# APPLICATION FOR NEW SOURCE REVIEW PERMIT

Charleston Area Medical Center
Teays Valley Hospital
Hurricane, Putnam County, West Virginia

Prepared for:
Charleston Area Medical Center, Inc.
3200 MacCorkle Avenue, SE
Charleston, West Virginia 25304

Prepared by:
Triad Engineering, Inc.
10541 Teays Valley Road
Scott Depot, West Virginia 25560

March 2016

## ***Contents***

Permit Application

Attachment A – Business Certificate

Attachment B – Map(s)

Attachment C – Installation and Start Up Schedule

Attachment D – Regulatory Discussion

Attachment E – Plot Plan

Attachment F – Detailed Process Flow Diagram(s)

Attachment G – Process Description

Attachment H – Material Safety Data Sheets (MSDS)

Attachment I – Emission Units Table

Attachment J – Emission Points Data Summary Sheet

Attachment K – Fugitive Emissions Data Summary Sheet

Attachment L – Emissions Unit Data Sheet(s)

Attachment N – Supporting Emissions Calculations

Attachment O – Monitoring/Recordkeeping/Reporting/Testing Plans

Attachment P – Public Notice

Application Fee

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

**DIVISION OF AIR QUALITY**

601 57th Street, SE
Charleston, WV 25304
(304) 926-0475
www.dep.wv.gov/daq

# *APPLICATION FOR NSR PERMIT AND TITLE V PERMIT REVISION (OPTIONAL)*

PLEASE CHECK ALL THAT APPLY TO **NSR (45CSR13)** (IF KNOWN):

☒ **CONSTRUCTION** ☐ **MODIFICATION** ☐ **RELOCATION**
☐ **CLASS I ADMINISTRATIVE UPDATE** ☐ **TEMPORARY**
☐ **CLASS II ADMINISTRATIVE UPDATE** ☒ **AFTER-THE-FACT**

PLEASE CHECK TYPE OF **45CSR30 (TITLE V)** REVISION (IF ANY):

☐ **ADMINISTRATIVE AMENDMENT** ☐ **MINOR MODIFICATION**
☐ **SIGNIFICANT MODIFICATION**

IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS **ATTACHMENT S** TO THIS APPLICATION

***FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.***

## *Section I. General*

1. Name of applicant *(as registered with the WV Secretary of State's Office):*
**Charleston Area Medical Center, Inc.**

2. Federal Employer ID No. ***(FEIN):***
**55-0526150**

3. Name of facility *(if different from above):*
**CAMC Teays Valley Hospital**

4. The applicant is the:
☐ **OWNER** ☐ **OPERATOR** ☒ **BOTH**

5A. Applicant's mailing address:
**3200 MacCorkle Avenue SE**
**Charleston, WV 25304**

5B. Facility's present physical address:
**1400 Hospital Drive**
**Hurricane, WV 25526**

6. **West Virginia Business Registration.** Is the applicant a resident of the State of West Virginia? ☒ **YES** ☐ **NO**

– If **YES,** provide a copy of the **Certificate of Incorporation/Organization/Limited Partnership** (one page) including any name change amendments or other Business Registration Certificate as **Attachment A.**
– If **NO,** provide a copy of the **Certificate of Authority/Authority of L.L.C./Registration** (one page) including any name change amendments or other Business Certificate as **Attachment A.**

7. If applicant is a subsidiary corporation, please provide the name of parent corporation:

8. Does the applicant own, lease, have an option to buy or otherwise have control of the *proposed site?* ☒ **YES** ☐ **NO**

– If **YES,** please explain: **The applicant owns the subject site.**
– If **NO,** you are not eligible for a permit for this source.

9. Type of plant or facility (stationary source) to be **constructed, modified, relocated, administratively updated** or **temporarily permitted** (e.g., coal preparation plant, primary crusher, etc.):
**Boilers and Emergency Generator**

10. North American Industry Classification System **(NAICS)** code for the facility:
**62211**

11A. DAQ Plant ID No. (for existing facilities only):
**–**

11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only):
**none**

***All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.***

12A.

- For **Modifications, Administrative Updates** or **Temporary permits** at an existing facility, please provide directions to the *present location* of the facility from the nearest state road;
- For **Construction** or **Relocation permits,** please provide directions to the *proposed new site location* from the nearest state road. Include a **MAP** as **Attachment B**.

**From Interstate 64, exit at WV-34 (Exit 39). Turn left (south) onto WV-34 and continue for approximately 1.2 miles. Turn right onto Hospital Drive and continue for approximately 0.3 miles. The facility will be on the left.**

| | | |
|---|---|---|
| 12.B. New site address (if applicable): **Not Applicable** | 12C. Nearest city or town: **Hurricane** | 12D. County: **Putnam** |
| 12.E. UTM Northing (KM): **4256.40** | 12F. UTM Easting (KM): **416.91** | 12G. UTM Zone: **17** |

13. Briefly describe the proposed change(s) at the facility:
**Permitting of hospital facility recently purchased by CAMC. The facility purchased did not have a construction permit in place. CAMC is now applying for a permit to cover emissions from two dual-fuel boilers and one emergency generator.**

| | |
|---|---|
| 14A. Provide the date of anticipated installation or change: **After-the-Fact**<br>– If this is an **After-The-Fact** permit application, provide the date upon which the proposed change did happen: **Not Applicable** | 14B. Date of anticipated Start-Up if a permit is granted: **Currently Operating** |

14C. Provide a **Schedule** of the planned **Installation** of/**Change** to and **Start-Up** of each of the units proposed in this permit application as **Attachment C** (if more than one unit is involved).

15. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application:
Hours Per Day **24** Days Per Week **7** Weeks Per Year **52**

16. Is demolition or physical renovation at an existing facility involved? ☐ **YES** ☒ **NO**

17**. Risk Management Plans.** If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your **Risk Management Plan (RMP)** to U. S. EPA Region III.

18**. Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process *(if known).* A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance *(if known).* Provide this information as **Attachment D.**

## *Section II. Additional attachments and supporting documents.*

19. Include a check payable to WVDEP – Division of Air Quality with the appropriate **application fee** (per 45CSR22 and 45CSR13).

20. Include a **Table of Contents** as the first page of your application package.

21. Provide a **Plot Plan,** e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as **Attachment E** (Refer to ***Plot Plan Guidance***) **.**

– Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).

22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as **Attachment F.**

23. Provide a **Process Description** as **Attachment G.**

– Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).

***All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.***

24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as **Attachment H.**

– For chemical processes, provide a MSDS for each compound emitted to the air.

25. Fill out the **Emission Units Table** and provide it as **Attachment I.**

26. Fill out the **Emission Points Data Summary Sheet (Table 1 and Table 2)** and provide it as **Attachment J.**

27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as **Attachment K.**

28. Check all applicable **Emissions Unit Data Sheets** listed below:

☐ Bulk Liquid Transfer Operations
☐ Chemical Processes
☐ Concrete Batch Plant
☐ Grey Iron and Steel Foundry
☐ General Emission Unit, specify

☐ Haul Road Emissions
☐ Hot Mix Asphalt Plant
☐ Incinerator
☒ Indirect Heat Exchanger

☐ Quarry
☐ Solid Materials Sizing, Handling and Storage Facilities
☒ Storage Tanks, Form G-65C used
☒ Engine Generator, Form G-65C used

Fill out and provide the **Emissions Unit Data Sheet(s)** as **Attachment L.**

29. Check all applicable **Air Pollution Control Device Sheets** listed below:

☐ Absorption Systems
☐ Adsorption Systems
☐ Afterburner

☐ Baghouse
☐ Condenser
☐ Electrostatic Precipitator

☐ Flare
☐ Mechanical Collector
☐ Wet Collecting System

☐ Other Collectors, specify

Fill out and provide the **Air Pollution Control Device Sheet(s)** as **Attachment M.**

30. Provide all **Supporting Emissions Calculations** as **Attachment N,** or attach the calculations directly to the forms listed in Items 28 through 31.

31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O.**

➢ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and ***Example Legal Advertisement*** for details). Please submit the **Affidavit of Publication** as **Attachment P** immediately upon receipt.

33**. Business Confidentiality Claims.** Does this application include confidential information (per 45CSR31)?

☐ **YES** ☒ **NO**

➢ If **YES,** identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's "***Precautionary Notice – Claims of Confidentiality"*** guidance found in the ***General Instructions*** as **Attachment Q.**

## *Section III. Certification of Information*

34. **Authority/Delegation of Authority.** Only required when someone other than the responsible official signs the application. Check applicable **Authority Form** below:

☐ Authority of Corporation or Other Business Entity
☐ Authority of Governmental Agency

☐ Authority of Partnership
☐ Authority of Limited Partnership

Submit completed and signed **Authority Form** as **Attachment R.**

***All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.***

35A. **Certification of Information.** To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

***Certification of Truth, Accuracy, and Completeness***

I, the undersigned ☒ **Responsible Official** / ☐ **Authorized Representative,** hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

***Compliance Certification***

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE Glenn Crotty Jr *(Please use blue ink)* DATE: 3/18/16 *(Please use blue ink)*

| | | |
|---|---|---|
| 35B. Printed name of signee: **Dr. Glenn Crotty, Jr., MD** | | 35C. Title: **Executive VP & COO** |
| 35D. E-mail: **Glenn.Crotty@camc.org** | 36E. Phone: **304.388.7647** | 36F. FAX: **304.388.7696** |
| 36A. Printed name of contact person (if different from above): **Nanci Keenan** | | 36B. Title: **Safety Manager** |
| 36C. E-mail: **Nanci.Keenan@camc.org** | 36D. Phone: **304.388.8890** | 36E. FAX: **304.388.8891** |

**PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:**

- ☒ **Attachment A: Business Certificate**
- ☒ **Attachment B: Map(s)**
- ☒ **Attachment C: Installation and Start Up Schedule**
- ☒ **Attachment D: Regulatory Discussion**
- ☒ **Attachment E: Plot Plan**
- ☒ **Attachment F: Detailed Process Flow Diagram(s)**
- ☒ **Attachment G: Process Description**
- ☒ **Attachment H: Material Safety Data Sheets (MSDS)**
- ☒ **Attachment I: Emission Units Table**
- ☒ **Attachment J: Emission Points Data Summary Sheet**
- ☒ **Attachment K: Fugitive Emissions Data Summary Sheet**
- ☒ **Attachment L: Emissions Unit Data Sheet(s)**
- ☐ **Attachment M: Air Pollution Control Device Sheet(s)**
- ☒ **Attachment N: Supporting Emissions Calculations**
- ☒ **Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans**
- ☒ **Attachment P: Public Notice**
- ☐ **Attachment Q: Business Confidential Claims**
- ☐ **Attachment R: Authority Forms**
- ☐ **Attachment S: Title V Permit Revision Information**
- ☒ **Application Fee**

***Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.***

***FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:***

- ☐ ***Forward 1 copy of the application to the Title V Permitting Group and:***
- ☐ ***For Title V Administrative Amendments:***
  - ☐ ***NSR permit writer should notify Title V permit writer of draft permit,***
- ☐ ***For Title V Minor Modifications:***
  - ☐ ***Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,***
  - ☐ ***NSR permit writer should notify Title V permit writer of draft permit.***
- ☐ ***For Title V Significant Modifications processed in parallel with NSR Permit revision:***
  - ☐ ***NSR permit writer should notify a Title V permit writer of draft permit,***
  - ☐ ***Public notice should reference both 45CSR13 and Title V permits,***
  - ☐ ***EPA has 45 day review period of a draft permit.***

***All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.***

# ***Attachment A***

Business Certificate

# WEST VIRGINIA
# STATE TAX DEPARTMENT

# BUSINESS REGISTRATION CERTIFICATE

ISSUED TO:
CHARLESTON AREA MEDICAL CENTER INC
DBA CHARLESTON AREA MEDICAL CENTER
PO BOX 1547
CHARLESTON, WV 25326-1547

BUSINESS REGISTRATION ACCOUNT NUMBER: 1035-7157

This certificate is issued on: 08/11/2010

*This certificate is issued by*
*the West Virginia State Tax Commissioner*
*in accordance with Chapter 11, Article 12, of the West Virginia Code*

*The person or organization identified on this certificate is registered*
*to conduct business in the State of West Virginia at the location above.*

This certificate is not transferrable and must be displayed at the location for which issued.

This certificate shall be permanent until cessation of the business for which the certificate of registration was granted or until it is suspended, revoked or cancelled by the Tax Commissioner.

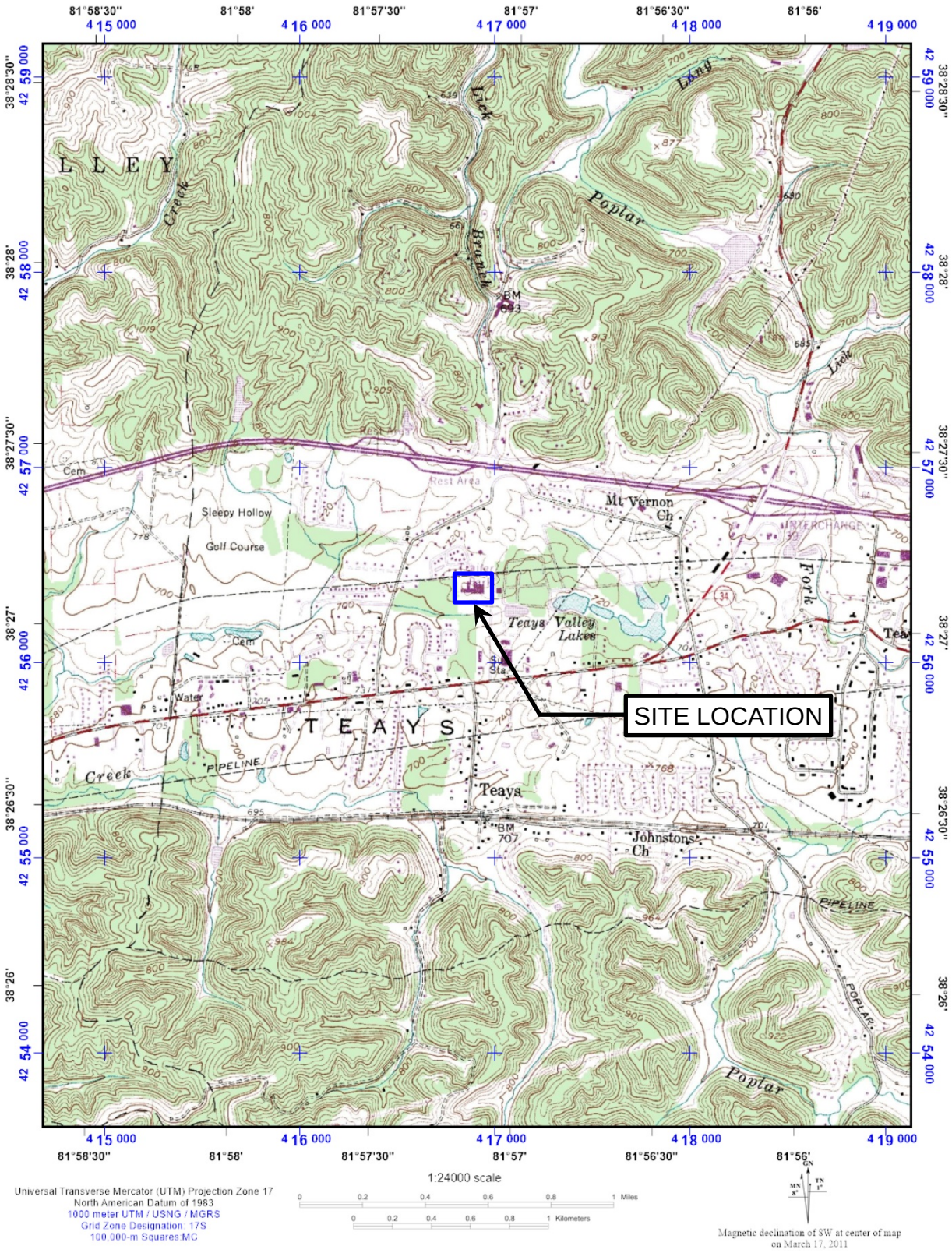
Change in name or change of location shall be considered a cessation of the business and a new certificate shall be required.

TRAVELING/STREET VENDORS: Must carry a copy of this certificate in every vehicle operated by them.
CONTRACTORS, DRILLING OPERATORS, TIMBER/LOGGING OPERATIONS: Must have a copy of this certificate displayed at every job site within West Virginia.

atL006 v.3
L0708060928

***Attachment B***

Map(s)




| CADD FILE: NA | | LOCATION MAP<br>CHARLESTON AREA MEDICAL CENTER<br>TEAYS VALLEY HOSPITAL – APPLICATION FOR NSR PERMIT<br>HURRICANE, PUTNAM COUNTY, WEST VIRGINIA | TRIAD ENGINEERING, INC.<br>www.triadeng.com<br>10541 TEAYS VALLEY ROAD<br>SCOTT DEPOT, WV 25560 |
|---|---|---|---|
| DRAWN BY: SSW | CHECKED BY: SLC | | |
| DATE: 01/20/16 | SCALE: 1:1 | PROJECT No.: 04-15-0164 FIGURE No.: B | |

# ***Attachment C***

Installation and Start Up Schedule

# Attachment C – Schedule of Installation/Start-Up

The Cleaver Brooks boilers (Boiler #1 and Boiler #2) are installed and operating at the subject facility. The emergency generator (Generator #1) is also installed and is operated as needed. CAMC purchased the subject facility, which was not historically permitted. Therefore, this is an after-the-fact permit application.

# ***Attachment D***

Regulatory Discussion

## Attachment D – Regulatory Discussion

The boilers are subject to 40 CFR 60, Subpart Dc (NSPS), and 40 CFR 63, Subpart JJJJJJ (NESHAP). Permit conditions will be required for these regulations. The pertinent provisions of Subpart Dc and Subpart JJJJJJ are included below.

**New Source Performance Standard, 40 CFR 60, Subpart Dc Applicable Provisions**

**§60.40c Applicability and delegation of authority.**

This subpart applies is each steam generating unit for which construction, modification, or reconstruction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 29 megawatts (MW) (100 million British thermal units per hour (MMBtu/h)) or less, but greater than or equal to 2.9 MW (10 MMBtu/h).

**§60.42c Standard for sulfur dioxide ($SO_2$).**

(d) On and after the date on which the initial performance test is completed or required to be completed under §60.8, whichever date comes first, no owner or operator of an affected facility that combusts oil shall cause to be discharged into the atmosphere from that affected facility any gases that contain $SO_2$ in excess of 215 ng/J (0.50 lb/MMBtu) heat input from oil; or, as an alternative, no owner or operator of an affected facility that combusts oil shall combust oil in the affected facility that contains greater than 0.5 weight percent sulfur. The percent reduction requirements are not applicable to affected facilities under this paragraph.

(h) For affected facilities listed under paragraphs (h)(1), (2), (3), or (4) of this section, compliance with the emission limits or fuel oil sulfur limits under this section may be determined based on a certification from the fuel supplier, as described under §60.48c(f), as applicable.

(1) Distillate oil-fired affected facilities with heat input capacities between 2.9 and 29 MW (10 and 100 MMBtu/hr).

(i) The $SO_2$ emission limits, fuel oil sulfur limits, and percent reduction requirements under this section apply at all times, including periods of startup, shutdown, and malfunction.

**§60.43c Standard for particulate matter (PM).**

(4) An owner or operator of an affected facility that commences construction, reconstruction, or modification after February 28, 2005, and that combusts only oil that contains no more than 0.50 weight percent sulfur or a mixture of 0.50 weight percent sulfur oil with other fuels not subject to a PM standard under §60.43c and not using a post-combustion technology (except a wet scrubber) to reduce PM or $SO_2$ emissions is not subject to the PM limit in this section.

**§60.44c Compliance and performance test methods and procedures for sulfur dioxide.**

(h) For affected facilities subject to §60.42c(h)(1), (2), or (3) where the owner or operator seeks to demonstrate compliance with the $SO_2$ standards based on fuel supplier certification, the performance test shall consist of the certification from the fuel supplier, as described in §60.48c(f), as applicable.

**§60.48c Reporting and recordkeeping requirements.**

(a) The owner or operator of each affected facility shall submit notification of the date of construction or reconstruction and actual startup, as provided by §60.7 of this part. This notification shall include:

(1) The design heat input capacity of the affected facility and identification of fuels to be combusted in the affected facility.

(3) The annual capacity factor at which the owner or operator anticipates operating the affected facility based on all fuels fired and based on each individual fuel fired.

(d) The owner or operator of each affected facility subject to the $SO_2$ emission limits, fuel oil sulfur limits, or percent reduction requirements under §60.42c shall submit reports to the Administrator.

(e) The owner or operator of each affected facility subject to the $SO_2$ emission limits, fuel oil sulfur limits, or percent reduction requirements under §60.42c shall keep records and submit reports as required under paragraph (d) of this section, including the following information, as applicable.

(1) Calendar dates covered in the reporting period.

(11) If fuel supplier certification is used to demonstrate compliance, records of fuel supplier certification as described under paragraph (f)(1), (2), (3), or (4) of this section, as applicable. In addition to records of fuel supplier certifications, the report shall include a certified statement signed by the owner or operator of the affected facility that the records of fuel supplier certifications submitted represent all of the fuel combusted during the reporting period.

(f) Fuel supplier certification shall include the following information:

(1) For distillate oil:

(i) The name of the oil supplier;

(ii) A statement from the oil supplier that the oil complies with the specifications under the definition of distillate oil in §60.41c; and

(iii) The sulfur content or maximum sulfur content of the oil.

(4) For other fuels:

(i) The name of the supplier of the fuel;

(ii) The potential sulfur emissions rate or maximum potential sulfur emissions rate of the fuel in ng/J heat input; and

(iii) The method used to determine the potential sulfur emissions rate of the fuel.

(2) As an alternative to daily recording of fuel use amounts, the owner or operator of an affected facility that combusts only natural gas, wood, fuels using fuel certification in §60.48c(f) to demonstrate compliance with the $SO_2$ standard, fuels not subject to an emissions standard (excluding opacity), or a mixture of these fuels may elect to record and maintain records of the amount of each fuel combusted during each calendar month.

(3) As an alternative to daily recording of fuel use amounts, the owner or operator of an affected facility or multiple affected facilities located on a contiguous property unit where the only fuels combusted in any steam generating unit (including steam generating units not subject to this subpart) at that property are natural gas, wood, distillate oil meeting the most current requirements in §60.42C to use fuel certification to demonstrate compliance with the $SO_2$ standard, and/or fuels, excluding coal and residual oil, not subject to an emissions standard (excluding opacity) may elect to record and maintain records of the total amount of each steam generating unit fuel delivered to that property during each calendar month.

(i) All records required under this section shall be maintained by the owner or operator of the affected facility for a period of two years following the date of such record.

(j) The reporting period for the reports required under this subpart is each six-month period. All reports shall be submitted to the Administrator and shall be postmarked by the 30th day following the end of the reporting period.

**National Emission Standards for Hazardous Air Pollutants Subpart JJJJJJ Applicable Provisions**

Requirements from 40 CFR 63, Subpart JJJJJJ applicable to new, oil-fired boilers with greater than 10 MMBtu/hr heat input, and with continuous oxygen trim, combusting only oil with less than 0.50 weight percent sulfur.

---

**§63.11196 What are my compliance dates?**

(c) If you start up a new affected source after May 20, 2011, you must achieve compliance with the provisions of this subpart upon startup of your affected source.

**§63.11201 What standards must I meet?**

(b) You must comply with each work practice standard, emission reduction measure, and management practice specified in Table 2 to this subpart that applies to your boiler.

**Table 2 to Subpart JJJJJJ of Part 63—Work Practice Standards, Emission Reduction Measures, and Management Practices**

| **If your boiler is in this subcategory . . .** | **You must meet the following . . .** |
|---|---|
| 1. Existing or new oil-fired boilers (units with heat input capacity of 10 MMBtu/hr or greater) | Minimize the boiler's startup and shutdown periods and conduct startups and shutdowns according to the manufacturer's recommended procedures. If manufacturer's recommended procedures are not available, you must follow recommended procedures for a unit of similar design for which manufacturer's recommended procedures are available. |
| 15. New oil-fired boilers with an oxygen trim system that maintains an optimum air-to-fuel ratio that would otherwise be subject to a biennial tune-up | Conduct a tune-up of the boiler every 5 years as specified in §63.11223. |

(d) These standards apply at all times the affected boiler is operating.

**§63.11205 What are my general requirements for complying with this subpart?**

(a) At all times you must operate and maintain any affected source, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. The general duty to minimize emissions does not require you to make any further efforts to reduce emissions if levels required by this standard have been achieved. Determination of whether such operation and maintenance procedures are being used will be based on information available to the Administrator that may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source.

**§63.11210 What are my initial compliance requirements and by what date must I conduct them?**

(e) For new or reconstructed oil-fired boilers that combust only oil that contains no more than 0.50 weight percent sulfur or a mixture of 0.50 weight percent sulfur oil with other fuels not subject to a PM emission limit under this subpart and that do not use a post-combustion technology (except a wet scrubber) to reduce particulate matter (PM) or sulfur dioxide emissions, you are not subject to the PM emission limit in Table 1 of this subpart providing you monitor and record on a monthly basis the type of fuel combusted.

(f) For new or reconstructed affected boilers that have applicable work practice standards or management practices, you are not required to complete an initial performance tune-up, but you are required to complete the applicable biennial or 5-year tune-up as specified in §63.11223 no later than 25 months or 61 months, respectively, after the initial startup of the new or reconstructed affected source.

**§63.11223 How do I demonstrate continuous compliance with the work practice and management practice standards?**

(a) For affected sources subject to the work practice standard or the management practices of a tune-up, you must conduct a performance tune-up according to paragraph (b) of this section and keep records as required in §63.11225(c) to demonstrate continuous compliance. You must conduct the tune-up while burning the type of fuel (or fuels in the case of boilers that routinely burn two types of fuels at the same time) that provided the majority of the heat input to the boiler over the 12 months prior to the tune-up.

(c) Boilers with an oxygen trim system that maintains an optimum air-to-fuel ratio that would otherwise be subject to a biennial tune-up must conduct a tune-up of the boiler every 5 years as specified in paragraphs (b)(1) through (7) of this section. Each 5-year tune-up must be conducted no more than 61 months after the previous tune-up. For a new or reconstructed boiler with an oxygen trim system, the first 5-year tune-up must be no later than 61 months after the initial startup. You may delay the burner inspection specified in paragraph (b)(1) of this section and inspection of the system controlling the air-to-fuel ratio specified in paragraph (b)(3) of this section until the next scheduled unit shutdown, but you must inspect each burner and system controlling the air-to-fuel ratio at least once every 72 months.

*Paragraph (b) is superceded by paragraph (c) for general conditions, specific provisions follow:*

(b)(1) As applicable, inspect the burner, and clean or replace any components of the burner as necessary (you may delay the burner inspection until the next scheduled unit shutdown, not to exceed 36 months from the previous inspection). Units that produce electricity for sale may delay the burner inspection until the first outage, not to exceed 36 months from the previous inspection.

(b)(2) Inspect the flame pattern, as applicable, and adjust the burner as necessary to optimize the flame pattern. The adjustment should be consistent with the manufacturer's specifications, if available.

(b)(3) Inspect the system controlling the air-to-fuel ratio, as applicable, and ensure that it is correctly calibrated and functioning properly (you may delay the inspection until the next scheduled unit shutdown, not to exceed 36 months from the previous inspection). Units that produce electricity for sale may delay the inspection until the first outage, not to exceed 36 months from the previous inspection.

(b)(4) Optimize total emissions of CO. This optimization should be consistent with the manufacturer's specifications, if available, and with any nitrogen oxide requirement to which the unit is subject.

(b)(5) Measure the concentrations in the effluent stream of CO in parts per million, by volume, and oxygen in volume percent, before and after the adjustments are made (measurements may be either on a dry or wet basis, as long as it is the same basis before and after the adjustments are made). Measurements may be taken using a portable CO analyzer.

(b)(6) Maintain on-site and submit, if requested by the Administrator, a report containing the information in paragraphs (b)(6)(i) through (iii) of this section.

(i) The concentrations of CO in the effluent stream in parts per million, by volume, and oxygen in volume percent, measured at high fire or typical operating load, before and after the tune-up of the boiler.

(ii) A description of any corrective actions taken as a part of the tune-up of the boiler.

(iii) The type and amount of fuel used over the 12 months prior to the tune-up of the boiler, but only if the unit was physically and legally capable of using more than one type of fuel during that period. Units sharing a fuel meter may estimate the fuel use by each unit.

(7) If the unit is not operating on the required date for a tune-up, the tune-up must be conducted within 30 days of startup.

**§63.11225 What are my notification, reporting, and recordkeeping requirements?**

(a) You must submit the notifications specified in paragraphs (a)(1) through (5) of this section to the administrator.

(1) You must submit all of the notifications in §§63.7(b); 63.8(e) and (f); and 63.9(b) through (e), (g), and (h) that apply to you by the dates specified in those sections except as specified in paragraphs (a)(2) and (4) of this section.

(2) An Initial Notification must be submitted within 120 days after the source becomes subject to the standard.

(4) You must submit the Notification of Compliance Status no later than 120 days after the applicable compliance date specified in §63.11196. You must submit the Notification of Compliance Status in accordance with paragraphs (a)(4)(i) and (vi) of this section. The Notification of Compliance Status must include the information and certification(s) of compliance in paragraphs (a)(4)(i) through (v) of this section, as applicable, and signed by a responsible official.

(i) You must submit the information required in §63.9(h)(2), except the information listed in §63.9(h)(2)(i)(B), (D), (E), and (F).

(v) For units that do not qualify for a statutory exemption as provided in section 129(g)(1) of the Clean Air Act: “No secondary materials that are solid waste were combusted in any affected unit.”

(vi) The notification must be submitted electronically using the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (*www.epa.gov/cdx*). However, if the reporting form specific to this subpart is not available in CEDRI at the time that the report is due, the written Notification of Compliance Status must be submitted to the Administrator at the appropriate address listed in §63.13.

(b) You must prepare, by March 1 of each year, and submit to the delegated authority upon request, an annual compliance certification report for the previous calendar year containing the information specified in paragraphs (b)(1) through (4) of this section. You must submit the report by March 15 if you had any instance described by paragraph (b)(3) of this section. For boilers that are subject only to a requirement to conduct a biennial or 5-year tune-up according to §63.11223(a) and not subject to emission limits or operating limits, you may prepare only a biennial or 5-year compliance report as specified in paragraphs (b)(1) and (2) of this section.

(1) Company name and address.

(2) Statement by a responsible official, with the official's name, title, phone number, email address, and signature, certifying the truth, accuracy and completeness of the notification and a statement of whether the source has complied with all the relevant standards and other requirements of this subpart. Your notification must include the following certification(s) of compliance, as applicable, and signed by a responsible official:

(i) “This facility complies with the requirements in §63.11223 to conduct a biennial or 5-year tune-up, as applicable, of each boiler.”

(ii) For units that do not qualify for a statutory exemption as provided in section 129(g)(1) of the Clean Air Act: “No secondary materials that are solid waste were combusted in any affected unit.”

(iii) “This facility complies with the requirement in §§63.11214(d) and 63.11223(g) to minimize the boiler's time spent during startup and shutdown and to conduct startups and shutdowns according to the manufacturer's recommended procedures or procedures specified for a boiler of similar design if manufacturer's recommended procedures are not available.”

(3) If the source experiences any deviations from the applicable requirements during the reporting period, include a description of deviations, the time periods during which the deviations occurred, and the corrective actions taken.

(4) The total fuel use by each affected boiler subject to an emission limit, for each calendar month within the reporting period, including, but not limited to, a description of the fuel, whether the fuel has received a non-waste determination by you or EPA through a petition process to be a non-waste under §241.3(c), whether the fuel(s) were processed from discarded non-hazardous secondary materials within the meaning of §241.3, and the total fuel usage amount with units of measure.

(c) You must maintain the records specified in paragraphs (c)(1) through (7) of this section.

(1) As required in §63.10(b)(2)(xiv), you must keep a copy of each notification and report that you submitted to comply with this subpart and all documentation supporting any Initial Notification or Notification of Compliance Status that you submitted.

(2) You must keep records to document conformance with the work practices, emission reduction measures, and management practices required by §63.11214 and §63.11223 as specified in paragraphs (c)(2)(i) through (vi) of this section.

(i) Records must identify each boiler, the date of tune-up, the procedures followed for tune-up, and the manufacturer's specifications to which the boiler was tuned.

(iv) For each boiler subject to an emission limit in Table 1 to this subpart, you must also keep records of monthly fuel use by each boiler, including the type(s) of fuel and amount(s) used.

(4) Records of the occurrence and duration of each malfunction of the boiler, or of the associated air pollution control and monitoring equipment.

(5) Records of actions taken during periods of malfunction to minimize emissions in accordance with the general duty to minimize emissions in §63.11205(a), including corrective actions to restore the malfunctioning boiler, air pollution control, or monitoring equipment to its normal or usual manner of operation.

(d) Your records must be in a form suitable and readily available for expeditious review. You must keep each record for 5 years following the date of each recorded action. You must keep each record on-site or be accessible from a central location by computer or other means that instantly provide access at the site for at least 2 years after the date of each recorded action. You may keep the records off site for the remaining 3 years.

## Attachment D – Regulatory Discussion

The new engine generator is subject to 40 CFR 60, Subpart IIII (NSPS). Permit conditions will be required for these regulations. The pertinent provisions of Subpart IIII follow the engine information below.

Engine Information:

Model: Caterpillar C27, Diesel, Stationary Emergency
Model Year: 2011
Certification: EPA Certificate Number CPX-NRCI-09-11
EPA Engine Family: 9CPXL27.0ESW
No Treatment or After Treatment Devices
Cylinder Displacement: 27.03 liters, 12 cylinders (2.25 liters per cylinder)
The engine does not meet non-emergency emission standards

Operating Assumptions:

The engine is not contractually obligated to be available for peak shaving or non-emergency demand response to supply power as part of a financial arrangement with another entity. The engine is not contractually obligated for more than 15 hours per calendar year for the purposes specified in 60.4211(f)(2)(ii) and (iii).

**New Source Performance Standard, 40 CFR 60, Subpart IIII Applicable Provisions**

| | |
|---|---|
| **Emission Limits**<br>40 CFR 60.4205(b)<br>40 CFR 89.112<br>40 CFR 89.113<br>40 CFR 60.4206 | 1) NMHC+NOx – 4.0 g/kW-hr, CO – 3.5 g/kW-hr, PM 0.20 g/kW-hr<br>2) Exhaust Opacity limits per 98.113:<br>a) 20 percent during the acceleration mode<br>b) 15 percent during the lugging mode<br>c) 50 percent during the peaks in either the acceleration or lugging modes<br>3) Owner's must maintain and operate the engine to meet the emission standards over the life of the engine. |
| **Fuel Requirements**<br>40 CFR 60.4207(b)<br>40 CFR 80.510(b) | Beginning October 1, 2010, you must use diesel fuel that meets the following requirements, except that any existing diesel fuel purchased prior to October 1, 2010 may be used until depleted:<br>a) Sulfur content - 15 ppm maximum<br>b) A minimum cetane index of 40, or a maximum aromatic content of 35 volume percent |
| **Monitoring Requirements**<br>40 CFR 60.4209(a) | The engine is certified to emergency standards and does not meet non-emergency standards. Therefore a non-resettable hour meter must be installed prior to start-up of the engine. |
| **Compliance Requirements – through installation, maintenance and operation in conformance with manufacturer's instructions**<br>40 CFR 60.4211(a),(c),(f) | 1) Purchase an engine certified to the emission standards shown in the emission limits section.<br>2) Install and configure the engine to meet the manufacturer's emission related specifications.<br>3) Maintain and operated the engine according to the manufacturer's emission-related written instructions<br>4) Change only those emission-related settings that are permitted by the manufacturer<br>5) You must do the following for the engine not to be reclassified as non-emergency (the engine emissions do not meet the non-emergency standards):<br>a) There is no time limit on the use of emergency stationary ICE in emergency situations<br>b) You may operate your emergency ICE for any combination of the purposes below for a maximum of 100 hours per calendar year:<br>i. Maintenance checks and readiness testing provided the tests are recommended by federal, state or local government, the manufacturer, the vendor, the regional transmission organization or the insurance company associated with the engine<br>ii. Emergency demand response for periods in which the Reliability Coordinator under the NERC Reliability Standard EOP-002-3, Capacity and Energy Emergencies, or other authorized entity has declared an Energy Emergency Alert Level 2 (15 hours per year limit).<br>iii. During periods where there is a deviation of voltage or frequency of 5 percent or greater below standard voltage or frequency (15 hours per year limit). |
| **Compliance Requirements – for non-compliance with installation, maintenance and operation in conformance with manufacturer's instructions**<br>40 CFR 60.4211(g)(2) | If you do not install, configure, operate, and maintain your engine according to the manufacturer's emissions–related written instructions, or you change emission-related settings in a way that is not permitted by the manufacturer, You must demonstrate compliance by:<br>a) Keeping a maintenance plan and records of conducted maintenance<br>b) Maintaining and operating the engine in a manner consistent with good air pollution control practice for minimizing emissions<br>c) Conduct an initial performance test (emissions test) to demonstrate compliance with the applicable emission standards within 1 year of startup, or within 1 year after an engine and control device is no longer installed, configured, operated, and maintained in accordance with the manufacturer's emission-related written instructions or within 1 year after you change emission-related settings in a way that is not permitted by the manufacturer. |
| **Recordkeeping – Keep Records for 5 years**<br>40 CFR 60.4214(b),(d) | 1) Maintain records to demonstrate compliance with requirements – engine certification, maintenance in accordance with manufacturer's recommendations, and fuel requirements.<br>2) Maintain records of the operation of the engine in emergency and non-emergency service recorded through the non-resettable hour meter. Record the time of operation of the engine and the reason the engine was in operation during that time.<br>3) If you operate the engine for other than emergency, or maintenance and readiness checks for more than 15 hours per calendar year, you must submit an annual report to EPA following the requirements in 40 CFR 60.4214. |

# ***Attachment E***

Plot Plan

**TRIAD ENGINEERING, INC.**
10541 TEAYS VALLEY ROAD
SCOTT DEPOT, WV 25560
PH: 304.755.0721 FAX: 304.755.1880
OFFICE LOCATIONS
MARYLAND ○ PENNSYLVANIA ○ VIRGINIA ○ WEST VIRGINIA ○ OHIO

| CADD FILE: | PROJECT No.: | DRAWN BY: | CHECKED BY: |
|---|---|---|---|
| NA | 04-15-0164 | SSW | SLC |
| | | DATE: 01/20/2016 | SCALE: as shown |

CHARLESTON AREA MEDICAL CENTER
TEAYS VALLEY HOSPITAL
APPLICATION FOR NSR PERMIT
HURRICANE, PUTNAM COUNTY, WV

# PLOT PLAN

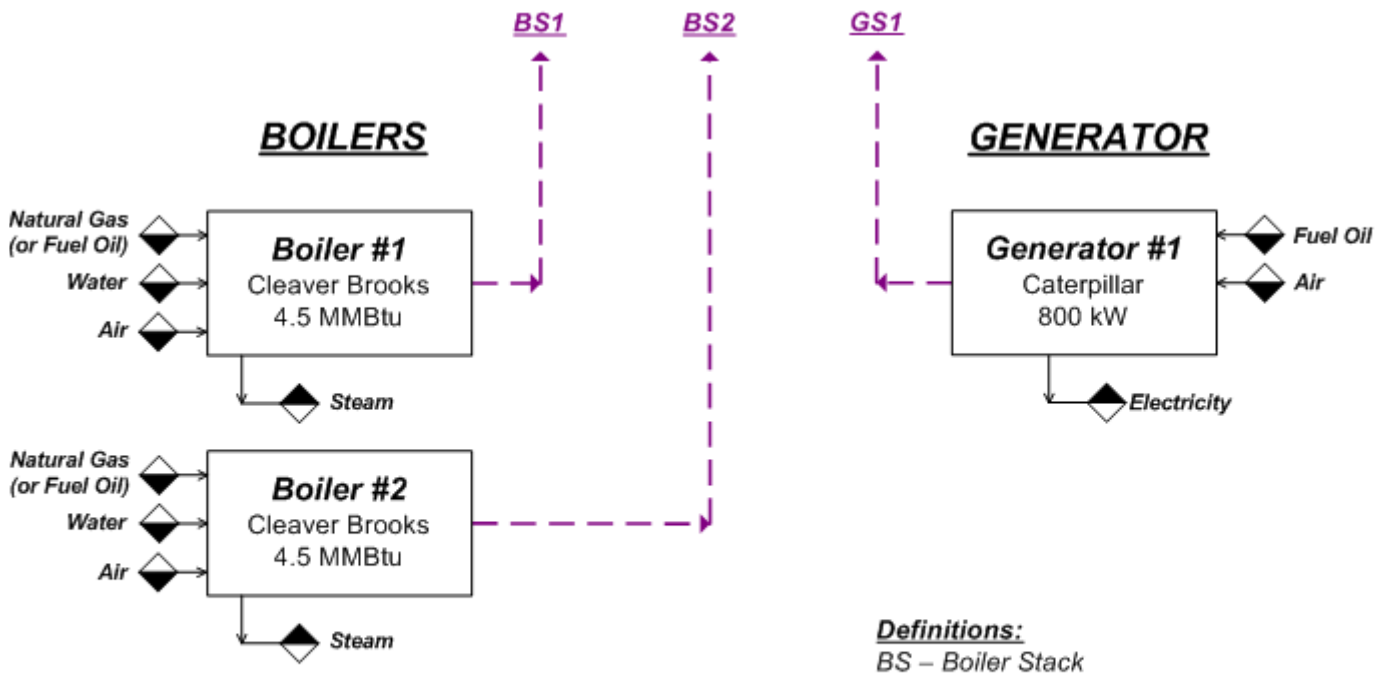
TRIAD ENGINEERING, INC.
www.triadeng.com

FIGURE No.:
**E**

PROJECT No.: 04-15-0164

# ***Attachment F***

Detailed Process Flow Diagram(s)




**Definitions:**
*BS – Boiler Stack*
*GS – Generator Stack*

**Notes:**
*See Emission Unit Data Sheet(s), Attachment L, for additional information on equipment.*

TRIAD ENGINEERING, INC.
www.triadeng.com
10541 TEAYS VALLEY ROAD
SCOTT DEPOT, WV 25560

PROCESS FLOW DIAGRAM
CHARLESTON AREA MEDICAL CENTER
TEAYS VALLEY HOSPITAL – APPLICATION FOR NSR PERMIT
HURRICANE, PUTNAM COUNTY, WV

FIGURE No.: F

PROJECT No.: 04-15-0164

| | |
|---|---|
| CADD FILE: | NA |
| DRAWN BY: | SSW |
| CHECKED BY: | SLC |
| DATE: | 01/20/16 |
| SCALE: | 1:1 |

# ***Attachment G***

Process Description

# Attachment G – Process Description

This Application for a New Source Review Permit outlines Charleston Area Medical Center – Teays Valley Hospital's need to permit two existing Cleaver Brooks boilers (4.5 MMBtu/hr each) and one existing emergency generator (800 kW).

The boilers are vented through double wall stacks (see Process Flow Diagram). The boilers are equipped with dual-fuel burners firing either natural gas or No. 2 fuel oil, but with No. 2 fuel oil to be fired only on an as-needed basis. No. 2 fuel oil firing will not exceed 500 hours per year. Emissions from the combustion of the fuel and natural gas supply will be vented to the atmosphere through their corresponding stacks as outlined above and on the Process Flow Diagram.

The generator is used to provide electricity throughout the facility in the event of a power failure. The generator is vented through a designated stack (see Process Flow Diagram). The generator is powered by No. 2 Fuel Oil (diesel fuel). Raw materials include the fuel and excess air, while products include electricity only. Emissions from the combustion of the fuel supply will be vented to the atmosphere through the corresponding stack as outlined above and on the Process Flow Diagram.

# ***Attachment H***

Material Safety Data Sheets (MSDS)

# SAFETY DATA SHEET

**SDS ID NO.:** 0293MAR019
**Revision Date:** 05/14/2015

## 1. IDENTIFICATION

**Product Name:** Marathon Petroleum No. 2 Ultra Low Sulfur Diesel 15 ppm Sulfur Max with 2-5% Biodiesel

**Synonym:** Ultra Low Sulfur No. 2 Diesel with B2 Biodiesel; Ultra Low Sulfur No. 2 Diesel with B2 Biodiesel and Polar Plus; Ultra Low Sulfur No. 2 Diesel with B5 Biodiesel; Ultra Low Sulfur No. 2 Diesel with B5 Biodiesel and Polar Plus; No. 2 Diesel with Biodiesel B2 Blend 15 ppm Sulfur Max; No. 2 Diesel with Biodiesel B2 Blend 15 ppm Sulfur Max with Polar Plus; No. 2 Diesel with Biodiesel B5 Blend 15 ppm Sulfur Max; No. 2 Diesel with Biodiesel B5 Blend 15 ppm Sulfur Max with Polar Plus

**Chemical Family:** Complex Hydrocarbon Substance

**Recommended Use:** Fuel.
**Use Restrictions:** All others.

**Supplier Name and Address:**
**MARATHON PETROLEUM COMPANY LP**
**539 South Main Street**
**Findlay, OH 45840**

**SDS information:** 1-419-421-3070

**Emergency Telephone:** 1-877-627-5463

## 2. HAZARD IDENTIFICATION

**Classification**

**OSHA Regulatory Status**
This chemical is considered hazardous according to the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

| | |
|---|---|
| Flammable liquids | Category 3 |
| Acute toxicity - Inhalation (Dusts/Mists) | Category 4 |
| Skin corrosion/irritation | Category 2 |
| Skin sensitization | Category 1 |
| Carcinogenicity | Category 2 |
| Specific target organ toxicity (single exposure) | Category 3 |
| Specific target organ toxicity (repeated exposure) | Category 2 |
| Aspiration toxicity | Category 1 |
| Acute aquatic toxicity | Category 2 |
| Chronic aquatic toxicity | Category 2 |

**Hazards Not Otherwise Classified (HNOC)**
Static accumulating flammable liquid

**Label elements**

**EMERGENCY OVERVIEW**

**Danger**

FLAMMABLE LIQUID AND VAPOR
May accumulate electrostatic charge and ignite or explode
May be fatal if swallowed and enters airways
Harmful if inhaled
Causes skin irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
Suspected of causing cancer
May cause damage to organs (thymus, liver, bone marrow) through prolonged or repeated exposure
Toxic to aquatic life with long lasting effects

**Appearance** Clear or Amber Liquid **Physical State** Liquid **Odor** Slight Hydrocarbon

**Precautionary Statements - Prevention**
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Keep away from heat/sparks/open flames/hot surfaces. — No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use only non-sparking tools
Use explosion-proof electrical/ventilating/lighting/equipment
Take precautionary measures against static discharge
Do not breathe mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Wash hands and any possibly exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Avoid release to the environment

**Precautionary Statements - Response**
IF exposed or concerned: Get medical attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation or rash occurs: Get medical attention
Wash contaminated clothing before reuse
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor if you feel unwell
IF SWALLOWED: Immediately call a POISON CENTER or doctor
Do NOT induce vomiting
In case of fire: Use water spray, fog or regular foam for extinction
Collect spillage

**Precautionary Statements - Storage**
Store in a well-ventilated place. Keep container tightly closed
Keep cool
Store locked up

**Precautionary Statements - Disposal**
Dispose of contents/container at an approved waste disposal plant

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

No. 2 Diesel with Biodiesel is a complex mixture of paraffins, olefins and aromatic hydrocarbons having hydrocarbon chain lengths predominantly in the range of eleven to twenty carbons. Contains a minor amount (2-5%) of Biodiesel that does not materially affect the health or safety of this product. May contain a trace amount of benzene (<0.01%). Contains a small amount of a lubricity additive (<0.1%) which is not considered hazardous at the concentration used. Contains a trace amount of sulfur (<0.0015%)

### Composition Information:

| Name | CAS Number | Weight % |
|---|---|---|
| No. 2 Diesel Fuel | 68476-34-6 | 49-98 |
| Kerosine, Petroleum | 8008-20-6 | 0-49 |
| Fuels, Diesel, C9-18-Alkane Branched and Linear | 1159170-26-9 | 0-5 |
| Biodiesel (Tallow derived) | 61788-61-2 | 0-5 |
| Biodiesel (Soybean derived) | 67784-80-9 | 0-5 |
| Biodiesel (Rapeseed derived) | 73891-99-3 | 0-5 |
| Biodiesel (Fatty Acid, Methyl Ester) | 68937-84-8 | 0-5 |
| Biodiesel (Canola derived) | 129828-16-6 | 0-5 |
| Alkanes, C10-C20 branched and linear | 928771-01-1 | 0-5 |
| Naphthalene | 91-20-3 | 0.01-0.5 |

## 4. FIRST AID MEASURES

**First Aid Measures**

**General advice** — In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

**Inhalation:** — Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

**Skin Contact:** — Immediately wash exposed skin with plenty of soap and water while removing contaminated clothing and shoes. May be absorbed through the skin in harmful amounts. Get medical attention if irritation or rash occurs. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).

Place contaminated clothing in closed container until cleaned or discarded. If clothing is to be laundered, inform the person performing the operation of contaminant's hazardous properties. Destroy contaminated, non-chemical resistant footwear.

**Eye Contact:** — Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. GET IMMEDIATE MEDICAL ATTENTION.

**Ingestion:** — Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

**Most important signs and symptoms, both short-term and delayed with overexposure**

**Adverse Effects:** Acute: Headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Delayed: Dry skin and possible irritation with repeated or prolonged exposure.

**Indication of any immediate medical attention and special treatment needed**

**NOTES TO PHYSICIAN:** SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.

INGESTION: This material represents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. The metabolism of fatty acid methyl ester may release free methanol in the body that could induce metabolic acidosis with delayed effects. If a large amount of product is ingested, i.e. several ounces, consider the use of ethanol or fomepizole (Antizol) and hemodialysis. Consult standard literature or contact a poison control center for treatment details.

## 5. FIRE-FIGHTING MEASURES

**Suitable extinguishing media**
For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

**Unsuitable extinguishing media**
Do not use straight water streams to avoid spreading fire.

**Specific hazards arising from the chemical**
This product has been determined to be a flammable liquid per the OSHA Hazard Communication Standard and should be handled accordingly. May accumulate electrostatic charge and ignite or explode. Vapors may travel along the ground or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback can occur along vapor trail. For additional fire related information, see NFPA 30 or the North American Emergency Response Guide 128.

**Hazardous combustion products**
Smoke, carbon monoxide, and other products of incomplete combustion.

**Explosion data**
**Sensitivity to Mechanical Impact** No.
**Sensitivity to Static Discharge** Yes.

**Special protective equipment and precautions for firefighters**
Firefighters should wear full protective clothing and positive-pressure self-contained breathing apparatus (SCBA) with a full face-piece, as appropriate. Avoid using straight water streams. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Avoid excessive water spray application. Keep surrounding area cool with water spray from a distance and prevent further ignition of combustible material. Keep run-off water out of sewers and water sources.

| **NFPA:** | Health 1 | Flammability 2 | Instability 0 | Special Hazards - |
|---|---|---|---|---|

## 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautions:** Keep public away. Isolate and evacuate area. Shut off source if safe to do so. Eliminate all ignition sources. All contaminated surfaces will be slippery.

**Protective Equipment:** Use personal protection measures as recommended in Section 8.

**Emergency Procedures:** Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.

**Environmental precautions:** Avoid release to the environment. Avoid subsoil penetration.

**Methods and materials for containment:** Contain liquid with sand or soil.

**Methods and materials for cleaning up:** Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers. When recovering free liquids ensure all equipment is grounded and bonded. Use only non-sparking tools.

## 7. HANDLING AND STORAGE

**Safe Handling Precautions:** NEVER SIPHON THIS PRODUCT BY MOUTH. Use appropriate grounding and bonding practices. Static accumulating flammable liquid. Bonding and grounding may be insufficient to eliminate the hazard from static electricity. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. No smoking. Avoid repeated and prolonged skin contact. Use personal protection measures as recommended in Section 8. Use only non-sparking tools. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

Hydrocarbons are basically non-conductors of electricity and can become electrostatically charged during mixing, filtering, pumping at high flow rates or loading and transfer operations. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic chemical vapors or mists from process equipment operating under elevated temperature and pressure, or sudden ingress of air into vacuum equipment may result in ignition of vapors or mists without the presence of obvious ignition sources. Nozzle spouts must be kept in contact with the containers or tank during the entire filling operation.

Portable containers should never be filled while in or on a motor vehicle or marine craft. Containers should be placed on the ground. Static electric discharge can ignite fuel vapors when filling non-grounded containers or vehicles on trailers. The nozzle spout must be kept in contact with the container before and during the entire filling operation. Use only approved containers.

A buildup of static electricity can occur upon re-entry into a vehicle during fueling especially in cold or dry climate conditions. The charge is generated by the action of dissimilar fabrics (i.e., clothing and upholstery) rubbing across each other as a person enters/exits the vehicle. A flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, do not get back in your vehicle while refueling.

Cellular phones and other electronic devices may have the potential to emit electrical charges (sparks). Sparks in potentially explosive atmospheres (including fueling areas such as gas stations) could cause an explosion if sufficient flammable vapors are present. Therefore, turn off cellular phones and other electronic devices when working in potentially explosive atmospheres or keep devices inside your vehicle during refueling.

High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).

**Storage Conditions:** Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area.

**Incompatible materials** Strong oxidizing agents.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

| Name | ACGIH TLV | OSHA PELS: | OSHA - Vacated PELs | NIOSH IDLH |
|---|---|---|---|---|
| No. 2 Diesel Fuel<br>68476-34-6 | 100 mg/m³ TWA<br>Skin - potential significant contribution to overall exposure by the cutaneous route | - | - | - |
| Kerosine, Petroleum<br>8008-20-6 | 200 mg/m³ TWA<br>Skin - potential significant contribution to overall exposure by the cutaneous route | - | - | - |
| Fuels, Diesel, C9-18-Alkane Branched and Linear<br>1159170-26-9 | - | - | - | - |
| Biodiesel (Tallow derived)<br>61788-61-2 | - | - | - | - |
| Biodiesel (Soybean derived)<br>67784-80-9 | - | - | - | - |
| Biodiesel (Rapeseed derived)<br>73891-99-3 | - | - | - | - |
| Biodiesel (Fatty Acid, Methyl Ester)<br>68937-84-8 | - | - | - | - |
| Biodiesel (Canola derived)<br>129828-16-6 | - | - | - | - |
| Alkanes, C10-C20 branched and linear<br>928771-01-1 | - | - | - | - |
| Naphthalene<br>91-20-3 | 10 ppm TWA<br>Skin - potential significant contribution to overall exposure by the cutaneous route | TWA: 10 ppm<br>TWA: 50 mg/m³ | 10 ppm TWA<br>50 mg/m³ TWA<br>15 ppm STEL<br>75 mg/m³ STEL | 250 ppm |

**Notes:** The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

**Engineering measures:** Local or general exhaust required in an enclosed area or with inadequate ventilation. Use mechanical ventilation equipment that is explosion-proof.

**Personal protective equipment**

**Eye protection:** Use goggles or face-shield if the potential for splashing exists.

**Skin and body protection:** Wear neoprene, nitrile or PVA gloves to prevent skin contact. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times.

**Respiratory protection:** Use an approved organic vapor chemical cartridge or supplied air respirators when material produces vapors that exceed permissible exposure limits or excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.

**Hygiene measures:** Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**Information on basic physical and chemical properties**

| | |
|---|---|
| **Physical State** | Liquid |
| **Appearance** | Clear or Amber Liquid |
| **Color** | Clear or Amber |
| **Odor** | Slight Hydrocarbon |
| **Odor Threshold** | No available data. |

| **Property** | **Values (Method)** |
|---|---|
| **Melting Point / Freezing Point** | No available data. |
| **Initial Boiling Point / Boiling Range** | 204-338 °C / 400-640 °F |
| **Flash Point** | 54-88 °C / 130-190 °F |
| **Evaporation Rate** | No available data. |
| **Flammability (solid, gas)** | Not applicable. |
| **Flammability Limit in Air (%)** | |
| **Upper Flammability Limit:** | 5.0 |
| **Lower Flammability Limit:** | 0.7 |
| **Vapor Pressure** | 1-10 mm Hg @ 20°C |
| **Vapor Density** | 4-5 |
| **Specific Gravity / Relative Density** | C.A. 0.8 |
| **Water Solubility** | No available data. |
| **Solubility in other solvents** | Negligible |
| **Partition Coefficient** | No available data. |
| **Decomposition temperature:** | No available data. |
| **pH:** | Not applicable |
| **Autoignition Temperature** | 336 °C / 637 °F |
| **Kinematic Viscosity** | 1.9-3.4 @ 40°C |
| **Dynamic Viscosity** | No available data. |
| **Explosive Properties** | No available data. |
| **Softening Point** | No available data. |
| **VOC Content (%)** | 10% |
| **Density** | 6.76 lbs/gal |
| **Bulk Density** | Not applicable. |

## 10. STABILITY AND REACTIVITY

| | |
|---|---|
| **Reactivity** | The product is non-reactive under normal conditions. |
| **Chemical stability** | Stable under recommended storage conditions. |
| **Possibility of hazardous reactions** | None under normal processing. |
| **Hazardous polymerization** | Will not occur. |
| **Conditions to avoid** | Sources of heat or ignition. |
| **Incompatible materials** | Strong oxidizing agents. |
| **Hazardous decomposition products** | None known under normal conditions of use. |

## 11. TOXICOLOGICAL INFORMATION

**Potential short-term adverse effects from overexposures**

**Inhalation** Harmful if inhaled. Inhalation of high vapor concentrations may cause irritation of the respiratory system. May cause drowsiness or dizziness.

**Eye contact** Causes mild eye irritation.

**Skin contact** Causes skin irritation. May cause sensitization by skin contact. May be absorbed through the skin in harmful amounts.

**Ingestion** May be fatal if swallowed or vomited and enters airways. May cause irritation of the mouth, throat and gastrointestinal tract.

**Acute Toxicological data**

| Name | Oral LD50 | Dermal LD50 | Inhalation LC50 |
|---|---|---|---|
| No. 2 Diesel Fuel<br>68476-34-6 | > 5000 mg/kg (Rat) | > 2000 mg/kg (Rabbit) | >1 - <5 mg/L (Rat) 4 h |
| Kerosine, Petroleum<br>8008-20-6 | > 5000 mg/kg (Rat) | > 2000 mg/kg (Rabbit) | > 5.28 mg/L (Rat) 4 h |
| Fuels, Diesel, C9-18-Alkane Branched and Linear<br>1159170-26-9 | - | - | >1 - <5 mg/l (Rat) 4 h |
| Biodiesel (Tallow derived)<br>61788-61-2 | - | - | - |
| Biodiesel (Soybean derived)<br>67784-80-9 | > 5000 mg/kg (Rat) | > 5000 mg/kg (Rabbit) | - |
| Biodiesel (Rapeseed derived)<br>73891-99-3 | - | - | - |
| Biodiesel (Fatty Acid, Methyl Ester)<br>68937-84-8 | > 2000 mg/kg (Rat) | - | - |
| Biodiesel (Canola derived)<br>129828-16-6 | - | - | - |
| Alkanes, C10-C20 branched and linear<br>928771-01-1 | - | - | >1 - <5 mg/l (Rat) 4 h |
| Naphthalene<br>91-20-3 | 490 mg/kg (Rat) | > 2000 mg/kg (Rabbit) | > 340 mg/m³ (Rat) 1 h |

**Delayed and immediate effects as well as chronic effects from short and long-term exposure**

Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffer's Encephalopathy), delirium, seizures, and sudden death have been reported from repeated overexposure to some hydrocarbon solvents, naphthas, and gasoline.

MIDDLE DISTILLATES, PETROLEUM: Long-term repeated (lifetime) skin exposure to similar materials has been reported to result in an increase in skin tumors in laboratory rodents. The relevance of these findings to humans is not clear at this time.

MIDDLE DISTILLATES WITH CRACKED STOCKS: Light cracked distillates have been shown to be carcinogenic in animal tests and have tested positive with in vitro genotoxicity tests. Repeated dermal exposures to high concentrations in test animals resulted in reduced litter size and litter weight, and increased fetal resorptions at maternally toxic doses. Dermal exposure to high concentrations resulted in severe skin irritation with weight loss and some mortality. Inhalation exposure to high concentrations resulted in respiratory tract irritation, lung changes/infiltration/accumulation, and reduction in lung function.

ISOPARAFFINS: Studies in laboratory animals have shown that long-term exposure to similar materials (isoparaffins) can cause kidney damage and kidney cancer in male laboratory rats. However, in-depth research indicates that these findings are unique to the male rat, and that these effects are not relevant to humans.

BIODIESEL (SOYBEAN DERIVED): Dermal sensitization study (Guinea Pigs) repeat insult patch procedure with induction and challenge patches indicated a positive sensitization response.

NAPHTHALENE: Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from overexposure to naphthalene. Persons with glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have been reported in persons overexposed to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect. Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) in vitro. Naphthalene has been classified as Possibly Carcinogenic to Humans (2B) by IARC, based on findings from studies in laboratory animals.

DIESEL EXHAUST: The combustion of diesel fuels produces gases including carbon monoxide, carbon dioxide, oxides of nitrogen and/or sulfur, and hydrocarbons that can be irritating and hazardous with overexposure. Long-term occupational overexposure to diesel exhaust and diesel exhaust particulate matter has been associated with an increased risk of respiratory disease, including lung cancer, and is characterized as a "known human carcinogen" by the International Agency for Research on Cancer (IARC), as "a reasonably anticipated human carcinogen" by the National Toxicology Program, and as "likely to be carcinogenic to humans" by the EPA, based upon animal and occupational exposure studies. However, uncertainty exists with these classifications because of deficiencies in the supporting occupational exposure/epidemiology studies, including reliable exposure estimates. Lifetime animal inhalation studies with pulmonary overloading exposure concentrations of diesel exhaust emissions have produced tumors and other adverse health effects. However, in more recent long-term animal inhalation studies of diesel exhaust emissions, no increase in tumor incidence and in fact a substantial reduction in adverse health effects along with significant reductions in the levels of hazardous material emissions were observed and are associated with fuel composition alterations coupled with new technology diesel engines.

**Adverse effects related to the physical, chemical and toxicological characteristics**

**Signs & Symptoms** Nausea, vomiting, signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue.

**Sensitization** May cause sensitization by skin contact. Not expected to be a respiratory sensitizer.

**Mutagenic effects** None known.

**Carcinogenicity** Cancer designations are listed in the table below.

| Name | ACGIH (Class) | IARC (Class) | NTP | OSHA |
|---|---|---|---|---|
| No. 2 Diesel Fuel 68476-34-6 | Confirmed animal carcinogen (A3) | Not Classifiable (3) | Not Listed | Not Listed |
| Kerosine, Petroleum 8008-20-6 | Confirmed animal carcinogen (A3) | Not Classifiable (3) | Not Listed | Not Listed |
| Fuels, Diesel, C9-18-Alkane Branched and Linear 1159170-26-9 | Not Listed | Not Listed | Not Listed | Not Listed |
| Biodiesel (Tallow derived) 61788-61-2 | Not Listed | Not Listed | Not Listed | Not Listed |
| Biodiesel (Soybean derived) 67784-80-9 | Not Listed | Not Listed | Not Listed | Not Listed |
| Biodiesel (Rapeseed derived) 73891-99-3 | Not Listed | Not Listed | Not Listed | Not Listed |
| Biodiesel (Fatty Acid, Methyl Ester) 68937-84-8 | Not Listed | Not Listed | Not Listed | Not Listed |
| Biodiesel (Canola derived) 129828-16-6 | Not Listed | Not Listed | Not Listed | Not Listed |
| Alkanes, C10-C20 branched and linear 928771-01-1 | Not Listed | Not Listed | Not Listed | Not Listed |
| Naphthalene 91-20-3 | Confirmed animal carcinogen (A3) | Possible human carcinogen (2B) | Reasonably anticipated to be a human carcinogen | Not Listed |

**Reproductive toxicity** None known.

**Specific Target Organ Toxicity (STOT) - single exposure** Central nervous system.

**Specific Target Organ Toxicity (STOT) - repeated exposure** Thymus. Liver. Bone marrow.

**Aspiration hazard** May be fatal if swallowed or vomited and enters airways.

## 12. ECOLOGICAL INFORMATION

**Ecotoxicity** This product should be considered toxic to aquatic organisms, with the potential to cause long lasting adverse effects in the aquatic environment.

| Name | Algae/aquatic plants | Fish | Toxicity to Microorganisms | Crustacea |
|---|---|---|---|---|
| No. 2 Diesel Fuel 68476-34-6 | - | 96-hr LC50 = 35 mg/l Fathead minnow (flow-through) | - | 48-hr EL50 = 6.4 mg/l Daphnia magna |
| Kerosine, Petroleum 8008-20-6 | 72-hr EL50 = 5.0-11 mg/l Algae | 96-hr LL50 = 18-25 mg/l Fish | - | 48-hr EL50 = 1.4-21 mg/l Invertebrates |
| Fuels, Diesel, C9-18-Alkane Branched and Linear 1159170-26-9 | - | - | - | - |

| | | | | |
|---|---|---|---|---|
| Biodiesel (Tallow derived) 61788-61-2 | - | - | - | - |
| Biodiesel (Soybean derived) 67784-80-9 | - | - | - | - |
| Biodiesel (Rapeseed derived) 73891-99-3 | - | - | - | - |
| Biodiesel (Fatty Acid, Methyl Ester) 68937-84-8 | - | 96-hr LC50 = 550 mg/l Zebrafish (semi-static) | - | 24-hr LC50 = 4.65 mg/l Daphnia magna |
| Biodiesel (Canola derived) 129828-16-6 | - | - | - | - |
| Alkanes, C10-C20 branched and linear 928771-01-1 | - | - | - | - |
| Naphthalene 91-20-3 | - | 96-hr LC50 = 0.91-2.82 mg/l Rainbow trout (static) 96-hr LC50 = 1.99 mg/l Fathead minnow (static) | - | 48-hr LC50 = 1.6 mg/l Daphnia magna |

**Persistence and degradability** Expected to be inherently biodegradable.

**Bioaccummulation** Has the potential to bioaccumulate.

**Mobility in soil** May partition into air, soil and water.

**Other adverse effects** No information available.

## 13. DISPOSAL CONSIDERATIONS

**Description of Waste Residues**
This material may be a flammable liquid waste.

**Safe Handling of Wastes**
Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required. Use appropriate grounding and bonding practices. Use only non-sparking tools. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. No smoking.

**Disposal of Wastes / Methods of Disposal**
The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

**Methods of Contaminated Packaging Disposal**
Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

## 14. TRANSPORT INFORMATION

**DOT (49 CFR 172.101):**

| | |
|---|---|
| **UN Proper shipping name:** | Fuel Oil, No. 2 |
| **UN/Identification No:** | NA 1993 |
| **Transport Hazard Class(es):** | 3 |
| **Packing group:** | III |

**TDG (Canada):**

| | |
|---|---|
| **UN Proper shipping name:** | Fuel Oil, No. 2 |
| **UN/Identification No:** | NA 1993 |
| **Transport Hazard Class(es):** | 3 |
| **Packing group:** | III |

## 15. REGULATORY INFORMATION

**US Federal Regulatory Information:**

US TSCA Chemical Inventory Section 8(b): This product and/or its components are listed on the TSCA Chemical Inventory.

**EPA Superfund Amendment & Reauthorization Act (SARA):**

**SARA Section 302:** This product does not contain any component(s) included on EPA's Extremely Hazardous Substance (EHS) List.

| Name | CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs |
|---|---|
| No. 2 Diesel Fuel | NA |
| Kerosine, Petroleum | NA |
| Fuels, Diesel, C9-18-Alkane Branched and Linear | NA |
| Biodiesel (Tallow derived) | NA |
| Biodiesel (Soybean derived) | NA |
| Biodiesel (Rapeseed derived) | NA |
| Biodiesel (Fatty Acid, Methyl Ester) | NA |
| Biodiesel (Canola derived) | NA |
| Alkanes, C10-C20 branched and linear | NA |
| Naphthalene | NA |

**SARA Section 304:** This product may contain component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

| Name | CERCLA/SARA - Hazardous Substances and their Reportable Quantities |
|---|---|
| No. 2 Diesel Fuel | NA |
| Kerosine, Petroleum | NA |
| Fuels, Diesel, C9-18-Alkane Branched and Linear | NA |
| Biodiesel (Tallow derived) | NA |
| Biodiesel (Soybean derived) | NA |
| Biodiesel (Rapeseed derived) | NA |
| Biodiesel (Fatty Acid, Methyl Ester) | NA |
| Biodiesel (Canola derived) | NA |
| Alkanes, C10-C20 branched and linear | NA |
| Naphthalene | 100 lb final RQ<br>45.4 kg final RQ |

**SARA:** The following EPA hazard categories apply to this product:

Acute Health Hazard
Fire Hazard
Chronic Health Hazard

**SARA Section 313:** This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

| Name | CERCLA/SARA 313 Emission reporting: |
|---|---|
| No. 2 Diesel Fuel | None |
| Kerosine, Petroleum | None |
| Fuels, Diesel, C9-18-Alkane Branched and Linear | None |
| Biodiesel (Tallow derived) | None |
| Biodiesel (Soybean derived) | None |
| Biodiesel (Rapeseed derived) | None |

| | |
|---|---|
| Biodiesel (Fatty Acid, Methyl Ester) | None |
| Biodiesel (Canola derived) | None |
| Alkanes, C10-C20 branched and linear | None |
| Naphthalene | 0.1 % de minimis concentration |

**State and Community Right-To-Know Regulations:**
The following component(s) of this material are identified on the regulatory lists below:

No. 2 Diesel Fuel

| | |
|---|---|
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | SN 2444 |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | SN 2444 TPQ: 10000 lb (Under N.J.A.C. 7:1G, environmental hazardous substances in mixtures such as gasoline or new and used petroleum oil may be reported under these categories) |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |

Kerosine, Petroleum

| | |
|---|---|
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | SN 1091 |
| Pennsylvania Right-To-Know: | Present |
| Massachusetts Right-To Know: | Present |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | SN 1091 TPQ: 10000 lb (Under N.J.A.C. 7:1G, environmental hazardous substances in mixtures such as gasoline or new and used petroleum oil may be reported under these categories) |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |

Fuels, Diesel, C9-18-Alkane Branched and Linear

| | |
|---|---|
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | Not Listed. |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |

| | |
|---|---|
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | Not Listed. |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |
| Biodiesel (Tallow derived) | |
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | Not Listed. |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | Not Listed. |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |
| Biodiesel (Soybean derived) | |
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | Not Listed. |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | Not Listed. |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |
| Biodiesel (Rapeseed derived) | |
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | Not Listed. |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |

| | |
|---|---|
| New Jersey - Environmental Hazardous Substances List: | Not Listed. |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |
| Biodiesel (Fatty Acid, Methyl Ester) | |
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | Not Listed. |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | Not Listed. |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |
| Biodiesel (Canola derived) | |
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | Not Listed. |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | Not Listed. |
| Illinois - Toxic Air Contaminants | Not Listed. |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |
| Alkanes, C10-C20 branched and linear | |
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Not Listed. |
| New Jersey Right-To-Know: | Not Listed. |
| Pennsylvania Right-To-Know: | Not Listed. |
| Massachusetts Right-To Know: | Not Listed. |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Not Listed. |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Not Listed. |
| New Jersey - Environmental Hazardous Substances List: | Not Listed. |
| Illinois - Toxic Air Contaminants | Not Listed. |

| | |
|---|---|
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | Not Listed. |
| Naphthalene | |
| Louisiana Right-To-Know: | Not Listed. |
| California Proposition 65: | Carcinogen, initial date 4/19/02 |
| New Jersey Right-To-Know: | SN 1322 SN 3758 |
| Pennsylvania Right-To-Know: | Environmental hazard Present (particulate) |
| Massachusetts Right-To Know: | Present |
| Florida Substance List: | Not Listed. |
| Rhode Island Right-To-Know: | Toxic; Flammable |
| Michigan Critical Materials Register List: | Not Listed. |
| Massachusetts Extraordinarily Hazardous Substances: | Not Listed. |
| California - Regulated Carcinogens: | Not Listed. |
| Pennsylvania RTK - Special Hazardous Substances: | Not Listed. |
| New Jersey - Special Hazardous Substances: | Carcinogen |
| New Jersey - Environmental Hazardous Substances List: | SN 1322 TPQ: 500 lb (Reportable at the de minimis quantity of >0.1%) |
| Illinois - Toxic Air Contaminants | Present |
| New York - Reporting of Releases Part 597 - List of Hazardous Substances: | 100 lb RQ (air); 1 lb RQ (land/water) |

**Canada DSL/NDSL Inventory:** This product contains the following component(s) that are listed on the Non-Domestic Substance List (NDSL): CAS# 1159170-26-9

**Canadian Regulatory Information:** "This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the (M)SDS contains all the information required by the Controlled Products Regulations."

| Name | Canada - WHMIS: Classifications of Substances: | Canada - WHMIS: Ingredient Disclosure: |
|---|---|---|
| No. 2 Diesel Fuel | B3,D2A,D2B | 0.1% |
| Kerosine, Petroleum | B3,D2B | 1% |
| Fuels, Diesel, C9-18-Alkane Branched and Linear | B3,D2A,D2B | 0.1% |
| Biodiesel (Tallow derived) | Uncontrolled product according to WHMIS classification criteria | - |
| Biodiesel (Soybean derived) | D2B | 1% |
| Biodiesel (Rapeseed derived) | Uncontrolled product according to WHMIS classification criteria | - |
| Biodiesel (Fatty Acid, Methyl Ester) | Uncontrolled product according to WHMIS classification criteria | - |
| Biodiesel (Canola derived) | Uncontrolled product according to WHMIS classification criteria | - |
| Alkanes, C10-C20 branched and linear | B3,D2A,D2B | 0.1% |
| Naphthalene | B4,D2A | 0.1% |

**NOTE:** Not Applicable.

## 16. OTHER INFORMATION

**Prepared By** Toxicology and Product Safety
**Revision Date:** 05/14/2015

**Revision Note:**

**Disclaimer**

**The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.**

# ***Attachment I***

Emission Units Table

## Attachment I

## Emission Units Table

**(includes all emission units and air pollution control devices that will be part of this permit application review, regardless of permitting status)**

| Emission Unit ID[1] | Emission Point ID[2] | Emission Unit Description | Year Installed/ Modified | Design Capacity | Type[3] and Date of Change | Control Device[4] |
|---|---|---|---|---|---|---|
| Boiler 1 | BS-1 | Existing Cleaver Brooks Boiler | Unknown | 4.5 MMBtu | Existing | |
| Boiler 2 | BS-2 | Existing Cleaver Brooks Boiler | Unknown | 4.5 MMBtu | Existing | |
| Generator 1 | GS-1 | Existing Emergency Generator | Unknown | 800 kW | Existing | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

[1] For Emission Units (or Sources) use the following numbering system:1S, 2S, 3S,... or other appropriate designation.
[2] For Emission Points use the following numbering system:1E, 2E, 3E, ... or other appropriate designation.
[3] New, modification, removal
[4] For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.

# ***Attachment J***

Emission Points Data Summary Sheet

# Attachment J
# EMISSION POINTS DATA SUMMARY SHEET

| Table 1: Emissions Data | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Point ID No. *(Must match Emission Units Table & Plot Plan)* | Emission Point Type[1] | Emission Unit Vented Through This Point *(Must match Emission Units Table & Plot Plan)* | | Air Pollution Control Device *(Must match Emission Units Table & Plot Plan)* | | Vent Time for Emission Unit *(chemical processes only)* | | All Regulated Pollutants - Chemical Name/CAS[3] *(Speciate VOCs & HAPS)* | Maximum Potential Uncontrolled Emissions [4] | | Maximum Potential Controlled Emissions [5] | | Emission Form or Phase *(At exit conditions, Solid, Liquid or Gas/Vapor)* | Est. Method Used [6] | Emission Concentration [7] (ppmv or mg/m$^4$) |
| | | ID No. | Source | ID No. | Device Type | Short Term[2] | Max (hr/yr) | | lb/hr | ton/yr | lb/hr | ton/yr | | | |
| Boiler 1 | Vertical | BS-1 | BS-1 | NA | NA | C | 8760 | CO<br>NOx<br>$PM_{10}$<br>$SO_2$<br>VOC<br>$CO_2$<br>$CH_4$<br>$N_2O$<br>$CO_2e$ | 0.79<br>1.32<br>0.13<br>1.86<br>0.15<br>1.01E+03<br>0.032<br>0.006 | 2.29<br>2.01<br>0.17<br>0.48<br>0.26<br>1.89E+03<br>0.039<br>0.004<br>1.89E+03 | NA | NA | Gas<br>Gas<br>Solid<br>Gas<br>Gas<br>Gas<br>Gas<br>Gas<br>Gas | Manuf.<br>Manuf.<br>Manuf.<br>AP-42<br>Manuf.<br>AP-42<br>AP-42<br>AP-42<br>AP-42 | NAv |
| Boiler 2 | Vertical | BS-2 | BS-2 | NA | NA | C | 8760 | CO<br>NOx<br>$PM_{10}$<br>$SO_2$<br>VOC<br>$CO_2$<br>$CH_4$<br>$N_2O$<br>$CO_2e$ | 0.79<br>1.32<br>0.13<br>1.86<br>0.15<br>1.01E+03<br>0.032<br>0.006 | 2.29<br>2.01<br>0.17<br>0.48<br>0.26<br>1.89E+03<br>0.039<br>0.004<br>1.89E+03 | NA | NA | Gas<br>Gas<br>Solid<br>Gas<br>Gas<br>Gas<br>Gas<br>Gas<br>Gas | Manuf.<br>Manuf.<br>Manuf.<br>AP-42<br>Manuf.<br>AP-42<br>AP-42<br>AP-42<br>AP-42 | NAv |
| Generator 1 | Vertical | GS-1 | GS-1 | NA | NA | C | 500 | CO<br>NOx<br>$PM_{10}$<br>$SO_2$<br>VOC<br>HAPs*<br>$CO_2$<br>$CH_4$<br>$N_2O$<br>$CO_2e$ | 1.42<br>12.88<br>0.23<br>0.0277<br>0.20<br><br>1.31E+03<br>0.053<br>0.11 | 0.35<br>3.22<br>0.496<br>0.06<br>0.05<br>0.008<br>3.27E+02<br>0.013<br>0.003<br>3.28E+02 | NA | NA | Gas<br>Gas<br>Solid<br>Gas<br>Gas<br>Gas<br>Gas<br>Gas<br>Gas<br>Gas | Manuf.<br>Manuf.<br>Manuf.<br>Manuf.<br>Manuf.<br>AP-42<br>AP-42<br>AP-42<br>AP-42<br>AP-42 | NAv |
| | | | | | | | | | | | | | | | |

**** A complete list HAPs emissions are provided in Attachment N.***

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

[1] Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.

[2] Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).

[3] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. **LIST** Acids, CO, $CS_2$, VOCs, $H_2S$, Inorganics, Lead, Organics, $O_3$, NO, $NO_2$, $SO_2$, $SO_3$, all applicable Greenhouse Gases (including $CO_2$ and methane), etc. **DO NOT LIST** $H_2$, $H_2O$, $N_2$, $O_2$, and Noble Gases.

[4] Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[5] Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[6] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

[7] Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter ($mg/m^3$) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is $SO_2$, use units of ppmv (See 45CSR10).

## Attachment J
## EMISSION POINTS DATA SUMMARY SHEET

| Table 2: Release Parameter Data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Emission Point ID No. *(Must match Emission Units Table)* | Inner Diameter (ft.) | Exit Gas | | | Emission Point Elevation (ft) | | UTM Coordinates (km) | |
| | | Temp. ($^{o}$F) | Volumetric Flow [1] (acfm) *at operating conditions* | Velocity (fps) | Ground Level *(Height above mean sea level)* | Stack Height [2] *(Release height of emissions above ground level)* | Northing | Easting |
| BS-1 | 1.99 | 450 | 1,544 | 8.19 | 600 | 20 | 4256.40 | 416.91 |
| BS-2 | 1.99 | 450 | 1,544 | 8.19 | 600 | 20 | 4256.40 | 416.91 |
| GS-1 | 1.99 | 450 | 2,093 | 11.1 | 600 | 20 | 4256.40 | 416.91 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1] Give at operating conditions. Include inerts.
[2] Release height of emissions above ground level.

# ***Attachment K***

Fugitive Emissions Data Summary Sheet

## Attachment K

## FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not typically considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.

Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions).

| APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS |
|---|
| 1.) Will there be haul road activities?<br>☐ Yes ☒ No<br>☐ If YES, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET. |
| 2.) Will there be Storage Piles?<br>☐ Yes ☒ No<br>☐ If YES, complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET. |
| 3.) Will there be Liquid Loading/Unloading Operations?<br>☐ Yes ☒ No<br>☐ If YES, complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET. |
| 4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation?<br>☐ Yes ☒ No<br>☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET. |
| 5.) Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)?<br>☐ Yes ☒ No<br>☐ If YES, complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET. |
| 6.) Will there be General Clean-up VOC Operations?<br>☐ Yes ☒ No<br>☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET. |
| 7.) Will there be any other activities that generate fugitive emissions?<br>☐ Yes ☒ No<br>☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form. |
| If you answered “NO” to all of the items above, it is not necessary to complete the following table, “Fugitive Emissions Summary.” |

| **FUGITIVE EMISSIONS SUMMARY** | All Regulated Pollutants - Chemical Name/CAS [1] | Maximum Potential Uncontrolled Emissions [2] | | Maximum Potential Controlled Emissions [3] | | Est. Method Used [4] |
|---|---|---|---|---|---|---|
| | | lb/hr | ton/yr | lb/hr | ton/yr | |
| Haul Road/Road Dust Emissions<br>Paved Haul Roads | | | | | | |
| Unpaved Haul Roads | | | | | | |
| Storage Pile Emissions | | | | | | |
| Loading/Unloading Operations | | | | | | |
| Wastewater Treatment Evaporation & Operations | | | | | | |
| Equipment Leaks | | Does not apply | | Does not apply | | |
| General Clean-up VOC Emissions | | | | | | |
| Other | | | | | | |

[1] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, $CS_2$, VOCs, $H_2S$, Inorganics, Lead, Organics, $O_3$, NO, $NO_2$, $SO_2$, $SO_3$, all applicable Greenhouse Gases (including $CO_2$ and methane), etc. DO NOT LIST $H_2$, $H_2O$, $N_2$, $O_2$, and Noble Gases.

[2] Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[3] Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[4] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

# ***Attachment L***

Emissions Unit Data Sheet(s)

# Attachment L
## Emission Unit Data Sheet
(INDIRECT HEAT EXCHANGER)

Control Device ID No. (must match List Form):

### Equipment Information

| | |
|---|---|
| 1. Manufacturer: Cleaver Brooks | 2. Model No. M4 P-4500<br>Serial No. 4G0Z9869/4G029866 |
| 3. Number of units: 2 | 4. Use Space and process heating |
| 5. Rated Boiler Horsepower: 107 hp | 6. Boiler Serial No.: 4G0Z9869/4G029866 |
| 7. Date constructed: 2000 | 8. Date of last modification and explain: |
| 9. Maximum design heat input per unit:<br>4.5 $\times 10^6$ BTU/hr | 10. Peak heat input per unit:<br>4.5 $\times 10^6$ BTU/hr |
| 11. Steam produced at maximum design output:<br>3,711 LB/hr<br>150 psig | 12. Projected Operating Schedule:<br>Hours/Day 24<br>Days/Week 7<br>Weeks/Year 52 |
| 13. Type of firing equipment to be used:<br>☐ Pulverized coal<br>☐ Spreader stoker<br>☒ Oil burners<br>☒ Natural Gas Burner<br>☐ Others, specify | 14. Proposed type of burners and orientation:<br>☐ Vertical<br>☒ Front Wall<br>☐ Opposed<br>☐ Tangential<br>☐ Others, specify |
| 15. Type of draft: ☒ Forced ☐ Induced | 16. Percent of ash retained in furnace: % |
| 17. Will flyash be reinjected? ☐ Yes ☐ No | 18. Percent of carbon in flyash: % |

### Stack or Vent Data

| | |
|---|---|
| 19. Inside diameter or dimensions: 2.0 ft. | 20. Gas exit temperature: 450 °F |
| 21. Height: 20 ft. | 22. Stack serves:<br>☒ This equipment only<br>☐ Other equipment also (submit type and rating of all other equipment exhausted through this stack or vent) |
| 23. Gas flow rate: 895 $ft^3$/min | |
| 24. Estimated percent of moisture: % | |

## Fuel Requirements

| 25. **Type** | Fuel Oil No. | Natural Gas | Gas (other, specify) | Coal, Type: | Other: |
|---|---|---|---|---|---|
| **Quantity** (at Design Output) | No. 2, 32.14 gph@60°F | 4,500 $ft^3$/hr | $ft^3$/hr | TPH | |
| **Annually** | 16.07 $\times 10^3$ gal | 39.42 $\times 10^6$ $ft^3$/hr | $\times 10^6$ $ft^3$/hr | tons | |
| **Sulfur** | Maximum: 0.0015 wt. % Average: 0.0015 wt. % | 2000 (AP-42) gr/100 $ft^3$ | gr/100 $ft^3$ | Maximum: wt. % | |
| **Ash (%)** | -- | -- | | Maximum | |
| **BTU Content** | 140,000 BTU/Gal. 7.0 Lbs/Gal.@60°F | 1010 BTU/$ft^3$ | BTU/$ft^3$ | BTU/lb | |
| **Source** | | | | | |
| **Supplier** | | | | | |
| **Halogens** (Yes/No) | | | | | |
| **List and Identify Metals** | | | | | |

26. Gas burner mode of control:
☐ Manual ☐ Automatic hi-low
☒ Automatic full modulation ☐ Automatic on-off

27. Gas burner manufacture: Cleaver Brooks

28. Oil burner manufacture: Cleaver Brooks

29. If fuel oil is used, how is it atomized? ☒ Oil Pressure ☐ Steam Pressure ☐ Compressed Air ☐ Rotary Cup ☐ Other, specify

30. Fuel oil preheated: ☐ Yes ☒ No

31. If yes, indicate temperature: °F

32. Specify the calculated theoretical air requirements for combustion of the fuel or mixture of fuels described above actual cubic feet (ACF) per unit of fuel:
@ °F, PSIA, % moisture

33. Emission rate at rated capacity: lb/hr

34. Percent excess air actually required for combustion of the fuel described: %

### Coal Characteristics

35. Seams:

36. Proximate analysis (dry basis): % of Fixed Carbon: % of Sulfur:
% of Moisture: % of Volatile Matter:
% of Ash:

**Emissions Stream**

37. What quantities of pollutants will be emitted from the boiler before controls?

| Pollutant | Pounds per Hour lb/hr | grain/ACF | @ °F | PSIA |
|---|---|---|---|---|
| CO | see calculations in | | | |
| Hydrocarbons | Attachment N | | | |
| $NO_x$ | | | | |
| Pb | | | | |
| $PM_{10}$ | | | | |
| $SO_2$ | | | | |
| VOCs | | | | |
| Other (specify) | | | | |
| | | | | |
| | | | | |
| | | | | |

38. What quantities of pollutants will be emitted from the boiler after controls?

| Pollutant | Pounds per Hour lb/hr | grain/ACF | @ °F | PSIA |
|---|---|---|---|---|
| CO | there are no add-on | | | |
| Hydrocarbons | emissions controls | | | |
| $NO_x$ | | | | |
| Pb | | | | |
| $PM_{10}$ | | | | |
| $SO_2$ | | | | |
| VOCs | | | | |
| Other (specify) | | | | |
| | | | | |
| | | | | |
| | | | | |

39. How will waste material from the process and control equipment be disposed of?

40. Have you completed an *Air Pollution Control Device Sheet(s)* for the control(s) used on this Emission Unit.

41. Have you included the ***air pollution rates*** on the Emissions Points Data Summary Sheet?

42. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

**MONITORING PLAN:** Please list (1) describe the process parameters and how they were chosen (2) the ranges and how they were established for monitoring to demonstrate compliance with the operation of this process equipment operation or air pollution control device.
Proposed monitoring is described in Attachment D.

**TESTING PLAN:** Please describe any proposed emissions testing for this process equipment or air pollution control device.
Emissions testing is not proposed.

**RECORDKEEPING:** Please describe the proposed recordkeeping that will accompany the monitoring.
Proposed monitoring is described in Attachment D.

**REPORTING:** Please describe the proposed frequency of reporting of the recordkeeping.
Proposed monitoring is described in Attachment D.

43. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.
Information on required maintenance and operating ranges will be submitted later with serial numbers for individual boilers.

# EMERGENCY GENERATOR ENGINE DATA SHEET

| | | | |
|---|---|---|---|
| Source Identification Number[1] | | EG-1 | |
| Engine Manufacturer and Model | | Caterpillar C27/ DWB01571 | |
| Manufacturer's Rated bhp/rpm | | 1,214/1,800 | |
| Source Status[2] | | ES | |
| Date Installed/Modified/Removed[3] | | 2011 | |
| Engine Manufactured/Reconstruction Date[4] | | 2011 | |
| Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart IIII? (Yes or No)[5] | | Yes | |
| Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart JJJJ? (Yes or No)[6] | | No | |
| Engine, Fuel and Combustion Data | Engine Type[7] | RB4S | |
| | APCD Type[8] | LEC | |
| | Fuel Type[9] | 2FO | |
| | $H_2S$ (gr/100 scf) | 15 ppm S | |
| | Operating bhp/rpm | 1,214/1,800 | |
| | BSFC (Btu/bhp-hr) | 6,608 | |
| | Fuel throughput ($ft^3$/hr) | 57.3 gallons/hour | |
| | Fuel throughput ($MMft^3$/yr) | 28,650 gallons/year | |
| | Operation (hrs/yr) | 500 | |
| Reference[10] | Potential Emissions[11] | lbs/hr | tons/yr |
| | $NO_X$ | | |
| | CO | | |
| | VOC | | |
| | $SO_2$ | | |
| | $PM_{10}$ | | |
| | Formaldehyde | | |
| | | | |
| See Emission Points Data Summary in Attachment J | See emissions calculations in Attachment N | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# ***Attachment N***

Supporting Emissions Calculations

**Charleston Area Medical Center - Teays Valley Hospital**
**Application for New Source Review Permit**

**Cleaver Brooks Boilers (2 identical units)**

| Operating Assumptions | | |
|---|---|---|
| Gas Firing Rate | 3.6 | MMBtu/hr |
| Gas Heat Content | 1,010 | Btu/CF |
| Max Gas Hours of Op | 8,260 | hr/yr |
| Max Gas Fuel Use | 3,564 | CFH |
| | 29.44 | MMCF/yr |
| | | |
| No 2 Oil Firing Rate | 3.6 | MMBtu/hr |
| No 2 Oil Heat Content | 140,000 | Btu/gal |
| Max Oil Hours of Op | 500 | hr/yr |
| Max Oil Fuel Use | 25.71 | GPH |
| | 1,800 | MMBtu/yr |

| Natural Gas Emissions | | | |
|---|---|---|---|
| **Pollutant** | **Emission Factor** | **lb/hr** | **tons/year** |
| PM10 | 0.01 lb/MMBtu | 0.04 | 0.15 |
| SO2 | 0.001 lb/MMBtu | 0.00 | 0.01 |
| NOx | 0.12 lb/MMBtu | 0.43 | 1.78 |
| CO | 0.15 lb/MMBtu | 0.54 | 2.23 |
| VOC | 0.016 lb/MMBtu | 0.06 | 0.24 |
| **No 2 Oil Emissions** | | | |
| **Pollutant** | **Emission Factor** | **lb/hr** | **tons/year** |
| PM10 | 0.025 lb/MMBtu | 0.09 | 0.02 |
| SO2 | 0.515 lb/MMBtu | 1.85 | 0.46 |
| NOx | 0.248 lb/MMBtu | 0.89 | 0.22 |
| CO | 0.07 lb/MMBtu | 0.25 | 0.06 |
| VOC | 0.025 lb/MMBtu | 0.09 | 0.02 |
| **TOTAL** | | | |
| **Pollutant** | **--** | **lb/hr** | **tons/year** |
| PM10 | -- | 0.13 | 0.17 |
| SO2 | -- | 1.86 | 0.48 |
| NOx | -- | 1.32 | 2.01 |
| CO | -- | 0.79 | 2.29 |
| VOC | -- | 0.15 | 0.26 |

Emission Factor Source: Manufacturer

Assumptions:
Hazardous Air Pollutant Emissions are a fraction of the VOC and PM10 emissions.
HAP emissions will decrease in proportion to the decrease in these pollutants.

**Charleston Area Medical Center - Teays Valley Hospital**
**Application for New Source Review Permit**

## Greenhouse Gas

| **Natural Gas Emissions** | | | |
|---|---|---|---|
| **Pollutant** | **Emission Factor** | **PPH** | **TPY** |
| CO2 | 53.06 kg/MMBtu | 421.118 | 1,739.216 |
| CH4 | 0.001 kg/MMBtu | 0.008 | 0.033 |
| N2O | 0.0001 kg/MMBtu | 0.001 | 0.003 |
| **Total CO2e** | 53.06 kg/MMBtu | **421.6** | **1,741.0** |
| **No 2 Oil Emissions** | | | |
| **Pollutant** | **Emission Factor** | **PPH** | **TPY** |
| CO2 | 73.96 kg/MMBtu | 586.993 | 146.748 |
| CH4 | 0.003 kg/MMBtu | 0.024 | 0.006 |
| N2O | 0.0006 kg/MMBtu | 0.005 | 0.001 |
| **Total CO2e** | 73.96 kg/MMBtu | **589.0** | **147.3** |
| **TOTAL** | | | |
| **Pollutant** | **--** | **PPH** | **TPY** |
| CO2 | -- | 1,008.111 | 1,885.964 |
| CH4 | -- | 0.032 | 0.039 |
| N2O | -- | 0.006 | 0.004 |
| **Total CO2e** | -- | **1,010.6** | **1,888.3** |

Emission Factor Source: 40 CFR 98, Table C-1 and C-2

Assumptions:

2.20462 lb/kg
25 global warming potential CH4
298 global warming potential N2O

# MODEL 4 BOILER

1,500 - 6,000 MBTU &
Watertube Boiler

**CONTENTS**

FEATURES AND BENEFITS . . . . . B2-3
PRODUCT OFFERING . . . . . B2-4
Standard Equipment . . . . . B2-4
Optional Equipment . . . . . B2-7
Insurance/Codes . . . . . B2-7
DIMENSIONS AND RATINGS . . . . . B2-8
PERFORMANCE DATA . . . . . B2-15
Efficiency . . . . . B2-15
Emissions . . . . . B2-16
ENGINEERING DATA . . . . . B2-16
Feedwater . . . . . B2-16
Blowdown . . . . . B2-17
Boiler Stacks . . . . . B2-17
Oil Piping . . . . . B2-20
Gas Piping . . . . . B2-20
SPECIFICATIONS . . . . . B2-27

ILLUSTRATIONS

Figure B2-1. Model 4 Dimension Drawing . . . . . B2-9
Figure B2-2. Model 4 Standard Pilot and Main Gas Trains . . . . . B2-2
Figure B2-3. Boiler room air supply - "Engineered Design" . . . . . B2-19
Figure B2-4. Typical gas header piping . . . . . B2-26

TABLES

Table B2-1. Model 4 Boiler Sizes . . . . . B2-5
Table B2-2. Model 4 Dimensions . . . . . B2-10
Table B2-3. Model 4 Steam Ratings . . . . . B2-11
Table B2-4. Recommended Steam Nozzle Size (to maintain 4000 to 5000 fpm nozzle velocity) . . . B2-11
Table B2-5. Min. req. NATURAL GAS pressure STANDARD UL, FM, & XL GAP gas trains . . . . . B2-13
Table B2-6. Min. req. NATURAL GAS pressure OVERSIZED UL, FM, & XL GAP gas trains . . . . . B2-13
Table B2-7. Min. req. PROPANE GAS pressure STANDARD UL, FM, & XL GAP gas trains . . . . . B2-14
Table B2-8. Min. req. PROPANE GAS pressure OVERSIZED UL, FM, & XL GAP gas trains . . . . . B2-14
Table B2-9. Safety valve outlet size . . . . . B2-15
Table B2-10. Predicted efficiency, 10 psig operating (includes radiation and convection losses) . . . B2-15
Table B2-11. Model 4 emission data - Natural Gas . . . . . B2-16
Table B2-12. Model 4 emission data - No. 2 Oil . . . . . B2-16
Table B2-13. Feedwater makeup rates . . . . . B2-17
Table B2-14. Water quality parameters . . . . . B2-17
Table B2-15. Model 4 fuel, combustion air, and flue gas flow rates . . . . . B2-19
Table B2-16. Gas line capacity - Schedule 40 metallic pipe . . . . . B2-22
Table B2-17. Gas line capacity - Schedule 40 metallic pipe . . . . . B2-22
Table B2-18. Gas line capacity - Schedule 40 metallic pipe . . . . . B2-23
Table B2-19. Gas line capacity - Schedule 40 metallic pipe . . . . . B2-24
Table B2-20. Gas line capacity - Schedule 40 metallic pipe . . . . . B2-25

This section contains information on the Model 4 Commercial Watertube Boiler product line for low and high pressure steam applications. Sizes range from 1.5 to 6 MMBtu/hr. The Model 4 Boiler is an excellent choice where high outputs are needed but space limitations exist. The model number designation is 1500 through 6000, representing MBtu/hr input (1,500,000 to 6,000,000 Btu/hr).

Fuel series designation is as follows:

- Series 100: No. 2 oil firing.
- Series 700: Natural gas firing.
- Series 200: No. 2 oil/natural gas firing.

Design pressure designation is stated as 15 psig, 150 psig, and 250 psig for steam. For example, an M4P-700-2500-150ST boiler designates a gas-fired, 2,500,000 Btu/hr, 150 psig, steam boiler.

## *FEATURES AND BENEFITS*

The following features and benefits apply to the Model 4 Boiler product line.

***33" Cased Width:***

- Boiler fits through most standard doorways.
- Reduced installation costs.

***Direct Driven, Vibration-Free Centrifugal Impeller:***

- Quiet operation.
- Sound levels below 79 dBA.
- Ideal for noise critical areas such as hospitals, churches, etc.

***Minimum Refractory:***

- Membrane waterwalls reduce the need for refractory by 95%.
- Reduced maintenance costs and refractory repair requirements.

***Membrane Waterwalls:***

- Enhanced heat transfer area in compact design.
- Full water wall furnace improves heat transfer for high efficiency.

***Small Boiler Footprint:***

- Savings of up to 50% in floor space.

***Weighs up to 40% less than Comparable Boilers:***

- Lower freight and rigging costs.
- Reduced structural requirements.

***Standard Built-in Soot Washers:***

- Boiler fireside cleaning without shutdown.
- Maintains peak boiler performance.

***Packaged Forced Draft Burner:***

- High pressure drop design.
- Optimum fuel and air mixing.
- Improved combustion efficiency.

***Burner/Windbox Davit:***

- Easy access to furnace with swing-open windbox.
- Reduced maintenance costs.

***Steam Design Pressures to 500 psig (optional):***

- High performance in a compact design.
- Proven vessel design for high design pressure applications.

## *PRODUCT OFFERING*

The Model 4 (M4) Boiler is a compact carbon steel, extended fin, watertube boiler. Heat transfer design is configured in a "3-pass" gas travel across the watertube surfaces. The pressure vessel is constructed to conform to the A.S.M.E. Code, either Section IV for low pressure steam @ 15 PSIG MAWP (maximum allowable working pressure) or Section I for MAWP greater than 15 PSIG.

The vessel (boiler) consists of two rows on each side of the vessel, of formed seamless tubes with extended fin surfaces and downcomers connected to the steam drum and lower drum. To reduce standby losses, the vessel is insulated with a fiberglass blanket and removable steel jacket.

Complete with an integral burner for either No.2 fuel oil or Natural Gas, the complete burner/boiler package is UL Approved, listed, and labeled.

**Standard Equipment**

The standard boiler/burner package is described below. Optional controls, trim, and devices may be added to meet project requirements. Some of those options are noted following this standards list.

1. Boiler

A. Designed, constructed, and hydrostatically tested in accordance with the A.S.M.E. Boiler and Pressure Vessel Code. The complete vessel is mounted on a structural steel frame.

B. Steam drum includes a hand hole in the rear head for drum water side inspection. Connections are included for the following:

- Feedwater Makeup w/internal dispersion tube.
- Surface Blowoff.
- Steam Supply.
- Safety Relief Valve.

C. Lower Drum includes hand holes at each end for waterside inspection. A drain/ blowoff tapping is provided at the front, bottom centerline.

D. Soot washer lances are provided on each side of the vessel between the two rows of tubes for fireside cleaning. Soot washer drains are located at the bottom of the boiler, with connections to drain located on each side of the lower drum at the rear.

E. Refractory is limited to the furnace floor, lower drum, and burner throat tile. High temperature insulation is installed on the front water wall and furnace access door.

F. Two lifting eyes are provided on the top centerline of the upper drum for ease of installation.

G. Furnace inspection/access door is provided in the furnace front wall.

H. The exhaust gas vent is located at the top rear centerline of the boiler. A stack thermometer is shipped loose for field installation by the installing contractor into the stack.

I. The complete vessel is fully insulated (2" fiberglass blanket) under a preformed, sectional steel jacket.

*Table B2-1. Model 4 Boiler Sizes*

| MODEL NO. | INPUT MBH | HEAT OUTPUT MBH | EQUIV HP | STEAM OUTPUT LB/HR | SHIPPING WEIGHT LBS |
|---|---|---|---|---|---|
| 1500 | 1500 | 1200 | 35 | 1237 | 3100 |
| 2000 | 2000 | 1600 | 47 | 1649 | 3100 |
| 2500 | 2500 | 2000 | 59 | 2062 | 3700 |
| 3000 | 3000 | 2400 | 71 | 2474 | 3700 |
| 3500 | 3500 | 2800 | 83 | 2887 | 4100 |
| 4000 | 4000 | 3200 | 95 | 3299 | 4100 |
| 4500 | 4500 | 3600 | 107 | 3711 | 4700 |
| 5000 | 5000 | 4000 | 119 | 4124 | 4700 |
| 6000 | 6000 | 4800 | 143 | 4949 | 5400 |

NOTE: Steam output from and at 212 °F.

J. Factory painted using hard-finish enamel.

2. Forced Draft Burner

A. The burner is a high radiant multi-port type approved for operation on natural gas and a pressure atomizing type approved for operation with commercial grade No. 2 fuel oil.

B. Consisting of the fan which is direct connected to the fan motor, wind box, air damper that is linkage connected to a damper drive motor, the complete assembly is factory mounted and tested.

C. To ensure proper air for pre purge and combustion is provided by the fan, a combustion air proving switch is provided.

D. The complete burner/wind box swings open via a davit arm attached to the upper drum. This permits fireside inspection of the furnace and burner internals.

E. Responding to steam demand from the drum mounted pressure control, the burner operates in the low-high-low-off firing mode. Ultra-violet (UV) flame scanner is provided for flame presence during firing.

F. An Ignition transformer is provided.

G. Ignition is direct spark on straight oil fired burners, and gas pilot on straight gas or combination gas/oil burners.

H. Oil Train consists of the following:

- 4 Solenoid Shutoff Valves providing low fire, intermediate transitional firing from low to high and high fire.
- An oil pump is mounted (belt driven from the fan motor) for pressure atomization of the fuel oil.
- Oil Pressure Gauge.
- Suction and return tubing connected to an oil connection block.

Gas Train consists of the following:

- Primary gas shutoff valve with integral proof of closure switch.
- A manual shutoff valve located ahead of the primary gas valve.
- A plugged leakage test connection and a second manual shutoff valve for tightness checking of the primary shutoff valve.
- Separate Gas Pressure Regulators for the pilot train and main gas train.
- Low Gas Pressure and High Gas Pressure Switches for units at 3000 and greater.
- A second motorized gas valve is provided in addition to the primary valve on size 6000 units.
- The pilot gas train includes a manual shutoff valve and solenoid shutoff valve.

3. Boiler Trim and Controls

A. 15 psig or 150 psig set A.S.M.E. safety relief valves.

B. Steam pressure gauge with inspectors test cock and connection.

C. Primary Water Column complete with gauge glass and column drain valve.

D. Low Water cutoff switch and pump control switch, integrally mounted in the primary water column.

E. Auxiliary Low Water Cutoff, manual reset type.

F. Steam Pressure Controls:

- Operating Limit.
- Excess Steam Pressure (High Limit), manual reset.
- Burner firing rate, low high low.

4. Burner Control Panel and Controls

A. The control panel is enclosed within a NEMA 1A Rated enclosure, mounted on the burner wind box at approximately eye level height.

B. Mounted within or on the control panel box are the following controls. Panel wiring is factory tested.

- Combustion Flame Safeguard Control, Model CB120 that provides pre purge, post purge, trial for ignition, main flame/burner operation, and safety shutdown.
- Fan Motor Starter wired into the non recycling circuit of the flame safeguard control.
- Indicating Lights for low water, flame failure, load demand, and fuel valve on.
- Burner On/Off Switch.
- Damper Positioning Switch.
- Fuel Selector Switch for combination fuel fired burners.
- Control Circuit Step-down Transformer with primary fuse protection.
- Terminals for interface wiring connection of controls.
- Oil, heat, and moisture resistant wire used. Each wire is number coded relative to the wiring diagram.

5. Electric Service Panel

An electric service panel (entrance box) is provided on the side of the boiler for all external wiring connections to remote control devices and the main power for the boiler. Wiring to this panel eliminates the need to disconnect wiring when the front burner wind box is opened for burner or boiler servicing.

**Optional Equipment**

For more detailed information on optional equipment, contact your local Cleaver-Brooks authorized representative. In summary, options include the following:

1. Boiler
   - Larger pressure gauges or specific manufacturer type.
   - Bottom Drain Valves for low pressure applications.
   - Bottom Blowoff Valves for high pressure applications.
   - Surface Blowoff Valve with internal collector pipe.
   - Feedwater Stop and Check Valves.
   - Steam Stop Valve.
   - ASME Hydro Test of Valves and Valve Piping.
   - Design pressures above 150 PSIG.
2. Burner/Control Options
   - Full Modulation Firing on Gas.
   - Lead/Lag Control.
   - Day-Night Controls.
   - Low Fire Hold Control.
   - Elapsed Time Meter.
   - Alarm with silence switch.
   - Additional Indicator Lights.
   - Main Power Disconnect.
   - Remote Oil Pump.
   - Optional NEMA Enclosures.
   - Special Fan Motor requirements (TEFC).
3. Fuel Options
   - Automatic Fuel Changeover (combination burner).
   - Propane Fuel Firing.
   - Special Gas Pressure Regulators.
   - Special fuel shut-off valves.
   - Dual Pilots (gas and oil).
   - Gas strainer.

**Insurance/Codes**

The boiler package can be equipped to meet various insurance or code requirements. Some of these insurance/code requirements are:

- Factory Mutual (FM)
- XL GAP (Formerly GE GAP/IRI).
- A.S.M.E. CSD-1.

**A. Factory Mutual (FM Global)** - Recommended guidelines as described by FM pertain to boilers rated at greater than 2.5 MMBtu/hr input on gas and 2.8 MMBtu/hr input on oil. Boilers that are labeled and tested in accordance with an independent testing lab such as UL or CSA and are below these inputs are exempt from these recommendations.

The Model 4 boiler is UL listed and labeled. In addition to the standard UL requirements the following are needed to comply with FM when required.

- Alarm Bell with silence switch for low water and safety shutdowns.
- Low Oil Pressure Switch if the oil pump is not direct driven from the fan motor.

**B. XL GAP (Formerly GE GAP/IRI)** Recommended guidelines as described by XL GAP pertain to boilers rated at 400,000 Btu/hr input to 12.0 MMBtu/hr input. For

these boilers, the requirements are the same as for A.S.M.E CSD-1 requirements. Above 12.0 MMBtu/hr input, the requirements defer to the NFPA 85 standards for single burner boilers.

**C. A.S.M.E. CSD-1 -** Recommended guidelines as described by this Code pertain to boilers rated at 400,000 Btu/hr input to 12.0 MMBtu/hr input. Above 12.0 MMBtu/hr input, the requirements defer to the NFPA 85 standards for single burner boilers. For the sizes this Code covers, the requirements are as follows, in addition to the standard UL package:

- Low Oil Pressure Switch for oil firing
- ¾" Pressure Control Piping
- If gas supply is > 5 psig, a relief valve is required after the gas pressure regulator in the main and pilot gas trains.
- Lever Handled shutoff cock for the pilot gas train.
- Non-fused disconnect to remove boiler from all sources of power.

## *DIMENSIONS AND RATINGS*

For layout purposes, the nominal dimensions and connections for the Model 4 Standard Package Boiler are shown in Figure B2-1 and Table B2-2. Ratings of each boiler size are noted in Table B2-3. Additional information is shown in the following figures, tables, and illustrations.

Table B2-4: Recommended steam nozzle sizes for high pressure boilers operating at lower and higher pressures.

Figure B2-2: Standard gas train dimensions and components.

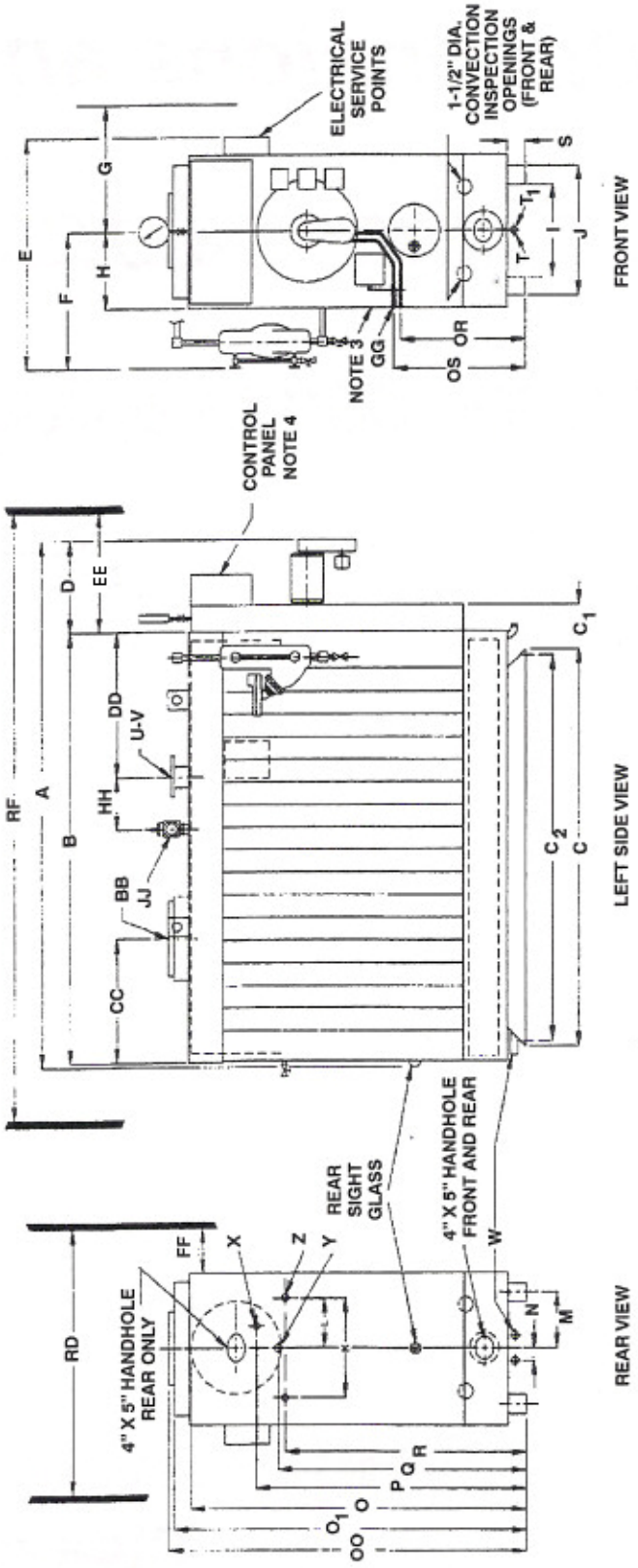
Table B2-5: Natural Gas Pressure Requirements, standard gas train size.

Table B2-6: Natural Gas Pressure Requirements, oversized gas train.

Table B2-7: Propane Gas Pressure Requirements, standard gas train size.

Table B2-8: Propane Gas Pressure Requirements, oversized gas train.

Table B2-9: Safety Valve Outlet Sizes.


ELECTRICAL SERVICE POINTS
1-1/2" DIA. CONVECTION INSPECTION OPENINGS (FRONT & REAR)
FRONT VIEW
NOTE 3
CONTROL PANEL NOTE 4
LEFT SIDE VIEW
REAR SIGHT GLASS
4" X 5" HANDHOLE FRONT AND REAR
4" X 5" HANDHOLE REAR ONLY
REAR VIEW

## *Table B2-2. Model 4 Dimensions*

| | | Boiler Size | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Note 1** | **1500** | **2000** | **2500** | **3000** | **3500** | **4000** | **4500** | **5000** | **6000** |
| | | All Dimensions are in inches | | | | | | | | |
| | **Lengths** | | | | | | | | | |
| A | Overall | 84.25 | 84.25 | 100.25 | 100.25 | 117.375 | 117.375 | 136.75 | 136.75 | 152.375 |
| B | Pressure Vessel w/casing | 61 | 61 | 77 | 77 | 92.375 | 92.375 | 109 | 109 | 124.625 |
| C | Base Frame | 54 | 54 | 69.625 | 69.625 | 85.25 | 85.25 | 101 | 101 | 116.5 |
| $C_1$ | Base to Burner/Windbox | 9.625 | 9.625 | 9.625 | 9.625 | 9.625 | 9.625 | 10 | 10 | 10 |
| $C_2$ | Base Frame Anchor Holes | 51.5 | 51.5 | 67.125 | 67.125 | 82.75 | 82.75 | 98.375 | 98.375 | 114 |
| CC | Rear Casing to Stack Connection | 25.8 | 25.8 | 26.25 | 26.25 | 26.25 | 26.25 | 30.375 | 30.375 | 30.375 |
| D | Burner/Windbox Extension | 20.1 | 20.1 | 20.1 | 20.1 | 21.9 | 21.9 | 24.6 | 24.6 | 24.6 |
| DD | Front Casing to Steam Nozzle | 17.25 | 17.25 | 25.25 | 25.25 | 30.75 | 30.75 | 37.375 | 37.375 | 45.25 |
| HH | Steam Nozzle to Safety Valve 15# | 8 | 8 | 12 | 12 | 11.5 | 11.5 | 13 | 13 | 17 |
| | Steam Nozzle to Safety Valve 150# | 8 | 8 | 12 | 12 | 17 | 17 | 17 | 17 | 17 |
| | **Widths** | | | | | | | | | |
| E | Overall | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 |
| F | Center to Water Column | 32.4 | 32.4 | 32.4 | 32.4 | 32.4 | 32.4 | 32.4 | 32.4 | 32.4 |
| G | Center to Opt. Aux. Water Column | 26.6 | 26.6 | 26.5 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 |
| H | Center to Outside Casing | 16.375 | 16.375 | 17.375 | 16.375 | 16.375 | 16.375 | 16.375 | 16.375 | 16.375 |
| I | Base Frame Inside | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| J | Base Frame Outside | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| K | Soot Washers, Center to Center | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 |
| L | Boiler Centerline to Soot Washer | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 |
| M | Boiler Centerline to Base Centerline | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| N | Boiler Centerline to Soot Drain | 5.25 | 5.25 | 5.25 | 5.25 | 5.25 | 5.25 | 5.25 | 5.25 | 5.25 |
| | **Heights** | | | | | | | | | |
| OO | Overall [Base to Stack Connection] | 78.75 | 78.75 | 78.75 | 78.75 | 78.75 | 78.75 | 78.75 | 78.75 | 78.75 |
| O | Base to Steam Nozzle 150# | 74.75 | 75.75 | 74.75 | 74.75 | 74.75 | 74.75 | 78 | 78 | 78 |
| O | Base to Steam Nozzle 15# | 75 | 75 | 75 | 75 | 78.25 | 78.25 | 78.25 | 78.25 | 78.25 |
| $O_1$ | Base to Stack Box. | 77.8 | 77.8 | 77.8 | 77.8 | 77.8 | 77.8 | 77.8 | 77.8 | 77.8 |
| $O_2$ | Base to Top of Control Panel | 83.25 | 83.25 | 83.25 | 83.25 | 83.25 | 83.25 | 83.25 | 83.25 | 83.25 |
| P | Base to Surface Blowoff | 59.25 | 59.25 | 59.25 | 59.25 | 59.25 | 59.25 | 59.25 | 59.25 | 59.25 |
| Q | Base to Feedwater Inlet | 57.25 | 57.25 | 57.25 | 57.25 | 57.25 | 57.25 | 57.25 | 57.25 | 57.25 |
| R | Base to Soot Washer Lance | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 |
| S | Height of Base | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| OS | Base to Oil Supply Connection | 27.75 | 27.75 | 27.75 | 27.75 | 27.75 | 27.75 | 27.75 | 27.75 | 27.75 |
| OR | Base to Oil Return Connection | 25.75 | 25.75 | 25.75 | 25.75 | 25.75 | 25.75 | 25.75 | 25.75 | 25.75 |
| | **Connections** | | | | | | | | | |
| BB. | OD Stack - Sleeve Connection | 12 | 12 | 12 | 12 | 12 | 12 | 16 | 16 | 16 |
| T | Bottom Drum Blow Down, 15# [one] | 1.25 | 1.25 | 1.25 | 1.25 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| $T_1$ | Bottom Drum Blow Down, 150# [one] | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| U | Steam Nozzle, 15# | 4[A] | 4[A] | 4[A] | 4[A] | 6[B] | 6[B] | 6[B] | 6[B] | 6[B] |
| V | Steam Nozzle, 150# | 2.5[A] | 2.5[A] | 3[A] | 3[A] | 3[A] | 3[A] | 4[B] | 4[B] | 4[B] |
| W | Soot Washer Drains [Two] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| X | Surface Blow off [One] | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Y | Feedwater Inlet [One] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Z | Soot Washer [Two] | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| GG | Oil Supply and Return | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| JJ | Relief Valve, 15# | 2 | 2 | 2 | 2 | 2 | 2.5 | 2.5 | 2.5 | 3 |
| | Relief Valve, 150# | 1 | 1.25 | 1.25 | 1.25 | 1.5 | 1.5 | 1.5 | 1.5 | 2 |
| | **Clearances** | | | | | | | | | |
| EE | Burner/Windbox Swing | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| FF | Tube removal each side | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| RF | Allowance for Burner/Windbox Swing and 30" Rear Aisle Space. | 124 | 124 | 140 | 140 | 155 | 155 | 172 | 172 | 187 |
| RD | Allowance for Tube Removal Each Side and Burner/Windbox Swing. | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 |

NOTES:
1. The above dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction via certified prints. For 200 PSIG design pressure and greater, contact Milwaukee Sales for certified prints.
2. Allow sufficient space at rear of boiler for removal of soot washer lance.
3. For access to the furnace, a 13" x 21" access door is provided behind the front door.
4. Control Panel may be larger (up to 4" in height) if certain control options are provided.

A. Connection is a Female Pipe Thread.

B. Connection is a 150# Flange, Flat Face.

## *Table B2-3. Model 4 Steam Ratings*

| Boiler SIZE | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 6000 |
|---|---|---|---|---|---|---|---|---|---|
| **Ratings [Note A]** | | | | | | | | | |
| Rated Capacity - Steam (lbs. steam/hr from & at 212° F.) | 1,237 | 1,649 | 2,062 | 2,474 | 2,887 | 3,299 | 3,711 | 4,124 | 4,949 |
| Rated Steam Capacity [kg/hr from and at 100 C] | 461.7 | 615.5 | 769.6 | 923.4 | 1,077.5 | 1,231.3 | 1,385.0 | 1,539.2 | 1,847.2 |
| Output Btu/hr [1,000 Btu/h] | 1,200 | 1,600 | 2,000 | 2,400 | 2,800 | 3,200 | 3,600 | 4,000 | 4,800 |
| Output Kcal/Hr [1,000 Kcal/h] | 302 | 403 | 504 | 605 | 706 | 806 | 907 | 1,007 | 1,210 |
| Output KW | 348 | 464 | 580 | 696 | 812 | 928 | 1,044 | 1,160 | 1,392 |
| **Approximate Fuel Consumption At Rated Capacity [ Input - Note B]** | | | | | | | | | |
| Natural Gas [$ft^3$/hr] - 15# Steam | 1,511 | 1,538 | 2,500 | 3,038 | 3,487 | 4,025 | 4,494 | 5,050 | 6,052 |
| Natural Gas [$ft^3$/hr] - 150# Steam | 1,572 | 2,133 | 2,597 | 3,117 | 3,590 | 4,155 | 4,657 | 5,194 | 6,233 |
| Natural Gas [$m^3$/hr] - 15# Steam | 42.8 | 43.5 | 70.8 | 86 | 98.7 | 114.0 | 127.0 | 143.0 | 171.4 |
| Natural Gas [$m^3$/hr] - 150# Steam | 44.5 | 60.4 | 73.5 | 88.3 | 101.6 | 117.6 | 131.8 | 147.0 | 176.5 |
| Propane Gas [$ft^3$/hr] - 15# Steam | 604 | 615 | 1,000 | 1,215 | 1,395 | 1,610 | 1,798 | 2,020 | 2,421 |
| Propane Gas [$ft^3$/hr] - 150# Steam | 629 | 853 | 1,039 | 1,247 | 1,436 | 1,662 | 1,863 | 2,078 | 2,493 |
| Propane Gas [$m^3$/hr] - 15# Steam | 17 | 17.4 | 28.3 | 34.4 | 39.5 | 45.6 | 51 | 57.2 | 68.5 |
| Propane Gas [$m^3$/hr] - 150# Steam | 17.8 | 24.1 | 29.4 | 35.3 | 40.7 | 47 | 52.7 | 58.8 | 70.6 |
| No.2 Oil Fuel - 15# Steam, gph | 10 | 14 | 17 | 21 | 24 | 28 | 31 | 35 | 42 |
| No.2 Oil Fuel - 150# Steam, gph | 11 | 15 | 18 | 22 | 25 | 28.9 | 32 | 36 | 43 |
| No.2 Oil Fuel - 15# Steam, liters/hour | 38 | 53 | 64 | 79 | 91 | 106 | 117 | 132 | 159 |
| No.2 Oil Fuel - 150# Steam, liters/hour | 41 | 56 | 68 | 82 | 95 | 109 | 121 | 136 | 163 |
| **Power Requirements - 3 Phase 60 Hz Standard [Note C]** | | | | | | | | | |
| Blower Motor HP - Gas Firing | 3/4 | 1 | 1-1/2 | 2 | 2 | 3 | 3 | 3 | 5 |
| Blower Motor HP - Oil or Combination | 1-1/2 | 1-1/2 | 2 | 2 | 3 | 5 | 3 | 3 | 5 |
| Oil Pump for Oil or Combination | ← Belt Driven from the Blower Motor → | | | | | | | | |
| **Minimum Ampacity** | | | | | | | | | |
| Blower Motor - Gas Firing Only, 230V | 1.53 | 3.3 | 4.7 | 6 | 6 | 9 | 9 | 9 | 15 |
| Blower Motor - Gas Firing Only, 460V | 0.77 | 1.7 | 2.4 | 3 | 3 | 4.5 | 4.5 | 4.5 | 7.5 |
| Blower Motor - Oil or Combination, 230V | 4.7 | 4.7 | 6 | 6 | 9 | 15 | 9 | 9 | 15 |
| Blower Motor - Oil or Combination, 460V | 2.4 | 2.4 | 3 | 3 | 4.5 | 7.5 | 4.5 | 4.5 | 7.5 |
| Control Circuit | 1.7 | 1.7 | 1.7 | 1.9 | 1.9 | 1.9 | 2.4 | 2.4 | 2.4 |
| **Weights** | | | | | | | | | |
| Operating Weight, lbs. | 3,758 | 3,758 | 4,566 | 4,566 | 5,175 | 5,175 | 5,991 | 5,991 | 6,900 |
| Operating Weight, kg | 1,399 | 1,399 | 1,704 | 1,704 | 1,932 | 1,932 | 2,236 | 2,236 | 2,575 |
| Water Content Normal, gallons | 79 | 79 | 104 | 104 | 130 | 130 | 156 | 156 | 181 |
| Water Content Normal, liters | 299 | 299 | 394 | 394 | 492 | 492 | 591 | 591 | 685 |
| Water Content Flooded, gallons | 109 | 109 | 145 | 145 | 177 | 177 | 213 | 213 | 245 |
| Water Content Flooded, liters | 413 | 413 | 549 | 549 | 670 | 670 | 806 | 806 | 927 |
| Shipping Weight, approximate lbs. | 3,100 | 3,100 | 3,700 | 3,700 | 4,100 | 4,100 | 4,700 | 4,700 | 5,400 |
| Shipping Weight, approximate kg | 1,157 | 1,157 | 1,381 | 1,381 | 1,530 | 1,530 | 1,754 | 1,754 | 2,015 |

Notes:

A. Ratings shown for elevation to 1000 Feet. For ratings above 1000 Feet, contact your local Cleaver-Brooks Representative.

B. Input calculated with Nat. Gas @ 1000 Btu/$ft^3$, Propane @ 2500 Btu/$ft^3$, and Oil @ 140,000Btu/gal.

C. For altitudes above 1000 Feet, contact your local Cleaver-Brooks authorized representative for verification of capacity rating.

## *Table B2-4. Recommended Steam Nozzle Size (to maintain 4000 to 5000 fpm nozzle velocity)*

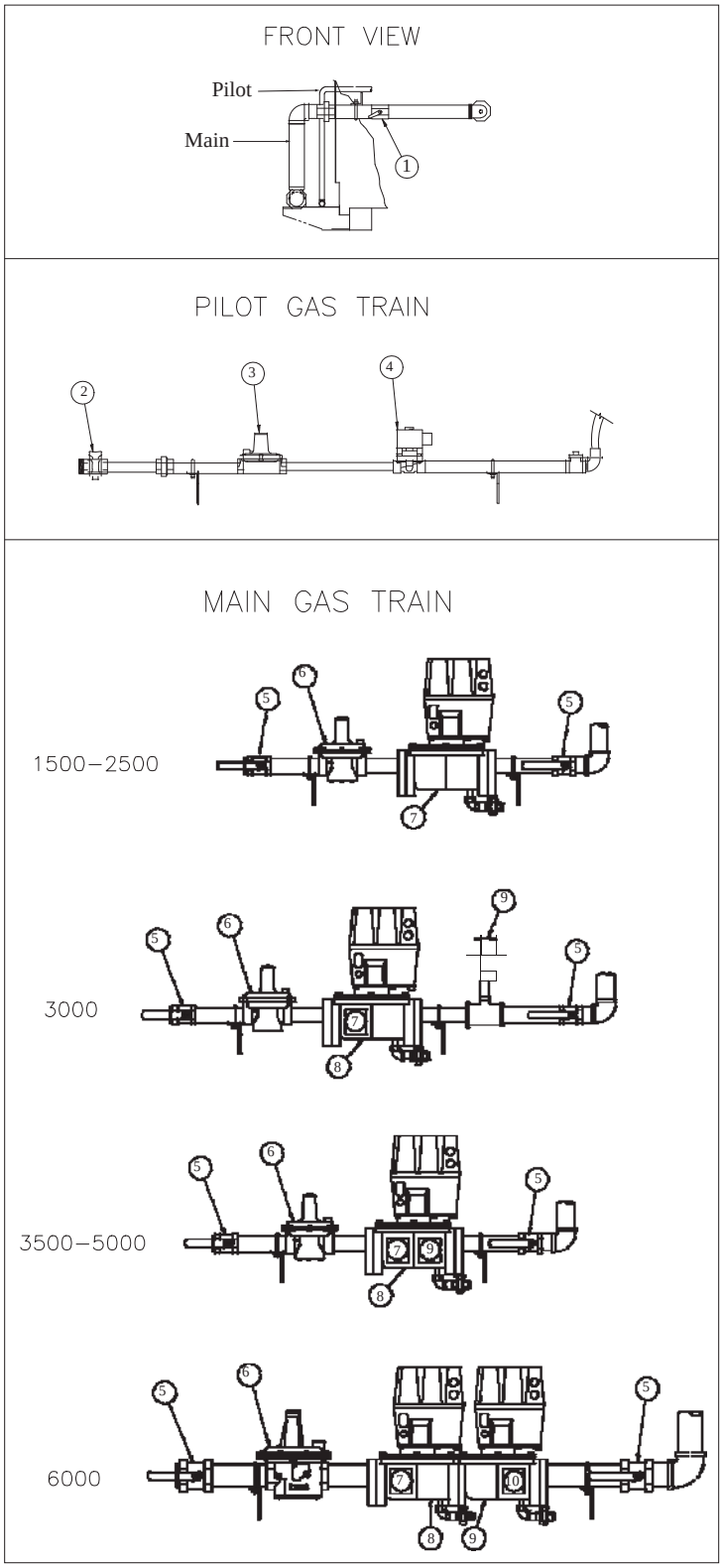
| Operating Pressure (PSIG) | BOILER SIZE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 6000 |
| 15 | 4 | 4 | 6 | 6 | 6 | 6 | 8 | 8 | 8 |
| 20 | 3 | 4 | 4 | 6 | 6 | 6 | 8 | 8 | 8 |
| 30 | 3 | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 |
| 40 | 2-1/2 | 3 | 3 | 4 | 4 | 4 | 6 | 6 | 6 |
| 50 | 2-1/2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 6 |
| 65 | 2-1/2 | 2-1/2 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| 75 | 2-1/2 | 2-1/2 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| 95 - 125[A] | 2-1/2 | 2-1/2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |
| 150 | 1-1/2 | 2 | 2 | 2-1/2 | 2-1/2 | 2-1/2 | 3 | 3 | 3 |
| 200 | 1-1/2 | 1-1/2 | 1-1/2 | 2 | 2 | 2-1/2 | 2-1/2 | 2-1/2 | 3 |
| 250 - 400 | 1-1/2 | 1-1/2 | 1-1/2 | 1-1/2 | 2 | 2 | 2 | 2 | 2-1/2 |

A. Standard nozzle size for 150 PSIG MAWP Boiler Design

Example 1: Size 3500, 150# boiler to operate @ 30 PSIG requires 4" steam nozzle in lieu of standard 3" nozzle.

Example 2: Size 3500, 150# boiler to operate @ 200 PSIG requires 2" steam nozzle in lieu of standard 2-1/2" nozzle.

***Figure B2-2. Model 4 Standard Pilot and Main Gas Trains***




| ITEM | PART DESCRIPTION | SIZES INCHES |
|---|---|---|
| Sizes 1500 TO 2500 | | |
| 1 | Butterfly Valve | 1-1/2 |
| 2 | Pilot Shutoff Cock | 1/2 |
| 3 | Pilot Gas Regulator | 1/2 |
| 4 | Pilot Solenoid Valve | 1/2 |
| 5 | Manual Shutoff Valve | 1-1/2 |
| 6 | Main Gas Regulator | 1-1/2 |
| 7 | Motorized Valve with P.O.C. | 1-1/2 |
| Size 3000 | | |
| 1 | Butterfly Valve | 1-1/2 |
| 2 | Pilot Shutoff Cock | 1/2 |
| 3 | Pilot Gas Regulator | 1/2 |
| 4 | Pilot Solenoid Valve | 1/2 |
| 5 | Manual Shutoff Valve | 1-1/2 |
| 6 | Main Gas Regulator | 1-1/2 |
| 7 | Low Gas Pressure Switch | 1/4 |
| 8 | Motorized Valve with P.O.C. | 1-1/2 |
| 9 | High Gas Pressure Switch | 1/4 |
| Sizes 3500 to 5000 | | |
| 1 | Butterfly Valve | 2 |
| 2 | Pilot Shutoff Cock | 1/2 |
| 3 | Pilot Gas Regulator | 1/2 |
| 4 | Pilot Solenoid Valve | 1/2 |
| 5 | Manual Shutoff Valve | 2 |
| 6 | Main Gas Regulator | 2 |
| 7 | Low Gas Pressure Switch | 1/4 |
| 8 | Motorized Valve with P.O.C. | 2 |
| 9 | High Gas Pressure Switch | 1/4 |
| Size 6000 | | |
| 1 | Butterfly Valve | 2 |
| 2 | Pilot Shutoff Cock | 1/2 |
| 3 | Pilot Gas Regulator | 1/2 |
| 4 | Pilot Solenoid Valve | 1/2 |
| 5 | Manual Shutoff Valve | 2 |
| 6 | Main Gas Regulator | 2-1/2 |
| 7 | Low Gas Pressure Switch | 1/4 |
| 8 | Motorized Valve (std) | 2 |
| 9 | Motorized Valve with P.O.C. | 2 |
| 10 | High Gas Pressure Switch | 1/4 |

***Table B2-5. Minimum required* NATURAL GAS *pressure at entrance to* STANDARD *UL, FM, & XL GAP gas trains (upstream of gas pressure regulator)***

| BOILER SIZE | INLET PIPE SIZE (inches) | HONEYWELL VALVE SIZE (inches) | PRESSURE REQUIRED | | REQUIRED FUEL FLOW (SCFH) |
|---|---|---|---|---|---|
| | | | MIN ("W.C.) | MAX ("W.C.) | |
| 1500 | 1.5 | 1.5 | 4.4 | 28.0 | 1500 |
| 2000 | 1.5 | 1.5 | 8.4 | 28.0 | 2000 |
| 2500 | 1.5 | 1.5 | 12.9 | 28.0 | 2500 |
| 3000 | 1.5 | 1.5 | 17.1 | 28.0 | 3000 |
| 3500 | 2.0 | 2.0 | 11.3 | 28.0 | 3500 |
| 4000 | 2.0 | 2.0 | 13.6 | 28.0 | 4000 |
| 4500 | 2.0 | 2.0 | 12.2 | 28.0 | 4500 |
| 5000 | 2.0 | 2.0 | 16.8 | 28.0 | 5000 |
| 6000 | 2.0 | 2.0 | 21.5 | 28.0 | 6000 |

Note: For altitude above 1000 feet, contact your local Cleaver-Brooks representative.
Natural Gas @ 1000 Btu/cu-ft, specific gravity @ 0.65

***Table B2-6. Minimum required* NATURAL GAS *pressure at entrance to* OVERSIZED *UL, FM, & XL GAP gas trains (upstream of gas pressure regulator)***

| BOILER SIZE | INLET PIPE SIZE (inches) | HONEYWELL VALVE SIZE (inches) | PRESSURE REQUIRED | | REQUIRED FUEL FLOW (SCFH) |
|---|---|---|---|---|---|
| | | | MIN ("W.C.) | MAX ("W.C.) | |
| 1500 | 2.0 | 2.0 | 2.3 | 28.0 | 1500 |
| 2000 | 2.0 | 2.0 | 4.8 | 28.0 | 2000 |
| 2500 | 2.0 | 2.0 | 6.5 | 28.0 | 2500 |
| | 2.5 | 2.5 | 5.7 | | |
| 3000 | 2.0 | 2.0 | 9.0 | 28.0 | 3000 |
| | 2.5 | 2.5 | 6.8 | | |
| | 3.0 | 3.0 | 6.0 | | |
| 3500 | 2.5 | 2.5 | 9.7 | | 3500 |
| | 3.0 | 3.0 | 7.1 | | |
| 4000 | 2.5 | 2.5 | 11.8 | | 4000 |
| | 3.0 | 3.0 | 8.5 | | |
| 4500 | 2.5 | 2.5 | 9.8 | | 4500 |
| | 3.0 | 3.0 | 5.6 | | |
| 5000 | 2.5 | 2.5 | 12.9 | 28.0 | 5000 |
| | 3.0 | 3.0 | 7.1 | | |
| | 4.0 | 4.0 | 5.6 | | |
| 6000 | 2.5 | 2.5 | 17.5 | 28.0 | 6000 |
| | 3.0 | 3.0 | 10.0 | | |
| | 4.0 | 4.0 | 7.9 | | |

Note: For altitude above 1000 feet, contact your local Cleaver-Brooks representative.
Natural Gas @ 1000 Btu/cu-ft, specific gravity @ 0.65

***Table B2-7. Minimum required* PROPANE GAS *pressure at entrance to* STANDARD *UL, FM, & XL GAP gas trains (upstream of gas pressure regulator)***

| BOILER SIZE | INLET PIPE SIZE (inches) | HONEYWELL VALVE SIZE (inches) | PRESSURE REQUIRED | | REQUIRED FUEL FLOW (SCFH) |
|---|---|---|---|---|---|
| | | | MIN ("W.C.) | MAX ("W.C.) | |
| 1500 | 1.5 | 1.5 | 6.7 | 28.0 | 600 |
| 2000 | 1.5 | 1.5 | 10.5 | 28.0 | 800 |
| 2500 | 1.5 | 1.5 | 13.3 | 28.0 | 1000 |
| 3000 | 1.5 | 1.5 | 17.0 | 28.0 | 1200 |
| 3500 | 2.0 | 2.0 | 14.3 | 28.0 | 1400 |
| 4000 | 2.0 | 2.0 | 16.5 | 28.0 | 1600 |
| 4500 | 2.0 | 2.0 | 14.8 | 28.0 | 1800 |
| 5000 | 2.0 | 2.0 | 16.4 | 28.0 | 2000 |
| 6000 | 2.0 | 2.0 | 19.6 | 28.0 | 2400 |

Note: For altitude above 1000 feet, contact your local Cleaver-Brooks representative.
Propane @ 2500 Btu/cu-ft, specific gravity @ 1.6

***Table B2-8. Minimum required* PROPANE GAS *pressure at entrance to* OVERSIZED *UL, FM, & XL GAP gas trains (upstream of gas pressure regulator)***

| BOILER SIZE | INLET PIPE SIZE (inches) | HONEYWELL VALVE SIZE (inches) | PRESSURE REQUIRED | | REQUIRED FUEL FLOW (SCFH) |
|---|---|---|---|---|---|
| | | | MIN ("W.C.) | MAX ("W.C.) | |
| 1500 | 2.0 | 2.0 | 5.9 | 28.0 | 600 |
| 2000 | 2.0 | 2.0 | 9.0 | 28.0 | 800 |
| 2500 | 2.0 | 2.0 | 10.8 | 28.0 | 1000 |
| | 2.5 | 2.5 | 10.5 | | |
| 3000 | 2.0 | 2.0 | 13.8 | 28.0 | 1200 |
| | 2.5 | 2.5 | 12.9 | | |
| | 3.0 | 3.0 | 12.6 | | |
| 3500 | 2.5 | 2.5 | 13.6 | | 1400 |
| | 3.0 | 3.0 | 12.6 | | |
| 4000 | 2.5 | 2.5 | 15.8 | | 1600 |
| | 3.0 | 3.0 | 14.5 | | |
| 4500 | 2.5 | 2.5 | 13.8 | | 1800 |
| | 3.0 | 3.0 | 12.1 | | |
| 5000 | 2.5 | 2.5 | 14.8 | 28.0 | 2000 |
| | 3.0 | 3.0 | 12.5 | | |
| | 4.0 | 4.0 | 12.0 | | |
| 6000 | 2.5 | 2.5 | 18.0 | 28.0 | 2400 |
| | 3.0 | 3.0 | 15.0 | | |
| | 4.0 | 4.0 | 14.1 | | |

Note: For altitude above 1000 feet, contact your local Cleaver-Brooks representative.
Propane @ 2500 Btu/cu-ft, specific gravity @ 1.6

***Table B2-9. Safety valve outlet size***

| | SAFETY VALVE SETTING | | | | | |
|---|---|---|---|---|---|---|
| | 15 PSIG STEAM | | | 150 PSIG STEAM | | |
| Boiler Size | VALVES REQ'D | OUTLET SIZE (IN.)** | VALVE CAPACITY | VALVES REQ'D | OUTLET SIZE (IN.)** | VALVE CAPACITY |
| 1500 | 1 | 2 | 3161 lbs/hr | 1 | 1 | 1651 lbs/hr |
| 2000 | 1 | 2 | 3161 lbs/hr | 1 | 1-1/4 | 2585 lbs/hr |
| 2500 | 1 | 2 | 3161 lbs/hr | 1 | 1-1/4 | 2585 lbs/hr |
| 3000 | 1 | 2 | 3161 lbs/hr | 1 | 1-1/4 | 2585 lbs/hr |
| 3500 | 1 | 2 | 3161 lbs/hr | 1 | 1-1/2 | 4240 lbs/hr |
| 4000 | 1 | 2-1/2 | 4676 lbs/hr | 1 | 1-1/2 | 4240 lbs/hr |
| 4500 | 1 | 2-1/2 | 4676 lbs/hr | 1 | 1-1/2 | 4240 lbs/hr |
| 5000 | 1 | 2-1/2 | 4676 lbs/hr | 1 | 1-1/2 | 4240 lbs/hr |
| 6000 | 1 | 3 | 6942 lbs/hr | 1 | 2 | 6596 lbs/hr |

** Female Pipe Thread Connection [FPT]

## *PERFORMANCE DATA*

**Efficiency**

Efficiency data provided in Table B2-10 is based on low pressure steam operation. For high pressure steam operation contact your local Cleaver-Brooks authorized representative for expected efficiency data.

***Table B2-10. Predicted efficiency, 10 psig operating (includes radiation and convection losses)***

| Boiler Size | Gas Fuel | | Oil Fuel | |
|---|---|---|---|---|
| | Firing Rate | | Firing Rate | |
| | Low Fire | High Fire | Low Fire | High Fire |
| 1500 | 81.6 | 81.9 | 84.1 | 84.4 |
| 2000 | 81.1 | 80.0 | 83.6 | 82.5 |
| 2500 | 81.6 | 81.5 | 84.1 | 84.0 |
| 3000 | 81.3 | 80.3 | 83.8 | 82.8 |
| 3500 | 81.6 | 81.5 | 84.1 | 84.0 |
| 4000 | 81.3 | 80.7 | 83.8 | 83.0 |
| 4500 | 81.1 | 80.9 | 83.6 | 83.4 |
| 5000 | 81.3 | 80.0 | 83.8 | 82.5 |
| 6000 | 81.6 | 79.8 | 84.1 | 82.4 |

**Emissions**

The following tables give typical emission levels for Nature Gas and No. 2 Oil. Please contact your local Cleaver-Brooks authorized representative if an emission guarantee is required.

***Table B2-11. Model 4 emission data - Natural Gas***

| POLLUTANT | | UNCONTROLLED |
|---|---|---|
| CO | ppm | xx200 |
| | lb/MMBtu | 0.15 |
| NOx | ppm | 100 |
| | lb/MMBtu | 0.12 |
| SOx | ppm | 1 |
| | lb/MMBtu | 0.001 |
| HC/ VOCs | ppm | 40 |
| | lb/MMBtu | 0.016 |
| PM | ppm | – |
| | lb/MMBtu | 0.01 |

***Table B2-12. Model 4 emission data - No. 2 Oil***

| POLLUTANT | | UNCONTROLLED |
|---|---|---|
| CO | ppm | 90 |
| | lb/MMBtu | 0.07 |
| NOx | ppm | 187 |
| | lb/MMBtu | 0.248 |
| SOx | ppm | 270 |
| | lb/MMBtu | 0.515 |
| HC/ VOCs | ppm | 50 |
| | lb/MMBtu | 0.025 |
| PM | ppm | – |
| | lb/MMBtu | 0.025 |

NOTES:
Based on fuel oil constituent levels:
Fuel bound nitrogen = 0.05% (max) by weight.
Sulfur = 0.5% (max) by weight.
Ash = 0.01% (max) by weight.

## *ENGINEERING DATA*

The following engineering information is provided for the Model 4 steam boiler. Additional information may be obtained from your local Cleaver-Brooks authorized representative.

**Feedwater**

Steam boilers require make-up water for steam production. This make-up can be a combination of condensate return and raw make-up, 100% condensate return or 100% raw make-up. Proper treatment of make-up water and boiler water is essential to the longevity and performance of the boiler. Table B2-13 shows the rate of make-up required and Table B2-14 shows the recommended water quality guidelines.

As a minimum, raw make-up should be piped into a water softener and then to a feed tank, which also can be the container that receives the system condensate returns. Chemical feed is recommended to be fed via a quill into the water make-up line feeding the boiler.

*Table B2-13. Feedwater makeup rates*

| Boiler Size | Gallons/Minute |
|---|---|
| 1500 | 2.5 |
| 2000 | 3.3 |
| 2500 | 4.1 |
| 3000 | 5 |
| 3500 | 5.8 |
| 4000 | 6.6 |
| 4500 | 7.5 |
| 5000 | 8.3 |
| 6000 | 9.9 |

*Table B2-14. Water quality parameters*

| Parameter | Boiler Water Limit |
|---|---|
| pH | 8.3 - 10.5 |
| Iron | 0.1 ppm |
| Oxygen | 0.1 mg/liter |
| Specific Conductivity | 2000 µmho/cm |
| Suspended Solids | 300 ppm |
| Total Hardness | 0 ppm as $CaCO_3$ |

**Blowdown**

As steam is produced, unwanted solids are left behind in the boiler water and become concentrated within the vessel. If these constituents are allowed to adhere to the heat transfer surfaces, they will impede the flow of energy into the water. Their removal requires proper blowdown that will include bottom and possibly surface blowoff. For proper TDS control, surface blowoff with a TDS monitoring device is recommended. Local codes will dictate the manner of treating the blowdown affluent.

**Boiler Stacks**

**General** - The Model 4 boiler operates with a positive vent pressure and a vent gas temperature that is non-condensing. Therefore, the stack must be a positive pressure design.

Proper design and installation of the flue gas venting is critical to efficient and safe operation of the burner. The vent should be designed with proper supports and clearances from combustible materials. Use insulated vent pipe spacers where the vent passes through walls and roofs.

The design of the stack and breeching must provide the required draft at each boiler stack connection. Although constant pressure at the flue gas outlet is not required, it is necessary to size the breeching and stack to limit flue gas pressure variations. Consideration of the draft must be given where lengthy runs of breeching or unusually high stacks are employed. Please note: the allowable pressure range for design of the stack and breeching is negative 0.25" w.c. (-62 Pa) to a positive 0.25" w.c. (+62 Pa) for proper light offs and combustion. **NOTE:** This pressure range does not pertain to the boiler room; that is, the boiler room must be neutral or slightly positive, never negative when using air from the boiler room for combustion.

When two or more Model 4 boilers are connected to a common breeching/stack, one should evaluate the affects of pressure variations that may occur during boiler sequencing while boilers are firing. It may be determined that some type of mechanical draft system be employed to ensure proper draft at each boiler is maintained.

**Combustion Air** - The burner for each boiler must be supplied with adequate volume of uncontaminated air to support proper combustion and equipment ventilation. Air shall be free of chlorides, halogens, fluorocarbons, construction dust or other contaminants that are detrimental to the burner or boiler heating surfaces.

Combustion air can be supplied by means of conventional venting, that is, with combustion air drawn from the area immediately surrounding the boiler (boiler

room is neutral or slightly positive pressure), or with a direct vent to outside the boiler room where air is drawn directly from the exterior of the building. Regardless of the method, all installations must comply with NFPA 54 (National Fuel Gas Code - NFGC) for U.S. installations and CAN/CSA B149/.1 and B149.2 for Canadian installations.

**Engineered Design** - When determining boiler room air requirements for the boiler, the "Engineered Design" method may be used. Following this method, consideration must be given to the size of the boiler room, airflow, and air velocity as follows:

A. Two permanent air supply openings in the outer walls of the boiler room are recommended. Locate one at each end of the boiler room, preferably below a height of 7 feet. This allows air to sweep the length of the boiler. Refer to Figure B2-3.

B. Air supply openings can be louvered for weather protection, but they should not be covered with a fine mesh wire, as this type of covering has poor air flow qualities and is subject to clogging with dirt and dust.

C. A vent fan in the boiler room is not recommended as it could create a slight vacuum under certain conditions and cause variations in the quantity of combustion air. This can result in unsafe burner performance.

D. It is forbidden to have the total area of the air supply openings at less than one square foot.

E. Size the openings by using the formula (Area in $ft^2 = cfm_a/fpm_a$), where $cfm_a$ = cubic feet per minute of air; $fpm_a$ = feet per minute of air.

F. Amount of air required (cfm):

1. Combustion Air = Maximum boiler horsepower (bhp) times 8 cfm.

2. Ventilation Air = Maximum boiler horsepower (bhp) times 2 cfm.

3. Total Air = 10 cfm per bhp (up to 1000 feet elevation, add 3% more per 1000 feet of added elevation).

G. Acceptable air velocity in the boiler room (fpm):

1. From floor to 7 feet high = 250 fpm.

2. Above 7 feet from boiler room floor = 500 fpm.

Example of required air openings (Engineered Method):

Determine the area of the boiler room air supply openings for [2] size 4500 Model 4 boilers at 750 feet elevation; each have a rating of 107 boiler horsepower. The air openings will be 5 feet above the floor level.

The total boiler horsepower (bhp): 107 x 2 = 214 bhp.

From F.3 above, total air required = 214 bhp x 10 = 2140 cfm.

Air Velocity: From G.1 above = 250 fpm.

Area required: From the formula in E above, 2140 cfm/250 fpm = 8.56 square feet total.

Area opening: 8.56 divided by 2 = 4.28 $ft^2$ per opening (2 required).

***Notice***

***Consult local codes, which may supersede these requirements.***

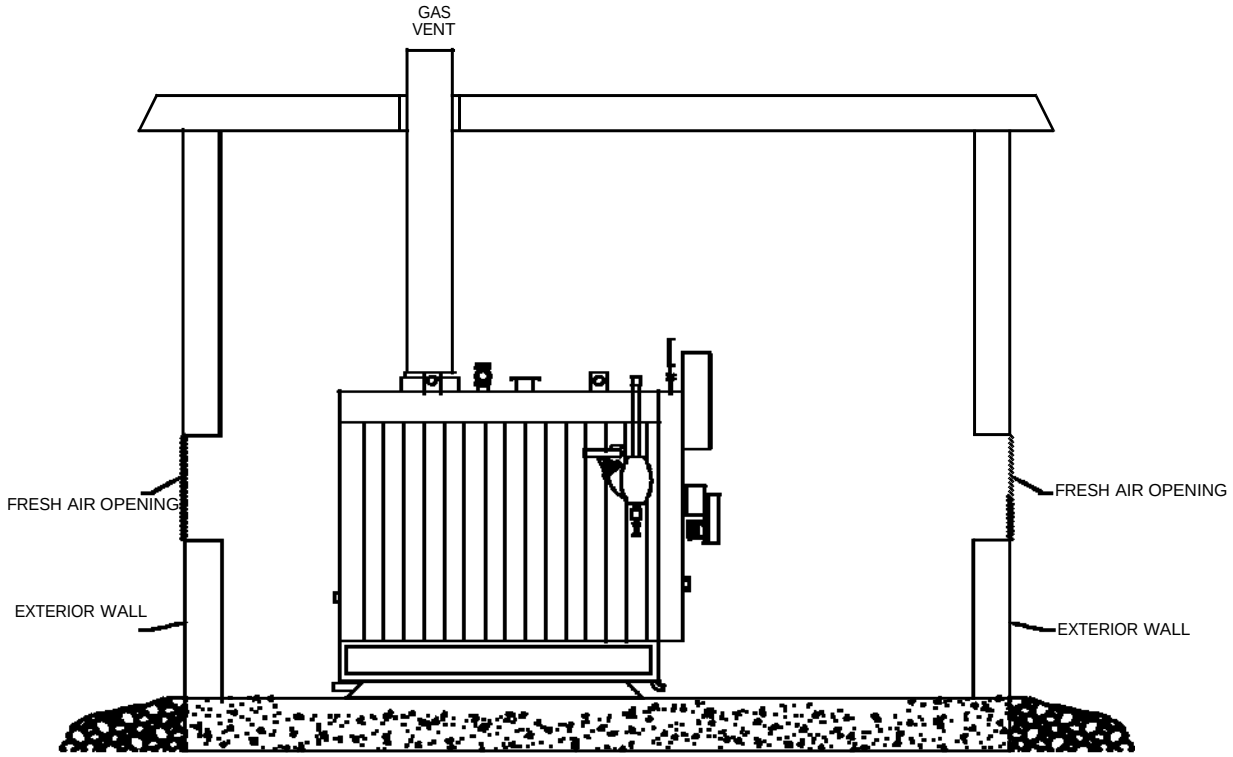
See Table B2-15 for combustion air and flue gas flow.

### *Table B2-15. Model 4 fuel, combustion air, and flue gas flow rates*

| | | | Boiler Size | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 6000 |
| Fuel Consumpi on | Gas | cfh | 1500 | 1500 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 6000 |
| | Oil | gph | 10.72 | 14.29 | 17.86 | 21.43 | 25.00 | 28.57 | 32.14 | 35.71 | 42.85 |
| Combustion Air | Gas | scfh | 15,480 | 20,640 | 25,800 | 30,960 | 36,120 | 41,280 | 46,440 | 51,600 | 61,920 |
| | | lb/hr | 1207 | 1609 | 2012 | 2414 | 2817 | 3219 | 3621 | 4024 | 4828 |
| | Oil | scfh | 17,049 | 22,733 | 28,414 | 34,098 | 39,782 | 45,463 | 51,147 | 56,831 | 68,196 |
| | | lb/hr | 1269 | 1692 | 2115 | 2538 | 2961 | 3384 | 3808 | 4231 | 5077 |
| Flue Gas | Gas | scfh | 17,520 | 23,360 | 29,200 | 35,040 | 40,880 | 46,720 | 52,560 | 58,400 | 70,080 |
| | | lb/hr | 1,278 | 1,704 | 2,130 | 2,556 | 2,983 | 3,409 | 3,835 | 4,261 | 5,113 |
| | Oil | scfh | 17,914 | 23,886 | 29,855 | 35,827 | 41,799 | 47,769 | 53,741 | 59,713 | 71,655 |
| | | lb/hr | 1,357 | 1,809 | 2,261 | 2,714 | 3,166 | 3,618 | 4,070 | 4,523 | 5,427 |

Notes:
A. Gas consumption, expressed in cubic feet per hour, is based on 1,000 Btu/cu.ft gas value.
B. Oil consumption,expressed in pounds per hour, is based on 140,000 Btu/gal oil value.
C. Oil supply lines must be sized for 125 gph pumping rate. Oil pump suction pressure to be -10" Hg to 3 psig.

### *Figure B2-3. Boiler room air supply - "Engineered Design"*



## Oil Piping

**General** - Oil operation of the Model 4 boiler requires proper oil to the standard burner mounted oil pump. As the combustion of oil utilizes mechanical pressure atomization, line sizing to the pump must be sufficient to provide 125 gph of oil to the suction side of the pump.

**Oil Train Components** - Oil flow to the burner is controlled by four solenoid valves. The oil flows through a primary or safety shutoff valve into a manifold block. This valve and the low fire valve are energized simultaneously by the flame safeguard control and when opened, allow flow of oil to the low fire nozzle.

As the damper motor moves to high fire position, the damper motor end switches close to energize in sequence, the intermediate and then high fire oil valve. The purpose of the intermediate valve is to smooth the transition from low to high fire by balancing the oil input with increasing flow of air.

High fire rating of the burner is obtained when all three nozzles are firing, assuming proper oil pressure and normally sized nozzles.

## Gas Piping

**General** - The Model 4 boiler requires appropriate gas supply pressure and volume for proper operation and long burner life. The gas requirements specified in this section must be satisfied to ensure efficient and stable combustion. Installation must follow these guidelines and of the local authorities that have installation jurisdiction.

**Gas Train Components** - Model 4 boilers are equipped with a gas train that meets the requirements of UL as standard. These components also comply with the recommendations of FM, XL GAP (formerly IRI/GE GAP) and ASME CSD-1. The gas train and its components have been designed and tested to operate for the highest combustion efficiency.

**Gas Pressure Requirements** - For proper and safe operation, each Model 4 boiler requires a stable gas pressure supply. The pressure requirements are listed in previous sections for standard gas train size, and oversized trains for reduced available pressure.

**Gas Piping** - Model 4 units are standardly equipped with a gas pressure regulator. If upstream pressure to the standard regulator will be greater than 1 psig, an additional upstream regulator should be provided with a pressure relief valve.

For buildings or boiler rooms with gas supply pressure exceeding 28" w.c., a "full lockup" type regulator is recommended along with proper overpressure protection. In addition to the regulator, a plug type or "butterball" type gas shutoff cock should be provided upstream of the regulator for use as a service valve. This is also required to provide positive shutoff and isolate the boiler gas train during gas piping tests.

Drip legs are required on any vertical piping at the gas supply to each boiler so that any dirt, weld slag, or debris can deposit in the drip leg rather than into the boiler gas train. The bottom of the drip leg should be removable without disassembling any gas piping. The connected piping to the boiler should be supported from pipe supports and not supported by the boiler gas train or the bottom of the drip leg.

All gas piping and components to the boiler gas train connection must comply with NFPA 54, local codes, and utility requirements as a minimum. Only gas approved fittings, valves, or pipe should be used. Standard industry practice for gas piping is normally Schedule 40 black iron pipe and fittings.

**Gas Supply Pipe Sizing** - For proper operation of a single unit or multiple units, we recommend that the gas pipe be sized to allow no more than 0.3" w.c. pressure drop from the source (gas header or utility meter) to the final unit location. The gas supplier (utility) should be consulted to confirm that sufficient volume and normal pressure are provided to the building at the discharge side of the gas meter or supply pipe (for installations of new boilers into an existing building, gas pressure should be measured with a manometer to ensure sufficient pressure is available).

A survey of all connected gas using devices should be made. If appliances other than the boiler are connected to the gas supply line, then a determination should be made of how much flow volume (cfh = cubic feet per hour) will be demanded at one time and the pressure drop requirements when all appliances are operating.

The total length of gas piping and all fittings must be considered when sizing the gas piping. Total equivalent length should be calculated from the utility meter or source to the final connection. As a minimum guideline, gas piping Tables B2 - 16 through B2 - 20 should be used. The data in these tables is from the NFPA source book, 2006 edition.

*Table B2-16. Gas line capacity - Schedule 40 metallic pipe*

| Pipe Size | | | | | | | |
|---|---|---|---|---|---|---|---|
| Nominal | 1" | 1-1/4" | 1-1/2" | 2" | 2-1/2" | 3" | 4" |
| Actual I.D. | 1.049 | 1.380" | 1.610" | 2.067" | 2.469" | 3.068" | 4.026" |
| Length in feet | **Maximum Capacity in Cubic Feet of Gas per Hour (cfh) | | | | | | |
| 10 | 514 | 1,060 | 1,580 | 3,050 | 4,860 | 8,580 | 17,500 |
| 20 | 363 | 726 | 1,090 | 2,090 | 3,340 | 5,900 | 12,000 |
| 30 | 284 | 583 | 873 | 1,680 | 2,680 | 4,740 | 9,660 |
| 40 | 243 | 499 | 747 | 1,440 | 2,290 | 4,050 | 8,290 |
| 50 | 215 | 442 | 662 | 1,280 | 2,030 | 3,590 | 7,330 |
| 60 | 195 | 400 | 600 | 1,160 | 1,840 | 3,260 | 6,640 |
| 70 | 179 | 368 | 552 | 1,060 | 1,690 | 3,000 | 6,110 |
| 80 | 167 | 343 | 514 | 989 | 1,580 | 2,790 | 5,680 |
| 90 | 157 | 322 | 482 | 928 | 1,480 | 2,610 | 5,330 |
| 100 | 148 | 304 | 455 | 877 | 1,400 | 2,470 | 5,040 |
| 125 | 131 | 269 | 403 | 777 | 1,240 | 2,190 | 4,460 |
| 150 | 119 | 244 | 366 | 704 | 1,120 | 1,980 | 4,050 |
| 175 | 109 | 209 | 336 | 648 | 1,030 | 1,820 | 3,720 |
| 200 | 102 | 185 | 313 | 602 | 960 | 1,700 | 3,460 |

**Fuel: Natural Gas
**Inlet Pressure: Less than 2.0 psi
**Pressure Drop: 0.30" w.c.
**Specific Gravity: 0.60

*Table B2-17. Gas line capacity - Schedule 40 metallic pipe*

| Pipe Size | | | | | | | |
|---|---|---|---|---|---|---|---|
| Nominal | 1" | 1-1/4" | 1-1/2" | 2" | 2-1/2" | 3" | 4" |
| Actual I.D. | 1.049" | 1.380" | 1.610" | 2.067" | 2.469" | 3.068" | 4.026" |
| Length in feet | **Maximum Capacity in Cubic Feet of Gas per Hour (cfh) | | | | | | |
| 10 | 678 | 1,390 | 2,090 | 4,020 | 6,400 | 11,300 | 23,100 |
| 20 | 466 | 957 | 1,430 | 2,760 | 4,400 | 7,780 | 15,900 |
| 30 | 374 | 768 | 1,150 | 2,220 | 3,530 | 6,250 | 12,700 |
| 40 | 320 | 657 | 985 | 1,900 | 3,020 | 5,350 | 10,900 |
| 50 | 284 | 583 | 873 | 1,680 | 2,680 | 4,740 | 9,600 |
| 60 | 257 | 528 | 791 | 1,520 | 2,430 | 4,290 | 8,760 |
| 70 | 237 | 486 | 728 | 1,400 | 2,230 | 3,950 | 8,050 |
| 80 | 220 | 452 | 677 | 1,300 | 2,080 | 3,670 | 7,490 |
| 90 | 207 | 424 | 635 | 1,220 | 1,950 | 3,450 | 7,030 |
| 100 | 195 | 400 | 600 | 1,160 | 1,840 | 3,260 | 6,640 |
| 125 | 173 | 355 | 532 | 1,020 | 1,630 | 2,890 | 5,890 |
| 150 | 157 | 322 | 482 | 928 | 1,480 | 2,610 | 5,330 |
| 175 | 144 | 296 | 443 | 854 | 1,360 | 2,410 | 4,910 |
| 200 | 134 | 275 | 412 | 794 | 1,270 | 2,240 | 4,560 |

**Fuel: Natural Gas
**Inlet Pressure: Less than 2.0 psi
**Pressure Drop: 0.50" w.c.
**Specific Gravity: 0.60

*Table B2-18. Gas line capacity - Schedule 40 metallic pipe*

| Pipe Size | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nominal | **1/2"** | **3/4"** | **1"** | **1-1/4"** | **1-1/2"** | **2"** | **2-1/2"** | **3"** | **4"** |
| Actual I.D. | **0.622** | **0.824** | **1.049"** | **1.380"** | **1.610"** | **2.067"** | **2.469"** | **3.068"** | **4.026"** |
| Length in feet | ****Maximum Capacity in Cubic Feet of Gas per Hour (cfh)** | | | | | | | | |
| 10 | 1,510 | 3,040 | 5,560 | 11,400 | 17,100 | 32,900 | 52,500 | 92,800 | 189,000 |
| 20 | 1,070 | 2,150 | 3,930 | 8,070 | 12,100 | 23,300 | 57,100 | 65,600 | 134,000 |
| 30 | 869 | 1,760 | 3,210 | 6,590 | 9,880 | 19,000 | 30,300 | 53,600 | 109,000 |
| 40 | 753 | 1,520 | 2,780 | 5,710 | 8,550 | 16,500 | 26,300 | 46,400 | 94,700 |
| 50 | 673 | 1,360 | 2,490 | 5,110 | 7,650 | 14,700 | 23,500 | 41,500 | 84,700 |
| 60 | 615 | 1,240 | 2,270 | 4,660 | 6,980 | 13,500 | 21,400 | 37,900 | 77,300 |
| 70 | 569 | 1,150 | 2,100 | 4,320 | 6,470 | 12,500 | 19,900 | 35,100 | 71,600 |
| 80 | 532 | 1,080 | 1,970 | 4,040 | 6,050 | 11,700 | 18,600 | 32,800 | 67,000 |
| 90 | 502 | 1,010 | 1,850 | 3,810 | 5,700 | 11,000 | 17,500 | 30,900 | 63,100 |
| 100 | 462 | 954 | 1,710 | 3,510 | 5,260 | 10,100 | 16,100 | 28,500 | 58,200 |
| 125 | 414 | 836 | 1,530 | 3,140 | 4,700 | 9,060 | 14,400 | 25,500 | 52,100 |
| 150 | 372 | 751 | 1,370 | 2,820 | 4,220 | 8,130 | 13,000 | 22,900 | 46,700 |
| 175 | 344 | 695 | 1,270 | 2,601 | 3,910 | 7,530 | 12,000 | 21,200 | 43,300 |
| 200 | 318 | 642 | 1,170 | 2,410 | 3,610 | 6,960 | 11,100 | 19,600 | 40,000 |
| 500 | 192 | 401 | 717 | 1,470 | 2,210 | 4,250 | 6,770 | 12,000 | 24,400 |
| 1000 | 132 | 275 | 493 | 1,010 | 1,520 | 2,920 | 4,650 | 8,220 | 16,800 |
| 1500 | 106 | 221 | 396 | 812 | 1,220 | 2,340 | 3,740 | 6,600 | 13,500 |

****Fuel: Natural Gas**

****Inlet Pressure: 2.0 psi**

****Pressure Drop: 1.0 psi**

****Specific Gravity: 0.60**

*Table B2-19. Gas line capacity - Schedule 40 metallic pipe*

| Pipe Size | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nominal | **1/2"** | **3/4"** | **1"** | **1-1/4"** | **1-1/2"** | **2"** | **2-1/2"** | **3"** | **4"** |
| Actual I.D. | **0.622** | **0.824** | **1.049"** | **1.380"** | **1.610"** | **2.067"** | **2.469"** | **3.068"** | **4.026"** |
| Length in feet | ****Maximum Capacity in Cubic Feet of Gas per Hour (cfh)** | | | | | | | | |
| 10 | 2,350 | 4,920 | 9,270 | 19,000 | 28,500 | 54,900 | 87,500 | 155,000 | 316,000 |
| 20 | 1,620 | 3,380 | 6,370 | 13,100 | 19,600 | 37,700 | 60,100 | 106,000 | 217,000 |
| 30 | 1,300 | 2,720 | 5,110 | 10,500 | 15,700 | 30,300 | 48,300 | 85,400 | 174,000 |
| 40 | 1,110 | 2,320 | 4,380 | 8,990 | 13,500 | 25,900 | 41,300 | 75,100 | 149,000 |
| 50 | 985 | 2,060 | 3,880 | 7,970 | 11,900 | 23,000 | 36,600 | 64,800 | 132,000 |
| 60 | 892 | 1,870 | 3,520 | 7,220 | 10,300 | 20,300 | 33,200 | 58,700 | 120,000 |
| 70 | 821 | 1,720 | 3,230 | 6,640 | 9,950 | 19,200 | 30,500 | 54,000 | 110,000 |
| 80 | 764 | 1,600 | 3,010 | 6,180 | 9,260 | 17,800 | 28,400 | 50,200 | 102,000 |
| 90 | 717 | 1,500 | 2,820 | 5,800 | 8,680 | 16,700 | 26,700 | 47,100 | 96,100 |
| 100 | 677 | 1,420 | 2,670 | 5,470 | 8,200 | 15,800 | 25,200 | 44,500 | 90,300 |
| 125 | 600 | 1,250 | 2,360 | 4,850 | 7,270 | 14,000 | 22,300 | 39,500 | 80,500 |
| 150 | 544 | 1,140 | 2,140 | 4,400 | 6,590 | 12,700 | 20,200 | 35,700 | 72,900 |
| 175 | 500 | 1,050 | 1,970 | 4,040 | 6,060 | 11,700 | 18,600 | 32,900 | 67,100 |
| 200 | 465 | 973 | 1,830 | 3,760 | 5,640 | 10,900 | 17,300 | 30,600 | 62,400 |
| 500 | 283 | 593 | 1,120 | 2,290 | 3,430 | 6,610 | 10,300 | 18,600 | 38,000 |
| 1000 | 195 | 407 | 897 | 1,380 | 2,360 | 4,550 | 7,240 | 12,000 | 26,100 |
| 1500 | 156 | 327 | 616 | 1,270 | 1,900 | 3,650 | 5,820 | 10,300 | 21,000 |

****Fuel: Natural Gas**

****Inlet Pressure: 3.0 psi**

****Pressure Drop: 2.0 psi**

****Specific Gravity: 0.60**

***Table B2-20. Gas line capacity - Schedule 40 metallic pipe***

| Pipe Size | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nominal | **1/2"** | **3/4"** | **1"** | **1-1/4"** | **1-1/2"** | **2"** | **2-1/2"** | **3"** | **4"** |
| Actual I.D. | **0.622** | **0.824** | **1.049"** | **1.380"** | **1.610"** | **2.067"** | **2.469"** | **3.068"** | **4.026"** |
| Length in feet | ****Maximum Capacity in Cubic Feet of Gas per Hour (cfh)** | | | | | | | | |
| 10 | 3,190 | 6,430 | 11,800 | 24,200 | 36,200 | 69,700 | 111,000 | 196,000 | 401,000 |
| 20 | 2,250 | 4,550 | 8,320 | 17,100 | 25,600 | 49,300 | 78,600 | 139,000 | 283,000 |
| 30 | 1,840 | 3,720 | 6,790 | 14,000 | 20,900 | 40,300 | 64,200 | 113,000 | 231,000 |
| 40 | 1,590 | 3,220 | 5,880 | 12,100 | 18,100 | 34,900 | 55,600 | 98,200 | 200,000 |
| 50 | 1,430 | 2,880 | 5,260 | 10,800 | 16,200 | 31,200 | 49,700 | 87,900 | 179,000 |
| 60 | 1,300 | 2,630 | 4,800 | 9,860 | 14,800 | 28,500 | 45,400 | 80,200 | 164,000 |
| 70 | 1,200 | 2,430 | 4,450 | 9,130 | 13,700 | 26,400 | 42,000 | 74,300 | 151,000 |
| 80 | 1,150 | 2,330 | 4,260 | 8,540 | 12,800 | 24,700 | 39,300 | 69,500 | 142,000 |
| 90 | 1,060 | 2,150 | 3,920 | 8,050 | 12,100 | 23,200 | 37,000 | 65,500 | 134,000 |
| 100 | 979 | 1,980 | 3,620 | 7,430 | 11,100 | 21,400 | 34,200 | 60,400 | 123,000 |
| 125 | 876 | 1,770 | 3,240 | 6,640 | 9,950 | 19,200 | 30,600 | 54,000 | 110,000 |
| 150 | 786 | 1,590 | 2,910 | 5,960 | 8,940 | 17,200 | 27,400 | 48,500 | 98,900 |
| 175 | 728 | 1,470 | 2,690 | 5,520 | 8,270 | 15,900 | 25,400 | 44,900 | 91,600 |
| 200 | 673 | 1,360 | 2,490 | 5,100 | 7,650 | 14,700 | 23,500 | 41,500 | 84,700 |
| 500 | 384 | 802 | 1,510 | 3,100 | 4,650 | 8,950 | 14,300 | 25,200 | 51,500 |
| 1000 | 264 | 551 | 1,040 | 2,130 | 3,200 | 6,150 | 9,810 | 17,300 | 35,400 |
| 1500 | 212 | 443 | 834 | 1,710 | 2,570 | 4,940 | 7,880 | 13,900 | 28,400 |

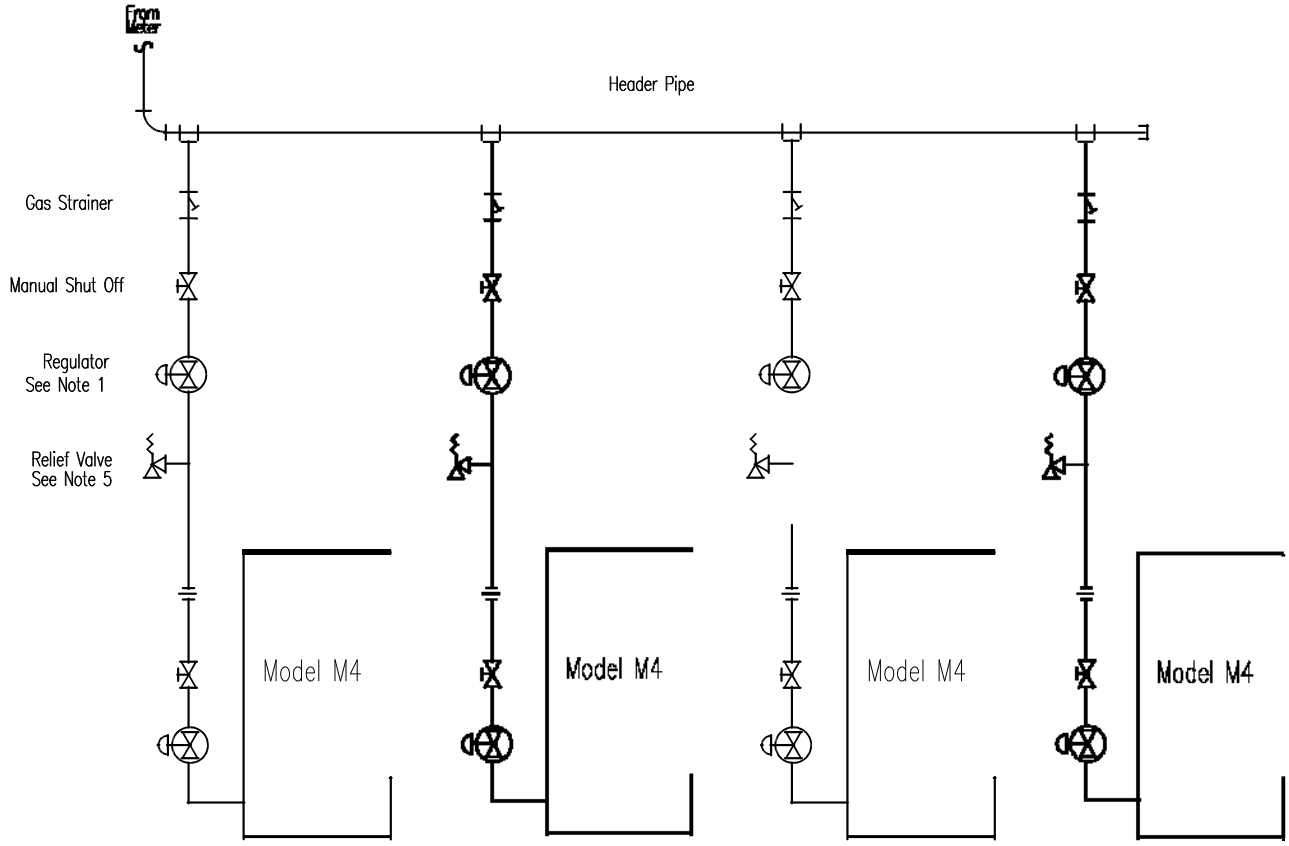
****Fuel: Natural Gas**

****Inlet Pressure: 5.0 psi**

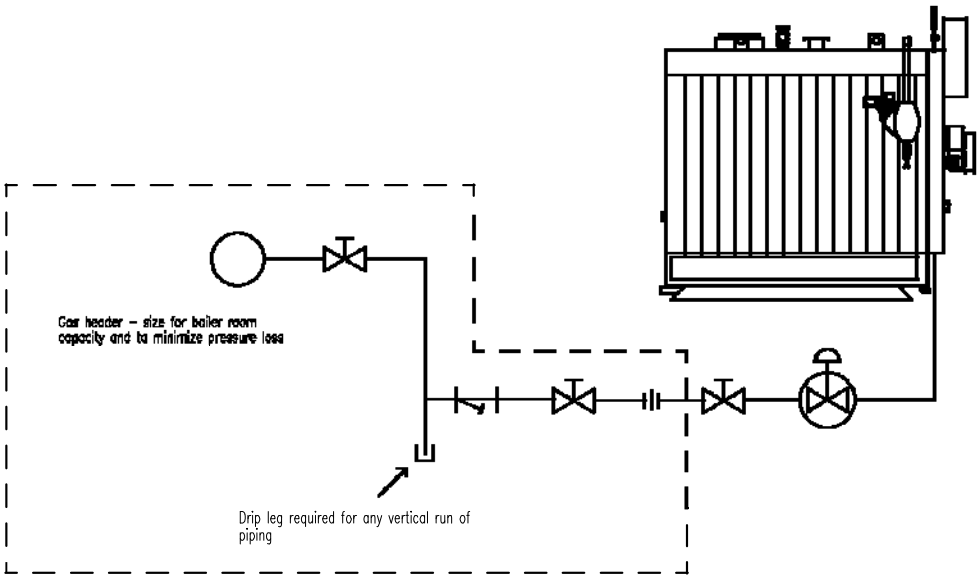
****Pressure Drop: 3.5 psi**

****Specific Gravity: 0.60**

***Figure B2-4. Typical gas header piping***




NOTES:
1. Upstream regulator required if supply pressure >1 psig.
2. Refer to local fuel gas codes when applicable.
3. Header to be sized for room capacity.
4. Provision required for measuring gas supply pressure at boiler.
5. Relief valve required if gas supply pressure >1 psig.



# Model 4 Boiler
# Steam Specifications

Submittals . . . . . B2-28
Codes . . . . . B2-28
Guarantees . . . . . B2-28
Type . . . . . B2-28
Design Criteria . . . . . B2-28
Product Design . . . . . B2-29
Burner Management System . . . . . B2-33
Shop Tests . . . . . B2-34
Shipment . . . . . B2-34
Installation . . . . . B2-34
Start–Up . . . . . B2-34
Operation and Maintenance Manuals . . . . . B2-35

## *SAMPLE SPECIFICATIONS*

The following sample specifications are provided by Cleaver-Brooks to assist you in specifying your customer's specific needs and application.

***PART 1 GENERAL***

1.1 SUBMITTALS

A. The manufacturer shall supply ____copies of a dimensional drawing indicating all relevant unit dimensions, layout and required clearances.

B. The manufacturer shall supply ____copies of a ladder type wiring diagram to include all internal unit wiring, external connections, and power supply requirements.

C. The manufacturer shall supply a copy of the authorized inspection report, to the purchaser, upon completion and shipment of the unit.

1.2 CODES

A. The boiler shall be designed, constructed, and hydrostatically tested in accordance with the ASME Boiler and Pressure Vessel Code.

B. The boiler shall be wired in accordance with the rules of the National Electric Code.

C. All electrical equipment shall be in conformity with the Underwriters Laboratories requirements.

D. The complete boiler–burner package shall be approved by Underwriters Laboratories and shall bear a UL label.

E. The boiler shall be built to comply with the following insurances _____. (Factory Mutual, XL-GAP, ASME CSD–1)

1.3 GUARANTEES

A. The complete boiler package shall be warranted from defects in materials and/or workmanship for a period of not less than 18 months from shipment or 12 months from unit start–up.

***PART 2 PRODUCTS***

2.1 TYPE

A. The boiler shall be a watertube type steam boiler with all steel membrane walls.

B. The boiler shall be a three gas pass type boiler mounted on a heavy duty steel frame.

C. The boiler shall have an integral forced draft burner and burner controls.

D. The boiler shall be a Cleaver Brooks Model 4, series _____(100 = No. 2 oil, 200 = No. 2 oil and gas, 700 = gas) steam boiler.

2.2 DESIGN CRITERIA

A. The boiler shall be designed in accordance with the ASME Boiler and Pressure Code Section ____(IV for low pressure, I for high pressure).

B. The boiler shall be designed for ____psig (15, 150, 250, 350, or 500). The maximum operating pressure will be ____psig.

C. The boiler shall be designed for a maximum output of _____lbs/hr of steam, or _____bhp. The boiler shall develop _____ lbs/hr of steam when operating at _____psig with a feedwater temperature of _____°F.

D. Electrical power available will be _____volts, _____phase, _____Hz.

E. The maximum sound level shall not exceed 80 dBA measured 3 feet in front of the boiler.

2.3 PRODUCT DESIGN

A. Pressure Vessel

1. The upper drum shall have a 20" OD, manufactured from SA–53 Gr. B seamless pipe, with a minimum wall thickness of 0.375".
2. The lower drum shall have an 8–5/8" OD, manufactured from SA–53 Gr. B seamless pipe, with a minimum wall thickness of 0.322".
3. The generating tubes shall be 2" OD, manufactured from SA–178 Gr. A tubing, with a minimum wall thickness of 0.095".
4. The boiler shall have two downcomers, located at the rear of the boiler, and be totally insulated from the generating tubes. These shall be a minimum of 2–1/2" OD, manufactured from SA–178 Gr. A tubing, with a minimum wall thickness of .105".
5. The upper drum shall have an inspection opening, located at the rear of the unit, to allow internal inspection, and shall be a minimum of 4"x6".
6. The lower drum shall have inspection openings, located at the front and rear of the unit, to allow internal inspection, and shall be a minimum of 4-7/8" x 5-7/8".
7. The boiler shall have inspection openings in the convection area.
8. A feedwater tapping and integral feedwater distribution pipe shall be located in the upper drum. The distribution pipe shall blend the feedwater with the boiler water.
9. A 3/4" surface blowoff connection shall be located in the rear head of the upper drum.
10. A _____" bottom blowoff connection shall be located in the lower drum.

B. Refractory

1. Refractory shall be limited to the furnace floor to insulate the lower drum, and to the burner throat tile.
2. High temperature insulation shall be installed on the front wall of the furnace.

C. Insulation and Casing

1. The boiler insulation shall be a minimum of 2" fiberglass, and shall cover the entire pressure vessel.
2. The insulation shall be covered with a corrugated metal lagging.
3. The metal lagging and insulation shall be arranged for easy removal and installation if required.
4. The front head (windbox) shall be attached with a davit arm, gasket sealed, and bolted. The front head shall swing open to provide full access to the furnace chamber and burner throat tile.

5. Observation ports shall be provided at each end of the boiler for visual inspection of the pilot and main flame conditions.
6. Two lifting eyes shall be located on top of the boiler.
7. The exhaust gases shall vent at the rear of the boiler, on the top centerline.

D. Trim

1. The water column shall be located on the left side of the boiler. It shall be piped with unions for easy removal.
2. A gauge glass set, gauge glass blowdown valve, and water column blowdown valve shall be provided.
3. The boiler feedwater control switch shall be included as an integral item of the water column. It shall provide automatic actuation of a motor driven feedwater pump or valve to maintain the boiler water level within normal limits.
4. The primary low water cutoff switch shall be an integral part of the water column. It shall be wired into the burner control circuit preventing burner operation if the boiler water level falls below the designated safe level.
5. A steam pressure gauge shall be located at the front end of the boiler and shall include a cock and test connection.
6. A safety relief valve shall be provided of a size and type to comply with ASME Code requirements. The safety relief valve set pressure shall be _____psig.
7. A high limit pressure control shall be provided. It shall be a manual reset type and shall be wired to prevent burner operation and lockout if excessive steam pressure occurs.
8. An operating limit control shall be provided. It shall be wired to provided on–off control of the burner at operating set points.
9. A firing rate control shall be provided. It shall control the firing rate of the burner based on the boiler load.
10. An auxiliary low water cutoff shall be provided (manual reset type). It shall be wired into the burner control circuit preventing burner operation if the boiler water level falls below the designated safe level.
11. A stack thermometer shall be shipped loose for field installation.

E. Soot Cleaning

1. Soot washer lances shall be provided in the convection area of the boiler measuring the full length of the pressure vessel.
2. Each lance shall be provided with a shutoff valve and the assembly shall be capable of rotating 360 degrees. This shall ensure complete washing of the convection zone while the boiler is operating in the low fire mode.
3. Soot washer troughs shall be provided at the bottom of the boiler. These shall be furnished for each convection side and shall The soot washer troughs shall be provided with 2" drain connections at the rear of the boiler, and shall have inspection/ cleanout openings at the front of the boiler.

F. Burner Design – General

1. The burner shall be integral to the windbox.
2. All air for combustion shall be supplied by a forced draft blower mounted in the windbox, above the burner, to minimize noise and vibration level.
3. The blower motor shall be an open drip proof type with a minimum service factor of 1.15.
4. The impeller shall be an enclosed centrifugal fan type, properly balanced, and directly connected to the blower motor shaft.
5. The combustion air damper shall be integral to the windbox and shall be operated by a single damper motor.
6. The burner shall remain in the low fire position during ignition and until main flame has been established.
7. A combustion air proving switch shall be provided to ensure adequate air for pre-purge and combustion.

G. Burner Design – Gas

1. The burner shall be the high radiant multi–port type approved for operation with natural gas.
2. The burner shall operate on the _____(low–high–low or full modulation) principle and must return to the low fire position prior to ignition.
3. Automatic electric ignition of the premix gas pilot shall be furnished. An electric scanner, of the UV principle, shall monitor the pilot, preventing the primary fuel valve from opening until the pilot flame has been established.
4. The single combustion air damper motor shall operate the gas butterfly valve. The damper motor shall regulate the fire according to system demand in response to the firing rate control.

H. Burner Design – No. 2 Oil

1. The burner shall be the pressure atomizing type approved for operation with commercial grade No. 2 oil.
2. The burner shall operate on the low–high–low principle, and must return to the low fire position prior to ignition.
3. The burner shall remain in the low fire position during ignition and until main flame has been proven. The ignition period shall be monitored with an electric scanner, of the UV principle, to confirm the presence of the low fire oil flame.
4. Automatic electric ignition of the low fire oil supply shall be provided with a minimum 10,000 volt transformer and heavy duty electrodes.

***Notice***

***Optional insurance compliance may require a premix gas pilot in lieu of direct spark ignition.***

5. [Optional] Automatic electric ignition of the premix gas pilot shall be furnished. An electric scanner, of the UV principle, shall confirm the pilot prior to the delivery of the low fire oil supply.
6. The single combustion air damper motor shall operate the low and high fire oil valves. The damper motor shall regulate the fire according to system demand in response to the firing rate control.

I. Burner Design – Gas and No. 2 Oil

1. The burner shall be the high radiant multi–port type for gas and shall be the pressure atomizing for oil. The burner must be approved for operation with either natural gas or commercial grade No. 2 oil.
2. The burner shall operate on the low–high–low principle, and must return to the low fire position prior to ignition.
3. The burner shall remain in the low fire position during ignition and until main flame has been proven.
4. Automatic electric ignition of the premix gas pilot shall be furnished. An electric scanner, of the UV principle, shall monitor the pilot, preventing the primary fuel valve from opening until the pilot flame has been established.
5. The single combustion air damper motor shall operate the low and high fire oil valves and the gas butterfly valve. The damper motor shall regulate the fire according to system demand in response to the firing rate control.

J. Main Gas Train

1. The gas burner piping shall include a primary gas shutoff valve. It shall be controlled by the programming relay to start or stop the burner and to close automatically in the event of power failure, flame failure, or a low water condition.
2. A manual shutoff valve shall be located ahead of the primary gas valve.
3. A plugged leakage test connection and a second manual shutoff valve shall be provided as a means for a tightness check of the primary shutoff valve.
4. A gas pressure regulator shall be factory mounted and piped for pressure regulation to the burner.
5. Gas Train Components
   a. [Sizes 1500–2500] The primary gas shutoff valve shall be motorized with a proof of closure switch.
   b. [Sizes 3000–5000] The primary gas shutoff valve shall be motorized with a proof of closure switch. High and low gas pressure switches shall be provided.
   c. [Size 6000] The primary gas shutoff valve shall be motorized with a proof of closure switch. A second gas safety shutoff valve and an additional plugged leakage test cock shall be provided. High and low gas pressure switches shall be provided.

K. Natural Gas Pilot Train

1. A pilot gas pressure regulator shall be factory mounted and piped for pressure regulation of the pilot gas to the burner.
2. The pilot gas train shall include a safety shutoff valve. It shall be controlled by the programming relay to start the burner.
3. A manual shutoff valve shall be located ahead of the pilot gas pressure regulator.

L. 2.3.12 Oil System

1. An oil pump shall be provided. The oil pump, integral with the burner, shall include a built–in relief valve and self–cleaning strainer.
2. The oil pump shall be belt driven from the blower motor.
3. The fuel oil system shall include supply and return tubing to a terminal block, an oil pressure gauge, shutoff cock, and four solenoid oil shutoff valves. These items shall be factory mounted and piped on the front head (windbox).

2.4 BURNER MANAGEMENT SYSTEM

A. Control Panels

1. The control panel shall be a NEMA 1 rated panel and have a key lock.
2. The control panel shall be mounted on the front head of the boiler and shall be conveniently located for the boiler operator.
3. The panel shall contain the blower motor starter, control circuit fuses, control circuit transformer, and control switches. A damper selector switch shall be provided to permit selection of automatic or manual selection of low or high firing.
4. A terminal board shall be provided to which all wires entering or leaving the panel shall be connected.
5. The panel shall include four indicating lights to show operating conditions of: red = low water; red = flame failure; white = load demand; and white = fuel valve open. The lights and switches shall be located on the panel switch ledge.
6. All electrical service connections shall be made to an electrical entrance box to be mounted on the right hand side of the boiler.
7. All electrical wiring shall be oil, heat, and moisture resistant and shall be number coded.

B. Combustion Safeguard Control

1. A combustion safeguard control (program relay) shall be provided to control ignition, starting, and stopping of the burner. It shall provide precombustion and postcombustion purge periods and shall stop burner operation in the event of ignition, pilot, or main flame failure. Trial for ignition shall be limited to 10 seconds.
2. The boiler shall be provided with a combustion safeguard controller that provides technology and functions equal to the Cleaver Brooks Model CB120E.

3. The combustion safeguard control shall be microprocessor based, with self–diagnostics, non–volatile memory, and a message center with a vocabulary of 42 different messages. Messages shall scroll across an alpha–numeric display and provide sequence status and flame failure mode information.
4. The combustion safeguard control shall have a fixed operating sequence incapable of being manually altered. The sequence shall include start, pre– purge, pilot and main fuel ignition run, and post–purge cycles.
5. The controller shall be the non–recycle type for maximum safety that will shut down the burner and indicate as a minimum the following trip functions: pilot failure, main flame failure, high and low fire proving switch faults, running interlocks open, false flame signal, and fuel valve open.
6. The controller shall have a test/run switch. It will allow interruptions to sequence just after pre–purge, during pilot ignition trial, and during run cycles, for adjustments to firing rate motor, damper linkages, and pilot flame for turndown tests.
7. The controller shall also have the following functions: display history of operating hours and totals of completed on–off cycles; provide a constant flame signal strength read–out; and have provisions for remote display capability and Modbus communication.

***PART 3 EXECUTION***

3.1 SHOP TESTS

A. The pressure vessel shall be hydrostatically tested in accordance with ASME requirements.

B. The boiler will be test fired by the manufactured, prior to shipment, to verify proper and safe operation.

3.2 SHIPMENT

A. Painting

1. The entire boiler, base frame, and other components shall be factory painted, before shipment, using a hard finish enamel.
2. The boiler surface shall be cleaned/prepared for painting using manufacturer's specifications and standard industrial painting practices.

B. Preparation

1. All boiler openings shall be plugged/covered prior to shipment.
2. The boiler shall be skid mounted and protected with a weather resistant covering.
3. All shipped loose components shall wrapped in protective material and packaged in a separate container(s).

3.3 INSTALLATION

3.4 START–UP

A. The boiler start–up shall be performed by a factory trained representative and will be done in accordance with the manufacturer's recommended procedures.

B. The boiler start–up shall include boiler operator training and shall cover boiler operation, water treatment, and maintenance of the unit.

3.5 OPERATION AND MAINTENANCE MANUALS

Manufacturer shall supply _____copies of the Operating & Maintenance Manual.

**Charleston Area Medical Center - Teays Valley Hospital**
**Application for New Source Review Permit**

**Generator #1 Criteria Pollutant Emissions**

| Operation: | 10% | | | 25% | | | 50% | | | 75% | | | 100% | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HP: | 210 | | | 380 | | | 654 | | | 932 | | | 1214 | | |
| Pollutant | gm/hp-hr | PPH | TPY | gm/hp-hr | PPH | TPY | gm/hp-hr | PPH | TPY | gm/hp-hr | PPH | TPY | gm/hp-hr | PPH | TPY |
| CO | 2.72 | 1.26 | 0.31 | 1.36 | 1.14 | 0.28 | 0.97 | 1.40 | 0.35 | 0.69 | 1.42 | 0.35 | 0.43 | 0.88 | 0.22 |
| NOx | 6.00 | 2.78 | 0.69 | 5.25 | 4.40 | 1.10 | 4.40 | 6.34 | 1.59 | 4.86 | 9.99 | 2.50 | 6.27 | 12.88 | 3.22 |
| PM10 | 0.49 | 0.23 | 0.06 | 0.26 | 0.22 | 0.05 | 0.13 | 0.19 | 0.05 | 0.06 | 0.12 | 0.03 | 0.05 | 0.10 | 0.03 |
| SO2 | 9.30E-01 | 4.31E-01 | 1.08E-01 | 9.30E-01 | 7.79E-01 | 1.95E-01 | 5.50E-03 | 7.94E-03 | 1.98E-03 | 5.50E-03 | 1.13E-02 | 2.83E-03 | 5.50E-03 | 1.13E-02 | 2.83E-03 |
| VOC | 0.41 | 0.19 | 0.05 | 0.19 | 0.16 | 0.04 | 0.14 | 0.20 | 0.05 | 0.09 | 0.18 | 0.05 | 0.05 | 0.10 | 0.03 |

Emission Factor Source: Manufacturer for all but SO2; SO2 from US EPA, AP-42, Chapter 3, Table 3.3-1 (less than 600HP) and Table 3.4-1 (greater than 600 HP). Sulfur content of fuel is 0.0015% (15 ppm) per attached MSDS.

Assumptions:

500 hours per year
453.6 gm/lb

**Charleston Area Medical Center - Teays Valley Hospital**
**Application for New Source Review Permit**

**Generator #1 Criteria Pollutant Emissions**

| Pollutant | Emission Factor | | PPH | TPY |
|---|---|---|---|---|
| Benzene | 9.33E-04 | lb/MMBtu | 0.007 | 0.002 |
| Toluene | 4.09E-04 | lb/MMBtu | 0.003 | 0.001 |
| Xylenes | 2.85E-04 | lb/MMBtu | 0.002 | 0.001 |
| 1,3-Butadiene | 3.91E-05 | lb/MMBtu | 0.000 | 0.000 |
| Formaldehyde | 1.18E-03 | lb/MMBtu | 0.009 | 0.002 |
| Acetaldehyde | 7.67E-04 | lb/MMBtu | 0.006 | 0.002 |
| Acrolein | 9.25E-05 | lb/MMBtu | 0.001 | 0.000 |
| Naphthalene | 8.48E-05 | lb/MMBtu | 0.001 | 0.000 |
| **Total HAPs** | 3.79E-03 | lb/MMBtu | **0.030** | **0.008** |

Emission Factor Source: US EPA, AP-42
Assumptions:

| | |
|---|---|
| 500 | hours/year |
| 140,000 | Btu/gallon No. 2 Diesel |
| 57.3 | gallons/hour max fuel use rate |

**Generator #1 Greenhouse Gas Emissions**

| Pollutant | Emission Factor | | PPH | TPY |
|---|---|---|---|---|
| CO2 | 73.96 | kg/MMBtu | 1308.017 | 327.004 |
| CH4 | 0.003 | kg/MMBtu | 0.053 | 0.013 |
| N2O | 0.0006 | kg/MMBtu | 0.011 | 0.003 |
| **Total CO2e** | 73.96 | kg/MMBtu | **1312.5** | **328.1** |

Emission Factor Source: 40 CFR 98, Table C-1 and C-2
Assumptions:

| | |
|---|---|
| 2.20462 | lb/kg |
| 25 | global warming potential CH4 |
| 298 | global warming potential N2O |

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

## Specifications

| Generator Set Specifications | |
|---|---|
| Minimum Rating | 680 ekW |
| Maximum Rating | 800 ekW |
| Voltage | 208 to 600 |
| Frequency | 60 Hz |
| Speed | 1800 RPM |

| Generator Set Configurations | |
|---|---|
| Emissions/Fuel Strategy | Low Fuel Consumption, U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards) |

| Engine Specifications | | |
|---|---|---|
| Engine Model | C27 ATAAC, V-12, 4-Stroke, Water-Cooled Diesel | |
| Compression Ratio | 16.5:1 | |
| Aspiration | TA | |
| Governor Type | Adem™A4 | |
| Fuel System | MEUI | |
| Bore | 137.2 mm | 5.4 in |
| Displacement | 27.03 L | 1649.47 in³ |
| Stroke | 152.4 mm | 6 in |


© 2015 Caterpillar All Rights Reserved

## Benefits And Features

### Cat 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

### 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 Control Panel

The EMCP controller features the reliability and durability you have come to expect from your Cat equipment. EMCP4 is a scalable control platform designed to ensure reliable generator set operation, providing extensive information about power output and engine operation. EMCP4 systems can be further customized to meet your needs through programming and expansion modules.

### 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, CBC 2010
- Pre-approved by OSHPD and carries an OSP-0321-10 for use in healthcare projects in California

### 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.

### Single-Source Supplier

Fully prototype tested with certified torsional vibration analysis available


© 2015 Caterpillar All Rights Reserved

### World Wide Product Support

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

## Standard Equipment

### Air Inlet

- Air Cleaner

### Cooling

- Package mounted radiator

### Exhaust

- Exhaust flange outlet

### Fuel

- Primary fuel filter with integral water separator
- Secondary fuel filter
- Fuel priming pump

### Generator

- Matched to the performance and output characteristics of Cat engines
- Load adjustment module provides engine relief upon load impact and improves load acceptance and recovery time
- IP23 Protection

### Power Termination

- Bus Bar

### Control Panel

- EMCP 4 Genset Controller

### General

- Paint - Caterpillar Yellow except rails and radiators gloss black

## Optional Equipment

### Exhaust

- Exhaust mufflers


© 2015 Caterpillar All Rights Reserved

## Generator

- Anti-condensation heater
- Excitation: [ ] Permanent Magnet Excited (PM) [ ] Internally Excited (IE)
- Oversize and premium generators

## Power Termination

- Circuit breakers, UL listed
- Circuit breakers, IEC compliant

## Control Panels

- EMCP (4.2) (4.3) (4.4)
- Generator temperature monitoring & protection
- Load share module
- Digital I/O module
- Remote monitoring software

## Mounting

- Rubber anti-vibration mounts
- Spring-type vibration isolator
- IBC isolators

## Starting/Charging

- Battery chargers
- Oversize batteries
- Jacket water heater
- Heavy-duty starting system
- Charging alternator
- Air starting motor with control and silencer

## General

- The following options are based on regional and product configuration:
- Seismic Certification per applicable building codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007
- UL 2200 package
- EU Certificate of Conformance (CE)
- CSA Certification
- EEC Declaration of Conformity
- Enclosures: sound attenuated, weather protective
- Automatic transfer switches (ATS)
- Integral & sub-base fuel tanks
- Integral & sub-base UL listed dual wall fuel tanks

The International System of Units (SI) is used in this publication. CAT, CATERPILLAR, their respective logos, ADEM, EUI, S•O•S, "Caterpillar Yellow" and the "Power Edge" trade dress, as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.


© 2015 Caterpillar All Rights Reserved

# ELECTRIC POWER - Technical Spec Sheet
STANDARD

C27 ACERT
800 ekW/ 1000 kVA/ 60 Hz/ 1800 rpm/ 480 V/ 0.8 Power Factor

Rating Type: STANDBY

Fuel Strategy: LOW FUEL CONSUMPTION

Image shown may not reflect actual configuration

C27 ACERT
800 ekW/ 1000 kVA
60 Hz/ 1800 rpm/ 480 V

| | Metric | English |
|---|---|---|
| **Package Performance** | | |
| Genset Power Rating with Fan @ 0.8 Power Factor | 800 ekW | |
| Genset Power Rating | 1000 kVA | |
| Aftercooler (Separate Circuit) | N/A | N/A |
| **Fuel Consumption** | | |
| 100% Load with Fan | 213.3 L/hr | 56.3 gal/hr |
| 75% Load with Fan | 164.6 L/hr | 43.5 gal/hr |
| 50% Load with Fan | 117.3 L/hr | 31.0 gal/hr |
| 25% Load with Fan | 72.0 L/hr | 19.0 gal/hr |
| **Cooling System[1]** | | |
| Engine Coolant Capacity | 55.0 L | 14.5 gal |
| **Inlet Air** | | |
| Combustion Air Inlet Flow Rate | 58.2 m³/min | 2055.3 cfm |
| Max. Allowable Combustion Air Inlet Temp | 48 ° C | 119 ° F |
| **Exhaust System** | | |
| Exhaust Stack Gas Temperature | 523.6 ° C | 974.4 ° F |
| Exhaust Gas Flow Rate | 160.3 m³/min | 5661.7 cfm |
| Exhaust System Backpressure (Maximum Allowable) | 10.0 kPa | 40.0 in. water |


© 2015 Caterpillar All Rights Reserved

Rating Type: STANDBY

Fuel Strategy: LOW FUEL CONSUMPTION

| Heat Rejection | | |
|---|---|---|
| Heat Rejection to Jacket Water | 350 kW | 19909 Btu/min |
| Heat Rejection to Exhaust (Total) | 765 kW | 43510 Btu/min |
| Heat Rejection to Aftercooler | 140 kW | 7966 Btu/min |
| Heat Rejection to Atmosphere from Engine | 105 kW | 5950 Btu/min |
| Heat Rejection to Atmosphere from Generator | 57 kW | 3213 Btu/min |

| Alternator[2] | |
|---|---|
| Motor Starting Capability @ 30% Voltage Dip | 2117 skVA |
| Current | 1203 amps |
| Frame Size | 1296 |
| Excitation | PM |
| Temperature Rise | 150 ° C |

| Emissions (Nominal)[3] | | |
|---|---|---|
| NOx | 3371.2 mg/Nm³ | 6.2 g/hp-hr |
| CO | 137.1 mg/Nm³ | 0.3 g/hp-hr |
| HC | 7.7 mg/Nm³ | 0.0 g/hp-hr |
| PM | 5.0 mg/Nm³ | 0.0 g/hp-hr |

## DEFINITIONS AND CONDITIONS

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

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

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


© 2015 Caterpillar All Rights Reserved

Rating Type: STANDBY

Fuel Strategy: LOW FUEL CONSUMPTION

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

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

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

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

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

www.Cat-ElectricPower.com

Performance No.: DM9068-01

Feature Code: C27DR67

Generator Arrangement: 3850654

Date: 10/16/2015

Source Country: U.S.

The International System of Units (SI) is used in this publication. CAT, CATERPILLAR, their respective logos, ADEM, EUI, S•O•S, "Caterpillar Yellow" and the "Power Edge" trade dress, as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.


© 2015 Caterpillar All Rights Reserved

# PERFORMANCE DATA [MJE01567]

**FEBRUARY 18, 2016**

*(MJE01567)-ENGINE (AFR03088)-GENERATOR (DWB01571)-GENSET*

**For Help Desk Phone Numbers** Click here

**Perf No: DM7696** **Change Level:** 02

General | Heat Rejection | Emissions | Regulatory | Altitude Derate | Cross Reference | Perf Param Ref

View PDF

| | | | |
|---|---|---|---|
| **SALES MODEL:** | C27 | **COMBUSTION:** | DI |
| **ENGINE POWER (BHP):** | 1,214 | **ENGINE SPEED (RPM):** | 1,800 |
| **GEN POWER WITH FAN (EKW):** | 800.0 | **HERTZ:** | 60 |
| **COMPRESSION RATIO:** | 16.5 | **FAN POWER (HP):** | 39.3 |
| **RATING LEVEL:** | STANDBY | **ADDITIONAL PARASITICS (HP):** | 52.2 |
| **PUMP QUANTITY:** | 1 | **ASPIRATION:** | TA |
| **FUEL TYPE:** | DIESEL | **AFTERCOOLER TYPE:** | ATAAC |
| **MANIFOLD TYPE:** | DRY | **AFTERCOOLER CIRCUIT TYPE:** | JW+OC, ATAAC |
| **GOVERNOR TYPE:** | ADEM4 | **INLET MANIFOLD AIR TEMP (F):** | 120 |
| **ELECTRONICS TYPE:** | ADEM4 | **JACKET WATER TEMP (F):** | 210.2 |
| **IGNITION TYPE:** | CI | **TURBO CONFIGURATION:** | PARALLEL |
| **INJECTOR TYPE:** | EUI | **TURBO QUANTITY:** | 2 |
| **REF EXH STACK DIAMETER (IN):** | 10 | **TURBOCHARGER MODEL:** | GTA5008BS-56T-1.60 |
| **MAX OPERATING ALTITUDE (FT):** | 7,999 | **CERTIFICATION YEAR:** | 2010 |
| | | **PISTON SPD @ RATED ENG SPD (FT/MIN):** | 1,800.0 |

| INDUSTRY | SUB INDUSTRY | APPLICATION |
|---|---|---|
| ELECTRIC POWER | STANDARD | PACKAGED GENSET |
| OIL AND GAS | LAND PRODUCTION | PACKAGED GENSET |

## General Performance Data Top

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | BRAKE MEAN EFF PRES (BMEP) | BRAKE SPEC FUEL CONSUMPTN (BSFC) | VOL FUEL CONSUMPTN (VFC) | INLET MFLD PRES | INLET MFLD TEMP | EXH MFLD TEMP | EXH MFLD PRES | ENGINE OUTLET TEMP |
|---|---|---|---|---|---|---|---|---|---|---|
| EKW | % | BHP | PSI | LB/BHP-HR | GAL/HR | IN-HG | DEG F | DEG F | IN-HG | DEG F |
| 800.0 | 100 | 1,214 | 324 | 0.330 | 57.3 | 58.6 | 120.5 | 1,230.6 | 41.1 | 952.5 |
| 720.0 | 90 | 1,100 | 294 | 0.334 | 52.5 | 53.7 | 115.2 | 1,195.3 | 37.5 | 932.4 |
| 640.0 | 80 | 988 | 264 | 0.339 | 47.8 | 48.4 | 113.4 | 1,168.6 | 33.4 | 919.7 |
| 600.0 | 75 | 932 | 249 | 0.341 | 45.4 | 45.5 | 113.0 | 1,155.3 | 31.2 | 913.8 |
| 560.0 | 70 | 876 | 234 | 0.342 | 42.9 | 42.2 | 111.6 | 1,138.9 | 28.8 | 906.0 |
| 480.0 | 60 | 765 | 204 | 0.344 | 37.6 | 34.9 | 107.3 | 1,095.6 | 23.9 | 882.8 |
| 400.0 | 50 | 654 | 175 | 0.346 | 32.3 | 27.3 | 102.5 | 1,039.6 | 19.1 | 850.4 |
| 320.0 | 40 | 545 | 145 | 0.349 | 27.1 | 20.4 | 98.3 | 967.7 | 14.9 | 804.3 |
| 240.0 | 30 | 436 | 116 | 0.355 | 22.1 | 14.5 | 95.0 | 875.5 | 11.4 | 739.0 |
| 200.0 | 25 | 380 | 101 | 0.359 | 19.5 | 11.7 | 93.6 | 822.1 | 9.9 | 699.4 |
| 160.0 | 20 | 324 | 86 | 0.366 | 17.0 | 9.1 | 92.4 | 763.2 | 8.5 | 654.7 |
| 80.0 | 10 | 210 | 56 | 0.402 | 12.0 | 5.1 | 92.2 | 626.6 | 6.3 | 544.7 |

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | COMPRESSOR OUTLET PRES | COMPRESSOR OUTLET TEMP | WET INLET AIR VOL FLOW RATE | ENGINE OUTLET WET EXH GAS VOL FLOW RATE | WET INLET AIR MASS FLOW RATE | WET EXH GAS MASS FLOW RATE | WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG) | DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG) |
|---|---|---|---|---|---|---|---|---|---|---|

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | COMPRESSOR OUTLET PRES | COMPRESSOR OUTLET TEMP | WET INLET AIR VOL FLOW RATE | ENGINE OUTLET WET EXH GAS VOL FLOW RATE | WET INLET AIR MASS FLOW RATE | WET EXH GAS MASS FLOW RATE | WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG) | DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG) |
|---|---|---|---|---|---|---|---|---|---|---|
| EKW | % | BHP | IN-HG | DEG F | CFM | CFM | LB/HR | LB/HR | FT3/MIN | FT3/MIN |
| 800.0 | 100 | 1,214 | 61 | 362.1 | 2,216.4 | 6,011.7 | 9,543.1 | 9,944.2 | 2,093.1 | 1,894.9 |
| 720.0 | 90 | 1,100 | 57 | 341.6 | 2,124.9 | 5,659.3 | 9,125.9 | 9,493.8 | 1,998.8 | 1,815.5 |
| 640.0 | 80 | 988 | 51 | 320.7 | 2,001.3 | 5,260.8 | 8,572.1 | 8,906.9 | 1,875.2 | 1,707.1 |
| 600.0 | 75 | 932 | 48 | 309.9 | 1,930.4 | 5,042.0 | 8,257.4 | 8,575.1 | 1,805.0 | 1,645.1 |
| 560.0 | 70 | 876 | 44 | 295.4 | 1,851.1 | 4,797.3 | 7,907.3 | 8,207.3 | 1,727.2 | 1,576.0 |
| 480.0 | 60 | 765 | 37 | 264.1 | 1,678.1 | 4,260.9 | 7,148.0 | 7,411.6 | 1,560.5 | 1,427.2 |
| 400.0 | 50 | 654 | 29 | 233.3 | 1,497.7 | 3,697.0 | 6,361.6 | 6,588.0 | 1,387.5 | 1,272.0 |
| 320.0 | 40 | 545 | 22 | 203.3 | 1,329.0 | 3,157.0 | 5,630.4 | 5,820.5 | 1,228.0 | 1,129.6 |
| 240.0 | 30 | 436 | 16 | 173.6 | 1,175.4 | 2,643.8 | 4,970.3 | 5,124.7 | 1,084.4 | 1,003.3 |
| 200.0 | 25 | 380 | 13 | 158.7 | 1,102.8 | 2,392.1 | 4,660.7 | 4,797.2 | 1,014.7 | 942.2 |
| 160.0 | 20 | 324 | 10 | 143.8 | 1,032.8 | 2,142.5 | 4,363.5 | 4,482.1 | 945.3 | 881.3 |
| 80.0 | 10 | 210 | 6 | 121.2 | 926.9 | 1,716.6 | 3,911.4 | 3,995.6 | 840.3 | 792.1 |

## Heat Rejection Data Top

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | REJECTION TO JACKET WATER | REJECTION TO ATMOSPHERE | REJECTION TO EXH | EXHUAST RECOVERY TO 350F | FROM OIL COOLER | FROM AFTERCOOLER | WORK ENERGY | LOW HEAT VALUE ENERGY | HIGH HEAT VALUE ENERGY |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EKW | % | BHP | BTU/MIN | BTU/MIN | BTU/MIN | BTU/MIN | BTU/MIN | BTU/MIN | BTU/MIN | BTU/MIN | BTU/MIN |
| 800.0 | 100 | 1,214 | 18,785 | 6,240 | 45,257 | 25,637 | 6,549 | 9,235 | 51,468 | 122,961 | 130,984 |
| 720.0 | 90 | 1,100 | 18,137 | 5,061 | 42,000 | 23,586 | 6,007 | 8,276 | 46,664 | 112,779 | 120,138 |
| 640.0 | 80 | 988 | 17,141 | 4,437 | 38,642 | 21,600 | 5,462 | 7,119 | 41,902 | 102,550 | 109,241 |
| 600.0 | 75 | 932 | 16,243 | 4,573 | 36,868 | 20,559 | 5,186 | 6,513 | 39,533 | 97,376 | 103,729 |
| 560.0 | 70 | 876 | 15,133 | 4,950 | 34,899 | 19,383 | 4,898 | 5,822 | 37,162 | 91,965 | 97,965 |
| 480.0 | 60 | 765 | 13,933 | 4,599 | 30,563 | 16,728 | 4,301 | 4,488 | 32,445 | 80,759 | 86,028 |
| 400.0 | 50 | 654 | 12,297 | 4,489 | 26,024 | 13,914 | 3,694 | 3,331 | 27,748 | 69,364 | 73,890 |
| 320.0 | 40 | 545 | 10,665 | 4,336 | 21,575 | 11,109 | 3,103 | 2,367 | 23,120 | 58,261 | 62,063 |
| 240.0 | 30 | 436 | 9,960 | 3,213 | 17,222 | 8,311 | 2,521 | 1,564 | 18,469 | 47,340 | 50,429 |
| 200.0 | 25 | 380 | 9,576 | 2,592 | 15,113 | 6,955 | 2,231 | 1,215 | 16,122 | 41,885 | 44,618 |
| 160.0 | 20 | 324 | 9,057 | 2,021 | 13,057 | 5,639 | 1,939 | 898 | 13,745 | 36,402 | 38,778 |
| 80.0 | 10 | 210 | 7,177 | 1,693 | 9,288 | 3,167 | 1,375 | 455 | 8,885 | 25,814 | 27,498 |

## Emissions Data Top

Units Filter All Units

**RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM**

| GENSET POWER WITH FAN | | EKW | 800.0 | 600.0 | 400.0 | 200.0 | 80.0 |
|---|---|---|---|---|---|---|---|
| ENGINE POWER | | BHP | 1,214 | 932 | 654 | 380 | 210 |
| PERCENT LOAD | | % | 100 | 75 | 50 | 25 | 10 |
| TOTAL NOX (AS NO2) | | G/HR | 7,541 | 4,507 | 2,865 | 1,989 | 1,253 |
| TOTAL CO | | G/HR | 517 | 644 | 630 | 514 | 567 |
| TOTAL HC | | G/HR | 66 | 83 | 90 | 71 | 85 |
| PART MATTER | | G/HR | 55.4 | 52.1 | 86.3 | 99.7 | 101.9 |
| TOTAL NOX (AS NO2) | (CORR 5% O2) | MG/NM3 | 3,121.8 | 2,374.5 | 2,149.1 | 2,626.2 | 2,606.8 |
| TOTAL CO | (CORR 5% O2) | MG/NM3 | 215.2 | 343.4 | 483.1 | 717.2 | 1,372.2 |
| TOTAL HC | (CORR 5% O2) | MG/NM3 | 23.7 | 38.9 | 59.2 | 87.9 | 183.2 |
| PART MATTER | (CORR 5% O2) | MG/NM3 | 18.9 | 22.9 | 55.1 | 113.5 | 210.1 |
| TOTAL NOX (AS NO2) | (CORR 5% O2) | PPM | 1,521 | 1,157 | 1,047 | 1,279 | 1,270 |
| TOTAL CO | (CORR 5% O2) | PPM | 172 | 275 | 386 | 574 | 1,098 |
| TOTAL HC | (CORR 5% O2) | PPM | 44 | 73 | 111 | 164 | 342 |
| TOTAL NOX (AS NO2) | | G/HP-HR | 6.27 | 4.86 | 4.40 | 5.25 | 6.00 |
| TOTAL CO | | G/HP-HR | 0.43 | 0.69 | 0.97 | 1.36 | 2.72 |
| TOTAL HC | | G/HP-HR | 0.05 | 0.09 | 0.14 | 0.19 | 0.41 |
| PART MATTER | | G/HP-HR | 0.05 | 0.06 | 0.13 | 0.26 | 0.49 |
| TOTAL NOX (AS NO2) | | LB/HR | 16.63 | 9.94 | 6.32 | 4.38 | 2.76 |
| TOTAL CO | | LB/HR | 1.14 | 1.42 | 1.39 | 1.13 | 1.25 |
| TOTAL HC | | LB/HR | 0.15 | 0.18 | 0.20 | 0.16 | 0.19 |
| PART MATTER | | LB/HR | 0.12 | 0.11 | 0.19 | 0.22 | 0.22 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **GENSET POWER WITH FAN** | | **EKW** | **800.0** | **600.0** | **400.0** | **200.0** | **80.0** |
| **ENGINE POWER** | | **BHP** | **1,214** | **932** | **654** | **380** | **210** |
| **PERCENT LOAD** | | **%** | **100** | **75** | **50** | **25** | **10** |

**RATED SPEED NOMINAL DATA: 1800 RPM**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **GENSET POWER WITH FAN** | | **EKW** | **800.0** | **600.0** | **400.0** | **200.0** | **80.0** |
| **ENGINE POWER** | | **BHP** | **1,214** | **932** | **654** | **380** | **210** |
| **PERCENT LOAD** | | **%** | **100** | **75** | **50** | **25** | **10** |
| TOTAL NOX (AS NO2) | | G/HR | 6,233 | 3,725 | 2,368 | 1,644 | 1,036 |
| TOTAL CO | | G/HR | 276 | 344 | 337 | 275 | 303 |
| TOTAL HC | | G/HR | 35 | 44 | 48 | 37 | 45 |
| TOTAL CO2 | | KG/HR | 563 | 445 | 315 | 188 | 116 |
| PART MATTER | | G/HR | 28.4 | 26.7 | 44.2 | 51.1 | 52.3 |
| TOTAL NOX (AS NO2) | (CORR 5% O2) | MG/NM3 | 2,580.0 | 1,962.4 | 1,776.1 | 2,170.4 | 2,154.4 |
| TOTAL CO | (CORR 5% O2) | MG/NM3 | 115.1 | 183.6 | 258.3 | 383.5 | 733.8 |
| TOTAL HC | (CORR 5% O2) | MG/NM3 | 12.5 | 20.6 | 31.3 | 46.5 | 96.9 |
| PART MATTER | (CORR 5% O2) | MG/NM3 | 9.7 | 11.8 | 28.3 | 58.2 | 107.7 |
| TOTAL NOX (AS NO2) | (CORR 5% O2) | PPM | 1,257 | 956 | 865 | 1,057 | 1,049 |
| TOTAL CO | (CORR 5% O2) | PPM | 92 | 147 | 207 | 307 | 587 |
| TOTAL HC | (CORR 5% O2) | PPM | 23 | 38 | 58 | 87 | 181 |
| TOTAL NOX (AS NO2) | | G/HP-HR | 5.18 | 4.02 | 3.63 | 4.34 | 4.96 |
| TOTAL CO | | G/HP-HR | 0.23 | 0.37 | 0.52 | 0.72 | 1.45 |
| TOTAL HC | | G/HP-HR | 0.03 | 0.05 | 0.07 | 0.10 | 0.22 |
| PART MATTER | | G/HP-HR | 0.02 | 0.03 | 0.07 | 0.13 | 0.25 |
| TOTAL NOX (AS NO2) | | LB/HR | 13.74 | 8.21 | 5.22 | 3.62 | 2.28 |
| TOTAL CO | | LB/HR | 0.61 | 0.76 | 0.74 | 0.61 | 0.67 |
| TOTAL HC | | LB/HR | 0.08 | 0.10 | 0.11 | 0.08 | 0.10 |
| TOTAL CO2 | | LB/HR | 1,240 | 982 | 694 | 414 | 255 |
| PART MATTER | | LB/HR | 0.06 | 0.06 | 0.10 | 0.11 | 0.12 |
| OXYGEN IN EXH | | % | 8.9 | 10.0 | 11.1 | 13.1 | 15.4 |
| DRY SMOKE OPACITY | | % | 0.2 | 1.1 | 2.6 | 4.3 | 5.3 |
| BOSCH SMOKE NUMBER | | | 0.14 | 0.39 | 0.96 | 1.51 | 1.69 |

## Regulatory Information Top

| **EPA TIER 2** | **2006 - 2010** |
|---|---|

GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 89 SUBPART D AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE NON-ROAD REGULATIONS.

| **Locality** | **Agency** | **Regulation** | **Tier/Stage** | **Max Limits - G/BKW - HR** |
|---|---|---|---|---|
| U.S. (INCL CALIF) | EPA | NON-ROAD | TIER 2 | CO: 3.5 NOx + HC: 6.4 PM: 0.20 |

| **EPA EMERGENCY STATIONARY** | **2011 - ----** |
|---|---|

GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE EMERGENCY STATIONARY REGULATIONS.

| **Locality** | **Agency** | **Regulation** | **Tier/Stage** | **Max Limits - G/BKW - HR** |
|---|---|---|---|---|
| U.S. (INCL CALIF) | EPA | STATIONARY | EMERGENCY STATIONARY | CO: 3.5 NOx + HC: 6.4 PM: 0.20 |

## Altitude Derate Data Top

**ALTITUDE CORRECTED POWER CAPABILITY (BHP)**

| **AMBIENT OPERATING TEMP (F)** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **NORMAL** |
|---|---|---|---|---|---|---|---|---|---|---|
| ALTITUDE (FT) | | | | | | | | | | |
| 0 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 |
| 1,000 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 |
| 2,000 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 |
| 3,000 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 |
| 4,000 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 |
| 5,000 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 |
| 6,000 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,197 | 1,214 |

| AMBIENT OPERATING TEMP (F) | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | NORMAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 7,000 | 1,214 | 1,214 | 1,214 | 1,214 | 1,214 | 1,212 | 1,191 | 1,170 | 1,150 | 1,214 |
| 8,000 | 1,214 | 1,214 | 1,214 | 1,207 | 1,185 | 1,164 | 1,144 | 1,124 | 1,105 | 1,214 |
| 9,000 | 1,214 | 1,204 | 1,181 | 1,159 | 1,138 | 1,118 | 1,098 | 1,079 | 1,061 | 1,214 |
| 10,000 | 1,178 | 1,155 | 1,134 | 1,113 | 1,092 | 1,073 | 1,054 | 1,036 | 1,018 | 1,195 |
| 11,000 | 1,130 | 1,109 | 1,088 | 1,067 | 1,048 | 1,029 | 1,011 | 994 | 977 | 1,154 |
| 12,000 | 1,084 | 1,063 | 1,043 | 1,024 | 1,005 | 987 | 970 | 953 | 937 | 1,115 |
| 13,000 | 1,039 | 1,019 | 1,000 | 981 | 964 | 946 | 930 | 914 | 898 | 1,077 |
| 14,000 | 996 | 977 | 958 | 940 | 923 | 907 | 891 | 876 | 861 | 1,039 |
| 15,000 | 954 | 935 | 918 | 901 | 884 | 869 | 853 | 839 | 824 | 1,003 |

## Cross Reference Top

**Engine Arrangement**

| Arrangement Number | Effective Serial Number | Engineering Model | Engineering Model Version |
|---|---|---|---|
| 2671232 | MJE00001 | GS327 | - |
| 3495619 | MJE00001 | GS603 | LS |
| 3541450 | PEN00001 | GS582 | - |

**Test Specification Data**

| Test Spec | Setting | Effective Serial Number | Engine Arrangement |
|---|---|---|---|
| 0K7925 | PP5660 | MJE00001 | 2671232 |
| 3704841 | GG0523 | MJE00001 | 3495619 |
| 0K4031 | GG0383 | PEN00001 | 3541450 |

## Performance Parameter Reference Top

**Parameters Reference: DM9600 - 08**

**PERFORMANCE DEFINITIONS**

### PERFORMANCE DEFINITIONS DM9600

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

**PERFORMANCE PARAMETER TOLERANCE FACTORS:**
Power +/- 3%
Torque +/- 3%
Exhaust stack temperature +/- 8%
Inlet airflow +/- 5%
Intake manifold pressure-gage +/- 10%
Exhaust flow +/- 6%
Specific fuel consumption +/- 3%
Fuel rate +/- 5%
Specific DEF consumption +/- 3%

DEF rate +/- 5%
Heat rejection +/- 5%
Heat rejection exhaust only +/- 10%
Heat rejection CEM only +/- 10%

Heat Rejection values based on using treated water.

Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.

On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.

These values do not apply to C280/3600. For these models, see the tolerances listed below.

**C280/3600 HEAT REJECTION TOLERANCE FACTORS:**
Heat rejection +/- 10%
Heat rejection to Atmosphere +/- 50%
Heat rejection to Lube Oil +/- 20%
Heat rejection to Aftercooler +/- 5%

**TEST CELL TRANSDUCER TOLERANCE FACTORS:**

Torque +/- 0.5%
Speed +/- 0.2%
Fuel flow +/- 1.0%
Temperature +/- 2.0 C degrees
Intake manifold pressure +/- 0.1 kPa

OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.

**REFERENCE ATMOSPHERIC INLET AIR**
FOR 3500 ENGINES AND SMALLER
SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.

FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.

**MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE**
Location for air temperature measurement air cleaner inlet at stabilized operating conditions.

**REFERENCE EXHAUST STACK DIAMETER**
The Reference Exhaust Stack Diameter published with this dataset

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

**REFERENCE FUEL**

DIESEL

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

GAS

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

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

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

**ALTITUDE CAPABILITY**

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

Standard temperature values versus altitude could be seen on TM2001.

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

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

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

**REGULATIONS AND PRODUCT COMPLIANCE**

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

representative.

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

**EMISSIONS DEFINITIONS:**
Emissions : DM1176

**HEAT REJECTION DEFINITIONS:**
Diesel Circuit Type and HHV Balance : DM9500

**HIGH DISPLACEMENT (HD) DEFINITIONS:**
3500: EM1500

**RATING DEFINITIONS:**
Agriculture : TM6008

Fire Pump : TM6009

Generator Set : TM6035

Generator (Gas) : TM6041

Industrial Diesel : TM6010

Industrial (Gas) : TM6040

Irrigation : TM5749

Locomotive : TM6037

Marine Auxiliary : TM6036

Marine Prop (Except 3600) : TM5747

Marine Prop (3600 only) : TM5748

MSHA : TM6042

Oil Field (Petroleum) : TM6011

Off-Highway Truck : TM6039

On-Highway Truck : TM6038

**SOUND DEFINITIONS:**
Sound Power : DM8702

Sound Pressure : TM7080

**Date Released : 7/7/15**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF TRANSPORTATION AND AIR QUALITY
WASHINGTON, DC 20460

# CERTIFICATE OF CONFORMITY
2009 MODEL YEAR

| | |
|---|---|
| Manufacturer: | **CATERPILLAR, INC.** |
| Engine Family: | **9CPXL27.0ESW** |
| Certificate Number: | **CPX-NRCI-09-11** |
| Intended Service Class: | **NR 9 (>560)** |
| Fuel Type: | **DIESEL** |
| FELs: g/kW-hr | NMHC+NOx: **6.3** NOx: **NA** PM: **0.19** |
| Effective Date: | **1/14/2009** |
| Date Issued: | **1/14/2009** |

Karl J. Simon, Director
Compliance and Innovative Strategies Division
Office of Transportation and Air Quality

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 89, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR 89 and produced in the stated model year.

This certificate of conformity covers only those nonroad compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 89 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 89.

This certificate of conformity is conditional upon compliance of said manufacturer with the averaging, banking and trading provisions of 40 CFR Part 89, Subpart C. Failure to comply with these provisions may render this certificate void ab initio.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 89.129-96 and 89.506-96 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to a revocation or suspension of this certificate for reasons specified in 40 CFR Part 89. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void ab initio for other reasons specified in 40 CFR Part 89.

This certificate does not cover nonroad engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

# ***Attachment O***

Monitoring/Recordkeeping/Reporting/Testing Plans

## Attachment O – Monitoring/Recordkeeping/Reporting/Testing Plans

Proposed monitoring, recordkeeping, and reporting requirements are outlined in Attachment D.

Emissions testing is not proposed.

# ***Attachment P***

Public Notice

# Attachment P – Public Notice

An example of the Class I legal advertisement to be published in the local newspaper is provided below.

## AIR QUALITY PERMIT NOTICE

## Notice of Application

Notice is given that Charleston Area Medical Center has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a Construction Permit for Teays Valley Hospital, located on Hospital Drive, in Hurricane, Putnam County, West Virginia. The latitude and longitude coordinates are: 38.451725°, -81.952255°.

The applicant estimates the potential to discharge the following Regulated Air Pollutants will be (in tons per year, TPY):

| | | |
|---|---|---|
| Carbon Monoxide | CO | 4.93 |
| Nitrogen Oxides | NOx | 7.24 |
| Particulate Matter | PM10 | 0.84 |
| Sulfur Oxides | SOx | 1.02 |
| Volatile Organic Compounds | VOC | 0.57 |

This is an after-the-fact permit; therefore, operation of the facility is ongoing. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1250, during normal business hours.

Dated this the 22nd day of February, 2016.

By: Charleston Area Medical Center
Dr. Glenn Crotty, Jr., MD
Executive VP & COO
3200 MacCorkle Avenue SE
Charleston, WV 25304

# ***Application Fee***