— San Manuel Band of Mission Indians —

November 5, 2018

Air Division Permits Office (Air-3)
U.S. EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

RE: Revised Tribal Synthetic Minor Permit Modification Application (TA-0003-CA)
San Manuel Casino; San Bernardino County, CA

The San Manuel Entertainment Authority (the "SMEA") is submitting the revised permit application package to modify its existing Tribal Synthetic Minor New Source Review Permit (Permit No. TA-0003-CA). The revised application package makes some changes as compared to the application package submitted on August 1, 2018, and addresses the EPA's review comments in the San Manuel Incompleteness Letter dated September 28, 2018 (the "September Letter").

The revised permit application includes the following:

- Narrative Description that contain all items required by the application forms;
- Appendix A -Application Forms, that include the following:
  - Application for New Construction; and
  - Application for Synthetic Minor Limit;
- Appendix B - Manufacturer specification sheets, vendor quotes and laboratory data for the proposed permitted equipment;
- Appendix C - Emission Calculations;
- Appendix D – Portions of the Final TEIR for the San Manuel Hotel and Casino Expansion Project; and
- Appendix E - Section 106 of the National Historic Preservation Act Review.

Changes as compared to the August 1, 2018 application include the following:

- Removed two additional Tier 1 non-emergency generators (EG-3 and EG-4) and replaced them with two new Tier 4 emergency generators (EG-8 and EG-9);
- No longer changing the existing permit conditions for diesel fire pump FP-1;
- Per Comment 1.1 in EPA's September Letter, updated the potential to emit (PTE) emission calculations for all emergency generators to be based on 200 hours per year (hrs/yr) of operation that includes both emergency situations and maintenance and testing activities.
- Per Comment 1.3 in EPA's September Letter, included startup and shutdown emission calculations using manufacturer provided emission factors for new emergency generators and the cogen generators;

26569 Community Center Drive • Highland, CA 92346 • Office: (909) 864-8933 • FAX (909) 864-3370

- Updated the proposed permit limits - updated the limits for testing and maintenance hours of new emergency generators per Comment 1.2 in EPA's September Letter, and updated the limits on the natural gas usages for new water heaters and/or boilers. With the update limits, the facility-wide NO_x PTE emissions still remains the same as the existing permit limit of 9.87 tons per year (tpy);
- Per Comment 3 in EPA's September Letter, added a Section 106 of the National Historic Preservation Act Review for the project and attached the letter report as Attachment E.

As to Comment 2 in EPA's September Letter regarding Air Quality Impact Analysis (AQIA) and stating that "*The EPA may request more information if we determine that the proposed project may cause or contribute to a NAAQS violation*", as explained in Narrative Description Section 9, SMEA doesn't think an AQIA is necessary because the post-project NO_x concentration contributed by the Casino at offsite receptors will be less than those allowed by the existing permit conditions, and therefore activities proposed in this application are not expected to cause adverse air quality effects. However, the SMEA looks forward to continuing working with the EPA on this application and will provide further documents and/or information as appropriate.

As you understand, it is crucial for the SMEA to obtain the permit by the second quarter of 2019 so as to avoid tremendous financial losses and avoid delaying the creation of thousands of new job opportunities. We look forward to continuing working with EPA on this important effort. Should you have any questions or comments regarding the permit application, please feel free to contact our consultant, Ms. Heidi Rous at (626) 204-6170 or myself at (909) 425-3590 ext. 104311.

Sincerely,

Clifford Batten, P.G.
Environmental Manager

Enclosures

cc: H. Rous

APPLICATION TO MODIFY TRIBAL NSR PERMIT NO. TA-0003-CA

Narrative Description

Prepared for
San Manuel Entertainment Authority

October 2018

ESA

APPLICATION TO MODIFY TRIBAL NSR PERMIT NO. TA-0003-CA

Narrative Description

Prepared for
San Manuel Entertainment Authority

October 2018

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APPLICATION TO MODIFY TRIBAL NSR PERMIT NO. TA-0003-CA

Narrative Description

1. Applicant and Contact Information

a. The name and address of the applicant is as follows:

San Manuel Entertainment Authority
777 San Manuel Blvd.
Highland, CA 92346

b. Facility Contact: Mike Hollingsworth, Facilities Director, (909) 863-5899 x2454

2. Facility Location

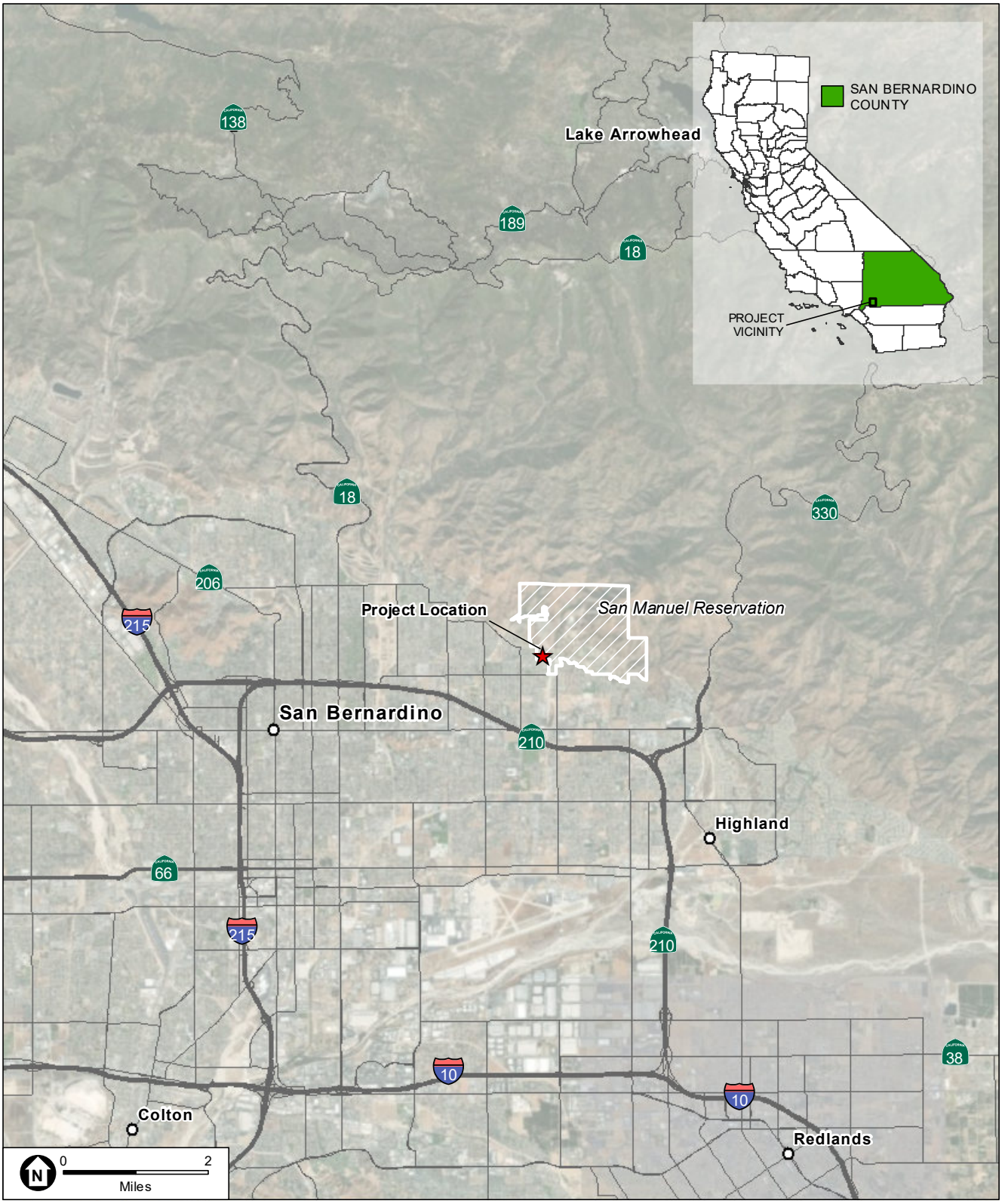
The San Manuel Casino (Casino or Facility) is located on the southwest portion of the San Manuel Reservation, adjacent to the City of Highland, in San Bernardino County, California, and within the South Coast Air Basin (SCAB). Non-tribal lands in the urban areas of the San Bernardino County fall under the jurisdiction of the South Coast Air Quality Management District (SCAQMD). The SCAB is currently designated as extreme non-attainment for the federal ozone ambient air quality standards, with a major source threshold for nitrogen oxides (NOx) of 10 tons per year (tpy). **Figure 1** shows the general facility location.

3. Permitting History, Background and Purpose

The San Manuel Entertainment Authority (SMEA) is an instrumentality of the San Manuel Band of Mission Indians Tribe (Tribe), which is a federally recognized Indian Tribe. SMEA operates the San Manuel Casino and obtained a Synthetic Minor New Source Review Permit (Permit No. TA-0003-CA) from the US EPA in September 2017 for emission units located at the Casino.

With this permit application, SMEA is requesting the following:

1. Remove four permitted Tier 1 diesel generators and three grandfathered cooling towers, change remaining two stand-by generators from non-emergency generators to emergency generators, and add a total of 22 new air emission units; and
2. Request new permit limits to accommodate the equipment change while retaining the synthetic minor source status.



SOURCE: USDA, 2016; ESRI, 2017; ESA, 2018.

Modification Application for Permit No. TA-0003-CA

Figure 1

General Facility Location

To accommodate the proposed changes, the existing Central Plant at the Casino will be modified to make room for the new equipment. Construction and operational activities associated with the proposed equipment in this permit application are part of the San Manuel Hotel and Casino Expansion Project. Such Project has completed the required environmental evaluation process pursuant to Section 11.0 of the Tribal-State Compact between the State of California and the San Manuel Band of Mission Indians (Compact). As part of such environmental review, a Tribal Environmental Impact Report (TEIR) was prepared, circulated to the public and finalized in March 2018.

4. Permit Application Forms

The following application forms are included in **Appendix A**:

- Application for New Construction; and
- Application for Synthetic Minor Limit.

5. Emission Units Description

To meet the needs of the Casino Expansion Project, SMEA is proposing the removal of some existing emission units to make physical room at the existing Central Plant for installation of new equipment. In addition to the new, more efficient and lower-emitting equipment, the Tribe is planning modifications to the operation of some existing equipment, so as to remain below the synthetic minor source facility-wide air emission limit. **Table 1** summarizes the existing permitted emission units, and proposed removal and addition of permit units. **Figure 2** shows locations of the existing emission sources and **Figure 3** shows post-project facility plot plan.

5.1. Modification to Existing Emission Units

SMEA is proposing the following modifications:

- Remove three existing/grandfathered poor-performing cooling towers, to make room for installing six new, efficient and low-drift cooling tower cells;
- Remove four Tier 1 stand-by diesel generators, EG-3, EG-4, EG-5 and EG-6;
- Change remaining stand-by diesel generators, EG-1 and EG-2, from non-emergency generators to emergency generators. Note that EG-1 through EG-6 used to participate in the demand response (DR) program, but SMEA quit the DR program in 2018. SMEA is committing to use EG-1 and EG-2 only as emergency generators per the definition in 40 CFR 63.6675; and
- Change Permit Condition 23.b to a new permit limit for emergency generators EG-1 and EG-2; The proposed revision in permit language for Permit Condition 23.b is as the following:

  23. Throughput ~~of natural gas and diesel fuel~~ shall not exceed the following amounts ~~based on a 12-month rolling basis~~;

  ...

b. ~~Non-~~Emergency IC Engines (EG-1, EG-2, ~~EG-5, EG-6~~): ~~58, 036 gallons per year of combined diesel fuel~~ testing and maintenance operations no more than 50 hours per year for EG-1 and 30 hours per year for EG-2;

...

- Revise Permit Condition 29 to change the New Source Performance Standard (NSPS) related condition for EG-1 from an existing non-emergency generator to that of an existing emergency generator; and
- Delete existing Permit Condition 30 because EG-3 and EG-4 will be removed, and with the proposed status change from non-emergency to emergency, generators EG-1 and EG-2 are no longer subject to National Emissions Standards for Hazardous Air Pollutants (NESHAP) per 40 CFR 63.6585. Since EG-2was installed in 2004, it is also exempt from NSPS Subpart IIII requirements because that regulation only applies to engines that were constructed after July 11, 2005.

For all other existing emission units (i.e., boilers and water heaters), this application will not make any physical and/or operational modifications and will retain their corresponding permit conditions.

5.2. Proposed New Emission Units

5.2.1. Combined Heat and Power Cogeneration System (Cogen System)

SMEA is proposing to install a 5 megawatt (MW) Cogen System at the existing Central Plant. The Cogen System would incorporate waste heat recovery from natural gas generators to produce hot water to offset and replace boiler gas consumption for space heating and domestic hot water, as well as produce chilled water for space cooling to reduce chiller electricity consumption. The Cogen System includes many pieces of equipment, but only the two natural gas generator engines (Cogen generators) listed in Table 1 will generate air emissions.

The Cogen generators will be operational year-round, except during scheduled maintenance and/or equipment failure. Maintenance activities will be sequenced such that only one generator will be offline at a time, allowing the other generator to supply uninterrupted power to the facility.

The Cogen System is estimated to serve the Casino's utility needs by providing up to 69% electricity, 56% chilled water and 21% heating hot water. The rest of the Casino's power needs will be served by one or more other sources, including existing and/or new connections to the Southern California Edison (SCE) electric grid, and solar power.

5.2.2. Cooling Towers

There are three existing cooling towers located at the Central Plant. SMEA is proposing to remove those units and replace them with the six 3,900-gallon per minute new cooling towers. These new cooling towers are high performance units and will be equipped with low drift fill to

reduce particulate matter (PM) emission, and are assumed to operate 24 hours per day, year-round.

5.2.3. Emergency Diesel Generators

A 500 kW diesel emergency generator (EG-7) will serve as the emergency backup power for the future new parking structure (garage generator).

Two 2,000 kW diesel emergency generators (EG-8 and EG-9) will be installed at the Central Plant to serve as emergency backup power similar to EG-1 and EG-2.

5.2.4. Water Heaters

Eleven natural gas fueled water heaters (WH-3 through WH-13), each rated at 2 million British Thermal Unit per hour (MMBtu/hr) or less, will be installed to support the new entertainment and hospitality facilities associated with the San Manuel Hotel and Casino Expansion Project.

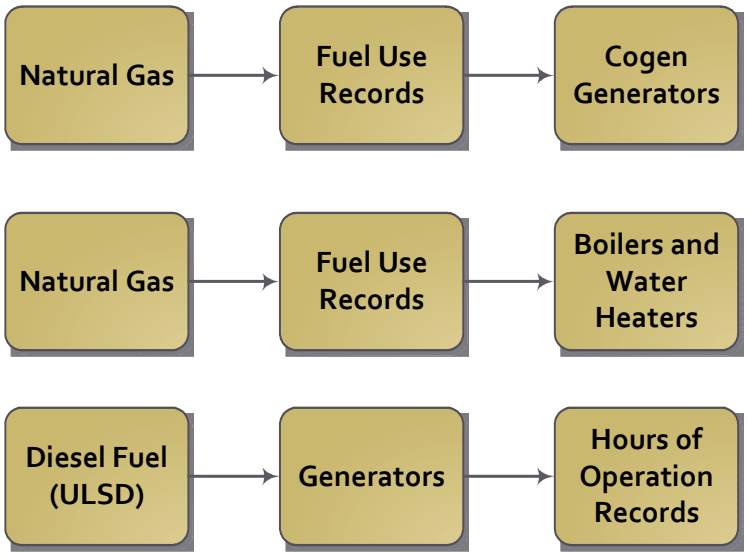
5.3. Fuels

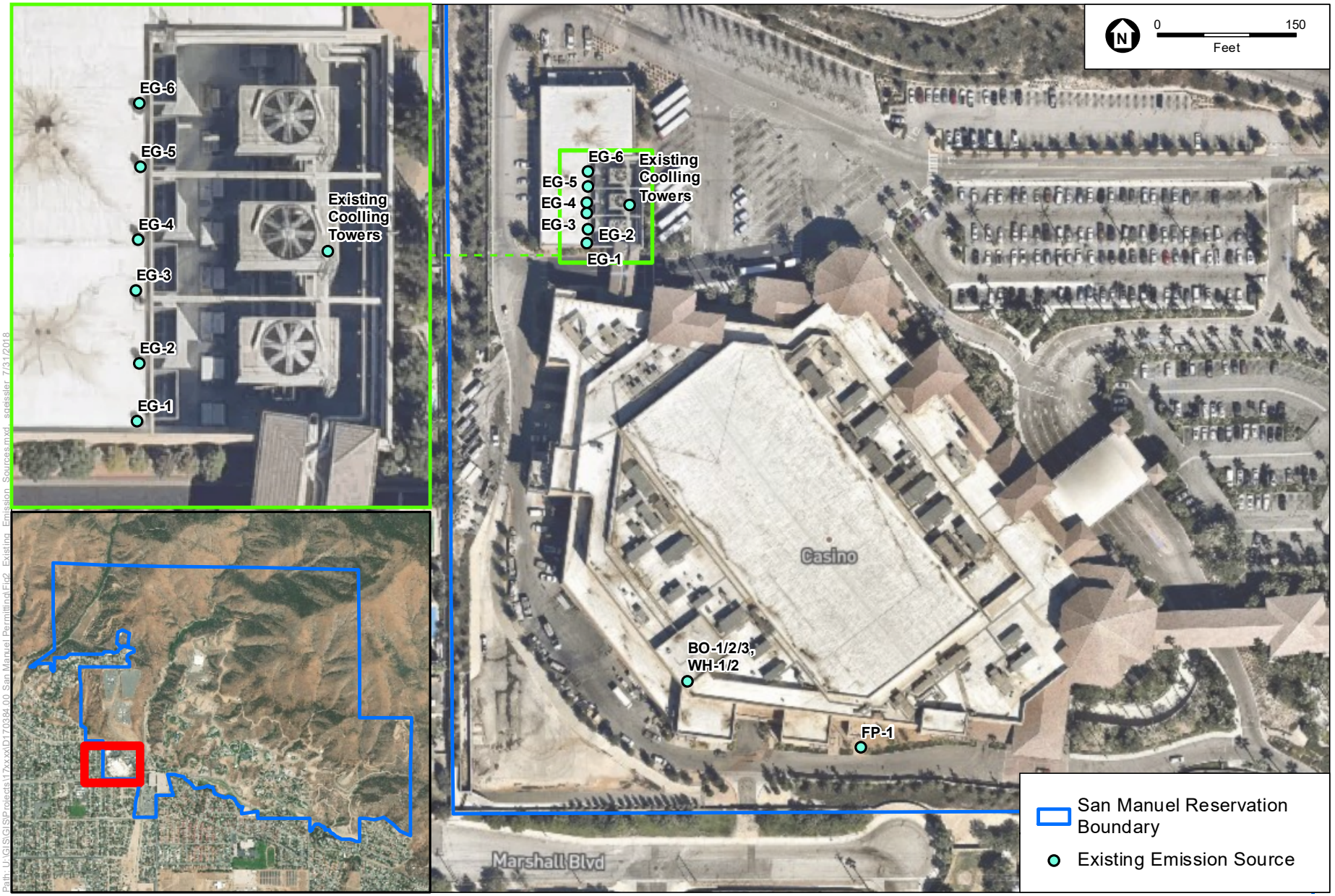
The Cogen generators and water heaters will use natural gas purchased from the Southern California Gas Company (SoCalGas), provided by the existing 4-inch natural gas pipeline.

The diesel generators will use ultra-low sulfur (0.0015% sulfur content) diesel. Each diesel generator has its own storage fuel tank. All fuel storage tanks are dual-walled for spill containment.

5.4. Process Flow Diagrams

The Process Flow Diagrams for SMEA's fuel burning equipment are as follows:



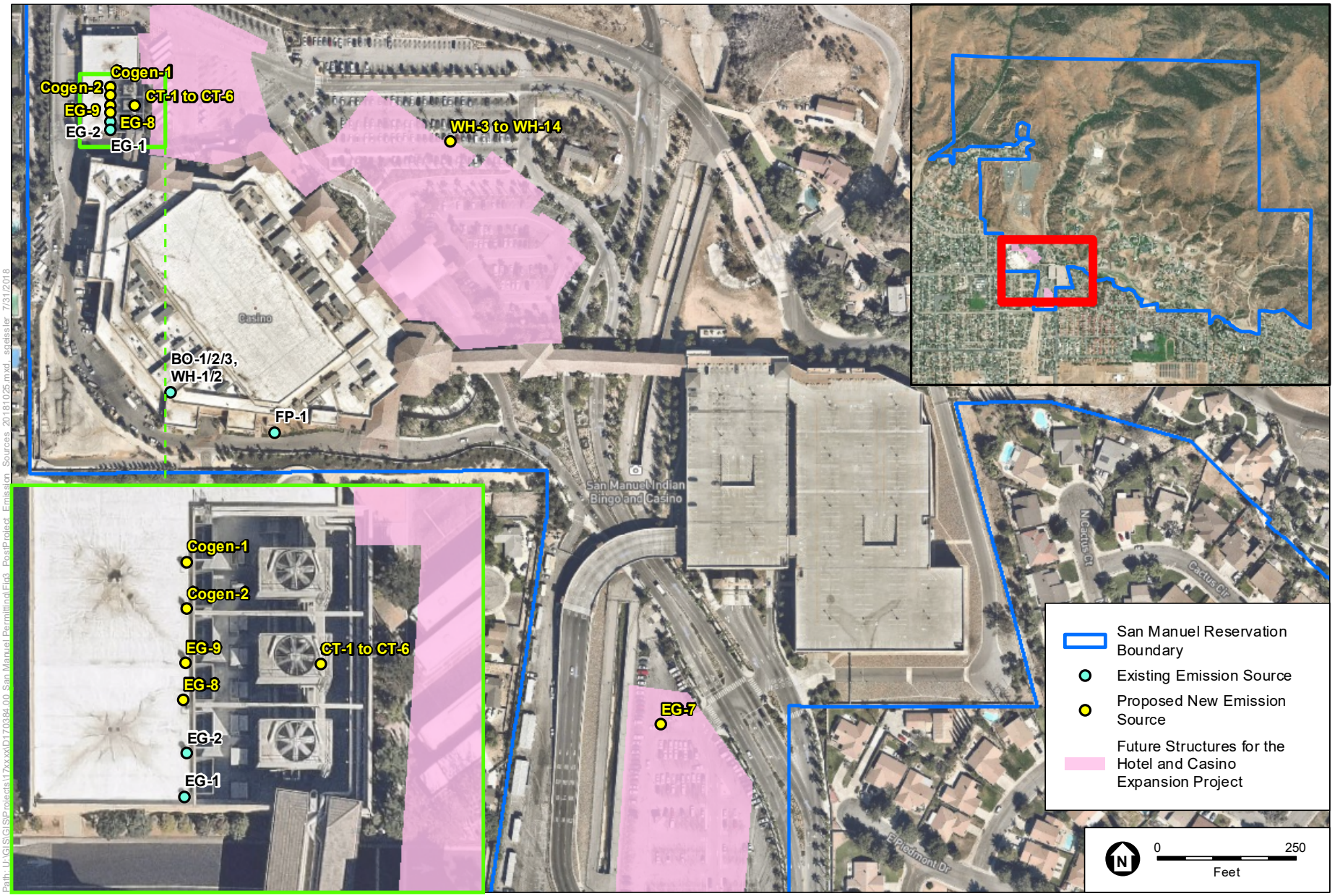


SOURCE: ESRI Imagery 8/19/2017

Modification Application for Permit No. TA-0003-CA

Figure 2
Existing Emission Sources

ESA



SOURCE: ESRI Imagery 8/19/2017

Modification Application for Permit No. TA-0003-CA

Figure 3

Post-project Emission Sources

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TABLE 1
EMISSION UNITS AND PROPOSED PERMIT LIMITS

Emission Unit I.D. No.	No. of Identical Equipment	Equipment Description	Existing Permit Limit	Proposed Change	New Permit Limit
Existing Permitted Units and Proposed Modifications					
EG-1	1	Caterpillar Model 3512 Tier 2 Non-Emergency IC engine, Diesel, 1,646 kW	Six engines combined: diesel fuel throughput shall not exceed 58,036 gallons per year (gal/yr)	Remove EG-3, EG-4, EG-5 and EG-6, change EG-1 and EG-2 to emergency generators. Revise Permit Conditions 23.b and 29, and delete Permit Condition 30	*Testing and maintenance operations shall not exceed 50 hours per year (hrs/yr) for EG-1 and shall not exceed 30 hrs/yr for EG-2*
EG-2 , EG-3, EG-4, EG-5, EG-6	5	Caterpillar Model 3512 Tier 1 Non-Emergency IC engine, Diesel, 1,620 kW; Equipped with an Oxidation Catalyst			
FP-1	1	John Deere Model PE4O4SD, Fire Pump, Diesel, 45 KW	Diesel fuel throughput shall not exceed 460 gal/yr	No Change	No Change
WH-1, WH-2	2	Lochnivar Model CWN1436PM, Water Heater, Natural Gas, 1.4 mmBtu/hr	Combination of 2 water heaters and 3 boilers: natural gas throughput shall not exceed 59,242,546 cubic feet per year (cf/yr)	No Change	No Change
BO-1, BO-2, BO-3	3	Unilux Model ZF1600W Boiler, Natural Gas, 15 mmBtu/hr, Equipped with Ultra Low NOx Burners			

Emission Unit I.D. No.	Number of Identical Equipment	Equipment Description	Equipment Location	Operation Schedule	Proposed Permit Limit
Proposed Addition of New Emission Units					
Cogen-1, Cogen-2	2	GE Cogeneration Unit, Model No. JMS 616 GS-J02, Natural Gas, 2,656 kW. Equipped with SCR/Oxidation Catalyst Systems.	Existing Central Utility Plant	Continuous, 8,760 hours per year (hrs/yr) per unit	*Post-control emission rate: VOC 0.1 lb/MW-hr; NOx 0.07 lb/MW-hr,CO 0.2 lb/MW-hr;* *Testing and maintenance operations shall not exceed 18 hrs/yr per engine*
CT-1, CT-2, CT-3,CT-4, CT-5, CT-6	6	Marley Cooling Towers, Model No. NC8414XCN6, 3,900 gallons per minute per cell (23,400 gallons per minute for all six cells), equipment with low drift fill for PM reduction.	Existing Central Utility Plant	Continuous, 8,760 hrs/yr per unit	No Limit
EG-7	1	CAT Generator, Model No. C18, Diesel, 500 ekW, equipped with SCR and comply with Tier 4 Final standard.	New parking structure (to be constructed)	Stand-by, emergency use only	Testing and maintenance operations shall not exceed 40 hrs/yr
EG-8, EG-9	2	CAT Generator, Model No. 3516C, Diesel, 2,000 ekW, equipped with SCR and comply with Tier 4 Final standard.	Existing Central Utility Plant	Stand-by, emergency use only	Testing and maintenance operations shall not exceed 40 hrs/yr per engine

Emission Unit I.D. No.	Number of Identical Equipment	Equipment Description	Equipment Location	Operation Schedule	Proposed Permit Limit
WH-3, WH-4, WH-5, WH-6, WH-7, WH-8	6	Lochinvar ARMOR X2 Water Heater, Model No. AWN1300PM, natural gas, 1.3 mmbtu/hr. Equipment with ultra-low NOx burner, and SCAQMD certified to comply with 20 ppm NOx @ 3% O_2.	New entertainment and hospitality facilities (to be constructed)	Continuous, 8,760 hrs/yr per unit	*11 water heaters (WH-3 to WH-13) natural gas throughput shall not exceed 79,827,647 cf/yr*
WH-9, WH-10, WH-11	3	Lochinvar ARMOR Water Heater, Model No. AWN400PM, Natural Gas, 0.4 mmbtu/hr. Equipment with ultra-low NOx burner, and SCAQMD certified to comply with 20 ppm NOx @ 3% O2.	New entertainment and hospitality facilities (to be constructed)	Continuous, 8,760 hrs/yr per unit	
WH-12, WH-13	2	Lochinvar POWER-PIN Water Heater, Model No. PFN2001PM, Natural Gas, 2 mmbtu/hr. Equipment with ultra-low NOx burner, and SCAQMD certified to comply with 20 ppm NOx @ 3% O2.	New entertainment and hospitality facilities (to be constructed)	Continuous, 8,760 hrs/yr per unit	

6. Control Technology Review and Proposed Standards

Table 1 also shows the proposed control equipment and technology for the new equipment, as well as proposed operation limits to ensure the facility retains its synthetic minor status. The section below describes these proposals in more detail.

6.1. Existing Permitted Sources

As mentioned is Section 2 above regarding existing sources, besides removal of four Tier 1 stand-by generators (EG-3, EG-4, EG-5 and EG-6), SMEA is proposing to change EG-1 and EG-2 from non-emergency to emergency generators. In addition, to be consistent with surrounding jurisdiction's limit for similar sources, i.e., the SCAQMD Rule 1470 limits, SMEA also proposes to change Permit Condition 23 to limit the annual testing and maintenance of Tier 2 generator EG-1 to 50 hrs/yr and that of Tier 1 generator EG-2 to 30 hrs/yr.

No physical and/or operational changes will occur at other existing permitted sources and the existing permit conditions applicable to these units (BO-1 through BO-3, WH-1 and WH-2) will remain the same.

6.2. New Cogen Generators

The two Cogen generators are four-cycle lean burn spark ignition engines and will be equipped with a Selective Catalytic Reduction (SCR) and oxidation catalyst emission control system. The emission control system will reduce NOx emissions by 96%, volatile organic carbon (VOC) emissions by 89.7% and carbon monoxide (CO) emissions by 97%. With the post-control

emission rate of 0.07 pound per megawatt hour (lb/MW-hr) for NOx, 0.1 lb/MW-hr for VOC and 0.2 lb/MW-hr for CO, these Cogen generator engines not only comply with New Source Performance Standard (NSPS) Subpart JJJJ standards, they are also cleaner than the stringent SCAQMD Rule 1110.2 emission standard for new combined power and heat engines, and are expected to be the same, if not lower, than the current Best Available Control Technology (BACT). The Cogen System proposal is included as part of **Appendix B**.

No operational limit is proposed for the Cogen generators. For compliance demonstration and to limit the facility's emissions below the major source threshold, SMEA is proposing the following performance standard for the Cogen generators: the post-control emission rate shall not exceed 0.1 lb/MW-hr for VOC, 0.07 lb/MW-hr for NOx and 0.2 lb/MW-hr for CO.

6.3. New Cooling Towers

The six new cooling tower cells will be equipped with low drift fill to reduce particulate matter (PM) emissions. No operational limit is proposed for these units.

6.4. New Emergency Generators

The three new emergency generators (EG-7, EG-8 and EG-9) will be certified to comply with USEPA Tier 4 final emission levels, so they will comply with the emission standards in NSPS Subpart IIII. SMEA proposes to limit the testing and maintenance operations of the three units to a maximum of 40 hrs/yr per engine, and no limit for emergency use.

6.5. New Water Heaters

All the proposed new water heater models are equipped with ultra-low NOx burners and have been certified to meet SCAQMD Rule 1146.2 limit of 20 ppmv NOx (@ 3% oxygen). These units are expected to operate continuously year-round.

The new water heaters (WH-3 through WH-13) will be limited to a combined natural gas usage limit of 47,450,000 cubic feet per year (cf/yr). The proposed fuel usage limit is equivalent to operating all 11 water heaters continuously year-round at 42.5% load; in reality, the annual-average load of these units are expected to be 30% or less.

7. Air Emissions Estimates

The estimates for allowable and Potential to Emit (PTE) emissions for all emissions units are included as **Appendix C**. The estimates for PTE and proposed allowable emissions are based on manufacture Specification Sheets (**Appendix B**), AP-42 emissions factors, and/or most recent site data.

The Unlimited PTE emissions were calculated with the following worst-case assumption:

- Existing sources:
  - Emergency generators EG-1 and EG-2 are assumed to operate a total of 200 hrs/yr per engine, PTE were scaled from the 2017 EPA's PTE calculation for these emission units

based on hours of operation; EG-3, EG-4, EG-5 and EG-6 will be removed; all remaining permitted source operate at existing permit limits and their corresponding PTE equals the 2017 EPA's PTE calculation for the existing permit;

- New sources:
  - The proposed new Cogen generators, cooling towers and the natural gas water heaters operate at 100% load continuously for 8,760 hours per year (hrs/yr), and the pre-control emission factors were used for Cogen generators; and
  - The proposed new emergency diesel engines (EG-7, EG-8 and EG-9): each engine operates 200 hrs/yr, of which 40 hrs/yr were testing and maintenance operations and the other 160 hrs/yr are normal emergency operations. Emissions calculations used emission factors provided by manufacturer, including those for testing and maintenance operations and those for normal emergency operations.

The allowable emissions calculations are based on the proposed operational limits in Section 4 above.

As summarized in **Table 2** below, based on the worst-case assumptions, the facility-wide total PTE emissions would exceed the major source thresholds; however, with the proposed permit limits and emission control devices, the facility's post-control PTE (allowable emissions) will remain below the major source threshold, with NOx emissions remaining at the current permit limit of 9.87 tpy (i.e., zero increase in NOx emissions).

TABLE 2
FACILITY-WIDE EMISSIONS SUMMARY - TONS PER YEAR (TPY)

	VOC	NO_X	CO	PM10	PM2.5	SO_2	Total HAPs
Total Unlimited PTE	26.59	51.09	185.28	2.89	2.89	0.17	13.11
Post-Control PTE*	5.50	9.87	10.63	2.65	2.65	0.15	1.46
Title V Threshold	10	10	50	70	NA	100	25

* Post-Control PTE levels are based upon the federally enforceable emissions and operational limits established in this permit application.

8. Record Keeping

SMEA will keep records on site to demonstrate that emissions are below the major source thresholds. These records will include the following:

- Hours for testing and maintenance of the emergency diesel generators, EG-1, EG-2, EG-7, EG-8 and EG-9;
- Combined natural gas fuel usage at existing boilers and water heaters (BO-1 through BO-3, WH-1 and WH-2);
- Combined natural gas fuel usage at new water heaters (WH-3 through WH-13); and

- All source test and/or equivalent performance test at the existing and proposed new generators, boilers and water heaters to demonstrate compliance with proposed permit limits.

9. Air Quality Review

Among the regulated pollutants that have an ambient air quality standard, NO_x is the only pollutant that is of potential concern because of the stringent federal 1-hour NO_2 ambient air quality standard and the fact that the SCAB is an extreme non-attainment area. Activities proposed in this application are not expected to cause adverse air quality effects because the post-project NO_x concentration contributed by the Casino at offsite receptors will be less than those allowed by the existing permit conditions, i.e., this project will result in net reduction in NO_x concentration for offsite sensitive receptors. In addition to proposing a zero increase in facility-wide NO_x emissions, this project will (1) remove four Tier 1 diesel generators from the existing Central Plant, (2) locate the proposed new water heaters that account for about 8% of the total NO_x emissions (existing and post-project) at the new entertainment and hospitality facilities that are further away from the Reservation boundary and offsite sensitive receptors than the Central Plant.

10. Endangered Species Act

All emission units are either existing sources or new sources constructed on existing disturbed land, so the permit action will not result in an increase in jeopardy to the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. As mentioned above, the proposed activities associated with this permit application were studied as part of the San Manuel Hotel and Casino Expansion Project, for which a final TEIR has been prepared and approved in March 2018. The cover sheets of the Final TEIR are included as **Appendix D**.

11. National Historic Preservation Act

Removal of existing emission units and construction of the proposed new sources will not demolish any structures or cause disturbance of any virgin lands, therefore, there will be no effect on cultural resources. Nevertheless, a cultural resources assessment report was prepared for the project and is included as Appendix E. In summary, a determination of **no historic properties affected** is recommended for the permit modification based on: 1) the developed nature of the area of potential effect (APE), 2) the absence of historic properties (or any cultural resources) within the APE, and 3) the low potential for the activities proposed under the permit modification to impact cultural resources. See **Appendices D and E**.

Appendix A
Permit Application Forms

- Application for New Construction;
- Application for Synthetic Minor Limit

ESA

OMB Control No. 2060-0003
Approval expires 04/30/2017

United States Environmental Protection Agency
Pacific Southwest – Region 9
Federal Minor New Source Review Program in Indian Country

Application for New Construction

Please check all that apply to show how you are using this form:

- ☐ Proposed Construction of a New Source
- ☒ Proposed Construction of New Equipment at an Existing Source
- ☒ Proposed Modification of an Existing Source
- ☐ Other – Please Explain_____

Please submit information to:

U.S. EPA at:

Air Division, Permits Office (Air-3)
U.S. EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105

For more information: http://www.epa.gov/caa-permitting/tribal-nsr-permits-region-9, call (415) 972-3974, or email R9AirPermits@epa.gov.

Tribe:

The Tribal Environmental Contact for the specific reservation:

Please contact EPA Region 9 if you need assistance in identifying the appropriate Tribal Environmental Contact and address.

A. General Source Information

1. Company Name	2. Source Name
San Manuel Entertainment Authority	San Manuel Casino
3. Type of Operation	**4. Portable Source?** ☐ Yes ☒ No **5. Temporary Source?** ☐ Yes ☒ No
Casino	
6. NAICS Code	**7. SIC Code**
713210	7993

8. Physical Address (home base for portable sources)

777 San Manuel Blvd., Highland, CA 92346

9. Reservation*	10. County*	11a. Latitude*	11b. Longitude*
San Manuel	San Bernardino	34 09'01.08"N	117 13'43.18"W
12a. Quarter-Quarter Section*	**12b. Section***	**12c. Township***	**12d. Range***
SE 1/4 of SE 1/4	19	1 North	3 West

* Provide all locations of operation for portable sources

B. Contact Information

1. Owner Name San Manuel Entertainment Authority	Title
Mailing Address 777 San Manuel Blvd., Highland, CA 92346	
Email Address mhollingsworth@SanManuel.com	
Telephone Number 909-863-5899x2454	Facsimile Number 909-425-3584
2. Operator Name (if different from owner) Same as owner	Title
Mailing Address	
Email Address	
Telephone Number	Facsimile Number
3. Source Contact Clifford Batten	Title Environmental Manager
Mailing Address 101 Pure Water Lane, Highland, CA 92346	
Email Address cbatten@sanmanuel-nsn.gov	
Telephone Number 909-425-3590 x104311	Facsimile Number
4. Compliance Contact Clifford Batten	Title Environmental Manager
Mailing Address 101 Pure Water Lane, Highland, CA 92346	
Email Address cbatten@sanmanuel-nsn.gov	
Telephone Number 909-425-3590 x104311	Facsimile Number

C. PREVIOUS PERMIT ACTIONS (Provide information in this format for each permit that has been issued to this source. Provide as an attachment if additional space is necessary)

Facility Name on the Permit San Manuel Casino
Permit Number T-0003-CA
Date of the Permit Action September 25, 2017

Facility Name on the Permit
Permit Number
Date of the Permit Action

Facility Name on the Permit
Permit Number
Date of the Permit Action

Facility Name on the Permit
Permit Number
Date of the Permit Action

Facility Name on the Permit
Permit Number
Date of the Permit Action

D. Attachments

Include all of the following information as attachments to this form

☐ **FORM SYNMIN -** New Source Review Synthetic Minor Limit Request Form, if synthetic minor limits are being requested.

☐ Narrative description of the proposed production processes. This description should follow the flow of the process flow diagram to be submitted with this application. Narrative Description attached in the beginning of the document

☐ Process flow chart identifying all proposed processing, combustion, handling, storage, and emission control equipment. See Narrative Description Section 5.4

☐ A list and descriptions of all proposed emission units and air pollution-generating activities. See Narrative Description Section 5, Table 1

☐ Type and quantity of fuels, including sulfur content of fuels, proposed to be used on a daily, annual and maximum hourly basis. See Narrative Description Section 5.3

☐ Type and quantity of raw materials used or final product produced proposed to be used on a daily, annual and maximum hourly basis. See Narrative Description Section 5.3

☐ Proposed operating schedule, including number of hours per day, number of days per week and number of weeks per year. See Narrative Description Section 6

☐ A list and description of all proposed emission controls, control efficiencies, emission limits, and monitoring for each emission unit and air pollution generating activity. See Narrative Description Section 6

☐ **Criteria Pollutant Emissions -** Estimates of Current Actual Emissions, Current Allowable Emissions, Post-Change Uncontrolled Emissions, and Post-Change Allowable Emissions for the following air pollutants: particulate matter, PM_{10}, $PM_{2.5}$, sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compound (VOC), lead (Pb) and lead compounds, fluorides (gaseous and particulate), sulfuric acid mist (H_2SO_4), hydrogen sulfide (H_2S), total reduced sulfur (TRS) and reduced sulfur compounds, including all calculations for the estimates. See Narrative Description Section 7 and Appendix C

These estimates are to be made for each emission unit, emission generating activity, and the project/source in total. Note, there are no insignificant emission units or activities in this permitting program, only exempted units and activities. Please see the regulation for a list of exempted units and activities.

☐ **Air Quality Review** See Narrative Description Section 9

☐ **ESA (Endangered Species Act)** See Narrative Description Section 10

☐ **NHPA (National Historic Preservation Act)** See NHPA Review Report in Appendix E and Narrative Description Section 11

E. TABLE OF ESTIMATED EMISSIONS

The following estimates of the total emissions in tons/year for all pollutants contained in your worksheet stated above should be provided.

E(i) – Proposed New Source

Pollutant	Total Actual Emissions (tpy)	Total Allowable or Potential Emissions (TPY)	
PM			PM - Particulate Matter PM_{10} - Particulate Matter less than 10 microns in size $PM_{2.5}$ - Particulate Matter less than 2.5 microns in size SO_2 - Sulfur Oxides NOx - Nitrogen Oxides CO - Carbon Monoxide VOC - Volatile Organic Compound Pb - Lead and lead compounds Fluorides - Gaseous and particulates H_2SO_4 - Sulfuric Acid Mist H_2S - Hydrogen Sulfide TRS - Total Reduced Sulfur RSC - Reduced Sulfur Compounds
PM_{10}			
$PM_{2.5}$			
SO_x			
NO_x			
CO			
VOC			
Pb			
NH_3			
Fluorides			
H_2SO_4			
H_2S			
TRS			
RSC			

Emissions calculations must include fugitive emissions if the source is one the following listed sources, pursuant to CAA Section 302(j):

(a) Coal cleaning plants (with thermal dryers);
(b) Kraft pulp mills;
(c) Portland cement plants;
(d) Primary zinc smelters;
(e) Iron and steel mills;
(f) Primary aluminum ore reduction plants;
(g) Primary copper smelters;
(h) Municipal incinerators capable of charging more than 250 tons of refuse per day;
(i) Hydrofluoric, sulfuric, or nitric acid plants;
(j) Petroleum refineries;
(k) Lime plants;
(l) Phosphate rock processing plants;
(m) Coke oven batteries;
(n) Sulfur recovery plants;
(o) Carbon black plants (furnace process);
(p) Primary lead smelters;
(q) Fuel conversion plants;
(r) Sintering plants;
(s) Secondary metal production plants;
(t) Chemical process plants
(u) Fossil-fuel boilers (or combination thereof) totaling more than 250 million British thermal units per hour heat input;
(v) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels;
(w) Taconite ore processing plants;
(x) Glass fiber processing plants;
(y) Charcoal production plants;
(z) Fossil fuel-fired steam electric plants of more that 250 million British thermal units per hour heat input, and
(aa) Any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the Act

E(ii) – Proposed New Construction at an Existing Source or Modification of an Existing Source

Pollutant	Current Actual Emissions (tpy)	Current Allowable Emissions (tpy)	Post-Change Potential Emissions (tpy)	Post-Change Allowable Emissions (tpy)
PM	0.76	0.36	2.89	2.65
PM_{10}	0.76	0.36	2.89	2.65
$PM_{2.5}$	0.76	0.36	2.89	2.65
SO_2	0.06	0.02	0.17	0.15
NO_x	4.89	9.87	51.09	9.87
CO	8.46	3.92	185.28	10.63
VOC	8.56	3.07	26.59	5.50
Pb	0	0	0	0
Fluorides	0	0	0	0
H_2SO_4	0	0	0	0
H_2S	0	0	0	0
TRS	0	0	0	0
RSC	0	0	0	0

PM - Particulate Matter
PM_{10} - Particulate Matter less than 10 microns in size
$PM_{2.5}$ - Particulate Matter less than 2.5 microns in size
SO_2 - Sulfur Oxides
NOx - Nitrogen Oxides
CO - Carbon Monoxide
VOC - Volatile Organic Compound
Pb - Lead and lead compounds
Fluorides - Gaseous and particulates
H_2SO_4 - Sulfuric Acid Mist
H_2S - Hydrogen Sulfide
TRS - Total Reduced Sulfur
RSC - Reduced Sulfur Compounds

The public reporting and recordkeeping burden for this collection of information is estimated to average 20 hours per response, unless a modeling analysis is required. If a modeling analysis is required, the public reporting and recordkeeping burden for this collection of information is estimated to average 60 hours per response .Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Instructions

(Please do not include a copy of these instructions in the application you submit to us.)

Use of This Form

- Proposed new construction or modifications should first be evaluated to determine if the change is major under the major NSR program using the procedures at 40 CFR 52.21 (i.e., baseline actual to projected actual applicability test). If the proposed construction does not qualify as a major under that test, then it may be subject to the requirements of the minor NSR rule at 40 CFR 49.151.

Helpful Definitions from the Federal Minor NSR Rule (40 CFR 49) – This is not a comprehensive list.

- *40 CFR 49.152(d) - Modification* means any physical or operational change at a source that would cause an increase in the allowable emissions of the affected emissions units for any regulated NSR pollutant or that would cause the emission of any regulated NSR pollutant not previously emitted.

  The following exemptions apply:

  (1) A physical or operational change does not include routine maintenance, repair, or replacement.

  (2) An increase in the hours of operation or in the production rate is not considered an operational change unless such increase is prohibited under any federally-enforceable permit condition or other permit condition that is enforceable as a practical matter.

  (3) A change in ownership at a source is not considered a modification.

- *40 CFR 49.152(d) - Allowable emissions* means ''allowable emissions'' as defined in §52.21(b)(16), except that the allowable emissions for any emissions unit are calculated considering any emission limitations that are enforceable as a practical matter on the emissions unit's potential to emit.

- *52.21(b)(16) - Allowable emissions* means the emissions rate of a stationary source calculated using the maximum rated capacity of the source (unless the source is subject to federally enforceable limits which restrict the operating rate, or hours of operation, or both) and the most stringent of the following:

  (i) The applicable standards as set forth in 40 CFR parts 60 and 61;

  (ii) The applicable State Implementation Plan emissions limitation, including those with a future compliance date; or

(iii) The emissions rate specified as a federally enforceable permit condition, including those with a future compliance date.

A. General Facility Information

1. Company Name & Operator Name (if the operator of the facility is different than the owner, please provide this information): Provide the complete company and operator names. For corporations, include divisions or subsidiary names, if any.

2. Facility Name: Provide the facility name. Please note that a facility is a site, place, location, etc… that may contain one or more air pollution emitting units.

3. Type of Operation: Indicate the generally accepted name for the operation (i.e., asphalt plant, gas station, dry cleaner, sand & gravel mining, oil and gas wellsite, tank battery, etc.).

4. Portable Source: Will this facility operate in more than one location? Some examples of portable sources include asphalt batch plants and concrete batch plants.

5. Temporary Source: A temporary source, in general, would have emissions that are expected last less than 12 months.

6. NAICS Code: North American Industry Classification System. The NAICS Code for your facility can be found at the following link → North American Industry Classification System (http://www.census.gov/epcd/naics/nsic2ndx.htm#S1).

7. SIC Code: Standard Industrial Classification Code. Although the new North American Industry Classification System (NAICS) has replaced the SIC codes, much of the Clean Air Act permitting processes continue to use these codes. The SIC Code for your facility can be found at the following link → Standard Industrial Classification Code (http://www.osha.gov/pls/imis/sic_manual.html).

8. Physical Address: Provide the actual address of where you are proposing to construct the new facility, not the mailing address. Include the State and the ZIP Code.

9. Reservation: Provide the name of the Indian reservation within which the facility will be constructed.

10. County: Provide the County within which the source will be constructed.

11a & 11b. Latitude & Longitude: These are GPS (global positioning system) coordinates.

12a – 12d. Section-Township-Range: Please provide these coordinates in 1/4 Section/Section/Township/Range. (e.g., SW ¼, NE ¼ S36/T10N/R21E).

B. Contact Information

Please provide the information, requested, in full.

1. Company Contact: Provide the full name of the primary contact for the company that owns the facility.

2. Operator Contact: Provide the name of the primary contact for the company that operates the facility if the company operating the facility is different from the company that owns the facility.

3. Permitting Contact: Provide the name of primary contact, for permitting decisions, at the company that owns the facility or the company that operates the facility.

4. Compliance Contact: Provide the name of primary contact, responsible for compliance of the facility, at the company that owns the facility or the company that operates the facility. If this is the same as the Permitting Contact please note this on the form.

B. Current Permit Information

Provide a list of all air quality permits that have been issued for this facility. This should include any Federal Minor New Source Review (MNSR), Prevention of Significant Deterioration (PSD) or Non-Attainment New Source Review (NA NSR) permits, in addition to the most recent Part 71 permit. The permit number must be included with each permit identified.

C. Attachments

This section lists the information needed to complete the requested approval. This information should be accompanied by the supporting information listed on the form and described below. The information should be presented in enough detail to document how the facility is currently operating and/or how it is proposed to be operated.

☐ **FORM SYNMIN**

If synthetic minor limits are being requested, a synthetic Minor Limit Application should be included with this application.

☐ Narrative description of the proposed production processes.

1. The narrative description should follow the flow of the process flow diagram to be submitted with this application. This needs to be as comprehensive as possible to help in understanding the proposed facility and how it will be operated. For example:

What are the raw materials?
What are the properties of the raw materials?
Does the production process include heating, drying, the application of chemicals, etc?
How will the raw materials be affected by this process?
What are the out puts from each step of the process (i.e., crushed ore, dry gas, water, etc…)?
Etc….

2. The proposed operating schedule presented in terms of hours per day, days per week, and weeks per year.
3. A list of the type and quantity of fuels and/or raw materials used. Each fuel and raw material should be described in enough detail to indicate its basic chemical components.

☐ A process flow chart identifying all proposed processing, combustion, handling, storage, and emission control equipment. This flow chart should illustrate the detailed narrative description requested above.

☐ List and describe all proposed units, emission units and air pollution-generating activities. At a minimum, provide the following:

1. The hourly, daily and annual maximum operating rates for each operating unit, production process, and activity.
2. The hourly, daily and annual maximum firing rates for each fuel and combustion equipment.
3. The capacity for storage units and the hourly, daily and annual maximum throughput of material in the storage units.
4. Material and product handling equipment and the hourly, daily and annual maximum throughput of material and product.
5. Tank designs, tank storage capacities, hourly, daily and annual maximum throughput of material and product.

☐ Type and quantity of fuels, including sulfur content of fuels, proposed to be used on a daily, annual and maximum hourly basis.

☐ Type and quantity of raw materials used or final product produced proposed to be used on a daily, annual and maximum hourly basis.

☐ Proposed operating schedule, including number of hours per day, number of days per week and number of weeks per year.

☐ A list and description of all proposed emission controls, control efficiencies, emission limits, and monitoring for each emission unit and air pollution generating activity.

1. Include manufacturer specifications and guarantees for each control device.

Criteria Pollutant Emissions Estimates

☐ Estimates of Current Actual Emissions, Current Allowable Emissions, Post-Change Uncontrolled Emissions, and Post-Change Allowable Emissions for the following air pollutants: particulate matter, PM_{10}, $PM_{2.5}$, sulfur oxides (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compound (VOC), lead (Pb) and lead compounds, ammonia (NH_3), fluorides (gaseous and particulate), sulfuric acid mist (H_2SO_4), hydrogen sulfide (H_2S), total reduced sulfur (TRS) and reduced sulfur compounds, including all calculations for the estimates.

1. These estimates are to be made for each emission unit, emission generating activity, in addition to total emissions.

2. The information should include all of the supporting calculations, assumptions and references. Emission estimates must address all emission units and pollutants proposed and/or affected by the limitation and be presented in short term (e.g. pounds per hour) as well as annual (tons per year) units.

3. Any emission estimates submitted to the Regional Administrator must be verifiable using currently accepted engineering criteria. The following procedures are generally acceptable for estimating emissions from air pollution sources:

   - Unit-specific emission tests;
   - Mass balance calculations;
   - Published, verifiable emission factors that are applicable to the unit. (i.e. manufacturer specifications)
   - Other engineering calculations; or
   - Other procedures to estimate emissions specifically approved by the Regional Administrator.

4. Guidance for estimating emissions can be found at http://www.epa.gov/ttn/chief/efpac/index.html.

Current Actual Emissions: Current actual emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the actual hourly emissions rate in pounds per hour (lbs/hr) times actual hours operated (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

1. For an **existing air pollution source (permitted and unpermitted)** that operated prior to the application submittal, the current actual emissions are the actual rate of emissions for the preceding calendar year and must be calculated using the actual operating hours, production rates, in-place control equipment, and types of materials processed, stored, or combusted during the preceding calendar year. The emission estimates must be based upon actual test data or, in the absence of such data, upon procedures acceptable to the Regional Administrator.

Current Allowable Emissions: Current allowable emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the allowed hourly emissions rate in pounds per hour (lbs/hr) times allowed hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

1. "Allowed" means the source is restricted by permit conditions that limit its emissions and are enforceable as a practical matter (i.e., allowable emissions). The allowable emissions for any

emissions unit are calculated considering any emissions limitations that are enforceable as a practical matter on the unit's PTE.

2. For an **existing permitted air pollution source** that operated prior to the application submittal, the current allowable emissions are the allowable rate of emissions for the preceding calendar year and must be calculated using the permitted operating hours, production rates, in-place control equipment, and types of materials processed, stored, or combusted during the preceding calendar year.

3. For an **existing air pollution source** that does not have an established allowable emissions level prior to the modification must report the pre-change uncontrolled emissions.

Post-Change Potential Emissions (Potential uncontrolled emissions from proposed project): This is the maximum capacity of a source to emit a pollutant under its physical and operational design. This is expressed in tpy and generally is calculated by multiplying the maximum hourly emissions rate in pounds per hour (lbs/hr) times 8,760 hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

Post-Change Allowable Emissions: A source's allowable emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the allowed hourly emissions rate in pounds per hour (lbs/hr) times allowed hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

1. Unless the source is restricted by permit conditions or other requirements that are enforceable as a practical matter, the post-change allowable emissions would be equivalent to post-change uncontrolled emissions. For the post-change allowable emissions a lower level of allowable emissions may be proposed.

2. For physical or operational changes at minor sources and for minor physical or operational changes at major sources, the total increase in allowable emissions resulting from your proposed change would be the sum of following:

   - For each new emissions unit that is to be added, the emissions increase would be the potential to emit of each unit.
   - For each emissions unit with an allowable emissions limit that is to be changed or replaced, the emissions increase would be the allowable emissions of the emissions unit after the change or replacement minus the allowable emissions prior to the change or replacement. However, this may not be a negative value. If the allowable emissions of an emissions unit would be reduced as a result of the change or replacement, use zero in the calculation.
   - For each unpermitted emissions unit (i.e., a unit without any emissions limitations before the change) that is to be changed or replaced, the emissions increase would be the allowable emissions of the unit after the change or replacement minus the potential to emit prior to the change or replacement. However, this may not be a negative value. If

the allowable emissions of an emissions unit would be reduced as a result of the change or replacement, use zero in the calculation.

☐ **Air Quality Review**

Provide a narrative description of the current air quality conditions and the expected impact the permitted source would have on that air quality. Factors to include in the qualitative discussion are meteorology, terrain, elevation, distance to ambient air, expected emissions, stack heights, etc…

Your reviewing authority may require you to provide additional information used to determine impacts that may result from your new source or modification. You may be required to conduct and submit an Air Quality Impact Analysis (AQIA) using dispersion modeling in accordance with 40 CFR part 51, Appendix W. If required, and the AQIA demonstrates that construction of your source or modification would cause or contribute to a NAAQS or PSD increment violation, you will also required to further reduce its impact before you could obtain a permit.

☐ **ESA**

The Endangered Species Act requires us, in consultation with the U.S. Fish and Wildlife Service and/or the NOAA Fisheries Service, to ensure that actions we authorize are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species.

To expedite the approval of your proposed construction, we encourage you to identify any listed species that you may be readily aware of that could be affected by your proposal. The following website has been provided to assist you: http://www.fws.gov/endangered/

Simply enter the State and County in which you propose to construct to obtain a general listing.

☐ **NHPA**

The National Historic Preservation Act requires us, in consultation with State and/or Tribal Historic Preservation Officers to ensure that actions we authorize are not likely to affect cultural resources.

To expedite the approval of your proposed construction, we encourage you to identify any cultural resources that you may be readily aware of that could be affected by your proposal. The following website has been provided to assist you:
http://nrhp.focus.nps.gov/natreghome.do?searchtype=natreghome

Simply enter the State and County in which you propose to construct to obtain a general listing.

OMB Control No. 2060-0003
Approval expires 04/30/2017

United States Environmental Protection Agency
Pacific Southwest - Region 9
Federal Minor New Source Review Program in Indian Country

Application for Synthetic Minor Limit

Please submit information to:

U.S. EPA at:

Air Division, Permits Office (Air-3)
U.S. EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105

For more information:
http://www.epa.gov/caa-permitting/tribal-nsr-permits-region-9, call (415) 972-3974, or email R9AirPermits@epa.gov.

Tribe:

The Tribal Environmental Contact for the specific reservation.

Please contact EPA Region 9 if you need assistance in identifying the appropriate Tribal Environmental Contact and address.

A. General Source Information

Company Name San Manuel Entertainment Authority
Source Name San Manuel Casino
Contact Information (name, title, phone number, email) Clifford Batten, Environmental Manager, 909-425-3590 x104311, cbatten@sanmanuel-nsn.gov
Mailing Address 777 San Manuel Blvd., Highland, CA 92346

B. Attachments

For each criteria air pollutant, hazardous air pollutant and for all emission units and air pollutant-generating activities to be covered by a limitation, include the following:

x **Item 1 -** The proposed limitation and a description of its effect on current actual, allowable and the potential to emit. See Narrative Description Section 6 and Section 7

☒ **Item 2 -** The proposed testing, monitoring, recordkeeping, and reporting requirements to be used to demonstrate and assure compliance with the proposed limitation. See Narrative Description Section 8

☒ **Item 3 -** A description of estimated efficiency of air pollution control equipment under present or anticipated operating conditions, including documentation of the manufacturer specifications and guarantees. See Narrative Description Section 6 and Attachment B

☒ **Item 4 -** Estimates of the Post-Change Allowable Emissions that would result from compliance with the proposed limitation, including all calculations for the estimates. See Narrative Description Section 7 and Attachement C

☒**Item 5 –** Estimates of the potential emissions of Greenhouse Gas (GHG) pollutants. See Attachment C

Instructions

Submit this form in addition to FORM NEW.

1. Who Can Request Federally-Enforceable Limitations Under the Tribal NSR Authority?

The Tribal NSR Rule applies only to sources located within the exterior boundaries of an Indian reservation in the United States of America or other lands as specified in 40 CFR part 49, collectively referred to as "Indian country". So, to use the authority in the Tribal NSR Rule to create federally-enforceable limitations, a source must be located within Indian country. Land ownership status (for example, whether the land is owned by a Tribal member or whether the land is owned in fee or in trust) does not affect how the rule applies.

2. Who Might Want to Request Federally-Enforceable Limitations?

The primary reason for requesting federally-enforceable limitations is to avoid an otherwise applicable federal Clean Air Act program, rule or requirement. Many federal Clean Air Act programs use a source's "potential to emit" (PTE) air pollution to determine which rules or requirements apply. A source's PTE is based on the maximum annual operational (production, throughput, etc) rate of the source taking into consideration the capacity and configuration of the equipment and operations. Emission or operational limits can also be taken into consideration as maximums if they are federally enforceable. So, using a synthetic minor NSR permit to establish federally enforceable limitations can lower a source's PTE and possibly allow the source to avoid certain federal Clean Air Act requirements.

Three examples of federal Clean Air Act programs that use PTE to determine whether they apply are (1) the Prevention of Significant Deterioration (PSD) construction permitting program, (2) the Title V operating permit program, and (3) the Maximum Achievable Control Technology (MACT) program. For example, existing sources that are considered "major" for Title V (meaning they have the potential to emit air pollution at levels defined in that rule as "major") must apply for a Title V operating permit. If a source accepts a federally-enforceable limitation through a synthetic minor NSR permit that reduces their PTE to below the "major" threshold, and the source does not meet any of the other requirements that would trigger applicability to the part 71 program, then the source no longer needs a Title V operating permit. When planning for the construction of a new source or expansion of an existing source, a source can also accept limitations on PTE (using a synthetic minor NSR permit) that allow the source to avoid PSD. Limitations on PTE can similarly help a source to avoid new MACT standards that would otherwise apply to the source.

3. Section B. Attachments

This section lists the information that must be attached to the application form for each requested limitation. The requested limitation(s) must be described for each affected emissions unit (or pollutant-generating activity) and pollutant and must be accompanied by the supporting information listed on the form and described below. Note that applicability of many federal Clean Air Act requirements (such as Title V, PSD and MACT) is often based on source-wide emission levels of specific pollutants. In that case, all emissions units at a source and all pollutants regulated by that given rule or regulation must be addressed by this section of the application form.

Item 1 – The requested limitation and its effect on actual emissions or potential to emit must be presented in enough detail to document how the limitation will limit the source's actual or potential emissions as a legal and practical matter and, if applicable, will allow the source to avoid an otherwise applicable requirement. The information presented must clearly explain how the limitation affects each emission unit and each air pollutant from that emission unit. Use the information provided in response to Item 4 below to explain how the limitation affects emissions before and after the limitation is in effect.

Item 2 – For each requested limitation, the application must include proposed testing, monitoring, recordkeeping and reporting that will be used to demonstrate and assure compliance with the limitation. Testing approaches should incorporate and reference appropriate EPA reference methods where applicable. Monitoring should describe the emission, control or process parameters that will be relied on and should address frequency, methods, and quality assurance.

Item 3 – The application must include a description and estimated efficiency of air pollution control equipment under present or anticipated operating conditions. For control equipment that is not proposed to be modified to meet the requested limit, simply note that fact; however, for equipment that is proposed to be modified (e.g. improved efficiency) or newly installed to meet the proposed limit, address both current and future descriptions and efficiencies. Include manufacturer specifications and guarantees for each control device.

Items 4 – Any emission estimates submitted to the Reviewing Authority must be verifiable using currently accepted engineering criteria. The following procedures are generally acceptable for estimating emissions from air pollution sources:

(i) Source-specific emission tests;
(ii) Mass balance calculations;
(iii) Published, verifiable emission factors that are applicable to the source. (i.e., manufacturer specifications).
(iv) Other engineering calculations; or
(v) Other procedures to estimate emissions specifically approved by the Reviewing Authority.

Post-Change Allowable Emissions: A source's allowable emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the allowed hourly emissions rate in pounds per hour (lbs/hr) times allowed hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

Appendix B

Equipment Information and Manufacturer Specification Sheets

ESA

Technical Description

Cogeneration Unit

JMS 616 GS-N.L

with Island Operation
with Black Start

Chiller Standard

JMS 616 J02 4160 V

Western Energy Systems

Standard rating of the engines is for an installation at an altitude ≤ **1640 ft** and combustion air temperature ≤ **86 °F** (T1)

Electrical output	2656	kW el.
Thermal output	3842	MBTU/hr

Emission values

NOx	< 0.6 g/bhp.hr (NO2)
CO	< 2.5 g/bhp.hr (CO)
NHMC	< 0.43 g/bhp.hr

0.01 Technical Data (at module)

			100%	75%	50%
Power input	[2]	MBTU/hr	20,446	15,682	10,915
Gas volume	*)	scfhr	22,296	17,102	11,903
Mechanical output	[1]	bhp	3,681	2,760	1,840
Electrical output	[4]	kW el.	2,656	1,982	1,306
Recoverable thermal output					
~ Intercooler 1st stage	[9]	MBTU/hr	2,412	1,367	570
~ Lube oil		MBTU/hr	~	~	~
~ Jacket water		MBTU/hr	1,430	1,259	1,054
~ Exhaust gas cooled to 642 °F		MBTU/hr	~	~	~
Total recoverable thermal output	[5]	MBTU/hr	3,842	2,626	1,624
Heat to be dissipated					
~ Intercooler 2nd stage (with gearbox)		MBTU/hr	1,004	644	425
~ Lube oil		MBTU/hr	925	822	699
~ Surface heat	ca. [7]	MBTU/hr	670	~	~
Spec. fuel consumption of engine electric	[2]	BTU/kWel.hr	7,698	7,912	8,358
Spec. fuel consumption of engine	[2]	BTU/bhp.hr	5,554	5,682	5,933
Lube oil consumption	ca. [3]	gal/hr	0.17	~	~
Electrical efficiency			44.3%	43.1%	40.8%
Thermal efficiency			18.8%	16.7%	14.9%
Total efficiency	[6]		63.1%	59.9%	55.7%
Hot water circuit:					
Forward temperature		°F	198.0	191.4	185.9
Return temperature		°F	177.0	177.0	177.0
Hot water flow rate		GPM	410.1	410.1	410.1
Fuel gas LHV		BTU/scft	917		

*) approximate value for pipework dimensioning
[_] Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance, and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...). In the specifications in addition to the general tolerance of ±8 % on the thermal output a further reserve of +5 % is recommended for the dimensioning of the cooling requirements.

Main dimensions and weights (at module)(with gearbox)

Length	in	~ 400
Width	in	~ 90
Height	in	~ 110
Weight empty	lbs	~ 68,130
Weight filled	lbs	~ 70,330

Connections

Hot water inlet and outlet [A/B]	in/lbs	4"/145
Exhaust gas outlet [C]	in/lbs	25"/145
Fuel Gas (at module) [D]	in/lbs	4"/145
Water drain ISO 228	G	½"
Condensate drain	in/lbs	2½"/145
Safety valve - jacket water ISO 228 [G]	in/lbs	2x1½"/2.5
Safety valve - hot water	in/lbs	2"/232
Lube oil replenishing (pipe) [I]	in	1.1
Lube oil drain (pipe) [J]	in	1.1
Jacket water - filling (flex pipe) [L]	in	0.5
Intercooler water-Inlet/Outlet 1st stage	in/lbs	4"/145
Intercooler water-Inlet/Outlet 2nd stage [M/N]	in/lbs	2½"/145

Output / fuel consumption

ISO standard fuel stop power ICFN	bhp	3,681
Mean effe. press. at stand. power and nom. speed	psi	319
Fuel gas type		Natural gas
Based on methane number | Min. methane number	MN	90 | 80 d)
Compression ratio	Epsilon	12
Min. fuel gas pressure for the pre chamber	psi	60.9 - 116
Min./Max. fuel gas pressure at inlet to main gas train	psi	1.8 – 2.9 c)
Max. rate of gas pressure fluctuation	psi/sec	0.145
Maximum Intercooler 2nd stage inlet water temperature	°F	113
Spec. fuel consumption of engine	BTU/bhp.hr	5,554
Specific lube oil consumption	g/bhp.hr	0.15
Max. Oil temperature	°F	176
Jacket-water temperature max.	°F	203
Filling capacity lube oil (refill)	gal	~ 171

c) Lower gas pressures upon inquiry
d) based on methane number calculation software AVL 3.2 (calculated without N2 and CO2)

0.02 Technical data of engine

Manufacturer		GE Jenbacher
Engine type		J 616 GS-J02
Working principle		4-Stroke
Configuration		V 60°
No. of cylinders		16
Bore	in	7.48
Stroke	in	8.66
Piston displacement	cu.in	6,090
Nominal speed	rpm	1,500
Mean piston speed	in/s	433
Length	in	193
Width	in	74
Height	in	99
Weight dry	lbs	27,558
Weight filled	lbs	29,762
Moment of inertia	lbs-ft²	1541.76
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	20
Starter motor voltage	V	24

Thermal energy balance

Power input	MBTU/hr	20,446 | 15,682 | 10,915
Intercooler	MBTU/hr	3,416 | 1,952 | 904
Lube oil	MBTU/hr	925 | 822 | 699
Jacket water	MBTU/hr	1,430 | 1,259 | 1,054
Exhaust gas cooled to 356 °F	MBTU/hr	2,593 | 2,532 | 2,109
Exhaust gas cooled to 212 °F	MBTU/hr	3,869 | 3,470 | 2,743
Surface heat	MBTU/hr	338 | 304 | 259

Exhaust gas data

Exhaust gas temperature at full load [8]	°F	642
Exhaust gas temperature at bmep= 239.3 [psi]	°F	~ 732
Exhaust gas temperature at bmep= 159.5 [psi]	°F	~ 819
Exhaust gas mass flow rate, wet	lbs/hr	34,608 | 25,437 | 17,128
Exhaust gas mass flow rate, dry	lbs/hr	32,553 | 23,861 | 16,030
Exhaust gas volume, wet	scfhr	438,133 | 322,305 |217,177
Exhaust gas volume, dry	scfhr	397,134 | 290,876 |195,318
Max.admissible exhaust back pressure after y-pipe	psi	0.725

Combustion air data

Combustion air mass flow rate	lbs/hr	33,693 | 24,736 | 16,638
Combustion air volume	SCFM	6,960 | 5,110 | 3,437
Max. admissible pressure drop at air-intake filter	psi	0.145

Sound pressure level

Aggregate a)		dB(A) re 20µPa	102
31,5	Hz	dB	83
63	Hz	dB	90
125	Hz	dB	96
250	Hz	dB	98
500	Hz	dB	97
1000	Hz	dB	95
2000	Hz	dB	94
4000	Hz	dB	94
8000	Hz	dB	92
Exhaust gas b)		dB(A) re 20µPa	119
31,5	Hz	dB	109
63	Hz	dB	119
125	Hz	dB	128
250	Hz	dB	117
500	Hz	dB	115
1000	Hz	dB	114
2000	Hz	dB	111
4000	Hz	dB	106
8000	Hz	dB	91

Sound power level

Aggregate	dB(A) re 1pW	124
Measurement surface	ft²	1,604
Exhaust gas	dB(A) re 1pW	127
Measurement surface	ft²	67.60

a) average sound pressure level on measurement surface in a distance of 3.28ft (converted to free field) according to DIN 45635, precision class 3.
b) average sound pressure level on measurement surface in a distance of 3.28ft according to DIN 45635, precision class 2.
The spectra are valid for aggregates up to bmep=319.083028 psi. (for higher bmep add safety margin of 1dB to all values per increase of 15 PSI pressure).
Engine tolerance ± 3 dB

0.02.01 Technical data of gearbox

Manufacturer		EISENBEISS
Type		~
Gearbox ratio		1:1.2
Efficiency	%	99.49
Mass	lbs	3,748

0.03 Technical data of generator

Manufacturer		AVK e)
Type		DIG 130 k/4 e)
Type rating	kVA	3,600
Driving power	bhp	3,662
Ratings at p.f.= 1.0	kW	2,656
Ratings at p.f. = 0.8	kW	2,633
Rated output at p.f. = 0.8	kVA	3,292
Rated reactive power at p.f. = 0.8	kVAr	1,975
Rated current at p.f. = 0.8	A	457
Frequency	Hz	60
Voltage	kV	4.16
Speed	rpm	1,800
Permissible overspeed	rpm	2,250
Power factor (lagging - leading)		0,8 - 1,0
Efficiency at p.f.= 1.0		97.3%
Efficiency at p.f. = 0.8		96.4%
Moment of inertia	lbs-ft²	2610.74
Mass	lbs	16,535
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Ik" Initial symmetrical short-circuit current	kA	2.66
Is Peak current	kA	6.77
Insulation class		F
Temperature rise (at driving power)		F
Maximum ambient temperature	°F	104

Reactance and time constants (saturated) at rated output

xd direct axis synchronous reactance	p.u.	2.05
xd' direct axis transient reactance	p.u.	0.27
xd" direct axis sub transient reactance	p.u.	0.17
x2 negative sequence reactance	p.u.	0.17
Td" sub transient reactance time constant	ms	15
Ta Time constant direct-current	ms	90
Tdo' open circuit field time constant	s	3.10

e) GE Jenbacher reserves the right to change the generator supplier and the generator type. The contractual data of the generator may thereby change slightly. The contractual produced electrical power will not change.

0.04 Technical data of heat recovery

General data - Hot water circuit

Total recoverable thermal output	MBTU/hr	3,842
Return temperature	°F	177.0
Forward temperature	°F	198.0
Hot water flow rate	GPM	410.1
Design pressure of hot water	lbs	145
min. operating pressure	psi	51.0
max. operating pressure	psi	131.0
Pressure drop hot water circuit	psi	17.40
Maximum Variation in return temperature	°F	+0/-21
Max. rate of return temperature fluctuation	°F/min	18

General data - Cooling water circuit

Heat to be dissipated	MBTU/hr	1,929
Return temperature	°F	104
Cooling water flow rate	GPM	154
Design pressure of cooling water	lbs	145
min. operating pressure	psi	7.0
max. operating pressure	psi	73.0
Loss of nominal pressure of cooling water	psi	~
Maximum Variation in return temperature	°F	+0/-21
Max. rate of return temperature fluctuation	°F/min	18

The final pressure drop will be given after final order clarification and must be taken from the P&ID order documentation.

connection variant K

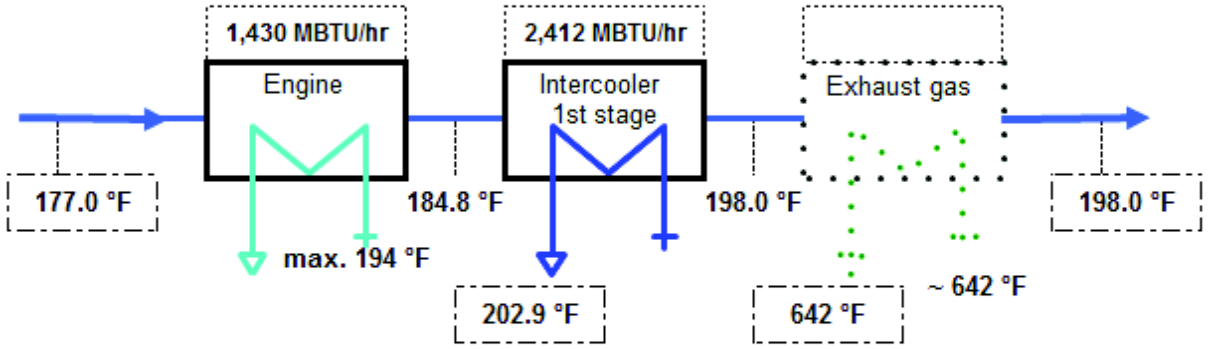
Hot water circuit (calculated with Glykol 37%)

Chiller Standard **J 616 GS-J02**

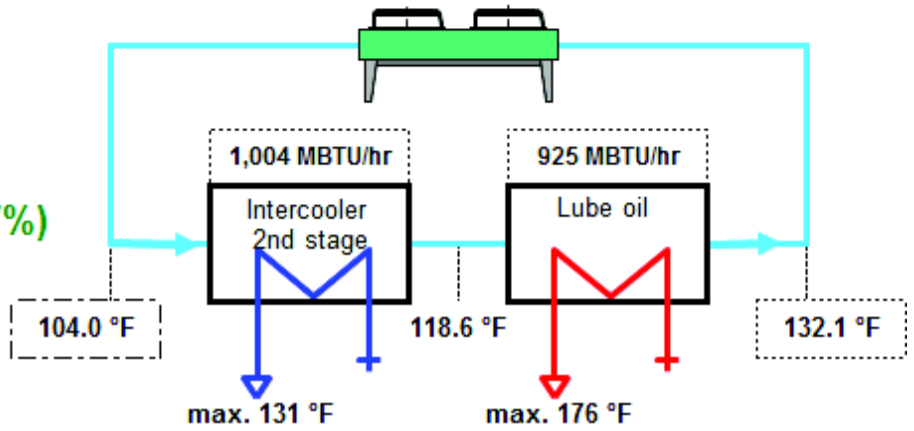
Recoverable thermal output = 3,842 MBTU/hr

(±8 % tolerance +5 % reserve for cooling requirements)

Hot water flow rate = 410.1 GPM



Low Temperature circuit (calculated with Glykol 37%)



Heat to be dissipated = 1,929 MBTU/hr

(±8 % tolerance +5 % reserve for cooling requirements)

Cooling water flow rate = 154.1 GPM

0.10 Technical parameters

All data in the technical specification are based on engine full load (unless stated otherwise) at specified temperatures as well as the methane number and subject to technical development and modifications. For isolated operation an output reduction may apply according to the block load diagram. Before being able to provide exact output numbers, a detailed site load profile needs to be provided (motor starting curves, etc.).

All pressure indications are to be measured and read with pressure gauges (psig).

(1) At nominal speed and standard reference conditions ICFN according to DIN-ISO 3046 and DIN 6271, respectively
(2) According to DIN-ISO 3046 and DIN 6271, respectively, with a tolerance of +5 %.
Efficiency performance is based on a new unit (immediately upon commissioning). Effects of degradation during normal operation can be mitigated through regular service and maintenance work.
(3) Average value between oil change intervals according to maintenance schedule, without oil change amount
(4) At p. f. = 1.0 according to VDE 0530 REM / IEC 34.1 with relative tolerances, all direct driven pumps are included
(5) Total output with a tolerance of ±8 %
(6) According to above parameters (1) through (5)
(7) Only valid for engine and generator; module and peripheral equipment not considered (at p. f. = 0,8) ,(guiding value)
(8) Exhaust temperature with a tolerance of ±8 %
(9) Intercooler heat on:
*** standard conditions (Vxx)** - If the turbocharger design is done for air intake temperature > 86°F w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/K starting from 77°F. Deviations between 77 – 86°F will be covered with the standard tolerance.
*** Hot Country application (Vxxx)** - If the turbocharger design is done for air intake temperature > 104°F w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/K starting from 95°F. Deviations between 95 – 104°F will be covered with the standard tolerance.

Radio interference level
The ignition system of the gas engines complies the radio interference levels of CISPR 12 and EN 55011 class B, (30-75 MHz, 75-400 MHz, 400-1000 MHz) and (30-230 MHz, 230-1000 MHz), respectively.

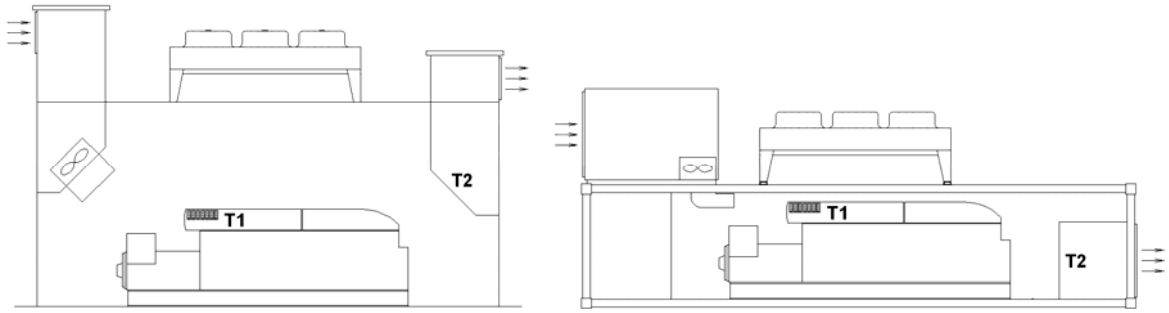
Definition of output
- ISO-ICFN continuous rated power:
  Net break power that the engine manufacturer declares an engine is capable of delivering continuously, at stated speed, between the normal maintenance intervals and overhauls as required by the manufacturer. Power determined under the operating conditions of the manufacturer's test bench and adjusted to the standard reference conditions.
- Standard reference conditions:
  Barometric pressure: 14.5 psi (1000 mbar) or 328 ft (100 m) above sea level

Air temperature:	77°F (25°C) or 298 K
Relative humidity:	30 %

- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)

Pressure:	1 atmosphere (1013.25 mbar)
Temperature:	32°F (0°C)

Output adjustment for turbo charged engines
Standard rating of the engines is for an installation at an altitude ≤ **1640 ft** and combustion air temperature ≤ **86 °F** (T1)
Engine room outlet temperature: **122°F** (T2) -> engine stop



If the actual methane number is lower than the specified, the knock control responds. First the ignition timing is changed at full rated power. Secondly the rated power is reduced. These functions are done by the engine management.
Exceedance of the voltage and frequency limits for generators according to IEC 60034-1 Zone A will lead to a derate in output.

Parameters for the operation of GE Jenbacher gas engines
The genset fulfills the limits for mechanical vibrations according to ISO 8528-9.
The following "Technical Instruction of GE JENBACHER" forms an integral part of a contract and must be strictly observed: **TA 1000-0004, TA 1100 0110, TA 1100-0111**, and **TA 1100-0112.**
Transport by rail should be avoided. See **TA 1000-0046** for further details

Failure to adhere to the requirements of the above-mentioned TA documents can lead to engine damage and may result in loss of warranty coverage.

Parameters for the operation of control unit and the electrical equipment
Relative humidity 50% by maximum temperature of 104°F.
Altitude up to 2000m above the sea level.

1.00 Scope of supply - Module

Design:
The module is built as a compact package. The engine base is bolted to the gearbox/generator base. The Engine output shafting is connected through a coupling to a gearbox. A second coupling is then provided connecting the gearbox to the generator. To provide the best possible isolation from the transmission of vibrations, the engine rests on the engine base-frame by means of anti-vibration mounts. The remaining vibrations are eliminated by mounting the complete module (engine and gearbox/generator frames) on isolating pads (e.g. Sylomer). This, in principle, allows for placing of the module to be directly on any floor capable of carrying the static load. No special foundation is required. Prevention of sound conducted through solids has to be provided locally.

1.01 Spark ignited gas engine

Four-stroke, air/gas mixture turbocharged, aftercooled, with high performance ignition system and electronically controlled air/gas mixture system.
The engine is equipped with the most advanced

LEANOX® LEAN-BURN COMBUSTION SYSTEM

developed by GE JENBACHER.

1.01.01 Engine design

Engine block
Single-piece crankcase and cylinder block made of special casting; crank case covers for engine inspection, welded steel oil pan.

Crankshaft and main bearings
Drop-forged, precision ground, surface hardened, statically and dynamically balanced; main bearings (upper bearing shell: grooved bearing / lower bearing shell: sputter bearing) arranged between crank pins, drilled oil passages for forced-feed lubrication of connecting rods.

Vibration damper
Maintenance free viscous damper

Flywheel
With ring gear for starter motor and additionally screwed on.

Pistons
Single-piece made of steel, with piston ring carrier and oil passages for cooling; piston rings made of high quality material, main combustion chamber specially designed for lean burn operation.

Connecting rods
Drop-forged, heat-treated, big end diagonally split and toothed. Big end bearings (upper bearing shell: sputter bearing / lower bearing shell: sputter bearing) and connecting rod bushing for piston pin.

Cylinder liner
Chromium alloy gray cast iron, wet, individually replaceable.

Cylinder head
Specially designed and developed for GE JENBACHER-lean burn engines with optimized fuel consumption and emissions; water cooled, made of special casting, individually replaceable; Valve seats and valve guides and spark plug sleeves individually replaceable; exhaust and inlet valve made of high quality material; Pre-chamber with check-valve.

Crankcase breather
Connected to combustion air intake system

Valve train
Camshaft, with replaceable bushings, driven by crankshaft through intermediate gears, valve lubrication by splash oil through rocker arms.

Combustion air/fuel gas system
Motorized carburetor for automatic adjustment according fuel gas characteristic. Exhaust driven turbocharger, mixture manifold with bellows, water-cooled intercooler, throttle valve and distribution manifolds to cylinders.

Ignition system
Most advanced, fully electronic high performance ignition system, external ignition control.
MORIS: Automatically, cylinder selective registration and control of the current needed ignition voltage.

Lubricating system
Gear-type lube oil pump to supply all moving parts with filtered lube oil, pressure control valve, pressure relief valve and full-flow filter cartridges. Cooling of the lube oil is arranged by a heat exchanger.

Engine cooling system
Jacket water pump complete with distribution pipework and manifolds.

Exhaust system
Turbocharger and exhaust manifold

Exhaust gas temperature measuring
Thermocouple for each cylinder

Electric actuator
For electronic speed and output control

Electronic speed monitoring for speed and output control
By magnetic inductive pick up over ring gear on flywheel

Starter motor
Engine mounted electric starter motor

1.01.02 Additional equipment for the engine (spares for commissioning)

The initial set of equipment with the essential spare parts for operation after commissioning is included in the scope of supply.

1.01.03 Engine accessories

Insulation of exhaust manifold:
Insulation of exhaust manifold is easily installed and removed

Sensors at the engine:
- Jacket water temperature sensor
- Jacket water pressure sensor
- Lube oil temperature sensor
- Lube oil pressure sensor
- Mixture temperature sensor
- Charge pressure sensor
- Minimum and maximum lube oil level switch
- Exhaust gas thermocouple for each cylinder
- Knock sensors
- Gas mixer / gas dosing valve position reporting.
- Air Filter DP sensor
- Crankcase pressure sensor

Actuator at the engine:
- Actuator - throttle valve
- Bypass-valve for turbocharger
- Control of the gas mixer / gas dosing valve

1.01.04 Standard tools (per installation)

The tools required for carrying out the most important maintenance work are included in the scope of supply and delivered in a toolbox.

1.02 Generator-medium voltage

The 2 bearing generator consists of the main generator (built as rotating field machine), the exciter machine (built as rotating armature machine) and the digital excitation system.
The digital regulator is powered by an auxiliary winding at the main stator or a PMG system

Main components:

- Enclosure of welded steel construction
- Stator core consist of thin insulated electrical sheet metal with integrated cooling channels.
- Stator winding with 5/6 Pitch
- Rotor consist of shaft with shrunken laminated poles, Exciter rotor, PMG (depending on Type) and fan.
- Damper cage
- Excitation unit with rotating rectifier diodes and overvoltage protection
- Dynamically balanced as per ISO 1940, Balance quality G2,5
- Drive end bracket with re-greaseable antifriction bearing
- Non-drive end bracket with re grease antifriction bearing
- Cooling IC01 - open ventilated, air entry at non-drive end, air outlet at the drive end side
- Main terminal box includes main terminals for power cables
- Regulator terminal box with auxiliary terminals for thermistor connection and regulator.
- Anti-condensation heater
- 3 PT100 for winding temperature monitoring+3 PT100 Spare
- 2 PT100 for bearing temperature monitoring
- Current transformer for protection and measuring in the star point
  xx/1A, 10P10 15VA, xx/1A, 1FS5, 15VA

Electrical data and features:

- Standards: IEC 60034, EN 60034, VDE 0530, ISO 8528-3, ISO 8528-9
- Voltage adjustment range: +/- 10 % of rated voltage (continuous)
- Frequency: -6/+4% of rated frequency
- Overload capacity: 10% for one hour within 6 hours, 50% for 30 seconds
- Asymmetric load: max. 8% I2 continuous, in case of fault I2 x t=20
- Altitude: < 1000m
- Max permitted generator intake air temperature: 5°C - 40°C
- Max. relative air humidity: 90%
- Voltage curve THD Ph-Ph: <3% at idle operation and <3% at full load operation with linear symmetrical load
- Generator suitable for parallel operating with the grid and other generators
- Sustained short circuit current at 3-pole terminal short circuit: minimum 3 times rated current for 5 seconds.
- Over speed test with 1.2 times of rated speed for 2 minutes according to IEC 60034

Digital Excitation system ABB Unitrol 1010 mounted within the AVR Terminal box with following features:

- Compact and robust Digital Excitation system for Continuous output current up to 10 A (20A Overload current 10s)
- Fast AVR response combined with high excitation voltage improves the transient stability during LVRT events.
- The system has free configurable measurement and analog or digital I/Os. The configuration is done via the local human machine interface or CMT1000
- Power Terminals
  3 phase excitation power input from PMG or auxiliary windings
  Auxiliary power input 24VDC
- Excitation output
- Measurement terminals: 3 phase machine voltage, 1 phase network voltage, 1 phase machine current
- Analog I/Os: 2 outputs / 3 inputs (configurable), +10 V / -10 V
- Digital I/O: 4 inputs only (configurable), 8 inputs / outputs (configurable)
- Serial fieldbus: RS485 for Modbus RTU or VDC (Reactive power load sharing for up to 31 GEJ engines in island operation), CAN-Bus for dual channel communication
- Regulator Control modes: Bump less transfer between all modes
  Automatic Voltage Regulator (AVR) accuracy 0,1% at 25°C ambient temperature
  Field Current Regulator (FCR)
  Power Factor Regulator (PF)
  Reactive Power Regulator (VAR)
- Limiters: Keeping synchronous machines in a safe and stable operation area
  Excitation current limiter (UEL min / OEL max)
  PQ minimum limiter
  Machine current limiter
  V / Hz limiter
  Machine voltage limiter
- Voltage matching during synchronization
- Rotating diode monitoring
- Dual channel / monitoring: Enables the dual channel operation based on self-diagnostics and setpoint follow up over CAN communication. As Option available
- Power System Stabilizer (PSS) is available as option. Compliant with the standard IEEE 421.5-2005 2A / 2B, the PSS improves the stability of the generator over the highest possible operation range.
- Computer representation for power system stability studies: ABB 3BHS354059 E01
- Certifications: CE, cUL certification according UL 508c (compliant with CSA), DNV Class B,

- **Commissioning and maintenance Tool CMT1000** (for trained commissioning/ maintenance personal)
- With this tool the technician can setup all parameters and tune the PID to guarantee stable operation. The CMT1000 software allows an extensive supervision of the system, which helps the user to identify and locate problems during commissioning on site. The CMT1000 is connected to the target over USB or Ethernet port, where Ethernet connection allows remote access over 100 m.
- Main window
  - Indication of access mode and device information.
  - Change of parameter is only possible in CONTROL access mode.

    - LED symbol indicates that all parameters are stored on none volatile memory.
- Setpoint adjust window
    - Overview of all control modes, generator status, active limiters status and alarms.
    - Adjust set point and apply steps for tuning of the PID.
- Oscilloscope
- 4 signals can be selected out of 20 recorded channels. The time resolution is 50 ms. Save files to your PC for further investigation.
- Measurement
    - All measurements on one screen.

Routine Test
Following routine tests will be carried out by the generator manufacturer
- Measuring of the DC-resistance of stator and rotor windings
- Check of the function of the fitted components (e.g. RTDs, space heater etc.)
- Insulation resistance of the following components
  Stator winding, rotor winding
  Stator winding RTDs
  Bearing RTDs
  Space heater
- No Load saturation characteristic (residual voltage)
- Stator voltage unbalance
- Direction of rotation, phase sequence
- High voltage test of the stator windings (2 x Unom. + 1000 V) and the rotor windings (min. 1500 V)

1.03 Module Accessories

Base frame
Split Base Frame fabricated with welded structural steel. First frame to mount the engine, jacket water heat exchangers, pumps and engine auxiliaries, the second to mount the gearbox and generator.

Coupling #1
Engine to Gearbox coupling is provided. The coupling isolates the major sub-harmonics of engine alternating torque from gear box.

Coupling #2
Gearbox to Generator Coupling is provided. This coupling is designed with a torque limiter to couple gear box with alternator.

Coupling housings
Provided for both Couplings

Anti-vibration mounts
2 sets of isolation, one is arranged between engine block assembly and base frame. The second is via insulating pads (SYLOMER) for placement between base frame and foundation, delivered loose.

Gear box:
A Single-stage spur gear with overhead shaft and closed loop lube oil system, completely mounted on the gearbox/generator base frame. The lube oil heat exchanger is integrated with the warm/cooling water circuit. The gear transmission ratio is 1:1.2. Oil volume is approximately 52 gals (196 liters).

Exhaust gas connection
A flanged connection is provided that collects the exhaust gas turbocharger output flows, includes flexible pipe connections (compensators) to compensate for heat expansions and vibrations.

Combustion air filter
A Dry type air filter with replaceable filter cartridges is fitted. The assembly includes flexible connections to the fuel mixer/carburetor and service indicator.

Interface panel (M1 cabinet)
Totally enclosed sheet steel cubicle with hinged doors, pre-wired to terminals, ready to operate. All Cable entry will be via bottom mounted cable gland plates.

Painting: RAL 7035

Protection: External NEMA 3 (IP 54), Internal IP 20 (protection against direct contact with live parts)

Cabinet design is according to IEC 439-1 (EN 60 439-1/1990) and DIN VDE 0660 part 500, respectively. Ambient temperature 41 - 104 °F (5 - 40 °C), Relative humidity 70%

Dimensions:
- Height: 51 in - 82 in (1300 mm-2100 mm)
- Width: 40 in - 47 in (1000 mm -1200 mm)
- Depth: 16 in - 24 in (400 mm-600 mm)

Control Power Source: The starter batteries and the cabinet mounted battery chargers will provide the power source for this enclosure.

Interface Panel contents and control functions:
- The cabinet houses the unit Battery Charger and primary 24VDC Control Power Distribution (breakers, fuses, and terminals) from the unit Batteries
- Distributed PLC Input and Output cards, located in the cabinet, gather all Engine, Gearbox and Generator Control I/O. These cards transmit data via data bus interface to the central engine control of the module control panel located in the A1 cabinet. Data bus is via CAN and B&R Proprietary Data Highway (Data Cables provided by GE)
- Speed monitoring relays for protection are provided.
- Gas Train I/O Collection, including interface relays and terminals for gas train shutoff valves.
- Transducer for generator functions, such as excitation voltage.
- Door Mounted Emergency Stop Switch with associated Emergency Stop Loop interface relays.
- Miscellaneous control relays, contacts, fuses, etc. for additional control valves, and auxiliaries.
- Interface Terminal Strips

Skid Mounted 3 Phase Devices are Powered by 3 x **480**/**277** V, **60** Hz, 50 A

AC Power for engine mounted auxiliaries (heater, pumps, etc.) are routed through a separate J-box mounted on the side M1 cabinet (Box E1). This is done to maintain signal segregation (AC from control)

NOTE: Generator Current Transformer wiring is connected directly to the Generator and does NOT pass through the M1 cabinet.

Exhaust gas scavenging blower
An exhaust gas scavenging blower is used to scavenge the remaining exhaust gas out of the exhaust gas pipe work, to prevent the appearance of deflagrations.

Function:
Before each start scavenging by blower is done for app. 1 minute (except at black out – start)

Supervisions:
- Scavenging air fan failure
- Scavenging air flap failure

Consisting of:
- Fan
- Exhaust gas flap
- Temperature switch
- Compensator and pipe work

1.03.01 Engine jacket water system

Engine jacket water system
Closed cooling circuit, consisting of:
- Expansion tank
- Filling device (check and pressure reducing valves, pressure gauge)
- Safety valve(s)
- Thermostatic valve
- Required pipework on module
- Vents and drains
- Electrical jacket water pump, including check valve
- Jacket water preheat device

1.03.02 Automatic lube oil replenishing system

Automatic lube oil replenishing system:
Includes float valve in lube oil feed line, including inspection glass. Electric monitoring system will be provided for engine shut-down at lube oil levels "MINIMUM" and "MAXIMUM". Solenoid valve in oil feed line is only activated during engine operation. Manual override of the solenoid valve, for filling procedure during oil changes is included.

Oil drain
By set mounted cock

Pre-lubrication- and aftercooling oil pump:
Mounted on the module base frame; it is used for pre-lubrication and aftercooling of the turbochargers.
Period of operation: Pre-lubrication: 1 minute both pumps
Aftercooling: 15 minutes from engine stop only the **480**/**277** V pump
Consisting of:
- 1 piece oil pump 1500 W, **480**/**277** V
- 1 piece oil pump 1500 W, 24 V
- All necessary vents
- Necessary pipework

1.05.01 Gas train <500mbar (7.3psi)

Pre-assembled, delivered loose, for installation into gas pipework to the engine.

Consisting of:
- Main gas train:
  - Manual shut off valve
  - Gas filter, filter fineness <3µm
  - Adapter with dismount to the pre-chamber gas train
  - Gas admission pressure regulator
  - Pressure gauge with push button valve; 0-7.25psi (0-500mbar)
  - Solenoid valves
  - Gas pressure switch (min.)
  - Leakage detector
  - Gas pressure regulator
  - TEC JET (has to be implemented horizontal)
  - Gas flow meter (option)
  - p/t compensation (option)

The gas train complies with DIN - DVGW regulations.
Maximum distance from TEC JET outlet to gas entry on engine, including flexible connections, is 39.37in (1m)

- **Pre-chamber gas train:**
  - Manual shut off valve
  - Gas filter, filter fineness <3 µm
  - Solenoid valves
  - Pressure regulator
  - Calming distance with reducer
  - Pressure gauge with push button valve; 0-72.5psi (1-5bar)

Pre-chamber gas pressure regulator (incl. stabilization section) assembled at the flexible connection pre chamber gas.

1.07 Painting

• Quality:	Oil resistant prime layer Synthetic resin varnish finishing coat	
• Color:	Engine:	RAL 6018 (green)
	Base frame:	RAL 6018 (green)
	Generator:	RAL 6018 (green)
	Module interface panel:	RAL 7035 (light grey)
	Control panel:	RAL 7035 (light grey)

1.11 Engine generator control panel per module- Dia.ne XT4 incl. Single synchronization of the generator breaker

Dimensions:

• Height:	87 in (including 8 in pedestal *)
• Width:	32 -48 in*)
• Depth:	24 in *)

Protection class:
- external IP42
- Internal IP 20 (protection again direct contact with live parts)

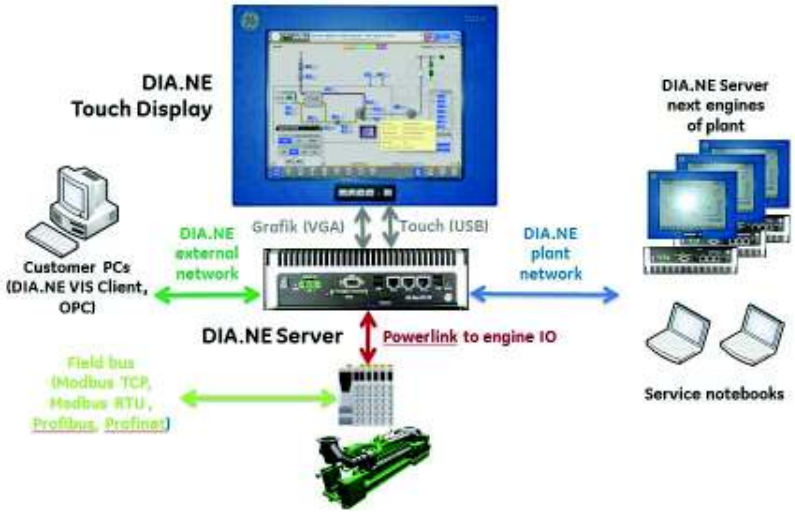
*) Control panels will be dimensioned on a project specific basis. Actual dimensions will be provided in the preliminary documentation for the project.

Control supply voltage from starter and control panel batteries: 24V DC

Auxiliaries power supply: (from provider of the auxiliary supply)
3 x **480**/**277** V, **60** Hz

Consisting of:
Motor - Management - System DIA.NE

Setup:
- a) Touch display visualization
- b) Central engine and unit control



Touch Display Screen:

15“ Industrial color graphic display with resistive touch.

Interfaces:
- 24V voltage supply
- VGA display connection
- USB interface for resistive touch

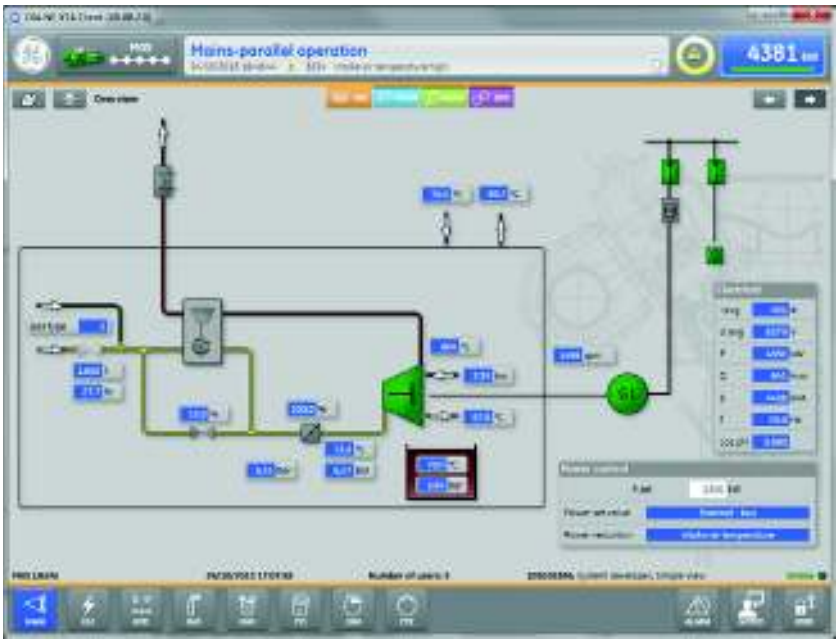
Protection class of DIA.NE XT panel front: IP 65
Dimensions: W x H x D = approx. 16x12x3in

The screen shows a clear and functional summary of the measurement values and simultaneously shows a graphical summary.

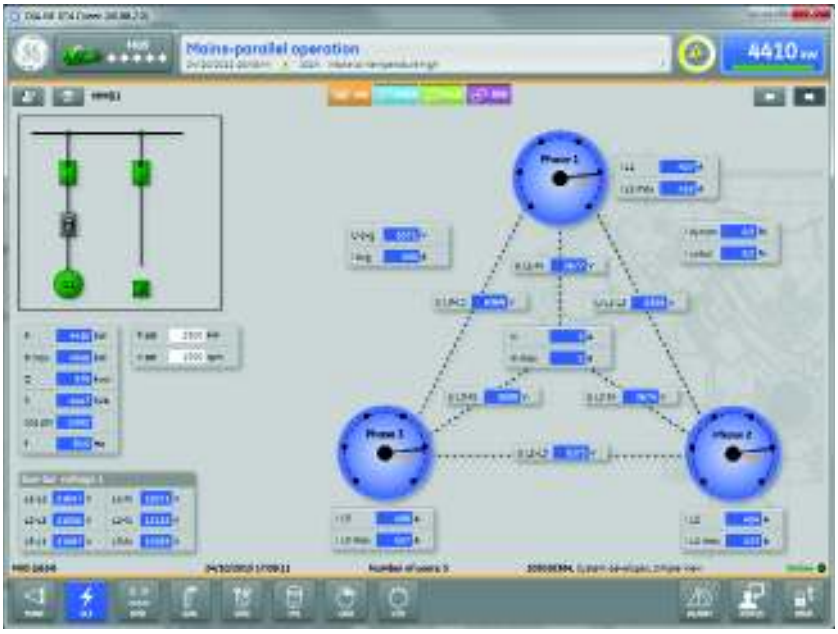
Operation is via the screen buttons on the touch screen
Numeric entries (set point values, parameters…) are entered on the touch numeric pad or via a scroll bar.
Determination of the operation mode and the method of synchronization via a permanently displayed button panel on the touch screen.

Main screens (examples):

Main: Display of the overview, auxiliaries' status, engine start and operating data.



ELE: Display of the generator connection with electrical measurement values and synchronization status



Trending
Trend with 100ms resolution

Measurement values:

- 500 data points are stored
- Measurement interval = 100ms
- Raw data availability with 100ms resolution: 3 hours + max. 50.000.000 changes in value at shut down (60 mins per shut down)
- Compression level 1: min, max, and average values with 1000ms resolution: 1 day
- Compression level 2: min, max, and average values with 30s resolution: 1 month
- Compression level 3: min, max, and average values with 10min resolution: 10 years

Messages:
1.000.000 message events

Actions (operator control actions):
100.000 Actions

System messages:
100.000 system messages

Central engine and module control:

An industrial PC- based modular industrial control system for module and engine sequencing control (start preparation, start, stop, aftercooling and control of auxiliaries) as well as all control functions.

Interfaces:

- Ethernet (twisted pair) for remote monitoring access
- Ethernet (twisted pair) for connection between engines
- Ethernet (twisted pair) for the Powerlink connection to the control input and output modules.
- USB interface for software updates

Connection to the local building management system according to the GE Jenbacher option list (OPTION)

- MODBUS-RTU Slave
- MODBUS-TCP Slave,
- PROFIBUS-DP Slave (120 words),
- PROFIBUS-DP Slave (190 words),
- ProfiNet Slave
- OPC DA Server

Control functions:

- Speed control in idle and in island mode
- Power output control in grid parallel operation, or according to an internal or external set point value on a case by case basis
- LEANOX control system which controls boost pressure according to the power at the generator terminals, and controls the mixture temperature according to the engine driven air-gas mixer
- Knocking control: in the event of knocking detection, ignition timing adjustment, power reduction and mixture temperature reduction (if this feature is installed)
- Load sharing between engines in island mode operation (option)
- Linear power reduction in the event of excessive mixture temperature and misfiring
- Linear power reduction according to CH4 signal (if available)
- Linear power reduction according to gas pressure (option)
- Linear power reduction according to air intake temperature (option)

Multi-transducer to record the following alternator electrical values:

- Phase current (with slave pointer))
- Neutral conductor current
- Voltages Ph/Ph and Ph/N
- Active power (with slave pointer)
- Reactive power
- Apparent power
- Power factor
- Frequency
- Active and reactive energy counter

Additional 0 (4) - 20 mA interface for active power as well as a pulse signal for active energy

The following alternator monitoring functions are integrated in the multi-measuring device:

- Overload/short-circuit [51], [50]
- Over voltage [59]
- Under voltage [27]
- Asymmetric voltage [64], [59N]
- Unbalance current [46]
- Excitation failure [40]
- Over frequency [81>]
- Under frequency [81<]

Lockable operation modes selectable via touch screen:

- "OFF" operation is not possible, running units will shut down immediately;
- "MANUAL" manual operation (start, stop) possible, unit is not available for fully automatic operation.
- "AUTOMATIC" fully automatic operation according to external demand signal:

Demand modes selectable via touch screen:

- external demand off („OFF“)
- external demand on („REMOTE“)
- override external demand („ON“)

Malfunction Notice list:

Shut down functions e.g.:

- Low lube oil pressure
- Low lube oil level
- High lube oil level
- High lube oil temperature
- Low jacket water pressure
- High jacket water pressure
- High jacket water temperature
- Overspeed
- Emergency stop/safety loop
- Gas train failure
- Start failure
- Stop failure
- Engine start blocked
- Engine operation blocked
- Misfiring
- High mixture temperature
- Measuring signal failure
- Overload/output signal failure
- Generator overload/short circuit

- Generator over/undervoltage
- Generator over/underfrequency
- Generator asymmetric voltage
- Generator unbalanced load
- Generator reverse power
- High generator winding temperature
- Synchronizing failure
- Cylinder selective Knocking failure

Warning functions e.g.:
- Cooling water temperature min.
- Cooling water pressure min.
- Generator winding temperature max.

Remote signals:
(volt free contacts)

1NO = 1 normally open
1NC = 1 normally closed
1COC = 1 change over contact

• Ready for automatic start (to Master control)	1NO
• Operation (engine running)	1NO
• Demand auxiliaries	1NO
• Collective signal "shut down"	1NC
• Collective signal "warning"	1NC

External (by others) provided command/status signals:

• Engine demand (from Master control)	1S
• Auxiliaries demanded and released	1S

Single synchronizing Automatic

For automatic synchronizing of the module with the generator circuit breaker to the grid by PLC- technology, integrated within the module control panel.

Consisting of:
- Hardware extension of the programmable control for fully automatic synchronization selection and synchronization of the module and for monitoring of the generator circuit breaker closed signal.
- Lockable synchronization selection via touch screen with the following selection modes:
    - "MANUAL" Manual initiation of synchronization via touch screen button followed by fully automatic synchronization of the module

- "AUTOMATIC" Automatic module synchronization, after synchronizing release from the module control
- "OFF" Selection and synchronization disabled
  Control of the generator circuit breaker according to the synchronization mode selected via touch screen.
- "Generator circuit breaker CLOSED/ Select" Touch-button on DIA.NE XT
- "Generator circuit breaker OPEN" Touch-button on DIA.NE XT

Status signals:
Generator circuit breaker closed
Generator circuit breaker open

Remote signals:
(volt free contacts)
Generator circuit breaker closed 1 NO

The following reference and status signals must be provided by the switchgear supplier:

- Generator circuit breaker CLOSED 1 NO
- Generator circuit breaker OPEN 1 NO
- Generator circuit breaker READY TO CLOSE 1 NO
- Mains circuit breaker CLOSED 1 NO
- Mains circuit breaker OPEN 1 NO

Mains voltage 3 x **480**/**277**V or 3x 110V/v3 other measurement voltages available on request
Bus bar voltage 3 x **480**/**277** V or 3x 110V/v3 – other measurement voltages available on request
Generator voltage 3 x **4.16 kV** or 3x 110V/v3 – other measurement voltages available on request

Voltage transformer in the star point with minimum 50VA and Class 0,5

The following volt free interface-signals will be provided by GE Jenbacher to be incorporated in switchgear:

- CLOSING/OPENING command for generator circuit breaker (permanent contact) 1 NO + 1 NC
- Signal for circuit breaker undervoltage trip 1 NO

Maximum distance between module control panel and engine/interface panel:	99ft
Maximum distance between module control panel and power panel:	164ft
Maximum distance between module control panel and master control panel:	164ft
Maximum distance between alternator and generator circuit breaker:	99ft

1.11.01 Remote messaging over MODBUS-TCP

Data transfer from the Jenbacher module control system to the customer's on-site central control system via MODBUS TCP using the ETHERNET 10 BASE-T/100BASE-TX protocol TCP/IP.

The Jenbacher module control system operates as a SLAVE unit.
The data transfer via the customer's MASTER must be carried out in cycles.

Data transmitted:
Individual error messages, operational messages, measured values for generator power, oil pressure, oil temperature, cooling water pressure, cooling water temperature, cylinder and collective exhaust gas temperatures.

GE Jenbacher limit of supply:
RJ45 socket at the interface module in the module control cabinet

1.11.02 Remote information by MODBUS-RTU

Data transfer from Jenbacher-engine control to customer's plant management system by MODBUS-RTU-network (RS 485).
The Jenbacher module control panel works as a SLAVE.
The data transmission by the customer's MASTER shall be cyclical.

Transmitted data:
Individual failure information, plant operating information, measuring values for generator power, oil pressure, oil temperature, jacket water pressure, jacket water temperature, cylinder and average exhaust gas temperatures.

GE Jenbacher limit of delivery:
Interface connector at the PLC in the engine control panel.

1.11.06 Remote Data-Transfer with DIA.NE XT4

General
DIA.NE XT4 offers remote connection with Ethernet.

Applications:

1.) DIA.NE XT4 HMI
DIA.NE XT4 HMI is the human-machine-interface of DIA.NE XT4 engine control and visualization system for GE Jenbacher gas engines.

The system offers extensive facilities for commissioning, monitoring, servicing and analysis of the site.
By installation of the DIA.NE XT4 HMI client program it can be used to establish connection to site, if connected to a network and access rights are provided.
The system runs on Microsoft Windows Operating systems (Windows XP, Windows 7, Windows 8, Windows 10)

Function
Functions of the visualization system at the engine control panel can be used remotely. These are among others control and monitoring, trend indications, alarm management, parameter management, and access to long term data recording. By providing access to multiple systems, also with multiple clients in parallel, additional useful functions are available like multi-user system, remote control, print and export functions and data backup.DIA.NE XT4 is available in several languages.

Option - Remote demand/blocking

If the service selectors switch at the module control panel is in pos."Automatic" and the demand-selector switch in pos."Remote", it is possible to enable (demanded) or disable (demand off) the module with a control button at the DIA.NE XT4 HMI
Note:
With this option, it makes no sense to have an additional clients demand (via hardware or data bus) or a self-guided operation (via GE Jenbacher master control, grid import /export etc.).

Option - Remote - reset (see TA-No. 1100-0111 chapter 1.7 an d1.9)

Scope of supply
- Software package DIA.NE XT4 HMI Client Setup (Download)
- Number of DIA.NE XT4 HMI - Client user license (Simultaneous right to access of one user to the engine control)

Nr. of license	Access
1	1 Users can be logged in at the same time with a PC (Workplace, control room or at home).
2 - “n“ (Optional)	2- “n” Users can be logged in at the same time with a PC (Workplace, control room or at home). If 2- “n” users are locally connected at Computers from office or control room, then it is not possible to log in from home.

Caution! This option includes the DIA.NE XT4 HMI client application and its license only – NO secured, encrypted connection will be provided by GE Jenbacher! A secured, encrypted connection – which is mandatory – has to be provided by the customer (via LAN connection or customer-side VPN), or can be realized by using option myPlant™.

Customer requirements
- Broad band network connection via Ethernet(100/1000BASE-TX) at RJ45 Connector (ETH3) at DIA.NE XT4 server inside module control panel

- Standard PC with keyboard, mouse or touch and monitor (min. resolution 1024*768)
- Operating system Windows XP, Windows 7, Windows 8, Windows 10
- DirectX 9.0 c compatible or newer 3D display adapter with 64 MB or higher memory

2.) myPlant™
Description see Annex 12 of Attachment 1

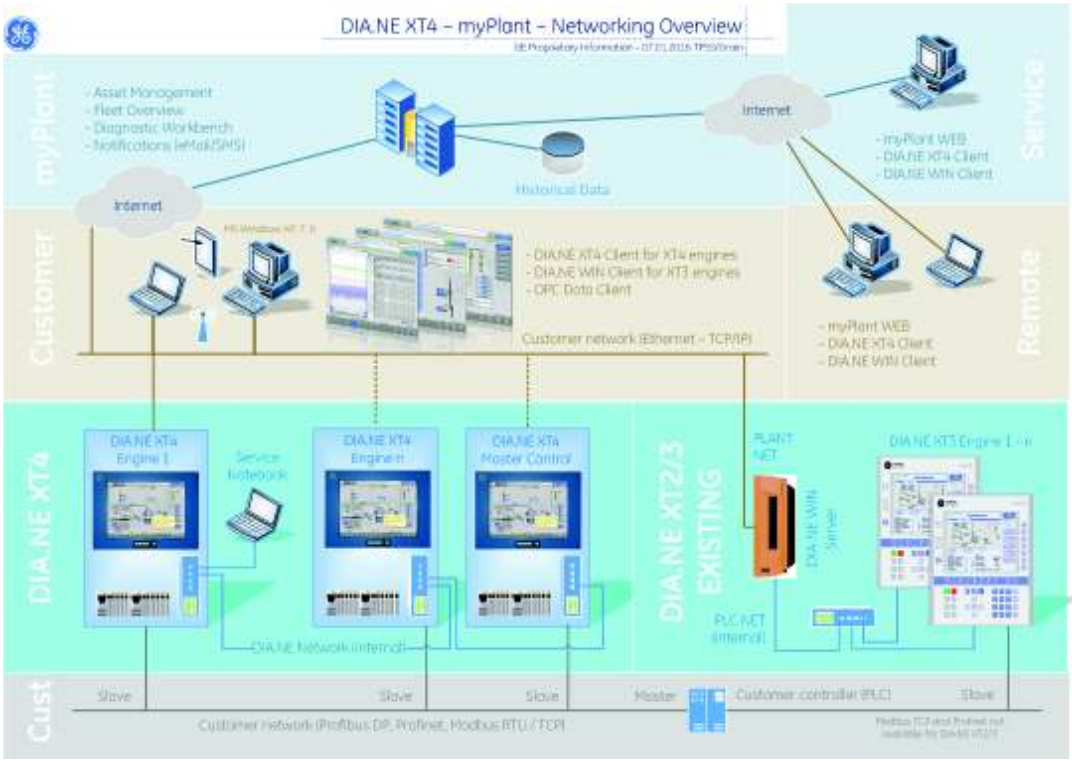
3.) Mobile Internet (OPTION)
Connection Plant - Customer via secured Internet - connection
See also technical instruction **TA 2300 - 0006**

Scope of delivery
- Mobile Internet router with antenna to connect to the DIA.NE Server XT4

Customer requirements
- SIM card for 3G / 4G

4.) Network overview

For information only!



1.11.14 Generator Overload / Short Circuit Protection

ANSI Function Code 50/51

Digital protection relay, 3-phase, integrated into the module control panel.
Connected to the protective current transformers in the generator star point
Acting on the generator circuit breaker and on the generator de-excitation
Alarm message on the DIA.NE screen

Characteristics / settings:

- Setting for overload: to 1,1 times of the generating set rated current,
- Dependent time characteristic acc. to IEC 60255-151: very inverse, time multiplier setting 0,6.
- Setting for short circuit: to 2,0 times of generating set rated current,
- Independent time characteristic: 300 ms (800 ms when dynamic network support).

1.11.15 Generator Differential Protection

ANSI function code 87

Digital protection relay, 3-phase, integrated into the module control panel.
Connected to the protective current transformers in the generator star point (GEJ scope of supply) and to the protective current transformers in the generator circuit breaker panel (current transformers by client, secondary 1A, optionally: 5A).
Acting on the generator circuit breaker and on the generator de-excitation
Alarm message on the DIA.NE screen

In plants with a unit generator-transformer configuration the protection is realized as generator/transformer differential protection.

1.11.16 Generator Earth Fault Protection (nondirectional)

Digital protection relay, integrated into the module control panel.
Acting on the generator circuit breaker and on the generator de-excitation
Alarm message on the DIA.NE screen

Dependent on the generator grounding method one of the following protection functions is applied:

1) ANSI function code 50N/G
   Detection of the earth fault current e.g. by means of a window-type current transformer
   (Current transformer by client, secondary 1A, optionally: 5A).
2) ANSI function code 59N/G

Detection of the residual voltage e.g. by means of the voltage measured across the broken-delta secondary windings of grounded voltage transformers (voltage transformers by client)

1.20.03 Starting system

Starter battery:
4 piece 12 V Pb battery, 200 Ah (according to DIN 72311), complete with cover plate, terminals and acid tester.

Battery voltage monitoring:
Monitoring by an undervoltage relay.

Battery charging equipment:
Capable for charging the starter battery with I/U characteristic and for the supply of all connected D.C. consumers.
Charging device is mounted inside of the module interface panel or module control panel.

- **General data:**
  - Power supply — **3 x 320 - 550 V, 47 - 63 Hz**
  - max. power consumption — 2120 W
  - Nominal D.C. voltage — 24 V (+/-1%)
  - Voltage setting range — 24V to 28,8V (adjustable)
  - Nominal current (max.) — 2 x 40 A
  - Dimensions — ca. 10 x 5 x 5 inch (240 x 125 x 125 mm)
  - Degree of protection — IP20 to IEC 529
  - Operating temperature — 32 °F – 140 °F (0 °C - 60 °C)
  - Protection class — 1
  - Humidity class — 3K3, no condensation.
  - Natural air convection
  - Standards — EN60950, EN50178
    UL/cUL (UL508/CSA 22.2)

Signalling:

Green Led:	Output voltage > 20,5V
Yellow Led:	Overload, Output Voltage < 20,5V
Red Led:	shutdown

Control accumulator:
- Pb battery 24 VDC/18 Ah

1.20.05 Electric jacket water preheating

Installed in the jacket water cooling circuit, consisting of:
- Heating elements
- Water circulating pump

The jacket water temperature of a stopped engine is maintained between 133 °F (56°C) and 140°F (60°C), to allow for immediate loading after engine start.

1.20.08 Flexible connections

Following flexible connections per module are included in the GE Jenbacher -scope of supply:

No.	Connection	Unit	Dimension	Material
2	Warm water in-/outlet	**in/lbs**	**4"/145**	Stainless steel
1	Exhaust gas outlet	**in/lbs**	**25"/145**	Stainless steel
1	Fuel gas inlet	**in/lbs**	**4"/232**	Stainless steel
2	Intercooler in-/outlet	**in/lbs**	**2½"/**	Stainless steel
2	Lube oil connection	**Error! Reference source not found.**		Hose

Seals and flanges for all flexible connections are included.

2.00 Electrical equipment

Totally enclosed floor mounted sheet steel cubicle with front door wired to terminals. Ready to operate, with cable entry at bottom. Naturally ventilated.

Protection:	IP 42 external, NEMA 12
	IP 20 internal (protection against direct contact with live parts)

Design according to EN 61439-2 / IEC 61439-2 and ISO 8528-4.
Ambient temperature 41 - 104 °F (5 - 40 °C), 70 % Relative humidity

Standard painting:	Panel:	RAL 7035
	Pedestal:	RAL 7020

2.02 Grid monitoring device

Standard without static Grid - 60Hz alternator

Function:
For immediate disconnection of the generator from the grid in case of grid failures.

Consisting of:
- High/low voltage monitoring
- High/low frequency monitoring
- Specially adjustable independent time for voltage and frequency monitoring
- Vector jump monitoring or df/dt monitoring for immediate disconnection of the generator from the grid for example at short interruptions
- Indication of all reference dimensions for normal operation and at the case of disturbance over LCD and LED
- Adjusting authority through password protection against adjusting of strangers

Scope of supply:
Digital grid protection relay with storage of defect data, indication of reference dimensions as well as monitoring by itself.

Grid protection values:

Parameter	Parameter limit	Max time delay[s]	**Comments**
59-61Hz			Do work normal
f<[ANSI 81U]	59Hz	0,5	Load reduction with 10%/HZ below 59Hz!
f<<[ANSI 81U]	58.5Hz	0,1	
f>[ANSI 81O]	61,5Hz	0,1	Load reduction with 30%/HZ above 61Hz!
U<[ANSI 27]	90%	1	Load reduction with 1%P /%U below 95%
U<<[ANSI 27]	80%	0,2	Load reduction with 1%P /%U below 95%
U>[ANSI 59]	110%	30	Load reduction with 1%P /%U above 105%
U>>[ANSI 59]	115%	0,2	Load reduction with 1% P/%U above 105%

Df/dt [ANSI 81R] **Or** **Vector shift** [ANSI 78]	2Hz/s, 5 Periods Or 8° -3pol		Cos phi range: 0,8ind (overexcited) - 1

3.71 Vibration Switch

A structural Vibration Switch will be installed on the package base frame to detect excessive vibrations. A signal we will sent to the control panel to indicate an alarm condition.

3.72 Seismic Protection

The main base will be supplied with pre-drilled holes to accommodate customer furnished bolts to act as retaining elements in the event of an earthquake. These customer foundation mounted bolts cannot come into contact with the unit base frame, as these bolts are for retention only, not mounting.

Details will be provided at first drawing submittal.

3.75 Penn Specific Design Requirements

- Jacket Water Heaters – 480 V heating units are required for all U.S. installations.
- Auxiliaries Transformer – 4KVA transformer required for this unit.

3.76 Control Strategy and Options (Type 6)

Control Strategy – The following control modes will be available in the Diane Control

- Grid Parallel with KW Control – Real Power Load Control of the Generator set will be either via a 4-20mA input from the customer representing a unit KW load setpoint or a KW load setpoint entered on the Diane XT3 screen. Upon breaker closure, the unit will ramp to the setpoint at a maximum rate of (Rated Unit KW) / 180 seconds.
- Grid Parallel with PF Control – Reactive Power Load Control of the Generator set will be either via a 4-20mA input from the customer representing a unit Power Factory setpoint or a Power Factor setpoint entered on the Diane XT3 screen. Upon breaker closure, the unit will maintain the setpoint.

- Grid Parallel with Import/Export Control - Load Control via an Import/Export KW level entered on the Diane XT3 screen. Required will be a customer 4-20mA signal representing the Site KW (Imported and/or Exported Power) that is to be controlled. Upon breaker closure, the unit will ramp to a load that will drive the KW value represented by the 4-20mA input signal to the level entered on Customer Import/Export Setpoint entered in the Diane XT3 screen. Once at the setpoint, the unit will raise and lower load to maintain this value. If the generator load required to maintain this setpoint drops below the minimum load level of the generator set, the unit 52G circuit breaker will be opened.

- Island Mode Operations with Blackout Starting – Island Operations with Black start capability will allow the engine to start and run without utility being present. The engine will be able to start the engine on battery power, close the generator breaker against a dead bus, and operate independently of a utility power source. The customer must ensure that there is sufficient fuel gas and pre-chamber gas at pressure in the event of a Type 6 engine so configured. The engine will start without the normal confirmation of engine block temperature or operation of a circulating AC water pump. It will be required of the operators that once the engine is connected to the generator bus, power to the engine auxiliaries be restored. Load Management is expected to be limited by the operators to the limits of the engine, as per GE Jenbacher TI 2108-0031. This system will work in conjunction with a GE Jenbacher Master Synchronizing Control (see appropriate Spec Section) if so equipped. If this is a single unit and synchronization with the utility after assuming operations is required, a *Grid Parallel with Single Unit Island Operations* option will be required.

Per Unit Hot Water Loop Controls - Hot Water Loop Panel Controls and Software to include:

- Hot Water Pump (Panel Control Parts and SW Only) - The option will add specific contact output and feedback input to/from an MCC for the Hot Water Pump. This will include relays and software.

- Hot Water Monitoring (Panel Control Parts and SW Only) - This option will monitor 3 hot water loop switches, flow, pressure and temperature. This option includes hardwired relays added to the trip loop, and internal software

- Hot Water Return Temperature Control (Panel Parts and SW Only) - This feature will provide all necessary controls to operate a 3 Way temperature control valve. The customer will provide a PT100 as a feedback signal and the Diane will provide a 4-20mA Analog Output to a customer provided valve. Control and Display Software are also provided.

- Emergency Hot Water Temperature Control (Panel Parts and SW Only) - This feature will provide all necessary controls to operate a 3 Way temperature control valve. The customer will provide a PT100 as a feedback signal and the Diane will provide a 4-20mA Analog Output to a customer provided valve. Control and Display Software are also provided.

Per Unit Intercooler Loop Controls - Intercooler Loop Panel Controls and Software to include:

- IC Temperature Control (Panel Parts and SW Only) - This feature will provide all necessary controls to operate a 3 Way temperature control valve in the IC Loop if Not Required by Site Conditions. The

Diane will provide a 4-20mA Analog Output to a customer provided valve and will utilize mixture temperature as a feedback input. Control and Display Software are also provided.

- Intercooler Pump Control (Panel Control Parts and SW Only) - The option will add specific contact output and feedback input to/from an MCC for the Intercooler Water Pump. This will include relays and software.

- Intercooler Loop Pressure (Panel Parts and SW Only) - This feature will provide an discrete input and associated software for the Intercooler Loop system pressure.

Per Unit Radiator Controls - Radiator Panel Controls and Software to include:

- Single Circuit High Temperature Loop Radiator Fan Control (Panel Parts and SW Only) - This feature will provide controls for a customer provided single circuit High Temperature Loop radiator (4 fan). The MCC control signals (DO/DI) will be provided, along with the necessary software

- Single Circuit Low Temperature Loop Radiator Fan Control (Panel Parts and SW Only) - This feature will provide controls for a customer provided single circuit Low Temperature Loop radiator (4 fan). The MCC control signals (DO/DI) will be provided, along with the necessary software

Per Unit Ventilation Related Controls - Diane XT3 System will be provided with the following additional features to operate a customer enclosure

- Ventilation Fan Control Option 1 - Customer Ventilation Fan control based on container internal temperature. Signal is based on a customer provide PT100 inside the container. A 4-20mA signal is provided for use by a customer provided VFD. Discrete IO is provided for starting and feedback signals to the VFD. It is assumed that the customer MCC will provide starter motor protection.

- Ventilation System Louver Control - Electrical and Control features are provided for louver opening and closing based on engine operation and compartment temperature. 4 Louver driver contacts are provided

- Discrete Input for Air Filter Differential Pressure – Additional Discrete Input and associated software for control

Per Unit Miscellaneous Controls - Diane XT3 System will be provided with the following additional features to operate a customer enclosure

- Additional Emergency Stop Signals - Additional Terminals for customer Estop switches

- Audible and Visual Alarm Indications - Hardware and software to drive a customer provided horn and strobe. Power for these devices is provided from the control system and is 24VDC

- SCR Control Signals – 2 additional discrete inputs and 1 analog will be required:
    - Discrete In 1 - Unit Operation/Engine Running (SSL20) to start the unit
    - Discrete In 2 - SCR Alarm (SS69) for display on the alarm Diane XT screen.
    - Analog Out 1 – Generator Power (0-100% = 4-20mA) for control of the SCR spray mechanism.

- Gas Flow Meter Trending - Gas Flowmeter Trending and Display (Flowmeter not included). Option includes a 4-20mA input that will accept the pressure and temperature corrected gas flow from a customer provided flow meter computer and will incorporate the signal into trending and displays in the Diane system.

- Gas Flow Meter Correction - Gas Flowmeter temperature and pressure compensation. Option includes three (3) 4-20mA inputs that will represent actual measured flow, pressure and temperature. Along with a customer provided flow meter calibration sheet, these 3 signals will be input to a calculation that will compensate the flowmeter flow signal to current gas conditions. The results will be incorporated into trending and displays in the Diane system.

4.00 Delivery, installation and commissioning

4.01 Carriage
According to contract.

4.02 Unloading
Unloading, moving of equipment to point of installation, mounting and adjustment of delivered equipment on intended foundations is not included in GE Jenbacher scope of supply.

4.03 Assembly and installation
Assembly and installation of all GE Jenbacher -components is not included in GE Jenbacher scope of supply.

4.04 Storage
The customer is responsible for secure and appropriate storage of all delivered equipment.

4.05 Emission measurement with exhaust gas analyzer
Emission measurement by GE Jenbacher personnel, to verify that the guaranteed toxic agent emissions have been achieved (costs for measurement by an independent agency will be an extra charge).

5.01 Limits of delivery

Electrical
- Module:
  - At terminals of module interface panel

- At terminals of generator terminal box
  (screwed glands to be provided locally)
- Module control panel:
  At terminal strips
- Auxiliaries:
  At terminals of equipment which is supplied separately

Warm water
- At inlet and outlet flanges on module
- At inlet and outlet flanges of the exhaust gas heat recovery system

Low temperature water
At inlet and outlet flanges at module

Exhaust gas
- At the exhaust gas exit of the engine
- At inlet and outlet flanges of the exhaust gas heat recovery system

Combustion air
The air filters are set mounted

Fuel gas
- At inlet and outlet flanges of gas train
- At inlet flange of gas pipework on module
- At outlet flange of the pre-chamber gas train
- At inlet flange of pre-chamber gas pipework on module
- At connection for boost pressure compensation on module
- At connection for boost pressure compensation on gas pressure regulator of the pre-chamber gas train

Lube oil
At lube oil connections on module

Draining connections and pressure relief
At module

Condensate
At condensate drain on exhaust gas heat exchanger

Insulation
Insulation of heat exchangers and pipe work is not included in our scope of supply and must be provided locally.

First filling
The first filling of the plant, (lube oil, engine jacket water, anti-freeze, anti-corrosive agent, battery acid) is not included in our scope of supply.

The composition and quality of the used consumables are to be strictly monitored in accordance with the "Technical Instructions" of GE JENBACHER.

Suitable bellows and flexible connections **must be provided locally** for all connections.
Cables from the module must be flexible.

5.02 Factory tests and inspections

The individual module components shall undergo the following tests and inspections:

5.02.01 Engine tests

Carried out as combined Engine- and Module test according to DIN ISO 3046 at GE Jenbacher test bench.
The following tests are made at 100%, 75% and 50% load, and the results are reported in a test certificate:

- Engine output
- Fuel consumption
- Jacket water temperatures
- Lube oil pressure
- Lube oil temperatures
- Boost pressure
- Exhaust gas temperatures, for each cylinder

5.02.02 Generator tests

Carried out on the premises of the generator supplier.

5.02.03 Module tests

The engine will be tested with natural gas (methane number 94). The performance data achieved at the test bench may therefore vary from the data as defined in the technical specification due to differences in fuel gas quality.
Carried out as combined Engine- and Module test commonly with module control panel at GE Jenbacher test bench, according to ISO 8528, DIN 6280. The following tests are made and the results are reported in a test certificate:
Visual inspection of scope of supply per specifications.

- Functional tests per technical specification of control system.
  - Starting in manual and automatic mode of operation
  - Power control in manual and automatic mode of operation
  - Function of all safety systems on module
- Measurements at 100%, 75% and 50% load:
  - Frequency
  - Voltage
  - Current
  - Generator output
  - Power factor
  - Fuel consumption

- Lube oil pressure
- Jacket water temperature
- Boost pressure
- Mixture temperature
- Exhaust emission (NOx)

The module test for operating frequenzy 50 Hz and 6,3-6,6kV / 10,5kV-11kV will be carried out with the original generator, except it is not possible because of the delivery date. Then a test generator will be used for the module test.
To prove characteristics of the above components, which are not tested on the test bench by GE JENBACHER, the manufacturers' certificate will be provided.

5.03 Documentation

60 days advance documentation, as per the technically clarified order placement
- Module drawing **1)**
- Technical diagram **1)**
- Drawings of the cabinet views **3**
- Electrical interface list **2)**
- Technical specification of the control system **2)**
- Technical drawings of accessories (if included in scope of supply of GE Jenbacher GmbH&CO OG) **1**

Before delivery(depending on progress in ordering the components, on request)
- Technical drawings for BoP components supplied separately (if included in scope of supply of GE Jenbacher GmbH&CO OG) **1)**

Upon delivery
- Circuit diagrams **3)**
- Cable list **3)**

Delivered with the engine
- Brief instructions (transport, erection, moving) **1)**

For commissioning
- Operation and maintenance instructions **4)**
- Spare parts catalogue **4)**
- Original supplier operation and maintenance instructions for any BoP components (installed in the GE Jenbacher GmbH&Co OG scope of supply) as Appendix **1)**

  All the components found in the GE Jenbacher GmbH&Co OG scope of supply are described in the operation and maintenance instructions, and in the spare parts catalogue.
  In addition, the manufacturer's original operation and maintenance instructions will be provided for every BoP component, in German and English as standard, as an Appendix for the operation and maintenance manual provided.

Additional costs of producing or providing the required documents using the KKS (power station coding system) and/or integration in subcontractors' documentation, or additional approval, design and proof of testing documentation must be negotiated or ordered separately.

This standard offer does not include:

- Approval documentation
- Design documentation
- Proof of testing documentation
- Printed copies and digital off-line versions (e.g. printed versions, CD, pdf, etc.) must be negotiated separately and ordered accordingly.

Cogen Generators' Emission Control System

STEULER ANLAGENBAU, GMBH & CO.

- Specification Sheet -

SCR/Oxidation Catalyst System - For NOx/CO/VOC Reduction

Customer: WES
Attention: Tom Marihart
Job Ref:

Notes: **CARB 1110.2**
Ref. No: B80201-1
Date: 05/08/18

Engine Mfg: Jenbacher
Model No: JMS616F02
EKW/BHP: 2656 EKW
Cycle: 4
RPM: 1500
Fuel Type: Pipeline Natural Gas
Load: 100%
Hours/Year: 8,300

SCR Model **DeNOx-J616F02/3681**
Nbr Units 2 to 4
SCR Controls: **Closed Loop**

Item Description	English	Units	Metric	Units
Engine Output	3,681	BHP	2,746	BKW
Exhaust Gas Mass Flow	34,617	Lbs/Hour	15,702	Kg/Hour
Exhaust Gas Temperature	644.0	°F	340.0	°C
Exhaust Flow - Standard Units	449,184	SCFH	12,719	SCMH
Pre-Catalyst NOx Emissions	0.600	G/BHP/Hr	0.805	G/BKW/Hr
Pre-Catalyst NOx Emissions	45	PPMV@15% O2	45	PPMV@15% O2
Pre-Catalyst NOx Emissions	4.87	Lbs/Hour	2.21	Kg/Hour
Pre-Catalyst NOx Emissions	1.77	Lbs/MW/Hr	0.80	Kg/MW/Hr
Post-Catalyst NOx Emissions	0.024	G/BHP/Hr	0.032	G/BKW/Hr
Post-Catalyst NOx Emissions	1.8	PPMV@15% O2	1.8	PPMV@15% O2
Post-Catalyst NOx Emissions	0.19	Lbs/Hour	0.09	Kg/Hour
Post-Catalyst NOx Emissions	0.070	Lbs/MW/Hr	0.032	Kg/MW/Hr
Percentage NOx Reduction	96.1	%	96.1	%
Pre-Catalyst CO Emissions	2.750	G/BHP/Hr	3.688	G/BKW/Hr
Pre-Catalyst CO Emissions	330	PPMV@15% O2	330	PPMV@15% O2
Pre-Catalyst CO Emissions	22.32	Lbs/Hour	10.12	Kg/Hour
Pre-Catalyst CO Emissions	8.12	Lbs/MW/Hr	3.68	Kg/MW/Hr
Post-Catalyst CO Emissions	0.068	G/BHP/Hr	0.091	G/BKW/Hr
Post-Catalyst CO Emissions	8	PPMV@15% O2	8	PPMV@15% O2
Post-Catalyst CO Emissions	0.55	Lbs/Hour	0.25	Kg/Hour
Post-Catalyst CO Emissions	0.20	Lbs/MW/Hr	0.09	Kg/MW/Hr
Percentage CO Reduction	97.5	%	97.5	%
Pre-Catalyst VOC Emissions	0.330	G/BHP/Hr	0.443	G/BKW/Hr
Pre-Catalyst VOC Emissions	71	PPMV@15% O2	71	PPMV@15% O2
Pre-Catalyst VOC Emissions	2.68	Lbs/Hour	1.21	Kg/Hour
Pre-Catalyst VOC Emissions	0.97	Lbs/MW/Hr	0.44	Kg/MW/Hr
Post-Catalyst VOC Emissions	0.035	G/BHP/Hr	0.047	G/BKW/Hr
Post-Catalyst VOC Emissions	8	PPMV@15% O2	8	PPMV@15% O2
Post-Catalyst VOC Emissions	0.28	Lbs/Hour	0.13	Kg/Hour
Post-Catalyst VOC Emissions	0.10	Lbs/MW/Hr	0.05	Kg/MW/Hr
Percentage VOC Reduction	89.4	%	89.4	%
Pressure Drop Across Catalyst/Mixer	5.0	In/H20	12.5	mbar
Ammonia (NH3) Slip	5	PPMV@15% O2	5	PPMV@15% O2
40%/60% Urea/H2O Consumption Rate	1.1	Gal/Hour	4.3	Liter/Hr
SCR Catalyst Volume	75.00	Cu/Ft	2.124	Cu/Meter
SCR Catalyst Configuration	10x10x3x12		10x10x3x300	
SCR Catalyst Space Velocity	5,989	SCFH/FT^3	5,989	SCMH/M^3
Oxidation Catalyst Volume	16.67	Cu/Ft	0.472	Cu/Meter
Oxidation Catalyst Configuration	10x10x2x4		10x10x2x100	
Oxidation Catalyst Space Velocity	26,952	SCFH/FT^3	26,952	SCMH/M^3

SCR/Oxidation Catalyst System - For NOx/CO/VOC Reduction

Notes:	**Rule 1110.2**
Ref. No:	San Manual
Date:	10/19/17

	J-616		KG-12V	
Engine Mfg	**Jenbacher**		**Kawaski**	
Load	**100%**		**100%**	
Hours in Operation	**8300**		**8300**	
RPM	**1500**		**720**	
Fuel Type	**Natural gas**		**Natural Gas**	
Stack Information	**30" Ø, 25 ft height**		**36" Ø, 30 ft height**	
Number of Units Installed	**2**		**1**	
Engine Output	**3,681**	BHP	**6,930**	BKW
Engine Output	**2,656**	EkW	**5,000**	EkW
Exhaust Gas Mass Flow	**34,617**	Lbs/Hour	**66,600**	Lbs/Hour
Exhaust Gas Temperature	**644.0**	°F	**608.0**	°F
Exhaust Flow - Standard Units	**449,184**	SCFH	**864,190**	SCMH
Pre-Catalyst NOx Emissions	**0.60**	G/BHP/Hr	**1.08**	G/BHP/Hr
Pre-Catalyst NOx Emissions	**50**	PPMV@15% O2	**102**	PPMV@15% O2
Pre-Catalyst NOx Emissions	**1.8**	Lbs/MWe/Hr	**3.3**	Lbs/MWe/Hr
Post-Catalyst NOx Emissions	**0.024**	G/BHP/Hr	**0.024**	G/BHP/Hr
Post-Catalyst NOx Emissions	**2.0**	PPMV@15% O2	**2.0**	PPMV@15% O2
Post-Catalyst NOx Emissions	**0.07**	Lbs/MWe/Hr	**0.07**	Lbs/MWe/Hr
Percentage NOx Reduction	**96.0**	%	**97.8**	%
Pre-Catalyst CO Emissions	**2.50**	G/BHP/Hr	**1.06**	G/BHP/Hr
Pre-Catalyst CO Emissions	**338**	PPMV@15% O2	**164**	PPMV@15% O2
Pre-Catalyst CO Emissions	**7.6**	Lbs/MWe/Hr	**3.1**	Lbs/MWe/Hr
Post-Catalyst CO Emissions	**0.067**	G/BHP/Hr	**0.067**	G/BHP/Hr
Post-Catalyst CO Emissions	**9.0**	PPMV@15% O2	**9.0**	PPMV@15% O2
Post-Catalyst CO Emissions	**0.20**	Lbs/MWe/Hr	**0.20**	Lbs/MWe/Hr
Percentage CO Reduction	**97.3**	%	**93.7**	%
Pre-Catalyst VOC Emissions	**0.33**	G/BHP/Hr	**0.31**	G/BHP/Hr
Pre-Catalyst VOC Emissions	**78**	PPMV@15% O2	**45**	PPMV@15% O2
Pre-Catalyst VOC Emissions	**1.0**	Lbs/MWe/Hr	**0.9**	Lbs/MWe/Hr
Post-Catalyst VOC Emissions	**0.034**	G/BHP/Hr	**0.034**	G/BHP/Hr
Post-Catalyst VOC Emissions	**8.0**	PPMV@15% O2	**8.0**	PPMV@15% O2
Post-Catalyst VOC Emissions	**0.10**	Lbs/MWe/Hr	**0.10**	Lbs/MWe/Hr
Percentage VOC Reduction	**89.7**	%	**89.0**	%
PM10 Emissions	**0.030**	G/BHP/Hr	**0.030**	G/BHP/Hr

1. Cells highlighted yellow indicate vendor provided data

2. Emission rates specified in the table are per unit

SAN MANUEL HOTEL AND CASINO EXPANSION PROJECT

Customer:	San Manuel	**Notes:**		**Rule 1110.2**	
Attention:	Irina Dubinsky	**Ref. No:**		B70626-1	
Job Ref:	L0047	**Date:**		07/09/18	
Engine Mfg:	Jenbacher	**Model No:**		JMS616F02	
EKW:	2,656	**Cycle:**	4	**RPM:**	1500
Fuel Type :	Pipeline Natural Gas	**Load:**	100%	**Hours/Year:**	8,300
SCR Model	DeNOx-J616F02/4601	**Nbr Units:**	1	**SCR Controls:**	Closed Loop

Item Description	English	Units			Metric	Units
Engine Output	**3,681**	BHP	2.7	MW	**2,746**	BKW
Exhaust Gas Mass Flow	**34,617**	Lbs/Hour			**15,702**	Kg/Hour
Exhaust Gas Temperature	**644.0**	°F			**340.0**	°C
Exhaust Flow - Standard Units	**449,184**	SCFH			**12,719**	SCMH
Pre-Catalyst NOx Emissions	**0.60**	G/BHP/Hr			**0.80**	G/BKW/Hr
Pre-Catalyst NOx Emissions	**50**	PPMV@15% O2			**50**	PPMV@15% O2
Pre-Catalyst NOx Emissions	**1.8**	Lbs/MWe/Hr			**0.8**	Kg/MWe/Hr
Post-Catalyst NOx Emissions	**0.024**	G/BHP/Hr	88.34	gram/hr	**0.032**	G/BKW/Hr
Post-Catalyst NOx Emissions	**2.0**	PPMV@15% O2			**2.0**	PPMV@15% O2
Post-Catalyst NOx Emissions	**0.07**	Lbs/MWe/Hr	0.19	Lbs/hr	**0.03**	Kg/MWe/Hr
Percentage NOx Reduction	**96.0**	%	4.67	lbs/day	**96.0**	%
Pre-Catalyst CO Emissions	**2.50**	G/BHP/Hr	1,616.52	Lbs/year	**3.35**	G/BKW/Hr
Pre-Catalyst CO Emissions	**338**	PPMV@15% O2			**338**	PPMV@15% O2
Pre-Catalyst CO Emissions	**7.6**	Lbs/MWe/Hr			**3.5**	Kg/MWe/Hr
Post-Catalyst CO Emissions	**0.067**	G/BHP/Hr	246.63	gram/hr	**0.090**	G/BKW/Hr
Post-Catalyst CO Emissions	**9.0**	PPMV@15% O2			**9.0**	PPMV@15% O2
Post-Catalyst CO Emissions	**0.20**	Lbs/MWe/Hr	0.55	Lbs/hr	**0.09**	Kg/MWe/Hr
Percentage CO Reduction	**97.3**	%	13.20	lbs/day	**97.3**	%
Pre-Catalyst VOC Emissions	**0.33**	G/BHP/Hr	4,565.00	Lbs/year	**0.44**	G/BKW/Hr
Pre-Catalyst VOC Emissions	**78**	PPMV@15% O2			**78**	PPMV@15% O2
Pre-Catalyst VOC Emissions	**1.0**	Lbs/MWe/Hr			**0.5**	Kg/MWe/Hr
Post-Catalyst VOC Emissions	**0.034**	G/BHP/Hr	125.15	gram/hr	**0.046**	G/BKW/Hr
Post-Catalyst VOC Emissions	**8.0**	PPMV@15% O2			**8.0**	PPMV@15% O2
Post-Catalyst VOC Emissions	**0.10**	Lbs/MWe/Hr	0.28	Lbs/hr	**0.05**	Kg/MWe/Hr
Percentage VOC Reduction	**89.7**	%	6.62	lbs/day	**89.7**	%
Pressure Drop Across Catalyst/Mixer	**6.0**	In. H20	2,290.08	Lbs/year	**15.0**	mbar
Maximum SCR System Ammonia Slip	**5**	PPMV			**5**	PPMV
40%/60% Urea/H2O Consumption Rate	**1.1**	Gal/Hour			**4.3**	Liter/Hr
SCR Catalyst Volume	**75.00**	Cu. Ft			**2.124**	Cu/Meter
SCR Catalyst Configuration	**10x10x3x12**				**10x10x3x300**	
SCR Catalyst Space Velocity	**5,989**	$SCFH/FT^3$			**5,989**	$SCMH/M^3$
Oxidation Catalyst Volume	**16.67**	Cu. Ft			**0.472**	Cu/Meter
Oxidation Catalyst Configuration	**10x10x2x4**				**10x10x2x100**	
Oxidation Catalyst Space Velocity	**26,952**	$SCFH/FT^3$			**26,952**	$SCMH/M^3$

AP-42 Table 3.2-2

	Lb/MMBTU	MMBTU/lb	MMBTU/lb	PPH	PPD	PPY
PM 10	7.71E-05	20.446	22.6275882	0.00174	0.04187	14.5
PM2.5	7.71E-05	20.446	22.6275882	0.00174	0.04187	14.5
SO2	5.88E-04	20.446	22.6275882	0.0133	0.3193	110.4

GE, Steve Hall e-mail dated 05-17-2018

	gr/bhp-hr	gr/hr	kg/hr	PPH	PPD	PPY
PM 10	2.50E-02	92.025	0.092	0.203	4.865	1,682
PM2.5	2.50E-02	92.025	0.092	0.203	4.865	1,682

Cooling Tower

Cooling Tower Cells		6
Cooling Tower Cells in Operation		5
ng Tower Circulating Water Rate per Cell		3,800
Cooling Tower Circulating Water Rate	gpm	19,000
Total Dissolved Solids	PPMW	7,000
Drift loss of circulating water	%	0.001
Density of water	lb/gal	8.34
Annual Operating hours	hrs	1

Total chiller capacity
Average Annual
Total CW flow
Average Annual CW Flow

PM =	lb/hr	**0.67**	lb/day	**15.97**	lb/year	**5,830.06**
$PM_{2.5}$ =	lb/hr	**0.40**	lb/day	**9.58**	lb/year	**3,498.04**

Cogen-1 and Cogen-2 Startup/Shutdown Schedule per Manufacturer

Tina Su

To: Thomas Marihart
Subject: RE: Proposal Requirements for 2 x JMS 616, Natural gas, casino, baseload, TriGen, SCAQMD

From: Thomas Marihart <TMarihart@nes-wes.com>
Sent: Thursday, September 27, 2018 6:40 PM
To: Dubinsky, Irina <IDubinsky@Vanderweil.com>
Cc: Matthew Niezgorski <MNiezgorski@nes-wes.com>; Adam Masten <AMasten@pennpowergroup.com>; MacMartin, Bryce <BMacMartin@Vanderweil.com>; Duncan, Jeff <JDuncan@Vanderweil.com>
Subject: Re: Proposal Requirements for 2 x JMS 616, Natural gas, casino, baseload, TriGen, SCAQMD

Irina,

I was able to speak with Matthew this evening (and he can chime in and correct any of the below as needed) and the general answers to your questions can be summarized as follows:

1. Startup: duration for each startup, numbers of startup per year based on maintenance requirements, and emissions or emission factors;

Generally speaking based on scheduled maintenance requirements, there are shut downs every 2000 hours or roughly 4 times per year/quarterly for about eight hours each time on average for oil changes and other types of service.

Assuming the engine is warm/with block warmers, the engine can start up in as fast as five minutes(typical warm start rate is 10 kW per second), and should typically be under 10 minutes, to be at both full rated output/full load, and have Emissions control system catalysts warmed up and functioning at permitted levels. Operational caveats: At 25% load, the Lenox system starts to kick in managing the raw emissions, and at 50% load the exhaust emissions after treatment system starts to kick in and manage towards permitted levels. Bottom line, after the engine reaches full load in just about five minutes, and within 10 minutes everything should be warmed up and functioning at permit conditions.

1. Shutdown: duration for each shutdown, numbers of shutdowns per year based on maintenance requirements, and emissions or emission factors;

Generally speaking the number of shut downs per year are the same as the number of start ups… Every 2000 hours, quarterly roughly 4 times per year for oil changes and other various service. Shutting Down is actually a bit quicker than start up and typically the engine can be shedding load from 100% to 0% load with cool downtime in about five minutes. Caveat: probably takes less than Half that time to get down to 50% load below which the emissions Control systems output is no longer optimal.

See also attached below some of the longer intervals and hours for downtime for scheduled maintenance on longer intervals.

J 616	2.000 Ophs	6.000 Ophs	10.000 Ophs	20.000 Ophs	30.000 Ophs	40.000 Ophs
	1 Tech.	1 Tech.	2 Tech.	2 Tech.	2 Tech.	2 Tech.

Gen Set

1.] Versions Maintenance schedule "A" & "C"

Working time / h	12	17	47	78	267	
Down time	12 h	16 h	3 Tage / days	4 Tage / days	16 Tage / days	

2.) Versions Maintenance schedule "B"

Working time / h	12	17	47	222	136	234
Down time	12 h	16 h	3 Tage / days	13 Tage / days	8 Tage / days	14 Tage / days

4.) Versions Maintenance schedule "D"

Working time / h	12	17	47	84	267	
Down time	12 h	16 h	3 Tage / days	4 Tage / days	16 Tage / days	

4.) Versions Maintenance schedule "D_2" (= Direct ignition)

Note in the chart above that it list 2000 operating hours Service intervals with 12 hours of downtime but my service team tells us this is worst-case and typical is eight hours as earlier stated above for both start ups and shut downs quarterly.

Between the earlier response from Adam and the above, are we good to go for the time being or did you have any follow-up questions?

Thank you,

Thomas Marihart

Business Development Manager

Western Energy Systems

Tmarihart@nes-wes.com

559-246-4045

http://www.nes-wes.com/

https://www.linkedin.com/pub/thomas-marihart/1/403/14b

New Cooling Towers

UPDATE™ Version 5.8.109
Product Data: 2/15/2018 (Current)

4/20/2018 3:22:25 PM

Job Information

Selected By

R.T. Forbes Company, Inc.
One Lummus Ave.
Danvers, MA
scogland@comcast.net

Jeff Scogland
Tel 978-777-1220
Fax 978-777-1750

Cooling Tower Definition

Manufacturer	Marley	Fan Motor Speed	1800 rpm
Product	NC Steel	Required Fan Motor Output per cell *	67.8 BHp
Model	NC8414XCN6	Required Fan Motor Output total *	406.8 BHp
Cells	6	Fan Motor Capacity per cell	100.0 Hp
CTI Certified	Yes	Fan Motor Output per cell	100.0 BHp
Fan	12.00 ft, 5 Blades	Fan Motor Output total	600.0 BHp
Fan Speed	260 rpm, 9801.8 fpm	Air Flow per cell	317700 cfm
Fans per cell	1	Air Flow total	1906500 cfm
Fill Type	MX75	Static Lift	22.96 ft
		Distribution Head Loss	0.00 ft
		ASHRAE 90.1 Performance	48.4 gpm/Hp

Model Group: Ultra Quiet Fan (C)

* Required Fan Motor Output assumes VFD operation

Conditions

Tower Water Flow	23400 gpm	Air Density In	0.07130 lb/ft³
Hot Water Temperature	96.00 °F	Air Density Out	0.07077 lb/ft³
Range	11.00 °F	Humidity Ratio In	0.01585
Cold Water Temperature	85.00 °F	Humidity Ratio Out	0.03170
Approach	9.00 °F	Wet-Bulb Temp. Out	90.49 °F
Wet-Bulb Temperature	76.00 °F	Estimated Evaporation	250 gpm
Relative Humidity	50.0 %	Total Heat Rejection	128240000 Btu/h
Capacity	112.4 %		

- This selection satisfies your design conditions.

Weights & Dimensions

	Per Cell	Total
Shipping Weight	21900 lb	131200 lb
Heaviest Section	12700 lb	
Max Operating Weight	48100 lb	288800 lb
Width	22.42 ft	22.42 ft
Length	13.90 ft	84.84 ft
Height	26.99 ft	

Minimum Enclosure Clearance

Clearance required on air inlet sides of tower without altering performance. Assumes no air from below tower.

Solid Wall	16.78 ft
50 % Open Wall	9.92 ft

Weights and dimensions do not include options; refer to sales drawings. For CAD layouts refer to file 8414_CN.dxf

Cold Weather Operation

Heater Sizing (to prevent freezing in the collection basin during periods of shutdown)

Heater kW/Cell	30.0	24.0	18.0	15.0	12.0	9.0	7.5
Ambient Temperature °F	-18.82	-6.29	6.25	12.51	18.78	25.05	28.18

New Cooling Towers - 6 Cells Total

UPDATE™ Version 5.8.109
Product Data: 2/15/2018 (Current)

4/20/2018 3:22:25 PM

Job Information

Selected By

R.T. Forbes Company, Inc.
One Lummus Ave.
Danvers, MA
scogland@comcast.net

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Cooling Tower Definition

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		Distribution Head Loss	0.00 ft
		ASHRAE 90.1 Performance	48.4 gpm/Hp

Model Group: Ultra Quiet Fan (C)

* Required Fan Motor Output assumes VFD operation

Conditions

Tower Water Flow	23400 gpm	Air Density In	0.07130 lb/ft³
Hot Water Temperature	96.00 °F	Air Density Out	0.07077 lb/ft³
Range	11.00 °F	Humidity Ratio In	0.01585
Cold Water Temperature	85.00 °F	Humidity Ratio Out	0.03170
Approach	9.00 °F	Wet-Bulb Temp. Out	90.49 °F
Wet-Bulb Temperature	76.00 °F	Estimated Evaporation	250 gpm
Relative Humidity	50.0 %	Total Heat Rejection	128240000 Btu/h
Capacity	112.4 %		

- This selection satisfies your design conditions.

Weights & Dimensions

	Per Cell	Total
Shipping Weight	21900 lb	131200 lb
Heaviest Section	12700 lb	
Max Operating Weight	48100 lb	288800 lb
Width	22.42 ft	22.42 ft
Length	13.90 ft	84.84 ft
Height	26.99 ft	

Minimum Enclosure Clearance

Clearance required on air inlet sides of tower without altering performance. Assumes no air from below tower.

Solid Wall	16.78 ft
50 % Open Wall	9.92 ft

Weights and dimensions do not include options; refer to sales drawings. For CAD layouts refer to file 8414_CN.dxf

Cold Weather Operation

Heater Sizing (to prevent freezing in the collection basin during periods of shutdown)

Heater kW/Cell	30.0	24.0	18.0	15.0	12.0	9.0	7.5
Ambient Temperature °F	-18.82	-6.29	6.25	12.51	18.78	25.05	28.18

Tina Su

From: Jeff Scogland <scogland@comcast.net>
Sent: Tuesday, July 10, 2018 11:46 AM
To: Tina Su
Subject: RE: Drift loss of this cooling tower

Tina,

Confirmed, the drift rate is still 0.0005% for this NC8414XCN6.

Thank You,

Jeff Scogland
R.T. Forbes Company
Office: 978-777-1220 Cell: 617-791-7485
SPX Cooling Technologies - Marley & Recold Products
Kelvion Plate Heat Exchangers
Puroflux Filters & Separators
Griswold Water Systems

From: Tina Su [mailto:TSu@esassoc.com]
Sent: Friday, July 06, 2018 2:24 PM
To: Jeff Scogland <scogland@comcast.net>
Subject: RE: Drift loss of this cooling tower

Hi Jeff,

We got an updated quote for a 23,400 gpm unit (see attached), can you please help double check whether the drift rate is still 0.0005%?

Thanks,
Tina

Tingzhi (Tina) Su
Managing Associate
ESA
949.870.1517

From: Jeff Scogland [mailto:scogland@comcast.net]
Sent: Thursday, June 28, 2018 7:30 AM
To: Tina Su <TSu@esassoc.com>
Subject: RE: Drift loss of this cooling tower

Tina,

Glad we asked:

For this NC8414XCN6 tower with a duty of 22,800 gpm @ 96.2/85/78 degF, the drift rate is 0.0005%.

Thanks,

Jeff Scogland
R.T. Forbes Company
Office: 978-777-1220 Cell: 617-791-7485
SPX Cooling Technologies - Marley & Recold Products
Kelvion Plate Heat Exchangers
Puroflux Filters & Separators
Griswold Water Systems

From: Tina Su [mailto:TSu@esassoc.com]
Sent: Wednesday, June 27, 2018 5:15 PM
To: Jeff Scogland <scogland@comcast.net>
Subject: RE: Drift loss of this cooling tower

Thanks, Jeff. That helps! If you do have the specific drift loss of the selection handy, that would be even better for us to use in the air permit application.

Tingzhi (Tina) Su
Managing Associate
ESA
949.870.1517

From: Jeff Scogland [mailto:scogland@comcast.net]
Sent: Wednesday, June 27, 2018 2:07 PM
To: Tina Su <TSu@esassoc.com>
Subject: RE: Drift loss of this cooling tower

Tina,

Thanks for reaching out. The drift loss is guaranteed to be less than 0.005% of the circulating water. That is a standard guarantee for all models that use the Marley DE, does the drift rate need to be less or would that help? I will forward to ratings to find the specific drift loss of the selection.

Thank You,

Jeff Scogland
R.T. Forbes Company
Office: 978-777-1220 Cell: 617-791-7485
SPX Cooling Technologies - Marley & Recold Products
Kelvion Plate Heat Exchangers
Puroflux Filters & Separators
Griswold Water Systems

From: Tina Su [mailto:TSu@esassoc.com]
Sent: Wednesday, June 27, 2018 4:51 PM
To: scogland@comcast.net
Subject: Drift loss of this cooling tower

Hi Jeff,

I'm doing some emission calculations for permitting purpose of the attached cooling tower for my client, would you please let me know what is the drift loss of this cooling tower?

Thanks,
Tina

Tingzhi (Tina) Su, Ph.D.
Managing Associate
ESA | Environmental Science Associates
2121 Alton Parkway, Suite 100
Irvine, CA 92606
949.753.7001 main | 949.753.7002 fax
949.870.1517 direct
TSu@esassoc.com | www.esassoc.com

Enviro – Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907
Cooling Towers

Date: June 19, 2018

Mr. Clifford Batten
San Manuel Band of Mission Indians
Environmental Department
26569 Community Center Drive
Highland, CA 92346
Tel(909)864-8933 Email:cbatten@sanmanuel-ncn.gov

Project: **Chiller 2018 3rd QTR**
Lab I.D.: **180618-43 through -46**

Dear Mr. Batten:

The **analytical results** for the water samples, received by our lab on June 18, 2018, are attached. The samples were received chilled, intact, and accompanying chain of custody.

Enviro-Chem appreciates the opportunity to provide you and your company this and other services. Please do not hesitate to call us if you have any questions.

Sincerely,

Curtis Desilets
Vice President/Program Manager

for
Andy Wang
Laboratory Manager

Enviro – Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

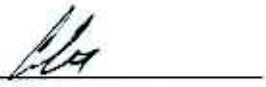
LABORATORY REPORT

CUSTOMER: **San Manuel Band of Mission Indians**
Environmental Department
26569 Community Center Drive, Highland, CA 92346
Tel(909)864-8933 Email:cbatten@sanmanuel-ncn.gov
PROJECT: **Chiller 2018 3rd QTR**
MATRIX:WATER DATE RECEIVED:06/18/18
DATE SAMPLED:06/18/18 DATE ANALYZED:06/19/18
REPORT TO:MR. CLIFFORD BATTEN DATE REPORTED:06/19/18

SAMPLE I.D.: **CHLL-1** LAB I.D.: 180618-43

PARAMETER	UNIT	SAMPLE RESULT	PQL	DF	TEST METHOD
TDS	mg/L	1300	1.00	1	SM 2540C

COMMENTS
DF = Dilution Factor
PQL = Practical Quantitation Limit
Actual Detection Limit = PQL X DF
mg/L = Milligram per Liter = PPM
TDS = Total Dissolved Solid

DATA REVIEWED AND APPROVED BY: 
CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro – Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: **San Manuel Band of Mission Indians**
Environmental Department
26569 Community Center Drive, Highland, CA 92346
Tel(909)864-8933 Email:cbatten@sanmanuel-ncn.gov
PROJECT: **Chiller 2018 3rd QTR**
MATRIX:WATER DATE RECEIVED:06/18/18
DATE SAMPLED:06/18/18 DATE ANALYZED:06/19/18
REPORT TO:MR. CLIFFORD BATTEN DATE REPORTED:06/19/18

SAMPLE I.D.: **CHLL-2** LAB I.D.: 180618-44

PARAMETER	UNIT	SAMPLE RESULT	PQL	DF	TEST METHOD
TDS	mg/L	1380	1.00	1	SM 2540C

COMMENTS
DF = Dilution Factor
PQL = Practical Quantitation Limit
Actual Detection Limit = PQL X DF
mg/L = Milligram per Liter = PPM
TDS = Total Dissolved Solid

DATA REVIEWED AND APPROVED BY: _____
CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro – Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: **San Manuel Band of Mission Indians**
Environmental Department
26569 Community Center Drive, Highland, CA 92346
Tel(909)864-8933 Email:cbatten@sanmanuel-ncn.gov
PROJECT: **Chiller 2018 3rd QTR**
MATRIX:WATER DATE RECEIVED:06/18/18
DATE SAMPLED:06/18/18 DATE ANALYZED:06/19/18
REPORT TO:MR. CLIFFORD BATTEN DATE REPORTED:06/19/18

SAMPLE I.D.: **CHLL-3** LAB I.D.: 180618-45

PARAMETER	UNIT	SAMPLE RESULT	PQL	DF	TEST METHOD
TDS	mg/L	1210	1.00	1	SM 2540C

COMMENTS
DF = Dilution Factor
PQL = Practical Quantitation Limit
Actual Detection Limit = PQL X DF
mg/L = Milligram per Liter = PPM
TDS = Total Dissolved Solid

DATA REVIEWED AND APPROVED BY: _____
CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro – Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: **San Manuel Band of Mission Indians**
Environmental Department
26569 Community Center Drive, Highland, CA 92346
Tel(909)864-8933 Email:cbatten@sanmanuel-ncn.gov
PROJECT: **Chiller 2018 3rd QTR**
MATRIX:WATER DATE RECEIVED:06/18/18
DATE SAMPLED:06/18/18 DATE ANALYZED:06/19/18
REPORT TO:MR. CLIFFORD BATTEN DATE REPORTED:06/19/18

SAMPLE I.D.: **CHLL-D** LAB I.D.: 180618-46

PARAMETER	UNIT	SAMPLE RESULT	PQL	DF	TEST METHOD
TDS	mg/L	1200	1.00	1	SM 2540C

COMMENTS
DF = Dilution Factor
PQL = Practical Quantitation Limit
Actual Detection Limit = PQL X DF
mg/L = Milligram per Liter = PPM
TDS = Total Dissolved Solid

DATA REVIEWED AND APPROVED BY: 
CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro-Chem, Inc. Laboratories
1214 E. Lexington Avenue,
Pomona, CA 91766
Tel: (909) 590-5905 Fax: (909) 590-5907
CA-DHS ELAP CERTIFICATE #1555

Turnaround Time
0 ~~Same Day~~
Ø 24 Hours
0 ~~48 Hours~~
0 72 Hours
0 1 Week (Standard)
Other: RUSH

SAMPLE ID	LAB ID	SAMPLING DATE	SAMPLING TIME	MATRIX	No. OF CONTAINERS	TEMPERATURE	PRESERVATION	TDS	Analysis Required	COMMENTS
CHLL-1	80618-43	6/18/18	12:34	H_2O	1	4°C	None		X	
CHLL-2	-44	6/18/18	12:36	↓	1	↓	↓		X	
CHLL-3	-45	6/18/18	12:39		1				X	
CHLL-D	-46	6/18/18	12:40		1				X	
					four 1pts					

Misc./PO#

Company Name: San Manuel Band of Mission Indians
Address: 101 Pure Water Lane
City/State/Zip: Highland, CA 92346

Project Contact: Clifford Batten
Tel: (909) 864-8933
Fax/Email: cbatten@sanmanuel-nsn.gov

Sampler's Signature:
Project Name/ID: Chiller 2018 3rd QTR

Relinquished by:	Received by:	Date & Time: 6/18/18 13:33	Instructions for Sample Storage After Analysis:
Relinquished by:	Received by:	Date & Time:	Ø Dispose of O Return to Client O Store (30 Days)
Relinquished by:	Received by:	Date & Time:	O Other:

CHAIN OF CUSTODY RECORD

Date: 6/18/18

WHITE WITH SAMPLE • YELLOW TO CLIENT

C18 Generator Set

Electric Power

Garage Emergency Generator: EG-7

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

Specifications

Generator Set Specifications	
Minimum Rating	455 ekW (569 kVA)
Maximum Rating	500 ekW (625 kVA)
Voltage	480 Volts
Frequency	60 Hz
Speed	1800 RPM

Generator Set Configurations	
Emissions/Fuel Strategy	U.S. EPA Tier 4 Final Nonroad Genset Emission Standards

Engine Specifications	
Engine Model	C18 ATAAC, I-6, 4-Stroke Water-Cooled Diesel
Bore	145 mm (5.71 in)
Displacement	18.13 L (1106.36 in3)
Stroke	183 mm (7.2 in)
Compression Ratio	14.5:1
Aspiration	Air to Air Aftercooled
Governor Type	Adem™A4
Fuel System	Electronic unit injection

Benefits And Features

Cat® Generator Set Packages

Cat® generator set packages have been fully prototype tested, and certified torsional vibration analysis reports are available. The packages are designed to meet the NFPA 110 requirement for loading, and conform to the ISO 8528-5 steady state and transient response requirements.

Cat Diesel Engines

The four cycle Cat diesel engine combines consistent performance with excellent fuel economy and transient response that meets or exceeds ISO 8528-5. The engines have been designed and built for a wide range of applications and can be optimized for low fuel consumption or low emissions. The engines feature a reliable, rugged, and durable design that has been field proven in thousands of applications worldwide from emergency standby installations to continuously operating power plants.

Cooling System

The cooling system has been designed to operate in standard ambient temperatures up to 50°C (122°F) with an air flow restriction of 0.5 in water. The factory installed cooling system has been designed and tested to ensure proper generator set cooling, and includes the radiator, fan, belts, and all guarding installed as standard. Contact your Cat Dealer for specific ambient and altitude capabilities.

Generators

The generators used on Cat packages have been designed and tested to work with the Cat engine. The generators are built with robust Class H insulation and provide industry leading motor starting capability. They provide high efficiency in a majority of applications and optional coastal protection for the windings is available for harsh environments.

Cat EMCP Control Panel

The EMCP controller features the reliability and durability you have come to expect from your Cat equipment. EMCP 4 is a scalable control platform designed to ensure reliable generator set operation, providing extensive information about power output and engine operation. EMCP 4 systems can be further customized to meet your needs through programming and expansion modules.

Cat Integrated Voltage Regulation

The Cat IVR has three phase sensing with adjustable volts-per-hertz regulation. It Provides precise control, excellent block loading, and constant voltage in the normal operating range.

Cat Clean Emissions Module (CEM)

Aftertreatment module consists of Cat Regeneration System (CRS), Diesel Oxidation Catalyst (DOC), Diesel Particulate Filter (DPF), and Selective Catalytic Reduction (SCR).

Diesel Exhaust Fluid (DEF) System

The DEF system consists of a 25 gallon tank with an on-tank fill, integrated pump, a level sensor and heating elements. This incorporates electrically heated DEF lines from the DEF tank to the CEM. The system is equipped with low and critically low level alarms and a critically low shutdown

World Wide Product Support

Cat dealers provide extensive post-sale support including maintenance and repair agreements. Cat dealers have over 1,800 dealer branch stores operating in 200 countries. The Caterpillar S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

Optional Equipment

Engine Options

- Air Cleaner: [ ] Disposable air cleaner [ ] Single element air cleaner [ ] Heavy duty air cleaner
- Batteries: [ ] Standard
- Starting Motors: [ ] Standard
- Battery Charger: [ ] 10 Amp UL Listed
- Starting Aids: [ ] Jacket Water Heater UL Listed

Control System

- Controller: [ ] EMCP 4.2 [ ] EMCP 4.4
- Local annunciator module: [ ] NFPA 110
- Remote annunciator Module: [ ] NFPA 110
- Additional Options: [ ] Expansion I/O module [ ] Remote monitoring software

Generator

- Excitation: [ ] Internally Excited (IE)
- Anti-condensation heater
- Oversize and premium generators
- Coastal protection

Power Termination

- Circuit breakers, UL listed

General

- Certifications: [ ] UL 2200 package
- Skid Base: [ ] Wide
- Fuel Tanks: [ ] Dual wall sub-base [ ] 5 Gallon spill containment with pipe extending to within 6" from bottom
  [ ] 5 Gallon spill containment with Overfill prevention valve
- Enclosures: [ ] Sound attenuated
- Automatic transfer switches (ATS)

Extended Service Contract (ESC)

- Extended Service Contract (ESC): [ ] 2 Year [ ] 3 Year [ ] 4 Year [ ] 5 Year

Rating Type: STANDBY

Emissions: U.S. EPA Tier 4 Final Nonroad Genset Emission Standards

Image shown may not reflect actual configuration

C18 ACERT

500 ekW/ 625 kVA
60 Hz/ 1800 rpm/ 480 V

	Metric	English
Package Performance		
Genset Power Rating with Fan @ 0.8 Power Factor	500 ekW	
Genset Power Rating	625 kVA	
Aftercooler (Separate Circuit)	N/A	N/A
Fuel Consumption		
100% Load with Fan	140.1 L/hr	37.0 gal/hr
75% Load with Fan	106.7 L/hr	28.2 gal/hr
50% Load with Fan	75.9 L/hr	20.1 gal/hr
25% Load with Fan	47.0 L/hr	12.4 gal/hr
Cooling System[1]		
Engine Coolant Capacity	26.9 L	7.1 gal
Inlet Air		
Combustion Air Inlet Flow Rate	37.9 m³/min	1340.0 cfm
Max. Allowable Combustion Air Inlet Temp	50 ° C	122 ° F
Exhaust System		
Exhaust Stack Gas Temperature	447.1 ° C	836.8 ° F
Exhaust Gas Flow Rate	69.8 m³/min	2465.3 cfm
Exhaust System Backpressure (Maximum Allowable)	10.0 kPa	40.0 in. water

Rating Type: STANDBY

Emissions: U.S. EPA Tier 4 Final Nonroad Genset Emission Standards

Heat Rejection		
Heat Rejection to Jacket Water	283 kW	16110 Btu/min
Heat Rejection to Exhaust (Total)	514 kW	29204 Btu/min
Heat Rejection to Aftercooler	113 kW	6454 Btu/min
Heat Rejection to Atmosphere from Engine	28 kW	1603 Btu/min
Heat Rejection to Atmosphere from Generator	29 kW	1621 Btu/min

Alternator[2]	
Motor Starting Capability @ 30% Voltage Dip	1729 skVA
Current	752 amps
Frame Size	LC6124G
Excitation	AR
Temperature Rise	105 ° C

Emissions (Nominal)[3]		
NOx	100.5 mg/Nm³	0.2 g/hp-hr
CO	N/A	N/A
HC	4.9 mg/Nm³	0.0 g/hp-hr
PM	2.2 mg/Nm³	0.0 g/hp-hr

DEFINITIONS AND CONDITIONS

1. For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.

2. UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics. Generator temperature rise is based on a 40° C ambient per NEMA MG1-32.

3. Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77° F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

Rating Type: STANDBY

Emissions: U.S. EPA Tier 4 Final Nonroad Genset Emission Standards

Applicable Codes and Standards:
AS1359, CSA C22.2 No100-04, UL142,UL489, UL869, UL2200,
NFPA37, NFPA70, NFPA99, NFPA110, IBC, IEC60034-1, ISO3046, ISO8528,
NEMA MG1-22,NEMA MG1-33, 2006/95/EC, 2006/42/EC, 2004/108/EC

Note: Codes may not be available in all model configurations. Please consult your local Cat dealer representative for availability.

STANDBY: Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions

Fuel Rates are based on fuel oil of 35º API [16º C (60º F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29º C (85º F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.). Additional ratings may be available for specific customer requirements, contact your Cat representative for details. For information regarding Low Sulfur fuel and Biodiesel capability, please consult your Cat dealer.

www.Cat-ElectricPower.com

Performance No.: EM1017-02

Feature Code: C18DE9D

Generator Arrangement: 4183885

Date: 03/09/2017

Source Country: U.S.

The International System of Units (SI) is used in this publication.

PERFORMANCE DATA[EM1017]

June 19, 2018

Performance Number: EM1017 **Change Level: 03**

SALES MODEL:	C18	**COMBUSTION:**	DI
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	779	**HERTZ:**	60
GEN POWER WITH FAN (EKW):	500.0	**FAN POWER (HP):**	32.2
COMPRESSION RATIO:	16.1	**ADDITIONAL PARASITICS (HP):**	2.7
RATING LEVEL:	STANDBY	**ASPIRATION:**	TA
PUMP QUANTITY:	1	**AFTERCOOLER TYPE:**	ATAAC
FUEL TYPE:	DIESEL	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
MANIFOLD TYPE:	DRY	**INLET MANIFOLD AIR TEMP (F):**	127
GOVERNOR TYPE:	ELEC	**JACKET WATER TEMP (F):**	192.2
ELECTRONICS TYPE:	ADEM4	**TURBO CONFIGURATION:**	SINGLE
CAMSHAFT TYPE:	STANDARD	**TURBO QUANTITY:**	1
IGNITION TYPE:	CI	**TURBOCHARGER MODEL:**	S430S 0.88 A/R VOF
INJECTOR TYPE:	EUI	**CERTIFICATION YEAR:**	2015
REF EXH STACK DIAMETER (IN):	6	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,161.4
MAX OPERATING ALTITUDE (FT):	3,002		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET

General Performance Data

INLET MANIFOLD AIR TEMPERATURE ("INLET MFLD TEMP") FOR THIS CONFIGURATION IS MEASURED AT THE OUTLET OF THE AFTERCOOLER.

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP
EKW	%	BHP	PSI	LB/BHP-HR	GAL/HR	IN-HG	DEG F	DEG F	IN-HG	DEG F
500.0	100	744	296	0.348	37.0	69.3	122.2	1,261.4	86.5	836.8
450.0	90	673	267	0.349	33.5	63.8	122.1	1,208.5	79.6	799.7
400.0	80	601	239	0.348	29.9	57.8	122.1	1,152.4	72.0	761.9
375.0	75	566	225	0.349	28.2	54.7	122.1	1,125.7	68.2	744.2
350.0	70	530	211	0.350	26.5	51.5	122.1	1,100.2	64.4	727.6
300.0	60	460	183	0.354	23.2	45.2	122.0	1,048.6	56.7	694.6
250.0	50	390	155	0.360	20.1	38.6	122.0	993.0	49.1	659.8
200.0	40	321	128	0.370	17.0	31.6	121.7	930.1	41.7	620.8
150.0	30	252	100	0.386	13.9	24.9	121.2	856.8	34.2	576.1
125.0	25	218	87	0.400	12.4	21.8	120.9	815.8	30.5	551.4
100.0	20	182	73	0.419	10.9	18.9	120.0	769.5	27.2	523.9
50.0	10	110	44	0.506	7.9	14.1	114.9	654.1	23.6	456.8

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	IN-HG	DEG F	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
500.0	100	744	76	401.6	1,340.0	2,465.3	5,817.5	6,076.5	934.9	843.1
450.0	90	673	70	382.0	1,282.0	2,350.9	5,554.9	5,788.7	917.8	831.6
400.0	80	601	64	360.3	1,211.3	2,221.8	5,237.0	5,446.2	894.3	813.8
375.0	75	566	60	349.3	1,173.9	2,156.0	5,069.8	5,267.1	880.5	802.8
350.0	70	530	57	338.1	1,135.6	2,089.2	4,899.2	5,084.7	865.2	790.2
300.0	60	460	50	315.1	1,056.3	1,949.9	4,547.3	4,709.8	830.6	761.4
250.0	50	390	43	290.8	972.6	1,801.9	4,177.8	4,318.1	791.4	728.3
200.0	40	321	36	261.7	871.7	1,621.2	3,735.6	3,854.2	737.7	682.0
150.0	30	252	29	232.7	780.5	1,440.5	3,336.9	3,434.4	683.8	635.7
125.0	25	218	25	218.8	742.6	1,354.0	3,171.5	3,258.4	658.4	614.1
100.0	20	182	22	205.9	714.2	1,274.2	3,047.2	3,123.6	637.0	596.4
50.0	10	110	18	183.4	688.2	1,136.5	2,933.1	2,988.7	609.7	577.6

Heat Rejection Data

GENSET POWER WITH	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET	REJECTION TO	REJECTION TO EXH	EXHUAST RECOVERY	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE	HIGH HEAT VALUE

PERFORMANCE DATA[EM1017]

June 19, 2018

FAN			WATER	ATMOSPHERE		TO 350F				ENERGY	ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
500.0	100	744	16,038	5,739	24,758	12,589	4,231	6,509	31,568	79,429	84,612
450.0	90	673	14,560	5,356	22,331	11,023	3,827	5,781	28,519	71,857	76,546
400.0	80	601	13,203	4,843	19,835	9,453	3,419	4,995	25,499	64,187	68,376
375.0	75	566	12,567	4,609	18,654	8,732	3,222	4,613	23,998	60,493	64,440
350.0	70	530	11,954	4,397	17,522	8,056	3,030	4,239	22,495	56,894	60,607
300.0	60	460	10,771	3,992	15,335	6,779	2,656	3,515	19,509	49,869	53,123
250.0	50	390	9,626	3,651	13,207	5,563	2,292	2,825	16,539	43,040	45,848
200.0	40	321	8,495	3,583	10,986	4,318	1,939	2,095	13,629	36,413	38,788
150.0	30	252	7,376	3,338	8,946	3,194	1,593	1,490	10,707	29,906	31,858
125.0	25	218	6,818	3,097	8,025	2,691	1,421	1,243	9,230	26,674	28,414
100.0	20	182	6,239	2,779	7,179	2,218	1,249	1,048	7,733	23,449	24,979
50.0	10	110	4,839	2,191	5,647	1,288	907	804	4,660	17,030	18,141

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	500.0	375.0	250.0	125.0	50.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	744	566	390	218	110
TOTAL NOX (AS NO2)		G/HR	232	225	70	22	53
TOTAL CO		G/HR	0	0	0	0	0
TOTAL HC		G/HR	20	8	0	0	0
PART MATTER		G/HR	16.6	7.8	5.0	3.2	2.1
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	144.8	183.4	80.3	45.3	188.2
TOTAL CO	(CORR 5% O2)	MG/NM3	0.0	0.0	0.0	0.0	0.1
TOTAL HC	(CORR 5% O2)	MG/NM3	10.5	5.4	0.0	0.0	0.0
PART MATTER	(CORR 5% O2)	MG/NM3	8.3	5.3	4.9	5.3	5.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	71	89	39	22	92
TOTAL CO	(CORR 5% O2)	PPM	0	0	0	0	0
TOTAL HC	(CORR 5% O2)	PPM	20	10	0	0	0
TOTAL NOX (AS NO2)		G/HP-HR	0.31	0.40	0.18	0.10	0.49
TOTAL CO		G/HP-HR	0.00	0.00	0.00	0.00	0.00
TOTAL HC		G/HP-HR	0.03	0.01	0.00	0.00	0.00
PART MATTER		G/HP-HR	0.02	0.01	0.01	0.01	0.02
TOTAL NOX (AS NO2)		LB/HR	0.51	0.50	0.15	0.05	0.12
TOTAL CO		LB/HR	0.00	0.00	0.00	0.00	0.00
TOTAL HC		LB/HR	0.04	0.02	0.00	0.00	0.00
PART MATTER		LB/HR	0.04	0.02	0.01	0.01	0.00

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		EKW	500.0	375.0	250.0	125.0	50.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	744	566	390	218	110
TOTAL NOX (AS NO2)		G/HR	161	156	48	15	37
TOTAL CO		G/HR	0	0	0	0	0
TOTAL HC		G/HR	9	4	0	0	0
TOTAL CO2		KG/HR	375	285	203	125	80
PART MATTER		G/HR	4.3	2.0	1.3	0.8	0.6
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	100.5	127.4	55.8	31.4	130.7
TOTAL CO	(CORR 5% O2)	MG/NM3	0.0	0.0	0.0	0.0	0.0
TOTAL HC	(CORR 5% O2)	MG/NM3	4.9	2.5	0.0	0.0	0.0
PART MATTER	(CORR 5% O2)	MG/NM3	2.2	1.4	1.3	1.4	1.5
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	49	62	27	15	64
TOTAL CO	(CORR 5% O2)	PPM	0	0	0	0	0
TOTAL HC	(CORR 5% O2)	PPM	9	5	0	0	0
FORMALDEHYDE	(CORR 15% O2)	PPM	0.00	0.00	0.00	0.03	0.01
ACROLEIN	(CORR 15% O2)	PPM	0.10	0.15	0.57	0.35	0.62
ACETALDEHYDE	(CORR 15% O2)	PPM	0.16	0.32	0.42	0.10	0.71
METHANOL	(CORR 15% O2)	PPM	0.00	0.07	0.03	0.00	0.00
NON-METHANE HC	(CORR 15% O2)	PPM	2.42	1.28	0.00	0.00	0.00
NON-ETHANE HC	(CORR 15% O2)	PPM	2.42	1.28	0.00	0.00	0.00
TOTAL NOX (AS NO2)		G/HP-HR	0.22	0.28	0.13	0.07	0.34
TOTAL CO		G/HP-HR	0.00	0.00	0.00	0.00	0.00
TOTAL HC		G/HP-HR	0.01	0.01	0.00	0.00	0.00
PART MATTER		G/HP-HR	0.01	0.00	0.00	0.00	0.01
TOTAL NOX (AS NO2)		LB/HR	0.36	0.34	0.11	0.03	0.08

TOTAL CO	LB/HR	0.00	0.00	0.00	0.00	0.00
TOTAL HC	LB/HR	0.02	0.01	0.00	0.00	0.00
TOTAL CO2	LB/HR	826	628	447	275	176
PART MATTER	LB/HR	0.01	0.00	0.00	0.00	0.00
OXYGEN IN EXH	%	7.6	9.5	11.1	13.2	15.7

Regulatory Information

EPA TIER 4 FINAL		2015 - ----		
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	NON-ROAD GENSET	TIER 4 FINAL	CO: 3.5 NOx: 0.67 HC: 0.19 PM: 0.03

Altitude Derate Data

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)											
0	779	779	779	779	777	774	771	768	576	516	779
1,000	779	779	779	777	774	771	768	699	557	511	778
2,000	779	778	776	774	771	751	719	593	529	501	776
3,000	777	775	773	770	751	651	571	543	516	489	773
4,000	773	771	769	754	674	582	552	526	501	476	770
5,000	769	761	736	669	602	557	533	509	485	462	765
6,000	725	679	653	604	560	536	514	492	470	449	704
7,000	648	592	577	560	537	515	495	474	454	435	648
8,000	585	567	553	538	516	495	475	456	437	418	595
9,000	557	544	531	516	496	476	456	436	418	400	573
10,000	533	522	508	494	474	454	431	404	380	362	555
11,000	514	503	495	487	462	431	398	373	358	357	534
12,000	495	485	483	471	445	417	384	372	371	369	514
13,000	473	463	461	444	412	381	379	378	376	374	495
14,000	449	434	420	392	381	379	378	376	374	372	470
15,000	397	379	367	381	379	377	376	374	372	370	442

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
4150867	PP7129	4190902	PS072	LS	CM800001	
4150867	PP7129	4190904	GS759	LS	CM800001	
5526359	PP7990	5424853	EE545	-	TC400001	

Performance Parameter Reference

Parameters Reference:DM9600-10

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600
APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.
PERFORMANCE PARAMETER TOLERANCE FACTORS:
Power +/- 3%

Torque +/- 3%
Exhaust stack temperature +/- 8%
Inlet airflow +/- 5%
Intake manifold pressure-gage +/- 10%
Exhaust flow +/- 6%
Specific fuel consumption +/- 3%
Fuel rate +/- 5%
Specific DEF consumption +/- 3%
DEF rate +/- 5%
Heat rejection +/- 5%
Heat rejection exhaust only +/- 10%
Heat rejection CEM only +/- 10%
Heat Rejection values based on using treated water.
Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.
On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.
These values do not apply to C280/3600. For these models, see the tolerances listed below.
C280/3600 HEAT REJECTION TOLERANCE FACTORS:
Heat rejection +/- 10%
Heat rejection to Atmosphere +/- 50%
Heat rejection to Lube Oil +/- 20%
Heat rejection to Aftercooler +/- 5%
TEST CELL TRANSDUCER TOLERANCE FACTORS:
Torque +/- 0.5%
Speed +/- 0.2%
Fuel flow +/- 1.0%
Temperature +/- 2.0 C degrees
Intake manifold pressure +/- 0.1 kPa
OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.
REFERENCE ATMOSPHERIC INLET AIR
FOR 3500 ENGINES AND SMALLER
SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.
FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.
MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE
Location for air temperature measurement air cleaner inlet at stabilized operating conditions.
REFERENCE EXHAUST STACK DIAMETER
The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.
REFERENCE FUEL
DIESEL
Reference fuel is #2 distillate diesel with a 35API gravity;
A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 29 deg C (84.2 deg F), where the density is 838.9 G/Liter (7.001 Lbs/Gal).
GAS
Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.
ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD
Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators. For Tier 4 ratings additional Parasitic losses would also include Intake, and Exhaust Restrictions.
ALTITUDE CAPABILITY
Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set.
Standard temperature values versus altitude could be seen on TM2001.
When viewing the altitude capability chart the ambient temperature

is the inlet air temp at the compressor inlet.
Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.
Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.
REGULATIONS AND PRODUCT COMPLIANCE
TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.
EMISSIONS DEFINITIONS:
Emissions : DM1176
HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500
HIGH DISPLACEMENT (HD) DEFINITIONS:
3500: EM1500
RATING DEFINITIONS:
Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 7/7/15

Cat® 3516C
Diesel Generator Sets

EG-8 and EG-9 of the Application

Image shown may not reflect actual configuration

Bore – mm (in)	170 (6.69)
Stroke – mm (in)	190 (7.48)
Displacement – L (in^3)	69 (4210.64)
Compression Ratio	14.7:1
Aspiration	TA
Fuel System	EUI
Governor Type	ADEM™ A3

Standby 60 Hz ekW (kVA)	Mission Critical 60 Hz ekW (kVA)	Prime 60 Hz ekW (kVA)	Emissions Performance
2000 (2500)	2000 (2500)	1825 (2281)	U.S. EPA Tier 4 Final

Standard Features

Cat® Diesel Engine
- Meets U.S. EPA Tier 4 Final emission standards
- Reliable performance proven in thousands of applications worldwide

Generator Set Package
- Accepts 100% block load in one step and meets other NFPA 110 loading requirements
- Conforms to ISO 8528-5 G3 load acceptance requirements
- Reliability verified through torsional vibration, fuel consumption, oil consumption, transient performance, and endurance testing

Alternators
- Superior motor starting capability minimizes need for oversizing generator
- Designed to match performance and output characteristics of Cat diesel engines

Cooling System
- Cooling systems available to operate in ambient temperatures up to 50°C (122°F)
- Tested to ensure proper generator set cooling

Clean Emissions Module
- Diesel oxidation catalyst for particulate matter (PM) and hydrocarbon (HC) control
- Selective catalytic reduction (SCR) for nitrogen oxides (NOx) control
- Integrated electronics for monitoring, protection, and closed loop NOx control

EMCP 4 Control Panels
- User-friendly interface and navigation
- Scalable system to meet a wide range of installation requirements
- Expansion modules and site specific programming for specific customer requirements

Warranty
- 24 months/1000-hour warranty for standby and mission critical ratings
- 12 months/unlimited hour warranty for prime and continuous ratings
- Extended service protection is available to provide extended coverage options

Worldwide Product Support
- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- Your local Cat dealer provides extensive post-sale support, including maintenance and repair agreements

Financing
- Caterpillar offers an array of financial products to help you succeed through financial service excellence
- Options include loans, finance lease, operating lease, working capital, and revolving line of credit
- Contact your local Cat dealer for availability in your region

Optional Equipment

Engine

Air Cleaner
- ❑ Single element
- ❑ Dual element

Muffler
- ❑ Industrial grade (12 dB)

Starting
- ❑ Standard batteries
- ❑ Oversized batteries
- ❑ Standard electric starter(s)
- ❑ Heavy duty electric starter(s)
- ❑ Air starter(s)
- ❑ Jacket water heater

Alternator

Output voltage
- ❑ 480V ❑ 6600V
- ❑ 600V ❑ 6900V
- ❑ 2400V ❑ 12470V
- ❑ 4160V ❑ 13200V
- ❑ 6300V ❑ 13800V

Temperature Rise (over 40°C ambient)
- ❑ 150°C
- ❑ 125°C/130°C
- ❑ 105°C
- ❑ 80°C

Winding type
- ❑ Random wound
- ❑ Form wound

Excitation
- ❑ Self excited
- ❑ Internal excitation (IE)
- ❑ Permanent magnet (PM)

Attachments
- ❑ Anti-condensation heater
- ❑ Stator and bearing temperature monitoring and protection

Power Termination

Type
- ❑ Bus bar
- ❑ Circuit breaker
- ❑ 3000A ❑ 4000A
- ❑ UL
- ❑ 3-pole ❑ 4-pole
- ❑ Manually operated
- ❑ Electrically operated

Trip Unit
- ❑ LSI ❑ LSI-G
- ❑ LSIG-P

Control System

Controller
- ❑ EMCP 4.2
- ❑ EMCP 4.3
- ❑ EMCP 4.4

Attachments
- ❑ Local annunciator module
- ❑ Remote annunciator module
- ❑ Expansion I/O module
- ❑ Remote monitoring software
- ❑ Ground fault relay

Charging

- ❑ Battery charger – 20A
- ❑ Battery charger – 35A
- ❑ Battery charger – 50A

Vibration Isolators

- ❑ Rubber
- ❑ Spring
- ❑ Seismic rated

Extended Service Options

Terms
- ❑ 2 year (prime)
- ❑ 3 year
- ❑ 5 year
- ❑ 10 year

Coverage
- ❑ Silver
- ❑ Gold
- ❑ Platinum
- ❑ Platinum Plus

Ancillary Equipment

- ❑ Automatic transfer switch (ATS)
- ❑ Uninterruptible power supply (UPS)
- ❑ Paralleling switchgear
- ❑ Paralleling controls

Certifications

- ❑ UL 2200 Listed
- ❑ CSA Certified
- ❑ IBC seismic certification
- ❑ OSHPD pre-approval

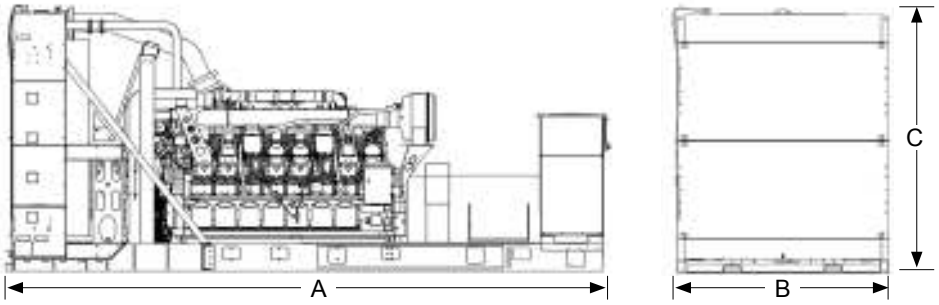
Note: *Some options may not be available on all models. Certifications may not be available with all model configurations. Consult factory for availability.*

Package Performance

Performance	Standby		Mission Critical		Prime	
Frequency	60 Hz		60 Hz		60 Hz	
Gen set power rating with fan	2000 ekW		2000 ekW		1825 ekW	
Gen set power rating with fan @ 0.8 power factor	2500 kVA		2500 kVA		2281 kVA	
Emissions	Tier 4 Final		Tier 4 Final		Tier 4 Final	
Performance number	DM9368-01		DM9300-01		DM9369-01	
Fuel Consumption						
100% load with fan – L/hr (gal/hr)	528.0	(139.5)	528.0	(139.5)	484.6	(128.8)
75% load with fan – L/hr (gal/hr)	409.8	(108.3)	409.8	(108.3)	382.2	(101.0)
50% load with fan – L/hr (gal/hr)	297.0	(78.5)	297.0	(78.5)	277.8	(73.4)
25% load with fan – L/hr (gal/hr)	181.3	(47.9)	181.3	(47.9)	172.7	(45.6)
Diesel Exhaust Fluid (DEF) Consumption						
100% load with fan – L/hr (gal/hr)	38.2	(10.1)	38.2	(10.1)	33.7	(8.9)
75% load with fan – L/hr (gal/hr)	25.0	(6.6)	25.0	(6.6)	21.2	(5.6)
50% load with fan – L/hr (gal/hr)	13.2	(3.5)	13.2	(3.5)	12.1	(3.2)
25% load with fan – L/hr (gal/hr)	6.1	(1.6)	6.1	(1.6)	5.7	(1.5)
Cooling System						
Radiator air flow restriction (system) – kPa (in. water)	0.12	(0.48)	0.12	(0.48)	0.12	(0.48)
Radiator air flow – m^3/min (cfm)	2661.0	(93972)	2661.0	(93972)	2661.0	(93972)
Engine coolant capacity – L (gal)	233.0	(61.6)	233.0	(61.6)	233.0	(61.6)
Radiator coolant capacity – L (gal)	238.5	(63.0)	238.5	(63.0)	238.5	(63.0)
Total coolant capacity – L (gal)	471.5	(124.6)	471.5	(124.6)	471.5	(124.6)
Inlet Air						
Combustion air inlet flow rate – m^3/min (cfm)	172.7	(6097.7)	172.7	(6097.7)	161.9	(5716.6)
Exhaust System						
Exhaust stack gas temperature – °C (°F)	493.7	(920.6)	493.7	(920.6)	487.8	(910.0)
Exhaust gas flow rate – m^3/min (cfm)	461.7	(16301.3)	461.7	(16301.3)	427.5	(15095.5)
Exhaust system backpressure (maximum allowable) – kPa (in. water)	6.0	(24.0)	6.0	(24.0)	6.0	(24.0)
CEM outlet temperature – °C (°F)	476.9	(890.5)	476.9	(890.5)	469.4	(876.9)
Heat Rejection						
Heat rejection to jacket water – kW (Btu/min)	705	(40104)	705	(40104)	663	(37690)
Heat rejection to exhaust (total) – kW (Btu/min)	2070	(117743)	2070	(117743)	1905	(108311)
Heat rejection to aftercooler – kW (Btu/min)	487	(27713)	487	(27713)	422	(24018)
Heat rejection to atmosphere from engine – kW (Btu/min)	151	(8584)	151	(8584)	146	(8304)
Heat rejection to atmosphere from CEM – kW (Btu/min)	85	(4826)	85	(4826)	86	(4886)
Heat rejection from alternator – kW (Btu/min)	96	(5482)	96	(5482)	86	(4891)

3516C Diesel Generator Sets
Electric Power

Weights and Dimensions



Dim "A" mm (in)	Dim "B" mm (in)	Dim "C" mm (in)	Dry Weight kg (lb)
6796.6 (267.6)	2378.7 (93.7)	2964.8 (116.7)	16 874 (37,200)

Note: *For reference only. Do not use for installation design. Contact your local Cat dealer for precise weights and dimensions.*

Dim "A" mm (in)	Dim "B" mm (in)	Dim "C" mm (in)	Dry Weight kg (lb)
3446.3 (135.7)	1537.3 (60.5)	895.1 (35.2)	2064 (4550)

Ratings Definitions

Standby
Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Mission Critical
Output available with varying load for the duration of the interruption of the normal source power. Average power output is 85% of the mission critical power rating. Typical peak demand up to 100% of rated power for up to 5% of the operating time. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Prime
Output available with varying load for an unlimited time. Average power output is 70% of the prime power rating. Typical peak demand is 100% of prime rated ekW with 10% overload capability for emergency use for a maximum of 1 hour in 12. Overload operation cannot exceed 25 hours per year.

Applicable Codes and Standards
AS 1359, CSA C22.2 No. 100-04, UL 142, UL 489, UL 869, UL 2200, NFPA37, NFPA70, NFPA99, NFPA110, IBC, IEC 60034-1, ISO 3046, ISO 8528, NEMA MG1-22, NEMA MG1-33, 2014/35/EU, 2006/42/EC, 2014/30/EU.

Note: Codes may not be available in all model configurations. Please consult your local Cat dealer for availability.

Data Center Applications
Tier III/Tier IV compliant per Uptime Institute requirements. ANSI/TIA-942 compliant for Rated-1 through Rated-4 data centers.

Fuel Rates
Fuel rates are based on fuel oil of 35º API [16°C (60ºF)] gravity having an LHV of 42,780 kJ/kg (18,390 Btu/lb) when used at 29ºC (85ºF) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.)

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3516-PGEL
LEHE1330-00 (6-17)

PERFORMANCE DATA[DM9368]

May 17, 2018

Performance Number: DM9368 **Change Level: 01**

SALES MODEL:	3516C	**COMBUSTION:**	DI
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	2,944	**HERTZ:**	60
GEN POWER WITH FAN (EKW):	2,000.0	**FAN POWER (HP):**	130.1
COMPRESSION RATIO:	14	**ASPIRATION:**	TA
RATING LEVEL:	STANDBY	**AFTERCOOLER TYPE:**	ATAAC
PUMP QUANTITY:	1	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
FUEL TYPE:	DIESEL	**INLET MANIFOLD AIR TEMP (F):**	113
MANIFOLD TYPE:	DRY	**JACKET WATER TEMP (F):**	210.2
GOVERNOR TYPE:	ADEM4	**TURBO CONFIGURATION:**	PARALLEL
ELECTRONICS TYPE:	ADEM4	**TURBO QUANTITY:**	4
CAMSHAFT TYPE:	STANDARD	**TURBOCHARGER MODEL:**	GTB6041BN-48T-1.04
IGNITION TYPE:	CI	**CERTIFICATION YEAR:**	2011
INJECTOR TYPE:	EUI	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	16.4
REF EXH STACK DIAMETER (IN):	12	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,539.4

INDUSTRY	SUBINDUSTRY	APPLICATION
OIL AND GAS	LAND PRODUCTION	PACKAGED GENSET
ELECTRIC POWER	STANDARD	PACKAGED GENSET

General Performance Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP
EKW	%	BHP	PSI	LB/BHP-HR	GAL/HR	IN-HG	DEG F	DEG F	IN-HG	DEG F
2,000.0	100	2,941	272	0.332	139.5	58.4	111.7	1,205.6	49.7	920.6
1,800.0	90	2,660	246	0.333	126.4	51.5	108.2	1,174.8	44.3	908.7
1,600.0	80	2,382	220	0.335	114.0	45.0	105.5	1,144.7	39.3	898.3
1,500.0	75	2,243	207	0.338	108.3	42.3	104.5	1,129.9	37.1	892.2
1,400.0	70	2,104	194	0.341	102.6	39.6	103.7	1,115.1	35.1	885.3
1,200.0	60	1,828	169	0.348	90.8	33.8	101.5	1,082.7	30.8	867.5
1,000.0	50	1,552	143	0.354	78.5	27.6	99.2	1,039.6	26.3	841.5
800.0	40	1,282	118	0.361	66.2	21.6	98.9	981.8	22.0	808.3
600.0	30	1,010	93	0.374	54.0	16.1	97.6	904.1	18.1	759.6
500.0	25	872	81	0.385	47.9	13.5	96.3	853.7	16.3	723.0
400.0	20	731	67	0.399	41.6	11.1	94.9	791.6	14.5	673.0
200.0	10	438	40	0.455	28.4	6.2	91.7	630.7	11.0	531.5

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	IN-HG	DEG F	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
2,000.0	100	2,941	63	370.2	6,097.7	16,301.3	26,599.0	27,575.8	5,806.5	5,297.4
1,800.0	90	2,660	56	346.1	5,660.9	14,926.0	24,582.5	25,468.0	5,363.1	4,900.5
1,600.0	80	2,382	49	322.4	5,234.1	13,626.0	22,639.9	23,438.1	4,933.5	4,514.8
1,500.0	75	2,243	46	311.8	5,056.2	13,081.3	21,839.0	22,597.2	4,757.5	4,358.3
1,400.0	70	2,104	43	301.1	4,882.3	12,547.1	21,061.2	21,779.8	4,586.7	4,206.5
1,200.0	60	1,828	37	276.7	4,500.8	11,363.7	19,357.3	19,993.3	4,209.7	3,870.7
1,000.0	50	1,552	31	248.9	4,080.3	10,053.1	17,494.9	18,044.3	3,798.7	3,503.4
800.0	40	1,282	24	220.0	3,648.0	8,724.5	15,655.6	16,119.6	3,383.2	3,131.9
600.0	30	1,010	18	191.5	3,260.2	7,457.1	13,913.7	14,292.1	3,007.1	2,798.1
500.0	25	872	16	177.6	3,086.0	6,839.3	13,166.0	13,501.6	2,843.2	2,654.9
400.0	20	731	13	163.5	2,914.4	6,185.8	12,427.8	12,719.3	2,685.1	2,518.0
200.0	10	438	8	135.0	2,580.5	4,776.4	10,987.0	11,186.4	2,369.4	2,245.9

Heat Rejection Data

HEAT REJECTION TO ATMOSPHERE SHOWN HERE IS ENGINE ONLY. CEM HEAT REJECTION TO ATMOSPHERE SHOWN IN THE SUPPLEMENTARY DATA IS THE ADDITIONAL HEAT REJECTED TO ATMOSPHERE FROM THE CEM. THIS ADDITIONAL HEAT IS INCLUDED IN THE HEAT REJECTION TO EXH AND EXH RECOVERY SHOWN HERE AND WOULD NEED TO BE DEDUCTED FROM THE EXH AND EXH RECOVERY VALUES WHEN SIZING EXHAUST RECOVERY HEAT EQUIPMENT.

PERFORMANCE DATA[DM9368]

May 17, 2018

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHUAST RECOVERY TO 350F	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
2,000.0	100	2,941	40,104	8,584	117,743	66,835	15,945	27,713	124,739	299,359	318,893
1,800.0	90	2,660	37,348	8,264	106,994	60,337	14,448	23,519	112,812	271,264	288,965
1,600.0	80	2,382	34,738	7,949	97,012	54,418	13,028	19,817	100,998	244,606	260,566
1,500.0	75	2,243	33,635	7,808	92,688	51,834	12,375	18,256	95,121	232,347	247,508
1,400.0	70	2,104	32,549	7,664	88,414	49,269	11,728	16,765	89,226	220,198	234,566
1,200.0	60	1,828	30,165	7,326	78,933	43,615	10,380	13,695	77,505	194,893	207,610
1,000.0	50	1,552	27,455	6,929	68,522	37,263	8,969	10,519	65,823	168,397	179,386
800.0	40	1,282	24,651	6,522	58,151	30,909	7,568	7,691	54,383	142,091	151,362
600.0	30	1,010	21,599	6,020	47,794	24,352	6,175	5,268	42,840	115,931	123,495
500.0	25	872	19,985	5,705	42,506	20,859	5,475	4,261	36,971	102,794	109,501
400.0	20	731	18,381	5,400	36,887	16,909	4,756	3,348	30,983	89,289	95,115
200.0	10	438	15,142	4,792	24,623	8,226	3,252	1,832	18,564	61,054	65,038

Sound Data

SOUND DATA REPRESENTATIVE OF NOISE PRODUCED BY THE "ENGINE AND CEM" AS A UNIT WITHOUT A MUFFLER INSTALLED

EXHAUST: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	100 HZ	125 HZ	160 HZ	200 HZ	250 HZ	315 HZ	400 HZ	500 HZ	630 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,941	97.8	68.7	75.2	74.3	82.8	87.5	87.1	84.5	88.6	88.2
1,800.0	90	2,660	95.8	67.9	74.7	72.8	80.9	85.7	85.4	83.1	86.6	86.1
1,600.0	80	2,382	94.0	67.4	74.6	71.3	79.2	84.1	84.0	82.4	85.0	84.3
1,500.0	75	2,243	93.2	67.2	74.7	70.6	78.4	83.4	83.5	82.1	84.2	83.4
1,400.0	70	2,104	92.3	67.0	74.7	69.8	77.5	82.7	82.8	81.8	83.4	82.5
1,200.0	60	1,828	90.7	66.6	74.9	68.3	75.7	81.2	81.5	81.3	81.8	80.8
1,000.0	50	1,552	89.4	64.9	75.8	67.5	74.6	79.5	79.8	80.5	80.4	79.6
800.0	40	1,282	88.0	65.1	75.5	65.7	72.7	78.2	78.9	80.2	78.9	77.6
600.0	30	1,010	86.6	64.6	75.5	64.9	70.8	76.6	77.4	79.4	77.3	75.9
500.0	25	872	86.2	62.8	76.3	65.9	70.4	75.4	75.9	78.6	76.4	75.6
400.0	20	731	85.9	60.9	77.1	67.0	70.1	74.4	74.5	77.8	75.5	75.5
200.0	10	438	85.8	60.5	77.3	67.2	70.0	74.2	74.2	77.6	75.3	75.5

EXHAUST: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	1250 HZ	1600 HZ	2000 HZ	2500 HZ	3150 HZ	4000 HZ	5000 HZ	6300 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,941	90.3	85.2	82.8	79.8	77.1	73.8	69.3	63.6	63.3	55.1
1,800.0	90	2,660	87.9	82.9	80.7	77.9	75.4	72.0	67.7	62.3	62.1	55.2
1,600.0	80	2,382	85.5	80.4	78.5	76.3	74.0	70.6	66.5	61.7	61.7	55.6
1,500.0	75	2,243	84.3	79.1	77.4	75.6	73.3	70.0	66.0	61.5	61.6	56.0
1,400.0	70	2,104	83.1	77.9	76.3	74.9	72.6	69.3	65.5	61.3	61.5	56.3
1,200.0	60	1,828	80.7	75.5	74.1	73.5	71.2	67.9	64.5	60.9	61.3	57.0
1,000.0	50	1,552	79.5	74.8	73.0	73.1	70.8	67.4	63.5	60.8	61.4	55.0
800.0	40	1,282	76.6	71.5	70.3	71.3	69.0	65.7	62.5	60.2	61.1	56.8
600.0	30	1,010	74.2	69.3	68.4	69.9	67.7	64.5	61.7	59.8	60.8	57.3
500.0	25	872	74.5	70.6	69.2	70.2	68.2	65.0	61.6	59.9	60.9	54.2
400.0	20	731	75.0	72.2	70.2	70.8	68.9	65.6	61.5	60.1	61.0	51.2
200.0	10	438	75.1	72.5	70.4	70.9	69.0	65.7	61.5	60.1	61.0	50.5

Sound Data (Continued)

MECHANICAL: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	100 HZ	125 HZ	160 HZ	200 HZ	250 HZ	315 HZ	400 HZ	500 HZ	630 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,941	123.0	89.3	107.2	96.2	99.4	100.3	102.8	101.0	105.5	106.8
1,800.0	90	2,660	122.2	88.6	106.6	95.4	98.5	99.4	102.5	100.9	105.4	106.5
1,600.0	80	2,382	121.4	88.1	106.0	94.6	97.5	98.5	102.0	100.9	104.7	106.1

1,500.0	75	2,243	121.1	88.0	105.7	94.1	97.0	98.1	101.8	100.8	104.2	106.0
1,400.0	70	2,104	120.8	87.8	105.4	93.5	96.3	97.5	101.4	100.5	103.8	105.9
1,200.0	60	1,828	120.3	87.7	104.7	92.0	94.5	96.2	100.4	99.7	103.4	106.1
1,000.0	50	1,552	119.9	87.8	104.3	91.0	93.7	95.8	99.7	101.4	103.4	106.2
800.0	40	1,282	119.5	87.9	103.9	90.9	93.3	95.6	98.5	101.6	103.9	106.0
600.0	30	1,010	119.3	87.6	103.4	90.9	93.6	95.3	97.8	100.6	105.1	106.1
500.0	25	872	119.1	87.1	103.3	90.5	94.3	95.2	98.2	100.3	105.9	106.6
400.0	20	731	119.0	86.5	103.1	90.2	94.9	95.0	98.8	100.2	106.6	107.1
200.0	10	438	119.0	85.8	102.4	90.0	94.7	95.5	99.2	101.4	106.4	107.7

MECHANICAL: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	1250 HZ	1600 HZ	2000 HZ	2500 HZ	3150 HZ	4000 HZ	5000 HZ	6300 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,000.0	100	2,941	112.2	113.0	111.8	111.5	110.6	110.0	109.1	108.6	107.3	106.4
1,800.0	90	2,660	112.1	112.5	111.3	111.2	110.3	109.7	108.8	108.3	106.8	106.2
1,600.0	80	2,382	111.8	111.9	110.9	110.7	109.8	109.2	108.2	107.8	106.2	106.4
1,500.0	75	2,243	111.6	111.6	110.7	110.3	109.6	109.0	107.9	107.5	105.9	106.8
1,400.0	70	2,104	111.4	111.3	110.5	109.9	109.4	108.7	107.5	107.2	105.7	108.0
1,200.0	60	1,828	111.1	110.8	110.3	109.5	109.0	108.2	106.9	106.6	105.4	111.2
1,000.0	50	1,552	110.9	110.7	110.0	109.4	108.8	108.1	106.5	106.2	105.2	109.7
800.0	40	1,282	110.9	110.6	109.5	109.1	108.7	107.7	106.0	105.9	107.0	105.7
600.0	30	1,010	110.8	110.2	108.8	108.8	108.4	107.3	105.4	105.6	107.7	101.8
500.0	25	872	110.7	109.9	108.6	108.7	108.3	107.0	105.1	105.7	106.0	100.6
400.0	20	731	110.7	109.7	108.4	108.6	108.2	106.8	104.8	105.7	104.0	99.7
200.0	10	438	110.3	109.8	108.1	108.4	108.1	106.8	105.7	104.9	102.0	98.7

Emissions Data

EMISSIONS VALUES ARE TAILPIPE OUT WITH AFTERTREATMENT. VALUES SHOWN AS ZERO MAY BE GREATER THAN ZERO BUT WERE BELOW THE DETECTION LEVEL OF THE EQUIPMENT USED AT TIME OF MEASUREMENT.

CATERPILLAR EMISSIONS CERTIFIED ENGINES TESTED WITHIN EPA SPECIFIED TEST CONDITIONS, AND USING TITLE 40 CFR PART 1065 TEST PROTOCOL, MEET THE NEW SOURCE PERFORMANCE STANDARDS. POTENTIAL SITE VARIATION DATA ACCOUNT FOR PRODUCTION ENGINE AND SYSTEM VARIABILITY IN ADDITION TO MEASUREMENT VARIABILITY FOR TYPICAL FIELD TEST METHODS AS DESCRIBED IN DM1176. THIS DATA ASSUMES SITE CORRECTIONS FOR AMBIENT HUMIDITY TO 75 GRAINS, AND STANDARD CONDITIONS OF 25 C (77 F) AIR TO TURBO TEMPERATURE AND 152.4 M (500 FT) ALTITUDE. GUIDANCE ON HUMIDITY CORRECTION METHODS ARE AVAILABLE IN TITLE 40 CFR SECTION 1065.670. FOR APPLICATIONS WITH GEOGRAPHIC OR AMBIENT CONDITIONS BEYOND THESE PUBLISHED VALUES, CONSULT CATERPILLAR (APPLICATION SUPPORT CENTER) FOR ADDITIONAL VARIABILITY INFORMATION.

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	2,000.0	1,500.0	1,000.0	500.0	200.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	2,941	2,243	1,552	872	438
TOTAL NOX (AS NO2)		G/HR	1,840	1,228	741	446	909
TOTAL CO		G/HR	367	251	165	103	98
TOTAL HC		G/HR	94	108	102	81	102
PART MATTER		G/HR	89.4	66.2	63.3	55.9	28.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	277.1	239.5	201.3	212.2	871.9
TOTAL CO	(CORR 5% O2)	MG/NM3	58.0	51.5	46.6	48.2	86.7
TOTAL HC	(CORR 5% O2)	MG/NM3	12.9	19.3	25.0	33.1	80.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	135	117	98	103	425
TOTAL CO	(CORR 5% O2)	PPM	46	41	37	39	69
TOTAL HC	(CORR 5% O2)	PPM	24	36	47	62	150
TOTAL NOX (AS NO2)		G/HP-HR	0.63	0.55	0.48	0.51	2.08
TOTAL CO		G/HP-HR	0.13	0.11	0.11	0.12	0.23
TOTAL HC		G/HP-HR	0.03	0.05	0.07	0.09	0.23
PART MATTER		G/HP-HR	0.03	0.03	0.04	0.06	0.06
TOTAL NOX (AS NO2)		LB/HR	4.06	2.71	1.63	0.98	2.00
TOTAL CO		LB/HR	0.81	0.55	0.36	0.23	0.22
TOTAL HC		LB/HR	0.21	0.24	0.22	0.18	0.23
PART MATTER		LB/HR	0.20	0.15	0.14	0.12	0.06

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN	EKW	2,000.0	1,500.0	1,000.0	500.0	200.0
PERCENT LOAD	%	100	75	50	25	10
ENGINE POWER	BHP	2,941	2,243	1,552	872	438
TOTAL NOX (AS NO2)	G/HR	1,150	767	463	279	568
TOTAL CO	G/HR	72	49	32	20	19

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TOTAL HC		G/HR	21	24	23	18	23
TOTAL CO2		KG/HR	1,441	1,111	805	490	293
PART MATTER		G/HR	34.4	25.5	24.4	21.5	10.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	173.2	149.7	125.8	132.6	544.9
TOTAL CO	(CORR 5% O2)	MG/NM3	11.4	10.1	9.1	9.5	17.0
TOTAL HC	(CORR 5% O2)	MG/NM3	2.9	4.3	5.5	7.4	17.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	84	73	61	65	265
TOTAL CO	(CORR 5% O2)	PPM	9	8	7	8	14
TOTAL HC	(CORR 5% O2)	PPM	5	8	10	14	33
FORMALDEHYDE	(CORR 15% O2)	PPM	0.02	0.02	0.02	0.05	0.25
ACROLEIN	(CORR 15% O2)	PPM	0.00	0.00	0.00	0.00	0.00
ACETALDEHYDE	(CORR 15% O2)	PPM	0.00	0.00	0.00	0.00	0.01
METHANOL	(CORR 15% O2)	PPM	0.00	0.00	0.00	0.00	0.03
TOTAL NOX (AS NO2)		G/HP-HR	0.39	0.34	0.30	0.32	1.30
TOTAL CO		G/HP-HR	0.02	0.02	0.02	0.02	0.04
TOTAL HC		G/HP-HR	0.01	0.01	0.01	0.02	0.05
PART MATTER		G/HP-HR	0.01	0.01	0.02	0.02	0.02
TOTAL NOX (AS NO2)		LB/HR	2.54	1.69	1.02	0.61	1.25
TOTAL CO		LB/HR	0.16	0.11	0.07	0.04	0.04
TOTAL HC		LB/HR	0.05	0.05	0.05	0.04	0.05
TOTAL CO2		LB/HR	3,178	2,450	1,775	1,080	645
PART MATTER		LB/HR	0.08	0.06	0.05	0.05	0.02
OXYGEN IN EXH		%	9.6	10.3	11.4	13.2	15.5
DRY SMOKE OPACITY		%	0.4	0.4	0.8	1.4	0.9
BOSCH SMOKE NUMBER			0.18	0.20	0.32	0.49	0.34

Regulatory Information

EPA TIER 4 FINAL		2015 - ----		
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	NON-ROAD GENSET	TIER 4 FINAL	CO: 3.5 NOx: 0.67 HC: 0.19 PM: 0.03

EPA TIER 4 INTERIM		2011 - 2014		
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	NON-ROAD GENSET	TIER 4 INTERIM	CO: 3.5 NOx: 0.67 HC: 0.4 PM: 0.10

EPA NON-EMERGENCY STATIONARY GENSET		2015 - ----		
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	STATIONARY	NON-EMERGENCY STATIONARY GENSET	CO: 3.5 NOx: 0.67 HC: 0.19 PM: 0.03

Altitude Derate Data

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944
1,000	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944
2,000	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944
3,000	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944
4,000	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944
5,000	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944
6,000	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,935	2,885	2,837	2,944
7,000	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,926	2,874	2,825	2,777	2,730	2,944
8,000	2,944	2,944	2,944	2,944	2,944	2,919	2,866	2,815	2,766	2,718	2,672	2,627	2,944
9,000	2,944	2,944	2,944	2,916	2,861	2,808	2,757	2,708	2,660	2,614	2,570	2,527	2,944
10,000	2,944	2,916	2,859	2,804	2,751	2,700	2,651	2,604	2,558	2,514	2,471	2,430	2,853
11,000	2,861	2,804	2,749	2,696	2,645	2,596	2,549	2,503	2,459	2,417	2,376	2,336	2,762
12,000	2,750	2,695	2,642	2,591	2,542	2,495	2,449	2,406	2,363	2,323	2,283	2,245	2,673
13,000	2,642	2,589	2,539	2,490	2,443	2,397	2,354	2,312	2,271	2,232	2,194	2,157	2,587
14,000	2,539	2,488	2,439	2,392	2,347	2,303	2,262	2,221	2,182	2,144	2,108	2,073	2,504
15,000	2,439	2,390	2,343	2,298	2,255	2,213	2,173	2,134	2,096	2,060	2,025	1,991	2,423

Cross Reference

PERFORMANCE DATA[DM9368]

May 17, 2018

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
3704798	LL6338	3709874	GS538	-	SCJ00001	
3704981	GG0624	3994250	GS718	-	DD700001	
3704981	GG0624	5075758	GS538	-	SCJ01000	
4581574	LL6763	5157722	PG238	-	LY600001	

Supplementary Data

Type	Classification	Performance Number
AFTERTREATMENT	SCR	DM8842

Performance Parameter Reference

Parameters Reference:DM9600-10

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600
APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.
PERFORMANCE PARAMETER TOLERANCE FACTORS:
Power +/- 3%
Torque +/- 3%
Exhaust stack temperature +/- 8%
Inlet airflow +/- 5%
Intake manifold pressure-gage +/- 10%
Exhaust flow +/- 6%
Specific fuel consumption +/- 3%
Fuel rate +/- 5%
Specific DEF consumption +/- 3%
DEF rate +/- 5%
Heat rejection +/- 5%
Heat rejection exhaust only +/- 10%
Heat rejection CEM only +/- 10%
Heat Rejection values based on using treated water.
Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.
On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.
These values do not apply to C280/3600. For these models, see the tolerances listed below.
C280/3600 HEAT REJECTION TOLERANCE FACTORS:
Heat rejection +/- 10%
Heat rejection to Atmosphere +/- 50%
Heat rejection to Lube Oil +/- 20%
Heat rejection to Aftercooler +/- 5%
TEST CELL TRANSDUCER TOLERANCE FACTORS:
Torque +/- 0.5%
Speed +/- 0.2%
Fuel flow +/- 1.0%
Temperature +/- 2.0 C degrees
Intake manifold pressure +/- 0.1 kPa
OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.
REFERENCE ATMOSPHERIC INLET AIR
FOR 3500 ENGINES AND SMALLER
SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.
FOR 3600 ENGINES

PERFORMANCE DATA[DM9368]

Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.

MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE

Location for air temperature measurement air cleaner inlet at stabilized operating conditions.

REFERENCE EXHAUST STACK DIAMETER

The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.

REFERENCE FUEL

DIESEL

Reference fuel is #2 distillate diesel with a 35API gravity; A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 29 deg C (84.2 deg F), where the density is 838.9 G/Liter (7.001 Lbs/Gal).

GAS

Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.

ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD

Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators. For Tier 4 ratings additional Parasitic losses would also include Intake, and Exhaust Restrictions.

ALTITUDE CAPABILITY

Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set.

Standard temperature values versus altitude could be seen on TM2001.

When viewing the altitude capability chart the ambient temperature is the inlet air temp at the compressor inlet.

Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.

Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.

REGULATIONS AND PRODUCT COMPLIANCE

TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.

Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.

EMISSIONS DEFINITIONS:

Emissions : DM1176

HEAT REJECTION DEFINITIONS:

Diesel Circuit Type and HHV Balance : DM9500

HIGH DISPLACEMENT (HD) DEFINITIONS:

3500: EM1500

RATING DEFINITIONS:

Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038

SOUND DEFINITIONS:

PERFORMANCE DATA[DM9368]

May 17, 2018

Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 7/7/15

New Tier 4 Emergency Generators: Startup/Shutdown Schedule and Emission Factors for EG-7, EG-8 and EG-9

Tina Su

To: MacMartin, Bryce
Subject: RE: Startup, shutdown, commissioning emissions - Update

From: MacMartin, Bryce <BMacMartin@Vanderweil.com>
Sent: Thursday, October 4, 2018 5:04 PM
To: Tina Su <TSu@esassoc.com>; Dubinsky, Irina <IDubinsky@Vanderweil.com>
Cc: Duncan, Jeff <JDuncan@Vanderweil.com>
Subject: RE: Startup, shutdown, commissioning emissions - Update

Tina,

Sorry for the delay in getting this information back to you, we just received this from the CAT/Quinn vendor this afternoon. Attached are three documents, a Tier 2 emissions data set and two Tier 4 Final tech sheets for a 500kW and 2000kW generator. In talking with CAT, they suggest using the Tier 2 data for the startup and shutdown durations due to the fact that the post-emissions control module won't get to the temperature required for final emissions destruction until after these durations, which are as follows:

For any and all Tier 4 systems, the frequency of run-time (annually) would be:

- 11 monthly tests @ 15 minutes each – Tier 2 emissions for the entirety of these tests
    - 165 minutes of Tier 2 emissions
- 1 yearly test for 1 hour, but with 15 minutes startup and shutdown time (@ Tier 2 emissions) and 30 minutes @ Tier 4 emissions
    - 30 minutes of Tier 2 emissions
- Any other assumed runtime would be for longer durations. We would propose using 2 additional start-up and shutdown periods for the year associated with these longer run-times, each of which would consist of 30 total minutes (15 min each for start-up and shut-down) of Tier 2 emissions production.
    - 60 minutes of Tier 2 emissions
- TOTAL Tier 2 emissions runtime = 255 minutes annually
- All other annual runtime associated with the Tier 4 systems would be Tier 4 emissions

Please let us know if you have any questions on the above.

Regards,

Bryce MacMartin, PE
Associate/Engineer, Power Group - West
R.G. Vanderweil Engineers, LLP
T 562.247.7710 | F 562.595.7513 | C 415.845.5367

San Manuel Requested Emissions Data

			EPA Engine Certification (2018) (g/bhp-hr)						TMI Reference Data (g/bhp-hr)	SCAQMD CEP Data Submitted (g/bhp-hr)					SCAQMD BACT Guidelines (2016) (g/bhp-hr)				
Model	Generator kW	HP	Family Name	HC	NOx	NMHC + NOx	CO	PM	TMI Reference	HC	NOx	NMHC + NOx	CO	PM	HC	NOx	NMHC + NOx	CO	PM
C15 Tier 2	500	762	JCPXL15.2NZS	0.07	4.01	4.10	1.19	0.07	DM8155-03	0.08	3.85		1.57	0.085			4.8	2.6	0.15
3516C T2	2000	2937	JCPXL78.1NZS	0.19	3.78	3.95	0.67	0.09	DM8263-03	0.25	3.93		0.49	0.082			4.8	2.6	0.15

New Tier 4 Emergency Generators: Startup/Shutdown Uncontrolled Emission Factors for EG-7 (500 kw), EG-8 and EG-9 (2000 kw)

South Coast Air Quality Management District (SCAQMD)

RULE 1146.2 - EMISSIONS OF OXIDES OF NITROGEN FROM LARGE WATER HEATERS AND SMALL BOILERS AND PROCESS HEATERS

LIST OF CERTIFIED UNITS PURSUANT TO RULE 1146.2 (Updated March 22, 2018)

NOTE: The SCAQMD does not endorse or warrant any specific product or manufacturer

Company/Brand Name	Type 2 (> 400,000--2,000,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 40 ng/J or 55 ppm NOx @ 3% O2) (Certification expires 12/31/2011, Except for Pool Heaters) (Sell-through until 12/31/2012, Except for Pool Heaters)	CONTACT Phone/E-mail/Web
Advanced Thermal Hydronics (Mestek)	KN-6, KN-10, KN-16, KN-20	KN-2, KN-4		John Chicoine 413-564-5872 Jchicoine@mestek.com
Aerco International Inc.	Benchmark: BMK 1.5, BMK 2.0 LN MLX-454, MLX-606, MLX-757, MLX-909, MLX-1060, BMK750, BMK1000, BMK1500, BMK2000, MLX EXT 481, MLX EXT 641, MLX EXT 802, MLX EXT 962, MLX EXT 1530, MLX EXT 1912, AM 500B, AM 500W, AM 750B, AM 750W, AM 1000B, AM 1000W MLX EXT 450, MLX EXT 600, MLX EXT 800, MLX EXT 1123, MLX EXT 1100, MLX EXT 1500 *Innovation : INN (600, 650, 750, 800, 850, 975, 1060, 1350)*	Esteem: EST 399 MLX-303, MLX EXT 321, AM 399B, AM 399W, AM 199R, AM 250R, AM399R, AM 500R		Peter Rimassa primassa@aerco.com Jerry Fioriti Jfioriti@aerco.com Earl Rightmier Erightmier@aerco.com 201-768-2400
Afras Industries		VIRON 450N HINRG400N		Reza Afshar 805-230-0011
Ace Heaters, LLC (Ace Heating Solutions LLC, Ajax Boiler)	WCP-050l-N, WCP-050W-N, WCP-100l-N, WCP-100W-N, WCP-150l-N, WCP-150W-N, WCP-200l-N, WCP-200W-N, WPG-525, WRPG-525, WPG-1050, WRPG-1050, WPG-1500, WRPG-1500, WPG-2000, WRPG-2100, BP-5-G, BP-7-G, BP-8-G, BP-11-G, BP-13G, BP-15-G, SRPG-12, SRPG-25, SRPG-35, SRPG-50, HRPG-12, HRPG-25, HRPG-35, HRPG-50, A050, A050G, A050G-W, A075, A075G, A075G-W,A100, A100G, A100G-W,A150, A150G, A150G-W,A200, A200G, A200G-W,A250, A250G, A250G-W,A300, A300G, A300G-W, T-200	BP-2-G, BP-3-G, BP-4-G		Kooshiar Karimi (951)738-2230 kkarimi@aceheaters.com www.aceheaters.com
American Standard Water Heater Corp.	ND80-512LN	HE-70-125, HE-100-150, HE-100-199, HE-100-250, ULN75-76AS, ULN80-125AS, ULN80-165AS, ULN80-180AS, ULN80-199AS, ULN100-76AS, ULN100-83AS, ULN100-199AS, ULN100T-199AS, ULN100-250AS, ULN100-270AS, ULN100-300AS, ULN80-365AS, ULN80-399AS TCWH199S-AS, TCWH180S-AS, TCWH150S-AS	N 75-76 AS, N 100-83 AS, D80-165 AS, D80-199 AS, D80-180AS, D75-365 AS, D75-365 ASME, D75-399AS, D75-399ASME, D80-512AS, D80-512ASME, D100-270AS, D100-270ASME, D100-250AS, D100-250ASME, D100-199AS, D100T-199AS, ND80-125-AS, ND80-512AS, ND80-512ASME, ND100-300AS, ND100-300ASME	James Bridegum 909-595-0560
American Water Heater-1 (A. O. Smith)	HCG3-119T500-4N 200, AHCG3-199T500-4N 200	HCG3-60T120-3N 200, AHCG3-60T120-3N 200, HCG3-100T150-3P 201, AHCG3-100T150-3P 201, HCG3-100T199-3P 201, AHCG3-100T199-3P 201, HCG3-100T250-3P 201, AHCG3-100T250-3P 201, HCG3-119T300-4N 200, AHCG3-199T300-4N 200, HCG3-119T400-4N 200, AHCG3-199T400-4N 200, BCN375T54NV100, UG6275T754NV100 GT-110C-N, GT-310C-N, GT-510C-N, GT-110U-I 200,GT-110U-E 200,GT-310U-I 200, GT-310U-E 200, GT-510U-I 200, GT-510U-E 200	G (1,3,5,6,8,9,10,12)2-75T75-4NO CG (1,3,5,6,8,9,10,12)2-75T75-4NO PBG(1,3,5,6,8,9,10,12)2-34S852NO PBCG(1,3,5,6,8,9,10,12)2-34S852NO PBG(1,3,5,6,8,9,10,12)2-50T852NO PBCG(1,3,5,6,8,9,10,12)2-50T852NO PG (1,3,5,6,8,9,10,12) 34-100-2NV PGC (1,3,5,6,8,9,10,12) 34-100-2NV PG(1,3,5,6,8,9,10,12) 50-175-3NV PGC(1,3,5,6,8,9,10,12) 50-175-3NV PG(1,3,5,6,8,9,10,12) 50-199-3NV PGC(1,3,5,6,8,9,10,12) 50-199-3NV PG(1,3,5,6,8,9,10,12)34-130-2NV PGC(1,3,5,6,8,9,10,12) 34-130-2NV PG(1,3,5,6,8,9,10,12) 50-130-2NV PGC(1,3,5,6,8,9,10,12) 50-130-2NV PVG(1,3,5,6,8,9,10,12)2-75T75-3NO PVCG(1,3,5,6,8,9,10,12)2-75T75-3NO PG(1,3,5,6,8,9,10,12)34-150-NV PCG(1,3,5,6,8,9,10,12)34-150-2NV G(1,3,5,6,8,9,10,12)2-100T77-4NOV CG(1,3,5,6,8,9,10,12)2-100T77-4NOV DCG3-100T199-6N(O,X,M,H,C,V) DCG5-100T199-6N(O,X, M,H,C,V) DCG6-100T199-6N(O,X,M,H,C,V) DCG(3,5,6)-100T270-7N(O)V ADCG(3,5,6)-100T270-7N(O)V PG(3,5,6,10,12)100-199-3NV PGC(3,5,6,10,12)100-100-3NV GT 305 NI200 GT 305 NE200 GT 505 NI200 GT 505 NE200 BCG3-95T199-6NOX-108, ABCG3-95T199-6NOX-108 (9/22/10)	Gary Delph 423-434-1540 gdelph@hotwater.com
American Water Heater-2 (A. O. Smith)		VG6250T100NV*, VG6250T 100NV 130, VG6275T 100NV 130 (A)HCG3-60T120-3N* (A)HCG3-100T150-3N* (A)HCG3-100T199-3N* (A)HCG3-100T250-3N* (A)HCG3130T300-3N* (A)HCG3130T400-3N* BCL395T1996NOX100, BCL385T2756NOX100, ABCL385T2756NOX100, BCL385T3906NOX100, ABCL385T3906NOX100, GT 110UI 100, GT 110UE 100, GT 310UI 100, GT 310UE 100, GT 510UI 100, GT 510UE 100, GT 240NIH 100, GT 240NEH 100, GT 340NIH 100, GT 340NEH 100, GT 540NIH 100, GT 540NEH 100, GT140NIH100, GT140NEH100, BCN3100T754NV100, UG62100T754NV100, BBCN375T754NV100, UBG6275T754NV100, BCL380T1206NOX 104, BCL380T1206NOX 200,BCL380T1546NOX 104, BCL380T1546NOX 200, BCL380T1806NOX 200, BCL395T1806NOX 104, BCL395T1996NOX 104, BCL395T2506NOX 104, BCL3100T2506NOX 200, BCL3100T2756NOX 200, ABCL3100T2756NOX 200, ABCL395T2506NOX 104, BCL385T2756NOX 104, ABCL385T2756NOX 104, BCL385T3106NOX 104, ABCL385T3106NOX 104, ABCL3100T2506NOX 200, BCL385T3666NOX 104, ABCL385T3666NOX 104, BCL385T3906NOX 104, ABCL385T3906NOX 104, BCL3100T1996NOX200, BCL380T1996NOX200, BCL386T3106NOX 200, ABCL386T3106NOX 200, BCL386T3666NOX 200, ABCL386T3666NOX 200, BCL386T3906NOX 200, ABCL386T3906NOX 200, GT-540P-NIH, GT-540P-NEH "A", added to the prefix indicates ASME construction.	CG32 100T77 4 NOV* G62 100T77 4 NOV* BCG3 70T 120-5NOX* BCG3-80T150-6NOX* BCG3 100T 180-6NOX* BCG3 100T 199-6NOX* (A)BCG3 95T 199-6NOX* (A)BCG3 100T 200-6NOX* (A)BCG3-100T 250-6NOX* (A)BCG3 100T 275-6NOX* (A)BCG3 85T 310-6NOX* (A)BCG3 85T 366-6NOX* (A)BCG3 85T 390-6NOX* BCG3-95T199-6NOX*, ABCG3-95T199-6NOX* (9/22/10) *Additional Leters and/or numbers will be placed here to indicate trim packages and/or tracking numbers. "A", added to the prefix indicates ASME construction.	Joe Wallace 843-335-8281 x462 jwallace@hotwater.com

South Coast Air Quality Management District (SCAQMD)

RULE 1146.2 - EMISSIONS OF OXIDES OF NITROGEN FROM LARGE WATER HEATERS AND SMALL BOILERS AND PROCESS HEATERS

LIST OF CERTIFIED UNITS PURSUANT TO RULE 1146.2 (Updated March 22, 2018)

NOTE: The SCAQMD does not endorse or warrant any specific product or manufacturer

Company/Brand Name	Type 2 (> 400,000--2,000,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 40 ng/J or 55 ppm NOx @ 3% O2) (Certification expires 12/31/2011, Except for Pool Heaters) (Sell-through until 12/31/2012, Except for Pool Heaters)	CONTACT Phone/E-mail/Web
American Water Heater-3 (A. O. Smith)		PG10341002NV200, PGC3341302NV200, PG10341302NV200, PGC3341502NV200, PG10341502NV200, PGC3501302NV200, PG10501302NV200, PGC3501502NV200, PG10501502NV200, PGC3501753NV200, PG10501753NV200, PGC3501993NV200, PG10501993NV200	PG(3,5,6,9,10,12)50-150-2NV PGC(3,5,6,9,10,12)50-150-2NV DCG(3,5,6)-80T199-6NOV DCG3-75T125-5NOV DCG3-75T300-7NOV DCG5-75T300-7NOV DCG6-75T300-NOV ADCG3-75T300-7NOV ADCG5-75T300-7NOV ADCG6-75T300-7NOV DCG3-80T399-8NOV DCG5-80T399-8NOV B75 GT-305I GT-305E GT-505I GT-505E GT-705I GT-705E AGT-705I AGT-705E	G. Russell Haynes 423-975-2473 ruhaynes@hotwater.com
Apollo Hydroheat & Cooling (A. O. Smith)			A6 75 XRRS* A10 75 XRRS* A6 75 YRVIT L* A10 75 YRVIT L* *Additional Letters and/or numbers will be placed here to indicate trim packages and/or tracking numbers.	Joe Wallace 843-335-8281 x462 jwallace@hotwater.com
A.O. Smith	VB/VW(500-100, 750-100, 1000-100, 1500-100, 2000-100) BTH 500, BTP 540A, BTP 650A, BTH 500 200, BTH 500A 200 XB(1000,1300, 1700, 2000) XWH(500, 600, 700, 800,1000,1300,1700,2000) GW 500 400, GB 500 400, GW 650 400, GB 650 400, GW 750 400, GB 750 400, GW 1000 500, GB 1000 500, GW 1300 500, GB 1300 500, GW 1850 500, GB 1850 500, GW 2000 500, GB 2000 500, GWH0400N, GWH0500N, GWH0650N, GWH0750N, GWH1000N, GWH1250N, GWH1450N, GWH1800N, GWH2100N, GWH2100N(CA), VWH0500N, VWH0750N, VWH1000N, VWH1500N, VWH2000N, VWH2000N(CA) **Additional Letters and/or numbers may be placed (as suffix) to indicate trim packages and/or tracking numbers.*	BTX 100*, BTX 100 130, BTXL 100 130, GDHE 50*, GDHE 50 130, GDHE 75 130 BTH 120*, BTH 150*, BTH 199*, BTH 250* BTH 300*, BTH 400*400 400, GW 400 400 BTL 199 100, BTL 275 100, BTL 275A 100, BTL 400 100, BTL 400A 100, GW 300 400, GW 400 400, GB 300 400, GB 400 400 *Additional Letters and/or numbers may be placed (as suffix) to indicate trim packages and/or tracking numbers. AT-H3J-DV-N, AT-H3J-OS-N, AT-H3S-DV-N, AT-H3S-OS-N, AT-H3-DV-N, AT-H3-OS-N, AT-H3M-DV-N, AT-H3M-OS-N, ATI 240H 100, ATO 240H 100, ATI 340H 100, ATO 340H 100, ATI 540H 100, ATO 540H 100, ATI-240H-N, ATI-240H-N, ATI-540H-N, ATI140H100, ATO140H100, BLN 75 100, GCBN 75 100, BL 100 100, GCN 100 100, BTL 120 104, BTL 120 200, BTL 154 104, BTL 154 200, BTL 180 104, BTL 180 200, BTL 199 104, BTL 199 200, BTL 198 200, BTL 250 104, BTL 250A 104, BTL 250 200, BTL 250A 200, BTL 275 104, BTL 275A 104, BTL 275 200, BTL 275A 200, BTL 310 104, BTL 310A 104, BTL 310 200, BTL 310A 200, BTL 366 104, BTL 366A 104, BTL 366 200, BTL 366A 200, BTL 400 104, BTL 400A 104, BTL 400 200, BTL 400A 200, BTH 120 200, BTH 120A 200, BTH 150 200, BTH 150A 200, BTH 199 200, BTH 199A 200, BTH 250 200, BTH 250A 200, BTH 300 200, BTH 300A 200, BTH 400 200, BTH 400A 200, BL 80 100, GCN75100, ATI-110U200, ATO-110U200, ATI-310U200, ATO-310U200, ATI-510U200, ATO-510U200, XWH(150,200,285,400), ATI-540P-N, ATO-540P-N, GSP100200, BSS130200, GSP130200, BSS150200, GSP150200, BTS130200, GTP130200, BTS150200, GTP150200, BTS175200, GTP175200, BTS199200, GTP199200 ACT-199I-N, ATX-199-N-100, ACT-199O-N	BTN 80* BTN 100* BTN 120*, BTN 154*, BTN 180*, BTN 199*, BTN 199C* BTN 200*, BTN 250*, BTN 275*, BTN 310*, BTN 366*, BTN 400*, BT 100*, FSG 100*, FGR 100*, FCG 100*, PCG 100*, BT 100* BT 80*, FSG 75*, FGR 75*, FCG 75* FPSH 75*, BTF 75*, BTF 80*, GPS 75*, BTI 80* BTX 75*, GPVH 50*, BTX 80*, GPHE 50*, BTP 740A* SDX80-140NE*, SDX100-199NE*, SDX100-260NW*, SDX80-140NE* SDX100-199NE*, SDX 100-260NE*, RTF 120*, GB/GW200*, GB/GW300* BTN-199C* (9/22/10) *Additional Letters and/or numbers will be placed here to indicate trim packages and/or tracking numbers.	Joe Wallace 843-335-8281 x462 jwallace@hotwater.com
A.O. Smith (Canada)		AT-H3J-DV-N, AT-H3S-DV-N, AT-H3-DV-N	**A.O.Smith**: HYB-90N **State**: GPH-90N **American**: GH-90N **Lowe's**: NHG90 **Kenmore (Sears)**: 153.331010 **Reliance**: PH-90G **US Craftmaster**: HG-90N	Arman Shahabi 519-843-1616 x4112 ashahabi@hotwater.com
A.O. Smith Water Products Company (Takagi Tankless Division)		ATI 110U 100, ATI-110U-N, ATO 110U 100, ATI 310U 100, ATI-310U-N, ATO 310U 100, ATI 510U 100, ATI-510U-N, ATO 510U 100, ATI-100C-N, ATI-310C-N, ATI510C-N AT-KJr3U-CV-NG, AT-K5U-CV-NG, AT-D3U-CV-NG, ATI-100C-N, ATI-310C-N, ATI-510C-N **State:** GTS-110C-N, GTS-310C-N, GTS-510C-N SCT-199I-N, STX-199-N-100, SCT-199O-N **American:**GT-110C-N, GT-310C-N, GT-510C-N MCT-199I-N, MTX-199-N-100, MCT-199O-N **Takagi:**TK-110C-N, TK-310C-N, TK-510C-N TCT-199I-N,TCT-199O-N **Reliance:** TS-110C-G, TS-310C-G, TS510C-G **US Craftmaster:** GTU-110C-N, GTU-310C-N, GTU-510C-N **John Woods**: JCT-199-N	**Takagi:** T-KJr2-IN-N, T-KJr2-OS-N, T-K4-IN-N, T-K4-OS-N, T-D2-IN-N, T-D2-OS-N T-H2S-DV-N, T-H2S-OS-N **AO Smith**: ATI 110 100, ATO 110 100, ATI 310 100, ATO 310 100, ATI 510 100, ATO 510 100, *ATI 520H 100, ATO 520H 100, ATIO 710 100, ATIO 710A 100, ATIO 910 100, ATIO 910A 100, ATI 320H 100, ATO 320H 100* **State**: GTS 110NI 100, GTS 110NE 100, GTS 310NI 100, GTS 310NE 100, GTS 510NI 100, GTS 510NE 100, *GTS 520NIH 100, GTS 520NEH 100, GTS 710NIE 100, GTS710NIE A 100, GTS 910NIE 100, GTS 910NIE A 100, GTS 320NIH 100, GTS 320NEH 100* **American**: GT110NI 100, GT110NE 100, GT310NI 100, GT310NE 100, GT510NI 100, GT510NE 100, *GT520NIH 100, GT 520NEH 100, GT710NIE 100, AGT710NIE 100, GT910NIE 100, AGT910NIE 100, GT320NIH 100, GT320NEH 100* **Reliance**: TS110GI 100, TS110GE 100, TS310GI 100, TS310GE 100, TS510GI 100, TS510GE 100, *TS520GIH 100, TS520GEH 100, TS320GIH 100, TS320GEH 100* **US Craftmaster**: GTU110NI 100, GTU110NE 100, GTU310NI 100, GTU310NE 100, GTU510NI 100, GTU510NE 100, *GTU520NIH 100, GTU520NEH 100, GTU320NIH 100, GTU320NEH 100* **Rainsoft**: GTR110NI 100, GTR110NE 100, GTR310NI 100, GTR310NE 100, GTR510NI 100, GTR510NE 100, *GTR510NIH 100, GTR510NEH 100* **Kenmore**: 154.332000, 154.332020, 154.335000, 154.335020, 154.336000, 154.336020 **John Wood**: JWT-110-N, JWT-310-N, JWT-510-N, *JWT-520-N, JWT-710-N, JWT-710-AN, JWT-910-N, JWT-910-AN, JWT-320-N* **GSW**: GSWT-110-N, GSWT-310-N, GSWT-510-N, *GSWT-520H-N, GSWT-710-N, GSWT-710-AN, GSWT-910-N, GSWT-910-AN, GSWT-320H-N*	Peter Phan 949-770-7171 x 2179 pphan@hotwater.com Indahwati Widjaja 949-770-7171 x2178
Bock Water Heaters, Inc.	OT500N, OT500N-A ODOT500N-A	OT125N, OT150N, OT199N, OT200N, OT200N-A, OT250N, OT250N-A, OT299N, OT299N-A, OT300N, OT300N-A, OT400N, OT400N-A ODOT125N, ODOT150N, ODOT199N,ODOT200N-A, ODOT250N-A ODOT299N-A, ODOT300N-A, ODOT400N-A	EZ 75-135N, EZ 80-156N, EZ 80-199N, EZ 100-199N	Mike Steinhafel 608-257-2225 mikes@bockwaterheaters.com

South Coast Air Quality Management District (SCAQMD)

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LIST OF CERTIFIED UNITS PURSUANT TO RULE 1146.2 (Updated March 22, 2018)

NOTE: The SCAQMD does not endorse or warrant any specific product or manufacturer

Company/Brand Name	Type 2 (> 400,000--2,000,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 40 ng/J or 55 ppm NOx @ 3% O2) (Certification expires 12/31/2011, Except for Pool Heaters) (Sell-through until 12/31/2012, Except for Pool Heaters)	CONTACT Phone/E-mail/Web
Bock Water Heaters, Inc.		60-HEC-125-NA, 60HEC-125-NA-A, 60HEC-150-NA, 60HEC-150-NA-A, 60HEC-199-NA, 60HEC-199-NA-A, 100HEC-150-NA, 100HEC-150-NA-A, 100HEC-199-NA, 100HEC-199-NA-A, 100HEC-250-NA, 100HEC-250-NA-A, 100HEC-300-NA, 100HEC-300-NA-A, 100HEC-399-NA, 100HEC-399-NA-A, ULN65L155E3N, ULN65L155E3NA, ULN65L199E3N, ULN65L199E3NA, ULN65L270E3N, ULN65L270E3NA, ULN100L199E3N, ULN100L199E3NA, ULN100L270E3N, ULN100L270E3NA, ULN100L300E3N, ULN100L300E3NA, ULN100L399E3N, ULN100L399E3NA	75HN-1N, 75W-125SDLN-NA, 38W-155SDLN-NA, 75W-160SDLN-NA, 80W-180SDLN-NA, 80W-199SDLN-NA, 80W-250SDLN-NA, 80W-250SDLN-NA-A, 100W-199SDLN-NA, 100W-250SDLN-NA, 100W-250SDLN-NA-A, 75W-300SDLN-NA, 75W-300SDLN-NA-A, 66W-370SDLN-NA, 66W-370SDLN-NA-A, 66W-399SDLN-NA, 66W-399SDLN-NA-A, 100W-270SDLN-NA, 100W-270SDLN-NA-A, 100W-300SDLN-NA, 100W-300SDLN-NA-A, 80PDVLN-300-NA, 80PDVLN-300-NA-A, 100PDVLN-360-NA, 100-PDVLN-360-NA-A, 80PDVILN-150-NA, 80PDVILN-200-NA, 80PDVILN-250-NA, 80PDVILN-250-NA-A, 100PDVILN-150-NA, 100PDVILN-200-NA, 100PDVILN-250-NA, 100PDVILN-250-NA-A	D.Jay Nethercot 269-795-3364 dnethercot@bradfordwhite.com BradfordWhite.com
Bosch	GB 312-120, GB 312-160, GB 312-200, GB 312-240, GB 312-280 SSB512, SB625WS(160, 220, 290, 370, 480, 640)	GB162-80, GB162-100, GB 312-90, GWH-C-920 CTDR-EFS-NG, INTEGRA 500 N, C 1210 ESC NG, C 1210 ES NG, C 1050 ES NG, C 950 ES NG, GWH-C-800 CTDR-EFS-NG ZBR 16-3, ZBR 21-3, ZBR 28-3, ZWB 28-3, ZBR 35-3, ZBR 42-3, ZWB 35-3, ZWB 42-3, KBR 16-3, KBR 21-3, KBR 28-3, KBR 35-3, KBR 42-3, KWB 28-3, KWB 35-3, KWB 42-3 830 ES NG, 940 ES NG SSB85, SSB120, SSB160, SSB255, SSB399, T9800(SE160, SEO160, SE199, SEO199, SEC199, SECO199), T9900(SE160, SE199), T9900i(SE199)	GB 162-80 HA, GB 162-100 HA, GWH-2400 CTDR EFS NG, GWH 640 EFS NG, 830 ES NG, INTEGRA 500N, GWH-715 CTDR EFS NG, GWH-2700 CTDR EFS NG, EVOLUTION 500 N, GWH-C 800 CTDR EFS NG, 940 ES NG, 940 ESO NG GB 162-80 LB, GB 162-100 LB Certified to fire at 28,000 BTU/Hr only: AQ125-X-NG, AQ125-FX-NG, AQ125-BNG (Certified to fire at 28,000 BTU/hr only). AQ125-HX-NG GWH-635-ES-N, 250SX-NG 660 EF, 660 EFO (certified by Noritz by extension to Bosch)	Dan Moffroid 603-965-7599 dan.moffroid@us.bosch.com
Bradford White (Tank Type)	BRHCH/BRHHH/BRHCV/BRHHV1200N, BRHCH/BRHHH/BRHCV/BRHHV1600N, BRHCH/BRHHH/BRHCV/BRHHV2000N BPNC(H,V)0500N, BPNCP0500N, BPNCH0750N, BPNCV0750N, BPNCP0750N, BPNCH1000N, BPNCV1000N, BPNCP1000N, BPNCH1250N, BPNCV1250N, BPNCP1250N, BPNCH1500N, BPNCV1500N, BPNCP1500N, BPNCH1750N, BPNCV1750N, BPNCP1750N, BPNCH2000N, BPNCV2000N, BPNCP2000N, BMT2H0500N, BMT2V0500N, BMT2P0500N, BMT2H0750N, BMT2V0750N, BMT2P0750N, BMT2H1000N, BMT2V1000N, BMT2P1000N, BMT2H1250N, BMT2V1250N, BMT2P1250N, BMT2H1500N, BMT2V1500N, BMT2P1500N, BMT2H1750N, BMT2V1750N, BMT2P1750N, BMT2H2000N, BMT2V2000N, BMT2P2000N, BMGH2000NXJCX1, BMGV2000NXJCX1 , BNTH500N(XN0, XN1, XN2, XX0, XX1, XX2, JX0, JX1, JX2, JN0,JN1,JN2); BNTH600N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); BNTH750N(XN0, XX0, XX1,XX2, JX0, JX1, JX2, JN0); BNTH850N(XN0, XX0, XX1, XX2, JX0, JX1, JX2, JN0); BNTH1000N(XX0,XX1,JX0,JX1), BNTH1700N(XX0,XX1,XJ0, SJ1) , BNTH1200N(XX1, JX1), BNTV500N(XN0,XN1,XN2, XX0, XX1, XX2, JX0, JX1, JX2, JN0,JN1,JN2); BNTV600N(XN0, XX0, XX1, XX2, JX0, JX1, JX2, JN0); BNTV750N(XN0, XX0, XX1, XX2, JX0, JX1, JX2, JN0); BNTV850N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); BNTV1000N(XX0,XX1,JX0,JX1), BNTV1700N(XX0,XX1,XJ0, SJ1) BNTV1200N(XX1, JX1), BMGH1600NX(XAX1, XBX1, XCX1, XDX1, XEX1, JAX1, JBX1, JCX1, JDX1, JEX1), BMGV1600NX(XAW1, XBW1, XCW1, XDW1, XEW1, JAW1, JBW1, JCW1, JDW1, JEW1)	*EFR160T1206EN (extended from EF60T125E3N2)* , EF60T125E3N2, EF60T125E3NA2, EF60T150E3N2, EF60T150E3NA2, EF60T199E3N2, EF60T199E3NA2, EF100T150E3N2, EF100T150E3NA2, EF100T199E3N2, EF100T199E3NA2, EF100T250E3N2, EF100T250E3NA2, EF100T300E3N2, EF100T300E3NA2, EF100T399E3N2, EF100T399E3NA2, U175S6RN, U2XR75S6RN, U2TW75T6RN, U2TW75T10RN, CSW2U75T10RN, CDW2U75T10RN, CSW2TWU75T10RN, CDW2TWU75T10RN, SDW2U75S6RN, SDW2U75S10RN, SDW2TWU75S6RN, SDW2TWU75S10RN, U75T80R3N, UTW475S76R3N, U100T6RN, U100T88R3N, U65L155E3N, U65L155E3NA, U65L199E3N, U65L199E3NA, U100L199E3N, U100L199E3NA, U65L270E3N, U65L270E3NA, U100L270E3N, U100L270E3NA, U100L300E3N, U100L300E3NA, U100L399E3N, U100L399E3NA UCG100H1803N(A), UCG100H1993N(A), UCG100H2503N(A), UCG100H2703N(A), UCG100H3003N(A), UCG100H3993N(A), UCG80H1253N(A)*, UCG80H1803N(A)*, UCG80H1993N(A)*, UCG80H2703N(A)*, UCG80H3993N(A)* URG275H6N, URG2100H6N, URG2PV75H6N, ULG275H763N, ULG2100H853N, ULG2PV75H763N BMT2(V,H)(0200, 0300, 0400)N **Brute LX Models:** BMLXHW 050(NA*XN, NA*LN), BMLXHW(NA*XN, NA*LN), BMLXHW 100(NA*XN, NA*LN), BMLXHW 125NA*XN, BMLXCW 125(NA*XN, NA*LN), BMLHW C125NA*LN, BMLXHW 150(NA*XN, NA*LN), BMLXCW 150(NA*XN, NA*LN), BMLXHW 175(NA*XN, NA*LN), BMLXCW 175(NA*XN, NA*LN), BMLXHW 220(NA*XN, NA*LN)	GX225S6BN, GX223S6BN, GX245S6BN, GX155S6BN, M175S6BN, M2XR75S6BN, 75T80B3N, MIITW75T6BN, TW375S75B3N, MI100T6BN, 100T88B3N, D75T125E3N, D75T125E3NA, DM75T125E3N, DM75T125E3NA, D38T155E3N, D38T155E3NA, DM38T155E3N, DM38T155E3NA, D75T160E3N, D75T160E3NA, DM75T160E3N, DM75T160E3NA, D80T180E3N, D80T180E3NA, DM80T180E3N, DM80T180E3NA, D80T199E3N, D80T199E3NA, DM80T199E3N, DM80T199E3NA, D80T250E3N, D80T250E3NA, DM80T250E3N, DM80T250E3NA, D100T199E3N, D100T199E3NA, DM100T199E3N, DM100T199E3NA, D100T250E3N, D100T250E3NA, DM100T250E3N, DM100T250E3NA, D75T300E3N, D75T300E3NA, D65T370E3N, D65T370E3NA, D65T399E3N, D65T399E3NA, D100S199E3N, D100S199E3NA, DM100S199E3N, DM100S199E3NA, D100S250E3N, D100S250E3NA, DM100S250E3N, DM100S250E3NA, D100L199E3N, D100L199E3NA, DM100L199E3N, DM100L199E3NA, D100L250E3N, D100L250E3NA, DM100L250E3N, DM100L250E3NA, D100L270E3N, D100L270E3NA, DM100L270E3N, DM100L270E3NA, D100L300E3N, D100L300E3NA, D80L399E3N, D80L399E3NA, PDV80T300E3N, PDV80T300E3NA, PDV100T360E3N, PDV100T360E3NA, PDV80S150E3N, PDV80S150E3NA, PDV80S200E3N, PDV80S200E3NA, PDV80S250E3N, PDV80S250E3NA, PDV100S150E3N, PDV100S150E3NA,PDV100S200E3N, PDV100S200E3NA, PDV100S250E3N, PDV100S250E3NA	D.Jay Nethercot 269-795-3364 dnethercot@bradfordwhite.com BradfordWhite.com
Bradford White(Tankless)	BNTH500N(XN0, XX0, JX0, JN0), BNTH600N(XN0, XX0, JX0, JN0), BNTH750N(XN0, XX0, JX0, JN0), BNTH850N(XN0, XX0, JX0, JN0), BRHHH/BRHHV1200N, BRHHH/BRHHV1600N, BRHHH/BRHHV2000N, BMT2(H,V,P)0500N, BMT2(H,V,P)0750N, BMT2(H,V,P)1000N, BMT2(H,V,P)1250N, BMT2(H,V,P)1500N, BMT2(H,V,P)1750N, BMT2(H,V,P)2000N	BNTH 080N(XN1, XN2), BNTH 105N(XN1, XN2), BNTH 150N(XN1, XN2), BNTH 210N(XN1, XN2), BNTH 285NXN0, BNTH400N(XN0, XX0), BNTV 080N(XN1,XN2), BNTV 105N(XN1, XN2), BNTV 150N(XN1, XN2), BNTV 210N(XN1, XN2), BNTV 285NXN0, BNTV400N(XN0, XX0), RTG-199HE-N, RTG-199ME-N, BFTCF199NA1XN, BFTCF175NA1XN, BFTCF140NA1XN, BFTCF120NA1XN, BFTCF100NA1XN, BFTCF80NA1XN, BFTCW199NA1XN, BFTCW175NA1XN, BFTCW140NA1XN, BFTCW120NA1XN, BFTCF100NA1XN, BFTCF80NA1XN, BFTHW199NA1XN, BFTHW175NA1XN, BFTHW140NA1XN, RHG-199HE-N, RHG-150HE-N, RHG140HE-N BMFTCF199NA1XN, BMFTCF175NA1XN, BMFTCF140NA1XN, BMFTCF120NA1XN, BMFTCF100NA1XN, BMFTCF80NA1XN	
Bradford White (Rinnai/Tankless)			TG-150I, TG-150E, TG-180I, TG-180E, TG-199I, TG-199E, TG-237I, TG-237E, TG-237I-A, TG-237E-A, TGHE-160I, TGHE-160E, TGHE-199I, TGHE-199E	Donald N. Emen Product Certification Engineer 800-621-9419 x 4414
Bradford White (Solar)			Bradford-White: M2XR75S6BN, M2TW75T6BN Bradford-White: SDW2275S6BN, SDW2TW75T6BN Velux: TFF0802205US, TFF0804205US Jomar: EVOTGB-NAV-, EVOTGB-NPV- Schuco: S-WW-70-1GPN	D.Jay Nethercot 269-795-3364 dnethercot@bradfordwhite.com BradfordWhite.com
Bryan Steam	AB150-W-FDGG-LX (Power Flame-PF-Burner Model LNICR2-GG-20A) ARC-1000 AB90-(W, S-15, S-150)-FDG-LX (PF burner NPMR30A-12-120) AB120-(W, S-15, S-150)-FDG-LX (PF burner NPMR30-12-120) AB150-(W, S-15, S-150)-FDG-LX (PF burner NPMR50-15-120) AB200-(W, S-15, S-150)-FDG-LX (PF burner NPMR50-15-120) TF150, TF150-RC, TF200, TF200-RC DR450-(W, S-15, S-150)-FDG-LX (PF burner NPMR15-10-120) DR650-(W, S-15, S-150)-FDG-LX (PF burner NPMR15-10-120) DR850-(W, S-15, S-150)-FDG-LX (PF burner NPMR15-10-120)	DR350-(W, S-15, S-150)-FDG-LX (PF burner NPMR15-10-120) DR400-S-100-FDG-LX	DR350-W-FDG-LX, DR350-S-15-FDG-LX, DR350-S-150-FDG-LX	Greg Minard 765-473-6651 x6029 gminard@bryansteam.com

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LIST OF CERTIFIED UNITS PURSUANT TO RULE 1146.2 (Updated March 22, 2018)

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Company/Brand Name	Type 2 (> 400,000--2,000,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 40 ng/J or 55 ppm NOx @ 3% O2) (Certification expires 12/31/2011, Except for Pool Heaters) (Sell-through until 12/31/2012, Except for Pool Heaters)	CONTACT Phone/E-mail/Web
Burnham Commercial Boilers U.S. Boiler Company (PowerFlame burner)	Multi-Pass: MPC4, MPC5, MPC6, MPC7, MPC8, MPC9, MPC10, MPC11 Apex: APX500 Alpine: ALP500, ALP600, ALP700, ALP800 Apex: APX800-NF-2L05 3P-25CA*, 3P-30CA*, 3P-40CA*, 3P-50CA* *suffix may be added to indicate characteristics unrelated to combustion C-Series: CL-20, CL-30, CL-40, CL-50	Apex: APX399 Alpine: ALP080, ALP105, ALP150, ALP210, ALP285, ALP399, ALP500,		Jim Knauss 717-293-5895 Jordan Zimmerman 717-293-5821 jzimmerman@burnhamcommercial.com www.burnhamcommercial.com
Camus Hydronics, LTD (Canada)	***Advantus:*** AVN(H,W)-0500-MS(I,O), AVN(H,W)-0600-MS(I,O), AVN(H,W)-0800-MS(I,O), AVN(H,W)-1000-MS(I,O), AVN(H,W)-1200-MS(I,O), AVN(H,W)-1400-MS(I,O), AVNH(H,W)-1600-MS(I,O), AVN(H,W)-1800-MS(I,O), AVN(H,W)-2000-MS(I,O) ***DynaMax:*** DMNH- 0501, DMNC-0503, (DMNW, THNW)-0502, DMNH- 0601, DMNC-0603, DMNW-0602, DMNH- 0701, DMNC-0703, DMNW-0702, DMNH- 0801, DMNC-0803, DMNW-0802 ***DynaFlame:*** DFN(H,W)-(0500, 0501, 0502, 0750, 0751, 0752, 1100, 1101, 1102, 1200, 1201, 1202, 1500, 1501, 1502, 1750, 1751, 1752, 2000, 2001, 2002) ***Dynaforce:*** DRN(H,W)(0500, 0600, 0700, 0800, 1000, 1200, 1400, 1600, 1800, 2000)-MS(I,O) ***MicroFlame:*** MFNH-500-2GI, MFNW-500-2GI, MFN (H,W)- (0500, 0502, 0600, 0602, 0800, 0802, 1000, 1002, 1200, 1202, 1400, 1402, 1600, 1602, 1800, 1802, 2000, 2002, 2010, 2012)	***DynaMax***: DMNH-(0081, 0101, 0151, 0201, 0251, 0211, 0261, 0291, 0391) DMNC-(0083, 0103, 0153, 0203, 0253, 0213, 0263, 0293, 0393) (DMNW, THNW)-(0082, 0102, 0152, 0202, 0252, 0212, 0262, 0292, 0392) ***Dynaforce:*** DRN(H,W)-(0300, 0350, 0400)-MS(I,O)	***MicoFlame***: MFN(H,W)-(0100, 0102, 0150, 0152, 0200, 0202, 0250, 0252, 0300, 0302, 0400, 0402)	Kevin Choi (Canada) Kevin.Choi@camus-hydronics.com 905-696-7800 Fax 905-696-8801 Claudio Petracca Claudio.Petracca@camus-hydronics.com Brian Dolan (RF MacDonald) Brian.Dolan@RFMacDonald.com
Clayton	SFG-50M-FMB, ECO-180XN			Ben Garcia 626 435 1238 ben.garcia@claytonindustries.com Lance Baroldi 626 435 1240 lance.baroldi@claytonindustries.com
Cleaver Brooks	FLX-700-150, FLX-700-200 *CFC-500* , MCF/CFC-750, MCF/CFC-1000, MCF/CFC-1500, MCF/CFC-1800 CFH700-15-15ST, CFH700-15-150ST, CFH700-20-15ST, CFH700-20-150ST, CFH700-25-15ST, CFH700-25-150ST, CFH700-30-15ST, CFH700-30-150ST, CFH700-40-15ST, CFH700-40-150ST, CFH700-50-15ST, CFH700-50-150ST, CFV700-15-15ST, CFV700-15-150ST, CFV700-20-15ST, CFV700-20-150ST, CFV700-25-15ST, CFV700-25-150ST, CFV700-30-15ST, CFV700-30-150ST, CFV700-40-15ST, CFV700-40-150ST, CFV700-50-15ST, CFV700-50-150ST, CFW700-500-125HW, CFW700-750-125HW, CFW700-1000-125HW, CFW700-1500-125HW, CFW700-2000-125HW CFCE-700-750-125, CFCE-700-1000-125, CFCE-700-1500-125, CFCE-700-2000-125 CFCE-700-500-125	CFH700-10-15ST, CFH700-10-150ST, CFV700-10-15ST, CFV700-10-150ST, CFW700-400-125HW		Brian Huibregtse, 414-577-2743, bhuibregtse@cleaverbrooks.com, www.cleaverbrooks.com
Climate Energy			CE95M-200	Peter Desens 315-797-1310 x4128 petdes@ecrinternational.com
Columbia Boiler Co.	MPH-15, MPH-20, MPH-30, MPH-40, MPH-50	MPH-10		Mike Bonjo (610) 323-2700
Contractors Supply Club			WH-201061-NG, WHO-201059-NG, WH-321063-L-NG, WHO-321064-L-NG	John Chicoine 413-564-5872 Jchicoine@mestek.com
Cosmo Gas (Mestek, Inc.)		45WN, 45AN, 45WE, 45AE		John Chicoine 413-564-5872 Jchicoine@mestek.com
Craftsmaster/EnviroTemp (A. O. Smith)		UG2F7575T4NV100		Joe Wallace 843-335-8281 x462 jwallace@hotwater.com
Crown Boiler Co.	PHNTM500, PHNTM500C	BWC070EN*, BWC120EN*, BWC151EN* *Suffix may be added to denote characteristics unrelated to combustion system. PHNTM399, PHNTM399C		Paul Sohler 215-535-8900
Daesung Industriial Co., LTD			SHW-99FF, SHW-120FF, SHW-180FF, SHW-199FF,, ESC-99 FFCD, ESC-120FFCD	82-2-2003-2362 82-2-736-6367 Fax
DDR (DeDietrich) Americas, Inc.	310ECO-5, 310ECO-6, 310ECO-7, 310ECO-8, 310ECO-9			519-650-0420
DeDietrich Americas, Inc.	GT430-8A, GT430-9A GT335A, GT336A, GT337A, GT338A, GT339A			www.dedietrichboilers.com
DyHot		GU160T/518(11,12)1160, GU130T/518(11,12)1130, GU125T/518(11,12)1125 DH40-100T		Anthony Hung anthony.hung@dyhot.com.tw
Dunkirk Boiler (ECR International)		Q90-125	Q90 100, Q90 75, Q90 50, Q90-150, Q90-175, Q90-200, Q95M-200	Peter Desens 315-797-1310 x4128 petdes@ecrinternational.com
ECR International		Q90-125 95B200MDN1NBOU	Q90-100, Q90-150, Q90-175, Q90-200, GHW-U150/151NP,	Peter Desens 315-797-1310 x4128 petdes@ecrinternational.com

South Coast Air Quality Management District (SCAQMD)

RULE 1146.2 - EMISSIONS OF OXIDES OF NITROGEN FROM LARGE WATER HEATERS AND SMALL BOILERS AND PROCESS HEATERS

LIST OF CERTIFIED UNITS PURSUANT TO RULE 1146.2 (Updated March 22, 2018)

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Company/Brand Name	Type 2 (> 400,000--2,000,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 40 ng/J or 55 ppm NOx @ 3% O2) (Certification expires 12/31/2011, Except for Pool Heaters) (Sell-through until 12/31/2012, Except for Pool Heaters)	CONTACT Phone/E-mail/Web
Embassy (Mestek, Inc.)		OX-160C, OX-160OC, OX-160B, OX-160OB	95B200MDN1NBOU	John Chicoine 413-564-5872 Jchicoine@mestek.com
Fulton Boiler Works	ICT (10, 15, 20, 25, 30)-LE FB-(010, 015, 020, 025, 030)-T-LE ICS/ICX/ICW (10, 15, 20, 25, 30, 40, 49.5)-LE FB-(010, 015, 020, 025, 030)-(A,F)-LE VMP (40, 49.5, 50)-LE, VMPW (40, 49.5, 50)-LE RLN-(500, 750, 1000, 1500, 2000); CAL-(500, 750, 850); EDR-(750, 1000, 1500, 2000) VSRT-30	ICT 9.5-LE FB-09.5-T-LE ICS/ICX/ICW 9.5-LE FB-09.5-(A,F)-LE; CAL-300		Francis Hicks 315-298-5121 fran.hicks@fulton.com www.fulton.com Jim Pettiford 315-298-7146
Gasmaster Industries, Inc.	GMIB-600, 800, 1M, 1.5M, 1.9M, 2M, GM1W-600, 800, 1M, 1.5M, 1.9M, 2M, GM1P-600, 800,	GMIB-200, 300, 400, GM1W-200, 300, 400, GM1P-200, 300, 400		
GENERAL BOILER. General Boiler Co., Inc. Los Angeles, CA.	**STEAM- POWER BOILERS:** GBS-M3-SM-LN-15, GBS-M3-SM-LN-20, GBS-M3-SM-LN-25, GBS-M3- SM-LN-30, GBS-M3-SM-LN-40, GBS-M3-SM-LN-45, GBS-M3-SM-LN- 50 **HOT WATER:** GBHW-M3-SM-LN630, GBHW-M3-SM-LN840, GBHW-M3-SM-LN999, GBHW-M3-SM-LN1260, GBHW-M3-SM-LN1600, GBHW-M3-SMLN1800, GBHW-M3-SM-LN2000	**STEAM-POWER BOILERS:** GBS-A3-03, GBS-A3-05, GBS-A3-06, GBS-A3-9.5 GBS-M3-SM-LN-03, GBS-M3-SM-LN-06, GBS-M3-SM-LN-9.5 **HOT WATER:** GBW-A3-03, GBW-A3-05, GBW-A3-06, GBW-A3-9.5 GBHW-M3-SM-LN125, GBHW-M3-SM-LN250, GBHW-M3-SM-LN399		Elmer Romero 323-233-1005 elmer@generalboiler.com generalblr@bcglobal.net www.generalboiler.com
General Electric Consumer & Electrical (Rinnai)			GN75DNSRSA, GN75ENSRSA, GN94DNSRSA, GN94ENSRSA, GP94DNSRSA, GP94ENSRSA	Donald N. Emen 800-621-9419 demen@rinnai.com
Gotairiku, Inc.			*Chofu brand -Tankless/Instantaneous* FO-C26FF (Indoor) FO-C26 (Outdoor)	Mitsu Kano kano@gotairiku.us 949-433-6843
Grand Hall Enterprises Co., Ltd.		GU100/508(11,12,21,22)1100; GU120/508(11,12,21,22)1120 GU145S/508(11,12,21,22)1145; GU145/508(11,12,21,22)1145 GU195S/508(11,12,21,22)1195; GU195M/508(11,12,21,22)1195 GU160T/518(11, 12)1160; GU125T/518(11,12)1125	GU145(S)/508(11,12,21,22)1145(S), GU195(S)/508(11,12,21,22)1195(S), GU195(M)/508(11,12,21,22)1195(M) (S-units that cannot be linked together, M-Units that can be linked together, upto 8)	Jason Sisler 214-550-8023 www.grandhall.com Paul Home 214-550-8032 paul@grandhall.com
GSW (A.O. Smith)		GSWT-110U-N, GSWT-310U-N, GSWT-510U-N, GSWT-240H-N, GSWT-340H-N, GSWT-540H-N, GSWT-540P-NIH		
Harsco Industrial (Patterson-Kelley Company)	N-700, N-900, N-1200, N-1500, N-1700, N-1900, PKN-1000, PKN-2000, NM-1000, NM-1500, NM-2000, C-450, C-750, C-900, C-1050, C-450LNX, C-750LNX, C-900LNX, C-1050LNX, C-1500, C-1500H, C-2000, C-2000H, N-1500MFD, N-2000MFD, N-1000MFD, N-750MFD D-700, *D-900* , D-1000, D-1200, D-1500, D-1700, *D-1900* , D-2000 D-750MFD, D-1000MFD, D-1500MFD, D-2000MFD, CM-500, SN-700, SN-900 SC-2000, SC-1500 SCD/SC1000, SCD/SC850, SCD/SC750, SCD/SC650	C-300, C-300LNX, CM-300, CM-399		J. Kevin Pollard 570-242-9452 kpollard@harsco.com Lucas Wonnel 570-994-4578 lwonnel@harsco.com www.harscopk.com
Hamilton Engineering	HWDN0059ASME, HWH999, HWD999, HWH1499, HWD1499, HWH1999, HWD1999	HWHN00129.8, HWHN00129ASME, HWDN00129ASME, HWDN00129		Allen Coleman 800-968-5530 734-419-0200 www.hamiltonengineering.com
Hayward Pool Products, Inc. (Pool Heaters)	H500FDN		*Pool Heaters (certification does not expire on 12/31/2011):* H100ID1, H250IDL, H400IDL, H150FDN, H200FDN, H250FDN, H300FDN, H350FDN, H400FDN, H135ID1 *Pool Heaters (certification does not expire on 12/31/2011):* ABG1001, H250IDL2, H400IDL2, H250FDNASME, H400FDNASME (cert by ext)	Vance Willis 615-255-3111
Heat Technology Products (Same models as Weil-Mclain)	W-M (480, 580, 680, 780, 880, 980, 1080, 1180, 1280)	W-M380		Wayne Najarian

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HTP Comfort Solutions, Inc.	**MODCON:**MODCON500, MODCON850, MODCON300VWH, MODCON500VWH, MODCON850VWH, MODCON 1000, MODCON 1700, MODCON700, MODCON700VWH	**Phoenix:** PH76-50*, PH76-60*, PH76-80*, PH 100-55, PH100-80, PH100-119, PH 130-55, PH 160-55, PH 160-80, PH 160-119, PH 199-55, PH 130-80, PH 130-80S, PH 199-80, PH199-55SA, PH 199-80S, PH 130-119, PH 130-119S, PH 199-119, PH 199-119S, PHP199-119, PHP199-119D, PHP260-119, PHP320-119, PHP399-119, PHM130-80, PHM130-100, PHM199-80, PHM199-100 **Versa-Hydro:** PHE 100-55, PHE 130-55, PHE 199-55, PHE 130-80, PHE 130-80S, PHE 199-80, PHE 199-80S, PHE 130-119, PHE 130-119S, PHE 199-119, PHE 199-119S **Pioneer:** PHR 100-55, PHR 130-55, PHR130-55C, PHR160-55, PHR160-55C, PHR 199-55, PHR199-55C **Elite:** EL-80, EP-80, EL-110, EP-110, EL-150, EP-150, EL-220, EP-220,EP-220VWH, EL-299, EP-299, EP-299VWH, EL-301, EP-301, EP-301VWH, EL-399, EP-399, EP-399VWH **MUNCHKIN:** T50M, 80M, T80M, 140M, 199M, 199VWH, 299VWH, 399VWH, 399M **SUPERSTOR:** SE, HE **MODCON:** MODCON300 **ELITE FT:** EFT-55, EFT-80, EFT-110, EFT-155, EFT-199, EFT-285, EFT-399 **ELITE PLUS:** ELP-110, ELP-199 EFTC-199F, EFTC-199W, EFTC-175F, EFTC-175W, EFTC-140F, EFTC-140W, EFTC-120F, EFTC120W, EFTC-100F, EFTC-100W, EFTC-80F, EFTC-80W, RT-180, RT-199, RT-150, EL-80NVWH, EL-110NVWH, EL-150NVWH, EL-220NVWH, EL-299NVWH, EL-399NVWH, UFT199W, UFT175W, UFT-120W, UFT-140W, UFT100W, UFT80W, RTC-199, RTC-180, RTC-150, RTO-199, RTO-180, RTO-150, RTP199, RTP-180, RTP-150, RGH-199, RGH-180, RGH-150, CGH-199, CGH-180, CGH-150, CGHO-199, CGHO-180, CGHO-150, RGH-100F, RGH-76F, RGH-75F, RGH40-100F, RGH20-75F, RGH20-76F, RGH20-100F UFTC-199*, UFTC-175*, UFTC-140*, UFTC-120*, UFTC-100*, UFTC-80* UFT-199*, UFT-175*, UFT-140*, UFT-120*, UFT-100*, UFT-80* RTCO-199, RTCO-180, RTCO-150 RGH-199*, RGHO-199, RGH-180*, RGHO-180, RGH-150*, RGHO-150 CGH-199*, CGH-180*, CGH-150*	MC SERIES: MC-50, MC-50W, MC-80, MC-80W, MC-99, MC-99W, MC-120, MC-120W	Donna M. Homen 774-271-3138 donnah@htproducts.com www.HTPRODUCTS.com
Hurst Boiler & Welding Co., Inc.	S250-G-50-150, S250-X-30-150-0, S250-G-50-125W 4VTLN-G-10-15, 4VTLN-G-10-150, 4VTLN-G-15-15, 4VTLN-G-15-150, 4VTLN-G-20-15, 4VTLN-G-20-150, 4VTLN-G-25-15, 4VTLN-G-25-150	4VTLN-G-6-15, 4VTLN-G-6-150		Ray Pierce 229-346-3545 John Clarkson
HydroTherm (Mestek, Inc.)	KN-6, KN-10, KN-16, KN-20	KN-2, KN-4, GX-150, GX-400		John Chicoine 413-564-5872 Jchicoine@mestek.com
Intellihot Green Technologies, Inc.	iQ750, iQ1000, iQ751, iQ1001, iQ1501	NG (150i, 185i, 200i), i150P, i185P, i200P, cNG200i, eNG200i, i200, i200X Hubbell Models: GX200P, GX200 Vaugh Models: VCON200P, VCON200 iQ250, iQ250D, iQ250P, iQ251, i250, i250P, i250X, i251X		Sivaprasad Akasam 309-473-8050 309-296-8984 Fax info@intellihot.com
Jacuzzi (Rinnai)		J-SN180F2, J-SN180W2, J-SN199W2, J-SN199F2-X		
John Wood (A.O. Smith)		JWT-110U-N, JWT-310U-N, JWT-510U-N, JWT-240H-N, JWT-340H-N, JWT-540H-N, JWT-540P-NIH		
Kemco Systems	L' Heater, Harry's Dye & Wash, 2 MMBTU Low Nox "GP"			John O'Hehir 800-633-7055
Kiturami Homsys		K1-19CCB, K1-17CCB, K1-14CCB, K1-12CCB, K1-10CCB, K1-08CCB, K1-19CC, K1-17CC, K1-14CC, K1-12CC, K1-10CC, K1-08CC, K1-19CCH, K1-17CCH, K1-14CCH, K1-12CCH, K1-10CCH, K1-08CCH, K1-19CCHB, K1-17CCHB, K1-14CCHB, K1-12CCHB, K1-10CCHB, K1-08CCHB, KCGB-120, KCGB-100, KCGB-80, KGWH-190, KGWH-180, KGWH-140, KGWH-190R, KGWH-180R, KGWH-150R, KGWH-190FR, KGWH-180FR, KGWH-150FR, K1-199WH, K1-180WH, K1-140WH, KCGB-120, KCGB-100, KCGB-80, KCGB-120S, KCGB-100S, KCGB-80S, KGWH-199, KGWH-181, KGWH-150, K1-199CWH, K1-180CWH, K1-140CWH		Terry Jeung (213) 251-8855

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LAARS Heating Systems	RHCH/RHHH/RHCV/RHHV1200N, RHCH/RHHH/RHCV/RHHV1600N, RHCH/RHHH/RHCV/RHHV2000N PNC(H,V)0500N, PNCP0500N, PNCH0750N, PNCV0750N, PNCP0750N, PNCH1000N, PNCV1000N, PNCP1000N, PNCH1250N, PNCV1250N, PNCP1250N, PNCH1500N, PNCV1500N, PNCP1500N, PNCH1750N, PNCV1750N, PNCP1750N, PNCH2000N, PNCV2000N, PNCP2000N, MT2H0500N, MT2V0500N, MT2P0500N, MT2H0750N, MT2V0750N, MT2P0750N, MT2H1000N, MT2V1000N, MT2P1000N, MT2H1250N, MT2V1250N, MT2P1250N, MT2H1500N, MT2V1500N, MT2P1500N, MT2H1750N, MT2V1750N, MT2P1750N, MT2H2000N, MT2V2000N, MT2P2000N, MGH2000NXJCX1, MGV2000NXJCX1 NTH500N(XN0,XN1,XN2, XX0,XX1,XX2,JX0,JX1,JX2,JN0,JN1,JN2); NTH600N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); NTH750N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); NTH850N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); NTH1000N(XX0,XX1,JX0,JX1), NTH1700N(XX0,XX1,XJ0, SJ1) NTH1200N(XX1, JX1) NTV500N(XN0,XN1,XN2, XX0,XX1,XX2,JX0,JX1,JX2,JN0,JN1,JN2); NTV600N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); NTV750N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); NTV850N(XN0,XX0,XX1,XX2,JX0,JX1,JX2,JN0); NTV1000N(XX0,XX1,JX0,JX1), NTV1700N(XX0,XX1,XJ0, SJ1) NTV1200N(XX1, JX1) MGH1600NX(XAX1, XBX1, XCX1, XDX1, XEX1, JAX1, JBX1, JCX1, JDX1, JEX1) MGV1600NX(XAW1, XBW1, XCW1, XDW1, XEW1, JAW1, JBW1, JCW1, JDW1, JEW1) BNTH100N(XX0, JX0, XX1, JX1) BNTV1000N(XX0, JX0, XX1, JX1) NTV500NXN3, NTV500NXX3, NTV500NXW3, NTV500NXL3,	EDP/EBP/EDN-110, EDP/EBP/EDN-175, LUHE60T 25E3N, LUHE60T 125E3NA, LUHE60T 150E3N, LUHE60T 150E3NA, LUHE60T 150E3NA, LUHE60T 199E3N, LUHE60T 199E3NA, LUHE100T 150E3N, LUHE100T 150E3NA, LUHE100T 199E3N, LUHE100T 199E3NA, LUHE100T 250E3N, LUHE100T 250E3NA, LUHE100T 300E3N, LUHE100T 300ENA, LUHE100T 399E3N, LUHE100T 399E3NA LMC125N Mascot II: LMH-125NAOXX, LMC-125NAOXX Mighty Stack: MS080(199, 300, 399) Mighty Therm: MT2(V,H)(0200, 0300, 0400)N NTH080N(XN1,XN2); NTH105N(XN1,XN2); NTH150N(XN1,XN2); NTH210N(XN1,XN2); NTH285N(XN0,XN1,XN2,XX0,XX1,XX2); NTH399N(XN0,XN1,XN2,XX0,XX1,XX2), NTV080N(XN1,XN2); NTV105N(XN1,XN2); NTV150N(XN1,XN2); NTV210N(XN1,XN2); NTV285N(XN0,XN1,XN2,XX0,XX1,XX2); NTV399N(XN0,XN1,XN2,XX0,XX1,XX2), LU65L155E3N, LU65L199E3N, LU65L270E3N, LU100L199E3N, LU100L270E3N, LU100L300E3N, LU100L399E3N, LU65L155E3NA, LU65L199E3NA, LU65L270E3NA, LU100L199E3NA, LU100L270E3NA, LU100L300E3NA, LU100L399E3NA; MLXHW050(NA*XN, NA*LN); MLXHW075(NA*XN, NA*LN); MLXHW100(NA*XN, NA*LN); MLXHW125NA*XN; MLXCW125(NA*XN, NA*LN); MLHWC125NA*LN; MLXHW150((NA*XN, NA*LN); MLXCW150((NA*XN, NA*LN); MLXHW175(NA*XN, NA*LN); MLXCW175((NA*XN, NA*LN); MLXHW220(NA*XN, NA*LN) MFTCF199NA1XN, MFTCF175NA1XN, MFTCF140NA1XN, MFTCF120NA1XN, MFTCF100NA1XN, MFTCF80NA1XN, MFTCW199NA1XN, MFTCW175NA1XN, MFTCW140NA1XN, MFTCW120NA1XN, MFTCW100NA1XN, MFTCW80NA1XN, MFTHW199NA1XN, MFTHW175NA1XN, MFTHW140NA1XN, MFTHW120NA1XN, MFTHW100NA1XN, MFTHW80NA1XN,	PNCH/PNCV0200NBCK1CXX, PNCH/PNCV0300NBCK1CXX, PNCH/PNCV0400BCK1CXX, MT2H/MT2V0200N, MT2H/MT2V0300N, MT2H/MT2V0400N	Chris Jacques 603-335-6300 certification@laars.com
Lattner, P.M., Manufacturing Company	10WLF, 15WLF, 20WLF, 25WLF, 30WLF, 40WLF, 50WLF	G-5	1.5HE, 3HE, 5HE, 7HE, 9.5HE (Type 1 <30 ppm) 9.5WLF (Type 1)	Sutherland Junge 800-345-1527
Lochinvar-1	**Power-Fin:** P(B,F)N0502, P(B,F)N0752, P(B,F)N1002, P(B,F)N1302, P(B,F)N1501, P(B,F)N1701, P(B,F)N2001 **Copper-Fin:** C(B,W)N0497, C(B,W)N0647, C(B,W)N0747, C(B,W)N0987, C(B,W)N1257, C(B,W)N1437, C(B,W)N1797, C(B,W)N2067, C(H,F,P)N0402, C(H,F,P)N0502, C(H,F,P)N0652, C(H,F,P)N0752, C(H,F,P)N0992, C(H,F,P)N1262, C(H,F,P)N1442, C(H,F,P)N1802, C(H,F,P)N2072 (BY EXT-10-27-10) **Knight:** KBN501, OKN501 **Knight XL:** KBN601, OKN601, KBN701, OKN701, KBN801, OKN801 **Sync:** SBN1000, SBN1300, SBN1500 **Armor:** AWN501PM, OAN501PM **Armor XL:** AWN601PM, OAN601PM, AWN701, OAN701PM, AWN801,OAN801PM **Armor X2:** AWN1000PM, AWN1300PM, AWN1500PM **Shield:** SNA501-125 **Crest:** FBN1500, FBN2000, FBD1500, FBD2000 FBN0751, FBN1001, FBN1251, FBN1501, FBN1751, FBN2001 OFN0751, OFN1001, OFN1251, OFN1501, OFN1751, OFN2001 **FTXL:** FTX500N, FTX600N, FTX725N, FTX850N *Note: Additional letters and/or numbers may be placed (as suffix) to indicate trim packages and/or tracking numbers*	**Knight:** KBN081, KBN106, KBN151, KBN211, KBN286, KBN400, OKN151, OKN211, OKN286, OKN400, KHN(055,085,110,155,199,285) **Armor:** AWN151PM, AWN200PM, AWN286PM, OAN151PM, OAN200PM, OAN286PM **Armor:** AWN400PM, OAN400PM **Armor Wall Hung:** WAN125PM, WAN200PM **Shield: S**NR126-065, SNR151-100, SNA151-100, SNR201-100, SNA201-100, SNA286-125, SNA401-125 **Wall Hung:** WHN(055,056,085,086,110,111,155,156,199,200,285,286,399,400) **Cadet:** CDN040, CDN070, CDN100, CDN120, CCN120 **FTX:** FTX400N **Delta:** NKB050N, NKB080N, NKB110N, NKC110N, NKB150N, NKC150N, NKB199N, NKC199N **Epic:** EPB050N, EPB080N, EPB110N, EPC110N, EPB150N, EPC150N, EPB199N, EPC199N *Note: Additional letters and/or numbers may be placed (as suffix) to indicate trim packages and/or tracking numbers*	**Efficiency Plus Group:** EW(N,L)150, 200, 250, 300 **EnergyRite:** ERN (152, 202, 252, 302, 402), ERL (152, 202, 252, 302, 402) ETN076, CNR080-076, DVN076-2, STN100, STN076-2, ETN100, ETN100-2, CNR085-100, CNR125-075-DF9-SC, CNR155-035-DF9-SC, CNR160-075-DF9-SC, CNR180-080-DF9-SC, CNR200-080-DF9-SC, CNR200-100-DF9-SC, CNR250-100-DF9-SC, CNA251-100-DF9-SC, CNR300-075-DF9-SC, CNA301-075-DF9-SC, CNR370-065-DF9-SC, CNA371-065-DF9-SC, CNR199-100-DF9-2SC, CNR400-080-DF9-2-SC, CNA401-080-DF9-2-SC, DNA301-080-SC, DNA361-100-SC, PNR150-080-SC, PNR200-080-SC, PNR250-080-SC, PNR150-100-SC, PNR200-100-SC, PNR250-100-SC, TNR125-060, TNA126-060, TNR150-060, TNA151-060, TNR200-060, TNA201-060, TNR150-100, TNA151-100, TNR200-100, TNA201-100, TNR250-100, TNA251-100, TNR300-100, TNA301-100, TNR400-100, TNA401-100, CLN075075100, UTN075075100 *Note: Additional letters and/or numbers may be placed (as suffix) to indicate trim packages and/or tracking numbers* **Discontinued Models:** ERN/L 401, ERN/L 301, ERN/L 251, ERN/L 201, ERN-L 151, EB(N,L)150, 200, 250, 300	Lisa Davis 615-889-8900 x2229

South Coast Air Quality Management District (SCAQMD)

RULE 1146.2 - EMISSIONS OF OXIDES OF NITROGEN FROM LARGE WATER HEATERS AND SMALL BOILERS AND PROCESS HEATERS

LIST OF CERTIFIED UNITS PURSUANT TO RULE 1146.2 (Updated March 22, 2018)

NOTE: The SCAQMD does not endorse or warrant any specific product or manufacturer

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Lochinvar-2	**Discontinued Models Intell-Fin:** I(B,W)N1500, I(B,W)N1750, I(B,W)N2000 **Discontinued Models Power-Fin:** P(B,F)N0501, P(B,F)N0751, P(B,F)N1001, P(B,F)N1300 **Discontinued Models Copper-Fin:** C(B,W)N0495, C(B,W)N0645, C(B,W)N0745, C(B,W)N986, C(B,W)N1256, C(B,W)N1436, C(B,W)N1796, C(B,W)N2066, C(H,F,P)N0401, C(H,F,P)N0501, C(H,F,P)N0651, C(H,F,P)N0751, C(H,F,P)N0991, C(H,F,P)N1261, C(H,F,P)N1441, C(H,F,P)N1801, C(H,F,P)N2071 **Discontinued Model Knight:** KBN500 **Discontinued Models Knight XL:** KBN600, KBN700, KBN800 **Discontinued Model Armor:** AWN500PM **Discontinued Models Armor XL:** AWN600, AWN700, AWN800 **Discontinued Models Shield:** SNA500-125 *Note: Additional letters and/or numbers may be placed (as suffix) to*	**Discontinued Models Knight:** KBN080, KBN105, KBN150KBN210, KBN285, KBN399 **Discontinued Models Knight Wall Mount:** WBN050, WBN051, WBN080, WBN081, WBN105, WBN106, WBN150, WBN151, WBN210, WBN211 **Discontinued Models Armor:** AWN150PM, AWN199PM, AWN285PM, **Discontinued Models Armor:** AWN399PM **Discontinued Models Shield:** SNR150-100, SNR200-100, SNA285-125, SNA400-125, SNA500-125 **Discontinued Models:** WBN050, WBN051, WBN080, WBN081, WBN105, WBN106, WBN150, WBN151, WBN210, WBN211 *Note: Additional letters and/or numbers may be placed (as suffix) to indicate trim packages and/or tracking numbers*	ETN076, CNR080-076, DVN076-2, STN100, STN076-2, ETN100, ETN100-2, CNR085-100, CNR125-075-DF9-SC, CNR155-035-DF9-SC, CNR160-075-DF9-SC, CNR180-080-DF9-SC, CNR200-080-DF9-SC, CNR200-100-DF9-SC, CNR250-100-DF9-SC, CNA251-100-DF9-SC, CNR300-075-DF9-SC, CNA301-075-DF9-SC, CNR370-065-DF9-SC, CNA371-065-DF9-SC, CNR199-100-DF9-2SC, CNR400-080-DF9-2-SC, CNA401-080-DF9-2-SC, DNA301-080-SC, DNA361-100-SC, PNR150-080-SC, PNR200-080-SC, PNR250-080-SC, PNR150-100-SC, PNR200-100-SC, PNR250-100-SC, TNR125-060, TNA126-060, TNR150-060, TNA151-060, TNR200-060, TNA201-060, TNR150-100, TNA151-100, TNR200-100, TNA201-100, TNR250-100, TNA251-100, TNR300-100, TNA301-100, TNR400-100, TNA401-100 *Note: Additional letters and/or numbers may be placed (as suffix) to indicate trim packages and/or tracking numbers*	Lisa Davis 615-889-8900 x2229
Lochinvar-3		CLN199100 100, CLN199100 200, CLN199060 200, CLN275085 100, CLN275085A 100, CLN400085 100, CLN400085A 100, CLN075100 100, UTN10075 100, UBG2F7575T4NV100, CLN120080 104, CLN154080 104, CLN180100 104, CLN199100 104, CLN250100 104, CLN250100A 104, CLN275085 104, CLN275085A 104, CLN310085 104, CLN310085A 104, CLN360085 104, CLN360085A 104	CGN075100, LTN10075 LVN(07580, 07580ST) CXN(120070, 155080, 180100) CXN(199100, 250100, 275100, 310085, 365085, 400085)(A)	Lisa Davis 615-889-8900 x2229
Marathon International		BAXI HT 380, BAXI HT 1.330, BAXI Luna Duo Tec 40GA, BAXI Luna Duo Tec 1.330GA, BAXI Luna HT 1.450, BAXI Luna HT 1.650, BAXI Luna HT 1.100		Mike Thomas 905-602-5360, 416-878-8137
McKenna Boiler	MH-15; MH-20; MH-25; MH-30; MH-40; MH-50 JFS-50PF, JFS-40PF, JFS-25PF, JFS-20PF	MH-10		
Miura Boiler West, Inc.	LX-50G, LX-50SG, LXW-50G, LXL-50G, LXL-50SG			Ricardo Alcatara 626-305-6622 rick.alcantara@miuraboiler.com www.miuraboiler.com
Monitor Products, Inc.			MZ25S, MZ25C, MZ40C, MZ20-40C MWH-180 (indoor), MWH-180EX (Outdoor)	Bogdan Blicharz 609-584-0505 x 21
Navien, Inc.		CR-180A NG, CR-210A NG, CR-240A NG, CR-180 NG, CR-210 NG, CR-240 NG CB-180, CB-210, CB-240 CH-180, CH-210, CH-240 CH-180 ASME, CH-210 ASME, CH-240 ASME NR-180 NG, NR-180A NG, NP-180 NG, NP-180A NG, NR-210 NG, NR-210A NG, NP-210 NG, NP-210A NG, NR-240 NG, NR-240A NG, NP-240 NG, NP-240A NG NPE-180A NG, NPE-210A NG, NPE-240A NG, NPE-180S, NPE-210S, NPE-240S, NCB-180, NCB-210, NCB-240, NHB-055, NHB-080, NHB-110, NHB-150, NCB-150, NPE-150S, NCB-150E, NCB-180E, NCB-210E, NCB-240E NFB-199, NFB-175		Kevin Pirotin 949-420-0420
New Yorker Boiler		GHE80B, GHE100B, GHE120B, GHE150B, GHE180B, GHE180M		John Busse jbusse@usboiler.net 717-239-4482
Noritz America Corp.		NR83-DVC, NR98(OD,DVC,SV), NRC111(OD,DV), NR199(OD,DVC) NRC98-(OD, DV), NCC199(OD,DV), NC199(OD,DVC) NRC83-(OD, DV), NRC661-(OD,DV), NRC1111-(OD,DV), NCC1991-(OD,DV), NCC1992-DV, NR981-(OD,DVC), NC1991-(OD,DVC), NR981-SV, EN18WI30LS, EN19WI30LS, NR501-OD NGA, NR662-OD NGA,NRC711-DV, NRC711-OD, NRC661A-DV, NRC661A-OD, NRCP982-DV, NRCP1112-DV, NRC663-FSV FFWI98XNRQ, FFWI71XNRQ, FFWE98XNRQ, FFWE66XNRQ, CB199-DV, CB180-DV, CB140-DV, GQ-C3259WZ-FFUS, GQ-C3259WX-FFUS, GQ-C2859WZ-FFUS, GQ-C2859WX-FFUS NRCB199DV (GHQ-3201 WX-FFUS), NRCB180DV (GHQ-2801WX-FFUS) NCC300OD (GQ-C5032WZ US), NCC300DV (GQ-C5032WZ-FF US), NR83OD (GQ-2457WS US)	N-042, N-063, N-084, N-132, N-063S, N-069M, N-132M, N-084M, N-084-DV, N-132M, N069M-1, N069M-OD, N-063S-1, N063S-OD, N-0751M-DV *NH-1501-DV, NH-2001-DV , N-0751M , N-0751M-OD , N-0631S , N-0631S-OD , N-0931M, N-0931M-DV , N-0931M-OD , N-0931M-ASME, N-0931M-DV-ASME , N-1321M-ASME , N-0531S , N-0531S-OD , N-0841 MC , N-0841 MC-DV , N-0751M-DVC , N-0842MC, N-842MC-DV* NR66-SV, NR66-OD, NR71-SV, NR71-OD, NR98-SV, NR98-OD, NR98-DVC, NC199-OD, NC199-DVC, NRC111-SV, NRC111-DV, NCC199-SV, NCC199-DV, NR111-SV, NR111-OD, NR111-DV, NC250-SV-ASME, NC250-DV-ASME, NC380-SV-ASME, NH150-DV, NH199-DV (These are alternate model names of models shown above in italics) NR50-OD	Teruko Kawada 714-433-7843 Fax 714-241-1196 tkawada@noritz.com

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LIST OF CERTIFIED UNITS PURSUANT TO RULE 1146.2 (Updated March 22, 2018)

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Pacific Steam	BP-210, BP-300, BP-300S, BP-400, BP-500	BP-100, BP-100S, BP-200, BP-200S, BP-200SX		David Kang 562-906-9292 skang@pacificsteam.com
Parker Boiler Company	103-15L, 103-20L, 103-25L, 15L, 15LR, 20L, 20LR, 25L, 25LR, 30LR, 40LR, 48LR, 70LR, HT432L, WH490L, WH490LR, T490L, T490LR, HT528L, T600L, T600LR, WH600L, WH600LR, HT672L, WH730L, WH730LR, T760L, T760LR, HT864L, T970L, T970LR, WH970L, WH970LR, HT1008L, WH1210L, WH1210LR, HT1296L, WH1410L, WH1410LR, T1460L, T1460LR, HT1536L, T1730L, T1730LR, WH1900L, WH1900LR, HT1920L, T2160L (1990), WH2270L (1990), WH2270LR(1990), HT2304L(1990), T2600L (1990), T2600LR (1990), HT2640L (1990), WH2650 (1990), WH2650L(1990), WH2650LR(1990), T2970L (1990), WH3000L (1990), WH3000LR(1990), HT3120L (1990), HT3456L (1990), T3600L (1990), T3900 (1990), HT4032 (1990), T4600L (1990), T1995LR, T1140LR, T1995L, 30L, 40L, 70L, 48L, G672LR, G72LRL, G1008R, G1008RL, G1536R, G1536RL, G2304R, G2304RL, T1140L TC150, TC150L, TC210, TC210L, TC350, TC350L, TC600, TC600L,	103-9.5L, 9.5L, 9.5LR, HT180L, HT247L, T300LR, T395L, T395LR, WH395LR, HT395L, HT126L, WH395L, T300L, WH300L, 9.6WWL	3LA, 7LA, 9.5LA	Greg Danenhauer (323) 727-9800 www.parkerboiler.com
Paloma (Paloma Industries, Inc). **Paloma** **Ecosense** **Raypak** **Rheem** **Rheem-Ruud**		**Paloma:**PH2-25R DVSN, PH2-25R OFN, PH2-20R DVSN, PH2-20R OFN, PHH-32RDVN, PHH-32ROFN, PH2-28RDVSLN, PH2-28ROFLN PH2-(25RDVSLN, 25ROFLN, 20RDVSLN, 20ROFLN, PHH-(32RDVSLN,32RDVLN-1, 32RDVLN, 29RDVSLN, 29RDVLN-1, 29RDVLN, 25RDVSLN, 25RDVLN-1, 25RDVLN, 32ROFLN, 32ROFLN-1, 29ROFLN, 29ROFLN-1, 25ROFLN, 25ROFLN-1), PH2-25RDVSLN-1, PH2-25ROFLN-1, PH2-20RDVSLN-1, PH2-20ROFLN-1, PH2-22RDVSLN-1, PH2-22ROFLN-1 **Ecosense:**ECO180DVN3, ECO180XN3, ECO150DVN3, ECO150XN3. ECOH200DVN, ECOH200XN,ECOH200, ECOH200XN, ECO200DVLN3, ECO200XLN3 ECO(180DVLN3, 180XLN3, 150DVLN3, 150XLN3), ECOH(200DVLN, 200XLN, 160DVLN, 160XLN), ECOH180DVLN, ECOH180XLN, ECO200DVLN3-1, ECO180DVLN3-1, ECO150DVLN3-1, ECO200XLN3-1, ECO180XLN3-1, ECO150XLN3-1, ECOH(200DVLN-1,180DVLN-1, 160DVLN-1, 200XLN-1, 180XLN-1, 160XLN-1) **Raypak:**209DVN, 209XN,NH-209DVN, NH-209XN,NH-188DVN, NH-188XN, NH-208DVLN, NH-208XLN, NH-(209DVLN-1, 159DVLN-1), NH-(188DVLN, 188XLN), NH-(209DVLN, 209XLN), NH-(159DVLN, 159XLN), NH-208DVLN-1, NH-188DVLN-1, NH-208XLN-1, NH(209XLN-1, 188XLN-1, 159XLN-1) **Rheem:**RTG-84DVN, RTG-84XN, RTG-64DVN, RTG-64XN, RTGH-95DVN, RTGH-95XN, RUTGH-95DVN, RUTGH-95XN RTG-95DVLN, RTG-95XLN RTG-(84DVLN, 84XLN, 64DVLN, 64XLN), RTGH-(95DVLN, 95XLN), RTGH-(84DVLN, 84XLN), RTGH-90DVLN, RTGH-90XLN, RTG-95DVLN-1, RTG-84DVLN-1, RTG-64DVLN-1, RTG-95XLN-1, RTG-84XLN-1, RTG-64XLN-1, RTGH(95DVLN-1, 90DVLN-1, 84DVLN-1, 95XLN-1, 90XLN-1, 84XLN-1) **Rheem-Ruud:**GT-180DVN, GT-180XN	**Paloma:**PH-16FSN, PTG-42PVN, PH-28RIFSN, PH-28ROFN, PTG-74PVN, PTG-74XN, PH-28CIFSN, PH-28COFN, PH-28 R DVSN, PH-28 C DVSN, PTG-74DVN, PTG2-42PVN, PTG-53PVN, PTG-53XN, PTG-53DVN, PH-16FISN, PH-20R IFSN, PH-20R OFN, PH-20R DVSN, PH-25R DVSN, PH-25R OFN, PH2-28R DVSN, PH2-28R OFN. PHH-25RDVN, PHH-25ROFN *(Also certified equivalent trade brand WaiWela, EcoSense, Rheem, Ruud, Richmond, Raypak, Sure Comfort)* ***Ecosense:** ECOH160DVN, ECOH160XN (equivalent from Paloma)* ***Raypak:** 159DVN, 159XN (equivalent from Paloma),NH-159DVN, NH-159XN,NH-208DVN, NH-208XN* ***Rheem:** RTG-16PVN, RTG-42PVN, RTG-74PVN, RTG-74XN, GT-199PV-N, GT-199X-N, RTG-74DVN, GT-199DV-N, RTG2-42PVN, RTG-53PVN, RTG-53XN, RTG-53DVN, RTGL74DVN, RTGL74PVN, RTGL74XN, RTG-66XN, RTG-66DVN, RTG-95DVN, RTG-95XN.* *RTGH-84DVN, RTGH-84XN (equivalent from Paloma)* ***Rheem-Ruud:** GT-199PV-N, GT-199X-N, GT-199DV-N, GT-200DVN, GT-200XN*	Hadi Takeuchi 805-278-5499
Paloma (Paloma Industries, Inc). **Richmond** **Ruud** **SureComfort** **WaiWela**		**Richmond:**RMTG84DVN, RMTG84XN, RMTG64DVN, RMTG64XN RMTGH95DVN, RMTGH95XN,RMTGH95DVN, RMTGH95XN RMTG95DVLN, RMTG95XLN RMTG-(84DVLN, 84XLN, 64DVLN, 64XLN), RMTGH-(95DVLN, 95XLN), RMTGH-(84DVLN, 84XLN), RMTGH90DVLN, RMTGH90XLN, RMTG-95DVLN-1, RMTG-84DVLN-1	***Richmond:** RMTG-42PVN, RMTG-74PVN, RMTG-74XN, RMTG-74DVN, RMTG2-42PVN, RMTG-53PVN, RMTG-53XN, RMTG-53DVN, RMTG-66DVN, RMTG-66XN, RMTG95DVN, RMTG95XN.* *RMTGH84DVN, RMTGH84XN (equivalent from Paloma)* ***Ruud:** RUTG-42PVN, RUTG-74PVN, RUTG-74XN, GT-199DV-N, GT-199PV-N, GT-*	Hadi Takeuchi 805-278-5499
Peerless Boilers **(PB Heat LLC)**	LC-04, LC-05R, LC-05, LC-06, LC-07, LC-08, LC-09, LC-10 PF-850, PF-1000, PF-1500	PF-50, PF-80, PF-110, PF-140 PF-210, PF-399 Cast 92-2, Cast 92-4 (certified on March 30, 2010 by Mestek, Inc.)		Dave Noyes 610-369-3257 NoyesD@PBHeat.com
Pentair Pool Products **(Pool Heaters)**		ETI400NA ASME, ETi400NA ASME ULTRATEMP ETI^{TM}230	**Pool Heaters (certification does not expire on 12/31/2011):** MasterTemp: 125, 200, 200 HD, 250, 250 HD, 250 ASME, 300, 300 HD, 400, 400 HD, 400 ASME	Mauricio Valencia (805) 553-5246
Pentair Pool Products **(Pool Heaters)**	**Pool Heaters:** PM (0500, 0750, 1000, 1250, 1500, 1750, 2000) NACC2BXN (Certified by Laars - 8/31/10)			
Precision Boilers	FTS-1-50-150-CS-N			Patrick Godsey (423) 587-9390 x253

South Coast Air Quality Management District (SCAQMD)

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NOTE: The SCAQMD does not endorse or warrant any specific product or manufacturer

Company/Brand Name	Type 2 (> 400,000--2,000,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 14 ng/J or 20 ppm NOx @ 3% O2)	Type 1 (≤ 400,000 BTU/HR) (Complies with 40 ng/J or 55 ppm NOx @ 3% O2) (Certification expires 12/31/2011, Except for Pool Heaters) (Sell-through until 12/31/2012, Except for Pool Heaters)	CONTACT Phone/E-mail/Web
Purpose Co. (AO Smith)		AT-KJr3U(IN-N, OS-N), AT-K5U(IN-N, OS-N), AT-D3U(IN-N, OS-N), AT-H3P-DV-N, AT-H3P-OS AT-H3C-DV-N, AT-H3C-OS-N ACB-110(S,H)-N, ACB-150(S,H)-N, ACB-199(S,H)-N		Indah Widjaja 949-770-7171 x2327
PVI Industries, Inc.	81PFL, 121PFL, 60(N/P/SS/*)125A-MXF, 80(N/P/SS/*)125A-MXF 90(N/P/SS/*)125A-MXF, 50(N/P/SS/*)(250/300)A-MXF 70(N/P/SS/*)300A-MXF, 80(N/P/SS/*)250A-MXF, 100(N/P/SS/*)(250/300)A-MXF, 120(N/P/SS/*)(250/300)A-MXF, 140(N/P/SS/*)300A-MXF, 160(N/P/SS/*)250A-MXF, 170(N/P/SS/*)300A-MXF, 190(N/P/SS/*)300A-MXF, 2566(N/P/SS/*)250A MXIF, 2566(N/P/SS/*)300A MXIF, 50(P,N,SS)(X)125A-(MXPV)IF, 65(P,N,SS)(X)125A-(MXPV)IF, 75(P,N,SS)(X)125A-(MXPV)IF, 85(P,N,SS)(X)125A-(MXPV)IF, 90(P,N,SS)(X)125A-(MXPV)IF, 50(P,N,SS)(X)250A-(MXPV)IF, 65(P,N,SS)(X)250A-(MXPV)IF, 75(P,N,SS)(X)250A-(MXPV)IF, 85(P,N,SS)(X)250A-(MXPV)IF, 90(P,N,SS)(X)250A-(MXPV)IF, 50(P,N,SS)(X)300A-(MXPV)IF, 65(P,N,SS)(X)300A-(MXPV)IF, 75(P,N,SS)(X)300A-(MXPV)IF, 85(P,N,SS)(X)300A-(MXPV)IF, 90(P,N,SS)(X)300A-(MXPV)IF, 50(P,N,SS/*)(X)125A-(MXPV)IF, 65(P,N,SS/*)(X)125A-(MXPV)IF, 75(P,N,SS/*)(X)125A-(MXPV)IF, 85(P,N,SS/*)(X)125A-(MXPV)IF, 90(P,N,SS/*)(X)125A-(MXPV)IF, 50(P,N,SS/*)(X)250A-(MXPV)IF, 65(P,N,SS/*)(X)250A-(MXPV)IF, 75(P,N,SS/*)(X)250A-(MXPV)IF, 85(P,N,SS/*)(X)250A-(MXPV)IF, 90(P,N,SS/*)(X)250A-(MXPV)IF, 50(P,N,SS/*)(X)300A-(MXPV)IF, 65(P,N,SS/*)(X)300A-(MXPV)IF, 75(P,N,SS/*)(X)300A-(MXPV)IF, 85(P,N,SS/*)(X)300A-(MXPV)IF, 90(P,N,SS/*)(X)300A-(MXPV)IF, 150(N/P/SS/*)(X)250A-(MXPV)IF, 180(N/P/SS/*)(X)250A-(MXPV)IF, 200(N/P/SS/*)(X)250A-(MXPV)IF, 150(N/P/SS/*)(X)300A-(MXPV)IF, 180(N/P/SS/*)(X)300A-(MXPV)IF, 200(N/P/SS/*)(X)300A-(MXPV)IF, 50L(SS,V)130A-GCML, 55L(SS,V)130A-GCML, 60L(SS,V)130A-	40(N/P/SS/*)125A-MXF, 199(N/P/SS/C/*) A-PN (SANI), 299(N/P/SS/C/*) A-PN (SANI) 25(P,N,SS)(X)125A-(MXPV) IF, 40(P,N,SS)(X)125A-(MXPV) IF, 25(N/P/SS/*)(X)125A-(MXPV) IF, 40(N/P/SS/*)(X)125A-(MXPV) IF, 20L(SS,V)130A-GCL, 30L(SS,V)130A-GCL, 40L(SS,V)130A-GCL, 20L 100A-GCL, 25L 100A-GCL, 30L 100A-GCL 40L*A-TPX	399(N/P/SS/C/*) A-PN (SANI), 20 (N/P/SS/*)125A-MXL, 27 (N/P/SS/*)125A-MXL, 40 (N/P/SS/*)125A-MXL, 27 (N/P/SS/*)250A-MXL, 40 (N/P/SS/*)250A-MXL, 2TPL, 3TPL, 4TPL	817 335 3419 x210 fmyers@ix.netcom.com www.pvi.com Michael Hubbard 214-216-3284
Quietside Corporation (Daesung Industriial Co., LTD-Mnfd)			ODW-099A, ODW-120A, ODW-180A, ODW-199A, DPW-099A, DPW-120A	888-699-6067 562-699-4351 Fax
	Hi-Delta Series: P-0502B, P-0652B, P-0752B, P-0902B, P-0992B, P-1262B, P-1532B, P-1802B, P-2002B, (H3,W3,WH3)-0502B,(H3,P,WH3)-0502C, (H3,W3,WH3)-0652B,(H3,P,WH3)-0652C (H3,W3,WH3)-0752B,(H3,P,WH3)-0752C, (H3,W3,WH3)-0902B,(H3,P,WH3)-0902C, (H8,W8,WH8)-0992B, (H8,P,WH8)-0992C,(H9,W9,WH9)-1262B,(H9,P,WH9)-1262C, (H9,W9,WH9)-1532B, (H9,P,WH9)-1532C,(H9,W9,WH9)-1802B, (H9,P,WH9)-1802C,(H9,W9,WH9,WHP)-2002B, (H9,P,WH9)-2002C,(H3,W3,WH3)-0502B(E), (H3,W3,WH3)-0652B(E), (H3,W3,WH3)-0752B(E), (H3,W3,WH3)-0902B(E), (H8,W8,WH8)-0992B(E), (H9,W9,WH9)-1262B(E), (H9,W9,WH9)-1532B(E), (H9,W9,WH9)-1802B(E), (H9,W9,WH9,WHP)-2002B(E) **Hi-Delta Limited Series**: (H3,WH3)-0499B, (H3,WH3)-0649B, (H3,WH3)-0749B, (H3,WH3)-0899B, (H3,WH3)-0989B, (H8,WH8)-1259B, (H9,WH9)-1529B, (H9,WH9)-1799B, (H9,WH9)-1999B **MVB Series**: (P,H7,W7,WH1,WHP)-0504, (P,H7,W7,WH1,WHP)-0754, (P,H7,W7,WH1,WHP)-1104, (P,H7,W7,WH1,WHP)-1504, (P,H7,W7,WH1,WHP)-2004, (P,H7,W7,WH1,WH7,WHP)-0504A,	**Hi-Delta Series**: P-0302B, P-0302C, P-0402B, P-0402C, (H3,W3,WH3)-0302B, (H3,W3,WH3)-0402B, (H3,W1,WH3)-0302B,(H3,WH3)-0302C, (H4,W1,WH1)-0302B (H4,WH1)-0302C, (H4,W1,WH1)-0402B, (H4,WH1)-0399B,(H4,WH1)-0402C, (H3,WH3)-0402C, (H3,W3,WH3)-0302B(E), (H3,W3,WH3)-0402B(E), (H4,W1,WH1)-0302B(E), (H4,W1,WH1)-0402B(E), (H3,WH1,WH3)-HD101, (H3,WH1,WH3)-HD151, (H3,WH1,WH3)-HD201, (H3,WH1,WH3)-HD251,	**Digital Pool Heaters**: (Certification does not expire on 12/31/2011) *Raypak brand:* (C,P)-R207A-EN-(C,X), (C,P)-R267A-EN-(C,X), (C,P)-R337A-EN-(C,X) (C,P)-R407A-EN-(C,X) X94 Professional Series: S-R410-EN *Rheem brand:* (C,P)-M207A-EN-(C,X), (C,P)-M267A-EN-(C,X), (C,P)-M337A-EN-(C,X) (C,P)-M407A-EN-(C,X) *Ruud brand:*	Puzant Sherbetjian

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Raypak	(P,H7,W7,WH1,WH7,WHP)-0754A, (P,H7,W7,WH1,WH7,WHP)-1104A, (P,H7,W7,WH1,WH7,WHP)-1504A, (P,H7,W7,WH1,WH7,WHP)-2004A, (H7,W7,WH7)-0503, (H7,W7,WH7)-0753, (H7,W7,WH7)-1003, (H7,W7,WH7)-1253, (H7,W7,WH7)-1503, (H7,W7,WH7)-1753, (H7,W7,WH7)-2003, (H7,W7,WH7)-0503A, (H7,W7,WH7)-0753A, (H7,W7,WH7)-1003A, (H7,W7,WH7)-1253A, (H7,W7,WH7)-1503A, (H7,W7,WH7)-1753A, (H7,W7,WH7)-2003A **XTherm Series**: (H7,W7,WH7,WHP,P)-1005, (H7,W7,WH7,WHP,P)-1505, (H7,W7,WH7,WHP,P)-2005, (H7,W7,WH7,WHP, P)-1005A, (H7,W7,WH7,WHP, P)-1505A, (H7,W7,WH7,WHP,P)-2005A **XFyre Series:** (H7,W7)-500, (H7,W7)-500A, (H7,W7)-700, (H7,W7)-700A, (H7,W7)-850, (H7,W7)-850A, WH7-500, WH7-500A, WH7-700, WH7-700A, WH7-850, WH7-850A **XVERS Series:** H7-0856*, H7-1006*, H7-1256*, H7-1506*, H7-1756*, H7-2006*	(H3,WH1,WH3)-HD301, (H3,WH1,WH3)-HD401 **XPak Series**: XPak 85, XPak 120 **XFyre Series**: (H7,W7)-300, (H7,W7)-300A, (H7,W7)-400, (H7,W7)-400A, WH7-300, WH7-300A, WH7-400, WH7-400A **84 Professional Series:** B-R259A-EN-X, B-R409A-EN-X **XPakFT Series:** H7-088AR-NS, H7-108AR-NS, H7-198AR-NS,H7-278AR-NS, H7-398A-NS	(C,P)-D207A-EN-(C,X), (C,P)-D267A-EN-(C,X), (C,P)-D337A-EN-(C,X) (C,P)-D407A-EN-(C,X) *Aquadura brand*: P-A267A-EN-(C,X), P-A407A-EN-(C,X) Raytherm Series boilers: (H4,WH1,H3,WH3)-0181, (H4,WH1,H3,WH3)-0261, (H4,WH1,H3,WH3)-0331, (H4,WH1,H3,WH3)-0401 *Jacuzzi brand*: JHN 266L, JHN 399L	(805) 278-5300 www.raypak.com
RBI (Mestek, Inc.)	FB500, FW500, FB750, FW750, FB1000, FW1000, FB1250, FW1250, FB1500, FW1500, FB1750, FW1750, FB1950, FW1950, LCDB600, LCDW600, LB600, LW600, LCDB750, LCDW750, LB750, LW750, LCDB900, LCDW900, LB900, LW900, LCDB1050, LCDW1050, LB1050, LW1050, LCDB1200, LCDW1200, LB1200, LW1200, LCDB1480, LCDW1480, LB1480, LW1480, LCDB1650, LCDW1650, LB1650, LW1650, LCDB1970, LCDW1970, LB1970, LW1970, DB600, DW600, DB750, DW750, DB900, DW900, DB1050, DW1050, DB1350, DW1350, DB1500, DW1500, DB1950, DW1950, MB500, MW500, MB750, MW750, MB1000, MW1000, MB1250, MW1250, MB1500, MW1500, MB1750, MW1750, MB2000, MW2000, CB500, CW500, CB750, CW750, CB1000, CW1000, CB1250, CW1250, CB1500, CW1500, CB1750, CW1750, CB2000, CW2000, IB1000, IB750, IB500, IW1000, IW750, IW500, CK2000, CK1500, CK1000, CK0850, DP600, DP750, DP900, DP1050, DP1350, DP1500, DP1950	LCDB225, LCDW225, LB225, LW225, LCDB300, LCDW300, LB300, LW300, LCDB400, LCDW400, LB400, LW400, DB300, DW300, DB400, DW400, IE-50, IE-80, IE-110, IE-140, IE-199, IEW-199, IE-210, IEW-210, IE-399, IEW-399, X7P9-12002-004, X7P9-12003-004, DP300, DP400		John Chicoine 413-564-5872 Jchicoine@mestek.com
Reliance Water Heater Co. (A. O. Smith)		6 50 YTPDT, 6 50 YTPDT 130, 6 75 YTPDT 130, HE 50 100NE, HE 50 100NE 130, HE 75 100N E 130 RUF 100 199 N* 100 (BTH 199 Brander) L 95199N E100, L 85275N E 100, L 85275N EA 100, L85390N E 100, L85390N EA 100, TS 110UI 100, TS 110UE 100, TS 310UI 100, TS 310UE 100, TS 510UI 100, TS 510UE 100, TS140GIH100, TS140GEH100, TS 240GIH 100, TS 240GEH 100, TS 340GIH 100, TS 340 GEH 100, TS 540GIH 100, TS 540GEH 100, 6 100 URRT100, 6 75 URRBS100, L81120N E 104, L81154N E 104, L95180N E 104, L95199N E 104, L95250N E 104, L95250N EA 104, L85275N E 104, L85275N EA 104, L85310N E 104, L85310N EA 104, L85366 E 104, L85366N EA 104, L85390 E 104, L85390N EA 104, RUF 100 19NE 200, RUF 100 199NEA 200, L81120NE 200, L81154NE 200, L81180NE 200, L100250NE 200, L100250NEA 200, L100275NE 200, L100275NEA 200, L86310NE 200, L86310NEA 200, L86366NE 200, L86366NEA 200, L86390NE 200, L86390NEA 200, 675URRS100 TS-110C-G, TS-310C-G, TS-510C-G, TS-110U-I 200,TS-110U-E 200,TS-310U-I 200, TS-310U-E 200, TS-510U-I 200, TS-510U-E 200	S 75 76 NE 6 75 XRRS (BT 80 Branders) S 100 76 NE 6 100 XRRT (BT 100 Branders) 6 75 YRVIT* 8 75 YQVIT* (BTF 80 Branders) 6 50 YTVIT HE 50 76 NE (BTX 80 Branders) N 71 120 NE* N81154N* (BTN Branders) N 81 180 N* N100200NET* (BTN Branders) N 100 200 NEAS* N 100 250 NE* (BTN Branders) N 100 275 NEA N 85 310 NE* (BTN Branders) N 85 366 NE* N 85 390 N* (BTN Branders)	Joe Wallace 843-335-8281 x462 jwallace@hotwater.com
Rheem Sales Company		**Rheem:** GNU82-156, GNU75-125, GNU65-360, GNU37-200, GNU72-250(A), GNU100-400(A), GNU91-200, GNU76-200, GNU100-200(A), GNU100-270(A), GNU100-250(A) GHE100-(130, 130A, 160, 160A, 200, 200A, 250, 250A, 300, 300A, 350, 350A, 400, 400A), GHE119-500, GHE125-500A GHE100ES-(130,160,200,250,300,350,400) GHE80-(130, 130A, 150, 150A, 200, 200A, 250, 250A, 300, 300A), GHE80ES-(130,150,200,250,300), 42V75UF, 42V100UF, 42X100UF, G75UN, G100UN, HE55-100, HE55-130, HE55-160, HE55-199, HE80-130, HE80-160, HE80-199, HE119-130, HE119-160, HE119-199 RTGH-C95DVLN, RTGH-CM95DVLN, RTGH-C95XLN, RTGH-CM95XLN RTG-70DVLN-1, RTG-70XLN-1, ECO160DVLN3-1, RTG-70DVLNWA-1, ECO160XLN3-1, RTG-70XLNWA-1 **Richmond:** TNU82-156, TNU75-125, TNU65-360, TNU37-200, TNU72-250(A), TNU100-400(A), TNU91-200, TNU76-200, TNU100-200(A), TNU100-270(A), TNU100-250(A) THE100-(130, 130A, 160, 160A, 200, 200A, 250, 250A, 300, 300A, 350, 350A, 400, 400A), THE100ES-(250,300) THE80-(130, 130A, 150, 150A, 200, 200A, 250, 250A, 300, 300A) THE80ES-(130,150,200,250,300), THE100ES-(130,160,200,350,400) **Rheem Pro:** RHGPRO75UF, RHGPRO100UF **Ruud:** PH2-75UF, P100UF, M100UF, RUTG-70DVLN-1, RUTG-70DVLNWA-1, RUTG-70XLN-1, RUTG-70XLNWA-1 RUUD Pro: RUGPRO75UF, RUGPRO100UF **Richmond:** 6G75-75UF, T75UN, 5V100UF, T100UN, RMTG70DVLN-1, RMTG70XLN-1 **General Electric:** GG75T06LRD **Rheem Tankless:** RTGH-RH11DVLN, ECOH200DVRHLN, RMTGH-RH111DVLN, RTGH-RH10DVLN, ECOH180DVRHLN, RTGH-RH84DVLN, ECOH150DVRHLN CRTGH-RH11DVLN, ECRTGH-RH11DVLN, CRTGH-RH10DVLN, ECRTGH-RH10DVLN, CRTGH-RH84DVLN, ECRTGH-RH84DVLN **Eemax:** ESG-70-DVLN-1, ESG-70-XLN-1	**Rheem**:RHGPRO75, 42V75F **GE**: GG75T06ASK00 **RUUD**: PH-75F, RUGPRO75F **VANGUARD**: 2LAC9 **Rheem**: RSG75, GN37-200, GN65-360(A), GN72-250(A), GN75-125, GN76-200, GN82-156, GN91-200, GN100-200(A), GN100-250(A), GN100-270(A), GN100-400(A) **Richmond**: RMSG75, GN37-200, GN65-360(A), GN72-250(A), GN75-125, GN76-200, GN82-156, GN91-200, GN100-200(A), GN100-250(A), GN100-270(A), GN100-400(A) **Ruud**: RUSG75 **SunEarth**: SUSG75 **ThermoMiser**: TMSG75	Ralph Hudnall (334) 213-3856 ralph.hudnall@rheem.com
Riello Canada Inc.	Steel Pro 150, AR1000, AR 1500, AR 2000	Steel Pro 25, Steel Pro 35, Steel Pro 45, Steel Pro 75, Steel Pro 115		Blaine Serio 905-542-0303x245 blaine.serio@riello.ca

South Coast Air Quality Management District (SCAQMD)

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Rinnai		E50CN,E50CR,E60SR, E75C, E75CR, E85SR, E110C, E110CR, E110SR Q85S, QP85,Q130S, QP130, Q175S, Q175C, Q205S REU-KB3237(WD, FFUD)-US-N; RU98eN, RU98iN REU-KB2530(WD, FFUD)-US-N; RU80eN, RU80iN REU-VC2837WD-US-N; RL94eN REU-VC2528(W, FFU)-US-N; V75e, V75i REU-VC2528(WD, FFUD)-US-N; RL75eN, RL75iN REU-VC2528(WD, FFUD)-US(A)-N; RL75eN, RL75iN REU-VC2025(W, FFU)-US-N; V65e, V65i REU-VC2025(WD, FFUD)-US-N; RL65eN, RL65iN REU-VC2737FFUD-US, RLX94i; REU-KBD3237FFUD-US, RUC98i; REU-KBD2530FFUD-US, RUC80i; REU-KBP3237FFUD-US, RUR98i; REU-KBP3237WD-US, RUR98e; REU-KBD2934FFUD-US, RUC90i; REU-KB2934WD-US, RU90e; REU-KBD3237FFUDC-US, C199i; REU-KB3237WDC-US, C199e REU-KCM2025FFU-US; RUCS65i REU-KCM2025W-US; RUS65e REU-KCM2528FFU-US; RUCS75i REU-KCM2528W-US; RUS75e REU-VC2837W-US; V94e REU-VC2737FFU-US; V94Xi-N, REU-N3237FF-US, RU199i, REU-NP3237FF-US, RUR199i, REU-N3237FFC-US, CU199i, REU-N3237W-US, RU199e, REU-NP3237W-US, RUR199e, REU-N3237WC-US, CU199e, REU-N2934FF-US, RU180i, REU-N2934W-US, RU180e, REU-N2530FF-US, RU160i, REU-NP2530FF-US, RUR160i, REU-N2530FFC-	REU-VA2019FFU-US, REU-VA2535FFUD-US, REU-VA3237W-US, REU-VA3237FFU-US, REU-VA2526FFU-US, REU-VA2528FFUD-US, REU-VA3237W-ASME, REU-VAM1620W-US, REU-VA2024WD-US, REU-VA2526W-US, REU-VA2528WD-US, REU-VA2535WD-US, REU-VA3237FFU-ASME, REU-VA2528FFUD(A)-US, REU-VA2528WD(A)-US, REU-VA2019 FFUD-UC, REU-VA2528 FFWD-UC, REU-VA2535 FFUD-UC, REU-VA2528 WD(A)-UC, REU-VA2535WD-UC, REU-VA2024WDD(A)-UC, REU-VA 1320 WF-US, REU-VB2020FFU-US, REU-VB2528FFUD-US, REU-VB2528WD-US, REU-VB2735FFUD-US, REU-VB2735WD-US, REU-KA2530FFUD-US, REU-KA2530WD-US, REU-KA3237FFUD-US, REU-KA3237WD-US REU-VC2837FFUD-US-N	Kelsey Dorrough 800-621-9419 x4442 kdorrough@rinnai.us
Rite Engineering & Mfg. Co.	48WG, 48WGE, 55WG, 55WGE, 63WG, 63WGE, 76WG, 76WGE, 85WG, 85WGE, 90WG, 90WGE, 105WG, 105WGE, 120WG, 120WGE, 135WG, 135WGE, 150WG, 150WGE, A150WG, A150WGE, 165WG, 165WGE, A165WG, A165WGE, 180WG	P9.5SG WP9.5SG		Jack Coe JackC@ritebolier.com 562-862-2135 www.ritebolier.com
Riverside Hydronics, LLC	750B, 750PW, 750W 51WB250A-IFC, 51WB300A-IFC, 50WB250A-IF, 50WB300A-IF 15WB-125A-MXF, 20WB 125A-MXF, 23WB 125A-MXF, 13WB 250A-MXF, 15WB 250A-MXF, 20WB 250A-MXF, 25WB 250A-MXF, 30WB 250A-MXF, 40WB 250A-MXF, 13WB 300A-MXF, 18WB 300A-MXF, 25WB 300A-MXF, 30WB 300A-MXF, 35WB 300A-MXF, 40WB 300A-MXF, 43WB 300A-MXF (Certified by PVI for Riverside Hydronics) 500(WB,WBX)125A-(IF,IFC), 650(WB,WBX)125A-(IF,IFC), 750(WB,WBX)125A-(IF,IFC), 850(WB,WBX)125A-(IF,IFC)	10WB 125A-MXF (Certified by PVI for Riverside Hydronics) 250(WB,WBX)125A-(IF,IFC), 400(WB,WBX)125A-(IF,IFC), 200WB130A-CBL, 300WB130A-CBL, 400WB130A-CBL		Frank Myers 817-335-3419 x 210 800-784-8326 www.pvi.com
Sears Roebuck and Co.			153.331761 153.331762 153.338074 153.338073 (BT 80 Branders) 153.338004 153.338004 (BT 100 Branders)	J. E. Wallace (Joe) 843-335-8281, Ext. 462 jwallace@hotwater.com
Sellers Engineering Co.	*Steam Boilers:* 20HP-15C, 30HP-15C, 40HP-15C, 50HP-15C 20HP-77C, 30HP-77C, 40HP-77C, 50HP-77C TP20-S, TP30-S, TP40-S, TP50-S *Hot Water Boilers:* 20HP-W, 30HP-W, 40HP-W, 50HP-W TP20-W, TP30-W, TP40-W, TP50-W *Domestic Hot water Boilers:* BT8-(250,360,650), BT12-(250,360,650,1000) BT16-(250,360,650,1000,1500) BT20-(250,360,650,1000,2100,2800)			Imran Husain 714-879-6085 imran2@ix.netcom.com www.globalboilers.com
Sioux Corporation	SF-15-LN			Shelby Docken 888-763-8833 email@sioux.com www.sioux.com
Smith Cast Iron Boilers Westcast, Inc. (SAI, Inc., dba Global Equipment Sales)	B19A-(S4, S5, S6, S7, S8, S9, S10, S11) B19A-(W4, W5, W6, W7, W8, W9, W10, W11) B28A-(S4, S5, S6, S7) B28A-(W4, W5, W6, W7) B40HE-(S4, S5, S6, S7, S8, S9, S10, S11)	B19A-S3, B19HE-S-3 B19A-W3,B19HE-W-3 These boilers are equipped with Weishaupt low NOx burners.		Imran Husain 714-879-6085 imran2@ix.netcom.com www.globalboilers.com
Smith Cast Iron (Mestek, Inc.)		GC-160C, GC-160OC, GC-160B, GC-160OB, GT-150, GT-400		John Chicoine 413-564-5872 Jchicoine@mestek.com

South Coast Air Quality Management District (SCAQMD)

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SpacePak (Mestek, Inc.)		SS-160C; SS160OC; SS-160B; SS-160OB		John Chicoine 413-564-5872 Jchicoine@mestek.com
Sta-Rite (Pentair) (Pool Heaters)			**Pool Heaters (Certification does not expire on 12/31/2011):** MAX-E-THERM: 200, 200HD, 250 ASME, 333, 333HD, 400, 400HD, 400ASME	Azur Dzindo 805-553-5376 (see Pentair)
State Water Heaters 1 (A. O. Smith)	SUF130 500NE, SUF 130 500NEA, SUF 119 500NE 200, SUF 119 500NEA 200	SHE 50 100NE, SHE 50 100N E 130, SHE 75 100N E 130, GP6 50 YTPDT, GP 6 50 YTPDT 130, GP 6 75 YTPDT 130, SUF 60 120NE, SUF 60 199NE, SUF 60 199NEA, SUF100 150NE, SUF 100 150 NEA, SUF100 199NE, SUF 100 199 NEA, RUF 100 199NE, SUF100 250NE, SUF 100 250 NEA, SUF130 300NE, SUF 130 300NEA, SUF130 400NE, SUF 130 400NEA SBL 95199N E 100, SBL 85275N E 100, SBL 85275N EA 100, SBL	SBS 75 76 NE GS6 75 XRRS SBS 100 76 NE GS6 100 XRRT GS6 75 YRVIT* GSX 75 YRVIT* SBP 75 76 NE* SBN7580NE SBN10090NE SHE 50 75 NE100 GP6 50 YFVIT100 SBN 71 120N SBN 81 154N SBN 100 180N SBN 100 200 NET SBN 100 200 NES SBN 100 250 N	J. E. Wallace (Joe) 843-335-8281, Ext. 462 jwallace@hotwater.com
State Water Heaters 2 (A. O. Smith)		SBL100250NE 200, SBL10025NEA 200, SBL100275NE 200, SBL100275NEA 200, SBL86310NE 200, SBL86310NEA 200, SBL86366NE 200, SBL86366NEA 200, SBL86390NE 200,		J. E. Wallace (Joe) 843-335-8281, Ext. 462 jwallace@hotwater.com
Sterling (Mestek, Inc.)	X7P9-1200*-0012, X7P9-1200*-0008			John Chicoine 413-564-5872 Jchicoine@mestek.com
Superior Boiler Works (formerly Triad Boiler Systems)	GMS 1600, GMS-900-HP-HEP, 8-5.2-250, 8-5-200	GMS-300-HP-HEP		Gabriel Dauphin (620) 662-6693
Takagi Industrial Co. USA, Inc. (Tankless)		T-KJr2U-IN-N, T-KJr2U-OS-N, T-K4U-IN-N, T-K4U-OS-N, T-D2U-IN-N, T-D2U-OS-N, (A)T-H3J-DV-N, (A)T-H3J-OS-N, (A)T-H3S-DV-N, (A)T-H3S-OS-N, (A)T-H3-DV-N, (A)T-H3-OS-N, (A)T-H3M-DV-N, (A)T-H3M-OS-N TK-110C-N, TK-310C-N, TK510C-N, TK-110U-I 200, TK-110U-E 200, TK-310U-I 200, TK-310U-E 200, TK-510U-I 200, TK-510U-E 200, TK-540P-NIH, TS-540P-NEH	**Takagi:** T-M1, Flash T-K2, T-KD20, T-K Jr., T-HI, T-H1, T-K3, T-K3-SP, T-K3-OS, T-M50T, T-M50 ASME, T-M32, T-M32ASME, T-K3-PRO. T-H2-DV, T-H2-OS	Peter Phan 949-770-7171 x 2179 pphan@hotwater.com Indah Widjaja 949-770-7171 x2327
Thermal Hydronic Supply, Ltd.			**Planet Dewy**: 30/50 BF, 60 BFR, 30 BFT **Murelle**: EV HE 30	Richard Konchka 905-265-1527 (Ontario/Canada)
Thermal Solutions	EVA-500, EVA-750, EVA-1000, EVA-1500, EVA-2000, EVO-500, EVO-750, EVO-1000, EVO-1500, EVO-2000, EVCA-750, EVCA-1000, EVCA-1500, EVCA-2000, EVS-500, EVS-750, EVS-1000, EVS-1500, EVS-2000, EVSW-500, EVSW-750, EVSW-1000, EVSW-1500, EVSW-2000, APX525, APX525C, APX625, APX625C, APX725, APX725C, APX825, APX825C ARC-1000 SOL-500, SOL-750, SOL-1000, SOL-1250, SOL-1500	EVA-250, EVO-250, EVS-250, EVSW-250, APX425, APX425C SOL-300	*EVA-250, EVO-250, EVS-250, EVSW-250* *SOL-300*	Randy Wirmer 717-239-7653 www.thermalsolutions.com
ThermoSteam Systems, Inc.	LN-10, LN-15, LN-25, LN-40	LN-9.5	VFT-9.5LN	Steve Katz 574-236-6222
Triangle Tube Inc.	KS500N(XN2,XX2,JX2,JN2); KS600N(XX2,JX2); KS750N(XX2,JX2); KS850N(XX2,JX2); KS1000N(XX1,JX1); KW500N(XN2,XX2,JX2,JN2); KW600N(XX2,JX2); KW750N(XX2,JX2); KW850N(XX2,JX2); KW1000N(XX1,JX1)	Prestige Solo 60, Prestige Solo 80, Prestige Solo 110, Prestige Solo 155, Prestige Solo 175, Prestige Solo 250, Prestige Solo 299, Prestige Solo 399, Prestige Excellence 110; KS080NXN2; KS105NXN2; KS150NXN2; KS210NXN2; KS285N(XN2,XX2); KS399N(XN2,XX2); KW080NXN2; KW105NXN2; KW150NXN2; KW210NXN2; KW285N(XN2,XX2); KW399N(XN2,XX2), CC85, CC85S, CC105, CC105S, CC125, CC125S TWH200, TWH180, TWH150	Challenger: CC85, CC105, CC125	Jim Nicholas/Kurt Bauer 856-228-8881 x127 www.Triangletube.com e-mail: jnicholas@triangletube.com

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Unilux Advanced Mfg., LLC	ZF 200W			
U. S. Boiler Company, Inc. (Burnham by U.S. Boiler)	Alpine: ALP500, ALP500C, ALP600, ALP600C, ALP700, ALP700C, ALP800, ALP800C	Alpine: ALP080, ALP105, ALP150, ALP210, ALP285, ALP399, ALP399C, K2WT-080B, K2WT-100B, K2WT-120B, K2WT-150B, K2WT-180B, K2WT-180M X-C080B, X-C100B, X-C120B, X-C150B, X-C180B, X-C180M ASPN-085, ASPN-110, ASPN-155, ASPNC-155, ASPN-205, ASPN-270, ASPN-320, ASPN-399		John Busse jbusse@usboiler.net 717-239-4482
U.S. Craftmaster Water Heaters (A.O. Smith)		GTU 110UI 100, GTU 110UE 100, GTU 310UI 100, GTU 310UE 100, GTU 510UI 100, GTU 510UE 100, GTU140NIH100, GTU140NEH100, GTU 240NIH 100, GTU 240NEH 100, GTU 340NIH 100, GTU 340NEH 100, GTU 540NIH 100, GTU 540NEH 100, GTU-110C-N, GTU-310C-N, GTU-510C-N, GTU-110U-I 200,GTU-110U-E 200,GTU-310U-I 200, GTU-310U-E 200, GTU-510U-I 200, GTU-510U-E 200, GTU-540P-NIH, GTU-540P-NEH	PVG2(A,E,F,H,J)7575T3NO, PVCG2(A,E,F,H,J)7575T3NO, G2(A,E,F,H,J)7575T4NO, CG2(A,E,F,H,J)7575T4NO, G2(A,E,F,H,J)10077T4NOV, CG2(A,E,F,H,J)10077T4NOV	G. Russell haynes 423-975-2473 ruhaynes@hotwater.com
Velocity Boiler Works		PHNTM080B, PHNTM100B, PHNTM120B, PHNTM150B, PHNTM180B, PHNTM180M SHADW080B, SHADW100B, SHADW120B, SHADW150B, SHADW180B, SHADW180M		John Busse jbusse@usboiler.net 717-239-4482
VESTA (DAESUNG CELTIC ENERSYS)		CUBE-199F, CUBE-150FF, VH-199, VH-150, VRS150, VRS199, VRP150, VRP199		
VIESSMANN MANUFACTURING	Vitodens: 200-W B2HA 150, 200-W B2HA 530	Vitodens: 200-WB2HB-19, Vitodens-222-FB2TB-19, Vitodens-200-WB2HB-26, Vitodens-200-WB2HB-35, Vitodens-222-FB2TB-35, Vitodens-200-WB2HB-45, Vitodens-200-WB2HB-57, Vitodens-200-WB2HA-80, Vitodens-200-WB2HA-88, Vitodens-200-WB2HA-100, 200-WB2HA-112 200-W B2HB 68, 222-F B2TB 68, 200-W B2HB 94, 200-W B2HB 125, 222-F B2TB 125, 200-W B2HB 160, 200-W B2HB 199, 200-W B2HA 285, 200-W B2HA 311, 200-W B2HA 352, 200-W B2HA 399		Erick Nessel nese@viessmann.com 519-888-6300
Weil-McLain	Ultra 550, Ultra 750, SF550, SF750, SF1000, SF1500, SF2000, 788R, 688	Ultra 80, Ultra 105, Ultra 399, EVG70, EVG 110, EVG 155, EVG 399, EVG 300, EVG 299, EVG220, WCB-120, WMB-155, WMB-120, WMB-80 WMG7+70-**, WMG7+110-**, WMG7+155-**, ECO 70, ECO 110, ECO	GV-4, GV-5, GV-6 Ultra 155, Ultra 230, Ultra 299, Ultra 310	Phillip Stephens pstephens@weil-mclain.com 219-873-0446
Westcast Boilers (Mestek)	UHE-600, UHE-1000, UHE-1600, UHE-2000	GC-160C, GC-160OC, GC-160B, GC-160OB		John Chicoine 413-564-5872 Jchicoine@mestek.com
Westinghouse		WGC055**100, WGC080**100, WGC119**100, WGC055**130, WGC080**130, WGC119**130, WGC055**160, WGC080**160,		Donna M. Homen 774-271-3138
Williamson-Thermoflo		FS-155, FS-120, FS-80		Erico Munhoz 219-878-5062 emunhoz@weil-mclain.com
Zodiac Pool Systems			JXI400N, JXI260N, JXI200N	Shajee Siddiqui 760-734-7035 shajee.siddiqui@zodiac.com

CREST COMMERCIAL CONDENSING BOILER

Submittal Sheet

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

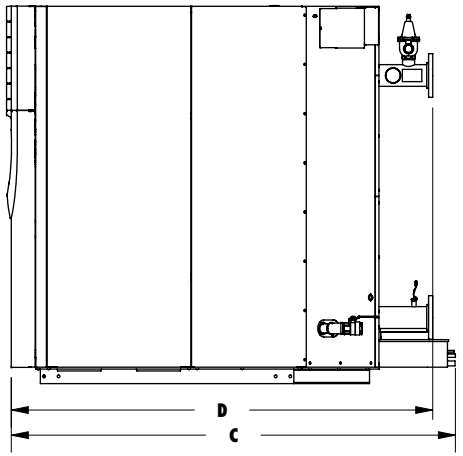
MODELS
FB 0751 - FB 6001

FBN-Sub-09

Job Name: _____ Location: _____ Contractor: _____ Type Gas: _____

Engineer: _____ Model #: _____ Agent/Wholesaler: _____ Equipment Tag(s): _____

SIDE



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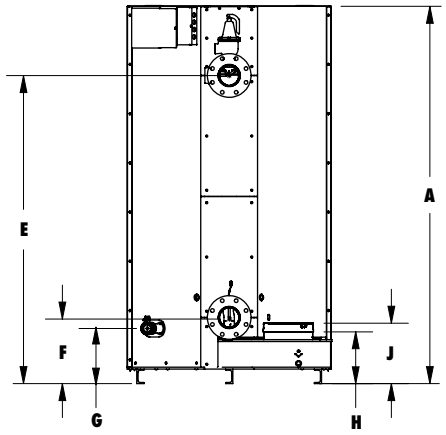

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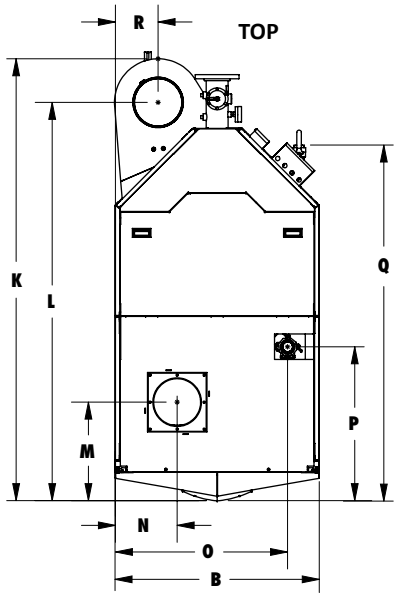


JOB NOTES:

Notes:

* *Insert "N" for natural gas, "L" for LP gas models and "D" for dual fuel.*

- *Indoor installation only. Information subject to change without notice.*
- *Low NOx Operation.*
- *Lochinvar should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.*
- *The ratings have been determined under the provisions governing forced draft burners.*
- *The Net AHRI water ratings shown are based on a piping and pickup allowance of 1.15.*

	Model Number	Input MBH Min	Input MBH Max	Thermal %	Gross Output MBH	Net Rating MBH	Turn-down	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	Gas Conn.	Water Inlet / Outlet	Air Intake	Vent Size	Oper. Weight (with water)	Ship. Weight (lbs.)
○	FB*0751	50	750	96.2%	722	627	15:1	78″	30″	55-1/2″	57-5/8″	66-1/8″	11-7/8″	11-3/8″	11-1/4″	12-1/2″	55″	51″	13″	8-3/4″	26-3/4″	23-3/4″	49-1/2″	7-3/8″	1-1/4″	3″	6″	6″	1,768	1,560
○	FB*1001	50	1,000	96.2%	962	837	20:1	78″	30″	56-1/2″	57-5/8″	66-1/8″	11-7/8″	11-3/8″	11-1/4″	12-1/2″	56″	51″	13″	8-3/4″	26-3/4″	23-1/8″	49-1/2″	6-1/2″	1-1/4″	3″	6″	6″	1,838	1,596
○	FB*1251	63	1,250	96.2%	1,203	1,046	20:1	78″	30″	56-1/2″	57-3/4″	66-1/8″	11-7/8″	11-3/8″	11-1/4″	12-1/2″	56″	51-3/8″	13″	8-3/4″	26-3/4″	21-5/8″	49-1/2″	6-1/2″	1-1/4″	3″	6″	8″	1,975	1,648
○	FB*1501	60	1,500	96.2%	1,443	1,255	25:1	78″	30″	67-3/4″	68″	65-3/8″	12-3/8″	11-3/8″	11-1/4″	12-1/2″	67-1/4″	62-3/8″	15-7/8″	9″	26-7/8″	27-7/8″	59-1/4″	5-1/8″	1-1/2″	4″	8″	8″	2,307	1,961
○	FB*1751	70	1,750	96.2%	1,684	1,464	25:1	78″	30″	66-1/4″	68″	65-3/8″	12-3/8″	11-3/8″	11-1/4″	12-1/2″	65-3/4″	61-1/2″	15-7/8″	9″	27″	27-1/8″	58-3/4″	5-1/8″	1-1/2″	4″	8″	8″	2,458	2,017
○	FB*2001	80	1,999	96.2%	1,924	1,673	25:1	78″	30″	66-1/2″	68″	65-3/8″	12-3/8″	11-3/8″	11-1/4″	12-1/2″	66″	61-1/2″	15-7/8″	9″	27″	26-3/4″	58-3/4″	5-1/8″	1-1/2″	4″	8″	8″	2,570	2,087
○	FB*2501	125	2,500	96%	2,400	2,087	20:1	77-3/4″	35″	83-3/4″	83-3/4″	63-3/4″	13-1/2″	11-1/4″	10-1/2″	12-1/4″	83-1/4″	76-1/4″	19-3/4″	9-1/4″	28-3/4″	32″	71″	7-1/4″	2″	4″	8″	9″	3,600	2,577
○	FB*3001	150	3,000	96%	2,880	2,504	20:1	77-3/4″	35″	83-3/4″	83-3/4″	63-3/4″	13-1/2″	11-1/4″	10-1/2″	12-1/4″	83-1/4″	76-1/4″	19-3/4″	9-1/4″	28-3/4″	32″	71″	7-1/4″	2″	4″	10″	10″	3,900	2,881
○	FB*3501	175	3,500	96%	3,360	2,921	20:1	77-3/4″	42″	91-1/2″	86-3/4″	63-1/2″	13-1/4″	11-1/2″	10-3/4″	12-1/2″	91″	82″	20-1/4″	12-3/4″	35-1/2″	31-3/4″	73-1/4″	8-3/4″	2″	4″	10″	10″	4,600	3,218
○	FB*4001	333	3,999	96%	3,840	3,339	12:1	77-3/4″	45-1/2″	103-1/2″	99″	63-1/2″	13-3/4″	11-1/2″	10-3/4″	12-1/2″	103″	94″	24-3/4″	13-1/2″	39-1/2″	42-1/4″	85-1/4″	10-1/2″	2-1/2″	4″	12″	12″	5,200	3,805
○	FB*5001	500	4,999	96%	4,800	4,173	10:1	77-3/4″	46-1/2″	102-1/4″	99-1/2″	63-1/2″	15″	11-1/2″	10-3/4″	12-1/2″	101-3/4″	92-1/2″	22″	14″	39-3/4″	39-1/2″	84″	9″	2-1/2″	6″	12″	14″	5,900	4,101
○	FB*6001	600	6,000	96%	5,760	5,008	10:1	77-3/4″	50″	102-3/4″	99-3/4″	63-1/4″	14-3/4″	11-1/2″	10-3/4″	12-1/2″	102-1/2″	93-1/4″	20″	15-3/4″	43-1/2″	36-1/2″	83-3/4″	9-1/4″	2-1/2″	6″	14″	14″	6,900	4,711

CREST®
CONDENSING BOILER

Codes & Registrations

- ASME certified, "H" Stamp / National Board
- California Code Compliant
- Canadian Registration Number (CRN)
- CSD1 / Factory Mutual / GE Gap Compliant
- South Coast Air Quality Management District Qualified (FB 0751-2001)

Smart Touch™ Features

CON·X·US Remote Connect

SMART TOUCH Touchscreen Operating Control

Full-Color 8" Touchscreen LCD Display

Built-in Cascading Sequencer for up to 8 Boilers
- › Built-in Redundancy
- › Cascade Multiple Sized Boilers
- › Lead/Lag Cascade
- › Efficiency Optimized Cascade

Front-End Loading Capability with Copper-Fin II® and Power-Fin® Boilers

Building Management System Integration with 0-10 VDC Input

BACnet MSTP Communications

Modbus Communication

Outdoor Reset Control with Outdoor Air Sensor

Password Security

Domestic Hot Water Prioritization
- › DHW tank piped with priority in the boiler loop
- › DHW tank piped as a zone in the system with the pumps controlled by the Smart System
- › DHW Modulation Limiting
- › Separately Adjustable SH/DHW Switching Times

Low Water Flow Safety Control & Indication

Inlet & Outlet Temperature Readout

Freeze Protection

Service Reminder

Time Clock

Data Logging
- › Hours Running, Space Heating
- › Hours Running, Domestic Hot Water
- › Hours Running, Modulation Rate
- › Ignition Attempts
- › Last 10 Lockouts

Programmable System Efficiency Optimizers
- › Night Setback
- › Anti-Cycling
- › Outdoor Air Reset Curve
- › Ramp Delay
- › Boost Temperature & Time
- › Modulation Factor Control

Three Pump Control
- › System Pump
- › Boiler Pump
- › Domestic Hot Water Pump

High-Voltage Terminal Strip
- › 120 VAC / 60 Hertz / 1 Phase Power Supply (FB 0751-2001)
- › 208 VAC/ 60 Hertz/ 3 Phase Power Supply (FB 2501-3501)
- › 480 VAC/60 Hertz/3 Phase Power Supply (FB 4001-6001)
- › System Pump, Boiler Pump and DHW Pump Power

Low-Voltage Terminal Strip
- › 24 VAC Auxiliary Device Relay
- › Auxiliary Proving Switch Contacts
- › Alarm on Any Failure Contacts
- › Runtime Contacts
- › DHW Thermostat Contacts
- › Unit Enable/Disable Contacts
- › System Sensor Contacts
- › DHW Tank Sensor Contacts
- › Outdoor Air Sensor Contacts
- › Cascade Contacts
- › 0-10 VDC BMS External Control Contact
- › 0-10 VDC Variable Speed Boiler Pump Control Contact

Standard Features

- Up to 96.2% Thermal Efficiency (AHRI)
- Proof of Closure Valve (FB 6001)
- Modulating Burner with up to 25:1 Turndown
- Direct-Spark Ignition
- Low NOx Operation
- Sealed Combustion
- Air Inlet Filter
- Low Gas Pressure Operation
- **Vertical and Horizontal Direct Venting**
  - › Direct Vent up to 100 Feet
  - › PVC, CPVC, Polypropylene or AL29-4C (FB 0751-3501)
  - › AL29-4C (FB 0751-6001)
- ASME "H" Stamped Heat Exchanger
- 316L Stainless Steel Fire Tubes
- 160 psi Working Pressure
- On/Off Switch
- Adjustable High Limit with Manual Reset
- Low Water Cutoff with Manual Reset & Test
- High & Low Gas Pressure Switches w/Manual Reset
- Low Air Pressure Switches
- Condensate Trap w/Blocked Drain Switch
- Drain Valve
- System Sensor
- Outdoor Air Sensor
- Inlet & Outlet Temperature Sensors
- High-Voltage Terminal Strip
- Low-Voltage Terminal Strip
- Downstream Gas Test Cocks
- 50 psi ASME Relief Valve
- Temperature & Pressure Gauge
- Zero Clearances to Combustible Materials
- High Altitude Models Available
- 10-Year Limited Warranty (See Warranty for Details)
- 1-Year Warranty on Parts (See Warranty for Details)

Optional Equipment

- ☐ Alarm Bell
- ☐ BMS Gateway - BACnet IP or LonWorks
- ☐ Condensate Neutralization Kit
- ☐ Common Vent Kits Damper
- ☐ Motorized Isolation Valve
- ☐ Variable Speed Boiler Pump
- ☐ Wireless Outdoor Temperature Sensor
- ☐ 75 psi ASME Relief Valve
- ☐ 100 psi ASME Relief Valve
- ☐ 125 psi ASME Relief Valve
- ☐ 150 psi ASME Relief Valve

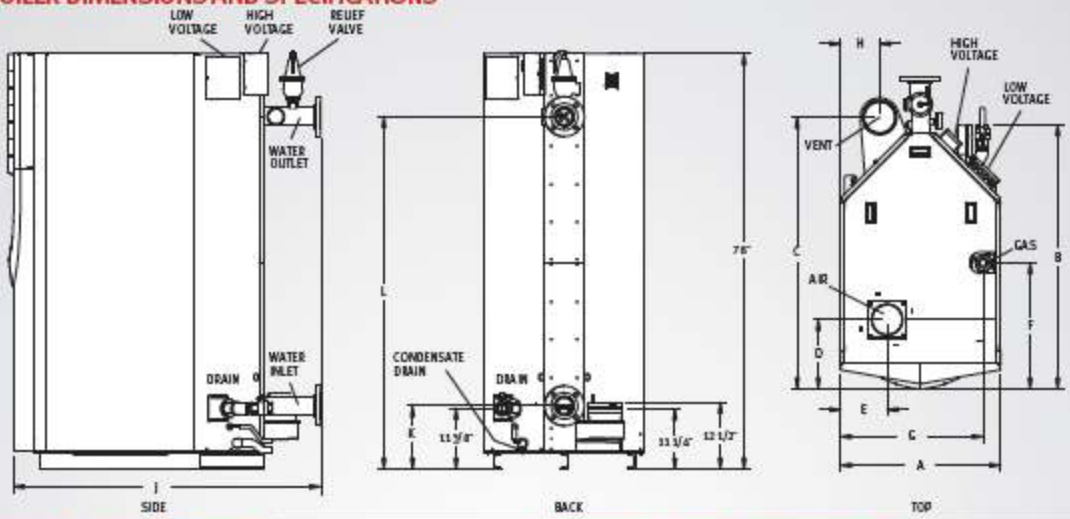
Electrical Options (Shipped Loose):
- › FB 0751-2001
  - ☐ 208V/ 1Ø/60 Hz → 120V/ 1Ø/60Hz
  - ☐ 480V/ 1Ø/60 Hz → 120V/ 1Ø/60Hz
  - ☐ 600V/ 1Ø/60 Hz → 120V/ 1Ø/60Hz
- › FB 2501-3501
  - ☐ 480V/ 3Ø/60 Hz → 208V/ 3Ø/60Hz
  - ☐ 600V/ 3Ø/60 Hz → 208V/ 3Ø/60Hz
- › FB 4001-6001
  - ☐ 600V/ 3Ø/60 Hz → 480V/ 3Ø/60Hz

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

Lochinvar, LLC
300 Maddox Simpson Parkway
Lebanon, Tennessee 37090
P: 615.889.8900 / F: 615.547.1000
Lochinvar.com

6/18—Printed in U.S.A.

CREST® BOILER DIMENSIONS AND SPECIFICATIONS



CREST HEATING BOILER

DIMENSIONS AND SPECIFICATIONS

Model Number	Input MBH Min	Input MBH Max	AHRI Thermal %	Gross Output MBH	Net AHRI Rating MBH	Turndown	A	B	C	D	E	F	G	H	I	K	L	Water Gas Conn.	Water Inlet/ Outlet	Air Intake	Vent Size	Oper. Weight	Ship. Weight
FBN0751	50	750	96.2%	722	617	15:1	30"	49-1/2"	51"	13"	8-3/4"	23-3/4"	24-3/4"	7-3/8"	57-5/8"	11-7/8"	66-1/8"	1-1/4"	3"	6"	6"	1,768	1,560
FBN1001	50	1,000	96.2%	962	837	20:1	30"	49-1/2"	51"	13"	8-3/4"	23-1/8"	24-3/4"	6-1/2"	57-5/8"	11-7/8"	66-1/8"	1-1/4"	3"	6"	6"	1,838	1,596
FBN1251	63	1,250	96.2%	1,203	1,046	20:1	30"	49-1/2"	51-3/8"	13"	8-3/4"	21-5/8"	24-3/4"	6-1/2"	57-3/4"	11-7/8"	66-1/8"	1-1/4"	3"	6"	8"	1,975	1,648
FBN1501	60	1,500	96.2%	1,443	1,255	25:1	30"	59-1/4"	62-3/8"	15-7/8"	9"	27-7/8"	26-7/8"	5-1/8"	68"	12-3/8"	65-3/8"	1-1/2"	4"	8"	8"	2,307	1,961
FBN1751	70	1,750	96.2%	1,684	1,464	25:1	30"	58-3/4"	61-1/2"	15-7/8"	9"	27-1/8"	27"	5-1/8"	68"	12-3/8"	65-3/8"	1-1/2"	4"	8"	8"	2,458	2,017
FBN2001	80	1,999	96.2%	1,924	1,673	25:1	30"	58-3/4"	61-1/2"	15-7/8"	9"	26-3/4"	27"	5-1/8"	68"	12-3/8"	65-3/8"	1-1/2"	4"	8"	8"	2,570	2,087

NOTES: Indoor installation only. Change "N" to "L" for LP gas models and to "D" for dual fuel models. (Consult factory for availability of Dual Fuel models)
**Thermal AHRI Water Ratings shown are based on a piping and pickup allowance of 1.15. **Information subject to change without notice.*

SMART TOUCH™ FEATURES

- CON-X-US Remote Connect
- SMART TOUCH Touchscreen Operating Control
- Full-Color 8" Touchscreen LCD Display
- Built-in Cascading Sequencer for up to 8 Boilers
  - › Built-in Redundancy
  - › Cascade Multiple Sized Boilers
  - › Lead/Lag Cascade
  - › Efficiency Optimized Cascade
- Front-End Loading Capability with Copper-Fin II® and Power-Fin® Boilers
- Building Management System Integration with 0-10 VDC Input
- BACnet MSTP Communications
- Modbus Communication
- Outdoor Reset Control with Outdoor Air Sensor
- Password Security
- Domestic Hot Water Prioritization
  - › DHW tank piped with priority in the boiler loop
  - › DHW tank piped as a zone in the system with the pumps controlled by the Smart System
  - › DHW Modulation Limiting
  - › Separately Adjustable SH/DHW Switching Times
- Low Water Flow Safety Control & Indication
- Inlet & Outlet Temperature Readout
- Freeze Protection
- Service Reminder
- Time Clock
- Data Logging
  - › Hours Running, Space Heating
  - › Hours Running, Domestic Hot Water
  - › Hours Running, Modulation Rate
  - › Ignition Attempts
  - › Last 10 Lockouts
- Programmable System Efficiency Optimizers
  - › Night Setback
  - › Anti-Cycling
  - › Outdoor Air Reset Curve
  - › Ramp Delay
  - › Boost Temperature & Time
  - › Modulation Factor Control
- Three Pump Control
  - › System Pump
  - › Boiler Pump
  - › Domestic Hot Water Pump
- High-Voltage Terminal Strip
  - › 120 VAC / 60 Hertz / 1 Phase Power Supply
  - › System Pump, Boiler Pump and DHW Pump Power
- Low-Voltage Terminal Strip
  - › 24 VAC Auxiliary Device Relay
  - › Auxiliary Proving Switch Contacts
  - › Alarm on Any Failure Contacts
  - › Runtime Contacts
  - › DHW Thermostat Contacts
  - › Unit Enable/Disable Contacts
  - › System Sensor Contacts
  - › DHW Tank Sensor Contacts
  - › Outdoor Air Sensor Contacts
  - › Cascade Contacts
  - › 0-10 VDC BMS External Control Contact
  - › 0-10 VDC Variable Speed Boiler Pump Control Contact

OPTIONAL EQUIPMENT

- Alarm Bell
- BMS Gateway - BACnet IP or LonWorks
- Wireless Outdoor Temperature Sensor
- Condensate Neutralization Kit
- SMART TOUCH PC Software
- Common Vent Kits
- Dual Fuel Gas Train
- Motorized Isolation Valve
- Variable Speed Boiler Pump
- Electrical Options (Shipped Loose):
  - › 208V/3Ø/60Hz
  - › 480V/3Ø/60Hz
  - › 600V/3Ø/60Hz

*Lochinvar should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, excessive piping systems, etc. *The ratings have been determined under the provisions governing forced draft burners.

CODES & REGISTRATIONS

- ANSI Z21.13/CSA Certified
- ASME Certified, "H" Stamp / National Board
- California Code Compliant
- CSD1 / Factory Mutual / GE Gap Compliant
- Canadian Registration Number (CRN)
- South Coast Air Quality Management District Qualified
- AHRI Certified

STANDARD FEATURES

- 96.2% Thermal Efficiency (AHRI)
- Up to 99% Thermal Efficiency in Low-Temp. Applications
- Modulating Burner with up to 25:1 Turndown
- Direct-Spark Ignition
- Low NOx Operation
- Sealed Combustion
- Air Inlet Filter w/Replacement Reminder
- Low Gas Pressure Operation
- Vertical and Horizontal Direct Venting
  - › Direct Vent up to 100 Feet
  - › PVC, CPVC, Polypropylene or AL29-4C
- ASME "H" Stamped Heat Exchanger
- 316L Stainless Steel Fire Tubes
- 160 psi Working Pressure
- On/Off Switch
- Adjustable High Limit with Manual Reset
- Low Water Cutoff with Manual Reset & Test
- High & Low Gas Pressure Switches w/Manual Reset
- Low Air Pressure Switches
- Condensate Trap w/Blocked Drain Switch
- Drain Valve
- System Sensor
- Outdoor Air Sensor
- Inlet & Outlet Temperature Sensors
- High-Voltage Terminal Strip
- Low-Voltage Terminal Strip
- Downstream Gas Test Cocks
- 50 psi ASME Relief Valve
- Temperature & Pressure Gauge
- Zero Clearances to Combustible Materials
- 10-Year Limited Warranty (See Warranty for Details)
- 1-Year Warranty on Parts (See Warranty for Details)

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Lochinvar.com

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

ARMOR Condensing Water Heater Submittal Sheet

AWN-Sub-06

ARMOR™ CONDENSING WATER HEATER

JOB NAME _____

LOCATION _____

ENGINEER _____

WHOLESALER _____

MECH. CONTRACTOR _____

MODEL NO. _____

TYPE GAS _____

Btu/hr INPUT _____

RECOVERY RATE IN GPH _____ **@** _____ **°F RISE**

NOTES

Standard Features

- **AHRI Certified 96% Thermal Efficiency**
- **Modulating Burner with 5:1 Turndown**
  - Direct-Spark Ignition
  - Low NOx Operation
  - Sealed Combustion
  - Low Gas Pressure Operation
- **Vertical & Horizontal Direct-Vent**
  - PVC, CPVC, Polypropylene or SS Venting up to 100 Feet
  - PVC/CPVC Sidewall Vent Termination
- **Stainless Steel Heat Exchanger**
  - All Welded Construction, Gasketless Design
  - 160 psi Working Pressure
  - ASME Construction (AW 286-801)
- Natural to L.P. Conversion Kit
- All Bronze Circulating Pump
- On/Off Switch
- Flow Switch
- ASME Temperature & Pressure Relief Valve (286-801)
- Downstream Test Valves (AW 501-801)
- Adjustable Leveling Legs
- Tank Sensor
- Adjustable High Limit w/ Manual Reset
- Automatic Reset High Limit
- Condensate Trap
- Zero Clearances to Combustible Material
- 5 Year Limited Warranty (See Warranty for Details)
- 1 Year Parts Warranty (See Warranty for Details)

Smart System Features

- **SMART SYSTEM Digital Operating Control**
- Multi Color Graphic LCD Display
- **Built in Cascading Sequencer for up to 8 Water Heaters**
  - Lead Lag
  - Efficiency Optimization
  - Front-End Loading Capability with CopperFin II
- **Building Management System Integration**
  - Modbus Communication (Optional)
  - 0-10 VDC Input to Control Modulation or Set point
  - 0-10 VDC Modulation Rate Output
  - 0-10 VDC Input to Enable/Disable call for heat
- Access to BMS Settings Through Graphic LCD Display
- Low Water Flow Safety Control & Indication
- Inlet & Outlet Temperature Sensors & Readout
- Flue Temperature Sensor
- Water Heater Pump Control
- Pump Delay with Freeze Protection
- Pump Exercise
- Night Setback
- Building Recirculation loop Pump Control*
  - Night Setback of Building Recirculation Loop*
- Time Clock
- **Maintenance Reminder**
  - Ability to program name and number into the product as contact
- **High Voltage Terminal Strip**
  - 120 VAC / 60 Hertz / 1 Phase Power Supply
  - Pump Control Contacts
    - Water Heater Pump Control Contacts
    - Building Recirculation Pump Control Contacts
- **Low Voltage Terminal Strip**
  - 24 VAC Auxiliary Device Relay
  - Auxiliary Proving Switch Contacts
  - Flow Switch Contacts
  - Alarm on Any Failure Contacts
  - Runtime Contacts
  - Tank Sensor Contacts
  - Cascade Contacts
  - 0-10 VDC BMS External Control Contact
  - 0-10 VDC Boiler Rate Output Contacts

Exclusive to Lochinvar

Optional Equipment

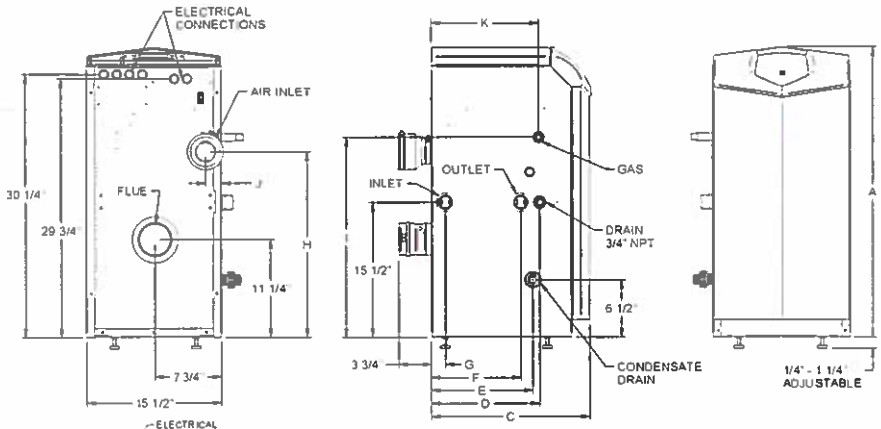
- ☐ CON·X·US® Remote Connectivity
- ☐ Alarm Bell
- ☐ Condensate Neutralization Kit
- ☐ High & Low Gas Pressure Switches (AW 501-801)
- ☐ Concentric Vent Kit (3" & 4" PVC/CPVC only)
- ☐ BMS Gateway
- ☐ ModBus Communications
- ☐ SMART SYSTEM PC Software
- ☐ Room Air Vent Kits
- ☐ Stack Frame

Firing Control Systems

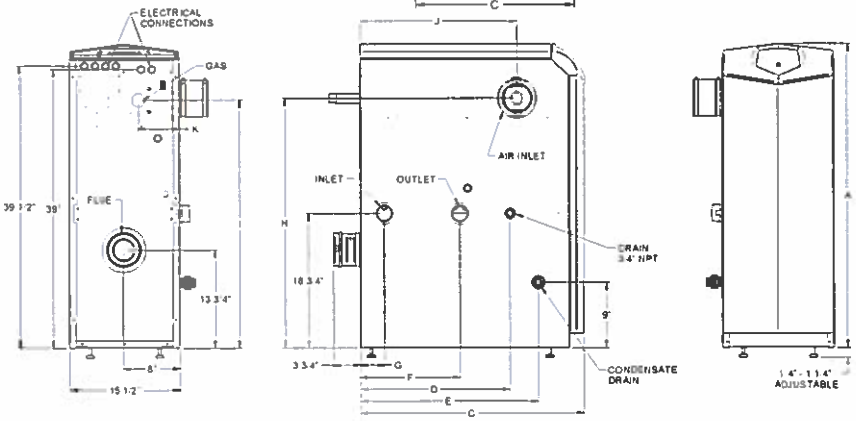
- M9 Standard Construction
- M7 California Code (AW 286-801)

ARMOR Condensing Water Heater Dimensions & Specifications

MODELS 151-200



MODELS 286-801



Model Number	Btu/hr Input	GPH @ 100° Rise	A	C	D	E	F	G	H	I	J	K	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
☐ AWN151PM	150,000	175	33-1/4"	18"	12-1/4"	11-1/2"	10"	1-1/2"	21-1/4"	23"	1-3/4"	12"	1/2"	1-1/4"	3"	3"	165
☑ AWN200PM	199,999	233	33-1/4"	22-1/4"	16-1/2"	15-3/4"	14-1/4"	5-1/4"	21-1/4"	23"	1-3/4"	16-1/4"	1/2"	1-1/4"	3"	3"	181
☐ AWN286PM	285,000	332	42-1/2"	19-3/4"	12-3/4"	13-1/2"	6"	2"	34"	31"	11-3/4"	4-1/4"	3/4"	2"	4"	4"	236
☑ AWN400PM	399,999	466	42-1/2"	27"	21"	20-3/4"	14"	3-1/2"	34"	34"	18-3/4"	2"	1"	2"	4"	4"	306
☑ AWN501PM	500,000	582	42-1/2"	31-1/2"	21"	25"	14"	3-1/2"	35"	35"	22"	5-3/4"	1"	2"	4"	4"	339
☑ AWN601PM	600,000	699	42-1/2"	36-1/4"	21"	25"	14"	3-1/2"	36"	32-3/4"	19-1/2"	5-1/2"	1"	2"	4"	4"	380
☑ AWN701PM	700,000	815	42-1/2"	40-1/4"	23"	29"	17"	3-1/2"	36"	32-3/4"	23-1/2"	3-1/4"	1"	2"	4"	6"	461
☐ AWN801PM	800,000	931	42-1/2"	45-1/4"	23"	33-1/4"	17"	3-1/2"	36"	32-3/4"	27-3/4"	3-1/4"	1"	2"	4"	6"	527

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ARMOR X2
Condensing Water Heater
Submittal Sheet

AWX-Sub-01c

ARMOR X2™ CONDENSING WATER HEATER

JOB NAME _____
LOCATION _____
ENGINEER _____
WHOLESALER _____
MECH. CONTRACTOR _____
MODEL NO. _____
TYPE GAS _____
Btu/hr INPUT _____
RECOVERY RATE IN GPH _____ **@** _____ **°F RISE**
NOTES

Standard Features

- 96% Thermal Efficiency (AHRI Certified)
- Modulating Burner with 10:1 Turndown
  - Direct-Spark Ignition
  - Low NOx Operation
  - Sealed Combustion
  - Low Gas Pressure Operation
  - 2 Low Lead Circulating Pumps
- Vertical & Horizontal Venting
  - Category IV Venting up to 100 Feet
  - PVC, CPVC, Polypropylene or AL29-4C Vent Material
  - Sidewall Vent Termination Provided
- ASME Stainless Steel Heat Exchanger
  - Gasketless Design
  - 160 psi Working Pressure
- On/Off Switch
- Adjustable High Limit with Manual Reset
- Low Air Pressure Switch
- Flow Switch
- Inlet & Outlet Temperature Sensors
- Two Easy Access Terminal Strips
- Temperature & Pressure ASME Relief Valve
- Zero Clearance to Combustible Material
- Approved for Combustible Floor Installation
- 1 Year Warranty on Parts
- 5 Year Limited Warranty (see warranties for details)

SMART TOUCH™ Features

- SMART TOUCH™ Touchscreen Operating Control
  - Full-Color Touchscreen LCD Display
  - Built-in Cascading Sequencer for up to 8 Water Heaters
  - Building Management System Integration with 0-10 VDC Input
  - Password Security
  - Low Water Flow Safety Control & Indication
  - Inlet & Outlet Temperature Readout
  - Freeze Protection
  - Service Reminder
  - Time Clock
- Data Logging
  - Hours Running
  - Ignition Attempts
  - Last 10 Lockouts
- Programmable System Efficiency Optimizers
  - Night Setback
  - Anti-Cycling
- Water Heater Pump Control
  - High Voltage Terminal Strip
  - 120 VAC / 60 Hertz / 1-Phase Power Supply
  - Pump Contacts
- Low Voltage Terminal Strip
  - 24 VAC Auxiliary Device Relay
  - Auxiliary Proving Switch Contacts
  - Alarm on Any Failure Contacts
  - Runtime Contacts
  - Tank Thermostat Contacts
  - Tank Sensor Contacts
  - Cascade Contacts

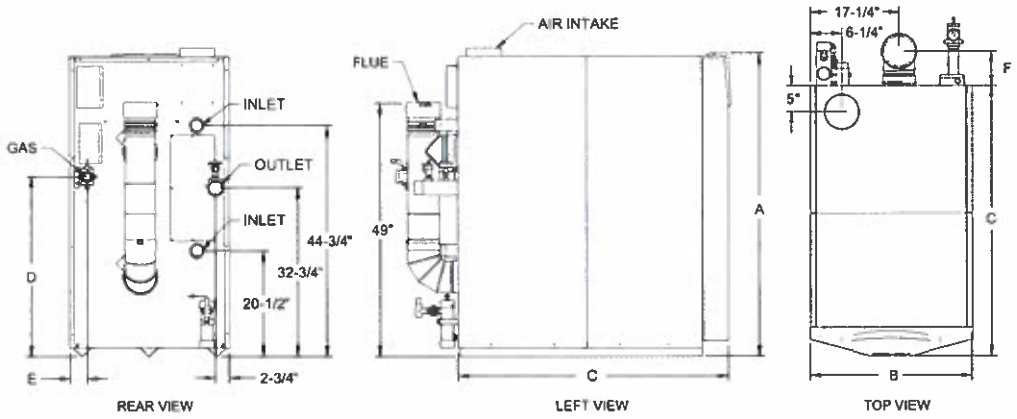
Optional Equipment

- ☐ Alarm Bell
- ☐ Condensate Neutralization Kit
- ☐ SMART TOUCH PC Software
- ☐ Modbus Communications
- ☐ Stainless Steel Vent Kits (1300 & 1500)
- ☐ BMS Gateway to LON or BacNet

Codes & Registrations

- ANSI Z21.10.3 compliant
- ASME certified, "HLW" stamp
- California Code compliant
- Massachusetts Code compliant
- South Coast Air Quality Management District registered

Dimensions & Specifications



ARMOR X2 Water Heater

Dimensions and Specifications

Model Number	Btu/hr Input	Thermal Efficiency	GPH @ 100° Rise	A	B	C	D	E	F	Gas Conn.	Inlet Water Conn.	Outlet Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
AWN1000PM	999,999	96.0%	1,164	58-3/4"	31"	48"	35"	4-1/2"	15"	1-1/2"	2 x 2"	3"	6"	6"	910
AWN1300PM	1,300,000	96.0%	1,513	58-3/4"	31"	52-1/4"	34-3/4"	3-1/2"	6-3/4"	1-1/2"	2 x 2"	3"	6"	6"	1049
AWN1500PM	1,500,000	96.0%	1,745	58-3/4"	31"	56-1/2"	34-3/4"	3-1/2"	6-3/4"	1-1/2"	2 x 2"	3"	6"	6"	1185

Notes: Change 'N' to 'L' for L.P. Gas Model. No deration on L.P. models. Performance data based on manufacturer test results. 120 VAC /15 AMP circuit required.

All dimensions shown in inches.

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POWER-FIN® WATER HEATER Submittal Sheet

PFX-Sub-05

POWER-FIN® GAS WATER HEATER 502, 752, 1002, 1302, 1501, 1701 & 2001 MODELS

JOB NAME San Manuel, Plumbing Kitchen Hot Water System
LOCATION Highland CA
ENGINEER JBA
MECH. CONTRACTOR
MODEL NO. PFN2001PM
TYPE GAS Natural
Btu/hr INPUT 2,000,000 Btu's
RECOVERY RATE IN GPH 2036 @ 100 °F RISE
NOTES

STANDARD FEATURES

- **85% Thermal Efficiency**
- **Outdoor Ready**
- **Modulating Burner with 5:1 Turndown**
  - Hot Surface Ignition
  - Low NOx Operation
  - Sealed Combustion
  - Low Gas Pressure Operation
- **Vertical & Horizontal Venting**
  - Category I or Category IV Venting
  - Cat IV converts to Cat II w/optional vent kit
  - CAT IV Venting up to 50 Feet
- **ASME Copper-Finned Tube Heat Exchanger**
  - ASME Certified, "HLW" Stamped
  - Gasketless design
  - 160 psi working pressure
- **On/Off Switch**
- **Adjustable High Limit w/ Manual Reset**
- **Flow Switch**
- **Low Air Pressure Switch**
- **Downstream Test Cocks**
- **150 psi Temperature & Pressure Relief Valve**
- **Combustion Air Filtration**
- **All Bronze Pump**
- **Zero Clearances to Combustible Material**
- **1 Year Warranty on Parts**
- **5 Year Limited Warranty**
  (See Warranties for Details)

SMART TOUCH™ FEATURES

- **SMART TOUCH Operating Control**
  - Full-Color 8" Touchscreen LCD Display
  - CON-X-US Remote Connect
  - Building Management System Integration with 0-10 VDC Input
  - Dual Level Password Security
  - Inlet & Outlet Temperature Readout
  - Freeze Protection
  - Service Reminder
  - Time Clock
- **Built-in Cascading Sequencer for up to 8 Water Heaters**
  - Built-in Redundancy
  - Cascade Multiple Sized Water Heaters
  - Lead/Lag Cascade
  - Efficiency Optimized Cascade
- **Low Water Flow Safety Control & Indication**
- **Data Logging**
  - Hours Running, Modulation Rate
  - Ignition Attempts
  - Last 10 Lockouts
- **Programmable System Efficiency Optimizers**
  - Night Setback
- **High-Voltage Terminal Strip**
  - 120V/60 Hertz/1 Phase Power Supply
- **Low-Voltage Terminal Strip**
  - 24 VAC Auxiliary Device Relay
  - Auxiliary Proving Switch Contacts
  - Alarm on Any Failure Contacts
  - Runtime Contacts
  - Thermostat Contacts
  - Unit Enable Contacts
  - Louver Proving Contacts
  - Tank Sensor Contacts
  - Cascade Contacts
  - 0-10 VDC BMS External Control Contact

FIRING CODES

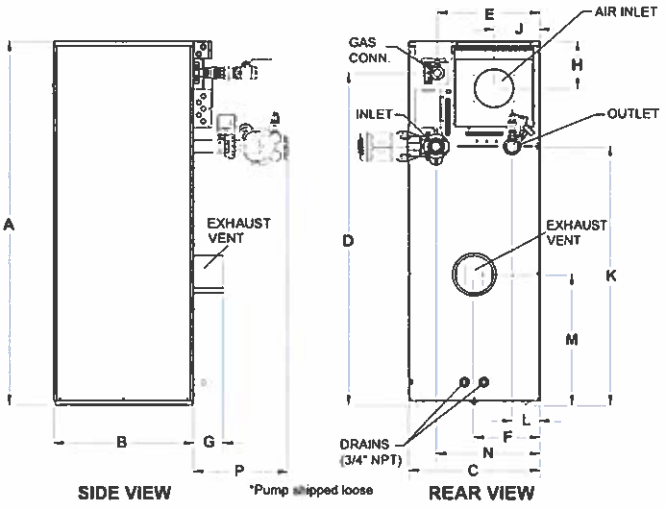
M Indicates 5:1 Turndown, Category IV
F Indicates 100% On/Off Fire, Category I

- ☑ M9 Standard
- ☐ F9 Special Order Factory Trimmed

OPTIONAL EQUIPMENT

- ☐ Cupro-Nickel Heat Exchanger
- ☑ High and Low Gas Pressure Switches w/Manual Reset
- ☐ Outdoor Kit
- ☑ Low Water Cutoff w/ Manual Reset & Test (required for California Code)
- ☑ Alarm Bell
- ☑ Modbus Communications
- ☑ BACnet MSTP Communications
- ☐ BMS Gateway to LON or BacNet IP
- **Vent Kits**
  - ☐ -Horizontal Exhaust Cap
  - ☐ -Horizontal Air Intake Cap
  - ☐ -Horizontal Direct Vent Cap
  - ☐ -Category IV to Catergory II Conversion Kit

Power-Fin Water Heater Dimensions & Specifications



Power-Fin Water Heater Dimensions and Specifications

	Model Number	Btu/Hr Input	GPH @ 100°F Rise (F)	A	B	C	D	E (F)	E (M)	E F	G	H	J
☐	PFN0502PM	500,000	515	44-1/2"	28-1/2"	23-1/4"	34"	18-3/4"	18-1/2"	6-1/2"	6"	8"	7-3/4"
☐	PFN0752PM	750,000	773	52"	28-1/2"	23-1/4"	41-3/4"	19"	18-3/4"	6-3/4"	6"	8"	7-3/4"
☐	PFN1002PM	999,999	1,030	59-1/4"	28-1/2"	23-1/4"	48-3/4"	17"	18-3/4"	7-1/4"	6"	8"	7-3/4"
☐	PFN1302PM	1,300,000	1,323	67-3/4"	28-1/2"	23-1/4"	57-1/4"	17"	18-3/4"	8-1/4"	6"	8"	7-3/4"
☐	PFN1501PM	1,500,000	1,527	65-1/2"	29-3/4"	27-1/4"	59"	21"	20-3/4"	13-1/2"	8"	10"	9-1/2"
☐	PFN1701PM	1,700,000	1,731	70"	29-3/4"	27-1/4"	63-1/2"	21"	20-3/4"	13-1/2"	8"	10"	9-1/2"
☑	PFN2001PM	2,000,000	2,036	76-3/4"	29-3/4"	27-1/4"	70"	21"	20-3/4"	13-1/2"	8"	10"	9-1/2"

Model Number	K	L	M	N	P (F)	P (M)	Gas Conn.	Air Inlet	Vent Sizes Cat I (F)	Cat II (M)	Cat IV (M)	Wt. (lbs)
PFN0502PM	23"	11-1/2"	11-1/4"	17-1/2"	15-1/4"	15-1/4"	1"	5"	7"	7"	4"	535
PFN0752PM	30-1/2"	11-1/2"	11-1/4"	17-1/2"	15-1/4"	15-1/4"	1-1/4"	5"	9"	9"	5"	584
PFN1002PM	37-3/4"	11-1/2"	11-1/4"	17-1/2"	15-1/4"	15-1/4"	1-1/4"	6"	10"	10"	6"	663
PFN1302PM	46-1/4"	11-1/2"	19-1/2"	17-1/2"	15-1/4"	15-1/4"	1-1/4"	6"	12"	12"	8"	682
PFN1501PM	43-1/2"	5-3/4"	22-1/4"	21-1/2"	24-1/2"	19-1/2"	1-1/2"	6"	12"	8"	6"	1,131
PFN1701PM	48"	5-3/4"	25"	21-1/2"	24-1/2"	19-1/2"	1-1/2"	7"	14"	9"	7"	1,166
PFN2001PM	54-3/4"	5-3/4"	27-1/2"	21-1/2"	24-1/2"	19-1/2"	1-1/2"	8"	14"	10"	8"	1,193

Notes: Change 'N' to 'L' for LP Gas Model No deration on LP models Temperature rise calculations based on firing rate of 100% All water connections are 2-1/2"

Venting Options

- ☑ Sidewall
- ☐ Vertical
- ☐ DirectAire Vertical w/ Sidewall Inlet
- ☐ DirectAire Horizontal w/ Rooftop Inlet
- ☐ Direct Vent Horizontal
- ☐ Direct Vent Vertical
- ☐ Intelligent Venting Solutions

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APPENDIX B. EMISSION CALCULATIONS

Engine Emissions - 1646 kW (2206 hp) Emergency Generator (Tier 2)

Engine Rating (Mechanical Output)		2,206	hp	
Average Brake Specific Fuel Consumption		7,000	Btu/hp-hr	(Per AP-42, Table 3.3-1, October 1996)
Engine Input Rating		15.44	MMBtu/hr	
Fuel		Diesel		
Fuel Consumption (100%)	manufacturer	104.8000	gal/hr	
Fuel Consumption (50%)	manufacturer	58.1000	gal/hr	
Fuel Sulfur Content		0.0015	%	(Per 40 CFR 80.510(b))
Annual Operation Hours		100	hr/yr	
Annual Operation Hours (six engines)		600	hr/yr	
Mass Conversion		2.205	lb/kg	
GWP of CO_2		1	lbs CO_2e/lb CO_2	
GWP of CH_4		25	lbs CO_2e/lb CH_4	
GWP of N_2O		298	lbs CO_2e/lb N_2O	

2017 EPA calculation of EG-1's PTE based on 100 hrs/yr operation

Emission Point Number	Pollutant	Emission Factors [1, 2] (lb/MMBtu)	Emissions (lb/hr)	Emissions (lb/day)	Emissions (tpy)	Reference/Assumption
EG01	NOx	1.25	19.23	461.52	0.96	Certified Emissions Data
	CO	0.38	5.81	139.33	0.29	Certified Emissions Data
	PM	0.033	0.51	12.19	0.025	Certified Emissions Data
	PM_{10}	0.033	0.51	12.19	0.025	Assume all PM10=PM
	$PM_{2.5}$	0.033	0.51	12.19	0.025	Assume all PM2.5=PM
	SO_2	0.0015	0.0234	0.56	0.0012	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	VOC	0.09	1.39	33.35	0.0695	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	Total HAPs	0.0044	0.07	1.62	0.0034	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CO_2	163	2,518	60,429.08	125.89	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CH_4	0.0066	0.102	2.45	0.0051	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	N_2O	0.0013	0.0204	0.49	0.0010	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	GHG (CO_2e)	-	2,527	60,636	126	40 CFR Part 98 Subpart A, Table A-1

[1] Criteria and HAP pollutant emission factors per AP-42, Section 3.4 Large Stationary Diesel Engines (> 600 hp), October 1996.

[2] GHG emission factors per 40 CFR Part 98 Subpart C, Table C-1 and C-2.

Certified Emissions g/kw-hr	EF (lb/MMBTU)	EF (lb/gal) (100% Load)	EF (lb/gal) (50% Load)	Limit (gal/yr) at 100% Load	Limit (gal/yr) at 50% Load
5.3	1.245300752	0.18061614	0.325792968	10646.85263	5902.501316
1.6	0.37593985	0.054525627	0.098352594		
0.14	0.032894737	0.004770992	0.008605852		

Engine Emissions - 1620 kW (2172 hp) Generator (Tier 1)

2017 EPA calculation of EG-2 's PTE based on 93 hrs/yr operation

Engine Rating (Mechanical Output)		2,172	hp	
Average Brake Specific Fuel Consumption		7,000	Btu/hp-hr	(Per AP-42, Table 3.3-1, October 1996)
Engine Input Rating		15.20	MMBtu/hr	
Fuel		Diesel		
Fuel Consumption (100%)	manufacturer	103.9800	gal/hr	
Fuel Consumption (50%)	estimated	58.0000	gal/hr	
Fuel Sulfur Content		0.0015	%	(Per 40 CFR 80.510(b))
Annual Operation Hours (one engine)		93	hr/yr	
Annual Operation Hours (six engines)		558	hr/yr	
Mass Conversion		2.205	lb/kg	
GWP of CO_2		1	lbs CO_2e/lb CO_2	
GWP of CH_4		25	lbs CO_2e/lb CH_4	
GWP of N_2O		298	lbs CO_2e/lb N_2O	

Emission Point Number	Pollutant	Emission Factors [1, 2]	Emissions			Reference
		(lb/MMBtu)	(lb/hr)	(lb/day)	(tpy)	
EG2-6	NOx	2.07	31.44	754	1.46	Certified Emissions Data
	CO	0.33	5.00	120	0.23	Certified Emissions Data
	PM	0.033	0.50	12.00	0.02	Certified Emissions Data
	PM_{10}	0.033	0.50	12.00	0.02	Assume all PM10=PM
	$PM_{2.5}$	0.033	0.50	12.00	0.02	Assume all PM2.5=PM
	SO_2	0.0015	0.023	0.55	0.0011	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	VOC	0.09	1.37	32.84	0.0636	Certified Emissions Data
	Total HAPs	0.0044	0.07	1.59	0.0031	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CO_2	163	2,479	59,498	115.28	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CH_4	0.0066	0.101	2.41	0.005	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	N_2O	0.0013	0.020	0.48	0.0009	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	GHG (CO_2e)	-	2,488	59,702	116	40 CFR Part 98 Subpart A, Table A-1

[1] Criteria pollutants per certified from engine manufacturer and HAP pollutant emission factors per AP-42, Section 3.4 Large Stationary Diesel Engines (> 600 hp), October 1996.

[2] GHG emission factors per 40 CFR Part 98 Subpart C, Table C-1 and C-2.

Certified Emissions g/kw-hr	EF (lb/MMBTU)	EF (lb/gal) (100% Load)	EF (lb/gal) (50% Load)	Limit (gal/yr) at 100% Load	Limit (gal/yr) at 50% Load	
8.8	2.067669173	0.302255928	0.541871921	9672.684774	5395.419474	
1.4	0.328947368			9672.684774		
0.18	0.042293233					
0.4	0.093984962			58036.10864		
Maximum fuel consumption for 6 engines (gal/yr)				58036.10864	32372.51684	
Maximum emissions for 6 engines (572.4 hours) (tpy)				8.770878947		
				8.770878947	1.461813158	tons/yr/engine
					93	hrs/yr/engine
					558	hrs/yr (6 engines)

HAP Emissions for 6 Engines

Hazardous Air Pollutant	Emission Factors [1, 2]	Emissions			Reference
	(lb/MMBtu)	(lb/hr)	(lb/day)	(tpy)	
Benzene	7.76E-04	0.011798	0.283159	0.003292	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Toulene	2.81E-04	0.004272	0.102536	0.001192	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Xylenes	1.93E-04	0.002934	0.070425	0.000819	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Propylene	2.79E-03	0.042419	1.018060	0.011835	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Formaldehyde	7.89E-05	0.001200	0.028790	0.000335	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Acetaldehyde	2.52E-05	0.000383	0.009195	0.000107	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Acrolein	7.88E-06	0.000120	0.002875	0.000033	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Total PAH	2.12E-04	0.003223	0.077358	0.000899	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)

	NOx	CO	PM	PM10	PM2.5	SO2	VOC
Engines	8.77	1.40	0.14	0.14	0.14	0.01	0.01
Boilers	0.88	2.34	0.21	0.21	0.21	0.02	2.53
Water Heaters	0.17	0.15	0.01	0.01	0.01	0.00	0.16
Fire Pump	0.05	0.03	0.00	0.00	0.00	0.00	0.00
Total	9.87	3.92	0.36	0.36	0.36	0.02	2.70
Total (lbs/month)	1645.361	652.9742	60.57509	60.57509	60.57509	4.00707536	449.6161

2017 EPA calculation of facility-wide controlled PTE

Appendix C
Emission Calculations

ESA

Table C1 - Summary of Potential to Emit (PTE) Emissions of Criteria Pollutants and HAPs

Unlimited PTE Emissions (tons/year) [1]

Source Description	VOC	NO_X	CO	PM10	PM2.5	SOx	Total HAPs
New Emission Sources:							
Two (2) Cogen Generators	23.267	41.88	176.83	1.79	1.79	0.11	12.9
Six (6) Cooling Tower Cells	-	-	-	0.33	0.33	-	0
One (1) 500 kW Emergency Garage Generator	0.00	0.13	0.0	0.003	0.003	0.0009	0.001
Two (2) 2000 kw Emergency Generators	0.046	1.134	0.135	0.028	0.028	0.007	0.003
Eleven (11) New Water Heaters	0.31	1.79	4.7	0.42	0.42	0.03	0.11
Existing Permitted Sources (Post-project)	2.97	6.17	3.6	0.32	0.32	0.02	0.07
Facility-wide PTE	**26.59**	**51.09**	**185.28**	**2.89**	**2.89**	**0.17**	**13.11**
Title V Threshold	10	10	50	70	NA	100	25
Exceed Title V Threshold (Yes/No)	*Yes*	*Yes*	*Yes*	*No*	*No*	*No*	*No*
Existing Permit Limit	3.07	9.87	3.92	0.36	0.36	0.02	0.07
Net Increase in PTE Emissions	*23.5*	*41.2*	*181.4*	*2.5*	*2.5*	*0.1*	*13.0*

Post-Control PTE Emissions[2] (tons/year)

Source Description	VOC	NO_X	CO	PM10	PM2.5	SOx	Total HAPs
New Emission Sources:							
Two (2) Cogen Generators	2.35	1.68	4.87	1.79	1.79	0.11	1.35
Six (6) Cooling Tower Cells	-	-	-	0.33	0.33	-	
One (1) 500 kW Stand-by Engine	0.003	0.127	0.029	0.003	0.003	0.001	0.001
Two (2) 2000 kw Stand-by Engines	0.046	1.134	0.135	0.028	0.028	0.007	0.003
Eleven (11) New Water Heaters	0.13	0.76	2.0	0.18	0.18	0.01	0.04
Existing Permitted Sources	2.97	6.17	3.6	0.32	0.32	0.02	0.07
Post-Project Total PTE	**5.50**	**9.87**	**10.63**	**2.65**	**2.65**	**0.15**	**1.46**
Title V Threshold	10	10	50	70	NA	100	25
Exceed Title V Threshold (Yes/No)	*No*	*No*	*No*	*No*	*No*	*No*	No
Existing Permit Limit	3.07	9.87	3.92	0.36	0.36	0.02	0.07
Net Increase in Emissions	*2.4*	*0.0*	*6.7*	*2.3*	*2.3*	*0.1*	1.39

1. Unlimited PTE levels include the following emissions: continuous operations of 2 cogen generators, 6 cooling towers and 11 new water heaters @ 100% load and at uncontrolled emission rate; 200 hrs/yr/engine operations of emergency generators that include emergency uses and testing and maintenance operations; existing permitted sources' emissions post the project that include 200 hrs/yr/engine operation of emergency generators EG-1 and EG-2, and operations of existing water heaters/boilers and fire pump at existing permit conditions.

2. Post-Control PTE emissions are based upon the federally enforceable emissions and operational limits established in this permit application: continuous operations of 2 cogen generators and 6 cooling towers @ 100% load and at controlled emission rate; continous operation of 11 new water heaters @ 42.5% load (annual average);200 hrs/yr/engine operations of emergency generators that include emergency uses and testing and maintenance operations; existing permitted sources' emissions post the project that include 200 hrs/yr/engine operation of emergency generators EG-1 and EG-2, and operations of existing water heaters/boilers and fire pump at existing permit conditions.

Table C1.1 Emissions from Proposed Cogen Generators (Cogen-1 and Cogen-2)

Equipment - Two identical Jenbacher J616 engines [1]

	Power rating	Heat Input	Operation Schedule	Hourly Throughput		Annual Throuput	
No. of engines	MW per engine	MMBTU/hr per engine	hrs/yr	MW-hr	MMBTU/hr	MW-hr/yr	MMBTU/yr
2	2.656	20.45	8760	5.31	40.89	46,533	358,214

Information from Manufacturer on Startup and Shutdown

Maintenance schedule	8	hrs/event, 4 times (events) per year
Start up	10	minutes/event, 5 minutes to reach full load, achive controlled emission level within 10 mins
Shut down	5	minutes/event, less than 2.5 minutes before emission control no longer optimal

Assumptions for PTE of Startup and Shutdown - 3 times the manufacturer's duration

	Uncontrolled Time (mins)	Uncontrolled Max Rate Time (mins)	Controlled Time (mins)	Total Time (hrs/Event)	Events/yr	Total/yr
Start up [2]	10.00	10.00	10.00	0.5	24	12
Shutdown [3]	8.00		7.00	0.25	24	6

Operation Schedule for PTE Calculation (units in hrs/yr)

Total hours	Normal Operation	Startup & Shutdown	Total Uncontrolled	Total Controlled
8,760	8,742	18	11.2	8,748.8

Criteria Pollutant Emission Factors [4]

Type	VOC lb/MW-hr	NOx lb/MW-hr	CO lb/MW-hr	PM10 lb/mmbtu	PM2.5 lb/mmbtu	SO2 lb/mmbtu
Uncontrolled	1.000	1.800	7.600	0.010	0.010	0.001
Controlled	0.100	0.070	0.200	0.010	0.010	0.001

Criteria Pollutant Emissions

Type	VOC	NOx	CO	PM10	PM2.5	SO2
Hourly Maximum Emission (lb/hr)						
Uncontrolled	5.31	9.56	40.37	0.41	0.41	0.02
Controlled	0.53	0.37	1.06	0.41	0.41	0.02
Annual Maximum (tons/year)						
Uncontrolled PTE	**23.27**	**41.88**	**176.83**	**1.79**	**1.79**	**0.11**
Allowable Uncontrolled	0.03	0.05	0.23	0.00	0.00	0.00
Controlled	2.32	1.63	4.65	1.79	1.79	0.11
Controlled PTE	**2.35**	**1.68**	**4.87**	**1.79**	**1.79**	**0.11**

HAP Emissions from Two Cogen Generators

VOC control efficiency [5] 89.70%

	Emission Factor - Uncontrolled [6]	Hourly Emissions (lbs/hr)		Annual Emissions (lbs/yr)			
Pollutant	**lb/mmbtu**	**Uncontrolled**	**Controlled**	**Uncontrolled PTE**	**Allowable Uncontrolled**	**Controlled**	**Total Controlled PTE**
1,1,2,2-Tetrachloroethane	<4.00E-05	1.64E-03	1.68E-04	1.43E+01	0.02	1.47	1.49
1,1,2-Trichloroethane	<3.18E-05	1.30E-03	1.34E-04	1.14E+01	0.01	1.17	1.19
1,3-Butadiene	0.000267	1.09E-02	1.12E-03	9.56E+01	0.12	9.84	9.96
1,3-Dichloropropene	<2.64E-05	1.08E-03	1.11E-04	9.46E+00	0.01	0.97	0.98
2-Methylnaphthalene	3.32E-05	1.36E-03	1.40E-04	1.19E+01	0.02	1.22	1.24
2,2,4-Trimethylpentane	2.5E-04	1.02E-02	1.05E-03	8.96E+01	0.11	9.21	9.33
Acenaphthene	1.25E-06	5.11E-05	5.26E-06	4.48E-01	0.00	0.05	0.05
Acenaphthylene	5.53E-06	2.26E-04	2.33E-05	1.98E+00	0.00	0.20	0.21
Acetaldehyde	8.36E-03	3.42E-01	3.52E-02	2.99E+03	3.83	308.06	311.89
Acrolein	5.14E-03	2.10E-01	2.16E-02	1.84E+03	2.35	189.40	191.76
Benzene	4.4E-04	1.80E-02	1.85E-03	1.58E+02	0.20	16.21	16.42
Benzo(b)fluoranthene	1.66E-07	6.79E-06	6.99E-07	5.95E-02	0.00	0.01	0.01
Benzo(e)pyrene	4.15E-07	1.70E-05	1.75E-06	1.49E-01	0.00	0.02	0.02
Benzo(g,h,i)perylene	4.14E-07	1.69E-05	1.74E-06	1.48E-01	0.00	0.02	0.02
Biphenyl	2.12E-04	8.67E-03	8.93E-04	7.59E+01	0.10	7.81	7.91
Carbon Tetrachloride	<3.67E-05	1.50E-03	1.55E-04	1.31E+01	0.02	1.35	1.37
Chlorobenzene	<3.04E-05	1.24E-03	1.28E-04	1.09E+01	0.01	1.12	1.13
Chloroform	<2.85E-05	1.17E-03	1.20E-04	1.02E+01	0.01	1.05	1.06
Chrysene	6.93E-07	2.83E-05	2.92E-06	2.48E-01	0.00	0.03	0.03
Ethylbenzene	3.97E-05	1.62E-03	1.67E-04	1.42E+01	0.02	1.46	1.48
Ethylene Dibromide	<4.43E-05	1.81E-03	1.87E-04	1.59E+01	0.02	1.63	1.65
Fluoranthene	1.11E-06	4.54E-05	4.68E-06	3.98E-01	0.00	0.04	0.04
Fluorene	5.67E-06	2.32E-04	2.39E-05	2.03E+00	0.00	0.21	0.21
Formaldehyde	5.28E-02	2.16E+00	2.22E-01	1.89E+04	24.18	1945.62	1969.80
Methanol	2.5E-03	1.02E-01	1.05E-02	8.96E+02	1.14	92.12	93.27
Methylene Chloride	2E-05	8.18E-04	8.42E-05	7.16E+00	0.01	0.74	0.75
n-Hexane	1.11E-03	4.54E-02	4.68E-03	3.98E+02	0.51	40.90	41.41
Naphthalene	7.44E-05	3.04E-03	3.13E-04	2.67E+01	0.03	2.74	2.78

HAP Emissions from Two Cogen Generators

VOC control efficiency [5] 89.70%

	Emission Factor - Uncontrolled [6]	Hourly Emissions (lbs/hr)		Annual Emissions (lbs/yr)			
Pollutant	**lb/mmbtu**	**Uncontrolled**	**Controlled**	**Uncontrolled PTE**	**Allowable Uncontrolled**	**Controlled**	**Total Controlled PTE**
PAH	2.69E-05	1.10E-03	1.13E-04	9.64E+00	0.01	0.99	1.00
Phenanthrene	1.04E-05	4.25E-04	4.38E-05	3.73E+00	0.00	0.38	0.39
Phenol	2.4E-05	9.81E-04	1.01E-04	8.60E+00	0.01	0.88	0.90
Pyrene	1.36E-06	5.56E-05	5.73E-06	4.87E-01	0.00	0.05	0.05
Styrene	<2.36E-05	9.65E-04	9.94E-05	8.45E+00	0.01	0.87	0.88
Tetrachloroethane	2.48E-06	1.01E-04	1.04E-05	8.88E-01	0.00	0.09	0.09
Toluene	4.08E-04	1.67E-02	1.72E-03	1.46E+02	0.19	15.03	15.22
Vinyl Chloride	1.49E-05	6.09E-04	6.28E-05	5.34E+00	0.01	0.55	0.56
Xylene	1.84E-04	7.52E-03	7.75E-04	6.59E+01	0.08	6.78	6.86
			Max Single HAP (tons/yr)	**9.46**			**0.98**
			Total HAPs (tons/yr)	**12.93**			**1.35**

Notes:

1. Equipment information based on manufacturer's specification sheet.

2. Assume the engines ramp up to the full load in first 10 mintues, then remail at maximum uncontrolled rate for another 10 mins, and then at the maximum controlled rate for 10 minutes.

3. Assume the engines had emissions at normal steady-state emission rates in first 7 minutes - during which the emissions are still controlled, then take another 8 minutes to fully shutdown - emissions are uncontrolled during this period.

4. VOC, NOx and CO emission factors were from vendor quote for two identical Jenbacher J616 engines, each 2,656 EkW. SO2 and PM emission factors are from AP-42 Table 3.2-2 for 4-stroke lean-burn natural gas engines.

5.VOC control efficiency were based on vendor provided emissions data.

6. HAPs emission factors are from AP-42 Table 3.2-2 for 4-stroke lean-burn natural gas engines.

Table C1.2 - Emissions from Proposed New Cooling Towers (CT-1 through CT-6)

Cooling Tower Information

Marley	Manufacturer
NC8414XCN6	Model
23,400	GPM - Flow rate for six cooling tower cells combined
8,760	hrs/yr - Operating Hours
12,299	Million gallons per year (MMGal/yr)

Emission Factor[1]

Drift [2]	TDS [3] ppm	pH_2O lb/gal	EF lb/mmgal
0.0005%	1272.5	8.33	0.05

PTE Emissions[2]

PM10	PM2.5
tons/year	
0.33	0.33

Notes:

1. Emission factor calculation method is from USEPA, Chapter 13.4

https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s04.pdf

2. Drift loss is based on manufacturer guarantee.

3. TDS value is based on 2018 site-specific test data.

TDS Values (mg/L or ppm)	
1,300	*Sample 1*
1,380	*Sample 2*
1,210	*Sample 3*
1,200	*Sample 4*
1,273	*Average*

Table C1.3 - Emissions from Proposed Garage Emergency Diesel Generator (EG-7)

Equipment Information[1]

# of Engines	Engine Model	Engine Tier	Power Rating	
			BHP	KW
1	CAT C18	Tier 4 Final	762	500

7,000 Btu/hp-hr, Average Brake Specific Fuel Consumption (Per AP-42, Table 3.3-1, October 1996)
5.334 mmbtu/hr - engine heat input

Startup & Shutdown Schedule

	Uncontrolled	Controlled	Total	
	hrs/yr	hrs/yr	hrs/yr	Events/year
Manufacturer Estimate [2]	3.75	1.50	5.25	11 monthly tests, 1 annual test.
For Permit Application's PTE [3]	28.57	11.43	40	

Operation Schedule for PTE Calculation

Total hours [4]	Normal Emergency	Startup & Shutdown	Total Uncontrolled	Total Controlled
200	160	40	28.57	171.43

Uncontrolled Emission Factors

VOC	NO_x	CO	PM10	PM2.5	SO_2
	g/bhp-hr[5]				lb/hp-hr[6]
0.07	4.01	1.19	0.07	0.07	1.21E-05

Controlled Emission Factors

VOC	NO_x	CO	PM10	PM2.5	SO_2	VOC control efficiency
	lb/hr[5]				lb/hp-hr[6]	71%
0.02	0.36	0	0.01	0.01	1.21E-05	

Criteria Pollutants Emission Calculations

VOC	NO_x	CO	PM10	PM2.5	SO_2
Uncontrolled hourly Emissions (lb/hr)					
0.12	6.74	2.00	0.12	0.12	0.01
Controlled Hourly Emissions (lb/hr)					
0.02	0.36	0	0.01	0.01	0.01
Uncontrolled Annual Emissions (tons/year)					
0.002	0.096	0	0.002	0.002	1.32E-04
Controlled Annual Emissions (tons/year)					
0.002	0.031	0	0.0009	0.001	7.93E-04
Total PTE Annual Emissions (tons/year)					
0.003	0.127	0	0.003	0.003	9.25E-04

HAPs Emission Calculations

Pollutant	Uncontrolled Emission Factor [7]	Controlled Emission Factor [8]	Uncontrolled Emissions	Controlled Emissions	Total PTE Emissions
	(lb/mmbtu)	(lb/mmbtu)	lbs/yr	lbs/yr	lbs/yr
Benzene	7.76E-04	2.22E-04	1.18E-01	0.20	0.32
Toulene	2.81E-04	8.03E-05	4.28E-02	0.07	0.12
Xylenes	1.93E-04	5.51E-05	2.94E-02	0.05	0.08
Propylene	2.79E-03	7.97E-04	4.25E-01	0.73	1.15
Formaldehyde	7.89E-05	2.25E-05	1.20E-02	0.02	0.03
Acetaldehyde	2.52E-05	7.20E-06	3.84E-03	0.01	0.01
Acrolein	7.88E-06	2.25E-06	1.20E-03	0.00	0.00
Total PAH	2.12E-04	6.06E-05	3.23E-02	0.06	0.09
				Max Single HAP (tons/yr)	**0.0006**
				Total HAPs (tons/yr)	**0.001**

Notes:

1. Equipment information and emission factors obtained from CAT C18 Performance Data

2. Manufactuerer estimated that there will be 11 monthly tests @ 15 minutes each and at Tier 2 emissions for the entirety of these tests, there will be one annual test that may have 3 startup/shutdowns and have totally 90 mintues uncontrolled emissions at Tier 2 levels and 90 minutes controlled emissions at Tier 4 levels. In summary, totally there will be 225 minutes (3.75 hrs) uncontrolled emissions and 90 minutes (1.5 hrs) controlled emissions associated with the annual testing and maitenance. See the correspondence from manufacturer consultation in Attachment B for detail.

3. The PTE calculation for this permit application conservatively assumed there will be 40 hr/yr testing and maintenance, 7.6 times of what manufacturer estimate. The uncontrolled and controlled hours are scaled accordingly based on the manufacturer's estimate.

4. PTE schedule is assumed to be 200 hrs/yr, of which 40 hrs/yr is assumed for maintenance and testing and 160 hrs/yr is assumed to be normal emergency usage.

5. Uncontrolled and controlled emission factors for VOC, Nox, CO and PM were from manufacturer, which are equivalent to Tier 2 levels for uncontrolled and Tier 4 levels fore controlled.

6. SO2 emission factors calculated based on method in USEPA AP-42, Chapter 3.4, Table 3.4-1.
*SO_2 EF (lb/hp-hr)= 0.00809 * (% sulfur in diesel)*
https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

7. Uncontrolled HAPs emission factors from USEPA AP-42, Chapter 3.4, Table 3.4-3.

*8. Controlled HAPs Emission Factor = Uncontrolled HAP Emission Factor * VOC Control Efficiency.*

Table C1.4 - Emissions from Proposed Garage Emergency Diesel Generator (EG-8 and EG-9)

Equipment Information[1]

# of Engines	Engine Model	Engine Tier	Power Rating	
			BHP	KW
2	3516C	Tier 4 Final	2,941	2,000

7,000 Btu/hp-hr, Average Brake Specific Fuel Consumption (Per AP-42, Table 3.3-1, October 1996)

20.587 mmbtu/hr/engine - engine heat input

Startup & Shutdown Schedule (units in hrs/yr)

	Uncontrolled	Controlled	Total	Events/year
Manufacturer Estimate [2]	3.75	1.50	5.25	11 monthly tests, 1 annual test.
For Permit Application's PTE [3]	28.57	11.43	40	

Operation Schedule for PTE Calculation (units in hrs/yr)

Total hours [4]	Normal Emergency	Startup & Shutdown	Total Uncontrolled	Total Controlled
200	160	40	28.57	171.43

Uncontrolled Emission Factors

VOC	NO_X	CO	PM10	PM2.5	SO_2
	g/bhp-hr[5]				lb/hp-hr[6]
0.19	3.78	0.67	0.09	0.09	1.21E-05

Controlled Emission Factors

VOC	NO_X	CO	PM10	PM2.5	SO_2	VOC control efficiency
	g/bhp-hr[5]				lb/hp-hr[6]	95%
0.01	0.39	0.01	0.01	0.01	1.21E-05	

Criteria Pollutants Emission Calculations (Two engines total)

VOC	NO_X	CO	PM10	PM2.5	SO_2
Uncontrolled hourly Emissions (lb/hr)					
2.46	49.02	8.69	1.17	1.17	0.07
Controlled Hourly Emissions (lb/hr) [5]					
0.13	5.06	0.13	0.13	0.13	0.07
Uncontrolled Annual Emissions (tons/year)					
0.035	0.70	0.1	0.017	0.017	1.02E-03
Controlled Annual Emissions (tons/year)					
0.011	0.43	0.01	0.011	0.011	6.12E-03
Total PTE Annual Emissions (tons/year)					
0.046	1.13	0.14	0.03	0.03	7.14E-03

HAPs Emission Calculations

Pollutant	**Uncontrolled Emission Factor [7]**	**Controlled Emission Factor [8]**	**Uncontrolled Emissions**	**Controlled Emissions**	**Total PTE Emissions**
	(lb/mmbtu)	**(lb/mmbtu)**	**lbs/yr**	**lbs/yr**	**lbs/yr**
Benzene	7.76E-04	4.08E-05	9.13E-01	0.29	1.20
Toulene	2.81E-04	1.48E-05	3.31E-01	0.10	0.43
Xylenes	1.93E-04	1.02E-05	2.27E-01	0.07	0.30
Propylene	2.79E-03	1.47E-04	3.28E+00	1.04	4.32
Formaldehyde	7.89E-05	4.15E-06	9.28E-02	0.03	0.12
Acetaldehyde	2.52E-05	1.33E-06	2.96E-02	0.01	0.04
Acrolein	7.88E-06	4.15E-07	9.27E-03	0.00	0.01
Total PAH	2.12E-04	1.12E-05	2.49E-01	0.08	0.33
				Max Single HAP (tons/yr)	**0.0022**
				Total HAPs (tons/yr)	**0.003**

Notes:

1. Equipment information and emission factors obtained from CAT 3516C Performance Data

2. Manufactuerer estimated that there will be 11 monthly tests @ 15 minutes each and at Tier 2 emissions for the entirety of these tests, there will be one annual test that may have 3 startup/shutdowns and have totally 90 mintues uncontrolled emissions at Tier 2 levels and 90 minutes controlled emissions at Tier 4 levels. In summary, totally there will be 225 minutes (3.75 hrs) uncontrolled emissions and 90 minutes (1.5 hrs) controlled emissions associated with the annual testing and maitenance. See the correspondence from manufacturer consultation in Attachment B for detail.

3. The PTE calculation for this permit application conservatively assumed there will be 40 hr/yr testing and maintenance, 7.6 times of what manufacturer estimate. The uncontrolled and controlled hours are scaled accordingly based on the manufacturer's estimate.

4. PTE schedule is assumed to be 200 hrs/yr, of which 40 hrs/yr is assumed for maintenance and testing and 160 hrs/yr is assumed to be normal emergency usage.

5. Uncontrolled and controlled emission factors for VOC, Nox, CO and PM were from manufacturer, which are equivalent to Tier 2 levels for uncontrolled and Tier 4 levels fore controlled.

6. SO2 emission factors calculated based on method in USEPA AP-42, Chapter 3.4, Table 3.4-1.
*SO_2 EF (lb/hp-hr)= 0.00809 * (0.0015% sulfur in diesel)*
https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

7. Uncontrolled HAPs emission factors from USEPA AP-42, Chapter 3.4, Table 3.4-3.

*8. Controlled HAPs Emission Factor = Uncontrolled HAP Emission Factor * VOC Control Efficiency.*

Table C1.5 - Criterial Pollutants Emissions from Proposed Natural Gas Water Heaters (WH-3 through WH-13)

Equipment [1]

Manufacturer	Model	Quantity	Heat Input (MMBTU/hr)	Operating Hours (hrs/year)	Max. NG Usage [2] mmscf/year	Proposed NG Usage	
						Load Factor	mmscf/yr
Lochinvar	AWN1300PM	6	1.3	8760	66.99	42.5%	28
Lochinvar	AWN400PM	3	0.4	8760	10.31	42.5%	4
Lochinvar	PFN2001PM	2	2	8760	34.35	42.5%	15
				Total	111.65		**47.450000**

Emission Calculations

Pollutant	Emission Factor (lb/mmscf) [3]	Uncontrolled PTE Emissions [4] (tons/yr)	Proposed PTE Emissions [5] (tons/yr)
VOC	**5.50**	**0.31**	**0.13**
NO_X	**32.00**	**1.79**	**0.76**
CO	**84.00**	**4.69**	**1.99**
PM10	**7.60**	**0.42**	**0.18**
PM2.5	**7.60**	**0.42**	**0.18**
SO_2	**0.60**	**0.03**	**0.01**
HAPs			
Arsenic	2.00E-04	2.23E-02	0.01
Benzene	2.10E-03	2.34E-01	0.10
Beryllium	1.20E-05	1.34E-03	0.00
Cadmium	1.10E-03	1.23E-01	0.05
Chromium	1.40E-03	1.56E-01	0.07
Cobalt	8.40E-05	9.38E-03	0.00
Dichlorobenzene	1.20E-03	1.34E-01	0.06
Formaldehyde	7.50E-02	8.37E+00	3.56
Hexane	1.80	2.01E+02	85.41
Manganese	3.80E-04	4.24E-02	0.02
Mercury	2.60E-04	2.90E-02	0.01
Nickel	2.10E-03	2.34E-01	0.10
POM **(See table to right)**	6.98E-04	7.80E-02	0.03
Selenium	2.40E-05	2.68E-03	0.00
Toluene	3.40E-03	3.80E-01	0.16
Max Single HAP (tons/yr)		**0.10**	**0.04**
Total HAPs (tons/yr)		**0.11**	**0.04**

Total polycyclic organic matter (POM):

HAP	Emission Factor (lb/mmscf)
2-Methylnaphthalene	2.40E-05
3-Methylchloranthrene	1.80E-06
7,12-Dimethylbenz(a)anthracene	1.60E-05
Acenaphthene	1.80E-06
Acenaphthylene	1.80E-06
Anthracene	2.40E-06
Benz(a)anthracene	1.80E-06
Benzo(a)pyrene	1.20E-06
Benzo(b)fluoranthene	1.80E-06
Benzo(g,h,i)perylene	1.20E-06
Benzo(k)fluoranthene	1.80E-06
Chrysene	1.80E-06
Dibenzo(a,h)anthracene	1.20E-06
Fluoranthene	3.00E-06
Fluorene	2.80E-06
Indeno(1,2,3-cd)pyrene	1.80E-06
Naphthalene	6.10E-04
Phenanthrene	1.70E-05
Pyrene	5.00E-06
TOTAL (POM):	6.98E-04

Notes:

1. Water Heater Models and Quantities were provided by the project design teams and vendors, the two PFN2001PM water heaters will be used for pluming infrastructure upgrade, the other 9 water heaters will be supporting the YAAMAVA project as domestic water heater.

2. To convert from lb/MMSCF to lb/MMBTU divide by 1,020.

3. Emissions factors obtained from USEPA AP-42, Chapter 1, Table 1.4-1 and Table 1.4-2 for boilers <100 MMBTU/hr, and Table 1.4-3 and Table 1.4-4 for HAPs. https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. The water heaters will be equipped with Low NOx burners that were certified by the SCAQMD to meet 20 ppm NOx at 3% O2.

4. PTE calculation for all units are based on operation at on 100% load for 8,760 hrs/yr.

*5. Proposed PTE = Uncontrolled PTE * Proposed Load Factor = Uncontrolled PTE * 42.5%.*

Table C1.6 - PTE of Existing Permitted Sources

Existing Permit Limits [1]

Sources	VOC	NO_X	CO	PM	PM10	PM2.5	SO2	Total HAPs
	tons/year							
EG-1 through EG-6	0.38	8.77	1.40	0.14	0.14	0.14	0.01	0.02
BO-1, BO-2 and BO-3	2.53	0.88	2.34	0.21	0.21	0.21	0.02	0.05
WH-1 and WH-2	0.16	0.17	0.15	0.01	0.01	0.01	0.00	0.00
FP-1	0.00	0.05	0.03	0.00	0.00	0.00	0.00	0.00
Total	***3.07***	***9.87***	***3.92***	***0.36***	***0.36***	***0.36***	***0.02***	***0.07***

Proposed Changes

1. Remove EG-3, EG-4, EG-5 and EG-6;
2. Change EG-1 and EG-2 from non-emergency to emergency generators.

PTE for EG-1 and EG-2

Existing PTE per EPA's 2017 Calculation	EPA's PTE Calculation for the Existing Permit Condition								
	hrs/year	VOC	NOX	CO	PM	PM10	PM2.5	SO2	Total HAPs
		tons/year							
EG-1 (Tier 2) [2]	100	0.07	0.96	0.29	0.03	0.03	0.03	0.001	0.003
EG-2 (Tier 1) [2]	93	0.06	1.46	0.23	0.02	0.02	0.02	0.001	0.003
New PTE	**Scale EPA's PTE Calculation to Change the Engines to Emergency Generators**								
	hrs/year	VOC	NOX	CO	PM	PM10	PM2.5	SO2	Total HAPs
		tons/year							
EG-1 (Tier 2)	200	0.14	1.92	0.58	0.05	0.05	0.05	0.002	0.01
EG-2 (Tier 1)	200	0.14	3.14	0.50	0.05	0.05	0.05	0.002	0.01

Post-project PTE Emissions Based on Proposed Changes

Sources	VOC	NO_X	CO	PM	PM10	PM2.5	SO2	Total HAPs
	tons/year							
EG-1 through EG-2	0.276	5.07	1.08	0.10	0.10	0.10	0.005	0.01
BO-1, BO-2 and BO-3	2.53	0.88	2.34	0.21	0.21	0.21	0.02	0.05
WH-1 and WH-2	0.16	0.17	0.15	0.01	0.01	0.01	0.001	0.00
FP-1	0.00	0.05	0.03	0.001	0.001	0.001	0.00004	0.00
Total	***2.97***	***6.17***	***3.60***	***0.32***	***0.32***	***0.32***	***0.02***	**0.07**

Notes:

1. From"Emission Summary (Controlled)" worksheet of the EPA-R09-OAR-2017-0269-0008. xlsx. Corrected the VOC emissions value because the EPA spreadsheet incorrectly linked the VOC of EG-1 throught EG-6 to SO2 data.

2. From"Emergency Generators" worksheet of the EPA-R09-OAR-2017-0269-0008.xlsx.

Table C2 - GHG Emissions Summary

Sources	CO_2e Emissions (MT/yr)
	Controlled PTE
Natural Gas Combustion Sources	24,680
Diesel Combustion Sources	1,078
Total	**25,758**

Table C2.1 - GHG Emission Calculations for Natural Gas Combustion Sources

	CO_2	CH_4	N_2O
Emission Factor (kg/MMBtu) [1,2]	53.06	1.00E-03	1.00E-04
GWP (kg CO_2e/kg)	1	25	298

53.11	CO_2e Emission Factor (kg/MMBtu)
1,000	Unit Conversion (kg/MT)
464,649	Proposed NG Throughput Total (MMBTU/yr)
24,680	**PTE GHG Emissions (MT CO_2e/yr)**

Fuel Usage at Proposed New Equipment [1]

Type	Manufacturer	Model	Quantity	Heat Input (MMBTU/hr)	Operating Hours (hrs/year)	Average Load Factor	Proposed Throughput MMBTU/yr
Water Heater	Lochinvar	AWN1300PM	6	1.3	8,760	43%	29,039
Water Heater	Lochinvar	AWN400PM	3	0.4	8,760	43%	4,468
Water Heater	Lochinvar	PFN2001PM	2	2	8,760	43%	14,892
Cogen Generators	GE	JMS 616 GS-J02	2	20.45	8,760	100%	358,214
						Total	**406,613**

Fuel Usage at Existing Sources

Emission Unit ID	Throughput Limit MMBTU/yr
BO-1, BO-2, BO-3, WH-1 and WH-2	58,036

Notes:

1. CO2 Emission Factor, Table C-1 to Subpart C of Part 98—Default CO2 Emission Factors and High Heat Values for Various Types of Fuel

2. CH4/NO2 Emission Factor, Table C-2 to Subpart C of Part 98—Default CH4 and N2O Emission Factors for Various Types of Fuel

Table C2.2 - GHG Emission Calculations for Diesel Combustion Sources

	CO_2	CH_4	N_2O
Emission Factor (kg/MMBtu) [1,2]	73.96	3.00E-03	6.00E-04
GWP (kg CO_2e/kg)	1	25	298

74.21	CO_2e Emission Factor (kg/MMBtu)
0.138	Default HHV [3] (mmbtu/gal diesel)
1,000	Unit Conversion (kg/MT)
105,252	PTE Total Diesel Usage (gal/yr)
1,078	**PTE GHG Emissions (MT CO_2e/yr)**

Fuel Usage at Proposed New Diesel Generators [1]

Emission Unit ID	Model	Quantity	Fuel Input (gal/hr/engine)	Operating Hours PTE (hrs/year/engine)	PTE Diesel Usage gal/yr
EG-7	CAT C18	1	37	200	7,400
EG-8, EG-9	CAT 3516C	2	139.5	200	55,800

Fuel Usage at Existing Diesel Generators

Emission Unit ID	Fuel Input (gal/hr/engine)	Existing Permit Limit gal/yr	PTE Hours/yr/engine	Proposed New Usage Limit gal/yr
EG-1 through EG-6	103.98	58,036	200	41,592
FP-1	4.6	460	No change	460

Notes:

1. CO2 Emission Factor, Table C-1 to Subpart C of Part 98—Default CO2 Emission Factors and High Heat Values for Various Types of Fuel

2. CH4/NO2 Emission Factor, Table C-2 to Subpart C of Part 98—Default CH4 and N2O Emission Factors for Various Types of Fuel

3. Default HHV from Table C-1 to Subpart C of Part 98—Default CO2 Emission Factors and High Heat Values for Various Types of Fuel

Table C3 - Summary of Actual Annual Emissions Based on 2017 and 2018 Facility Data [1] (TPY)

Existing Source	NOx	CO	PM	PM10	PM2.5	SO2	VOC	Total HAPS	CO2	CH4	N2O	GHG (CO2e)
							tons per year					
Engines [1]	3.82	0.67	0.07	0.07	0.07	0.00	0.18	0.01	322.86	0.01	0.00	323.97
Boilers	0.85	7.61	0.68	0.68	0.68	0.05	8.22	0.17	10,744.09	0.21	0.06	10,766.32
Water Heaters	0.17	0.15	0.01	0.01	0.01	0.00	0.16	0.00	205.88	0.00	0.00	206.31
Fire Pump	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	4.57	0.00	0.00	4.58
Total	**4.89**	**8.46**	**0.76**	**0.76**	**0.76**	**0.06**	**8.56**	**0.18**	**11,277.40**	**0.22**	**0.06**	**11,301.18**

Notes:

1. Since the current permit issuance in September 2017, the only operational records available at the time of this permit application was from October 2017 to March 2018 for the engines and boilers. The Actual emissions of the engines and boilers were calculated based on those two quarters' data and scaled it up to 12 months (e.g., multiply the 6-month total by 2 to generate the 12-month data. Facility records for water heaters and fire pump were not readily available at the time of this application, and calculation was based on the allowable emissions per the existing permit conditions

Engine Emissions - 1646 kW (2206 hp) Emergency Generator (Tier 2)

Engine Rating (Mechanical Output)		2,206	hp	
Average Brake Specific Fuel Consumption		7,000	Btu/hp-hr	(Per AP-42, Table 3.3-1, October 1996)
Engine Input Rating		15.44	MMBtu/hr	
Fuel		Diesel		
Fuel Consumption (100%)	manufacturer	104.8000	gal/hr	
Fuel Consumption (50%)	manufacturer	58.1000	gal/hr	
Fuel Sulfur Content		0.0015	%	(Per 40 CFR 80.510(b))
Total Operation Hours[3]		42.8	hr/yr	
Mass Conversion		2.205	lb/kg	
GWP of CO_2		1	lbs CO_2e/lb CO_2	
GWP of CH_4		25	lbs CO_2e/lb CH_4	
GWP of N_2O		298	lbs CO_2e/lb N_2O	

Emission Point Number	Pollutant	Emission Factors [1, 2]	Emissions			Reference/Assumption
		(lb/MMBtu)	(lb/hr)	(lb/day)	(tpy)	
EG01	NOx	1.25	19.23	461.52	0.41	Certified Emissions Data
	CO	0.38	5.81	139.33	0.12	Certified Emissions Data
	PM	0.033	0.51	12.19	0.011	Certified Emissions Data
	PM_{10}	0.033	0.51	12.19	0.011	Assume all PM10=PM
	$PM_{2.5}$	0.033	0.51	12.19	0.011	Assume all PM2.5=PM
	SO_2	0.0015	0.0234	0.56	0.0005	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	VOC	0.09	1.39	33.35	0.0297	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	Total HAPs	0.0044	0.07	1.62	0.0014	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CO_2	163	2,518	60,429.08	53.88	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CH_4	0.0066	0.102	2.45	0.0022	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	N_2O	0.0013	0.0204	0.49	0.0004	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	GHG (CO_2e)	-	2,527	60,636	54	40 CFR Part 98 Subpart A, Table A-1

[1] Criteria and HAP pollutant emission factors per AP-42, Section 3.4 Large Stationary Diesel Engines (> 600 hp), October 1996.

[2] GHG emission factors per 40 CFR Part 98 Subpart C, Table C-1 and C-2.

3 Based on October 2017 to March 2018 facility data (Air Permit Recordkeeping 1 of 2)

HAP Emissions for (1) Tier 2 Engine					
Hazardous Air Pollutant	Emission Factors [1, 2]	Emissions			Reference
	(lb/MMBtu)	(lb/hr)	(lb/day)	(tpy)	
Benzene	7.76E-04	0.011983	0.287592	0.003343	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Toulene	2.81E-04	0.004339	0.104141	0.001211	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Xylenes	1.93E-04	0.002980	0.071527	0.000832	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Propylene	2.79E-03	0.043083	1.033996	0.012020	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Formaldehyde	7.89E-05	0.001218	0.029241	0.000340	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Acetaldehyde	2.52E-05	0.000389	0.009339	0.000109	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Acrolein	7.88E-06	0.000122	0.002920	0.000034	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Total PAH	2.12E-04	0.003274	0.078569	0.000913	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Total	4.36E-03	0.066350	1.592399	0.018512	

Engine Emissions - 1620 kW (2172 hp) Generator (Tier 1)

Engine Rating (Mechanical Output)		2,172	hp	
Average Brake Specific Fuel Consumption		7,000	Btu/hp-hr	(Per AP-42, Table 3.3-1, October 1996)
Engine Input Rating		15.20	MMBtu/hr	
Fuel		Diesel		
Fuel Consumption (100%)	manufacturer	103.9800	gal/hr	
Fuel Consumption (50%)	estimated	58.0000	gal/hr	
Fuel Sulfur Content		0.0015	%	(Per 40 CFR 80.510(b))
Annual Operation Hours (5 engines)[3]		217.0	hr/yr	
Mass Conversion		2.205	lb/kg	
GWP of CO_2		1	lbs CO_2e/lb CO_2	
GWP of CH_4		25	lbs CO_2e/lb CH_4	
GWP of N_2O		298	lbs CO_2e/lb N_2O	

Emission Point Number	Pollutant	Emission Factors [1, 2]	Emissions for (5) Tier 1 Engines			Reference
		(lb/MMBtu)	(lb/hr)	(lb/day)	(tpy)	
EG2-6	NOx	2.07	31.44	754	3.41	Certified Emissions Data
	CO	0.33	5.00	120	0.54	Certified Emissions Data
	PM	0.033	0.50	12.00	0.05	Certified Emissions Data
	PM_{10}	0.033	0.50	12.00	0.05	Assume all PM10=PM
	$PM_{2.5}$	0.033	0.50	12.00	0.05	Assume all PM2.5=PM
	SO_2	0.0015	0.023	0.55	0.00	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	VOC	0.09	1.37	32.84	0.15	Certified Emissions Data
	Total HAPs	0.0044	0.07	1.59	0.0072	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CO_2	163	2,479	59,498	268.98	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CH_4	0.0066	0.101	2.41	0.011	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	N_2O	0.0013	0.020	0.48	0.0022	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	GHG (CO_2e)	-	2,488	59,702	270	40 CFR Part 98 Subpart A, Table A-1

[1] Criteria pollutants per certified from engine manufacturer and HAP pollutant emission factors per AP-42, Section 3.4 Large Stationary Diesel Engines (> 600 hp), October 1996.

[2] GHG emission factors per 40 CFR Part 98 Subpart C, Table C-1 and C-2.

3 Based on October 2017 to March 2018 facility data (Air Permit Recordkeeping 1 of 2)

HAP Emissions for 5 Engines					
Hazardous Air Pollutant	Emission Factors [1, 2]	Emissions			Reference
	(lb/MMBtu)	(lb/hr)	(lb/day)	(tpy)	
Benzene	7.76E-04	0.011798	0.283159	0.001280	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Toulene	2.81E-04	0.004272	0.102536	0.000464	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Xylenes	1.93E-04	0.002934	0.070425	0.000318	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Propylene	2.79E-03	0.042419	1.018060	0.004602	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Formaldehyde	7.89E-05	0.001200	0.028790	0.000130	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Acetaldehyde	2.52E-05	0.000383	0.009195	0.000042	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Acrolein	7.88E-06	0.000120	0.002875	0.000013	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Total PAH	2.12E-04	0.003223	0.077358	0.000350	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
Total	4.36E-03	0.066350	1.592399	0.007199	

Boiler Emissions - 15 mmBTU//hr

Boiler Heat Input Rating		15.00	MMBtu/hr
Fuel		Natural Gas	
CO Emission Factor		85	$lb/10^6 scf$
PM Emissions Factor		7.6	$lb/10^6 scf$
VOC Emissions Factor		5.5	$lb/10^6 scf$
SO2 Emissions Factor		0.6	$lb/10^6 scf$
CO_2 Emissions Factor		120,000	$lb/10^6 scf$
Methane Emissions Factor		2.3	$lb/10^6 scf$
N2O Emissions Factor		0.64	$lb/10^6 scf$
Total HAPs		1.88	$lb/10^6 scf$
Fuel Consumption (100%)	applicant	14,700	scf/hr
Annual Operation Hours for 3 Boilers [1]		12,177	hr/yr
Worst Case Natural Gas Cons. (total facility)		43,000	therms/yr
Therm to Cubic Feet Conversion		99.9761	scf/therm
HHV Natural Gas		1,020	Btu/scf
Mass Conversion		2.205	lb/kg
GWP of CO_2		1	lbs CO_2e/lb CO_2
GWP of CH_4		25	lbs CO_2e/lb CH_4
GWP of N_2O		298	lbs CO_2e/lb N_2O

Emission Point Number	Pollutant	Emission Factors [2, 3, 4] (lb/MMBtu)	Emissions for 3 Boilers (lb/hr)	(lb/day)	(tpy)	Reference/Assumption
BO-1, BO-2, BO-3	NOx	0.009	0.14	3.36	0.85	Source Test Data
	CO	0.083	1.25	30.00	7.61	AP-42 Section 1.4 (Table 1.4-2)
	PM	0.007	0.11	2.68	0.680	AP-42 Section 1.4 (Table 1.4-2)
	PM_{10}	0.007	0.11	2.68	0.680	Assume all PM10=PM
	$PM_{2.5}$	0.007	0.11	2.68	0.680	Assume all PM2.5=PM
	SO_2	0.0006	0.0088	0.21	0.0537	AP-42 Section 1.4 (Table 1.4-2)
	VOC	0.09	1.35	32.40	8.2192	AP-42 Section 1.4 (Table 1.4-2)
	Total HAPs	0.0018	0.03	0.66	0.1683	AP-42 Section 1.4 (Table 1.4-3)
	CO_2	118	1,765	42,352.94	10,744.09	AP-42 Section 1.4 (Table 1.4-3)
	CH_4	0.0023	0.034	0.81	0.2059	AP-42 Section 1.4 (Table 1.4-3)
	N_2O	0.0006	0.0094	0.23	0.0573	AP-42 Section 1.4 (Table 1.4-3)
	GHG (CO_2e)	-	1,768	42,441	10,766	40 CFR Part 98 Subpart A, Table A-1

[1] Usage data is based on October 2017 to February 2018 facility record, multiplied by 12/5 to scale up to annual usage.

[2] Criteria and HAP pollutant emission factors per AP-42, Section 1.4 Natural Gas Combustion, Tables 1.4-1, Table 1.4-2, Table 1.4-3 (<100 MMBtu/hr), October 1996.

[3] GHG emission factors per 40 CFR Part 98 Subpart C, Table C-1 and C-2.

[4] NOx emission factor based on Source Test performed on March 12th and 13th

Boiler Emission Factors From 2018 Source Test

Unit ID	NOx (lb/MMBTU)
BO-1	0.011
BO-2	0.007
BO-3	0.01
Average	**0.0093**

Water Heaters - 1.4 mmBTU/hr

Boiler Heat Input Rating		1.40	MMBtu/hr
Fuel		Natural Gas	
NO_x Emission Factor		100	$lb/10^6scf$
CO Emission Factor		85	$lb/10^6scf$
PM Emissions Factor		7.6	$lb/10^6scf$
VOC Emissions Factor		5.5	$lb/10^6scf$
SO2 Emissions Factor		0.6	$lb/10^6scf$
CO_2 Emissions Factor		120,000	$lb/10^6scf$
Methane Emissions Factor		2.3	$lb/10^6scf$
N2O Emissions Factor		0.64	$lb/10^6scf$
Total HAPs		1.88	$lb/10^6scf$
Fuel Consumption (100%)	applicant	14,700	scf/hr
Annual Operation Hours		1,250	hr/yr
HHV Natural Gas		1,020	Btu/scf
Mass Conversion		2.205	lb/kg
GWP of CO_2		1	lbs CO_2e/lb CO_2
GWP of CH_4		25	lbs CO_2e/lb CH_4
GWP of N_2O		298	lbs CO_2e/lb N_2O

Emission Point Number	Pollutant	Emission Factors [1, 2] (lb/MMBtu)	Emissions (lb/hr)	Emissions (lb/day)	Emissions (tpy)	Reference/Assumption
WH-1, WH-2	NOx	0.098	0.14	3.29	0.09	AP-42 Section 1.4 (Table 1.4-1)
	CO	0.083	0.12	2.80	0.07	AP-42 Section 1.4 (Table 1.4-2)
	PM	0.007	0.01	0.25	0.007	AP-42 Section 1.4 (Table 1.4-2)
	PM_{10}	0.007	0.01	0.25	0.007	Assume all PM10=PM
	$PM_{2.5}$	0.007	0.01	0.25	0.007	Assume all PM2.5=PM
	SO_2	0.0006	0.0008	0.02	0.0005	AP-42 Section 1.4 (Table 1.4-2)
	VOC	0.09	0.13	3.02	0.0788	AP-42 Section 1.4 (Table 1.4-2)
	Total HAPs	0.0018	0.00	0.06	0.0016	AP-42 Section 1.4 (Table 1.4-3)
	CO_2	118	165	3,952.94	102.94	AP-42 Section 1.4 (Table 1.4-3)
	CH_4	0.0023	0.003	0.08	0.0020	AP-42 Section 1.4 (Table 1.4-3)
	N_2O	0.0006	0.0009	0.02	0.0005	AP-42 Section 1.4 (Table 1.4-3)
	GHG (CO_2e)	-	165	3,961	103	40 CFR Part 98 Subpart A, Table A-1

[1] Criteria and HAP pollutant emission factors per AP-42, Section 1.4 Natural Gas Combustion, Tables 1.4-1, Table 1.4-2, Table 1.4-3 (<100 MMBtu/hr), October 199

[2] GHG emission factors per 40 CFR Part 98 Subpart C, Table C-1 and C-2.

Firepump Emissions - 60 kW (80 hp) Firepump (Tier 2 Compliant)

Engine Rating (Mechanical Output)		80	hp	
Average Brake Specific Fuel Consumption		7,000	Btu/hp-hr	(Per AP-42, Table 3.3-1, October 1996)
Engine Input Rating		0.56	MMBtu/hr	
Fuel		Diesel		
Fuel Consumption (100%)	manufacturer	4.6000	gal/hr	
Fuel Sulfur Content		0.0015	%	(Per 40 CFR 80.510(b))
Annual Operation Hours		100	hr/yr	
Mass Conversion		2.205	lb/kg	
GWP of CO_2		1	lbs CO_2e/lb CO_2	
GWP of CH_4		25	lbs CO_2e/lb CH_4	
GWP of N_2O		298	lbs CO_2e/lb N_2O	

Emission Point Number	Pollutant	Emission Factors [1, 2]	Emissions			Reference/Assumption
		(lb/MMBtu)	(lb/hr)	(lb/day)	(tpy)	
FP-1	NOx	1.69	0.95	22.74	0.05	Tier 2 Marine Standard
	CO	1.17	0.66	15.79	0.03	Certified Emissions Data
	PM	0.047	0.03	0.63	0.001	Certified Emissions Data
	PM_{10}	0.047	0.03	0.63	0.001	Assume all PM10=PM
	$PM_{2.5}$	0.047	0.03	0.63	0.001	Assume all PM2.5=PM
	SO_2	0.0015	0.0008	0.02	0.0000	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	VOC	0.09	0.05	1.21	0.0025	AP-42 Section 3.4 (10/96) (Table 3.4-1)
	Total HAPs	0.0044	0.00	0.06	0.0001	AP-42 Section 3.4 (10/96) (Tables 3.4-3 and 3.4-4)
	CO_2	163	91	2,191.44	4.57	40 CFR Part 98 Subpart C, Table C-1
	CH_4	0.0066	0.004	0.09	0.0002	40 CFR Part 98 Subpart C, Table C-2
	N_2O	0.0013	0.0007	0.02	0.0000	40 CFR Part 98 Subpart C, Table C-2
	GHG (CO_2e)	-	92	2,199	5	40 CFR Part 98 Subpart A, Table A-1

[1] Criteria and HAP pollutant emission factors per AP-42, Section 3.4 Large Stationary Diesel Engines (> 600 hp), October 1996.

[2] GHG emission factors per 40 CFR Part 98 Subpart C, Table C-1 and C-2.

Appendix D

San Manuel Hotel and Casino Expansion Project TEIR

To save paper, only the cover sheets and the Executive Summary of the TEIR (first 17 pages of the TEIR) are attached. The full TEIR document can be accessed online at https://sanmanuel-nsn.gov/sanmanuelteir

ESA

SAN MANUEL HOTEL AND CASINO EXPANSION PROJECT

Final Tribal Environmental Impact Report

Lead Agency
San Manuel Band of Mission Indians

March 2018

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Final Tribal Environmental Impact Report

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March 2018

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Notice of Completion of a Final Tribal Environmental Impact Report

The San Manuel Band of Mission Indians (Tribe), as lead agency, is issuing notification of the availability of a Final Tribal Environmental Impact Report (TEIR). The Final TEIR analyzes the potential off-Reservation environmental effects of the proposed Hotel & Casino Expansion Project (Project) and responds to all comments received on the Draft TEIR. The Final TEIR has been developed in accordance with the requirements of the Tribal-State Gaming Compact (Compact) between the Tribe and the State of California.

Project Description: The Project includes the development of approximately 795,000 square feet of new entertainment and hospitality facilities, including a hotel, performance venue, additional gaming area, restaurants and other guest amenities, back of house and administrative facilities, an approximately 2,200 stall parking structure and additional power utility infrastructure. The Project is anticipated to provide approximately 1,400 jobs during the construction phase and approximately 1,200 jobs during operation. The TEIR assesses a Phase 1 with 55,000 square feet of additional gaming and a Phase 2 which increases this number to 100,000 square feet through the conversion of meeting and event and back-of-house space. In addition, the TEIR considers several different sources to provide power to the Project, including obtaining power from Southern California Edison via existing lines, and/or development of a customer dedicated substation on the Tribe's Reservation (with new 66 kilovolt [kV] transmission poles, a new 66 kV transmission conductor, and telecommunications lines on existing structures), and/or a future Tribal owned combined heat and power cogeneration, and/or fuel cell power facilities on the Tribe's Reservation.

Project Location: The Project is located on the Tribe's Reservation in San Bernardino County, California, adjacent to the City of San Bernardino and approximately one mile north of the City of Highland. Regional access to the casino is provided by Interstate 210, with local access provided by Highland Avenue and Victoria Avenue. Construction and operational activities would occur within a 70± acre Project site in the southwestern portion of the Reservation, which includes or is adjacent to existing casino facilities.

Availability of the Final TEIR: The Final TEIR is available on the Tribe's website: www.SanManuelTEIR.com. Copies of the Final TEIR are available at the Howard M. Rowe Branch Library at 108 East Marshall Boulevard in the City of San Bernardino and the Highland Sam J. Racadio Library at 7863 Central Avenue in the City of Highland.

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EXECUTIVE SUMMARY

San Manuel Hotel and Casino Expansion Project

S.1 Background

This ~~Draft~~Final Tribal Environmental Impact Report (TEIR) has been prepared by the San Manuel Band of Mission Indians (Tribe) to analyze the potential off-Reservation environmental effects of the proposed Hotel and Casino Expansion Project (referred to in this ~~Draft~~Final TEIR as the Project). The Project is located on the Tribe's Reservation in San Bernardino County, California. This ~~Draft~~Final TEIR was prepared pursuant to Section 11.0 of the 2016 Tribal-State Compact between the State of California and the San Manuel Band of Mission Indians (Compact). The Tribe serves as the Lead Agency for the TEIR.

S.2 Summary Description of the Project

The Project includes the development of approximately 795,000 square feet of new entertainment and hospitality facilities, including a hotel, performance venue, additional gaming area, restaurants and other guest amenities, back of house and administrative facilities, an approximately 2,200 stall parking structure and additional power utility infrastructure. The Project is anticipated to provide approximately 1,400 jobs during the construction phase and approximately 1,200 jobs during operation. The ~~Draft~~Final TEIR assesses a Phase 1 with 55,000 square feet of additional gaming and a Phase 2 which increases this number to 100,000 square feet through the conversion of meeting and event and back-of-house space. Although it is anticipated that the Project will obtain electrical power through existing power lines from its current provider, Southern California Edison, the ~~Draft~~Final TEIR also studies the impacts of alternative sources for power, including a customer dedicated substation (with new 66 kilovolt [kV] transmission poles, a new 66 kV transmission conductor, and telecommunications lines on existing structures), a combined heat and power cogeneration facility and a fuel cell power facility.

The Project has adopted the following Project design features and construction standards:

- California Building Code and Public Safety Code Applicable to San Bernardino County: The development would be constructed in compliance with standards which meet or exceed the California Building Code and Public Safety Code applicable to San Bernardino County, as set forth in titles 19 and 24 of the California Code of Regulations. In addition, the Project would

comply with the federal Americans with Disabilities Act, P.L. 101-336, as amended, 42 U.S.C. § 12101 et seq.

- Light and Glare Shielding: The Project will provide shielding consistent with those used on the existing casino and parking structure to reduce light and glare on adjacent off-Reservation residences, including providing shields along the parking structure ramps, use of landscaping screens and walls, shielded light fixtures and the use of directional controls where applicable.

- Dust and Water Quality Controls: Prior to construction, the Project will obtain a National Pollution Discharge Elimination System (NPDES) Construction General Permit from the United States Environmental Protection Agency. As required for such permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and followed throughout the duration of the construction. The SWPPP would provide erosion, sediment and dust controls during construction.

- Operational Sound Control: The Project will maintain existing on and off-Reservation sound walls, wherever feasible. Such sound walls include those walls located between the existing casino and central plant and the off-Reservation residences located on the end of Glenmare Street along Marshall Boulevard, Val Mar Circle and along Blythe Avenue, at the end of Edgemont Drive, along Marshall Boulevard. The performance venue will include soundproofing.

- Aesthetics and Landscaping: The Project will be in keeping with the design of the landscaping and architectural themes of the existing casino facility.

- Construction Equipment Air Quality Controls: The Project will require all off-road diesel construction equipment greater than 50 horsepower (hp) used for this Project to meet U.S. EPA Tier 3 off-road emission standards or best available control technology, wherever feasible.

- Construction Dust Control: The Project will implement the following fugitive dust control measures:

  – Water spray/mists or similar suppressant (e.g., SoilSeal) shall be used during bulk material handling, earth-moving, construction and demolition activities, and vehicle movement on unpaved roads. Application of water dust suppressant shall occur at least 3 times per day on active areas of disturbance and unpaved roads.

  – To minimize dust on unpaved roads at the site, limit truck speed to 15 miles per hour or less on unpaved roads.

- Low-VOC Paint for Architectural Coating. The Project will use low-VOC paint and coating for architectural coating.

- California Green (CalGreen) Building Standards. The Tribe has adopted the CalGreen building standards applicable to San Bernardino County for this Project.

- Anti-Idling Program. The Tribe will implement an anti-idling policy for this Project. Vendors will be instructed to advise drivers that trucks and other equipment shall not be left idling for more than 5 minutes. Signs informing truck drivers of the anti-idling policy will be posted in the loading docks of the Project.

- Promote Eco-friendly Vehicles Usage. For this Project, the Tribe will pre-wire for EV charging of a portion of the new parking stalls, in accordance with CalGreen standards, as applicable to the County of San Bernardino. The Project will also purchase eco-friendly vehicles for use by the Project.

- Cogeneration Facility Standards. The cogeneration facility will be covered by an air permit issued by the U.S. Environmental Protection Agency and will be designed to meet applicable South Coast Air Quality Management District emissions standards, wherever feasible.

- Geotechnical Recommendations. Construction shall adhere to the recommendations of the Geotechnical Investigation for the Project. Recommendations may be superseded in additional investigations prepared by a California certified engineering geologist.

- Construction Noise Control:
  - Equipment and trucks used for Project construction will use the industry standard noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically-attenuating shields or shrouds, wherever feasible). Idling of equipment and vehicles which are not in use will be limited to the extent feasible.

  - Impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for construction will be hydraulically or electrically powered wherever feasible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust will be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves will be used where feasible; this could achieve a reduction of 5 dBA. Quieter procedures, such as use of drills rather than impact tools, will be used whenever feasible.

  - Stationary noise sources will be muffled and enclosed within temporary sheds, incorporate insulation barriers, or other measures to the extent feasible.

  - The Tribe shall require construction contractors to limit exterior construction to the hours of 7:00 a.m. through 8:00 p.m.

S.3 Environmental Process

Notice of Preparation

The Tribe filed a Notice of Preparation (NOP) of a Draft TEIR on November 7, 2017 in accordance with Section 11.2 of the Compact, which is included as **Appendix A**. The NOP was distributed to the California State Clearinghouse, County of San Bernardino, City of Highland, City of San Bernardino, resource agencies with off-Reservation jurisdiction and other interested parties. The NOP was also published on the Tribe's website (www.SanManuelTEIR.com) and in the legal notice section of the San Bernardino Sun and Highland Community News newspapers. The NOP was prepared to inform agencies, interested parties and the general public that a Draft TEIR was being prepared and to invite comments on the scope and content of such document. Comments were accepted for a 30-day period ending on December 7, 2017 and comments

received during that time are included in **Appendix B** and summarized in Chapter 6, Agency and Public Comments.

Notice of Completion and Draft TEIR

The Notice of Completion (NOC) and the Draft TEIR were distributed to the California State Clearinghouse, County of San Bernardino, City of Highland, City of San Bernardino, the State Gaming Agency, the California Department of Justice, Office of the Attorney General, resource agencies with off-Reservation jurisdiction and other interested parties. In addition, the NOC and the Draft TEIR were posted on the Tribe's website (www.SanManuelTEIR.com) and published in both the Highland Community News and the San Bernardino Sun. The Tribe delivered 10 copies of the NOC and Draft TEIR to the Clerk of the Board of Supervisors with a request to post public notice of the Draft TEIR at the office of the County Board of Supervisors and to furnish the public notice to the libraries serving the County. The County of San Bernardino confirmed that such posting was completed.

The Draft TEIR was released for public and agency review on January 10, 2018 and the public review period ended on February 26, 2018. During this review period, on January 25, 2018, the Tribe held a public information meeting on the Draft TEIR at the San Manuel Village Events Center.

Final TEIR

The Final TEIR includes all comments received on the Draft TEIR in **Appendix G**, including comments received at the public information meeting. Responses to comments are provided in Section 6.2 of this Final TEIR. The Tribe has prepared, certified and made the Final TEIR available to the County of San Bernardino, City of San Bernardino, City of Highland, the State Clearinghouse, the State Gaming Agency and the California Department of Justice, Office of the Attorney General. In addition, the NOC and the Final TEIR were posted on the Tribe's website (www.SanManuelTEIR.com).

S.4 Environmental Impacts and Proposed Mitigation Measures

The Compact requires the study of potential impacts to the off-Reservation environment for the impact concerns set forth in the Compact Checklist. The categories of resources and the analysis of the impact concerns set forth in the Compact Checklist are listed in **Table S-1** along with a summary of potential impacts and proposed mitigation measures relevant to the Project. In the table, the level of significance of each environmental impact is indicated both before and after the application of recommended mitigation measures. This Draft TEIR uses the following terminology to describe environmental effects of the Project:

- **No Impact:** Term used if the Project would not result in an impact to the off-Reservation environment.

- **Less Than Significant Impact:** Term used if the Project would not result in a substantial, adverse change in the physical conditions of the off-Reservation environment. The Project may result in minor adverse changes that are not considered substantial in light of the environmental setting or other factors. Mitigation measures are not required, but may be recommended.

- **Less Than Significant Impact With Mitigation Incorporated:** Term used if the Project would not result in a substantial, adverse change in the physical conditions of the off-Reservation environment if proposed mitigation measures were incorporated. The Project may result in minor adverse changes that are not considered substantial in light of the environmental setting or other factors. Any feasible mitigation measures needed to reduce the impact to less than significant are required.

- **Significant Impact:** Term used if the Project may cause a substantial, adverse change in the physical conditions of the off-Reservation environment. Mitigation measures are identified to reduce or eliminate these potential effects to the environment where feasible.

For detailed discussions of all project impacts and mitigation measures, the reader is referred to the individual environmental analysis chapters of the ~~Draft~~Final TEIR.

TABLE S-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Significance Before Mitigation	Mitigation Measure	Residual Impacts
3.1 Effects Found Not to be Significant			
Agriculture and Forest Resources			NA
A. Involve changes in the existing environment, which, due to their location or nature, could result in conversion of off-Reservation farmland to non-agricultural use?	NI	None required.	NA
Cultural Resources			
A. Cause a substantial adverse change in the significance of an off-Reservation historical or archeological resource?	NI	None required.	NA
B. Directly or indirectly destroy a unique off-Reservation paleontological resource or site or unique off-Reservation geologic feature?	NI	None required.	NA
C. Disturb any off-Reservation human remains, including those interred outside of formal cemeteries?	NI	None required.	NA
Mineral Resources			
A. Result in the loss of availability of a known off-Reservation mineral resource classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state?	NI	None required.	NA
B. Result in the loss of availability of an off-Reservation locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	NI	None required.	NA
Population and Housing			
A. Induce substantial off-Reservation population growth?	NI	None required.	NA
B. Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere off-Reservation?	NI	None required.	NA
Recreation			
A. Increase the use of existing off-Reservation neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	NI	None required.	NA
3.2 Aesthetics			
A. Would the Project have a substantial adverse effect on a scenic vista?	LS	None required.	NA
B. Would the Project substantially damage off-Reservation scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a scenic highway?	LS	None required.	NA

NI=No Impact, LS=Less than Significant, LSM=Less than Significant with Mitigation, S=Significant, NA=Not Applicable

TABLE S-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Significance Before Mitigation	Mitigation Measure	Residual Impacts
C. Would the Project create a new source of substantial light or glare, which would adversely affect day or nighttime views of historic buildings or views in the area?	LS	None required.	NA
3.3 Air Quality, Energy, Greenhouse Gas Emissions			
A. Would the Project conflict with or obstruct implementation of the applicable air quality plan?	LS	None required.	NA
B. Would the Project violate any air quality standard or contribute to an existing or projected air quality violation?	LS	None required.	NA
C. Would the Project result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?	LS	None required.	NA
D. Would the Project expose off-Reservation sensitive receptors to substantial pollutant concentrations?	LS	None required.	NA
E. Would the Project create objectionable odors affecting a substantial number of people off-Reservation?	LS	None required.	NA
3.4 Biological Resources			
A. Would the Project have a substantial adverse impact, either directly or through habitat modifications, on any special-status species identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	LS	None required.	NA
B. Would the Project have a substantial adverse effect on any off-Reservation riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	LS	None required.	NA
C. Would the Project have a substantial adverse effect on federally protected off-Reservation wetlands as defined by Section 404 of the Clean Water Act?	LS	None required.	NA
D. Would the Project interfere substantially with the off-Reservation movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	LS	None required.	NA
E. Would the Project conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	LS	None required.	NA

NI=No Impact, LS=Less than Significant, LSM=Less than Significant with Mitigation, S=Significant, NA=Not Applicable

TABLE S-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Significance Before Mitigation	Mitigation Measure	Residual Impacts
3.5 Geology and Soils			
A. Would the Project expose off-Reservation people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving (1) the rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault, or (2) strong seismic ground shaking?	LS	None required.	NA
B. Would the Project expose off-Reservation people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction?	LS	None required.	NA
C. Would the Project expose off-Reservation people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?	LS	None required.	NA
D. Would the Project result in substantial off-Reservation soil erosion or the loss of topsoil?	LS	None required.	NA
3.6 Hazards and Hazardous Materials			
A. Would the Project create a significant hazard to the off-Reservation public or the off-Reservation environment through the routine transport, use, or disposal of hazardous materials?	LS	None required.	NA
B. Would the Project create a significant hazard to the off-Reservation public or the off-Reservation environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	LS	None required.	NA
C. Would the Project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed off-Reservation school?	LS	None required.	NA
D. Would the Project expose off-Reservation people or structures to a significant risk of loss, injury or death involving wildland fires?	LS	None required.	NA
3.7 Land Use			
A. Would the Project conflict with any off-Reservation land use plan, policy, or regulation of an agency adopted for the purpose of avoiding or mitigating an environmental effect?	LS	None required.	NA
B. Would the Project conflict with any applicable habitat conservation plan or natural communities conservation plan covering off-Reservation lands?	LS	None required.	NA

NI=No Impact, LS=Less than Significant, LSM=Less than Significant with Mitigation, S=Significant, NA=Not Applicable

TABLE S-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Significance Before Mitigation	Mitigation Measure	Residual Impacts
3.8 Noise			
A. Would the Project result in exposure of off-Reservation persons to noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	LS	None required.	NA
B. Would the Project result in exposure of off-Reservation persons to excessive groundborne vibration or groundborne noise levels?	LS	None required.	NA
C. Would the Project result in a substantial permanent increase in ambient noise levels in the off-Reservation vicinity of the project?	LS	None required.	NA
D. Would the Project result in a substantial temporary or periodic increase in ambient noise levels in the off-Reservation vicinity of the project?	LS	None required.	NA
3.9 Public Services			
A. Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered off-Reservation governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for off-Reservation fire protection and emergency medical services?	LS	None required.	NA
B. Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered off-Reservation governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for off-Reservation law enforcement services?	LS	None required.	NA
C. Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered off-Reservation governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for off-Reservation public school services?	LS	None required.	NA
3.10 Transportation and Traffic			
A. Would the Project cause an increase in off-Reservation traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)?	S	**Mitigation Measure 3.10-1**: Arden Avenue/Highland Avenue Intersection Improvements – the Applicant shall pay a fair-share contribution to stripe the northbound through lane to a second northbound left-turn lane and restripe the northbound right-turn lane to a northbound shared through-right-turn lane on Arden Avenue; and modify the existing traffic signal and include the northbound and southbound left-turn movements as lead-lag to avoid conflict.	LSM

NI=No Impact, LS=Less than Significant, LSM=Less than Significant with Mitigation, S=Significant, NA=Not Applicable

TABLE S-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Significance Before Mitigation	Mitigation Measure	Residual Impacts
B. Would the Project exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated off-Reservation roads or highways?	LS	None required.	NA
C. Would the Project substantially increase hazards to an off-Reservation design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	LS	None required.	NA
D. Would the Project result in inadequate emergency access for off-Reservation responders?	LS	None required.	NA
3.11 Utilities and Service Systems			
A. Would the Project exceed off-Reservation wastewater treatment requirements of the applicable Regional Water Quality Control Board?	LS	None required.	NA
B. Would the Project require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant off-Reservation environmental effects?	LS	None required.	NA
C. Would the Project require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant off-Reservation environmental effects?	LS	None required.	NA
D. Would the Project result in a determination by an off-Reservation wastewater treatment provider (if applicable), which serves or may serve the Project that it has inadequate capacity to serve the Project's projected demand in addition to the provider's existing commitments?	LS	None required.	NA
3.12 Water Resources			
A. Would the Project: (i) violate any water quality standards or waste discharge requirements, (ii) substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion of siltation off-site, (iii) substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding off-site, or (iv) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff off-Reservation?	LS	None required.	NA

NI=No Impact, LS=Less than Significant, LSM=Less than Significant with Mitigation, S=Significant, NA=Not Applicable

TABLE S-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Significance Before Mitigation	Mitigation Measure	Residual Impacts
B. Would the Project substantially deplete off-Reservation groundwater supplies or interfere substantially with groundwater recharge such that there should be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	LS	None required.	NA
C. Would the Project: (i) place structures within a 100-year flood hazard area, which would impede or redirect off-Reservation flood flows, or (ii) expose off-Reservation people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	LS	None required.	NA
Cumulative			
A. Have impacts that are individually limited, but cumulatively considerable off-Reservation? "Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past, current, or probable future projects.	S	**Mitigation Measure 3.10-1**: Arden Avenue / Highland Avenue Intersection Improvements – the Applicant shall pay a fair-share contribution to stripe the northbound through lane to a second northbound left-turn lane and restripe the northbound right-turn lane to a northbound shared through-right-turn lane on Arden Avenue; and modify the existing traffic signal and include the northbound and southbound left-turn movements as lead-lag to avoid conflict.	LSM

NI=No Impact, LS=Less than Significant, LSM=Less than Significant with Mitigation, S=Significant, NA=Not Applicable

Appendix E

Section 106 of the National Historic Preservation Act Review

ESA

San Manuel Band of Mission Indians

October 29, 2018

Gerardo C. Rios
Manager, Air Permits Office
U.S. Environmental Protection Agency
Region 9, Air Division, Permits Office
75 Hawthorne St. (AIR-3)
San Francisco, CA 94105

Subject: Section 106 of the National Historic Preservation Act Review for Tribal Synthetic Minor Permit Modification Application (TA-0003-CA), San Manuel Casino; San Bernardino County, CA

Dear Mr. Rios:

This letter is being written in support of the report generated by Environmental Science Associates (ESA) which is being submitted to the Environmental Protection Agency (EPA) to address and satisfy requirements under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, for the above-referenced Permit Modification Application.

As the Director of San Manuel Band of Mission Indians' (SMBMI) Cultural Resources Management Department, I have reviewed both the ESA letter report related to the permit modification application, as well as the Tribal Environmental Impact Report (TEIR) for the larger Hotel and Casino Expansion project, of which the permit modification request is a part. Based on my review of these documents, by this communication I am confirming that:

(1) the Area of Potential Effect (APE) has been properly defined and delineated;

(2) sufficient prior study has been conducted within the APE to identify potential historic properties;

(3) there are no resources of religious or cultural significance to SMBMI located within the APE;

(4) the proposed undertaking is occurring within a previously developed area and will not impact undisturbed natural sediments within the APE and; therefore,

(4) the ESA determination of **no effect to historic properties** is appropriate and a recommendation with which I concur.

If you have any questions about this correspondence, please contact me at your convenience at (909) 864-8933 or via e-mail at lclauss@sanmanuel-nsn.gov.

Respectfully,

Lee Clauss

Lee Clauss

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October 25, 2018

Clifford Batten
Environmental Manager
San Manuel Band of Mission Indians
101 Pure Water Lane
Highland, California 92346

Subject: Section 106 of the National Historic Preservation Act Review for Tribal Synthetic Minor Permit Modification Application (TA-0003-CA), San Manuel Casino; San Bernardino County, CA

Dear Mr. Batten:

This letter report provides the results of a cultural resources assessment for the permit modification application of Tribal NSR Permit No. TA-0003-CA, to address and satisfy requirements under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The purpose of this cultural resources assessment is to determine if there are historic properties, meaning resources listed in or eligible for listing in the National Register of Historic Places (National Register), within the Area of Potential Effect (APE) for the undertaking and, if so, whether proposed activities under the permit modification will have an adverse effect on said historic properties.

Introduction

The San Manuel Entertainment Authority (the "SMEA") is an instrumentality of San Manuel Band of Mission Indians ("Tribe"), a federally recognized Indian Tribe. The SMEA operates the San Manuel Casino (the "Casino") and holds a Tribal Synthetic Minor New Source Review Permit (Permit No. TA-0003-CA). The SMEA is constructing a Hotel and Casino Expansion Project (the "Project") that will include new sources. Accordingly, SMEA submitted a permit modification application on August 1, 2018 under EPA's Federal Minor New Source Review ("NSR") Program in Indian Country to remove old and poor performing equipment and add new, energy efficient and cleaner equipment while retaining the synthetic minor source status. The Project, which includes construction and operational activities associated with the proposed equipment defined in the NSR permit modification application, has undergone an environmental evaluation process pursuant to Section 11.0 of the Tribal-State Compact between the State of California and the San Manuel Band of Mission Indians (Compact). As part of that environmental review, a Tribal Environmental Impact Report (TEIR) was prepared, circulated to the public and finalized in March 2018.

The cultural resources impact analysis presented in the TEIR for the Project (which encompasses, but is far larger and more complex than the activities proposed in the permit modification application) concluded that the Project (1) will only occur in previously disturbed areas; (2) would create no new direct or indirect effects to historic properties and; (3) as a result, would have no impact on historic properties. To supplement that analysis, at the request of the Environmental Protection Agency (EPA), the Tribe contracted with Environmental Science

Associates (ESA) to conduct a focused cultural resources assessment that pertains to the activities listed in the NSR permit modification application only. As is further detailed in this letter report, as part of this analysis, ESA conducted consultation with the Tribe's Cultural Resources Management Department.

Area of Potential Effects

The Casino is located on the southwest portion of the San Manuel Reservation, adjacent to the City of Highland, in San Bernardino County, California. **Figure 1** shows the general facility location. Pursuant to Section 106 of the NHPA, an Area of Potential Effects (APE) was established for the undertaking. According to Section 106 of the NHPA, an APE is defined as:

> *"the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" (36 Code Federal Regulations [CFR] 800.16[d]).*

Figure 2 shows the APE for the permit modification application, which consists of three discontinuous areas covering the footprints of the buildings (both extant and proposed as part of the approved Hotel and Casino Expansion Project) where existing emission units will be removed and/or new emission units will be installed. These removals, replacements, and/or additions of emissions units constitute the totality of activities that would fall under the permit modification. The work would be restricted to buildings, with all access routes to those buildings being paved and not requiring improvement beyond what was analyzed in the approved TEIR as part of the Hotel and Casino expansion. As such, the activities that fall within the permit modification will not require surficial or subsurface disturbance of native sediments, and therefore the definition of a vertical APE is not necessary for this project. In conclusion, the removal of existing emission units and construction of the proposed new units will occur in previously developed or otherwise disturbed areas and will not alter, damage, or demolish any historic or culturally-sensitive structures or impact any undisturbed natural sediments.

In addition, as demonstrated by the air emissions values in the permit application and the TEIR, as well as the NO_2 and $PM_{2.5}$ air dispersion modeling in the TEIR, the proposed permit modification will not (1) change the Casino's synthetic minor source status, (2) increase the facility-wide NO_x emissions, (3) have significant increases in emissions of other criteria pollutants and toxic air pollutants, or (4) cause violation of the national ambient air quality standards (NAAQS). Therefore, air emissions from the proposed permitting activity do not have the potential to impact historic properties. Furthermore, because the activities covered by the permit modification involve the removal and/or addition of emissions units on existing or TEIR-approved future buildings, the activities covered by the permit modification will not alter the setting or appearance of the area within or adjacent to the APE. In conclusion, due to the lack of potential for visual, auditory, or atmospheric impacts to historic properties, the APE for the proposed undertaking (see Figure 2) reflects the area where direct effects, not indirect effects, may occur.

Regulatory Context

Section 106 of the NHPA

Archaeological resources are protected through the NHPA of 1966, as amended (16 United States Code [USC] 470f), and its implementing regulation, Protection of Historic Properties (36 CFR Part 800), the Archaeological and Historic Preservation Act of 1974, and the Archaeological Resources Protection Act of 1979. Prior to implementing an "undertaking" (e.g., issuing a federal permit), Section 106 of the NHPA requires federal agencies to consider the effects of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) and the State Historic Preservation Officer (SHPO) a reasonable opportunity to comment on any undertaking that would adversely affect properties eligible for listing in the National Register. As indicated in Section 101(d)(6)(A) of the NHPA, properties of traditional religious and cultural importance to a tribe are eligible for inclusion in the National Register. Under the NHPA, a resource is considered significant if it meets the National Register listing criteria at 36 CFR 60.4.

National Register of Historic Places

The National Register was established by the NHPA of 1966, as "an authoritative guide to be used by federal, State, and local governments, private groups and citizens to identify the Nation's historic resources and to indicate what properties should be considered for protection from destruction or impairment" (36 CFR 60.2). The National Register recognizes both historic-period and prehistoric archaeological properties that are significant at the national, state, and local levels.

To be eligible for listing in the National Register, a resource must be significant in American history, architecture, archaeology, engineering, or culture. Districts, sites, buildings, structures, and objects of potential significance must meet one or more of the following four established criteria (U.S. Department of the Interior, 2002):

A. Are associated with events that have made a significant contribution to the broad patterns of our history;

B. Are associated with the lives of persons significant in our past;

C. Embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Have yielded, or may be likely to yield, information important in prehistory or history.

Unless the property possesses exceptional significance, it must be at least 50 years old to be eligible for National Register listing (U.S. Department of the Interior, 2002).

In addition to meeting the criteria of significance, a property must have integrity. Integrity is defined as "the ability of a property to convey its significance" (U.S. Department of the Interior, 2002). The National Register recognizes seven qualities that, in various combinations, define integrity. The seven factors that define integrity

are location, design, setting, materials, workmanship, feeling, and association. To retain historic integrity a property must possess several, and usually most, of these seven aspects. Thus, the retention of the specific aspects of integrity is paramount for a property to convey its significance.

Identification of Historic Properties

Cultural Resources Records Searches

The APE shown in Figure 2 is within the study area buffers for records searches conducted by ESA for previous projects for the Tribe on July 7, 2016 and March 1, 2018. These searches were conducted at the South Central Coastal Information Center (SCCIC) of the California Historical Resources Information System (CHRIS), housed at California State University, Fullerton. The records searches included a review of all recorded archaeological and architectural resources and cultural resource reports on file within the search areas for the previous projects, which cover the entirety of the APE for the current proposed permit modification, as well as ½–mile or more beyond the APE. The searches also included a review of California Points of Historical Interest (PHI), California Historical Landmarks (CHL), the California Register of Historical Resources (California Register), the National Register, and the California State Historic Resources Inventory (HRI) listings. In addition, ESA reviewed an online database of the National Register for the area around the APE. Because the entire APE is either developed with buildings or paved (meaning natural ground surfaces are not visible), and because the APE has been covered by previous surveys (see below), a pedestrian archaeological field survey was not conducted.

The records searches indicate that the APE has been covered in its entirety by two previous cultural resource studies (SB-3394 and SB-3443), and the northern portion by a third study (SB-2248). These studies are summarized in **Table 1**. The studies that covered the full APE pre-date the development of the Casino, and so provide an assessment of the APE prior to development.

TABLE 1
PREVIOUS CULTURAL RESOURCES STUDIES COVERING ALL OR PORTIONS OF THE APE

Author	Report # (SB-)	Title	Year
McKenna, Jeanette A.	02248	*A Phase I Archaeological Investigation of the Approximately 45 Acres in North San Bernardino, San Bernardino County, California*	1991
York, Andrew and Christy Dolan	03394*	*Cultural Resource Inventory of Portions of the San Manuel Reservation, San Bernardino County, CA*	1998
York, Andrew and Christy Dolan	03443*	*Cultural Resource Inventory of Portions of the San Manuel Reservation, San Bernardino County, CA*	1998

*Study covers entire APE

The results of the records searches also indicate that no cultural resources, including historic properties, have been documented within the permit modification application-based APE.

Section 106 Finding

The cultural resources assessment of the APE associated with the proposed activities described in the proposed NSR permit modification application showed that the entire APE has been covered by previous cultural resources surveys and that no cultural resources, including historic properties, have been documented within the APE. In addition, because the proposed activities will not impact undisturbed natural sediments, there is no potential to affect undocumented (e.g., buried) archaeological resources that could qualify as historic properties, should any such resources be present. As part of this review, ESA also consulted with the San Manuel Band of Mission Indians Cultural Resources Management Department, which indicated that no places of cultural or religious significance to the Tribe occur within the APE.

Based on: 1) the nature of the undertaking; 2) the developed nature of the APE; 3) the absence of historic properties or resources significant to the Tribe within the APE and; 4) the exceedingly low potential for the activities proposed under the permit modification to impact cultural resources, a determination of **no effect** is recommended for the permit modification.

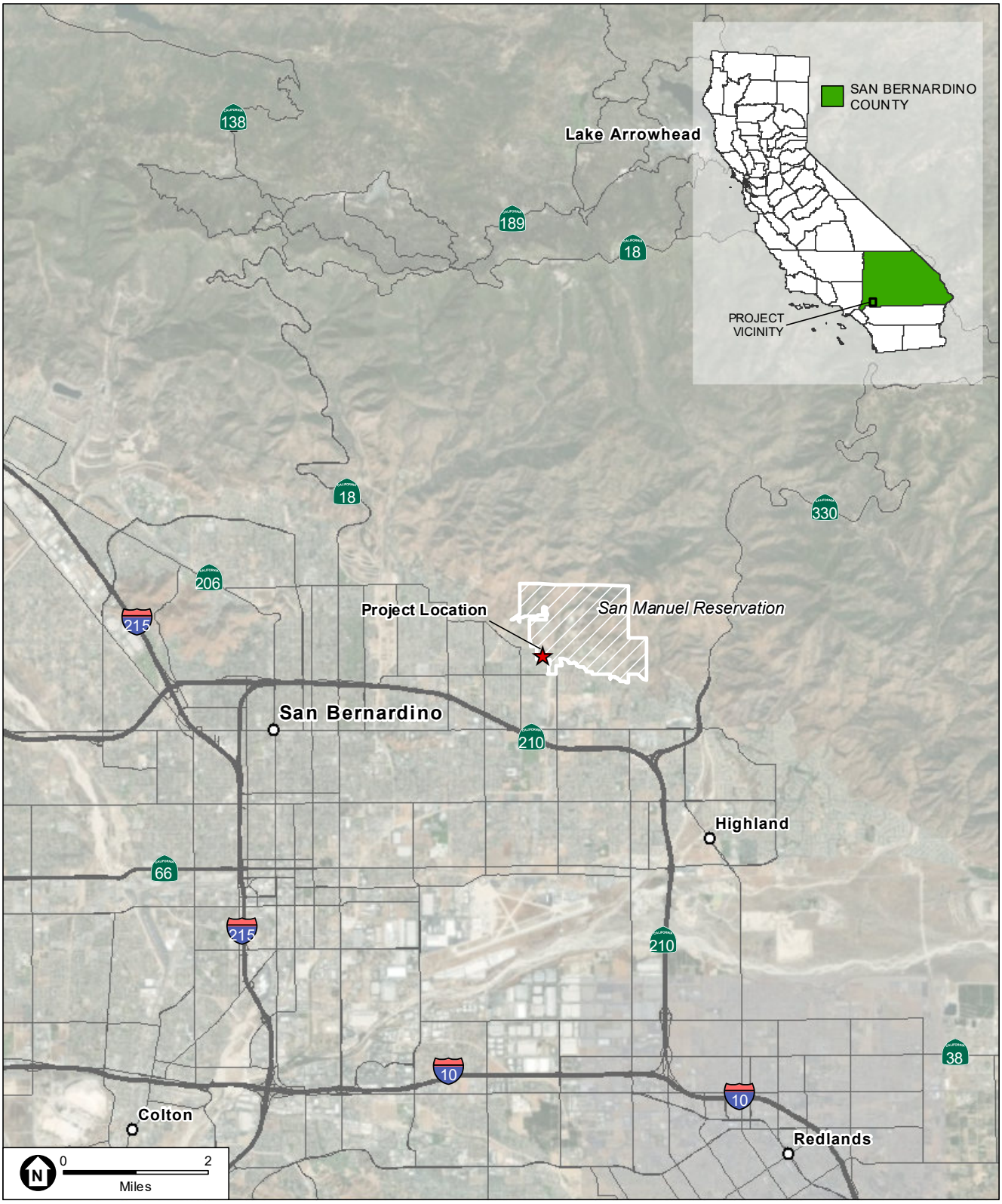
If you have any questions about the information provided in this letter report, please do not hesitate to contact me at (619) 719-4200 or email at mbever@esassoc.com.

Sincerely,

Michael R. Bever, PhD, RPA
Senior Cultural Resources Specialist

Attachments:

Figure 1. Vicinity Map
Figure 2. APE Map

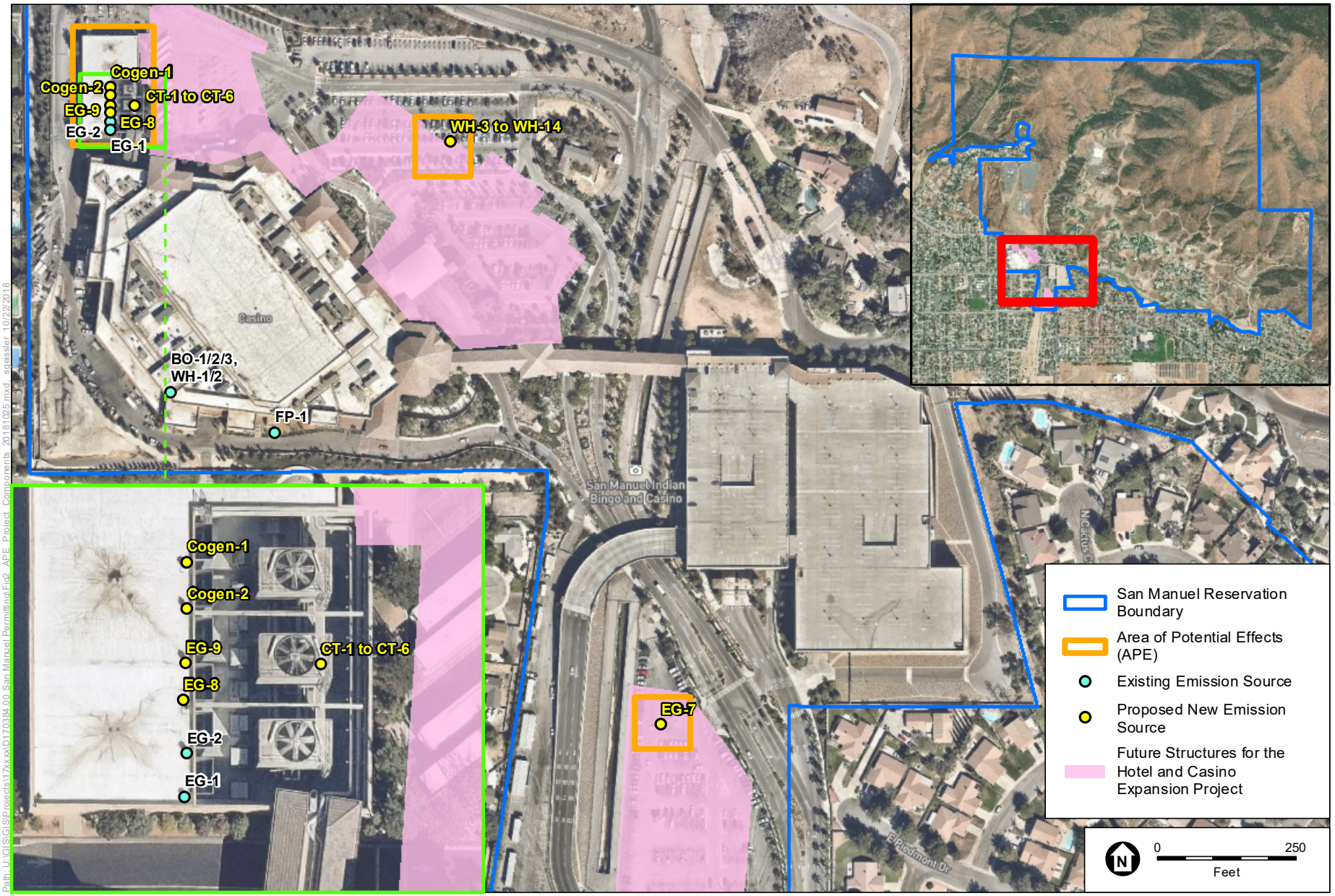


SOURCE: USDA, 2016; ESRI, 2017; ESA, 2018.

Modification Application for Permit No. TA-0003-CA

Figure 1

General Facility Location



SOURCE: ESRI Imagery 8/19/2017

Modification Application for Permit No. TA-0003-CA

Figure 2

Area of Potential Effects and Project Components

ESA