FOCUSED NOISE ANALYSIS

Valley Center 7th Day Adventist Church – Proposed Modification and Addition

San Diego County Case Numbers: PDS2013-MUP-81-098W1,
Environmental Log No. PDS2013-ER-81-08-155A

Lead Agency:

County of San Diego
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Job #B41105N1

December 3, 2014

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EXECUTIVE SUMMARY

The proposed project, the Valley Center 7th Day Adventist Church Modification and Addition, consists of the construction of a new Fellowship Hall building at an existing church site. The project site is located at 14919 Fruitvale Road in the unincorporated community of Valley Center, County of San Diego, California.

The purpose of this report is to assess noise impacts from existing and proposed HVAC equipment at the church facility and to determine if mitigation is necessary and feasible to reduce project-related property line noise impacts to comply with applicable noise limits. Noise limits specified within the County of San Diego Noise Ordinance must be met at neighboring property lines.

Based on the project information available, calculations show that, with the eight-foot wall to be located between the existing and proposed buildings on site, noise impacts from the operation of the existing and proposed HVAC equipment on site are expected to comply with County of San Diego property line noise limits at surrounding property lines.

1.0 INTRODUCTION

This acoustical analysis report is submitted to satisfy the noise requirements of the County of San Diego. Its purpose is to assess noise impacts from on-site project related mechanical noise sources, and to determine if the proposed mitigation will reduce the noise impacts to meet the applicable noise limits of the County of San Diego.

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A-weighting, abbreviated "dBA," to approximate the hearing sensitivity of humans. Time-averaged noise levels are expressed by the symbol "L_{EQ}." Unless a different time period is specified, "L_{EQ}" is implied to mean a period of one hour. Some of the data may also be presented as octave-band-filtered and/or A-octave-band-filtered data, which are a series of sound spectra centered about each stated frequency, with half of the bandwidth above and half of the bandwidth below each stated frequency. This data is typically used for machinery noise analysis and barrier-effectiveness calculations.

Sound pressure is the actual noise experienced by a human or registered by a sound level instrument. When sound pressure is used to describe a noise source, the distance from the noise source must be specified in order to provide complete information. Sound power, on the other hand, is a specialized analytical method to provide information without the distance requirement, but it may be used to calculate the sound pressure at any desired distance.

1.1 Project Description

The proposed project, the Valley Center 7th Day Adventist Church Modification and Addition, consists of the construction of a new Fellowship Hall building at an existing church site. The new building will be serviced by three new HVAC units to be ground-mounted near the northwest corner of the building. The six existing HVAC units ground-mounted adjacent to the Sanctuary building and the three proposed HVAC units are the focus of this analysis. Although not currently shown in project plans, the owner intends to install an eight-foot high CMU wall to be continuous from the southwest corner of the existing building to the northwest corner of the proposed building to provide noise shielding at the west property line.

For additional project details and equipment positioning, please refer to the project plans, dated February 26, 2013, and the marked up site plan showing the location of the three newly proposed HVAC units and the eight-foot high CMU wall. These documents are provided in Appendix A.

1.2 Environmental Settings and Existing Conditions

1.2.1 Project Location

The subject property is located at 14919 Fruitvale Road in the unincorporated community of Valley Center, County of San Diego, California. The Assessor's Parcel Number (APN) is 188-271-15-00. The owner of the property is the Southeastern California Conference of 7th Day Adventist. The existing church building and associated parking currently occupy the project site. The subject property and surrounding properties to the north, south, east, and west are zoned A70, agricultural.

For a graphical representation of the site, please refer to the Vicinity Map, Assessor's Parcel Map, Satellite Aerial Photograph, and Topographic Map provided as Figures 1 through 4, respectively.

1.2.2 Measured Noise Level

An on-site inspection was conducted at 3:10 p.m. on Monday, December 1, 2014. The weather conditions were as follows: little to no measurable wind, moderate humidity, and temperatures in the high 60's. An ambient noise measurement was taken near the southwest corner of the existing building, near the existing HVAC units which were not operational for the duration of the measurement. The microphone position was approximately five feet above the existing grade. The measured noise level can be seen in Table 1. Noise sources present during this measurement included traffic on Fruitvale Road, birds, hammering and a compressor operating intermittently in the distance, dog barking, and a helicopter. The ambient noise measurement location is shown in Figure 5.

Table 1. On-Site Noise Measurement Conditions and Results	
Date	Monday, December 1, 2014
Time	3:10 p.m. – 3:20 p.m.
Conditions	Overcast skies, little to no measurable wind, temperature in the high 60's with moderate humidity
Measured Noise Level	44.7 dBA L_{EQ}

1.2.3 Existing Equipment Noise

The existing equipment on site consists of six HVAC units manufactured by Payne, Bryant, and Goodman. Noise levels have been provided for the Payne PH13NR048-C and Payne PH13NR060-C units as octave band sound power levels, while noise data for the Bryant 541DB060, Payne PH10JA060, and Goodman VSZ130601AC units has been provided as the sound rating number, tested in accordance with ARI Standard 270-84. A representative from Johnstone Supply, a Goodman HVAC supplier, confirmed that noise levels on Goodman data sheets are the standard sound rating number, although they are simply indicated as "Decibels" on product data sheets.

For units without octave band noise data, octave band noise levels were approximated using the data for the aforementioned Payne units. As the sum of octave band noise levels given for the Payne PH13NR060-C was found to be slightly less than the given sound rating, the octave band

noise levels were increased accordingly such that the total sum was equal to the sound rating. The resultant estimated noise spectra for all existing units are shown below in Table 2. More information is provided in Appendix B: Manufacturer Data Sheets.

Table 2. Sound Power Levels of Existing HVAC Units

Source	Octave Band Frequency Sound Power Level (dBA)							Sound Rating (dBA)
	125	250	500	1K	2K	4K	8K	
Payne PH13NR060-C (Unit 1)	62.0	70.5	74.0	74.5	73.0	70.5	63.0	80
Payne PH13NR048-C (Unit 2)	63.0	69.5	74.5	75.0	73.0	68.5	62.0	80
Bryant 541DB060 (Unit 3)	64.0	72.5	76.0	76.5	75.0	72.5	65.0	82
Payne PH10JA060-G (Unit 4)	62.0	70.5	74.0	74.5	73.0	70.5	63.0	80
GMC VSZ130601AC (Units 5 and 6)	59.0	67.5	71.0	71.5	70.0	67.5	60.0	77

1.3 Methodology and Equipment

1.3.1 Formulas and Calculations

Sound Power to Sound Pressure

To convert sound power levels to sound pressure levels, the following formula is used:

$$SPL = SWL - 20\log(D) - 0.5$$

where SPL= Calculated sound pressure level at distance, and
D = Distance from source to location of calculated sound pressure level.

Attenuation Due To Distance

Attenuation due to distance is calculated by the equation:

$$SPL_2 = SPL_1 - 20\log(\frac{D_2}{D_1})$$

where SPL_1 = Known sound pressure level at known distance,
SPL_2 = Calculated sound pressure level at distance,
D_1 = Distance from source to known sound pressure level, and
D_2 = Distance from source to location of calculated sound pressure level.

This is identical to the more commonly used reference of 6 dB reduction for every doubling of distance. This equation does not take into account reduction in noise due to atmospheric absorption.

Decibel Addition

To determine the combined logarithmic noise level of known noise source levels, the values are converted to the base values, added together, and then converted back to the final logarithmic value, using the following formula:

$$L_C = 10\log(10^{L1/10} + 10^{L2/10} + \ldots 10^{LN/10})$$

where L_C = the combined noise level (dB), and
L_N = the individual noise sources (dB).

This procedure is also valid when used successively for each added noise source beyond the first two. The reverse procedure can be used to estimate the contribution of one source when the contribution of another concurrent source is known and the combined noise level is known. These methods can be used for L_{EQ} or other metrics (such as L_{DN} or CNEL), as long as the same metric is used for all components.

Barrier Insertion Loss

When a barrier is placed between a source and receiver, sound attenuation can be achieved. The amount of attenuation is dependent on the height of the barrier, the wavelength of the sound, and the distance between source and receiver, source and barrier, and barrier and receiver. The amount of attenuation achieved is known as "insertion loss." The maximum amount of sound attenuation that can be achieved by a barrier is usually between 15 and 20 dB.

1.3.2 Measurement Equipment

Some or all of the following equipment was used at the site to measure existing ambient noise levels:

- Larson Davis Model 720, Type 2 Sound Level Meter, S/N 0462, with microphone & windscreen
- Larson Davis Model CA150, Type 2 Calibrator, S/N 0203

The sound level meter was field-calibrated immediately prior to the noise measurement and checked afterwards, to ensure accuracy. All sound level measurements conducted and presented in this report, in accordance with the regulations, were made with sound level meters that conform to the American National Standards Institute specifications for sound level meters (ANSI S1.4-1983, R2001). All instruments are maintained with National Bureau of Standards traceable calibration, per the manufacturers' standards.

2.0 PROJECT-GENERATED AIRBORNE NOISE

2.1 Guidelines for Determination of Significance

The County of San Diego Municipal Code states that noise levels from stationary sources shall not exceed 55 dBA between the hours of 7 a.m. and 10 p.m. and 45 dBA between the hours of 10 p.m. and 7 a.m. at properties zoned A70. Noise from the operation of the existing and proposed mechanical equipment at this site should meet these guidelines. Pertinent sections of the County of San Diego Noise Ordinance are provided in Appendix C.

2.2 Potential Operational Noise Impacts

The future noise environment in the vicinity of the project site is anticipated to consist of the same ambient and equipment noise sources as well as noise created by the proposed HVAC equipment.

The three proposed HVAC units are manufactured by Goodman, model number SSZ160361A. Noise levels for this unit have been provided as the sound rating number in product data sheets, as confirmed by Johnstone Supply. Octave band sound power levels have been estimated using octave data for a 3-ton Payne unit (PH13NR036-C). The estimated sound power spectrum is shown in Table 3, and manufacturer data sheets are provided in Appendix B.

Table 3. Sound Power Levels of Proposed HVAC Units

Source	Octave Band Frequency Sound Power Level (dBA)							Sound Rating (dBA)
	125	250	500	1K	2K	4K	8K	
Goodman SSZ16036 (Units 7, 8, and 9)	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71

Noise levels of the existing and proposed HVAC units were calculated using the methodology described in Section 1.3.1 at the east and west property lines. These two receivers represent the nearest affected noise-sensitive receiver locations, and therefore, other noise-sensitive receivers located to the north or south will be exposed to lesser noise impacts due to additional attenuation from distance and shielding that will be received from intervening structures.

Results of this analysis are shown in Tables 4 and 5. Calculations were performed to show noise levels at the west property line with and without the proposed eight-foot high wall between the two buildings, as indicated on the marked up project plan in Appendix A. Equipment and receiver locations are also shown in Figure 5, and additional information can be found in Appendix D: Barrier Calculation Sheets.

Table 4. Calculated HVAC Noise Levels without 8-Foot High Barrier Wall Between Buildings				
Unit #	East Property Line		West Property Line	
	Distance (ft)	Noise Level (dBA)	Distance (ft)	Noise Level (dBA)
1	130	37	43	47
2	135	37	38	48
3	140	38	33	51
4	145	36	28	50
5	150	33	23	49
6	155	32	18	51
7	155	27	18	45
8	150	27	23	43
9	145	27	28	41
All	**Total Noise Exposure:**	**44**	**Total Noise Exposure:**	**58**

Table 5. Calculated HVAC Noise Levels at West PL with 8-Foot High Barrier Wall Between Buildings		
Unit #	Distance (ft)	Noise Level (dBA)
1	43	36
2	38	37
3	33	39
4	28	38
5	23	36
6	18	36
7	18	29
8	23	29
9	28	29
All	**Total Noise Exposure:**	**45**

As shown in Table 4, noise levels at the east property line are expected to meet applicable nighttime noise regulations without any mitigation in place. For this reason, the north and south property lines are also expected to have compliant noise levels, as these receivers are located at a greater distance from equipment and will also receive shielding from existing and proposed building structures. Noise levels at the west property line will not comply with daytime or nighttime noise limits without mitigation in place. For this reason, the proposed eight-foot high wall to be located between the existing and proposed buildings is required as mitigation. With this wall in place, equipment noise levels at the west property line are anticipated to be adequately reduced to be in compliance with County of San Diego noise regulations, as shown in Table 5.

In order to be effective, the proposed eight-foot high sound attenuation wall should be continuous from the southwest corner of the existing building to the northwest corner of the proposed building. The wall should be solid and constructed of masonry, wood, plastic, fiberglass, steel, or a combination of those materials, with no cracks or gaps, through or below the wall. Any seams or cracks must be filled or caulked. If wood is used, it can be tongue and groove and must be at least 7/8-inch thick or have a surface density of at least 3-1/2 pounds per square foot. Any door or gate(s) must be designed with overlapping closures on the bottom and sides and meet the minimum specifications of the wall materials described above. The gate(s) may be of 3/4-inch thick or greater wood, solid-sheet metal of at least 18-gauge metal, or an exterior-grade solid-core steel door with prefabricated door jambs.

3.0 CONCLUSION

Based on the project information available, calculations show that, with the eight-foot wall to be located between the existing and proposed buildings on site, noise impacts from the operation of the existing and proposed HVAC equipment on site are expected to comply with County of San Diego property line noise limits at surrounding property lines.

This analysis is based upon a current worst case scenario of anticipated, typical equipment for this type of facility. Substitution of equipment with higher noise emission levels may invalidate the recommendations of this study. These conclusions and recommendations are based on the most up-to-date, project-related information available.

4.0 CERTIFICATION

The findings and recommendations of this acoustical analysis report are based on the information available and are a true and factual analysis of the potential acoustical issues associated with the Valley Center 7th Day Adventist Church Modification and Addition, located at 14919 Fruitvale Road in the unincorporated community of Valley Center, County of San Diego, California. This report was prepared by Amy Hool and Jonathan Brothers.

Amy Lynn Hool

Amy Hool, Principal Acoustical Consultant

Jonathan Brothers, Senior Acoustical Consultant

5.0 REFERENCES

1. Beranek, Leo L., *Acoustical Measurements*, Published for the Acoustical Society of America by the American Institute of Physics, Revised Edition, 1988.

2. County of San Diego Noise Ordinance.

3. Harris, Cyril M., *Handbook of Acoustical Measurements and Noise Control*, Acoustical Society of America, 3rd Edition, 1998.

4. Harris, Cyril M., Ph.D., *Noise Control in Buildings*, Original Edition, 1994.

5. Hirschorn, Martin, *Noise Control Reference Handbook*, Revised Edition, 1989.

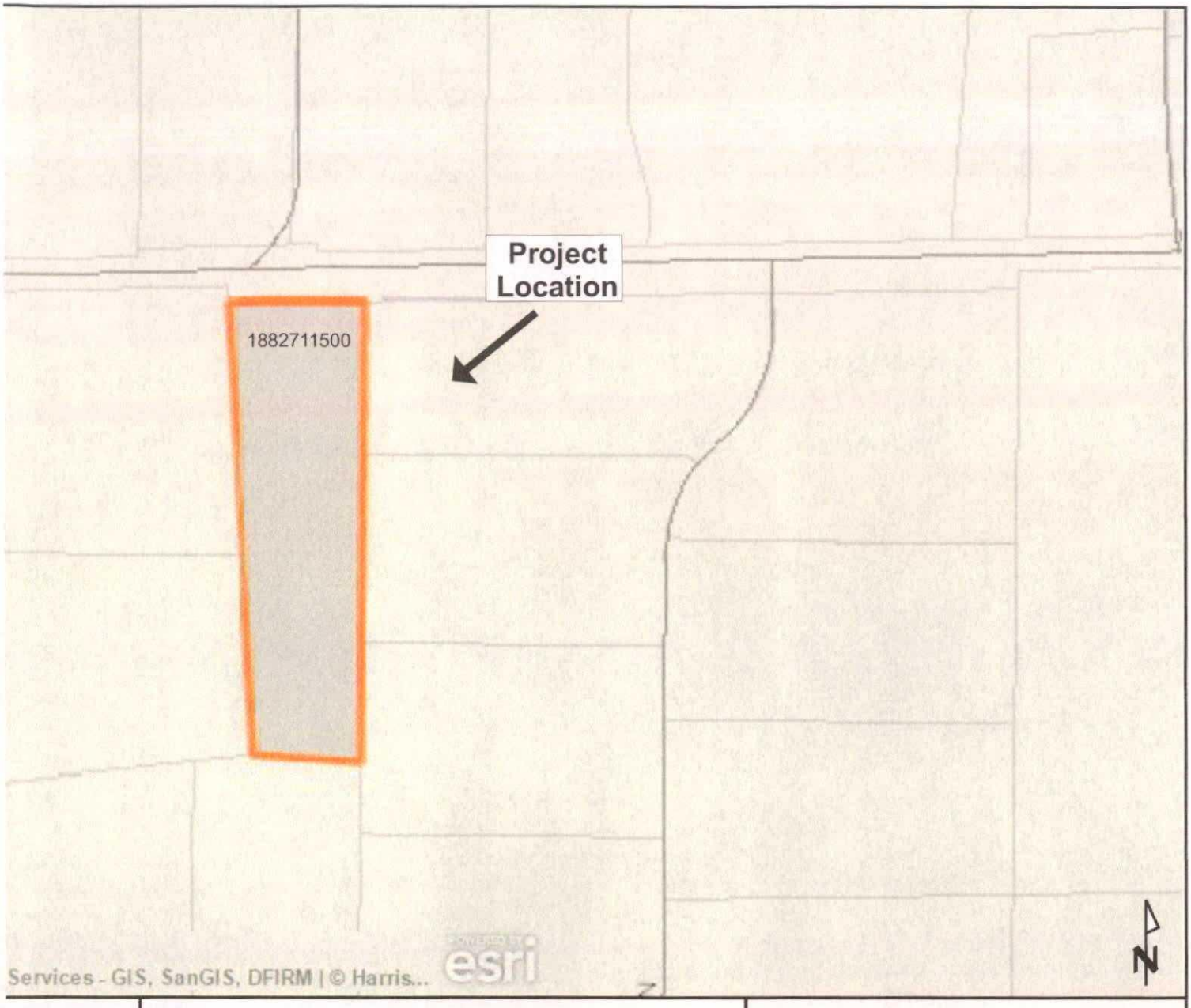
6. Irvine, Leland K. and Richards, Roy L., *Acoustics and Noise Control Handbook for Architects and Builders*, Original Edition, 1998.

7. Knudsen, Vern O. and Harris, Cyril M., *Acoustical Designing In Architecture*, American Institute of Physics for the Acoustical Society of America, 2nd Edition, 1978.

8. Raichel, Daniel R., *The Science and Applications of Acoustics*, American Institute of Physics Press for the Acoustical Society of America, 1st Edition, 2000.

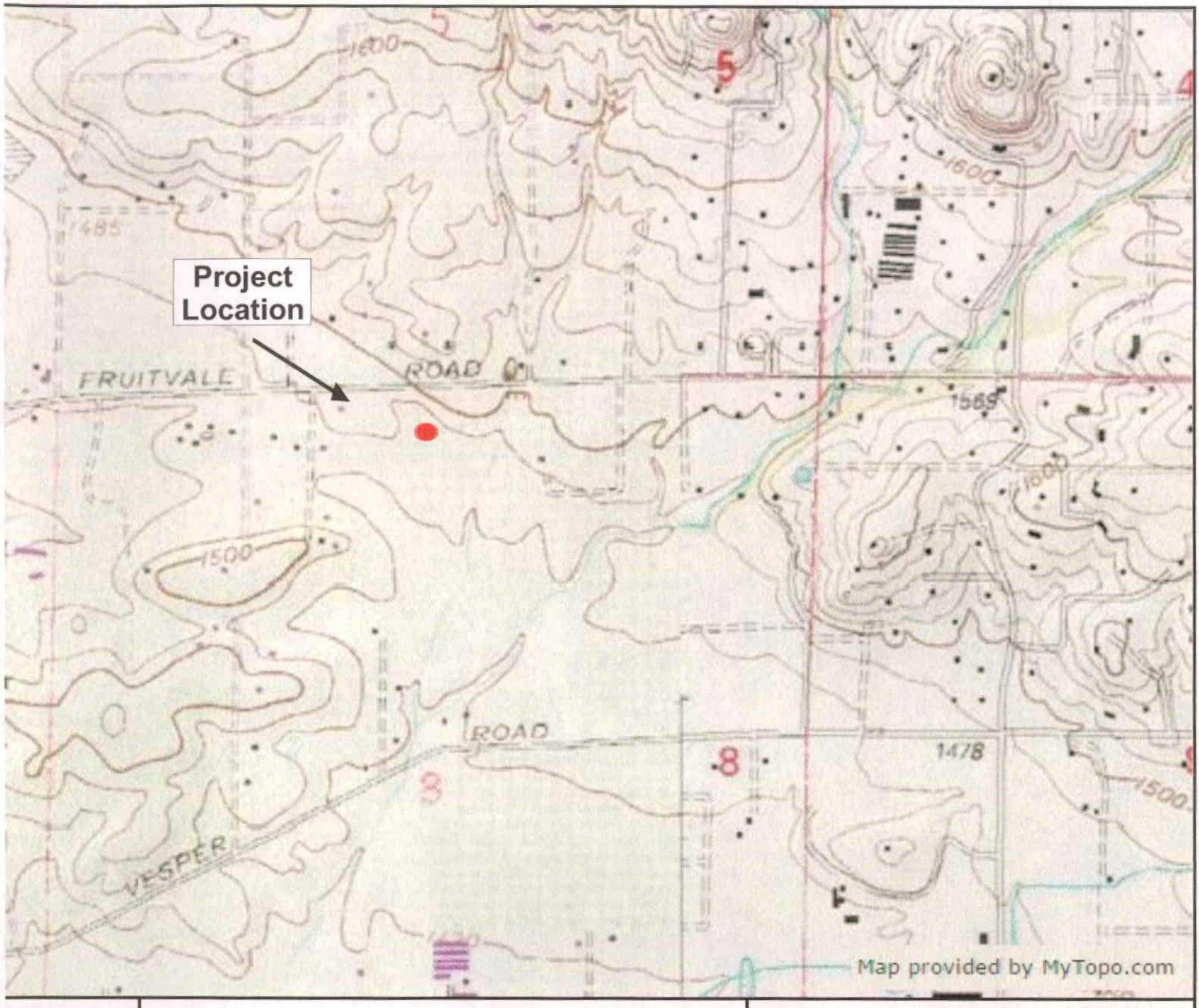
FIGURES

ıc. Suite 100 92025	**Vicinity Map** **Job # B41105N1**	**Figure 1**

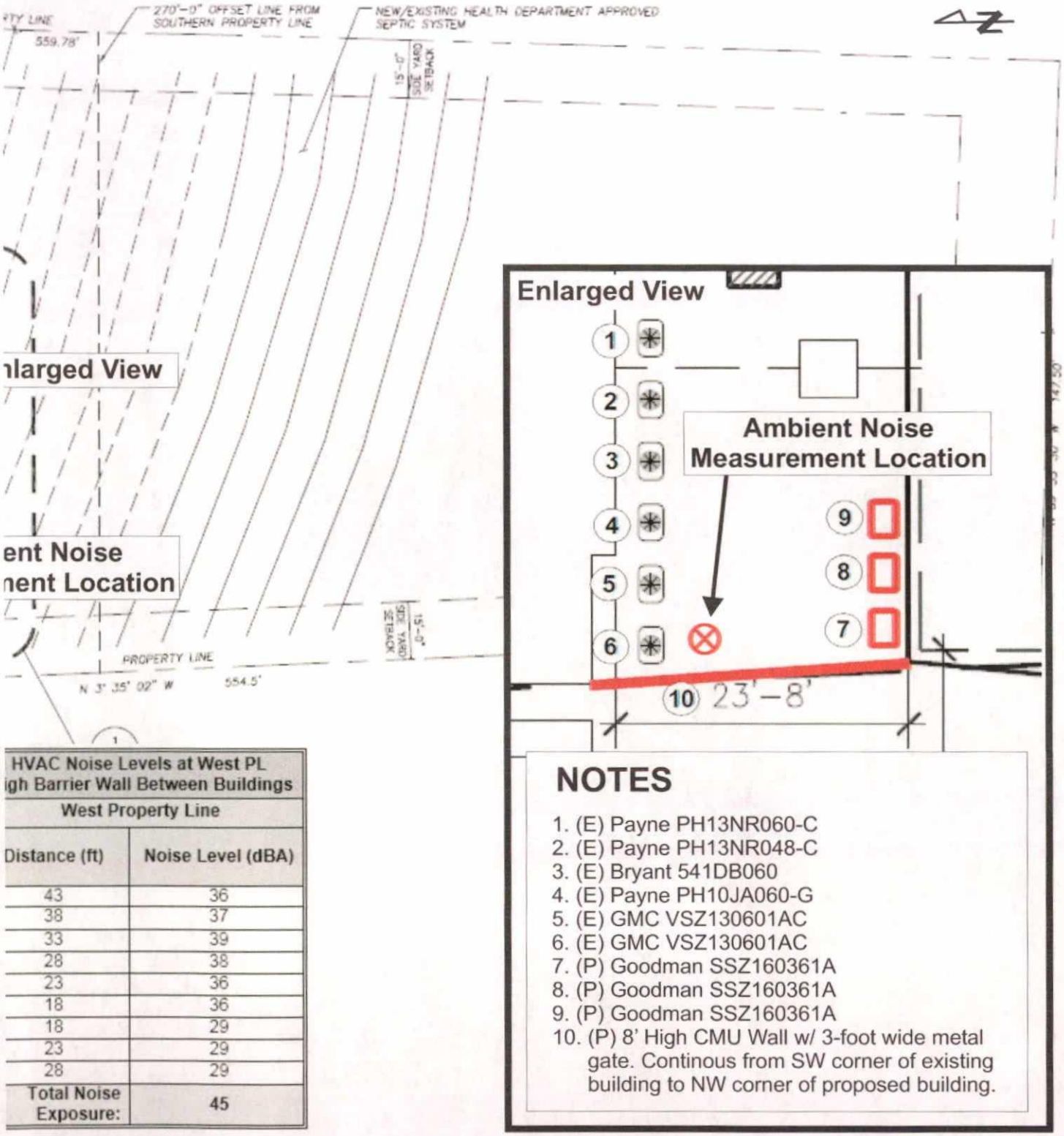


C. Suite 100 92025	**Assessor's Parcel Map** **Job # B41105N1**	**Figure 2**

C. Suite 100 92025	**Satellite Aerial Photograph** **Job # B41105N1**	**Figure 3**



ıc. Suite 100 92025	Topographic Map Job # B41105N1	Figure 4



HVAC Noise Levels at West PL igh Barrier Wall Between Buildings	
West Property Line	
Distance (ft)	Noise Level (dBA)
43	36
38	37
33	39
28	38
23	36
18	36
18	29
23	29
28	29
Total Noise Exposure:	45

NOTES

1. (E) Payne PH13NR060-C
2. (E) Payne PH13NR048-C
3. (E) Bryant 541DB060
4. (E) Payne PH10JA060-G
5. (E) GMC VSZ130601AC
6. (E) GMC VSZ130601AC
7. (P) Goodman SSZ160361A
8. (P) Goodman SSZ160361A
9. (P) Goodman SSZ160361A
10. (P) 8' High CMU Wall w/ 3-foot wide metal gate. Continous from SW corner of existing building to NW corner of proposed building.

ipment and Receiver Locations
B41105N1

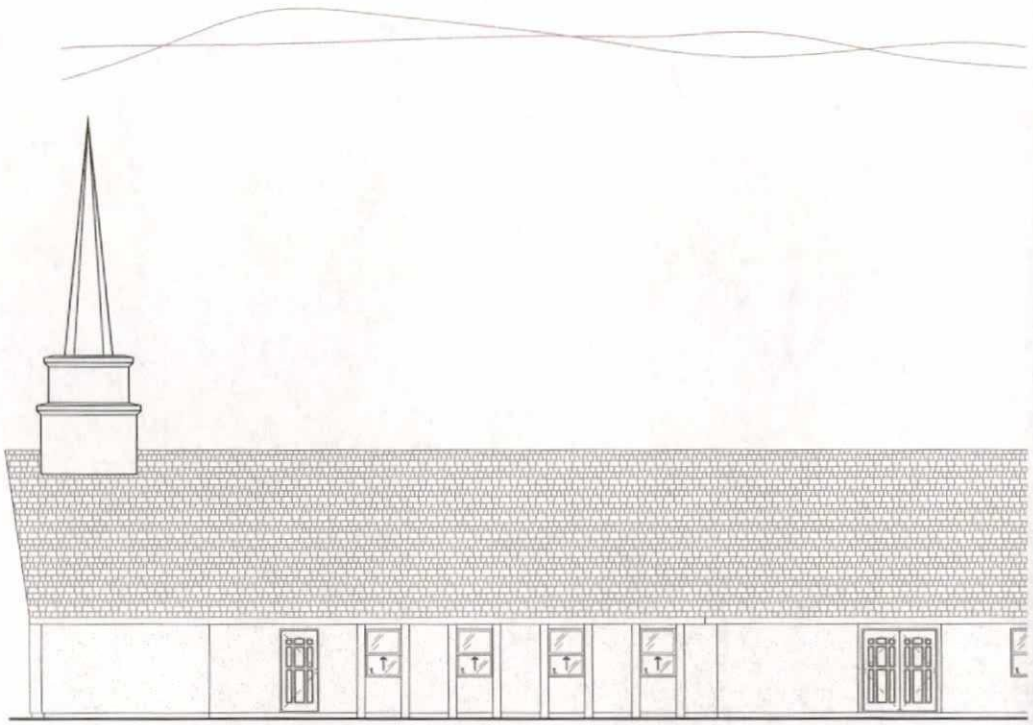
Figure 5

APPENDIX A

Project Plans, Dated February 23, 2013, and Marked Up Site Plan

VALLEY CENTER ADVENTIST

14919 FRUIT
VALLEY CENTER



PROJECT PERSONEL

OWNER:

SOUTHEASTERN CALIFORNIA CONFERENCE
OF SEVENTH DAY ADVENTIST
P.O. BOX 8050
RIVERSIDE, CA 92515

DESIGNER:

WT DESIGN CONSULTING
WILL TATE / DESIGNER
9419 FAIRGROVE LANE #202
SAN DIEGO, CA. 92129
PH. (619) 846-8302

GENERAL CONTRACTOR:

TBD

PROJECT DATA

PROJECT ADDRESS:

14918 FRUITVALE ROAD
VALLEY CENTER, CA. 92082

LEGAL DESCRIPTION:

SEE SURVEY

ASSESSOR PARCEL #:

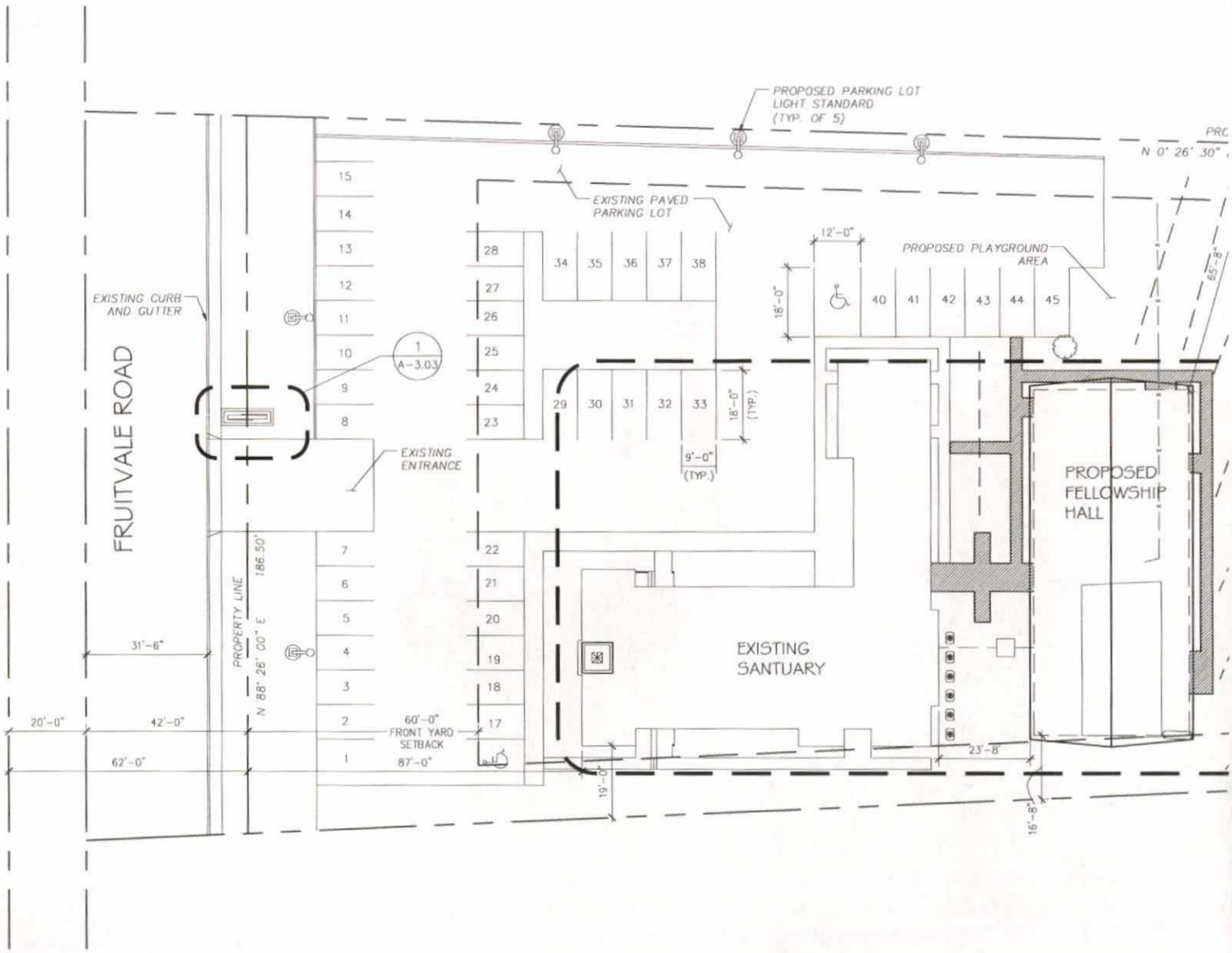
188-271-15-00

PARCEL NET:

2.12 ACRES

SETBACKS

FRONT = 60' (FROM CENTERLINE OF ROAD)
REAR = 25'
SIDE = 15'



ABBREVIATIONS:

FF	FINISH FLOOR
FS	FINISH SURFACE
FG	FINISH GRADE
GFF	GARAGE FINISH FLOOR
FL	FLOW LINE
TG	TOP OF GRATE
TW	TOP OF WALL
TF	TOP OF FOOTING

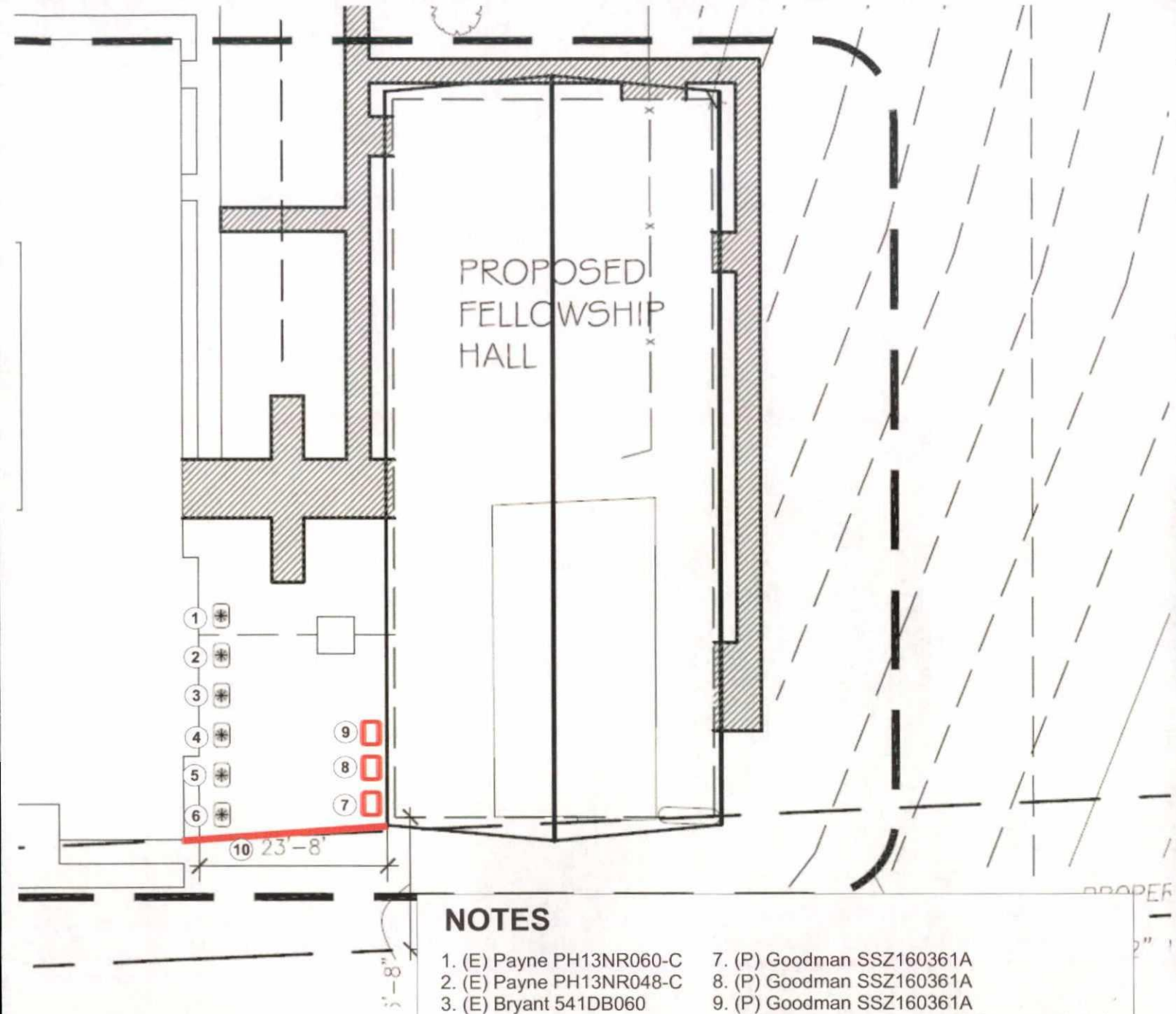
LEGEND:

	SYMBOL:
PROPERTY BOUNDARY	
CUT/FILL SLOPE (2:1 SLOPE RATIO TYPICAL, UNLESS SHOWN OTHERWISE ON PLANS)	
EXISTING LEACH LINES	
NEW LEACH LINE LOCATIONS	
EXISTING CONTOUR	

GRADING NOTE:

GRADING IN EXCESS OF 200 CUBIC YARDS OF MATERIAL WILL NOT BE REQUIRED. A SEPERATE PRELIMINARY GRADING PLAN WILL NOT BE REQUIRED.

SITE PLAN



NOTES

1. (E) Payne PH13NR060-C
2. (E) Payne PH13NR048-C
3. (E) Bryant 541DB060
4. (E) Payne PH10JA060-G
5. (E) GMC VSZ130601AC
6. (E) GMC VSZ130601AC
7. (P) Goodman SSZ160361A
8. (P) Goodman SSZ160361A
9. (P) Goodman SSZ160361A
10. (P) 8' High CMU Wall w/ 3-foot wide metal gate. Continous from SW corner of existing building to NW corner of proposed building.

APPENDIX B

Manufacturer Data Sheets

Abundant Air Systems
Complete Residential & Light Commercial HVAC
Installation, Service & Repair

Condensing units for Valley Center Seventh-Day Adventist Church. Total of six, four existing, and two added spring of 2014.

Section One:

Existing Condensing units:

1. PAYNE, PH13NR060-C
2. PAYNE, PH13NR048-C
3. Bryant, 541DB060
4. PAYNE, PH10JA060-G

Section Two:

Five Ton Units installed 2014:

1. G.M.C., VSZ130601AC

760-415-2483 tel. Lic # 917181 EIN # 262637233 760-650-4100 fax.

Abundant Air Systems
Complete Residential & Light Commercial HVAC
Installation, Service & Repair

Section One:

Existing Condensing units:

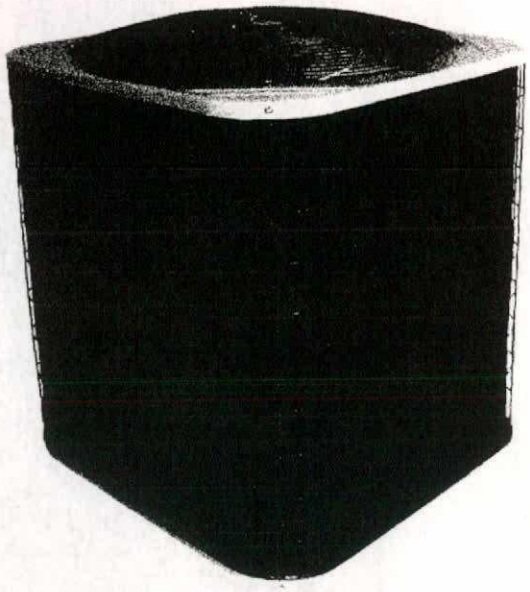
1. PAYNE, PH13NR060-C
2. PAYNE, PH13NR048-C
3. Bryant, 541DB060
4. PAYNE, PH10JA060-G

760-415-2483 tel. Lic # 917181 EIN # 262637233 760-650-4100 fax.

PH13NR

SPLIT SYSTEM HEAT PUMP
1 AND 3 PHASE
1–1/2 TO 5 TONS (018 – 060)

Product Data



WARRANTY:

10 year limited warranty for parts and compressor on porducts registered within 90 days to original residential homeowner. Products not registered, installed commercially, or installed in multi-family applications carry the following warranty:

Single Phase - Limited 5-year compressor / 5-year parts

Three Phase - Limited 5-year compressor / 1-year parts

FEATURES AND BENEFITS

AVAILABLE SIZES:

Nominal sizes are available from 018 through 060 to meet the needs of residential and light commercial applications.

PERFORMANCE:

All models are verified for efficiency and capacity by ARI.

ELECTRICAL RANGE:

All units are offered in 208/230-1, single phase, with 208/230-3 three phase offered in models 048 - 060.

FAN MOTOR:

The totally enclosed fan motor provides greater reliability under adverse conditions and dependable performance for many years. The permanent split capacitor type motor was designed for optimum efficiency. The motor was then qualified under extreme conditions to help ensure a long, reliable life.

CABINET:

A weather protective cabinet of prepainted steel is protected underneath by a galvanized coating and treated with a layer of zinc phosphate for a finish that will last for many years. All screws on cabinet exterior are coated for a long-lasting, rust-resistant, quality appearance.

UNIT DESIGN:

The copper tube, enhanced sine wave, aluminum fin coil is designed for optimum heat transfer. Vertical air discharge carries sound and condenser air up and away from adjacent patio areas and foliage. The base pan is designed for easy removal of water, dirt, and leaves.

DEFROST CONTROL BOARD:

Incorporates defrost relay, defrost timer, and low voltage terminations. The defrost control is a time/temperature initiation/termination control which includes three field-selectable time periods of 30, 60 and 90 minutes.

COMPRESSOR:

Each compressor is protected with internal temperature- and current-sensitive overloads. An internal pressure relief valve provides high pressure protection to the refrigerant system. For improved serviceability, all models are equipped with a compressor terminal plug.

SERVICE VALVES:

Both service valves are brass, front seating type with sweat connections. Valves are externally located so refrigerant tube connections can be made quickly and easily. Each valve has a service port for ease of checking operating refrigerant pressures.

SERVICEABILITY:

One access panel provides access to electrical controls. Removal of top gives access to fan motor, compressor, and condenser coil.

A-WEIGHTED SOUND POWER

UNIT SIZE – SERIES	Standard Rating (dBA)	TYPICAL OCTAVE BAND SPECTRUM (dBA without tone adjustment)						
		125	250	500	1000	2000	4000	8000
018–H	76	52.5	57.0	64.5	65.5	60.5	57.5	53.5
024–H	76	57.5	59.5	68.0	69.0	66.0	63.5	60.5
030–H	76	55.0	62.0	68.5	71.0	67.5	69.0	58.5
036–H	77	55.5	66.5	69.5	72.0	70.5	66.0	60.0
042–H	80	60.5	65.5	71.0	72.5	70.0	66.0	62.5
048–H	80	63.0	69.5	74.5	75.0	73.0	68.5	62.0
060–H	80	60.0	68.5	72.0	72.5	71.0	68.5	61.0

Note: Tested in accordance with ARI standard 270.95 (Not listed with ARI)

METERING DEVICE

UNIT SIZE–SERIES	OUTDOOR PISTON	REQUIRED SUBCOOLING °F (°C)	INDOOR METERING DEVICE
018–H	42	21 (11.7)	TXV*
024–H	52	13 (7.2)	
030–H	57	12 (6.7)	
036–H	63	14 (7.8)	
042–H	67	14 (7.8)	
048–H	73	16 (8.9)	
060–H	76	16 (8.9)	

* TXV must be ordered separately when indoor coil is not equipped with a TXV. TXV must be hard–shutoff type.

RECOMMENDED TUBE DIAMETERS

UNIT SIZE	TUBE LENGTH ft. (m)*	LIQUID TUBE DIAMETER (In.)	VAPOR TUBE DIAMETER (In.)
018, 024, 030	0 to 80 (0 to 24.38)	3/8	3/4
036, 042			7/8
048, 060			1–1/8

* For tube set over 80 ft / 24.38 m horizontal and/or 20 ft / 6.10 m vertical differential, consult Residential Split System Long Line Application Guidelines.

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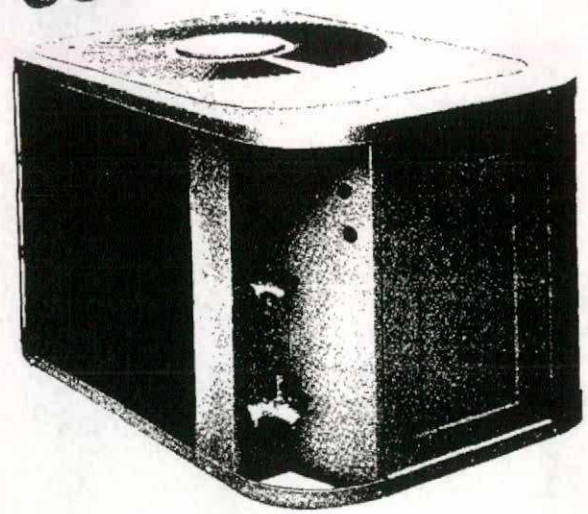
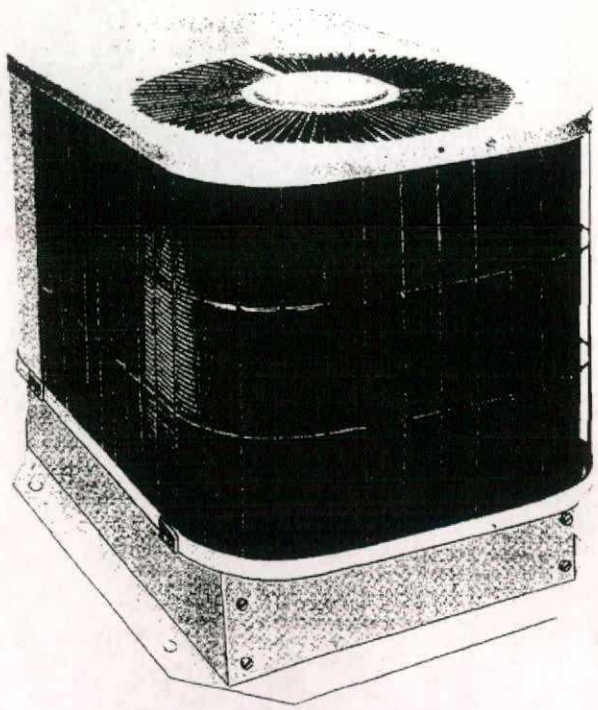




Model 541D024 with 301392-701 optional mounting base

The 541D Outdoor Sections of split-system heat pumps are designed for quiet, reliable heating during the winter and cooling during the summer. These heat pump systems provide economy of operation through energy conservation. They recover heat for indoor comfort from outdoor air during the heating season and, by automatically reversing the refrigerant system, remove indoor heat and excess humidity during the cooling season. All models are ARI certified. The cooling seasonal energy-efficiency ratio (SEER) and heating seasonal performance factor (HSPF) are sufficient to meet all known state requirements.

FEATURES

COMPRESSOR—Designed specifically for heat pump duty, with high energy efficiency during heating and cooling operation. Each compressor is hermetically sealed against contamination to assure long life and dependable performance. They are internally sprung and externally mounted on rubber isolators for quiet operation. Continuous compressor operation is approved down to −40°F in the heating mode, and down to 55°F in the cooling mode. (See heating and cooling performance tables.) All models include a discharge-tube muffler to prevent sound transmission of the compressor pulsations to the indoors or outdoors.

BUILT-IN RELIABILITY COMPONENTS—Include a suction-tube accumulator that keeps liquid refrigerant from reaching the compressor; a low-pressure switch that stops the compressor if refrigerant charge is lost; a crankcase heater to keep the compressor oil warm and free of refrigerant for maximum lubricity; a compressor relief valve for high-pressure protection; and compressor quick-start components to assure reliable operation of the units during brownout conditions and low outdoor temperatures.

PRINTED-CIRCUIT BOARD—The board incorporates a defrost control which contains the defrost relay, defrost timer, and low-voltage terminal board. The defrost control is a time/temperature initation/termination control which includes three field-selectable time periods of 30, 50, and 90 minutes.

The printed-circuit board also has a speedup feature that converts the defrost cycle time from minutes to seconds to aid in troubleshooting.

WEATHER-PROTECTIVE CABINET—The low-profile design of the 541D units, with the pleasing malibu beige and jade exterior, blends in well with plants and shrubbery. Galvanized steel, coated with a layer of zinc phosphate to which a coat of aklyd melamine enamel is applied and baked on, is used throughout. This provides a hard, smooth finish that lasts for many years. All screws in the cabinet exterior are stainless steel for a durable, rust-resistant, quality appearance.

SPECIFICATIONS

MODEL	541DB060, 541DK060, & 541DE060						
SERIES	A						
PERFORMANCE DATA							
ARI Noise Rating Number*	8.2						
506B	060	—	—	—	—	—	—
507D or 518A	—	060	—	—	—	—	—
507H or 518B	—	—	060	—	—	—	—
517A	—	—	—	090	120	—	—
517E or 517G	—	—	—	—	—	060	—
518A060/520B060	—	—	—	—	—	—	060
Rated Heating Capacity—47°F†	59,500	60,500	60,500	62,500	123,000	61,000	61,000
HSPF	6.80	6.90	7.00	7.00	7.00	6.85	6.70
Rated Cooling Capacity Btuh†	54,000	54,500	56,500	56,000	111,000	55,000	53,500
SEER	8.40	8.50	8.50	8.30	8.30	8.10	8.00
ELECTRICAL							
Model	541DB060		541DK060		541DE060		
Unit Volts—Hertz—Phase	230—60—1		208-230—60—3		460—60—3		
Operating Voltage Range	207—253		197—253		414—506		
Unit Ampacity for Wire Sizing	39.2		32.2		15.7		
Min Wire Size (60° Copper) (AWG)‡	8		8		12		
Max Branch Circuit Fuse Size (Amps)‡‡	60		50		25		
Total Unit Amps	30.7		24.1		11.4		
Compressor Rated Load Amps	29.5		23.9		11.6		
Locked Rotor Amps	130.0		98.0		49.0		
Fan Motor	1/3 HP, PSC						
Full Load Amps	2.3		2.3		1.2		
COMPRESSOR & REFRIGERANT							
Compressor	Hermetic						
Refrigerant Charge—Type & Amount**	R-22 & 11 lbs—8 oz						
OUTDOOR COIL & FAN							
Coil Face Area (Sq Ft)	17.1						
Rows & Fins Per Inch	2 & 20						
Fan Diameter & No. of Blades	22 & 3						
Rated Airflow (Ft^3/Min)†	3200						
OPTIONAL EQUIPMENT							
Unit Mounting Base	301392-702						
Room Thermostat w/Auto. Changeover, Emergency Heat Switch, and Indicator Light	P271-3453						
Room Thermostat w/Manual Changeover Switch, Emergency Heat Switch, and Indicator Light	P271-3454						
Room Thermostat w/Manual Changeover Switch (No Emergency Switch)	P271-3773						
ENERGY MINDER®	941A						
High-Pressure Switch	301619-701						
Thermal Expansion Valve Kit	308006-705						
2-Way Flow Filter-Drier—Liquid Tube	301399-701						
Filter-Drier—Vapor Tube	54871D14						
Outdoor Thermostat and Mtg Bracket	301380-703						
Second Outdoor Thermostat and Emergency Heat Relay††	301380-702						
COMPROTEC®	301600-701						
Swivel Ells—Liquid/Vapor Tubes	IBN1616R/IBN2424R						
Vapor Tube Adapter 3/4 Flare x 1-1/8 Tube (Pkg of 6)	301892-704						

*Rated in accordance with ARI Standard 270-84.

†Rated in accordance with ARI Standard 240-81. Some combinations require a CHECK-FLO-RATER piston change to obtain rated capacities. See CHECK-FLO-RATER piston chart for requirements.

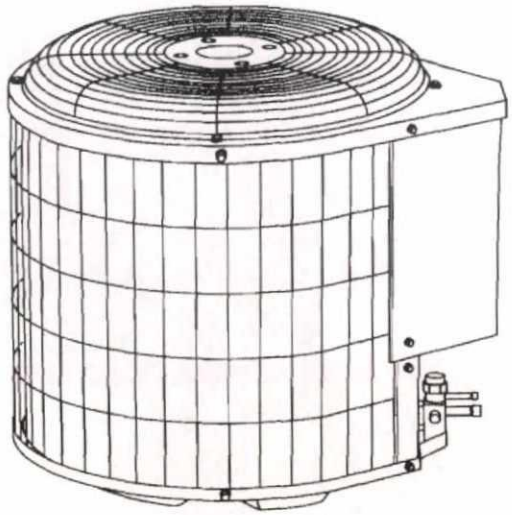
‡If other than 60°C copper wire is used, size can be determined from unit ampacity given in above table and applicable table of National Electric Code. Wire size selected must have current capacity not less than that of copper wire specified and must not create a voltage drop between service panel and unit in excess of 2% of unit rated voltage.

**The factory refrigerant charge is sufficient for systems requiring up to 30 ft of interconnecting tubing. For tubing lengths other than 30 ft, see installation instructions for additional refrigerant requirements.

††Required only for systems with 30-KW supplemental heat.

‡‡Single-phase units may use fuses or HACR-type circuit breakers of same size as noted.

PAYNE
Heating & Cooling



Model PH10

10 SEER SPLIT-SYSTEM HEAT PUMP UNIT

FEATURES

AVAILABLE SIZES: Nominal sizes are available from 018 through 060 to meet the needs of residential and light commercial applications.

EFFICIENCY: With SEER of at least 10.0 and HSPF of 6.8, these heat pump systems provide economy of operation through energy conservation. They recover heat for indoor comfort from outdoor air during the heating season and, by automatically reversing the refrigerant system, remove indoor heat and excess humidity during the cooling season.

CERTIFICATION: All models are listed with UL, c-UL, ARI, CEC, and CSA-EEV.

ELECTRICAL RANGE: Units are offered in 208–230v, single phase 018 thru 060 sizes and 208–230v 3 phase in the 048 and 060 sizes.

FAN MOTOR: The totally enclosed fan motor means greater reliability under adverse weather conditions and dependable performance for many years. Permanent split capacitor type motors provide more economical operation.

CABINET: The steel cabinet is protected with a galvanized coating and treated with a layer of zinc phosphate. A modified polyester powder coating is then applied and baked on, providing each unit with a hard, smooth finish that will last for many years. All screws on cabinet exterior are coated for a long-lasting, rust-resistant, quality appearance.

UNIT DESIGN: The copper tube, enhanced sine wave, aluminum fin coil is designed for optimum heat transfer. Vertical air discharge carries sound and hot condenser air up and away from adjacent patio areas and foliage. The base pan is designed for easy removal of water, dirt, and leaves.

COMPONENTS: Includes a suction-tube accumulator that minimizes the amount of liquid refrigerant reaching the compressor; a low-pressure switch that stops the compressor if refrigerant charge is lost; and an internal compressor relief valve on all sizes.

DEFROST CONTROL BOARD: Incorporates a defrost relay, defrost timer and low-voltage terminations. The defrost control is a time/temperature initiation/termination control which includes 3 field-selectable time periods of 30, 50, and 90 minutes. The control includes built-in 5-minute compressor delay.

COMPRESSOR: Designed specifically for heat pump duty, with energy efficiency during heating and cooling operation. Each compressor is hermetically sealed against contamination to assure long life and dependable performance and is internally sprung (018–036 sizes) and externally mounted on rubber isolators for quiet operation. Continuous compressor operation is approved down to –30°F (–34°C) in the heating mode and down to 55°F (12.8°C) in the cooling mode.

SERVICE VALVES: Both service valves are brass, front seating type with sweat connections. Valves are externally located so refrigerant tube connections can be made quickly and easily. Each valve has a service port for ease of checking operating refrigerant pressures.

SERVICEABILTY: One panel provides access to electrical controls. Removal of top gives access to fan motor, compressor, and condenser coil.

REFRIGERANT METERING DEVICE AND LINE SET DATA

UNIT SIZE-SERIES	018-D,E	024-D,E	030-D	036-D,E	042-B	048-B,C	060-B,C
METERING DEVICE							
Outdoor Piston Size	40/42	46/52	55	61/57	63	67	76
Indoor Piston Size*	55	61/63	70	78/73	82	88	101
Required Subcooling (°F)†	8/10	14/12	14/10	10/9	10	12	11
REFRIGERANT LINE CONNECTION DIAMETERS (IN. ID)							
Liquid Line	3/8						
Vapor Line	5/8	5/8	3/4	3/4	7/8	7/8	7/8
REFRIGERANT LINE DIAMETERS (IN. OD)							
Liquid Line (All Applications)	3/8						
Vapor Line (0–50 Ft Line Lengths)	5/8	5/8	3/4	3/4	7/8	7/8	1-1/8
Vapor Line (Long-Line Applications)	3/4	3/4	7/8	7/8	1-1/8	1-1/8	1-1/8

* Piston listed is for any approved coil combination.

† Charging subcooling for indoor TXV-type expansion device.

c UL US

CSA

CERTIFICATION APPLIES ONLY WHEN THE COMPLETE SYSTEM IS LISTED WITH ARI.

SOUND RATING (dBA)

UNIT SIZE–SERIES	SOUND RATING
018-D, E	80/78
024-D, E	78/78
030-D	80
036-D, E	80/81
042-B	80
048-B, C	80
060-B, C	80

OPTIONAL EQUIPMENT USAGE GUIDELINE

ACCESSORY	REQUIRED FOR LOW-AMBIENT APPLICATIONS (Below 55°F)	REQUIRED FOR LONG-LINE APPLICATIONS* (Over 50 Ft)
Crankcase Heater	Yes	Yes
Evaporator Freeze Thermostat	Yes	No
Accumulator	No	No
Compressor Start Assist Capacitor and Relay	Yes	Yes
MotorMaster® Control *or* Low-Ambient Pressure Switch	Yes	No
Wind Baffle	See Low-Ambient Instructions	No
Support Feet	Recommended	No
Liquid-Line Solenoid Valve or Hard Shutoff TXV	No	See Long-Line Application Guideline
Ball Bearing Fan Motor	Yes‡	No

* For tubing line sets between 50 and 175 ft, refer to the Residential Split-System Long-Line Application Guideline.

‡ Required for low-ambient controller (full modulation feature) and MotorMaster® Control only.

Abundant Air Systems
Complete Residential & Light Commercial HVAC
Installation, Service & Repair

Section Two:

Condensing units added in 2014:

1. G.M.C., VSZ130601AC

GMC®
Air Conditioning & Heating

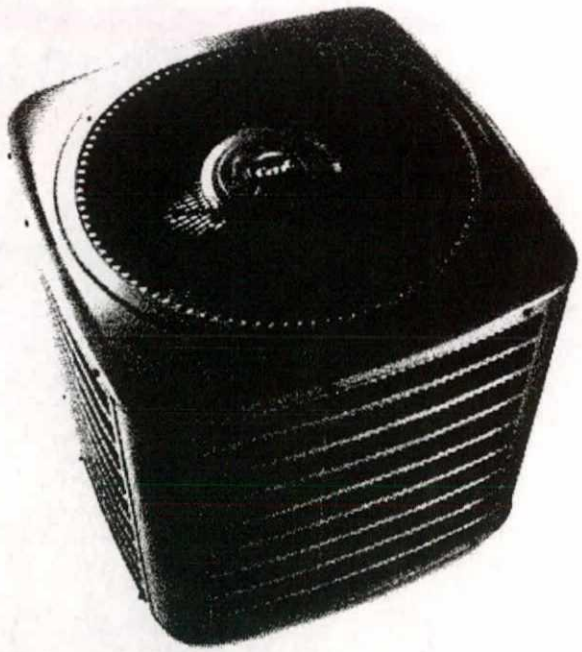
VSX13

Split System Air Conditioner

13 SEER

1½ to 5 Tons

Cooling Capacity: 18,000 - 60,000 BTU/h



Contents

Standard Features

- Energy-efficient compressor
- Quiet condenser fan system
- Factory-installed liquid line filter drier
- Copper tube/aluminum fin coil
- R-410A refrigerant-charged for 15' of refrigerant lines
- Brass liquid and suction service valves with sweat connections
- Ground lug connection
- AHRI Certified; ETL Listed

Cabinet Features

- Sound control top designed for quiet operation
- Steel louver coil guard
- Heavy-gauge galvanized-steel cabinet
- Attractive Bahama Beige powder-paint finish with 500-hour salt-spray approval
- When properly anchored, meets the 2010 Florida Building Code unit integrity requirements for hurricane-type winds (Anchor bracket kits available.)

10 YEARS* LIMITED WARRANTY | R-410A REFRIGERANT | c ETL us

* Complete warranty details available from your local dealer or at www.goodmanmfg.com/gmc

SPECIFICATIONS

	VSX13 0181E*	VSX13 0241D*	VSX13 0241E*	VSX13 0301A*	VSX13 0361E*	VSX13 0421B*	VSX13 0481B*	VSX13 0601B*	VSX13 0611A*
CAPACITIES									
Nominal Cooling (BTU/h)	18,000	24,000	23,000	30,000	36,000	42,000	48,000	60,000	60,000
SEER / EER	13 / 11	13 / 11	13 / 11	13 / 11	13 / 11	13 / 11	13 / 11	13 / 11	13/11
Decibels	75	75	75	73	74	75	76	77	72
COMPRESSOR									
RLA	6.7	13.5	8.4	12.8	14.1	17.9	19.9	25.0	26.4
LRA	41	58.3	37	64	77	112	109	134	134
CONDENSER FAN MOTOR									
Horsepower	1/8	1/8	1/8	1/8	1/4	1/4	1/4	1/4	1/4
FLA	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	1.5
REFRIGERATION SYSTEM									
Refrigerant Line Size [1]									
Liquid Line Size ("O.D.)	⅜"	⅜"	⅜"	⅜"	⅜"	⅜"	⅜"	⅜"	⅜"
Suction Line Size ("O.D.)	¾"	¾"	¾"	¾"	⅞"	1⅛"	1⅛"	1⅛"	⅞"
Refrigerant Connection Size									
Liquid Valve Size ("O.D.)	⅜"	¼"	¼"	⅜"	⅜"	⅜"	⅜"	⅜"	⅜"
Suction Valve Size ("O.D.) [4,5]	¾"	¾"	¾"	¾"	¾" [4]	⅞" [5]	⅞" [5]	⅞" [5]	¾"
Valve Type	Sweat	Sweat	Sweat	Sweat	Sweat	Sweat	Sweat	Sweat	Sweat
Refrigerant Charge	58	52	64	62	64	83	97	100	111
Shipped with Orifice Size	0.051	0.057	0.055	0.061	0.070	0.076	0.080	0.086	0.086
ELECTRICAL DATA									
Voltage-Phase (60 Hz)	208/230-1	208/230-1	208/230-1	208/230-1	208/230-1	208/230-1	208/230-1	208/230-1	208/230-1
Minimum Circuit Ampacity [2]	9.1	17.6	11.2	16.7	19.1	23.9	26.4	32.8	34.5
Max. Overcurrent Protection [3]	15 amps	30 amps	15 amps	25 amps	30 amps	40 amps	45 amps	50 amps	60 amps
Min / Max Volts	197/253	197/253	197/253	197/253	197/253	197/253	197/253	197/253	197/253
Electrical Conduit Size	½" or ¾"	½" or ¾"	½" or ¾"	½" or ¾"	½" or ¾"	½" or ¾"	½" or ¾"	½" or ¾"	½" or ¾"
EQUIPMENT WEIGHT (LBS)	102	115	103	115	118	171	175	184	211
SHIP WEIGHT (LBS)	117	128	120	132	135	189	193	202	233

[1] Line sizes denoted for 25' line sets, tested and rated in accordance with AHRI Standard 210/240. For other line-set lengths or sizes, refer to the installation & Operating instructions and/or the long line-set guidelines.

[2] Wire size should be determined in accordance with National Electrical Codes; extensive wire runs will require larger wire sizes

[3] Must use time-delay fuses or HACR-type circuit breakers of the same size as noted.

[4] Installer will need to supply ¾" to ¾" adapters for suction line connections.

[5] Installer will need to supply ⅞" to 1⅛" adapters for suction line connections.

NOTES

- Always check the S&R plate for electrical data on the unit being installed.
- Unit is charged with refrigerant for 15' of ⅜" liquid line. System charge must be adjusted per Installation Instructions Final Charge Procedure.

PROPOSED

3 UNITS

Goodman

Air Conditioning & Heating

SSZ16

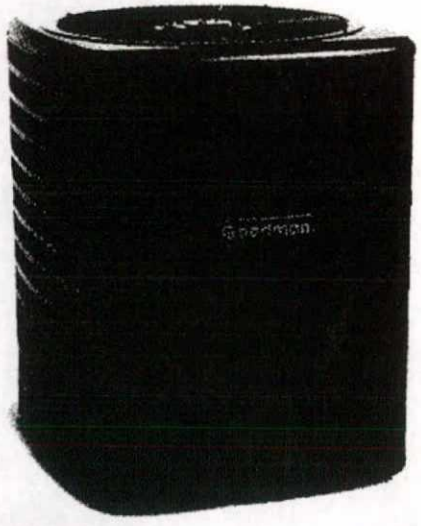
High-Efficiency Split System Heat Pump

Up to 16 SEER

Cooling Capacity: 24,000 to 57,000 BTU/h

Heating Capacity: 24,000 to 57,000 BTU/h

Contents



Standard Features

- R-410A chlorine-free refrigerant
- High-efficiency scroll compressor
- High-density foam compressor sound blanket
- SmartShift® technology to ensure quiet, reliable defrost
- Factory-installed bi-flow liquid-line filter drier
- Factory-installed suction-line accumulator
- Compressor short-cycle protection
- 850 RPM condenser fan motor
- Factory-installed compressor crankcase heater
- Factory-installed high-capacity muffler
- High- and low-pressure switches
- Service valves with sweat connections with easy access to gauge ports
- Copper tube / enhanced aluminum fin coil
- Fully charged for 15' of tubing length
- Contactor with lug connection
- Ground lug connection
- AHRI Certified; ETL Listed

Cabinet Features

- Goodman® brand sound control top design
- Steel louver coil guard
- Heavy-gauge galvanized-steel cabinet
- Attractive Architectural Gray powder-paint finish with 500-hour salt-spray approval
- Top and side compressor and tubing access
- Service ports and controls are accessible while unit is operating
- When properly anchored, meets the 2010 Florida Building Code unit integrity requirements for hurricane-type winds (Anchor bracket kits available.)

LIFETIME LIMITED WARRANTY* | 10 YEAR PARTS LIMITED WARRANTY* | R-410A REFRIGERANT

* Complete warranty details available from your local dealer or at www.goodmanmfg.com. To receive the Lifetime Compressor Limited Warranty (good for as long as you own your home) and the 10-Year Parts Limited Warranty, online registration must be completed within 60 days of installation. Online registration is not required in California or Quebec.

SPECIFICATIONS

	SSZ16 0241A	SSZ16 0361A	SSZ16 0481A	SSZ16 0601B
CAPACITIES AND RATINGS				
Nominal Cooling (BTU/h)	24,000	36,000	48,000	60,000
Nominal Heating (BTU/h)	24,000	36,000	48,000	60,000
Decibels	70	71	72	72
COMPRESSOR				
RLA	13.5	14.1	19.9	28.8
LRA	58.3	77.0	109.0	152.9
CONDENSER FAN MOTOR				
Horsepower	1/6	1/6	1/6	1/6
FLA	1.1	1.0	1.0	1.0
REFRIGERATION SYSTEM				
Refrigerant Line Size[1]				
Liquid Line Size ("O.D.)	⅜"	⅜"	⅜"	⅜"
Suction Line Size ("O.D.)	¾"	⅞"	1⅛"	1⅛"
Refrigerant Connection Size				
Liquid Valve Size ("O.D.)	⅜"	⅜"	⅜"	⅜"
Suction Valve Size ("O.D.)	¾"	⅞"	⅞"	⅞"
Valve Connection Type	Sweat	Sweat	Sweat	Sweat
Refrigerant Charge	153	186	278	273
ELECTRICAL DATA				
Volts-Hz	208/230-60	208/230-60	208/230-60	208/230-60
Minimum Circuit Ampacity[2]	17.9	18.6	25.9	37
Max. Overcurrent Protection[3]	30	30	40	60
Min / Max Volts	197/253	197/253	197/253	197/253
Electrical Conduit Size	½" or ¾"	½" or ¾"	½" or ¾"	½" or ¾"
EQUIPMENT WEIGHT (LBS)	190	233	305	309
SHIP WEIGHT (LBS)	208	255	327	331

[1] Tested and rated in accordance with AHRI Standard 210/240

[2] Wire size should be determined in accordance with National Electrical Codes; extensive wire runs will require larger wire sizes

[3] Must use time-delay fuses or HACR-type circuit breakers of the same size as noted.

NOTES

- Always check the rating plate for electrical data on the unit being installed.
- Installer will need to supply ⅞" to 1⅛" adapters for suction line connections.
- Unit is charged with refrigerant for 15' of ¾" liquid line. System charge must be adjusted per Installation Instructions Final Charge Procedure.
- Installation of these units requires the specified TXV Kit to be installed on the indoor coil. THE SPECIFIED TXV IS DETERMINED BY THE OUTDOOR UNIT NOT THE INDOOR COIL.

APPENDIX C

Pertinent Sections of the County of San Diego Noise Ordinance

Cross reference(s)--Definitions, § 12.101 et seq.

SEC. 36.403. SOUND LEVEL MEASUREMENT.

(a) A sound level measurement made pursuant to this chapter shall be measured with a sound level meter using A-weighting and a "slow" response time, as these terms are used in ANSI S1.1-1994 or its latest revision.

(b) Each measurement shall be conducted at the boundary line of the property on which the noise source is located or any place on the affected property, but no closer than five feet from the noise source.

(c) The sound level meter shall be calibrated and adjusted by means of an acoustical calibrator of the coupler-type to assure meter accuracy within the tolerances in the ANSI specifications for sound level meters, ANSI S1.4-1983 or its latest revision. The sound level meter shall be used as provided in the manufacturer's instructions.

(Amended by Ord. No. 9962 (N.S.), effective 1-9-09)

SEC. 36.404. GENERAL SOUND LEVEL LIMITS.

(a) Except as provided in section 36.409 of this chapter, it shall be unlawful for any person to cause or allow the creation of any noise, which exceeds the one-hour average sound level limits in Table 36.404, when the one-hour average sound level is measured at the property line of the property on which the noise is produced or at any location on a property that is receiving the noise.

TABLE 36.404
SOUND LEVEL LIMITS IN DECIBELS (dBA)

ZONE	TIME	ONE-HOUR AVERAGE SOUND LEVEL LIMITS (dBA)
(1) RS, RD, RR, RMH, A70, A72, S80, S81, S90, S92, RV, and RU with a General Plan Land Use Designation density of less than 10.9 dwelling units per acre.	7 a.m. to 10 p.m.	50
	10 p.m. to 7 a.m.	45
(2) RRO, RC, RM, S86, V5, RV and RU with a General Plan Land Use Designation density of 10.9 or more dwelling units per acre.	7 a.m. to 10 p.m.	55
	10 p.m. to 7 a.m.	50
(3) S94, V4, and all commercial zones.	7 a.m. to 10 p.m.	60
	10 p.m. to 7 a.m.	55
(4) V1, V2	7 a.m. to 7 p.m.	60
V1, V2	7 p.m. to 10 p.m.	55
V1	10 p.m. to 7 a.m.	55
V2	10 p.m. to 7 a.m.	50
V3	7 a.m. to 10 p.m.	70
	10 p.m. to 7 a.m.	65
(5) M50, M52, and M54	Anytime	70

(6)	S82, M56, and M58.	Anytime	75
(7)	S88 (see subsection (c) below)		

(b) Where a noise study has been conducted and the noise mitigation measures recommended by that study have been made conditions of approval of a Major Use Permit, which authorizes the noise-generating use or activity and the decision making body approving the Major Use Permit determined that those mitigation measures reduce potential noise impacts to a level below significance, implementation and compliance with those noise mitigation measures shall constitute compliance with subsection (a) above.

(c) S88 zones are Specific Planning Areas which allow different uses. The sound level limits in Table 36.404 above that apply in an S88 zone depend on the use being made of the property. The limits in Table 36.404, subsection (1) apply to property with a residential, agricultural or civic use. The limits in subsection (3) apply to property with a commercial use. The limits in subsection (5) apply to property with an industrial use that would only be allowed in an M50, M52 or M54 zone. The limits in subsection (6) apply to all property with an extractive use or a use that would only be allowed in an M56 or M58 zone.

(d) If the measured ambient noise level exceeds the applicable limit in Table 36.404, the allowable one-hour average sound level shall be the one-hour average ambient noise level, plus three decibels. The ambient noise level shall be measured when the alleged noise violation source is not operating.

(e) The sound level limit at a location on a boundary between two zones is the arithmetic mean of the respective limits for the two zones. The one-hour average sound level limit applicable to extractive industries, however, including but not limited to borrow pits and mines, shall be 75 decibels at the property line regardless of the zone in which the extractive industry is located.

(f) A fixed-location public utility distribution or transmission facility located on or adjacent to a property line shall be subject to the sound level limits of this section measured at or beyond six feet from the boundary of the easement upon which the facility is located.

(Amended by Ord. No. 7094 (N.S.), effective 3-25-86; amended by Ord. No. 9478 (N.S.), effective 7-19-02; amended by Ord. No. 9621 (N.S.), effective 1-9-04; amended by Ord. No. 9962 (N.S.), effective 1-9-09; amended by Ord. No. 10211 (N.S.), effective 6-1-12)

SEC. 36.405. REPAIRING, REBUILDING OR TESTING MOTOR VEHICLES.

It shall be unlawful for any person to repair, rebuild or test any motor vehicle in such a manner as to cause a disturbing, excessive or offensive noise as defined in section 36.402 of this chapter.

(Amended by Ord. No. 9962 (N.S.), effective 1-9-09)

SEC. 36.406. POWERED MODEL VEHICLES.

It shall be unlawful for any person to operate a powered model vehicle between 9 p.m. and 7 a.m. A powered model vehicle operated in a County park shall meet the daytime sound level standards for an RS zone measured at a point 100 feet from the park property line or 100 feet from where the model vehicle is being operated, whichever is less.

(Amended by Ord. No. 9962 (N.S.), effective 1-9-09)

SEC. 36.407. REFUSE VEHICLES & PARKING LOT SWEEPERS.

No person shall operate or allow to be operated, a refuse compacting, processing, or collection vehicle or a parking lot sweeper between the hours of 10 p.m. to 6 a.m., in or within 100 feet of a residential zone.

APPENDIX D

Barrier Calculation Sheets

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ACOUSTICAL CONSULTING

Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	4.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	130.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 1 (PH13[060])
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**130.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	62.0	70.5	74.0	74.5	73.0	70.5	63.0	80.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**19.0**	**27.5**	**31.0**	**31.5**	**30.0**	**27.5**	**20.0**	36.9	(dBA)	at	130.0	(ft)

Combined Sound Pressure Level at Receiver

Total Sound Pressure Level:	36.9	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**36.9**	(dBA) at	130.0	(ft)

East - 1 - Without Barrier

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	135.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 2 (PH13[048])
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**135.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	63.0	69.5	74.5	75.0	73.0	68.5	62.0	80.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**19.6**	**26.1**	**31.1**	**31.6**	**29.6**	**25.1**	**18.6**	36.6	(dBA)	at	135.0	(ft)

Combined Sound Pressure Level at Receiver

Total Sound Pressure Level:	36.6	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**36.6**	(dBA) at	135.0	(ft)

East - 2 - Without Barrier

Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	140.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 3 (Bryant)
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**140.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	64.0	72.5	76.0	76.5	75.0	72.5	65.0	82.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log\ (r) - 0.75$	**20.3**	**28.8**	**32.3**	**32.8**	**31.3**	**28.8**	**21.3**	38.3	(dBA)	at	140.0	(ft)

Combined Sound Pressure Level at Receiver					
Total Sound Pressure Level:	38.3	(dBA)			
# of sources	1				
Combined Sound Pressure Level:	**38.3**	(dBA)	at	140.0	(ft)

East - 3 - Without Barrier

Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	145.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 4 (PH10 [060])
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**145.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	62.0	70.5	74.0	74.5	73.0	70.5	63.0	80.0	(dBA)			
Sound Pressure Level: $L_p = L_W - 20\ log(r) - 0.75$	**18.0**	**26.5**	**30.0**	**30.5**	**29.0**	**26.5**	**19.0**	36.0	(dBA)	at	145.0	(ft)

Combined Sound Pressure Level at Receiver				
Total Sound Pressure Level:	36.0	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**36.0**	(dBA) at	145.0	(ft)

East - 4 - Without Barrier

Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	150.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 5 (GMC 060)
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**150.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	59.0	67.5	71.0	71.5	70.0	67.5	60.0	77.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20 \log(r) - 0.75$	**14.7**	**23.2**	**26.7**	**27.2**	**25.7**	**23.2**	**15.7**	32.7	(dBA)	at	150.0	(ft)

Combined Sound Pressure Level at Receiver				
Total Sound Pressure Level:	32.7	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**32.7**	(dBA) at	150.0	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	155.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 6 (GMC 060)
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**155.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	59.0	67.5	71.0	71.5	70.0	67.5	60.0	77.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**14.4**	**22.9**	**26.4**	**26.9**	**25.4**	**22.9**	**15.4**	32.4	(dBA)	at	155.0	(ft)

Combined Sound Pressure Level at Receiver

Total Sound Pressure Level:	32.4	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**32.4**	(dBA) at	155.0	(ft)

East - 6 - Without Barrier

Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	155.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 7 (Goodman)
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**155.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**5.3**	**16.3**	**19.3**	**21.8**	**20.3**	**15.8**	**9.8**	26.5	(dBA) at 155.0 (ft)

Combined Sound Pressure Level at Receiver			
Total Sound Pressure Level:	26.5	(dBA)	
# of sources	1		
Combined Sound Pressure Level:	**26.5**	(dBA) at 155.0	(ft)

East - 7 - Without Barrier

Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	150.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 8 (Goodman)
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**150.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20 \log(r) - 0.75$	**5.6**	**16.6**	**19.6**	**22.1**	**20.6**	**16.1**	**10.1**	26.7	(dBA)	at	150.0	(ft)

Combined Sound Pressure Level at Receiver

Total Sound Pressure Level:	26.7	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**26.7**	(dBA) at	150.0	(ft)

East - 8 - Without Barrier

Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	145.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 9 (Goodman)
Path Description: East PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**145.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**5.9**	**16.9**	**19.9**	**22.4**	**20.9**	**16.4**	**10.4**	27.0	(dBA)	at	145.0	(ft)

Combined Sound Pressure Level at Receiver				
Total Sound Pressure Level:	27.0	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**27.0**	(dBA) at	145.0	(ft)

East - 9 - Without Barrier

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Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Project Name:	7th Day HVAC		
Project Number:	B41105N1		
Date:	12/2/2014		
Source Description:	Unit 1 (PH13[060])		
Path Description:	West PL		

Barrier Parameters

Source Height:	h_S =	4.0	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	28.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Path Calculations

Source to Barrier Edge Path Distance:	d_1 =	**28.3**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**43.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	62.0	70.5	74.0	74.5	73.0	70.5	63.0	80.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log\ (r) - 0.75$	**28.6**	**37.1**	**40.6**	**41.1**	**39.6**	**37.1**	**29.6**	46.5	(dBA)	at	43.0	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.13	0.25	0.50	1.01	2.02	4.03	8.07					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	6.3	7.4	9.1	11.2	13.6	16.4	19.2		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**22.3**	**29.7**	**31.5**	**29.9**	**25.9**	**20.7**	**10.4**	36.0	(dBA)	at	43.0	(ft)

Combined Sound Pressure Level at Receiver With Barrier

Total Sound Pressure Level:	36.0	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**36.0**	(dBA) at	43.0	(ft)

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Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	23.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 2 (PH13[048])
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**23.4**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**38.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	63.0	69.5	74.5	75.0	73.0	68.5	62.0	80.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**30.6**	**37.1**	**42.1**	**42.6**	**40.6**	**36.1**	**29.6**	47.6	(dBA)	at	38.0	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.16	0.31	0.62	1.25	2.49	4.98	9.96					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	6.6	7.9	9.7	11.9	14.5	17.2	20.0		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**24.1**	**29.3**	**32.5**	**30.8**	**26.2**	**18.9**	**9.6**	36.6	(dBA)	at	38.0	(ft)

Combined Sound Pressure Level at Receiver With Barrier				
Total Sound Pressure Level:	36.6	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**36.6**	(dBA) at	38.0	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	33.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 3 (Bryant)
Path Description: West PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**33.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	64.0	72.5	76.0	76.5	75.0	72.5	65.0	82.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**32.9**	**41.4**	**44.9**	**45.4**	**43.9**	**41.4**	**33.9**	50.8	(dBA)	at	33.0	(ft)

Combined Sound Pressure Level at Receiver				
Total Sound Pressure Level:	50.8	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**50.8**	(dBA) at	33.0	(ft)

West - 3 - Without Barrier

Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	18.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 3 (Bryant)
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**18.6**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**33.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	64.0	72.5	76.0	76.5	75.0	72.5	65.0	82.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**32.9**	**41.4**	**44.9**	**45.4**	**43.9**	**41.4**	**33.9**	50.8	(dBA)	at	33.0	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.18	0.36	0.72	1.45	2.89	5.78	11.57					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	6.8	8.2	10.1	12.4	15.0	17.8	20.0		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**26.1**	**33.2**	**34.8**	**33.0**	**28.8**	**23.5**	**13.9**	39.3	(dBA)	at	33.0	(ft)

Combined Sound Pressure Level at Receiver With Barrier

Total Sound Pressure Level:	39.3	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**39.3**	(dBA) at	33.0	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	28.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 4 (PH10 [060])
Path Description: West PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**28.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	62.0	70.5	74.0	74.5	73.0	70.5	63.0	80.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**32.3**	**40.8**	**44.3**	**44.8**	**43.3**	**40.8**	**33.3**	50.3	(dBA)	at	28.0	(ft)

Combined Sound Pressure Level at Receiver

Total Sound Pressure Level:	50.3	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**50.3**	(dBA) at	28.0	(ft)

West - 4 - Without Barrier

Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	13.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 4 (PH10 [060])
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**13.8**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**28.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	62.0	70.5	74.0	74.5	73.0	70.5	63.0	80.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**32.3**	**40.8**	**44.3**	**44.8**	**43.3**	**40.8**	**33.3**	50.3	(dBA)	at	28.0	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.22	0.45	0.90	1.79	3.59	7.18	14.35					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	7.2	8.7	10.8	13.2	15.9	18.7	20.0		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**25.1**	**32.1**	**33.5**	**31.6**	**27.4**	**22.1**	**13.3**	38.0	(dBA)	at	28.0	(ft)

Combined Sound Pressure Level at Receiver With Barrier

Total Sound Pressure Level:	38.0	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**38.0**	(dBA) at	28.0	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	23.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 5 (GMC 060)
Path Description: West PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**23.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	59.0	67.5	71.0	71.5	70.0	67.5	60.0	77.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**31.0**	**39.5**	**43.0**	**43.5**	**42.0**	**39.5**	**32.0**	49.0	(dBA)	at	23.0	(ft)

Combined Sound Pressure Level at Receiver				
Total Sound Pressure Level:	49.0	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**49.0**	(dBA) at	23.0	(ft)

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Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	8.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 5 (GMC 060)
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**9.2**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**23.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	59.0	67.5	71.0	71.5	70.0	67.5	60.0	77.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**31.0**	**39.5**	**43.0**	**43.5**	**42.0**	**39.5**	**32.0**	49.0	(dBA)	at	23.0	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.32	0.63	1.26	2.53	5.05	10.10	20.20					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	7.9	9.7	11.9	14.5	17.3	20.0	20.0		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**23.1**	**29.8**	**31.1**	**29.0**	**24.7**	**19.5**	**12.0**	35.6	(dBA)	at	23.0	(ft)

Combined Sound Pressure Level at Receiver With Barrier

Total Sound Pressure Level:	35.6	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**35.6**	(dBA) at	23.0	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	18.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 6 (GMC 060)
Path Description: West PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**18.1**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	59.0	67.5	71.0	71.5	70.0	67.5	60.0	77.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**33.1**	**41.6**	**45.1**	**45.6**	**44.1**	**41.6**	**34.1**	51.1	(dBA)	at	18.1	(ft)

Combined Sound Pressure Level at Receiver

Total Sound Pressure Level:	51.1	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**51.1**	(dBA) at	18.1	(ft)

West - 6 - Without Barrier

Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	3.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 6 (GMC 060)
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**5.4**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**18.1**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	59.0	67.5	71.0	71.5	70.0	67.5	60.0	77.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log\ (r) - 0.75$	**33.1**	**41.6**	**45.1**	**45.6**	**44.1**	**41.6**	**34.1**	51.1	(dBA)	at	18.1	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.58	1.17	2.34	4.68	9.36	18.71	37.42					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	9.5	11.7	14.2	17.0	19.8	20.0	20.0		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**23.6**	**29.9**	**30.9**	**28.6**	**24.3**	**21.6**	**14.1**	35.6	(dBA)	at	18.1	(ft)

Combined Sound Pressure Level at Receiver With Barrier

Total Sound Pressure Level:	35.6	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**35.6**	(dBA) at	18.1	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	18.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 7 (Goodman)
Path Description: West PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**18.1**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20 \log(r) - 0.75$	**24.0**	**35.0**	**38.0**	**40.5**	**39.0**	**34.5**	**28.5**	45.1	(dBA)	at	18.1	(ft)

Combined Sound Pressure Level at Receiver				
Total Sound Pressure Level:	45.1	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**45.1**	(dBA) at	18.1	(ft)

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Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	3.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 7 (Goodman)
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**5.4**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**18.1**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**24.0**	**35.0**	**38.0**	**40.5**	**39.0**	**34.5**	**28.5**	45.1	(dBA)	at	18.1	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.58	1.17	2.34	4.68	9.36	18.71	37.42					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	9.5	11.7	14.2	17.0	19.8	20.0	20.0		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**14.5**	**23.3**	**23.8**	**23.5**	**19.2**	**14.5**	**8.5**	29.2	(dBA)	at	18.1	(ft)

Combined Sound Pressure Level at Receiver With Barrier

Total Sound Pressure Level:	29.2	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**29.2**	(dBA) at	18.1	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	23.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 8 (Goodman)
Path Description: West PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**23.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: Lw	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**21.9**	**32.9**	**35.9**	**38.4**	**36.9**	**32.4**	**26.4**	43.0	(dBA)	at	23.0	(ft)

Combined Sound Pressure Level at Receiver

Total Sound Pressure Level:	43.0	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**43.0**	(dBA) at	23.0	(ft)

West - 8 - Without Barrier

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Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	8.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 8 (Goodman)
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**9.2**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**23.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**21.9**	**32.9**	**35.9**	**38.4**	**36.9**	**32.4**	**26.4**	43.0	(dBA)	at	23.0	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)\ [d_1 + d_2 - d]$	0.32	0.63	1.26	2.53	5.05	10.10	20.20					
Barrier Insertion Loss: $IL = 10\ log\ [3+10N]$	7.9	9.7	11.9	14.5	17.3	20.0	20.0		(dB)			
Sound Pressure Level With Barrier: $L_P - IL$	**14.0**	**23.2**	**24.0**	**23.9**	**19.6**	**12.4**	**6.4**	29.2	(dBA)	at	23.0	(ft)

Combined Sound Pressure Level at Receiver With Barrier

Total Sound Pressure Level:	29.2	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**29.2**	(dBA) at	23.0	(ft)

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Sound Power Level to Sound Pressure Level Analysis

Distances			
Source Height:	h_S =	3.5	(ft)
Receiver Height:	h_R =	5.0	(ft)
Source to Receiver Distance:	d_{SR} =	28.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 9 (Goodman)
Path Description: West PL

Path Calculation			
Source to Receiver Direct Path Distance:	r =	**28.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20\ log(r) - 0.75$	**20.2**	**31.2**	**34.2**	**36.7**	**35.2**	**30.7**	**24.7**	41.3	(dBA)	at	28.0	(ft)

Combined Sound Pressure Level at Receiver				
Total Sound Pressure Level:	41.3	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**41.3**	(dBA) at	28.0	(ft)

West - 9 - Without Barrier

Sound Power Level to Sound Pressure Level and Barrier Insertion Loss Analysis

Barrier Parameters			
Source Height:	h_S =	3.5	(ft)
Barrier Height:	h_B =	8.0	(ft)
Receiver Height:	h_R =	5.0	(ft)
Horizontal Source to Barrier Distance:	d_{SB} =	13.0	(ft)
Horizontal Barrier to Receiver Distance:	d_{BR} =	15.0	(ft)

Project Name: 7th Day HVAC
Project Number: B41105N1
Date: 12/2/2014
Source Description: Unit 9 (Goodman)
Path Description: West PL

Path Calculations			
Source to Barrier Edge Path Distance:	d_1 =	**13.8**	(ft)
Barrier to Receiver Diffracted Path Distance:	d_2 =	**15.3**	(ft)
Source to Receiver Direct Path Distance:	r =	**28.0**	(ft)

Sound Power to Sound Pressure Calculations

Octave Band	125	250	500	1000	2000	4000	8000		(Hz)			
Sound Power Level: L_W	49.9	60.9	63.9	66.4	64.9	60.4	54.4	71.0	(dBA)			
Sound Pressure Level: $L_P = L_W - 20 \log(r) - 0.75$	**20.2**	**31.2**	**34.2**	**36.7**	**35.2**	**30.7**	**24.7**	41.3	(dBA)	at	28.0	(ft)

Barrier Insertion Loss Calculations

Octave Band	125	250	500	1000	2000	4000	8000	Total	(Hz)			
Wavelength: λ	9.04	4.52	2.26	1.13	0.57	0.28	0.14		(ft)			
Fresnel Number: $N = (2/\lambda)[d_1 + d_2 - d]$	0.22	0.45	0.90	1.79	3.59	7.18	14.35					
Barrier Insertion Loss: $IL = 10 \log [3+10N]$	7.2	8.7	10.8	13.2	15.9	18.7	20.0		(dB)			
Sound Pressure Level With Barrier: L_P - IL	**13.0**	**22.5**	**23.4**	**23.5**	**19.3**	**12.0**	**4.7**	28.7	(dBA)	at	28.0	(ft)

Combined Sound Pressure Level at Receiver With Barrier				
Total Sound Pressure Level:	28.7	(dBA)		
# of sources	1			
Combined Sound Pressure Level:	**28.7**	(dBA) at	28.0	(ft)

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