CITY OF ST. PETERSBURG
May 5, 2014
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Mr. Jeff Koerner
Program Administrator
Florida Department of Environmental Protection
Division of Air Resource Management
Office of Permitting and Compliance
Bob Martinez Center
2600 Blair Stone Road MS#5505
Tallahassee, FL 32399-2400

Re: Permit Application
Proposed Biosolids Improvement Project
City of St. Petersburg
Southwest Water Reclamation Facility

Dear Mr. Koerner,

Enclosed please find an original and two (2) copies of an air construction permit application for the proposed Biosolids Improvement Project at the Southwest Water Reclamation Facility in St. Petersburg, Florida. The purpose of the proposed Biosolids Improvement Project is to consolidate the City of St. Petersburg's biosolids operation for all treatment plants at the Southwest Water Reclamation Facility and to capture the digester gas and clean it to natural gas standards with the intention of using the gas beneficially. Please see the application support document for a more detailed description of the requested construction. A check in the amount of $4,000 is enclosed for the application processing fee.

We look forward to working with your office and staff as this application proceeds through the review process. If you have any questions, please don't hesitate to contact me at sdmarsha@stpete.org or (727) 893-7851.

Sincerely,

Steven D. Marshall
Project Manager
Engineering Department
City of St. Petersburg

AIR CONSTRUCTION PERMIT APPLICATION

City of St. Petersburg

Southwest Water Reclamation Facility

Biosolids Improvement Project

B&V PROJECT NO. 179508

PREPARED FOR

City of St. Petersburg

1 MAY 2014

BLACK & VEATCH
Building a world of difference.

Table of Contents

1.0 Introduction

The City of St. Petersburg (the City) owns and operates the Southwest Water Reclamation Facility (SWWRF) located at 3800 54th Ave S in St. Petersburg, FL. SWWRF is one of four water reclamation facilities operated by the City (the others being Northeast WRF, Albert Whitted WRF, and Northwest WRF). Between the four facilities, the City provides wastewater treatment services to the City of St. Petersburg, Treasure Island, St. Pete Beach, Gulfport, South Pasadena, and portions of Pinellas Park.

The City proposes to undertake the Biosolids Improvement Project (BIP) at the SWWRF. The purpose of the BIP is to consolidate the City's biosolids operation for all of their treatment plants at the SWWRF and to capture the digester gas and clean it to natural gas standards with the intention of using the gas as fuel for the City's sanitation vehicle fleet. The BIP consists of several discreet projects, including the following which involve air emissions sources;

- The Biosolids to Energy Project;
- The Biosolids Dewatering Project;
- The Generator and Electrical Improvements Project.
- The following sections provide a brief description of each of these subprojects within the BIP.

1.1 THE BIOSOLIDS TO ENERGY PROJECT

The Biosolids to Energy Project consists of a major biosolids processing facility upgrade including new and upgraded clarification systems, new anaerobic digesters and improvements to an existing digester, new sludge handling equipment, new digester gas handling facilities, new digester gas upgrade systems, and new odor control facilities. The Biosolids to Energy Project proposes to utilize the following air emissions source(s);

- Two flares to combust excess digester gas from the digesters;
- One thermal oxidizer to combust waste gas from the Biogas Upgrade System (BUS);
- One flare to combust BUS product gas during system startup;
- Carbon scrubbers to control odor emissions from the primary clarifiers, the sludge storage tank, and the thickening facilities.

1.2 THE BIOSOLIDS DEWATERING PROJECT

The Biosolids Dewatering Project includes expansion of the SWWRF sludge thickening process and upgrading of the sludge dewatering system. The Biosolids Dewatering Project proposes to utilize carbon scrubbers to control odor emissions from the sludge dewatering and truck loading areas.

1.3 THE GENERATOR AND ELECTRICAL IMPROVEMENTS PROJECT

The Generator and Electrical Improvements Project involves the construction of a combined heat and power (CHP) facility coupled with an expanded emergency backup power system. The Generator and Electrical Improvements Project proposes to utilize the following air emissions source(s);

- Two new gas fueled engine generators to be fueled by natural gas and/or BUS product gas;

- Two existing diesel fueled engine generators, one of which is being relocated from the Albert Whitted WRF;
- Two 6.38 MBtu/hr natural gas-fired boilers.

2.0 Project Emissions and NSR/PSD Applicability

The federal Clean Air Act (CAA) New Source Review (NSR) provisions are implemented under two programs; the PSD program outlined in 40 CFR §52.21 for areas in attainment of the National Ambient Air Quality Standards (NAAQS), and the Non-Attainment NSR (NA-NSR) program outlined in 40 CFR §51 and §52 for areas not in attainment of the NAAQS for one or more criteria pollutants (i.e., non-attainment areas). Currently, Pinellas County, Florida is in attainment of the applicable NAAQS and, therefore, the applicability of the provisions of the PSD program to the BIP must be examined.

The SWWRF is not a major stationary source of regulated pollutants and is not classifiable as one of the 28 listed major source categories. Therefore, in order to determine the BIP's NSR/PSD applicability (i.e., whether the BIP constitutes a major or minor modification) the BIP's emissions increases are compared against the 250 tons per year (tpy) major source threshold for each regulated pollutant aside from greenhouse gases (GHGs)[1].

The BIP's emissions are produced solely by new sources. As such, NSR/PSD applicability is determined by examining the per pollutant aggregate of each of the BIP's emissions sources' potential to emit (PTE) against the 250 tpy major source threshold. PTE is defined in Rule 62-210.200(225), F.A.C. as, "the maximum capacity of an emission unit or facility to emit a pollutant under its physical and operational design".

The BIP's PTE includes the individual PTE's from the following equipment;

2.1 FLARES

Temperature-Controlled Enclosed Biogas Flare (Flare 1)

Flare 1 will be an enclosed ground flare for consuming excess combustible digester gas (or all digester gas in the case of an emergency) produced by the SWWRF's new anaerobic digesters (digesters 1 & 2). As gas is produced, the pressure relief valve functions to maintain a preset pressure in the digester gas collection manifold. As gas production causes the pressure to increase, excess gas is released to the waste gas burner for combustion. The flare has a maximum capacity of 760 scfm.

Waste Gas Burner (Flare 2)

Flare 2 will be a candlestick type flare for combusting the digester gas produced in SWWRF's digester 3. As gas is produced, the pressure relief valve functions to maintain a preset pressure in the digester gas collection manifold. As gas production causes the pressure to increase, excess gas is released to the waste gas burner for combustion. The flare has a maximum capacity of 600 scfm.

Low-Btu Waste Gas Burner (Flare 3)

Flare 3 will be a thermal oxidizer for the incineration of low-pressure waste gas produced by the BUS. Flare 3 has a maximum capacity of 140 scfm.

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[1] GHG major source threshold established by Tailoring Rule, which was promulgated by the USEPA in May of 2010. The Tailoring Rule includes several criteria that a project has to meet in order to be subject to PSD for GHGs. For the proposed BIP, the major source threshold essentially defaults to 100,000 tpy CO2e. CO2e emissions are based on the aggregate sum of six greenhouse gases that constitute the pollutant that is subject to regulation.

BUS Startup Flare (Flare 4)

Flare 4 will be a waste gas burner for consuming excess product gas from the BUS. Gas produced from the BUS will be wasted and combusted during its normal startup process and occasionally during normal operation for pressure control. Flare 4 has a maximum capacity of 200 scfm.

2.2 ODOR CONTROL SYSTEMS

Carbon Scrubbers to Control Odor Emissions from the Primary Clarifiers, Sludge Storage Tank, and Thickening Facilities

Odor control systems will be installed as part of the Biosolids to Energy Project to treat foul air generated by the primary clarifiers, sludge storage tank, and thickening facilities. Three carbon scrubbers will be installed downstream of two biotrickling filters. Only two of the three carbon scrubbers will be in service at any one time, with the third scrubber held in standby mode. The foul air will flow through the scrubbers at a maximum rate of 12,000 scfm each. The scrubbers will clean the foul air with a 95 percent H_2S removal efficiency[2] before the air stream is emitted to the atmosphere.

Carbon Scrubbers to Control Odor Emissions from the Dewatering Building

Odor control systems will be installed as part of the Biosolids Dewatering Project to treat foul air generated in the sludge dewatering building and truck loading area. The foul air will flow through the odor control system at a maximum rate of 24,000 scfm[3]. The system will clean the foul air with a 95 percent H_2S removal efficiency[2] before the air stream is emitted to the atmosphere.

2.3 GENERATOR AND ELECTRICAL IMPROVEMENT PROJECT EQUIPMENT

Natural Gas Engine Generators

Two new minimum 1,100 kW (1517 HP) rated natural gas fueled engine generators will be provided to operate in dual service modes of 1) continuous electrical paralleling operation to reduce the plant's use of utility-provided electrical powerloads and 2) to supplement emergency backup power generation in parallel operation with the emergency backup diesel generators. The engine generators will be initially fueled by utility provided natural gas, but in the future will be fueled by utility natural gas, cleaned digester gas (enriched to utility natural gas heating value), or a combination of the two.

Emergency Diesel Engine Generator

The existing diesel fueled engine generator backup power supply system will be modified and expanded at the SWWRF. These changes will consist of providing backup power using a paralleled configuration of two existing diesel fueled emergency engine generators, along with the new natural gas fueled engine generators. A 1,750 kW (2,347 HP) diesel fueled emergency engine generator will be relocated from its current location at Albert Whitted WRF to the SWWRF. The existing 2,000 kW emergency diesel generator will be moved within the facility as part of the Generator and Electrical Improvement Project. Because this relocation will not result in a change in emissions at the SWWRF, the 2,000 kW emergency generator is not considered part of the project

[2] Scrubbers are specified to have a 99% H2S control efficiency. 95% was conservatively used for this application.
[3] Based on preliminary engineering estimates.

and, as such, its emissions of PSD pollutants were not considered in the calculation of the BIP PTE. However, its emissions of hazardous air pollutants (HAPs) were considered in the determination of whether the SWWRF was a major or area source of HAPs in order to identify the requirements for the 1,750 kW emergency generator under the RICE MACT standard (40 CFR §63, Subpart ZZZZ) and determine whether the SWWRF would be considered a Title V facility post BIP. Further details are provided in the Federal and State Air Quality Requirements section of this document and Appendix A to this application package.

Primary Heating Water System Boilers

A primary heating water system will be provided to supply heating water to the Biosolids to Energy Project. Primary heating water pumps will circulate heating water through the natural gas fueled engine generator heat recovery system, to two heating water boilers, which will provide supplemental heating. The heating water is then fed to the new digester facility being designed and constructed as part of the Biosolids to Energy Project. The two heating water boilers will have a maximum 6.38 MBtu/hr (HHV) each.

2.4 BIP PTE

The BIP PTE is included in Table 2-1. As can be seen, the BIP's emissions are such that the project does not equal or exceed the applicable major source thresholds and therefore will not be subject to the requirements of the NSR/PSD program. As such, the City is applying for a minor source air construction permit pursuant to Rule 62-210.300, F.A.C. in order to authorize the construction of the BIP.

Table 2-1 BIP PTE Compared to NSR/PSD Major Source Threshold

POTENTIAL ANNUAL EMISSIONS FROM BIP			
	PTE[1]	MAJOR SOURCE THRESHOLD (TPY)	EQUALS/EXCEEDS MAJOR SOURCE THRESHOLD? (YES/NO)
NO_X	38.6	250	No
CO	55.0	250	No
VOC	16.1	250	No
SO_2	39.5	250	No
$PM_{(filterable)}$	1.3	250	No
$PM_{10(filterable+condensible)}$	2.46	250	No
$PM_{2.5(filterable+condensible)}$	2.46	250	No
Lead	2.74E-05	250	No
H_2SO_4	0.128	250	No
H_2S	1.53	250	No
CO_2	19,026	--	--
CH_4	106	--	--
N_2O	1.21E-01	--	--
GHG - Mass Basis	19,310	--	--
GHG - CO_{2e} Basis	21,899	100,000	No

Notes [ ]:

1. **See Appendix A for Detailed Emissions Calculations**

3.0 Federal and State Air Quality Requirements

Air quality permitting in Florida is under the jurisdiction of the FDEP. The USEPA has given the FDEP authority to implement and enforce the federal Clean Air Act (CAA) provisions and state air regulations under its approved State Implementation Plan (SIP). The following subsections discuss federal and state requirements applicable to the Project.

3.1 NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS[4]

Section 112 of the Clean Air Act addresses the emissions of HAPs. The 1990 CAA Amendments revised Section 112 to first require issuance of technology-based standards for major sources and certain area sources of HAP emissions. For major sources, Section 112 requires that USEPA establish emission standards that require the maximum degree of reduction in HAP emissions. These emission standards are commonly referred to as "maximum achievable control technology (MACT) standards and are found in 40 CFR §63 and adopted by reference in Rule 62-204.800(11), F.A.C. Applicability of MACT standards to the proposed BIP is reviewed in this section.

Subpart JJJJJJ – National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources

On March 21, 2011, the USEPA published the final National Emission Standards for Hazardous Air Pollutants (NESHAP) for industrial, commercial, and institutional boilers at area sources. 40 CFR §63.11195(e) exempts gas-fired boilers as defined in the Subpart from any limitations or requirements under the MACT. As defined in 40 CFR §63.11237, a gas-fired boiler *includes any boiler that burns gaseous fuels not combined with any solid fuels and burns liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or periodic testing on liquid fuel.* The primary heating water system boilers qualify as gas-fired boilers under this Subpart, and therefore are not applicable to the limitations and requirements stipulated therein.

Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

On June 15, 2004, the USEPA established national emission limitations and operating limitations for HAPs emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. This rule has since been amended several times, most recently on January 30, 2013. The stationary RICE MACT is applicable to the BIP's natural gas engine generators and 1,750 kW emergency diesel generator.

The proposed natural gas engine generators will be considered new stationary spark ignition RICE at an area source of HAPs. As such, the requirements of Subpart ZZZZ are to comply with the requirements of 40 CFR §60, Subpart JJJJ (NSPS JJJJ). The natural gas engine generators will meet the emissions limitations and other requirements of NSPS JJJJ and will thereby be in compliance with Subpart ZZZZ.

The 1,750 kW emergency diesel generator, which will be relocated from the Albert Whitted WRF as part of the Generator and Electrical Improvement Project will be considered an existing stationary

[4] The SWWRF will continue to qualify as an area source of HAPS (i.e., emissions are less than 10 tpy for individual HAPs and less than 25 tpy for cumulative HAPs emissions) once the proposed BIP is constructed. See Appendix A for detailed calculations.

compression-ignition emergency RICE located at an area source of HAPs. As such, Subpart ZZZZ stipulates management practices, recordkeeping, and reporting requirements. The City will satisfy these requirements, and will thereby be in compliance with Subpart ZZZZ.

3.2 NEW SOURCE PERFORMANCE STANDARDS

Section 111 of the CAA authorized the USEPA to develop technology based standards which apply to specific categories of stationary sources. These standards are referred to as New Source Performance Standards (NSPS) and are found in 40 CFR §60 and adopted by reference in Rule 62-204.800(8), F.A.C. Applicability of NSPS regulations to the proposed BIP is reviewed in this section.

Subpart A – General Provisions

There are several applicable notification, reporting, and recordkeeping requirements listed under Subpart A, which are summarized in this section.

- 40 CFR §60.7 Notification and Record Keeping
  - (a)(1) Notification of the date of construction – 30 days after such date
  - (a)(3) Notification of actual date of initial startup – within 15 days after such date
  - (a)(5) Notification of date which demonstrates CEM – not less than 30 days prior to date
  - (b) Maintain records of all startups, shutdowns, and malfunctions
  - (c) Excess emissions reports – semi-annually by the 30th day following 6-month period (required even if no excess emissions occurred)
  - (d) Maintain file of all measurements for 2 years
- 40 CFR §60.8 Performance Tests
  - (a) Must be performed within 60 days after achieving maximum production rate, but no later than 180 days after initial startup
  - (d) Notification of performance tests at least 30 days prior to them occurring

Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

On June 13, 2007, the USEPA published the Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units. 40 CFR §60.40c(a) states that requirements of Subpart Dc apply to units that have a maximum design heat input of less than 100 MBtu/hr, and greater than 10 MBtu/hr. The primary heating water system boilers have a maximum heat input of 6.38 MBtu/hr each. Therefore, the requirements of Subpart Dc do not apply to the primary heating water system boilers.

Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

On July 11, 2006, the USEPA published Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. Subpart IIII applies to CI RICE that were purchased after July 11, 2005 and manufactured after April 1, 2006. The 1,750 kW emergency diesel generator that is being relocated from the Albert Whitted WRF was originally installed in 2000. Therefore, the

limitations and requirements of Subpart IIII do not apply to the 1,750 kW emergency diesel generator.

Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

On January 18, 2008 the USEPA published Standards of Performance for Stationary Spark Ignition Internal Combustion Engines. Subpart JJJJ applies to the natural gas engine generators. Beginning with engines manufactured on or after July 1, 2007, the onus of this rule falls on the engine manufacturer as they are required to produce engines that comply with the rule. Along with various monitoring and reporting requirements, the requirement of this rule for owners and operators of these RICE is the purchase of certified engines. The City will purchase certified engines and fulfill the aforementioned monitoring and reporting requirements of this Subpart.

3.3 APPLICABLE FLORIDA RULES

As mentioned earlier, the FDEP has permitting and review authority for all air quality projects in Florida through their USEPA-approved SIP. Additionally, FDEP has promulgated regulations for new and modified air pollutant sources, which are published in Florida Rule Chapter 62. Several of these rules have already been addressed in previous sections of this application, as the Florida rules adopt or incorporate several federal regulations by reference. Other applicable state regulations not previously discussed or referred to are presented below.

Rule 62-4.050 Procedures to Obtain Permits and Other Authorizations; Applications

Any person desiring to obtain a permit from the Department shall apply on forms prescribed by the Department and shall submit such additional information as the Department by law may require. A processing fee for a construction permit shall also be submitted along with the application. The applicable forms required by this regulation are provided in Appendix B of this document. The remaining requirements of this rule are met through the submittal of this application.

Rule 62-210.300 Permits Required

An air construction permit shall be obtained by the owner or operator of any proposed new, reconstructed, or modified facility or emission unit. The requirements of this rule are met through the submittal of this application.

4.0 Exemptions

Rule 62-212.300(3) F.A.C. provides exemptions from the requirement to obtain an air construction permit for units that meet the requirements of Rule 62-212.300(3)(a), F.A.C., *Categorical and Conditional Exemptions*, and Rule 62-212.300(3)(b), F.A.C., *Generic and Temporary Exemptions*. In order to qualify for these exemptions the applicable emissions unit cannot be subject to any unit-specific limitation or requirement (e.g. NSPS, NESHAPS), unless compliance with the aforementioned limitation or requirement is specified as a condition of the exemption. Additionally, an applicable emissions unit is not eligible for an exemption under Rule 62-212.300(3) if its emissions contribute to a major modification. The following emissions units included in the BIP satisfy the general conditions outlined above and the specific conditions of the applicable exemption as provided by Rule 62-212.300(3)(a), F.A.C. or Rule 62-212.300(3)(b), F.A.C. as detailed below.

4.1 CATEGORICAL AND CONDITIONAL EXEMPTIONS

1,750 kW Emergency Diesel Generator

The 1,750 kW emergency diesel generator qualifies for an exemption from the requirement to obtain an air construction permit under the conditions of Rule 62-212.300(3)(a)(35), F.A.C. The conditions of Rule 62-212.300(3)(a)(35), F.A.C. and the demonstration of the satisfaction of these conditions are as follows;

Rule 62-212.300(3)(a)(35)(a) – *The Engine is not subject to the Acid Rain Program, CAIR Program, or any other unit-specific limitation or requirement other than any such limitation or requirement that may apply pursuant to 40 C.F.R. Part 60, Subpart IIII or JJJJ, or 40 C.F.R. Part 63, Subpart ZZZZ, all adopted and incorporated by reference at Rule 62-204.800, F.A.C.*

The ARP and CAIR Programs apply to fossil fuel-fired electric generating units (EGUs) that serve a generator greater than or equal to 25 MW in order to produce electricity for sale. The 1,750 kW emergency diesel generator will not meet the 25 MW threshold, nor will the SWWRF produce electricity for sale on the grid. Furthermore, as demonstrated in the preceding applicability analysis, the backup diesel generator is not subject to any unit-specific limitation or requirement aside from the requirements of NESHAPS, Subpart ZZZZ.

Rule 62-212.300(3)(a)(35)(b) – *The engine shall not burn used oil or any other fuels other than natural gas, propane, gasoline, and diesel fuels.*

The 1,750 kW emergency diesel generator will exclusively burn diesel fuel.

Rule 62-212.300(3)(a)(35)(c) – *Collectively, all engines claiming this exemption at the same facility shall not burn more than the collective maximum annual amount of a single fuel, as given in sub-paragraph d., or equivalent collective maximum annual amounts of multiple fuels, as addressed in sub-paragraph e.*

Rule 62-212.300(3)(a)(35)(d) – *If burning only one type of fuel, the collective annual amount of fuel burned by all engines claiming this exemption at the same facility shall not exceed 5,400 gallons of gasoline, 64,000 gallons of diesel fuel, 288,000 gallons of propane, or 8.8 million standard cubic feet of natural gas.*

The 1,750 kW emergency diesel generator will fire a maximum of 12,600 gallons of diesel fuel annually. The combined consumption of diesel fuel from both emergency diesel generators at the SWWRF will be 24,600 gallons annually[5].

Rule 62-212.300(3)(a)(35)(e) – *Not applicable.*

Rule 62-212.300(3)(a)(35)(f) – *If the engine is a stationary compression ignition internal combustion engine that is subject to 40 C.F.R. Part 60, Subpart IIII, adopted and incorporated by reference at Rule 62-204.800, F.A.C., or by virtue of modification or reconstruction becomes subject to such subpart, the owner or operator shall comply with all limitations and requirements of Subpart IIII that apply to the engine.*

As shown in the preceding Federal and State Air Quality Requirements section, the 1,750 kW emergency diesel generator is not subject to NSPS, Subpart IIII.

Rule 62-212.300(3)(a)(35)(g) – *Not applicable.*

Rule 62-212.300(3)(a)(35)(h) – *If the engine is a stationary reciprocating internal combustion engine subject to 40 C.F.R. Part 63, Subpart ZZZZ, adopted and incorporated by reference at Rule 62-204.800, F.A.C., the owner or operator shall comply with all limitations and requirements of Subpart ZZZZ that apply to the engine. If emissions testing is required pursuant to Subpart ZZZZ, all notifications of upcoming tests and reports shall be submitted to the Department in accordance with the provisions of Subpart ZZZZ.*

As discussed in the preceding Federal and State Air Quality Requirements section, the 1,750 kW engine is subject to management practices, record keeping, and reporting requirements under NESHAPS, Subpart ZZZZ. The City will comply with these requirements.

Primary Heating Water System Boilers

The two 6.38 MBtu/hr primary heating water system boilers qualify for an exemption from the requirement to obtain an air construction permit under the conditions of Rule 62-212.300(3)(a)(34), F.A.C. The conditions of Rule 62-212.300(3)(a)(34), F.A.C. and the demonstration of the satisfaction of these conditions are as follows;

Rule 62-212.300(3)(a)(34)(a) – *The unit is not subject to any unit-specific limitation or requirement.*

As discussed in the preceding Federal and State Air Quality Requirements section, the primary heating water system boilers are not subject to any unit-specific limitation or requirement.

Rule 62-212.300(3)(a)(34)(b) – *The rated heat input capacity of the unit is less than 100 million Btu per hour and, collectively, the total rated heat input capacity of all units claiming this exemption at the same facility is less than 250 million Btu per hour.*

The primary heating water system boilers are rated at 6.38 MBtu/hr each and 12.8 MBtu/hr, collectively.

[5] See Appendix A for detailed calculations.

Rule 62-212.300(3)(a)(34)(c) – *The unit shall not burn more than the maximum annual amount of a single fuel, as given in sub-paragraph e., or equivalent maximum annual amounts of multiple fuels, as addressed in sub-paragraph f.*

Rule 62-212.300(3)(a)(34)(d) – *Collectively, all units claiming this exemption at the same facility shall not burn more than the collective maximum annual amount of a single fuel, as given in sub-paragraph g., or equivalent collective maximum annual amounts of multiple fuels, as addressed in sub-paragraph f.*

Rule 62-212.300(3)(a)(34)(e) – *If burning only (1) type of fuel, the annual amount of fuel burned by the unit shall not exceed 150 million standard cubic feet of natural gas, one million gallons of propane, one million gallons of fuel oil with a sulfur content not exceeding 0.05 percent, by weight, 290,000 gallons of fuel oil with a sulfur content not exceeding 0.5 percent, by weight, or 145,000 gallons of fuel oil with a sulfur content not exceeding 1.0 percent, by weight.*

Each primary heating water system boiler will burn a maximum of 55 million standard cubic feet of natural gas on an annual basis[5].

Rule 62-212.300(3)(a)(34)(f) – *Not applicable.*

Rule 62-212.300(3)(a)(34)(g) – *If burning only one (1) type of fuel, the collective annual amount of fuel burned by all units claiming this exemption at the same facility shall not exceed 375 million standard cubic feet of natural gas, 2.5 million gallons of propane, 2.5 million gallons of fuel oil with a sulfur content not exceeding 0.05 percent, by weight, 290,000 gallons of fuel oil with a sulfur content not exceeding 0.5 percent, by weight, or 145,000 gallons of fuel oil with a sulfur content not exceeding 1.0 percent by weight.*

Both primary heating water system boilers will collectively burn a maximum of 110 million standard cubic feet of natural gas on an annual basis[5].

Rule 62-212.300(3)(a)(34)(h) – *Not applicable.*

4.2 GENERIC AND TEMPORARY EXEMPTIONS

Flares 1, 2, and 4 and the Carbon Scrubbers

Flares 1, 2, and 4 as well as the carbon scrubbers qualify for an exemption from the requirement to obtain an air construction permit under the conditions of Rule 62-212.300(3)(b)(1), F.A.C. The conditions of Rule 62-212.300(3)(b)(1), F.A.C. and the demonstration of the satisfaction of these conditions are as follows;

Rule 62-212.300(3)(b)(1)(a) – *It would not be subject to any unit-specific limitation or requirement.*

Flares 1, 2, and 4 as well as the proposed carbon scrubbers are not subject to any unit-specific limitations or requirements.

Rule 62-212.300(3)(b)(1)(b) – *Its emissions, in combination with the emissions of other units and activities at the facility, would not cause the facility to emit or have the potential to emit any pollutant in such amount as to create a Title V source.*

The BIP, including Flares 1, 2, and 4 and the carbon scrubbers, will not have an effect on the SWWRF's status as a non-Title V source[5].

Rule 62-212.300(3)(b)(1)(c) – *It would neither emit nor have the potential to emit 500 pounds per year or more of lead and lead compounds expressed as lead, 1,000 pounds per year or more of any hazardous air pollutant, 2,500 pounds per year or more of total hazardous air pollutants, or 5.0 tons per year or more of any other regulated pollutant as defined at Rule 62-210.200, F.A.C.*

Emissions of lead, lead compounds expressed as lead, and/or HAPs from Flares 1, 2, and 4 and the carbon scrubbers are either negligible or nonexistent. Furthermore, emissions of the remaining applicable pollutants as defined by Rule 62-210.200, F.A.C. are less than the 5.0 ton threshold[5].

Rule 62-212.300(3)(b)(1)(d) – *In the case of a proposed new emissions unit at an existing facility, the emissions of such unit, in combination with the emissions of any other proposed new or modified units and activities at the facility, would not result in a modification subject to the review requirements of subparagraph 62-204.800(11)(d)2, Rule 62-212.400 or Rule 62-212.500, F.A.C.*

Rule 62-204.800(11)(d)(2) adopts by reference 40 CFR Part 63, Subpart B, *Requirements for Control Technology Determinations for Major Sources in Accordance with Clean Air Sections, §§112(g) and 112(j).* The SWWRF is currently and will remain an area source of HAPs and, therefore, this review does not apply. Rules 62-212.400 and 62-212.500, F.A.C. set forth the preconstruction review requirements for the NSR/PSD and non-attainment NSR Programs. As has been demonstrated in this document, neither of these preconstruction review requirements apply to the BIP.

Rule 62-212.300(3)(b)(1)(e) – *In the case of a proposed new pollutant-emitting activity, such activity would not constitute a modification of any existing non-exempt emissions unit at a non-Title V source or any existing non-insignificant emissions unit at a Title V source.*

The applicable flares and carbon scrubbers will be installed to support the operations of the new digesters, the new BUS, and the new sludge handling and processing systems and will, therefore, not constitute a modification of any existing non-exempt emissions unit.

Appendix A. Emissions Calculations

St. Petersburg - SW WRF
Biosolids Improvement Program (BIP)

Major/Minor Source & 62-210.300, FAC Exemption Applicability Determination

Major/Minor Source Applicability Determination for Criteria Pollutants & HAPs Emitted by the Project[3]

Projected Annual Emissions (tpy) of PSD Pollutants from Entire Project

	BIP PTE	Major Source Threshold (tpy)	Equals/Exceeds Major Source Threshold? (Yes/No)
NO_X	38.6	250	No
CO	55.0	250	No
VOC	16.1	250	No
SO_2	39.5	250	No
$PM_{(filterable)}$[4]	1.3	250	No
$PM_{10(filterable+condensible)}$	2.46	250	No
$PM_{2.5(filterable+condensible)}$	2.46	250	No
Lead	2.74E-05	250	No
H_2SO4	0.128	250	No
H_2S	1.53	250	No
CO_2	19,203	--	--
CH_4	106	--	--
N_2O	1.21E-01	--	--
GHG - Mass Basis	19,310	--	--
GHG - CO_{2e} Basis	21,899	100,000	No

Projected Annual Emissions (tpy) of Individual HAPs from Entire Project

	PTE	Major Source Threshold (tpy)	Equals/Exceeds Major Source Threshold? (Yes/No)
1,1,2,2 Tetrachloroethane	3.36E-03	10	No
1,1,2 Trichloroethane	2.67E-03	10	No
1,3 Butadiene	2.25E-02	10	No
1,3 Dichloropropene	2.22E-03	10	No
2,2,4 Trimethylpentane	2.10E-02	10	No
Acetaldehyde	7.03E-01	10	No
Acrolein	4.32E-01	10	No
Benzene	3.85E-02	10	No
Biphenyl	1.78E-02	10	No
Carbon Tetrachloride	3.09E-03	10	No
Chlorobenzene	2.56E-03	10	No
Chloroform	2.40E-03	10	No
Dichlorobenzene	6.58E-05	10	No
Ethylene Dibromide	3.73E-03	10	No
Formaldehyde	4.45E+00	10	No
Methanol	2.10E-01	10	No
Methylene Chloride	1.68E-03	10	No
Napthalene	6.53E-03	10	No
Hexane	1.92E-01	10	No
Phenol	2.02E-03	10	No
Styrene	1.98E-03	10	No
Tetrachloroethylene	2.09E-04	10	No
Toluene	3.50E-02	10	No
Vinyl Chloride	1.25E-03	10	No
Xylene	1.58E-02	10	No
Polycyclic Organic Matter[2]	8.79E-03	10	No
Lead	2.74E-05	10	No
Arsenic	1.89E-05	10	No
Beryllium	5.31E-06	10	No
Cadmium	7.99E-05	10	No
Chromium	1.65E-04	10	No
Cobalt	4.61E-06	10	No
Manganese	4.04E-05	10	No
Mercury	5.15E-05	10	No
Nickel	4.30E-04	10	No
Selenium	1.32E-06	10	No
Total HAPs Project PTE (tpy)	**6.18E+00**	**25**	**No**

62-210.300, FAC Exemption Applicability Determination

Exemption for Natural Gas Boilers (62-210.300(3)(a)(34), FAC)

Per Unit Threshold for Exemption (mmscf/yr)	Per Unit Projected Fuel Use	Combined Fuel Use Threshold for Exemption (tpy)	Combined Projected Fuel Use from Both Units	Qualifies for Exemption?
150	55	375	110	**Yes**

Exemption for Natural Diesel Generators (62-210.300(3)(a)(35),FAC)

Combined Fuel Use Threshold for Exemption (gallons/year)	Combined Projected Fuel Use from Both Units	Qualifies for Exemption?
64,000	26,400	**Yes**

Generic Exemption Applicability for Flares & Carbon Scrubbers (62-210.300(3)(b)(1)(c), FAC)

Threshold	Lead	HAPs		Other[1]	
		Indvidual	Total		
	500 lb/yr	1,000 lb/yr	2,500 lb/yr	5.0 tpy	Exemption Applies? (Yes/No)
Flare 1	NA			1.91	Yes
Flare 2				0.72	Yes
Flare 3				36.79	**No**
Flare 4				4.24E-02	Yes
Scrubbers				1.53	Yes

Generic Exemption Applicability for Flares & Carbon Scrubbers (62-210.300(3)(b)(1)(b), FAC)

	Facility PTE	Title V Threshold (tpy)	Equals/Exceeds Threshold? (Yes/No)
NO_X	40.2	100	No
CO	55.1	100	No
VOC	16.1	100	No
SO_2	39.5	100	No
$PM_{(filterable)}$[4]	1.3	100	No
$PM_{10(filterable+condensible)}$	2.47	100	No
$PM_{2.5(filterable+condensible)}$	2.47	100	No
Lead	2.74E-05	100	No
H_2SO4	0.130	100	No
H_2S	1.53	100	No
CO_2	19,359	--	--
CH_4	106	--	--
N_2O	1.21E-01	--	--
GHG - Mass Basis	19,465	--	--
GHG - CO_{2e} Basis	22,054	100,000	No

Notes [ ]:

1. 62-210.300(3)(b)(1)(c.), FAC specifies that the unit must not have the potential to emit 5.0 tpy of any regulated pollutant (other than HAPs and Lead) as defined by 62-210.200, FAC. For the BIP Project flares, these "other" pollutants include NOX, VOC, SO2, PM10, PM2.5. Only the maximum amount emitted is shown here. Please see "Flares" and "Carbon Scrubber Emissions" for individual pollutant emissions.
2. Polycyclic Organic Matter includes Polycyclic Aromatic Hydrocarbons (PAH) emissions from the relocated diesel generator.
3. The 1,750 kW diesel generator is being relocated from the Albert Whitted facility to the SWWRF. Therefore, it is considered a new emissions source and is included as a component of the BIP Project and its PTE is included in the major source applicability deteremination. The 2,000 kW generator is currently located at the SWWRF. Therefore, the 2,000 kW emissions are not included in the major source applicability determination and it is only shown in this appendix in order to determine the applicability of exemptions pursuant to 62-210.300, FAC.
4. USEPA issued a final rule (Reference 2) which removed a requirement in the definition of "regulated NSR pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate matter known as "particulate matter emissions" in the context of the PSD and NSR regulations; therefore, only the filterable portion is regulated with regards to PM emissions.

St. Petersburg - SW WRF

Biosolids Improvement Program (BIP)

Potential to Emit - Gas - Fired Engine Generators

Cummins Model C1100 N6C		
No. of Engines	2	
Engine Output	1517	hp[1]
Heat Input (HHV)	9.60	MBtu/hr[1,6]
Exhaust Gas Flow @100% Load	6650	acfm[1]
Annual Hours of Operation	8760	hrs
Exhaust Gas Temperature	757	°F[1]
SO_2 to SO_3 Conversion Rate (assumed)	100	%
Molecular Weight of SO_2	64	lb/lb-mol
Molecular Weight of H_2SO_4	98	lb/lb-mol
Emission Factors PSD Pollutants		
NO_X	1	g/hp-hr[1,2]
NMHC (VOCs)	0.5	g/hp-hr[1,2]
$PM_{10(filterable)}$	0.03	g/hp-hr[1,2]
$PM_{2.5(filterable)}$	0.03	g/hp-hr[1,2]
$PM_{(filterable)}$	0.03	g/hp-hr[1,2]
$PM_{(condensible)}$	9.91E-03	lb/Mbtu[4]
SO_2	5.88E-04	lb/Mbtu[4]
CO	1.6	g/hp-hr[1]
CO_2	6.4 64000	% (dry)[1,3] ppmvd
CH_4	1.25	lb/Mbtu[4]
Annual Emissions of PSD Pollutants with Both Engines Operating		
NO_X	29.3	tpy
NMHC (VOCs)	14.6	tpy
$PM_{10(Filterable+Condensible)}$	1.7	tpy[5]
$PM_{2.5(Filterable+Condensible)}$	1.7	tpy[5]
$PM_{(filterable)}$	0.9	tpy[5,7]
SO_2	4.95E-02	tpy
H_2SO_4[9]	7.57E-02	tpy
CO	46.9	tpy
CO_2	11079	tpy
CH_4	105.1	tpy
CO2e[8]	13707	tpy

Hazardous Air Pollutants (HAPS)	Emission Factors (lb/MBtu)[4]	Emission Rate (lb/hr) (per unit)	PTE (tpy) (Both Engines Operating)
1,1,2,2 Tetrachloroethane	4.00E-05	3.84E-04	3.36E-03
1,1,2 Trichloroethane	3.18E-05	3.05E-04	2.67E-03
1,3 Butadiene	2.67E-04	2.56E-03	2.25E-02
1,3 Dichloropropene	2.64E-05	2.53E-04	2.22E-03
2,2,4 Trimethylpentane	2.50E-04	2.40E-03	2.10E-02
Acetaldehyde	8.36E-03	8.03E-02	7.03E-01
Acrolein	5.14E-03	4.94E-02	4.32E-01
Benzene	4.40E-04	4.22E-03	3.70E-02
Biphenyl	2.12E-04	2.04E-03	1.78E-02
Carbon Tetrachloride	3.67E-05	3.52E-04	3.09E-03
Chlorobenzene	3.04E-05	2.92E-04	2.56E-03
Chloroform	2.85E-05	2.74E-04	2.40E-03
Ethylene Dibromide	4.43E-05	4.25E-04	3.73E-03
Formaldehyde	5.28E-02	5.07E-01	4.44E+00
Methanol	2.50E-03	2.40E-02	2.10E-01
Methylene Chloride	2.00E-05	1.92E-04	1.68E-03
Napthalene	7.44E-05	7.14E-04	6.26E-03
Hexane	1.11E-03	1.07E-02	9.34E-02
Phenol	2.40E-05	2.30E-04	2.02E-03
Styrene	2.36E-05	2.27E-04	1.98E-03
Tetrachloroethylene	2.48E-06	2.38E-05	2.09E-04
Toluene	4.08E-04	3.92E-03	3.43E-02
Vinyl Chloride	1.49E-05	1.43E-04	1.25E-03
Xylene	1.84E-04	1.77E-03	1.55E-02
Polycyclic Organic Matter	--	9.59E-04	8.40E-03
2 Methylnaphthalene	3.32E-05	3.19E-04	--
Acenaphthene	1.25E-06	1.20E-05	--
Acenaphthylene	5.53E-06	5.31E-05	--
Benzo(b)fluoranthene	1.66E-07	1.59E-06	--
Benzo(g,h,i)perylene	4.14E-07	3.98E-06	--
Benzo(e)pyrene	4.15E-07	3.98E-06	--
Chrysene	6.93E-07	6.65E-06	--
Ethylbenzene	3.97E-05	3.81E-04	--
Fluoranthene	1.11E-06	1.07E-05	--
Fluorene	5.67E-06	5.44E-05	--
Phenanthrene	1.04E-05	9.99E-05	--
Pyrene	1.36E-06	1.31E-05	--
		Total HAPs	**6.07E+00**

Notes [ ]:

1. Based on preliminary vendor data.
2. Emissions assuming 5% O_2 concentration in exhaust gas.
3. Preliminary vendor data contains CO_2 exaust percentage by volume on a dry basis. The value is conservatively assumed to be on an actual basis in this Appendix.
4. Emission factor obtained from AP-42 (Reference 1a).
5. Assumes all PM is less than 2.5 microns.
6. Based on ratio of average heat content of natural gas at LHV & HHV. HHV=LHV*1.11
7. USEPA issued a final rule (Reference 2) which removed a requirement in the definition of "regulated NSR pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate matter known as "particulate matter emissions" in the context of the PSD and NSR regulations; therefore, only the filterable portion is regulated with regards to PM emissions.
8. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
9. Assumes 100% (by volume) of SO_2 oxidized to form SO_3.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.2 "Natural Gas-Fired Reciprocating Engines". April 2000.
   a. Table 3.2-2 "Uncontrolled Emission Factors For 4-Stroke Lean-Burn Engines."
2. "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$): Amendment to the Definition of "Regulated NSR Pollutant" Concerning Condensable Particulate Matter", 77 Federal Register 207 (25 October 2012), pp. 65107 - 65119.

St. Petersburg - SW WRF
Biosolids Improvement Program (BIP)

Potential to Emit - Flares

Flare	Maximum Output (scfm)[1]
Flare 1 - Enclosed Flare to Combust Excess Gas from Digesters 1 & 2	760 scfm
Flare 2 - Candlestick Flare to Combust Excess Gas from Digester 3 (16-inch pressure zone)	600 scfm
Flare 3 - Thermal Oxidizer to Combust Waste Gas From BUS	140 scfm
Flare 4 - Candlestick Startup Flare Combusting BUS Product Gas	200 scfm

Emissions Factors	Flare 1 [1]	Flare 3[1]	Flares 2 & 4[2]
NO_x (lb/MBtu)	0.06	0.06	0.068
CO (lb/MBtu)	0.15	0.30	0.37
VOC (lb/MBtu)	0.08	0.08	0.14
PM (lb/mmscf)[3]	60	--	--
PM_{10} (lb/mmscf)[3]	60	--	--
$PM_{2.5}$ (lb/mmscf)[3]	60	--	--
CO_2 (lb/MBtu)[4]	117	117	117
CH_4 (lb/MBtu)[5]	0.08	0.08	0.08
N2O(lb/Mbtu)[4]	2.20E-04	2.20E-04	2.20E-04

Add N2O Emissions Part 98 Table C-1

H_2S Concentration in Digester Gas Upstream of Biogas Upgrade System (BUS)	2,500 ppmv[6]
H_2S Concentration in BUS Product Gas	50 ppmv[1]
Heat Content of Digester Gas Upstream of Biogas Upgrade System (BUS)	645 Btu/scf[6]
Heat Content of BUS Waste Gas	186 Btu/scf[1]
Heat Content of BUS Product Gas	985 Btu/scf[1]
Heat Content of Pilot Fuel Gas	1020 Btu/scf[9]
Temperature of Digester Gas	83 °F[1]
Temperature of BUS Product Gas	100 °F[1]
Moecular Weight of SO_2	64 lb/lb-mol
Flare 1 Gas Throughput	9435039 scf/yr[6]
Flare 1 Pilot Gas Throughput	438000 scf/yr[6]
Flare 2 Gas Throughput	3570459 scf/yr[6]
Flare 2 Pilot Gas Throughput	438000 scf/yr[6]
Flare 3 Gas Throughput	73584000 scf/yr[6]
Flare 3 Pilot Gas Throughput	876000 scf/yr[6]
Flare 4 Gas Throughput	6088 scf/yr[6]
Flare 4 Pilot Gas Throughput	219000 scf/yr[6]

Annual Emissions (tpy) of PSD Pollutants from Flaring of Gas				
	Flare 1	Flare 2	Flare 3	Flare 4
NO_x	0.18	0.08	0.41	2.04E-04
CO	0.46	0.43	2.05	1.11E-03
VOC	0.24	0.16	0.55	4.20E-04
SO_2	1.90	0.72	36.79	2.38E-05
PM[3]	0.28	--	--	--
PM_{10}[3]	0.28	--	--	--
$PM_{2.5}$[3]	0.28	--	--	--
CO_2	356	135	801	3.51E-01
CH_4	0.23	0.089	0.527	2.31E-04
N_2O	6.69E-04	2.53E-04	1.51E-03	6.60E-07
CO_{2e}[8]	362	137	814	3.57E-01

Annual Emissions (tpy) of PSD Pollutants from Flare Pilots[2]				
	Flare 1	Flare 2	Flare 3	Flare 4
NO_x	0.015	0.015	0.030	7.59E-03
CO	0.083	0.083	0.17	4.13E-02
VOC	0.031	0.031	0.063	1.56E-02
SO_2[7]	3.13E-04	3.13E-04	6.26E-04	1.56E-04
CO_2[4]	26.1	26.1	52.3	13.1
CH_4	0.017	0.017	0.034	8.31E-03
N_2O	4.91E-05	4.91E-05	9.83E-05	2.37E-05
CO_{2e}[8]	27	27	53	13.3

Total Annual Emissions (tpy) of PSD Pollutants from Flaring of Gas & Pilot Emissions				
	Flare 1	Flare 2	Flare 3	Flare 4
NO_x	0.20	0.09	0.44	7.80E-03
CO	0.54	0.51	2.22	4.24E-02
VOC	0.27	0.19	0.61	1.61E-02
SO_2[7]	1.91	0.72	36.79	1.80E-04
PM[3]	0.28	--	--	--
PM_{10}[3]	0.28	--	--	--
$PM_{2.5}$[3]	0.28	--	--	--
CO_2[4]	382	161	853	13.4
CH_4	0.25	0.106	0.561	8.54E-03
N_2O	7.19E-04	3.02E-04	1.60E-03	2.44E-05
CO_{2e}[8]	389	164	867	13.6

Notes [ ]:

1. Information obtained from Brown & Caldwell 30% Preliminary Design Report (PDR) and Technical Specifications - Volume No. 2, 60% Submittal.
2. Emission factor obtained from AP-42 (Reference 1a).
3. Assumed to be both filterable and condensible & less than 2.5 microns.
4. CO_2 emission factor obtained from Table C-1 to Subpart C of 40 CFR Part 98. Conservatively used emission factor for natural gas for each flare as the value is greater than the emission factor for combusted biogas.
5. Emission factor obtained from AP-42 (Reference 1b.). Methane emissions are assumed to be 55% of total VOC emissions.
6. Calculated using information obtained from "Air Permit Info.xlsx" sent to Black & Veatch on 12/6/2013 from Christian Aristizabal of Brown & Caldwell.
7. Assumes 1 grain per 100 scf sulfur content in the pilot gas and all sulfur in the fuel is converted to SO_2 during combustion.
8. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
9. Assumed value.

1. **References:**

USEPA, AP-42, Fifth Edition, Vol. I. Chapter 13 "Miscellaneous Sources", Section 13.5 "Industrial Flares". April 2000.
a. Table 13.5-1 "Emission Factors for Flare Operations".
b. Table 13.5-2 "Hydrocarbon Composition of Flare Emission"

St. Petersburg - SW WRF

Biosolids Improvement Program (BIP)

Potential to Emit - Backup Heating Boilers for Digesters

Basis:

Number of Units	2	
Fuel	Natural Gas	
Heat Input	6.38	mmBtu/hr [1]
Heating Value of Fuel	1,020	Btu/scf [2]
Fuel Burn Rate	0.0063	mmscf/hr [1]
SO_2 to SO_3 Conversion Rate	100	% by volume (assumed)

Fuel consumed by each unit operating 8760 hours per year	**55**	mmscf/yr
Combined fuel consumed by both units operating 8760 hours per year	**110**	mmscf/yr

Global Warming Potentials [3]

CO_2	1
CH_4	25
N_2O	298

Annual Potential Emissions

Pollutant	Mass Emission Rate (Per Unit)			Annual Emissions When Both Units Operating 8760 hrs (tpy)
	(lb/mmscf)	Notes	(lb/hr)	
CO	84	[4]	5.26E-01	4.605
NO_X	100	[4]	6.26E-01	5.48
PM	1.9	[6, 7]	1.19E-02	0.104
PM_{10}	7.6	[6, 8]	4.76E-02	0.417
$PM_{2.5}$	7.6	[6, 8]	4.76E-02	0.417
SO_2	0.60	[9]	3.76E-03	0.0329
VOC	5.5	[6]	3.44E-02	0.302
Lead	0.0005	[6]	3.13E-06	2.74E-05
H_2SO_4	0.92	[10]	5.75E-03	0.0504
CO_2	120,000	[6]	751.06	6,579.28
CH_4	2.3	[6]	1.44E-02	1.26E-01
N_2O	2.2	[6]	1.38E-02	1.21E-01
GHG-CO2e	--	[11]	--	6,618

CAS Number	Pollutant	Mass Emission Rate (per unit)			PTE
		(lb/mmscf)	Notes	(lb/hr)	(tpy)
71-43-2	Benzene	2.10E-03	[12]	1.31E-05	1.15E-04
25321-22-6	Dichlorobenzene	1.20E-03	[12]	7.51E-06	6.58E-05
50-00-0	Formaldehyde	7.50E-02	[12]	4.69E-04	4.11E-03
110-54-3	Hexane	1.80E+00	[12]	1.13E-02	9.87E-02
91-20-3	Naphthalene	6.10E-04	[12]	3.82E-06	3.34E-05
--	Polycyclic Organic Matter	8.82E-05	[12, 4]	5.52E-07	4.84E-06
91-57-6	2-Methylnaphthalene	2.40E-05	[12, 5]	--	--
56-49-5	3-Methylchloranthrene	1.80E-06	[12, 5]	--	--
57-97-6	7,12-Dimethylbenz(a)anthracene	1.60E-05	[12, 5]	--	--
83-32-9	Acenaphthene	1.80E-06	[12, 5]	--	--
203-96-8	Acenaphthylene	1.80E-06	[12, 5]	--	--
120-12-7	Anthracene	2.40E-06	[12, 5]	--	--
56-55-3	Benz(a)anthracene	1.80E-06	[12, 5]	--	--
50-32-8	Benzo(a)pyrene	1.20E-06	[12, 5]	--	--
205-99-2	Benzo(b)fluoranthene	1.80E-06	[12, 5]	--	--
191-24-2	Benzo(g,h,i)perylene	1.20E-06	[12, 5]	--	--
205-82-3	Benzo(k)fluoranthene	1.80E-06	[12, 5]	--	--
218-01-9	Chrysene	1.80E-06	[12, 5]	--	--
53-70-3	Dibenzo(a,h)anthracene	1.20E-06	[12, 5]	--	--
206-44-0	Fluoranthene	3.00E-06	[12, 5]	--	--
86-73-7	Fluorene	2.80E-06	[12, 5]	--	--
193-39-5	Indeno(1,2,3-cd)pyrene	1.80E-06	[12, 5]	--	--
85-01-8	Phenanathrene	1.70E-05	[12, 5]	--	--
129-00-0	Pyrene	5.00E-06	[12, 5]	--	--
108-88-3	Toluene	3.40E-03	[12]	2.13E-05	1.86E-04
[6]	Lead	5.00E-04	[13]	3.13E-06	2.74E-05
[6]	Arsenic	2.00E-04	[13]	1.25E-06	1.10E-05
[6]	Beryllium	1.20E-05	[13]	7.51E-08	6.58E-07
[6]	Cadmium	1.10E-03	[13]	6.88E-06	6.03E-05
[6]	Chromium	1.40E-03	[13]	8.76E-06	7.68E-05
[6]	Cobalt	8.40E-05	[13]	5.26E-07	4.61E-06
[6]	Manganese	3.80E-04	[13]	2.38E-06	2.08E-05
[6]	Mercury	2.60E-04	[13]	1.63E-06	1.43E-05
[6]	Nickel	2.10E-03	[13]	1.31E-05	1.15E-04
[6]	Selenium	2.40E-05	[13]	1.50E-07	1.32E-06
				Total HAPs	1.04E-01

Notes [ ]:

1. Based on preliminary vendor data.
2. Based on site-specific data.
3. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
4. Emission factor obtained from AP-42 (Reference 1a); for a small boiler (<100 mmBtu/hr), uncontrolled.
5. Pollutant is assumed to be a POM.
6. Emission factor obtained from AP-42 (Reference 1b).
7. USEPA issued a final rule (Reference 2) which removed a requirement in the definition of "regulated NSR pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate matter known as "particulate matter emissions" in the context of the PSD and NSR regulations; therefore, only the filterable portion is regulated with regards to PM emissions.
8. Based on information provided in AP-42 (Reference 1), all particulate matter (filterable and condensable) is assumed to be less than 1.0 micrometer in diameter.
9. Assumed all sulfur in the fuel is converted to SO_2.
10. Assumes 100% (by volume) of SO_2 is oxidized to form SO_3.
11. The GHG emissions is the sum of all applicable GHG pollutants.
12. Emission factor obtained from AP-42 (Reference 1c).
13. Emission factor obtained from AP-42 (Reference 1d).
14. Polycyclic Organic Matter (POM) emissions is the summation of individual POM pollutants.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 1 "External Combustion Sources", Section 1.4 "Natural Gas Combustion". July 1998.
   a. Table 1.4-1 "Emission Factors for Nitrogen Oxides (NO_X) and Carbon Monoxide (CO) from Natural Gas Combustion".
   b. Table 1.4-2 "Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion".
   c. Table 1.4-3 "Emission Factors for Speciated Organic Compounds from Natural Gas Combustion".
   d. Table 1.4-4 "Emission Factors for Metals from Natural Gas Combustion".
2. "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$): Amendment to the Definition of "Regulated NSR Pollutant" Concerning Condensable Particulate Matter", 77 Federal Register 207 (25 October 2012), pp. 65107 - 65119

St. Petersburg - SW WRF

Biosolids Improvement Program (BIP)

Potential to Emit - Odor Control Systems

H_2S Emissions			
H_2S Concentration in Foul Air (Primary Clarifiers & Gravity Belt Thickener Building)		10	ppmvd[1]
H_2S Concentration in Foul Air (Dewatering Building)		45	ppmvd[3]
AverageTemperature of Foul Air		68	°F[1]
Molecular Weight of H_2S		34	lb/lb-mol
Assumes Continuous Annual Operation		8760	hours
Control Efficiency (per scrubber)[1,2]		95	%
Design Capacity[1]			
Scrubber 1 - Primary Clarifiers & Gravity Belt Thickener Building		12000	scfm
Scrubber 2 - Primary Clarifiers & Gravity Belt Thickener Building		12000	scfm
Scrubber 3 - Dewatering Building[6]		24000	scfm
H_2S PTE (tons per year)[5]			
Scrubber 1 - Primary Clarifiers & Gravity Belt Thickener Building		0.139	tpy
Scrubber 2 - Primary Clarifiers & Gravity Belt Thickener Building		0.139	tpy
Scrubber 3 - Dewatering Building[6]		1.26	tpy
	Total	**1.53**	**tpy**

Notes: [ ]:

1. Information obtained from Brown & Caldwell 30% Preliminary Design Report (PDR) and Technical Specifications - Volume No. 3, 60% Submittal. Value is downstream of Biotrickling Filters at inlet of carbon scrubbers.
2. Specifications are for 99% control efficiency. 95% conservatively assumed.
3. Based on engineering estimates. Conservatively assumes maximum H_2S concentration of 45 ppmvd.
4. Based on 60% Methane content in digester gas.
5. 3 total scrubbers available to Primary Clarifiers & Gravity Belt Thickener Building, however, only 2 in use at any one time, with one stand-by.
6. Foul air flow through scrubber 3 assumed to be equal to aggregate of scrubbers 1 & 2.

St. Petersburg - SW WRF

Biosolids Improvement Program (BIP)

Potential to Emit - Relocated 1750 kW Diesel Emergency Generator (New Source)

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,347	HP
Heat Input	17.26	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	126	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]
Sulfur Content of Fuel	0.0015	% [3]

Global Warming Potentials [4]	
CO_2	1
CH_4	25
N_2O	298

Pollutant	Mass Emission Rate			PTE
	g/hp-hr	Notes	(lb/hr)	(tpy)
CO	0.87	[1,10]	4.52	0.23
NO_X	11.84	[1,10]	61.24	3.06
PM	0.20	[1,10]	1.04	0.052
PM_{10}	0.20	[5]	1.04	0.052
$PM_{2.5}$	0.20	[5]	1.04	0.052
SO_2	0.0052	[6]	0.027	0.0013
VOC	0.25	[1,10]	1.28	0.064
Lead	--		--	--
H_2SO_4	0.0079	[7]	0.041	0.0020
Fluorides	--		--	--
TRS (including H_2S)	--		--	--
GHG-Mass	526.196	[9]	2,723	136
CO_2	5.26E+02	[8]	2,722.52	136.13
CH_4	2.88E-02	[8]	0.15	0.01
N_2O	--		--	--
GHG-CO2e	526.887	[9]	2,726	136
CO_2	5.26E+02	[4]	2,722.52	136.13
CH_4	7.20E-01	[4]	3.72	0.19
N_2O	--		--	--

Notes [ ]:

1. Caterpillar Model 3516 1750 kW generator installed at Albert Whitted facility in 2000, to be relocated at SWWRF as part of BIP. Data from this specific engine is unavailable. Therefore, calculations based on 1999 performance data from vendor for Model 3516B 1825 kW diesel generator.
2. Based on diesel fuel characteristics listed in Reference 2.
3. Based on the requirements of 40 CFR Part 63, Subpart ZZZZ and 40 CFR Part 80.510(b).
4. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
5. Conservatively assumed all particulate matter emissions are less than 2.5 micrometers in diameter.
6. Assumed all sulfur in the fuel is converted to SO_2.
7. Assumed 100% conversion of SO_2 to H_2SO_4.
8. Greenhouse gases (CO_2 and CH_4) emission factors obtained from AP-42 (Reference 1a), for a large stationary diesel engine (2-02-004-01).
9. The GHG emissions is the sum of all applicable GHG pollutants.
10. Emission factors enveloped across varying operational conditions to represent worst-case emissions.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
    a. Table 3.4-1 "Gaseous Emission Factors for Large Stationary Diesel and All Stationary Duel-Fuel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.

St. Petersburg - SW WRF

Biosolids Improvement Program (BIP)

HAP Emissions - Relocated 1750 kW Diesel Emergency Generator (New Source)

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,347	HP
Heat Input	17.26	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	126	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]

Pollutant	Composition [3] (%wt)
Arsenic	8.50E-06
Beryllium	5.00E-06
Cadmium	2.10E-05
Chromium	9.50E-05
Manganese	2.10E-05
Mercury	4.00E-05
Nickel	3.38E-04

Pollutant	Mass Emission Rate (lb/mmBtu)	Notes	(lb/hr)	PTE (tpy)
Benzene	7.76E-04	[4]	1.34E-02	6.70E-04
Toluene	2.81E-04	[4]	4.85E-03	2.43E-04
Xylenes	1.93E-04	[4]	3.33E-03	1.67E-04
Formaldehyde	7.89E-05	[4]	1.36E-03	6.81E-05
Acetaldehyde	2.52E-05	[4]	4.35E-04	2.18E-05
Acrolein	7.88E-06	[4]	1.36E-04	6.80E-06
Naphthalene	1.30E-04	[5]	2.24E-03	1.12E-04
PAH	2.12E-04	[5]	3.66E-03	1.83E-04
Arsenic	4.37E-06	[6, 7]	7.55E-05	3.78E-06
Beryllium	2.57E-06	[6, 7]	4.44E-05	2.22E-06
Cadmium	1.08E-05	[6, 7]	1.87E-04	9.33E-06
Chromium	4.89E-05	[6, 7]	8.44E-04	4.22E-05
Manganese	1.08E-05	[6, 7]	1.87E-04	9.33E-06
Mercury	2.06E-05	[6, 7]	3.55E-04	1.78E-05
Nickel	1.74E-04	[6, 7]	3.00E-03	1.50E-04
			Total HAPs	1.71E-03

Notes [ ]:

1. Caterpillar Model 3516 1750 kW generator installed at Albert Whitted facility in 2000, to be relocated at SWWRF as part of BIP. Data from this specific engine is unavailable. Therefore, calculations based on 1999 performance data from vendor for Model 3516B 1825 kW diesel generator.
2. Based on diesel fuel characteristics listed in Reference 2.
3. Based on data provided by USEPA (Reference 3a) for No. 2 fuel oil/diesel fuel.
4. Emission factor obtained from AP-42 (Reference 1a).
5. Emission factor obtained from AP-42 (Reference 1b).
6. Conservatively assumed all metal in the fuel oil is emitted into the atmosphere.
7. Emission factor based on the metal composition in the fuel. See Table C47 of this Appendix for details.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
    a. Table 3.4-3 "Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines".
    b. Table 3.4-4 "PAH Emission Factors for Large Uncontrolled Stationary Diesel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.
3. USEPA, EPCRA Section 313: Industry Guidance: Electricity Generating Facilities. EPA-745-B-00-004. February 2000.
    a. Table 3-4 "Estimated Concentration Values of EPCRA Section 313 Constituents in Crude Oil and Petroleum Products (Weight Percent)".

St. Petersburg - SW WRF

Biosolids Improvement Program (BIP)

Potential to Emit - 2000 kW Diesel Emergency Generator

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,682	HP
Heat Input	18.91	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	138	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]
Sulfur Content of Fuel	0.0015	% [3]

Global Warming Potentials [4]	
CO_2	1
CH_4	25
N_2O	298

Pollutant	Mass Emission Rate			PTE
	g/hp-hr	Notes	(lb/hr)	(tpy)
CO	0.30	[1,10]	1.77	0.09
NO_X	5.45	[1,10]	32.22	1.61
PM	0.03	[1,10]	0.15	0.007
PM_{10}	0.03	[5]	0.15	0.007
$PM_{2.5}$	0.03	[5]	0.15	0.007
SO_2	0.0049	[6]	0.029	0.0015
VOC	0.11	[1,10]	0.65	0.033
Lead	--		--	--
H_2SO_4	0.0076	[7]	0.045	0.0022
Fluorides	--		--	--
TRS (including H_2S)	--		--	--
GHG-Mass	526.196	[9]	3,111	156
CO_2	5.26E+02	[8]	3,111.12	155.56
CH_4	2.88E-02	[8]	0.17	0.01
N_2O	--		--	--
GHG-CO2e	526.887	[9]	3,115	156
CO_2	5.26E+02	[4]	3,111.12	155.56
CH_4	7.20E-01	[4]	4.25	0.21
N_2O	--		--	--

Notes [ ]:

1. Based on performance data for Caterpillar model 3516C 2000 eKW Diesel Generator Set.
2. Based on diesel fuel characteristics listed in Reference 2.
3. Based on the requirements of 40 CFR Part 63, Subpart ZZZZ and 40 CFR Part 80.510(b).
4. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
5. Conservatively assumed all particulate matter emissions are less than 2.5 micrometers in diameter.
6. Assumed all sulfur in the fuel is converted to SO_2.
7. Assumed 100% conversion of SO_2 to H_2SO_4.
8. Greenhouse gases (CO_2 and CH_4) emission factors obtained from AP-42 (Reference 1a), for a large stationary diesel engine (2-02-004-01).
9. The GHG emissions is the sum of all applicable GHG pollutants.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
    a. Table 3.4-1 "Gaseous Emission Factors for Large Stationary Diesel and All Stationary Duel-Fuel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.

St. Petersburg - SW WRF

Biosolids Improvement Program (BIP)

HAP Emissions - 2,000 kW Diesel Emergency Generator

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,682	HP
Heat Input	18.91	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	138	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]

Pollutant	Composition [3] (%wt)
Arsenic	8.50E-06
Beryllium	5.00E-06
Cadmium	2.10E-05
Chromium	9.50E-05
Manganese	2.10E-05
Mercury	4.00E-05
Nickel	3.38E-04

Pollutant	Mass Emission Rate			PTE
	(lb/mmBtu)	Notes	(lb/hr)	(tpy)
Benzene	7.76E-04	[4]	1.47E-02	7.34E-04
Toluene	2.81E-04	[4]	5.31E-03	2.66E-04
Xylenes	1.93E-04	[4]	3.65E-03	1.82E-04
Formaldehyde	7.89E-05	[4]	1.49E-03	7.46E-05
Acetaldehyde	2.52E-05	[4]	4.76E-04	2.38E-05
Acrolein	7.88E-06	[4]	1.49E-04	7.45E-06
Naphthalene	1.30E-04	[5]	2.46E-03	1.23E-04
PAH	2.12E-04	[5]	4.01E-03	2.00E-04
Arsenic	4.37E-06	[6, 7]	8.27E-05	4.13E-06
Beryllium	2.57E-06	[6, 7]	4.86E-05	2.43E-06
Cadmium	1.08E-05	[6, 7]	2.04E-04	1.02E-05
Chromium	4.89E-05	[6, 7]	9.24E-04	4.62E-05
Manganese	1.08E-05	[6, 7]	2.04E-04	1.02E-05
Mercury	2.06E-05	[6, 7]	3.89E-04	1.95E-05
Nickel	1.74E-04	[6, 7]	3.29E-03	1.64E-04
			Total HAPs	1.87E-03

Notes [ ]:

1. Based on performance data for Caterpillar model 3516C 2000 eKW Diesel Generator Set.
2. Based on distillate oil characteristics listed in Reference 2.
3. Based on data provided by USEPA (Reference 3a) for No. 2 fuel oil/diesel fuel.
4. Emission factor obtained from AP-42 (Reference 1a).
5. Emission factor obtained from AP-42 (Reference 1b).
6. Conservatively assumed all metal in the fuel oil is emitted into the atmosphere.
7. Emission factor based on the metal composition in the fuel. See Table C47 of this Appendix for details.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
    a. Table 3.4-3 "Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines".
    b. Table 3.4-4 "PAH Emission Factors for Large Uncontrolled Stationary Diesel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.
3. USEPA, EPCRA Section 313: Industry Guidance: Electricity Generating Facilities. EPA-745-B-00-004. February 2000.
    a. Table 3-4 "Estimated Concentration Values of EPCRA Section 313 Constituents in Crude Oil and Petroleum Products (Weight Percent)".

Appendix B. FDEP Forms

Department of
Environmental Protection

Division of Air Resources Management

APPLICATION FOR AIR PERMIT - NON-TITLE V SOURCE

See Instructions for Form No. 62-210.900(3)

I. APPLICATION INFORMATION

Identification of Facility

1. Facility Owner/Company Name: City of St. Petersburg	
2. Site Name: City of St. Petersburg Southwest WRF	
3. Facility Identification Number: [X] Unknown	
4. Facility Location: Street Address or Other Locator: 3800 54th Avenue South City: St. Petersburg County: Pinellas Zip Code: 33711	
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [ ] Yes [X] No

Application Contact

1. Name and Title of Application Contact: Steve Marshall – Project Manager
2. Application Contact Mailing Address: Organization/Firm: Engineering Department - City of St. Petersburg Street Address: One Fourth Street North City: St. Petersburg State: Florida Zip Code: 33701
3. Application Contact Telephone Numbers: Telephone: (727) 893-7851 Fax: (727) 892-5243
4. Application Contact E-mail Address: sdmarsha@stpete.org

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	
2. Permit Number:	

Purpose of Application

Air Operation Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[ ] Initial non-Title V air operation permit for one or more existing, but previously unpermitted, emissions units.

[ ] Initial non-Title V air operation permit for one or more newly constructed or modified emissions units.

Current construction permit number:_____

[ ] Non-Title V air operation permit revision to address one or more newly constructed or modified emissions units.

Current construction permit number:_____

Operation permit number to be revised:_____

[ ] Initial non-Title V air operation permit under Rule 62-210.300(2)(b), F.A.C., for an existing facility seeking classification as a synthetic non-Title V source.

Current operation/construction permit number(s):

_____

[ ] Non-Title V air operation permit revision for a synthetic non-Title V source. Give reason for revision; e.g., to address one or more newly constructed or modified emissions units.

Operation permit number to be revised:_____

Reason for revision:_____

Air Construction Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[X] Air construction permit to construct or modify one or more emissions units.

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Owner/Authorized Representative

1. Name and Title of Owner/Authorized Representative: Steve Leavitt, P.E. – Director, Water Resources Department
2. Owner/Authorized Representative Mailing Address: Organization/Firm: City of St. Petersburg Water Resources Department Street Address: 1635 Third Avenue North City: St. Petersburg State: Florida Zip Code: 33713
3. Owner/Authorized Representative Telephone Numbers: Telephone: (727)893-4165 Fax: (727) 892-5476
4. Owner/Authorized Representative E-mail Address: Steve.Leavitt@stpete.org
5. Owner/Authorized Representative Statement: *I, the undersigned, am the owner or authorized representative* of the facility addressed in this application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.* Steven Leavitt 04/24/17 Signature Date

* Attach letter of authorization if not currently on file.

Professional Engineer Certification

1. Professional Engineer Name: Andrew A. Westfall, P.E. Registration Number: 47693
2. Professional Engineer Mailing Address: Organization/Firm: Black & Veatch Street Address: 4890 West Kennedy Blvd, Suite 950 City: Tampa State: Florida Zip Code: 33609
3. Professional Engineer Telephone Numbers: Telephone: (813)-281-0032 Fax: (813)-281-0881
4. Professional Engineer E-mail Address: WestfallAA@bv.com

5. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [✓], if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ], if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature Andrew A Westfall Date 4-22-2014

(seal) 47693

* Attach any exception to certification statement.

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type	Processing Fee
1	Natural Gas Fired Engine Generator Unit No. 1	AC1D	$2,000
2	Natural Gas Fired Engine Generator Unit No. 2	AC1D	NA
3	Thermal Oxidizer (Waste Gas Burner) Unit No. 3	AC1D	$2,000

Application Processing Fee

Check one: [X] Attached - Amount: $4,000_____[ ] Not Applicable

Construction/Modification Information

1. Description of Proposed Project or Alterations: See Sections 1 and 2 of the Technical Support Document preceding these forms.

2. Projected or Actual Date of Commencement of Construction: September 2014

3. Projected Date of Completion of Construction: September 2018

Application Comment

The City of St. Petersburg is requesting a construction permit for the Biosolids Improvement Project at its Southwest Water Reclamation Facility (SWWRF). The Biosolids Improvement Project consists of the installation of two (2) 1100 kW gas fueled engine generators (Unit Nos. 1 & 2) that will be capable of firing pipeline natural gas as well as cleaned digester gas, a thermal oxidizer (waste gas burner) (Unit No. 3), and a number of exempt sources.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates: Zone: East (km): North (km):			
2. Facility Latitude/Longitude: Latitude (DD/MM/SS):27° 43’ 08” N Longitude (DD/MM/SS):82° 41’ 10” W			
3. Governmental Facility Code: 4	4. Facility Status Code: A	5. Facility Major Group SIC Code: 49	6. Facility SIC(s): 4952
7. Facility Comment (limit to 500 characters):			

Facility Contact

1. Name and Title of Facility Contact: George (Ken) Wise – Lead Operator, SWWRF
2. Facility Contact Mailing Address: Organization/Firm: City of St. Petersburg, SWWRF Street Address: 3800 54th Avenue City: St. Petersburg State: Florida Zip Code: 33711
3. Facility Contact Telephone Numbers: Telephone: (727)-893-7497 Fax: ( ) -
4. Facility Contact E-mail Address: George.Wise@StPete.org

Facility Regulatory Classifications

Check all that apply:

1. [ ] Small Business Stationary Source? [ ] Unknown
2. [ ] Synthetic Non-Title V Source?
3. [ ] Synthetic Minor Source of Pollutants Other than HAPs?
4. [ ] Synthetic Minor Source of HAPs?
5. [X] One or More Emissions Units Subject to NSPS?
6. [X] One or More Emission Units Subject to NESHAP Recordkeeping or Reporting?
7. Facility Regulatory Classifications Comment (limit to 200 characters):

Rule Applicability Analysis

See Section 3 of the Technical Support Document preceding these forms.

B. FACILITY POLLUTANTS

List of Pollutants Emitted

1. Pollutant Emitted	2. Pollutant Classif.	3. Requested Emissions Cap lb/hour	tons/year	4. Basis for Emissions Cap	5. Pollutant Comment
CO	B				
NOX	B				
VOC	B				
SO2	B				
PM	B				
PM10	B				
PM2.5	B				
PB	B				
H2S	B				
SAM	B				
HAPS	B				

C. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Area Map Showing Facility Location: [X] Attached, Document ID: Appendix C
2. Facility Plot Plan: [X] Attached, Document ID: Appendix C
3. Process Flow Diagram(s): [X] Attached, Document ID: Appendix C
4. Precautions to Prevent Emissions of Unconfined Particulate Matter: [X] Attached, Document ID: Appendix E
5. Supplemental Information for Construction Permit Application: [ ] Attached, Document ID:_____ [ ] Not Applicable
6. Supplemental Requirements Comment:

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through G as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in This Section (limit to 60 characters):
Cummins model C1100 N6C 1100 kW (1517 bhp) Natural Gas Engine Generator No. 1 (or equivalent)

3. Emissions Unit Identification Number:
ID: 1
[ ] No ID
[ ] ID Unknown

4. Emissions Unit Status Code: C	5. Initial Startup Date: January 2016	6. Emissions Unit Major Group SIC Code: 49

7. Emissions Unit Comment: (Limit to 500 Characters)

Emissions Unit Control Equipment

1. Control Equipment/Method Description (limit to 200 characters per device or method):
2. Control Device or Method Code(s):

Emissions Unit Details

1. Package Unit:	
Manufacturer: Cummins (or equivalent)	Model Number: C1100 N6C
2. Generator Nameplate Rating: 1.1 MW	
3. Incinerator Information:	
Dwell Temperature:	°F
Dwell Time:	seconds
Incinerator Afterburner Temperature:	°F

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate: 9.6		mmBtu/hr
2. Maximum Incineration Rate:	lb/hr	tons/day
3. Maximum Process or Throughput Rate:		
4. Maximum Production Rate:		
5. Requested Maximum Operating Schedule:		
	hours/day	days/week
	weeks/year	8760 hours/year
6. Operating Capacity/Schedule Comment (limit to 200 characters):		

B. EMISSION POINT (STACK/VENT) INFORMATION

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? EP-01	2. Emission Point Type Code: 1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:		
5. Discharge Type Code: V	6. Stack Height: 25 feet	7. Exit Diameter: 1.33 feet
8. Exit Temperature: 757 °F	9. Actual Volumetric Flow Rate: 6650 acfm	10. Water Vapor: %
11. Maximum Dry Standard Flow Rate: dscfm	12. Nonstack Emission Point Height: feet	
13. Emission Point UTM Coordinates: Zone: 17 East (km): 333.89166 North (km): 3067.11021		
14. Emission Point Comment (limit to 200 characters):		

C. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment __1___ of __2___

1. Segment Description (Process/Fuel Type) (limit to 500 characters): Natural Gas combusted in Natural Gas Engine Generator No. 1		
2. Source Classification Code (SCC): 2-01-002-02	3. SCC Units: Million cubic feet burned	
4. Maximum Hourly Rate: 0.0094 mmscf/hr	5. Maximum Annual Rate: 82.34 mmscf/yr	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 1020 (HHV) (Approx.)
10. Segment Comment (limit to 200 characters):		

Segment Description and Rate: Segment ___2__ of __2___

1. Segment Description (Process/Fuel Type) (limit to 500 characters): BUS Product Gas combusted in Natural Gas Engine Generator No. 1		
2. Source Classification Code (SCC): 2-01-007-02	3. SCC Units: Million cubic feet burned	
4. Maximum Hourly Rate: 0.0097	5. Maximum Annual Rate: 84.97 mmscf/yr	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 985 (HHV)(Approx.)
10. Segment Comment (limit to 200 characters):		

D. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION

Potential Emissions

1. Pollutant Emitted: CO	2. Pollutant Regulatory Code:NS	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions __1__ of __1__

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 2.0 g/bhp-hr	4. Equivalent Allowable Emissions: 6.69 lb/hour 29.3 tons/year
5. Method of Compliance (limit to 60 characters): Stack Testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): CO emissions limit required by NSPS, Subpart JJJJ	

Potential Emissions

1. Pollutant Emitted: NOX	2. Pollutant Regulatory Code:NS	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions __1__ of __1__

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 1.0 g/bhp-hr	4. Equivalent Allowable Emissions: 3.34 lb/hour 14.63 tons/year
5. Method of Compliance (limit to 60 characters): Stack Testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): NOX emissions limit required by NSPS, Subpart JJJJ	

Potential Emissions

1. Pollutant Emitted: VOC	2. Pollutant Regulatory Code:NS	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions __1__ of __1__

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.7 g/bhp-hr	4. Equivalent Allowable Emissions: 2.34 lb/hour 10.25 tons/year
5. Method of Compliance (limit to 60 characters): Stack Testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): VOC emissions limit required by NSPS, Subpart JJJJ	

Potential Emissions

1. Pollutant Emitted: SO2	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 3
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: PM	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: PM10	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: PM2.5	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: SAM	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 2
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: HAPS	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 3
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

E. VISIBLE EMISSIONS INFORMATION
(Only Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation _____ of _____

1. Visible Emissions Subtype: VE20	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: 20% Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: Annual USEPA Method 9 Test	
5. Visible Emissions Comment (limit to 200 characters): Required by Rule 62-296.320, F.A.C.	

F. CONTINUOUS MONITOR INFORMATION
(Only Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement: [ ] Rule [ ] Other	
4. Monitor Information: Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters):	

G. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: App. C
2. Fuel Analysis or Specification [X] Attached, Document ID: App. E
3. Detailed Description of Control Equipment [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
4. Description of Stack Sampling Facilities [X] Attached, Document ID: App. E
5. Compliance Test Report [ ] Attached, Document ID:_____ [ ] Previously submitted, Date:_____ [X] Not Applicable
6. Procedures for Startup and Shutdown [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [X] Attached, Document ID: App. E
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: App. D
9. Other Information Required by Rule or Statute [ ] Attached, Document ID:_____ [X] Not Applicable
10. Supplemental Requirements Comment:

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through G as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in This Section (limit to 60 characters):
Cummins model C1100 N6C 1100 kW (1517 bhp) Natural Gas Engine Generator No. 2 (or equivalent)

3. Emissions Unit Identification Number:
ID: 2
[ ] No ID
[ ] ID Unknown

4. Emissions Unit Status Code: C	5. Initial Startup Date: January 2016	6. Emissions Unit Major Group SIC Code: 49

7. Emissions Unit Comment: (Limit to 500 Characters)

Emissions Unit Control Equipment

1. Control Equipment/Method Description (limit to 200 characters per device or method):
2. Control Device or Method Code(s):

Emissions Unit Details

1. Package Unit:	
Manufacturer: Cummins (or equivalent)	Model Number: C1100 N6C
2. Generator Nameplate Rating: 1.1 MW	
3. Incinerator Information:	
Dwell Temperature:	°F
Dwell Time:	seconds
Incinerator Afterburner Temperature:	°F

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate: 9.6		mmBtu/hr
2. Maximum Incineration Rate:	lb/hr	tons/day
3. Maximum Process or Throughput Rate:		
4. Maximum Production Rate:		
5. Requested Maximum Operating Schedule:		
	hours/day	days/week
	weeks/year	8760 hours/year
6. Operating Capacity/Schedule Comment (limit to 200 characters):		

B. EMISSION POINT (STACK/VENT) INFORMATION

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? EP-02	2. Emission Point Type Code: 1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:		
5. Discharge Type Code: V	6. Stack Height: 25 feet	7. Exit Diameter: 1.33 feet
8. Exit Temperature: 757 °F	9. Actual Volumetric Flow Rate: 6650 acfm	10. Water Vapor: %
11. Maximum Dry Standard Flow Rate: dscfm	12. Nonstack Emission Point Height: feet	
13. Emission Point UTM Coordinates: Zone: 17 East (km): 333.89166 North (km): 3067.11734		
14. Emission Point Comment (limit to 200 characters):		

C. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment __1___ of __2___

3. Segment Description (Process/Fuel Type) (limit to 500 characters): Natural Gas combusted in Natural Gas Engine Generator No. 2		
4. Source Classification Code (SCC): 2-01-002-02	3. SCC Units: Million cubic feet burned	
4. Maximum Hourly Rate: 0.0094 mmscf/hr	5. Maximum Annual Rate: 82.34 mmscf/yr	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 1020 (HHV) (Approx.)
10. Segment Comment (limit to 200 characters):		

Segment Description and Rate: Segment ___2__ of __2___

1. Segment Description (Process/Fuel Type) (limit to 500 characters): BUS Product Gas combusted in Natural Gas Engine Generator No. 2		
2. Source Classification Code (SCC): 2-01-007-02	3. SCC Units: Million cubic feet burned	
4. Maximum Hourly Rate: 0.0097	5. Maximum Annual Rate: 84.97 mmscf/yr	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 985 (HHV)(Approx.)
10. Segment Comment (limit to 200 characters):		

D. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION

Potential Emissions

1. Pollutant Emitted: CO		2. Pollutant Regulatory Code: NS
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions __1__ of __1__

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 2.0 g/bhp-hr	4. Equivalent Allowable Emissions: 6.69 lb/hour 29.3 tons/year
5. Method of Compliance (limit to 60 characters): Stack Testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): CO emissions limit required by NSPS, Subpart JJJJ	

Emissions Unit Information Section ___2__ of __3___

Pollutant Detail Information Page ___2__ of __9___

Potential Emissions

1. Pollutant Emitted: NOX		2. Pollutant Regulatory Code:NS
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions __1__ of __1__

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 1.0 g/bhp-hr	4. Equivalent Allowable Emissions: 3.34 lb/hour 14.63 tons/year
5. Method of Compliance (limit to 60 characters): Stack Testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): NOX emissions limit required by NSPS, Subpart JJJJ	

Potential Emissions

1. Pollutant Emitted: VOC	2. Pollutant Regulatory Code:NS	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions __1__ of __1__

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.7 g/bhp-hr	4. Equivalent Allowable Emissions: 2.34 lb/hour 10.25 tons/year
5. Method of Compliance (limit to 60 characters): Stack Testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): VOC emissions limit required by NSPS, Subpart JJJJ	

Potential Emissions

1. Pollutant Emitted: SO2	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 3
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: PM	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: PM10	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: PM2.5	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: SAM	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 2
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: HAPS	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 3
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

E. VISIBLE EMISSIONS INFORMATION
(Only Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation _____ of _____

1. Visible Emissions Subtype: VE20	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: 20% Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: Annual USEPA Method 9 Test	
5. Visible Emissions Comment (limit to 200 characters): Required by Rule 62-296.320, F.A.C.	

F. CONTINUOUS MONITOR INFORMATION
(Only Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement: [ ] Rule [ ] Other	
4. Monitor Information: Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters):	

G. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: App. C
2. Fuel Analysis or Specification [X] Attached, Document ID: App. E
3. Detailed Description of Control Equipment [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
4. Description of Stack Sampling Facilities [X] Attached, Document ID: App. E
5. Compliance Test Report [ ] Attached, Document ID:_____ [ ] Previously submitted, Date:_____ [X] Not Applicable
6. Procedures for Startup and Shutdown [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [X] Attached, Document ID: App. E
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: App. D
9. Other Information Required by Rule or Statute [ ] Attached, Document ID:_____ [X] Not Applicable
10. Supplemental Requirements Comment:

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through G as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in This Section (limit to 60 characters):
140 scfm Thermal Oxidizer (Waste Gas Burner) No. 3

3. Emissions Unit Identification Number:
ID: 3
[ ] No ID
[ ] ID Unknown

4. Emissions Unit Status Code: C	5. Initial Startup Date: September 2018	6. Emissions Unit Major Group SIC Code: 49

7. Emissions Unit Comment: (Limit to 500 Characters)

Emissions Unit Control Equipment

1. Control Equipment/Method Description (limit to 200 characters per device or method):
2. Control Device or Method Code(s):

Emissions Unit Details

1. Package Unit:		
Manufacturer: TBD	Model Number:	TBD
2. Generator Nameplate Rating: 140 scfm		
3. Incinerator Information:		
Dwell Temperature:		°F
Dwell Time:		seconds
Incinerator Afterburner Temperature:		°F

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:		mmBtu/hr
2. Maximum Incineration Rate:	lb/hr	tons/day
3. Maximum Process or Throughput Rate: 140 scfm		
4. Maximum Production Rate:		
5. Requested Maximum Operating Schedule:		
	hours/day	days/week
	weeks/year	8760 hours/year
6. Operating Capacity/Schedule Comment (limit to 200 characters):		

B. EMISSION POINT (STACK/VENT) INFORMATION

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? EP-03	2. Emission Point Type Code: 1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:		
5. Discharge Type Code: V	6. Stack Height: feet	7. Exit Diameter: feet
8. Exit Temperature: 2,700 °F	9. Actual Volumetric Flow Rate: TBD acfm	10. Water Vapor: %
11. Maximum Dry Standard Flow Rate: dscfm	12. Nonstack Emission Point Height: 20 feet	
13. Emission Point UTM Coordinates: Zone: 17 East (km): 334.19148 North (km): 3067.03692		
14. Emission Point Comment (limit to 200 characters):		

C. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment __1___ of __2___

5. Segment Description (Process/Fuel Type) (limit to 500 characters): Waste Gas Combusted by Thermal Oxidizer No. 3		
6. Source Classification Code (SCC): 5-01-007-89	3. SCC Units: Million cubic feet burned	
4. Maximum Hourly Rate: 0.0084 mmscf/hr	5. Maximum Annual Rate: 73.58 mmscf/yr	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 186 (Approx.)
10. Segment Comment (limit to 200 characters):		

Segment Description and Rate: Segment ___2__ of __2___

1. Segment Description (Process/Fuel Type) (limit to 500 characters): Natural Gas combusted by Thermal Oxidizer No. 3 pilot		
2. Source Classification Code (SCC): 2-01-007-02	3. SCC Units: Million cubic feet burned	
4. Maximum Hourly Rate: 0.0001	5. Maximum Annual Rate: 0.876 mmscf/yr	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 1020 (HHV)(Approx.)
10. Segment Comment (limit to 200 characters):		

D. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION

Potential Emissions

1. Pollutant Emitted: CO	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: NOX	2. Pollutant Regulatory Code:EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters): Stack Testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: VOC	2. Pollutant Regulatory Code: EL	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

Potential Emissions

1. Pollutant Emitted: SO2	2. Pollutant Regulatory Code: NS	
3. Primary Control Device Code:	4. Secondary Control Device Code:	5. Total Percent Efficiency of Control:
6. Potential Emissions: See Appendix A for emissions calculations		7. Synthetically Limited? [ ]
8. Emission Factor: Reference:		9. Emissions Method Code: 5
10. Calculation of Emissions (limit to 600 characters): See Appendix A for emissions calculations		
11. Pollutant Potential Emissions Comment (limit to 200 characters):		

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code: Rule	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

E. VISIBLE EMISSIONS INFORMATION
(Only Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation _____ of _____

1. Visible Emissions Subtype: VE20	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: 20% Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: Annual USEPA Method 9 Test	
5. Visible Emissions Comment (limit to 200 characters): Required by Rule 62-296.320, F.A.C.	

F. CONTINUOUS MONITOR INFORMATION
(Only Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement: [ ] Rule [ ] Other	
4. Monitor Information: Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters):	

G. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: App. C
2. Fuel Analysis or Specification [X] Attached, Document ID: App. E
3. Detailed Description of Control Equipment [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
4. Description of Stack Sampling Facilities [X] Attached, Document ID: App. E
5. Compliance Test Report [ ] Attached, Document ID:_____ [ ] Previously submitted, Date:_____ [X] Not Applicable
6. Procedures for Startup and Shutdown [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [X] Attached, Document ID: App. E
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: App. D
9. Other Information Required by Rule or Statute [ ] Attached, Document ID:_____ [X] Not Applicable
10. Supplemental Requirements Comment:

Appendix C. Drawings and Process Flow Diagrams

This appendix provides the following drawings and process flow diagrams:

- Site Map
- Site Layout Drawing
- Natural Gas Engine Generators, Emergency Diesel Engine Generators, and Primary Heating Water System Boilers
    - 3D Drawing
    - Plan View
    - Process Flow Diagrams
- Flares
    - Flares 1 & 2
    - Flares 3 & 4
    - Process Flow Diagrams
- Carbon Scrubbers
    - Plan View
    - Process Flow Diagrams


53RD AVE S
41ST ST S
54TH AVE S
I-275
I-275
SWWRF Property Boundary
AVENUE OF STATES DR
Jacksonville
Tampa
SWWRF
Miami
0
250
500
Feet
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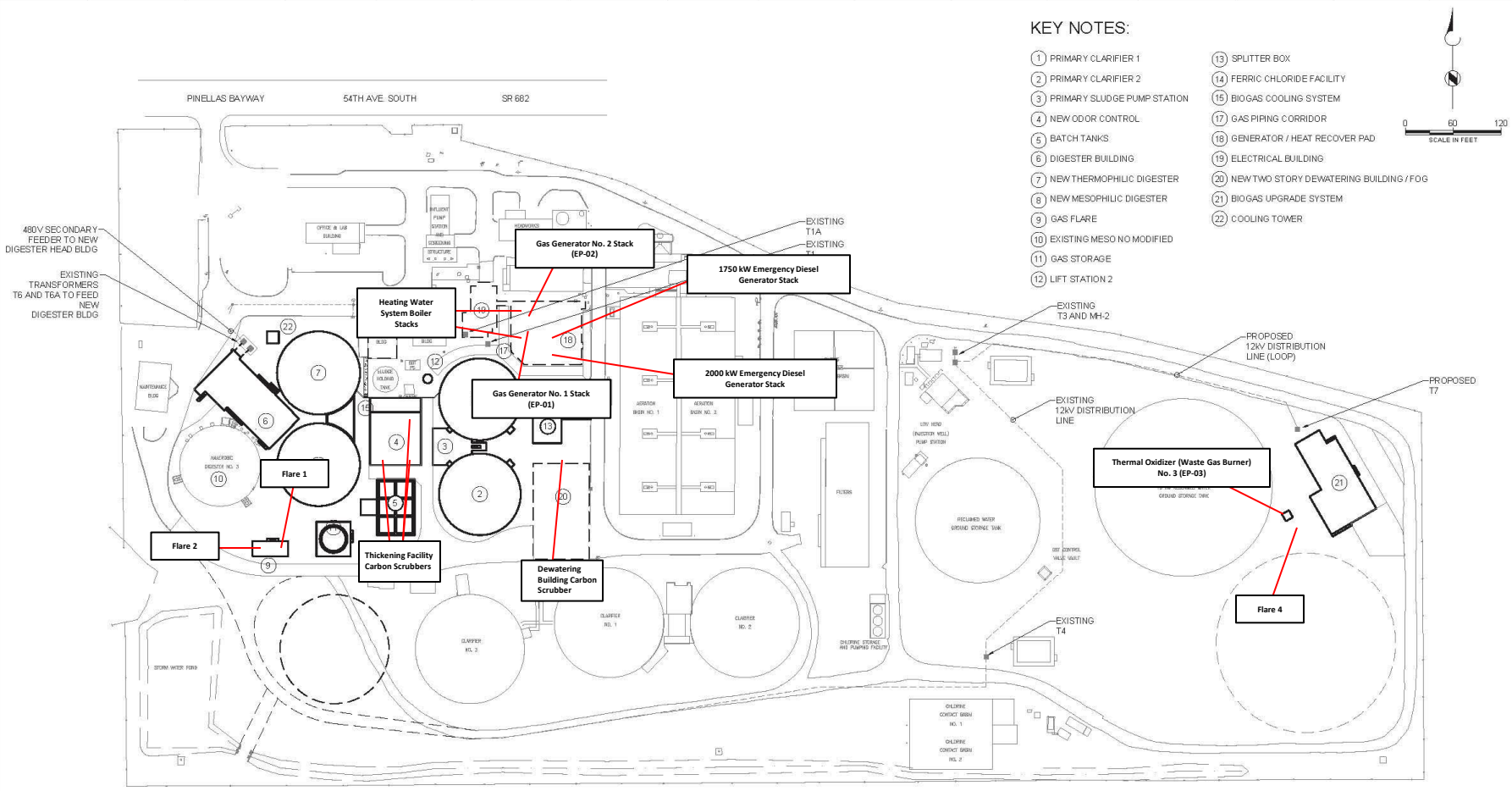

Brown AND Caldwell
TAMPA, FLORIDA

SUBMITTED: _____ PROJECT MANAGER DATE
APPROVED: _____ BROWN AND CALDWELL DATE
DECEMBER 2013

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: B DICKERSON
DRAWN: B DICKERSON
CHECKED: J DIEDRICH
CHECKED: J DIEDRICH
APPROVED: J DIEDRICH

EXTERNAL REFERENCE FILES
144490-TB-XXEDD-01.dwg
XC-DESIGN.dwg
XC-EXISTING.dwg
XC-12KVDIST.dwg

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CITY OF St. PETERSBURG
3800 54th AVE. S
St. PETERSBURG, FL. 33711

BIOSOLIDS TO ENERGY

ELECTRICAL

SITE PLAN

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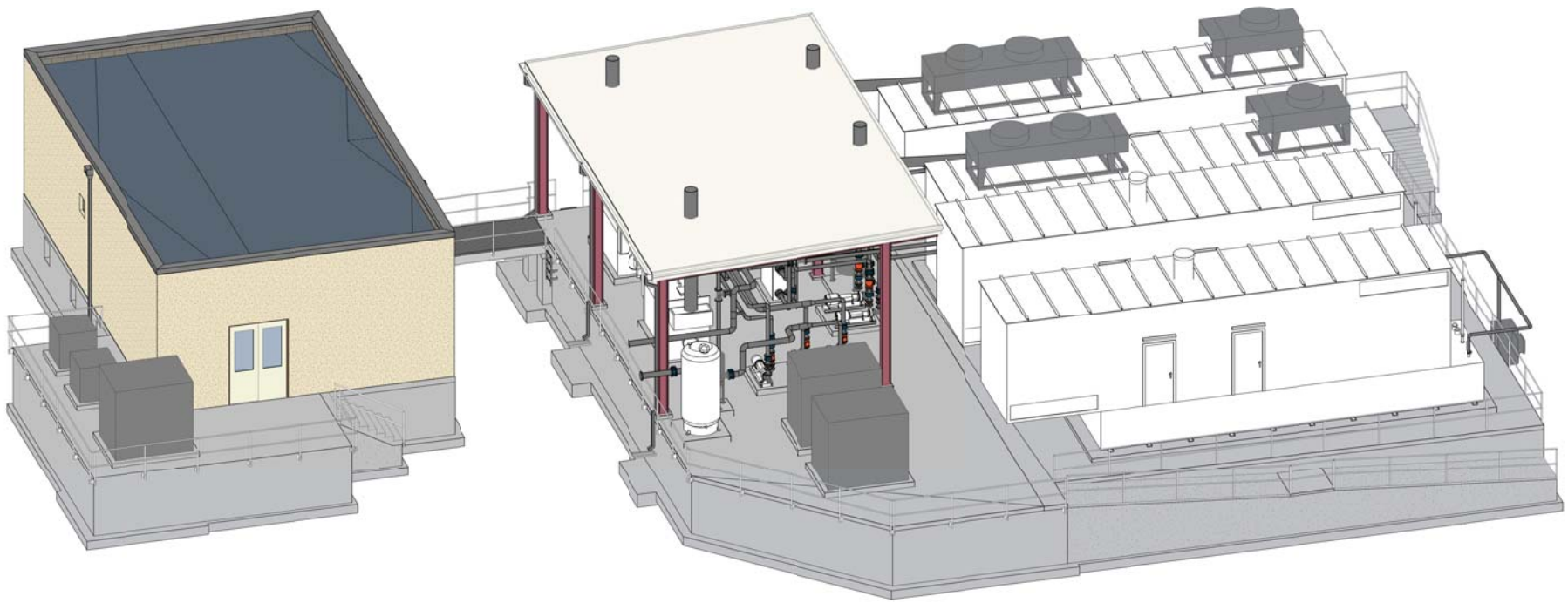
BC PROJECT NUMBER 144490
CLIENT PROJECT NUMBER ---
DRAWING NUMBER E-01-21
SHEET NUMBER ---- OF



3D PERSPECTIVE

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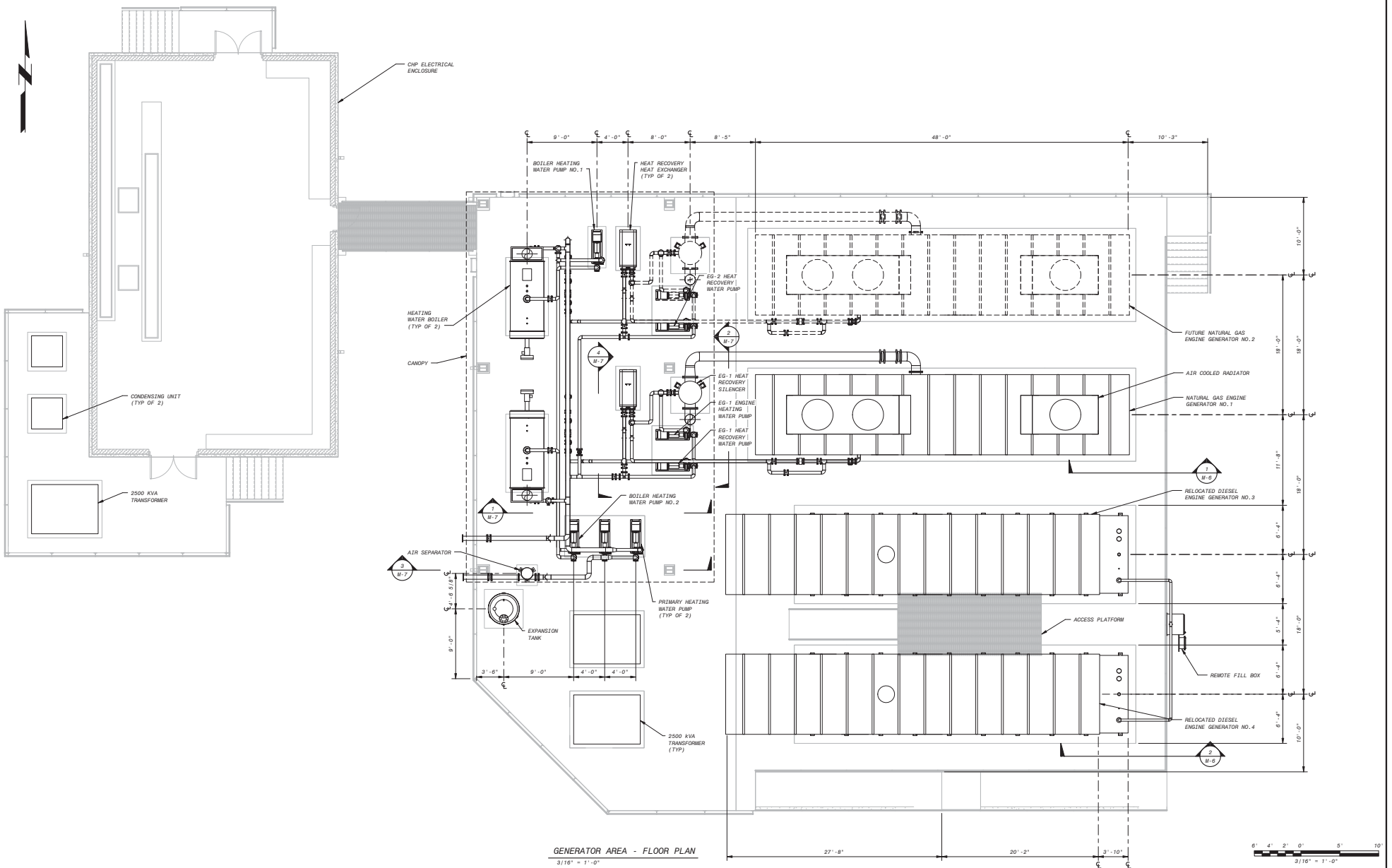
DESIGNED BY: Designer DATE: DRAWN BY: Author DATE: CHECKED BY: Checker DATE: FIELD BOOK No: PAGE THRU BM No.: EL. LOCATION:	REVISIONS	BY	DATE	BLACK & VEATCH Building a world of difference. Black & Veatch Corporation 4890 West Kennedy Boulevard, Suite 950 Tampa, Florida - Certificate No. 8132	ENGINEER OF RECORD: FLORIDA LICENSE NO.:	ENGINEERING and CAPITAL IMPROVEMENTS DEPARTMENT CITY of ST. PETERSBURG APPROVED BY:	CITY OF ST. PETERSBURG SOUTHWEST WRF GENERATOR AND ELECTRICAL IMPROVEMENTS MECHANICAL 3D PERSPECTIVE	DATE: MARCH 2014 SCALE: DRAWING No. 10945-41 PROJECT No. 175508 SHEET No. M-1



GENERATOR AREA - FLOOR PLAN

3/16" = 1'-0"

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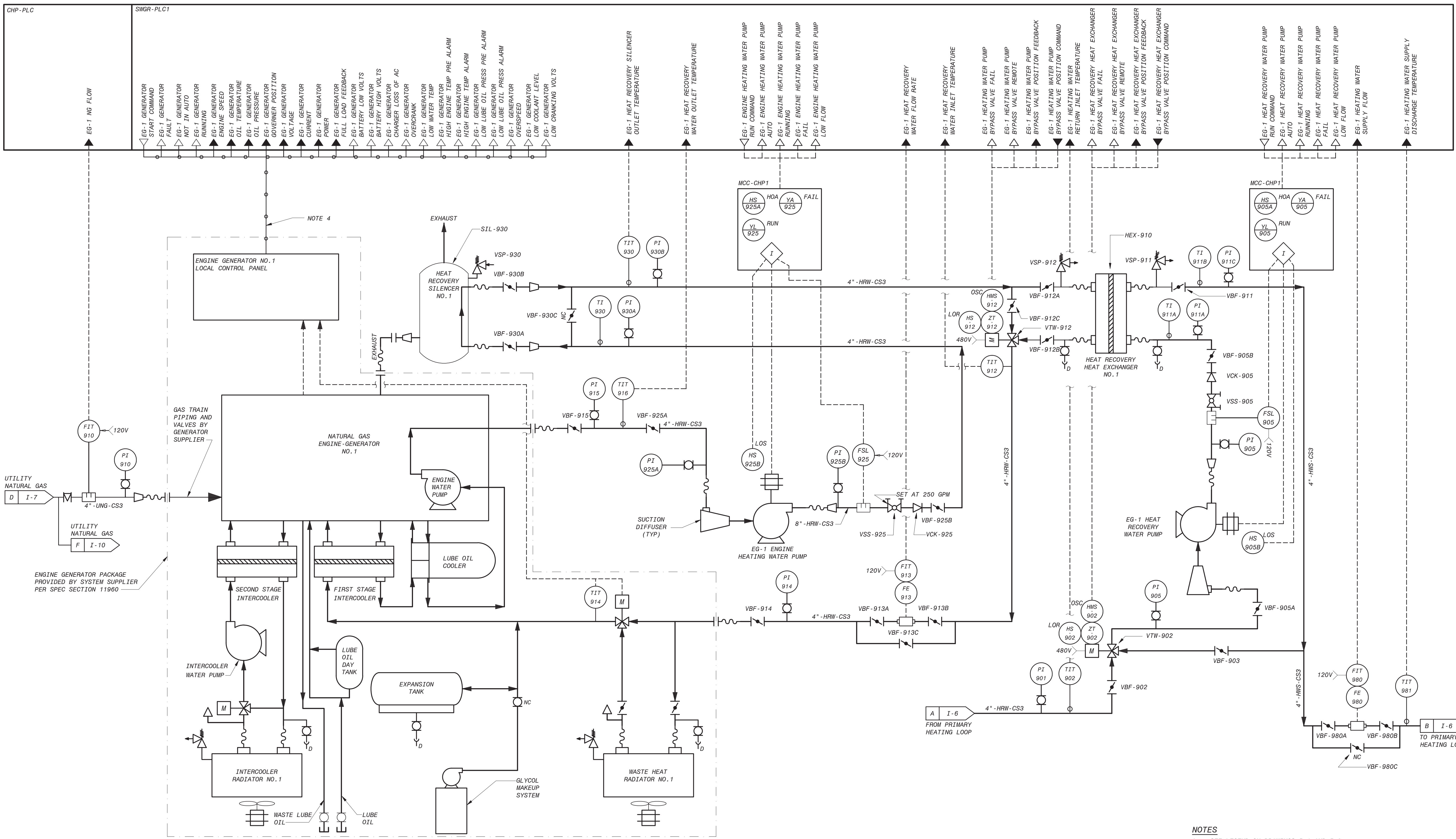

NOTES

1. SEE LEGEND ON DRAWINGS I-1 AND I-2.
2. ALL BUTTERFLY VALVES ON THIS P&ID ARE INDUSTRIAL BUTTERFLY VALVES.
3. ALL HRW, HWS AND HWR PIPING SHALL BE INSULATED AND LAGGED AS SPECIFIED IN SPECIFICATION SECTION 15250.
4. GENERATOR I/O SHALL BE PER SPECIFICATION SECTION 11961.

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CITY of ST. PETERSBURG
APPROVED BY:

CITY OF ST. PETERSBURG
SOUTHWEST WRF
GENERATOR AND ELECTRICAL IMPROVEMENTS

INSTRUMENTATION
GAS ENGINE GENERATOR NO.1
P&ID

DATE: MARCH 2014	
SCALE: NONE	
DRAWING No. 10945-70	
PROJECT No. 179508	
SHEET No. I-9	

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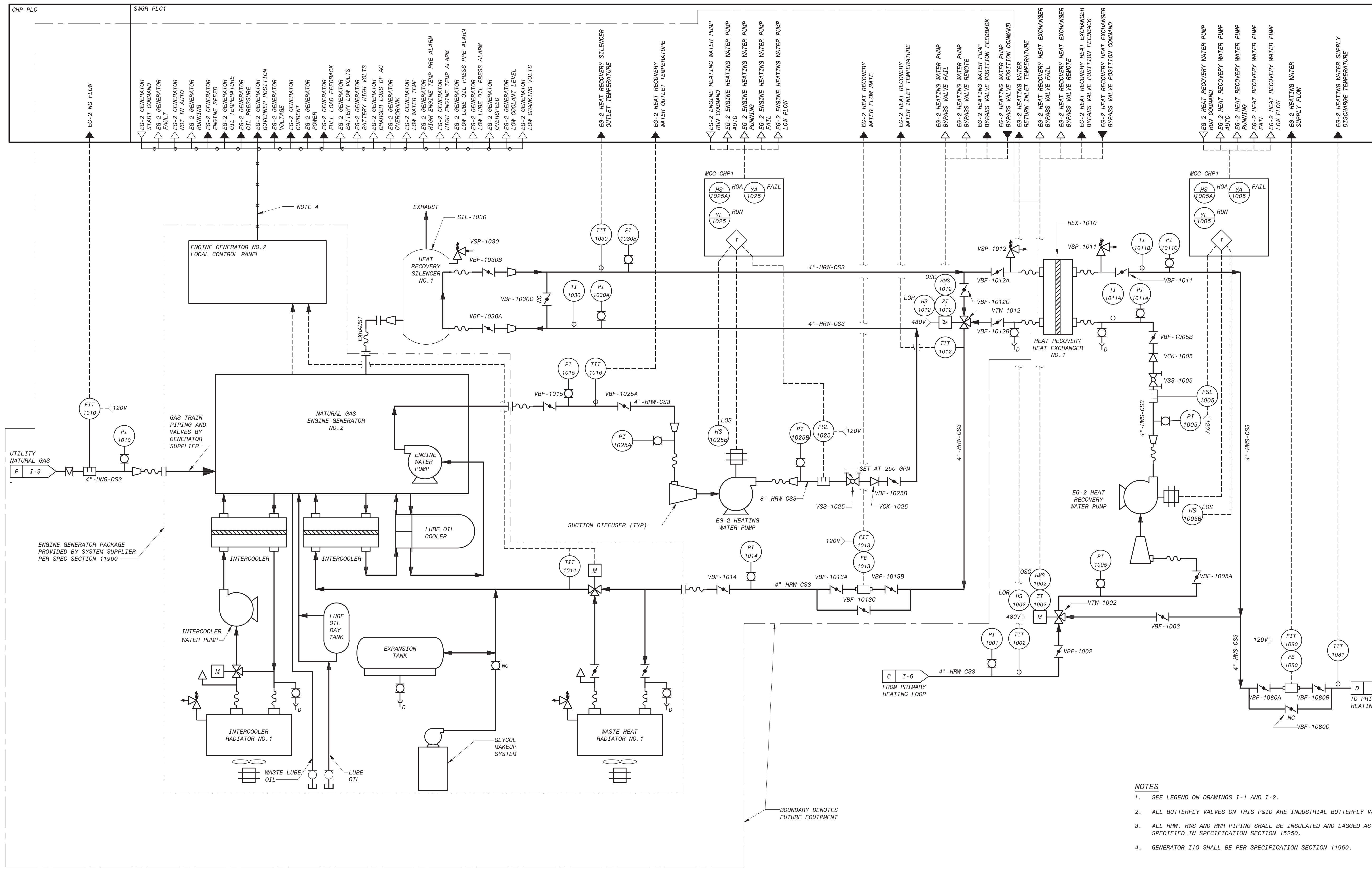

NOTES

1. SEE LEGEND ON DRAWINGS I-1 AND I-2.
2. ALL BUTTERFLY VALVES ON THIS P&ID ARE INDUSTRIAL BUTTERFLY VALVES.
3. ALL HRW, HWS AND HWR PIPING SHALL BE INSULATED AND LAGGED AS SPECIFIED IN SPECIFICATION SECTION 15250.
4. GENERATOR I/O SHALL BE PER SPECIFICATION SECTION 11960.

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APPROVED BY:

CITY OF ST. PETERSBURG
SOUTHWEST WRF
GENERATOR AND ELECTRICAL IMPROVEMENTS
INSTRUMENTATION
FUTURE GAS ENGINE GENERATOR NO.2
P&ID

DATE:	MARCH 2014
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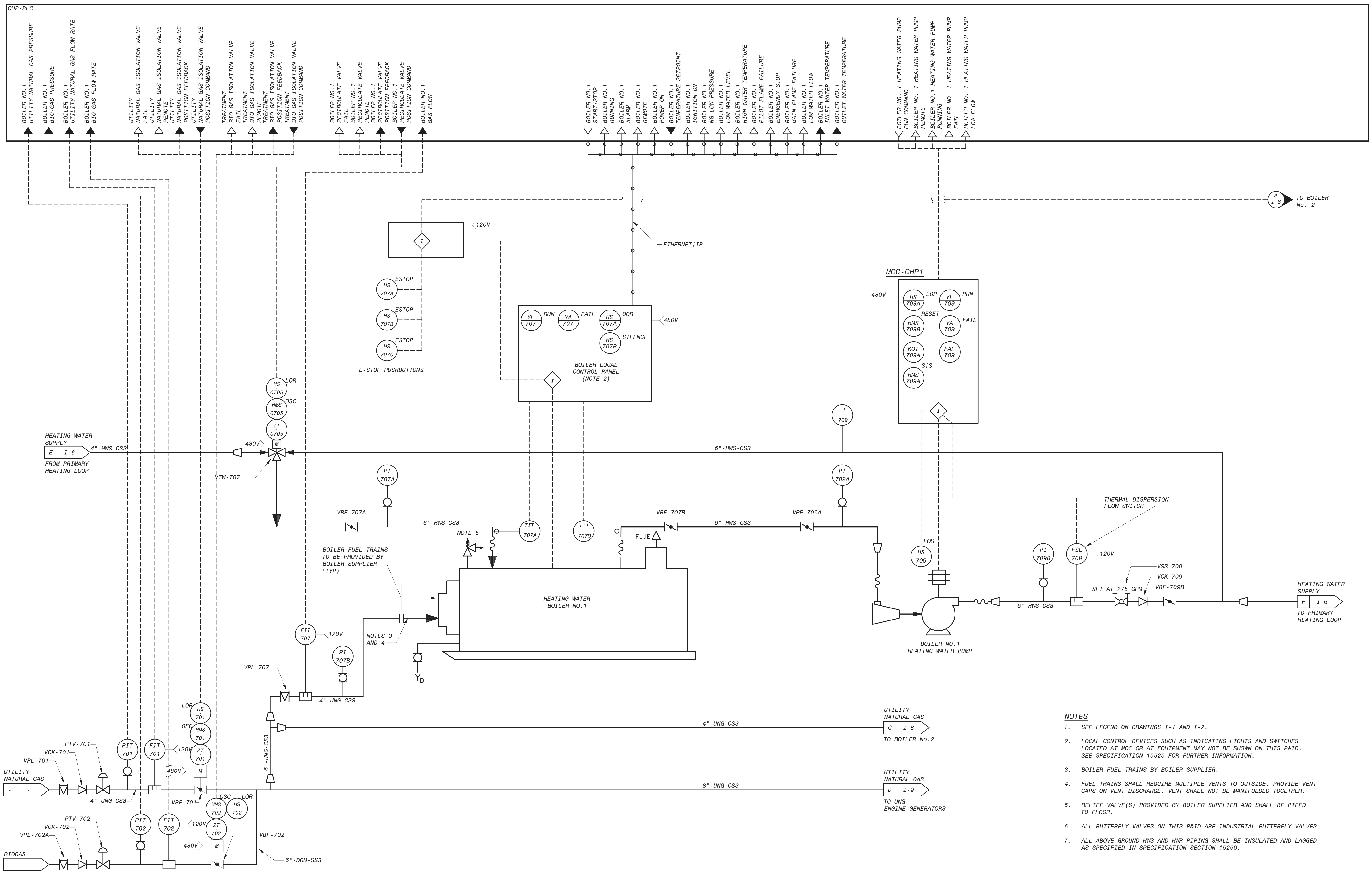

NOTES

1. SEE LEGEND ON DRAWINGS I-1 AND I-2.
2. LOCAL CONTROL DEVICES SUCH AS INDICATING LIGHTS AND SWITCHES LOCATED AT MCC OR AT EQUIPMENT MAY NOT BE SHOWN ON THIS P&ID. SEE SPECIFICATION 15525 FOR FURTHER INFORMATION.
3. BOILER FUEL TRAINS BY BOILER SUPPLIER.
4. FUEL TRAINS SHALL REQUIRE MULTIPLE VENTS TO OUTSIDE. PROVIDE VENT CAPS ON VENT DISCHARGE. VENT SHALL NOT BE MANIFOLDED TOGETHER.
5. RELIEF VALVE(S) PROVIDED BY BOILER SUPPLIER AND SHALL BE PIPED TO FLOOR.
6. ALL BUTTERFLY VALVES ON THIS P&ID ARE INDUSTRIAL BUTTERFLY VALVES.
7. ALL ABOVE GROUND HWS AND HWR PIPING SHALL BE INSULATED AND LAGGED AS SPECIFIED IN SPECIFICATION SECTION 15250.

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CHECKED BY: VJB DATE:
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BM No.: EL.
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CITY of ST. PETERSBURG
APPROVED BY:

CITY OF ST. PETERSBURG
SOUTHWEST WRF
GENERATOR AND ELECTRICAL IMPROVEMENTS
INSTRUMENTATION
HEATING WATER BOILER NO.1
P&ID

DATE: MARCH 2014
SCALE: NONE
DRAWING No. 10945-68
PROJECT No. 179508
SHEET No. I-7

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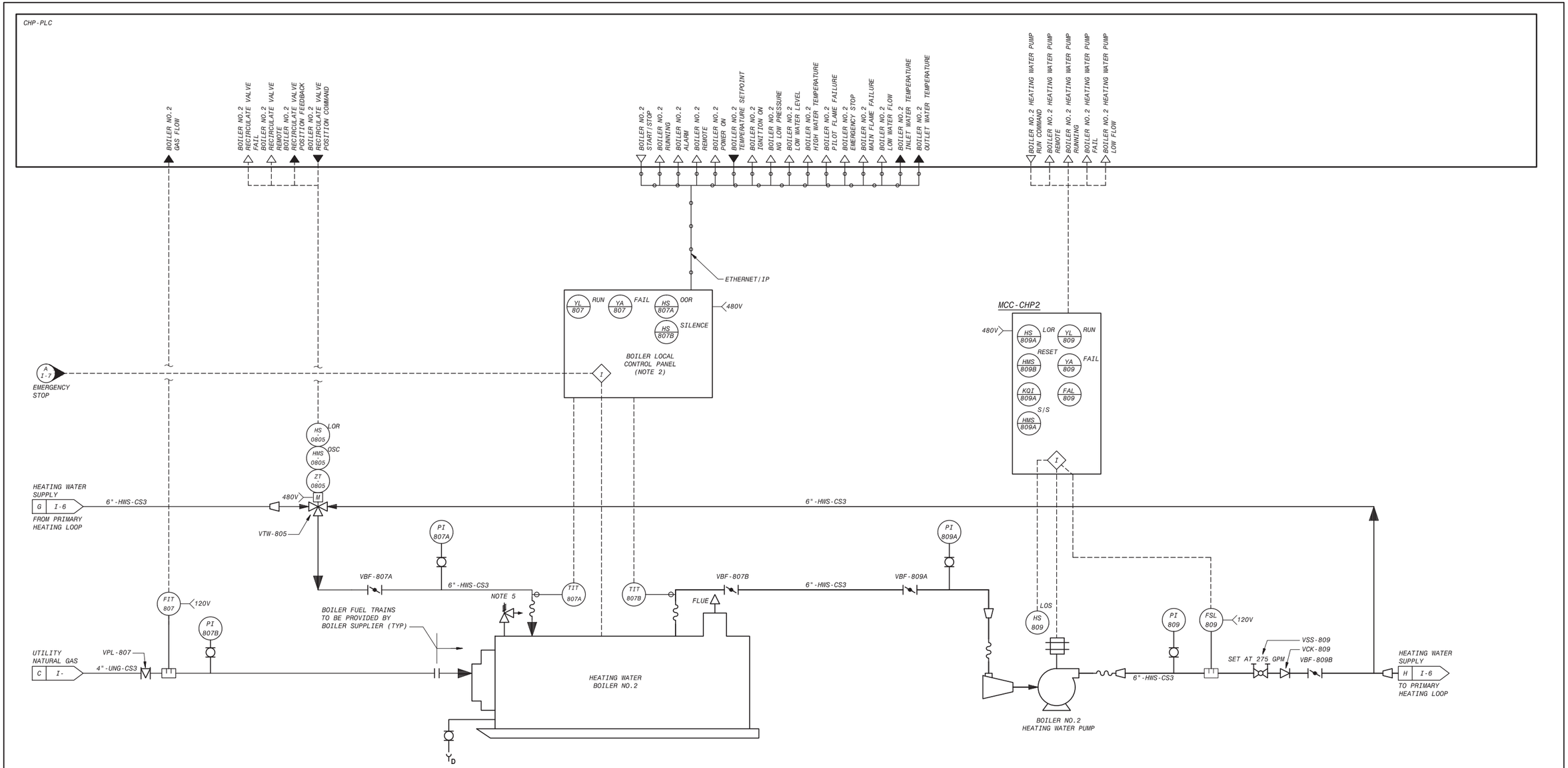

NOTES

1. SEE LEGEND ON DRAWINGS I-1 AND I-2.
2. LOCAL CONTROL DEVICES SUCH AS INDICATING LIGHTS AND SWITCHES LOCATED AT MCC OR AT EQUIPMENT MAY NOT BE SHOWN ON THIS P&ID. SEE SPECIFICATION 15525 FOR FURTHER INFORMATION.
3. BOILER FUEL TRAINS BY BOILER SUPPLIER.
4. FUEL TRAINS SHALL REQUIRE MULTIPLE VENTS TO OUTSIDE. PROVIDE VENT CAPS ON VENT DISCHARGE. VENT SHALL NOT BE MANIFOLDED TOGETHER.
5. RELIEF VALVE(S) PROVIDED BY BOILER SUPPLIER AND SHALL BE PIPED TO FLOOR.
6. ALL BUTTERFLY VALVES ON THIS P&ID ARE INDUSTRIAL BUTTERFLY VALVES.
7. ALL ABOVE GROUND HWS AND HWR PIPING SHALL BE INSULATED AND LAGGED AS SPECIFIED IN SPECIFICATION SECTION 15250.

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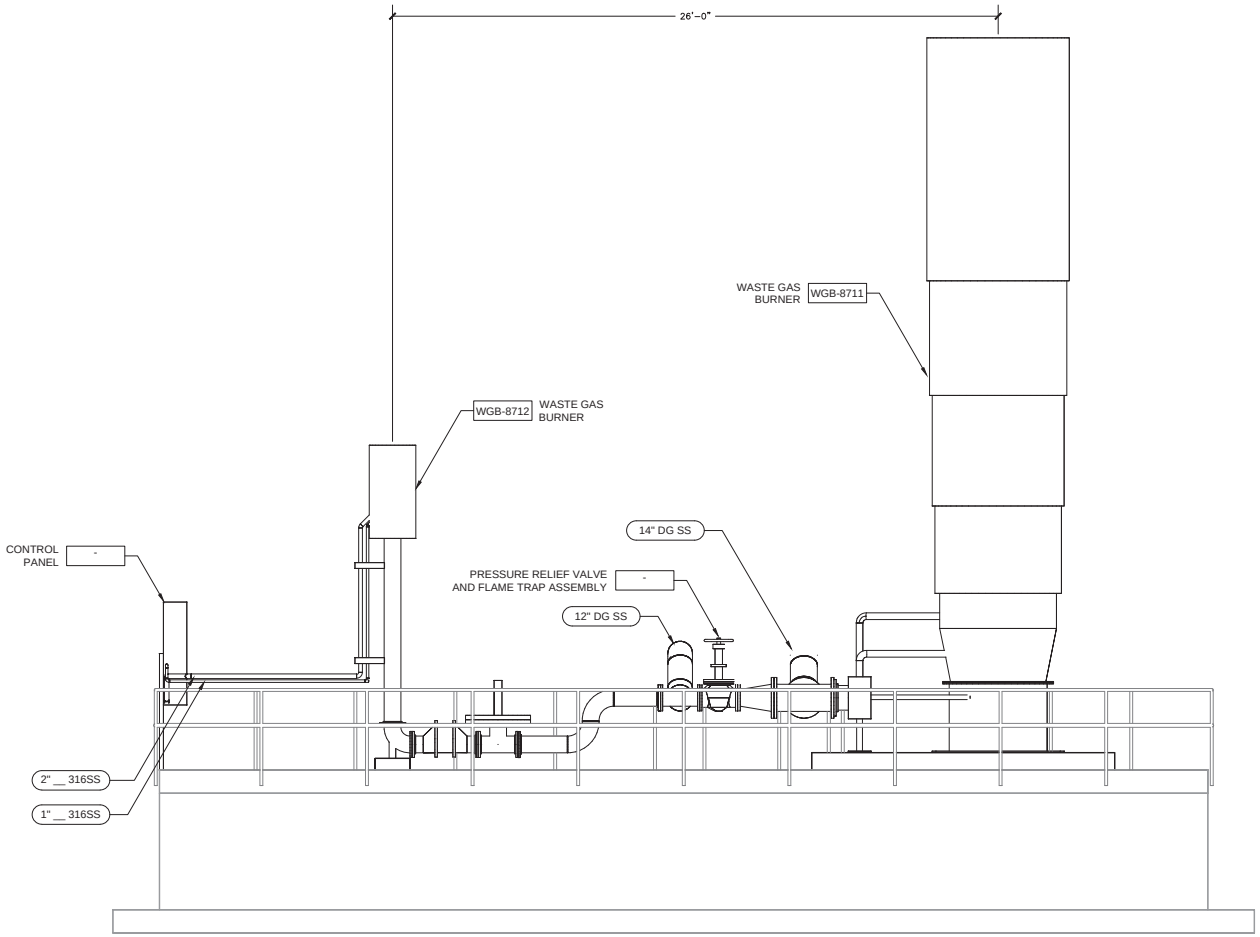

SECTION 1 / M-87-11

SCALE: 1/2"=1'-0"

Brown AND Caldwell TAMPA, FLORIDA	LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)	EXTERNAL REFERENCE FILES: 144490-TBK-0000-01.dwg; X-87M01-ZP-EQPM-BC.dwg; X-87M01-ZP-PIPE.dwg; X-87S01-ZP-STRC-BC.dwg; X-80M02-ZP-PIPE.dwg
SUBMITTED: _____ PROJECT MANAGER DATE	DESIGNED: B ELEAZER	
APPROVED: _____ BROWN AND CALDWELL DATE	DRAWN: A LAMBERT	
DECEMBER 2013	CHECKED: B ELEAZER	
	CHECKED: T.BOSSO	
	APPROVED: T.BOSSO	

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3800 54th AVE. S
St. PETERSBURG, FL. 33711

BIOSOLIDS TO ENERGY

MECHANICAL

DIGESTER GAS BURNER AND FLARE ELEVATION

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CLIENT PROJECT NUMBER	----
DRAWING NUMBER	M-87-31
SHEET NUMBER OF	

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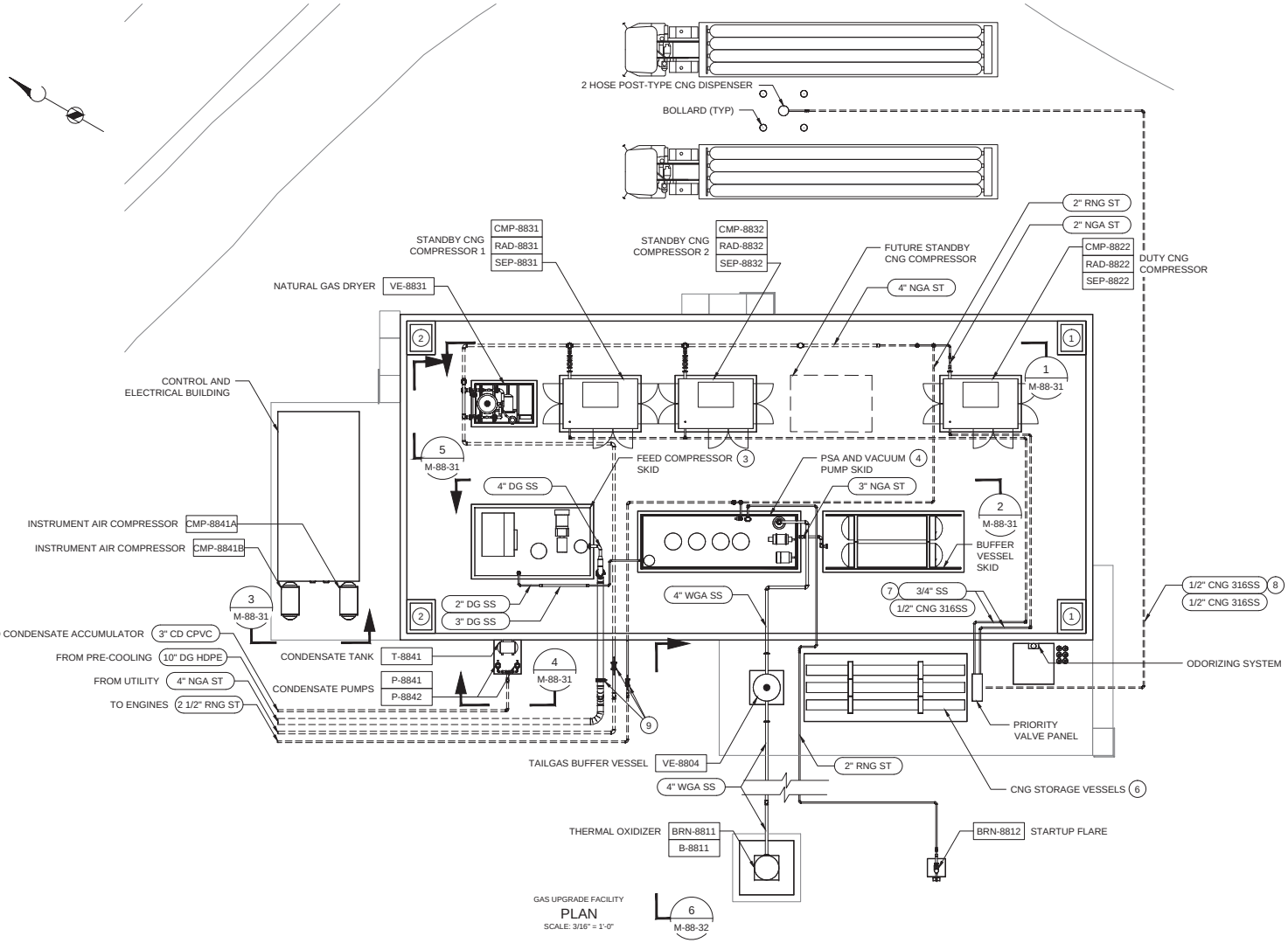

GENERAL NOTES:

1. MECHANICAL LAYOUT IS REPRESENTATIVE ONLY. MECHANICAL FOR CONSTRUCTION IS BY DESIGN BUILDER.
2. SLOPE ABOVE GRADE DIGESTER GAS PIPE AT 1.5% MINIMUM.
3. SLOPE BELOW GRAD DIGESTER GAS PIPE AT 4% MINIMUM.
4. PROVIDE 15'-0" SET BACK FROM DRIVE TO ELEVATED EQUIPMENT AREA.
5. PROVIDE 50'-0" SET BACK BETWEEN GAS SOURCE AND THERMAL OXIDIZER AND STARTUP FLARE.

KEY NOTES:

(1) EXHAUST AIR FANS WITH EXHAUST SILENCERS AND ENCLOSURES. EQUIPMENT TAG NUMBERS ARE LISTED BELOW:
- F-8842A
- F-8842B

(2) SUPPLY AIR FAN WITH INLET SILENCER AND ENCLOSURE. EQUIPMENT TAG NUMBERS ARE LISTED BELOW:
- F-8841A
- F-8841B

(3) FEED COMPRESSOR SKID INCLUDES THE FOLLOW EQUIPMENT:
- SEP-8801-1: FEED INLET SEPARATOR
- SEP-8801-2: COMPRESSOR DISCHARGE SEPARATOR
- SEP-8801-3: FEED DISCHARGE SEPARATOR
- CMP-8801: FEED COMPRESSOR
- RAD-8801: GAS/OIL COOLER
- HEX-8801-1: FEED HEAT EXCHANGER

(4) PSA AND VACUUM PUMP SKID INCLUDES THE FOLLOWING EQUIPMENT:
- SEP-8802-1: PSA SEPARATOR
- SEP-8802-2: TAIL GAS SEPARATOR
- VE-8802-1: PSA VESSEL 1
- VE-8802-2: PSA VESSEL 2
- VE-8802-3: PSA VESSEL 3
- B-8801: VACUUM PUMP
- RAD-8802: TAIL GAS COOLER

(5) BUFFER VESSEL SKID INCLUDES THE FOLLOWING EQUIPMENT:
- VE-8803-1: BUFFER VESSEL 1
- VE-8803-2: BUFFER VESSEL 2
- VE-8803-3: BUFFER VESSEL 3
- VE-8803-4: BUFFER VESSEL 4
- VE-8803-5: BUFFER VESSEL 5

(6) CNG STORAGE VESSELS INCLUDES THE FOLLOWING EQUIPMENT:
- VE-8823-1: CNG STORAGE VESSEL 1
- VE-8823-2: CNG STORAGE VESSEL 2
- VE-8823-3: CNG STORAGE VESSEL 3
- VE-8823-4: CNG STORAGE VESSEL 4
- VE-8823-5: CNG STORAGE VESSEL 5
- VE-8823-6: CNG STORAGE VESSEL 6
- VE-8823-7: CNG STORAGE VESSEL 7
- VE-8823-8: CNG STORAGE VESSEL 8
- VE-8823-9: CNG STORAGE VESSEL 9

(7) 3/4"x0.109" SS AND 1/2" CNG 316SS IN A 2" HDPE SLEEVE.

(8) (2) 1/2" CNG 316SS PIPES IN 2" HDPE SLEEVE.

(9) GAS SHUT OFF VALVES.

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TAMPA, FLORIDA

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DECEMBER 2013

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:	E JACOBSON
DRAWN:	A LAMBERT
CHECKED:	B ELEAZER
CHECKED:	E JACOBSON
APPROVED:	T BOSSO

EXTERNAL REFERENCE FILES
144490-TBK-0000-01.dwg
X-C-DESIGN.dwg
X-C-EXISTING.dwg
X-C-PIPING-NEW.DWG
X-88M01-ZP-PIPE.dwg
X-88S01-ZP-STRC-BC.dwg
X-88M01-ZP-EQPM.dwg

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BIOSOLIDS TO ENERGY

MECHANICAL

BIOGAS UPGRADE SYSTEM AND CNG FACILITY PLAN

FILENAME: 144490-M-88-11.dwg
BC PROJECT NUMBER: 144490
CLIENT PROJECT NUMBER: ----
DRAWING NUMBER: M-88-11
SHEET NUMBER: ---- OF

Dec 06, 2013 - 11:17pm
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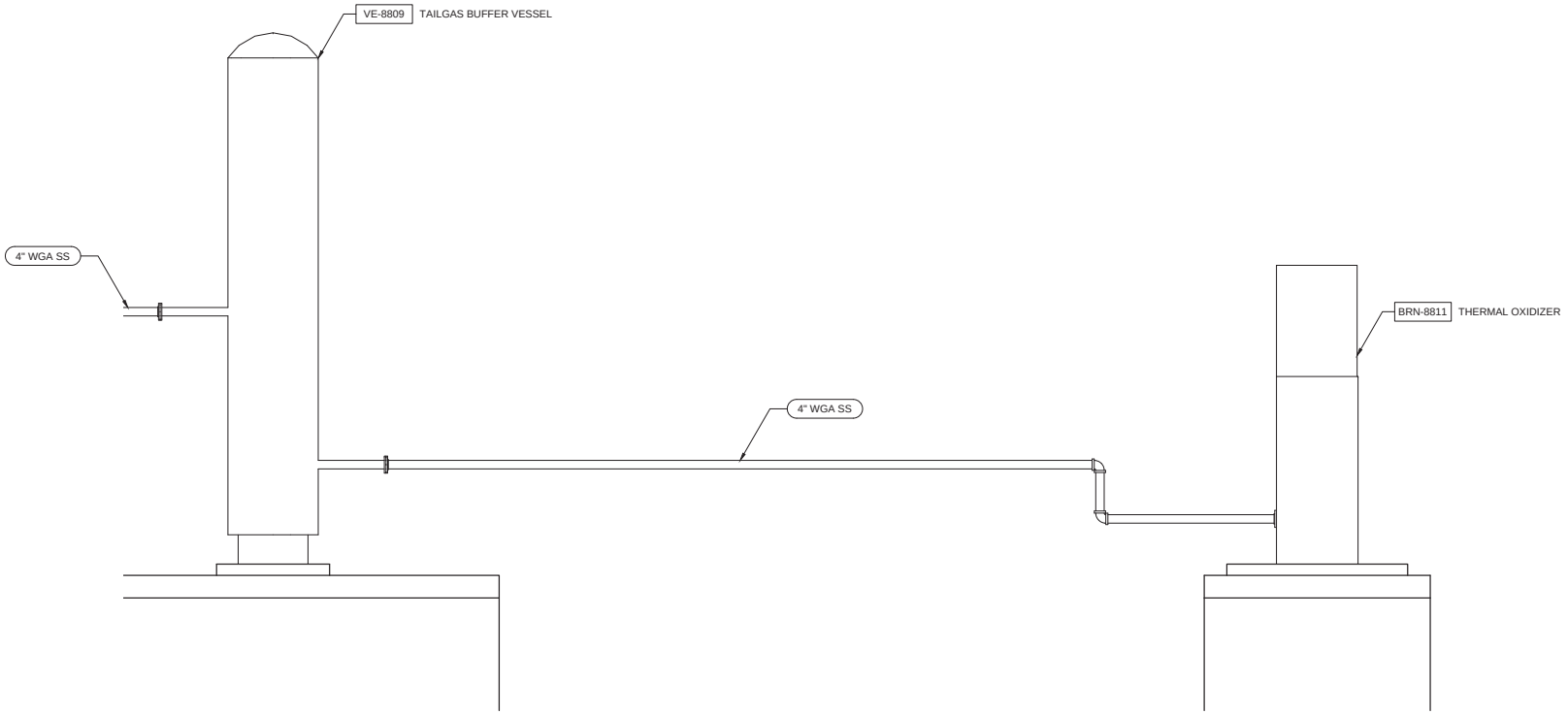

SECTION 6 / M-88-11

SCALE: 3/8"=1'-0"

Brown AND Caldwell TAMPA, FLORIDA	LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)	EXTERNAL REFERENCE FILES: 144490-TBK-0000-01.dwg; X-BIM00-ZP-SECT-BC.dwg
SUBMITTED: _____ PROJECT MANAGER DATE	DESIGNED: B ELEAZER	60% SUBMITTAL
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	CHECKED: T.BOSSO	
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BIOSOLIDS TO ENERGY

MECHANICAL

BIOGAS UPGRADE SYSTEM AND CNG FACILITY SECTION 2

FILENAME	144490-M-88-32.dwg
BC PROJECT NUMBER	144490
CLIENT PROJECT NUMBER	----
DRAWING NUMBER	M-88-32
SHEET NUMBER	---- OF

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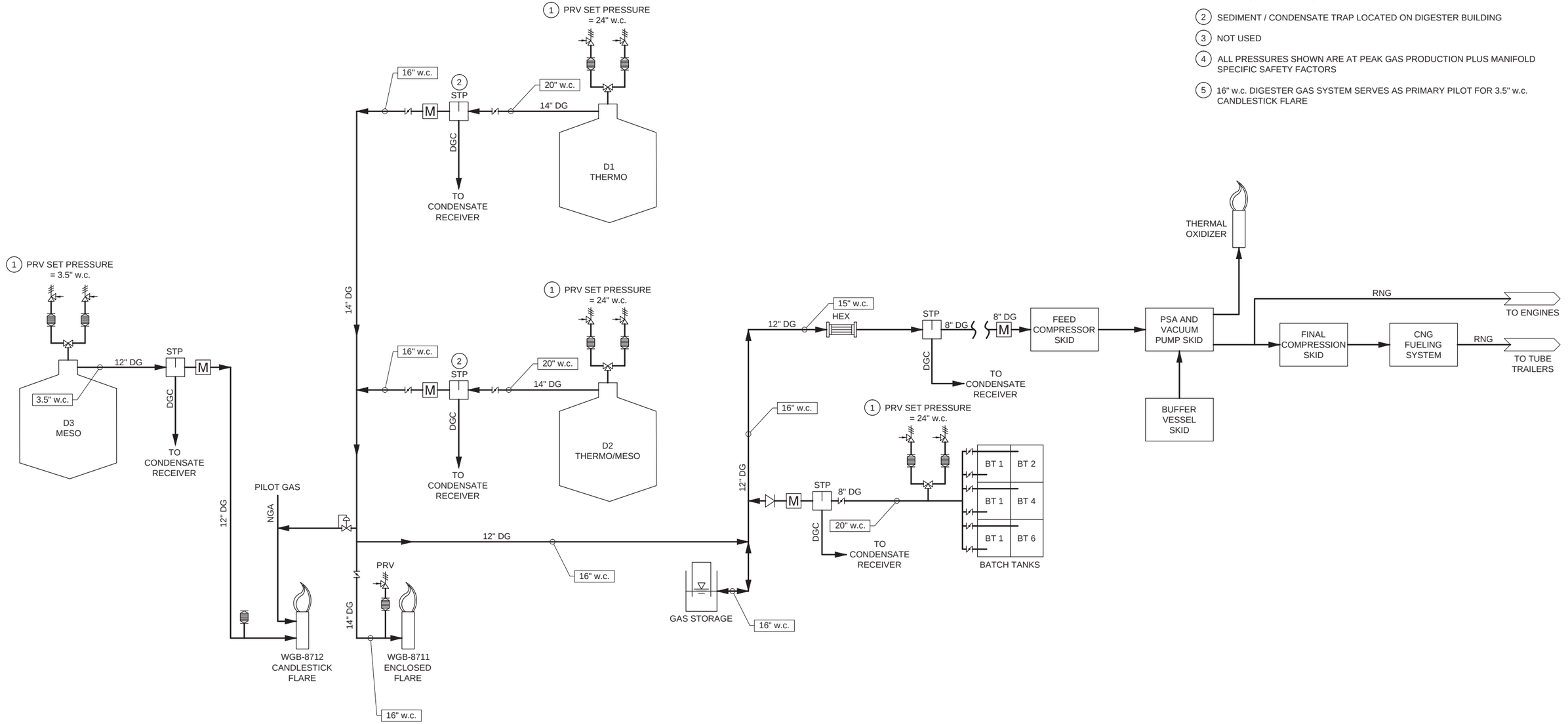
GENERAL NOTES:

1. REFER TO M-DRAWINGS FOR ADDITIONAL DETAIL REGARDING THE GAS TREATMENT SYSTEM.
2. FOR DIGESTER 1, DIGESTER 2 AND BATCH TANKS:
   a. SYSTEM TARGET OPERATING PRESSURE = 16" w.c.
   b. PRV SET PRESSURE RELIEF = 24" w.c.
   c. STRUCTURAL DESIGN PRESSURE = 36" w.c.

KEY NOTES:

1. COMBINATION VACUUM / PRESSURE RELIEF VALVE / FLAME ARRESTOR, DOUBLE ARRANGEMENT WITH 3-WAY VALVE
2. SEDIMENT / CONDENSATE TRAP LOCATED ON DIGESTER BUILDING
3. NOT USED
4. ALL PRESSURES SHOWN ARE AT PEAK GAS PRODUCTION PLUS MANIFOLD SPECIFIC SAFETY FACTORS
5. 16" w.c. DIGESTER GAS SYSTEM SERVES AS PRIMARY PILOT FOR 3.5" w.c. CANDLESTICK FLARE



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DECEMBER 2013

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

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DRAWN:	T DIMICELI
CHECKED:	B ELEAZER
CHECKED:	T BOSSO
APPROVED:	T BOSSO

EXTERNAL REFERENCE FILES
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BIOSOLIDS TO ENERGY

GENERAL

GAS PROCESS SCHEMATIC

FILENAME 144490-G-00-32.dwg
BC PROJECT NUMBER 144490
CLIENT PROJECT NUMBER ----
DRAWING NUMBER G-00-32
SHEET NUMBER ---- OF

Dec 04, 2013 - 11:03pm
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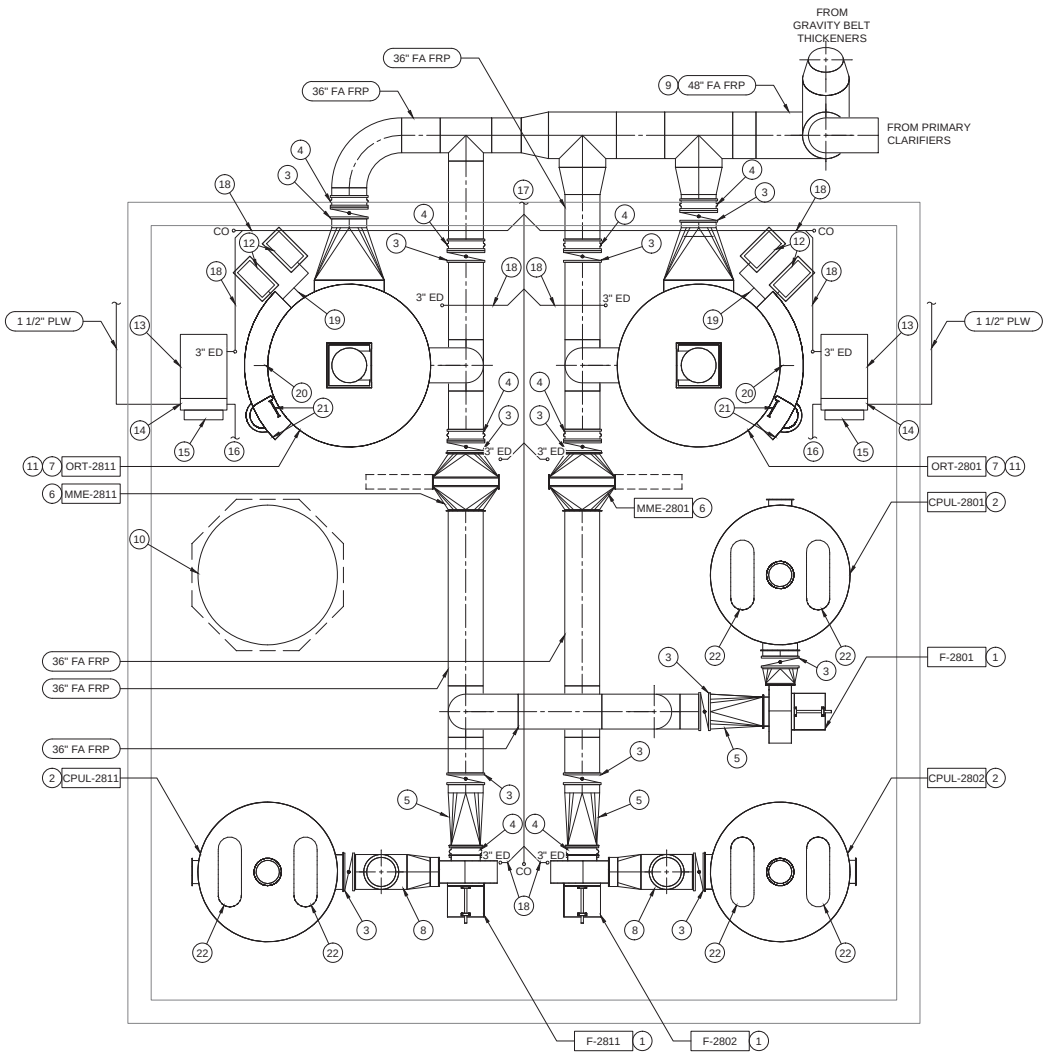

ODOR CONTROL
PLAN AT 152.00'
SCALE: 3/16" = 1'-0"

KEY NOTES:

1. ODOR CONTROL UNIT FAN.
2. 12'Ø, 12000 CFM DUAL BED CARBON UNIT.
3. 36" DAMPER.
4. 36" FLEXIBLE COUPLING.
5. 36"x30" REDUCER.
6. 36" MIST ELIMINATOR.
7. 14'Ø BIOTRICKLING FILTER.
8. 30"x30" TEE.
9. 48" ODOROUS AIR DUCT FROM PRIMARY CLARIFIERS AND SPLITTER BOX.
10. 12'-0" Ø CARBON VESSEL IF REQUIRED FOR DEWATERING BUILDING ODOR CONTROL.
11. ACCESS PLATFORM LOCATED HIGH.
12. CHEMICAL RECIRCULATION PUMP.
13. NUTRIENT TANK AND PUMP.
14. WATER CONTROL UNIT PANEL.
15. WATER CONTROL UNIT ELECTRICAL PANEL.
16. FIELD ROUTE 1-1/2" PLW TO BIOTRICKLING FILTER MAKE UP WATER CONNECTION.
17. 3" CD TO LIFT STATION 2.
18. 2" CD.
19. FIELD ROUTE 3" CHEMICAL RECIRCULATION PIPING TO SPRAY HEADER.
20. SPRAY HEADER.
21. CAGED LADDER AND WALKWAY PLATFORM SHALL BE PROVIDED BY THE ODOR CONTROL EQUIPMENT MANUFACTURER.
22. 24" DISCHARGE WITH GOOSENECK

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DRAWN:	T DIMICELI
CHECKED:	B ELEAZER
CHECKED:	D SHAH
APPROVED:	T BOSSO

EXTERNAL REFERENCE FILES
144490-TBK-0000-01.dwg
X-28M01-ZP-PIPE.dwg
X-28S01-ZP-STRC.dwg
X-28M01-ZP-EQPM.dwg

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BIOSOLIDS TO ENERGY

MECHANICAL

ODOR CONTROL SYSTEM PLAN

FILENAME	144490-M-28-11.dwg
BC PROJECT NUMBER	144490
CLIENT PROJECT NUMBER	----
DRAWING NUMBER	M-28-11
SHEET NUMBER	---- OF ----

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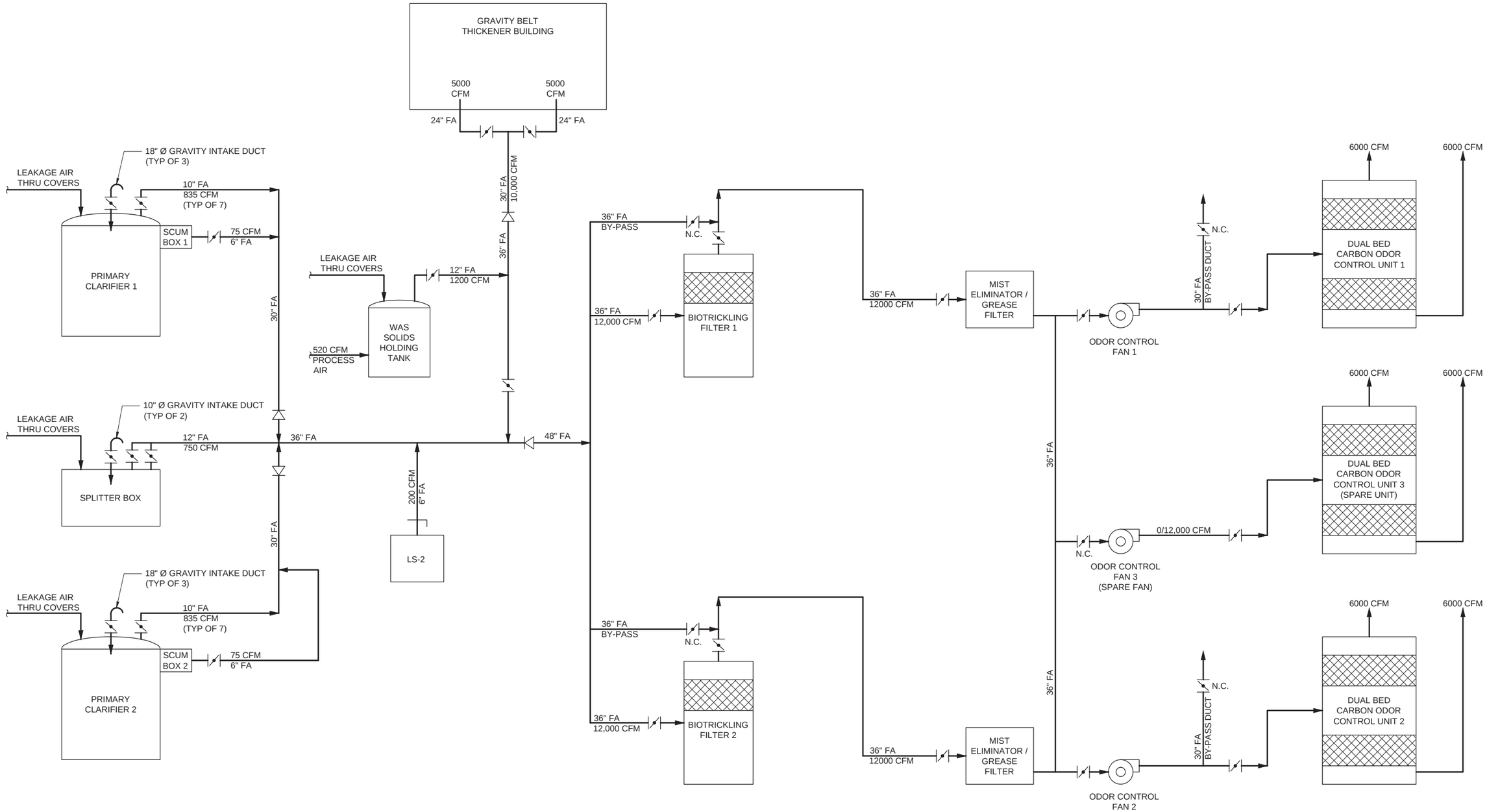

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LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:	D SHAH
DRAWN:	T DIMICELI
CHECKED:	B ELEAZER
CHECKED:	T BOSSO
APPROVED:	T BOSSO

EXTERNAL REFERENCE FILES
144490-TBK-0000-01.dwg

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BIOSOLIDS TO ENERGY

GENERAL

FOUL AIR PROCESS SCHEMATIC

FILENAME 144490-G-00-33.dwg
BC PROJECT NUMBER 144490
CLIENT PROJECT NUMBER ----
DRAWING NUMBER G-00-33
SHEET NUMBER ---- OF

Dec 04, 2013 - 11:03pm
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Appendix D. Basis Documents

This appendix provides the following documents:

- Manufacturer's Data
    - Natural Gas Engine Generators
    - Emergency Diesel Engine Generators
    - Primary Heating Water System Boilers
- Design Specifications
    - Flares
    - Carbon Scrubbers

Model: C1100 N6C
Frequency: 60 Hz
Fuel Type: Natural Gas MI 82 +
Emissions NOx: 1.0 g/hp-h
LT Water Inlet Temp: 40°C (104°F)
HT Water Outlet Temp: 90°C (194°F)

Generator set data sheet
1100 kW continuous

Our energy working for you.™

Power Generation

Measured Sound Performance Data Sheet:	MSP-1068
Prototype Test Summary Data:	PTS-288
Generator Set Outline Drawing:	A029E093 Heavy Duty Air Cleaner A029U550 Standard Air Cleaner

Fuel Consumption (ISO3046/1)	**100% Load**	**90% Load**	**75% Load**	**50% Load**
Fuel Consumption (LHV) ISO3046/1, kW (MMBTU/hr) [1,2,3,4,6]	2533 (8.65)	2297 (7.84)	1954 (6.67)	1373 (4.69)
Mechanical Efficiency ISO3046/1, percent [1,3,4,6]	44.7%	44.3%	43.4%	41.3%
Electrical Efficiency ISO3046/1, percent [1,2,3,4,6]	43.4%	43.1%	42.2%	40.1%

Engine	
Engine Manufacturer	Cummins
Engine Model	QSK60G
Configuration	V16
Displacement, L (cu.in)	60 (3671)
Aspiration	Turbocharged (1)
Gross Engine Power Output, kWm (hp)	1132 (1517)
BMEP, bar (psi)	19 (276)
Bore, mm (in)	159 (6.26)
Stroke, mm (in)	190 (7.48)
Rated Speed, rpm	1200
Piston Speed, m/s (ft/min)	7.6 (1496)
Compression Ratio	13.7:1
Lube Oil Capacity, L (qt)	380 (400)
Overspeed Limit, rpm	1500
Regenerative Power, kW	N/A
Full Load Lubricating oil consumption, g/kWe-hr (g/hp-hr)	0.15 (0.12)

Fuel System	
Gas supply pressure to engine inlet, bar (psi) [8]	0.2 (2.9)
Minimum Methane Index	82

Engine Electrical System(s)	
Electric starter voltage, volts	24
Ignition timing, deg before top dead center	20
Minimum battery capacity @ 40 deg.C (104 deg.F), AH	720

Genset Dimensions	
Genset Length, m (ft) [5]	5.12 (16.8)
Genset Width, m (ft) [5]	2.23 (7.30)
Genset Height, m (ft) [5]	2.77 (9.08)
Genset Weight (wet), kg (lbs) [5]	15625 (34,375)

Notes:

1.At ISO3046 reference conditions, altitude 1013 mbar (30in Hg), air inlet temperature 25°C (77°F)
2. Power output and efficiency include the effect of Cummins supplied engine driven LT coolant pump
3. At electrical output of 1.0 Power Factor
4. Based on pipeline natural gas with LHV of 33.44mJ/Nm^3 (905 BTU/ft^3)
5. Subtract 3°C ambient temperature capability for each 100 mm (4 in) H_2O back pressure above the information shown on page 2.
6. Weights and dimensions represent a generator set with its standard features only. See outline drawing for other configurations.
7. According to ISO 3046/1 with fuel consumption tolerance of +5% -0%
8. Minimum gas supply pressure dependant on LHV of fuel

Energy Data	100% Load	90% Load	75% Load	50% Load
Continuous Generator Electrical Output kWe [1,5,6,7]	1100	990	825	550
Continuous Shaft Power, kWm (bhp) [1,5,6,7]	1132 (1517)	1017 (1363)	848 (1137)	567 (760)
Total Heat Rejected in LT Circuit, kW (MMBTU/h) [2]	85 (0.29)	77 (0.26)	63 (0.21)	47 (0.16)
Total Heat Rejected in HT Circuit, kW (MMBTU/h) [2]	526 (1.79)	469 (1.6)	386 (1.32)	244 (0.83)
Unburnt, kW (MMBTU/h) [2]	73 (0.25)	66 (0.23)	56 (0.19)	38 (0.13)
Heat Radiated to Ambient, kW (MMBTU/h) [2]	164 (0.56)	146 (0.5)	124 (0.42)	88 (0.3)
Available Exhaust heat to 105C, kW (MMBTU/h) [2]	523 (1.78)	486 (1.66)	427 (1.46)	311 (1.06)
Intake Air Flow				
Intake Air Flow Mass, kg/s (lb/hr) [2]	1.58 (12510)	1.42 (11250)	1.18 (9350)	0.79 (6260)
Intake Air Flow Volume, m3/s @ 0°C (scfm) [2]	1.22 (2720)	1.1 (2460)	0.91 (2030)	0.61 (1360)
Maximum inlet restriction (after filter, limit for changing filters), below 35°C ambient temp, mm HG, (in H_2O)	28 (15)	22.7 (12.1)	15.7 (8.4)	7 (3.7)
Maximum inlet restriction (after filter, limit for changing filters), above 35°C ambient temp, mm HG, (in H_2O)	18.7 (10)	15.2 (8.1)	10.5 (5.6)	0 (2.5)
Exhaust Air Flow				
Exhaust Gas Flow Mass, kg/s (lb/hr) [2]	1.64 (12990)	1.47 (11640)	1.22 (9660)	0.82 (6490)
Exhaust Gas Flow Volume, m3/s (cfm) [2]	3.14 (6650)	2.86 (6060)	2.44 (5170)	1.7 (3600)
Exhaust Temperature After Turbine, °C (°F) [1]	403 (757)	414 (777)	432 (810)	460 (860)
Max Exhaust System Back Pressure, mmHG (in H_2O) [8]	38 (20)	31 (17)	21 (11)	10 (5)
HT Cooling Circuit				
HT Circuit Engine Coolant Volume, l (gal)	181 (48)	181 (48)	181 (48)	181 (48)
HT Coolant Flow @ Max Ext Restriction, m^3/h (gal/min)	63 (277)	63 (277)	63 (277)	63 (277)
Max HT Engine Coolant Inlet Temp, °C (°F) Reference [3]	81 (178)	82 (180)	83 (181)	85 (185)
HT Coolant Outlet Temp, °C (°F) [3]	90 (194)	90 (194)	90 (194)	90 (194)
Max Pressure Drop in External HT Circuit, bar (psig)	1.4 (20)	1.4 (20)	1.4 (20)	1.4 (20)
HT Circuit Maximum Pressure, bar (psig)	5 (73)	5 (73)	5 (73)	5 (73)
Static Head Pump Inlet, bar (psig)	.5-1.5 (7-20)	.5-1.5 (7-20)	.5-1.5 (7-20)	.5-1.5 (7-20)
LT Cooling Circuit				
LT Circuit Engine Coolant Volume, l (gal)	34 (9)	34 (9)	34 (9)	34 (9)
LT Coolant Flow @ Max Ext Restriction, m^3/h (gal/min)	17 (75)	17 (75)	17 (75)	17 (75)
LT Coolant Inlet Temp, Thermostat Controlled °C (°F) [4]	40 (104)	40 (104)	40 (104)	40 (104)
LT Coolant Inlet Temperature Maximum [4]	50 (122)	52 (126)	56 (133)	63 (145)
Max Pressure Drop in External LT Circuit, bar (psig)	1 (15)	1 (15)	1 (15)	1 (15)
LT Circuit Maximum Pressure, bar (psig)	5 (73)	5 (73)	5 (73)	5 (73)
Static Head Pump Inlet, bar (psig)	.5-1.5 (7-20)	.5-1.5 (7-20)	.5-1.5 (7-20)	.5-1.5 (7-20)

Notes:

1. At ISO3046 reference conditions, altitude 1013 mbar (30in Hg), air inlet temperature 25°C (77°F)
2. Production variation/tolerance ±5%
3. Outlet temperature controlled by thermostat. Inlet temperature for reference only.
4. Inlet temperature controlled by thermostat to 40 °C but is allowed to go to 50 °C and ignition timing is retarded resulting in efficiency loss of 0.4 - 0.6%.
5. Power output and efficiency include the effect of Cummins supplied engine driven LT coolant pump
6. At electrical output of 1.0 Power Factor
7. Based on pipeline natural gas with LHV of 33.44mJ/Nm ^{3} (905 BTU/ft^3)
8. Subtract 3 °C ambient temperature capability for each 100 mm (4 in) H_2O back pressure above the information shown on page 2.

Altitude and Temperature Derate Multiplication Factor [1.2.3]

Barometer		Altitude		Table A								
In Hg	mbar	Feet	Meters	Derate Multiplier for all operation modes								
20.7	701	9843	3000	0.75	0.75	0.75	0.75	0.71	0.68	0.61	0.53	-
21.4	723	9022	2750	0.79	0.79	0.79	0.78	0.73	0.70	0.63	0.54	-
22.1	747	8202	2500	0.82	0.82	0.82	0.81	0.76	0.72	0.64	0.55	-
22.8	771	7382	2250	0.86	0.86	0.86	0.84	0.80	0.74	0.65	0.55	-
23.5	795	6562	2000	0.89	0.89	0.89	0.88	0.83	0.78	0.67	0.56	-
24.3	820	5741	1750	0.93	0.93	0.93	0.91	0.86	0.81	0.68	0.56	-
25.0	846	4921	1500	0.96	0.96	0.96	0.94	0.90	0.85	0.69	0.57	-
25.8	872	4101	1250	1.00	1.00	1.00	0.97	0.93	0.89	0.71	0.57	-
26.6	899	3281	1000	1.00	1.00	1.00	1.00	0.97	0.93	0.72	0.58	-
27.4	926	2461	750	1.00	1.00	1.00	1.00	1.00	0.96	0.74	0.58	-
28.3	954	1640	500	1.00	1.00	1.00	1.00	1.00	1.00	0.75	0.59	-
29.1	983	820	250	1.00	1.00	1.00	1.00	1.00	1.00	0.75	0.59	-
29.5	995	492	150	1.00	1.00	1.00	1.00	1.00	1.00	0.75	0.59	-
30.0	1012	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.75	0.59	-
Air Filter Inlet Temperature			**°C**	**0**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
			°F	**32**	**59**	**68**	**77**	**86**	**95**	**104**	**113**	**122**

Methane Number vs LT Temp - Table C [4]

		LT Return Temperature		
		40°C	**45°C**	**50°C**
Methane Number	**92**			
	87			
	82			
	77			
	72			

Methane Number Capability Table B

Load (Percent of Rated)			
100%	90%	75%	50%
82	75	60	60

Table D Altitude and AmbientHeat Rejection Factor adjustment for HT and LT Circuits

LT & HT Circuit Heat Rejection Calculation Procedure

1. Determine derate multiplier vs. temp derate from Table A.
2. Using the multipliere from #1 above as the percent load factor, determine the heat rejection
3. From table D find the HT and LT circuit multiplier
4. Multiply the result of step 2 by the result of step 3 to obtain the heat rejection at your altitude and temperature.

Barometer		Altitude										
In Hg	mbar	Feet	Meters	Multiplier for HT & LT Heat Rejection vs Alt & Temp.								
20.7	701	9843	3000	1.06	1.10	1.11	1.13	1.14	1.15	1.17	1.18	1.19
21.4	723	9022	2750	1.05	1.09	1.10	1.12	1.13	1.14	1.15	1.17	1.18
22.1	747	8202	2500	1.04	1.08	1.09	1.10	1.12	1.13	1.14	1.16	1.17
22.8	771	7382	2250	1.03	1.07	1.08	1.09	1.11	1.12	1.13	1.14	1.16
23.5	795	6562	2000	1.02	1.06	1.07	1.08	1.09	1.11	1.12	1.13	1.15
24.3	820	5741	1750	1.01	1.04	1.06	1.07	1.08	1.10	1.11	1.12	1.14
25.0	846	4921	1500	0.99	1.03	1.05	1.06	1.07	1.09	1.10	1.11	1.12
25.8	872	4101	1250	0.98	1.02	1.04	1.05	1.06	1.07	1.09	1.10	1.11
26.6	899	3281	1000	0.97	1.01	1.02	1.04	1.05	1.06	1.08	1.09	1.10
27.4	926	2461	750	0.96	1.00	1.01	1.03	1.04	1.05	1.07	1.08	1.09
28.3	954	1640	500	0.95	0.99	1.00	1.02	1.03	1.04	1.05	1.07	1.08
29.1	983	820	250	0.94	0.98	0.99	1.00	1.02	1.03	1.04	1.06	1.07
29.5	995	492	150	0.94	0.97	0.99	1.00	1.01	1.03	1.04	1.05	1.06
30.0	1012	0	0	0.93	0.97	0.98	0.99	1.01	1.02	1.03	1.05	1.06
Air Filter Inlet Temperature			**°C**	**0**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
			°F	**32**	**59**	**68**	**77**	**86**	**95**	**104**	**113**	**122**

Notes:

1. Ambient temperature is the same as air filter inlet temperature. LT inlet temperature is 40 °C, or 10°C above ambient, whichever is higher.

2. Table refers to the capability to run at continuous power level. For short periods of time the genset can run at 5 °C higher temperature with reduced efficiency.

3. Subtract 3°C ambient temperature capability for each 100 mm (4 in) H_2O back pressure above the information shown on page 2.

4.This generator set is capable of operating for short periods of time under with the LT temperature and/or the fuel methane number outside of the recommended limits with decreased performance. Operation in the green area will result in normal performance. Operation in the yellow area is recommended only for short periods of time and will result in reduced efficiency and shorter spark plug life. Operation in the red area is NOT recommended.

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Alternator Data

Voltage Range	Connection Configuration	Temp Rise Degrees C	Duty Cycle[4]	Single Phase	Max Surge kVA [5]	Alternator Data Sheet	Feature Code
380-480	Wye, 3 Phase	80	C	N/A	See Note 7	N/A	B830-2
416-480	Wye, 3 Phase	105	C	N/A	5202	539	B627-2
600	Wye, 3 Phase	80	C	N/A	3459	N/A	B582-2
4160	Wye, 3 Phase	80	C	N/A	3875	N/A	B590-2
4160	Wye, 3 Phase	105	C	N/A	3500	N/A	B834-2
12470-13800	Wye, 3 Phase	80	C	N/A	4750	N/A	B591-2

Continuous Rating Definition

Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO8528, ISO3046, AS2789, DIN6271, and BS5514). This rating is not applicable to all generator set models.

Emissions	100% Load	90% Load	75% Load	50% Load
NO_x Emissions dry, ppm [1]	178	186	180	197
NO_x Emissions mg/Nm^3 @ 5% O_2, (g/hp-h) [1]	500 (1)	500 (1)	500 (1)	500 (1.1)
THC Emissions wet, ppm [2]	1536	1571	1601	1635
THC Exhaust Emissions, mg/Nm^3 @ 5% O_2, (g/hp-h) [2]	1720 (3.3)	1750 (3.4)	1750 (3.4)	1720 (3.5)
NMHC Emissions wet, ppm [2,3]	230	236	240	245
NMHC Exhaust Emissions, mg/Nm^3 @ 5% O_2, (g/hp-h) [2,3]	260 (0.5)	260 (0.5)	260 (0.5)	260 (0.5)
HCHO Emissions (wet), ppm [6]	70	70	70	70
HCHO Exhaust Emissions, mg/Nm^3 @ 5% O_2, (g/hp-h) [6]	150 (0.28)	150 (0.28)	140 (0.28)	140 (0.28)
CO Emissions (dry), ppm [2]	469	470	466	466
CO Emissions Rate, mg/Nm3 [2] @ 5% O_2, (g/hp-h)	810 (1.6)	810 (1.6)	790 (1.5)	750 (1.5)
CO2 Emisions (dry), percent [1]	6.4	6.4	6.5	6.9
O2 Emissions (dry), percent [2]	9.5	9.4	9.2	8.6
Particulates PM10, g/hp-h [2]	< 0.03	< 0.03	< 0.03	< 0.03

Notes

1. Production variation/tolerance ±5%
2. Tolerance +/- 15%.
3. NMHC emission are an estimate. Actual NMHC emsisions are a function of the non-methane hydrocarbons in the fuel.
4. Standby (S), Prime (P), Continuous (C) ratings.
5. Maximum rated starting kVA that results in minimum of 90% of rated sustained voltage during starting.
6. Tolerance +/- 35%.
7. Maximum Surge KVA or specific alterantor data can be obtained by request if not published.

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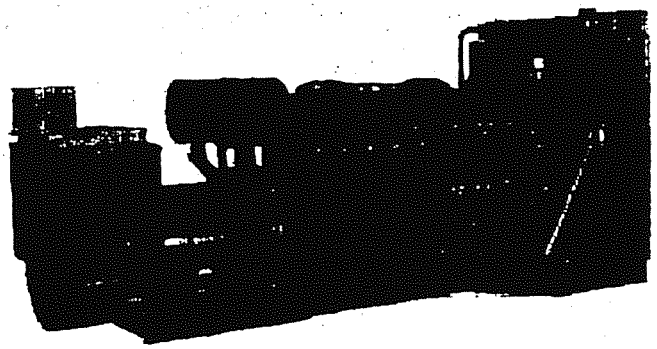
CATERPILLAR

Generator Set

3516B

1800 rpm
1825 kW 60 Hz

Prime Power



Shown with
Optional Equipment

CATERPILLAR® ENGINE SPECIFICATIONS

V-16, 4-Stroke-Cycle Watercooled Diesel
Bore — mm (in) 170 (6.7)
Stroke — mm (in) 190 (7.5)
Displacement — L (cu in) 69 (4210)
Compression ratio 14:1
Oil CF-4

CATERPILLAR ENGINE FACILITIES ISO 9001 CERTIFIED

FEATURES

- **CAT® DIESEL GENERATOR SETS**
  Factory designed, certified prototype tested with torsional analysis. Production tested and delivered to you in a package that is ready to be connected to your fuel and power lines. EPG Designer computer sizing available. Supported 100% by your Caterpillar dealer with warranty on parts and labor. Extended warranty available in some areas. The generator set was designed and manufactured in an ISO 9001 compliant facility. Generator set and components meet or exceed the following specifications: ABGSM TM3, AS1359, AS2789, BS4999, BS5000, BS5514, DIN6271, DIN6280, EGSA101P, IEC 34/1, ISO3046/1, ISO8528, JEM1359, NEMA MG1-22, VDE0530, 89/392/EEC, 89/336/EEC.
- **RELIABLE, FUEL EFFICIENT DIESEL**
  The compact, four-stroke-cycle diesel engine combines durability with minimum weight while providing dependability and economy. The fuel system operates on a variety of fuels.
- **CATERPILLAR® SR4B GENERATOR**
  Single bearing, wye connected, static regulated, brushless self excited generator designed to match the performance and output characteristics of the Caterpillar diesel engine that drives it.
- **EXCLUSIVE CATERPILLAR VOLTAGE REGULATOR**
  Three-phase sensing and Volts per Hertz regulation give precise control, excellent block loading, and constant voltage in the normal operating range.

CATERPILLAR® SR4B GENERATOR

Type ..... Brushless, revolving field, solid-state exciter
Construction ..... Single bearing, close coupled
Three phase ..... Wye connected
Insulation ..... Class H with tropicalization and antiabrasion
Enclosure ..... Drip proof IP 22
Alignment ..... Pilot shaft
Overspeed capability 150%
Wave form ..... Less than 5% deviation
Paralleling capability ..... standard with adjustable voltage droop
Voltage regulator ..... 3 phase sensing with Volts-per-Hertz
Voltage regulation ..... Less than ± 1/2%
Voltage gain ..... Adjustable to compensate for engine speed droop and line loss
TIF ..... Less than 50
THF ..... Less than 3%

CATERPILLAR CONTROL PANEL

24 Volt DC Control
Terminal box mounted
Vibration isolated
NEMA 1, IP 23 enclosure
Electrically dead front
Lockable hinged door
Generator instruments meet ANSI C-39-1

Voltages Available
60 Hz
380, 480, 600, and 4160
(Available a minimum of ±10%)
Other voltages available – consult your Caterpillar dealer.
Some voltages require derating.

CATERPILLAR®

3516B GENERATOR SET

STANDARD EQUIPMENT

Engine
Aftercooler
Air cleaner
regular duty
Breather, crankcase
Cooler, lubricating oil
Exhaust fitting and flange
Filters, right hand
fuel and lubricating oil
Flywheel housing
SAE No. 00
standard rotation
Fuel system
electronic controlled unit injectors
Governor
ADEM electronic control
Manifold, exhaust, dry
Oil pan, shallow
Pumps,
fuel transfer;
aftercooler water,
jacket water and
lubricating oil –
gear driven
Radiator
Rails, mounting
Shutoff, manual
Starting, electric,
24 Volt DC
Turbochargers
Vibration damper

Generator
SR4B brushless
permanent magnet excited with VR3 voltage regulator
Space heaters

ELECTRONIC MODULAR CONTROL PANEL (EMCP)
Standard generator controls and monitoring:
Ammeter/voltmeter
phase selector switch
Digital ammeter,
voltmeter, and
frequency meter
Voltage adjust rheostat
Standard engine controls and monitoring:
Automatic/manual
start-stop control
Engine control switch
for:
off/reset, auto start,
manual start, stop,
cooldown timer,
cycle cranking,
emergency stop
pushbutton
Safety shutoff protection and LED indicators for:
High coolant temp.
Low oil pressure
Overcrank
Overspeed
Emergency stop
pushbutton

PRIME POWER ATTACHMENTS

Engine
Air cleaners
Charging systems
Cooling systems
fan drives, radiators, fans, expansion tanks
Control systems
governor, Woodward 2301A load share
Exhaust system
fittings, elbows, flanges, muffler
Lube system
Mounting systems
Protection devices
Starting system

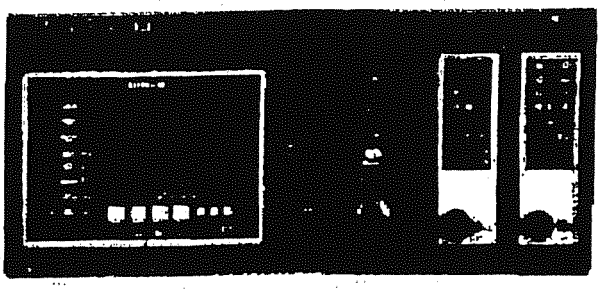
Generator
Oversized generators
Manual voltage control
RFI Filters –
N level (VDE 875), BS800, MIL Std 461B
Digital voltage regulator
2:1 volts per hertz VR3

Control Panel
Auxiliary relay
Enclosure,
NEMA 12/IP 44
Governor speed switch
Illuminating lights
Installed speed sensing governor (Woodward)
Low coolant level
Provision for:
alarm module –
NFPA 99
alarm module –
NFPA 110
Reverse power relay
Starting aid switch
Synchronizing lights

Caterpillar® EMCP II

Electronic Modular Control Panel

The Electronic Modular Control Panel (EMCP II) is a generator-mounted control panel, available on all Caterpillar packaged generator sets. It utilizes environmentally sealed, solid-state, microprocessor-based modules for engine control and AC metering. This new application of mature, high-tech electronics to generator monitoring provides more features, accuracy, and reliability than present electromechanical and many competitive panel systems.



The EMCP II provides these standard control and monitoring features, many of which are options on other panels:

- Automatic/manual start-stop engine control with programmable safety shutdowns and associated flashing LED indicators for low oil pressure, high coolant temperature, overspeed, overcrank, and emergency stop
- Cycle cranking – adjustable 1-60 second crank/rest periods
- Cooldown timer – adjustable 0-30 minutes
- Energized to run or shutdown fuel control systems
- LCD digital readout for: engine oil pressure, coolant temperature, engine rpm, system DC volts, engine running hours, system diagnostic codes, generator AC volts, generator AC amps, and generator frequency
- Engine control switch
- Ammeter-voltmeter phase selector switch
- Emergency stop pushbutton
- Indicator/display test switch
- Voltage adjust potentiometer
- Rugged NEMA 1/IP 23 cabinet

3516B GENERATOR SET

CATERPILLAR

TECHNICAL DATA

3516B Prime Power Generator Sets — 1800 rpm

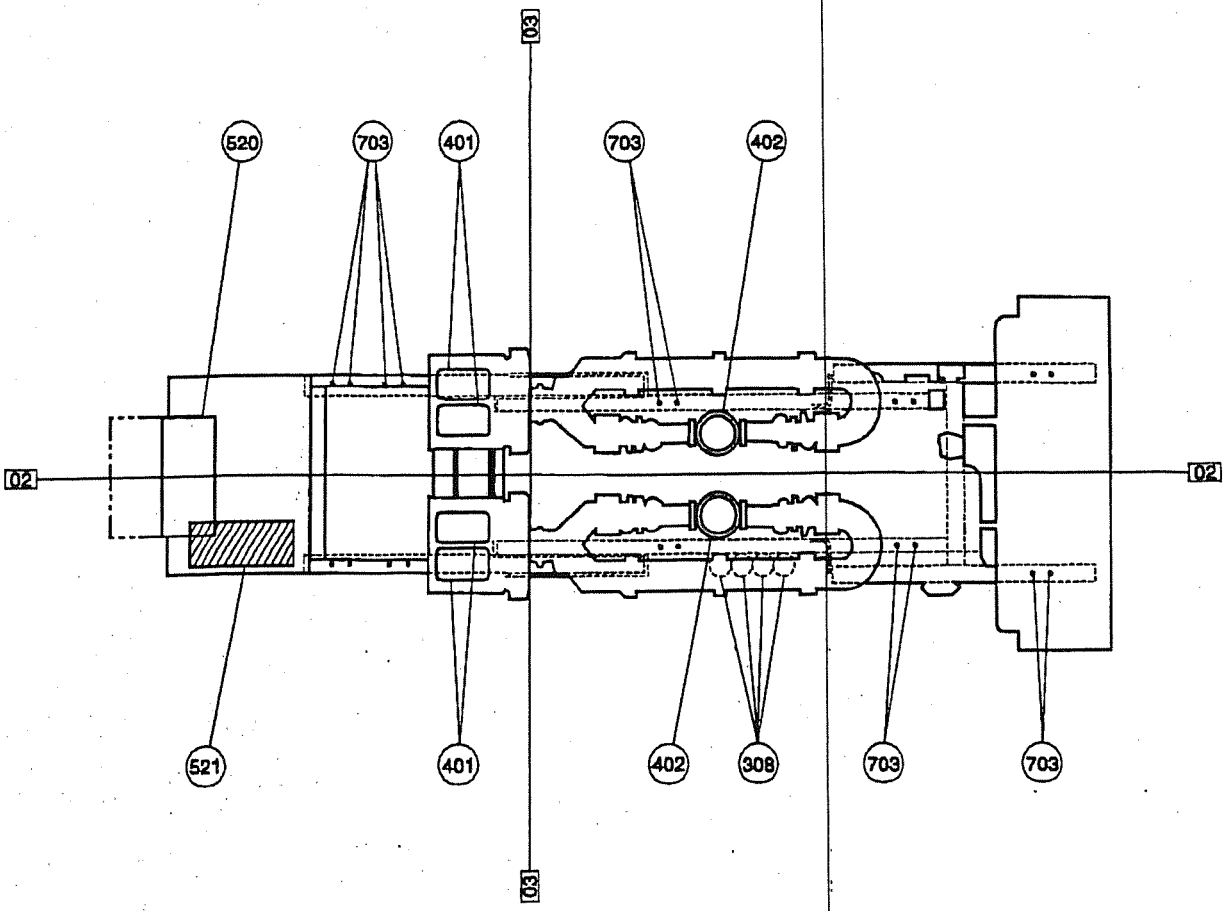
Power Rating @ 0.8 PF with Fan	ekW kV•A	1825 2281			
Engine Rating without Fan	bhp	2628			
Generator Frame Size		825			
Engine Lubricating Oil Capacity — Requires CF-4 Oil	qts	440			
Engine Coolant Capacity without Radiator	gal	62			
System Backpressure (Max Allowable)	in water	27			
Exhaust Flange Size — (Internal Diameter) (Dual)	in	8			
			Low Emissions Version		Lo BSFC
Coolant to Aftercooler Temperature (Max)	F	85	140	195	195
Length	in	223	223	223	224
Width	in	82	82	82	92
Height	in	97	97	97	102
Shipping Weight	lbs	32 650	32 650	33 650	33 200
Engine Coolant Capacity with Radiator	gal	107	107	107	121
Separate Circuit Aftercooler Aftercooler Cooling Circuit Aftercooler Pump Coolant Flow at 9.5 feet water head	gal gal/min	11 159	11 159	11 159	N/A N/A
100% Load Fuel Consumption (100% load) with Fan per ISO3046/1: +5%, -0% tolerance	gal/hr	126	125	124	120
*NOx emissions at ISO standard conditions: + or - 15% tolerance	lb/hr g/hr	24.4 11 205	30.2 13 690	39.2 17 770	50.7 23 000
75% Load Fuel Consumption (75% load) with Fan per ISO3046/1: +5%, -0% tolerance	gal/hr	93	93	94	91
*NOx emissions at ISO standard conditions: + or - 15% tolerance	lb/hr g/hr	18.4 8370	22.3 10 085	26.4 11 960	37.9 17 180
50% Load Fuel Consumption (50% load) with Fan per ISO3046/1: +5%, -0% tolerance	gal/hr	65	65	65	64
*NOx emissions at ISO standard conditions + or - 15% tolerance	lb/hr g/hr	12.6 5730	15.4 6990	19.5 8825	26.6 12 075
Combustion Air Inlet Flow Rate	ft³/min	6345	6205	6065	5790
Exhaust Gas Flow Rate	ft³/min	15 435	15 580	15 790	14 715
Heat Rejection to Jacket Water	BTU/min	41 515	41 290	41 175	40 320
Heat Rejection to Aftercooler	BTU/min	30 653	26 965	21 100	18 890
Heat Rejection to Exhaust (total)	BTU/min	107 770	110 045	114 250	106 975
Heat Rejection to Atmosphere from Engine	BTU/min	7620	7620	7620	7620
Heat Rejection to Atmosphere from Generator	BTU/min	3650	3650	3650	3650
Exhaust Gas Stack Temperature	Deg F	846	886	936	904
Deration for Engine Altitude - 3% per 1000 feet above	ft	4100	3690	3280	7630

*Note: For permitting see TMI data.

CATERPILLAR®

3516B GENERATOR SET

PRIME POWER GENERATOR SET PACKAGE — TOP VIEW



02	Centerline of Engine	308	Oil Filter	402	Exhaust	521	Conduit Entrance
03	Rear Face of Cylinder Block	401	Air Inlet	520	Control and Power Panel	703	Customer Mounting Holes

For overall length see technical data section (page 3).

Note: General configuration not to be used for installation. See general dimension drawings for detail.

CONDITIONS AND DEFINITIONS

Prime — Output available with varying load for an unlimited time. Prime power in accordance with ISO8528. 10% overload power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514 available on request.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046/1, DIN6271, and BS5514 standard conditions.

Fuel rates are based on fuel oil of 35° API (16° C or 60° F) gravity having an LHV of 42 780 kJ/kg (18 390 Btu/lb) when used at 29° C (85°F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.). Lubricating oil – requires CF-4 oil.

Additional ratings may be available for specific customer requirements. Consult your Caterpillar representative for details.

-GKGPE3- TMI - ENGINE AND COMP PERF DATE: 08/10/99
TIME: 14:28:35

09 - PACKAGE SET PERFORMANCE
3516B DI TA JW DRY MANF TURBO QTY 4 PARALLEL ADEM GOV
DM3147-03 PGS PRIME 60 HERTZ EXH STK DIA 12.0 IN
GEN 1825.0 W/F EKW 1880.0 W/O F EKW W/F BHP 2628 W/O F BHP @ 1800 RPM
LOW BSFC STRATEGY
INFO CODE 05 - EMISSIONS DATA * * REFERENCE NOTES - NOT TO EXCEED * * * * * * *
EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 86 SUBPART D AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NUMBER 2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB.

TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION, (APPLICATION GKN402, PROGRAM 03).

INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING
"NOT TO EXCEED DATA"

GEN PWR EKW	% LOAD	ENG PWR BHP	NOX (AS NO2) * * * * * * * * *	CO	TOTAL HC LB/HR * * * * * * * *	PART MATTER	O2 (DRY) IN EXH (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1825.0	100	2593.0	61.24	3.57	.98	.580	10.30	1.1	1.28
1368.8	75	1957.7	50.91	2.33	.98	.480	11.30	1.2	1.28
912.5	50	1327.6	35.40	1.99	.87	.460	12.10	2.0	1.28
456.3	25	703.6	20.96	1.47	.70	.380	13.30	2.6	1.28

INFO CODE 05 - EMISSIONS DATA * * * * * RATED CONDITIONS * * STANDARD TIMING
"NOMINAL DATA"
AT RATED:

WET EXHAUST MASS	25022 LB/HR
WET EXHAUST FLOW (901 DEG F STACK TEMP)	14507 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5241 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	4785 STD CFM
FUEL FLOW RATE	123.9 GAL/HR

-GKGPE3- TMI - ENGINE AND COMP PERF DATE: 08/10/99
09 - PACKAGE SET PERFORMANCE TIME: 14:34:44
3516B DI TA SC DRY MANF TURBO QTY 4 PARALLEL ADEM GOV
DM1052-09 PGS PRIME 60 HERTZ EXH STK DIA 12.0 IN
GEN 1825.0 W/F EKW 1880.0 W/O F EKW W/F BHP 2628 W/O F BHP @ 1800 RPM
LOW BSFC STRATEGY A/C TEMP: DEG F 86

INFO CODE 05 - EMISSIONS DATA * * REFERENCE NOTES - NOT TO EXCEED * * * * * * *
EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 86 SUBPART D AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NUMBER 2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB.

TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION, (APPLICATION GKN402, PROGRAM 03).

INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING
"NOT TO EXCEED DATA"

GEN PWR EKW	% LOAD	ENG PWR BHP	NOX (AS NO2) * * * * * * * *	CO	TOTAL HC LB/HR * * * * * * *	PART MATTER * *	O2 (DRY) IN EXH (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1825.0	100	2593.0	55.22	4.25	1.25	.720	11.10	1.5	1.28
1368.8	75	1957.7	43.89	3.57	1.02	.600	12.10	1.5	1.28
912.5	50	1327.6	31.12	2.80	.81	.520	13.10	1.9	1.28
456.3	25	703.6	15.84	2.06	.66	.460	14.60	2.3	1.28

INFO CODE 05 - EMISSIONS DATA * * * * * RATED CONDITIONS * * STANDARD TIMING
"NOMINAL DATA"
AT RATED:

WET EXHAUST MASS	26081 LB/HR
WET EXHAUST FLOW (790 DEG F STACK TEMP)	13861 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)...	5453 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)...	5050 STD CFM
FUEL FLOW RATE	120.2 GAL/HR

-GKGPE3- TMI - ENGINE AND COMP PERF DATE: 08/10/99
09 - PACKAGE SET PERFORMANCE TIME: 14:35:38
3516B DI TA SC DRY MANF TURBO QTY 4 PARALLEL ADEM GOV
DM1392-08 PGS PRIME 60 HERTZ EXH STK DIA 12.0 IN
GEN 1825.0 W/F EKW 1880.0 W/O F EKW W/F BHP 2628 W/O F BHP @ 1800 RPM
LOW BSFC STRATEGY A/C TEMP: DEG F 140
INFO CODE 05 - EMISSIONS DATA * * REFERENCE NOTES - NOT TO EXCEED * * * * * * *
EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 86 SUBPART D AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NUMBER 2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB.

TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION, (APPLICATION GKN402, PROGRAM 03).

INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING
"NOT TO EXCEED DATA"

GEN PWR EKW	% LOAD	ENG PWR BHP	NOX (AS NO2) * * * * * * * * *	CO	TOTAL HC LB/HR * * * * * * * * *	PART MATTER	O2 (DRY) IN EXH (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1825.0	100	2593.0	60.97	2.83	1.14	.590	10.70	1.1	1.28
1368.8	75	1957.7	50.75	2.08	1.04	.490	11.70	1.1	1.28
912.5	50	1327.6	34.52	2.14	.82	.460	12.60	1.8	1.28
456.3	25	703.6	18.16	2.28	.67	.430	14.10	2.4	1.28

INFO CODE 05 - EMISSIONS DATA * * * * * RATED CONDITIONS * * STANDARD TIMING
"NOMINAL DATA"
AT RATED:

WET EXHAUST MASS	25485	LB/HR
WET EXHAUST FLOW (846 DEG F STACK TEMP)	14168	CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5333	STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	4895	STD CFM
FUEL FLOW RATE	121.8	GAL/HR

-GKGPE3- TMI - ENGINE AND COMP PERF DATE: 08/10/99
09 - PACKAGE SET PERFORMANCE TIME: 14:36:25
3516B DI TA SC DRY MANF TURBO QTY 4 PARALLEL ADEM GOV
DM1393-08 PGS PRIME 60 HERTZ EXH STK DIA 12.0 IN
GEN 1825.0 W/F EKW 1880.0 W/O F EKW W/F BHP 2628 W/O F BHP @ 1800 RPM
LOW BSFC STRATEGY A/C TEMP: DEG F 194
INFO CODE 05 - EMISSIONS DATA * * REFERENCE NOTES - NOT TO EXCEED * * * * * * *
EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 86 SUBPART D AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NUMBER 2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB.

TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION, (APPLICATION GKN402, PROGRAM 03).

INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING
"NOT TO EXCEED DATA"

GEN PWR EKW	% LOAD	ENG PWR BHP	NOX (AS NO2) * * * * * * * * *	CO	TOTAL HC LB/HR * * * * * * * * *	PART MATTER	IN EXH O2 (DRY) (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1825.0	100	2593.0	61.24	3.57	.98	.580	10.30	1.1	1.28
1368.8	75	1957.7	50.91	2.33	.98	.480	11.30	1.2	1.28
912.5	50	1327.6	35.40	1.99	.87	.460	12.10	2.0	1.28
456.3	25	703.6	20.96	1.47	.70	.380	13.30	2.6	1.28

INFO CODE 05 - EMISSIONS DATA * * * * * RATED CONDITIONS * * STANDARD TIMING
"NOMINAL DATA"
AT RATED:

WET EXHAUST MASS	25022 LB/HR
WET EXHAUST FLOW (900 DEG F STACK TEMP)	14493 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5241 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	4785 STD CFM
FUEL FLOW RATE	123.9 GAL/HR

-GKGPE3- TMI - ENGINE AND COMP PERF DATE: 08/10/99
TIME: 14:37:02

09 - PACKAGE SET PERFORMANCE
3516B DI TA SC DRY MANF TURBO QTY 4 PARALLEL ADEM GOV
DM1054-10 PGS PRIME 60 HERTZ EXH STK DIA 12.0 IN
GEN 1825.0 W/F EKW 1880.0 W/O F EKW W/F BHP 2628 W/O F BHP @ 1800 RPM
EMISSIONS STRATEGY A/C TEMP: DEG F 86
INFO CODE 05 - EMISSIONS DATA * * REFERENCE NOTES - NOT TO EXCEED * * * * * * *
EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 86 SUBPART D AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NUMBER 2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB.

TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION, (APPLICATION GKN402, PROGRAM 03).

INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING
"NOT TO EXCEED DATA"

GEN PWR EKW	% LOAD	ENG PWR BHP	NOX (AS NO2) * * * * * * * *	CO	TOTAL HC LB/HR * * * * * * * *	PART MATTER	O2 (DRY) IN EXH (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1825.0	100	2593.0	30.60	4.52	1.28	1.040	11.00	2.4	1.28
1368.8	75	1957.7	22.99	3.91	1.15	1.010	12.40	2.7	1.28
912.5	50	1327.6	15.62	3.04	.93	.950	13.40	3.6	1.28
456.3	25	703.6	10.48	2.13	.72	.670	14.80	3.7	1.28

INFO CODE 05 - EMISSIONS DATA * * * * * RATED CONDITIONS * * STANDARD TIMING
"NOMINAL DATA"
AT RATED:

WET EXHAUST MASS	27756 LB/HR
WET EXHAUST FLOW (859 DEG F STACK TEMP)	15574 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5806 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5368 STD CFM
FUEL FLOW RATE	129.7 GAL/HR

-GKGPE3- TMI - ENGINE AND COMP PERF DATE: 08/10/99
TIME: 14:37:30

09 - PACKAGE SET PERFORMANCE
3516B DI TA SC DRY MANF TURBO QTY 4 PARALLEL ADEM GOV
DM1390-10 PGS PRIME 60 HERTZ EXH STK DIA 12.0 IN
GEN 1825.0 W/F EKW 1880.0 W/O F EKW W/F BHP 2628 W/O F BHP @ 1800 RPM
EMISSIONS STRATEGY A/C TEMP: DEG F 140
INFO CODE 05 - EMISSIONS DATA * * REFERENCE NOTES - NOT TO EXCEED * * * * * * *
EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 86 SUBPART D AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NUMBER 2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB.

TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION, (APPLICATION GKN402, PROGRAM 03).

INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING
"NOT TO EXCEED DATA"

GEN PWR EKW	% LOAD	ENG PWR BHP	NOX (AS NO2) * * * * * * * *	CO	TOTAL HC LB/HR * * * * *	PART MATTER * * *	O2 (DRY) IN EXH (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1825.0	100	2593.0	37.44	3.05	1.16	.870	10.70	2.1	1.28
1368.8	75	1957.7	28.11	3.01	1.16	.790	12.00	2.3	1.28
912.5	50	1327.6	19.10	2.61	1.01	.750	12.90	2.8	1.28
456.3	25	703.6	12.51	2.18	.69	.520	14.20	2.9	1.28

INFO CODE 05 - EMISSIONS DATA * * * * * RATED CONDITIONS * * STANDARD TIMING
"NOMINAL DATA"
AT RATED:

WET EXHAUST MASS	27095 LB/HR
WET EXHAUST FLOW (899 DEG F STACK TEMP)	15676 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5672 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5205 STD CFM
FUEL FLOW RATE	130.2 GAL/HR

-GKGPE3- TMI - ENGINE AND COMP PERF DATE: 08/10/99
09 - PACKAGE SET PERFORMANCE TIME: 14:37:59
3516B DI TA SC DRY MANF TURBO QTY 4 PARALLEL ADEM GOV
DM1391-11 PGS PRIME 60 HERTZ EXH STK DIA 12.0 IN
GEN 1825.0 W/F EKW 1880.0 W/O F EKW W/F BHP 2628 W/O F BHP @ 1800 RPM
EMISSIONS STRATEGY A/C TEMP: DEG F 194
INFO CODE 05 - EMISSIONS DATA * * REFERENCE NOTES - NOT TO EXCEED * * * * * * *
EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 86 SUBPART D AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NUMBER 2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB.

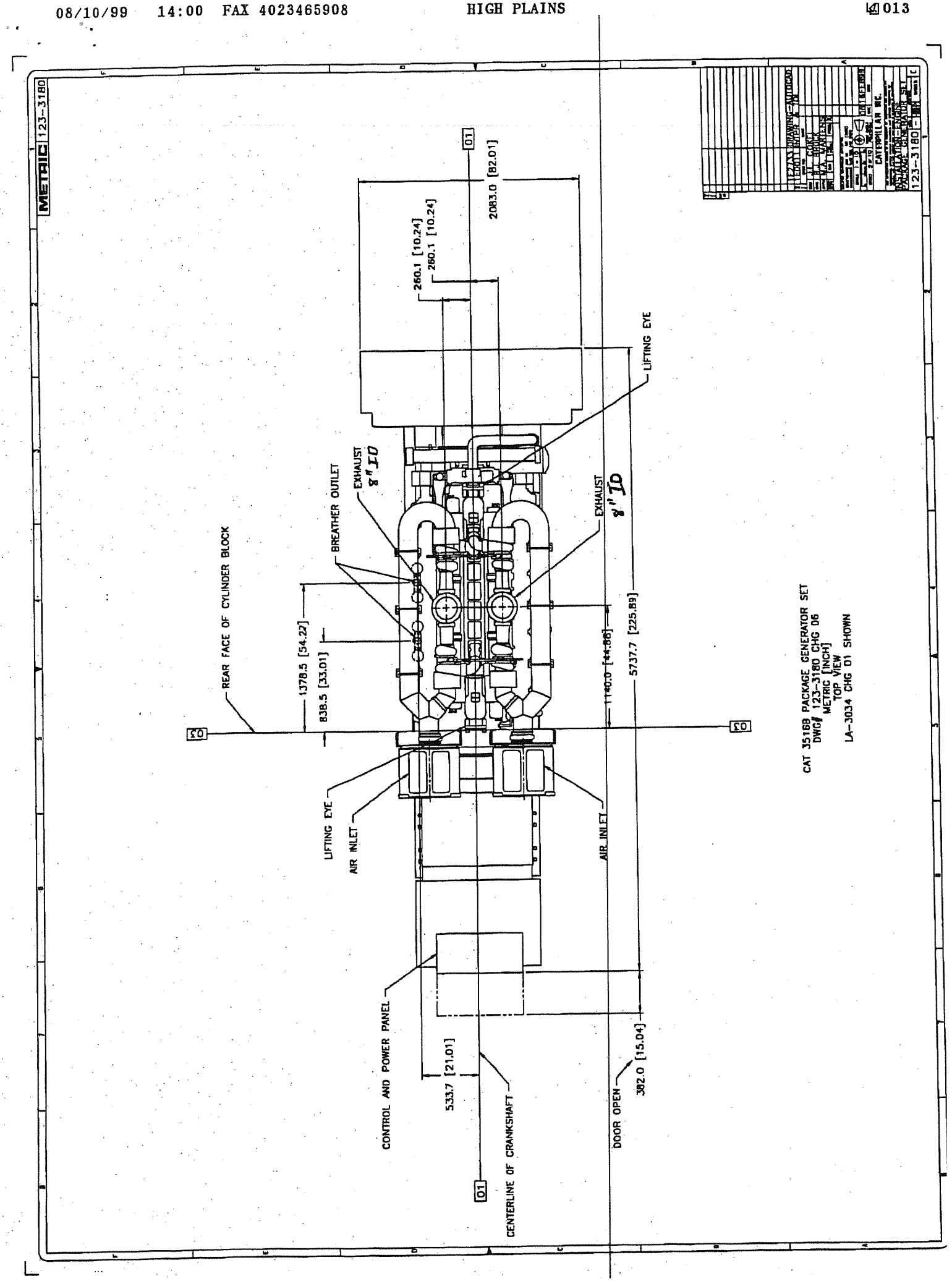
TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION, (APPLICATION GKN402, PROGRAM 03).

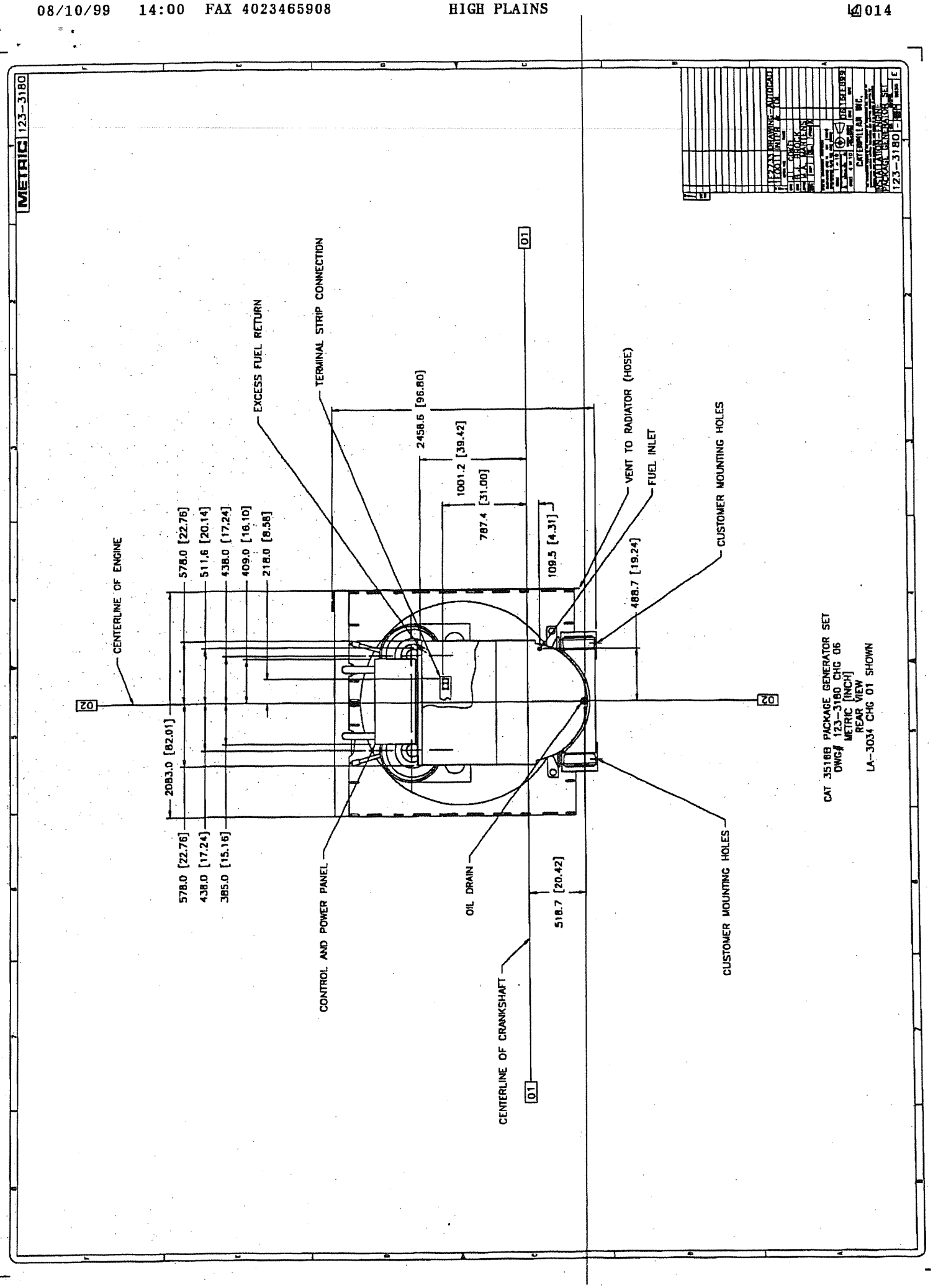
INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING
"NOT TO EXCEED DATA"

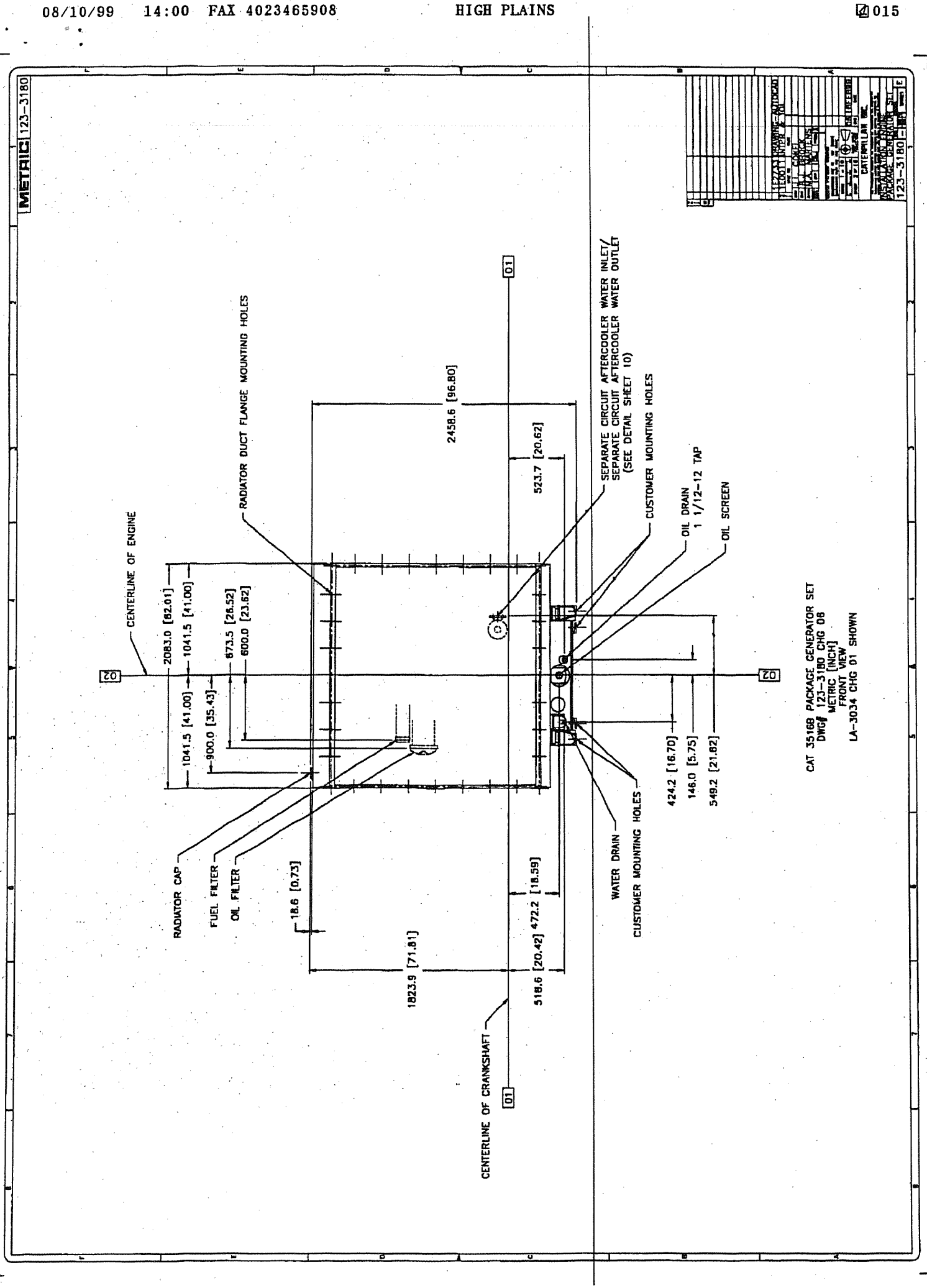
GEN PWR EKW	% LOAD	ENG PWR BHP	NOX (AS NO2) * * * * * * * *	CO	TOTAL HC LB/HR * * * * * * * *	PART MATTER	O2 (DRY) IN EXH (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1825.0	100	2593.0	47.69	3.67	1.06	.720	10.30	1.7	1.28
1368.8	75	1957.7	35.90	2.86	1.05	.610	11.50	1.7	1.28
912.5	50	1327.6	24.67	3.25	1.00	.550	12.40	2.2	1.28
456.3	25	703.6	20.28	2.17	.70	.390	13.30	2.6	1.28

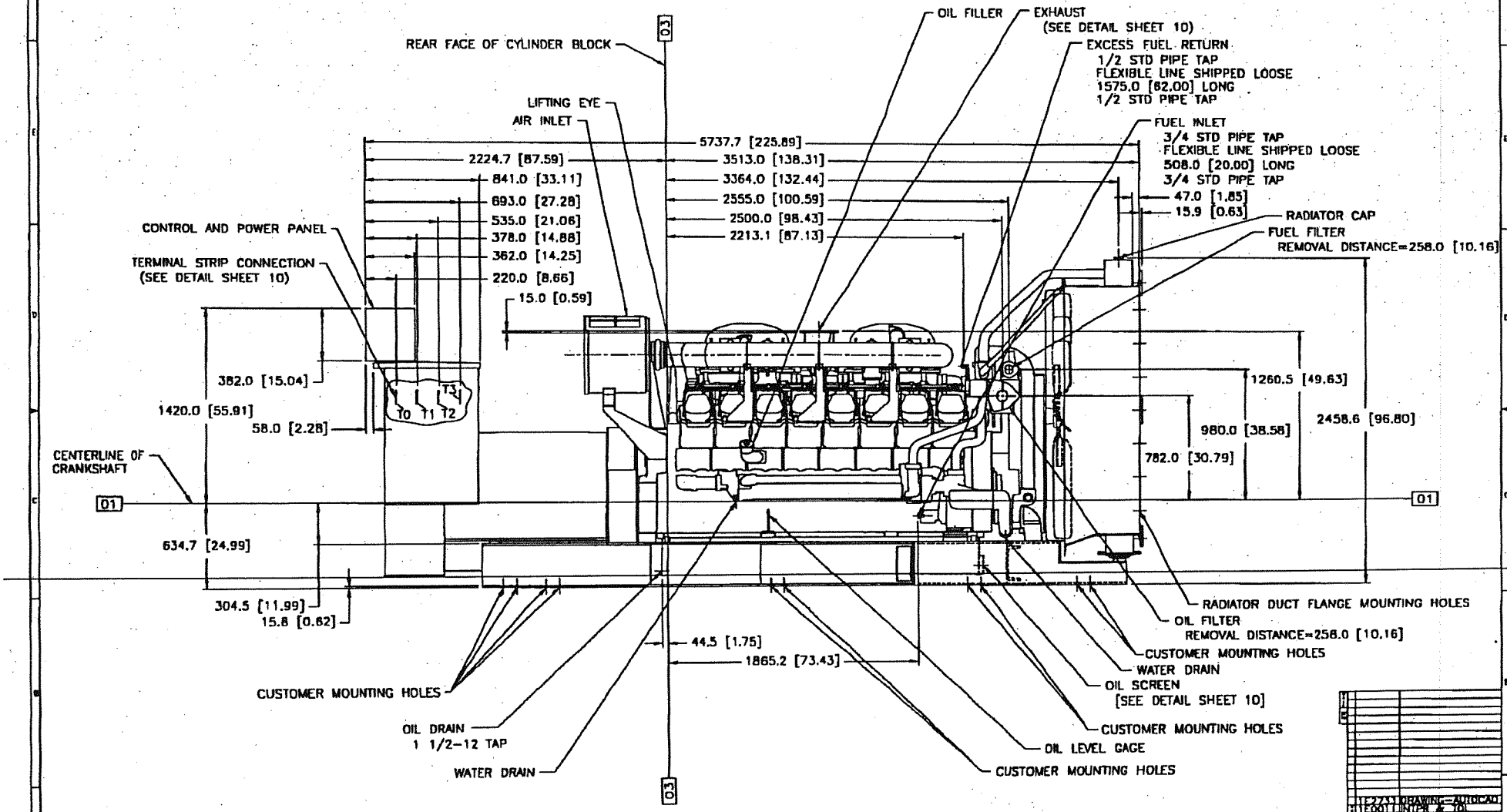
INFO CODE 05 - EMISSIONS DATA * * * * * RATED CONDITIONS * * STANDARD TIMING
"NOMINAL DATA"
AT RATED:

WET EXHAUST MASS	25838 LB/HR
WET EXHAUST FLOW (922 DEG F STACK TEMP)	15221 CFM
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	5414 STD CFM
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	4944 STD CFM
FUEL FLOW RATE	128.4 GAL/HR


METRIC 123-3180
2083.0 [82.01]
260.1 [10.24]
260.1 [10.24]
LIFTING EYE
EXHAUST 8" ID
BREATHER OUTLET
EXHAUST 8" ID
REAR FACE OF CYLINDER BLOCK
1378.5 [54.27]
838.5 [33.01]
1140.0 [44.88]
5737.7 [225.89]
LIFTING EYE
AIR INLET
AIR INLET
CONTROL AND POWER PANEL
533.7 [21.01]
382.0 [15.04]
DOOR OPEN
CENTERLINE OF CRANKSHAFT
CAT 3516B PACKAGE GENERATOR SET
DWG# 123-3180 CHG 06
METRIC [INCH]
TOP VIEW
LA-3034 CHG 01 SHOWN
123-3180


METRIC 123-3180
CENTERLINE OF ENGINE
EXCESS FUEL RETURN
TERMINAL STRIP CONNECTION
VENT TO RADIATOR (HOSE)
FUEL INLET
CUSTOMER MOUNTING HOLES
2458.6 [96.80]
1001.2 [39.42]
787.4 [31.00]
109.5 [4.31]
488.7 [19.24]
578.0 [22.76]
511.6 [20.14]
438.0 [17.24]
409.0 [16.10]
218.0 [8.58]
2083.0 [82.01]
578.0 [22.76]
438.0 [17.24]
385.0 [15.16]
CONTROL AND POWER PANEL
OIL DRAIN
CENTERLINE OF CRANKSHAFT
518.7 [20.42]
CUSTOMER MOUNTING HOLES
CAT 3516B PACKAGE GENERATOR SET
DWG# 123-3180 CHG 06
METRIC [INCH]
REAR VIEW
LA-3034 CHG 01 SHOWN


METRIC 123-3180
RADIATOR DUCT FLANGE MOUNTING HOLES
SEPARATE CIRCUIT AFTERCOOLER WATER INLET/
SEPARATE CIRCUIT AFTERCOOLER WATER OUTLET
(SEE DETAIL SHEET 10)
CUSTOMER MOUNTING HOLES
OIL DRAIN
1 1/12-12 TAP
OIL SCREEN
CENTERLINE OF ENGINE
2458.6 [96.80]
523.7 [20.62]
2083.0 [82.01]
1041.5 [41.00]
873.5 [26.52]
600.0 [23.62]
1041.5 [41.00]
900.0 [35.43]
424.2 [16.70]
146.0 [5.75]
549.2 [21.62]
RADIATOR CAP
FUEL FILTER
OIL FILTER
18.6 [0.73]
WATER DRAIN
CUSTOMER MOUNTING HOLES
472.2 [18.59]
1823.9 [71.81]
518.6 [20.42]
CENTERLINE OF CRANKSHAFT
01
02
CAT 3516B PACKAGE GENERATOR SET
DWG 123-3180 CHG 06
METRIC [INCH]
FRONT VIEW
LA-3034 CHG 01 SHOWN



CAT 3516B PACKAGE GENERATOR SET
DWG# 123-3180 CHG 06
METRIC [INCH]
RIGHT SIDE VIEW
LA-3034 CHG 01 SHOWN

MODEL	TYPE	PRICING AR
3516B	P	LA-3034 CHG 01
		LA-3036 CHG 01

CATERPILLAR INC.
INSTALLATION-ENGINE
PACKAGE GENERATOR SET
123-3180

DIESEL GENERATOR SET

Image shown may not reflect actual package.

STANDBY
2000 ekW 2500 kVA
60 Hz 1800 rpm 480 Volts

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

FEATURES

FUEL/EMISSIONS STRATEGY
- EPA Certified for Stationary Emergency Application (EPA Tier 2 emissions levels)

DESIGN CRITERIA
- The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response.

UL 2200 / CSA - Optional
- UL 2200 listed packages
- CSA Certified

Certain restrictions may apply. Consult with your Cat® Dealer.

FULL RANGE OF ATTACHMENTS
- Wide range of bolt-on system expansion attachments, factory designed and tested
- Flexible packaging options for easy and cost effective installation

SINGLE-SOURCE SUPPLIER
- Fully prototype tested with certified torsional vibration analysis available

WORLDWIDE 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 Cat® S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

CAT® 3516C TA DIESEL ENGINE
- Reliable, rugged, durable design
- Field-proven in thousands of applications worldwide
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight

CAT GENERATOR
- Matched to the performance and output characteristics of Cat engines
- Industry leading mechanical and electrical design
- Industry leading motor starting capabilities
- High Efficiency

CAT EMCP 4 CONTROL PANELS
- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway

SEISMIC CERTIFICATION
- Seismic Certification available
- Anchoring details are site specific, and are dependent on many factors such as generator set size, weight, and concrete strength. IBC Certification requires that the anchoring system used is reviewed and approved by a Professional Engineer
- Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007
- Pre-approved by OSHPD and carries an OSP-0084-10 for use in healthcare projects in California

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	• Single element canister type air cleaner • Service indicator	[ ] Dual element & heavy duty air cleaners [ ] Air inlet adapters & shut-off
Cooling	• Radiator with guard • Coolant drain line with valve • Fan and belt guards • Cat® Extended Life Coolant	[ ] Radiator duct flange
Exhaust	• Dry exhaust manifold • Flanged faced outlets	[ ] Mufflers and Silencers [ ] Stainless steel exhaust flex fittings [ ] Elbows, flanges, expanders & Y adapters
Fuel	• Secondary fuel filters • Fuel priming pump • Flexible fuel lines • Fuel cooler*	[ ] Water separator [ ] Duplex fuel filter
Generator	• Cat digital voltage regulator (CDVR) with kVAR/PF control, 3-phase sensing • Winding temperature detectors • Anti-condensation heaters	[ ] Oversize & premium generators [ ] Bearing temperature detectors
Power Termination	• Bus bar (NEMA or IEC mechanical lug holes)- right side standard • Top and bottom cable entry	[ ] Circuit breakers, UL listed, 3 pole with shunt trip,100% rated, manual or electrically operated [ ] Circuit breakers, IEC compliant, 3 or 4 pole with shunt trip, manual or electrically operated [ ] Bottom cable entry [ ] Power terminations can be located on the right, left and/or rear as an option.
Governor	• ADEM™ 3	[ ] Load share module
Control Panels	• EMCP 4.2 Genset controller	[ ] Digital I/O Module [ ] Generator temperature monitoring & protection
Lube	• Lubricating oil and filter • Oil drain line with valves • Fumes disposal • Gear type lube oil pump	[ ] Oil level regulator [ ] Deep sump oil pan [ ] Electric & air prelube pumps [ ] Manual prelube with sump pump [ ] Duplex oil filter
Mounting	• Rails - engine / generator / radiator mounting • Rubber anti-vibration mounts (shipped loose)	[ ] Spring-type vibration isolator [ ] IBC Isolators
Starting/Charging	• 24 volt starting motor(s) • Batteries with rack and cables • Battery disconnect switch	[ ] Battery chargers [ ] Charging alternator [ ] Oversize batteries [ ] Ether starting aid [ ] Heavy duty starting motors [ ] Barring device (manual) [ ] Air starting motor with control & silencer [ ] Jacket water heater
General	• Right-hand service • Paint - Caterpillar Yellow except rails and radiators are gloss black • SAE standard rotation • Flywheel and flywheel housing - SAE No. 00	[ ] UL 2200 [ ] CSA certification [ ] CE Certificate of Conformance [ ] Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007
Note	Standard and optional equipment may vary for UL 2200 Listed Packages. UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics.	

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

SPECIFICATIONS

CAT GENERATOR

Cat Generator
Frame size..... 825
Excitation..... Permanent Magnet
Pitch..... 0.6667
Number of poles..... 4
Number of bearings..... Single bearing
Number of Leads..... 006
Insulation..... UL 1446 Recognized Class H with tropicalization and antiabrasion
- Consult your Caterpillar dealer for available voltages
IP Rating..... IP23
Alignment..... Pilot Shaft
Overspeed capability..... 150
Wave form Deviation (Line to Line)..... 003.00
Voltage regulator..... 3 Phase sensing with selectible volts/Hz
Voltage regulation..... Less than +/- 1/2% (steady state)
Less than +/- 1/2% (w/3% speed change)

CAT DIESEL ENGINE

3516C ATAAC, V-16, 4-Stroke Water-cooled Diesel
Bore..... 170.00 mm (6.69 in)
Stroke..... 190.00 mm (7.48 in)
Displacement..... 69.00 L (4210.64 in^3)
Compression Ratio..... 14.7:1
Aspiration..... TA
Fuel System..... Electronic unit injection
Governor Type..... ADEM3

CAT EMCP 4 SERIES CONTROLS

EMCP 4 controls including:
- Run / Auto / Stop Control
- Speed and Voltage Adjust
- Engine Cycle Crank
- 24-volt DC operation
- Environmental sealed front face
- Text alarm/event descriptions

Digital indication for:
- RPM
- DC volts
- Operating hours
- Oil pressure (psi, kPa or bar)
- Coolant temperature
- Volts (L-L & L-N), frequency (Hz)
- Amps (per phase & average)
- ekW, kVA, kVAR, kW-hr, %kW, PF

Warning/shutdown with common LED indication of:
- Low oil pressure
- High coolant temperature
- Overspeed
- Emergency stop
- Failure to start (overcrank)
- Low coolant temperature
- Low coolant level

Programmable protective relaying functions:
- Generator phase sequence
- Over/Under voltage (27/59)
- Over/Under Frequency (81 o/u)
- Reverse Power (kW) (32)
- Reverse reactive power (kVAr) (32RV)
- Overcurrent (50/51)

Communications:
- Six digital inputs (4.2 only)
- Four relay outputs (Form A)
- Two relay outputs (Form C)
- Two digital outputs
- Customer data link (Modbus RTU)
- Accessory module data link
- Serial annunciator module data link
- Emergency stop pushbutton

Compatible with the following:
- Digital I/O module
- Local Annunciator
- Remote CAN annunciator
- Remote serial annunciator

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

TECHNICAL DATA

Open Generator Set - - 1800 rpm/60 Hz/480 Volts	DM8263	
EPA Certified for Stationary Emergency Application (EPA Tier 2 emissions levels)		
Generator Set Package Performance		
Genset Power rating @ 0.8 pf	2500 kVA	
Genset Power rating with fan	2000 ekW	
Fuel Consumption		
100% load with fan	522.5 L/hr	138.0 Gal/hr
75% load with fan	406.8 L/hr	107.5 Gal/hr
50% load with fan	293.6 L/hr	77.6 Gal/hr
Cooling System[1]		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Air flow (max @ rated speed for radiator arrangement)	2480 m³/min	87580 cfm
Engine Coolant capacity with radiator/exp. tank	475.0 L	125.5 gal
Engine coolant capacity	233.0 L	61.6 gal
Radiator coolant capacity	242.0 L	63.9 gal
Inlet Air		
Combustion air inlet flow rate	185.5 m³/min	6550.9 cfm
Exhaust System		
Exhaust stack gas temperature	400.1 ° C	752.2 ° F
Exhaust gas flow rate	433.1 m³/min	15294.8 cfm
Exhaust flange size (internal diameter)	203.2 mm	8.0 in
Exhaust system backpressure (maximum allowable)	6.7 kPa	26.9 in. water
Heat Rejection		
Heat rejection to coolant (total)	759 kW	43164 Btu/min
Heat rejection to exhaust (total)	1788 kW	101683 Btu/min
Heat rejection to aftercooler	672 kW	38217 Btu/min
Heat rejection to atmosphere from engine	133 kW	7564 Btu/min
Heat rejection to atmosphere from generator	107.5 kW	6113.5 Btu/min
Alternator[2]		
Motor starting capability @ 30% voltage dip	4647 skVA	
Frame	825	
Temperature Rise	130 ° C	234 ° F
Lube System		
Sump refill with filter	466.0 L	123.1 gal
Emissions (Nominal)[3]		
NOx g/hp-hr	5.45 g/hp-hr	
CO g/hp-hr	.3 g/hp-hr	
HC g/hp-hr	.11 g/hp-hr	
PM g/hp-hr	.025 g/hp-hr	

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

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

[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 DEFINITIONS AND CONDITIONS

Meets or Exceeds International Specifications: AS1359, CSA, IEC60034-1, ISO3046, ISO8528, NEMA MG 1-22, NEMA MG 1-33, UL508A, 72/23/EEC, 98/37/EC, 2004/108/EC

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. Standby power in accordance with ISO8528. Fuel stop power in accordance with ISO3046. Standby ambients shown indicate ambient temperature at 100% load which results in a coolant top tank temperature just below the shutdown temperature.

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

Fuel rates are based on fuel oil of 35° API [16° C (60° F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29° C (85° 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.

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

DIMENSIONS

Package Dimensions		
Length	**6434.6 mm**	**253.33 in**
Width	**2378.7 mm**	**93.65 in**
Height	**2958.4 mm**	**116.47 in**

NOTE: For reference only - do not use for installation design. Please contact your local dealer for exact weight and dimensions. (General Dimension Drawing #2846051).

Performance No.: DM8263

Feature Code: 516DE7E

Gen. Arr. Number: 2628106

Source: U.S. Sourced

November 06 2012

20932134

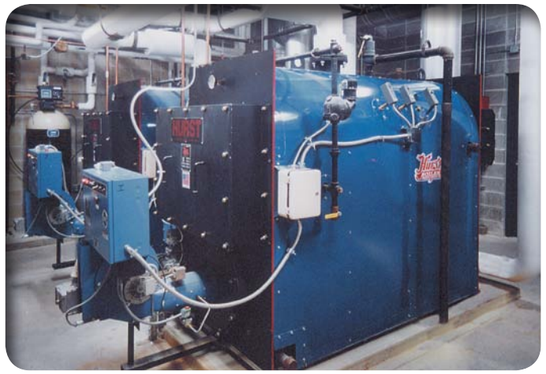
www.Cat-ElectricPower.com

HURST

HURST PERFORMANCE SERIES BOILERS

SERIES 45

- Efficient 3-Pass Design
- Flexibility – Gas, Oil, Heavy Oil, and Combination Gas/Oil
- ASME Code Constructed & Stamped for 15 PSI Steam/60-100 PSI Water
- Registered with the National Board of Boiler Inspectors
- Competitively Priced, Easily Maintained, Designed for Efficiency
- Large Furnace Volume for Ultimate Combustion Efficiency
- Unified Refractory Base Floor
- Steel Skids and Lifting Eyes
- Low Heat Release
- Factory Insulated – 2” Mineral Wool
- Factory Jacketed & Painted
- Easy Access to Fireside Surfaces
- Ample Waterside Clean-Out Openings
- Fully Automatic Operation
- U.L. Listed, Forced Draft Burners
- Wet Back Construction
- U.L. Listed Controls & Trim
- Factory Test Fired
- Flame Observation Ports Front & Rear



All units are factory packaged with operating controls, relief valves, burner and fuel train. Installation is made simple in that only service connections are needed to place in operation. Flexible burner systems are available for firing natural gas, LP gas, #2 oil, heavy oil, or combinations. High density 2” mineral wool insulation assures lower radiant heat loss. In addition to meeting the requirements of U.L., burner systems are optionally available to meet the requirements of FM, IRI, MILITARY and others.

Standard Steam Trim

- Operating & high limit pressure control
- Modulating pressure control (when appl.)
- Water column with gauge glass, combination low water cut-off & pump control
- Probe Aux, L.W.C.O. w/ Manual Reset Steam pressure gauge, syphon & test cock
- Stack Thermometer, Water column drain valve
- Safety relief valve(s) per ASME Code

Standard Water Trim

- Operating & high limit temperature control
- Modulating temperature control (when appl.)
- Probe type low water cut-off control w/ Manual Reset
- Combination pressure & temperature gauge
- Hot water return baffle for shock resistance
- Safety relief valve(s) per ASME Code
- Stack Thermometer

HBC-09509
01/2011

hurstboiler.com

HURST BOILER & WELDING CO., INC.

100 Boilermaker Lane • Coolidge, GA 31738-0530
Tel: (229) 346-3545 • Fax: (229) 346-3874
email: info@hurstboiler.com

HURST

BOILER & WELDING CO., INC

AVAILABLE WITH LOW NOX

SERIES 45

LOW PRESSURE BOILER.
Capacities From 8.5 to 813 BHP.
285 to 27215 MBTU/HR.

UL Listed
Burner/Boiler Packaged

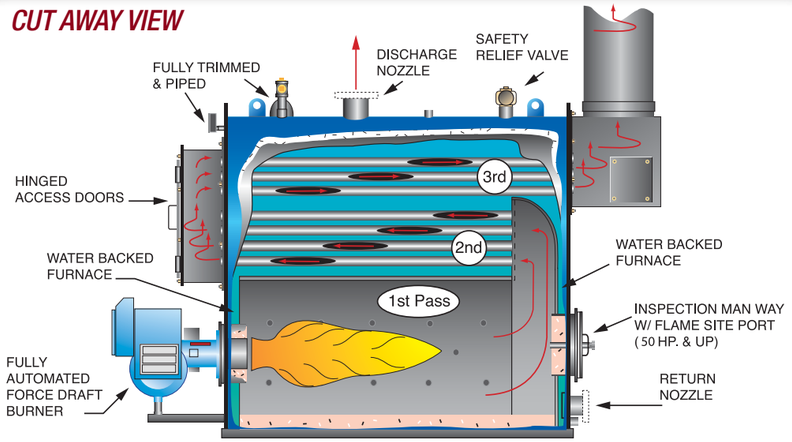
3-PASS EFFICIENCY
ALL STEEL FIREBOX CONSTRUCTION

COMPACT DESIGN
EASY INSTALLATION

Section IV
15 PSI. STEAM
30-60-100 PSI. HOT WATER

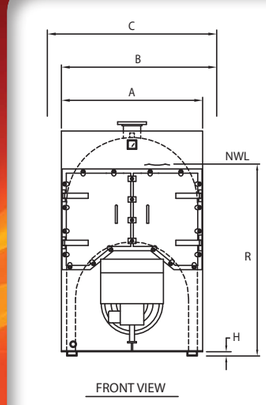
HURST PERFORMANCE SERIES BOILERS

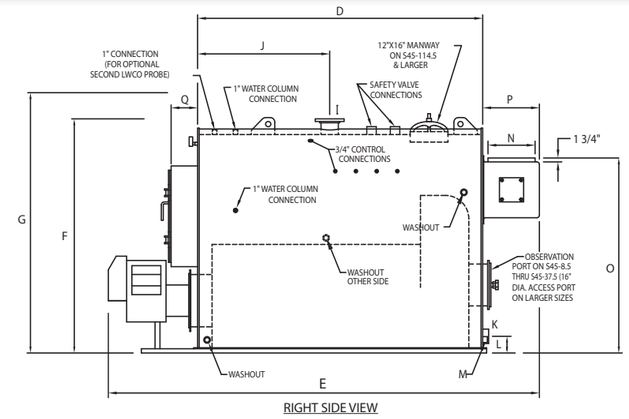
CUT AWAY VIEW



Inspected and registered with the National Board of Boiler & Pressure Vessel Inspectors.

Designed, constructed and stamped in accordance with the requirements of the ASME Boiler Codes.





SPECIFICATIONS	SERIES 100 MODEL NO.		S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45
BOILER HORSE POWER			8.5	13.4	16.4	20	25	30	37.5	50	56	62.5	75	87.5	100	114.5	126.3	
STEAM OUTPUT	FROM & @212° F	LBS/HR	293	462	566	690	863	1035	1294	1725	1932	2156	2588	3019	3450	3950	4357	
GROSS OUTPUT		MBH	285	449	549	670	837	1004	1255	1674	1875	2092	2511	2929	3348	3833	4228	
FIRING RATE, GAS	1,000 BTU	CFH	357	563	689	840	1050	1260	1575	2100	2352	2625	3150	3675	4200	4809	5304	
FIRING RATE, #2 OIL	140,000 BTU	GPH	2.6	4	5	6	7.5	9	11.3	15	17	19	22.5	26	30	34	38	
FIRING RATE, HEAVY OIL	150,000 BTU	GPH	NA	NA	NA	NA	NA	NA	NA	14	16	17.5	21	25	28	32	35	
TOTAL HEATING SURFACE	FIRESIDE	SQ.FT.	37	55	67	86	105	125	150	200	225	250	300	350	411	458	505	
RADIANT HEATING SURFACE	FIRESIDE	SQ.FT.	17.4	22.7	23.5	28.7	32.6	34.2	39.3	48	48.6	55	60	77	87	90.5	92	
FURNACE VOLUME		CU.FT.	6.8	7.3	9.2	12.4	14.8	18.7	22.5	27.4	30.7	33	40.6	52	67	68	73	
FURNACE HEAT RELEASE	MBH/CU.FT.		53	77	75	68	71	67	70	77	77	80	78	71	63	71	73	
A WIDTH WITHOUT TRIM		IN	28	30	30	30	30	36	36	42	42	42	42	48	48	54	54	A
B WIDTH WITH TRIM	APPROX	IN	35	37	37	37	37	43	43	49	49	49	49	55	55	61	61	B
C WIDTH WITH GAS TRAIN	APPROX	IN	47	49	49	49	49	55	55	61	61	61	61	67	67	73	73	C
D LENGTH OVER TUBE SHTS.		IN	31	31	37	49	60	57	68	58	65	70	85	73	85	83	89	D
E OVERALL LENGTH with/	STD.BURNER	IN	78	78	84	96	107	106	121	113	120	125	145	135	147	148	159	E
F HEIGHT WITHOUT TRIM		IN	55.75	63.63	63.63	63.63	63.63	63	63	75.5	77.5	77.5	77.5	90	90	90	90	F
G HEIGHT WITH TRIM	APPROX	IN	60	70	70	70	70	70	70	83	85	85	85	97	97	99	99	G
H BASE HEIGHT		IN	2	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	H
I SUPPLY SIZE		IN	3	4	4	4	4	4	4	4	6	6	6	6	6	6	6	I
J SUPPLY LOCATION		IN	13.5	17	18.5	24.5	24.5	25	30	28.5	30.5	30.5	36.5	31.5	36.5	39.5	42.5	J
K RETURN SIZE		IN	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	K
L RETURN LOCATION		IN	6	5	5	5	5	6.25	6.25	6.38	6.38	6.38	6.38	6.38	6.38	6.38	6.38	L
M DRAIN/ BLWD. SIZE		IN	1	1	1	1	1	1	1.25	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5	M
N EXHAUST STACK DIA.	O.DIA.	IN	6	8	8	8	8	10	10	12	12	12	12	14	14	18	18	N
O STACK HEIGHT		IN	42.38	52.75	52.75	52.75	52.75	50.5	50.5	62	62	62	62	72.5	72.5	74.63	74.63	O
P REAR SMOKEBOX DEPTH		IN	10	12	12	12	12	14	14	16	16	16	16	18	18	22	22	P
Q FRONT SMOKEBOX DEPTH		IN	6.75	7.25	7.25	7.25	7.25	8.25	8.25	10.25	10.25	10.25	10.25	11	11	11	11	Q
R NORMAL WATER LINE	STEAM	IN	40	51	51	51	51	50.5	50.5	61	61	61	61	71	71	71	71	R
WATER VOLUME	STEAM	GAL.	50	82	126	143	156	176	217	257	274	289	355	368	454	479	508	
WATER VOLUME	FLOODED	GAL.	72	102	150	175	195	218	267	312	336	356	436	471	574	608	647	
SHIPPING WEIGHT APPROX.	STD.TRIM	LBS.	1500	1700	1800	2000	2100	3100	3350	4000	4400	5300	5700	7000	8400	9100	9500	
BOILER HORSEPOWER			8.5	13.4	16.4	20	25	30	37.5	50	56	62.5	75	87.5	100	114.5	126.3	

	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	S45	
	152	187.8	207.5	225	250	290	331	415	500	625	769	813	
	5244	6479	7159	7763	8625	10005	11420	14318	17250	21563	26531	28049	
	5088	6287	6946	7532	8369	9708	11080	13892	16738	20922	25742	27215	
	6384	7887	8715	9450	10500	12180	13902	17430	21000	26250	32298	34166	
	45.6	56	62	67.5	75	87	99	124.5	150	187.5	231	244	
	42.5	52.5	58	63	70	81	93	116	140	175	215	228	
	625	750	830	900	1000	1160	1325	1660	2000	2500	3075	3250	
	112	121	132	140	150	166	179	207	233	280	327	342	
	92	116	132	142	155	188.7	210	261	329	407	502	535	
	69	68	66	66.5	67.7	64.5	66	67	64	64.5	64	64	
A	54	66.75	66.75	66.75	66.75	72	72	72	84	84	84	84	A
B	61	74	74	74	74	79	79	79	91	91	91	91	B
C	73	86	86	86	86	93	93	93	105	105	105	105	C
D	109	103	113	121	133	109	121	151	136.5	169.5	209.5	223.5	D
E	179	175	185	193	205	184	196	234	230	268	308	322	E
F	90	102	102	102	102	132.88	132.88	132.88	149.25	149.25	149.25	149.25	F
G	99	113	113	113	113	144.38	144.38	144.38	156	156	156	156	G
H	1.63	1.63	1.63	1.63	1.63	8	8	8	8	8	8	8	H
I	6	8	8	8	8	8	8	10	10	10	12	12	I
J	50.5	36.5	48.5	42.5	57.5	39.5	39.5	42.5	50.75	65.25	82.75	92.75	J
K	4	6	6	6	6	6	6	8	8	8	10	10	K
L	6.38	8	8	8	8	15.75	15.75	15.75	15.75	15.75	16.75	16.75	L
M	2	2	2	2	2	2	2	2	2	2	2	2	M
N	18	20	20	20	20	22	22	22	28	28	28	28	N
O	74.63	85.75	85.75	85.75	85.75	112.38	112.38	112.38	123.88	123.88	123.88	123.88	O
P	22	24	24	24	24	26	26	26	32	32	32	32	P
Q	11	13.25	13.25	13.25	13.25	15.25	15.25	15.25	18	18	18	18	Q
R	71	80.25	80.25	80.25	80.25	107.5	107.5	107.5	122	122	122	122	R
	624	603	858	913	1005	1160	1195	1557	1801	2267	2765	2955	
	794	856	1136	1211	1333	1485	1595	2056	2400	3013	3690	3942	
	10200	12000	13500	14750	16000	19000	21000	24000	29000	38000	45000	49000	
	152	187.8	207.5	225	250	290	331	415	500	625	769	813	

NOTE: CONNECTIONS UP TO 4" SIZE ARE NPT. THREAD, CONN'TNS. 6" & ABOVE ARE 150# ANSI FLANGE.
NOTE: 458 SQ.FT. AND LARGER HAS 12" X 16" MANWAY

ALL DIMENSIONS ARE IN INCHES
CERTIFIED DRAWING AVAILABLE UPON REQUEST.
DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE.

BOILER DESIGN: Three-Pass "FireBox" design with stress relieving *"Wetback"* Firetube construction. Pressure designs for steam are
- 8.5-813 HP } 15 psi. max.

Built to *Section-IV ASME Code.* Hot Water pressures models are from
- 8.5-415 HP } 100 psi. max.
- 500-813 HP } 60 psi. max.

Built to *Section-IV ASME Code*. Hot water temperature not to exceed 250° degrees F. at or near the outlet of boiler.

STEAM MODEL TRIM: Safety relief valve, operating pressure control, high limit pressure control with manual reset, steam pressure gauge with syphon, combination pump control and low water cut-off with gauge glass assembly and drain valve, auxiliary low water cut-off with manual reset.

HOT WATER MODEL TRIM: Safety relief valve, operating temperature control, high limit temperature control with manual reset, combination pressure & temperature gauge, low water cut-off control with manual reset.

BURNER: Matched UL listed "forced draft" power burners with factory pre-piped, wired and tested fuel configurations for natural gas, propane (LP) gas, No. 2 (diesel) oil, or combination of both gas/oil.

SECTION 11565

WASTE GAS BURNER

PART 1 – GENERAL

1.01 DESCRIPTION

A. SCOPE

This section specifies the waste gas burner for consuming excess combustible digester gas. The waste gas burner shall be of the flare type with automatic ignition specifically designed for burning low pressure digester gas.

The burner shall be located on a concrete pad south of the digester complex. The manufacturer shall review the mechanical layout drawings to familiarize themselves with the location and the set-up of the equipment specified and shall assure themselves that the equipment specified is appropriate for and coordinated with what is shown on the contract drawings.

The manufacturer shall also review the relevant electrical plan and one-line diagram and the relevant process and instrumentation diagram drawing to ensure that the contract drawings are appropriate and coordinated with the equipment and controls specified.

B. EQUIPMENT LIST

Item	Equipment No.
Waste gas burner	
Solenoid valve	
Pilot Gas Pressure Reducing Valve	
Natural Gas Pressure Gage	
Natural Gas Flame Trap	
Digester Gas Flame Trap	
Thermal Shutoff Valve	
Control panel	

C. PERFORMANCE AND DESIGN REQUIREMENTS

1. GENERAL: Gas produced from the water reclamation facility's anaerobic digester 3 will be wasted and combusted. As gas is produced, the pressure

relief valve functions to maintain a preset pressure in the digester gas collection manifold. As gas production causes the pressure to increase, excess gas is released to the waste gas burner for combustion. Accordingly, digester gas will be supplied to the waste gas burner at rates from near zero to the maximums specified.

Equipment specified in this specification shall be suitable for continuous duty under all weather conditions with gas evolved from anaerobic digesters. The gas is expected to contain 40 to 70 percent methane with the remainder composed of 30 to 40 percent carbon dioxide, trace quantities of nitrogen and hydrogen and up to 2,000 ppm hydrogen sulfide. The gas will contain particulate materials and greasy oils. Digester gas specific gravity is approximately 0.84. Digester gas temperatures may be expected to range between 40 degrees F and 125 degrees F at the burner. Natural gas will be supplied for the burner's pilot burner at pressures between 1 and 5 psig.

2. OPERATING REQUIREMENTS

Waste gas burner:	
Capacity	36,000 cu ft/hr
Size	12 inch
Waste gas connection	12 inch, 125 lb, ANSI flange
Maximum pressure drop	0.5 inch W.C.

D. RELATED SECTIONS AND PARAGRAPHS

The waste gas burner specified shall be provided in accordance with the following sections and paragraphs. Unless otherwise specified, the equipment supplied under this specification shall be supplied in accordance with these related sections and paragraphs. This is not a comprehensive list of related sections and paragraphs. Additional related sections and paragraphs requiring compliance are specified throughout this section.

- 11000 General Requirements for Equipment
- 11010 Equipment Controls
- 15153 Pressure Regulating Valves
- 15230 Condensate Drip Traps
- 15235 Flame Trap with Thermal Shutoff Valve
- 16175 Electrical Devices

- 16176 Control Panels

1.02 QUALITY ASSURANCE

A. STANDARDS

The waste gas burner shall be approved by Associated Mutual Laboratories and listed by Underwriters Laboratories Inc. In addition, environmental provisions of Article C500 in the National Electrical Code shall apply to this specification. Design shall meet IBC seismic requirements for Seismic Zone 2.

B. UNIT RESPONSIBILITY

The Contractor shall assign unit responsibility as specified in paragraph 11000-1.02C to the supplier of the equipment specified in this section. A certificate of responsibility shall be provided.

C. FACTORY TESTS

No specific factory tests are specified.

D. WARRANTY AND PERFORMANCE AFFIDAVIT

A one year 100% parts and labor warranty against manufacturing defects or failure of the equipment specified in this section caused by normal wear and tear shall be provided. The warranty period shall start from the date of final acceptance of the equipment specified in this section.

No performance affidavit above and beyond the inclusion of the checkmarked section(s) as specified in the Submittals paragraph of this section is specified.

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01300.

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements or those parts which are to be provided by the Contractor or others. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by

the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. A copy of the contract document control diagrams and process and instrumentation diagrams and mechanical layout drawings relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required"*. Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

3. Certificate of Unit Responsibility attesting that the Contractor has assigned unit responsibility in accordance with the requirements of this section and paragraph 11000-1.02 C. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.

4. Equipment control panel wiring diagram identifying internal and face mounted components and connections to remote equipment.

5. Shop drawings indicating construction and installation details, a complete detailing of the materials construction and equipment weights.

6. Factory testing information either as standard from the manufacturer or as specifically required in this section.

7. Dimensioned drawings of all equipment an accessories as a complete system including cross-section views.

8. Warranty information.

9. Performance affidavit if specified.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

Waste gas burners shall be by Varec or Zeeco, modified as necessary to provide the specified features and to meet specified operating conditions.

2.02 MATERIALS

All materials shall be suitable for use in Class I, Division 2, Group D, exposed locations as defined by the N.E.C. Unless otherwise specified, the waste gas burner shall use stainless steel construction throughout except for a mild steel lower section. Pilot gas nozzles and thermocouple sheath shall be made of stainless steel.

2.03 EQUIPMENT

The waste gas burner shall have a venturi type air/gas mixture system mounted adjacent to the stack. The mounting pedestal shall be internally insulated and shall include a flanged baseplate suitable for mounting as shown on the drawings.

The waste gas burner shall be equipped with a sparking electrode type ignition system capable of automatically igniting the pilot gas with natural gas. In case of pilot failure, the ignitor shall automatically activate the gas pilot. The ignitor shall operate on 120V single phase power.

The waste gas burner shall be capable of automatic repeated attempts to ignite the pilot until the thermocouple senses that the pilot is burning. Ignition and control components shall be installed in a panel remote to the burner in a NEMA 7 enclosure which shall comply with applicable portions of Division 16.

The panel shall be equipped with a MANUAL/OFF/AUTO selector switch, pilot status indicating lights, manual spark button, alarm light, and reset button. A normally closed dry contact shall be provided for a remote common alarm.

The waste gas burner shall be provided with a thermal valve and flame trap assembly, as shown and as specified in Section 15235. An explosion-proof solenoid valve, pressure gage, pressure regulating valves and shutoff valve shall be provided on the pilot line as part of the manufacturer's package.

A flame trap shall be installed in the 1/2-inch natural gas pilot line upstream of the waste gas burner. Housing shall be designed to permit easy removal of the element for inspection and cleaning and shall be constructed of cast aluminum. Flame trap shall be as specified in Section 15234.

The waste gas burner shall utilize natural gas as the pilot gas. The supply pilot natural gas pressure is expected to be 50.0 psig.

2.04 SPARE PARTS AND SPECIAL TOOLS

Provide one set of special tools required for maintenance of the equipment specified in this section.

2.05 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Operation and maintenance information specified in Section 01730.

2. Manufacturer's Installation Certification Form 11000-A specified in Part 3.

3. Product information, calculations, charts or graphs to verify that the product provided meets the requirements set forth in this specification.

4. Manufacturer's Instruction Certification Form 11000-B specified in Part 3.

5. Field test results verifying specified flow rates as specified in Part 3.

PART 3 – EXECUTION

3.01 SHIPMENT AND STORAGE

Equipment shall be shipped and stored in accordance with Section 01605.

3.02 INSTALLATION

Installation shall be in accordance with Sections 11000 and 11002. The installation and initial operation of all components shall be certified on Form 11000-A as specified in Section 01999.

3.03 START-UP

The equipment manufacturer shall provide a factory-trained representative for one working day (8 hours). The factory representative shall start up and calibrate the equipment, and train plant personnel on operating and maintenance requirements.

3.04 TRAINING

A minimum of 4 hours of training, as specified in Section 01664, shall be provided. Training shall be certified on Form 11000-B specified in Section 01999.

END OF SECTION

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SECTION 11566

TEMPERATURE-CONTROLLED ENCLOSED BIOGAS FLARES

PART 1 – GENERAL

1.01 DESCRIPTION

A. SCOPE

This section specifies the waste gas burner for consuming excess combustible digester gas. The waste gas burner shall be of the enclosed flare type with automatic ignition specifically designed for burning low pressure digester gas.

The burner shall be located on a concrete pad south of the digester complex. The manufacturer shall review the mechanical layout drawings to familiarize themselves with the location and the set-up of the equipment specified and shall assure themselves that the equipment specified is appropriate for and coordinated with what is shown on the contract drawings.

The manufacturer shall also review the relevant electrical plan and one-line diagram and the relevant process and instrumentation diagram drawing to ensure that the contract drawings are appropriate and coordinated with the equipment and controls specified.

B. TYPE

The ground flare shall be of the enclosed type with automatic ignition and shall be designed for burning low pressure municipal biogas.

C. EQUIPMENT LIST

Item	Equipment No.
Waste gas burner	
Solenoid valve	
Pilot Gas Pressure Reducing Valve	
Natural Gas Pressure Gage	
Natural Gas Flame Trap	
Digester Gas Flame Trap	
Thermal Shutoff Valve	
Control panel	

1.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. GENERAL

Excess gas or all gas, during emergencies, produced from the water reclamation facility's anaerobic digester 1 and 2 will be wasted and combusted. As gas is produced, the pressure relief valve functions to maintain a preset pressure in the digester gas collection manifold. As gas production causes the pressure to increase, excess gas is released to the waste gas burner for combustion. Accordingly, digester gas will be supplied to the waste gas burner at rates from near zero to the maximums specified.

Equipment specified in this specification shall be suitable for intermittent/continuous duty under all weather conditions with gas evolved from anaerobic digesters. The gas is expected to contain 40 to 70 percent methane with the remainder composed of 30 to 40 percent carbon dioxide, trace quantities of nitrogen and hydrogen and up to 2,000 ppm hydrogen sulfide. The gas will contain particulate materials and greasy oils. Digester gas specific gravity is approximately 0.84. Digester gas temperatures may be expected to range between 40 degrees F and 125 degrees F at the burner. Natural gas will be supplied for the burner's pilot burner at pressures between 1 and 5 psig. Provision for personnel safety shall be made at the bottom of the flare.

B. OPERATING REQUIREMENTS

The biogas enclosed flare shall have a minimum height of XX feet and be designed to meet the following requirements:

1.	Maximum capacity, standard cubic feet per minute	760
2.	Minimum gas residence time in stack, seconds	X.X seconds
3.	Operating exit gas temperature, degrees F	X,XXX
4.	Minimum exit gas temperature, at all flow rates, degrees F (shut off temperature)	X,XXX
5.	Maximum gas pressure requirement at the gas burner, inches of water column	X
6.	Gas flow rate, standard cubic feet per minute	0 to 760
7.	Burner noise at 3 feet from outer surface of flare for specified flows	82 dBA
8.	Maximum skin temperature, degrees F	250

9. Sample ports should be located a distance equal to 1/2 the flare diameter from the top of the flare. Four 3-inch diameter ports, located at 90-degree intervals, should be used.

10. Air emission rates for all conditions listed in this specification section shall not exceed the following:

Maximum NO_x	0.06 lbs/MMBtu
Maximum CO	0.15 lbs/MMBtu
Maximum volatile organic compounds (VOCs)	0.08 lbs/MMBtu
Maximum Particulates standard cubic feet	60 lbs/million

11. Operable turndown ratio from maximum gas flow rate and maximum heat input 5:1

C. CONTROL REQUIREMENTS

The gas enclosed flare supplier shall be responsible for designing and furnishing a control system capable of automatically operating the flare, exhausters and related valving together as an integrated system. The flare supplier shall submit the proposed control system design with the flare system equipment for review by the Engineer in accordance with Section 01300. The integrated control system shall include the following conditions:

1. Exhausters shall be shutdown automatically for the following:

   a. Low flame temperature (adjustable from 1300 to 1600 degrees F).

   b. Excessive vacuum at the suction side of the exhausters (adjustable over 15 to 25 inches of water column).

   c. Excessive discharge pressure at the discharge side of the exhausters (adjustable over 30 to 40 inches of water column).

   d. Combined vacuum and discharge pressure at the exhauster in excess of 55 inches of water column.

2. Shutdown of the exhausters shall be preceded by:

   a. Closing of the main gas shutoff valve (XXXXXX).

3. Automatic restarting of the exhausters shall be controlled by manually adjustable timers, capable of being set to 1-hour intervals over a total time span of 7 days. Timer(s) shall allow system operators to adjust exhauster

restart time according to total number of hours following shutdown or day and time during the week.

4. Start-up of the exhausters shall be preceded by:

   a. Start-up of the liquid propane gas (LPG) pilot ignition system.

   b. Opening of the main gas shutoff valve.

The gas system shall be fully controllable in manual mode as well as automatic mode. Applicable interlocks associated with the automatic mode shall also apply in the manual mode.

1.03 ENVIRONMENTAL CONDITIONS

Equipment will be located outdoors in a marine environment at a municipal water reclamation facility site in Tampa, Florida, at an elevation approximately 10 feet above sea level. Outside air temperature is expected to range between 32 and 100 degrees F. Humidity will range between 50 and 100 percent. Environmental conditions are described in further detail in Section 01800.

1.04 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section, as specified and modified. In case of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
NFPA 54	National Fuel Gas Code
NFPA 70-93	National Electric Code (NEC)
ASTM	American Society of Testing Materials
OSHA	Occupational Safety and Health Association Code
NFPA 820	National Fire Protection
NEMA 250-85	Enclosures for Electrical Equipment
S.F.B.C	South Florida Building Code

B. STANDARDS

All control devices and panels shall be approved by Associated Mutual Laboratories and listed by Underwriters Laboratories, Inc. All components shall meet NEMA 4 requirements for outdoor electrical installations, and shall comply with NFPA 54 (National Fuel Gas Code).

C. FACTORY TESTING

1. Factory testing shall conform to the requirements of Section 01660 and the detailed requirements specified herein. Testing shall be conducted using the equipment actually provided for this project.

2. Each flare shall be operated at the factory, on propane and a gas mixture of 50 percent natural gas and 50 percent carbon dioxide used to represent typical gas constituents. The natural gas/CO_2 mixture shall be burned at a heat release rate equal to that projected for the equipment burning gas at its design capacity plus 10 percent. The test shall be scheduled four weeks in advance with the Engineer and the City, so that the Engineer and/or City may witness the tests. Measurements of operating temperature, propane and natural gas/CO_2 flow rates, dBA weighted sound pressure levels and fuel train inlet pressures shall be taken and recorded. The 110 percent capacity test shall be of a minimum 15 minutes duration.

1.05 SPARE PARTS

The following spare parts shall be provided with the enclosed flare:

1--spare ignition assembly kit (spark plug and transformer)

1--panel kit (2 spare relays and 2 panel light bulbs)

1--spare thermocouple for each type used

1--ultraviolet eye bulb

1--1-year supply of temperature recorder paper and ink

1.06 SUBMITTALS TO BE PROVIDED

The following submittals shall be provided in accordance with Section 01300:

1. Manufacturer's catalog data confirming rated capacity size, burn retention time, electrical and propane requirements.

2. Parts list noting materials of construction.

3. Details of ignition assembly.

4. Drawings, showing general dimensions and confirming piping connections and construction details.

5. Wiring and control diagrams.

6. Verification of compliance with S.F.B.C Requirements.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

The gas enclosed flare shall be manufactured by Varec, or approved equal.

2.02 EQUIPMENT

A. GENERAL

The flare shall include the following items as a minimum:

1. Burner and burner chamber for gas and pilot fuel supply.

2. Refractory.

3. Stack.

4. Electro/pneumatic fail-safe valve.

5. Flame arrestor.

6. Non-continuous, pilot system, including 150-gallon tank (suitable for use with pressure propane), electric ignitor and pressure regulator. The 150-gallon propane tank will be provided by the City's gas supplier.

7. All controls, panel, and wiring, including temperature monitoring and recording equipment.

8. Louvered openings for inspection and maintenance of burners.

9. The exposed metal surface shall be painted in the shop as specified in Section 09900.

10. Automatically adjustable air inlet dampers to modulate combustion air based on exit gas temperature. Operation shall be such that air is decreased to increase temperature back to setpoint, and air is increased to decrease temperature back to setpoint.

11. Four 3-inch diameter exit gas sampling ports, located 1/2-diameter from the top of the stack at 90 degrees from each other.

12. Instruments for continuous recording of exit stack gas temperature in flare stack control panel at a remote location.

13. A sight port, at least 3 inches in diameter, located directly across from the pilot and burner.

B. INSTALLATION FEATURES

The enclosed flare shall be installed on a concrete slab to meet manufacturer's specification. All necessary support angles and anchor bolts to install the flare on concrete slab shall be furnished by flare manufacturer. The gas supply pipe for the pilot light, and all pipe connections furnished with the flare shall be horizontally offset 1 foot beyond the outermost dimension of flare. The biogas pipes and header furnished with the flare shall be provided such that they connect to a single 14-inch flanged gas pipe. Manufacturer shall provide a bolt template plate to set anchor bolts for the flare. Grounding rods shall be provided for the entire flare station.

C. IGNITION SYSTEM

The burner shall be equipped with an Underwriters Laboratories-recognized and FM-approved electronic flame safeguard control system having the following functions:

1. The control shall accomplish a safe start component check during each start, which will prevent fuel valve energization under any condition which causes the flame-actuated relay to assume or hold its energized state, a flame simulating component failure or mechanical failure or blower failure.

2. Flame detection scanner and amplifier. Flame detection scanner shall provide safety shutdown including exhauster lockout within 4 seconds following a flame failure or the opening of any running interlock. Scanner shall be backed up with a low temperature (thermocouple) shutdown.

3. Local alarm panel and remote visible-only alarm to indicate flare shutdown.

4. The control system shall prevent the opening of the main gas valve until after the presence of the pilot flame is confirmed.

5. The control system shall be designed for 120-volt operation, with one side grounded. All switching shall be accomplished in the hot circuit.

6. The pilot and main flames shall be monitored by an ultraviolet-sensitive flame scanner which shall not be actuated by hot refractory.

7. The scanner shall be suitable for operation to 200 degrees F, as measured on the mounting hub.

D. REFRACTORY

Two-inch lightweight, insulating refractory blanket shall be shop-installed in the flare stack. Refractory shall be rated for the design operating temperature. Refractory shall not require warm-up or cool-down procedures to avoid refractory damage. The flare may be subject to sudden start-up after prolonged idle periods during which these components are exposed to weather conditions. In addition, sudden shut down may occur after prolonged operational periods.

E. STACK

Flare stack shall be made from carbon steel with minimum wall thickness of 1/4-inch. The flare stack shall have a continuous flange with anchor bolt holes for anchoring of the stack to the slab. Anchor bolt size and spacing shall be determined by the stack manufacturer. Refractory pins and keepers shall be made of Inconel and placed to anchor the insulation to the shell in accordance with the recommendations of the refractory manufacturer. The bottom section of the flare stack shall be equipped with a personnel guard. Stack and anchor bolts shall be designed to comply with the latest revision of the South Florida Building Code.

F. AIR DAMPER

Automatically adjustable air inlet damper for regulating the amount of air available to the burner to maintain a minimum exit gas temperature of 1400 degrees F.

G. BURNERS

Burners shall be made from 300 series stainless steel with minimum thickness of 16 gauge. The manifold shall be of a sectional header arrangement to accommodate removal and repair of individual headers.

H. PILOT GAS

Pilot gas piping train shall include solenoid shut-off valve, pressure reducing valve, pressure taps, strainer, flame check (Varec Series 52 or equal), manual bypass and a manual isolating valve. Propane shall be used for pilot light. A pressure reducing valve shall be provided on the pilot line to regulate the pressure as required for flare operation. The Contractor shall provide propane tank supports as recommended by the City's gas supplier. The City's gas supplier will supply the propane tank.

I. CONTROLS

Multiple thermocouples shall be provided on the stack for the purpose of monitoring the flame during flare operation. One thermocouple shall be located 1/2 stack diameter below the top

of the stack. The other thermocouples shall be located on the stack at points appropriate for monitoring exit gas temperature at gas flow rates of 1,000, 2,000, and 4,000 scfm and a residence time of 0.6 seconds. A manual selector switch shall be provided on the control panel to allow operator selection of the thermocouple to be used for controlling burner operation.

The control panel shall be free-standing. The panel enclosure shall be hinged, dust tight, and NEMA 12. The panel shall contain all instruments not mounted on the unit, including the combustion safeguard relay; power on-off switch; gas pilot light ignition system; operating lights for power-on, ignition on, pilot on, gas on, and flare failure; temperature recorder/indicator; terminal strips; control circuit fuse; name plates; isolated contacts for remote alarm; power surge arrestor; and interlocking contact for the exhauster motor start circuits. The ignition transformer shall be mounted adjacent to the flare. Flare manufacturer shall provide high temperature ignition cable which is UL listed for temperatures up to 550 degrees C.

J. FLAME TRAP ASSEMBLY

The gas low pressure pipe system shall include a flame trap assembly consisting of a flame arrester and a thermal operated shutoff valve as part of the prefabricated gas burner system. The flame arrester shall be Varec, Model 5010, or equal. The thermal operated valve shall be Varec, Model 430, or equal. The flame arrester shall have cast aluminum housing and shall be equipped with a threaded connection for draining condensate to a drip trap. The internal parts of the flame arrestor shall be made of series 300 stainless steel.

K. CONDENSATE AND SEDIMENT TRAP

A 48-inch condensate and sediment trap shall be provided on the vacuum piping to remove condensate and sediment from gas prior to reaching the exhausters. The condensate and sediment trap shall be of 3/8-inch welded A36 steel construction and shall be fabricated in conformance with ASME Code 8 for Unfixed Pressure Vessels. All NPT connectors and miscellaneous hardware shall be stainless steel. The unit shall have design features for easy cleaning and a maximum pressure loss of 1 inch of water column at maximum design flow. Interior and exterior surfaces shall be coated as specified in Section 09900. The condensate and sediment trap shall be pressure tested with compressed air at 5 psig for a minimum of 30 minutes in the shop prior to shipment to the project site. The condensate and sediment trap shall be as manufactured by LFG Specialties, Inc., or equal. Condensate shall be
discharged by gravity to the condensate lift station.

As an alternate to steel, the condensate and sediment trap may be fabricated from HDPE pipe with an SDR of 17 or less. If fabrication from HDPE is selected, inside surfaces require no coating. Outside above grade surfaces shall be coated the same as above grade PVC pipe. All NPT hardware and connectors shall be stainless steel. The same pressure testing requirements stated for steel apply to HDPE condensate and sediment traps.

L. GAGE TAPS

Gage taps shall be provided on the suction and discharge of all exhausters, downstream of the flame arrester assembly, upstream of the butterfly valve, and upstream of the condensate and sediment trap. Gage taps shall consist of a 1/4-inch gage cock attached by a threaded nipple to the pipeline, duct or equipment.

2.03 PRODUCT DATA

The following information shall be provided in accordance with Section 01300-1.01:

1. All operation and maintenance information specified in Section 01730.

2. Structural calculations for the stack and anchor bolts confirming compliance with the latest revision of the South Florida Building Code.

PART 3 – EXECUTION

3.01 INSTALLATION

The enclosed flare shall be assembled and installed at the project site in strict accordance with the manufacturer's instructions.

3.02 PERFORMANCE TESTING

After installation, the equipment specified in this section shall be completely field-tested by the Contractor over the entire specified range of operation to demonstrate satisfaction of all specified requirements. Should the City determine during the testing that the equipment does not perform to, or meet the requirements as specified herein, the Contractor shall cause the necessary modifications or replacements to be made.

Testing of the flare system shall be conducted subsequent to the completed installation of the gas system, including all piping, appurtenances and flare. Completion of installation for testing shall require approval by both the Contractor and the City.

The Contractor shall successfully operate the system for a period of 120 continuous hours to demonstrate satisfaction of the performance requirements specified herein. Performance testing shall be accomplished over the full range of gas flow rates specified. During the 120 hour performance test period, Contractor shall demonstrate operation of all system components in both manual and automatic modes, including startup and shutdown of exhausters and flare by all control mechanisms and control options. Satisfaction of emission requirements shall be documented by an independent testing laboratory to be provided by the City.

Contractor shall be subject to all costs for removal of any defective equipment and replacing, restoring, starting-up, and re-testing of the equipment as required for a satisfactory installation as specified.

3.03 START-UP AND INSTRUCTIONAL PERSONNEL

The Contractor shall provide a complete operation and maintenance manual for the flare system. Contractor shall also provide a factory-trained manufacturer's representative for start-up assistance plus 8 hours of instruction of the City's operating personnel as to the proper method of operation and maintenance procedures. Instruction shall be conducted after the system has been checked out, started up, and satisfied performance testing requirements.

END OF SECTION

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SECTION 11567

STARTUP FLARE

PART 1 – GENERAL

1.01 DESCRIPTION

A. SCOPE

This section specifies the startup flare for consuming excess product gas from a biogas upgrading system. The startup flare shall be of the waste gas burner type with automatic ignition.

The flare shall be located on a concrete pad south of the biogas upgrading system area.

B. EQUIPMENT LIST

Item	Equipment No.
Startup Flare	BRN-8822

C. PERFORMANCE AND DESIGN REQUIREMENTS

1. GENERAL: Gas produced from the biogas upgrading system specified in Section 11045 shall be wasted and combusted during its normal startup process and occasionally during normal operation for pressure control. Equipment specified in this specification shall be suitable for continuous duty under all weather conditions with product gas evolved from the biogas upgrading system specified in Section 11045. The gas is expected to contain up to 98 percent methane with the remainder composed of carbon dioxide, trace quantities of nitrogen and hydrogen less than 50 ppm hydrogen sulfide. The product gas temperature is expected to be between 50 and 150 degrees F. The gas pressure is expected to be 0.5 psig to 1 psig. Natural gas will be supplied for the burner's pilot burner at pressures between 40 and 50 psig.

2. All electrical components, instruments and wiring shall be suitable for use in the following exposed locations as defined by the NEC:

   a. Class I, Division 1 within 10 feet of all gas fixtures, appurtenances and housing.

   b. Class I, Division 2, in an envelope 19 feet above and 5 feet on all sides of the Division 1 envelope.

3. OPERATING REQUIREMENTS

Startup Flare:	
Capacity	12,000 standard cubic ft/hr
Size	4 inch
Waste gas connection	4 inch, 125 lb, ANSI flange
Maximum pressure drop	5 inch W.C.

D. RELATED SECTIONS AND PARAGRAPHS

The flare specified shall be provided in accordance with the following sections and paragraphs. Unless otherwise specified, the equipment supplied under this specification shall be supplied in accordance with these related sections and paragraphs. This is not a comprehensive list of related sections and paragraphs. Additional related sections and paragraphs requiring compliance are specified throughout this section.

- 11000 General Requirements for Equipment
- 11010 Equipment Controls
- 15230 Condensate Drip Traps
- 15235 Flame Trap with Thermal Shutoff Valve
- 16175 Electrical Devices
- 16176 Control Panels

1.02 QUALITY ASSURANCE

A. STANDARDS

The flare shall be approved by Associated Mutual Laboratories and listed by Underwriters Laboratories Inc. In addition, environmental provisions of Article C500 in the National Electrical Code shall apply to this specification.

B. UNIT RESPONSIBILITY

The Contractor shall assign unit responsibility as specified in paragraph 11000-1.02C to the supplier of the equipment specified in this section. A certificate of responsibility shall be provided.

C. WARRANTY

A one year 100% parts and labor warranty against manufacturing defects or failure of the equipment specified in this section caused by normal wear and tear shall be provided. The warranty period shall start from the date of final acceptance of the equipment specified in this section.

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01300.

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements or those parts which are to be provided by the Contractor or others. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. A copy of the contract document control diagrams and process and instrumentation diagrams and mechanical layout drawings relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required"*. Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

3. Certificate of Unit Responsibility attesting that the Contractor has assigned unit responsibility in accordance with the requirements of this section and paragraph 11000-1.02 C. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.

4. Equipment control panel wiring diagram identifying internal and face mounted components and connections to remote equipment.

5. Shop drawings indicating construction and installation details, a complete detailing of the materials construction and equipment weights.

6. Factory testing information either as standard from the manufacturer or as specifically required in this section.

7. Dimensioned drawings of all equipment an accessories as a complete system including cross-section views.

8. Warranty information.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

Flare shall be by John Zink, Varec or Zeeco, modified as necessary to provide the specified features and to meet specified operating conditions.

2.02 MATERIALS

Unless otherwise specified, the flare shall use stainless steel construction throughout. Pilot gas nozzles and thermocouple sheath shall be made of stainless steel.

2.03 EQUIPMENT

1. FLARE AND IGNITOR:

   a. The flare shall have a venturi type air/gas mixture system mounted adjacent to the stack. The mounting pedestal shall be internally insulated and shall include a flanged baseplate suitable for mounting on a concrete slab.

   b. The flare shall be equipped with a sparking electrode type ignition system capable of automatically igniting the pilot gas with natural gas. In case of pilot failure, the ignitor shall automatically activate the gas pilot. The ignitor shall operate on 120V single phase power.

   c. The flare shall be capable of automatic repeated attempts to ignite the pilot until the thermocouple senses that the pilot is burning. Ignition and control components shall be installed in a panel remote to the burner in a NEMA 7 enclosure which shall comply with applicable portions of Division 16.

   d. The flare shall have a stainless steel wind shield to protect the flame.

e. The flare shall be provided with a flame trap assembly including a flame arrestor and thermal shutoff valve as specified in Section 15235.

2. CONTROL PANEL:

a. The panel shall be equipped with a MANUAL/OFF/AUTO selector switch, pilot status indicating lights, manual spark button, alarm light, and reset button.

b. A normally closed dry contact shall be provided for a remote common alarm.

c. A normally closed dry contact shall be provided for a remote 'PILOT ON' signal.

d. Provide any other signals required for proper BUS operation.

3. PILOT:

a. An explosion-proof solenoid valve, pressure gage, pressure regulating valves and shutoff valve shall be provided on the pilot line as part of the manufacturer's package.

b. A flame check shall be installed in the natural gas pilot line upstream of the flare. Housing shall be designed to permit easy removal of the element for inspection and cleaning and shall be constructed of cast aluminum. Flame check shall be as specified in Section 15234.

c. The flare shall utilize natural gas as the pilot gas. The supply pilot natural gas pressure is expected to be between 45 an 55 psig.

2.04 SPARE PARTS AND SPECIAL TOOLS

Provide one set of special tools required for maintenance of the equipment specified in this section.

2.05 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Operation and maintenance information specified in Section 01730.

2. Manufacturer's Installation Certification Form 11000-A specified in Part 3.

3. Product information, calculations, charts or graphs to verify that the product provided meets the requirements set forth in this specification.

4. Manufacturer's Instruction Certification Form 11000-B specified in Part 3.

5. Field test results verifying specified flow rates as specified in Part 3.

PART 3 – EXECUTION

3.01 SHIPMENT AND STORAGE

Equipment shall be shipped and stored in accordance with Section 01605.

3.02 INSTALLATION

Installation shall be in accordance with Sections 11000 and 11002. The installation and initial operation of all components shall be certified on Form 11000-A as specified in Section 01999.

3.03 START-UP

The equipment manufacturer shall provide a factory-trained representative for one working day (8 hours). The factory representative shall start up and calibrate the equipment, and train plant personnel on operating and maintenance requirements.

3.04 TRAINING

A minimum of 4 hours of training, as specified in Section 01664, shall be provided. Training shall be certified on Form 11000-B specified in Section 01999.

END OF SECTION

SECTION 11568

LOW-BTU WASTE GAS BURNER

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE

This section describes a low-Btu waste gas burner or thermal oxidizer designed for the incineration of low-pressure waste gas produced by a biogas upgrading system. The waste gas burner shall have a pilot system capable of utilizing natural gas or product gas from the biogas upgrading system. The Contractor shall procure a third-party lab to conduct emissions testing of the waste gas burner exhaust.

B. TYPE

The equipment shall include a fully-packaged, low-Btu waste gas burner, blower, pilot systems, control valves, control panels, and all other associated equipment to form a complete package to combust waste gas from the biogas upgrading system specified in Section 11045.

C. DEFINITIONS

Terminology used in this specification conforms to the following definitions:

1. Standard Cubic Feet Per Minute (scfm): The volumetric flow rate in cubic feet per minute at 60 degrees F., 14.69 pounds per square inch absolute pressure.

2. Low-Btu waste gas burner and thermal oxidizer are used interchangeably in this Section. Both names refer to a self-sustaining combustion device for the waste gas from the biogas upgrading system specified in Section 11045.

3. BUS is the acronym for the biogas upgrading system. BUS product gas refers to the natural gas pipeline quality biomethane produced by the BUS.

D. EQUIPMENT LIST

Item	Equipment No.
Thermal Oxidizer	BRN-8811
Thermal Oxidizer Blower	B-8811
Control Panel	VCP-8811

1.02 DESIGN AND PERFORMANCE CRITERIA

A. OPERATING CONDITIONS

The equipment specified in this Section shall be suitable for continuous duty under all weather conditions. The waste gas burner shall be capable of combusting waste gas over the following range of conditions:

Description	Value	
	Condition 1 Normal Max Flow	Condition 2 Normal Min Flow
Waste gas flow, scfm	140	56
Methane, % by volume	18.40%	15.30%
Carbon dioxide, % by volume	79.10%	82.40%
Water, % by volume	1.90%	0.53%
Hydrogen sulfide, % by volume	0.59%	1.70%
Nitrogen, % by volume	0%	0%
Siloxanes, ppmv	12	12
VOCs, ppmv	240	240
Higher heating value, Btu/scf	186	155
Energy (HHV), Btu/hr	1,560,000	520,000

B. DESIGN AND PERFORMANCE REQUIREMENTS

The waste gas burner shall meet the performance requirements listed below for all operating conditions:

Description	BRN-8811
Minimum methane destruction efficiency, %	99.9
Maximum noise at 10 feet, dBA	70
Maximum air emission rates:	
NOx, lbs/MMBtu input	0.06
CO, lbs/MMBtu input	0.30
VOCs, lb/MMBtu input	0.08

C. ELECTRICAL CLASSIFICATION

All low-Btu waste gas burner system equipment, instruments and appurtenances shall conform to the following as a minimum:

1. Class I Division 1 per NEC within 5 feet each low-Btu waste gas burner; NEMA 4X and NEMA 7 (or intrinsically safe).

2. Class I Division 2 per NEC within 10 feet of each low-Btu waste gas burner; NEMA 4X and NEMA 7 (or intrinsically safe).

3. Unclassified: All areas not governed by 1 and 2 above.

1.03 QUALITY ASSURANCE

A. REFERENCE STANDARDS

This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ASTM	American Society of Testing Materials
IBC	International Building Code
NEMA 250-85	Enclosures for Electrical Equipment
NFPA 54	National Fuel Gas Code
NFPA 70-93	National Electric Code (NEC)
NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities
OSHA	Occupational Safety and Health Association Code
UL 508	The Underwriters' Laboratories, Inc. (UL) Safety Standard for Industrial Control Equipment

B. UNIT RESPONSIBILITY

The Contractor shall assign unit responsibility, as specified in paragraph 11000-1.02 C, to the manufacturer of the waste gas burners provided under this section. This manufacturer is the

unit responsibility manufacturer and has unit responsibility, as specified in paragraph 11000-1.02, for both the equipment assembly specified in this section and all other equipment assembly components specified elsewhere but referenced in this section. A completed, signed, and notarized Certificate of Unit Responsibility (Form 11000 C, Section 01999) shall be provided.

C. SUPPLIER QUALIFICATIONS

The Supplier shall have a minimum of 5 installations of similar low-Btu waste gas burners for biogas applications. The Supplier shall provide descriptions and complete contact information, with phone numbers of the five projects that meet this requirement.

D. FACTORY TESTS

Factory tests shall be performed according to the manufacturer's standard test procedures. Certified test results shall be provided as product data.

E. SHIPMENT, PROTECTION AND STORAGE

Equipment shipment, protection and storage shall conform to the requirements specified in Section 01605.

1.04 ENVIRONMENTAL CONDITIONS

The low emissions waste gas burner shall be installed outdoors as shown on the drawings. Environmental conditions are described in Section 01800.

1.05 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements or those parts which are to be provided by the Contractor or others. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined shall signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. A copy of the contract document control diagrams and process and instrumentation diagrams and mechanical layout drawings relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required"*. Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

3. Certificate of Unit Responsibility attesting that the Contractor has assigned unit responsibility in accordance with the requirements of this section and paragraph 11000-1.02 C. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.

4. Drawings showing general dimensions and confirming the size of equipment, motors and drives, and piping connections.

5. Manufacturer's data including materials of construction, construction details of equipment, wiring diagrams, and weight of equipment.

6. Operating data from similar installations including feed gas, flare exhaust gas compositions, and flare exhaust velocities.

7. Manufacturer's product literature.

8. Equipment control panel wiring diagrams identifying internal and face mounted components and connections to remote equipment.

9. Structural calculations for the stack and anchor bolts confirming compliance with the latest revision of the International Building Code in accordance with Section 01900. Calculations shall be signed by a professional engineer registered in the State of Florida.

10. Manufacturer's recommended installation instructions.

11. Grounding rod location and installation detail for lightning protection.

1.06 ANCHORAGE AND STRUCTURAL DATA

Mechanical, instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist wind loading forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 01900.

PART 2-- PRODUCTS

2.01 ACCEPTABLE PRODUCTS

The Owner and Design Engineer believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that the named manufacturer's standard equipment or products will comply with the requirements of this Section. Candidate manufacturer are listed below.

1. Flare Industries, type CEB
2. Catalytic Products Incorporated, type NRV
3. Approved Equal

2.02 MATERIALS

Materials for components shall be as follows:

Component	Material
Waste Gas Burner Inlet	ASTM A312, Type 316
Burners	Type 316 stainless steel
Frame and housing	Carbon steel
Combustion Stack Assembly	Type 316 stainless steel
Waste Gas Supply Piping	ASTM A312, Type 316
Pilot gas piping	Carbon Steel

Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet the required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

2.03 EQUIPMENT FEATURES

A. GENERAL

All equipment listed in this Section shall be fully packaged and factory pre-wired.

B. COMBUSTION STACK ASSEMBLY AND BURNERS

1. Combustion stack assembly shall mount on the burner base and shall be self-supporting, without the use of guy wires. Lugs shall be provided on stack assembly as required for support.

2. The combustion stack assembly refractory lining shall be replaceable.

3. The combustion stack assembly shall be able to use natural gas and BUS product gas as the pilot gas.

4. The burner shall have no visible flame and be designed to combust BUS waste gas efficiently without limiting the gas flow range.

5. Sample ports shall be located a distance equal to 1/2 the flare diameter from the top of the flare. Two 2-inch-diameter ports, located at 180-degree intervals, shall be used.

6. The low-Btu waste gas burners shall be provided with refractory constructed with ceramic fiber blanket or block modules suitable for 2,700 degree F service and to maintain a maximum skin temperature of 350 degrees F. The ceramic fiber blanket shall be overlapped to compensate for a minimum shrinkage factor of 8 percent. The blanket or block modules shall have a maximum density of 8 pounds per cubic foot on the hot face (inside) and 6 pounds per cubic foot on the back side. The upper edge of the ceramic fiber blanket or block modules shall be protected from rain saturation by a protective shield. The refractory shall also protect the concrete foundation.

C. STACK BURNER BASE AND PEDESTAL

1. Burner base and pedestal shall have 3 to 4 mil P-Series TGIC polyester top coat powder coating for corrosion resistance, in accordance with Section 09900.

2. Burner base and pedestal shall be designed to secure the stack firmly to the skid with bolt holes and anchor bolts.

D. FLAME TRAP ASSEMBLY

1. The waste gas burner shall be provided with a flame trap assembly, installed on the gas header to each burner and no more than 5 feet from the burner. The flame trap assembly shall be as specified in Section 11556.

E. PILOT GAS SUPPLY

1. A continuous flame nozzle shall be mounted integral to the burner. The pilot flame shall design shall ensure ignition of waste gas regardless of the flow rate. The pilot shall withstand winds up to 110 mph (177 km/h).

2. The waste gas burner shall operate using the following pilot gas systems:

   a. Natural gas or BUS product gas, 50 SCFH maximum at 10 PSIG minimum to 100 PSIG maximum.

3. The pilot gas and air shall be mixed and ignited at ground level, remote from the combustion stack assembly. Specifically, no component of the ignition system shall be mounted to the burner stack or shroud; nor shall heat shields be substituted in an attempt to protect such devices from the heat of combustion.

4. The pilot shall burn a stoichiometric (an ideal gas-to-air burning ratio), non-smoking flame at all times, allowing for variations in the waste gas flow or BTU content.

F. PILOT GAS CONTROL COMPONENTS

1. The waste gas burner shall be provided with a pilot gas control package. The pilot gas control components shall be mounted on a control panel.

2. The pilot gas control package shall be mounted on the waste gas burner skid and all piping shall be provided on the skid.

3. The pilot gas control components shall include the following:

   a. A fail-closed stainless steel solenoid valve.

   b. Pressure gauges, 0-100 PSIG range on the natural gas pilot system.

   c. Isolation valves designed for natural gas service

   d. All tubing and threaded fittings shall be provided in steel or stainless steel construction.

4. The waste gas burner ignition system shall be provided with a flame check sized per manufacturer's recommendation. Housing shall be of "pipe union" design to permit easy disassembly for inspection and cleaning. Element shall be replaceable and be made of compressed 316 SS woven wire. Housing shall be constructed of low copper cast aluminum. Maximum working pressure shall be 25 psig (172 kPa). The flame check shall meet the following design requirements.

G. CONDENSATE CONTROL

1. Provide a low-pressure drip trap on the drain port of the flame trap assembly. The drip trap shall be as specified in Section 11556.

H. COMBUSTION AIR BLOWER

1. TBD

I. IGNITION SYSTEM

1. The low-Btu waste gas burner shall be equipped with an electric ignition system. The ignition systems shall be fully automatic, and shall provide flame monitoring, auto-ignition from a contact closure or from a manual override, sense pilot flame status, automatic re-ignition sequencing and flame failure alarms. The igniter shall be a spark-type electrode using 120V AC, single phase power to a 6000 Volt ignition transformer mounted on the low-Btu waste gas burner in a stainless steel enclosure.

2. The low-Btu waste gas burner shall be provided with two ultraviolet repetitive, self-checking flame scanners, one to detect the presence of the pilot flame, and one to prove main pilot operation. Each scanner shall have an individual UL listed and FM approved solid state flame safeguard relay mounted in the control panel.

3. Flame scanners shall be mounted with a ball swivel assembly or to allow for field aiming.

4. The low-Btu waste gas burner shall be equipped with an observation port for visual flame confirmation.

J. CONTROL DEVICES AND PANELS

1. All control devices and panels shall be listed by UL. All components shall meet the requirements for outdoor electrical installations, as specified in Divisions 16 and 17, and shall comply with UL 1203, UL 508A, NFPA 54, NFPA 820, and the NEC.

2. All power and control connections shall be provided to one connection location at the control panel. The manufacturer shall be responsible for wiring all other power and control components associated with the skid.

3. The low-Btu waste gas burner shall include a panel enclosure mounted on the control panel stand. The panel enclosure shall meet the requirements of NEC Article 500 Class I, Division 1 and shall be corrosion resistant. Ignition and control components shall be installed within the low-Btu waste gas burner structure, in a stainless steel enclosure or the panel shall be located a minimum of 10 feet away from the nearest burner and 10 feet

away from the nearest gas piping appurtenance. The panel shall be operated by 120 VAC, single phase, 60 Hz, and draw no more than 24 Amps at 120VAC single phase. Control panel shall be a UL 508 flame safeguard listed system, equipped with a local power disconnect.

4. The controller shall consist of dedicated solid-state electronic microprocessor. The control system shall have the capability for repeated ignition cycles. The panel shall contain all instruments not mounted on the unit, including:

   a. Power on-off switch;

   b. REMOTE/LOCAL switch;

   c. Manual start/stop button;

   d. Contacts for remote start/stop;

   e. Contacts for remote “Pilot Proven” indication;

   f. Contacts for remote “Ready” indication;

   g. Contacts for a remote common trouble alarm;

   h. Pilot flame monitoring;

   i. Status lights or LCD on the control panel door for the following:

      i. "Power On" indication

      ii. “Blower on” indication

      iii. "Pilot Gas On" indication

      iv. "Pilot Proven" indication

      v. "Flame Proved" indication

      vi. "High Flare Stack Temperature" indication

      vii. "Low Flare Stack Temp" indication

      viii. "Flame Failure" indication

      ix. Any other alarms as required to make the system fully operational and for maintenance troubleshooting

   j. Stack temperature digital display;

k. Combustion efficiency display;

l. Control power transformer;

m. Contacts for remote monitoring of system;

n. Flame scanner failure;

o. Test buttons;

p. Control circuit breaker, and

q. Name plate.

5. The control panel shall include necessary pilot controls to provide automatic re-ignition of the burner. The control panel shall provide a flame sensing and re-ignition sequence in case the pilot is lost. In case of a pilot flame failure, the solenoid valves shall fail close/powered open.

6. Pilot gas shall be operated only when a pre-start signal is provided from the local control panel.

K. CONTROL NARRATIVE

1. The low-Btu waste gas burner shall close the "Ready" contacts when the unit is ready to receive waste gas.

2. In the REMOTE position, the low-Btu waste gas burner shall start and stop with a discrete signal provided by the biogas upgrading system control system.

3. In the LOCAL position, the low-Btu waste gas burner shall start and stop with local start/stop button.

4. The low-Btu waste gas burner shall automatically adjust to changing waste gas flows and Btu content to provide proper combustion over the range of operating conditions.

2.04 SPARE PARTS

Each low-Btu waste gas burner shall be provided with the following spare parts:

1. Two - spare ignition spark plugs.

2. Two - spare thermocouples.

3. Two - spare time delay relays.

4. One – burner.

5. One – flame scanner.

6. One – pilot nozzle.

7. One – waste gas flame arrestor element.

8. One – pilot gas flame check or arrestor element.

Spare parts shall be packed and boxed as specified in Section 11000.

2.05 PRODUCT DATA

The following product data shall be provided in accordance with Section 01300:

1. Applicable operating and maintenance information specified in Section 01730.

2. Instruction material specified in paragraph 3.05.

3. Manufacturer's product literature for specified equipment.

4. Manufacturer's Installation Certification Form 11000-A specified in paragraph 3.03.

5. Manufacturer's Instruction Certification Form 11000-B specified in paragraph 3.05.

PART 3--EXECUTION

3.01 ASSEMBLY AND DELIVERY

The waste gas burner shall be factory assembly on a skid (stack separate) and shall be shipped to the Site for installation by the Contractor.

3.02 COATINGS

Coatings shall be provided in accordance with Section 09900. All coatings for the waste gas burner shall be factory applied.

3.03 INSTALLATION

The equipment provided under this section shall be aligned, connected, and installed in accordance with the manufacturer's recommendations. The Contractor shall install a grounding rod for lightning protection and attach it to the flare stack per the manufacturer’s recommendation. The installation shall be certified on Form 11000-A specified in Section 01999.

3.04 TESTING

In addition to the testing requirements of this Section, the Contractor shall perform all testing for this product or system to fulfill the requirements of Section 01660, the applicable codes, and the manufacturer's current quality assurance program. The Contractor shall perform the following testing:

1. Operate the system for a period of 120 continuous hours to demonstrate satisfaction of the performance requirements specified herein.

2. To the extent the gas is available, operating over the full range of gas flow rates specified.

3. Satisfaction of the emissions requirements for air permit testing shall be documented by an independent testing laboratory. The Contractor shall pay for and arrange to have an independent and fully certified testing laboratory perform exhaust emissions testing to confirm performance with this Section. The testing laboratory shall be subject to approval by the Owner. All emissions testing shall be open to the Owner for observation. The emissions shall be tested using digester gas as the pilot fuel. Submit certified test result to the Owner for acceptance.

If required, the Contractor shall take corrective action and have the system retested to ensure full compliance with the specified requirements.

3.05 MANUFACTURER'S SERVICES

Training shall conform to Section 01664 and shall be certified by the manufacturer's authorized representative on Form 11000-B as specified in Section 01999. At a minimum, the Contractor shall provide a factory-trained manufacturer's representative for two 8-hour days for start-up assistance/commissioning. Prior to start-up/commissioning, the factory-trained manufacturer's representative shall inspect and verify the installation is correct. The factory-trained manufacturer's representative shall provide two 4-hour training sessions for the Owner's operating personnel as to the proper method of operation and maintenance procedures. Instruction shall be conducted after the system has been checked out, started up, and satisfied performance testing requirements. Contractor shall provide a factory-trained manufacturer's representative for one 8-hour day for assistance during emissions testing.

END OF SECTION

3.14.5 Odor Control Technologies

The applicability of odor control technologies is a function of the air flow and the odor concentration of the air streams to be controlled. A relatively new technology is a liquid biotrickling filter. It is physically similar to a chemical scrubber, but the process is biological. A fixed film biomass is formed on lava rock, plastic media or foam. As circulating water trickles past filter media, microbes degrade foul air pollutants. Soluble odorous gases and oxygen are continuously absorbed into the scrubber water and biological oxidation occurs. Biotrickling filters are sometimes used when biological degradation products (e.g. acids produced from H_2S and NH3 removal) could harm a biofilter bed.

Biotrickling filters are excellent for treating relatively high H_2S concentrations. H_2S removal is at least 90% for systems having concentrations of at least 10 to 20 ppm. However, removal of organic odors may be only 40 to 50% in biotrickling filters so improvement in organic odor removal effluence is an area of current research and development. Typically these units are followed by a polishing unit such as a carbon adsorber when high level control of organic sulfides or volatile organic compounds is required.

A pair of typical biotrickling filters is shown in Figure 3-22.

Figure 3-22. Two Bio-trickling Filters

To determine which foul air treatment system is most appropriate for the odorous air stream, a first-level screening analysis was performed comparing H_2S concentration versus flow as shown in Table 3-26.

H_2S concentration is used because it is the best indicator of the treatment systems' ability to control odors for most wastewater processes.

Table 3-26. First Level Screening Matrix Based on Hydrogen Sulfide for Selecting Technology

Condition	Low Concentration <10 ppm	Medium Concentration 10-50 ppm	High Concentration >50 ppm
Low Flow <5,000 cfm	Adsorber	Adsorber Biofilter	Biofilter
Medium Flow 5,000 – 20,000 cfm	Adsorber	Biofilter Biotrickling Filter Chemical Scrubber	Biotrickling Filter Chemical Scrubber
High Flow > 20,000 cfm	Adsorber Biofilter	Biofilter Biotrickling Filter	Biotrickling Filter

Table 3-26. First Level Screening Matrix Based on Hydrogen Sulfide for Selecting Technology			
	Chemical Scrubber	Chemical Scrubber	

When moderate to high organic sulfide concentrations are present either chemical scrubbing and biofiltration are appropriate and at low organic sulfide concentrations adsorbers are adequate. Based on the previous characterization of the odor air streams, the combined concentrated air stream has and air flow of 18,000 cfm and a high H_2S concentration.

Based on the guidelines presented in Table 3-26 and the anticipated odor characteristics and air flows presented in Tables 3-24 and 3-25, either a biotrickling filter (BTF) or possibly a chemical scrubber could serve as an appropriate technology. A biotrickling filter is recommended for the following reasons:

- Avoids hazardous chemicals.
- Lower operational and maintenance demands.
- Longer media life.
- Biological System familiar to process operators.

A polishing second stage using activated carbon is recommended to account for organic sulfides and other trace organics in the foul air which may be present as well as to capture any residual H_2S which may pass the biotrickling filter, though the biotrickling filter will be specified and capable of obtaining 99% H_2S removal. The foul air stream from the Gravity Thickener Building Room having a low concentration and medium air flow would be appropriately treated by the activated carbon technology. That air stream will therefore be blended with the air stream exiting the biotrickling filters and the combined air stream treated through activated carbon.

3.14.6 Summary of Proposed Foul Air Capture and Transport

The following defines key points regarding the proposed foul air capture and transport systems. Drawing G-00-33 provides a schematic of these concepts and provides air flows and sizes of the ductwork.

- Flat Covers and hoods designed to contain and capture the odorous air.
- Above grade FRP ductwork to transport the air to treatment.
- It is important that odorous buildings or tanks be maintained under negative pressure to avoid outgassing of odorous gases. If a building or tank is under positive pressure, outgassing is continuous, and even at neutral pressure the eduction effect of wind passing by the building or tank can induce outgassing. In a building, the method of achieving negative pressurization is ensuring that the exhaust air rate is greater than the supply air rate; in a tank, it is ensuring that there is sufficient educed infiltration air to overcome the wind effects.

3.14.7 Summary of Proposed Odor Control Treatment Facilities

The following defines key points regarding the proposed foul air treatment system. Reference also the following drawings:

- Drawing G-00-33: Schematic of collection and the treatment system.
- Drawing I-28-10: Process and instrumentation diagram of the proposed treatment system.
- Drawing M-28-11: Preliminary mechanical plan.

3.14.7.1 Key Development Information, Features and Design Data

The odor control system includes the following features. Table 3-27 and Table 3-28 summarize the critical process data.

- Two first-stage biotrickling filters in parallel handling equal air flow.
- Two second-stage activated carbon units in parallel handling equal air flow.
- Fans located between biotrickling filters and carbon to reduce air humidity.
- Air from GBT room treated by carbon alone.
- Redundant fan and redundant carbon unit.
- Nutrient tanks and pumps to serve biotrickling filters.
- A ferric addition system will be incorporated into the design and located near the Primary Clarifiers. This system is further discussed in Section 3.5. It serves to aid with overall odor control, H_2S removal in the digester gas and struvite control in the digestion systems.

Table 3-27. Biotrickling Filter Design Criteria

Parameter	Value
Number or Units	2
Detention time	12 seconds
Bed depth	16 ft
Vessel diameter	12 ft
Media Volume	1800 cu ft
Media Life	>10 years
Gas velocity	80 fpm
H_2S removal, typical	99%

Table 3-28. Activated Carbon System Design Criteria

Parameter	Guidelines
Detention time	3.39 secs
Bed depth	3 ft
Gas velocity	53 fpm
H_2S treatment efficiency	99.9%
Influent H_2S concentration	Up to 5 ppm
Odors treated	H_2S, organic sulfides
Pressure drop across carbon bed	2 inches per ft of media
Air flow direction	Upflow
Types of carbon	Coconut Shell
Inlet foul air relative humidity (RH)	$\leq$ 70% for virgin carbon $\leq$ 90% for catalytic carbon
Carbon vessel material	FRP

3.14.7.2 Operation and Control Narrative

The odor control system will consists of two biotrickling filters, two operating fans and a third spare fan, two activated dual bed activated carbon units and a third spare activated carbon unit.

The more concentrated foul air from two primary clarifiers, WAS holding tank, splitter box and gravity belt thickener hoods will be first treated by two biotrickling filters and then treated by two polishing activated carbon units. The room air from gravity building which is less odorous will be treated by the activated carbon units only.

Normal Operation

Normal odor control operation is as follows.

- Two biotrickling filter (each rated at 9,000 cfm), followed by two duty and one standby dual bed activated carbon units (each rated at 12,000 cfm). Both odor control systems will operate continuously 24 hours a day.
- The odor control system will include air flow measuring devices and variable speed drive fan motors; speed will be changed manually. The goal is to maintain desired air flow through each system. Fan speed will be modulated to maintain a flow rate of approximately 12,000 cfm for each system while maintaining a negative pressure in tanks.
- Pressure under the covers of the primary clarifier tank, WAS holding tank and splitter box will be manually monitored to ensure that tanks are kept under negative pressure. Ductwork dampers and fan speed may be adjusted to maintain that pressure.
- The hydrogen sulfide levels downstream of biotrickling filter will be monitored to ensure that the biotrickling filter is performing satisfactorily.

Standby Operations

There are several standby operating scenarios using the spare fan rated at 12,000 cfm and the spare dual bed activated carbon unit rated at 12,000 cfm. Refer to drawing G-00-33.

- If an operating fan is out of service the standby fan can be used as a substitute for either fan.
- If a biotrickling filter is out of service foul air can bypass the biotrickling filter and go straight to the carbon system.
- If an operating carbon unit is out of service the standby carbon unit can be used as a substitute for either operating carbon unit.
- If both carbon units are out of service the exhaust from the biotrickling filter passes straight to the atmosphere.
- If an entire odor control train is down, the system can be run with one train on line only; though with less effective capture at the process unit.

3.15 Supporting Processes

The following presents a review of the existing supporting process facilities and any new proposed facilities which are a part of the proposed improvements.

3.15.1Drain Pumping

The SWWRF's existing process drain facilities are made of two separate collection systems that collect a series of interconnected gravity drains. These two gravity systems drain to respective lift stations (LS-1 and LS-2) which collect the onsite drain water and pump their respective flows back the headworks for treatment. In addition to collecting process drain water, the lift stations also collect localized stormwater run-off, this is discussed in more detail in Section 4.1.3.4.

This project will only impact LS-2. As a result of the improvements, a large portion of the existing process drain pipes it currently receives will be demolished. A new LS-2 wetwell will be constructed and it is anticipated that the existing pumps will be relocated. A detailed evaluation of the existing pumps will be conducted during the detailed design to verify the hydraulic discharge will match the new influent flow rates. The existing location of LS-2 can be seen on Drawing CD-01-01 and the proposed new location can be seen on Drawings C-01-01.

Appendix E. Form Attachments

This appendix provides the following attachments associated with the FDEP forms.

- Precautions to Prevent Emissions of Unconfined Particulate Matter
- Fuel Analysis or Specification
- Operation and Maintenance Plan
- Description of Stack Sampling Facilities

Precautions to Prevent Emissions of Unconfined Particulate Matter

Reasonable precautions to control unconfined emissions of particulate matter as listed in Rule 62-296.320(4), F.A.C. will be employed as appropriate. Additionally, watering will be used as needed to prevent emissions from unpaved areas.

Fuel Analysis or Specification

Fuel for the emissions sources in this application is specified as pipeline natural gas and/or B.U.S. product gas.

Operation and Maintenance Plan

The emission units will be operated and maintained in accordance with manufacturer's recommendations, operations and maintenance experience, and technical guidance taking into account protection of equipment, safety of personnel, and other factors as deemed necessary to maintain compliance with the permitted limits.

Description of Stack Sampling Facilities

The emissions sources in this application will be equipped with stack sampling facilities appropriate for performing required stack testing. A detailed description of stack sampling facilities is not available at this time. When available, if requested by the Department, the stack sampling facilities description will be supplied to the Department.