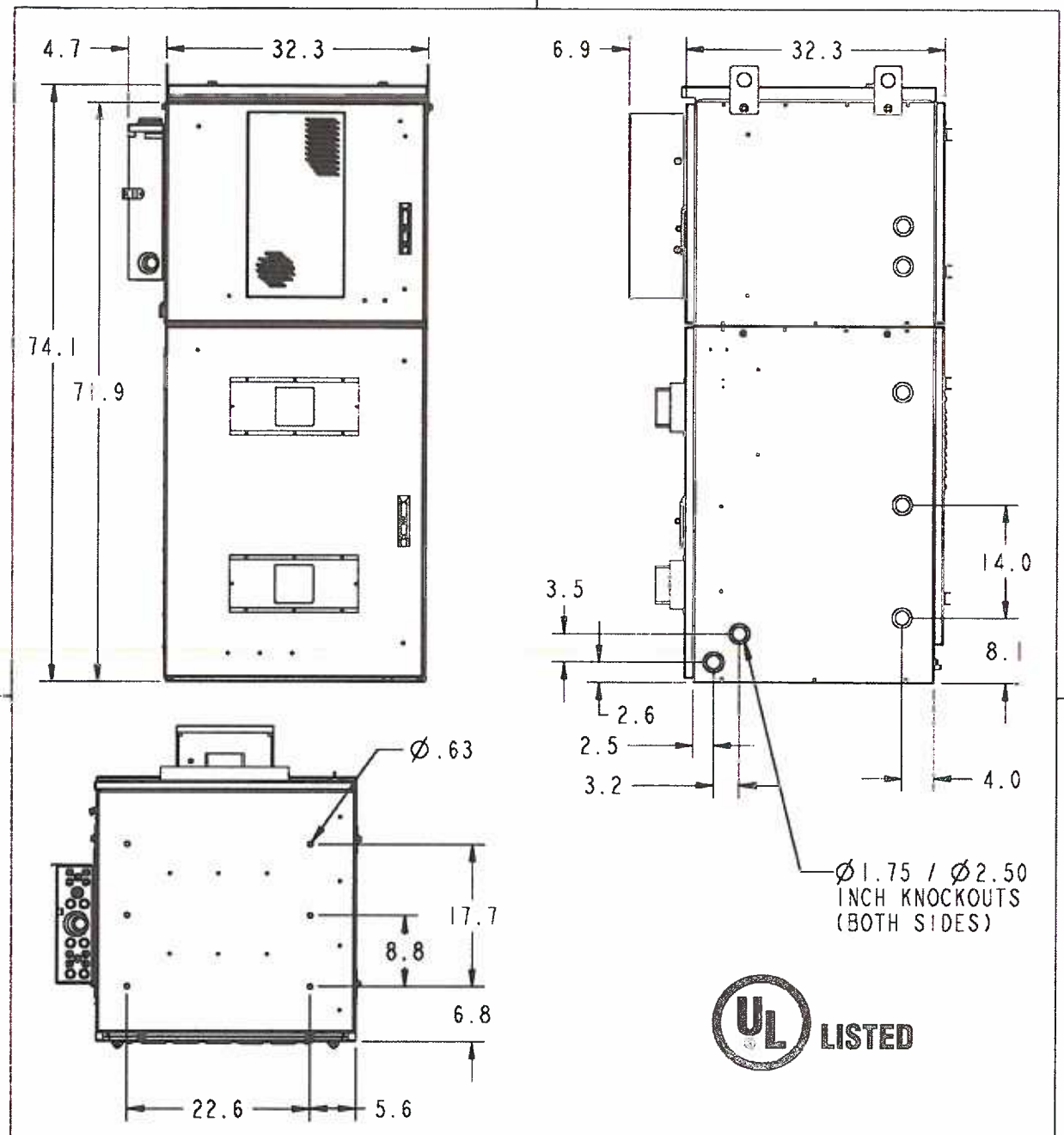
Typical A-Weighted Sound Levels of Common Noise Sources

Decibel Scale (dBA)*



*Sources:
www.cdc.gov/niosh/topics/noise/noisemeter.html
http://e-a-r.com/hearingconservation/faq_main.cfm

Appendix C-1



UL LISTED

WEIGHT WITH BATTERIES:
2296 LBS.
NorthStar NSB-170FT batteries at 128 lbs each, Qty 12

WEIGHT WITHOUT BATTERIES:
760 LBS.

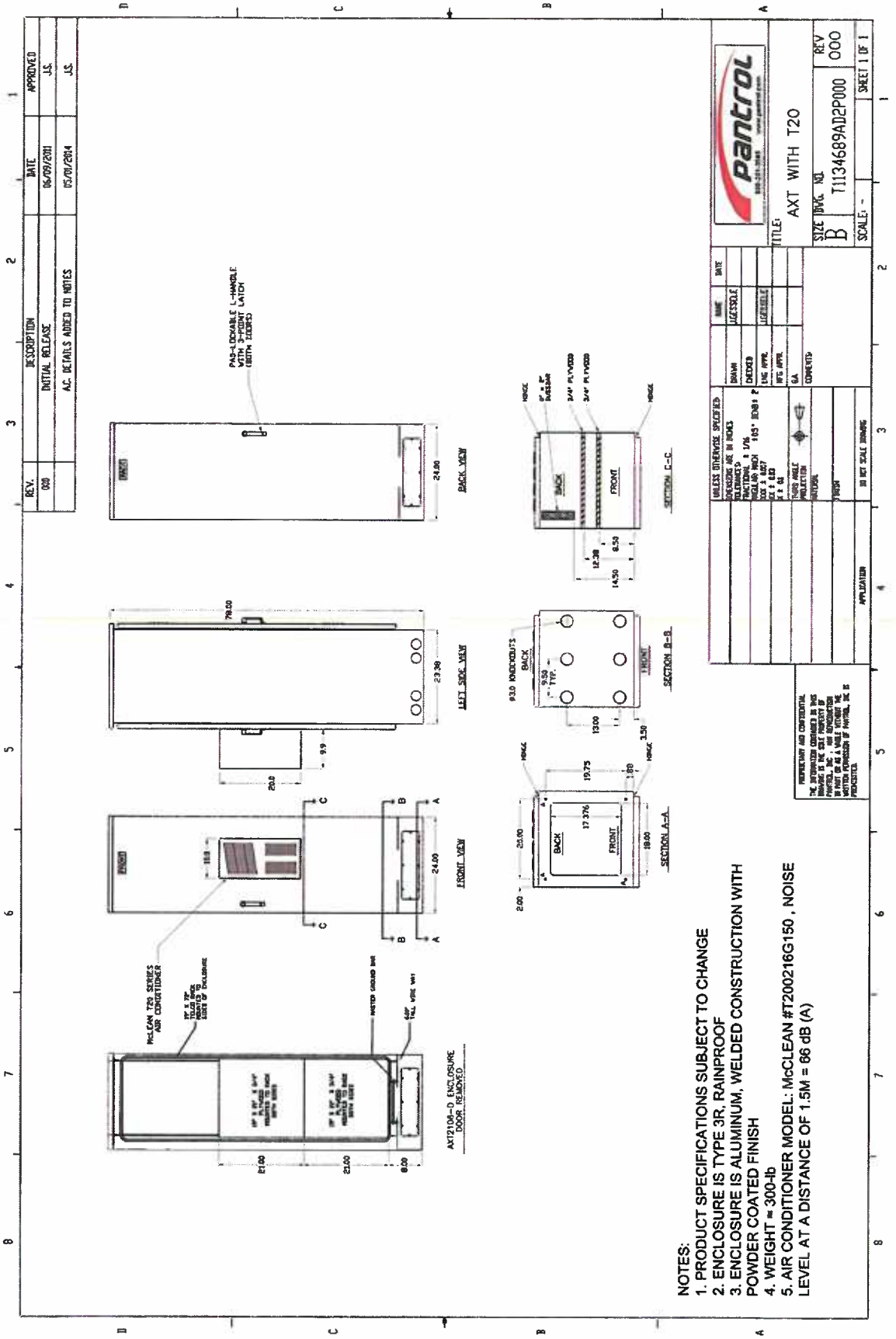
MAX NOISE LEVEL:
55-60dB

CHARLES PART #
CUBE-SS4C215XC1

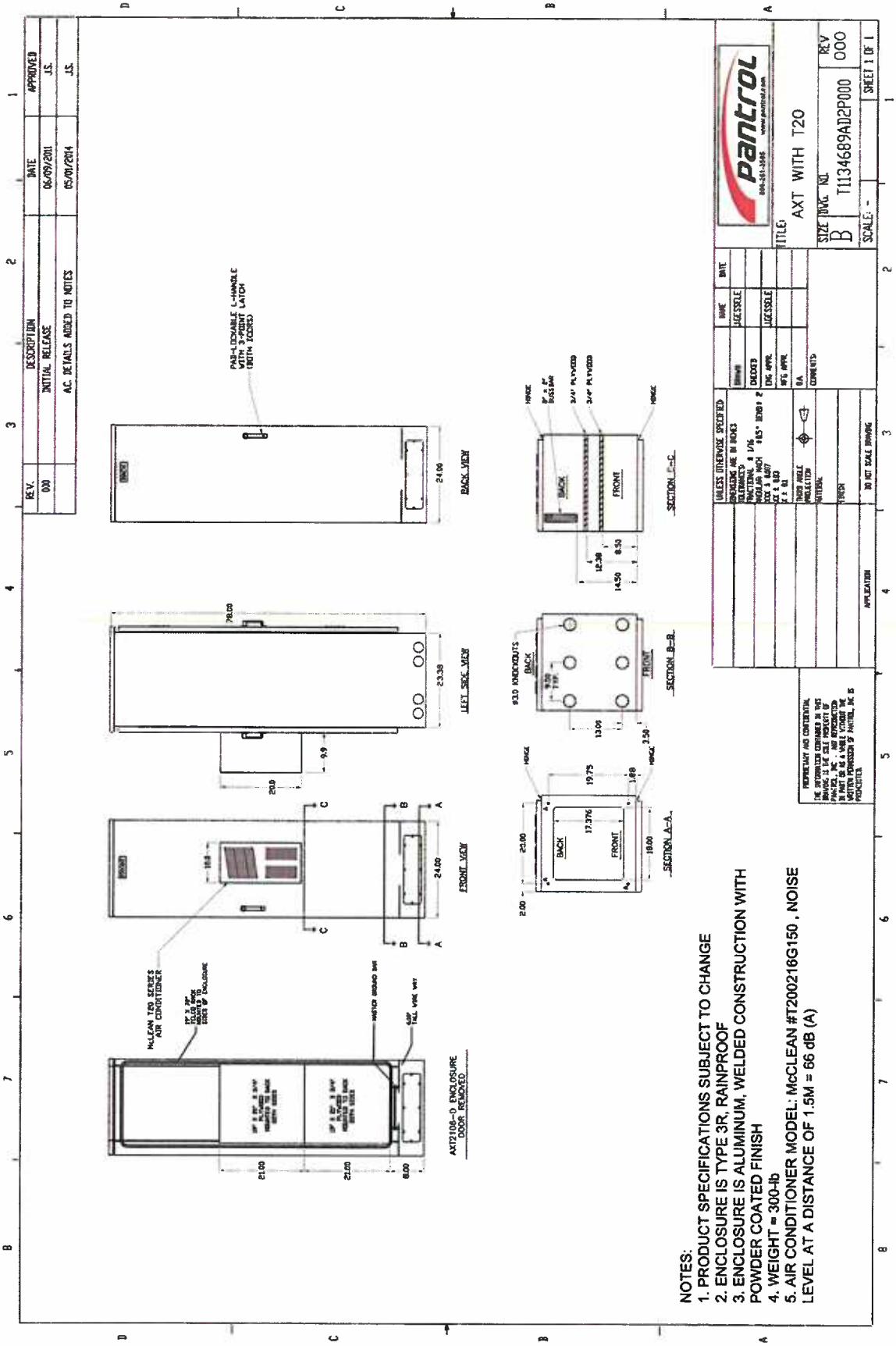
Charles Industries Ltd.
Telecommunications Group
Charles Center, 5600 Apollo Drive
Rolling Meadows, IL 60008
Telephone: 847-806-6300

Verizon Wireless
Large Site Support Enclosure

Appendix C-2


REV.
DESCRIPTION
DATE
APPROVED
000
INITIAL RELEASE
06/09/2011
J.S.
A.C. DETAILS ADDED TO NOTES
05/01/2014
J.S.
PAD-LOCKABLE L-HANDLE WITH 3-POINT LATCH (WITH KEYED)
BACK VIEW
LEFT SIDE VIEW
FRONT VIEW
SECTION C-C
SECTION B-B
SECTION A-A
McCLEAN T20 SERIES AIR CONDITIONER
AXT2104-D ENCLOSURE DOOR REMOVED
UNLESS OTHERWISE SPECIFIED
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS
APPLICATION
DO NOT SCALE DRAWING
pantrol
TITLE:
AXT WITH T20
SIZE
B
DWG. NO
T1134689AD2P000
REV
000
SCALE: -
SHEET 1 OF 1
NOTES:
1. PRODUCT SPECIFICATIONS SUBJECT TO CHANGE
2. ENCLOSURE IS TYPE 3R, RAINPROOF
3. ENCLOSURE IS ALUMINUM, WELDED CONSTRUCTION WITH POWDER COATED FINISH
4. WEIGHT = 300-lb
5. AIR CONDITIONER MODEL: McCLEAN #T200216G150 , NOISE LEVEL AT A DISTANCE OF 1.5M = 66 dB (A)

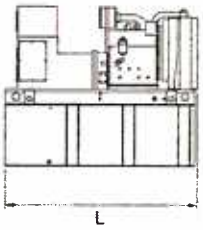
Appendix C-2

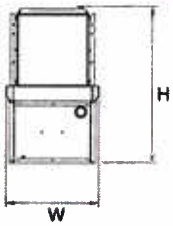

NOTES:
1. PRODUCT SPECIFICATIONS SUBJECT TO CHANGE
2. ENCLOSURE IS TYPE 3R, RAINPROOF
3. ENCLOSURE IS ALUMINUM, WELDED CONSTRUCTION WITH POWDER COATED FINISH
4. WEIGHT = 300-lb
5. AIR CONDITIONER MODEL: McCLEAN #T200216G150 , NOISE LEVEL AT A DISTANCE OF 1.5M = 66 dB (A)
DESCRIPTION
INITIAL RELEASE
A/C DETAILS ADDED TO NOTES
APPROVED
J.S.
05/01/2014
AXT WITH T20
T1134689AD2P000
SHEET 1 OF 1

GENERAC | INDUSTRIAL POWER

SD030

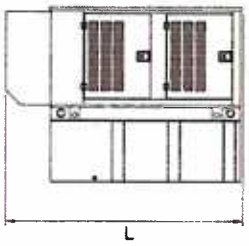
dimensions, weights and sound levels

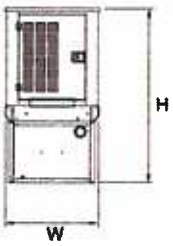




OPEN SET

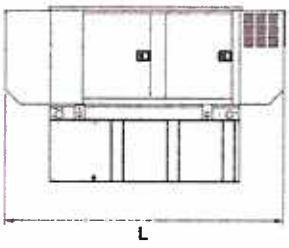
RUN TIME HOURS	USABLE CAPACITY (GAL)	L	W	H	WT	dBA*
NO TANK	-	76	38	46	2060	62
20	54	76	38	59	2540	
48	132	76	38	71	2770	
77	211	76	38	83	2979	
109	300	93	38	67	3042	

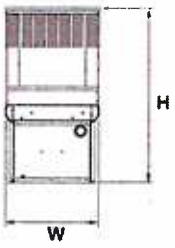




STANDARD ENCLOSURE

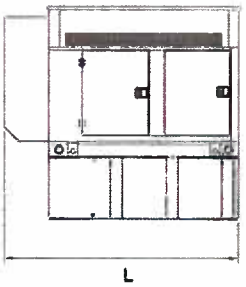
RUN TIME HOURS	USABLE CAPACITY (GAL)	L	W	H	WT	dBA*
NO TANK	-	95	38	50	2362	77
20	54	95	38	63	2842	
48	132	95	38	75	3072	
77	211	95	38	87	3281	
109	300	95	38	91	3344	

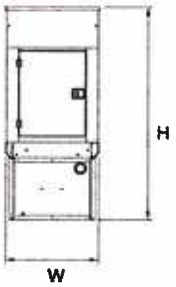




LEVEL 1 ACOUSTIC ENCLOSURE

RUN TIME HOURS	USABLE CAPACITY (GAL)	L	W	H	WT	dBA*
NO TANK	-	113	38	50	2515	70
20	54	113	38	63	2995	
48	132	113	38	75	3225	
77	211	113	38	87	3434	
109	300	113	38	91	3497	





LEVEL 2 ACOUSTIC ENCLOSURE

RUN TIME HOURS	USABLE CAPACITY (GAL)	L	W	H	WT	dBA*
NO TANK	-	95	38	62	2520	68
20	54	95	38	75	3000	
48	132	95	38	87	3230	
77	211	95	38	99	3439	
109	300	95	38	103	3502	

*All measurements are approximate and for estimation purposes only. Weights are without fuel in tank. Sound levels measured at 23ft (7m) and does not account for ambient site conditions.

Tank Options

○	MDEQ	OPT
○	Florida DERM/DEP	OPT
○	Chicago Fire Code	OPT
○	IFC Certification	CALL
○	ULC	CALL

Other Custom Options Available from your Generac Industrial Power Dealer

YOUR FACTORY RECOGNIZED GENERAC INDUSTRIAL DEALER

Specification characteristics may change without notice. Dimensions and weights are for preliminary purposes only. Please consult a Generac Power Systems Industrial Dealer for detailed installation drawings.

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