NOISE ASSESSMENT

AES Battery Energy Storage System
MPA-18-010; SAN DIEGO COUNTY, CA

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COMMON TERMS

Sound Pressure Level (SPL): a ratio of one sound pressure to a reference pressure (L_{ref}) of 20 µPa. Because of the dynamic range of the human ear, the ratio is calculated logarithmically by 20 log (L/L_{ref}).

A-weighted Sound Pressure Level (dBA): Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more.

Minimum Sound Level (L_{min}): Minimum SPL or the lowest SPL measured over the time interval using the A-weighted network and slow time weighting.

Maximum Sound Level (L_{max}): Maximum SPL or the highest SPL measured over the time interval the A-weighted network and slow time weighting.

Equivalent sound level (L_{eq}): the true equivalent sound level measured over the run time. Leq is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

Day Night Sound Level (Ldn): Representing the Day/Night sound level, this measurement is a 24 –hour average sound level where 10 dB is added to all the readings that occur between 10 pm and 7 am. This is primarily used in community noise regulations where there is a 10 dB "Penalty" for night time noise. Typically, Ldn's are measured using A weighting.

Community Noise Exposure Level (CNEL): The accumulated exposure to sound measured in a 24-hour sampling interval and artificially boosted during certain hours. For CNEL, samples taken between 7 pm and 10 pm are boosted by 5 dB; samples taken between 10 pm and 7 am are boosted by 10 dB.

Octave Band: An octave band is defined as a frequency band whose upper band-edge frequency is twice the lower band frequency.

Third-Octave Band: A third-octave band is defined as a frequency band whose upper band-edge frequency is 1.26 times the lower band frequency.

Response Time (F,S,I): The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) or impulse (I) time response relationships. Time response can be described with a time constant. The time constants for fast, slow and impulse responses are 1.0 seconds, 0.125 seconds and 0.35 milliseconds, respectively.

EXECUTIVE SUMMARY

This noise study has been completed to determine the noise impacts associated with the development of the proposed AES Distributed Energy (AES) Battery Energy Storage System (BESS) Project located on multiple parcels of land with easements on an adjoining property to allow for the construction and maintenance of power lines. The project is located in the unincorporated community of Fallbrook in the northwestern portion of San Diego County, CA.

Operational Noise

Based on the empirical data, the manufacturers specifications and the distances to the property lines, the unshielded cumulative noise levels from the proposed inverters and heating, ventilation, and air conditioning (HVAC) units were found to be below the most restrictive nighttime property line standard of 57.5 dBA at the adjacent properties zoned Rural Residential (RR). No impacts are anticipated and no mitigation is required.

Major facility maintenance is anticipated to occur approximately 10 times per year and would generally require less than a day to complete. Maintenance activities would be limited during the daytime hours of 7am - 10pm. No direct or cumulative noise impacts are anticipated with these noise reduction measures.

Construction Noise

At a distance as close as 240 feet, the point source noise attenuation from the grading activities and the nearest property line is -13.6 dBA. This would result in an anticipated worst-case 8-hour average combined noise level of 66 dBA at the property line during grading. During the construction of the off-site transmission line, noise levels of 69 dBA L_{eq} are anticipated at the edge of the easement. Given these noise levels and the spatial separation of the equipment over the site, the noise levels of the grading transmission line construction are anticipated to comply with the County of San Diego's 75 dBA standard at all project property lines.

No blasting or rock crushing is anticipated during the grading operations. Therefore, no impulsive noise sources are expected and the Project will comply with Section 36.410 of the County Noise Ordinance.

1.0 INTRODUCTION

1.1 Purpose of this Study

This noise study was completed to determine the noise impacts associated with the construction or operation of the proposed Battery Energy Storage System (BESS) Project. The project site is located within the northeastern portion of the unincorporated community of Fallbrook, in northwestern San Diego County (County), approximately 19 miles inland from the Pacific Ocean, 6 miles northeast of Camp Pendleton, 3 miles south of Riverside County, and 3 miles west of Interstate 15. A general project vicinity map is shown in Figure 1-A.

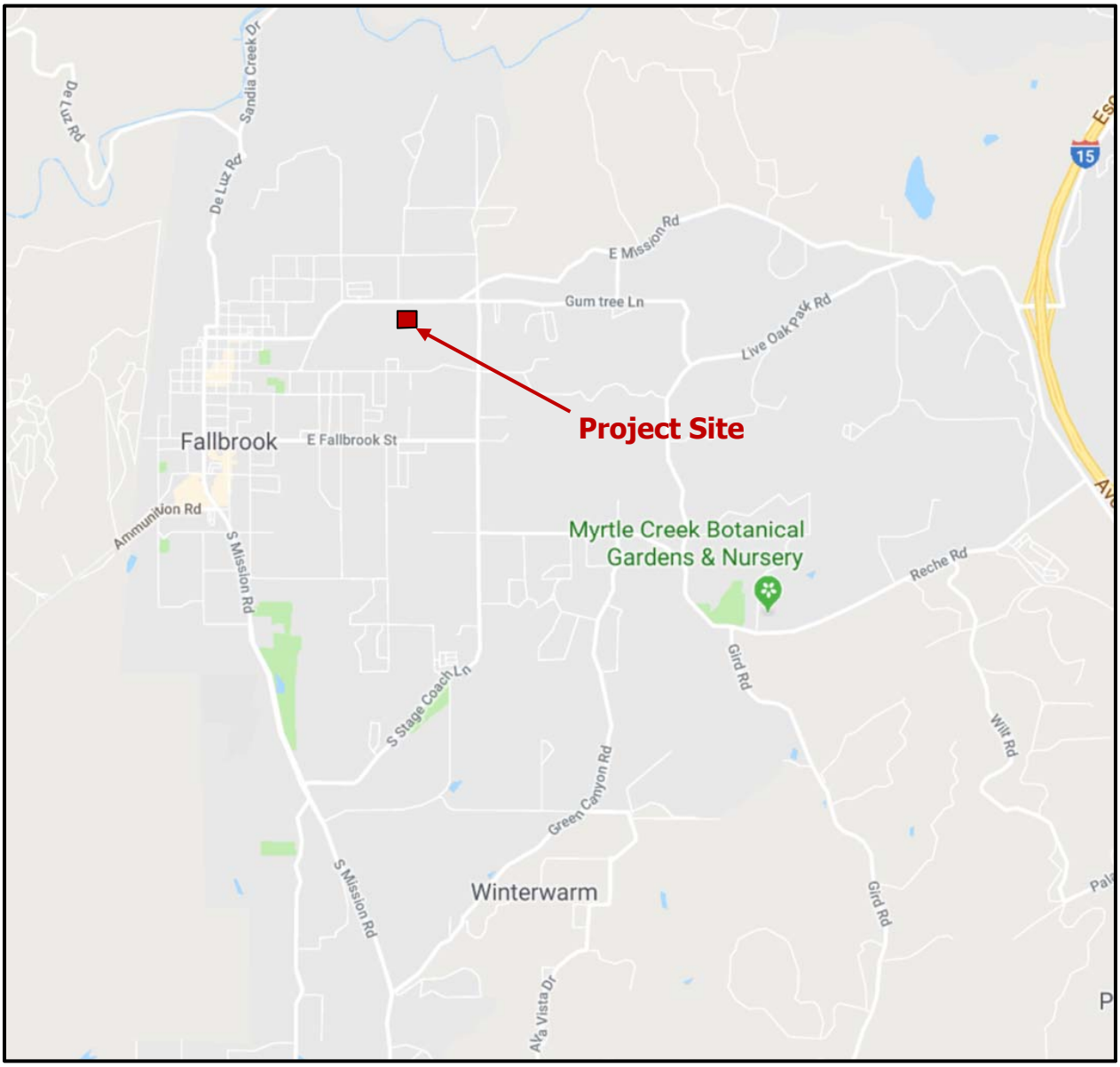
1.2 Project Description

The project proposes to construct 40 megawatts (MW) of battery energy storage on parcels designated for M52 Limited Impact Industrial uses in Fallbrook as well as a 24-foot wide project access road via East Mission Road to the north side of the site. Off-site improvements to connect the BESS into the 69-kV Avocado substation 450 feet to the west will also be required. Construction of the project is anticipated to begin in late 2019 and be completed early 2021.

The utility connection from the project to the substation would exit the site on the south and continue to the southern border of parcel 105-410-19 before turning west and then run along the northern portion of parcel 105-410-44 and ultimately connect to the Avocado substation. The proposed BESS system would consist of up to 16 battery storage systems of which each system is 756 Square Feet (SF) in size and would include necessary voltage converters. Figure 1-B on Page 3 of this report shows the Conceptual Plan of the project.

The proposed project would be operated by San Diego Gas and Electric (SDG&E) remotely however would require periodic site visits for minor maintenance activities along with basic landscaping and weed control. On-site site visits would be expected a four-person crew accessing the site twice monthly. Major facility maintenance is anticipated to occur approximately 10 times per year and would generally require less than a day to complete.

Figure 1-A: Project Vicinity Map



Source: (Google, 2018)

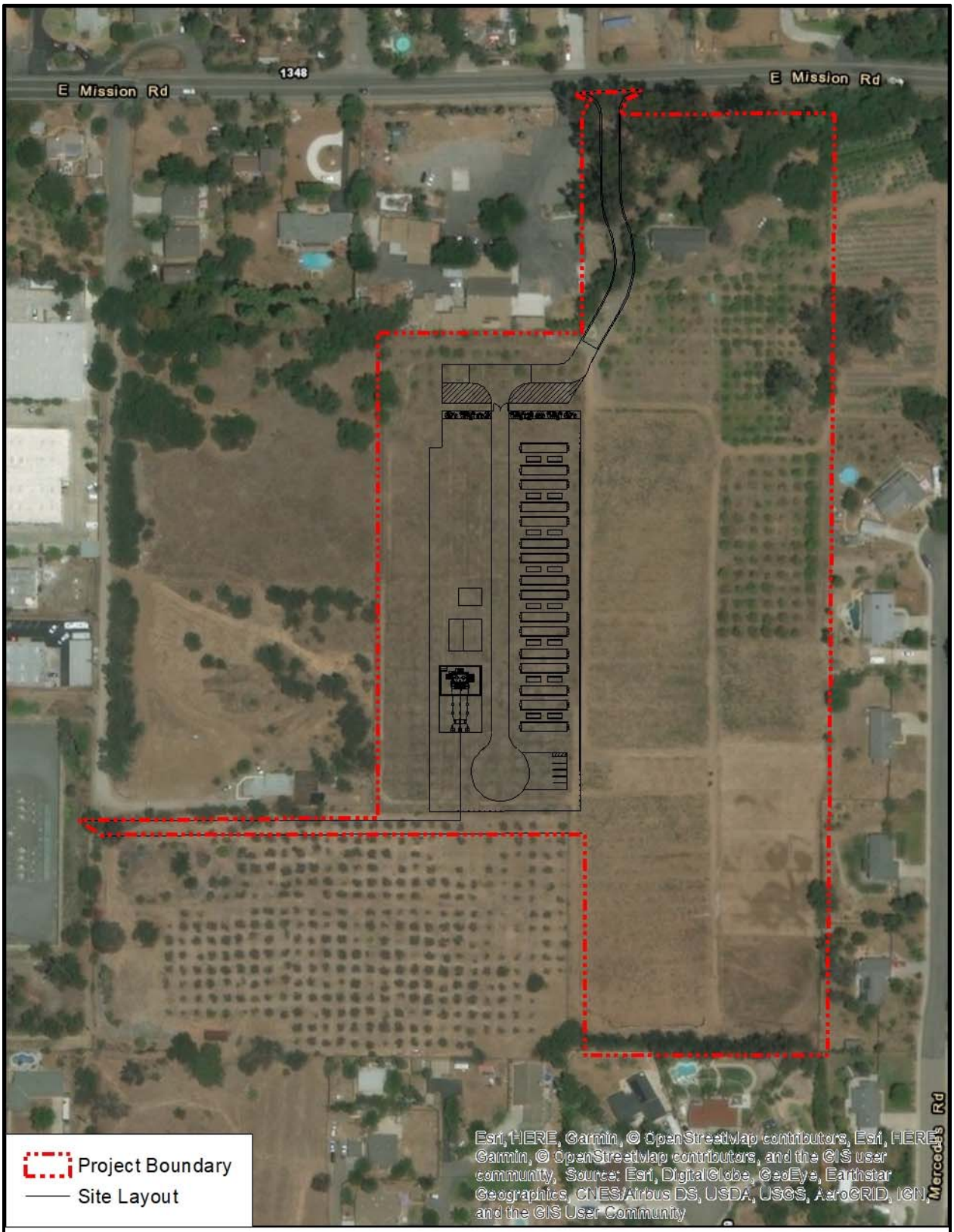


Figure 1-B: Overall Project Layout

1.3 Environmental Settings & Existing Conditions

a) Settings & Locations

The project site and the parcels adjacent to the south and southwest are designated for Limited Impact Industrial uses in the County's General Plan. This designation provides for both freestanding and campus-style industrial development in Village and Semi-Rural areas with access to key transportation corridors at a maximum floor area ratio (FAR) of 0.60. This designation may be located in close proximity to residential and commercial designations in Village and Semi-Rural areas with suitable screening and buffering. Supporting uses—such as office, business service, and institutional uses—and accessory retail uses are also allowed (General Plan, page 3-15).

The project site is subject to M52 Limited Impact Industrial zoning regulations which are intended to create and preserve areas where manufacturing and industrial uses which evidence no or very low nuisance characteristics may locate. Typically, the M52 Use Regulations would be applied in urban or suburban areas where nuisance characteristics involving noise, odor, traffic generation or unsightliness were undesired and where all uses (with certain exceptions) would be conducted entirely within enclosed buildings (County Zoning Ordinance; page 2-10). The area is within a B-designator area, which means all new construction and design changes to existing structures must be reviewed and approved by the Fallbrook Design Review Board.

Uses allowed under the M52 zoning designation include Minor Impact Utilities defined as public utilities which have a local impact on surrounding properties and are necessary to provide essential services (typical uses are electrical and gas distribution substations) and Major Impact Service and Utilities are defined as public services and utilities which have substantial impact. Major impact uses may be conditionally permitted in any zone when the public interest supersedes the usual limitations placed on land use and transcends the usual zoning restraints (typical uses include wind turbine, schools, airports, hospitals, law enforcement, training facilities, and landfills).

The site is generally flat, and on-site elevations range from approximately 789 feet above mean sea level (AMSL) to 832 feet AMSL. The project is currently surrounded by rural residential and agricultural uses. The closet residential receptor to the project is roughly 20 meters from the southern project boundary and roughly 200 meters from the project centroid.

b) Existing Noise Conditions

The site is located south of East Mission Road. East Mission Road is a Major Arterial roadway in the County of San Diego's Circulation Element. Existing noise occurs mainly from vehicular traffic traveling on nearby roadways.

1.4 Methodology

Noise is defined as unwanted or annoying sound which interferes with or disrupts normal activities. Exposure to high noise levels has been demonstrated to cause hearing loss. The individual human response to environmental noise is based on the sensitivity of that individual, the type of noise that occurs and when the noise occurs.

Sound is measured on a logarithmic scale consisting of sound pressure levels known as a decibel (dB). The sounds heard by humans typically do not consist of a single frequency but of a broadband of frequencies having different sound pressure levels. The method for evaluating all the frequencies of the sound is to apply an A-weighting to reflect how the human ear responds to the different sound levels at different frequencies. The A-weighted sound level adequately describes the instantaneous noise whereas the equivalent sound level depicted as L_{eq} represents a steady sound level containing the same total acoustical energy as the actual fluctuating sound level over a given time interval.

The Community Noise Equivalent Level (CNEL) is the 24 hour A-weighted average for sound, with corrections for evening and nighttime hours. The corrections require an addition of 5 decibels to sound levels in the evening hours between 7 p.m. and 10 p.m. and an addition of 10 decibels to sound levels at nighttime hours between 10 p.m. and 7 a.m. These additions are made to account for the increased sensitivity during the evening and nighttime hours when sound appears louder.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiant in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions. Hard site conditions consist of concrete, asphalt and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas and vegetation. On the other hand, fixed/point sources radiate outward uniformly as it travels away from the source. Their sound levels attenuate or drop off at a rate of 6 dBA for each doubling of distance.

The most effective noise reduction methods consist of controlling the noise at the source, blocking the noise transmission with barriers or relocating the receiver. Any or all of these methods could be required to reduce noise levels to an acceptable level.

2.0 OPERATIONAL ACTIVITIES

2.1 Guidelines for the Determination of Significance

Section 36.404 of the County of San Diego noise ordinance provides performance standards and noise control guidelines for determining and mitigating non-transportation, or stationary, noise source impacts to adjacent properties. The purpose of the noise ordinance is to protect, create and maintain an environment free from noise that may jeopardize the health or welfare, or degrade the quality of life. The County Noise Ordinance states that it shall be unlawful for any person to cause or allow the creation of any noise to the extent that the one-hour average sound level, at any point on or beyond the boundaries of the property exceeds the applicable limits provided in Table 2-1.

Table 2-1: Sound Level Limits in Decibels (dBA)

ZONE		APPLICABLE LIMIT ONE-HOUR AVERAGE SOUND LEVEL (DECIBELS)
R-S, R-D, R-R, R-MH, A-70, A-72, S-80, S-81, S-87, S-88, S-90, S-92, R-V, and R-U Use Regulations with a density of less than 11 dwelling units per acre.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	50 45
R-RO, R-C, R-M, C-30, S-86, R-V, R-U and V5. Use Regulations with a density of 11 or more dwelling units per acre.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	55 50
S-94, V4, and all other commercial zones.	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	60 55
V1, V2 V1, V2 V1 V2	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m. 10 p.m. to 7 a.m.	60 55 55 50
V3	7 a.m. to 10 p.m. 10 p.m. to 7 a.m.	70 65
M-50, M-52, M-54	Anytime	70
S-82, M-58, and all other industrial zones.	Anytime	75

Source: County of San Diego Noise Ordinance Section 36.404

As stated above in Section 1, the project and surrounding properties are zoned light industrial M-52 and Rural Residential (RR). Section 36.404 of the Noise Ordinance sets a most restrictive operational exterior noise limit for the RR noise sensitive land uses of 50 dBA L_{eq} for daytime hours of 7 a.m. to 10 p.m. and 45 dBA L_{eq} during the noise sensitive nighttime hours of 10 p.m. to 7 a.m. as shown in Table 2-1 above. The project site noise level limit is 70 dBA L_{eq} regardless of time. According to the noise ordinance when different zones adjoin, the limit is based on the arithmetic mean of the different zone noise level limit. Most of the project components will only operate during the daytime hours but a few may operate during nighttime or early morning hours and therefore the most restrictive and conservative approach is to apply the 57.5 dBA L_{eq} nighttime standard at the property lines.

2.2 Potential Operational Noise Impacts

This section examines the potential stationary noise source impacts associated with the operation of the proposed project. Specifically, noise levels from the proposed inverters, heating, ventilation, and air conditioning (HVAC), and project maintenance. Electrical current is transferred to the inverters, which convert the Direct Current (DC) stored by the batteries into Alternating Current (AC).

The BESS facility would consists of several separate battery storage containers with rechargeable batteries, with a total capacity of 40 MW. The containers are of a metal frame construction and insulated and air conditioned. Operation of the air conditioning equipment used to cool the batteries would be the dominant source of noise during operation of the proposed project. Each BESS container utilizes 3 HVAC units, with two on the eastern façade and one on the western façade. A secondary noise source would be the inverters used to convert the electricity stored in the batteries between DC and AC; the proposed project would locate the inverter units between the BESS containers.

The proposed inverter/transformer pad locations for the site can be seen in Figure 2-A on the following page. The project is not proposing any back-up generators. On-site operation is anticipated to be remote with occasional major maintenance trips approximately 10 times a year and minor maintenance/landscaping visits twice monthly.

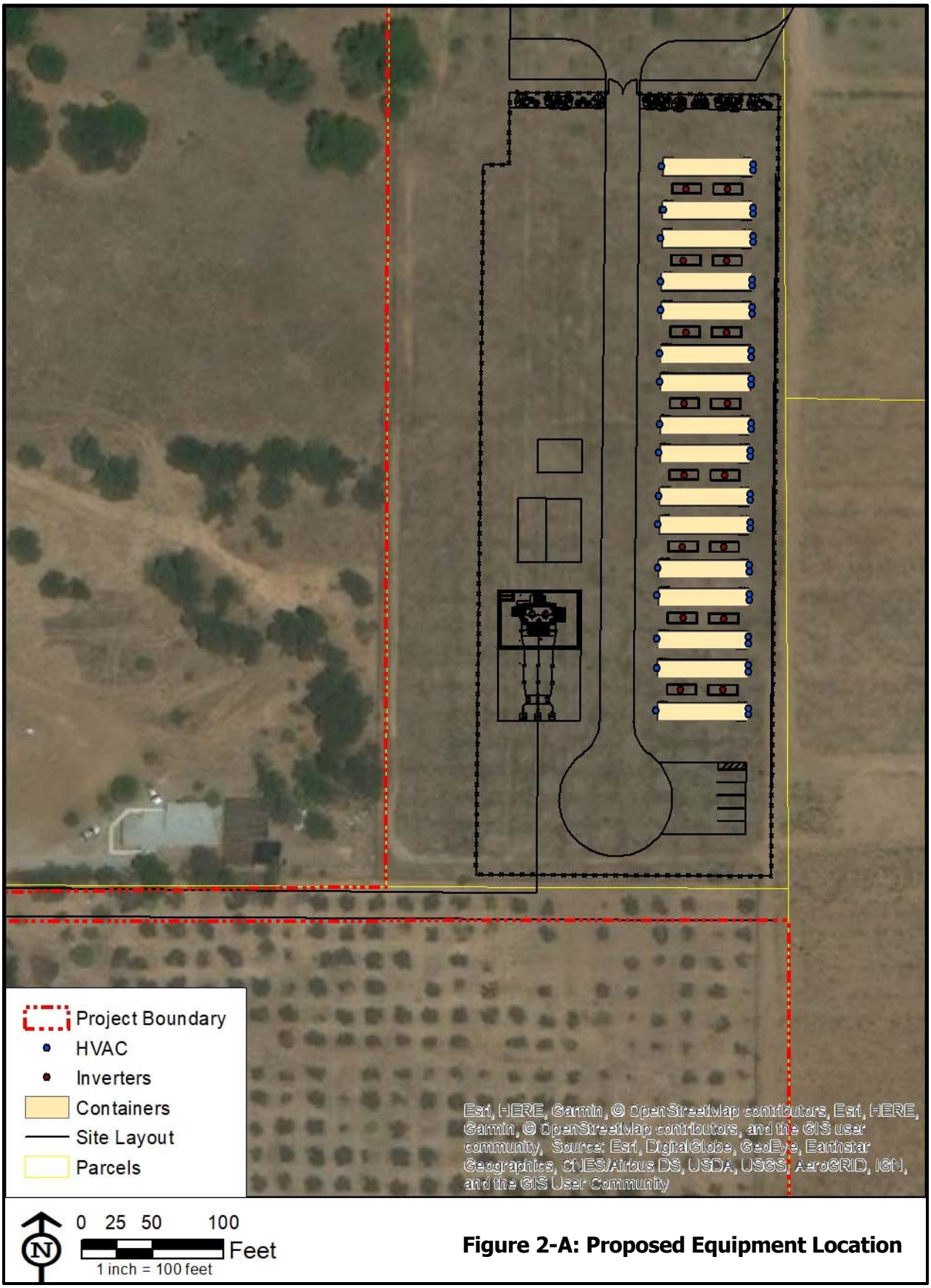


Figure 2-A: Proposed Equipment Location

2.2.1 Operational Equipment Noise Levels On-site

Energy stored by the project would be transmitted via underground cable/vaults that would enable connection of the project to the Avocado substation; an easement is being acquired along the northern boundary of parcel 105-410-44. Connection would be made from the project to the substation and no new substation is needed or proposed.

The proposed 2.76-kilowatt (kW) Inverters, Power Electronics Model FS1331CH, have unshielded noise rating of 79 dBA at 1 meter (3 feet) *(Source: Power Electronics Pure Energy Solar Solutions Inverters/Stations)*. The HVAC would be Marvair ComPac Model AVP60ACA and would have an unshielded noise level rating of 79 dBA at 5 Feet (1.5 meters) *(Source: Marvair ComPac I & ComPac II 2-6 Vertical All Mount Air Conditions, Models AVP24-30-36-42-48-60-72)*. The National Electrical Manufacturers Association (NEMA) test results for the transformers and the proposed inverters manufacturer's specifications are provided as ***Attachment A*** of this report.

Noise levels from the proposed BESS facility were modeled with SoundPlan Essential, version 4.0 (SoundPlan), a three-dimensional acoustical modeling software package. Propagation of modeled stationary noise sources was based on ISO Standard 9613-2, "Attenuation of Sound during Propagation Outdoors, Part 2: General Method of Calculation." The assessment methodology assumes that all receptors would be downwind of stationary sources. This is a worst-case assumption for total noise impacts, since, in reality, only some receptors will be downwind at any one time.

The primary on-site sources would be the inverters and HVAC systems. The modeled source noise levels are presented in Table 2-2. All sound power reference levels were taken from manufactured specification sheets.

Table 2-2: Source Noise Level in Decibels (dBA)

Name	Sound Power Level (dBA)
Inverters	86.2
HVAC	86.4

To be conservative, all HVAC were modeled as active at 100 percent power for a full hour during all hours. Similarly, the inverters were assumed to operate at full power during the entire hour regardless of the time period. This is considered a reasonably conservative assumption as it would be unlikely that the HVAC or inverters would be active for a full hour at the same time regardless of temperature.

Based on these inputs and the site layout shown in Figure 2-A, the proposed project would not exceed the noise levels limit at any property, see Table 2-3 and Figure 4-A for the potential noise level resulting from the project. Thus, the proposed project would not require noise abatement.

Table 2-3: Operational Noise Levels in Decibels (dBA)

Receiver	Description	Land Use	Noise Level (dBA Leq)	County Standard	Does the noise level exceed standard?
1	1397 Mission Rd.	RR	50	57.5	No
2	397 Mercedes Rd.	RR	51	57.5	No
3	349 Mercedes Rd.	RR	50	57.5	No
4	1309 Mission Rd.	RR	52	70	No
5A	1305 Mission Rd. (South)	M52	51	70	No
5B	1305 Mission Rd. (North)	M52	54	70	No

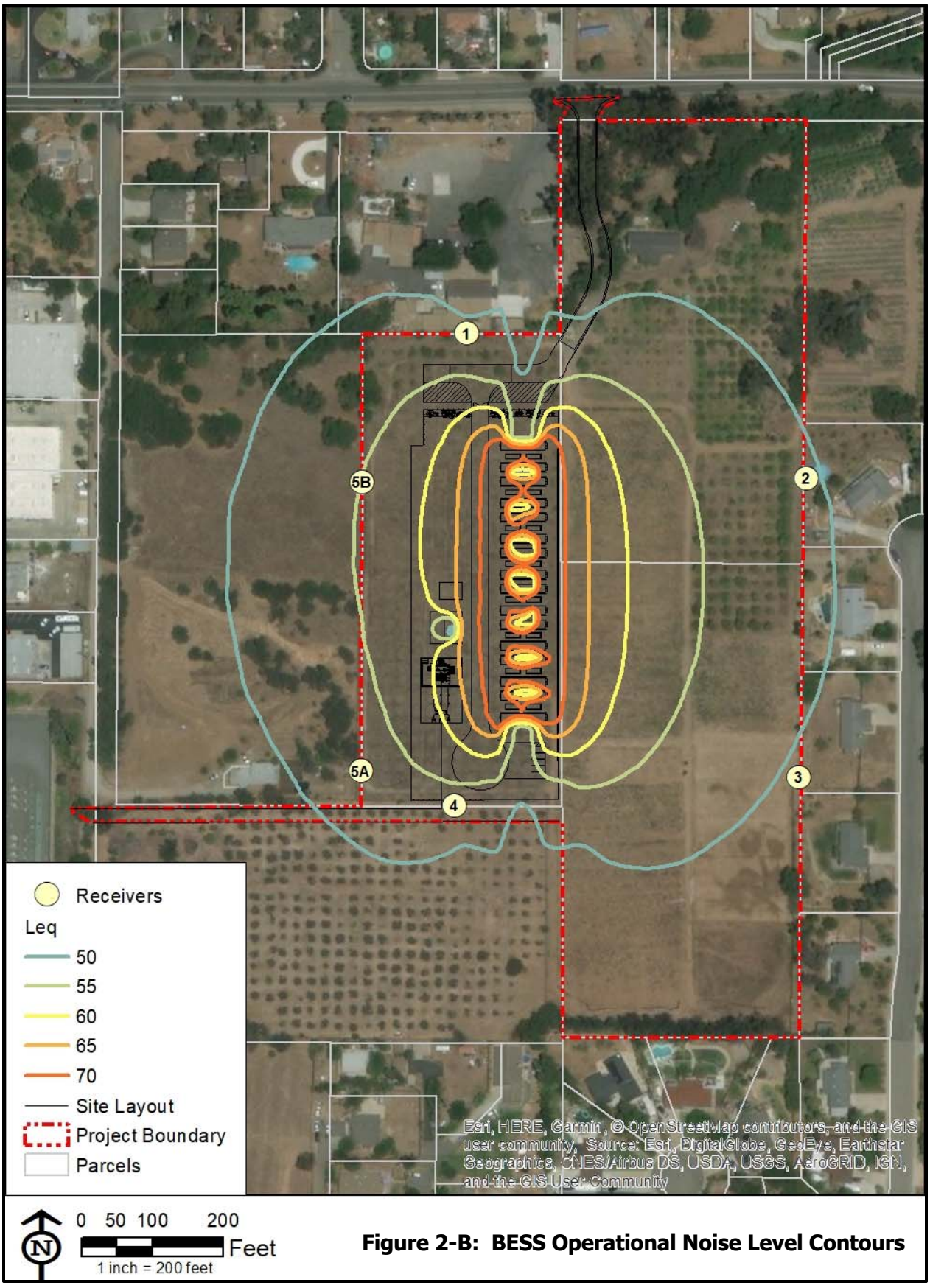


Figure 2-B: BESS Operational Noise Level Contours

2.2.2 Maintenance Noise Levels On-site

Periodic site maintenance of the BESS facility would be required. Section 36.404 of the Noise Ordinance sets a most restrictive operational exterior noise limit for the noise sensitive land uses of 57.5 dBA L_{eq} for daytime hours of 7 a.m. to 10 p.m. Therefore, the most restrictive 57.5 dBA L_{eq} standard was applied at the property lines. On-site activities are not anticipated to result in noise levels in excess of existing landscape maintenance on the existing and surrounding properties. Therefore, on-site maintenance is not anticipated to result in a substantial increase in noise levels. Similarly, on-site maintenance is not anticipated to exceed County noise standards. Additionally, since the on-site operations will be limited to the daytime hours of 7 a.m. to 10 p.m., no impacts are anticipated.

2.3 Conclusions

Based on the empirical data, the manufacturers specifications and the distances to the property lines, the unshielded cumulative noise levels from the proposed HVAC and inverters were found to be below the most restrictive nighttime property line standard of 57.5 dBA at the adjacent properties zoned RR. No impacts are anticipated, and no mitigation is required. On-site maintenance would be limited during the daytime hours of 7am to 10pm. No direct or cumulative no impacts are anticipated with these noise reduction measures.

3.0 CONSTRUCTION ACTIVITIES

3.1 Guidelines for the Determination of Significance

Construction Noise: Noise generated by construction activities related to the project will exceed the standards listed in San Diego County Code Sections as follows.

SEC. 36.408: HOURS OF OPERATION OF CONSTRUCTION EQUIPMENT

Except for emergency work, it shall be unlawful for any person to operate or cause to be operated, construction equipment:

a. Between 7 p.m. and 7 a.m.

b. On a Sunday or a holiday. For purposes of this section, a holiday means January 1st, the last Monday in May, July 4th, the first Monday in September, December 25th and any day appointed by the President as a special national holiday or the Governor of the State as a special State holiday. A person may, however, operate construction equipment on a Sunday or holiday between the hours of 10 a.m. and 5 p.m. at the person's residence or for the purpose of constructing a residence for himself or herself, provided that the operation of construction equipment is not carried out for financial consideration or other consideration of any kind and does not violate the limitations in sections 36.409 and 36.410.

SEC. 36.409: SOUND LEVEL LIMITATIONS ON CONSTRUCTION EQUIPMENT

Except for emergency work, it shall be unlawful for any person to operate construction equipment or cause construction equipment to be operated, that exceeds an average sound level of 75 decibels for an eight-hour period, between 7 a.m. and 7 p.m., when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is being received.

SEC. 36.410: SOUND LEVEL LIMITATIONS ON IMPULSIVE NOISE

In addition to the general limitations on sound levels in section 36.404 and the limitations on construction equipment in section 36.409, the following additional sound level limitations shall apply:

(a) Except for emergency work or work on a public road project, no person shall produce or cause to be produced an impulsive noise that exceeds the maximum sound level shown in Table 36.410A (provided below), when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is received, for 25 percent of the minutes in the measurement period, as described in subsection (c) below. The maximum sound level depends on the use being made of the occupied property. The uses in Table 36.410A are as described in the County Zoning Ordinance.

TABLE 36.410A: MAXIMUM SOUND LEVEL (IMPULSIVE) MEASURED AT OCCUPIED PROPERTY IN DECIBELS (dBA)

OCCUPIED PROPERTY USE	DECIBELS (dBA)
Residential, village zoning or civic use	82
Agricultural, commercial or industrial use	85

(b) Except for emergency work, no person working on a public road project shall produce or cause to be produced an impulsive noise that exceeds the maximum sound level shown in Table 36.410B, when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is received, for 25 percent of the minutes in the measurement period, as described in subsection (c) below. The maximum sound level depends on the use being made of the occupied property. The uses in Table 36.410B are as described in the County Zoning Ordinance.

TABLE 36.410B: MAXIMUM SOUND LEVEL (IMPULSIVE) MEASURED AT OCCUPIED PROPERTY IN DECIBELS (dBA) FOR PUBLIC ROAD PROJECTS

OCCUPIED PROPERTY USE	dB(A)
Residential, village zoning or civic use	85
Agricultural, commercial or industrial use	90

(c) The minimum measurement period for any measurements conducted under this section shall be one hour. During the measurement period a measurement shall be conducted every minute from a fixed location on an occupied property. The measurements shall measure the maximum sound level during each minute of the measurement period. If the sound level caused by construction equipment or the producer of the impulsive noise exceeds the maximum sound level for any portion of any minute, it will be deemed that the maximum sound level was exceeded during that minute.

3.2 Potential Construction Noise Impacts

Construction noise represents a short-term impact on the ambient noise levels. Noise generated by construction equipment includes haul trucks, water trucks, graders, dozers, loaders and scrapers can reach relatively high levels. Grading activities typically represent one of the highest potential sources for noise impacts and limited grading will be necessary for this project. The most effective method of controlling construction noise is through local control of construction hours and by limiting the hours of construction to normal weekday working hours.

The U.S. Environmental Protection Agency (U.S. EPA) has compiled data regarding the noise generating characteristics of specific types of construction equipment. Noise levels generated by heavy construction equipment at a distance of 50 feet can range from 60 dBA for a small tractor up to 100 dBA for rock breakers. However, these noise levels diminish rapidly with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 87 dBA measured at 50 feet from the noise source would be reduced to 81 dBA at 100 feet from the source and be further reduced to 75 dBA at 200 feet from the source.

Using a point-source noise prediction model, calculations of the expected construction noise impacts were completed. The essential model input data for these performance equations include the source levels of each type of equipment, relative source to receiver horizontal and vertical separations, the amount of time the equipment is operating in a given day, also referred to as the duty-cycle and any transmission loss from topography or barriers. To determine the worst-case noise levels for the grading operations no topographic attenuation, duty-cycle reductions or barrier reductions were utilized. According to the project applicant, the project site will be grubbed to remove vegetation and compacted in one phase followed by the installation of the BESS containers in one phase.

On-site Construction

Grading operations are typically the loudest construction activity. The grading operations may utilize a total of up to a dozer, a grader, and a tractor/loader/backhoe. This list is considered conservative and provides a worst-case assessment from a noise perspective. The noise levels utilized in this analysis of on-site construction are based upon the conservative list of equipment as shown in Table 3-1 below. Most of the construction activities will consist of clearing and grubbing the site for the preparation of the BESS containers and inverters. The equipment is anticipated to be located on the eastern portion of the site with some equipment potentially operating at or near the eastern property line of parcel 105-410-19, while the majority of the equipment would be located more than 100 feet from any property line. Based on the project site plan, the acoustical center for the grading operation would be approximately 240 feet from the nearest property line with an occupied structure.

As can be seen in Table 3-1, if all the equipment was operating in the same location, which is not physically possible, at a distance as close as 240 feet from the nearest property line the point source noise attenuation from construction activities is -13.6 dBA. This would result in an anticipated worst-case eight-hour average combined noise level of 66.2 dBA at the western property line. Given this and the spatial separation of the equipment, the noise levels will comply with the County of San Diego's 75 dBA standard at all project property lines. The project will not be conducting any offsite construction, all improvements are located within the site and adjacent right-of-way.

Table 3-1: On-Site Preparation Noise Levels

Construction Equipment	Quantity	Duty Cycle Hours/Day)	Source Level @ 50-Feet (dBA)	Combined Noise Level @ 50-Feet (dBA Leq-8h)
Grader	1	8	74	74.0
Scraper	1	8	75	75.0
Loader/Tractor	2	8	73	76.0
Total Noise Level @ 50 Feet (dBA)				**79.8**
Distance				**240**
Noise Reduction Due To Distance				**-13.6**
NEAREST PROPERTY LINE NOISE LEVEL				**66.2**

Off-site Construction

Power stored by the project would be conveyed from the project to an SDG&E switchyard via an approximately 700-foot underground transmission line. The transmission line would be located along the northern boundary of APN 105-410-44 (1309 East Mission Road) and immediately south of APN 105-410-18 (1305 East Mission Road). Construction of the transmission line would generate noise primarily from the operation of construction vehicles and equipment.

Construction of the transmission line will primarily involve intermittent use backhoe loader and ground compactor. Construction activities will be limited to daytime hours (between 7:00 a.m. and 7:00 p.m.) with some exceptions as required for safety considerations or certain construction procedures that cannot be interrupted. The hourly construction noise level would be approximately 78 dBA at 50 feet. Due to the linear nature of the transmission line work, construction activity would occur along 300 feet of the alignment.

As discussed, construction involves equipment moving from one point to another, work breaks, and idle time, and thus the long-term noise averages are lower than louder short-term noise events. Additionally, due to this dynamic activity, noise levels are calculated from the center of the activity. Linear construction projects, such as roadway, transmission line, and pipeline add another complexity by moving along a fixed alignment. The noise levels utilized in this analysis of on-site construction are based upon the conservative list of equipment as shown in Table 3-2 below.

For purposes of analysis of the proposed project transmission line, the center of the construction activity for the transmission line would be 150 feet. Based on this distance, a maximum 1-hour noise level of approximately 69 dBA L_{eq} at the edge of the easement. Thus, the equipment would generate an hourly noise level of approximately 69 dBA L_{eq} at the property line of the nearest property with an occupied structure.

Table 3-2: Off-Site Preparation Noise Levels

Construction Equipment	Quantity	Duty Cycle Hours/Day)	Source Level @ 50-Feet (dBA)	Combined Noise Level @ 50-Feet (dBA Leq-8h)
Roller	1	8	80.0	76.0
Excavator	1	8	80.7	79.7
			Total Noise Level @ 50 Feet (dBA)	**78.3**
			Distance	**150**
			Noise Reduction Due To Distance	**-9.5**
			NEAREST PROPERTY LINE NOISE LEVEL	**68.8**

No blasting or rock crushing is anticipated during the grading operations. Therefore, no impulsive noise sources are expected and the Project is anticipated to comply with Section 36.410 of the County Noise Ordinance and no further analysis is required.

3.3 Construction Conclusions

Construction of the proposed project would generate noise; however, given the spatial separation of the equipment over the site area and along the transmission line easement, the noise levels of the grading and transmission line construction are anticipated to comply with the County's 75 dBA standard at all project property lines. Noise associated with construction would occur between 7:00 a.m. and 7:00 p.m. Thus, daytime construction would not result in significant noise impacts.

No blasting or rock crushing is anticipated during the grading operations. Therefore, no impulsive noise sources are expected and the Project will comply with Section 36.410 of the County Noise Ordinance.

4.0 SUMMARY OF PROJECT IMPACTS, MITIGATION & CONCLUSIONS

- Operational Noise Analysis

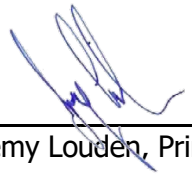
  Based on the empirical data, the manufacturers specifications and the distances to the property lines, the unshielded cumulative noise levels from the proposed transformers/inverters and HVAC were found to be below the most restrictive nighttime property line standard of 57.5 dBA at the adjacent properties zoned RR. No impacts are anticipated and no mitigation is required.

- Construction Noise Analysis

  At a distance as close as 240 feet, the point source noise attenuation from the grading activities and the nearest property line is -13.6 dBA. This would result in an anticipated worst-case 8-hour average combined noise level of 66 dBA at the property line during grading. During the construction of the off-site transmission line, noise levels of 69 dBA L_{eq} are anticipated at the edge of the easement. Given these noise levels and the spatial separation of the equipment over the site, the noise levels of the grading transmission line construction are anticipated to comply with the County of San Diego's 75 dBA standard at all project property lines.

5.0 CERTIFICATIONS

The contents of this report represent an accurate depiction of the existing and future acoustical environment and impacts within the proposed AES BESS Project. The report was prepared by Jeremy Louden; a County approved CEQA Consultant for Acoustics.



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Date February 7, 2019

ATTACHMENT A

NOISE SPECIFICATIONS AND NOISE DATA
(Transformers and Inverters)

Marvair®
AIRXCEL®, Inc.
ISO 9001 2000 REGISTERED COMPANY

ComPac® I & ComPac® II 2 to 6 Ton Vertical Wall Mount Air Conditioners

Models AVP24-30-36-42-48-60-72

General Description

The Marvair® ComPac® I and ComPac® II air conditioners are used primarily to cool electronic and communication equipment shelters. Due to the high internal heat load, these shelters require cooling even when outside temperatures drop below 60°F (15°C). The ComPac I and ComPac II air conditioners have the necessary controls and components for operation during these (less than 60°F [15°C]) temperatures.

The primary difference between the two models is that the ComPac® II air conditioner has a factory installed economizer. When cool and dry, the economizer uses outside air to cool the shelter. The economizer provides temperature control, energy cost savings, and increased reliability by decreasing the operating hours of the compressor and the condenser fan. The ComPac I and ComPac II air conditioners are problem solvers for a wide range of conditions and applications. To insure proper operation and optimum performance, all economizers are non-removable, factory installed and tested. In addition, factory and field installed accessories can be used to meet specific requirements.

AVP36ACA-10C

The ComPac® I and ComPac® II air conditioners are listed by ETL. Ratings and specifications are in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards and manufactured and tested to UL Standard 1995, 2nd Ed. and CAN/CSA C22.2 No. 236-95, 2nd Ed.

Standard Features

Designed for Operation in Low Ambient Conditions

- Low ambient control cycles condenser fan to maintain proper refrigerant pressures.
- Three minute by-pass of the low pressure switch for start-up of compressor when outdoor temperatures are below 55°F (13°C).
- Factory built-in economizer.*

High Efficiency

- All units meet or exceed current NAECA** requirements.
- High efficiency compressor.
- Lanced fins and rifled tubing on many condenser & evaporator coils.

Built-in Reliability

- High pressure switch and low pressure switch with lockout protects refrigerant circuit.
- Three minute delay on break for short cycle protection.

Remote Alarm Capability

- Dry contacts can be used for remote alarm or notification upon air conditioner lockout.

Ease of Installation

- Sloped top with flashing eliminates need of rainhood.
- Built-in mounting flanges facilitate installation and minimize chance of water leaks.
- Supply and return openings exactly match previous models.
- Factory installed disconnect on all 208/230v units, optional 460V units.
- Outside air hood is standard.

Rugged Construction

- Copper tube, aluminum fin evaporator & condenser coils.
- Factory installed heaters on discharge side of evaporator coil (optional)
- Baked on neutral beige finish over galvanneal steel for maximum cabinet life. (Other finishes are available.)

Ease of Service

- Service access valves are standard.
- Standard 2” (50 mm) pleated filter changeable from outside.
- All major components are readily accessible.
- Front Control Panel allows easy access and complies with NEC clearance codes on redundant side-by-side systems.
- LEDs indicate operational status and fault conditions.

*ComPac® II air conditioner only

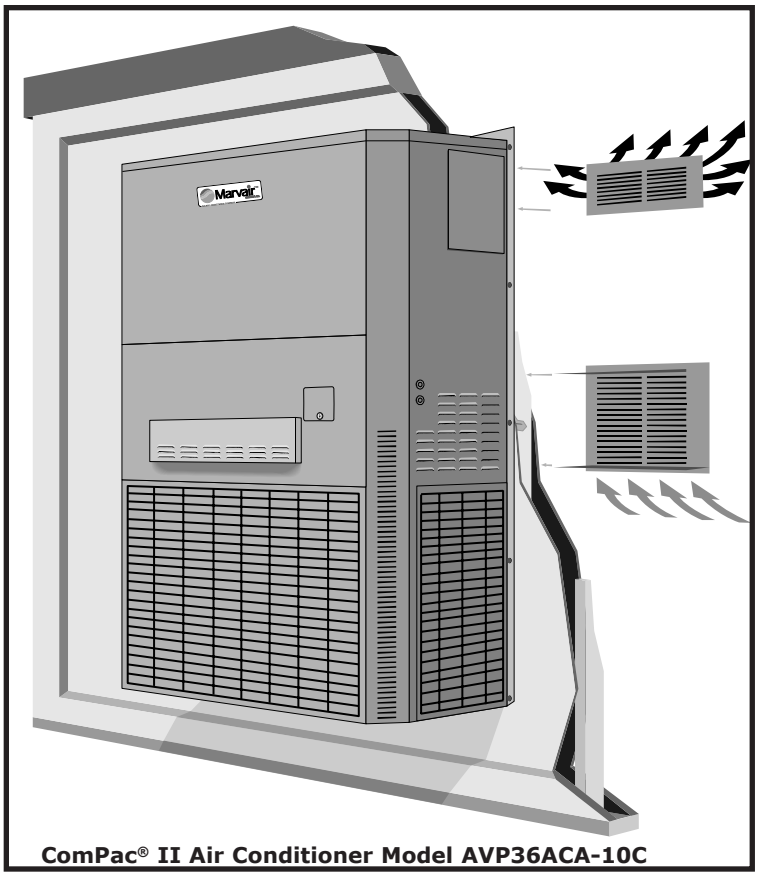
** National Appliance Energy Conservation Act

ComPac PD, 1/06
supersedes 3/04

A Marvair® First – Factory Installed Economizer

Marvair's ComPac® II air conditioner has been the industry standard since its introduction in 1986. Tens of thousands of ComPac II air conditioners are in operation from the metropolitan areas of North America to the deserts of the Mid-East to the Siberian tundra. Here's how the economizer works:

On a signal from the wall mounted indoor thermostat that cooling is required, either mechanical cooling with the compressor or free cooling with the economizer is provided. A factory installed enthalpy controller determines whether the outside air is sufficiently cool and dry to be used for cooling. If suitable, the compressor is locked out and the economizer damper opens to bring in outside air. Integral pressure relief allows the interior air to exit the shelter, permitting outside air to enter the shelter. The temperature at which the economizer opens is adjustable from 53°F (12°C) at 50% Relative Humidity to 78°F (26°C) at 50% Relative Humidity.



ComPac® II Air Conditioner Model AVP36ACA-10C

After the enthalpy control has activated and outside air is being brought into the building, the mixed air sensor measures the temperature of the air entering the indoor blower and then modulates the economizer damper to mix the right proportion of cool outside air with warm indoor air to maintain 50-56°F (10 - 13°C) air being delivered to the building. This prevents shocking the electronic components with cold outside air. The compressor is not permitted to operate when the economizer is functioning.

If the outside air becomes too hot or humid, the economizer damper closes completely, or to a minimum open position with an optional minimum position potentiometer, and mechanical cooling is activated.

Controllers and Thermostats

Controllers

CommStat3™ Lead/Lag Microprocessor Controller P/N S/04581

Solid state controller designed to operate a fully or partially redundant air conditioning system. Insures equal wear on both air conditioners while allowing the lag unit to assist upon demand. Lead/ lag changeover is factory set at 7 days, but is field programmable in 1/2 day increments from 1/2 to 7 days. The CommStat 3™ Controller has LED's to indicate status & function, digital display of temperature, a comfort override button for energy savings, five alarm relays, a built in temperature sensor and is fully programmable. See CommStat 3™ Controller Product Data Sheet for details on operation & installation.

LL357D2 Lead/Lag Controller P/N S/05579

Two stage heat and cool thermostat with solid state module for redundant operation with adjustable (2°-12°F (1.1° - 6.7°C)) interstage differential. (See the LL357D2 Product Data Sheet for details.)

Thermostats & Thermostat Guards

Thermostat P/N 50123

Digital thermostat. 1 stage heat, 1 stage cool. 7 day programmable. Fan switch: Auto & On. Auto-change over. Keypad lockout. Non-volatile program memory.

Thermostat P/N 50107

Digital thermostat. 2 stage heat, 2 stage cool. 7 day programmable. Fan switch: Auto & On. Auto-change over. Status LED's. Backlit display. Programmable fan. Non-volatile program memory.

Thermostat Guard P/N 50092

Thermostat guard for use with the 50123 and 50107 thermostats.

Accessories

Supply Grilles

For AVP24
20” x 8” (508 mm x 203 mm) P/N 80674

For AVP30,36
28” x 8” (711 mm x 203 mm) P/N 80675

For AVP42,48,60,72
30” x 10” (762 mm x 254 mm) P/N 80676

Return Grilles

For AVP24
20” x 12” (508 mm x 305 mm) P/N 80677

For AVP30,36
28” x 14” (711 mm x 356 mm) P/N 80678

For AVP42,48,60,72
30” x 16” (762 mm x 406 mm) P/N 80679

Return Filter Grilles

Used when filter must be changed from the interior. Not recommended for ComPac® II air conditioner. Note: Filter used in Return Filter Grille is 1” (25 mm) thick.

For AVP24
20” x 12” (508 mm x 305 mm) P/N 80671

For AVP30,36
28” x 14” (711 mm x 356 mm) P/N 80672

For AVP42,48,60,72
30” x 16” (762 mm x 406 mm) P/N 80673

Options

The ComPac® I and ComPac® II air conditioners were designed and are built to stringent requirements of the communications/electronic shelter. Applications occur that have special requirements. Numerous options are available for the ComPac I and ComPac II air conditioners that meet these special needs.

Hard Start Kit - Used on single phase equipment to give the compressor higher starting torque under low voltage conditions. (Field installed only) (Note: Not recommended for use on scroll compressors.)

Extreme Duty Package - ComPac® I and ComPac® II A/C - The Extreme Duty Package allows selected Marvair® ComPac I & ComPac II air conditioners to operate in extremely cold and hot ambient conditions. The Extreme Duty Kit is always factory installed and is available on all ComPac air conditioners.

ComPac® I air conditioners (non-economizer units) will operate from 0°F to 130°F (-18° to 54°C). ComPac® II air conditioners (economizer units) will operate from -20°F to -130°F (-29° to 54°C).

The Extreme Duty Package includes a suction line accumulator, thermal expansion valve (TXV), crankcase heater, hard start kit, an auto reset high pressure switch and an outdoor thermostat and fan cycle switch. The fan cycle control is standard on all ComPac air conditioners and operates based upon the liquid line pressure. The outside thermostat opens whenever the outside temperature is below 50°F (10°C) and closes when the outside temperature is 50°F (10°C) or higher. Whenever the temperature is below 50°F (10°C), the fan cycle switch is in the circuit; when temperatures are 50°F (10°C) or higher, the fan cycle switch is not in the circuit. The outdoor thermostat is used with a TXV to prevent excessive cycling or “hunting” of the TXV.

Dehumidification – ComPac® I and ComPac® II A/C – Humidity controller overrides thermostat and allows electric heat to operate simultaneously with cooling. See Dehumidification Application Bulletin for details.

Note: The electrical characteristics and requirements of air conditioners with the dehumidification option are different from standard air conditioners. Refer to the appropriate Summary Rating Charts for the electrical characteristics of units with Electric Reheat.

Coastal Environment Package – ComPac® I A/C only – Recommended for units to be installed near an ocean or on seacoast. Includes Dacromet® fasteners, sealed condenser fan motor, sealed control box, protective coating applied to all exposed internal copper in the condenser section and a phenolic or impregnated polyurethane coating on the condenser coil.

External Low Noise Blower (ELNB) *– ComPac® I and ComPac® II A/C – A field installed kit that consists of a condenser air hood, a centrifugal blower, controls and a compressor jacket to reduce the sound level by up to 6 dbA of Marvair ComPac air conditioners. Available for models AVP30-60. See External Low Noise Blower Product Data Sheet for details.*

ComPac® II Air Conditioner Transition Curb – ComPac II A/C only – A sheet metal curb that enables a 3-1/2, 4 or 5 ton ComPac II air conditioner to replace a 2-1/2 or 3 ton ComPac II unit. Curb transitions supply and return openings of the 3-1/2, 4 and 5 ton units to the smaller openings.

Economizer Damper Control – ComPac® II A/C only – A minimum position potentiometer that can be adjusted to prevent the economizer damper from closing completely. This control ensures that whenever the evaporator fan is operating, fresh air is being introduced into the building. Field or factory installed.

Hot Gas By-pass – ComPac® I A/C Only – Used in specialty applications; i.e., Magnetic Resonance Imaging (MRI) buildings, to prevent magnetic voltage disturbance caused by compressor cycling. Hot gas by-pass option packages are available to allow

Options (cont'd)

operation to 20°F (-7°C). Please refer to Hot Gas By-pass Application Bulletin for details.

High Filtration – ComPac® I and ComPac® II A/C - Units are built with up to 65% efficient filters. Filters are rated according to ASHRAE Dust Spot Test. ComPac II units have a prefilter on outside air. Not to be used with HEPA or absolute filters.

Color - ComPac® I and ComPac® II air conditioners are available in five different cabinet colors -the standard Marvair® beige and white, gray, brown and dark bronze. The standard cabinet's sides, top and front panels are constructed of 20 gauge painted steel. As an option, these panels can be built of 16 gauge steel in beige & gray or .050 stucco aluminum. When the 16 gauge painted steel or the aluminum is used, only the side, top and front panels are 16 gauge or aluminum. Contact your Marvair representative for color chips. The entire cabinet can also be constructed of type 316 stainless steel. When the stainless steel cabinet is ordered, the top, sides, front panels, back panel and all internal cabinet steel are stainless.

Protective Coil Coatings - Two coil coatings are offered. Either the condenser or evaporator coil can be coated, however, coating of the evaporator coil is not common. For harsh conditions, e.g., power plants, paper mills or sites were the unit will be exposed to salt water, the coil should be coated with either a phenolic (trade name Heresite®) or an impregnated polyurethane (trade name BlyGold®). The phenolic and the impregnated polyurethane coatings pass 3,000 hours of B117. The phenolic coating is dipped and baked; the polyurethane coating is sprayed on. Note: Cooling capacity may be reduced by up to 5% on units with coated coils.

Factory Installed Disconnects on 460V Units - Factory installed disconnects are standard on all 208-230V, 2 through 6 ton units. As an option, all 460V. units may be ordered with a disconnect.

Extended Warranty - A first year labor - Silver, and a two year labor - Gold, are available.

Dirty Filter Indicator - A factory installed option that measures the difference in pressure across the internal filter and closes a set of contacts when the pressure exceeds the desired difference.

Scroll Compressor - Scroll compressors are standard on the AVP42-72. As an option, ComPac® I and II air conditioners may be ordered with scroll compressors.

Single Point Power Entry - A field installed option that allows a single power entry into the air conditioner.

Control Box

The internal control board in the ComPac® air conditioners simplifies wiring, consolidates several of the electrical functions onto one device and improves the reliability of the air conditioner. In addition, the control board has LED's that indicate operational status and fault conditions.

LED Indicator Lights

COLOR	TYPE	STATUS	DESCRIPTION
Green	Power	Constant On	24 VAC power has been applied
Red	Status	Constant On	Normal operation
		1 Blink	High pressure switch has opened twice
		2 Blinks	Low pressure switch has opened twice
		3 Blinks	Freeze stat (optional) - indoor coil temperature is below 35°F (1°C)

Modes of Operation

Normal Start-up: On a call for cooling, and the with the high pressure switch closed, the cooling system (compressor, indoor blower motor and outdoor fan motor) will be energized. (Note: See the Delay on Make feature). The cooling system will remain energized during the three minute low pressure switch bypass cycle. If the low pressure is closed, the cooling system will continue to operate after the three-minute bypass. If the low pressure switch is open after the three-minute bypass, the cooling system will be de-energized.
Lockout Mode: If either the high or low pressure switch opens twice, the control board enters into the lockout mode. In the lockout mode, the compressor is turned off, the alarm output is energized and the status LED's will blink to indicate which fault has occurred. If there is a call for air flow, the indoor blower will remain energized. When the lockout condition has cleared, the unit will reset if the demand of the thermostat is removed or when power is reset. The ComPac® air conditioners are factory wired for normally open contacts. The user can now have normally closed contacts by moving a wire on the control board.
Delay on Make: On initial power up or on resumption of power, the air conditioner will wait .03 to 10 minutes from a call for cooling before allowing the contactor to energize.

Model Identification

AVP ___ ● **AC** ● ● ● ●

Nominal Cooling
24 = 24,000 BTUH
30 = 29,400 BTUH
36 = 35,000 BTUH
42 = 42,500 BTUH
48 = 48,000 BTUH
60 = 56,000 BTUH
72 = 72,000 BTUH

Power Supply
A = 208/230V,1ø,60Hz
C = 208.230V,3ø,60Hz
D = 460V,3ø,60Hz
E = 380V,3ø,50Hz
F = 220V,1ø,50Hz
G = 220V,3ø,50Hz
H = 380V,3ø,60Hz
J = 460V,3ø,50Hz
L = 208/230V,1ø,60Hz & 200V,1ø,50Hz
M= 200V,1ø,50Hz

Special Option Code
R = Electric Reheat
U = Scroll Comp.

Configuration
N = ComPac® I A/C
C = ComPac® II A/C

Air
Source
Vertical
Package

System Type
Air Conditioner

Electric Heat – kW
00 04 08 10
2.2 05 09 15

Summary Ratings (Wire Sizing) - Standard Compressor

ELECT. HEAT		00 = None		04 = 4 kw		05 = 5 kw		06 = 6 kw		08 = 8 kw		09 = 9 kw		10 = 10 kw		12 = 12 kw				15 = 15 kw			
BASIC MODEL	VOLTAGE PHASE	CKT #1		CKT #1		CKT #1		CKT #1		CKT #1		CKT #1		CKT #1		CKT #1		CKT #2		CKT #1		CKT #2	
		MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS
AVP24ACA	208-230/1	15.2	20	22.3	25	27.4	30	32.7	35	43.1	45			53.5	60								
AVP30ACA	208-230/1	21.4	35	23.4	35	28.5	35	33.8	35	44.2	45			54.6	60	23.4	35	41.6	45	28.5	35	52.1	60
AVP36ACA	208-230/1	24.4	40	24.4	40	28.5	40	33.8	40	44.2	45			54.6	60	24.4	40	41.6	45	28.5	40	52.1	60
AVP42ACA	208-230/1	28.3	45			29.1	45							55.2	60	28.3	45	41.6	45	29.1	45	52.1	60
AVP48ACA	208-230/1	29.9	45			29.9	45							55.2	60	29.9	45	41.6	45	29.9	45	52.1	60
AVP60ACA	208-230/1	39.3	60			39.3	60							57.3	60	39.3	60	41.6	45	39.3	60	52.1	60
AVP72ACA	208-230/1	44.1	60			44.1	60							57.3	60	44.1	60	41.6	45	44.1	60	52.1	60
AVP24ACC	208-230/3	11.3	15					19.4	20			28.5	30			37.5	40						
AVP30ACC	208-230/3	15.6	20					20.5	25			29.6	30			38.6	40			47.6	50		
AVP36ACC	208-230/3	17.1	25					20.5	25			29.6	30			38.6	40			47.6	50		
AVP42ACC	208-230/3	21.4	30					21.4	30			30.2	35			39.2	40			48.2	50		
AVP48ACC	208-230/3	24.3	35					24.3	35			30.2	35			39.2	40			48.2	50		
AVP60ACC	208-230/3	29.6	45					29.6	45			32.3	45			41.3	45			50.3	60		
AVP72ACC	208-230/3	31.4	45					31.4	45			32.3	45			41.3	45			50.3	60		
AVP24ACD	460/3	5.8	15					9.7	15			14.2	15			18.7	20						
AVP30ACD	460/3	7.5	15					10.3	15			14.8	15			19.3	20			23.8	25		
AVP36ACD	460/3	7.5	15					10.3	15			14.8	15			19.3	20			23.8	25		
AVP42ACD	460/3	10.2	15					10.6	15			15.1	20			19.6	20			24.1	25		
AVP48ACD	460/3	11.7	15					11.7	15			15.1	20			19.6	20			24.1	25		
AVP60ACD	460/3	13.3	20					13.3	20			16.1	20			20.6	25			25.1	30		
AVP72ACD	460/3	15.3	20					15.3	20			16.1	20			20.6	25			25.1	30		

The above chart should be used as a general guideline for estimating conductor size and overcurrent protection for the unit models listed. For specific requirements, refer to the data label attached to the unit cabinet.
MCA = Minimum Circuit Ampacity (Wiring Size Amps) MFS = Maximum External Fuse or External HACR Circuit Breaker Size.

Unit Load Amps

BASIC MODEL NUMBER	VOLTAGE PHASE HERTZ	CURRENT AMPS		LOAD OF RESISTIVE HEATING ELEMENTS ONLY (AMPS)								TOTAL MAXIMUM HEATING AMPS (STANDARD UNIT)							
		AC	IBM	04 kW	05 kW	06 kW	08 kW	09 kW	10 kW	12 kW	15 kW	04 kW	05 kW	06 kW	08 kW	09 kW	10 kW	12 kW	15 kW
AVP24ACA	208-230/1/60	12.7	1.4	16.7	n/a	25.0	33.3	n/a	41.7	n/a	n/a	18.1	22.2	n/a	34.7	n/a	43.1	n/a	n/a
AVP30ACA	208-230/1/60	18.0	2.5	16.7	20.8	25.0	33.3	n/a	41.7	50.0	62.5	19.2	23.3	27.5	35.8	n/a	44.2	52.5	65.0
AVP36ACA	208-230/1/60	20.4	2.5	16.7	20.8	25.0	33.3	n/a	41.7	50.0	62.5	19.2	23.3	27.5	35.8	n/a	44.2	52.5	65.0
AVP42ACA	208-230/1/60	23.8	3.1	n/a	20.8	n/a	n/a	n/a	41.7	50.0	62.5	n/a	23.9	n/a	n/a	n/a	44.8	53.1	65.6
AVP48ACA	208-230/1/60	25.1	3.1	n/a	20.8	n/a	n/a	n/a	41.7	50.0	62.5	n/a	23.9	n/a	n/a	n/a	44.8	53.1	65.6
AVP60ACA	208-230/1/60	33.0	5.2	n/a	20.8	n/a	n/a	n/a	41.7	50.0	62.5	n/a	26.0	n/a	n/a	n/a	46.9	55.2	67.7
AVP72ACA	208-230/1/60	36.9	5.2	n/a	20.8	n/a	n/a	n/a	41.7	50.0	62.5	n/a	26.0	n/a	n/a	n/a	46.9	55.2	67.7
AVP24ACC	208-230/3/60	9.6	1.4	n/a	n/a	14.4	n/a	21.7	n/a	28.9	36.1	n/a	n/a	15.8	n/a	23.1	n/a	30.3	37.5
AVP30ACC	208-230/3/60	13.3	2.5	n/a	n/a	14.4	n/a	21.7	n/a	28.9	36.1	n/a	n/a	16.9	n/a	24.2	n/a	31.4	38.6
AVP36ACC	208-230/3/60	14.5	2.5	n/a	n/a	14.4	n/a	21.7	n/a	28.9	36.1	n/a	n/a	16.9	n/a	24.2	n/a	31.4	38.6
AVP42ACC	208-230/3/60	18.3	3.1	n/a	n/a	14.4	n/a	21.7	n/a	28.9	36.1	n/a	n/a	17.5	n/a	24.8	n/a	32.0	39.2
AVP48ACC	208-230/3/60	20.6	3.1	n/a	n/a	14.4	n/a	21.7	n/a	28.9	36.1	n/a	n/a	17.5	n/a	24.8	n/a	32.0	39.2
AVP60ACC	208-230/3/60	25.3	5.2	n/a	n/a	14.4	n/a	21.7	n/a	28.9	36.1	n/a	n/a	19.6	n/a	26.9	n/a	34.1	41.3
AVP72ACC	208-230/3/60	26.7	5.2	n/a	n/a	14.4	n/a	21.7	n/a	28.9	36.1	n/a	n/a	19.6	n/a	26.9	n/a	34.1	41.3
AVP24ACD	460/3/60	5.0	0.7	n/a	n/a	7.2	n/a	10.8	n/a	14.4	18.0	n/a	n/a	7.9	n/a	11.5	n/a	15.1	18.7
AVP30ACD	460/3/60	6.5	1.3	n/a	n/a	7.2	n/a	10.8	n/a	14.4	18.0	n/a	n/a	8.5	n/a	12.1	n/a	15.7	19.3
AVP36ACD	460/3/60	6.5	1.3	n/a	n/a	7.2	n/a	10.8	n/a	14.4	18.0	n/a	n/a	8.5	n/a	12.1	n/a	15.7	19.3
AVP42ACD	460/3/60	8.8	1.6	n/a	n/a	7.2	n/a	10.8	n/a	14.4	18.0	n/a	n/a	8.8	n/a	12.4	n/a	16.0	19.6
AVP48ACD	460/3/60	10.0	1.6	n/a	n/a	7.2	n/a	10.8	n/a	14.4	18.0	n/a	n/a	8.8	n/a	12.4	n/a	16.0	19.6
AVP60ACD	460/3/60	11.4	2.6	n/a	n/a	7.2	n/a	10.8	n/a	14.4	18.0	n/a	n/a	9.8	n/a	13.4	n/a	17.0	20.6
AVP72ACD	460/3/60	13.1	2.6	n/a	n/a	7.2	n/a	10.8	n/a	14.4	18.0	n/a	n/a	9.8	n/a	13.4	n/a	17.0	20.6

•Heating kW shown for 240V. Derate heat output by 25% for 208V service. ••Total heating amps for ALL ACA units with 15kW includes both circuits (#1 and #2) •••Heater kW shown for 480V.
NOTE: Three phase equipment contains single-phase motor loads. Values shown are maximum phase loads. Loads are not equally balanced on each phase. Total cooling and total heating amps include motor loads.

Efficiency and Capacity Ratings in accordance with ARI Standard 210

MODEL	24			30			36			42			48			60			72		
	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD
COOLING BTUH	24,000			29,400			35,000			42,500			48,000			56,000			64,000	71,000	71,000
SERIES	C1			C1			B1			B1			B1			C1			A1	A1	A1
SEER	10.1			10.2			10.0			10.2			10.2			10.0			11.1	N/A	N/A
EER	N/A			N/A			N/A			N/A			N/A			N/A			9.9	9	9
RATED CFM	840			1000			1220			1520			1760			1850			2200	1950	1950
ESP	0.1			0.15			0.15			0.15			0.20			0.20			0.2	0.25	0.25

Note: All performance and capacity ratings are for a 60 Hz power supply. Please see SI Product Data Sheet for ratings at 50 Hz. Ratings are also affected by altitude.

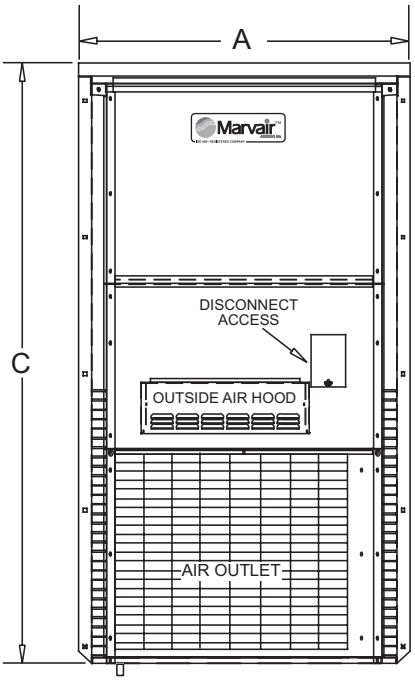
Certified Efficiency and Capacity Ratings @ ARI Standard 390

MODEL	24			30			36			42			48			60			72		
	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD
COOLING BTUH 208V	n/a			n/a			n/a			n/a			n/a			n/a			n/a	69,000	69,000
COOLING BTUH 230V	24,000			29,400			35,000			42,500			48,000			56,000			64,000	71,000	71,000
EER 208V	n/a			n/a			n/a			n/a			n/a			n/a			n/a	9.00	9.00
EER 230V	9.00			9.00			9.00			9.00			9.00			9.00			9.60	9.00	9.00
SCFM (OUTDOOR)	1800			2200			2200			2700			2700			2800			4250	4250	4250
SCFM (INDOOR)	840			1000			1220			1520			1760			1850			2050	2200	2200

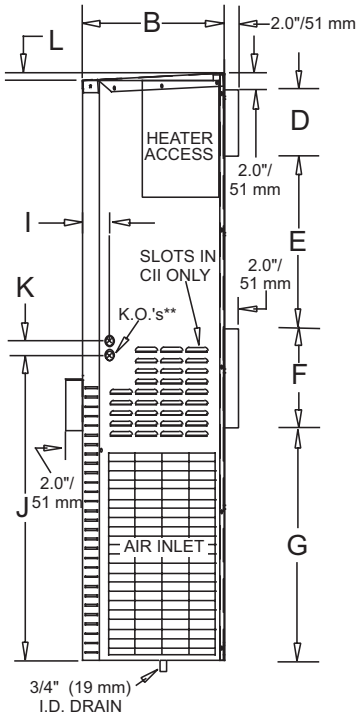
Dimensional Data - AVP24-36 ComPac® I & ComPac® II Air Conditioners

MODEL	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	AA	BB
24 (in.)	39 1/2	17 1/4	71 1/2	8	20 1/2	12	27 11/16	20	3 3/4	36 5/16	1 11/16	7/8	38	27 11/16	26	3 5/8	17 5/8	35 1/4
24 (mm)	1003	438	1816	203	521	305	703	508	95	922	43	22	965	703	660	92	448	895
30/36 (in.)	44 9/16	17 1/4	71 1/2	8	18	14	28 7/16	28	3 3/4	36 5/16	1 11/16	7/8	43 1/8	27 11/16	26	3 5/8	20 1/4	40 1/2
30/36 (mm)	1132	438	1816	203	457	356	722	711	95	922	43	22	1095	703	660	92	514	1029

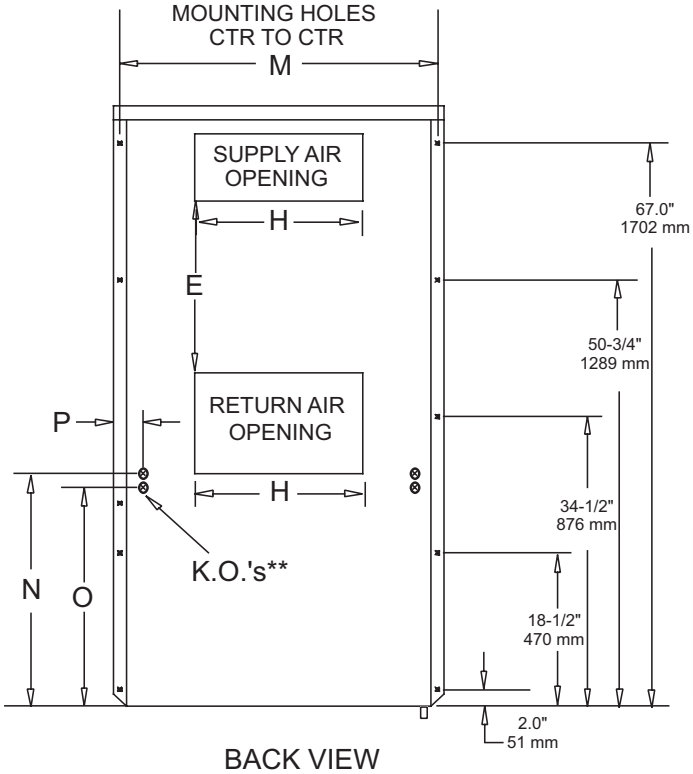
NOTE: Dimensional tolerance ± 1/16”



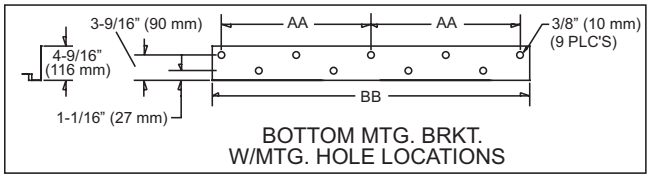
FRONT VIEW



R.H. SIDE VIEW



BACK VIEW



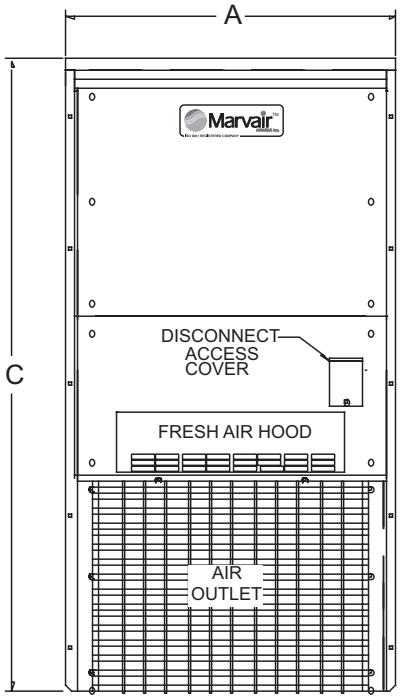
BOTTOM MTG. BRKT. W/MTG. HOLE LOCATIONS

* CI does not have side louvers
** KO=knockouts-sized to accept 3/4” (19 mm) x 1” (25 mm) electrical conduit
“H” dimension centered between “A” dimension

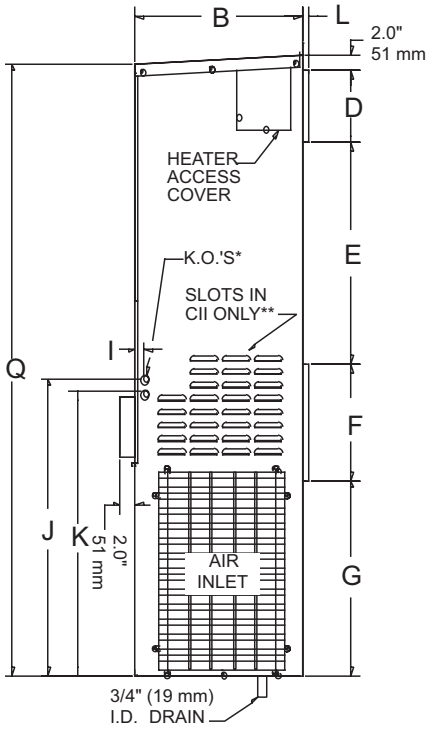
Dimensional Data - AVP42-60 ComPac® I & ComPac® II Air Conditioners

MODEL	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
42/48/60 (in.)	45	22 5/8	86	10	30	16	26 1/2	30	1 5/16	40 9/16	38 9/16	1 1/8	43 1/2	32 3/8	30 3/8	1 1/4	83 5/16	1 3/4
42/48/60 (mm)	1143	575	2184	254	762	406	673	762	33	1030	979	29	1105	822	772	32	2116	44

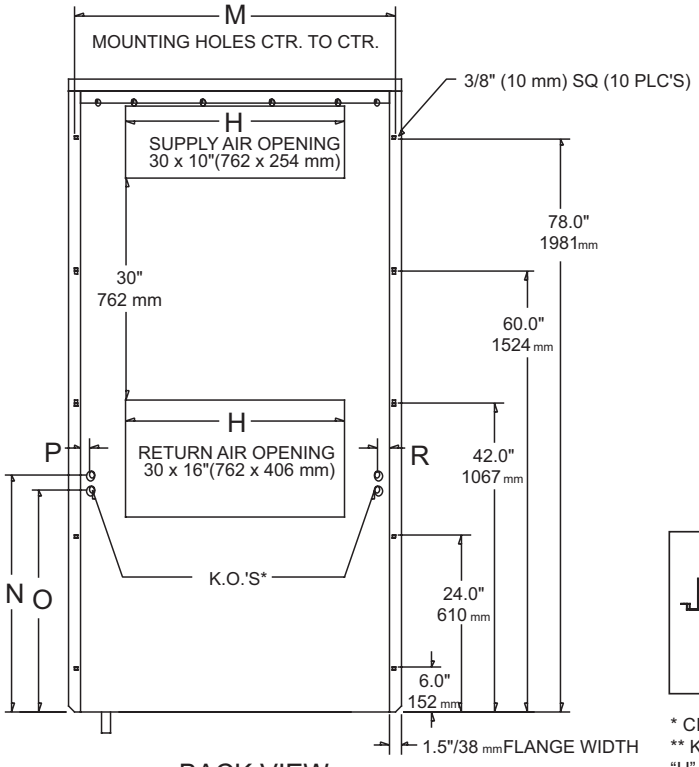
NOTE: Dimensional tolerance ± 1/16"



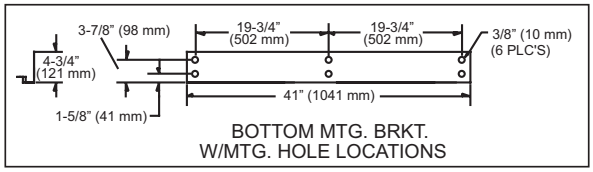
FRONT VIEW



R.H. SIDE VIEW



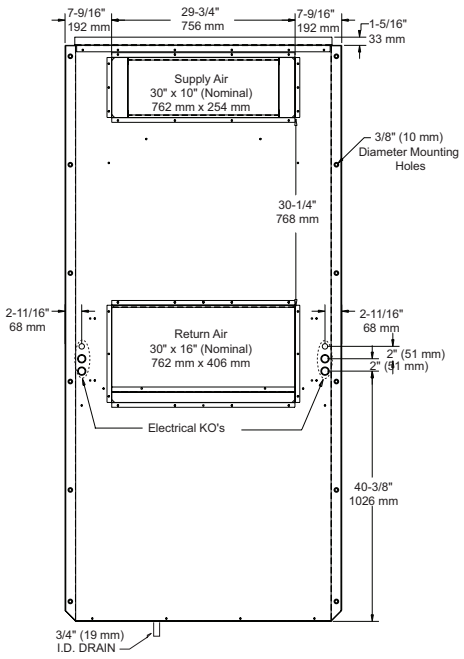
BACK VIEW



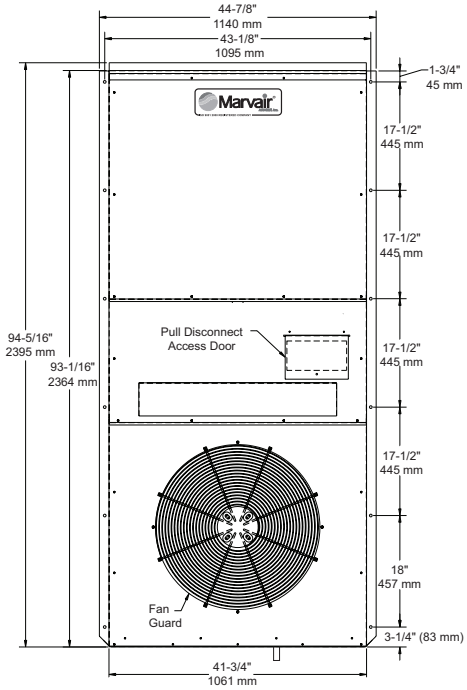
BOTTOM MTG. BRKT. W/MTG. HOLE LOCATIONS

* CI does not have side louvers
** KO=knockouts-sized to accept 3/4" (19 mm) x 1" (25 mm) electrical conduit
"H" dimension centered between "A" dimension

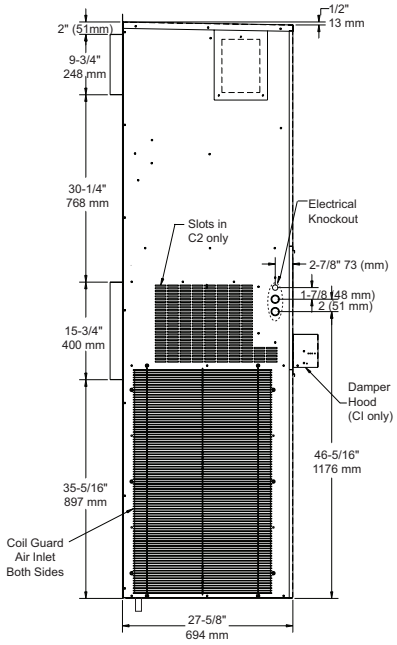
Dimensional Data - AVP72 ComPac® I & ComPac® II Air Conditioners



BACK VIEW



FRONT VIEW



LEFT SIDE VIEW

Please consult the Marvair® website at www.marvair.com for the latest product literature. Complete installation instructions are in the ComPac® Air Conditioners I&O Manual. Detailed dimensional data is available upon request. A complete warranty statement can be found in each product's Installation/Operation Manual, on our website or by contacting Marvair at 229-273-3636. As part of the Marvair continuous improvement program, specifications are subject to change without notice.

Marvair® AIRXCEL®, Inc.
ISO 9001 2000 REGISTERED COMPANY
P.O. Box 400 • Cordele, GA 31010
156 Seedling Drive • Cordele, GA 31015
Ph: 229-273-3636 • Fax: 229-273-5154
Email: marvair@airxcel.com • Internet: www.marvair.com

Marvair

156 Seedling Drive
Cordele, Georgia 31015
229-273-8058

Marvair Sound Data for the ComPac I/II Air Conditioners (dE					
Distance From Unit (Feet)	Model Number				
	AVP12ACA	AVP24ACA	AVP36ACA	*AVP42ACA	AVP48ACA
5	65	66	70	70	72
10	62	61	66	66	68
20	60	56	62	62	63
30	56	53	58	60	61
40	53	51	56	59	58
50	52	50	55	57	57
60	51	49	53	56	56
70					
80					

Notes: (1) Test Date: March 16, 2000
(2) Background Sound Level: 42 to 48 dBA

(*) Test Date: March 1, 2011
(*) Background Sound Level: 30 to 33 dBA

BA)	
AVP60ACA	*AVP72ACA
73	69
70	64
65	60
63	58
61	56
60	55
58	53
57	
56	

POWER ELECTRONICS

PURE ENERGY

SOLAR SOLUTIONS

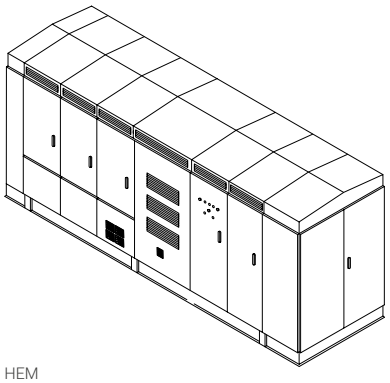
INVERTERS | STATIONS

PURE ENERGY

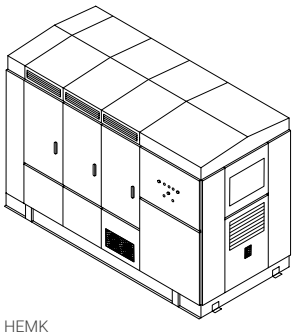
Pure Energy is our motivation for leading the renewable energy generation, it is the search for product and service perfection, it is our vision of a world, clean and sustainable for our children and future generations.

PRODUCT RANGE

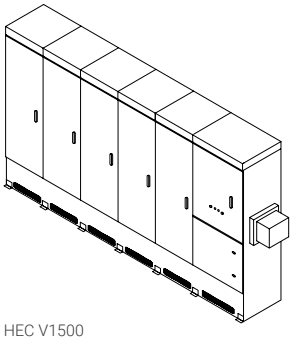
SOLAR INVERTERS



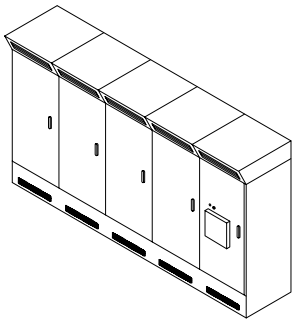
HEM
3000 kVA - 3630 kVA
34.5V
1500 Vdc
P. 15



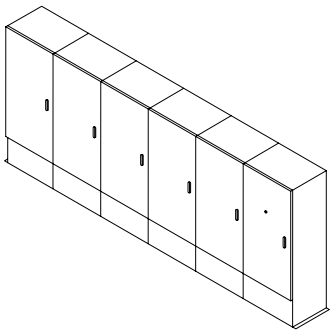
HEMK
2000 kVA - 3800 kVA
600 Vac - 690 Vac
1500 Vdc
P. 29



HEC V1500
1050 kVA - 3500 kVA
565 Vac - 690 Vac
P. 43

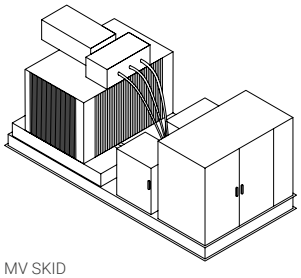


HEC PLUS
1000 kVA - 2550 kVA
400 Vac - 460 Vac
1000 Vdc
P. 65

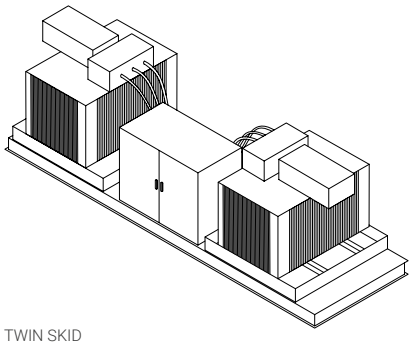


HE PLUS
1000 kVA - 2550 kVA
400 Vac - 460 Vac
1000 Vdc
P. 85

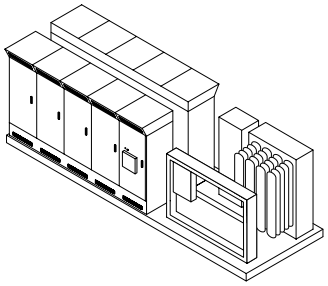
SOLAR STATIONS



MV SKID
1050 kVA - 3800 kVA
12 kV - 36 kVac
Oil Transformer
2L+P/V Switchgear
P. 99

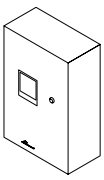


TWIN SKID
3000 kVA - 7600 kVA
12 kV - 36 kVac
Oil Transformer
2L+ 2P/2V Switchgear
P. 103

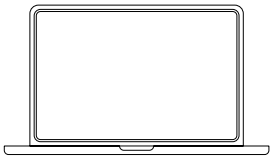


HEK
1000 kVA - 7000 kVA
12.47 kV - 34.5 kV
1000 Vdc - 1500 Vdc
Open Skid Station
P. 107

CONTROL AND MONITORING SOLUTIONS



FREESUN PPC
P. 113



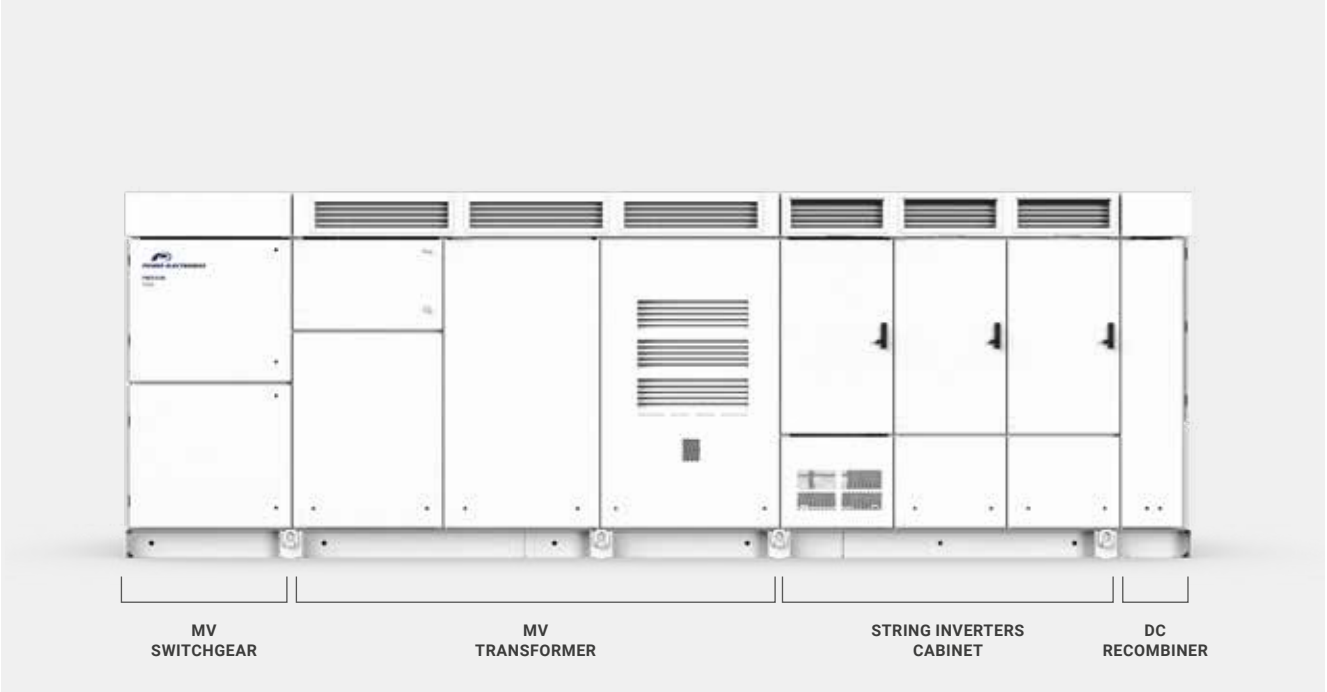
FREESUN PORTAL
P. 117

FREESUN APP
P. 119

REAL TURN-KEY SOLUTION - EASY TO SERVICE

With the HEM, Power Electronics offers a real turn-key solution, including the MV transformer and switchgear fully assembled and tested at the factory. The HEM is a compact turn-key solution that will reduce site design, installation and connection costs.

By providing full front access the HEM series simplifies the maintenance tasks, reducing the MTTR (and achieving a lower OPEX). The total access allows a fast swap of the FRUs without the need of qualified technical personnel.



STRING CONCEPT POWER STAGES

The HEM combines the advantages of a central inverter with the modularity of the string inverters. Its power stages are designed to be easily replaceable on the field without the need of advanced technical service personnel, providing a safe, reliable and fast Plug&Play assembly system.

Following the modular philosophy of the Freesun series, the HEM is composed of 6 FRUs (field replaceable units), being able to work with up to 6 different MPPts, providing a perfect solution for irregular locations, where each area of the PV plant has a different production curve. HEM is also available with a single MPPt, where all the power stages are physically joined in the DC side and therefore, in the event of a fault, the faulty module is taken off-line and its power is distributed evenly among the remaining functioning FRUs.

VAR AT NIGHT

At night, the HEM inverter can shift to reactive power compensation mode. The inverter can respond to an external dynamic signal, a Power Plant Controller command or pre-set reactive power level (kVAr).

ACTIVE HEATING

At night, when the unit is not actively exporting power, the inverter can import a small amount of power to keep the inverter internal ambient temperature above -20°C, without using external resistors.

This autonomous heating system is the most efficient and homogeneous way to prevent condensation, increasing the inverters availability and reducing maintenance. **PATENTED**

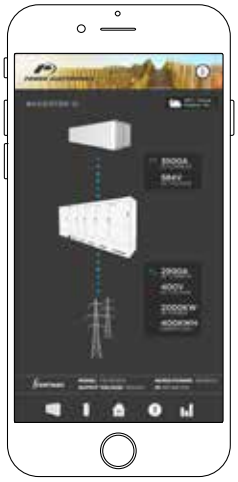
ECON MODE

This innovative control mode allows increasing the efficiency of the MV transformer up to 25%, reducing the power consumption of the plant and therefore providing considerable savings. Available as an optional kit, this feature has a payback time of less than a few years, therefore resulting in the increase of the plant lifetime overall revenue.

EASY TO MONITOR

The Freesun app is the easiest way to monitor the status of our inverters. All our inverters come with built-in wifi, allowing remote connectivity to any smart device for detailed updates and information without the need to open cabinet doors.

The app user-friendly interface allows quick and easy access to critical information (energy registers, production and events).



AVAILABLE INFORMATION	Grid and PV field data. Inverter and Power module data (Voltages, currents, power, temperatures, I/O status...). Weather conditions. Alarms and warnings events. Energy registers. Others.
FEATURES	Easy Wireless connection. Comprehensive interface. Real time data. Save and copy settings.
LANGUAGE	English, Spanish.
SYSTEM REQUIREMENTS	iOS or Android devices.
SETTINGS CONTROL	Yes

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3300M
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	3300
	AC Output Power(kVA/kW) @25°C [1]	3630
	Operating Grid Voltage(VAC) [2]	34.5kV ±10%
	Operating Grid Frequency(Hz)	50Hz/60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	934V-1310V
	Maximum DC voltage	1500V
	Number of inputs [2]	Up to 36
	Max. DC continuous current (A)	3970
	Max. DC short circuit current (A)	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98% including MV transformer (preliminary)
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [4]	2000m
	Noise level [5]	< 79 dBA
CONTROL INTERFACE	Interface	Graphic Display
	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2
	Compliance	NEC 2014 / NEC 2017 (optional)
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003.

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for other altitudes.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3225M
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	3225
	AC Output Power(kVA/kW) @25°C [1]	3550
	Operating Grid Voltage(VAC) [2]	34.5kV ±10%
	Operating Grid Frequency(Hz)	50Hz/60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	913V-1310V
	Maximum DC voltage	1500V
	Number of inputs [2]	Up to 36
	Max. DC continuous current (A)	3970
	Max. DC short circuit current (A)	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98% including MV transformer (preliminary)
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [4]	2000m
	Noise level [5]	< 79 dBA
CONTROL INTERFACE	Interface	Graphic Display
	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2
	Compliance	NEC 2014 / NEC 2017 (optional)
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003.

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for other altitudes.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3150M
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	3150
	AC Output Power(kVA/kW) @25°C [1]	3465
	Operating Grid Voltage(VAC) [2]	34.5kV ±10%
	Operating Grid Frequency(Hz)	50Hz/60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	891V-1310V
	Maximum DC voltage	1500V
	Number of inputs [2]	Up to 36
	Max. DC continuous current (A)	3970
	Max. DC short circuit current (A)	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98% including MV transformer (preliminary)
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [4]	2000m
	Noise level [5]	< 79 dBA
CONTROL INTERFACE	Interface	Graphic Display
	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2
	Compliance	NEC 2014 / NEC 2017 (optional)
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003.

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for other altitudes.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3075M
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	3075
	AC Output Power(kVA/kW) @25°C [1]	3380
	Operating Grid Voltage(VAC) [2]	34.5kV ±10%
	Operating Grid Frequency(Hz)	50Hz/60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	870V-1310V
	Maximum DC voltage	1500V
	Number of inputs [2]	Up to 36
	Max. DC continuous current (A)	3970
	Max. DC short circuit current (A)	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98% including MV transformer (preliminary)
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [4]	2000m
	Noise level [5]	< 79 dBA
CONTROL INTERFACE	Interface	Graphic Display
	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2
	Compliance	NEC 2014 / NEC 2017 (optional)
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003.

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for other altitudes.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3000M
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	3000
	AC Output Power(kVA/kW) @25°C [1]	3300
	Operating Grid Voltage(VAC) [2]	34.5kV ±10%
	Operating Grid Frequency(Hz)	50Hz/60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	849V-1310V
	Maximum DC voltage	1500V
	Number of inputs [2]	Up to 36
	Max. DC continuous current (A)	3970
	Max. DC short circuit current (A)	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98% including MV transformer (preliminary)
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [4]	2000m
	Noise level [5]	< 79 dBA
CONTROL INTERFACE	Interface	Graphic Display
	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2
	Compliance	NEC 2014 / NEC 2017 (optional)
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003.

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for other altitudes.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEMK 690V

		FRAME 1	FRAME 2
REFERENCE		**FS2300K**	**FS3450K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2300	3450
	AC Output Power(kVA/kW) @25°C [1]	2530	3800
	Max. AC Output Current (A) @25°C	2120	3175
	Operating Grid Voltage(VAC) [2]	690V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	976V-1310V	
	Maximum DC voltage	1500V	
	Number of inputs [2]	Up to 36	
	Number of MPPts	Up to 4	Up to 6
	Max. DC continuous current (A)	2645	3970
	Max. DC short circuit current (A)	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.9	98.9
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	9 x 7 x 7	12.3 x 7 x 7
	Dimensions [WxDxH] (m)	2.7 x 2.2 x 2.2	3.7 x 2.2 x 2.2
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [4]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2014 / NEC 2017 (optional)	
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: Q(kVAr)=√(S(kVA)2-P(kW)2).
[4] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 660V

		FRAME 1	FRAME 2
REFERENCE		**FS2200K**	**FS3300K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2200	3300
	AC Output Power(kVA/kW) @25°C [1]	2420	3630
	Max. AC Output Current (A) @25°C	2120	3175
	Operating Grid Voltage(VAC) [2]	660V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	934V-1310V	
	Maximum DC voltage	1500V	
	Number of inputs [2]	Up to 36	
	Number of MPPts	Up to 4	Up to 6
	Max. DC continuous current (A)	2645	3970
	Max. DC short circuit current (A)	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.8%	98.9%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	9 x 7 x 7	12 x 7 x 7
	Dimensions [WxDxH] (m)	2.7 x 2.2 x 2.2	3.7 x 2.2 x 2.2
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [4]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2014 / NEC 2017 (optional)	
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: Q(kVAr)=√(S(kVA)2-P(kW)2).
[4] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEMK 645V

		FRAME 1	FRAME 2
REFERENCE		**FS2150K**	**FS3225K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2150	3225
	AC Output Power(kVA/kW) @25°C [1]	2365	3550
	Max. AC Output Current (A) @25°C	2120	3175
	Operating Grid Voltage(VAC) [2]	645V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	913V-1310V	
	Maximum DC voltage	1500V	
	Number of inputs [2]	Up to 36	
	Number of MPPts	Up to 4	Up to 6
	Max. DC continuous current (A)	2645	3970
	Max. DC short circuit current (A)	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.8%	98.9%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	9 x 7 x 7	12 x 7 x 7
	Dimensions [WxDxH] (m)	2.7 x 2.2 x 2.2	3.7 x 2.2 x 2.2
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [4]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2014 / NEC 2017 (optional)	
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: Q(kVAr)=√(S(kVA)2-P(kW)2).
[4] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 630V

		FRAME 1	FRAME 2
REFERENCE		**FS2100K**	**FS3150K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2100	3150
	AC Output Power(kVA/kW) @25°C [1]	2310	3465
	Max. AC Output Current (A) @25°C	2120	3175
	Operating Grid Voltage(VAC) [2]	630V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	891V-1310V	
	Maximum DC voltage	1500V	
	Number of inputs [2]	Up to 36	
	Number of MPPts	Up to 4	Up to 6
	Max. DC continuous current (A)	2645	3970
	Max. DC short circuit current (A)	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.8%	98.8%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	9 x 7 x 7	12 x 7 x 7
	Dimensions [WxDxH] (m)	2.7 x 2.2 x 2.2	3.7 x 2.2 x 2.2
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [4]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2014 / NEC 2017 (optional)	
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: Q(kVAr)=√(S(kVA)2-P(kW)2).
[4] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEMK 615V

		FRAME 1	FRAME 2
REFERENCE		**FS2050K**	**FS3075K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2050	3075
	AC Output Power(kVA/kW) @25°C [1]	2225	3380
	Max. AC Output Current (A) @25°C	2120	3175
	Operating Grid Voltage(VAC) [2]	615V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	870V-1310V	
	Maximum DC voltage	1500V	
	Number of inputs [2]	Up to 36	
	Number of MPPts	Up to 4	Up to 6
	Max. DC continuous current (A)	2645	3970
	Max. DC short circuit current (A)	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.8%	98.8%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	9 x 7 x 7	12 x 7 x 7
	Dimensions [WxDxH] (m)	2.7 x 2.2 x 2.2	3.7 x 2.2 x 2.2
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [4]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2014 / NEC 2017 (optional)	
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: Q(kVAr)=√(S(kVA)2-P(kW)2).
[4] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 600V

		FRAME 1	FRAME 2
REFERENCE		**FS2000K**	**FS3000K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2000	3000
	AC Output Power(kVA/kW) @25°C [1]	2200	3300
	Max. AC Output Current (A) @25°C	2120	3175
	Operating Grid Voltage(VAC) [2]	600V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	849V-1310V	
	Maximum DC voltage	1500V	
	Number of inputs [2]	Up to 36	
	Number of MPPts	Up to 4	Up to 6
	Max. DC continuous current (A)	2645	3970
	Max. DC short circuit current (A)	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.8%	98.8%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	9 x 7 x 7	12 x 7 x 7
	Dimensions [WxDxH] (m)	2.7 x 2.2 x 2.2	3.7 x 2.2 x 2.2
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA3R - IP54 / IP65 available	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [4]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2014 / NEC 2017 (optional)	
	Utility interconnect	UL 1741SA-Sept.2016, IEEE 1547-2003	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: Q(kVAr)=√(S(kVA)2-P(kW)2).
[4] Readings taken 1 meter from the back of the unit.