Notice of Construction Application
Supporting Information Report
New Natural Gas Boiler and Water Heaters
Central Washington University
Ellensburg, Washington

September 1, 2022

Prepared for

MW Engineers
601 West 1st Avenue, Suite 1300
Spokane, Washington

LANDAU ASSOCIATES

155 NE 100th St, Ste 302
Seattle, WA 98125
206.631.8680

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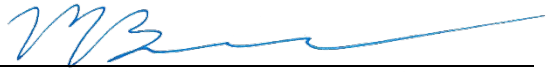
This document was prepared by, or under the direct supervision of, the technical professionals noted below.

Document prepared by:  Kathryn Baker
Primary Author

Document reviewed by:  Mark Brunner
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LANDAU ASSOCIATES

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LIST OF ABBREVIATIONS AND ACRONYMS

AERMOD ..... AMS/EPA Regulatory Model
AMS ..... American Meteorological Society
ASIL ..... acceptable source impact level
BACT ..... Best Available Control Technology
CFR ..... Code of Federal Regulations
CO ..... carbon monoxide
CWU ..... Central Washington University
Ecology ..... Washington State Department of Ecology
EPA ..... US Environmental Protection Agency
Facility ..... Central Washington University
GEP ..... Good Engineering Practice
HAP ..... hazardous air pollutant
HC ..... hydrocarbons
hr ..... hour
K ..... Kelvin
km ..... kilometer
Landau ..... Landau Associates, Inc.
lb ..... pounds
$\mu g/m^3$ ..... micrograms per cubic meter
m ..... meters
MBtu ..... thousand British thermal units
MMBtu ..... million British thermal units
MMscf ..... million standard cubic feet
m/s ..... meters per second
NATA ..... National Air Toxics Assessment
NO_2 ..... nitrogen dioxide
NOC ..... Notice of Construction
NO_X ..... oxides of nitrogen
NSR ..... New Source Review
NWS ..... National Weather Service
PM ..... particulate matter
$PM_{2.5}$ ..... particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10} ..... particulate matter with an aerodynamic diameter less than or equal to 10 microns
ppmvd ..... parts per million volumetric, dry basis
scf ..... standard cubic feet
SO_2 ..... sulfur dioxide

LIST OF ABBREVIATIONS AND ACRONYMS (CONTINUED)

SQER ..... small-quantity emission rate
TAP ..... toxic air pollutant
VOC ..... volatile organic compound
WAC ..... Washington Administrative Code
yr ..... year

1.0 INTRODUCTION

Landau Associates, Inc. (Landau) has been contracted by MW Engineers to develop an air quality Notice of Construction (NOC) application required by the Washington State Department of Ecology (Ecology) for the replacement of three existing natural gas-fired boilers and installation of two new water heaters at Central Washington University's (CWU's) north campus in Ellensburg, Washington. This supporting information report provides the detailed information required for the NOC application for CWU (Facility). The information presented herein includes specifications for the equipment and detailed operations information, calculated potential emissions that would result from operation of the equipment, a review of the applicable regulations, and air dispersion modeling results. A review of Best Available Control Technology (BACT) is also included. The NOC application form with detailed Facility and contact information is provided in Appendix A.

2.0 BACKGROUND INFORMATION

CWU plans to replace three existing natural gas-fired Cleaver Brooks CFC-E 1500 heating water boilers. Each new boiler will have a maximum heat input value of 1.5 million British thermal units per hour (MMBtu/hr) and will be a direct replacement for an existing boiler that has the same model number, maximum heat input capacity, and emissions profile. Additionally, CWU plans to install two Hubbell NX500 high-efficiency, gas-fired condensing water heaters in Wendell Hill Hall. Each new water heater will have a maximum heat input value of 500 thousand British thermal units per hour (MBtu/hr). These two water heaters will replace four existing units that have a different manufacturer but are similar technology. The combined heat input capacity of the two new water heaters is lower than the combined heat input capacity of the four existing water heaters they will be replacing. This report addresses operations and emissions associated with the new boilers and water heaters.

The combustion of fuels in boiler and water heater operations cause emissions of regulated air pollutants. Potential air pollutants that will be emitted during boiler operations include particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOCs), and oxides of nitrogen (NO_X), which are regulated as criteria pollutants. Other combustion-related emissions are regulated as hazardous air pollutants (HAPs) and/or toxic air pollutants (TAPs).

Washington environmental regulations establish air permitting requirements for natural gas-fired boilers or heaters with combined heat input limits of greater than 4 MMBtu/hr under Washington Administrative Code (WAC) 173-400-110. These regulations also require that, prior to construction of a facility that may emit air contaminants, an NOC application be submitted to and reviewed by Ecology. Upon Ecology's determination that the operations will be in accordance with all applicable air quality requirements, an Approval Order is issued, which authorizes construction of the project to commence.

3.0 FACILITY DESCRIPTION

CWU is an institution of higher education located in Kittitas County, Washington. Figure 1 is a map of the vicinity with the Facility location identified. Figure 2 shows a site view of the Facility.

The Facility operates in accordance with Air Quality Approval Order No. 10AQ-C147, First Revision issued by Ecology on June 25, 2020 (Ecology 2020). This permit establishes emission limitations for boilers, emergency generators, and a paint booth.

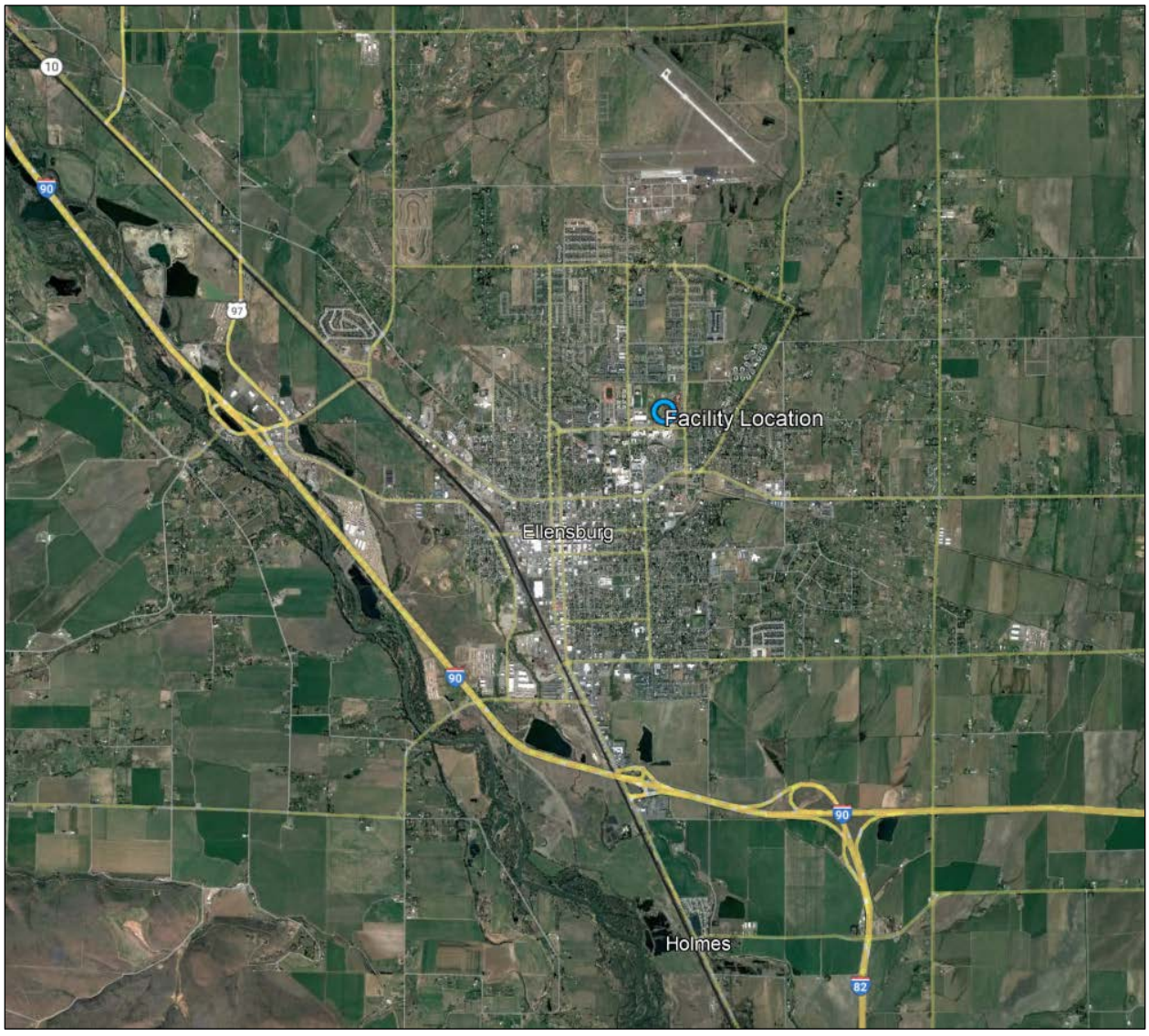

Figure 1: Vicinity Map

Figure 2: Facility Layout

4.0 PROJECT DESCRIPTION

The recent failure of the three natural gas-fired boilers has resulted in the need to install three new natural gas-fired boilers. The four existing water heaters are at the end of their useful life, and will be replaced with two new units. With this NOC application, MW Engineers and CWU propose the installation and operation of three new boilers and two new water heaters to provide for continued operations at the Facility.

4.1 Equipment Description

This section presents a detailed description of the boilers and water heaters related to this project. Figure 3 is a process flow diagram showing the boiler system configuration including the new replacement boilers.

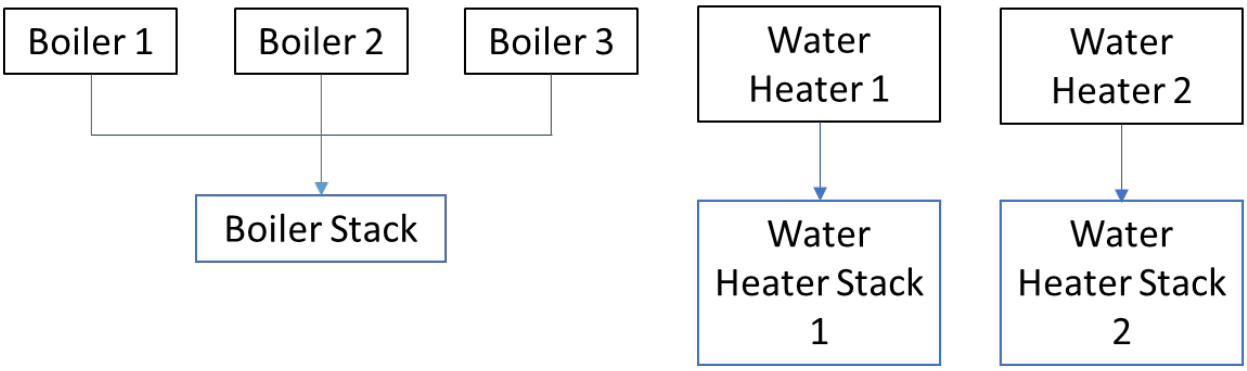

Figure 3: Process Flow Diagram

4.1.1 Boilers

The three existing boilers (installed in 2019) and the three proposed boilers are Cleaver Brooks CFC-E 1500 heating water boilers. Each boiler has a maximum heat input value of 1.5 MMBtu/hr. The proposed boilers will be a direct replacement of the existing boilers that have the same model number, maximum heat input capacity, and emissions profile.

4.1.2 Water Heaters

CWU plans to install two Hubbell NX500 high-efficiency, gas-fired condensing water heaters in Wendell Hill Hall. Each new water heater will have a maximum heat input value of 500 MBtu/hr. These two water heaters will replace four existing units that have a different manufacturer but are similar technology. The combined heat input capacity of the two new water heaters is lower than the combined heat input capacity of the four existing water heaters they will be replacing.

4.2 Air Contaminants Emitted

The combustion of natural gas to fire the proposed new boilers and water heaters will cause the generation and emissions of air pollutants including PM, CO, VOCs, and NO_X, which are regulated as criteria pollutants. Other combustion-related emissions are regulated as HAPs and/or TAPs.

Air contaminants that may be emitted during boiler operations are listed in Table 1, which also identifies whether the pollutant is regulated as a criteria pollutant, HAP, and/or TAP.

Table 1: List of Pollutants Emitted During Combustion of Natural Gas

Pollutant	Criteria	HAP	TAP
CO	Yes		Yes
NO_X	Yes		Yes – NO_2
SO_2	Yes		Yes
HC/VOCs	Yes		
PM_{10} (filt + cond)	Yes		
$PM_{2.5}$ (filt + cond)	Yes		
Lead	Yes		Yes
Acetaldehyde		Yes	Yes
Acrolein		Yes	No
Ammonia		No	Yes
Arsenic		Yes	Yes
Benzene		Yes	Yes
Beryllium		Yes	Yes
Cadmium		Yes	Yes
Chromium (total)		Yes	Yes
Chromium (VI)		Yes	Yes
Cobalt		Yes	Yes
Copper		No	Yes
Ethylbenzene		Yes	No
Formaldehyde		Yes	Yes
Hexane		Yes	No
Lead		Yes	Yes
Manganese		Yes	Yes
Mercury		Yes	Yes
Naphthalene		Yes	Yes
Nickel		Yes	Yes

Pollutant	Criteria	HAP	TAP
Polycyclic Organic Matter		Yes	Yes
2-Methylnaphthalene		No	Yes
3-Methylchloranthrene		Yes	Yes
7,12-Dimethylbenz(a)anthracene		No	Yes
Acenaphthene		No	Yes
Acenaphthylene		No	Yes
Anthracene		Yes	No
Benz(a)anthracene		No	Yes
Benzo(a)pyrene		No	Yes
Benzo(b)fluoranthene		No	Yes
Benzo(g,h,i)perylene		No	Yes
Benzo(k)fluoranthene		Yes	Yes
Chrysene		No	Yes
Dibenzo(a,h)anthracene		Yes	Yes
Dichlorobenzene		Yes	No
Fluoranthene		No	Yes
Fluorene		No	Yes
Indeno(1,2,3-cd)pyrene		No	Yes
Naphthalene		Yes	Yes
Phenanthrene		No	Yes
Pyrene		No	No
Propylene		No	No
Selenium		No	Yes
Toluene		Yes	No
Vanadium		No	Yes
Xylenes		Yes	No

Abbreviations and Acronyms:

CO = carbon monoxide
cond = condensable
filt = filterable
HAP = hazardous air pollutant
HC = hydrocarbons
NO_2 = nitrogen dioxide
NO_X = oxides of nitrogen
$PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns
SO_2 = sulfur dioxide
TAP = toxic air pollutant
VOC = volatile organic compound

4.3 Projected Construction Start and Completion Dates

The proposed boilers and water heaters will be installed once an Approval Order is issued for that equipment.

4.4 Operating Schedule and Production Rates

The proposed new boilers and water heaters will be operated up to 24 hours/day and 7 days/week. The maximum heat input rate for each boiler is 1.5 MMBtu/hr and for each water heater is 500 MBtu/hr.

4.5 Fuel Specifications

The burner will be fired with natural gas only.

5.0 APPLICABLE REGULATORY REQUIREMENTS

The proposed boiler replacement is subject to state and federal regulatory requirements related to control of emissions of criteria pollutants, TAPs, and HAPs. This section summarizes the applicable requirements.

5.1 Washington Administrative Codes

The Facility and the proposed new boilers are regulated under portions of the WAC pursuant to the Washington Clean Air Act and Chapter 70.94 of the Revised Code of Washington. This subsection summarizes the WAC requirements relevant to the proposed modifications.

5.1.1 Chapter 173-400 WAC: General Regulations for Air Pollution Sources

Under Chapter 173-400 WAC, the Facility is regulated as a stationary source and the proposed boiler is regulated as an emissions unit. Specific provisions of Chapter 173-400 WAC that are relevant to the proposed modifications consist of:

- WAC 173-400-040: General standards for maximum emissions
- WAC 173-400-050: Emission standards for combustion and incineration units
- WAC 173-400-075: Emission standards for sources emitting hazardous air pollutants
- WAC 173-400-110: New source review (NSR) for sources and portable sources
- WAC 173-400-113: New sources in attainment or unclassifiable areas.

5.1.2 Chapter 173-401 WAC: Operating Permit Regulation

The Facility is a "minor source" of air pollutants in accordance with Chapter 173-401 WAC and is not subject to the operating permit requirements of Chapter 173-401 WAC.

5.1.3 Chapter 173-460 WAC: Controls for New Sources of Toxic Air Pollutants

WAC 173-460-040 establishes review requirements for modified TAP sources. If the increase in emissions from a modification is less than the applicable *de minimis* emission threshold for that TAP listed in WAC 173-460-150, the modification is exempt from NSR for that TAP. WAC 173-460-150 also establishes small-quantity emission rate (SQER) thresholds for TAP emissions that trigger the requirement to conduct dispersion modeling.

5.2 New Source Performance Standards

The proposed new boilers and water heaters are not subject to 40 Code of Federal Regulations (CFR) Part 60 Subpart Dc, *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units*, because they are steam-generating units with a design capacity of less than 10 MMBtu/hr heat input.

5.3 National Emission Standards for Hazardous Air Pollutants

The Facility is not a major source for HAP emissions. Boilers constructed after June 4, 2010 at area sources of HAPs are subject to 40 CFR Part 63 Subpart JJJJJJ, *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources*. However, natural gas-fired boilers are exempt from Subpart JJJJJJ.

6.0 EMISSIONS EVALUATION

This section describes the methodology, emission factors, and estimated emission rates for each of the emitted air contaminants. Emission rates for the proposed new boiler are compared to emission rates for the existing boiler and to the regulatory thresholds and standards for each pollutant.

6.1 Methodology for Estimating Emissions

Methods, factors, and operating parameters that have been used to estimate hourly and annual emissions rates for the air contaminants emitted by the existing and proposed boilers and water heaters are described below.

6.1.1 Emission Factors

Factors used to estimate emissions were taken from three sources:

1. The US Environmental Protection Agency's (EPA's) Inventory of Emission Factors, AP-42, Tables 1.4 (EPA 1998) for small boilers (boilers with a rating less than 100 MMBtu/yr) provides emission factors used to calculate criteria pollutant emissions and most TAPs/HAPs, except as noted in items 2 through 5 below.
2. The Ventura County Air Pollution Control District, AB 2588, Combustion Emission Factors (VCAPCD 2001) provides emission factors for the calculation of acrolein, benzene, ethylbenzene, propylene, toluene, and xylenes.
3. The emission factor for acetaldehyde was from the California Air Toxics Emission Factor database for natural gas-fired boilers (CARB; accessed August 2022).
4. The AP-42 document titled "Development and Selection of Ammonia Emission Factors" provides the emission factor for ammonia from natural gas-fired boilers (Battye et al. 1994).
5. The 2014 National Air Toxics Assessment (NATA) used source classification code-based speciation factors to speciate total chromium into constituent chromium compounds. The speciation factor to calculate hexavalent chromium from total chromium is 0.04 (EPA 2018).

Table 2 shows the specific emission factor used for calculating emissions and the reference for each factor.

Table 2: Emission Factors Used to Calculate Potential Emissions of Criteria Pollutants

Criteria Pollutant	Boilers (proposed)		Water Heaters (proposed)	
	Emission Factor Reference	Emission Factor (lb/MMscf nat gas)	Emission Factor Reference	Emission Factor (lb/MMscf nat gas)
CO	Manufacturer	37.7	Manufacturer	37.7
NO_X	Manufacturer	24.8	Manufacturer	24.8
SO_2	AP-42 Table 1.4-2	0.6	AP-42 Table 1.4-2	0.6
HC/VOCs	AP-42 Table 1.4-2	5.5	AP-42 Table 1.4-2	5.5
Total PM	AP-42 Table 1.4-2	7.6	AP-42 Table 1.4-2	7.6
PM_{10} (filt + cond)				
$PM_{2.5}$ (filt + cond)				
Lead	AP-42 Table 1.4-2	0.0005	AP-42 Table 1.4-2	0.0005

Abbreviations and Acronyms:

CO = carbon monoxide
cond = condensable
filt = filterable
HC = hydrocarbons
lb = pounds
MMscf = million standard cubic feet
nat gas = natural gas
NO_X = oxides of nitrogen
PM = particulate matter
$PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Table 3 identifies the emission factors and the reference used for calculating TAP emissions from both the new and the old boilers.

Table 3: Emission Factors Used to Calculate Potential Emissions of Toxic Air Pollutants

Washington TAPs	Emission Factor	Emission Factor (lb/10^6 scf nat gas)
Acetaldehyde	CATEF	0.00847
Acrolein	AB2588	0.0027
Ammonia	From AP-42 Ammonia EF	3.2
Arsenic	AP-42 Section 1.4	0.0002
Benzene	AB2588	0.0058
Beryllium	AB2588	0.000012
Cadmium	AP-42 Section 1.4	0.0011
Chromium (total)	AP-42 Section 1.4	0.0014
Chromium (VI)	NATA	0.000056

Washington TAPs	Emission Factor	Emission Factor (lb/10^6 scf nat gas)
Cobalt	AP-42 Section 1.4	0.000084
Copper	AP-42 Section 1.4	0.00085
Ethylbenzene	AB2588	0.0069
Formaldehyde	AP-42 Section 1.4	0.075
Hexane	AP-42 Section 1.4	1.8
Lead	AP-42 Section 1.4	0.0005
Manganese	AP-42 Section 1.4	0.00038
Mercury	AP-42 Section 1.4	0.00026
Naphthalene	AP-42 Section 1.4	0.00061
Nickel	AP-42 Section 1.4	0.0021
Polycyclic Organic Matter		0.0019
2-Methylnaphthalene	AP-42 Section 1.4	0.000024
3-Methylchloranthrene	AP-42 Section 1.4	0.0000018
7,12-Dimethylbenz(a)anthracene	AP-42 Section 1.4	0.000016
Acenaphthene	AP-42 Section 1.4	0.0000018
Acenaphthylene	AP-42 Section 1.4	0.0000018
Anthracene	AP-42 Section 1.4	0.0000024
Benz(a)anthracene	AP-42 Section 1.4	0.0000018
Benzo(a)pyrene	AP-42 Section 1.4	0.0000012
Benzo(b)fluoranthene	AP-42 Section 1.4	0.0000018
Benzo(g,h,i)perylene	AP-42 Section 1.4	0.0000012
Benzo(k)fluoranthene	AP-42 Section 1.4	0.0000018
Chrysene	AP-42 Section 1.4	0.0000018
Dibenzo(a,h)anthracene	AP-42 Section 1.4	0.0000012
Dichlorobenzene	AP-42 Section 1.4	0.0012
Fluoranthene	AP-42 Section 1.4	0.000003
Fluorene	AP-42 Section 1.4	2.80E-06
Indeno(1,2,3-cd)pyrene	AP-42 Section 1.4	1.80E-06
Naphthalene	AP-42 Section 1.4	6.10E-04
Phenanthrene	AP-42 Section 1.4	1.70E-05
Pyrene	AP-42 Section 1.4	5.00E-06
Propylene	AB2588	5.30E-01
Selenium	AP-42 Section 1.4	2.40E-05
Toluene	AB2588	2.65E-02

Washington TAPs	Emission Factor	Emission Factor (lb/10^6 scf nat gas)
Vanadium	AP-42 Section 1.4	2.30E-03
Xylenes	AB2588	1.97E-02

Abbreviations and Acronyms:

AB2588 = Ventura County Air Pollution Control District AB 2588 Combustion Emission Factors (VCAPCD 2001)
AP-42 Ammonia EF = Development and Selection of Ammonia Emission Factors (Battye et al. 1994)
CATEF = California Air Toxics Emission Factor Database (CARB; accessed August 2022)
lb = pounds
nat gas = natural gas
NATA = National Air Toxics Assessment (EPA 2018)
scf = standard cubic foot
TAPS = toxic air pollutants

6.2 Calculation of Estimated Pollutant Emissions

Potential hourly emissions of each criteria air pollutant and TAP have been calculated using the following formula:

$E = E_f * HI * (1MMscf/1020\ MMBtu)$

Where,

E = Contaminant emissions (lb/hr)

E_f = Emission factor (lb/MMscf of natural gas)

HI = Maximum heat input rate (MMBtu/hr).

For CO and NO_x emissions from the existing and proposed boiler, emissions were calculated based on the vendor-reported maximum concentrations using methods outlined in the EPA's Preferred and Alternative Methods for Estimating Air Emissions from Boilers (EPA 2001).

$E = (C \times MW \times Q \times 60) / (V \times 10^6)$

Where,

E = Hourly emissions in lb/hr of pollutant

C = pollutant concentration in parts per million volumetric, dry basis (ppmvd)

MW = molecular weight of the pollutant in lb/lb-mole

Q = stack gas volumetric flow rate in dry standard cubic feet per minute

V = volume occupied by 1 mole of ideal gas as standard conditions (385 cubic feet/lb-mole @ 68 degrees Fahrenheit [°F] and 1 atmosphere).

The guidance also provides an equation for the calculation of Q when exhaust gas flow rates are unavailable:

$Q = F_d \times (20.9/(20.9 - \%O_2) \times (HI/60)$

Where,

F_d= Ratio of the gas volume of fuel components per unit of heat. For natural gas, this value is provided by EPA Method 19 as 8710 scf/MMBtu.

$\%O_2$ = measured oxygen concentration dry basis.

HI = Heat input rate in MMBtu/hr.

Annual emissions have been calculated by multiplying the hourly emissions by the total annual hours of operation.

6.3 Calculated Emissions

Tables 4 and 5 summarize the estimated potential emissions for all pollutants during operation of the proposed new boilers and water heaters, respectively. Table B-1 shows the past actual HAP/TAP emissions for the existing boilers and Table B-2 shows the past actual HAP/TAP emissions for the existing heaters. Landau understands that, for permit applicability determinations, minor NSR considers only criteria pollutant emission increases associated with new equipment, and not emission decreases associated with equipment to be removed or decommissioned.

The Excel worksheet developed for these emission calculations has been submitted to Ecology electronically.

Table 4: Estimated Maximum Potential Emissions from the New Boilers

Criteria Pollutant	Emission Factor (pounds [lbs]/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(tons/year)	(lbs/day)	(lbs/hour)	
NO_X	24.8	0.5	2.6	0.11	year
CO	37.7	0.7	4.0	0.17	year
SO_2	0.6	0.012	0.064	0.00	year
PM	7.6	0.1	0.80	0.03	year
PM_{10}	7.6	0.1	0.80	0.03	year
$PM_{2.5}$	7.6	0.1	0.80	0.03	year
HC/VOCs	5.5	0.1	0.58	0.02	year

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Acetaldehyde	0.00847	3.7E-05	9.0E-04	3.3E-01	year
Acrolein	0.0027	1.2E-05	2.9E-04	1.0E-01	24-hr
Ammonia	3.2	1.4E-02	3.4E-01	1.2E+02	24-hr
Arsenic	0.0002	8.8E-07	2.1E-05	7.7E-03	--
Benzene	0.0058	2.6E-05	6.1E-04	2.2E-01	year
Beryllium	0.000012	5.3E-08	1.3E-06	4.6E-04	year
Cadmium	0.0011	4.9E-06	1.2E-04	4.3E-02	year
Chromium (total)	0.0014	6.2E-06	1.5E-04	5.4E-02	year
Chromium (VI)	0.000056	2.5E-07	5.9E-06	2.2E-03	--
Cobalt	0.000084	3.7E-07	8.9E-06	3.2E-03	year
Copper	0.00085	3.8E-06	9.0E-05	3.3E-02	24-hr
Ethylbenzene	0.0069	3.0E-05	7.3E-04	2.7E-01	1-hr
Formaldehyde	0.075	3.3E-04	7.9E-03	2.9E+00	year
Hexane	1.8	7.9E-03	1.9E-01	7.0E+01	year
Lead	0.0005	2.2E-06	5.3E-05	1.9E-02	24-hr
Manganese	0.00038	1.7E-06	4.0E-05	1.5E-02	year
Mercury	0.00026	1.1E-06	2.8E-05	1.0E-02	24-hr
Naphthalene	0.00061	2.7E-06	6.5E-05	2.4E-02	24-hr
Nickel	0.0021	9.3E-06	2.2E-04	8.1E-02	year
Polycyclic Organic Matter	0.0019	8.4E-06	2.0E-04	7.3E-02	year
2-Methylnaphthalene	0.000024	1.1E-07	2.5E-06	9.3E-04	--
3-Methylchloranthrene	0.0000018	7.9E-09	1.9E-07	7.0E-05	--
7,12-Dimethylbenz(a)anthracene	0.000016	7.1E-08	1.7E-06	6.2E-04	--
Acenaphthene	0.0000018	7.9E-09	1.9E-07	7.0E-05	--
Acenaphthylene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Anthracene	0.0000024	1.1E-08	2.5E-07	9.3E-05	year
Benz(a)anthracene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Benzo(a)pyrene	0.0000012	5.3E-09	1.3E-07	4.6E-05	--
Benzo(b)fluoranthene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Benzo(g,h,i)perylene	0.0000012	5.3E-09	1.3E-07	4.6E-05	year
Benzo(k)fluoranthene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Chrysene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Dibenzo(a,h)anthracene	0.0000012	5.3E-09	1.3E-07	4.6E-05	year
Dichlorobenzene	0.0012	5.3E-06	1.3E-04	4.6E-02	--

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Fluoranthene	0.000003	1.3E-08	3.2E-07	1.2E-04	--
Fluorene	2.80E-06	1.2E-08	3.0E-07	1.1E-04	year
Indeno(1,2,3-cd)pyrene	1.80E-06	7.9E-09	1.9E-07	7.0E-05	--
Naphthalene	6.10E-04	2.7E-06	6.5E-05	2.4E-02	year
Phenanthrene	1.70E-05	7.5E-08	1.8E-06	6.6E-04	year
Pyrene	5.00E-06	2.2E-08	5.3E-07	1.9E-04	--
Propylene	5.30E-01	2.3E-03	5.6E-02	2.0E+01	--
Selenium	2.40E-05	1.1E-07	2.5E-06	9.3E-04	24-hr
Toluene	2.65E-02	1.2E-04	2.8E-03	1.0E+00	24-hr
Vanadium	2.30E-03	1.0E-05	2.4E-04	8.9E-02	24-hr
Xylenes	1.97E-02	8.7E-05	2.1E-03	7.6E-01	24-hr

Table 5: Estimated Maximum Potential Emissions from the New Water Heaters

Criteria Pollutant	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(tons/year)	(lbs/day)	(lbs/hour)	
NO_X	24.8	0.1	0.58	0.02	year
CO	37.7	0.4	0.89	0.08	year
SO_2	0.6	0.003	0.014	0.00	year
PM	7.6	0.0	0.18	0.01	year
PM_{10}	7.6	0.0	0.18	0.01	year
$PM_{2.5}$	7.6	0.0	0.18	0.01	year
HC/VOCs	5.5	0.0	0.13	0.01	year
Washington Toxic Air Pollutants	**Emission Factor (lbs/10^6 scf nat gas)**	**Emissions**			**Regulatory Averaging Period**
		(lbs/hour)	**(lbs/day)**	**(lbs/year)**	
Acetaldehyde	0.00847	8.3E-06	2.0E-04	7.3E-02	year
Acrolein	0.0027	2.6E-06	6.4E-05	2.3E-02	24-hr
Ammonia	3.2	3.1E-03	7.5E-02	2.7E+01	24-hr
Arsenic	0.0002	2.0E-07	4.7E-06	1.7E-03	--
Benzene	0.0058	5.7E-06	1.4E-04	5.0E-02	year
Beryllium	0.000012	1.2E-08	2.8E-07	1.0E-04	year
Cadmium	0.0011	1.1E-06	2.6E-05	9.4E-03	year
Chromium (total)	0.0014	1.4E-06	3.3E-05	1.2E-02	year
Chromium (VI)	0.000056	5.5E-08	1.3E-06	4.8E-04	--

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Cobalt	0.000084	8.2E-08	2.0E-06	7.2E-04	year
Copper	0.00085	8.3E-07	2.0E-05	7.3E-03	24-hr
Ethylbenzene	0.0069	6.8E-06	1.6E-04	5.9E-02	1-hr
Formaldehyde	0.075	7.4E-05	1.8E-03	6.4E-01	year
Hexane	1.8	1.8E-03	4.2E-02	1.5E+01	year
Lead	0.0005	4.9E-07	1.2E-05	4.3E-03	24-hr
Manganese	0.00038	3.7E-07	8.9E-06	3.3E-03	year
Mercury	0.00026	2.5E-07	6.1E-06	2.2E-03	24-hr
Naphthalene	0.00061	6.0E-07	1.4E-05	5.2E-03	24-hr
Nickel	0.0021	2.1E-06	4.9E-05	1.8E-02	year
Polycyclic Organic Matter	0.0019	1.9E-06	4.5E-05	1.6E-02	year
2-Methylnaphthalene	0.000024	2.4E-08	5.6E-07	2.1E-04	--
3-Methylchloranthrene	0.0000018	1.8E-09	4.2E-08	1.5E-05	--
7,12-Dimethylbenz(a)anthracene	0.000016	1.6E-08	3.8E-07	1.4E-04	--
Acenaphthene	0.0000018	1.8E-09	4.2E-08	1.5E-05	--
Acenaphthylene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Anthracene	0.0000024	2.4E-09	5.6E-08	2.1E-05	year
Benz(a)anthracene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Benzo(a)pyrene	0.0000012	1.2E-09	2.8E-08	1.0E-05	--
Benzo(b)fluoranthene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Benzo(g,h,i)perylene	0.0000012	1.2E-09	2.8E-08	1.0E-05	year
Benzo(k)fluoranthene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Chrysene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Dibenzo(a,h)anthracene	0.0000012	1.2E-09	2.8E-08	1.0E-05	year
Dichlorobenzene	0.0012	1.2E-06	2.8E-05	1.0E-02	--
Fluoranthene	0.000003	2.9E-09	7.1E-08	2.6E-05	--
Fluorene	2.80E-06	2.7E-09	6.6E-08	2.4E-05	year
Indeno(1,2,3-cd)pyrene	1.80E-06	1.8E-09	4.2E-08	1.5E-05	--
Naphthalene	6.10E-04	6.0E-07	1.4E-05	5.2E-03	year
Phenanthrene	1.70E-05	1.7E-08	4.0E-07	1.5E-04	year
Pyrene	5.00E-06	4.9E-09	1.2E-07	4.3E-05	--
Propylene	5.30E-01	5.2E-04	1.2E-02	4.6E+00	--
Selenium	2.40E-05	2.4E-08	5.6E-07	2.1E-04	24-hr
Toluene	2.65E-02	2.6E-05	6.2E-04	2.3E-01	24-hr

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Vanadium	2.30E-03	2.3E-06	5.4E-05	2.0E-02	24-hr
Xylenes	1.97E-02	1.9E-05	4.6E-04	1.7E-01	24-hr

6.4 Comparison – Netting Analysis

Past actual TAP emission rates for the existing boilers and water heaters were calculated using the emission factors in Table 3 and actual natural gas throughput averaged over 2 consecutive years in which Facility production was representative of normal operating conditions. To identify production rates during these years, annual natural gas purchase reports from 2016 through 2021 were examined. The reported natural gas quantities are provided in Tables B-1 and B-2 in Appendix B.

The differences in potential TAP emissions between the operation of the new boilers and water heaters and the past actual emissions from the existing boilers and water heaters are provided in Table 6. The SQERs promulgated in WAC 173-460-150 are also provided for comparison.

Table 6: Comparison of Potential Emissions to WAC 173-460-150 Small-Quantity Emission Rates

TAP	Averaging Period	New Boiler Emissions (lb/avg per)	Existing Boiler Emissions (lb/avg per)	New Water Heaters Emissions (lb/avg per)	Existing Water Heaters (lb/avg per)	Net Change in Emissions (lb/avg per)	SQER (lb/avg per)	Modeling Required?
Acetaldehyde	year	3.27E-01	-7.85E-02	7.27E-02	-1.62E-02	3.05E-01	6.00E+01	No
Acrolein	24-hr	2.86E-04	-6.85E-05	6.35E-05	-1.41E-05	2.67E-04	2.60E-02	No
Ammonia	24-hr	3.39E-01	-8.12E-02	7.53E-02	-1.67E-02	3.16E-01	3.70E+01	No
Arsenic	year	7.73E-03	-1.85E-03	1.72E-03	-3.82E-04	7.21E-03	4.90E-02	No
Benzene	year	2.24E-01	-5.37E-02	4.98E-02	-1.11E-02	2.09E-01	2.10E+01	No
Beryllium	year	4.64E-04	-1.11E-04	1.03E-04	-2.29E-05	4.33E-04	6.80E-02	No
Cadmium	year	4.25E-02	-1.02E-02	9.45E-03	-2.10E-03	3.97E-02	3.90E-02	Yes
Chromium (VI)	year	2.16E-03	-5.19E-04	4.81E-04	-1.07E-04	2.02E-03	6.50E-04	Yes
Cobalt	24-hr	8.89E-06	-2.13E-06	1.98E-06	-4.39E-07	8.30E-06	7.40E-03	No
Copper	1-hr	3.75E-06	-8.99E-07	8.33E-07	-1.85E-07	3.50E-06	1.90E-01	No
Ethylbenzene	year	2.67E-01	-6.39E-02	5.93E-02	-1.32E-02	2.49E-01	6.50E+01	No
Formaldehyde	year	2.90E+00	-6.95E-01	6.44E-01	-1.43E-01	2.70E+00	2.70E+01	No
Hexane	24-hr	1.91E-01	-4.57E-02	4.24E-02	-9.41E-03	1.78E-01	5.20E+01	No
Lead	year	1.93E-02	-4.63E-03	4.29E-03	-9.54E-04	1.80E-02	1.40E+01	No
Manganese	24-hr	4.02E-05	-9.64E-06	8.94E-06	-1.99E-06	3.75E-05	2.20E-02	No
Mercury	24-hr	2.75E-05	-6.60E-06	6.12E-06	-1.36E-06	2.57E-05	2.20E-03	No

TAP	Averaging Period	New Boiler Emissions (lb/avg per)	Existing Boiler Emissions (lb/avg per)	New Water Heaters Emissions (lb/avg per)	Existing Water Heaters (lb/avg per)	Net Change in Emissions (lb/avg per)	SQER (lb/avg per)	Modeling Required?
Nickel	year	8.12E-02	-1.95E-02	1.80E-02	-4.01E-03	7.57E-02	6.20E-01	No
Benz(a)-anthracene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
Benzo(a)-pyrene	year	4.64E-05	-1.11E-05	1.03E-05	-2.29E-06	4.33E-05	1.60E-01	No
Benzo(b)-fluoranthene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
Benzo(k)-fluoranthene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
Chrysene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E+00	No
Dibenzo(a,h)-anthracene	year	4.64E-05	-1.11E-05	1.03E-05	-2.29E-06	4.33E-05	8.20E-02	No
Dichloro-benzene	year	4.64E-02	-1.11E-02	1.03E-02	-2.29E-03	4.33E-02	1.50E+01	No
7,12-Dimethylbenz-(a)anthracene	year	6.18E-04	-1.48E-04	1.37E-04	-3.05E-05	5.77E-04	1.40E-03	No
Indeno(1,2,3-cd)pyrene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
3-Methylchlor-anthrene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	1.60E-02	No
Naphthalene	year	2.36E-02	-5.65E-03	5.24E-03	-1.16E-03	2.20E-02	4.80E+00	No
Propylene	24-hr	5.61E-02	-1.35E-02	1.25E-02	-2.77E-03	5.24E-02	2.20E+02	No
Selenium	24-hr	2.54E-06	-6.09E-07	5.65E-07	-1.26E-07	2.37E-06	1.50E+00	No
Toluene	24-hr	2.81E-03	-6.73E-04	6.24E-04	-1.39E-04	2.62E-03	3.70E+02	No
Vanadium	24-hr	2.44E-04	-5.84E-05	5.41E-05	-1.20E-05	2.27E-04	7.40E-03	No
Xylenes	24-hr	2.09E-03	-5.00E-04	4.64E-04	-1.03E-04	1.95E-03	1.60E+01	No

Abbreviations and Acronyms:

avg = average
lb = pound
SQER = small-quantity emission rate
TAP = toxic air pollutant

Results indicate that emissions of cadmium and hexavalent chromium are greater than the applicable SQER and, therefore, will require a modeling analysis.

7.0 COMPLIANCE WITH APPLICABLE REQUIREMENTS

This section discusses the estimated emissions in relation to the applicable requirements.

7.1 Washington Administrative Code Requirements

The project and its estimated emissions in relation to the applicable WAC requirements are discussed in the subsections below.

7.1.1 WAC 173-400-050: Emission Standards for Combustion Units.

This provision limits the emissions of PM to 0.23 grams per dry cubic meter at standard conditions (0.1 grain per dry standard cubic foot). The proposed boilers are identical to the proposed boilers, so it is expected that the new boilers will continue to meet the limit established by this regulation.

7.1.2 WAC 173-400-075: Emission Standards for Sources Emitting Hazardous Air Pollutants

See Section 5.3 for a discussion of HAP compliance.

7.1.3 WAC 173-400-110: New Source Review

The proposed new boilers are a modification to an existing stationary source and a modification to a source of TAPs. NSR is required for natural gas-fired combustion units with a heat input of >4 MMBtu/hr. The new boilers have a combined rated heat input of 4.5 MMBtu/hr, so they are not categorically exempt from NSR.

7.1.4 WAC 173-400-113: New Sources in Attainment or Unclassifiable Areas

As required under WAC 173-400-113, this project will comply with the following regulatory requirements:

1. Compliance with New Source Performance Standards is addressed in Section 5.2. Compliance with National Emission Standards for Hazardous Air Pollutants is addressed in Section 5.3.
2. A BACT review and recommendation for this project are provided in Section 8.
3. Compliance with ambient air quality standards for criteria pollutants is discussed in Section 9.

7.2 Chapter 173-401 WAC: Operating Permit Regulation

The Facility is not considered a major source under Chapter 173-401 WAC.

7.3 Chapter 173-460 WAC: Controls for Sources of Toxic Air Pollutants

See Sections 6.4 and 9 for a discussion of TAP emissions compliance.

8.0 BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

BACT proposals for the natural gas boilers and water heaters are summarized in Table 7. The NO_X proposed BACT was based on the South Coast Air Quality Management District (SCAQMD) Rule 1146.2 (SCAQMD 2018). Vendor specification sheets and a low NO_X approval certificate from SCAQMD are provided in Appendix C. CO is the presumptive BACT for natural gas boilers.

Table 7: Proposed Best Available Control Technology

Pollutant	Proposed BACT Limit/Work Practice
SO_2	Good combustion practices and natural gas
VOCs	Good combustion practices and natural gas
CO	50 ppmvd @ 3% O_2, 60-minute average
NO_X	20 ppmvd @ 3% O_2, 60-minute average
PM	Good combustion practices and natural gas

9.0 AMBIENT AIR QUALITY IMPACT ANALYSIS

This section discusses the air dispersion modeling conducted for TAPs exceeding the SQERs, for comparison with the acceptable source impact levels (ASILs). Copies of the electronic modeling files and inputs are provided in Appendix D.

Emissions from two TAPs (cadmium and hexavalent chromium) exceed their respective SQERs necessitating a comparison to the ASILs. As discussed in the following subsections, modeled impacts from both are less than their ASILs. Therefore, no second-tier health impact assessment will be conducted.

9.1 Model Methodology and Assumptions

Air dispersion modeling was conducted using version 22112 of the AERMOD[1] modeling system in general accordance with the EPA's 40 CFR 51 Appendix W; Final Rule (EPA 2017).

AERMOD requires input from several pre-processors, described below, for meteorological parameters, downwash parameters, and terrain heights. AERMOD incorporates the data from the pre-processors with emission estimates and physical exhaust release point characteristics to predict ambient concentrations as a result of the proposed project. The model calculates concentrations based on various averaging times (e.g., 1 hour, 24 hours, annual, etc.) for a network of receptors and results are compared to air quality standards.

AERMOD was used to estimate the annual average impacts of cadmium and hexavalent chromium emissions.

9.1.1 Stack Parameters

Three release points were modeled, a stack releasing the combined emissions of all three boilers, and two capped stacks releasing emissions from each water heater. Emissions from the water heaters are divided evenly between the two stacks. The boiler stack releases from the rooftop of Alford-Montgomery Hall. The water heater stacks release from a small utility building south of Alford-Montgomery Hall. Source identification and stack parameters are provided in Table 8. Each stack is shown as a blue point relative to the buildings as shown on Figure 4.

[1] American Meteorological Society (AMS)/US Environmental Protection Agency (EPA) Regulatory Model.

Table 8: AERMOD Stack Parameters

Source ID	Source Type	UTM Easting (Zone 10N)	UTM Northing (Zone 10N)	Release Height (m)	Elevation (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
BOILER	POINT	687393.00	5208971.00	11.1	488	372.0	6.4	0.2
WHEATER1	POINTCAP	687414.00	5208912.00	8.0	488	327.6	5.8	0.1
WHEATER2	POINTCAP	687414.00	5208912.45	8.0	488	327.6	5.8	0.1

Abbreviations and Acronyms:

K = Kelvin
m = meters
m/s = meters per second
UTM = universal transverse mercator

Figure 4: AERMOD Model Setup

9.1.2 Building Downwash

Building downwash occurs when the aerodynamic turbulence induced by nearby buildings causes a pollutant emitted from an elevated source to be mixed rapidly toward the ground (downwash), resulting in higher ground-level pollutant concentrations. The Building Profile Input Program-Plume Rise Model Enhancements was used to determine if exhaust from emission units would be affected by nearby building structures. In general, these determinations are made if a stack's height is less than the height defined by the EPA's Good Engineering Practice (GEP) stack height.

GEP stack height is defined as the height of the nearby structure(s) measured from the ground-level elevation at the base of the stack plus 1.5 times the lesser dimension, height, or projected width of the nearby structure(s).

Two buildings were included in the model setup, Alford-Montgomery Hall, and the water heater utility building. Both were assumed to be a single tier of a height equal to the highest point of the roof line. Building elevations and heights are provided in Table 9, and the location of each building is shown on Figure 4.

Table 9: Building Elevations and Heights

Building ID	Elevation (m)	Height (m)
AlfordMont	488	10.7
WWendellHTR	488	7.6

9.1.3 Receptor Grid

To model complex terrain, AERMOD requires information about the surrounding terrain. The AMS/EPA Regulatory Model Terrain Pre-processor (AERMAP, version 18081) was used to obtain the hill height scale and the base elevation for each receptor location.

A receptor flagpole height of 1.5 meters (m) above ground was defined to approximate the human breathing zone. The ambient air boundary was defined as the perimeters of the included buildings. The receptor grid near the project is shown overlaid on aerial imagery on Figure 5. The receptor grid spacing increases with distance from this boundary, as listed below:

- 12.5-m spacing from the ambient air boundary to 150 m
- 25-m spacing from 150 m to 400 m
- 50-m spacing from 400 m to 900 m
- 100-m spacing from 900 m to 2,000 m.

AERMAP requires the use of topographic data to estimate surface elevations above mean sea level. Digital topographic data (in the form of National Elevation Data files) with a resolution of approximately 10 m (⅓ arc-second) were used.

Figure 5: Receptor Locations near Project

9.1.4 Meteorology

The AERMOD Meteorological Pre-Processor (AERMET; Version 22112) is the meteorological pre-processor model that estimates boundary-layer parameters for use in AERMOD. AERMET processes formatted meteorological data from observation stations and generates two input files for the AERMOD model: the Surface File with hourly boundary-layer parameter estimates; and the Profile File with multi-level observations of wind speed, wind direction, temperature, and standard deviations of fluctuating wind components. Five years (January 1, 2016 through December 31, 2020) of meteorological observation data were processed by AERMET for this project as described below.

9.1.4.1 Surface Observations

National Weather Service (NWS) hourly surface observations from Bowers Field Airport (call sign KELN) in Ellensburg, Washington were used to provide surface-level observations. The airport is located approximately 1.5 miles from the project.

AERMINUTE was run to reduce the instance of "calms." A potential concern related to the use of meteorological data for dispersion modeling is the high incidence of "calms," or periods of time with low wind speeds. NWS and Federal Aviation Administration data coding defines a wind speed of less than 3 knots as "calm" and assigns a value of 0 knots. This results in an overestimation of the amount of calm conditions. Similarly, if wind speed is up to 6 knots, but wind direction varies more than 60 degrees during a 2-minute averaging period, wind direction is reported as "missing." AERMINUTE reprocesses Automated Surface Observation System 1-minute wind data at a lower threshold and calculates hourly average wind speed and directions to supplement the standard hourly data processed in AERMET.

A wind rose showing trends in wind direction in degrees and speed in meters per second (m/s) is provided as Figure 6. This figure shows that high-speed winds are primarily from the northwest. Lower wind speeds are common from all directions, but come especially frequently from the east and northwest.

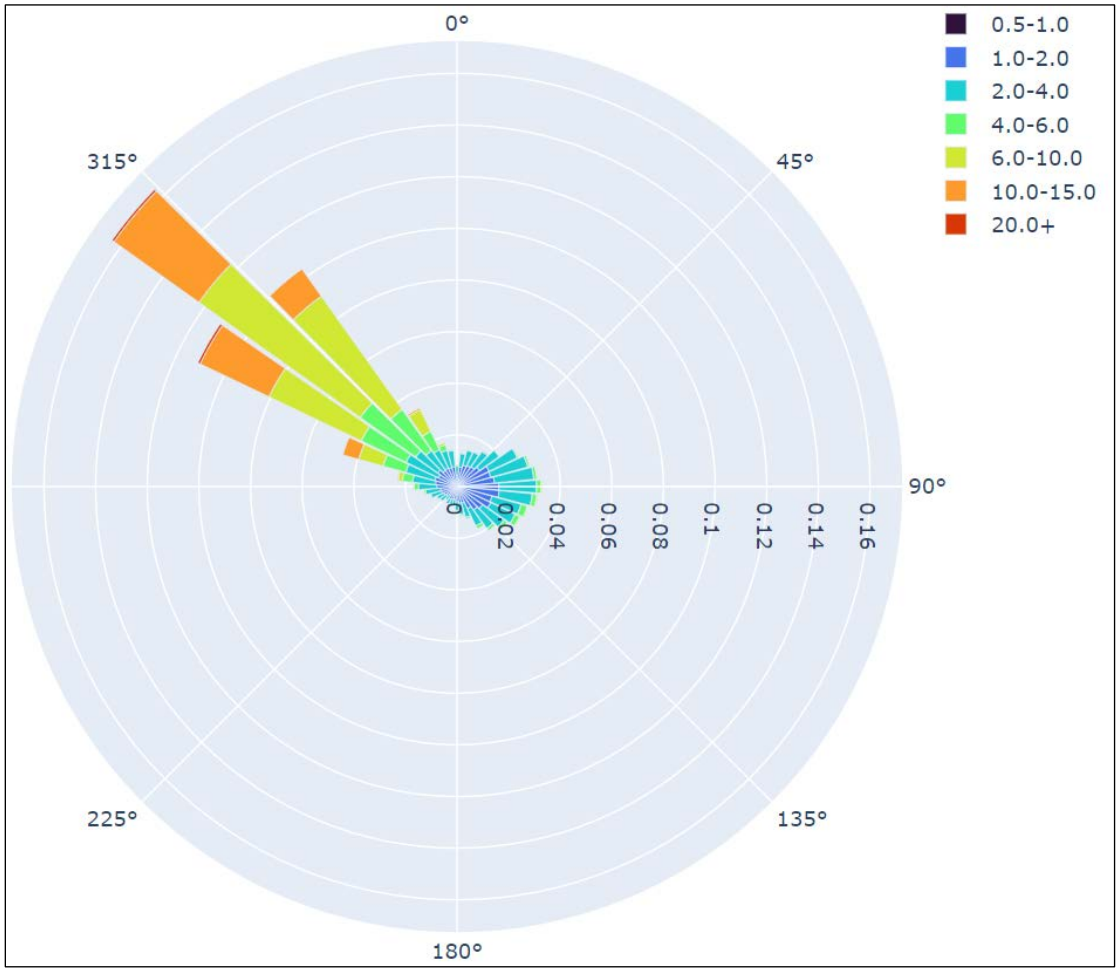

Figure 6: Wind Rose for KELN – 2016 through 2020

9.1.4.2 Upper Air Soundings

NWS twice-daily upper air soundings were obtained from Spokane, Washington from the RAwinsionde Observation database in FSL format. This station is located approximately 150 miles northeast of the project.

9.1.4.3 Surface Characteristics

Surface characteristics of albedo, Bowen ratio, and surface roughness are used by AERMET in stage 3 of the processing. Albedo is a measure of the solar radiation reflected back from earth into space. The Bowen ratio is an evaporation-related measurement and is defined as the ratio of sensible heat to latent heat. The surface roughness length is the theoretical height above ground where the wind speed becomes zero.

AERSURFACE version 20060 was used to determine the albedo, Bowen ratio, and surface roughness based on data on the use of land surrounding the surface observation site from the 2016 National Land Cover Database (USGS 1992). AERSURFACE calculates the percentage of land-use type within each of 12 equal sectors of a circle centered on the surface station tower. The default study radii of 1 kilometer (km) for surface roughness and 10 km for the Bowen ratio and albedo were used. Default months were assigned in AERSURFACE to represent the four seasonal categories as follows: 1) mid-summer with lush vegetation; 2) autumn with unharvested cropland; 3) winter with continuous snow; and 4) transitional spring with partial green coverage or short annuals. The AERSURFACE designation for an airport location (with the assumed surface roughness calculated based on 95 percent transportation and 5 percent commercial and industrial) is appropriate for this site for all sectors.

9.1.5 First-Tier Screening of Toxic Air Pollutant Impacts

A first-tier TAP assessment compares the forecast emission rates to the SQERs and compares the maximum ambient concentrations to ASILs. Table 6 shows the estimated project emission rates for each TAP emitted, and compares those emission rates to the corresponding SQER. Each SQER is an emission rate threshold, below which Ecology does not require an air quality impact assessment for the corresponding TAP. As shown in Table 6, estimated project-only emissions of cadmium and hexavalent chromium are greater than their respective SQERs, so an ambient impact analysis was completed for those TAPs.

Ecology requires facilities to conduct a first-tier screening analysis for each TAP whose emissions exceed its SQER by modeling the 1st-highest 1-hour, 1st-highest 24-hour, and annual ambient impacts (depending on the TAP of interest), then comparing the modeled values to the ASILs (WAC 173-460-080). The ASILs for both TAPs examined are annual averages, so only annual modeling was conducted.

9.2 Predicted Toxic Air Pollutant Ambient Concentrations

The first-tier ambient concentration analysis for cadmium and hexavalent chromium is summarized in Table 10. These results show that maximum modeled ambient concentrations for both TAPs are less than their respective ASILs. Because all examined pollutants pass first-tier screening requirements, no further evaluation is required.

Table 10: Comparison of Modeled Concentrations to ASILs

Pollutant	Averaging Period	AERMOD Concentration (µg/m^3)	ASIL (µg/m^3)	Over ASIL?
Cadmium	Annual	5.87E-05	2.40E-04	No
Chromium	Annual	2.99E-06	4.00E-06	No

Abbreviations and Acronyms:

ASIL = acceptable source impact level
µg/m^3 = micrograms per cubic meter

10.0 USE OF THIS REPORT

This report has been prepared for the exclusive use of MW Engineers for specific application to the Central Washington University North Campus heating upgrades project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau, shall be at the user's sole risk. Landau warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. Landau makes no other warranty, either express or implied.

11.0 REFERENCES

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APPENDIX A

Notice of Construction Application Form

Notice of Construction Application

A notice of construction permit is required before installing a new source of air pollution or modifying an existing source of air pollution. This application applies to facilities in Ecology's jurisdiction. Submit this application for review of your project. For general information about completing the application, refer to Ecology Forms ECY 070-410a-g, "Instructions for Ecology's Notice of Construction Application."

Ecology offers up to two hours of free pre-application assistance. We encourage you to schedule a pre-application meeting with the contact person specified for the location of your proposal, below. If you use up your two hours of free pre-application assistance, we will continue to assist you after you submit Part 1 of the application and the application fee. You may schedule a meeting with us at any point in the process.

Upon completion of the application, please enclose a check for the initial fee and mail to:

Department of Ecology
Cashiering Unit
P.O. Box 47611
Olympia, WA 98504-7611

For Fiscal Office Use Only:
001-NSR-216-0299-000404

Check the box for the location of your proposal. For assistance, call the contact listed below:		
	Ecology Permitting Office	**Contact**
☒ **CRO**	**Chelan, Douglas, Kittitas, Klickitat, or Okanogan County** Ecology Central Regional Office – Air Quality Program	Lynnette Haller (509) 457-7126 lynnette.haller@ecy.wa.gov
☐ **ERO**	**Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla or Whitman County** Ecology Eastern Regional Office – Air Quality Program	Karin Baldwin (509) 329-3452 karin.baldwin@ecy.wa.govmailto:gregory.flibbert@ecy.wa.gov
☐ **NWRO**	**San Juan County** Ecology Northwest Regional Office – Air Quality Program	David Adler (425) 649-7267 david.adler@ecy.wa.gov
☐ **IND**	**For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters** Ecology Industrial Section – Waste 2 Resources Program Permit manager: _____	James DeMay (360) 407-6868 james.demay@ecy.wa.gov
☐ **NWP**	**For actions taken on the US Department of Energy Hanford Reservation** Ecology Nuclear Waste Program	Lilyann Murphy (509) 372-7951 lilyann.murphy@ecy.wa.gov

Check the box below for the fee that applies to your application.

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Construction Application

New project or equipment:

☒	**$1,500: Basic project** initial fee covers up to 16 hours of review.
☐	**$10,000: Complex project** initial fee covers up to 106 hours of review.

Change to an existing permit or equipment:

☐	**$200: Administrative or simple change** initial fee covers up to 3 hours of review Ecology may determine your change is complex during completeness review of your application. If your project is complex, you must pay the additional $675 before we will continue working on your application.
☐	**$875: Complex change** initial fee covers up to 10 hours of review
☐	**$350** flat fee: **Replace or alter control technology equipment under WAC 173-400-114** Ecology will contact you if we determine your change belongs in another fee category. You must pay the fee associated with that category before we will continue working on your application.

Read each statement, then check the box next to it to acknowledge that you agree.	
☒	The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours Ecology spends exceeds the hours included in your initial fee, Ecology will bill you $95 per hour for the extra time.
☒	You must include all information requested by this application. Ecology may not process your application if it does not include all the information requested.
☒	Submittal of this application allows Ecology staff to visit and inspect your facility.

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Construction Application

Part 1: General Information

I. Project, Facility, and Company Information

1. Project Name CWU Student Village New Boilers and Water Heaters
2. Facility Name Central Washington University
3. Facility Street Address 400 East University Way
4. Facility Legal Description TOWN EBURG COLLEGE ADDITION BLOCK 7
5. Company Legal Name (if different from Facility Name)
6. Company Mailing Address (street, city, state, zip) 205 East 11th Avenue, Ellensburg, WA 98926

II. Contact Information and Certification

1. Facility Contact Name (who will be onsite) Jeremiah Eilers	
2. Facility Contact Mailing Address (if different than Company Mailing Address)	
3. Facility Contact Phone Number 509-929-0224	4. Facility Contact E-mail Jeremiah.Eilers@cwu.edu
5. Billing Contact Name (who should receive billing information) Kathleen Reeder	
6. Billing Contact Mailing Address (if different than Company Mailing Address) 205 East 11th Avenue, Ellensburg, WA 98926	
7. Billing Contact Phone Number 509-963-1538	8. Billing Contact E-mail Kathleen.Reeder@cwu.edu
9. Consultant Name (optional – if 3rd party hired to complete application elements) Kathryn Baker	
10. Consultant Organization/Company Landau Associates, Inc.	
11. Consultant Mailing Address (street, city, state, zip) 155 NE 100th St, Ste 302, Seattle, WA 98125	
12. Consultant Phone Number 425-329-0305	13.Consultant E-mail kbaker@landauinc.com
14. Responsible Official Name and Title (who is responsible for project policy or decision-making) Delano Palmer	
16. Responsible Official Phone 509-963-2906	17. Responsible Official E-mail Delano.Palmer@cwu.edu
18. Responsible Official Certification and Signature I certify that the information on this application is accurate and complete. Signature [signature] Date 9/1/22	

Part 2: Technical Information

Notice of Construction Application
Part 2: Technical Information

The Technical Information may be sent with this application form to the Cashiering Unit, or may be sent directly to the Ecology regional office with jurisdiction along with a copy of this application form.

For all sections, check the box next to each item as you complete it.

III. Project Description

Please attach the following to your application.

☒ Written narrative describing your proposed project.
☒ Projected construction start and completion dates.
☒ Operating schedule and production rates.
☒ List of all major process equipment with manufacturer and maximum rated capacity.
☒ Process flow diagram with all emission points identified.
☒ Plan view site map.

☒ Manufacturer specification sheets for major process equipment components.
☒ Manufacturer specification sheets for pollution control equipment.
☒ Fuel specifications, including type, consumption (per hour & per year) and percent sulfur.

IV. State Environmental Policy Act (SEPA) Compliance

Check the appropriate box below.

☐ SEPA review is complete:
Include a copy of the final SEPA checklist and SEPA determination (e.g., DNS, MDNS, EIS) with your application.

☒ SEPA review has not been conducted:

☐ If review will be conducted by another agency, list the agency. You must provide a copy of the final SEPA checklist and SEPA determination before Ecology will issue your permit.
Agency Reviewing SEPA:

_____

☒ If the review will be conducted by Ecology, fill out a SEPA checklist and submit it with your application. You can find a SEPA checklist online at https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-document-templates

Notice of Construction Application

V. Emissions Estimations of Criteria Pollutants

Does your project generate criteria air pollutant emissions? ☒ Yes ☐ No

If yes, please provide the following information regarding your criteria emissions in your application.

☒ The names of the criteria air pollutants emitted (i.e., NO_x, SO_2, CO, $PM_{2.5}$, PM_{10}, TSP, VOC, and Pb)

☒ Potential emissions of criteria air pollutants in tons per hour, tons per day, and tons per year (include calculations)

☒ If there will be any fugitive criteria pollutant emissions, clearly identify the pollutant and quantity

VI. Emissions Estimations of Toxic Air Pollutants

Does your project generate toxic air pollutant emissions? ☒ Yes ☐ No

If yes, please provide the following information regarding your toxic air pollutant emissions in your application.

☒ The names of the toxic air pollutants emitted (specified in WAC 173-460-150[1])

☒ Potential emissions of toxic air pollutants in pounds per hour, pounds per day, and pounds per year (include calculations)

☒ If there will be any fugitive toxic air pollutant emissions, clearly identify the pollutant and quantity

VII. Emission Standard Compliance

☒ Provide a list of all applicable new source performance standards, national emission standards for hazardous air pollutants, national emission standards for hazardous air pollutants for source categories, and emission standards adopted under Chapter 70.94 RCW.

Does your project comply with all applicable standards identified? ☒ Yes ☐ No

VIII. Best Available Control Technology

☒ Provide a complete evaluation of Best Available Control Technology (BACT) for your proposal.

[1] http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Construction Application

IX. Ambient Air Impacts Analyses

Please provide the following:

☐ Ambient air impacts analyses for Criteria Air Pollutants (including fugitive emissions)

☒ Ambient air impacts analyses for Toxic Air Pollutants (including fugitive emissions)

☒ Discharge point data for each point included in air impacts analyses (include only if modeling is required)

- ☒ Exhaust height
- ☒ Exhaust inside dimensions (ex. diameter or length and width)
- ☒ Exhaust gas velocity or volumetric flow rate
- ☒ Exhaust gas exit temperature
- ☒ The volumetric flow rate
- ☒ Description of the discharges (i.e., vertically or horizontally) and whether there are any obstructions (ex., raincap)
- ☒ Identification of the emission unit(s) discharging from the point
- ☒ The distance from the stack to the nearest property line
- ☒ Emission unit building height, width, and length
- ☒ Height of tallest building on-site or in the vicinity and the nearest distance of that building to the exhaust
- ☒ Whether the facility is in an urban or rural location

Does your project cause or contribute to a violation of any ambient air quality standard or acceptable source impact level? ☐ Yes ☒ No

APPENDIX B

Results of Emission Evaluations

Table B-1
Central Washington University (CWU)
Past Actual Boiler Emissions
Ellensburg, Washington

Actual Usage - 2016 - 2021

	All Boilers (therms/year)	All Boilers (mmbtu/year)	All Boilers (mmbtu/hr)
2016	111,171	11,117	1.27
2017	114,817	11,482	1.31
2018	95,725	9,572	1.09
2019	93,265	9,327	1.06
2020	72,147	7,215	0.82
2021	71,655	7,165	0.82

Boiler Emission Calculations - Gas Combustion - Past Actual Emissions

All Boilers - NG Heat Input 1.1 MMBtu/hr
Annual Operating Hours 8760 hr/yr

Toxic Air Pollutant	CAS	Gas Emission Factor [a] (lb/MMscf)	Gas Emission Factor [a] (lb/MMBtu)	Boiler Gas Hourly Emissions [b] (lb/hr)	Gas Daily Emissions [c] (lb/day)	Gas Annual Emissions [d] (lb/yr)
Acetaldehyde	75-07-0	0.00847	8.30E-06	9.0E-06	2.1E-04	7.8E-02
Acrolein[f]	107-02-8	0.0027	2.65E-06	2.9E-06	6.9E-05	2.5E-02
Ammonia[g]	7664-41-7	3.2	3.14E-03	3.4E-03	8.1E-02	3.0E+01
Arsenic	7440-38-2	0.0002	1.96E-07	2.1E-07	5.1E-06	1.9E-03
Benzene[f]	71-43-2	0.0058	5.69E-06	6.1E-06	1.5E-04	5.4E-02
Beryllium	7440-41-7	0.000012	1.18E-08	1.3E-08	3.0E-07	1.1E-04
Cadmium	7440-43-9	0.0011	1.08E-06	1.2E-06	2.8E-05	1.0E-02
Chromium(total)	7440-47-3	0.0014	1.37E-06	1.5E-06	3.6E-05	1.3E-02
Chromium(VI)[e]	18540-29-9	0.000056	5.49E-08	5.9E-08	1.4E-06	5.2E-04
Cobalt	7440-48-4	0.000084	8.24E-08	8.9E-08	2.1E-06	7.8E-04
Copper	7440-50-8	0.00085	8.33E-07	9.0E-07	2.2E-05	7.9E-03
Ethylbenzene[f]	100-41-4	0.0069	6.76E-06	7.3E-06	1.8E-04	6.4E-02
Formaldehyde	50-00-0	0.075	7.35E-05	7.9E-05	1.9E-03	6.9E-01
Hexane	110-54-3	1.8	1.76E-03	1.9E-03	4.6E-02	1.7E+01
Lead	7439-92-1	0.0005	4.90E-07	5.3E-07	1.3E-05	4.6E-03
Manganese	7439-96-5	0.00038	3.73E-07	4.0E-07	9.6E-06	3.5E-03
Mercury	7439-97-6	0.00026	2.55E-07	2.7E-07	6.6E-06	2.4E-03
Naphthalene	91-20-3	0.00061	5.98E-07	6.5E-07	1.5E-05	5.7E-03
Nickel	7440-02-0	0.0021	2.06E-06	2.2E-06	5.3E-05	1.9E-02
Polycyclic Organic Matter	POM	0.0019	1.86E-06	2.0E-06	4.8E-05	1.8E-02
2-Methylnaphthalene	91-57-6	0.000024	2.35E-08	2.5E-08	6.1E-07	2.2E-04
3-Methylchloranthrene	56-49-5	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
7,12-Dimethylbenz(a)anthracene	57-97-6	0.000016	1.57E-08	1.7E-08	4.1E-07	1.5E-04
Acenaphthene	83-32-9	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Acenaphthylene	208-96-8	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Anthracene	120-12-7	0.0000024	2.35E-09	2.5E-09	6.1E-08	2.2E-05
Benz(a)anthracene	56-55-3	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Benzo(a)pyrene	50-32-8	0.0000012	1.18E-09	1.3E-09	3.0E-08	1.1E-05
Benzo(b)fluoranthene	205-99-2	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Benzo(g,h,i)perylene	191-24-2	0.0000012	1.18E-09	1.3E-09	3.0E-08	1.1E-05
Benzo(k)fluoranthene	207-08-9	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Chrysene	218-01-9	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Dibenzo(a,h)anthracene	53-70-3	0.0000012	1.18E-09	1.3E-09	3.0E-08	1.1E-05
Dichlorobenzene	106-46-7	0.0012	1.18E-06	1.3E-06	3.0E-05	1.1E-02
Fluoranthene	206-44-0	0.000003	2.94E-09	3.2E-09	7.6E-08	2.8E-05
Fluorene	86-73-7	2.80E-06	2.75E-09	3.0E-09	7.1E-08	2.6E-05
Indeno(1,2,3-cd)pyrene	193-39-5	1.80E-06	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Naphthalene	91-20-3	6.10E-04	5.98E-07	6.5E-07	1.5E-05	5.7E-03
Phenanathrene	85-01-8	1.70E-05	1.67E-08	1.8E-08	4.3E-07	1.6E-04
Pyrene	129-00-0	5.00E-06	4.90E-09	5.3E-09	1.3E-07	4.6E-05
Propylene[f]	115-07-1	5.30E-01	5.20E-04	5.6E-04	1.3E-02	4.9E+00
Selenium	7782-49-2	2.40E-05	2.35E-08	2.5E-08	6.1E-07	2.2E-04
Toluene[f]	108-88-3	2.65E-02	2.60E-05	2.8E-05	6.7E-04	2.5E-01
Vanadium	7440-62-2	2.30E-03	2.25E-06	2.4E-06	5.8E-05	2.1E-02
Xylenes[f]	1330-20-7	1.97E-02	1.93E-05	2.1E-05	5.0E-04	1.8E-01

Notes:

a - Emission factors for toxic air pollutants are the maximum between AP-42 emission factors, mean emission factors from CATEF and Ventura County Air Pollution Control District

b - Hourly Emissions calculated using emission factors (lb/MMBtu) and 1.1 MMBtu/hr.

c - Daily Emissions calculated using hourly emissions and 24 hours of operation per day.

d - Annual Emissions calculated using hourly emissions and 8,760 hours of operation per year.

e - The 2014 NATA used SCC-based speciation factors to speciate total chromium into constituent chromium compounds, provided in Section 2.2.2 of the National Emissions Inventory, version 2 Technical Support Document," July 2018. The speciation factor to calculate Chromium VI from Total Chromium is 0.04. (https://www.epa.gov/sites/default/files/2018-07/documents/nei2014v2_tsd_05jul2018.pdf)

f - Emission factors from AB2588 Combustion Emission Factors (converted to lb/mmbtu using 1020 btu/scf) obtained from Ventura County Air Pollution Control

g - Emission factor from the EPA's Development and Selection of Ammonia Emission Factors (https://www3.epa.gov/ttnchie1/old/efdocs/ammonia.pdf)

Table B-2
Central Washington University (CWU)
Past Actual Gas-Fired Water Heaters
Ellensburg, Washington

Water Heater Emission Calculations - Gas Combustion

	Total (CCF)	Total (Therms)	Total (mmbtu/hr)
2016	16171	16,817	0.192
2017	18051	18,773	0.214
2018	18928	19,685	0.225
2019	18511	19,251	0.220
2020	11712	12,180	0.139
2021	11789	12,261	0.140

Water Heater Emission Calculations - Gas Combustion - Past Actual Emissions

All Water Heaters - NG Heat Input 0.2 MMBtu/hr
Annual Operating Hours 8760 hr/yr

Toxic Air Pollutant	CAS	Gas Emission Factor [a] (lb/MMscf)	Gas Emission Factor [a] (lb/MMBtu)	Gas Hourly Emissions [b] (lb/hr)	Gas Daily Emissions [c] (lb/day)	Gas Annual Emissions [d] (lb/yr)
Acetaldehyde	75-07-0	0.00847	8.30E-06	1.8E-06	4.4E-05	1.6E-02
Acrolein[f]	107-02-8	0.0027	2.65E-06	5.9E-07	1.4E-05	5.2E-03
Ammonia[g]	7664-41-7	3.2	3.14E-03	7.0E-04	1.7E-02	6.1E+00
Arsenic	7440-38-2	0.0002	1.96E-07	4.4E-08	1.0E-06	3.8E-04
Benzene[f]	71-43-2	0.0058	5.69E-06	1.3E-06	3.0E-05	1.1E-02
Beryllium	7440-41-7	0.000012	1.18E-08	2.6E-09	6.3E-08	2.3E-05
Cadmium	7440-43-9	0.0011	1.08E-06	2.4E-07	5.8E-06	2.1E-03
Chromium(total)	7440-47-3	0.0014	1.37E-06	3.1E-07	7.3E-06	2.7E-03
Chromium(VI)[e]	18540-29-9	0.000056	5.49E-08	1.2E-08	2.9E-07	1.1E-04
Cobalt	7440-48-4	0.000084	8.24E-08	1.8E-08	4.4E-07	1.6E-04
Copper	7440-50-8	0.00085	8.33E-07	1.9E-07	4.4E-06	1.6E-03
Ethylbenzene[f]	100-41-4	0.0069	6.76E-06	1.5E-06	3.6E-05	1.3E-02
Formaldehyde	50-00-0	0.075	7.35E-05	1.6E-05	3.9E-04	1.4E-01
Hexane	110-54-3	1.8	1.76E-03	3.9E-04	9.4E-03	3.4E+00
Lead	7439-92-1	0.0005	4.90E-07	1.1E-07	2.6E-06	9.5E-04
Manganese	7439-96-5	0.00038	3.73E-07	8.3E-08	2.0E-06	7.3E-04
Mercury	7439-97-6	0.00026	2.55E-07	5.7E-08	1.4E-06	5.0E-04
Naphthalene	91-20-3	0.00061	5.98E-07	1.3E-07	3.2E-06	1.2E-03
Nickel	7440-02-0	0.0021	2.06E-06	4.6E-07	1.1E-05	4.0E-03
Polycyclic Organic Matter	POM	0.0019	1.86E-06	4.1E-07	9.9E-06	3.6E-03
2-Methylnaphthalene	91-57-6	0.000024	2.35E-08	5.2E-09	1.3E-07	4.6E-05
3-Methylchloranthrene	56-49-5	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
7,12-Dimethylbenz(a)anthracene	57-97-6	0.000016	1.57E-08	3.5E-09	8.4E-08	3.1E-05
Acenaphthene	83-32-9	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Acenaphthylene	208-96-8	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Anthracene	120-12-7	0.0000024	2.35E-09	5.2E-10	1.3E-08	4.6E-06
Benz(a)anthracene	56-55-3	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Benzo(a)pyrene	50-32-8	0.0000012	1.18E-09	2.6E-10	6.3E-09	2.3E-06
Benzo(b)fluoranthene	205-99-2	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Benzo(g,h,i)perylene	191-24-2	0.0000012	1.18E-09	2.6E-10	6.3E-09	2.3E-06
Benzo(k)fluoranthene	207-08-9	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Chrysene	218-01-9	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Dibenzo(a,h)anthracene	53-70-3	0.0000012	1.18E-09	2.6E-10	6.3E-09	2.3E-06
Dichlorobenzene	106-46-7	0.0012	1.18E-06	2.6E-07	6.3E-06	2.3E-03
Fluoranthene	206-44-0	0.000003	2.94E-09	6.5E-10	1.6E-08	5.7E-06
Fluorene	86-73-7	2.80E-06	2.75E-09	6.1E-10	1.5E-08	5.3E-06
Indeno(1,2,3-cd)pyrene	193-39-5	1.80E-06	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Naphthalene	91-20-3	6.10E-04	5.98E-07	1.3E-07	3.2E-06	1.2E-03
Phenanathrene	85-01-8	1.70E-05	1.67E-08	3.7E-09	8.9E-08	3.2E-05
Pyrene	129-00-0	5.00E-06	4.90E-09	1.1E-09	2.6E-08	9.5E-06
Propylene[f]	115-07-1	5.30E-01	5.20E-04	1.2E-04	2.8E-03	1.0E+00
Selenium	7782-49-2	2.40E-05	2.35E-08	5.2E-09	1.3E-07	4.6E-05
Toluene[f]	108-88-3	2.65E-02	2.60E-05	5.8E-06	1.4E-04	5.1E-02
Vanadium	7440-62-2	2.30E-03	2.25E-06	5.0E-07	1.2E-05	4.4E-03
Xylenes[f]	1330-20-7	1.97E-02	1.93E-05	4.3E-06	1.0E-04	3.8E-02

Notes:

a - Emission factors for toxic air pollutants are the maximum between AP-42 emission factors, mean emission factors from CATEF and Ventura County Air Pollution Control District.
b - Hourly Emissions calculated using emission factors (lb/MMBtu) and 0.2 MMBtu/hr.
c - Daily Emissions calculated using hourly emissions and 24 hours of operation per day.
d - Annual Emissions calculated using hourly emissions and 8,760 hours of operation per year.
e - The 2014 NATA used SCC-based speciation factors to speciate total chromium into constituent chromium compounds, provided in Section 2.2.2 of the National
f - Emission factors from AB2588 Combustion Emission Factors (converted to lb/mmbtu using 1020 btu/scf) obtained from Ventura County Air Pollution Control District.
g - Emission factor from the EPA's Development and Selection of Ammonia Emission Factors (https://www3.epa.gov/ttnchie1/old/efdocs/ammonia.pdf)

APPENDIX C

Vendor Specification Sheets

CFC-E 1500

ClearFire-CE

Submittal Sheet

Condensing Boiler

1500 MBTU

*JOB NAME:*_____

REVIEWER NOTES:

CB-8556-1500

PROJECT INFORMATION

CB REPRESENTATIVE _____

JOB NAME _____

EQUIPMENT TAGS _____

LOCATION _____

ALTITUDE _____

CONTRACTOR _____

ENGINEER _____

MODEL NUMBER _____ QTY_____

FUEL _____NATURAL GAS _____PROPANE

BOILER ROOM GAS SUPPLY PRESSURE _____

VOLTAGE _____

DESIGN SUPPLY AND RETURN WATER TEMPERATURE _____

FLOW RATE (GPM)_____WATERSIDE PRESSURE DROP (FT HEAD @ FLOW RATE)_____

_____WATER _____GLYCOL (if glycol, type and percentage):_____

BOILER OUTPUT W/GLYCOL DERATE (or N/A)_____

BOILER RATINGS

Description	Units	1500
Input Max.	Btu/hr	1,500,000
Natural Gas	ft^3/hr	1500
Propane	ft^3/hr	600
Output at 120/80 F [49/27 C] 100% Firing	Btu/hr	1,410,000
Output at 180/140 F [82/60 C] 100% Firing	Btu/hr	1,320,000
MAWP	psi	125
Operating Temp., Max.	°F	210
Dry Weight	pounds	1861
Shipping Weight	pounds	1986
Operating Weight	pounds	2777
Water Volume	gallons	110
Fan Motor Size	Watts	1,700
Operating Voltage, Fan	Volts/ph/Hz	115/1/60
Control Circuit	Volts/ph/Hz	115/1/60
Current Draw, Fan	Amperes	13.5
Current Draw Cont. Ckt.	Amperes	2
Full Load Amps	Amperes	16
Max Over Current Protection	Amperes	20
Condensate Quantity Firing Nat. Gas & operating @ 120/80 F.	gal/hr	10
Flue Gas Mass Flow @ 100% Firing	lb/hr	1,670
Flue Gas Temp. Oper. 180/140 F	°F	180
Flue Gas Temp. Oper. 120/80 F	°F	120
Effective fireside heating surface	ft^2	387.5

STANDARD FEATURES

- Duplex Stainless Steel ALUFER firetube heat exchanger.
  - True counterflow design
  - Thermal shock proof design
  - Superior effective heating surface area for excellent operational efficiency
  - Dual temperature returns provide 6% efficiency gain
  - Single pass design
- High water volume and low waterside pressure drop
  - Ideal for Primary Variable Flow pumping
  - Reduced cycling with no buffer tank required
  - Capable of low flow situations with no need for a flow switch
- Low emission premix burner featuring:
  - Self-regulating linkageless control
  - ECM variable speed combustion air blower modulation
  - Whisper quiet operation (<70dBA at high fire)
  - 5:1 turndown [natural gas]
  - <20 ppm NOx standard [natural gas]
  - SCAQMD Rule 1146.2 certified
- UL certified for natural gas or propane
- Combustion air intake via room air or direct vent connection on boiler
- Spark ignition with UV scanner for flame supervision
- ASME CSD-1 and XL-GAP compliant
- ENERGY STAR certified
- Factory tested prior to shipment

STANDARD EQUIPMENT

- Trim and Controls
  -Manual reset high limit temperature cut-off with adjustable set point
  -Low water cutoff, probe type, manual reset with test switch
  -Thermistor sensors for supply and return water temperature readings
  -Combination temperature/pressure gauge
  -ASME Safety relief valve (ship loose)
  -Combustion air proving switch
  -Blocked flue/condensate safety switch
- Gas Train in Accordance with ASME CSD-1 and Includes:
  -Low and high gas pressure switches
  -Single body gas valve, dual solenoid safety shutoff
  -Leak test cocks
  -Manual shutoff valve

INTELLIGENT, INTEGRATED CONTROLS

- Falcon integrated boiler safety and system control
- Color touch-screen display/interface with trending
- Multiple loop PID set point control - central heat, domestic hot water and lead/lag demand priority
- Lead Lag control for up to eight boilers
- Boiler pump, isolation valve, damper enable/disable
- Modulating pump speed control
- Outdoor temperature reset
- Post shutdown pump or valve delay
- Remote enable and set point capability
- Modbus (RS485) Communications
- Multiple protocol gateway solutions available for other BMS integration requirements
- Built-in annunciator screen with real time graphical trending
- Remote alarm & boiler status contacts standard
- Non-volatile alarm history (last 15 lockouts)
- Cloud enabled for remote monitoring capabilities

CFC-E Boiler Options Selection Guide

All options ship loose for field installation

Boiler Options	
☐	Reusable air filter
☐	Adjustable feet
☐	Condensate neutralization
☐	Combination trap / tank (8000 MBH) [pad mounted boilers only]
☐	Tank only (8000 MBH)
☐	Auto air vent
☐	Stack Thermometer
☐	Boiler drain valve
☐	Boiler Electrical Disconnect (NEMA 1 - non fused)
☐	Automatic isolation valve (24VAC standard)
☐	Auxiliary low water cut off
☐	Seismic anchor provisions
Gas train options	
☐	Gas pressure regulator - stepdown
☐	low pressure: up to 21 in. WC
☐	medium pressure: 22 - 56 in. WC
☐	high pressure: 2 - 15 psig
☐	Gas pressure relief valve (required above 2 psig)
Control Options	
☐	Falcon Lead-Lag Kit - includes supply header sensor, Falcon program module
☐	System pump control Module (in NEMA 1 enclosure with fuse and power supply) Includes:
☐	Temperature control (two temperature transmitters)
☐	Pressure control (D/P transmitter)
☐	Alarm lights and horn package
☐	Outdoor temperature sensor (with weather cover)
☐	Stack temperature limit sensor
☐	Flow switch
☐	Emergency Stop switch
☐	Protocol translator (in NEMA1 Enclosure with fuse and power supply) Modbus RTU communication standard
☐	BACnet MSTP
☐	BACnet IP
☐	Modbus TCP
☐	Metasys N2
☐	LonWorks
☐	Protocol translator ship loose for mounting in boiler control panel (includes 24VDC power supply)
☐	BACnet MSTP
☐	BACnet IP
☐	Modbus TCP
☐	Metasys N2
☐	LonWorks

OPERATING EFFICIENCIES

Percent Efficiency

% Firing Rate	Return Water Temperature °F (°C)						
	68 (20)	80 (27)	100 (38)	120 (49)	130 (55)	140 (60)	160 (72)
20%	98.5	97.6	95.2	91.8	90.1	88.8	88.0
50%	97.1	95.9	93.4	90.6	89.3	88.3	87.8
75%	96.0	94.4	91.9	89.6	88.6	87.9	87.5
100%	94.9	93.0	90.4	88.6	87.9	87.5	87.3

Conditions: Natural Gas; ΔT = 40°F

AHRI Certified Efficiency

Combustion Efficiency (%)	Thermal Efficiency (%)
94.4	95.1

FLOW RATES

CFC-E Flow Rates

System Temperature Drop °F					
10	20	30	40	50	60
Flow Rate GPM					
283	141	94	71	57	47

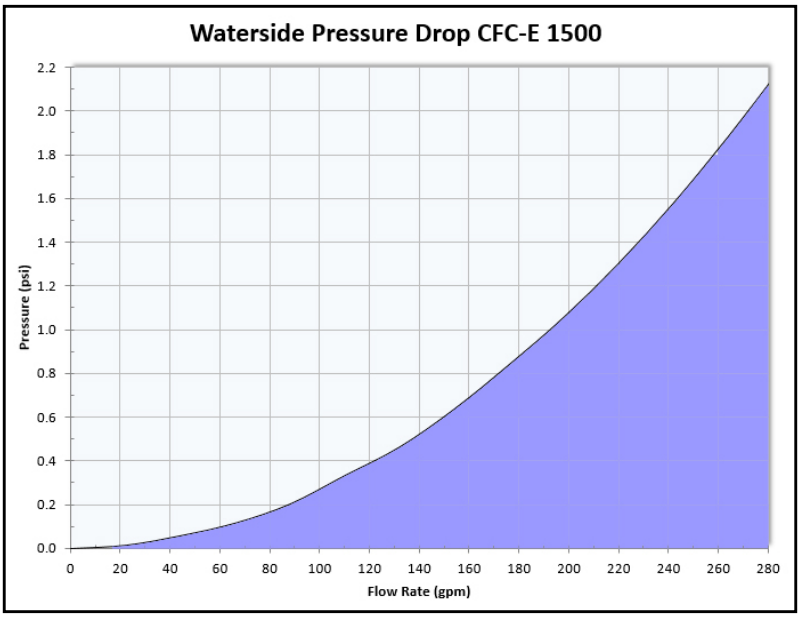
Recommended flow rates relative to temperature drop so as not to exceed boiler output.

Based on 94% nominal efficiency.

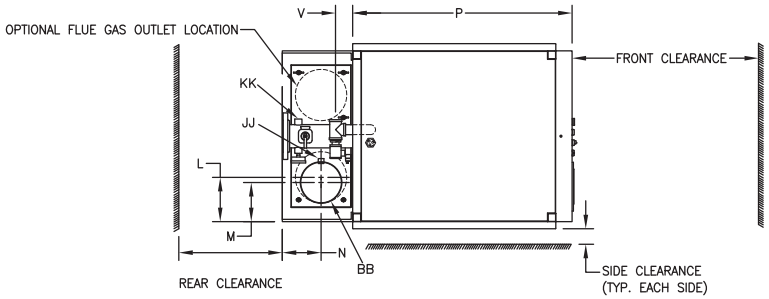
NOTE: Flow rates based on 100% water only. Not applicable to glycol solutions. Contact local C-B representative for assistance with glycol systems.

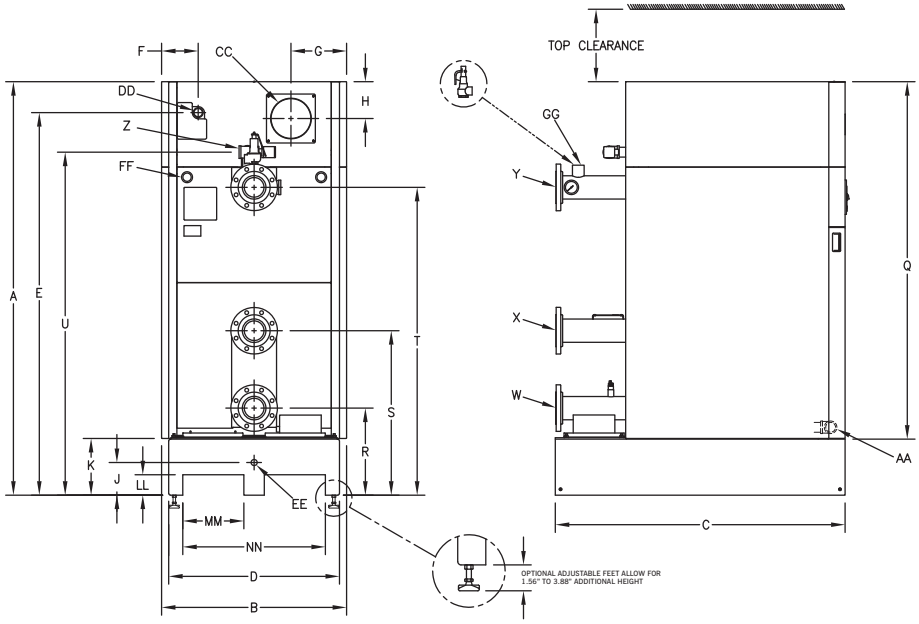
NOTE: The flow rates shown are recommended design flow rates. The CFC-E is capable of handling delta T up to 120 deg F without damage to the heat exchanger.

PRESSURE DROP



DIMENSIONS AND CONNECTION SIZES





DIMENSIONS (inches) CFC-E 1500

A	Overall Height	79.9
B	Overall Width	35.8
C	Overall Depth	56
D	Width Less Casing	33.0
E	Gas Connection to Floor	73.9
F	Side of Casing to Gas Connection	7.1
G	Side of Casing to Air Inlet	10.8
H	Top of Casing to Air Inlet	7.1
J	Floor to Condensate Drain	6.3
K	Floor to Bottom of Casing	11.0
L	Side of Base to Flue Outlet (Centered)	8.5
M	Side of Base to Flue Outlet (Offset)	7.5
N	Rear of Base to Flue Outlet	7.5
P	Casing Depth	42.4
Q	Casing Height	68.9
R	Floor to Lower Return Connection	16.8
S	Floor to Upper Return Connection	31.8
T	Floor to Supply Connection	59.5
U	Floor to Air vent Connection	66.3
V	Air Vent Line Projection From Rear of Casing	3.3

FORK POCKETS (inches)

LL	Pocket Height	4.0
MM	Pocket Width	11.8
NN	Overall Pocket Width	27.6

CONNECTIONS

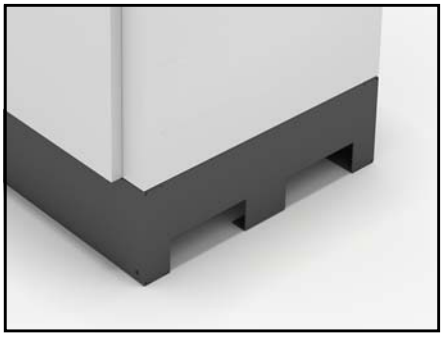
W	Water Low Temp. Return, CL150 RF Flange	4"
X	Water High Temp. Return, CL150 RF Flange	4"
Y	Water Supply, CL150 RF Flange	4"
Z	Air Vent, NPT	1-1/2"
AA	Vessel Drain, NPT	1-1/2"
BB	Flue Gas Outlet	
	Standard (Offset)	8"
	Option	10"
CC	Combustion Air	8"
DD	Gas, NPT	1-1/2"
EE	Condensate Drain, NPT	1"
FF	Electrical Conduit, Left or Right	1.6"
GG	Safety Relief Valve Vessel Connection, NPT	1-1/4"
HH	Safety Relief Valve	
	30 psig Inlet x Outlet, NPT	1" x 1-1/4"
	50 - 125 psig Inlet x Outlet, NPT	3/4" x 1"
JJ	Flue Coupling, NPT	3/4"
KK	Water Outlet Coupling, NPT	1/2"

CLEARANCES

Top	14"
Side	3"
Rear	20"
Front	36"

Notes:
Boiler rear must be accessible for servicing.
Side clearance to wall or between boilers.
Side clearance typical each side.

RIGGING AND TRANSPORTATION



The boiler should be lifted by the base using a suitable fork lift or pallet jack. **Note:** The boiler should not be moved by pushing, prying, or pulling on any part of the casing. If the floor is not level, piers or a raised pad slightly larger in length and width than the boiler base dimensions will make boiler installation and leveling easier.The boiler must be installed so that all components remain accessible for inspection, cleaning, or maintenance. Field-installed piping and electrical connections must be arranged so as to avoid interfering with removal of the casing panels or with the burner door.

To avoid damage to casing, removal of front and side casing panels is recommended during installation.

Care should be taken to secure load at the top to prevent tipping.

WARNING! Do not install the boiler on carpeting.

NOTE: For crane lifting refer to CFC-E manual for instructions.

STACK DESIGN

STACK SIZING USING OUTSIDE AIR FOR COMBUSTION (DIRECT VENT)

Boiler	Combustion Air Duct (Inches Diameter)	Combustion Air SCFM Rrquired	Flue Connection/Duct (Inches Diameter)	Max. Length* (Equivalent Feet)
CFC-E 1500	8	375	8 standard	100
			10 optional	120

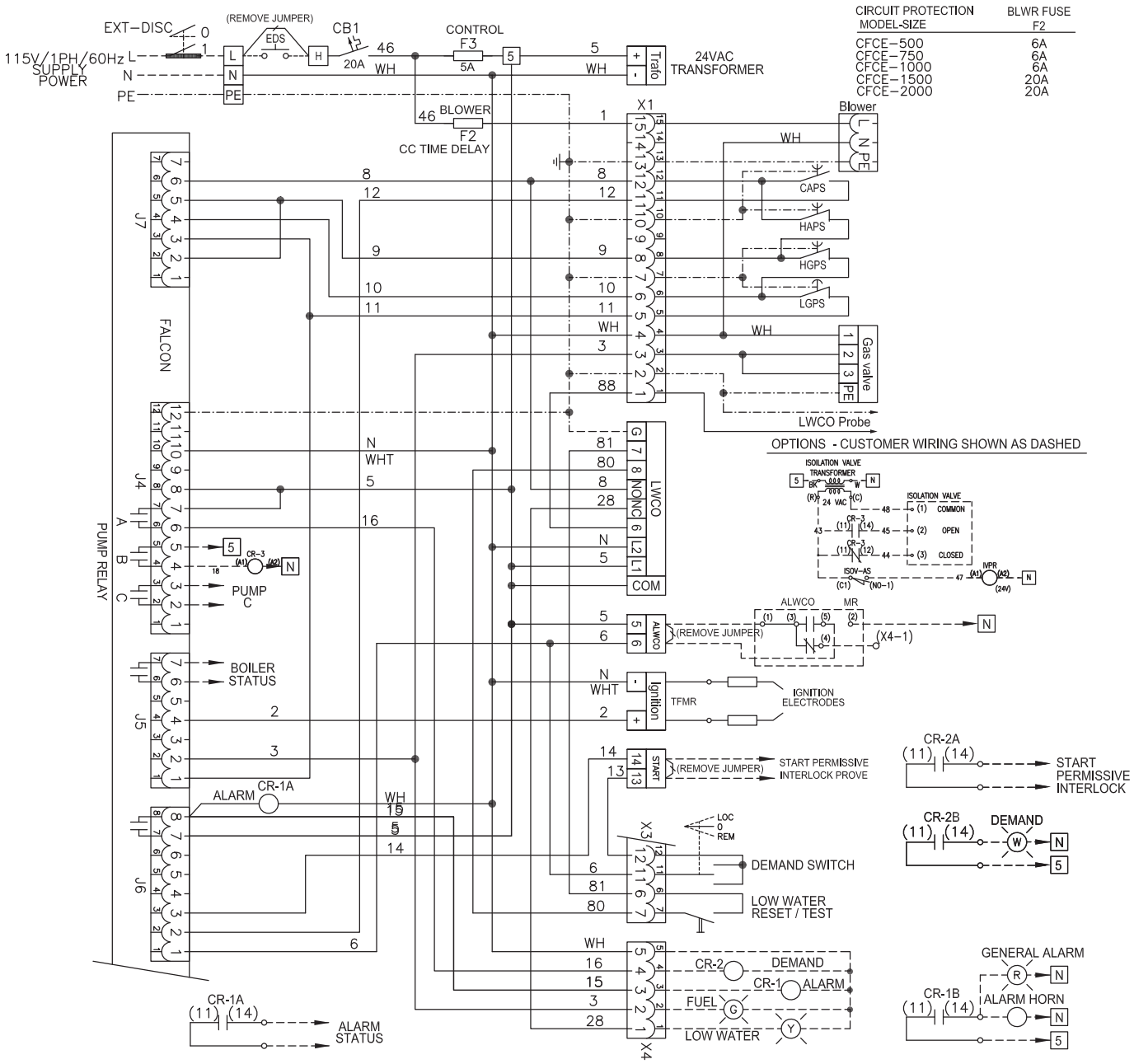
Each additional 90° elbow equals 5 equivalent feet of ductwork. Flue terminations may add 5-10 feet to the equivalent length and should also be included in the equivalent length calculation.

Draft tolerance at boiler flue connection during operation is +/-0.25” W.C.

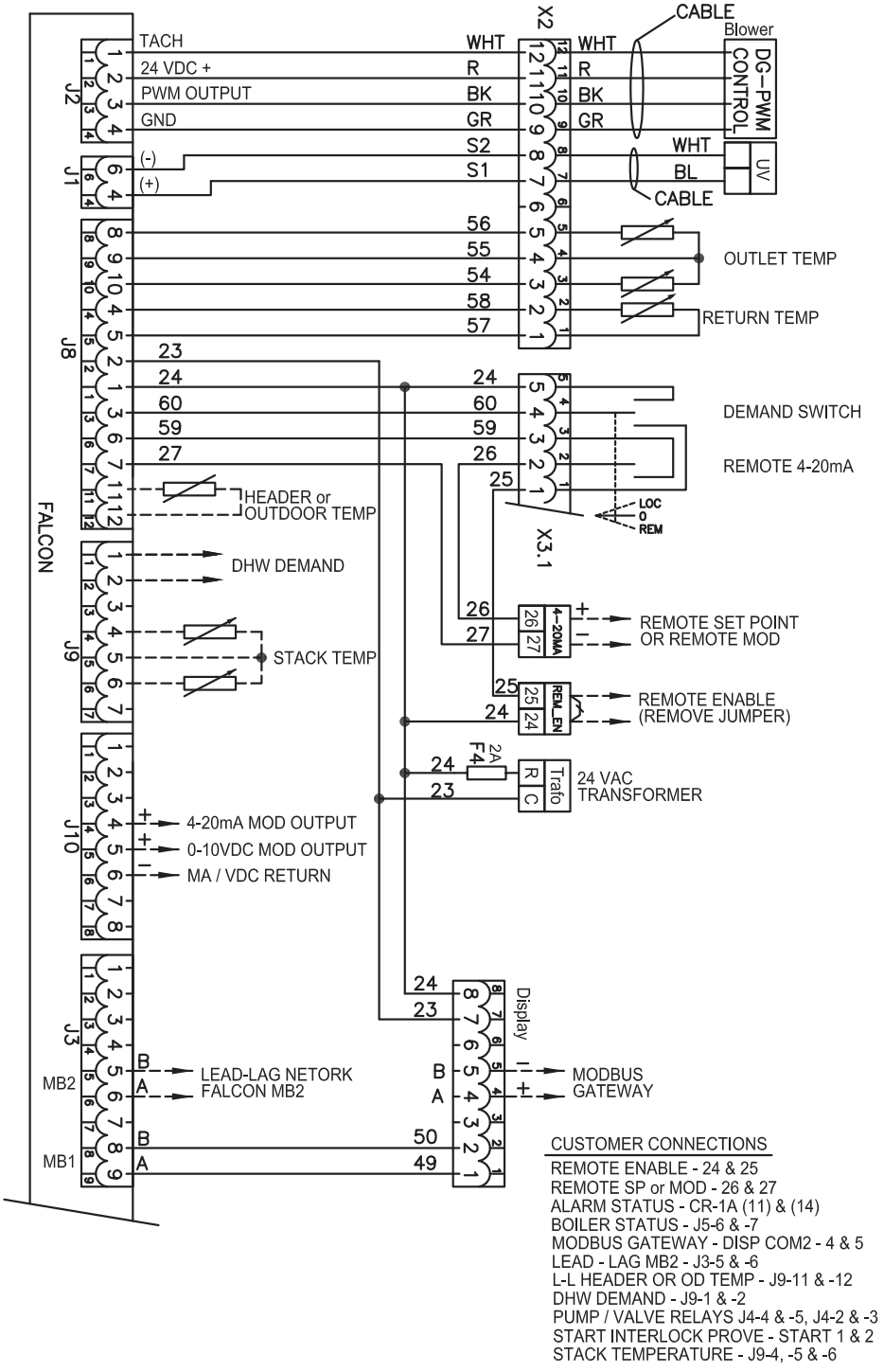
*Maximum vent length assumes horizontal run and sidewall terminations. Larger diameter venting, vertical flue runs, and vertical flue termination may allow for longer vent lengths than indicated here, provided the engineered draft calculations are within the allowable operational tolerance of +/-0.25” W.C.

WIRING DIAGRAM

WD is typical and may not reflect actual customer boiler. Refer to job specific WD for actual wiring connections.



LINE VOLTAGE WIRING **WD pg 1 of 2**



CUSTOMER CONNECTIONS

REMOTE ENABLE - 24 & 25
REMOTE SP or MOD - 26 & 27
ALARM STATUS - CR-1A (11) & (14)
BOILER STATUS - J5-6 & -7
MODBUS GATEWAY - DISP COM2 - 4 & 5
LEAD - LAG MB2 - J3-5 & -6
L-L HEADER OR OD TEMP - J9-11 & -12
DHW DEMAND - J9-1 & -2
PUMP / VALVE RELAYS J4-4 & -5, J4-2 & -3
START INTERLOCK PROVE - START 1 & 2
STACK TEMPERATURE - J9-4, -5 & -6

24V CONTROL VOLTAGE WIRING **WD pg 2 of 2**

WARRANTY

In addition to our Standard Warranty, Cleaver Brooks offers the following non-prorated Extended Warranty on the ClearFire CFC-E boilers:

1. The pressure vessel is guaranteed against thermal shock for the lifetime of the boiler when utilized in a closed loop hydronic heating system with a temperature differential of 120°F or less. The boiler pressure vessel is guaranteed accordingly without a minimum flow rate or return water temperature requirement. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.
2. The pressure vessel, tubes, and tube sheets (heat exchanger) are guaranteed against flue gas corrosion and materials/workmanship for a period of fifteen (15) years.
3. The condensate collection box shall be guaranteed against corrosion for twenty (20) years.
4. The burner cylinder shall be warranted for a period of five (5) years.

All parts not covered by the above warranties are valid for twenty-four (24) months from the date of initial operation of the Equipment, but in no event shall the Warranty extend more than thirty (30) months from the date of shipment of the Equipment by Cleaver-Brooks. This includes all electrical and burner components.

The pressure vessel thermal shock warranty covers leaks in the pressure vessel including the furnaces, tubes, tube sheets, and shell (not including failed gaskets), which, from our inspection, are attributed to unequal or rapid expansion, typically referred to as “thermal shock,” or stress cracking. This warranty does not cover damage or failures that are attributed, by our inspection, to corrosion, operation at low water level, accumulation of scale, sludge or dirt in the boiler, or other improper service, operation, or neglect.

Cleaver Brooks' liability hereunder is limited to repairing or furnishing a replacement pressure vessel or component parts thereof, as deemed necessary by our inspection. Cleaver Brooks is not responsible for shipping, handling, installation and other costs, including all costs associated with the removal and disposition of the old pressure vessel or component parts. In no event shall Cleaver Brooks be responsible for any incidental, consequential or other damages, including, without limitation, any damages resulting from loss of use of the boiler.

Refer to official warranty documents for specific warranty information.

Estimated Exhaust/Emission Performance Data

Date: 6/29/2022

Boiler: CFC-E-700-1500, 125# HW

Fuel: Natural Gas

Customer: CWU Student Village
Location: Ellensburg WA
Prepared By: Catie VanWormer
Elevation: SL (exhaust calcs)
Boiler Type: Firetube
Water Temp: 160F Out/130F In
LE Option: Standard

Flue Dia. (in.) 8

		Firing Rate			
		25%	50%	75%	100%
Input Btu/hr		375,000	750,000	1,125,000	1,500,000
Output Btu/hr		337,875	669,750	996,750	1,318,500
Efficiency		90.1%	89.3%	88.6%	87.9%
Projected Emissions					
CO	ppm	10	10	10	10
	lb/MMBTU	0.007	0.007	0.007	0.007
	lb/hr	0.003	0.005	0.008	0.011
NOx	ppm	19	19	19	19
	lb/MMBTU	0.022	0.022	0.022	0.022
	lb/hr	0.008	0.017	0.025	0.034
S0x	ppm	0.4	0.4	0.4	0.4
	lb/MMBTU	0.001	0.001	0.001	0.001
	lb/hr	0.000	0.001	0.001	0.001
HC/VOC's	ppm	4	4	4	4
	lb/mmbtu	0.002	0.002	0.002	0.002
	lb/hr	0.001	0.001	0.002	0.002
PM	ppm	NA	NA	NA	NA
	lb/mmbtu	0.006	0.006	0.006	0.006
	lb/hr	0.002	0.004	0.006	0.009
Exhaust Data					
Temperature, F		131	139	148	160
Flow	ACFM	107	216	330	448
	SCFM	93	186	278	371
	lb/hr	418	835	1253	1670
Velocity	ft/sec	5.1	10.3	15.7	21.4

Corrections to 3% O2
Assumes Natural Gas HHV = 1000 Btu/ft^3

Chimney and Gas Vent Calculation Program

Please note the following calculation program is based on the ASHRAE Chimney Design Equation as well as the ASHRAE Duct Design Equations. Jeremias Exhaust Systems disclaims any responsibility for any improper vent system performance as a result of the use of this software.

jeremias® EXHAUST SYSTEMS

Common ✓

Project Name:	CWU	Project By:	Steven Steele
Project City:	Ellensburg	Project For:	Rand Ingham - Cole Industrial
Project State:	Washington		CFCE-1500

Appliance Input Data:

Appliance Fuel Type:	1 - Natural Gas or Equivalent.	Chimney Type:	UL 1738
Appliance Input(MBH):	6000 MBH	Ambient Temperature(F):	60 F
Applaince CO2%:	9 %	Altitude(Ft):	1542 Feet
Fuel Gas Temperature (F):	210	Allowable Back Pressure:	***0 to 0***

Combustion Air Vent Data:

Combustion Air Duct Length (Ft):	0	15 Degree Elbow:	0
Additional Resistance (k):	0	30 Degree Elbow:	0
Additional Pressure Loss:	0	45 Degree Elbow:	0
		90 Degree Elbow:	0

Exhaust Vent Data:

Total Length of Exhaust (Ft):	20	15 Degree Elbow:	0
Total Height of Exhaust (Ft):	28	30 Degree Elbow:	0
Straight Tee with End Cap:	0	45 Degree Elbow:	2
Lateral Tee with End Cap:	2	90 Degree Elbow:	0
Stack Cap Termintation.		Additional Resistance (k):	0
		Additional Pressure(In. W.C.):	0

System Information:

Barometric Pressure:	28.378 Inches of Water	Exhaust Mass Flow	98.7 lbs. @ 9 %CO2
Combustion Air Density:	0.073 lb/ft^3	Exhaust Gas Density:	0.056 lb/ft^3)
Combustion Air Flow:	1268.4 Ft^3/min	Exhaust Gas Flow:	1759.6 Ft^3/Min
Combustion Air Fitting Friction:	0 K.	Exhaust Fitting Friction:	1.9 K.
Combustion Friction Loss (k):	0 .K	Exhaust Vent Friction Loss (k):	2.577 .K

Solution:	Selected Diameters
Combustion Duct Diameter (In):	0 Inches
Combustion Air Velocity (Ft/min):	717.8 Ft/Min
Combustion Air Pressure Loss (In W.C.):	0 In. W.C.
Exhaust Vent Diameter (Inches):	18 Inches
Exhaust Gas Velocity (Ft/min):	995.7 Ft/ Min
Dt, Theoretical Draft:	0.09 In. W.C.
dP, Pressure loss (In. W.C.):	0.12 In. W.C.
Da, Available Draft (In W.C.):	0.03 In. W.C.
Total Pressure (In. W.C.):	***0.03 In. W.C.***
Db, Draft Booster Pressure Rq'd (In. WC):	0.03

0.03"
+0.08"
0.11" W.C. ✓

1/2

Chimney and Gas Vent Calculation Program

Please note the following calculation program is based on the ASHRAE Chimney Design Equation as well as the ASHRAE Duct Design Equations. Jeremias Exhaust Systems disclaims any responsibility for any improper vent system performance as a result of the use of this software.

jeremias® EXHAUST SYSTEMS

Connector

Project Name:	CWU	Project By:	Steven Steele
Project City:	Ellensburg	Project For:	Rand Ingham - Cole Industrial
Project State:	Washington		CFCE-1500

Appliance Input Data:

Appliance Fuel Type:	1 - Natural Gas or Equivalent.	Chimney Type:	UL 1738
Appliance Input(MBH):	1500 MBH	Ambient Temperature(F):	60 F
Applaince CO2%:	9 %	Altitude(Ft):	1542 Feet
Fuel Gas Temperature (F):	210	Allowable Back Pressure:	*0 to 0*

Combustion Air Vent Data:

Combustion Air Duct Length (Ft):	0	15 Degree Elbow:	0
Additional Resistance (k):	0	30 Degree Elbow:	0
Additional Pressure Loss:	0	45 Degree Elbow:	0
		90 Degree Elbow:	0

Exhaust Vent Data:

Total Length of Exhaust (Ft):	1	15 Degree Elbow:	0
Total Height of Exhaust (Ft):	8	30 Degree Elbow:	0
Straight Tee with End Cap:	0	45 Degree Elbow:	3
Lateral Tee with End Cap:	0	90 Degree Elbow:	0
No Termination Specified		Additional Resistance (k):	.5 On/off Damper
		Additional Pressure(In. W.C.):	0

System Information:

Barometric Pressure:	28.378 Inches of Water	Exhaust Mass Flow	24.68 lbs. @ 9 %CO2
Combustion Air Density:	0.073 lb/ft^3	Exhaust Gas Density:	0.056 lb/ft^3)
Combustion Air Flow:	317.1 Ft^3/min	Exhaust Gas Flow:	439.9 Ft^3/Min
Combustion Air Fitting Friction:	0 K.	Exhaust Fitting Friction:	0.95 K.
Combustion Friction Loss (k):	0 .K	Exhaust Vent Friction Loss (k):	1.385 .K

Solution:	Selected Diameters
Combustion Duct Diameter (In):	0 Inches
Combustion Air Velocity (Ft/min):	908.4 Ft/Min
Combustion Air Pressure Loss (In W.C.):	0 In. W.C.
Exhaust Vent Diameter (Inches):	8 Inches
Exhaust Gas Velocity (Ft/min):	1260.2 Ft/ Min
Dt, Theoretical Draft:	0.02 In. W.C.
dP, Pressure loss (In. W.C.):	0.1 In. W.C.
Da, Available Draft (In W.C.):	0.08 In. W.C.
Total Pressure (In. W.C.):	***0.08 In. W.C.***
Db, Draft Booster Pressure Rq'd (In. WC):	0.08

2/2

NX500
High Efficiency Gas-Fired Condensing Water Heater

Submittal Sheet

Section 1 - Specifications
Section 2 - Dimensions
Section 3 - Electrical

Project Name: _____ **Date:** _____
Location: _____
Engineer: _____
Contractor: _____ **Rep:** _____

1 SPECIFICATIONS

General Specifications

► Product Features
- Certified to ANSI Z21.10.3 / CSA 4.3 Gas Water Heater Standard
- ASME "H" stamped, designed and constructed in compliance with the ASME Boiler and Pressure Vessel Code Section IV
- SA-249 TP316L Stainless Steel Heat Exchanger
- CSD-1 compliant
- Maximum operating pressure 160 psi [1103 kPa]
- Modulating burner, 5:1 turndown
- Direct Spark Ignition
- Zero clearance to combustibles (clearances required for service)

► Optional Side Wall Vent Terminal Kits Hubbell part # 84355, 84358

► Optional Air Filter Kit Hubbell part # 84093 (indoor combustion air only)

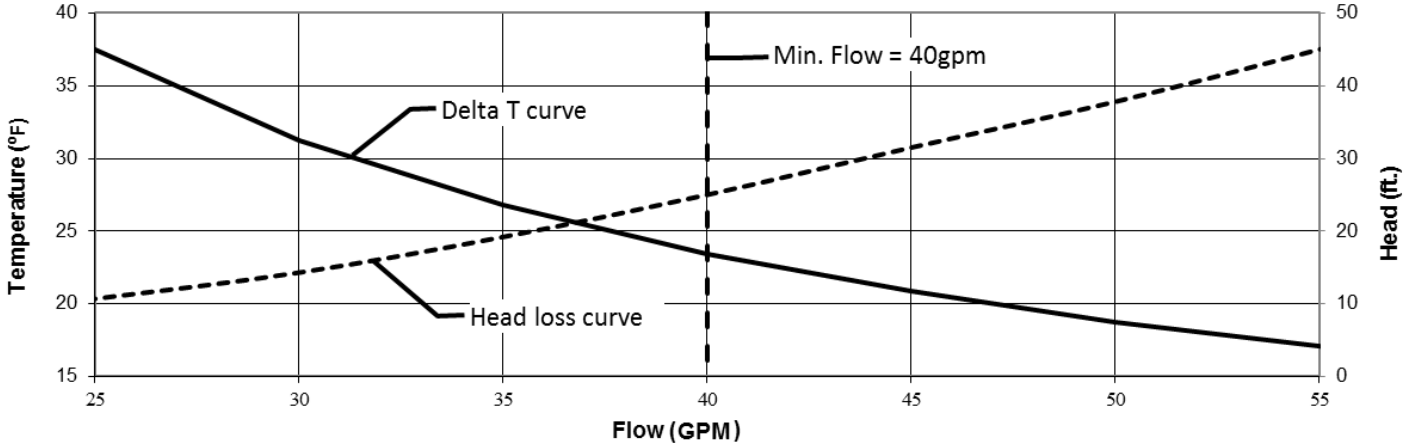
► Factory Supplied Items
- Flow switch
- 150PSI ASME Relief Valve
- 160PSI Pressure Gauge

► Control Features
- Integral microprocessor safety control
- Time of day input
- Lead-Lag up to 8 series water heaters
- Integrated Modbus RTU for connection to BMS gateways

Water Connections NPT, in.	Gas Connection NPT, in.	Vent/Air-inlet Pipe Diameter, in.	Vent/Air-inlet Max. Length, ft.	Approx. Weight with Water, lb.
2 (Female)	¾ (Male)	4	100	320

Performance Specifications

Input Modulation, MBH	Gross Output Capacity, MBH	Thermal Efficiency, %	Recovery Rate @ 100°F Rise, USGPH
100 – 500	480	96	576



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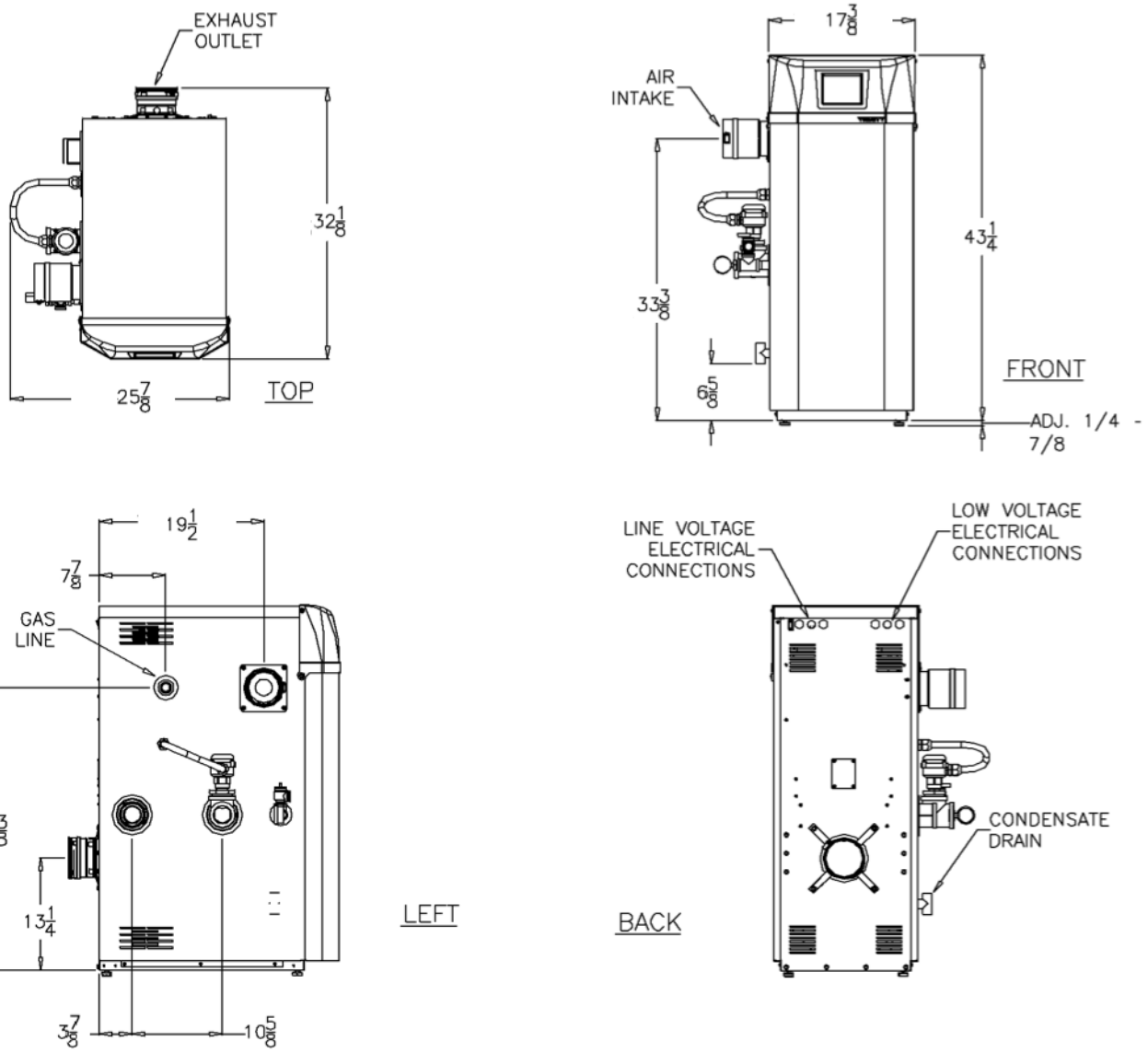
Rev.0

NX500
High Efficiency Gas-Fired Condensing Water Heater

Submittal Sheet

DIMENSIONS

Product Dimensions – in.



Recommended Clearances – in.

Top	Front	Left	Right	Back	Bottom
24	24	24	12	24	0

3 ELECTRICAL

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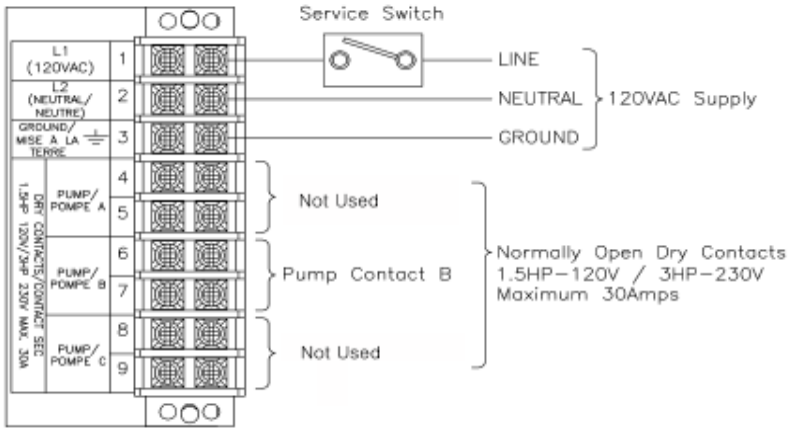
NX500
High Efficiency Gas-Fired Condensing Water Heater

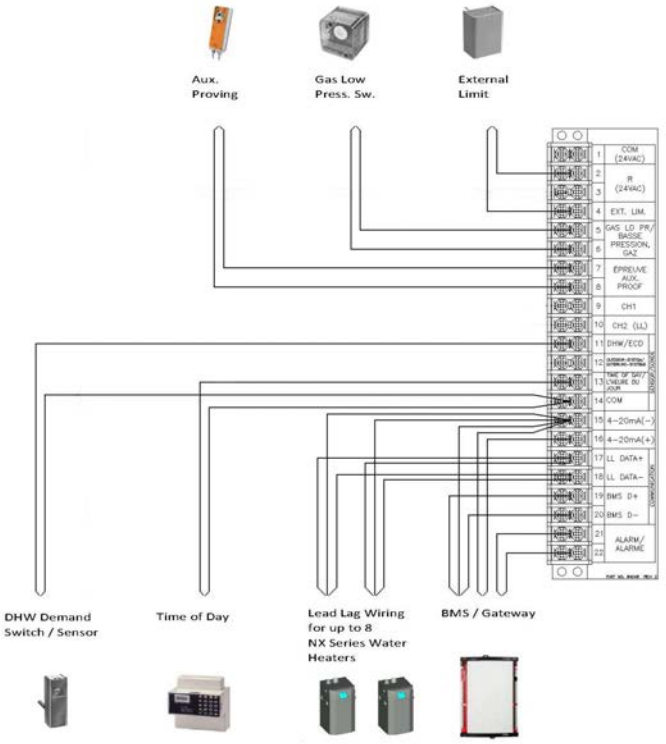
Submittal Sheet

Simplified Wiring

Line Voltage Electrical:

- ► 120VAC / 60 Hz / 1 Phase / 12 Amp
- ► Barrier Strip for field wiring terminations
- ► Pump output (Pump B)
  Note: Pumps are field supplied.





Low Voltage Electrical:

- ► Barrier Strip for field wiring terminations
- ► 120/24 VAC Transformer 40VA (factory supplied)
- ► Inputs
  - Indirect DHW aquastat (by others) or DHW Tank sensor (factory option)
  - External Limit (by others)
  - 4-20mA external modulating control (by others)
- ► Outputs
  - Alarm dry contact (24VAC 0.63A max.)
- ► EIA-485 Modbus communications for Lead-Lag
- ► EIA-485 Modbus to BMS gateways (not shown).
  Optional available gateways:
  - BACnet/N2- Hubbell part # 84946
  - LonWorks- Hubbell part # 84947

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4.0 GENERAL VENTING

The Hubbell NX is certified as a “Category IV” water heater requiring a “Special Venting System” designed for pressurized venting. The Exhaust Vent must be piped to the outdoors, using the vent materials and rules outlined in this section. Under no conditions may this unit vent gases into a masonry chimney, unless it is vacant, and utilizes the approved venting material and rules described in this section.

Vent and Air-inlet are to be piped separately. The Hubbell NX cannot share a common vent or air-inlet with multiple appliances. Failure to comply will result in serious injury or death.

Removing an Existing Water heater from Common Venting System

Do not install the Hubbell NX into a common venting system with any other appliances. Failure to comply with this warning will cause flue gas spillage and leech carbon monoxide emissions into the surrounding air resulting in serious injury or death.

When an existing water heater is removed from a common venting system, the common venting system is likely to be too large for proper venting of the remaining appliances connected to it.

Direct Vent Installation (Mandatory for models NX200-NX400)

When installed as a Direct Vent water heater the combustion air-inlet must also be piped directly to the outdoors using the methods described in this section and in accordance with the National Fuel Gas Code, ANSI Z223.1 (U.S.) or CSA B149.1 (Canada) and local requirements.

Indoor Combustion Air (Optional for models NX500-NX800)

When the installation uses Indoor Combustion Air (i.e. piping is not directly connecting the water heater air-inlet fitting to the outdoors), provisions for combustion and ventilation air, in accordance with section "Air for Combustion and Ventilation," of the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* (U.S.), or Clause 8.2, 8.3 or 8.4 of *Natural Gas and Propane Installation Code, CAN/CSA B149.1* (Canada), or applicable provisions of the local building codes, must be adhered to.

NOTICE The water heater shall be located so as not to interfere with proper circulation of combustion, ventilation, and dilution air.

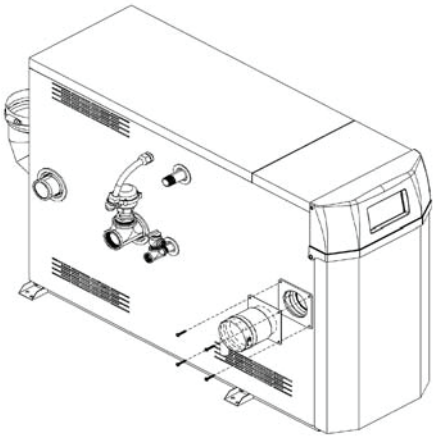
⚠ WARNING Make up air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements. Failure to ensure adequate make up air to all appliances may result in personal injury or death.

NOTICE **Controller RPM Adjustments** – To avoid the potential water heater lockouts due to wind and static pressure differences, the Lightoff and Minimum Modulation RPM Rates must be adjusted as per Figures 4-11 and 4-21 in Appendix A when using indoor combustion air.

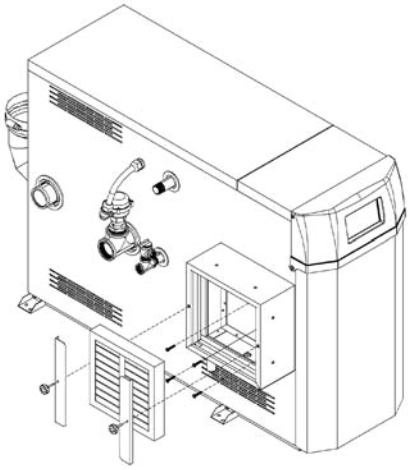
Air Filter Kit (P/N HUB-84093) – When using indoor combustion air (non-Direct Vent), it is highly recommended to use the optional Air Filter Kit (P/N HUB- 84093) to limit the amount of dust that enters the combustion system. The Air Filter Kit (P/N HUB- 84093) can be installed on water heater models NX500-NX800, as illustrated in Figure 4-1 (comprehensive installation instructions are provided with the Filter Kit).

NOTICE **Venting Limitation** – When using the Air Filter Kit on models NX500 & NX600, the maximum equivalent exhaust vent length is limited to 30 ft. with 4" piping, or 90 ft. with 6" piping; see warning below Table 4-5.

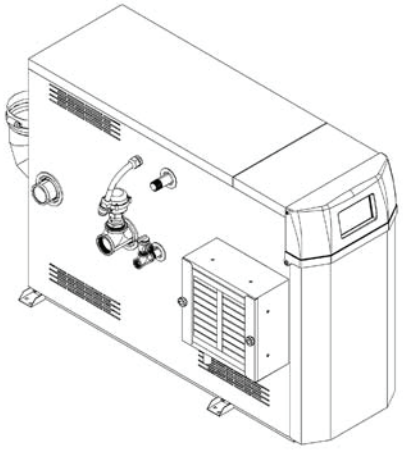
Figure 4-1 Installation of Optional Air Filter Kit (P/N HUB-84093)



1. Remove factory appliance air-inlet adapter; keep screws from installation of filter kit



2. Secure filter kit using factory screws removed in step 1. Reuse the factory gasket.



3. Secure the filter in place with the brackets and knurled screws provided in the filter kit.

Combustion Air-inlet Contamination

Be careful not to locate the Air-inlet termination in an area where contaminants can be drawn in and used for combustion. Combustion air containing dust, debris or air-borne contaminants will drastically increase the required maintenance and may cause a corrosive reaction in the Heat Exchanger which could result in premature failure, fire, serious injury, or death. See Table 4-1 for a list of areas to avoid when terminating air-intake piping:

Table 4-1 Corrosive Products and Contaminant Sources

Products to Avoid	Contaminated Sources to Avoid
Antistatic fabric softeners, bleaches, detergents, cleaners	Laundry facilities
Perchloroethylene (PCE), hydrocarbon based cleaners	Dry cleaning facilities
Chemical fertilizer, herbicides/pesticides, dust, methane gas	Farms or areas with livestock and manure
Paint or varnish removers, cements or glues, sawdust	Wood working or furniture refinishing shops
Water chlorination chemicals (chloride, fluoride)	Swimming pools, hot tubs
Solvents, cutting oils, fiberglass, cleaning solvents	Auto body or metal working shops
Refrigerant charge with CFC or HCFC	Refrigerant repair shops
Permanent wave solutions	Beauty shops
Fixer, hydrochloric acid (muriatic acid), bromide, iodine	Photo labs, chemical / plastics processing plants
Cement powder, crack fill dust, cellulose, fiber based insulation	Concrete plant or construction site

⚠ WARNING Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Failure to follow instructions may result in serious injury or death.

NOTICE It is **BEST PRACTICE** to pipe the combustion air-inlet directly to the outdoors (Direct Vent installation) to avoid contamination often contained in indoor air.

Flammable Solvents and Plastic Piping

Due to the extremely flammable characteristics of most glues, cements, solvents and primers used in the process of joining plastic vent and air-inlet pipe, explosive solvent vapors must be evacuated from the vent and air-intake prior to start-up. Avoid using excess cement or primer that may lead to pooling inside the pipe assembly. Freshly assembled piping assembly should be allowed to cure for a minimum of 8 hours before applying power to the gas fired appliance. Refer to **Mandatory Pre-commissioning Procedure for Plastic Venting** in this section.

⚠ DANGER **Flammable Cements and Primers**–It is the installers'responsibility to familiarize themselves with the hazards associated with explosive solvents and to take all precautions to reduce these risks. Failure to follow these instructions can cause explosions, property damage, injury or death.

Mandatory Pre-commissioning Procedure for Plastic Venting (PVC or CPVC)

⚠ WARNING Do not apply power to the water heater prior to Step 4 in the Mandatory Pre-commissioning Procedure for Plastic Venting.

⚠ WARNING **Spark Igniter Cable** - Maintain a minimum 2" separation between spark igniter circuit and conductors. Failure to follow instructions may result in component failure, injury or death.

1) Working with the power turned off to the water heater, completely install the vent and air-inlet system, securely cementing joints together. If possible, allow primers/cements to cure for 8 hours before firing the burner. If curing time is less than 8 hours, proceed with Steps 2 through 6.
2) Maintain the water heater gas supply shut-off valve in the off position.
3) Disconnect electrical leads to the Hot Surface or Spark Igniter. Ensure the cables are placed in a fashion where they will not arc to ground or other conductor. Refer to warning regarding Spark Igniter Cable.
4) Turn power on to the water heater and apply a heat demand.
5) Allow for 3 complete trials for ignition, consisting of pre and post purge of the combustion blower, until an ignition lockout occurs. Repeat the process two more times (i.e. 9 complete ignition sequences in total).
6) Turn power off and reconnect the electrical leads to the Igniter.

Near Water Heater Vent/Air Piping

Each Hubbell NX is equipped with a short piece of approved CPVC vent pipe (see Table 4-2 CPVC Vent Pipe Transition Piece). Insert one end into the water heater flue outlet adapter and cement the other to field venting (see Table 4-4 for approved venting material). The CPVC vent pipe should extend fully into the water heater flue outlet adapter (see Table 4-2). Ensure that the venting system does not apply a load or strain on the water heater flue outlet adapter. The manufacturer recommends using two elbows to create a "swing joint" to reduce potential strain on vent piping and cemented joints; see Figures 4-2 through 4-5.

⚠ WARNING **Gasket Seating** - Improper seating can cause leakage and eventual failure of the sealing gasket. Failure to follow these instructions may result in serious injury or death.

⚠ WARNING **PVC Exhaust Venting** – **DO NOT** insert PVC pipe directly into the water heater exhaust adapter, as it can deform from the clamping force of the gear clamp. Failure to follow these instructions may result in gasket failure and/or the dislodging of the exhaust pipe from the water heater adapter, resulting in property damage, serious injury or death.

Table 4-2 CPVC Vent Pipe Transition Piece (used when venting with PVC)

Model No.	CPVC Vent Pipe Size	CPVC Transition Vent Pipe Length	Full Insertion Depth
NX200	3"	Minimum 5"[127 mm]	2-7/8" [73 mm]
NX300-NX600	4"	Minimum 4" [100 mm]	1-7/8" [48 mm]
NX700 & NX800	6"	Minimum 6" [152 mm]	2-1/2" [63 mm]

⚠ WARNING **Polypropylene or Stainless Steel Venting** – When using Polypropylene or Stainless Steel piping, the appropriate water heater adapters must be used to transition the water heater vent connections to accept the respective Polypropylene or Stainless Steel venting. See Table 4-3 for a list of approved adapters. Failure to use the correct adapter will result in flue gas leakage resulting in property damage, serious injury or death.

Table 4-3 Water heater Adapters for Polypropylene and Stainless Steel Venting

Model No.	Vent Material	Venting Brand	Adapter Part No. [1,2]
NX200	Polypropylene	DuraVent – PolyPro	300150
		Centrotherm - InnoFlue	ISANY0303
	Stainless Steel	DuraVent – FasNSeal	300715
NX300-NX600	Polypropylene	DuraVent – PolyPro	300151
		Centrotherm - InnoFlue	ISAA0404
	Stainless Steel	DuraVent – FasNSeal	303631
NX700 & NX800	Polypropylene	DuraVent – PolyPro	810004281
		Centrotherm - InnoFlue	ISAA0606
	Stainless Steel	DuraVent – FasNSeal	810005231

Notes: [1] Listed water heater adapters are only approved for use with the respective venting brand; i.e. a PolyPro water heater adapter shall not be used with InnoFlue venting.
[2] PolyPro and FasNSeal water heater adapters are available from DuraVent (1-800-835-4429 or www.duravent.com); InnoFlue water heater adapters are available from Centrotherm Eco Systems (1-877-434-3432 or www.centrotherm.us.com).

⚠ DANGER Exhaust venting must be supported to reduce strain on piping joints. Failure to follow these instructions may result in result in damage, serious injury or death.

NOTICE In Canada, the first **3 ft (915 mm)** of vent piping must be readily accessible for inspection.

Figure4- 2(a) Near Water Heater Venting (CPVC)

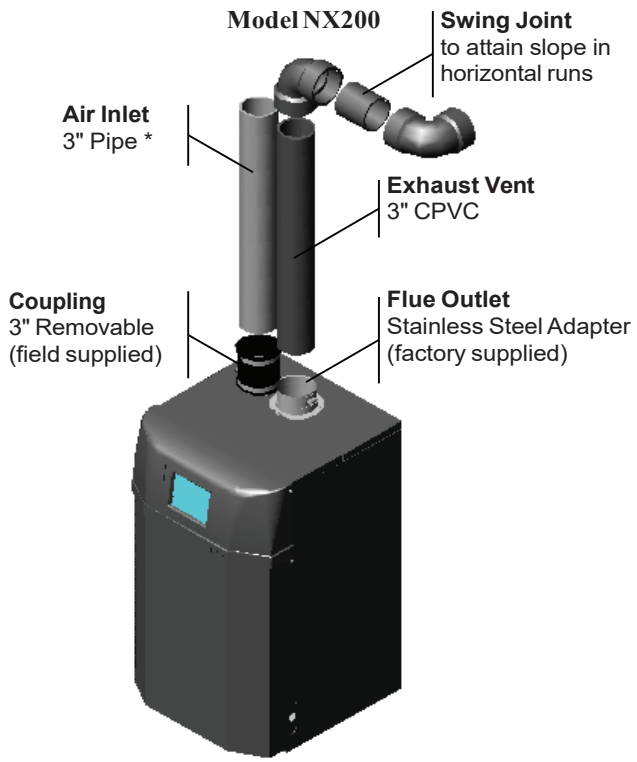


Figure 4-2(b) Near Water Heater Venting (PVC)

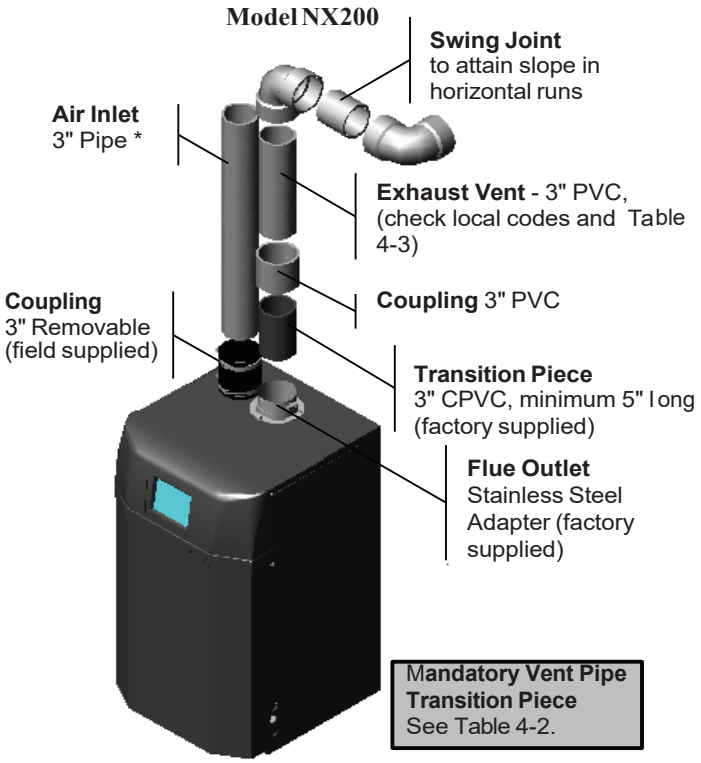


Figure 4-3(a) Near Water Heater Venting (CPVC)

Models NX300 & NX400

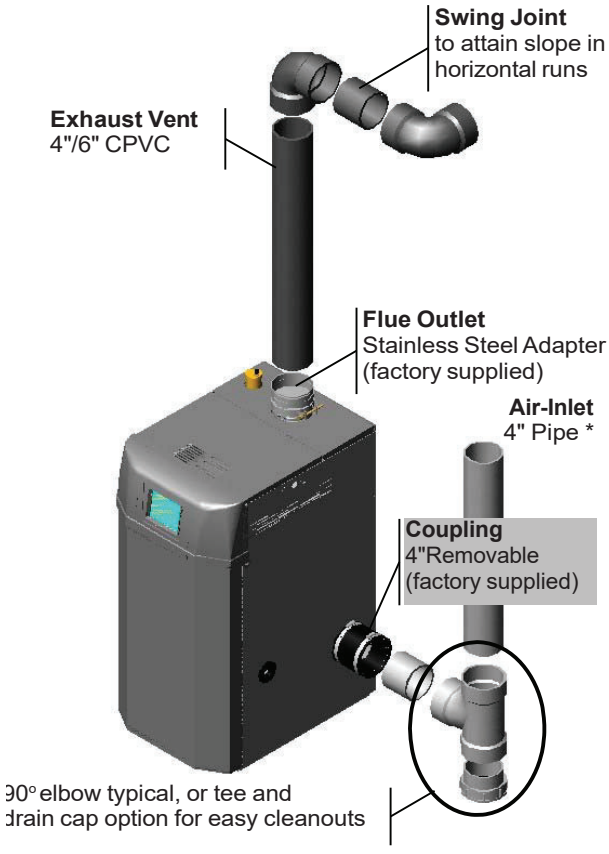
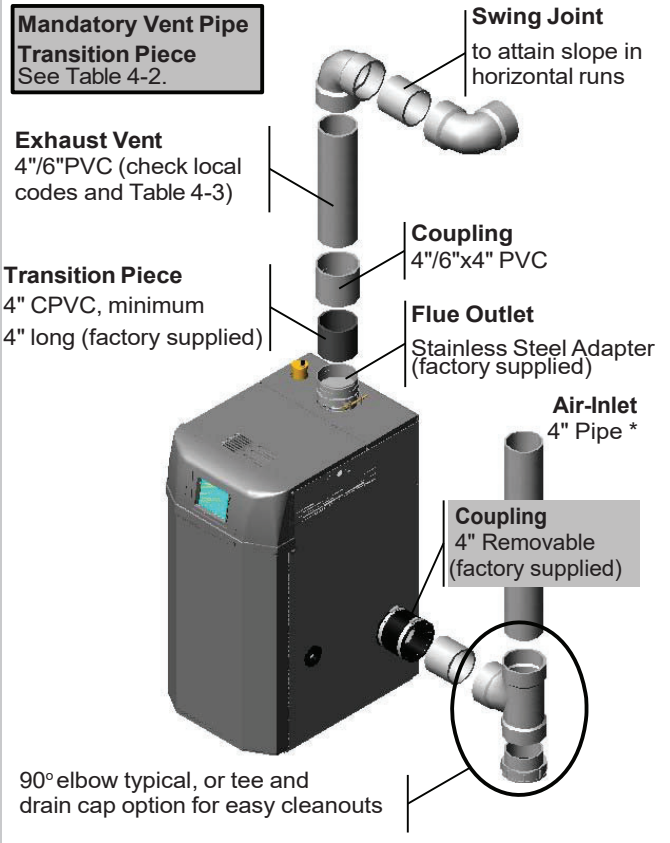


Figure 4-3(b) Near Water Heater Venting (PVC)

Models NX300 & NX400



*** Air-Inlet- check with applicable local codes for acceptable pipe material**

Figure 4-4(a) Near Water Heater Venting (CPVC/PVC)

Models NX500 & NX600

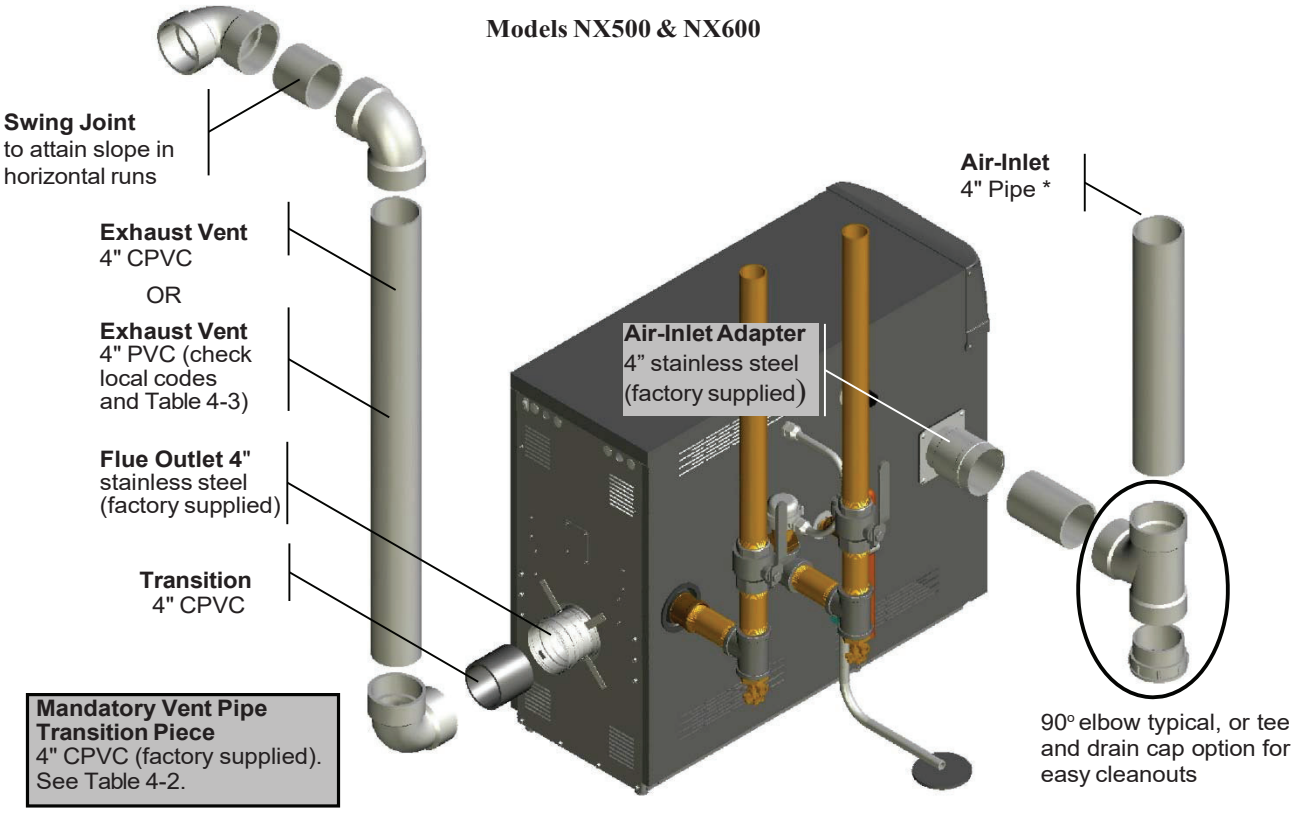


Figure 4-5(a) Near Water Heater Venting (CPVC)

Models NX700 & NX800

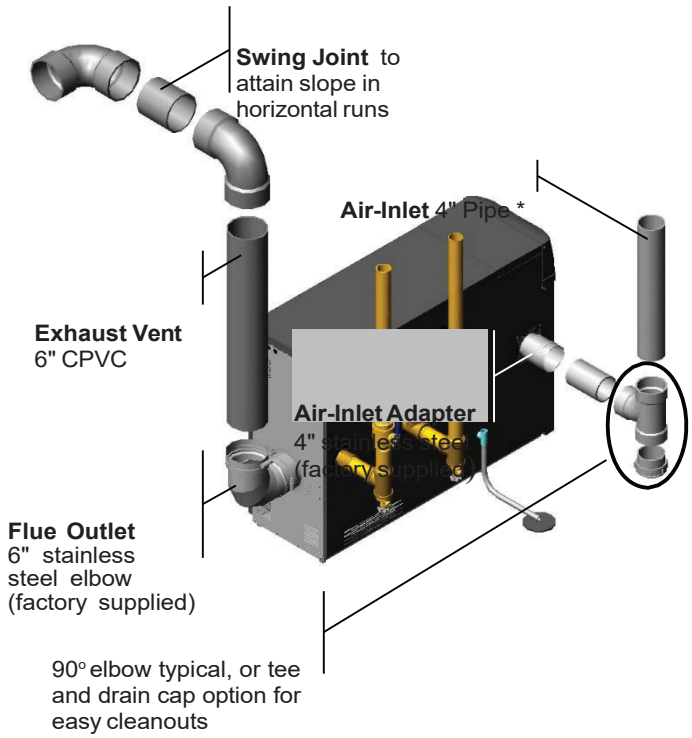
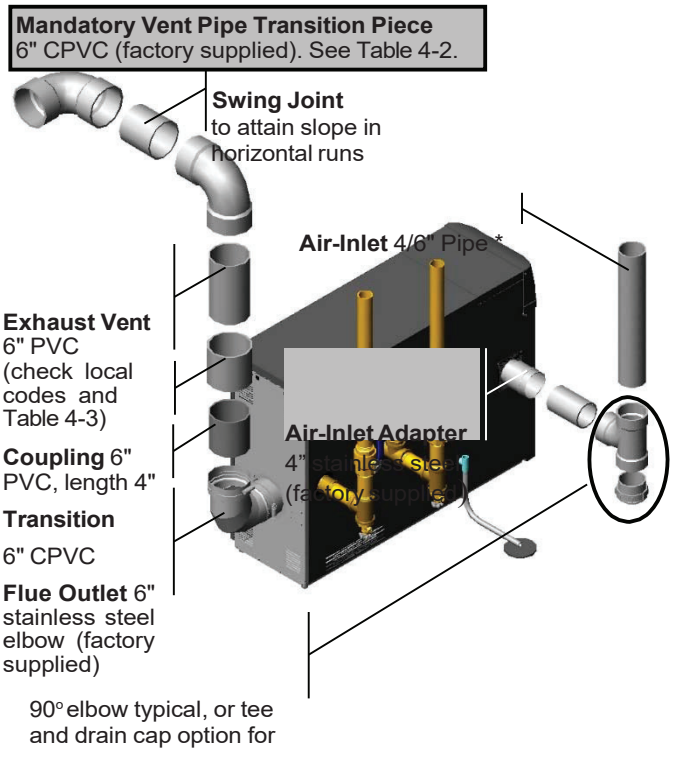


Figure 4-5(b) Near Water Heater Venting (PVC)

Models NX700 & NX800



***Air-Inlet** - check with applicable local codes for acceptable pipe material.

Vent/Air-inlet Pipe Material

Table 4-4 Acceptable Vent and Air-inlet Pipe Material

Items [1]	Materials [2,3]	Installation Standards		WARNING
		United States	Canada [4]	
Vent Piping and Fittings	PVC - DWV	ANSI/ASTM D2265	All venting material in Canada must be **ULC S636 approved**. See Note 4 below for appropriate temperature applications.	All Vent and Air-inlet materials installed on gas fired appliances in CAN/US must meet the Standards listed in Table 4-4. Failure to comply could result in fire, serious injury or death.
	PVC Schedule 40	ANSI/ASTM D1785		
	CPVC Schedule 40	ANSI/ASTM F441		
	AL29-4C	UL-1738		
	Polypropylene (PP)	-		
Pipe Cement	PVC	ANSI/ASTM D2564		
	CPVC	ANSI/ASTM F493		
Primers	PVC / CPVC	ANSI/ASTM F656		

Notes:
[1] Refer to Table 4-5 for Allowable Vent and Air-inlet Pipe Sizes and Lengths.
[2] PVC venting (exhaust and air-intake) is not permitted within the Closet/alcove of a Closet/alcove installation.
[3] The Air-Intake does not require high temperature pipe material. Check applicable local codes for acceptable materials.
[4] ULC S636 PVC is approved for flue gas temperatures up to 149°F (65°C) and must only be used for low temperature applications. High temperature applications requiring water heater supply water temperatures greater than 140°F (60°C) must use ULC S636 CPVC, PP or AL29-4C.

WARNING

The use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in the exhaust venting system is prohibited. Failure to follow these instructions may result in property damage, personal injury or death.

WARNING

Covering non-metallic vent pipe and fittings with thermal insulation is prohibited. Failure to follow these instructions may result in property damage, personal injury or death.

Vent and Air-inlet Pipe Length Determination

Use Table 4-5 to determine the maximum pipe length that can be used. The table calculates sweep, 90º elbows, and 45º elbows at 5 equivalent feet each. Note: model NX200 has limitations when operating with Propane Gas (LP).

***Example*:** An NX200 can be installed with 105 equivalent feet of air-inlet piping and 105 equivalent feet of exhaust vent piping when operating with Natural Gas. When operating with Propane Gas (LP), the maximum length of each the exhaust vent and air-inlet pipe is limited to 50 equivalent feet (3" diameter pipe).

NOTICE

The length of one vent pipe (air-inlet or exhaust) may not exceed the length of the other vent pipe by more than 20 equivalent feet.

Table 4-5 Allowable Vent and Air-Intake Pipe Size and Lengths

Model	Pipe Size	Gas	Length ft.	Number of Elbows (90's or 45's) and Equivalent Feet								
				1	2	3	4	5	6	7	8	9
NX200	3"	LP	50	45	40	35	30	25	20	15	10	5
	3"	NG	105	100	95	90	85	80	75	70	65	60
	4"	NG & LP	105	100	95	90	85	80	75	70	65	60
NX300& NX400	4" or 6"	NG & LP	100	95	90	85	80	75	70	65	60	55
NX500	4" or 6"[3]	NG & LP	100	95	90	85	80	75	70	65	60	55
NX600	4"or 6"[3]	NG[2]	100	95	90	85	80	75	70	65	60	55
NX700 & NX800	6"[1]	NG[2]	100	95	90	85	80	75	70	65	60	55

Notes:
[1] Only 6" exhaust vent is permissible for models NX700-800. Air-inlet pipe can be 4" or 6" (6" is highly recommended).
[2] Models NX600-NX800 operate with Natural Gas only.
[3] Models NX500 & NX600 are limited to 30 ft. of 4" or 90 ft. of 6" exhaust venting when using the Air Filter Kit (P/N HUB-84093).

⚠ WARNING

Air Filter Kit venting restrictions - Models NX500 & NX600 are limited to 30 equivalent feet of 4" (or 90 equivalent feet of 6") exhaust vent when using the optional Air Filter Kit. When transitioning from 4" to 6", the 4" venting used must be counted 3 times to convert to an equivalent length in 6".

Example: An application uses one 90º elbow and 5 feet of 4" venting before converting to 6"; therefore, the 4" venting has an equivalent length of 30' [(5'+5') x 3] of 6" venting; thus allowing an additional 60' equivalent of 6"venting *(Note: Example is only true with NX500-600 models using the optional Indoor Combustion Air Kit).*

Termination Options – Direct Vent Installation

The venting system of the Hubbell NX may be terminated using field supplied piping to construct a "Two-Pipe" termination, see Figures 4-6(b), 4-7(a), 4-7(b) and 4-8(a); alternatively the venting may be terminated using a factory kit selected from Table 4-6.

Kits certified with the Hubbell NX are listed in Table 4-6 and available from IPEX, DuraVent, Centrotherm, and/or Hubbell. For more information on System 636 Vent Kits or wholesaler locations contact IPEX directly **USA:** 1-800-463-9572 or www.IPEXamerica.com | **CAN:** 1-866-473-9462 or www.ipexinc.com. For more information on PolyPro Vent Kits or wholesaler locations contact DuraVent directly 1-800-835-4429 or www.duravent.com. For more information on InnoFlue Vent Kits or wholesaler locations contact Centrotherm directly at 1-877-434-3432 or www.centrotherm.us.com.

Table 4-6 Optional Vent Termination Kits

Description	Vent Size	Supplier P/N	Figure	Vent Material Compatibility	Vent Option	
						Wall
IPEX Low Profile (Flush Mount)[7]	3"	196985 (Hubbell P/N 84357)	4-9	PVC/CPVC[7]	✘	✔
	4"	196986 (Hubbell P/N 84358)				
IPEX Concentric (Wall/Roof)[5,6,7,8]	3"	196116 (Hubbell P/N 82666)	4-9(b), 4-10(b)	PVC/CPVC[7]	✔	✔
	4"	196021 (Hubbell P/N 84355)				
DuraVent - PolyPro Concentric (Wall)	3"	3PPS-HK	4-9(d)	PVC/CPVC/PP	✘	✔
	4"	4PPS-HK				
DuraVent - PolyPro Concentric (Roof)	3"	3PPS-VK	4-10(c)	PVC/CPVC/PP	✔	✘
	4"	4PPS-VK				
Centrotherm – InnoFlue (Flush Mount)	3"	ISLPT0303	4-9	PVC/CPVC/PP	✘	✔
Centrotherm – InnoFlue Concentric (Wall)[9]	3"	ICWS3513 & ICTC0335	4-9(d)	PVC/CPVC/PP	✘	✔
	4"	ICWS4639 & ICTC0446				
Centrotherm – InnoFlue Concentric (Roof)[9]	3"	ICRT3539 & ICTC0335	4-10(c)	PVC/CPVC/PP	✔	✘
	4"	ICRT4679 & ICTC0446				

⚠ WARNING Models NX300-NX800 are not approved for use with any of the 3" vent termination kits; only 4" vent termination kits, listed in Table 4-6, are acceptable.

IMPORTANT **PVC In Canada** - Authorities in some jurisdictions may not allow the use of any PVC venting materials with condensing water heaters; check with the local safety inspector to verify compliance prior to installing a PVC Concentric Vent Kit with a Hubbell NX.

IMPORTANT

Sidewall Termination - Due to potential moisture loading (build-up) along the exterior wall, sidewall venting may not be the preferred venting option. Refer to Figures 4-8 and 4-10 for roof top venting options.

Sidewall Termination Examples – Direct Vent Installation

Figure 4-6(a) Concentric Sidewall Termination (NX200 Illustrated)

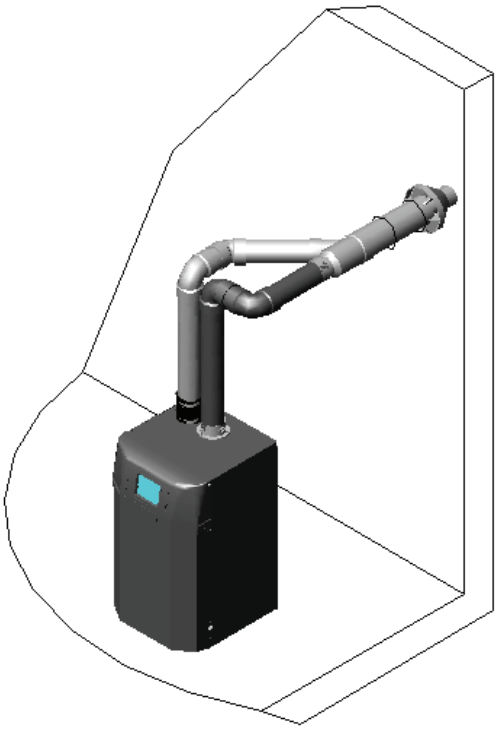


Figure 4-6(b) Two-Pipe Sidewall Termination (NX200 Illustrated)

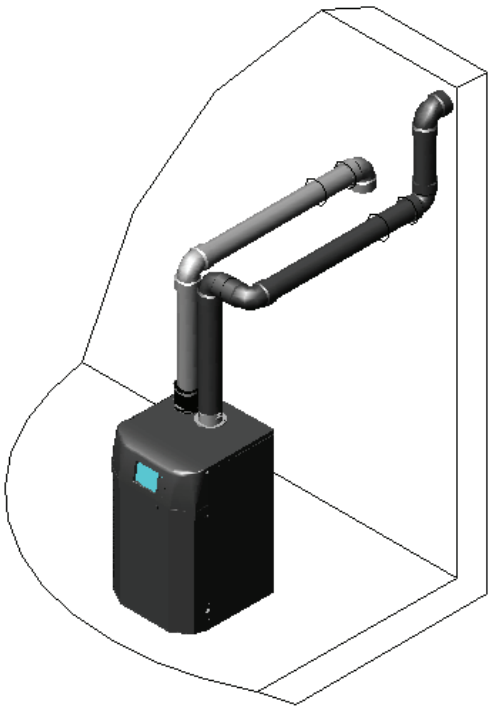


Figure 4-7(a) Two-Pipe Sidewall Termination (NX800 Illustrated)

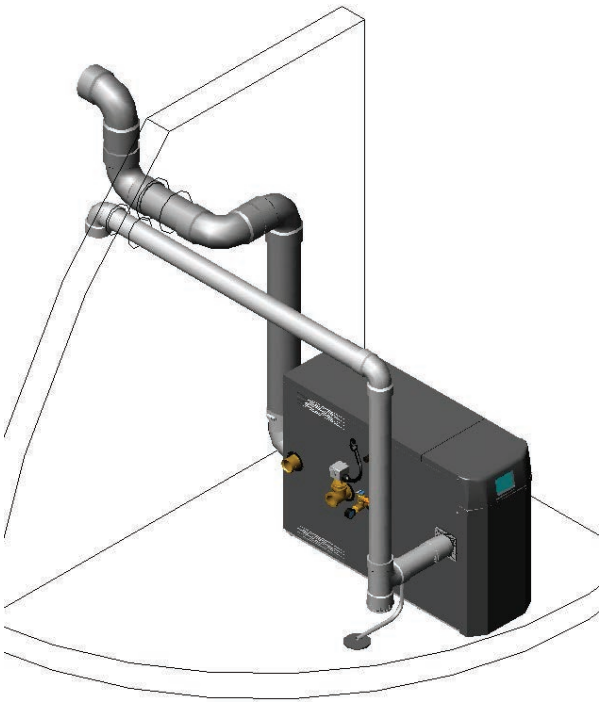
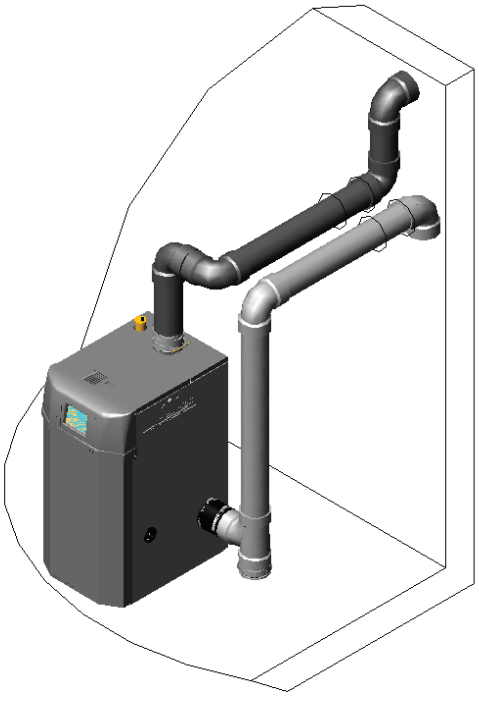


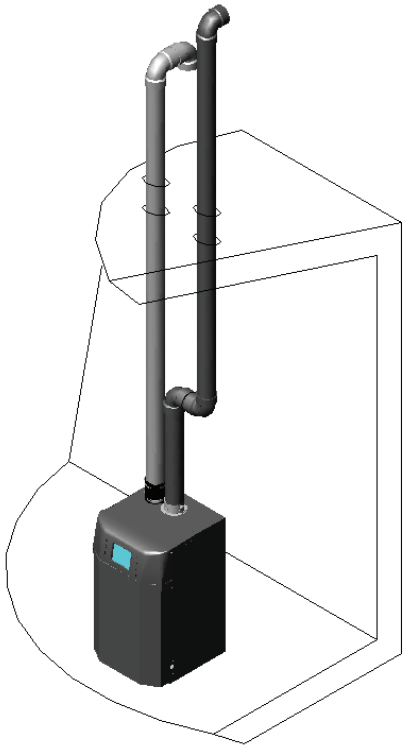
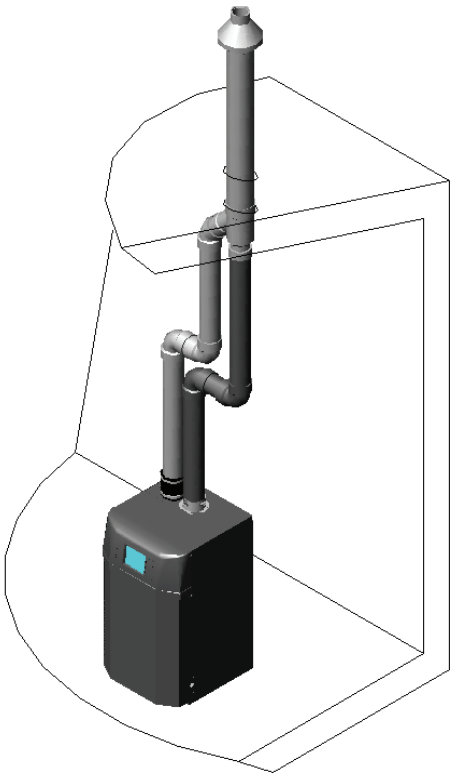
Figure 4-7(b) Two-Pipe Sidewall Termination (NX400 Illustrated)



⚠ WARNING

Extra precaution must be taken to adequately support the weight of the Vent/Air-inlet piping in applications using roof-top terminations. Failure to follow these instructions may result in venting or water heater component failure resulting in flue gas spillage leading to property damage, serious injury or death.

Roof Termination Examples – Direct Vent Installation

Figure 4-8(a) Two-Pipe Roof Termination	Figure 4-8(b) Concentric Roof Termination
(NX200 Illustrated)	(NX200 Illustrated)
	

Sidewall Termination Details – Direct Vent Installation

Figure 4-9(a)

Two-Pipe Termination (Sidewall)

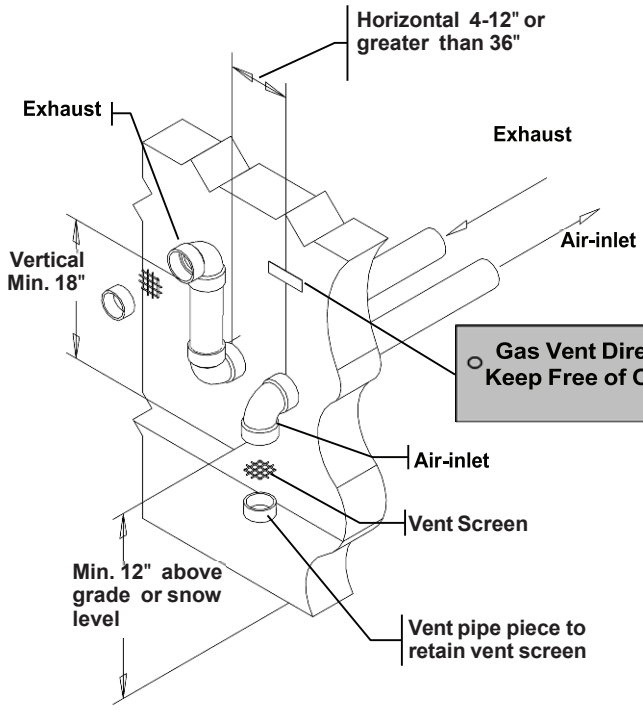


Figure 4-9(b)

IPEX Concentric Termination (Sidewall)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

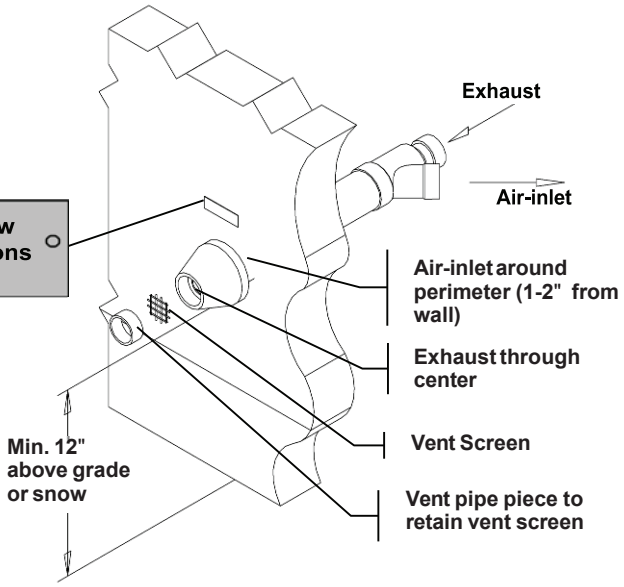


Figure 4-9(c)

Low Profil Termination (Sidewall)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

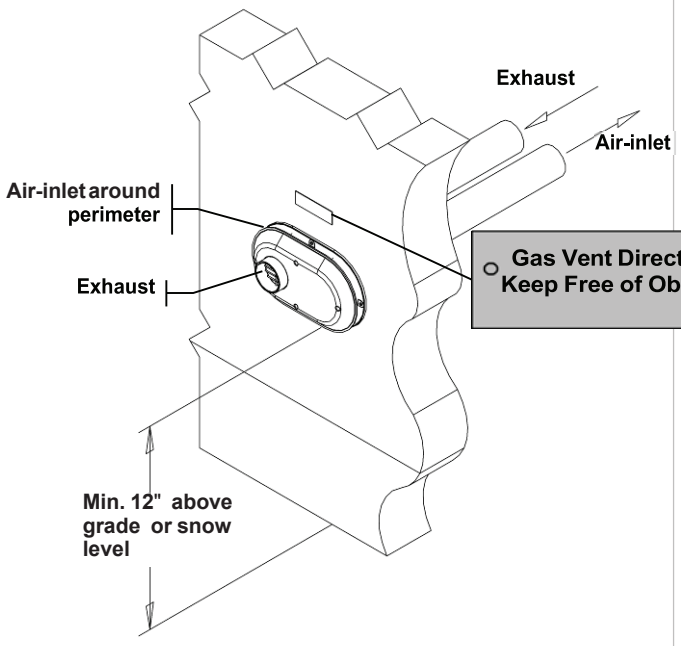
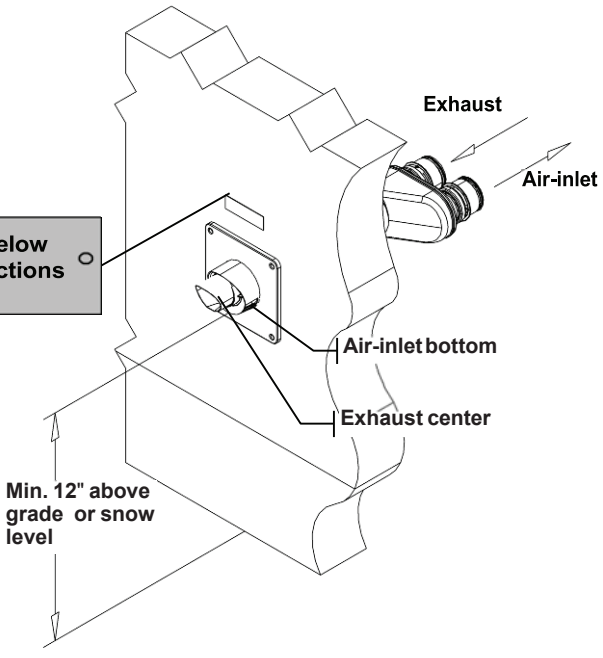


Figure 4-9(d)

PolyPro / InnoFlue Termination (Sidewall)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.



Roof Termination Details – Direct Vent Installation

Figure 4-10(a)

Two-Pipe Termination (Roof)

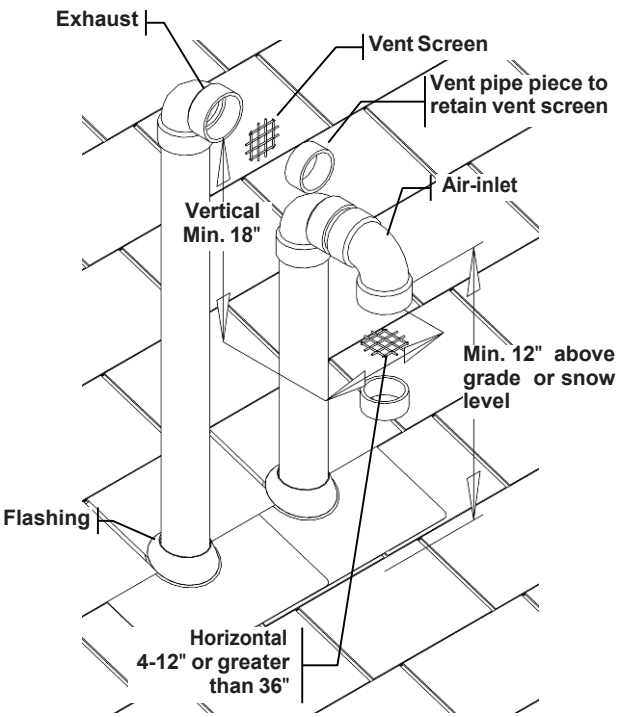


Figure 4-10(b)

IPEX Concentric Termination (Roof)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

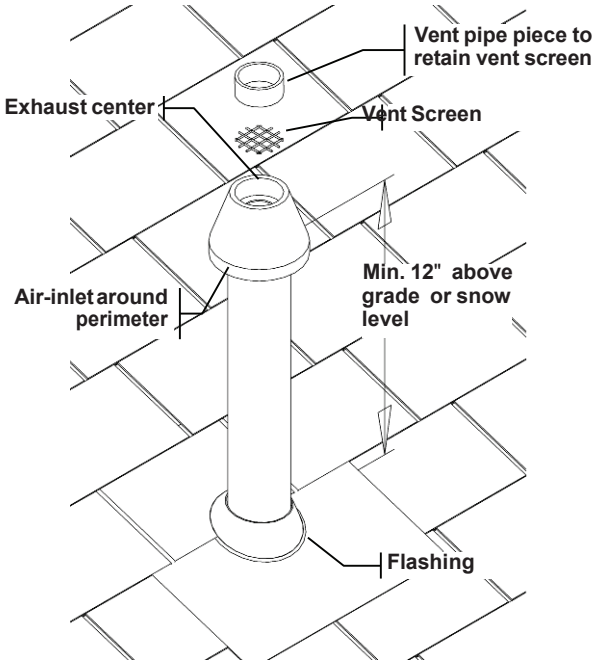


Figure 4-10(c)

PolyPro / InnoFlue Termination (Roof)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

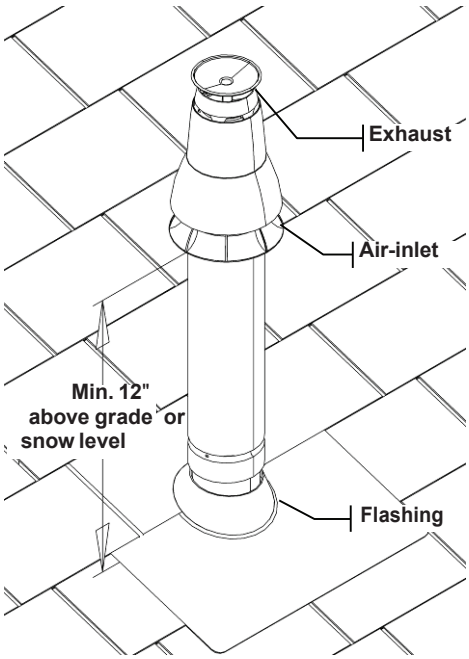
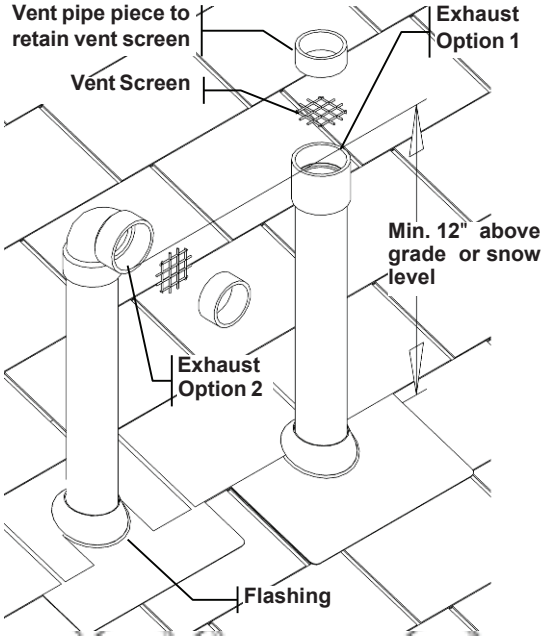


Figure 4-10(d)

Exhaust only Termination (Roof)

⚠ WARNING

Figure illustrates two options for exhaust termination only; neither vent pipe illustrated is for combustion air-inlet.



Venting Rules and Guidelines

1. **Prevailing Winds:** Ensure the vent is located where it will not be exposed to normal prevailing winds.
2. **Combustion Air-inlet Contamination:** Air for combustion must be drawn from an area free of dust and contaminants. Combustion air containing chemicals such as chloride, fluoride, bromine or iodine or dust and debris will cause corrosion damage of the heat exchanger voiding your Hubbell warranty. Refer to Table 4-1 for a list of corrosive products and contaminants sources to avoid.
3. **Vertical Separation:** The exhaust must be a minimum of 18 in. above the air inlet, and the air inlet must always be a minimum of 12 in. plus snow allowance above any surface that will support snow. (Two feet plus snow allowance is highly recommended). Consult your weather office for the maximum typical snowfall for your region.
4. **Horizontal Separation:** The horizontal distance between the inlet and exhaust must be a minimum of 4" center to center.
5. **Wall Flashing:** Under normal operating conditions this water heater will produce a plume of white gases, and should be taken into consideration when selecting an adequate location. A 36 in. diameter stainless, plastic, or vinyl shield can be used to flash the exterior of the building.
6. **Flue Gas Hazard:** Position the vent termination where vapors cannot make accidental contact with people and pets or damage nearby shrubs and plants.
7. **Elbow Extensions:** Elbows on outside of wall must be no more than 1⁄2 in. away from the wall.
8. **Vent Sloping:** All indoor exhaust piping must be on a slope back to the water heater a minimum of 1⁄4 in. per linear foot of vent. For applications where excessive condensation is possible 1⁄2 in. per linear foot is recommended.
9. **Vent Supports:** Where required Vent and Air-inlet piping shall be secured to the wall for more rigidity. All interior vent pipe shall be supported a minimum of every 36 in..
10. **Roof Exhaust:** In all roof applications the discharge must point away from the pitch of the roof.
11. **Roof Flashing:** Install adequate flashing where the pipe enters the roof, to prevent water leakage.
12. **Rain Cap:** Install and seal a rain cap over existing chimney openings, in vacant chimney applications.
13. **Venting Below Grade:** For installations that exit the wall below grade refer to Figure 4-11.
14. **Vent Screens:** Install factory supplied vent screens on the outside of the last elbow for both the inlet and exhaust vent terminal elbows. Install the screen into the female opening of the elbow, and then cut a small piece of pipe to sandwich the screen into the elbow. NOTE: ensure the small piece of pipe cut, does not extend past the end of the elbow. Two screens are provided in the package. See Figures 4-9 and 4-10.
15. **Condensate Hazard:** Do not locate vent over public walkways, driveways or parking lots. Condensate could drip and freeze resulting in a slip hazard or damage to vehicles and machinery.
16. **Warning Plate:** For Sidewall Venting, install the warning plate “Gas Vent Directly Below”, directly above (within 4 ft. vertically) the location of the air-inlet pipe, so it is visible from at least 8 ft away. See Figure 4-9.
17. **Wall Thickness:** Direct vent terminations are designed to work with any standard wall thickness. Installation guidelines for min/max wall thickness are as follows: Min. = 1 in., Max. = 60 in..
18. **Venting Options:** Due to potential moisture loading (build-up) along the exterior wall, sidewall venting may not be the preferred venting option. Refer to Figures 4-8 and 4-10 for roof top venting options.

⚠ WARNING The vent for this water heater shall not terminate over public walkways; or near soffit vents or crawl space vents or other area where condensate of vapor could create a nuisance or hazard or cause property damage; or where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Figure 4-11 Venting Below Grade

For installations that exit the wall below grade:

1. Excavate site to a point below where the pipes are to exit as shown.
2. Ensure the wall is fully sealed where the pipes penetrate.
3. The Vent/Air-inlet piping MUST be secured to the side of the building above grade, as shown, to provide rigidity.
4. Optional mounting bracket P/N. HUB-82075 for securing the exhaust pipes (only applicable for 3 in. PVC/CPVC venting).
5. Ensure that the Vent/Air-inlet clearances are maintained, see Section 5.0 for details.

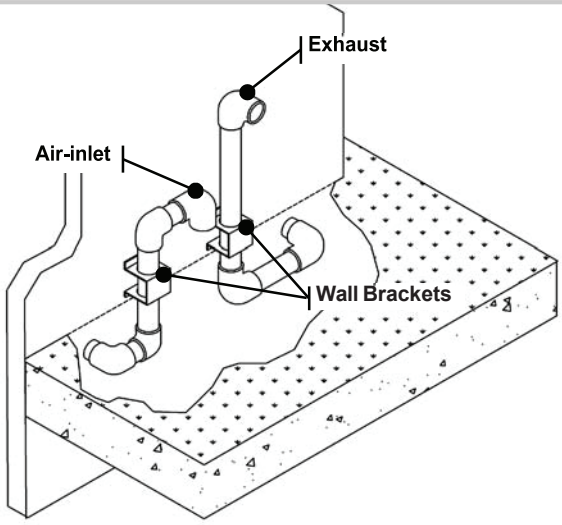


Figure 4-12 Outdoor Venting

Vent piping outside the building is permitted under the following conditions:

1. The maximum length outside the building is 20 ft. Note that outdoor length must be included in the overall vent length calculation.
2. All normal termination clearances are maintained.
3. The pipe is supported every 24 in..
4. The exhaust and inlet are sloped back to the water heater 1⁄2 in. elevation for every linear foot.

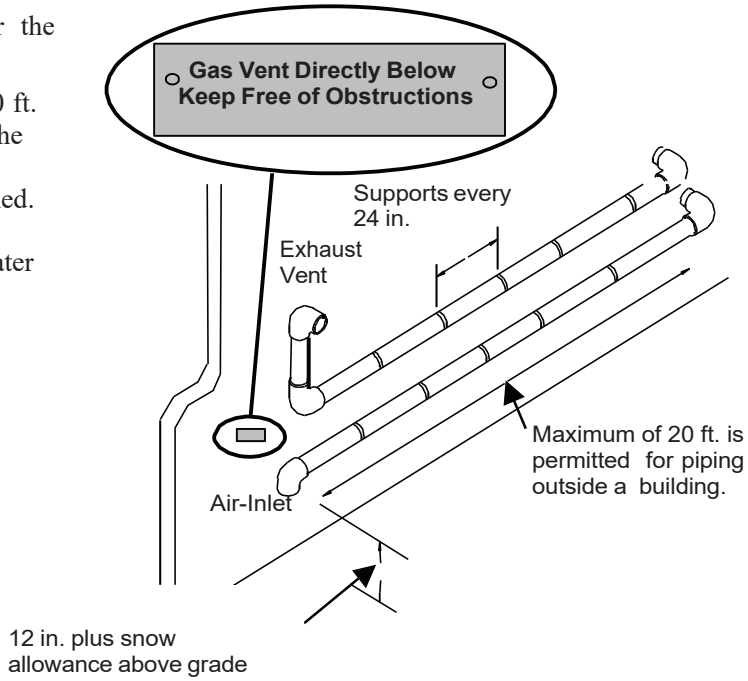
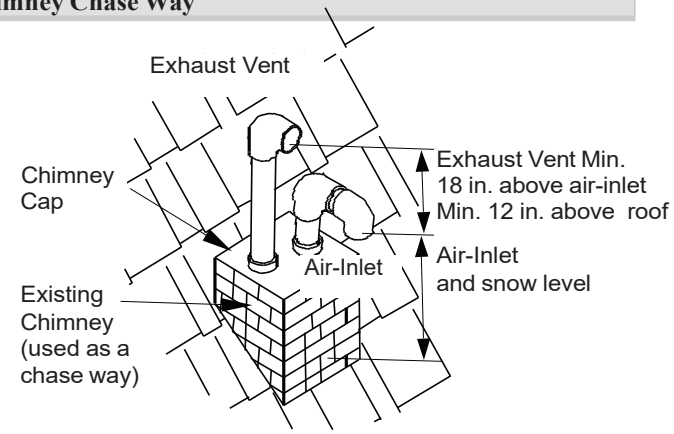


Figure 4-13 Existing Chimney Chase Way

It is permissible to use an existing chimney as a chase way to run the Vent/Air-inlet piping as long as:

1. The chimney is not being used by any other water heater.
2. Flue gases do not enter the vacant chimney.
3. Only Hubbell NX certified venting materials are used, see Table 4-4.
4. Vent lengths are within the maximums specified.
5. The top of the chimney is capped and the Vent/ Air-inlet pipes are flashed to prevent leakage into the vacant chimney.



⚠ DANGER Under no circumstances may an existing chimney or chase-way be used to vent or

provide combustion intake air to a Hubbell NX. Failure to follow these instructions will result in fire, property damage, serious injury or death.

5.0 VENT AND AIR-INTAKE TERMINATION CLEARANCES

⚠ WARNING The quick reference table below is to be read in conjunction with the numbered notes as indicated, Figures 5-1 through 5-6, and the Venting Rules and Guidelines in Section 4.0. The instructions detailed in this section are a combination of Hubbell NX specific and National Gas Code restrictions. Compliance alone doesn't insure a satisfactory installation as good common sense must also be applied. Failure to follow these instructions may result in fire, property damage, serious injury or death.

Table 5-1 Termination Clearances Quick Reference Table

Clearances to Air-Inlet Termination	USA[1] Min. Distance		Canada[2] Min. Distance
A Above grade/roofline and snow level [8]	12 in.	305 mm	12 in.
B Above roof line - Concentric Vent [6, 11, 13]	24 in.	610 mm	24 in.
C To exhaust vent from any other water heater	12 in.	305 mm	36 in.
Clearances to Exhaust Vent Termination	**Min. Distance**		**Min. Distance**
A Above grade/roofline and snow level [8]	12 in.	305 mm	12 in.
D Minimum vertical separation above air inlet [9]	18 in.	457 mm	18 in.
E Minimum horizontal separation from air inlet [3]	4 in.	102 mm	4 in.
F Window or door that may be opened, or other building opening	12 in.	305 mm	36 in.
G To combustion air inlet of any other appliance	12 in.	305 mm	36 in.
H Non-mechanical air supply inlet to building	12 in.	305 mm	36 in.
I Mechanical air supply inlet to building [4]	3 ft.	915mm	6 ft.
J Soffit, overhang, eave or parapet	24 in.	610mm	24 in.
K Soffit vent or vent opening in an overhang, eave or parapet	6 ft.	1.83 m	6 ft.
L Outside corner [10]	-	-	-
M Inside corner of an L-shaped structure (including walls and fences)	36 in.	915 mm	36 in.
N Service regulator / vent outlet	36 in.	915mm	36 in.
P Each side of center line above or below meter / regulator assembly [5]	36 in.	915mm	36 in.
Q Above a paved sidewalk, driveway, or parking lot on public property if adjacent [12]	7 ft.	2.13 m	7 ft.
R Above a public walkway	x	x	x
S Above a sidewalk or paved driveway that is located between two single family dwellings and services both dwellings	x	x	x
T Under a concrete veranda, porch, deck, or balcony [7]	24 in.	610 mm	24 in.
U Above, under or near exterior stairs	x	x	x
V Into a canopy or carport	x	x	x

Notes:
1 - Canadian installations must comply with the current CSA B149.1 Natural Gas and Propane Installation Code and local building codes.
2 - US installations must comply with current ANSI Z223.1/ NFPA 54 National Fuel Gas Code and local building codes.
3 - Horizontal separation center-to-center (c.c.) 4"-12" (102-305 mm).
4 - For US installations, an exhaust vent must be 3 ft above a mechanical air supply inlet if within 10 ft. horizontally.
5 - Horizontal clearance must be observed up to a height of 15 ft. [4.6 m] above/below the meter, regulator, or relief devices.
6 - Concentric Vent must protrude from the roof precisely 24"[610 mm] measuring from the terminal end-cap vanes.
7 - Permitted if veranda, porch, deck, or balcony is made of concrete and a minimum of two sides are fully open beneath.
8 - 24" is the recommended snow level allowance above grade/roofline or any surface that will support snow, debris, or ice (i.e. for roof venting clearances - roofline and snow level). If living in a snowfall region, consult your local weather office for the maximum typical snowfall for your area.
9 - Note that the vent must maintain a minimum vertical distance above the air-inlet. Example: Vent height = 18" (457 mm) above air inlet + 12" (305 mm) for air inlet above grade/roof line and snow level = 30" (762 mm) above grade and snow level.
10 - Clearances to an outside corner to be in accordance with local installation codes.
11 - In Canada, concentric vent materials are subject to approval by local inspectors. See Termination Kits in Section 4.0.
12 - Above public walkways, driveways or parking lots if adjacent to it and condensate cannot drip, freeze, or create a hazard.
13 - Contact Hubbell for special exemptions relating to multiple water heater installations using concentric vents.

Figure 5-1 Termination Clearances Quick Reference Diagram

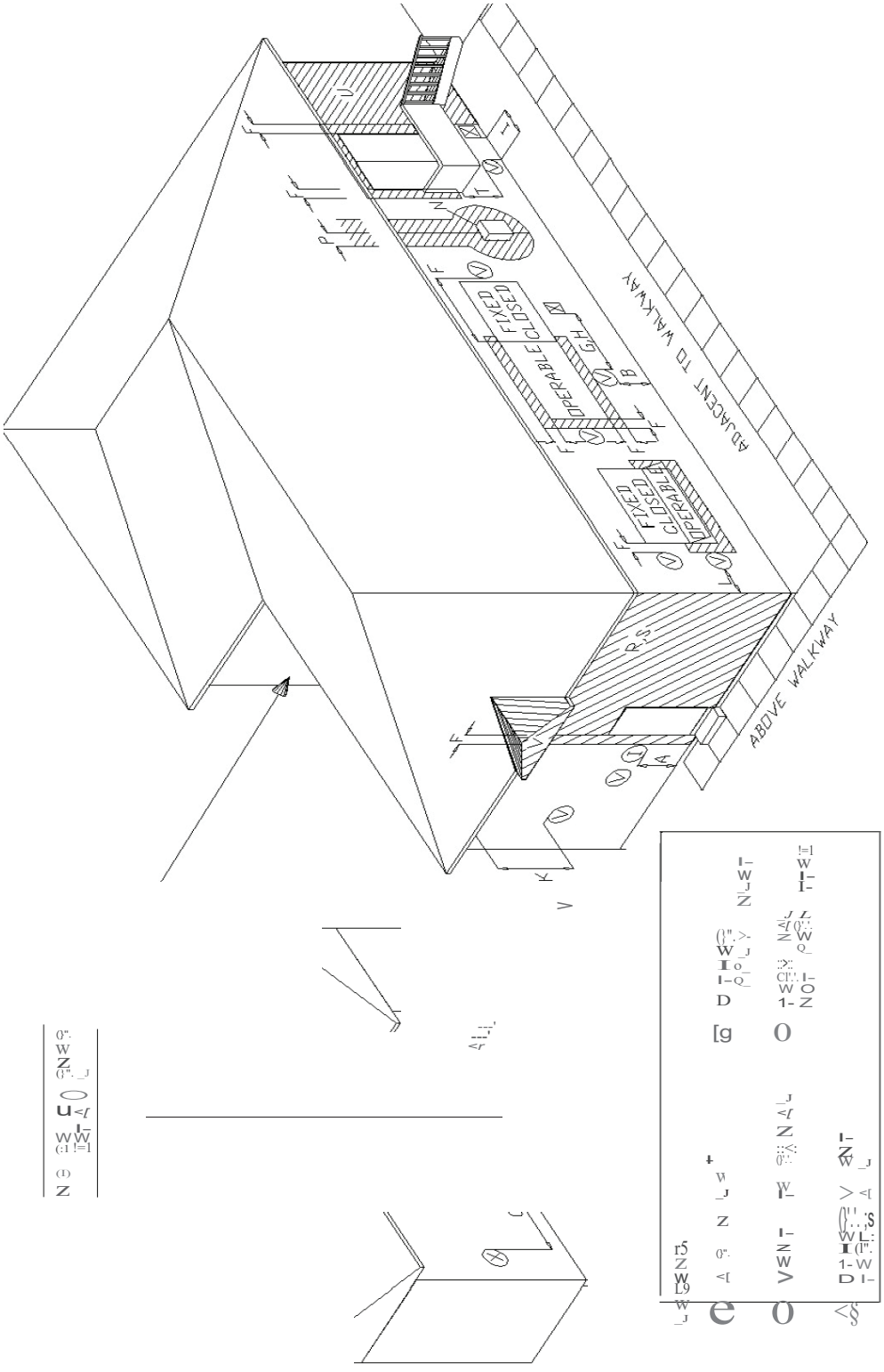
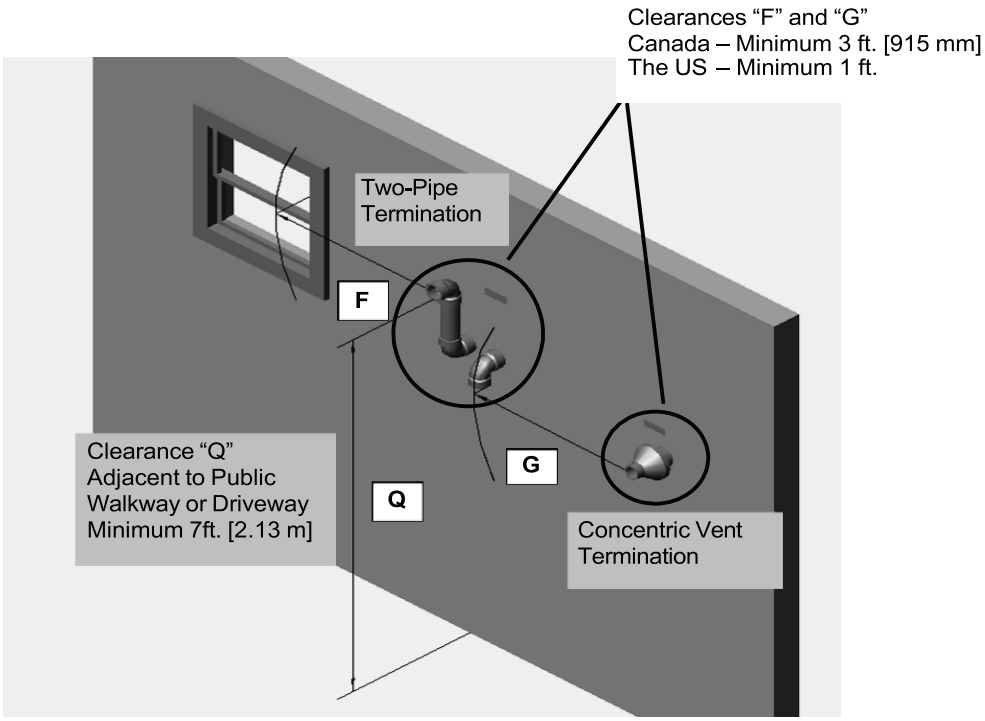


Figure 5-2 Sidewall Termination Clearances (See Table 5-1)



G – Letter represents a specific Termination Position. Refer to Table 5-1 for corresponding termination clearances.

July 25, 2019

TECHNICAL BULLETIN – South Coast AQMD Low NOx Approval (NX)

Product Series: NX

Models: NX200, NX300, NX400, NX500, NX600, NX700, NX800

Update: SCAQMD Rule 1146.2 Low NOx approval

Implementation Date: July 23, 2019

The South Coast Air Quality Management District (SCAQMD) has approved and certified the above listed natural gas-fired boiler and water heater models, subject to Rule 1146.2 – *Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters*, to comply with 20 ppm @ 3% O_2 NOx emission limit.

Encl.: SCAQMD certificate (NX Series)

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

Kevin Choi
Underwriters Laboratories of Canada
7 Underwriters Rd.
Tonoto, Ontario M1R 3A9
Canada

July 18, 2019

Subject: Rule 1146.2 Certification – Hubbell The Electric Heater Company

Dear Mr. Choi,

As requested in your email dated June 26, 2019, submitted on behalf of Hubbell, the South Coast Air Quality Management District (South Coast AQMD) has approved and certified the following natural gas-fired hot water heater models subject to Rule 1146.2 – *Emissions of Oxides of Nitrogen from Larger Water Heaters and Small Boilers and Process Heaters*, to comply with 20 ppm @ 3% O_2 NOx emission limit. This certification is based on approval of the NOx Emission Test Report for models NX200, NX500, and NX800, dated June 25, 2019, by UL Canada (SCAQMD Source Test Reference ID # R19198).

Certified Models	Heat Input Rating (BTU/hr)	Type
Hubbell NX Series		
NX200*	199,000	1
NX300	275,000	1
NX400	399,000	1
NX500*	500,000	2
NX600	600,000	2
NX700	700,000	2
NX800*	800,000	2

*Tested Models

Please note that South Coast AQMD does not endorse or warrant any specific product or manufacturer. Modification of the products listed here will void this certification. If you have any questions or require further assistance, please contact CJ Change at (909) 396-3293 or via e-mail at cchang@aqmd.gov.

Sincerely,

George Illes
Supervising Air Quality Engineer
Engineering & Permitting

APPENDIX D

Electronic Modeling Files Archive

(Provided Under Separate Cover)

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background [HELP]

1. Name of proposed project, if applicable:
   CWU North Campus Heating Upgrades
2. Name of applicant:
   Central Washington University Representative, Delano Palmer
3. Address and phone number of applicant and contact person:
   206 East 11th Ave.

Ellensburg, WA 98926

Cell: 509-929-0224

4. Date checklist prepared:
   September 1, 2022
5. Agency requesting checklist:
   Washington State Department of Ecology.
6. Proposed timing or schedule (including phasing, if applicable):
   Construction will commence upon issuance of an Approval Order.
7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.
   No.
8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.
   Notice of Construction (NOC) application.
9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.
   None are known.
10. List any government approvals or permits that will be needed for your proposal, if known.
    No.
11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)
    Replacement of three existing natural gas-fired boilers of the same size and model (max. heat input 1.5 MMBtu/hr), and installation of two new water heaters (max. heat input 500 MBtu/hr) to replace the similar existing four units.
12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.
    The project will take place at Central Washington University's (CWU's) north campus in Ellensburg, Washington. See attached figures.

B. Environmental Elements [HELP]

1. *Earth* [help]

a. General description of the site:

(circle one) **Flat,** rolling, hilly, steep slopes, mountainous, other _____

b. What is the steepest slope on the site (approximate percent slope)?
   ~0%

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.
N/A. The site is already constructed on and will not change commercial status or soils located at the site.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.
No.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.
None are proposed.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.
No.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?
The site is pre-existing, and no changes will be made to impervious surfaces.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:
N/A.

2. Air [help]

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.
CO, NOx, SO2, PM, HC/VOCs, and Lead will be some of the criteria pollutants that will be emitted during operation. Full list and details can be found in the NOC application.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
No.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:
Best Available Control Technologies (BACT) will be used. Full list and details can be found in the NOC application.

3. Water [help]

a. Surface Water: [help]

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.
No.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.
N/A

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.
N/A

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.
No.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.
No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.
No.

b. Ground Water: [help]

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.
No.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.
None.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.
No.

2) Could waste materials enter ground or surface waters? If so, generally describe.
No.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.
No.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:
None.

4. Plants [help]

a. Check the types of vegetation found on the site:

__X__ deciduous tree: alder, maple, aspen, other
__X__ evergreen tree: fir, cedar, pine, other
_____ shrubs
__X__ grass
_____ pasture
_____ crop or grain
_____ orchards, vineyards or other permanent crops.

_____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
_____ water plants: water lily, eelgrass, milfoil, other
_____ other types of vegetation

b. What kind and amount of vegetation will be removed or altered?
None.

c. List threatened and endangered species known to be on or near the site.
None.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:
None. No changes will be made.

e. List all noxious weeds and invasive species known to be on or near the site.
None.

5. Animals [help]

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

Examples include:

birds: hawk, heron, eagle, songbirds, other: starlings
mammals: deer, bear, elk, beaver, other: _____
fish: bass, salmon, trout, herring, shellfish, other: _____

b. List any threatened and endangered species known to be on or near the site.
None.

c. Is the site part of a migration route? If so, explain.
No.

d. Proposed measures to preserve or enhance wildlife, if any:
None proposed.

e. List any invasive animal species known to be on or near the site.
None.

6. Energy and Natural Resources [help]

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.
Electricity will be used to run the blowers on the boilers. Natural gas will be used for powering the boilers and heaters (water heating). Both energy sources are existing sources.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

None proposed.

7. *Environmental Health* [help]

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

None.

1) Describe any known or possible contamination at the site from present or past uses.

None.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

None.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

None.

4) Describe special emergency services that might be required.

None.

5) Proposed measures to reduce or control environmental health hazards, if any:

N/A

b. *Noise*

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Minor traffic noise from muffled construction vehicles.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Boiler fan noises will be present during operation.

3) Proposed measures to reduce or control noise impacts, if any:

N/A. The equipment will be operating during non-occupied days.

8. *Land and Shoreline Use* [help]

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The site is located on CWU's property. The proposal will not affect current land use.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

No.

c. Describe any structures on the site.
27' L x 15.5' W x 10' T facility for housing the boilers (existing).

d. Will any structures be demolished? If so, what?
No.

e. What is the current zoning classification of the site?
76 – Services - Governmental

f. What is the current comprehensive plan designation of the site?
No modifications are being made.

g. If applicable, what is the current shoreline master program designation of the site?
N/A

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.
No.

i. Approximately how many people would reside or work in the completed project?
None.

j. Approximately how many people would the completed project displace?
None.

k. Proposed measures to avoid or reduce displacement impacts, if any:
N/A

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:
N/A

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:
N/A

9. Housing [help]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.
None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.
None.

c. Proposed measures to reduce or control housing impacts, if any:
N/A

10. Aesthetics [help]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?
No modifications are being made.

b. What views in the immediate vicinity would be altered or obstructed?
No modifications are being made.

c. Proposed measures to reduce or control aesthetic impacts, if any:

N/A

11. Light and Glare [help]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?
None.

b. Could light or glare from the finished project be a safety hazard or interfere with views?
N/A

c. What existing off-site sources of light or glare may affect your proposal?
None.

d. Proposed measures to reduce or control light and glare impacts, if any:
N/A

12. Recreation [help]

a. What designated and informal recreational opportunities are in the immediate vicinity?
Biking and walking.

b. Would the proposed project displace any existing recreational uses? If so, describe.
No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:
Ensure that all equipment is out of the way of pedestrians.

13. Historic and cultural preservation [help]

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers? If so, specifically describe.
N/A

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.
N/A

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.
N/A

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.
N/A

14. Transportation [help]

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

No modifications are being made.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?
~ 1 mi to the nearest transit stop. This project will have no effects on public transit.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?
None.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle, or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).
No.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.
No.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?
No changes to existing conditions.

g. Will the proposal interfere with, affect, or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.
No.

h. Proposed measures to reduce or control transportation impacts, if any:
N/A

15. Public Services [help]

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.
No.

b. Proposed measures to reduce or control direct impacts on public services, if any.
N/A

16. Utilities [help]

a. Circle utilities currently available at the site:

electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other: _____

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.
All utilities are existing, and no changes will be made.

C. Signature [HELP]

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: .....

Name of signee: Delano Palmer

Position and Agency/Organization: Director, Capital Planning and Construction

Date Submitted: 09/01/22

Figure 1: Vicinity Map

Figure 2: Facility Layout

Notice of Construction Application
Supporting Information Report
New Natural Gas Boiler and Water Heaters
Central Washington University
Ellensburg, Washington

November 7, 2022

Prepared for

MW Engineers
601 West 1st Avenue, Suite 1300
Spokane, Washington

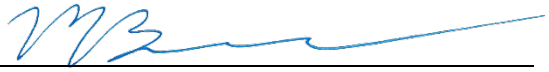
LANDAU ASSOCIATES

155 NE 100th St, Ste 302
Seattle, WA 98125
206.631.8680

Notice of Construction Application Supporting Information Report
New Natural Gas Boiler and Water Heaters
Central Washington University
Ellensburg, Washington

This document was prepared by, or under the direct supervision of, the technical professionals noted below.

Document prepared by:  Kathryn Baker
Primary Author

Document reviewed by:  Mark Brunner
Quality Reviewer

Date:	November 7, 2022
Project No.:	0336003.010
File path:	P:\336\003\R\NOC Supporting Information Report
Project Coordinator:	Christopher C. Young

LANDAU ASSOCIATES

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LIST OF ABBREVIATIONS AND ACRONYMS

AERMOD ..... AMS/EPA Regulatory Model
AMS ..... American Meteorological Society
ASIL ..... acceptable source impact level
BACT ..... Best Available Control Technology
CFR ..... Code of Federal Regulations
CO ..... carbon monoxide
CWU ..... Central Washington University
Ecology ..... Washington State Department of Ecology
EPA ..... US Environmental Protection Agency
Facility ..... Central Washington University
GEP ..... Good Engineering Practice
HAP ..... hazardous air pollutant
HC ..... hydrocarbons
hr ..... hour
K ..... Kelvin
km ..... kilometer
Landau ..... Landau Associates, Inc.
lb ..... pounds
$\mu g/m^3$ ..... micrograms per cubic meter
m ..... meters
MBtu ..... thousand British thermal units
MMBtu ..... million British thermal units
MMscf ..... million standard cubic feet
m/s ..... meters per second
NATA ..... National Air Toxics Assessment
NO_2 ..... nitrogen dioxide
NOC ..... Notice of Construction
NO_X ..... oxides of nitrogen
NSR ..... New Source Review
NWS ..... National Weather Service
PM ..... particulate matter
$PM_{2.5}$ ..... particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10} ..... particulate matter with an aerodynamic diameter less than or equal to 10 microns
ppmvd ..... parts per million volumetric, dry basis
scf ..... standard cubic feet
SO_2 ..... sulfur dioxide

LIST OF ABBREVIATIONS AND ACRONYMS (CONTINUED)

SQER ..... small-quantity emission rate
TAP ..... toxic air pollutant
VOC ..... volatile organic compound
WAC ..... Washington Administrative Code
yr ..... year

1.0 INTRODUCTION

Landau Associates, Inc. (Landau) has been contracted by MW Engineers to develop an air quality Notice of Construction (NOC) application required by the Washington State Department of Ecology (Ecology) for the replacement of three existing natural gas-fired boilers and installation of two new water heaters at Central Washington University's (CWU's) north campus in Ellensburg, Washington. This supporting information report provides the detailed information required for the NOC application for CWU (Facility). The information presented herein includes specifications for the equipment and detailed operations information, calculated potential emissions that would result from operation of the equipment, a review of the applicable regulations, and air dispersion modeling results. A review of Best Available Control Technology (BACT) is also included. The NOC application form with detailed Facility and contact information is provided in Appendix A.

2.0 BACKGROUND INFORMATION

CWU plans to replace three existing natural gas-fired Cleaver Brooks CFC-E 1500 heating water boilers. Each new boiler will have a maximum heat input value of 1.5 million British thermal units per hour (MMBtu/hr) and will be a direct replacement for an existing boiler that has the same model number, maximum heat input capacity, and emissions profile. Additionally, CWU plans to install two Hubbell NX500 high-efficiency, gas-fired condensing water heaters in Wendell Hill Hall. Each new water heater will have a maximum heat input value of 500 thousand British thermal units per hour (MBtu/hr). These two water heaters will replace four existing units that have a different manufacturer but are similar technology. The combined heat input capacity of the two new water heaters is lower than the combined heat input capacity of the four existing water heaters they will be replacing. This report addresses operations and emissions associated with the new boilers and water heaters.

The combustion of fuels in boiler and water heater operations cause emissions of regulated air pollutants. Potential air pollutants that will be emitted during boiler operations include particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOCs), and oxides of nitrogen (NO_X), which are regulated as criteria pollutants. Other combustion-related emissions are regulated as hazardous air pollutants (HAPs) and/or toxic air pollutants (TAPs).

Washington environmental regulations establish air permitting requirements for natural gas-fired boilers or heaters with combined heat input limits of greater than 4 MMBtu/hr under Washington Administrative Code (WAC) 173-400-110. These regulations also require that, prior to construction of a facility that may emit air contaminants, an NOC application be submitted to and reviewed by Ecology. Upon Ecology's determination that the operations will be in accordance with all applicable air quality requirements, an Approval Order is issued, which authorizes construction of the project to commence.

3.0 FACILITY DESCRIPTION

CWU is an institution of higher education located in Kittitas County, Washington. Figure 1 is a map of the vicinity with the Facility location identified. Figure 2 shows a site view of the Facility.

The Facility operates in accordance with Air Quality Approval Order No. 10AQ-C147, First Revision issued by Ecology on June 25, 2020 (Ecology 2020). This permit establishes emission limitations for boilers, emergency generators, and a paint booth.

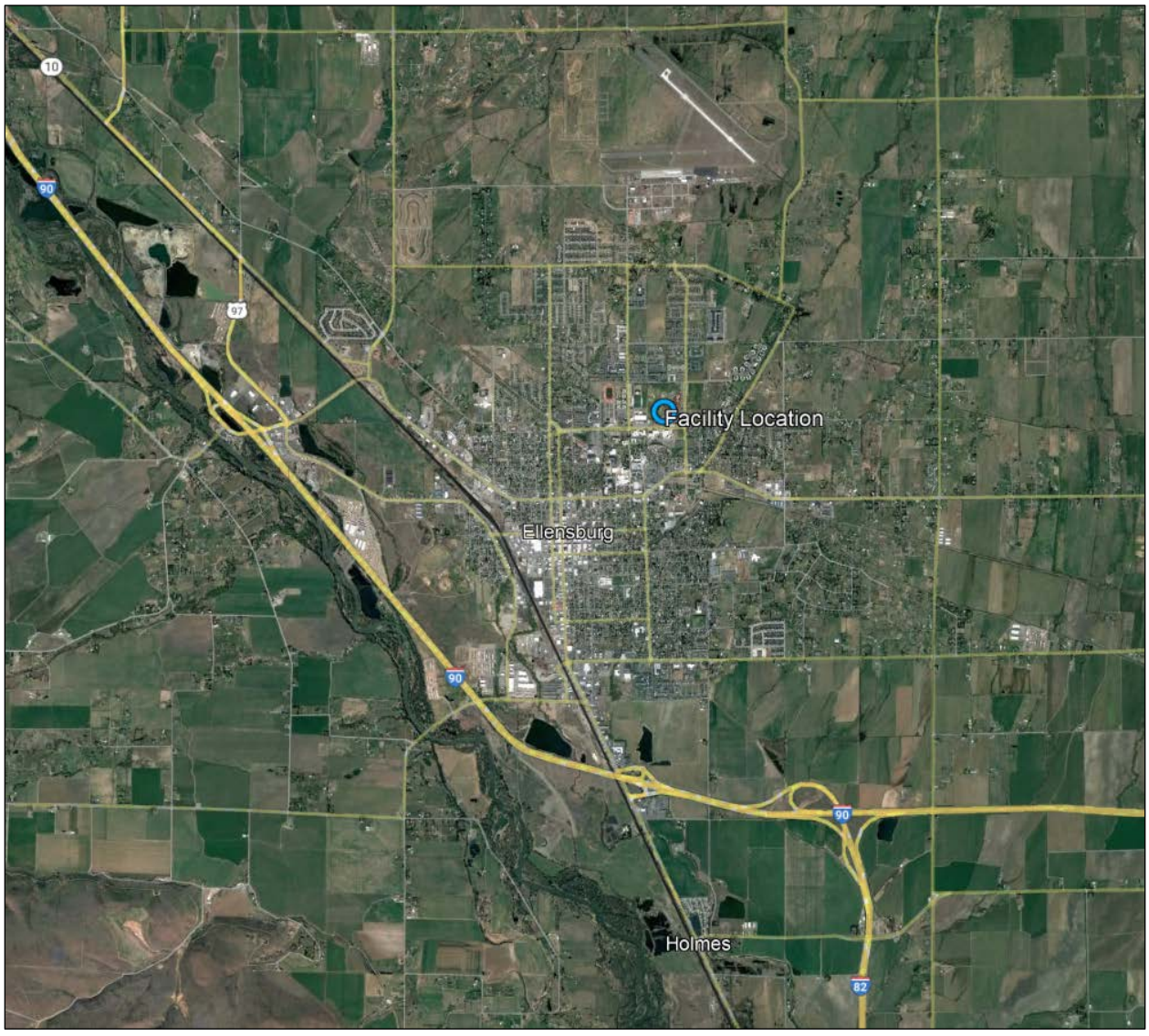

Figure 1: Vicinity Map

Figure 2: Facility Layout

4.0 PROJECT DESCRIPTION

The recent failure of the three natural gas-fired boilers has resulted in the need to install three new natural gas-fired boilers. The four existing water heaters are at the end of their useful life, and will be replaced with two new units. With this NOC application, MW Engineers and CWU propose the installation and operation of three new boilers and two new water heaters to provide for continued operations at the Facility.

4.1 Equipment Description

This section presents a detailed description of the boilers and water heaters related to this project. Figure 3 is a process flow diagram showing the boiler system configuration including the new replacement boilers.

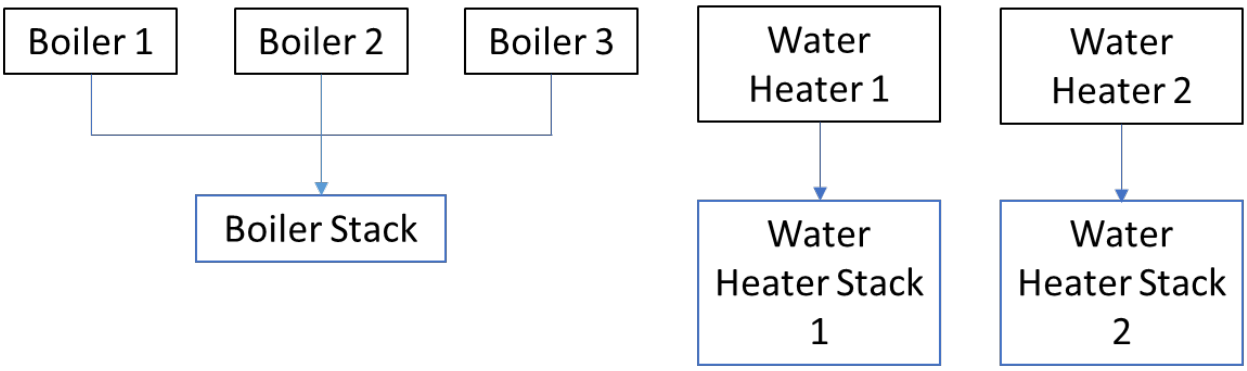

Figure 3: Process Flow Diagram

4.1.1 Boilers

The three existing boilers (installed in 2019) and the three proposed boilers are Cleaver Brooks CFC-E 1500 heating water boilers. Each boiler has a maximum heat input value of 1.5 MMBtu/hr. The proposed boilers will be a direct replacement of the existing boilers that have the same model number, maximum heat input capacity, and emissions profile.

4.1.2 Water Heaters

CWU plans to install two Hubbell NX500 high-efficiency, gas-fired condensing water heaters in Wendell Hill Hall. Each new water heater will have a maximum heat input value of 500 MBtu/hr. These two water heaters will replace four existing units that have a different manufacturer but are similar technology. The combined heat input capacity of the two new water heaters is lower than the combined heat input capacity of the four existing water heaters they will be replacing.

4.2 Air Contaminants Emitted

The combustion of natural gas to fire the proposed new boilers and water heaters will cause the generation and emissions of air pollutants including PM, CO, VOCs, and NO_X, which are regulated as criteria pollutants. Other combustion-related emissions are regulated as HAPs and/or TAPs.

Air contaminants that may be emitted during boiler operations are listed in Table 1, which also identifies whether the pollutant is regulated as a criteria pollutant, HAP, and/or TAP.

Table 1: List of Pollutants Emitted During Combustion of Natural Gas

Pollutant	Criteria	HAP	TAP
CO	Yes		Yes
NO_X	Yes		Yes – NO_2
SO_2	Yes		Yes
HC/VOCs	Yes		
PM_{10} (filt + cond)	Yes		
$PM_{2.5}$ (filt + cond)	Yes		
Lead	Yes		Yes
Acetaldehyde		Yes	Yes
Acrolein		Yes	No
Ammonia		No	Yes
Arsenic		Yes	Yes
Benzene		Yes	Yes
Beryllium		Yes	Yes
Cadmium		Yes	Yes
Chromium (total)		Yes	Yes
Chromium (VI)		Yes	Yes
Cobalt		Yes	Yes
Copper		No	Yes
Ethylbenzene		Yes	No
Formaldehyde		Yes	Yes
Hexane		Yes	No
Lead		Yes	Yes
Manganese		Yes	Yes
Mercury		Yes	Yes
Naphthalene		Yes	Yes
Nickel		Yes	Yes

Pollutant	Criteria	HAP	TAP
Polycyclic Organic Matter		Yes	Yes
2-Methylnaphthalene		No	Yes
3-Methylchloranthrene		Yes	Yes
7,12-Dimethylbenz(a)anthracene		No	Yes
Acenaphthene		No	Yes
Acenaphthylene		No	Yes
Anthracene		Yes	No
Benz(a)anthracene		No	Yes
Benzo(a)pyrene		No	Yes
Benzo(b)fluoranthene		No	Yes
Benzo(g,h,i)perylene		No	Yes
Benzo(k)fluoranthene		Yes	Yes
Chrysene		No	Yes
Dibenzo(a,h)anthracene		Yes	Yes
Dichlorobenzene		Yes	No
Fluoranthene		No	Yes
Fluorene		No	Yes
Indeno(1,2,3-cd)pyrene		No	Yes
Naphthalene		Yes	Yes
Phenanthrene		No	Yes
Pyrene		No	No
Propylene		No	No
Selenium		No	Yes
Toluene		Yes	No
Vanadium		No	Yes
Xylenes		Yes	No

Abbreviations and Acronyms:

CO = carbon monoxide
cond = condensable
filt = filterable
HAP = hazardous air pollutant
HC = hydrocarbons
NO_2 = nitrogen dioxide
NO_X = oxides of nitrogen
$PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns
SO_2 = sulfur dioxide
TAP = toxic air pollutant
VOC = volatile organic compound

4.3 Projected Construction Start and Completion Dates

The proposed boilers and water heaters will be installed once an Approval Order is issued for that equipment.

4.4 Operating Schedule and Production Rates

The proposed new boilers and water heaters will be operated up to 24 hours/day and 7 days/week. The maximum heat input rate for each boiler is 1.5 MMBtu/hr and for each water heater is 500 MBtu/hr.

4.5 Fuel Specifications

The burner will be fired with natural gas only.

5.0 APPLICABLE REGULATORY REQUIREMENTS

The proposed boiler replacement is subject to state and federal regulatory requirements related to control of emissions of criteria pollutants, TAPs, and HAPs. This section summarizes the applicable requirements.

5.1 Washington Administrative Codes

The Facility and the proposed new boilers are regulated under portions of the WAC pursuant to the Washington Clean Air Act and Chapter 70.94 of the Revised Code of Washington. This subsection summarizes the WAC requirements relevant to the proposed modifications.

5.1.1 Chapter 173-400 WAC: General Regulations for Air Pollution Sources

Under Chapter 173-400 WAC, the Facility is regulated as a stationary source and the proposed boiler is regulated as an emissions unit. Specific provisions of Chapter 173-400 WAC that are relevant to the proposed modifications consist of:

- WAC 173-400-040: General standards for maximum emissions
- WAC 173-400-050: Emission standards for combustion and incineration units
- WAC 173-400-075: Emission standards for sources emitting hazardous air pollutants
- WAC 173-400-110: New source review (NSR) for sources and portable sources
- WAC 173-400-113: New sources in attainment or unclassifiable areas.

5.1.2 Chapter 173-401 WAC: Operating Permit Regulation

The Facility is a "minor source" of air pollutants in accordance with Chapter 173-401 WAC and is not subject to the operating permit requirements of Chapter 173-401 WAC.

5.1.3 Chapter 173-460 WAC: Controls for New Sources of Toxic Air Pollutants

WAC 173-460-040 establishes review requirements for modified TAP sources. If the increase in emissions from a new stationary source is less than the applicable *de minimis* emission threshold for that TAP listed in WAC 173-460-150, the modification is exempt from NSR for that TAP. WAC 173-460-150 also establishes small-quantity emission rate (SQER) thresholds for TAP emissions that trigger the requirement to conduct dispersion modeling.

5.2 New Source Performance Standards

The proposed new boilers and water heaters are not subject to 40 Code of Federal Regulations (CFR) Part 60 Subpart Dc, *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units*, because they are steam-generating units with a design capacity of less than 10 MMBtu/hr heat input.

5.3 National Emission Standards for Hazardous Air Pollutants

The Facility is not a major source for HAP emissions. Boilers constructed after June 4, 2010 at area sources of HAPs are subject to 40 CFR Part 63 Subpart JJJJJJ, *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources*. However, natural gas-fired boilers are exempt from Subpart JJJJJJ.

6.0 EMISSIONS EVALUATION

This section describes the methodology, emission factors, and estimated emission rates for each of the emitted air contaminants. Emission rates for the proposed new boiler are compared to emission rates for the existing boiler and to the regulatory thresholds and standards for each pollutant.

6.1 Methodology for Estimating Emissions

Methods, factors, and operating parameters that have been used to estimate hourly and annual emissions rates for the air contaminants emitted by the existing and proposed boilers and water heaters are described below.

6.1.1 Emission Factors

Factors used to estimate emissions were taken from three sources:

1. The US Environmental Protection Agency's (EPA's) Inventory of Emission Factors, AP-42, Tables 1.4 (EPA 1998) for small boilers (boilers with a rating less than 100 MMBtu/yr) provides emission factors used to calculate criteria pollutant emissions and most TAPs/HAPs, except as noted in items 2 through 5 below.
2. The Ventura County Air Pollution Control District (VCAPCD), AB 2588, Combustion Emission Factors (VCAPCD 2001) provides emission factors for the calculation of acrolein, benzene, ethylbenzene, propylene, toluene, and xylenes.
3. The emission factor for acetaldehyde and formaldehyde were from the California Air Toxics Emission Factor database for natural gas-fired boilers (CARB; accessed October 2022).
4. The AP-42 document titled "Development and Selection of Ammonia Emission Factors" provides the emission factor for ammonia from natural gas-fired boilers (Battye et al. 1994).
5. The 2014 National Air Toxics Assessment (NATA) used source classification code-based speciation factors to speciate total chromium into constituent chromium compounds. The speciation factor to calculate hexavalent chromium from total chromium is 0.04 (EPA 2018).
6. The emission factor for benzo(a)pyrene was calculated by subtracting the VCAPCD emission factor for naphthalene from the emission factor for polycyclic aromatic hydrocarbons (PAHs), then adjusting the emission factor by the NATA 4.7 percent relative risk of PAHs as compared to benzo(a)pyrene.

Table 2 shows the specific emission factor used for calculating emissions and the reference for each factor.

Table 2: Emission Factors Used to Calculate Potential Emissions of Criteria Pollutants

Criteria Pollutant	Boilers (proposed)		Water Heaters (proposed)	
	Emission Factor Reference	Emission Factor (lb/MMscf nat gas)	Emission Factor Reference	Emission Factor (lb/MMscf nat gas)
CO	Manufacturer	37.7	Manufacturer	37.7
NO_X	Manufacturer	24.8	Manufacturer	24.8
SO_2	AP-42 Table 1.4-2	0.6	AP-42 Table 1.4-2	0.6
HC/VOCs	AP-42 Table 1.4-2	5.5	AP-42 Table 1.4-2	5.5
Total PM	AP-42 Table 1.4-2	7.6	AP-42 Table 1.4-2	7.6
PM_{10} (filt + cond)				
$PM_{2.5}$ (filt + cond)				
Lead	AP-42 Table 1.4-2	0.0005	AP-42 Table 1.4-2	0.0005

Abbreviations and Acronyms:

CO = carbon monoxide
cond = condensable
filt = filterable
HC = hydrocarbons
lb = pounds
MMscf = million standard cubic feet
nat gas = natural gas
NO_X = oxides of nitrogen
PM = particulate matter
$PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Table 3 identifies the emission factors and the reference used for calculating TAP emissions from both the new and the old boilers.

Table 3: Emission Factors Used to Calculate Potential Emissions of Toxic Air Pollutants

Washington TAPs	Emission Factor	Emission Factor (lb/10^6 scf nat gas)
Acetaldehyde	CATEF	0.00887
Acrolein	AB2588	0.0027
Ammonia	From AP-42 Ammonia EF	3.2
Arsenic	AP-42 Section 1.4	0.0002
Benzene	AB2588	0.008
Beryllium	AB2588	0.000012
Cadmium	AP-42 Section 1.4	0.0011
Chromium (total)	AP-42 Section 1.4	0.0014
Chromium (VI)	NATA	0.000056

Washington TAPs	Emission Factor	Emission Factor (lb/10^6 scf nat gas)
Cobalt	AP-42 Section 1.4	0.000084
Copper	AP-42 Section 1.4	0.00085
Ethylbenzene	AB2588	0.0095
Formaldehyde	CATEF	0.221
Hexane	AP-42 Section 1.4	1.8
Lead	AP-42 Section 1.4	0.0005
Manganese	AP-42 Section 1.4	0.00038
Mercury	AP-42 Section 1.4	0.00026
Naphthalene	AP-42 Section 1.4	0.00061
Nickel	AP-42 Section 1.4	0.0021
Polycyclic Organic Matter		0.0019
2-Methylnaphthalene	AP-42 Section 1.4	0.000024
3-Methylchloranthrene	AP-42 Section 1.4	0.0000018
7,12-Dimethylbenz(a)anthracene	AP-42 Section 1.4	0.000016
Acenaphthene	AP-42 Section 1.4	0.0000018
Acenaphthylene	AP-42 Section 1.4	0.0000018
Anthracene	AP-42 Section 1.4	0.0000024
Benz(a)anthracene	AP-42 Section 1.4	0.0000018
Benzo(a)pyrene	AB2588 and NATA	0.0000047
Benzo(b)fluoranthene	AP-42 Section 1.4	0.0000018
Benzo(g,h,i)perylene	AP-42 Section 1.4	0.0000012
Benzo(k)fluoranthene	AP-42 Section 1.4	0.0000018
Chrysene	AP-42 Section 1.4	0.0000018
Dibenzo(a,h)anthracene	AP-42 Section 1.4	0.0000012
Dichlorobenzene	AP-42 Section 1.4	0.0012
Fluoranthene	AP-42 Section 1.4	0.000003
Fluorene	AP-42 Section 1.4	2.80E-06
Indeno(1,2,3-cd)pyrene	AP-42 Section 1.4	1.80E-06
Naphthalene	AP-42 Section 1.4	6.10E-04
Phenanthrene	AP-42 Section 1.4	1.70E-05
Pyrene	AP-42 Section 1.4	5.00E-06
Propylene	AB2588	7.31E-01
Selenium	AP-42 Section 1.4	2.40E-05
Toluene	AB2588	3.66E-02

Washington TAPs	Emission Factor	Emission Factor (lb/10^6 scf nat gas)
Vanadium	AP-42 Section 1.4	2.30E-03
Xylenes	AB2588	2.72E-02

Abbreviations and Acronyms:

AB2588 = Ventura County Air Pollution Control District AB 2588 Combustion Emission Factors (VCAPCD 2001)
AP-42 Ammonia EF = Development and Selection of Ammonia Emission Factors (Battye et al. 1994)
CATEF = California Air Toxics Emission Factor Database (CARB; accessed August 2022)
lb = pounds
nat gas = natural gas
NATA = National Air Toxics Assessment (EPA 2018)
scf = standard cubic foot
TAPS = toxic air pollutants

6.2 Calculation of Estimated Pollutant Emissions

Potential hourly emissions of each criteria air pollutant and TAP have been calculated using the following formula:

$E = E_f * HI * (1MMscf/1020\ MMBtu)$

Where,

E = Contaminant emissions (lb/hr)

E_f = Emission factor (lb/MMscf of natural gas)

HI = Maximum heat input rate (MMBtu/hr).

For CO and NO_x emissions from the existing and proposed boiler, emissions were calculated based on the vendor-reported maximum concentrations using methods outlined in the EPA's Preferred and Alternative Methods for Estimating Air Emissions from Boilers (EPA 2001).

$E = (C \times MW \times Q \times 60) / (V \times 10^6)$

Where,

E = Hourly emissions in lb/hr of pollutant

C = pollutant concentration in parts per million volumetric, dry basis (ppmvd)

MW = molecular weight of the pollutant in lb/lb-mole

Q = stack gas volumetric flow rate in dry standard cubic feet per minute

V = volume occupied by 1 mole of ideal gas as standard conditions (385 cubic feet/lb-mole @ 68 degrees Fahrenheit [°F] and 1 atmosphere).

The guidance also provides an equation for the calculation of Q when exhaust gas flow rates are unavailable:

$Q = F_d \times (20.9/(20.9 - \%O_2) \times (HI/60)$

Where,

F_d= Ratio of the gas volume of fuel components per unit of heat. For natural gas, this value is provided by EPA Method 19 as 8710 scf/MMBtu.

$\%O_2$ = measured oxygen concentration dry basis.

HI = Heat input rate in MMBtu/hr.

Annual emissions have been calculated by multiplying the hourly emissions by the total annual hours of operation.

6.3 Calculated Emissions

Tables 4 and 5 summarize the estimated potential emissions for all pollutants during operation of the proposed new boilers and water heaters, respectively. Table B-1 shows the past actual HAP/TAP emissions for the existing boilers and Table B-2 shows the past actual HAP/TAP emissions for the existing heaters. Landau understands that, for permit applicability determinations, minor NSR considers only criteria pollutant emission increases associated with new equipment, and not emission decreases associated with equipment to be removed or decommissioned.

The Excel worksheet developed for these emission calculations has been submitted to Ecology electronically.

Table 4: Estimated Maximum Potential Emissions from the New Boilers

Criteria Pollutant	Emission Factor (pounds [lbs]/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(tons/year)	(lbs/day)	(lbs/hour)	
NO_X	24.8	0.5	2.6	0.11	year
CO	37.7	0.7	4.0	0.17	year
SO_2	0.6	0.012	0.064	0.00	year
PM	7.6	0.1	0.80	0.03	year
PM_{10}	7.6	0.1	0.80	0.03	year
$PM_{2.5}$	7.6	0.1	0.80	0.03	year
HC/VOCs	5.5	0.1	0.58	0.02	year

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Acetaldehyde	0.00887	3.9E-05	9.4E-04	3.4E-01	year
Acrolein	0.0027	1.2E-05	2.9E-04	1.0E-01	24-hr
Ammonia	3.2	1.4E-02	3.4E-01	1.2E+02	24-hr
Arsenic	0.0002	8.8E-07	2.1E-05	7.7E-03	--
Benzene	0.008	3.5E-05	8.5E-04	3.1E-01	year
Beryllium	0.000012	5.3E-08	1.3E-06	4.6E-04	year
Cadmium	0.0011	4.9E-06	1.2E-04	4.3E-02	year
Chromium (total)	0.0014	6.2E-06	1.5E-04	5.4E-02	year
Chromium (VI)	0.000056	2.5E-07	5.9E-06	2.2E-03	--
Cobalt	0.000084	3.7E-07	8.9E-06	3.2E-03	year
Copper	0.00085	3.8E-06	9.0E-05	3.3E-02	24-hr
Ethylbenzene	0.0095	4.2E-05	1.0E-03	3.7E-01	1-hr
Formaldehyde	0.221	9.8E-04	2.3E-02	8.6E+00	year
Hexane	1.8	7.9E-03	1.9E-01	7.0E+01	year
Lead	0.0005	2.2E-06	5.3E-05	1.9E-02	24-hr
Manganese	0.00038	1.7E-06	4.0E-05	1.5E-02	year
Mercury	0.00026	1.1E-06	2.8E-05	1.0E-02	24-hr
Naphthalene	0.00061	2.7E-06	6.5E-05	2.4E-02	24-hr
Nickel	0.0021	9.3E-06	2.2E-04	8.1E-02	year
Polycyclic Organic Matter	0.0019	8.4E-06	2.0E-04	7.3E-02	year
2-Methylnaphthalene	0.000024	1.1E-07	2.5E-06	9.3E-04	--
3-Methylchloranthrene	0.0000018	7.9E-09	1.9E-07	7.0E-05	--
7,12-Dimethylbenz(a)anthracene	0.000016	7.1E-08	1.7E-06	6.2E-04	--
Acenaphthene	0.0000018	7.9E-09	1.9E-07	7.0E-05	--
Acenaphthylene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Anthracene	0.0000024	1.1E-08	2.5E-07	9.3E-05	year
Benz(a)anthracene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Benzo(a)pyrene	0.0000047	2.1E-08	5.0E-07	1.8E-04	--
Benzo(b)fluoranthene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Benzo(g,h,i)perylene	0.0000012	5.3E-09	1.3E-07	4.6E-05	year
Benzo(k)fluoranthene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Chrysene	0.0000018	7.9E-09	1.9E-07	7.0E-05	year
Dibenzo(a,h)anthracene	0.0000012	5.3E-09	1.3E-07	4.6E-05	year
Dichlorobenzene	0.0012	5.3E-06	1.3E-04	4.6E-02	--

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Fluoranthene	0.000003	1.3E-08	3.2E-07	1.2E-04	--
Fluorene	2.80E-06	1.2E-08	3.0E-07	1.1E-04	year
Indeno(1,2,3-cd)pyrene	1.80E-06	7.9E-09	1.9E-07	7.0E-05	--
Naphthalene	6.10E-04	2.7E-06	6.5E-05	2.4E-02	year
Phenanthrene	1.70E-05	7.5E-08	1.8E-06	6.6E-04	year
Pyrene	5.00E-06	2.2E-08	5.3E-07	1.9E-04	--
Propylene	7.31E-01	3.2E-03	7.7E-02	2.8E+01	--
Selenium	2.40E-05	1.1E-07	2.5E-06	9.3E-04	24-hr
Toluene	3.66E-02	1.6E-04	3.9E-03	1.4E+00	24-hr
Vanadium	2.30E-03	1.0E-05	2.4E-04	8.9E-02	24-hr
Xylenes	2.72E-02	1.2E-04	2.9E-03	1.1E+00	24-hr

Table 5: Estimated Maximum Potential Emissions from the New Water Heaters

Criteria Pollutant	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(tons/year)	(lbs/day)	(lbs/hour)	
NO_X	24.8	0.1	0.58	0.02	year
CO	37.7	0.4	0.89	0.08	year
SO_2	0.6	0.003	0.014	0.00	year
PM	7.6	0.0	0.18	0.01	year
PM_{10}	7.6	0.0	0.18	0.01	year
$PM_{2.5}$	7.6	0.0	0.18	0.01	year
HC/VOCs	5.5	0.0	0.13	0.01	year
Washington Toxic Air Pollutants	**Emission Factor (lbs/10^6 scf nat gas)**	**Emissions**			**Regulatory Averaging Period**
		(lbs/hour)	**(lbs/day)**	**(lbs/year)**	
Acetaldehyde	0.00887	8.7E-06	2.1E-04	7.6E-02	year
Acrolein	0.0027	2.6E-06	6.4E-05	2.3E-02	24-hr
Ammonia	3.2	3.1E-03	7.5E-02	2.7E+01	24-hr
Arsenic	0.0002	2.0E-07	4.7E-06	1.7E-03	--
Benzene	0.008	7.8E-06	1.9E-04	6.9E-02	year
Beryllium	0.000012	1.2E-08	2.8E-07	1.0E-04	year
Cadmium	0.0011	1.1E-06	2.6E-05	9.4E-03	year
Chromium (total)	0.0014	1.4E-06	3.3E-05	1.2E-02	year
Chromium (VI)	0.000056	5.5E-08	1.3E-06	4.8E-04	--

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Cobalt	0.000084	8.2E-08	2.0E-06	7.2E-04	year
Copper	0.00085	8.3E-07	2.0E-05	7.3E-03	24-hr
Ethylbenzene	0.0095	9.3E-06	2.2E-04	8.2E-02	1-hr
Formaldehyde	0.22	2.2E-04	5.2E-03	1.9E+00	year
Hexane	1.8	1.8E-03	4.2E-02	1.5E+01	year
Lead	0.0005	4.9E-07	1.2E-05	4.3E-03	24-hr
Manganese	0.00038	3.7E-07	8.9E-06	3.3E-03	year
Mercury	0.00026	2.5E-07	6.1E-06	2.2E-03	24-hr
Naphthalene	0.00061	6.0E-07	1.4E-05	5.2E-03	24-hr
Nickel	0.0021	2.1E-06	4.9E-05	1.8E-02	year
Polycyclic Organic Matter	0.0019	1.9E-06	4.5E-05	1.6E-02	year
2-Methylnaphthalene	0.000024	2.4E-08	5.6E-07	2.1E-04	--
3-Methylchloranthrene	0.0000018	1.8E-09	4.2E-08	1.5E-05	--
7,12-Dimethylbenz(a)anthracene	0.000016	1.6E-08	3.8E-07	1.4E-04	--
Acenaphthene	0.0000018	1.8E-09	4.2E-08	1.5E-05	--
Acenaphthylene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Anthracene	0.0000024	2.4E-09	5.6E-08	2.1E-05	year
Benz(a)anthracene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Benzo(a)pyrene	0.0000047	4.6E-09	1.1E-07	4.0E-05	--
Benzo(b)fluoranthene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Benzo(g,h,i)perylene	0.0000012	1.2E-09	2.8E-08	1.0E-05	year
Benzo(k)fluoranthene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Chrysene	0.0000018	1.8E-09	4.2E-08	1.5E-05	year
Dibenzo(a,h)anthracene	0.0000012	1.2E-09	2.8E-08	1.0E-05	year
Dichlorobenzene	0.0012	1.2E-06	2.8E-05	1.0E-02	--
Fluoranthene	0.000003	2.9E-09	7.1E-08	2.6E-05	--
Fluorene	2.80E-06	2.7E-09	6.6E-08	2.4E-05	year
Indeno(1,2,3-cd)pyrene	1.80E-06	1.8E-09	4.2E-08	1.5E-05	--
Naphthalene	6.10E-04	6.0E-07	1.4E-05	5.2E-03	year
Phenanthrene	1.70E-05	1.7E-08	4.0E-07	1.5E-04	year
Pyrene	5.00E-06	4.9E-09	1.2E-07	4.3E-05	--
Propylene	7.31E-01	7.2E-04	1.7E-02	6.3E+00	--
Selenium	2.40E-05	2.4E-08	5.6E-07	2.1E-04	24-hr
Toluene	3.66E-02	3.6E-05	8.6E-04	3.1E-01	24-hr

Washington Toxic Air Pollutants	Emission Factor (lbs/10^6 scf nat gas)	Emissions			Regulatory Averaging Period
		(lbs/hour)	(lbs/day)	(lbs/year)	
Vanadium	2.30E-03	2.3E-06	5.4E-05	2.0E-02	24-hr
Xylenes	2.72E-02	2.7E-05	6.4E-04	2.3E-01	24-hr

6.4 Comparison – Netting Analysis

Past actual TAP emission rates for the existing boilers and water heaters were calculated using the emission factors in Table 3 and actual natural gas throughput averaged over 2 consecutive years in which Facility production was representative of normal operating conditions. To identify production rates during these years, annual natural gas purchase reports from 2016 through 2021 were examined. The reported natural gas quantities are provided in Tables B-1 and B-2 in Appendix B.

The differences in potential TAP emissions between the operation of the new boilers and water heaters and the past actual emissions from the existing boilers and water heaters are provided in Table 6. The SQERs promulgated in WAC 173-460-150 are also provided for comparison.

Table 6: Comparison of Potential Emissions to WAC 173-460-150 Small-Quantity Emission Rates

TAP	Averaging Period	New Boiler Emissions (lb/avg per)	Existing Boiler Emissions (lb/avg per)	New Water Heaters Emissions (lb/avg per)	Existing Water Heaters (lb/avg per)	Net Change in Emissions (lb/avg per)	SQER (lb/avg per)	Modeling Required?
Acetaldehyde	year	3.43E-01	-8.22E-02	7.62E-02	-1.69E-02	3.20E-01	6.00E+01	No
Acrolein	24-hr	2.86E-04	-6.85E-05	6.35E-05	-1.41E-05	2.67E-04	2.60E-02	No
Ammonia	24-hr	3.39E-01	-8.12E-02	7.53E-02	-1.67E-02	3.16E-01	3.70E+01	No
Arsenic	year	7.73E-03	-1.85E-03	1.72E-03	-3.82E-04	7.21E-03	4.90E-02	No
Benzene	year	3.09E-01	-7.41E-02	6.87E-02	-1.53E-02	2.88E-01	2.10E+01	No
Beryllium	year	4.64E-04	-1.11E-04	1.03E-04	-2.29E-05	4.33E-04	6.80E-02	No
Cadmium	year	4.25E-02	-1.02E-02	9.45E-03	-2.10E-03	3.97E-02	3.90E-02	Yes
Chromium (VI)	year	2.16E-03	-5.19E-04	4.81E-04	-1.07E-04	2.02E-03	6.50E-04	Yes
Cobalt	24-hr	8.89E-06	-2.13E-06	1.98E-06	-4.39E-07	8.30E-06	7.40E-03	No
Copper	1-hr	3.75E-06	-8.99E-07	8.33E-07	-1.85E-07	3.50E-06	1.90E-01	No
Ethylbenzene	year	3.67E-01	-8.80E-02	8.16E-02	-1.81E-02	3.43E-01	6.50E+01	No
Formaldehyde	year	8.56E+00	-2.05E+00	1.90E+00	-4.23E-01	7.99E+00	2.70E+01	No
Hexane	24-hr	1.91E-01	-4.57E-02	4.24E-02	-9.41E-03	1.78E-01	5.20E+01	No
Lead	year	1.93E-02	-4.63E-03	4.29E-03	-9.54E-04	1.80E-02	1.40E+01	No
Manganese	24-hr	4.02E-05	-9.64E-06	8.94E-06	-1.99E-06	3.75E-05	2.20E-02	No
Mercury	24-hr	2.75E-05	-6.60E-06	6.12E-06	-1.36E-06	2.57E-05	2.20E-03	No

TAP	Averaging Period	New Boiler Emissions (lb/avg per)	Existing Boiler Emissions (lb/avg per)	New Water Heaters Emissions (lb/avg per)	Existing Water Heaters (lb/avg per)	Net Change in Emissions (lb/avg per)	SQER (lb/avg per)	Modeling Required?
Nickel	year	8.12E-02	-1.95E-02	1.80E-02	-4.01E-03	7.57E-02	6.20E-01	No
Benz(a)-anthracene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
Benzo(a)-pyrene	year	1.81E-04	-4.34E-05	4.03E-05	-8.95E-06	1.69E-04	1.60E-01	No
Benzo(b)-fluoranthene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
Benzo(k)-fluoranthene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
Chrysene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E+00	No
Dibenzo(a,h)-anthracene	year	4.64E-05	-1.11E-05	1.03E-05	-2.29E-06	4.33E-05	8.20E-02	No
Dichloro-benzene	year	4.64E-02	-1.11E-02	1.03E-02	-2.29E-03	4.33E-02	1.50E+01	No
7,12-Dimethylbenz-(a)anthracene	year	6.18E-04	-1.48E-04	1.37E-04	-3.05E-05	5.77E-04	1.40E-03	No
Indeno(1,2,3-cd)pyrene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	8.90E-01	No
3-Methylchlor-anthrene	year	6.96E-05	-1.67E-05	1.55E-05	-3.44E-06	6.49E-05	1.60E-02	No
Naphthalene	year	2.36E-02	-5.65E-03	5.24E-03	-1.16E-03	2.20E-02	4.80E+00	No
Propylene	24-hr	7.74E-02	-1.86E-02	1.72E-02	-3.82E-03	7.22E-02	2.20E+02	No
Selenium	24-hr	2.54E-06	-6.09E-07	5.65E-07	-1.26E-07	2.37E-06	1.50E+00	No
Toluene	24-hr	3.88E-03	-9.29E-04	8.61E-04	-1.91E-04	3.62E-03	3.70E+02	No
Vanadium	24-hr	2.44E-04	-5.84E-05	5.41E-05	-1.20E-05	2.27E-04	7.40E-03	No
Xylenes	24-hr	2.88E-03	-6.90E-04	6.40E-04	-1.42E-04	2.69E-03	1.60E+01	No

Abbreviations and Acronyms:

avg = average
lb = pound
SQER = small-quantity emission rate
TAP = toxic air pollutant

Results indicate that emissions of cadmium and hexavalent chromium are greater than the applicable SQER and, therefore, will require a modeling analysis.

7.0 COMPLIANCE WITH APPLICABLE REQUIREMENTS

This section discusses the estimated emissions in relation to the applicable requirements.

7.1 Washington Administrative Code Requirements

The project and its estimated emissions in relation to the applicable WAC requirements are discussed in the subsections below.

7.1.1 WAC 173-400-050: Emission Standards for Combustion Units.

This provision limits the emissions of PM to 0.23 grams per dry cubic meter at standard conditions (0.1 grain per dry standard cubic foot). The proposed boilers are identical to the proposed boilers, so it is expected that the new boilers will continue to meet the limit established by this regulation.

7.1.2 WAC 173-400-075: Emission Standards for Sources Emitting Hazardous Air Pollutants

See Section 5.3 for a discussion of HAP compliance.

7.1.3 WAC 173-400-110: New Source Review

The proposed new boilers are a modification to an existing stationary source and a modification to a source of TAPs. NSR is required for natural gas-fired combustion units with a heat input of >4 MMBtu/hr. The new boilers have a combined rated heat input of 4.5 MMBtu/hr, so they are not categorically exempt from NSR.

7.1.4 WAC 173-400-113: New Sources in Attainment or Unclassifiable Areas

As required under WAC 173-400-113, this project will comply with the following regulatory requirements:

1. Compliance with New Source Performance Standards is addressed in Section 5.2. Compliance with National Emission Standards for Hazardous Air Pollutants is addressed in Section 5.3.
2. A BACT review and recommendation for this project are provided in Section 8.
3. Compliance with ambient air quality standards for criteria pollutants is discussed in Section 9.

7.2 Chapter 173-401 WAC: Operating Permit Regulation

The Facility is not considered a major source under Chapter 173-401 WAC.

7.3 Chapter 173-460 WAC: Controls for Sources of Toxic Air Pollutants

See Sections 6.4 and 9 for a discussion of TAP emissions compliance.

8.0 BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

BACT proposals for the natural gas boilers and water heaters are summarized in Table 7. The NO_X proposed BACT was based on the South Coast Air Quality Management District (SCAQMD) Rule 1146.2 (SCAQMD 2018).

Landau requested information on the availability of ultra-low NO_X burners for the proposed boilers and water heaters. The vendor indicated that ultra-low NO_X burners are not available for the proposed boilers and water heaters due to their small size. Vendor specification sheets, vendor confirmation of the unavailability of the ultra-low NO_X burners, and a low NO_X approval certificate from SCAQMD are provided in Appendix C. CO is the presumptive BACT for natural gas boilers.

Table 7: Proposed Best Available Control Technology

Pollutant	Proposed BACT Limit/Work Practice
SO_2	Good combustion practices and natural gas
VOCs	Good combustion practices and natural gas
CO	50 ppmvd @ 3% O_2, 60-minute average
NO_X	20 ppmvd @ 3% O_2, 60-minute average
PM	Good combustion practices and natural gas

9.0 AMBIENT AIR QUALITY IMPACT ANALYSIS

This section discusses the air dispersion modeling conducted for TAPs exceeding the SQERs, for comparison with the acceptable source impact levels (ASILs). Copies of the electronic modeling files and inputs are provided in Appendix D.

Emissions from two TAPs (cadmium and hexavalent chromium) exceed their respective SQERs necessitating a comparison to the ASILs. As discussed in the following subsections, modeled impacts from both are less than their ASILs. Therefore, no second-tier health impact assessment will be conducted.

9.1 Model Methodology and Assumptions

Air dispersion modeling was conducted using version 22112 of the AERMOD[1] modeling system in general accordance with the EPA's 40 CFR 51 Appendix W; Final Rule (EPA 2017).

AERMOD requires input from several pre-processors, described below, for meteorological parameters, downwash parameters, and terrain heights. AERMOD incorporates the data from the pre-processors with emission estimates and physical exhaust release point characteristics to predict ambient concentrations as a result of the proposed project. The model calculates concentrations based on various averaging times (e.g., 1 hour, 24 hours, annual, etc.) for a network of receptors and results are compared to air quality standards.

AERMOD was used to estimate the annual average impacts of cadmium and hexavalent chromium emissions.

9.1.1 Stack Parameters

Three release points were modeled, a stack releasing the combined emissions of all three boilers, and two capped stacks releasing emissions from each water heater. Emissions from the water heaters are divided evenly between the two stacks. The boiler stack releases from the rooftop of Alford-Montgomery Hall. The water heater stacks release from a small utility building south of Alford-Montgomery Hall. Source identification and stack parameters are provided in Table 8. Each stack is shown as a blue point relative to the buildings as shown on Figure 4.

[1] American Meteorological Society (AMS)/US Environmental Protection Agency (EPA) Regulatory Model.

Table 8: AERMOD Stack Parameters

Source ID	Source Type	UTM Easting (Zone 10N)	UTM Northing (Zone 10N)	Release Height (m)	Elevation (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
BOILER	POINT	687393.00	5208971.00	11.1	488	372.0	6.4	0.2
WHEATER1	POINTCAP	687414.00	5208912.00	8.0	488	327.6	5.8	0.1
WHEATER2	POINTCAP	687414.00	5208912.45	8.0	488	327.6	5.8	0.1

Abbreviations and Acronyms:

K = Kelvin
m = meters
m/s = meters per second
UTM = universal transverse mercator

Figure 4: AERMOD Model Setup

9.1.2 Building Downwash

Building downwash occurs when the aerodynamic turbulence induced by nearby buildings causes a pollutant emitted from an elevated source to be mixed rapidly toward the ground (downwash), resulting in higher ground-level pollutant concentrations. The Building Profile Input Program-Plume Rise Model Enhancements was used to determine if exhaust from emission units would be affected by nearby building structures. In general, these determinations are made if a stack's height is less than the height defined by the EPA's Good Engineering Practice (GEP) stack height.

GEP stack height is defined as the height of the nearby structure(s) measured from the ground-level elevation at the base of the stack plus 1.5 times the lesser dimension, height, or projected width of the nearby structure(s).

Two buildings were included in the model setup, Alford-Montgomery Hall, and the water heater utility building. Both were assumed to be a single tier of a height equal to the highest point of the roof line. Building elevations and heights are provided in Table 9, and the location of each building is shown on Figure 4.

Table 9: Building Elevations and Heights

Building ID	Elevation (m)	Height (m)
AlfordMont	488	10.7
WWendellHTR	488	7.6

9.1.3 Receptor Grid

To model complex terrain, AERMOD requires information about the surrounding terrain. The AMS/EPA Regulatory Model Terrain Pre-processor (AERMAP, version 18081) was used to obtain the hill height scale and the base elevation for each receptor location.

A receptor flagpole height of 1.5 meters (m) above ground was defined to approximate the human breathing zone. The ambient air boundary was defined as the perimeters of the included buildings. The receptor grid near the project is shown overlaid on aerial imagery on Figure 5. The receptor grid spacing increases with distance from this boundary, as listed below:

- 12.5-m spacing from the ambient air boundary to 150 m
- 25-m spacing from 150 m to 400 m
- 50-m spacing from 400 m to 900 m
- 100-m spacing from 900 m to 2,000 m.

AERMAP requires the use of topographic data to estimate surface elevations above mean sea level. Digital topographic data (in the form of National Elevation Data files) with a resolution of approximately 10 m (⅓ arc-second) were used.

Figure 5: Receptor Locations near Project

9.1.4 Meteorology

The AERMOD Meteorological Pre-Processor (AERMET; Version 22112) is the meteorological pre-processor model that estimates boundary-layer parameters for use in AERMOD. AERMET processes formatted meteorological data from observation stations and generates two input files for the AERMOD model: the Surface File with hourly boundary-layer parameter estimates; and the Profile File with multi-level observations of wind speed, wind direction, temperature, and standard deviations of fluctuating wind components. Five years (January 1, 2016 through December 31, 2020) of meteorological observation data were processed by AERMET for this project as described below.

9.1.4.1 Surface Observations

National Weather Service (NWS) hourly surface observations from Bowers Field Airport (call sign KELN) in Ellensburg, Washington were used to provide surface-level observations. The airport is located approximately 1.5 miles from the project.

AERMINUTE was run to reduce the instance of "calms." A potential concern related to the use of meteorological data for dispersion modeling is the high incidence of "calms," or periods of time with low wind speeds. NWS and Federal Aviation Administration data coding defines a wind speed of less than 3 knots as "calm" and assigns a value of 0 knots. This results in an overestimation of the amount of calm conditions. Similarly, if wind speed is up to 6 knots, but wind direction varies more than 60 degrees during a 2-minute averaging period, wind direction is reported as "missing." AERMINUTE reprocesses Automated Surface Observation System 1-minute wind data at a lower threshold and calculates hourly average wind speed and directions to supplement the standard hourly data processed in AERMET.

A wind rose showing trends in wind direction in degrees and speed in meters per second (m/s) is provided as Figure 6. This figure shows that high-speed winds are primarily from the northwest. Lower wind speeds are common from all directions, but come especially frequently from the east and northwest.

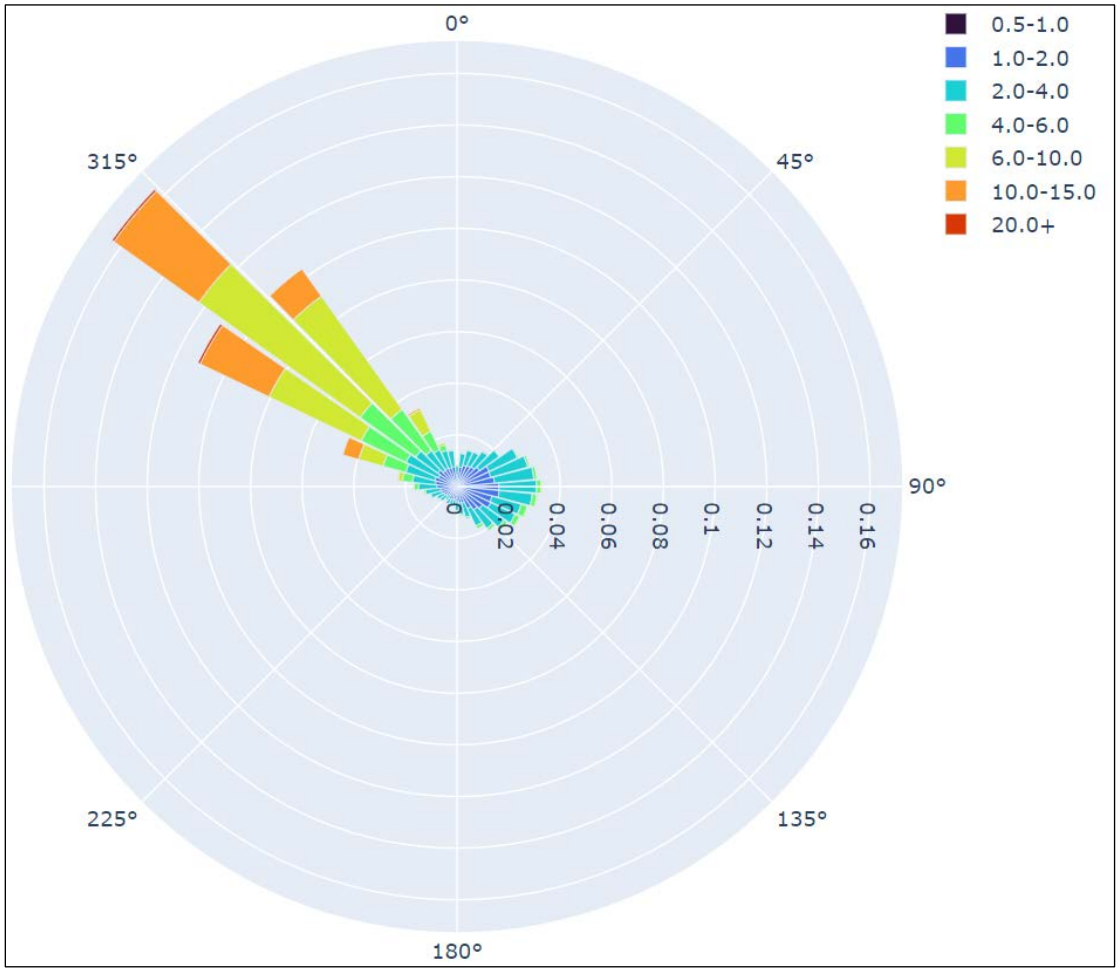

Figure 6: Wind Rose for KELN – 2016 through 2020

9.1.4.2 Upper Air Soundings

NWS twice-daily upper air soundings were obtained from Spokane, Washington from the RAwinsionde Observation database in FSL format. This station is located approximately 150 miles northeast of the project.

9.1.4.3 Surface Characteristics

Surface characteristics of albedo, Bowen ratio, and surface roughness are used by AERMET in stage 3 of the processing. Albedo is a measure of the solar radiation reflected back from earth into space. The Bowen ratio is an evaporation-related measurement and is defined as the ratio of sensible heat to latent heat. The surface roughness length is the theoretical height above ground where the wind speed becomes zero.

AERSURFACE version 20060 was used to determine the albedo, Bowen ratio, and surface roughness based on data on the use of land surrounding the surface observation site from the 2016 National Land Cover Database (USGS 1992). AERSURFACE calculates the percentage of land-use type within each of 12 equal sectors of a circle centered on the surface station tower. The default study radii of 1 kilometer (km) for surface roughness and 10 km for the Bowen ratio and albedo were used. Default months were assigned in AERSURFACE to represent the four seasonal categories as follows: 1) mid-summer with lush vegetation; 2) autumn with unharvested cropland; 3) winter with continuous snow; and 4) transitional spring with partial green coverage or short annuals. The AERSURFACE designation for an airport location (with the assumed surface roughness calculated based on 95 percent transportation and 5 percent commercial and industrial) is appropriate for this site for all sectors.

9.1.5 First-Tier Screening of Toxic Air Pollutant Impacts

A first-tier TAP assessment compares the forecast emission rates to the SQERs and compares the maximum ambient concentrations to ASILs. Table 6 shows the estimated project emission rates for each TAP emitted, and compares those emission rates to the corresponding SQER. Each SQER is an emission rate threshold, below which Ecology does not require an air quality impact assessment for the corresponding TAP. As shown in Table 6, estimated project-only emissions of cadmium and hexavalent chromium are greater than their respective SQERs, so an ambient impact analysis was completed for those TAPs.

Ecology requires facilities to conduct a first-tier screening analysis for each TAP whose emissions exceed its SQER by modeling the 1st-highest 1-hour, 1st-highest 24-hour, and annual ambient impacts (depending on the TAP of interest), then comparing the modeled values to the ASILs (WAC 173-460-080). The ASILs for both TAPs examined are annual averages, so only annual modeling was conducted.

9.2 Predicted Toxic Air Pollutant Ambient Concentrations

The first-tier ambient concentration analysis for cadmium and hexavalent chromium is summarized in Table 10. These results show that maximum modeled ambient concentrations for both TAPs are less than their respective ASILs. Because all examined pollutants pass first-tier screening requirements, no further evaluation is required.

Table 10: Comparison of Modeled Concentrations to ASILs

Pollutant	Averaging Period	AERMOD Concentration (µg/m^3)	ASIL (µg/m^3)	Over ASIL?
Cadmium	Annual	5.87E-05	2.40E-04	No
Chromium	Annual	2.99E-06	4.00E-06	No

Abbreviations and Acronyms:

ASIL = acceptable source impact level
µg/m^3 = micrograms per cubic meter

10.0 USE OF THIS REPORT

This report has been prepared for the exclusive use of MW Engineers for specific application to the Central Washington University North Campus heating upgrades project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau, shall be at the user's sole risk. Landau warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. Landau makes no other warranty, either express or implied.

11.0 REFERENCES

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APPENDIX A

Notice of Construction Application Form

Notice of Construction Application

A notice of construction permit is required before installing a new source of air pollution or modifying an existing source of air pollution. This application applies to facilities in Ecology's jurisdiction. Submit this application for review of your project. For general information about completing the application, refer to Ecology Forms ECY 070-410a-g, "Instructions for Ecology's Notice of Construction Application."

Ecology offers up to two hours of free pre-application assistance. We encourage you to schedule a pre-application meeting with the contact person specified for the location of your proposal, below. If you use up your two hours of free pre-application assistance, we will continue to assist you after you submit Part 1 of the application and the application fee. You may schedule a meeting with us at any point in the process.

Upon completion of the application, please enclose a check for the initial fee and mail to:

Department of Ecology
Cashiering Unit
P.O. Box 47611
Olympia, WA 98504-7611

For Fiscal Office Use Only:
001-NSR-216-0299-000404

Check the box for the location of your proposal. For assistance, call the contact listed below:		
	Ecology Permitting Office	**Contact**
☒ **CRO**	**Chelan, Douglas, Kittitas, Klickitat, or Okanogan County** Ecology Central Regional Office – Air Quality Program	Lynnette Haller (509) 457-7126 lynnette.haller@ecy.wa.gov
☐ **ERO**	**Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla or Whitman County** Ecology Eastern Regional Office – Air Quality Program	Karin Baldwin (509) 329-3452 karin.baldwin@ecy.wa.govmailto:gregory.flibbert@ecy.wa.gov
☐ **NWRO**	**San Juan County** Ecology Northwest Regional Office – Air Quality Program	David Adler (425) 649-7267 david.adler@ecy.wa.gov
☐ **IND**	**For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters** Ecology Industrial Section – Waste 2 Resources Program Permit manager: _____	James DeMay (360) 407-6868 james.demay@ecy.wa.gov
☐ **NWP**	**For actions taken on the US Department of Energy Hanford Reservation** Ecology Nuclear Waste Program	Lilyann Murphy (509) 372-7951 lilyann.murphy@ecy.wa.gov

Check the box below for the fee that applies to your application.

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Construction Application

New project or equipment:

☒	**$1,500: Basic project** initial fee covers up to 16 hours of review.
☐	**$10,000: Complex project** initial fee covers up to 106 hours of review.

Change to an existing permit or equipment:

☐	**$200: Administrative or simple change** initial fee covers up to 3 hours of review Ecology may determine your change is complex during completeness review of your application. If your project is complex, you must pay the additional $675 before we will continue working on your application.
☐	**$875: Complex change** initial fee covers up to 10 hours of review
☐	**$350** flat fee: **Replace or alter control technology equipment under WAC 173-400-114** Ecology will contact you if we determine your change belongs in another fee category. You must pay the fee associated with that category before we will continue working on your application.

Read each statement, then check the box next to it to acknowledge that you agree.	
☒	The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours Ecology spends exceeds the hours included in your initial fee, Ecology will bill you $95 per hour for the extra time.
☒	You must include all information requested by this application. Ecology may not process your application if it does not include all the information requested.
☒	Submittal of this application allows Ecology staff to visit and inspect your facility.

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Construction Application

Part 1: General Information

I. Project, Facility, and Company Information

1. Project Name CWU Student Village New Boilers and Water Heaters
2. Facility Name Central Washington University
3. Facility Street Address 400 East University Way
4. Facility Legal Description TOWN EBURG COLLEGE ADDITION BLOCK 7
5. Company Legal Name (if different from Facility Name)
6. Company Mailing Address (street, city, state, zip) 205 East 11th Avenue, Ellensburg, WA 98926

II. Contact Information and Certification

1. Facility Contact Name (who will be onsite) Jeremiah Eilers	
2. Facility Contact Mailing Address (if different than Company Mailing Address)	
3. Facility Contact Phone Number 509-929-0224	4. Facility Contact E-mail Jeremiah.Eilers@cwu.edu
5. Billing Contact Name (who should receive billing information) Kathleen Reeder	
6. Billing Contact Mailing Address (if different than Company Mailing Address) 205 East 11th Avenue, Ellensburg, WA 98926	
7. Billing Contact Phone Number 509-963-1538	8. Billing Contact E-mail Kathleen.Reeder@cwu.edu
9. Consultant Name (optional – if 3rd party hired to complete application elements) Kathryn Baker	
10. Consultant Organization/Company Landau Associates, Inc.	
11. Consultant Mailing Address (street, city, state, zip) 155 NE 100th St, Ste 302, Seattle, WA 98125	
12. Consultant Phone Number 425-329-0305	13.Consultant E-mail kbaker@landauinc.com
14. Responsible Official Name and Title (who is responsible for project policy or decision-making) Delano Palmer	
16. Responsible Official Phone 509-963-2906	17. Responsible Official E-mail Delano.Palmer@cwu.edu
18. Responsible Official Certification and Signature I certify that the information on this application is accurate and complete. Signature [signature] Date 9/1/22	

Part 2: Technical Information

Notice of Construction Application
Part 2: Technical Information

The Technical Information may be sent with this application form to the Cashiering Unit, or may be sent directly to the Ecology regional office with jurisdiction along with a copy of this application form.

For all sections, check the box next to each item as you complete it.

III. Project Description

Please attach the following to your application.

☒ Written narrative describing your proposed project.
☒ Projected construction start and completion dates.
☒ Operating schedule and production rates.
☒ List of all major process equipment with manufacturer and maximum rated capacity.
☒ Process flow diagram with all emission points identified.
☒ Plan view site map.

☒ Manufacturer specification sheets for major process equipment components.
☒ Manufacturer specification sheets for pollution control equipment.
☒ Fuel specifications, including type, consumption (per hour & per year) and percent sulfur.

IV. State Environmental Policy Act (SEPA) Compliance

Check the appropriate box below.

☐ SEPA review is complete:
Include a copy of the final SEPA checklist and SEPA determination (e.g., DNS, MDNS, EIS) with your application.

☒ SEPA review has not been conducted:

☐ If review will be conducted by another agency, list the agency. You must provide a copy of the final SEPA checklist and SEPA determination before Ecology will issue your permit.
Agency Reviewing SEPA:

_____

☒ If the review will be conducted by Ecology, fill out a SEPA checklist and submit it with your application. You can find a SEPA checklist online at https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-document-templates

Notice of Construction Application

V. Emissions Estimations of Criteria Pollutants

Does your project generate criteria air pollutant emissions? ☒ Yes ☐ No

If yes, please provide the following information regarding your criteria emissions in your application.

☒ The names of the criteria air pollutants emitted (i.e., NO_x, SO_2, CO, $PM_{2.5}$, PM_{10}, TSP, VOC, and Pb)

☒ Potential emissions of criteria air pollutants in tons per hour, tons per day, and tons per year (include calculations)

☒ If there will be any fugitive criteria pollutant emissions, clearly identify the pollutant and quantity

VI. Emissions Estimations of Toxic Air Pollutants

Does your project generate toxic air pollutant emissions? ☒ Yes ☐ No

If yes, please provide the following information regarding your toxic air pollutant emissions in your application.

☒ The names of the toxic air pollutants emitted (specified in WAC 173-460-150[1])

☒ Potential emissions of toxic air pollutants in pounds per hour, pounds per day, and pounds per year (include calculations)

☒ If there will be any fugitive toxic air pollutant emissions, clearly identify the pollutant and quantity

VII. Emission Standard Compliance

☒ Provide a list of all applicable new source performance standards, national emission standards for hazardous air pollutants, national emission standards for hazardous air pollutants for source categories, and emission standards adopted under Chapter 70.94 RCW.

Does your project comply with all applicable standards identified? ☒ Yes ☐ No

VIII. Best Available Control Technology

☒ Provide a complete evaluation of Best Available Control Technology (BACT) for your proposal.

[1] http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Construction Application

IX. Ambient Air Impacts Analyses

Please provide the following:

☐ Ambient air impacts analyses for Criteria Air Pollutants (including fugitive emissions)

☒ Ambient air impacts analyses for Toxic Air Pollutants (including fugitive emissions)

☒ Discharge point data for each point included in air impacts analyses (include only if modeling is required)

- ☒ Exhaust height
- ☒ Exhaust inside dimensions (ex. diameter or length and width)
- ☒ Exhaust gas velocity or volumetric flow rate
- ☒ Exhaust gas exit temperature
- ☒ The volumetric flow rate
- ☒ Description of the discharges (i.e., vertically or horizontally) and whether there are any obstructions (ex., raincap)
- ☒ Identification of the emission unit(s) discharging from the point
- ☒ The distance from the stack to the nearest property line
- ☒ Emission unit building height, width, and length
- ☒ Height of tallest building on-site or in the vicinity and the nearest distance of that building to the exhaust
- ☒ Whether the facility is in an urban or rural location

Does your project cause or contribute to a violation of any ambient air quality standard or acceptable source impact level? ☐ Yes ☒ No

APPENDIX B

Results of Emission Evaluations

Table B-1
Central Washington University (CWU)
Past Actual Boiler Emissions
Ellensburg, Washington

Actual Usage - 2016 - 2021

	All Boilers (therms/year)	All Boilers (mmbtu/year)	All Boilers (mmbtu/hr)
2016	111,171	11,117	1.27
2017	114,817	11,482	1.31
2018	95,725	9,572	1.09
2019	93,265	9,327	1.06
2020	72,147	7,215	0.82
2021	71,655	7,165	0.82

Boiler Emission Calculations - Gas Combustion - Past Actual Emissions
All Boilers - NG Heat Input 1.1 MMBtu/hr
Annual Operating Hours 8760 hr/yr

Toxic Air Pollutant	CAS	Gas Emission Factor [a] (lb/MMscf)	Gas Emission Factor [a] (lb/MMBtu)	Boiler Gas Hourly Emissions [b] (lb/hr)	Gas Daily Emissions [c] (lb/day)	Gas Annual Emissions [d] (lb/yr)
Acetaldehyde	75-07-0	0.0089	8.69E-06	9.4E-06	2.3E-04	8.2E-02
Acrolein[f]	107-02-8	0.0027	2.65E-06	2.9E-06	6.9E-05	2.5E-02
Ammonia[g]	7664-41-7	3.2	3.14E-03	3.4E-03	8.1E-02	3.0E+01
Arsenic	7440-38-2	0.0002	1.96E-07	2.1E-07	5.1E-06	1.9E-03
Benzene[f]	71-43-2	0.008	7.84E-06	8.5E-06	2.0E-04	7.4E-02
Beryllium	7440-41-7	0.000012	1.18E-08	1.3E-08	3.0E-07	1.1E-04
Cadmium	7440-43-9	0.0011	1.08E-06	1.2E-06	2.8E-05	1.0E-02
Chromium(total)	7440-47-3	0.0014	1.37E-06	1.5E-06	3.6E-05	1.3E-02
Chromium(VI)[e]	18540-29-9	0.000056	5.49E-08	5.9E-08	1.4E-06	5.2E-04
Cobalt	7440-48-4	0.000084	8.24E-08	8.9E-08	2.1E-06	7.8E-04
Copper	7440-50-8	0.00085	8.33E-07	9.0E-07	2.2E-05	7.9E-03
Ethylbenzene[f]	100-41-4	0.0095	9.31E-06	1.0E-05	2.4E-04	8.8E-02
Formaldehyde	50-00-0	0.221	2.17E-04	2.3E-04	5.6E-03	2.1E+00
Hexane	110-54-3	1.8	1.76E-03	1.9E-03	4.6E-02	1.7E+01
Lead	7439-92-1	0.0005	4.90E-07	5.3E-07	1.3E-05	4.6E-03
Manganese	7439-96-5	0.00038	3.73E-07	4.0E-07	9.6E-06	3.5E-03
Mercury	7439-97-6	0.00026	2.55E-07	2.7E-07	6.6E-06	2.4E-03
Naphthalene	91-20-3	0.00061	5.98E-07	6.5E-07	1.5E-05	5.7E-03
Nickel	7440-02-0	0.0021	2.06E-06	2.2E-06	5.3E-05	1.9E-02
Polycyclic Organic Matter	POM	0.0019	1.86E-06	2.0E-06	4.8E-05	1.8E-02
2-Methylnaphthalene	91-57-6	0.000024	2.35E-08	2.5E-08	6.1E-07	2.2E-04
3-Methylchloranthrene	56-49-5	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
7,12-Dimethylbenz(a)anthracene	57-97-6	0.000016	1.57E-08	1.7E-08	4.1E-07	1.5E-04
Acenaphthene	83-32-9	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Acenaphthylene	208-96-8	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Anthracene	120-12-7	0.0000024	2.35E-09	2.5E-09	6.1E-08	2.2E-05
Benz(a)anthracene	56-55-3	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Benzo(a)pyrene [h]	50-32-8	4.7E-06	4.60E-09	5.0E-09	1.2E-07	4.3E-05
Benzo(b)fluoranthene	205-99-2	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Benzo(g,h,i)perylene	191-24-2	0.0000012	1.18E-09	1.3E-09	3.0E-08	1.1E-05
Benzo(k)fluoranthene	207-08-9	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Chrysene	218-01-9	0.0000018	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Dibenzo(a,h)anthracene	53-70-3	0.0000012	1.18E-09	1.3E-09	3.0E-08	1.1E-05
Dichlorobenzene	106-46-7	0.0012	1.18E-06	1.3E-06	3.0E-05	1.1E-02
Fluoranthene	206-44-0	0.000003	2.94E-09	3.2E-09	7.6E-08	2.8E-05
Fluorene	86-73-7	2.80E-06	2.75E-09	3.0E-09	7.1E-08	2.6E-05
Indeno(1,2,3-cd)pyrene	193-39-5	1.80E-06	1.76E-09	1.9E-09	4.6E-08	1.7E-05
Naphthalene	91-20-3	6.10E-04	5.98E-07	6.5E-07	1.5E-05	5.7E-03
Phenanathrene	85-01-8	1.70E-05	1.67E-08	1.8E-08	4.3E-07	1.6E-04
Pyrene	129-00-0	5.00E-06	4.90E-09	5.3E-09	1.3E-07	4.6E-05
Propylene[f]	115-07-1	7.31E-01	7.17E-04	7.7E-04	1.9E-02	6.8E+00
Selenium	7782-49-2	2.40E-05	2.35E-08	2.5E-08	6.1E-07	2.2E-04
Toluene[f]	108-88-3	3.66E-02	3.59E-05	3.9E-05	9.3E-04	3.4E-01
Vanadium	7440-62-2	2.30E-03	2.25E-06	2.4E-06	5.8E-05	2.1E-02
Xylenes[f]	1330-20-7	2.72E-02	2.67E-05	2.9E-05	6.9E-04	2.5E-01

Notes:

a - Emission factors for toxic air pollutants are the maximum between AP-42 emission factors, mean emission factors from CATEF and Ventura County Air Pollution Control District

b - Hourly Emissions calculated using emission factors (lb/MMBtu) and 1.1 MMBtu/hr.

c - Daily Emissions calculated using hourly emissions and 24 hours of operation per day.

d - Annual Emissions calculated using hourly emissions and 8,760 hours of operation per year.

e - The 2014 NATA used SCC-based speciation factors to speciate total chromium into constituent chromium compounds, provided in Section 2.2.2 of the National Emissions Inventory, version 2 Technical Support Document," July 2018. The speciation factor to calculate Chromium VI from Total Chromium is 0.04. (https://www.epa.gov/sites/default/files/2018-07/documents/nei2014v2_tsd_05jul2018.pdf)

f - Emission factors from AB2588 Combustion Emission Factors (converted to lb/mmbtu using 1020 btu/scf) obtained from Ventura County Air Pollution Control District.

g - Emission factor from the EPA's Development and Selection of Ammonia Emission Factors (https://www3.epa.gov/ttnchie1/old/efdocs/ammonia.pdf)

h - Emission factor is based on the VCAPCD emission factor for PAH with naphthalene, after subtracting out naphthalene, and adjusted per the NATA 4.7% relative risk of PAH as compared to b(a)p

Table B-2
Central Washington University (CWU)
Past Actual Gas-Fired Water Heaters
Ellensburg, Washington

Water Heater Emission Calculations - Gas Combustion

	Total (CCF)	Total (Therms)	Total (mmbtu/hr)
2016	16171	16,817	0.192
2017	18051	18,773	0.214
2018	18928	19,685	0.225
2019	18511	19,251	0.220
2020	11712	12,180	0.139
2021	11789	12,261	0.140

Water Heater Emission Calculations - Gas Combustion - Past Actual Emissions

All Water Heaters - NG Heat Input 0.2 MMBtu/hr
Annual Operating Hours 8760 hr/yr

Toxic Air Pollutant	CAS	Gas Emission Factor [a] (lb/MMscf)	Gas Emission Factor [a] (lb/MMBtu)	Gas Hourly Emissions [b] (lb/hr)	Gas Daily Emissions [c] (lb/day)	Gas Annual Emissions [d] (lb/yr)
Acetaldehyde	75-07-0	0.0089	8.69E-06	1.9E-06	4.6E-05	1.7E-02
Acrolein[f]	107-02-8	0.0027	2.65E-06	5.9E-07	1.4E-05	5.2E-03
Ammonia[g]	7664-41-7	3.2	3.14E-03	7.0E-04	1.7E-02	6.1E+00
Arsenic	7440-38-2	0.0002	1.96E-07	4.4E-08	1.0E-06	3.8E-04
Benzene[f]	71-43-2	0.008	7.84E-06	1.7E-06	4.2E-05	1.5E-02
Beryllium	7440-41-7	0.000012	1.18E-08	2.6E-09	6.3E-08	2.3E-05
Cadmium	7440-43-9	0.0011	1.08E-06	2.4E-07	5.8E-06	2.1E-03
Chromium(total)	7440-47-3	0.0014	1.37E-06	3.1E-07	7.3E-06	2.7E-03
Chromium(VI)[e]	18540-29-9	0.000056	5.49E-08	1.2E-08	2.9E-07	1.1E-04
Cobalt	7440-48-4	0.000084	8.24E-08	1.8E-08	4.4E-07	1.6E-04
Copper	7440-50-8	0.00085	8.33E-07	1.9E-07	4.4E-06	1.6E-03
Ethylbenzene[f]	100-41-4	0.0095	9.31E-06	2.1E-06	5.0E-05	1.8E-02
Formaldehyde	50-00-0	0.221	2.17E-04	4.8E-05	1.2E-03	4.2E-01
Hexane	110-54-3	1.8	1.76E-03	3.9E-04	9.4E-03	3.4E+00
Lead	7439-92-1	0.0005	4.90E-07	1.1E-07	2.6E-06	9.5E-04
Manganese	7439-96-5	0.00038	3.73E-07	8.3E-08	2.0E-06	7.3E-04
Mercury	7439-97-6	0.00026	2.55E-07	5.7E-08	1.4E-06	5.0E-04
Naphthalene	91-20-3	0.00061	5.98E-07	1.3E-07	3.2E-06	1.2E-03
Nickel	7440-02-0	0.0021	2.06E-06	4.6E-07	1.1E-05	4.0E-03
Polycyclic Organic Matter	POM	0.0019	1.86E-06	4.1E-07	9.9E-06	3.6E-03
2-Methylnaphthalene	91-57-6	0.000024	2.35E-08	5.2E-09	1.3E-07	4.6E-05
3-Methylchloranthrene	56-49-5	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
7,12-Dimethylbenz(a)anthracene	57-97-6	0.000016	1.57E-08	3.5E-09	8.4E-08	3.1E-05
Acenaphthene	83-32-9	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Acenaphthylene	208-96-8	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Anthracene	120-12-7	0.0000024	2.35E-09	5.2E-10	1.3E-08	4.6E-06
Benz(a)anthracene	56-55-3	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Benzo(a)pyrene [h]	50-32-8	4.7E-06	4.60E-09	1.0E-09	2.5E-08	8.9E-06
Benzo(b)fluoranthene	205-99-2	0.0000018	1.76E-09	3.9E-10	9.4E-09	3.4E-06
Benzo(g,h,i)perylene	191-24-2	0.0000012	1.18E-09	2.6E-10	6.3E-09	2.3E-06
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Phenanathrene	85-01-8	1.70E-05	1.67E-08	3.7E-09	8.9E-08	3.2E-05
Pyrene	129-00-0	5.00E-06	4.90E-09	1.1E-09	2.6E-08	9.5E-06
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Selenium	7782-49-2	2.40E-05	2.35E-08	5.2E-09	1.3E-07	4.6E-05
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h - Emission factor is based on the VCAPCD emission factor for PAH with naphthalene, after subtracting out naphthalene, and adjusted per the NATA 4.7% relative risk of PAH as compared to b(a)p

APPENDIX C

Vendor Specification Sheets

CFC-E 1500

ClearFire-CE

Submittal Sheet

Condensing Boiler

1500 MBTU

*JOB NAME:*_____

REVIEWER NOTES:

CB-8556-1500

PROJECT INFORMATION

CB REPRESENTATIVE _____

JOB NAME _____

EQUIPMENT TAGS _____

LOCATION _____

ALTITUDE _____

CONTRACTOR _____

ENGINEER _____

MODEL NUMBER _____ QTY_____

FUEL _____NATURAL GAS _____PROPANE

BOILER ROOM GAS SUPPLY PRESSURE _____

VOLTAGE _____

DESIGN SUPPLY AND RETURN WATER TEMPERATURE _____

FLOW RATE (GPM)_____WATERSIDE PRESSURE DROP (FT HEAD @ FLOW RATE)_____

_____WATER _____GLYCOL (if glycol, type and percentage):_____

BOILER OUTPUT W/GLYCOL DERATE (or N/A)_____

BOILER RATINGS

Description	Units	1500
Input Max.	Btu/hr	1,500,000
Natural Gas	ft^3/hr	1500
Propane	ft^3/hr	600
Output at 120/80 F [49/27 C] 100% Firing	Btu/hr	1,410,000
Output at 180/140 F [82/60 C] 100% Firing	Btu/hr	1,320,000
MAWP	psi	125
Operating Temp., Max.	°F	210
Dry Weight	pounds	1861
Shipping Weight	pounds	1986
Operating Weight	pounds	2777
Water Volume	gallons	110
Fan Motor Size	Watts	1,700
Operating Voltage, Fan	Volts/ph/Hz	115/1/60
Control Circuit	Volts/ph/Hz	115/1/60
Current Draw, Fan	Amperes	13.5
Current Draw Cont. Ckt.	Amperes	2
Full Load Amps	Amperes	16
Max Over Current Protection	Amperes	20
Condensate Quantity Firing Nat. Gas & operating @ 120/80 F.	gal/hr	10
Flue Gas Mass Flow @ 100% Firing	lb/hr	1,670
Flue Gas Temp. Oper. 180/140 F	°F	180
Flue Gas Temp. Oper. 120/80 F	°F	120
Effective fireside heating surface	ft^2	387.5

STANDARD FEATURES

- Duplex Stainless Steel ALUFER firetube heat exchanger.
  - True counterflow design
  - Thermal shock proof design
  - Superior effective heating surface area for excellent operational efficiency
  - Dual temperature returns provide 6% efficiency gain
  - Single pass design
- High water volume and low waterside pressure drop
  - Ideal for Primary Variable Flow pumping
  - Reduced cycling with no buffer tank required
  - Capable of low flow situations with no need for a flow switch
- Low emission premix burner featuring:
  - Self-regulating linkageless control
  - ECM variable speed combustion air blower modulation
  - Whisper quiet operation (<70dBA at high fire)
  - 5:1 turndown [natural gas]
  - <20 ppm NOx standard [natural gas]
  - SCAQMD Rule 1146.2 certified
- UL certified for natural gas or propane
- Combustion air intake via room air or direct vent connection on boiler
- Spark ignition with UV scanner for flame supervision
- ASME CSD-1 and XL-GAP compliant
- ENERGY STAR certified
- Factory tested prior to shipment

STANDARD EQUIPMENT

- Trim and Controls
  -Manual reset high limit temperature cut-off with adjustable set point
  -Low water cutoff, probe type, manual reset with test switch
  -Thermistor sensors for supply and return water temperature readings
  -Combination temperature/pressure gauge
  -ASME Safety relief valve (ship loose)
  -Combustion air proving switch
  -Blocked flue/condensate safety switch
- Gas Train in Accordance with ASME CSD-1 and Includes:
  -Low and high gas pressure switches
  -Single body gas valve, dual solenoid safety shutoff
  -Leak test cocks
  -Manual shutoff valve

INTELLIGENT, INTEGRATED CONTROLS

- Falcon integrated boiler safety and system control
- Color touch-screen display/interface with trending
- Multiple loop PID set point control - central heat, domestic hot water and lead/lag demand priority
- Lead Lag control for up to eight boilers
- Boiler pump, isolation valve, damper enable/disable
- Modulating pump speed control
- Outdoor temperature reset
- Post shutdown pump or valve delay
- Remote enable and set point capability
- Modbus (RS485) Communications
- Multiple protocol gateway solutions available for other BMS integration requirements
- Built-in annunciator screen with real time graphical trending
- Remote alarm & boiler status contacts standard
- Non-volatile alarm history (last 15 lockouts)
- Cloud enabled for remote monitoring capabilities

CFC-E Boiler Options Selection Guide

All options ship loose for field installation

Boiler Options	
☐	Reusable air filter
☐	Adjustable feet
☐	Condensate neutralization
☐	Combination trap / tank (8000 MBH) [pad mounted boilers only]
☐	Tank only (8000 MBH)
☐	Auto air vent
☐	Stack Thermometer
☐	Boiler drain valve
☐	Boiler Electrical Disconnect (NEMA 1 - non fused)
☐	Automatic isolation valve (24VAC standard)
☐	Auxiliary low water cut off
☐	Seismic anchor provisions
Gas train options	
☐	Gas pressure regulator - stepdown
☐	low pressure: up to 21 in. WC
☐	medium pressure: 22 - 56 in. WC
☐	high pressure: 2 - 15 psig
☐	Gas pressure relief valve (required above 2 psig)
Control Options	
☐	Falcon Lead-Lag Kit - includes supply header sensor, Falcon program module
☐	System pump control Module (in NEMA 1 enclosure with fuse and power supply) Includes:
☐	Temperature control (two temperature transmitters)
☐	Pressure control (D/P transmitter)
☐	Alarm lights and horn package
☐	Outdoor temperature sensor (with weather cover)
☐	Stack temperature limit sensor
☐	Flow switch
☐	Emergency Stop switch
☐	Protocol translator (in NEMA1 Enclosure with fuse and power supply) Modbus RTU communication standard
☐	BACnet MSTP
☐	BACnet IP
☐	Modbus TCP
☐	Metasys N2
☐	LonWorks
☐	Protocol translator ship loose for mounting in boiler control panel (includes 24VDC power supply)
☐	BACnet MSTP
☐	BACnet IP
☐	Modbus TCP
☐	Metasys N2
☐	LonWorks

OPERATING EFFICIENCIES

Percent Efficiency

% Firing Rate	Return Water Temperature °F (°C)						
	68 (20)	80 (27)	100 (38)	120 (49)	130 (55)	140 (60)	160 (72)
20%	98.5	97.6	95.2	91.8	90.1	88.8	88.0
50%	97.1	95.9	93.4	90.6	89.3	88.3	87.8
75%	96.0	94.4	91.9	89.6	88.6	87.9	87.5
100%	94.9	93.0	90.4	88.6	87.9	87.5	87.3

Conditions: Natural Gas; ΔT = 40°F

AHRI Certified Efficiency

Combustion Efficiency (%)	Thermal Efficiency (%)
94.4	95.1

FLOW RATES

CFC-E Flow Rates

System Temperature Drop °F					
10	20	30	40	50	60
Flow Rate GPM					
283	141	94	71	57	47

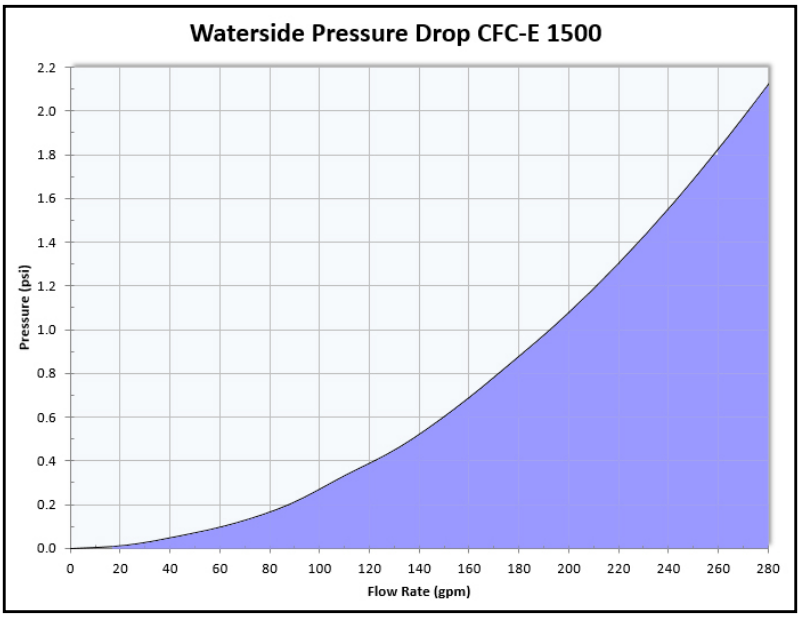
Recommended flow rates relative to temperature drop so as not to exceed boiler output.

Based on 94% nominal efficiency.

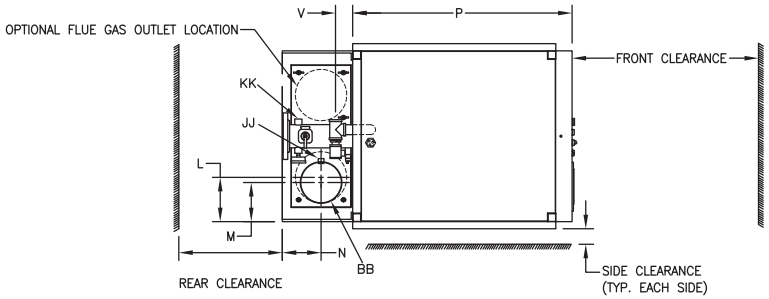
NOTE: Flow rates based on 100% water only. Not applicable to glycol solutions. Contact local C-B representative for assistance with glycol systems.

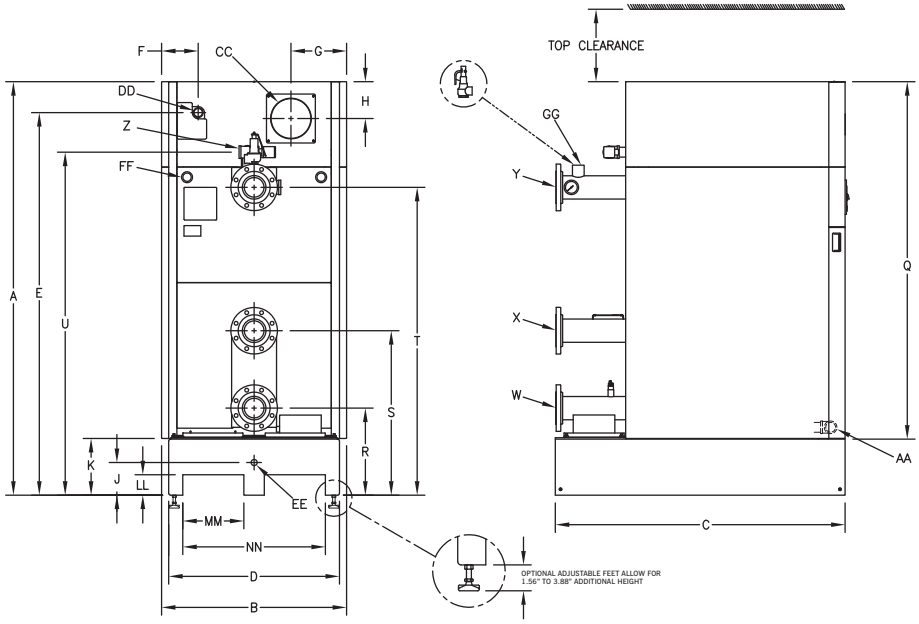
NOTE: The flow rates shown are recommended design flow rates. The CFC-E is capable of handling delta T up to 120 deg F without damage to the heat exchanger.

PRESSURE DROP



DIMENSIONS AND CONNECTION SIZES





DIMENSIONS (inches) CFC-E 1500

A	Overall Height	79.9
B	Overall Width	35.8
C	Overall Depth	56
D	Width Less Casing	33.0
E	Gas Connection to Floor	73.9
F	Side of Casing to Gas Connection	7.1
G	Side of Casing to Air Inlet	10.8
H	Top of Casing to Air Inlet	7.1
J	Floor to Condensate Drain	6.3
K	Floor to Bottom of Casing	11.0
L	Side of Base to Flue Outlet (Centered)	8.5
M	Side of Base to Flue Outlet (Offset)	7.5
N	Rear of Base to Flue Outlet	7.5
P	Casing Depth	42.4
Q	Casing Height	68.9
R	Floor to Lower Return Connection	16.8
S	Floor to Upper Return Connection	31.8
T	Floor to Supply Connection	59.5
U	Floor to Air vent Connection	66.3
V	Air Vent Line Projection From Rear of Casing	3.3

FORK POCKETS (inches)

LL	Pocket Height	4.0
MM	Pocket Width	11.8
NN	Overall Pocket Width	27.6

CONNECTIONS

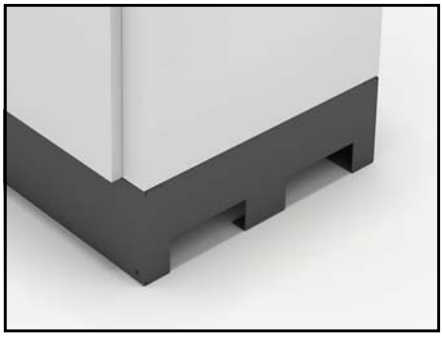
W	Water Low Temp. Return, CL150 RF Flange	4"
X	Water High Temp. Return, CL150 RF Flange	4"
Y	Water Supply, CL150 RF Flange	4"
Z	Air Vent, NPT	1-1/2"
AA	Vessel Drain, NPT	1-1/2"
BB	Flue Gas Outlet	
	Standard (Offset)	8"
	Option	10"
CC	Combustion Air	8"
DD	Gas, NPT	1-1/2"
EE	Condensate Drain, NPT	1"
FF	Electrical Conduit, Left or Right	1.6"
GG	Safety Relief Valve Vessel Connection, NPT	1-1/4"
HH	Safety Relief Valve	
	30 psig Inlet x Outlet, NPT	1" x 1-1/4"
	50 - 125 psig Inlet x Outlet, NPT	3/4" x 1"
JJ	Flue Coupling, NPT	3/4"
KK	Water Outlet Coupling, NPT	1/2"

CLEARANCES

Top	14"
Side	3"
Rear	20"
Front	36"

Notes:
Boiler rear must be accessible for servicing.
Side clearance to wall or between boilers.
Side clearance typical each side.

RIGGING AND TRANSPORTATION



The boiler should be lifted by the base using a suitable fork lift or pallet jack. **Note:** The boiler should not be moved by pushing, prying, or pulling on any part of the casing. If the floor is not level, piers or a raised pad slightly larger in length and width than the boiler base dimensions will make boiler installation and leveling easier.The boiler must be installed so that all components remain accessible for inspection, cleaning, or maintenance. Field-installed piping and electrical connections must be arranged so as to avoid interfering with removal of the casing panels or with the burner door.

To avoid damage to casing, removal of front and side casing panels is recommended during installation.

Care should be taken to secure load at the top to prevent tipping.

WARNING! Do not install the boiler on carpeting.

NOTE: For crane lifting refer to CFC-E manual for instructions.

STACK DESIGN

STACK SIZING USING OUTSIDE AIR FOR COMBUSTION (DIRECT VENT)

Boiler	Combustion Air Duct (Inches Diameter)	Combustion Air SCFM Rrquired	Flue Connection/Duct (Inches Diameter)	Max. Length* (Equivalent Feet)
CFC-E 1500	8	375	8 standard	100
			10 optional	120

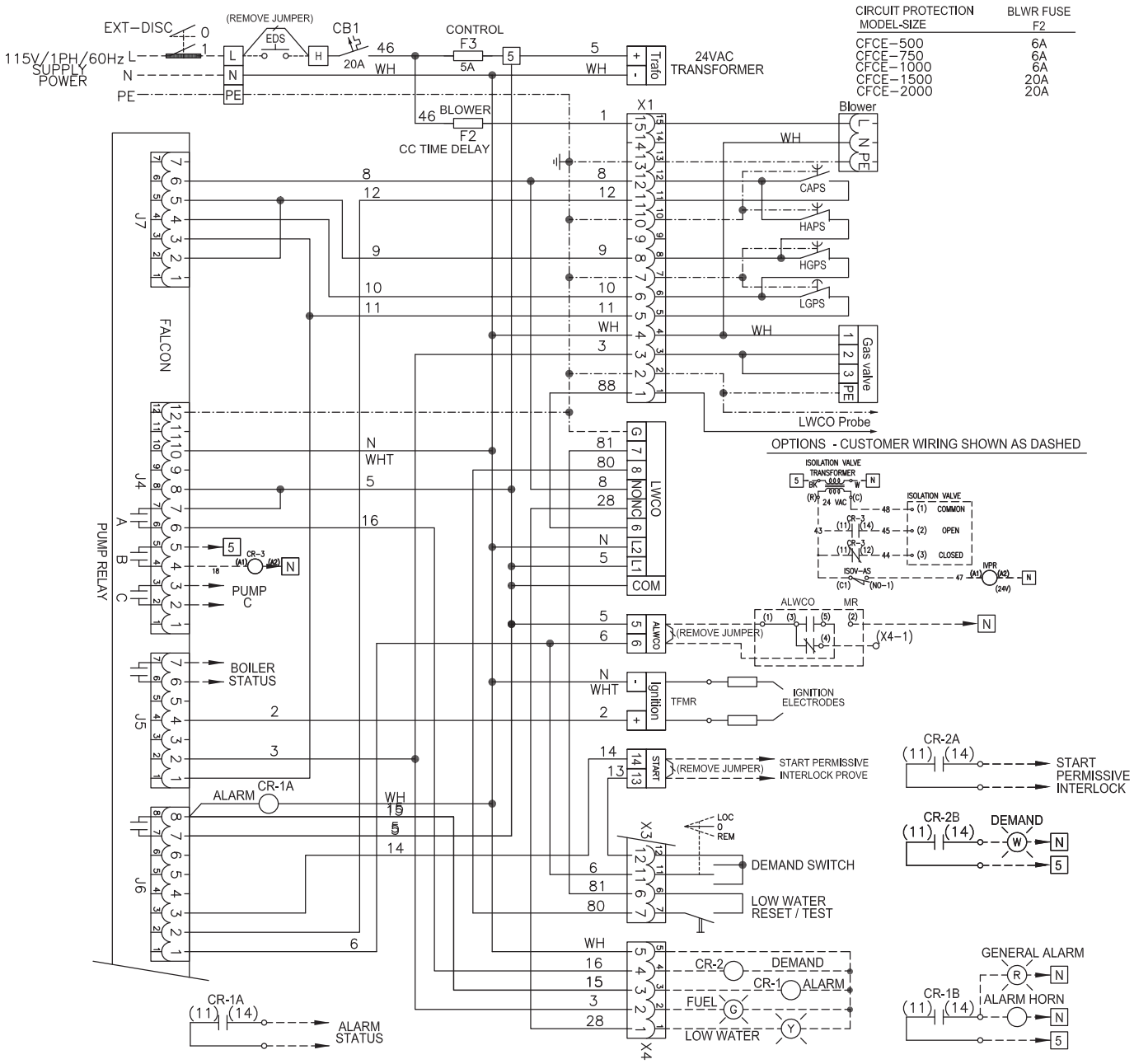
Each additional 90° elbow equals 5 equivalent feet of ductwork. Flue terminations may add 5-10 feet to the equivalent length and should also be included in the equivalent length calculation.

Draft tolerance at boiler flue connection during operation is +/-0.25” W.C.

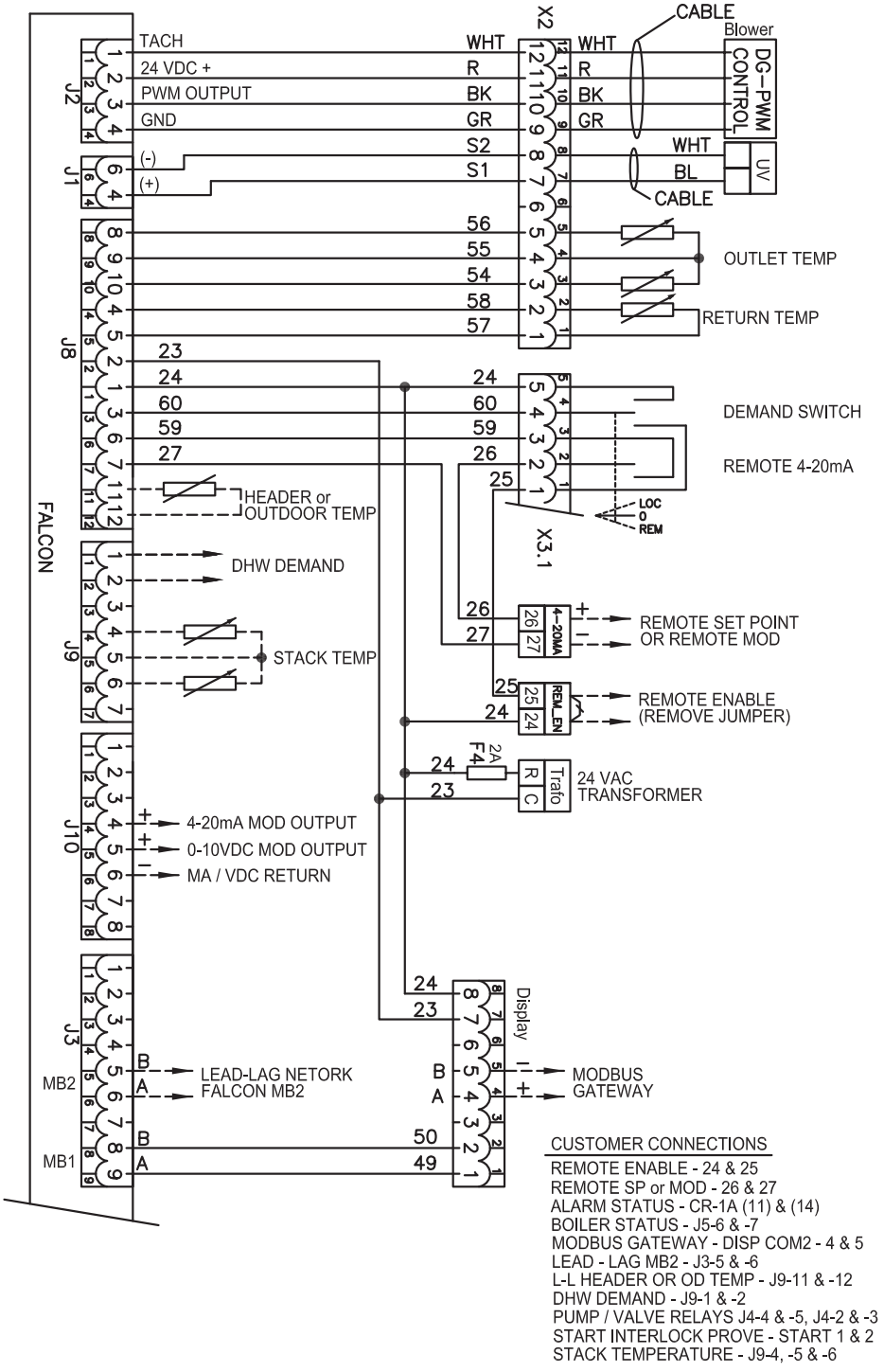
*Maximum vent length assumes horizontal run and sidewall terminations. Larger diameter venting, vertical flue runs, and vertical flue termination may allow for longer vent lengths than indicated here, provided the engineered draft calculations are within the allowable operational tolerance of +/-0.25” W.C.

WIRING DIAGRAM

WD is typical and may not reflect actual customer boiler. Refer to job specific WD for actual wiring connections.



LINE VOLTAGE WIRING **WD pg 1 of 2**



CUSTOMER CONNECTIONS

REMOTE ENABLE - 24 & 25
REMOTE SP or MOD - 26 & 27
ALARM STATUS - CR-1A (11) & (14)
BOILER STATUS - J5-6 & -7
MODBUS GATEWAY - DISP COM2 - 4 & 5
LEAD - LAG MB2 - J3-5 & -6
L-L HEADER OR OD TEMP - J9-11 & -12
DHW DEMAND - J9-1 & -2
PUMP / VALVE RELAYS J4-4 & -5, J4-2 & -3
START INTERLOCK PROVE - START 1 & 2
STACK TEMPERATURE - J9-4, -5 & -6

24V CONTROL VOLTAGE WIRING **WD pg 2 of 2**

WARRANTY

In addition to our Standard Warranty, Cleaver Brooks offers the following non-prorated Extended Warranty on the ClearFire CFC-E boilers:

1. The pressure vessel is guaranteed against thermal shock for the lifetime of the boiler when utilized in a closed loop hydronic heating system with a temperature differential of 120°F or less. The boiler pressure vessel is guaranteed accordingly without a minimum flow rate or return water temperature requirement. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.
2. The pressure vessel, tubes, and tube sheets (heat exchanger) are guaranteed against flue gas corrosion and materials/workmanship for a period of fifteen (15) years.
3. The condensate collection box shall be guaranteed against corrosion for twenty (20) years.
4. The burner cylinder shall be warranted for a period of five (5) years.

All parts not covered by the above warranties are valid for twenty-four (24) months from the date of initial operation of the Equipment, but in no event shall the Warranty extend more than thirty (30) months from the date of shipment of the Equipment by Cleaver-Brooks. This includes all electrical and burner components.

The pressure vessel thermal shock warranty covers leaks in the pressure vessel including the furnaces, tubes, tube sheets, and shell (not including failed gaskets), which, from our inspection, are attributed to unequal or rapid expansion, typically referred to as “thermal shock,” or stress cracking. This warranty does not cover damage or failures that are attributed, by our inspection, to corrosion, operation at low water level, accumulation of scale, sludge or dirt in the boiler, or other improper service, operation, or neglect.

Cleaver Brooks' liability hereunder is limited to repairing or furnishing a replacement pressure vessel or component parts thereof, as deemed necessary by our inspection. Cleaver Brooks is not responsible for shipping, handling, installation and other costs, including all costs associated with the removal and disposition of the old pressure vessel or component parts. In no event shall Cleaver Brooks be responsible for any incidental, consequential or other damages, including, without limitation, any damages resulting from loss of use of the boiler.

Refer to official warranty documents for specific warranty information.

Estimated Exhaust/Emission Performance Data

Date: 6/29/2022

Boiler: CFC-E-700-1500, 125# HW

Fuel: Natural Gas

Customer: CWU Student Village
Location: Ellensburg WA
Prepared By: Catie VanWormer
Elevation: SL (exhaust calcs)
Boiler Type: Firetube
Water Temp: 160F Out/130F In
LE Option: Standard

Flue Dia. (in.) 8

		Firing Rate			
		25%	50%	75%	100%
Input Btu/hr		375,000	750,000	1,125,000	1,500,000
Output Btu/hr		337,875	669,750	996,750	1,318,500
Efficiency		90.1%	89.3%	88.6%	87.9%
Projected Emissions					
CO	ppm	10	10	10	10
	lb/MMBTU	0.007	0.007	0.007	0.007
	lb/hr	0.003	0.005	0.008	0.011
NOx	ppm	19	19	19	19
	lb/MMBTU	0.022	0.022	0.022	0.022
	lb/hr	0.008	0.017	0.025	0.034
S0x	ppm	0.4	0.4	0.4	0.4
	lb/MMBTU	0.001	0.001	0.001	0.001
	lb/hr	0.000	0.001	0.001	0.001
HC/VOC's	ppm	4	4	4	4
	lb/mmbtu	0.002	0.002	0.002	0.002
	lb/hr	0.001	0.001	0.002	0.002
PM	ppm	NA	NA	NA	NA
	lb/mmbtu	0.006	0.006	0.006	0.006
	lb/hr	0.002	0.004	0.006	0.009
Exhaust Data					
Temperature, F		131	139	148	160
Flow	ACFM	107	216	330	448
	SCFM	93	186	278	371
	lb/hr	418	835	1253	1670
Velocity	ft/sec	5.1	10.3	15.7	21.4

Corrections to 3% O2
Assumes Natural Gas HHV = 1000 Btu/ft^3

Chimney and Gas Vent Calculation Program

Please note the following calculation program is based on the ASHRAE Chimney Design Equation as well as the ASHRAE Duct Design Equations. Jeremias Exhaust Systems disclaims any responsibility for any improper vent system performance as a result of the use of this software.

jeremias® EXHAUST SYSTEMS

Common ✓

Project Name:	CWU	Project By:	Steven Steele
Project City:	Ellensburg	Project For:	Rand Ingham - Cole Industrial
Project State:	Washington		CFCE-1500

Appliance Input Data:

Appliance Fuel Type:	1 - Natural Gas or Equivalent.	Chimney Type:	UL 1738
Appliance Input(MBH):	6000 MBH	Ambient Temperature(F):	60 F
Applaince CO2%:	9 %	Altitude(Ft):	1542 Feet
Fuel Gas Temperature (F):	210	Allowable Back Pressure:	***0 to 0***

Combustion Air Vent Data:

Combustion Air Duct Length (Ft):	0	15 Degree Elbow:	0
Additional Resistance (k):	0	30 Degree Elbow:	0
Additional Pressure Loss:	0	45 Degree Elbow:	0
		90 Degree Elbow:	0

Exhaust Vent Data:

Total Length of Exhaust (Ft):	20	15 Degree Elbow:	0
Total Height of Exhaust (Ft):	28	30 Degree Elbow:	0
Straight Tee with End Cap:	0	45 Degree Elbow:	2
Lateral Tee with End Cap:	2	90 Degree Elbow:	0
Stack Cap Termintation.		Additional Resistance (k):	0
		Additional Pressure(In. W.C.):	0

System Information:

Barometric Pressure:	28.378 Inches of Water	Exhaust Mass Flow	98.7 lbs. @ 9 %CO2
Combustion Air Density:	0.073 lb/ft^3	Exhaust Gas Density:	0.056 lb/ft^3)
Combustion Air Flow:	1268.4 Ft^3/min	Exhaust Gas Flow:	1759.6 Ft^3/Min
Combustion Air Fitting Friction:	0 K.	Exhaust Fitting Friction:	1.9 K.
Combustion Friction Loss (k):	0 .K	Exhaust Vent Friction Loss (k):	2.577 .K

Solution:	Selected Diameters
Combustion Duct Diameter (In):	0 Inches
Combustion Air Velocity (Ft/min):	717.8 Ft/Min
Combustion Air Pressure Loss (In W.C.):	0 In. W.C.
Exhaust Vent Diameter (Inches):	18 Inches
Exhaust Gas Velocity (Ft/min):	995.7 Ft/ Min
Dt, Theoretical Draft:	0.09 In. W.C.
dP, Pressure loss (In. W.C.):	0.12 In. W.C.
Da, Available Draft (In W.C.):	0.03 In. W.C.
Total Pressure (In. W.C.):	***0.03 In. W.C.***
Db, Draft Booster Pressure Rq'd (In. WC):	0.03

0.03"
+0.08"
0.11" W.C. ✓

1/2

Chimney and Gas Vent Calculation Program

Please note the following calculation program is based on the ASHRAE Chimney Design Equation as well as the ASHRAE Duct Design Equations. Jeremias Exhaust Systems disclaims any responsibility for any improper vent system performance as a result of the use of this software.

jeremias® EXHAUST SYSTEMS

Connector

Project Name:	CWU	Project By:	Steven Steele
Project City:	Ellensburg	Project For:	Rand Ingham - Cole Industrial
Project State:	Washington		CFCE-1500

Appliance Input Data:

Appliance Fuel Type:	1 - Natural Gas or Equivalent.	Chimney Type:	UL 1738
Appliance Input(MBH):	1500 MBH	Ambient Temperature(F):	60 F
Applaince CO2%:	9 %	Altitude(Ft):	1542 Feet
Fuel Gas Temperature (F):	210	Allowable Back Pressure:	*0 to 0*

Combustion Air Vent Data:

Combustion Air Duct Length (Ft):	0	15 Degree Elbow:	0
Additional Resistance (k):	0	30 Degree Elbow:	0
Additional Pressure Loss:	0	45 Degree Elbow:	0
		90 Degree Elbow:	0

Exhaust Vent Data:

Total Length of Exhaust (Ft):	1	15 Degree Elbow:	0
Total Height of Exhaust (Ft):	8	30 Degree Elbow:	0
Straight Tee with End Cap:	0	45 Degree Elbow:	3
Lateral Tee with End Cap:	0	90 Degree Elbow:	0
No Termination Specified		Additional Resistance (k):	.5 On/off Damper
		Additional Pressure(In. W.C.):	0

System Information:

Barometric Pressure:	28.378 Inches of Water	Exhaust Mass Flow	24.68 lbs. @ 9 %CO2
Combustion Air Density:	0.073 lb/ft^3	Exhaust Gas Density:	0.056 lb/ft^3)
Combustion Air Flow:	317.1 Ft^3/min	Exhaust Gas Flow:	439.9 Ft^3/Min
Combustion Air Fitting Friction:	0 K.	Exhaust Fitting Friction:	0.95 K.
Combustion Friction Loss (k):	0 .K	Exhaust Vent Friction Loss (k):	1.385 .K

Solution:	Selected Diameters
Combustion Duct Diameter (In):	0 Inches
Combustion Air Velocity (Ft/min):	908.4 Ft/Min
Combustion Air Pressure Loss (In W.C.):	0 In. W.C.
Exhaust Vent Diameter (Inches):	8 Inches
Exhaust Gas Velocity (Ft/min):	1260.2 Ft/ Min
Dt, Theoretical Draft:	0.02 In. W.C.
dP, Pressure loss (In. W.C.):	0.1 In. W.C.
Da, Available Draft (In W.C.):	0.08 In. W.C.
Total Pressure (In. W.C.):	***0.08 In. W.C.***
Db, Draft Booster Pressure Rq'd (In. WC):	0.08

2/2

Kat Baker

From: Richard Wheaton <rwheaton@coleindust.com>
Sent: Friday, September 30, 2022 1:09 PM
To: Kat Baker
Cc: Mark Brunner; Eric Albright; Kjersten Kuhta; David Johnson
Subject: RE: Ultra-Low NOx Burners: Hubble NX500 & CFCE-1500

Categories: 0336003.010 MW Engineers / CWU North Campus Heating Upgrades, Filed in TonicDM

Good afternoon Kat,
Both the Hubbell NX500 and Cleaver Brooks CFCE-1500 are too small of units to achieve ultra-low NOx less than 20ppm . The cost for R&D and the burner design changes that would be necessary makes it impractical for the manufacturers to pursue in this boiler and hot water class of vessels.
Regards,

RICHARD WHEATON
OUTSIDE SALES ACCOUNT MANAGER
5924 203RD ST SW, LYNNWOOD, WA 98036

M: (509) 406-7788
RWHEATON@COLEINDUST.COM

COLEINDUST.COM
1 (800) 627-2653

PARTS | RENTALS | REPAIR | SALES | SERVICE | TRAINING

From: Kat Baker <kbaker@landauinc.com>
Sent: Friday, September 30, 2022 1:01 PM
To: Richard Wheaton <rwheaton@coleindust.com>
Cc: Mark Brunner <mbrunner@landauinc.com>; Eric Albright <ealbright@landauinc.com>; Kjersten Kuhta <kjerstenk@mwengineers.com>; David Johnson <DavidJ@mwengineers.com>
Subject: Ultra-Low NOx Burners: Hubble NX500 & CFCE-1500

Richard,

Thank you for speaking with me yesterday.

Can you confirm if ultra-low NOx (less than 20ppm) burners are technically feasible for the Hubble NX500 Water Heater or the Cleaver Brooks CFCE-1500 Boiler ?

NX500
High Efficiency Gas-Fired Condensing Water Heater

Submittal Sheet

Section 1 - Specifications
Section 2 - Dimensions
Section 3 - Electrical

Project Name: _____ **Date:** _____
Location: _____
Engineer: _____
Contractor: _____ **Rep:** _____

1 SPECIFICATIONS

General Specifications

► Product Features
- Certified to ANSI Z21.10.3 / CSA 4.3 Gas Water Heater Standard
- ASME "H" stamped, designed and constructed in compliance with the ASME Boiler and Pressure Vessel Code Section IV
- SA-249 TP316L Stainless Steel Heat Exchanger
- CSD-1 compliant
- Maximum operating pressure 160 psi [1103 kPa]
- Modulating burner, 5:1 turndown
- Direct Spark Ignition
- Zero clearance to combustibles (clearances required for service)

► Optional Side Wall Vent Terminal Kits Hubbell part # 84355, 84358

► Optional Air Filter Kit Hubbell part # 84093 (indoor combustion air only)

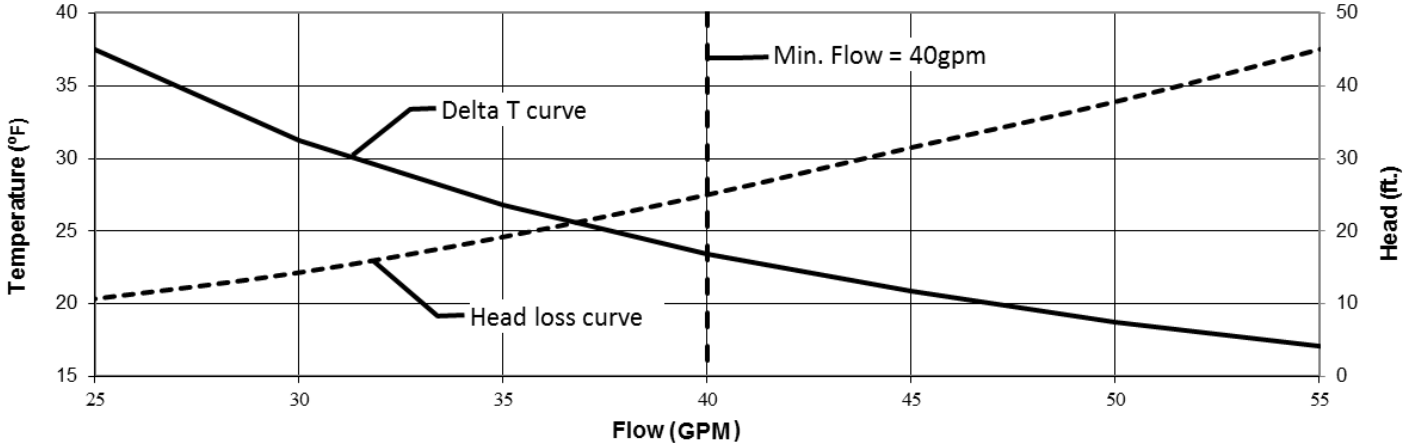
► Factory Supplied Items
- Flow switch
- 150PSI ASME Relief Valve
- 160PSI Pressure Gauge

► Control Features
- Integral microprocessor safety control
- Time of day input
- Lead-Lag up to 8 series water heaters
- Integrated Modbus RTU for connection to BMS gateways

Water Connections NPT, in.	Gas Connection NPT, in.	Vent/Air-inlet Pipe Diameter, in.	Vent/Air-inlet Max. Length, ft.	Approx. Weight with Water, lb.
2 (Female)	¾ (Male)	4	100	320

Performance Specifications

Input Modulation, MBH	Gross Output Capacity, MBH	Thermal Efficiency, %	Recovery Rate @ 100°F Rise, USGPH
100 – 500	480	96	576



Hubbell Electric Heater Company
P.O. Box 288, Stratford, CT 06615
Sale: (203) 378-2659 Fax: (203) 378-3596 Web: http://www.hubbellheaters.com

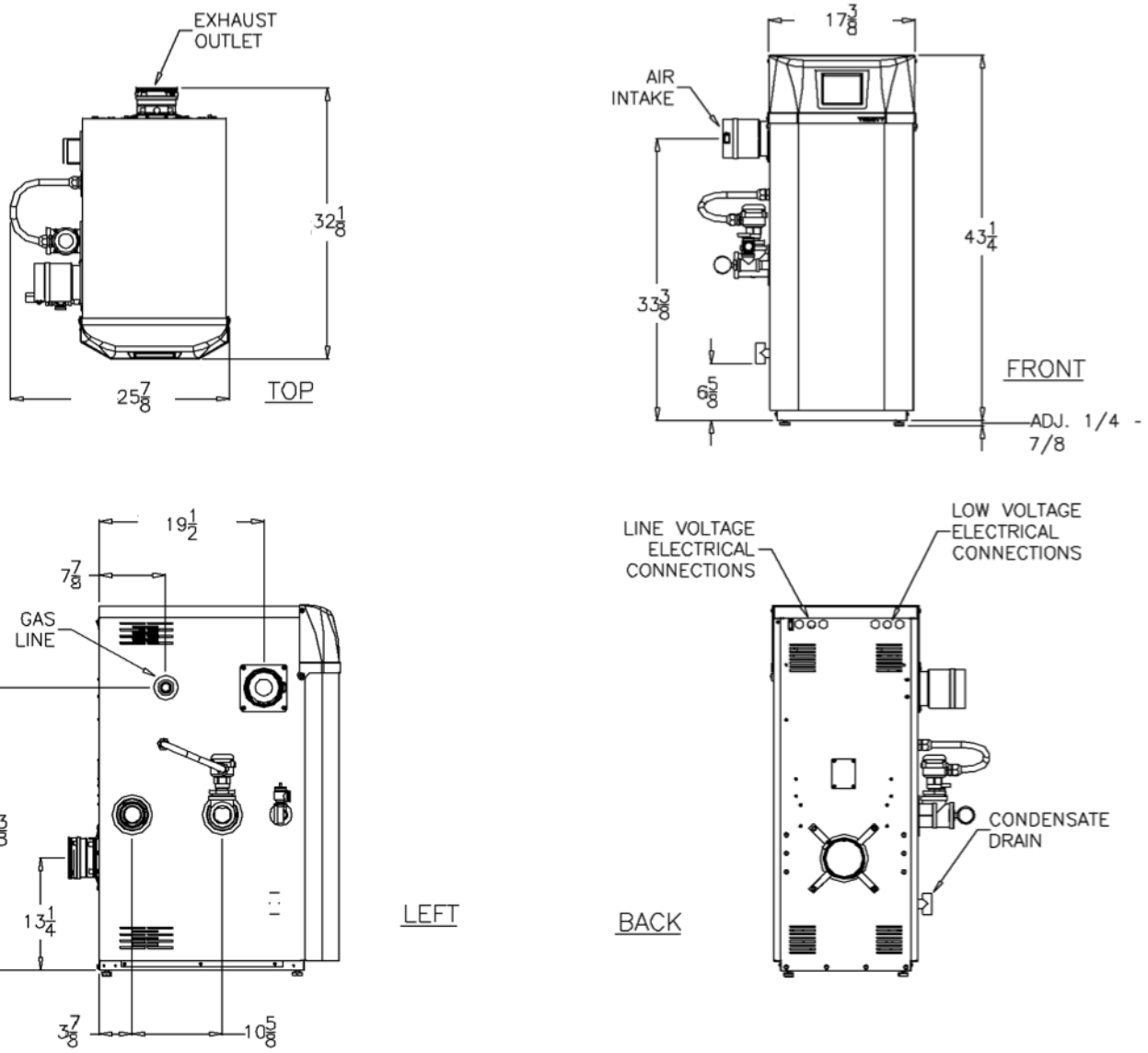
2016-04-27
Rev.0

NX500
High Efficiency Gas-Fired Condensing Water Heater

Submittal Sheet

DIMENSIONS

Product Dimensions – in.



Recommended Clearances – in.

Top	Front	Left	Right	Back	Bottom
24	24	24	12	24	0

3 ELECTRICAL

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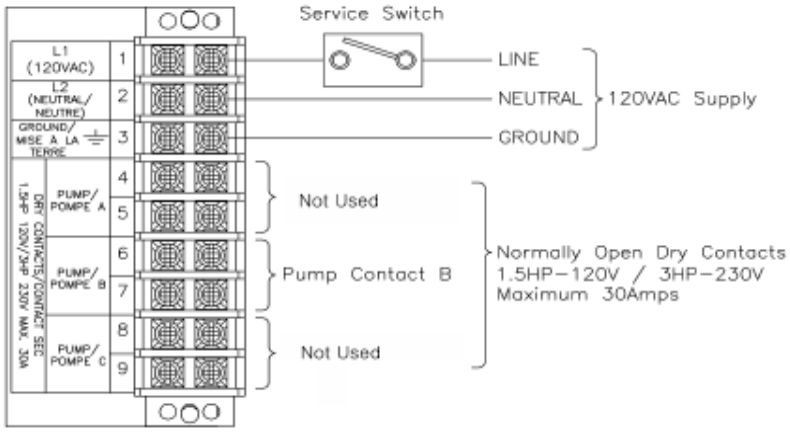
NX500
High Efficiency Gas-Fired Condensing Water Heater

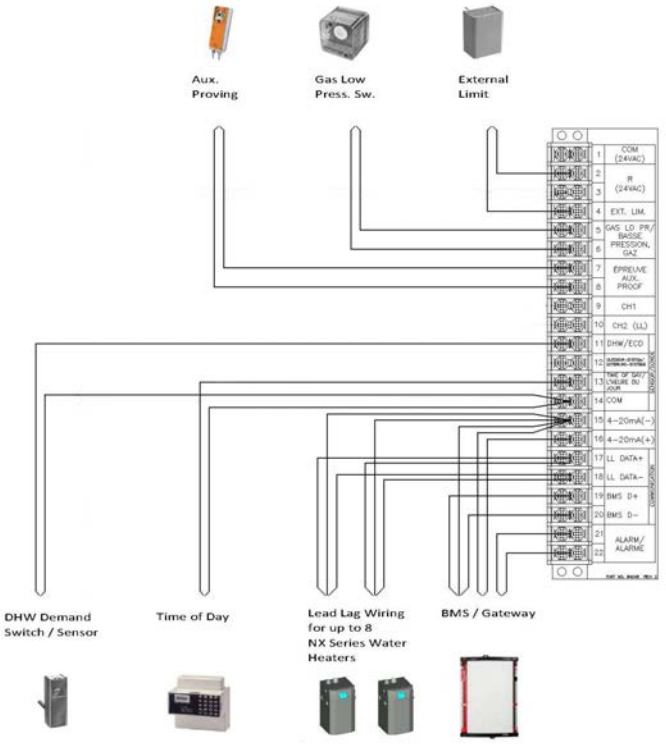
Submittal Sheet

Simplified Wiring

Line Voltage Electrical:

- ► 120VAC / 60 Hz / 1 Phase / 12 Amp
- ► Barrier Strip for field wiring terminations
- ► Pump output (Pump B)
  Note: Pumps are field supplied.





Low Voltage Electrical:

- ► Barrier Strip for field wiring terminations
- ► 120/24 VAC Transformer 40VA (factory supplied)
- ► Inputs
  - Indirect DHW aquastat (by others) or DHW Tank sensor (factory option)
  - External Limit (by others)
  - 4-20mA external modulating control (by others)
- ► Outputs
  - Alarm dry contact (24VAC 0.63A max.)
- ► EIA-485 Modbus communications for Lead-Lag
- ► EIA-485 Modbus to BMS gateways (not shown).
  Optional available gateways:
  - BACnet/N2- Hubbell part # 84946
  - LonWorks- Hubbell part # 84947

Hubbell Electric Heater Company
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Sale: (203) 378-2659 Fax: (203) 378-3596 Web: http://www.hubbellheaters.com

2016-04-27
Rev.0

4.0 GENERAL VENTING

The Hubbell NX is certified as a “Category IV” water heater requiring a “Special Venting System” designed for pressurized venting. The Exhaust Vent must be piped to the outdoors, using the vent materials and rules outlined in this section. Under no conditions may this unit vent gases into a masonry chimney, unless it is vacant, and utilizes the approved venting material and rules described in this section.

Vent and Air-inlet are to be piped separately. The Hubbell NX cannot share a common vent or air-inlet with multiple appliances. Failure to comply will result in serious injury or death.

Removing an Existing Water heater from Common Venting System

Do not install the Hubbell NX into a common venting system with any other appliances. Failure to comply with this warning will cause flue gas spillage and leech carbon monoxide emissions into the surrounding air resulting in serious injury or death.

When an existing water heater is removed from a common venting system, the common venting system is likely to be too large for proper venting of the remaining appliances connected to it.

Direct Vent Installation (Mandatory for models NX200-NX400)

When installed as a Direct Vent water heater the combustion air-inlet must also be piped directly to the outdoors using the methods described in this section and in accordance with the National Fuel Gas Code, ANSI Z223.1 (U.S.) or CSA B149.1 (Canada) and local requirements.

Indoor Combustion Air (Optional for models NX500-NX800)

When the installation uses Indoor Combustion Air (i.e. piping is not directly connecting the water heater air-inlet fitting to the outdoors), provisions for combustion and ventilation air, in accordance with section "Air for Combustion and Ventilation," of the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* (U.S.), or Clause 8.2, 8.3 or 8.4 of *Natural Gas and Propane Installation Code, CAN/CSA B149.1* (Canada), or applicable provisions of the local building codes, must be adhered to.

NOTICE The water heater shall be located so as not to interfere with proper circulation of combustion, ventilation, and dilution air.

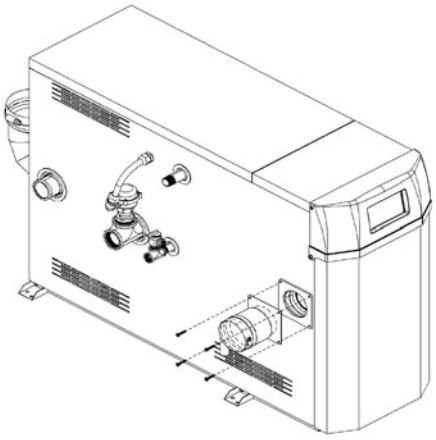
⚠ WARNING Make up air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements. Failure to ensure adequate make up air to all appliances may result in personal injury or death.

NOTICE **Controller RPM Adjustments** – To avoid the potential water heater lockouts due to wind and static pressure differences, the Lightoff and Minimum Modulation RPM Rates must be adjusted as per Figures 4-11 and 4-21 in Appendix A when using indoor combustion air.

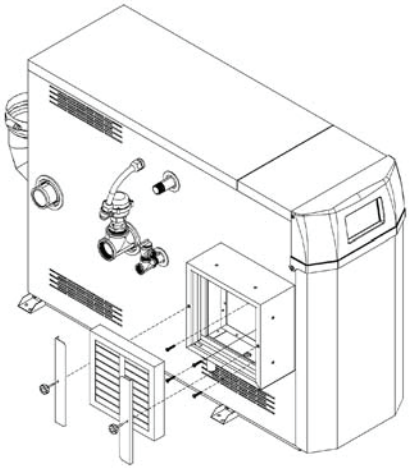
Air Filter Kit (P/N HUB-84093) – When using indoor combustion air (non-Direct Vent), it is highly recommended to use the optional Air Filter Kit (P/N HUB- 84093) to limit the amount of dust that enters the combustion system. The Air Filter Kit (P/N HUB- 84093) can be installed on water heater models NX500-NX800, as illustrated in Figure 4-1 (comprehensive installation instructions are provided with the Filter Kit).

NOTICE **Venting Limitation** – When using the Air Filter Kit on models NX500 & NX600, the maximum equivalent exhaust vent length is limited to 30 ft. with 4" piping, or 90 ft. with 6" piping; see warning below Table 4-5.

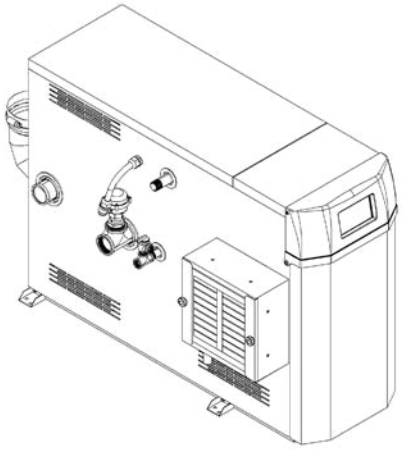
Figure 4-1 Installation of Optional Air Filter Kit (P/N HUB-84093)



1. Remove factory appliance air-inlet adapter; keep screws from installation of filter kit



2. Secure filter kit using factory screws removed in step 1. Reuse the factory gasket.



3. Secure the filter in place with the brackets and knurled screws provided in the filter kit.

Combustion Air-inlet Contamination

Be careful not to locate the Air-inlet termination in an area where contaminants can be drawn in and used for combustion. Combustion air containing dust, debris or air-borne contaminants will drastically increase the required maintenance and may cause a corrosive reaction in the Heat Exchanger which could result in premature failure, fire, serious injury, or death. See Table 4-1 for a list of areas to avoid when terminating air-intake piping:

Table 4-1 Corrosive Products and Contaminant Sources

Products to Avoid	Contaminated Sources to Avoid
Antistatic fabric softeners, bleaches, detergents, cleaners	Laundry facilities
Perchloroethylene (PCE), hydrocarbon based cleaners	Dry cleaning facilities
Chemical fertilizer, herbicides/pesticides, dust, methane gas	Farms or areas with livestock and manure
Paint or varnish removers, cements or glues, sawdust	Wood working or furniture refinishing shops
Water chlorination chemicals (chloride, fluoride)	Swimming pools, hot tubs
Solvents, cutting oils, fiberglass, cleaning solvents	Auto body or metal working shops
Refrigerant charge with CFC or HCFC	Refrigerant repair shops
Permanent wave solutions	Beauty shops
Fixer, hydrochloric acid (muriatic acid), bromide, iodine	Photo labs, chemical / plastics processing plants
Cement powder, crack fill dust, cellulose, fiber based insulation	Concrete plant or construction site

⚠ WARNING Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Failure to follow instructions may result in serious injury or death.

NOTICE It is **BEST PRACTICE** to pipe the combustion air-inlet directly to the outdoors (Direct Vent installation) to avoid contamination often contained in indoor air.

Flammable Solvents and Plastic Piping

Due to the extremely flammable characteristics of most glues, cements, solvents and primers used in the process of joining plastic vent and air-inlet pipe, explosive solvent vapors must be evacuated from the vent and air-intake prior to start-up. Avoid using excess cement or primer that may lead to pooling inside the pipe assembly. Freshly assembled piping assembly should be allowed to cure for a minimum of 8 hours before applying power to the gas fired appliance. Refer to **Mandatory Pre-commissioning Procedure for Plastic Venting** in this section.

⚠ DANGER **Flammable Cements and Primers**–It is the installers'responsibility to familiarize themselves with the hazards associated with explosive solvents and to take all precautions to reduce these risks. Failure to follow these instructions can cause explosions, property damage, injury or death.

Mandatory Pre-commissioning Procedure for Plastic Venting (PVC or CPVC)

⚠ WARNING Do not apply power to the water heater prior to Step 4 in the Mandatory Pre-commissioning Procedure for Plastic Venting.

⚠ WARNING **Spark Igniter Cable** - Maintain a minimum 2" separation between spark igniter circuit and conductors. Failure to follow instructions may result in component failure, injury or death.

1) Working with the power turned off to the water heater, completely install the vent and air-inlet system, securely cementing joints together. If possible, allow primers/cements to cure for 8 hours before firing the burner. If curing time is less than 8 hours, proceed with Steps 2 through 6.
2) Maintain the water heater gas supply shut-off valve in the off position.
3) Disconnect electrical leads to the Hot Surface or Spark Igniter. Ensure the cables are placed in a fashion where they will not arc to ground or other conductor. Refer to warning regarding Spark Igniter Cable.
4) Turn power on to the water heater and apply a heat demand.
5) Allow for 3 complete trials for ignition, consisting of pre and post purge of the combustion blower, until an ignition lockout occurs. Repeat the process two more times (i.e. 9 complete ignition sequences in total).
6) Turn power off and reconnect the electrical leads to the Igniter.

Near Water Heater Vent/Air Piping

Each Hubbell NX is equipped with a short piece of approved CPVC vent pipe (see Table 4-2 CPVC Vent Pipe Transition Piece). Insert one end into the water heater flue outlet adapter and cement the other to field venting (see Table 4-4 for approved venting material). The CPVC vent pipe should extend fully into the water heater flue outlet adapter (see Table 4-2). Ensure that the venting system does not apply a load or strain on the water heater flue outlet adapter. The manufacturer recommends using two elbows to create a "swing joint" to reduce potential strain on vent piping and cemented joints; see Figures 4-2 through 4-5.

⚠ WARNING **Gasket Seating** - Improper seating can cause leakage and eventual failure of the sealing gasket. Failure to follow these instructions may result in serious injury or death.

⚠ WARNING **PVC Exhaust Venting** – **DO NOT** insert PVC pipe directly into the water heater exhaust adapter, as it can deform from the clamping force of the gear clamp. Failure to follow these instructions may result in gasket failure and/or the dislodging of the exhaust pipe from the water heater adapter, resulting in property damage, serious injury or death.

Table 4-2 CPVC Vent Pipe Transition Piece (used when venting with PVC)

Model No.	CPVC Vent Pipe Size	CPVC Transition Vent Pipe Length	Full Insertion Depth
NX200	3"	Minimum 5"[127 mm]	2-7/8" [73 mm]
NX300-NX600	4"	Minimum 4" [100 mm]	1-7/8" [48 mm]
NX700 & NX800	6"	Minimum 6" [152 mm]	2-1/2" [63 mm]

⚠ WARNING **Polypropylene or Stainless Steel Venting** – When using Polypropylene or Stainless Steel piping, the appropriate water heater adapters must be used to transition the water heater vent connections to accept the respective Polypropylene or Stainless Steel venting. See Table 4-3 for a list of approved adapters. Failure to use the correct adapter will result in flue gas leakage resulting in property damage, serious injury or death.

Table 4-3 Water heater Adapters for Polypropylene and Stainless Steel Venting

Model No.	Vent Material	Venting Brand	Adapter Part No. [1,2]
NX200	Polypropylene	DuraVent – PolyPro	300150
		Centrotherm - InnoFlue	ISANY0303
	Stainless Steel	DuraVent – FasNSeal	300715
NX300-NX600	Polypropylene	DuraVent – PolyPro	300151
		Centrotherm - InnoFlue	ISAA0404
	Stainless Steel	DuraVent – FasNSeal	303631
NX700 & NX800	Polypropylene	DuraVent – PolyPro	810004281
		Centrotherm - InnoFlue	ISAA0606
	Stainless Steel	DuraVent – FasNSeal	810005231

Notes: [1] Listed water heater adapters are only approved for use with the respective venting brand; i.e. a PolyPro water heater adapter shall not be used with InnoFlue venting.
[2] PolyPro and FasNSeal water heater adapters are available from DuraVent (1-800-835-4429 or www.duravent.com); InnoFlue water heater adapters are available from Centrotherm Eco Systems (1-877-434-3432 or www.centrotherm.us.com).

⚠ DANGER Exhaust venting must be supported to reduce strain on piping joints. Failure to follow these instructions may result in result in damage, serious injury or death.

NOTICE In Canada, the first **3 ft (915 mm)** of vent piping must be readily accessible for inspection.

Figure4- 2(a) Near Water Heater Venting (CPVC)

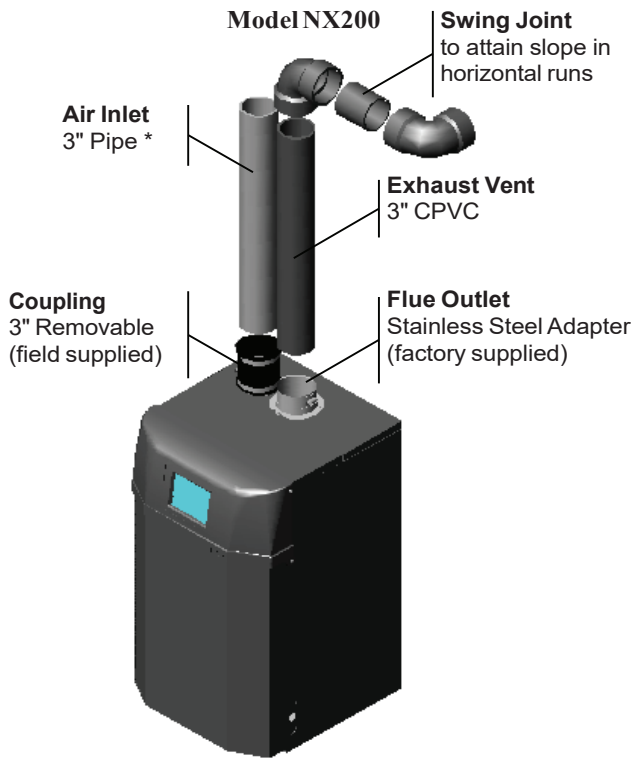


Figure 4-2(b) Near Water Heater Venting (PVC)

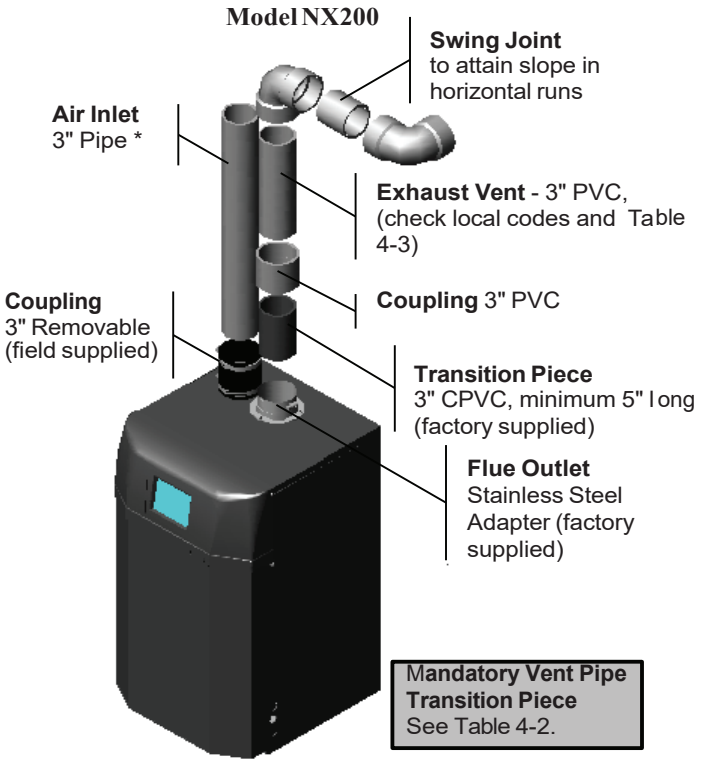


Figure 4-3(a) Near Water Heater Venting (CPVC)

Models NX300 & NX400

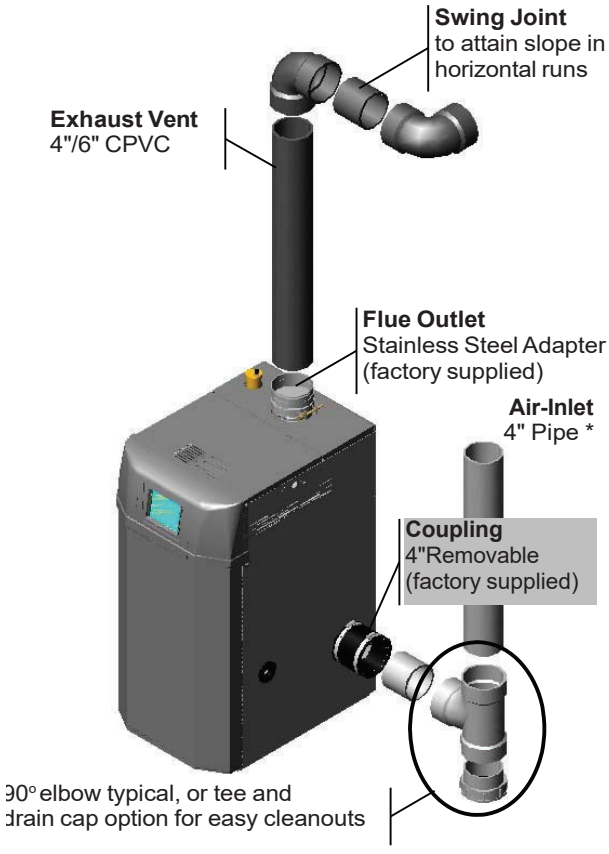
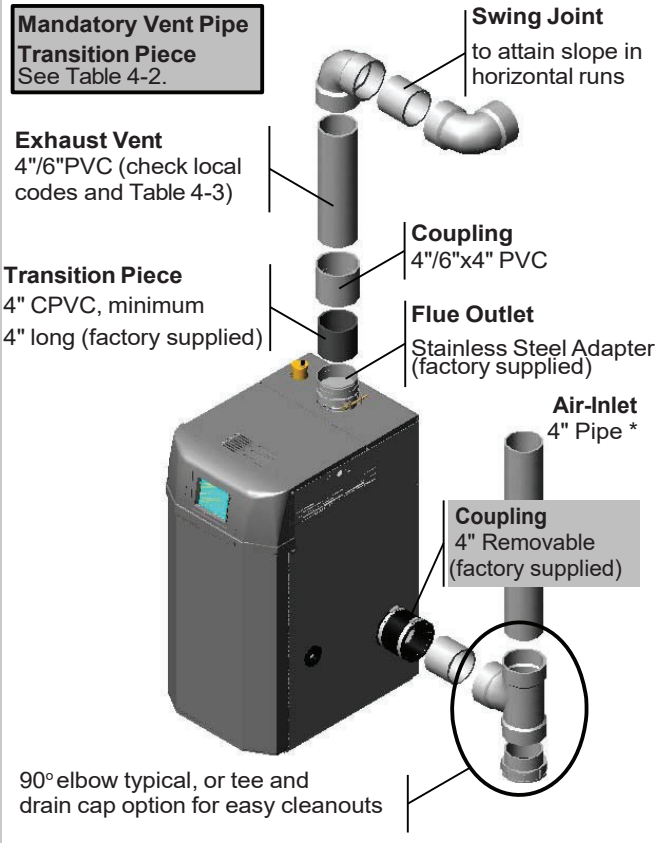


Figure 4-3(b) Near Water Heater Venting (PVC)

Models NX300 & NX400



*** Air-Inlet- check with applicable local codes for acceptable pipe material**

Figure 4-4(a) Near Water Heater Venting (CPVC/PVC)

Models NX500 & NX600

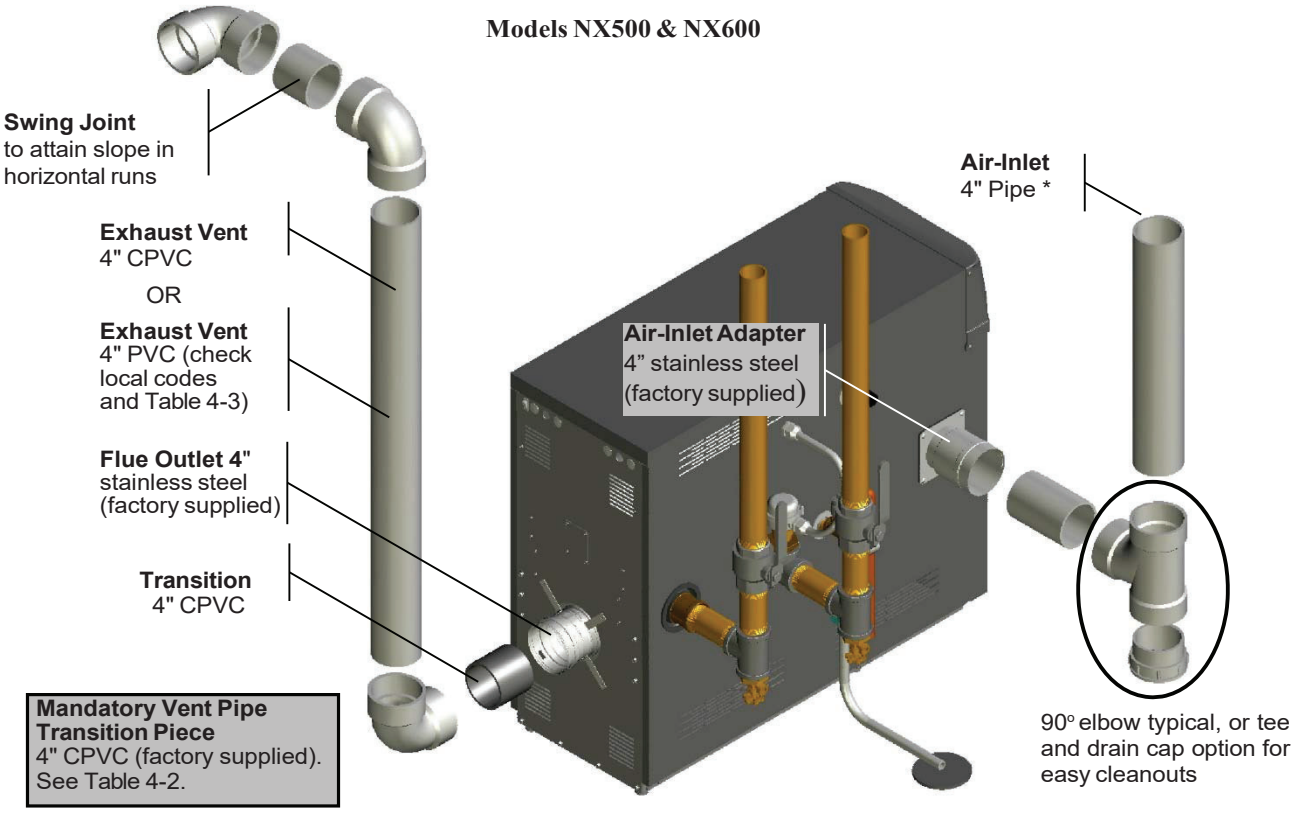


Figure 4-5(a) Near Water Heater Venting (CPVC)

Models NX700 & NX800

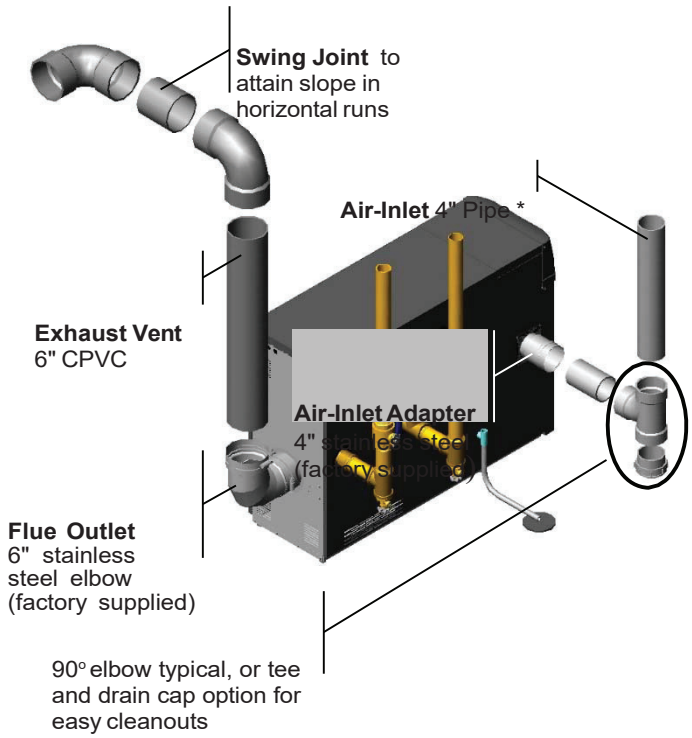
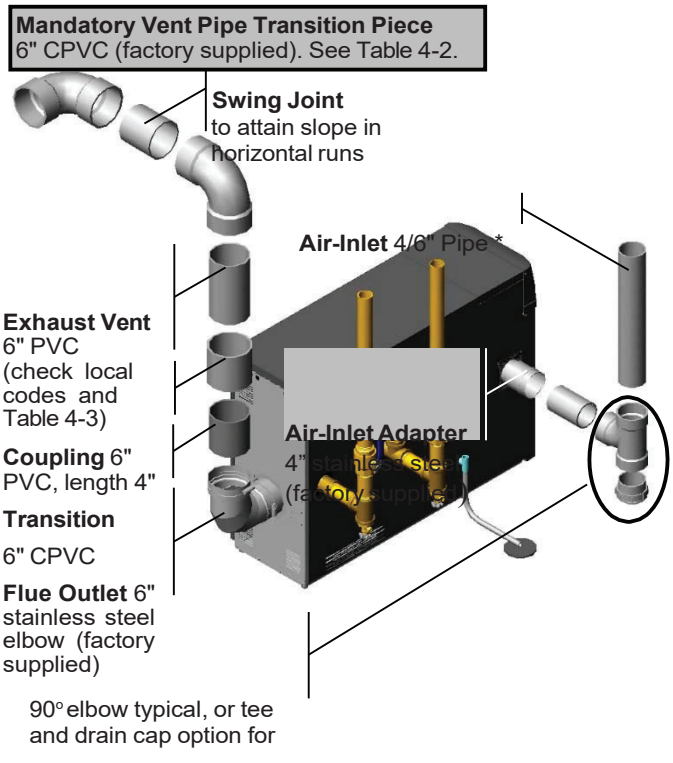


Figure 4-5(b) Near Water Heater Venting (PVC)

Models NX700 & NX800



***Air-Inlet** - check with applicable local codes for acceptable pipe material.

Vent/Air-inlet Pipe Material

Table 4-4 Acceptable Vent and Air-inlet Pipe Material

Items [1]	Materials [2,3]	Installation Standards		WARNING
		United States	Canada [4]	
Vent Piping and Fittings	PVC - DWV	ANSI/ASTM D2265	All venting material in Canada must be **ULC S636 approved**. See Note 4 below for appropriate temperature applications.	All Vent and Air-inlet materials installed on gas fired appliances in CAN/US must meet the Standards listed in Table 4-4. Failure to comply could result in fire, serious injury or death.
	PVC Schedule 40	ANSI/ASTM D1785		
	CPVC Schedule 40	ANSI/ASTM F441		
	AL29-4C	UL-1738		
	Polypropylene (PP)	-		
Pipe Cement	PVC	ANSI/ASTM D2564		
	CPVC	ANSI/ASTM F493		
Primers	PVC / CPVC	ANSI/ASTM F656		

Notes:
[1] Refer to Table 4-5 for Allowable Vent and Air-inlet Pipe Sizes and Lengths.
[2] PVC venting (exhaust and air-intake) is not permitted within the Closet/alcove of a Closet/alcove installation.
[3] The Air-Intake does not require high temperature pipe material. Check applicable local codes for acceptable materials.
[4] ULC S636 PVC is approved for flue gas temperatures up to 149°F (65°C) and must only be used for low temperature applications. High temperature applications requiring water heater supply water temperatures greater than 140°F (60°C) must use ULC S636 CPVC, PP or AL29-4C.

WARNING

The use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in the exhaust venting system is prohibited. Failure to follow these instructions may result in property damage, personal injury or death.

WARNING

Covering non-metallic vent pipe and fittings with thermal insulation is prohibited. Failure to follow these instructions may result in property damage, personal injury or death.

Vent and Air-inlet Pipe Length Determination

Use Table 4-5 to determine the maximum pipe length that can be used. The table calculates sweep, 90º elbows, and 45º elbows at 5 equivalent feet each. Note: model NX200 has limitations when operating with Propane Gas (LP).

***Example*:** An NX200 can be installed with 105 equivalent feet of air-inlet piping and 105 equivalent feet of exhaust vent piping when operating with Natural Gas. When operating with Propane Gas (LP), the maximum length of each the exhaust vent and air-inlet pipe is limited to 50 equivalent feet (3" diameter pipe).

NOTICE

The length of one vent pipe (air-inlet or exhaust) may not exceed the length of the other vent pipe by more than 20 equivalent feet.

Table 4-5 Allowable Vent and Air-Intake Pipe Size and Lengths

Model	Pipe Size	Gas	Length ft.	Number of Elbows (90's or 45's) and Equivalent Feet								
				1	2	3	4	5	6	7	8	9
NX200	3"	LP	50	45	40	35	30	25	20	15	10	5
	3"	NG	105	100	95	90	85	80	75	70	65	60
	4"	NG & LP	105	100	95	90	85	80	75	70	65	60
NX300& NX400	4" or 6"	NG & LP	100	95	90	85	80	75	70	65	60	55
NX500	4" or 6"[3]	NG & LP	100	95	90	85	80	75	70	65	60	55
NX600	4"or 6"[3]	NG[2]	100	95	90	85	80	75	70	65	60	55
NX700 & NX800	6"[1]	NG[2]	100	95	90	85	80	75	70	65	60	55

Notes:
[1] Only 6" exhaust vent is permissible for models NX700-800. Air-inlet pipe can be 4" or 6" (6" is highly recommended).
[2] Models NX600-NX800 operate with Natural Gas only.
[3] Models NX500 & NX600 are limited to 30 ft. of 4" or 90 ft. of 6" exhaust venting when using the Air Filter Kit (P/N HUB-84093).

⚠ WARNING

Air Filter Kit venting restrictions - Models NX500 & NX600 are limited to 30 equivalent feet of 4" (or 90 equivalent feet of 6") exhaust vent when using the optional Air Filter Kit. When transitioning from 4" to 6", the 4" venting used must be counted 3 times to convert to an equivalent length in 6".

Example: An application uses one 90º elbow and 5 feet of 4" venting before converting to 6"; therefore, the 4" venting has an equivalent length of 30' [(5'+5') x 3] of 6" venting; thus allowing an additional 60' equivalent of 6"venting *(Note: Example is only true with NX500-600 models using the optional Indoor Combustion Air Kit).*

Termination Options – Direct Vent Installation

The venting system of the Hubbell NX may be terminated using field supplied piping to construct a "Two-Pipe" termination, see Figures 4-6(b), 4-7(a), 4-7(b) and 4-8(a); alternatively the venting may be terminated using a factory kit selected from Table 4-6.

Kits certified with the Hubbell NX are listed in Table 4-6 and available from IPEX, DuraVent, Centrotherm, and/or Hubbell. For more information on System 636 Vent Kits or wholesaler locations contact IPEX directly **USA:** 1-800-463-9572 or www.IPEXamerica.com | **CAN:** 1-866-473-9462 or www.ipexinc.com. For more information on PolyPro Vent Kits or wholesaler locations contact DuraVent directly 1-800-835-4429 or www.duravent.com. For more information on InnoFlue Vent Kits or wholesaler locations contact Centrotherm directly at 1-877-434-3432 or www.centrotherm.us.com.

Table 4-6 Optional Vent Termination Kits

Description	Vent Size	Supplier P/N	Figure	Vent Material Compatibility	Vent Option	
						Wall
IPEX Low Profile (Flush Mount)[7]	3"	196985 (Hubbell P/N 84357)	4-9	PVC/CPVC[7]	✘	✔
	4"	196986 (Hubbell P/N 84358)				
IPEX Concentric (Wall/Roof)[5,6,7,8]	3"	196116 (Hubbell P/N 82666)	4-9(b), 4-10(b)	PVC/CPVC[7]	✔	✔
	4"	196021 (Hubbell P/N 84355)				
DuraVent - PolyPro Concentric (Wall)	3"	3PPS-HK	4-9(d)	PVC/CPVC/PP	✘	✔
	4"	4PPS-HK				
DuraVent - PolyPro Concentric (Roof)	3"	3PPS-VK	4-10(c)	PVC/CPVC/PP	✔	✘
	4"	4PPS-VK				
Centrotherm – InnoFlue (Flush Mount)	3"	ISLPT0303	4-9	PVC/CPVC/PP	✘	✔
Centrotherm – InnoFlue Concentric (Wall)[9]	3"	ICWS3513 & ICTC0335	4-9(d)	PVC/CPVC/PP	✘	✔
	4"	ICWS4639 & ICTC0446				
Centrotherm – InnoFlue Concentric (Roof)[9]	3"	ICRT3539 & ICTC0335	4-10(c)	PVC/CPVC/PP	✔	✘
	4"	ICRT4679 & ICTC0446				

⚠ WARNING Models NX300-NX800 are not approved for use with any of the 3" vent termination kits; only 4" vent termination kits, listed in Table 4-6, are acceptable.

IMPORTANT **PVC In Canada** - Authorities in some jurisdictions may not allow the use of any PVC venting materials with condensing water heaters; check with the local safety inspector to verify compliance prior to installing a PVC Concentric Vent Kit with a Hubbell NX.

IMPORTANT

Sidewall Termination - Due to potential moisture loading (build-up) along the exterior wall, sidewall venting may not be the preferred venting option. Refer to Figures 4-8 and 4-10 for roof top venting options.

Sidewall Termination Examples – Direct Vent Installation

Figure 4-6(a) Concentric Sidewall Termination (NX200 Illustrated)

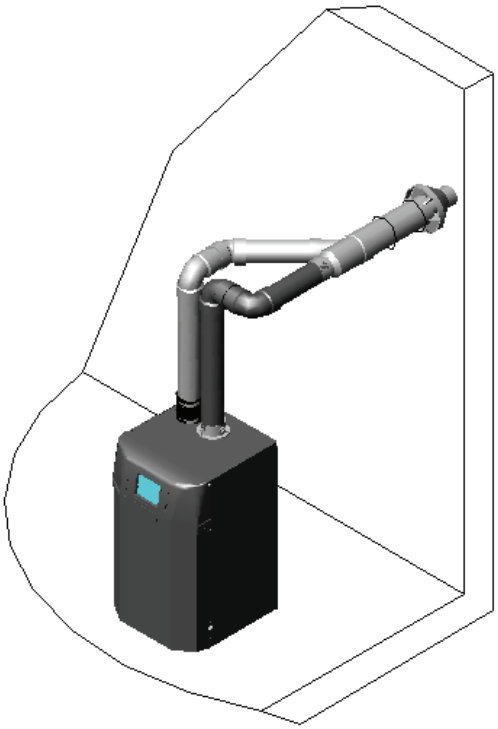


Figure 4-6(b) Two-Pipe Sidewall Termination (NX200 Illustrated)

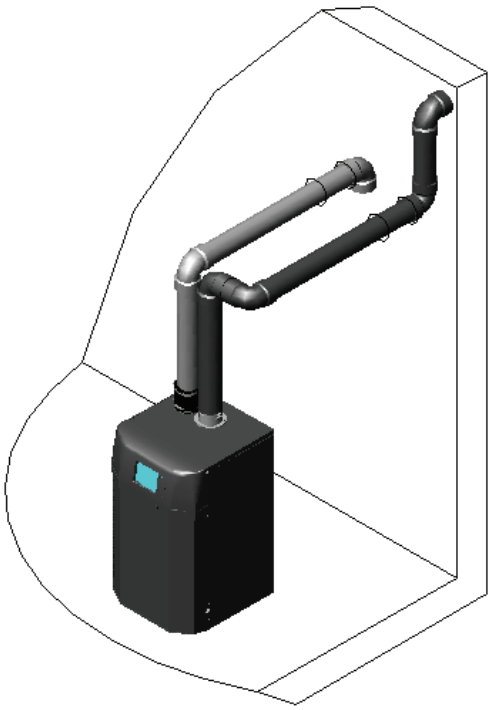


Figure 4-7(a) Two-Pipe Sidewall Termination (NX800 Illustrated)

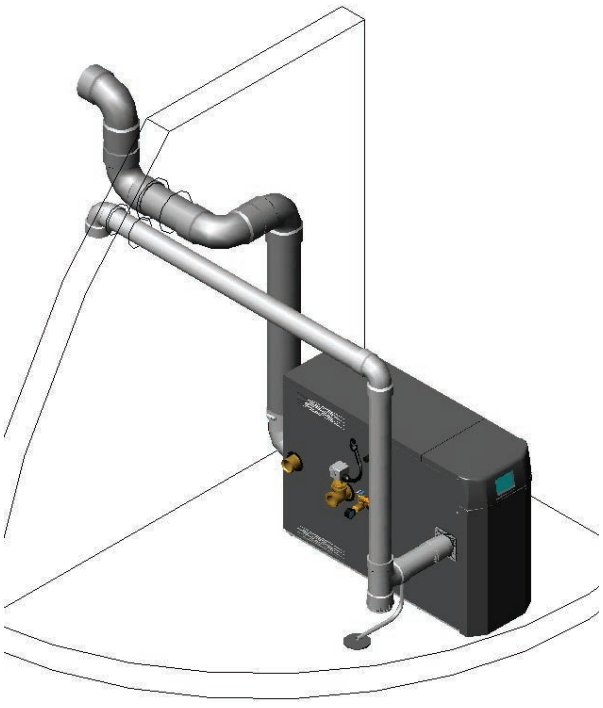
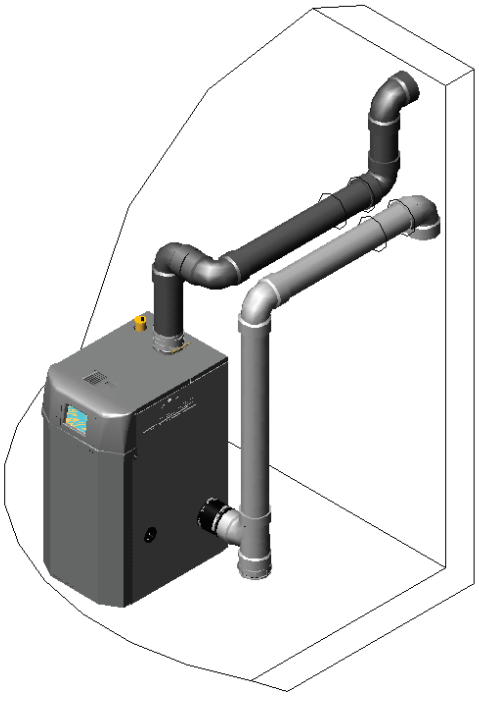


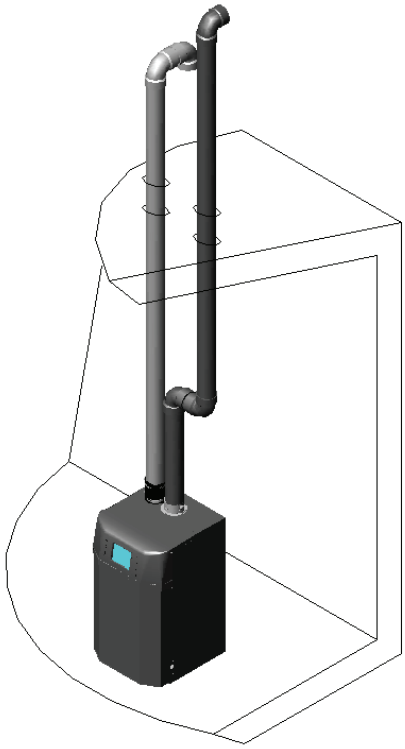
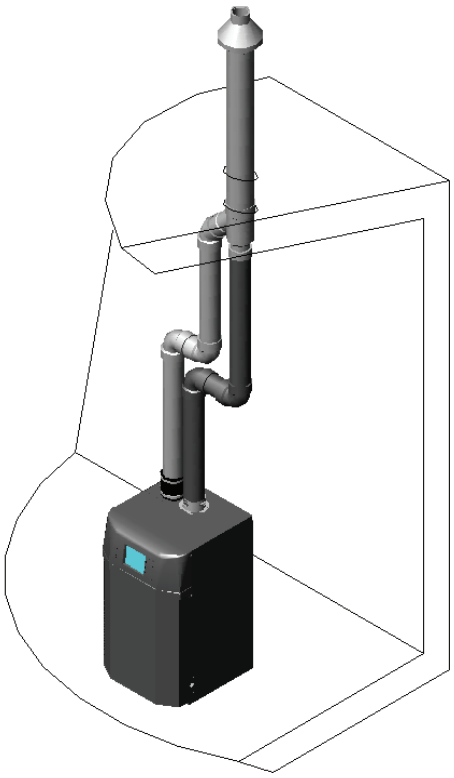
Figure 4-7(b) Two-Pipe Sidewall Termination (NX400 Illustrated)



⚠ WARNING

Extra precaution must be taken to adequately support the weight of the Vent/Air-inlet piping in applications using roof-top terminations. Failure to follow these instructions may result in venting or water heater component failure resulting in flue gas spillage leading to property damage, serious injury or death.

Roof Termination Examples – Direct Vent Installation

Figure 4-8(a) Two-Pipe Roof Termination	Figure 4-8(b) Concentric Roof Termination
(NX200 Illustrated)	(NX200 Illustrated)
	

Sidewall Termination Details – Direct Vent Installation

Figure 4-9(a)

Two-Pipe Termination (Sidewall)

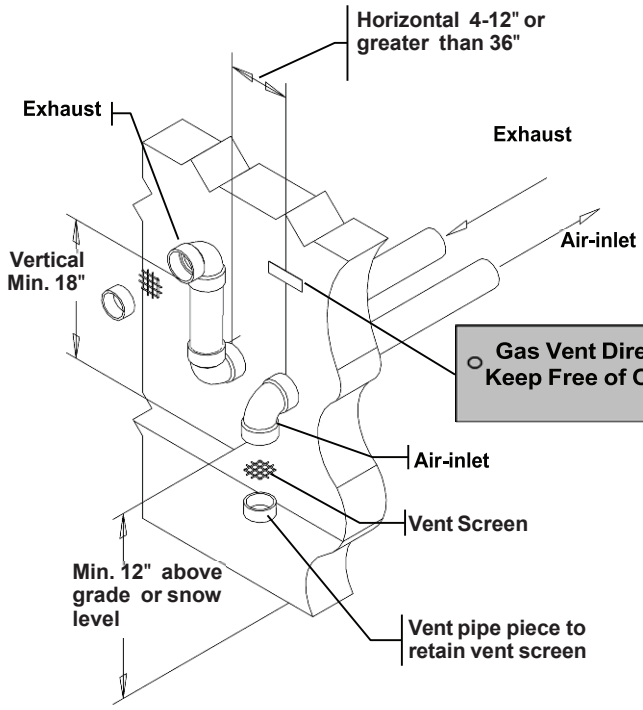


Figure 4-9(b)

IPEX Concentric Termination (Sidewall)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

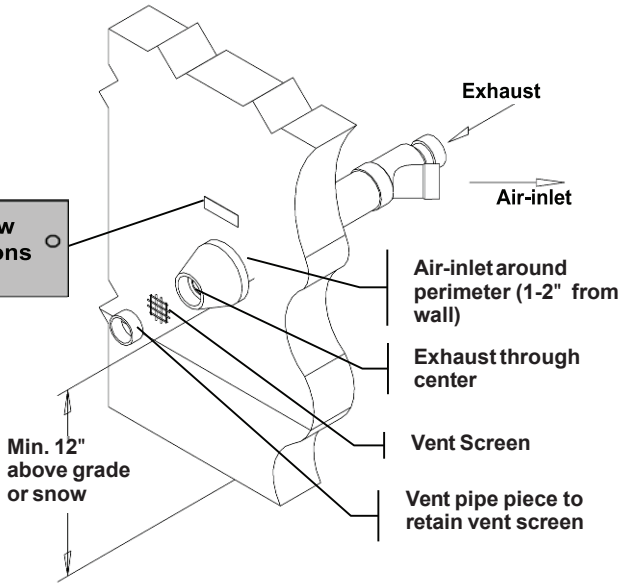


Figure 4-9(c)

Low Profil Termination (Sidewall)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

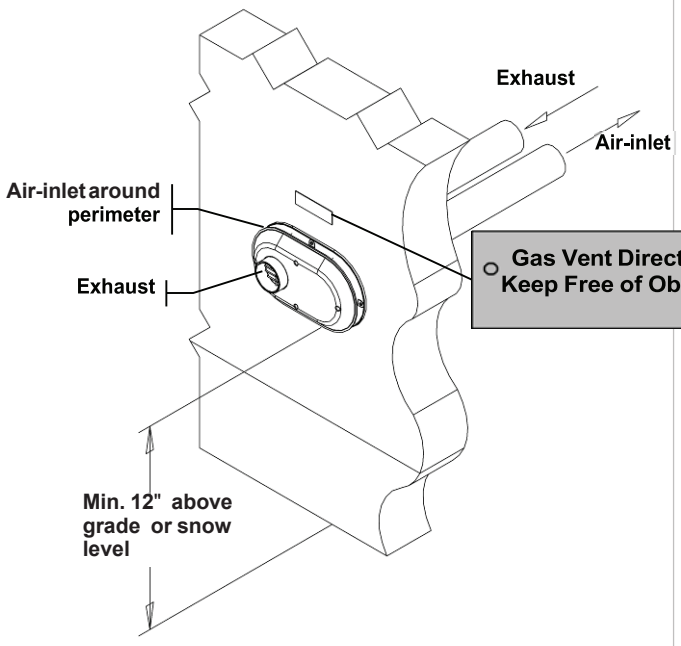
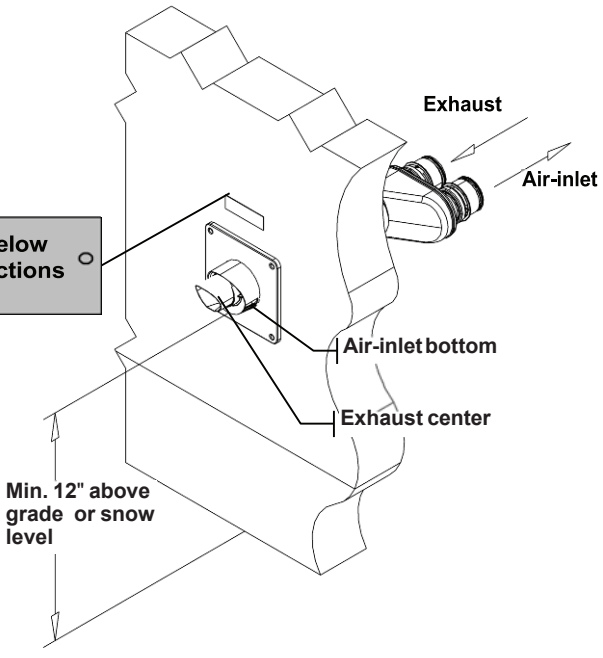


Figure 4-9(d)

PolyPro / InnoFlue Termination (Sidewall)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.



Roof Termination Details – Direct Vent Installation

Figure 4-10(a)

Two-Pipe Termination (Roof)

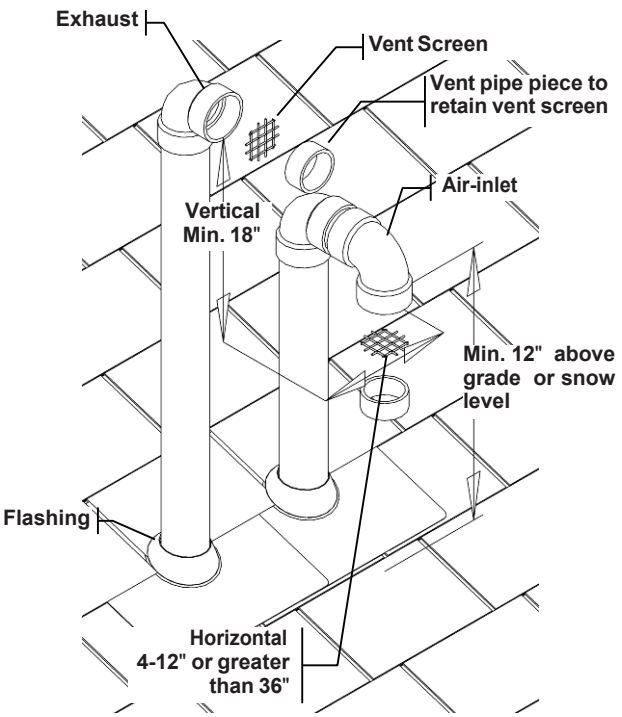


Figure 4-10(b)

IPEX Concentric Termination (Roof)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

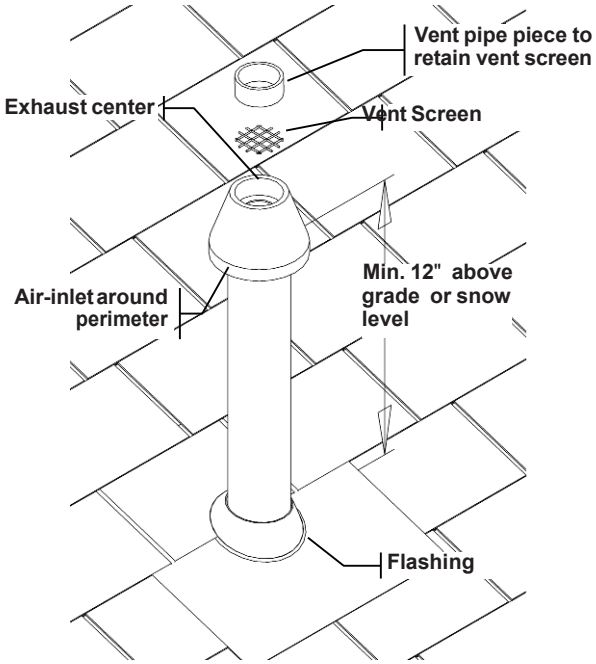


Figure 4-10(c)

PolyPro / InnoFlue Termination (Roof)

⚠ WARNING

Refer to documentation included with termination kit for complete installation instructions.

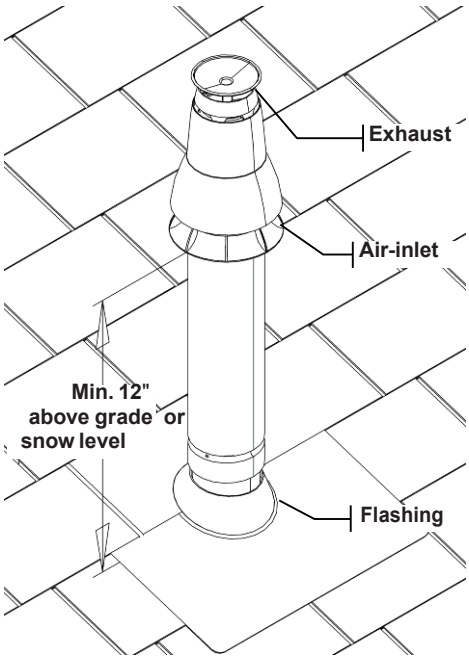
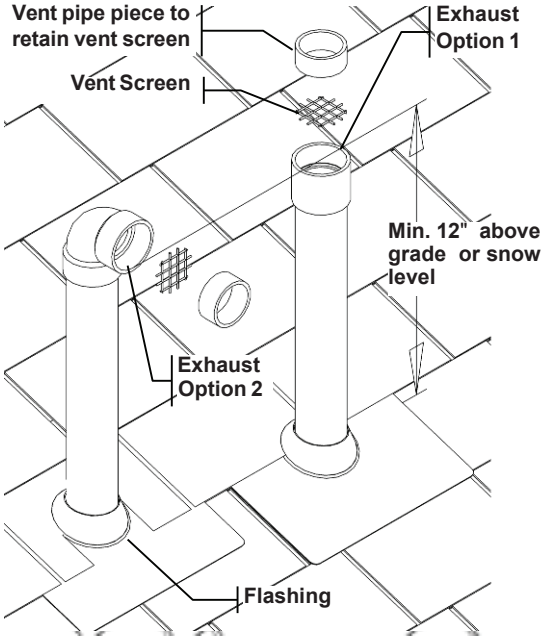


Figure 4-10(d)

Exhaust only Termination (Roof)

⚠ WARNING

Figure illustrates two options for exhaust termination only; neither vent pipe illustrated is for combustion air-inlet.



Venting Rules and Guidelines

1. **Prevailing Winds:** Ensure the vent is located where it will not be exposed to normal prevailing winds.
2. **Combustion Air-inlet Contamination:** Air for combustion must be drawn from an area free of dust and contaminants. Combustion air containing chemicals such as chloride, fluoride, bromine or iodine or dust and debris will cause corrosion damage of the heat exchanger voiding your Hubbell warranty. Refer to Table 4-1 for a list of corrosive products and contaminants sources to avoid.
3. **Vertical Separation:** The exhaust must be a minimum of 18 in. above the air inlet, and the air inlet must always be a minimum of 12 in. plus snow allowance above any surface that will support snow. (Two feet plus snow allowance is highly recommended). Consult your weather office for the maximum typical snowfall for your region.
4. **Horizontal Separation:** The horizontal distance between the inlet and exhaust must be a minimum of 4" center to center.
5. **Wall Flashing:** Under normal operating conditions this water heater will produce a plume of white gases, and should be taken into consideration when selecting an adequate location. A 36 in. diameter stainless, plastic, or vinyl shield can be used to flash the exterior of the building.
6. **Flue Gas Hazard:** Position the vent termination where vapors cannot make accidental contact with people and pets or damage nearby shrubs and plants.
7. **Elbow Extensions:** Elbows on outside of wall must be no more than 1⁄2 in. away from the wall.
8. **Vent Sloping:** All indoor exhaust piping must be on a slope back to the water heater a minimum of 1⁄4 in. per linear foot of vent. For applications where excessive condensation is possible 1⁄2 in. per linear foot is recommended.
9. **Vent Supports:** Where required Vent and Air-inlet piping shall be secured to the wall for more rigidity. All interior vent pipe shall be supported a minimum of every 36 in..
10. **Roof Exhaust:** In all roof applications the discharge must point away from the pitch of the roof.
11. **Roof Flashing:** Install adequate flashing where the pipe enters the roof, to prevent water leakage.
12. **Rain Cap:** Install and seal a rain cap over existing chimney openings, in vacant chimney applications.
13. **Venting Below Grade:** For installations that exit the wall below grade refer to Figure 4-11.
14. **Vent Screens:** Install factory supplied vent screens on the outside of the last elbow for both the inlet and exhaust vent terminal elbows. Install the screen into the female opening of the elbow, and then cut a small piece of pipe to sandwich the screen into the elbow. NOTE: ensure the small piece of pipe cut, does not extend past the end of the elbow. Two screens are provided in the package. See Figures 4-9 and 4-10.
15. **Condensate Hazard:** Do not locate vent over public walkways, driveways or parking lots. Condensate could drip and freeze resulting in a slip hazard or damage to vehicles and machinery.
16. **Warning Plate:** For Sidewall Venting, install the warning plate “Gas Vent Directly Below”, directly above (within 4 ft. vertically) the location of the air-inlet pipe, so it is visible from at least 8 ft away. See Figure 4-9.
17. **Wall Thickness:** Direct vent terminations are designed to work with any standard wall thickness. Installation guidelines for min/max wall thickness are as follows: Min. = 1 in., Max. = 60 in..
18. **Venting Options:** Due to potential moisture loading (build-up) along the exterior wall, sidewall venting may not be the preferred venting option. Refer to Figures 4-8 and 4-10 for roof top venting options.

⚠ WARNING The vent for this water heater shall not terminate over public walkways; or near soffit vents or crawl space vents or other area where condensate of vapor could create a nuisance or hazard or cause property damage; or where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Figure 4-11 Venting Below Grade

For installations that exit the wall below grade:

1. Excavate site to a point below where the pipes are to exit as shown.
2. Ensure the wall is fully sealed where the pipes penetrate.
3. The Vent/Air-inlet piping MUST be secured to the side of the building above grade, as shown, to provide rigidity.
4. Optional mounting bracket P/N. HUB-82075 for securing the exhaust pipes (only applicable for 3 in. PVC/CPVC venting).
5. Ensure that the Vent/Air-inlet clearances are maintained, see Section 5.0 for details.

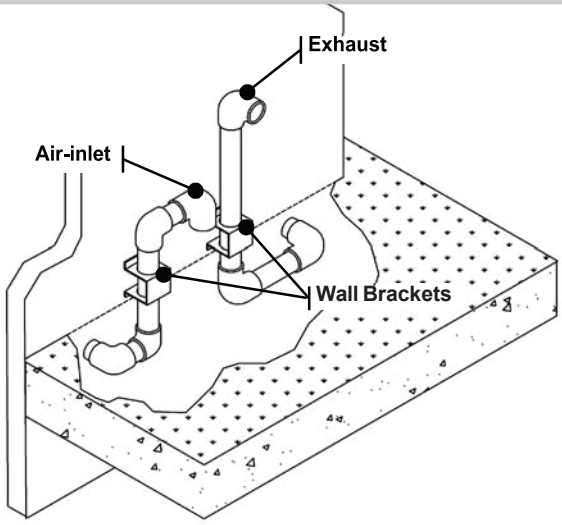


Figure 4-12 Outdoor Venting

Vent piping outside the building is permitted under the following conditions:

1. The maximum length outside the building is 20 ft. Note that outdoor length must be included in the overall vent length calculation.
2. All normal termination clearances are maintained.
3. The pipe is supported every 24 in..
4. The exhaust and inlet are sloped back to the water heater 1⁄2 in. elevation for every linear foot.

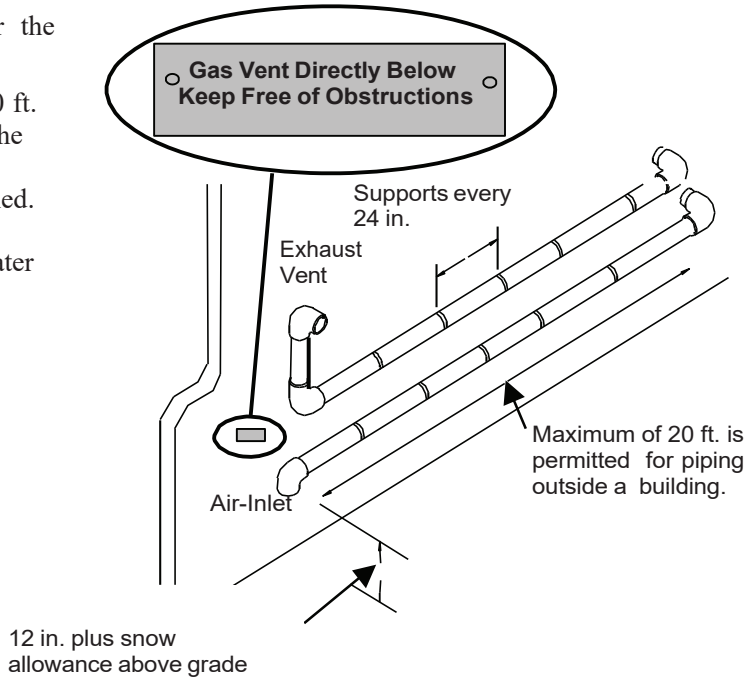
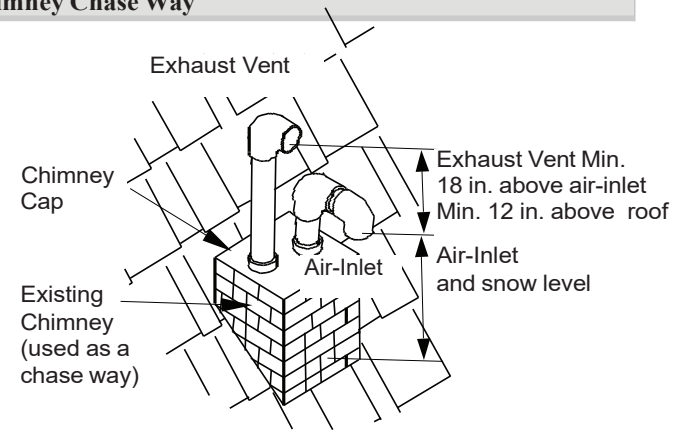


Figure 4-13 Existing Chimney Chase Way

It is permissible to use an existing chimney as a chase way to run the Vent/Air-inlet piping as long as:

1. The chimney is not being used by any other water heater.
2. Flue gases do not enter the vacant chimney.
3. Only Hubbell NX certified venting materials are used, see Table 4-4.
4. Vent lengths are within the maximums specified.
5. The top of the chimney is capped and the Vent/ Air-inlet pipes are flashed to prevent leakage into the vacant chimney.



⚠ DANGER Under no circumstances may an existing chimney or chase-way be used to vent or

provide combustion intake air to a Hubbell NX. Failure to follow these instructions will result in fire, property damage, serious injury or death.

5.0 VENT AND AIR-INTAKE TERMINATION CLEARANCES

⚠ WARNING The quick reference table below is to be read in conjunction with the numbered notes as indicated, Figures 5-1 through 5-6, and the Venting Rules and Guidelines in Section 4.0. The instructions detailed in this section are a combination of Hubbell NX specific and National Gas Code restrictions. Compliance alone doesn't insure a satisfactory installation as good common sense must also be applied. Failure to follow these instructions may result in fire, property damage, serious injury or death.

Table 5-1 Termination Clearances Quick Reference Table

Clearances to Air-Inlet Termination	USA[1] Min. Distance		Canada[2] Min. Distance
A Above grade/roofline and snow level [8]	12 in.	305 mm	12 in.
B Above roof line - Concentric Vent [6, 11, 13]	24 in.	610 mm	24 in.
C To exhaust vent from any other water heater	12 in.	305 mm	36 in.
Clearances to Exhaust Vent Termination	**Min. Distance**		**Min. Distance**
A Above grade/roofline and snow level [8]	12 in.	305 mm	12 in.
D Minimum vertical separation above air inlet [9]	18 in.	457 mm	18 in.
E Minimum horizontal separation from air inlet [3]	4 in.	102 mm	4 in.
F Window or door that may be opened, or other building opening	12 in.	305 mm	36 in.
G To combustion air inlet of any other appliance	12 in.	305 mm	36 in.
H Non-mechanical air supply inlet to building	12 in.	305 mm	36 in.
I Mechanical air supply inlet to building [4]	3 ft.	915mm	6 ft.
J Soffit, overhang, eave or parapet	24 in.	610mm	24 in.
K Soffit vent or vent opening in an overhang, eave or parapet	6 ft.	1.83 m	6 ft.
L Outside corner [10]	-	-	-
M Inside corner of an L-shaped structure (including walls and fences)	36 in.	915 mm	36 in.
N Service regulator / vent outlet	36 in.	915mm	36 in.
P Each side of center line above or below meter / regulator assembly [5]	36 in.	915mm	36 in.
Q Above a paved sidewalk, driveway, or parking lot on public property if adjacent [12]	7 ft.	2.13 m	7 ft.
R Above a public walkway	x	x	x
S Above a sidewalk or paved driveway that is located between two single family dwellings and services both dwellings	x	x	x
T Under a concrete veranda, porch, deck, or balcony [7]	24 in.	610 mm	24 in.
U Above, under or near exterior stairs	x	x	x
V Into a canopy or carport	x	x	x

Notes:
1 - Canadian installations must comply with the current CSA B149.1 Natural Gas and Propane Installation Code and local building codes.
2 - US installations must comply with current ANSI Z223.1/ NFPA 54 National Fuel Gas Code and local building codes.
3 - Horizontal separation center-to-center (c.c.) 4"-12" (102-305 mm).
4 - For US installations, an exhaust vent must be 3 ft above a mechanical air supply inlet if within 10 ft. horizontally.
5 - Horizontal clearance must be observed up to a height of 15 ft. [4.6 m] above/below the meter, regulator, or relief devices.
6 - Concentric Vent must protrude from the roof precisely 24"[610 mm] measuring from the terminal end-cap vanes.
7 - Permitted if veranda, porch, deck, or balcony is made of concrete and a minimum of two sides are fully open beneath.
8 - 24" is the recommended snow level allowance above grade/roofline or any surface that will support snow, debris, or ice (i.e. for roof venting clearances - roofline and snow level). If living in a snowfall region, consult your local weather office for the maximum typical snowfall for your area.
9 - Note that the vent must maintain a minimum vertical distance above the air-inlet. Example: Vent height = 18" (457 mm) above air inlet + 12" (305 mm) for air inlet above grade/roof line and snow level = 30" (762 mm) above grade and snow level.
10 - Clearances to an outside corner to be in accordance with local installation codes.
11 - In Canada, concentric vent materials are subject to approval by local inspectors. See Termination Kits in Section 4.0.
12 - Above public walkways, driveways or parking lots if adjacent to it and condensate cannot drip, freeze, or create a hazard.
13 - Contact Hubbell for special exemptions relating to multiple water heater installations using concentric vents.

Figure 5-1 Termination Clearances Quick Reference Diagram

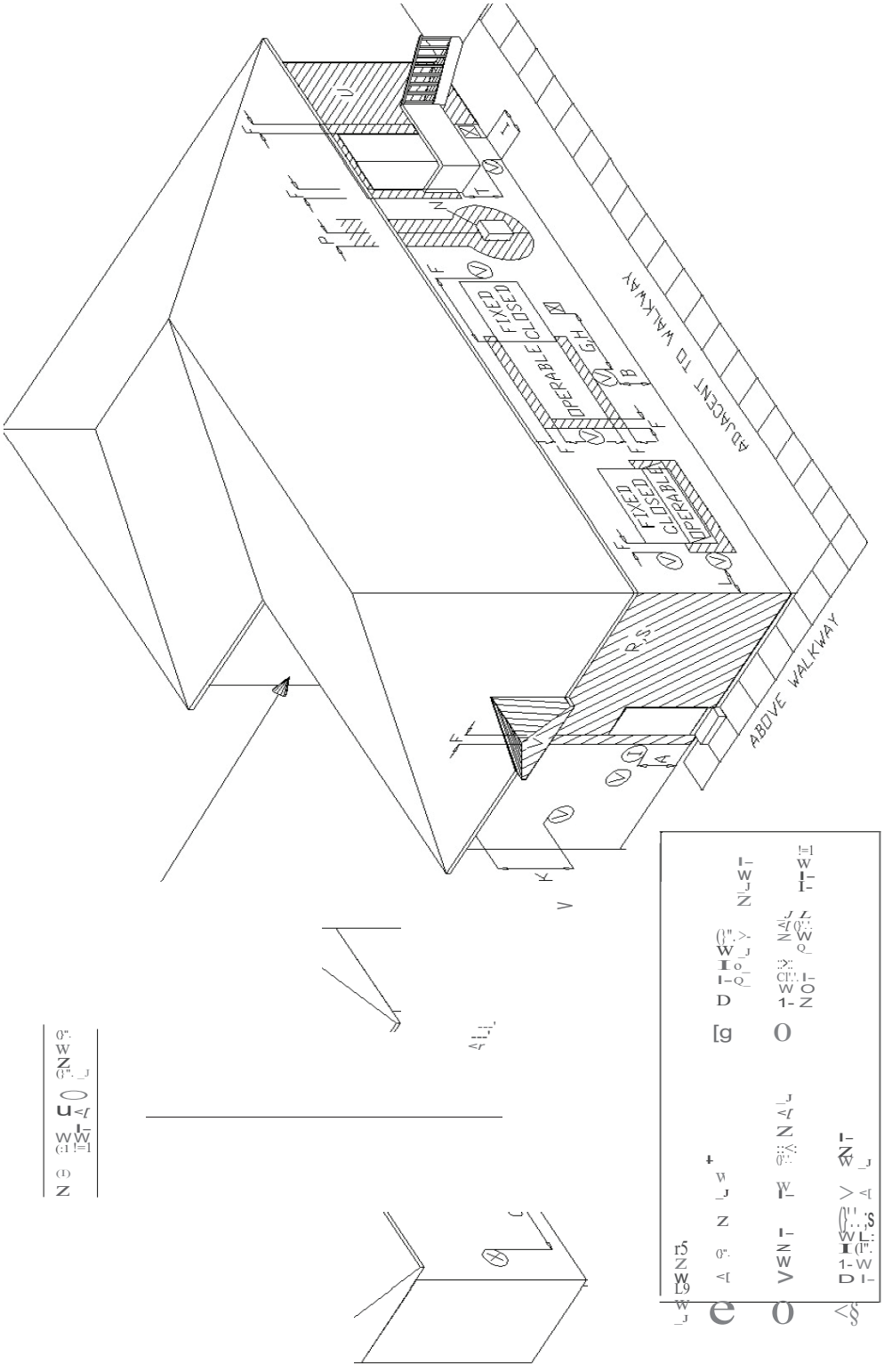
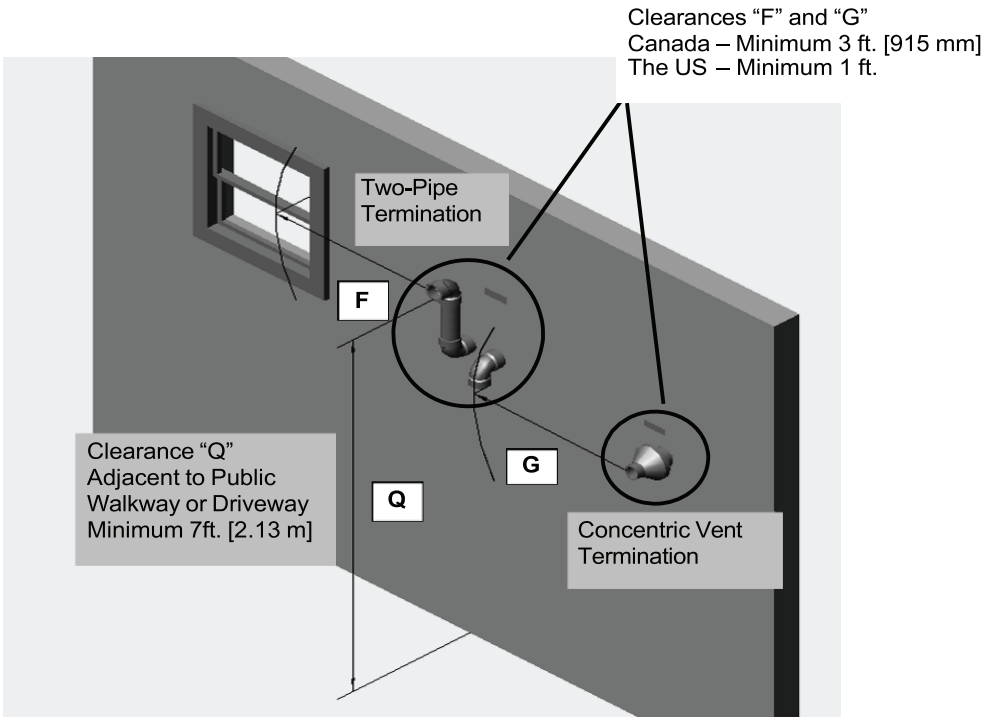


Figure 5-2 Sidewall Termination Clearances (See Table 5-1)



G – Letter represents a specific Termination Position. Refer to Table 5-1 for corresponding termination clearances.

July 25, 2019

TECHNICAL BULLETIN – South Coast AQMD Low NOx Approval (NX)

Product Series: NX

Models: NX200, NX300, NX400, NX500, NX600, NX700, NX800

Update: SCAQMD Rule 1146.2 Low NOx approval

Implementation Date: July 23, 2019

The South Coast Air Quality Management District (SCAQMD) has approved and certified the above listed natural gas-fired boiler and water heater models, subject to Rule 1146.2 – *Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters*, to comply with 20 ppm @ 3% O_2 NOx emission limit.

Encl.: SCAQMD certificate (NX Series)

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

Kevin Choi
Underwriters Laboratories of Canada
7 Underwriters Rd.
Tonoto, Ontario M1R 3A9
Canada

July 18, 2019

Subject: Rule 1146.2 Certification – Hubbell The Electric Heater Company

Dear Mr. Choi,

As requested in your email dated June 26, 2019, submitted on behalf of Hubbell, the South Coast Air Quality Management District (South Coast AQMD) has approved and certified the following natural gas-fired hot water heater models subject to Rule 1146.2 – *Emissions of Oxides of Nitrogen from Larger Water Heaters and Small Boilers and Process Heaters*, to comply with 20 ppm @ 3% O_2 NOx emission limit. This certification is based on approval of the NOx Emission Test Report for models NX200, NX500, and NX800, dated June 25, 2019, by UL Canada (SCAQMD Source Test Reference ID # R19198).

Certified Models	Heat Input Rating (BTU/hr)	Type
Hubbell NX Series		
NX200*	199,000	1
NX300	275,000	1
NX400	399,000	1
NX500*	500,000	2
NX600	600,000	2
NX700	700,000	2
NX800*	800,000	2

*Tested Models

Please note that South Coast AQMD does not endorse or warrant any specific product or manufacturer. Modification of the products listed here will void this certification. If you have any questions or require further assistance, please contact CJ Change at (909) 396-3293 or via e-mail at cchang@aqmd.gov.

Sincerely,

George Illes
Supervising Air Quality Engineer
Engineering & Permitting

APPENDIX D

Electronic Modeling Files Archive

(Provided Under Separate Cover)

November 12, 2024

Transmitted via email to: rvic461@ecy.wa.gov

Washington State Department of Ecology
Central Regional Office
1250 West Alder Street
Union Gap, WA 98903-0009

Attn: Ryan Vicente

Re: Revised Request for Air Permit Approval Order Amendments
Central Washington University
Ellensburg, Washington

Dear Mr. Vicente:

Central Washington University (CWU), located in Ellensburg, Washington, is authorized to operate multiple air emission units under Order of Approval No. 10AQ-C147, First Revision, issued June 25, 2020 (Approval Order). Landau Associates, Inc. (Landau), on behalf of CWU, submitted a Notice of Construction (NOC) application on December 1, 2023 to the Washington State Department of Ecology (Ecology) to request amendments to the Approval Order. On December 18, 2023, CWU received a response from Ryan Vicente of Ecology indicating that the application was incomplete. This letter and its attachments provide Ecology with information to complete the following amendments to the Approval Order:

- Re-evaluating the potential-to-emit (PTE) of existing emission units to establish that the campus has a PTE below 80 percent of the Title V major source (SM-80) threshold.
- Removing one generator (Unit ID No. G1) and five boilers (Unit ID Nos. B8, B9, B10, B11, and B12) from the Approval Order
- Updating the equipment list for emission units that are categorically exempt from New Source Review (NSR).

CWU is also requesting that Ecology update the Approval Order to include equipment that underwent NSR in 2022 for replacement of three natural gas-fired boilers and addition of two natural gas-fired water heaters, as described in the NOC application that was submitted to Ecology on November 7, 2022. The November 2022 NOC application was considered by Ecology to be complete on November 16, 2022, but CWU has not received a revised Approval Order.

Campus-Wide Emissions

An equipment list that presents all permitted and categorically exempt emission units at the campus is provided as Attachment 1. Additionally, Attachment 1 includes the unit identification number,

manufacturer, model, rating, location, date installed, and other details as available for each piece of equipment.

PTE emission estimates are provided in Attachment 2. For the permitted boilers, generators, and paint booths, CWU is requesting voluntary enforceable permit limits in accordance with Washington Administrative Code (WAC) 173-400-091 that restrict equipment usage and emissions.[1] Since the dust collectors, kilns, including the smelting pot, and unpermitted paint booths are categorically exempt from NSR, the PTE has not been estimated; however, CWU can include actual emission estimates for these pieces of equipment as part of its annual report at Ecology's request.

Fuel and equipment usage assumptions used for the PTE calculations are provided in Attachment 3. As demonstrated in Attachment 2, the maximum estimated PTE for all natural gas and diesel-fueled is 41 tons/year of nitrogen oxides (NO_X), 28 tons/year of carbon monoxide, 3.0 tons/year of $PM_{10}/PM_{2.5}$,[2] 0.79 tons/year of sulfur dioxide (SO_2), and 2.5 tons/year of volatile organic compounds (VOCs). No changes are requested to the permitted PTE for the paint booth.

Decommissioned Equipment

Five boilers that are permitted in the Approval Order as Unit ID Nos. B8, B9, B10, B11, and B12 have now been decommissioned and removed from the campus. Additionally, one generator permitted in the Approval Order as Unit ID No. G1 has been decommissioned due to breakdown and removed from the campus. CWU requests that the above-noted equipment be removed from the Approval Order.

Change of Portable Generator Status

One generator that is permitted in the Approval Order under G7 has now been removed from the portable skid and has become stationary. Based on the current Approval Order, "G7 qualified as new stationary sources under WAC 173-400-110, filed October 23, 1998, and as new TAP [toxic air pollutant] sources under WAC 173-460-040, filed July 21, 1998"; therefore, CWU understands that no additional review is required for this unit. CWU requests that this unit be designated as "stationary" in the Approval Order.

Categorically Exempt Emission Units

CWU requests that the equipment described below be added to the Approval Order as categorically exempt emission units. A list of all equipment is provided in Attachment 1.

Paint Booths

One paint booth at the Grounds Warehouse Building is currently permitted under the existing Approval Order. Three additional paint booths exist on campus. Information pertaining to the use of these three paint booths was provided to Ecology on September 19, 2024 (Attachment 4). Ecology

[1] Limits to restrict usage have been set so they are equal to 200 percent of maximum annual usage between 2018 and 2022.

[2] Particulate matter with an aerodynamic diameter of 10 microns or 2.5 microns or less.

responded to Landau by email on September 24, 2024 (Attachment 4) indicating that the paint booths are categorically exempt from NSR in accordance with WAC 173-400-110(4)(a) and (f).

Dust Collectors

CWU operates six stationary dust collectors on campus. Information pertaining to the use of these dust collectors was provided to Ecology on September 19, 2024 (Attachment 4). Ecology responded to Landau by email on September 24, 2024 (Attachment 4) indicating that the dust collectors are categorically exempt from NSR in accordance with WAC 173-400-110(4)(a) and (f).

Additionally, six shop vacuums, two metal polishing tables and associated dust collectors, one abrasive blasting table, one sanding table, a portable vacuum, and a welding fume/smoke filter are located in Randall Hall. These units are used only indoors in the classroom, are portable equipment with rollers, and emissions from these units are negligible.

Kilns and Smelting Pot

CWU operates two natural gas-fired kilns, one wood-fired kiln, and one natural gas-fired smelting pot. Information pertaining to the use of the kilns was provided to Ecology on September 19, 2024 (Attachment 4). Ecology responded to Landau by email on September 24, 2024 (Attachment 4) indicating that the kilns are categorically exempt from NSR in accordance with WAC 173-400-110(4)(c).

Boilers

In 2023, two natural gas-fired boilers were constructed at the Getz Short Apartments and two at the Student Union building location. These four boilers collectively are rated at less than 4 million British thermal units per hour (MMBtu/hr) and are exempt from NSR as noted in WAC 173-400-110(4)(c)(v). The exemption applicability of these boilers was previously confirmed with Ryan Vicente of Ecology in an email dated January 11, 2023, which was sent prior to the start of construction of the four boilers (Attachment 4).

Similarly, two natural gas-fired boilers located at Dugmore Hall, each rated at 0.5 MMBtu/hr, were constructed on campus in 2019. These boilers are also categorically exempt from NSR per WAC 173-400-110(4)(c)(v).

Generators

In 2024, the G1 diesel generator broke down and was replaced with a new, temporary diesel generator. The new generator has been de-rated by the manufacturer upon startup to produce no more than 300 kilowatts of power, or less than 457 horsepower (hp). Notes from the manufacturer and the general performance data are included as Attachment 5. This generator is <500 hp and is exempt from NSR as noted in WAC 173-400-110(4)(h)(xxxix), which CWU confirmed with Ecology prior to permanent installation of the generator in emails dated April 11 and 22, 2024 (Attachment 5).

Electric Kiln

One electric smelting pot is located in Hogue Hall. This kiln is electric and thus has no associated air emissions.

Conclusion

In summary, CWU requests that the campus-wide PTE and status of existing, permitted equipment be updated, and that the new emission units be added in an amendment to the current Approval Order. If Ecology concurs with the reduced emissions provided in Attachment 2, CWU requests that it be used as a basis for lowering the registration tier (and associated fees) that is applicable to the campus.

* * * * *

Please contact Aimi Tanada or Mark Brunner if you have any comments or questions about this request. Thank you for your time and consideration of this request.

LANDAU ASSOCIATES, INC.

Aimi Tanada
Senior Staff Scientist

Mark Brunner
Principal

AT/MWB/ccy
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cc: Jeremiah Eilers, Central Washington University (jeremiah.eilers@cwu.edu)

Attachments

Attachment 1: Equipment List
Attachment 2: Emission Calculations
Attachment 3: Proposed Permit Limits
Attachment 4: New Source Review Exemptions
Attachment 5: New Generator Manufacturer's Quote and Specifications

ATTACHMENT 1

Equipment List

Attachment 1
Central Washington University
Ellensburg, Washington

Equipment List

ID[i]	Equipment Type	Manufacturer	Model	Rating	Location	Installed	Note
Emission Units							
B1	NG Boiler	National U.S.	209	0.42 MMBtu/hr	Presidents Res.	1967	
B2	NG/Diesel Boiler	Cleaver-Brooks	DL-76 (WT400X-CN7)	85.846 MMBtu/hr	New Heating Plant	1975	
B3	NG/Diesel Boiler	Cleaver-Brooks	DL-76 (WT400X-CN7)	85.846 MMBtu/hr	New Heating Plant	1975	
B4	NG/Diesel Boiler	Cleaver-Brooks	DL-76 (WT439X-CN7)	87.7 MMBtu/hr	New Heating Plant	1975	
B5	NG Boiler	Cleaver-Brooks	CB200-800	33.476 MMBtu/hr	New Heating Plant	1983	
B6	NG Boiler	Thermal Solutions	EV A0250BN1 UAB	0.25 MMBtu/hr	Brooklane	2003	
B7	NG Boiler	Thermal Solutions	EV A0250BN1 UAB	0.25 MMBtu/hr	Brooklane	2003	
B8	NG Boiler	RBI	MW1250	0.125 MMBtu/hr	Student Union	2005	a
B9	NG Boiler	RBI	MW1250	0.125 MMBtu/hr	Student Union	2005	a
B10	NG Boiler	RBI	MW1250	0.125 MMBtu/hr	Student Union	2005	a
B11	NG Boiler	RBI	CB750	0.75 MMBtu/hr	Getz Short Apts.	2011	a
B12	NG Boiler	RBI	CB750	0.75 MMBtu/hr	Getz Short Apts.	2011	a
B13	NG Boiler	Hamilton Engineering	EVO 199.1	0.20 MMBtu/hr	Getz Short Apts.	2012	
B14	NG Boiler	Hamilton Engineering	EVO 199.1	0.20 MMBtu/hr	Getz Short Apts.	2012	
B15	NG Boiler	Cleaver-Brooks	MCF700	1.8 MMBtu/hr	Wahle Hall Apts.	2017	
B16	NG Boiler	Cleaver-Brooks	CFC700	1.8 MMBtu/hr	Wahle Hall Apts.	2015	
B17	NG Boiler	Viessmann	Vitodens 200-W	0.5 MMBtu/hr	Health Center	2018	
B18	NG Boiler	Viessmann	Vitodens 200-W	0.5 MMBtu/hr	Health Center	2018	
(B19)	NG Boiler	Cleaver-Brooks	CFC-E-700-1500-125HW	1.5 MMBtu/hr	Student Village	2023	b
(B20)	NG Boiler	Cleaver-Brooks	CFC-E-700-1500-125HW	1.5 MMBtu/hr	Student Village	2023	b
(B21)	NG Boiler	Cleaver-Brooks	CFC-E-700-1500-125HW	1.5 MMBtu/hr	Student Village	2023	b
(B22)	NG Boiler	Hubbell	NX500WH	0.5 MMBtu/hr	Wendell Hill Hall	2023	b
(B23)	NG Boiler	Hubbell	NX500WH	0.5 MMBtu/hr	Wendell Hill Hall	2023	b
G1	Diesel Generator	Caterpillar	D346	490 hp	New Heating Plant	1974	a
G2	Diesel Generator	Onan	17.5RDJF-4XR	32 hp	Psychology Bldg.	1974	
G3	Diesel Generator	Onan/Allis-Chalmers	3500	148 hp	Library	1974	
G4	Diesel Generator	Perkins	1100	65 hp	SOD Farm	1994	
G5	Diesel Generator	Detroit Diesel	8083-7416	643 hp	Science Building	1996	
G6	Diesel Generator	Caterpillar	3412T	749 hp	Substation B	1999	
G7	Diesel Generator	Caterpillar	3412T	749 hp	Substation B	1999	c
G8	Diesel Generator	Perkins	1306-E8TTA300	325 hp	Computer Center	2003	
G9	Diesel Generator	Cummins	DQAF	470 hp	Student Union	2005	
G10	NG Generator	Cummins/Ford	GGHE-7082116	115 hp	Dean Hall	2008	
G11	NG Generator	Olympian	G150LG2	231 hp	Discovery Hall	2019	
PB1	Paint Booth	Blowtherm	OSD 215	9000 cfm	Grounds Storage	2002	
Insignificant Emission Units							
(IEU1)	NG Boiler	Hubbell	NX800WH	0.8 MMBtu/hr	Student Union	2023	d

Attachment 1
Central Washington University
Ellensburg, Washington

ID[i]	Equipment Type	Manufacturer	Model	Rating	Location	Installed	Note
(IEU2)	NG Boiler	Hubbell	NX800WH	0.8 MMBtu/hr	Student Union	2023	d
(IEU3)	NG Boiler	Cleaver-Brooks	CFC-E-700-750-125HW	0.75 MMBtu/hr	Getz Short Apts.	2023	d
(IEU4)	NG Boiler	Cleaver-Brooks	CFC-E-700-750-125HW	0.75 MMBtu/hr	Getz Short Apts.	2023	d
(IEU5)	NG Boiler	Lochinvar	AWN501P	0.5 MMBtu/hr	Dugmore Hall	2019	d
(IEU6)	NG Boiler	Lochinvar	AWN501P	0.5 MMBtu/hr	Dugmore Hall	2019	d
(IEU7)	Diesel Generator	Caterpillar	C13	457 hp	New Heating Plant	2024	d
(IEU8)	Paint Booth	Global Finishing Solutions	IDB-67 (Unit SB-1)	5250 cfm	Randall Hall	2004	f
(IEU9)	Paint Booth	Paasche Spray Booth	FABF-4	2560 cfm	Randall Hall	2004	f
(IEU10)	Paint Booth	Col-met	IB1008	8000 cfm	Hogue Hall	2011	f
(IEU11)	Dust Collector	Torit	36CYC	7000 cfm	Jongeward Shops	2001	e
(IEU12)	Dust Collector	Sternvent	DKCD96030-4	9600 cfm	Hogue Hall	2011	f
(IEU13)	Dust Collector	United Air Specialists	BDC-21-P	2200 cfm	Hogue Hall	2011	f
(IEU14)	Dust Collector	Sternvent	DKRD24405	2400 cfm	McConnell Hall	2004	f
(IEU15)	Dust Collector	Sternvent	DKRD48020	4800 cfm	Randall Hall	2004	f
(IEU16)	Dust Collector	Sternvent	DKRD36010	3600 cfm	Randall Hall	2004	f
(IEU17)	Shop Vacuum (Dust Collector)	Cincinnati	Dust Master 50S/T1	< 500 cfm	Randall Hall	2004	f
(IEU18)	Shop Vacuum (Dust Collector)	Cincinnati	Dust Master 33S/T1	< 500 cfm	Randall Hall	2004	f
(IEU19)	Shop Vacuum (Dust Collector)	Cincinnati	Dust Master 50S/T1	< 500 cfm	Randall Hall	2004	f
(IEU20)	Shop Vacuum (Dust Collector)	Cincinnati	Dust Master 50S/T1	< 500 cfm	Randall Hall	2004	f
(IEU21)	Shop Vacuum (Dust Collector)	Cincinnati	Dust Master 50S/T1	< 500 cfm	Randall Hall	2004	f
(IEU22)	Shop Vacuum (Dust Collector)	Cincinnati	Dust Master 50S/T1	< 500 cfm	Randall Hall	2004	f
(IEU23)	Metal Polishing Table (Dust Collector)	Handler	75-2 Dyna Series	< 500 cfm	Randall Hall	2004	f
(IEU24)	Metal Polishing Table (Dust Collector)	Handler	75-2 Dyna Series	< 500 cfm	Randall Hall	2004	f
(IEU25)	Abrasive Blasting Table (Dust Collector)	Econoline	4KR11	< 500 cfm	Randall Hall	2004	f
(IEU26)	Sanding Table (Dust Collector)	Denray	2872	3400 cfm	Randall Hall	--	f
(IEU27)	Vacuum (Dust Collector)	Becker	VTLF 2.250	< 500 cfm	Randall Hall	2010	f
(IEU28)	Welding Fume/Smoke Filter (Dust Collector)	Car-mon	CMX-120PA	1389 cfm	Randall Hall	--	f
(IEU29)	NG Kiln	Bailey	Shuttle Pro 54	0.36 MMBtu/hr	Randall Hall	2004	d, f
(IEU30)	NG Kiln	Geil	DLB 16	0.20 MMBtu/hr	Randall Hall	2008	d, f
(IEU31)	NG Melting Furnace	MIFCo	B-301	0.75 MMBtu/hr	Hogue Hall	2011	d, f
(IEU32)	Wood Kiln	Hand-built brick kiln	N/A	0.02 MMBtu/hr[i]	Randall Hall	2022	d, f, g
(IEU33)	Electric Smelting Pot (Kiln)	Inductotherm	Power-Trak 175-30	175 kW	Hogue Hall	2011	f, h

Attachment 1
Central Washington University
Ellensburg, Washington

Notes:

a. Previously permitted equipment that have been newly removed from the facility.
b. Previously noted changes that are addressed in the NOC application submitted November 2022.
c. Equipment was previously permitted as portable, but have become stationary in 2016.
d. Equipment meets categorical exemption from NSR for combustion units in accordance with WAC 173-400-110(4)(c).
e. Equipment meets categorical exemption from New Source Review (NSR) for plant maintenance and upkeep activities in accordance with WAC 173-400-110(4)(a)(v).
f. Equipment meets categorical exemption from NSR for research or education activities in accordance with WAC 173-400-110(4)(f)(iv).
g. Calculated based on conservative assumptions of 36.6 MMBtu/cord heating value of firewood , 1,330 kg/m^3 density of firewood , and 3 kg/hr burn rate of firewood.
h. Electric equipment; no associated emissions.
i. IDs noted in parentheses are equipment that are not currently included in the permit and are temporary IDs used as placeholders for purposes of this application only.

ATTACHMENT 2

Emission Calculations

Attachment 2
Central Washington University
Ellensburg, Washington

Annual Campus Emissions

Pollutant Name	CAS No./ID	Campus Emissions (tons per year)				
		Diesel Boilers	Natural Gas Boilers	Diesel Generators	Natural Gas Generators	Campus Total
Criteria Pollutants						
Carbon monoxide	CO	6.24E-02	26.17	1.98	2.15E-01	28.42
Nitrogen oxides	NOX	2.50E-01	31.15	9.18	1.39E-01	40.72
Particulate matter	PM	2.50E-02	2.37	0.65	6.06E-04	3.04
PM_{10}	PM10	2.50E-02	2.37	0.65	5.81E-04	3.04
$PM_{2.5}$	PM2.5	2.50E-02	2.37	0.65	5.81E-04	3.04
Sulfur dioxide	SO2	2.66E-03	0.19	0.60	3.60E-05	0.79
Volatile organic compounds	VOC	4.24E-03	1.71	0.75	1.81E-03	2.47
Greenhouse Gas Pollutants						
Carbon dioxide	CO2	0.52	37,381	329	6.73	37,718
Methane	CH4	2.70E-03	7.16E-01	1.34E-02	1.41E-02	0.75
Nitrous oxide	N2O	3.25E-03	6.85E-01	2.67E-03	--	0.69
CO_2e	CO2e	1.04	37,603	330.50	7.08	37,942
Toxic Air Pollutants (TAPs)/Hazardous Air Pollutants (HAPs)						
1,1,1-Trichloroethane	71-55-6	2.95E-06	--	--	--	2.95E-06
1,1,2,2-Tetrachloroethane	79-34-5	--	--	--	1.55E-06	1.55E-06
1,1,2-Trichloroethane	79-00-5	--	--	--	9.36E-07	9.36E-07
1,1-Dichloroethane	75-34-3	--	--	--	6.92E-07	6.92E-07
1,2,4-Trimethylbenzene	95-63-6	--	--	--	--	--
1,2-Dichloroethane	107-06-2	--	--	--	6.92E-07	6.92E-07
1,2-Dichloropropane	78-87-5	--	--	--	7.96E-07	7.96E-07
1,3,5-Trimethylbenzene	108-67-8	--	--	--	--	--
1,3-Butadiene	106-99-0	1.85E-04	--	3.18E-03	4.06E-05	3.41E-03
1,3-Dichloropropene	542-75-6	--	--	--	7.77E-07	7.77E-07
2-butoxyethanol	111-76-2	--	--	--	--	--
3-Methylchloranthrene	56-49-5	--	5.61E-07	--	--	5.61E-07
7,12-Dimethylbenz[a]anthracene	57-97-6	--	4.98E-06	--	--	4.98E-06
Acetaldehyde	75-07-0	4.38E-03	2.76E-03	1.15E-02	1.71E-04	1.88E-02
Acrolein	107-02-8	4.38E-03	8.41E-04	4.96E-04	1.61E-04	5.87E-03
Ammonia	7664-41-7	--	--	7.09E-02	--	7.09E-02
Arsenic	7440-38-2	2.00E-05	6.23E-05	2.34E-05	--	1.06E-04
Benz[a]anthracene	56-55-3	5.01E-08	5.61E-07	1.58E-05	--	1.65E-05
Benzene	71-43-2	5.49E-05	1.86E-03	2.73E-03	9.67E-05	4.74E-03
Benzo[a]pyrene	50-32-8	--	3.74E-07	1.71E-05	--	1.75E-05
Benzo[b]fluoranthene	205-99-2	--	5.61E-07	2.56E-05	--	2.62E-05
Benzo[k]fluoranthene	207-08-9	--	5.61E-07	2.52E-05	--	2.58E-05
Beryllium	7440-41-7	5.13E-06	3.74E-06	--	--	8.87E-06
Cadmium	7440-43-9	1.87E-05	3.43E-04	2.20E-05	--	3.83E-04
Carbon Tetrachloride	56-23-5	--	--	--	1.08E-06	1.08E-06
Chlorobenzene	108-90-7	2.50E-06	--	2.93E-06	7.89E-07	6.21E-06
Chloroform	67-66-3	--	--	--	8.38E-07	8.38E-07
Chromium, hexavalent	18540-29-9	1.25E-06	--	1.46E-06	--	2.71E-06
Chromium, total	7440-47-3	7.49E-06	4.36E-04	8.78E-06	--	4.52E-04
Chrysene	218-01-9	2.97E-08	5.61E-07	1.42E-05	--	1.48E-05
Cobalt	7440-48-4	--	2.62E-05	--	--	2.62E-05
Copper	7440-50-8	5.12E-05	2.65E-04	6.00E-05	--	3.76E-04
Cyclohexane	110-82-7	--	--	--	--	--
Dibenz[a,h]anthracene	53-70-3	2.08E-08	3.74E-07	1.36E-05	--	1.40E-05

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Pollutant Name	CAS No./ID	Campus Emissions (tons per year)				
		Diesel Boilers	Natural Gas Boilers	Diesel Generators	Natural Gas Generators	Campus Total
Diesel engine exhaust particles	DEEP	--	--	6.45E-01	--	6.45E-01
Ethylbenzene	100-41-4	2.50E-06	2.21E-03	1.60E-04	1.52E-06	2.38E-03
Ethylene Dibromide	106-93-4	--	--	--	1.30E-06	1.30E-06
Ethylene glycol	107-21-1	--	--	--	--	--
Formaldehyde	50-00-0	4.38E-03	6.90E-02	2.53E-02	1.25E-03	9.99E-02
Hexane	110-54-3	4.37E-05	5.61E-01	3.94E-04	--	5.61E-01
Hydrogen chloride	7647-01-0	2.33E-03	--	2.73E-03	--	5.05E-03
Hydrogen fluoride	7664-39-3	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	2.67E-08	5.61E-07	1.35E-05	--	1.40E-05
Isopropyl alcohol	67-63-0	--	--	--	--	--
Lead	7439-92-1	1.04E-04	1.56E-04	1.21E-04	--	3.81E-04
Manganese	7439-96-5	3.87E-05	1.18E-04	4.54E-05	--	2.02E-04
Mercury	7439-97-6	2.50E-05	8.10E-05	2.93E-05	--	1.35E-04
Methanol	67-56-1	--	--	--	1.87E-04	1.87E-04
Methyl ethyl ketone (MEK)	78-93-3	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	108-10-1	--	--	--	--	--
Methylene Chloride	75-09-2	--	--	--	2.52E-06	2.52E-06
Naphthalene	91-20-3	6.62E-05	1.90E-04	5.22E-04	5.94E-06	7.85E-04
Nickel	7440-02-0	4.87E-05	6.54E-04	5.71E-05	--	7.60E-04
OCDD	3268-87-9	3.87E-11	--	--	--	3.87E-11
Polycyclic aromatic hydrocarbons	PAH	6.22E-04	1.25E-04	--	8.63E-06	7.55E-04
Propylene	115-07-1	1.25E-04	1.70E-01	6.84E-03	--	1.77E-01
Selenium	7782-49-2	2.75E-05	7.48E-06	3.22E-05	--	6.71E-05
Styrene	100-42-5	--	--	--	7.28E-07	7.28E-07
Toluene	108-88-3	7.74E-05	8.51E-03	1.54E-03	3.41E-05	1.02E-02
Vanadium	7440-62-2	--	7.16E-04	--	--	7.16E-04
Vinyl Chloride	75-01-4	--	--	--	4.39E-07	4.39E-07
m-Xylene	108-38-3	--	--	3.16E-04	--	3.16E-04
o-Xylene	95-47-6	1.36E-06	--	3.06E-04	--	3.07E-04
Xylenes	1330-20-7	2.00E-05	6.32E-03	6.21E-04	1.19E-05	6.98E-03
Single Highest HAP (Hexane)	110-54-3					0.56
Total HAPs	HAP	1.69E-02	6.55E-01	4.96E-02	1.98E-03	0.72

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Emissions from Diesel-Fired Boilers

Parameters			Notes
Diesel-Fired Boilers	B2, B3, B4		
Diesel Fuel Sulfur Content	0.0015	% (wt.)	b
Diesel Fuel Heating Value	19,300	Btu/lb	a
Diesel Fuel Density	7.1	lb/gal	a
Maximum Hourly Rate	259	MMBtu/hr	a
	1,893	gal/hr	a
Maximum Daily Usage	24	hr/day	
Maximum Annual Usage	200%	of Historical Max.	a
	24,964	gal/yr	a
	3.42E-03	10^{12} Btu/yr	a

Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Criteria Pollutants							
CO	CO	5 lb/Mgal	b	9.46	227.15	124.82	6.24E-02
NO_X	NOX	20 lb/Mgal	b	37.86	908.62	499.28	2.50E-01
PM	PM	2 lb/Mgal	b	3.79	90.86	49.93	2.50E-02
PM_{10}	PM10	2 lb/Mgal	b	3.79	90.86	49.93	2.50E-02
$PM_{2.5}$	PM2.5	2 lb/Mgal	b	3.79	90.86	49.93	2.50E-02
SO_2	SO2	0.213 lb/Mgal	b	0.40	9.68	5.32	2.66E-03
VOC	VOC	0.34 lb/Mgal	b	0.64	15.45	8.49	4.24E-03
Greenhouse Gas Pollutants							
CO_2	CO2	0.304 lb/MMBtu	c	78.92	1,894	1,041	0.52
CH_4	CH4	0.216 lb/Mgal	b	4.09E-01	9.81	5.39	2.70E-03
N_2O	N2O	0.26 lb/Mgal	b	4.92E-01	11.81	6.49	3.25E-03
CO_2e	CO2e	83 lb/Mgal	c	157.46	3,779.14	2,076.61	1.04
Toxic Air Pollutants/Hazardous Air Pollutants							
1,1,1-Trichloroethane	71-55-6	2.36E-04 lb/Mgal	d	4.47E-04	1.07E-02	5.89E-03	2.95E-06
1,3-Butadiene	106-99-0	1.48E-02 lb/Mgal	e	2.80E-02	6.72E-01	3.69E-01	1.85E-04
Acenaphthene	83-32-9	2.11E-05 lb/Mgal	d	3.99E-05	9.59E-04	5.27E-04	2.63E-07
Acenaphthylene	208-96-8	2.53E-07 lb/Mgal	d	4.79E-07	1.15E-05	6.32E-06	3.16E-09
Acetaldehyde	75-07-0	3.51E-01 lb/Mgal	e	6.64E-01	1.59E+01	8.75E+00	4.38E-03
Acrolein	107-02-8	3.51E-01 lb/Mgal	e	6.64E-01	1.59E+01	8.75E+00	4.38E-03
Anthracene	120-12-7	1.22E-06 lb/Mgal	d	2.31E-06	5.54E-05	3.05E-05	1.52E-08
Benz(a)anthracene	56-55-3	4.01E-06 lb/Mgal	d	7.59E-06	1.82E-04	1.00E-04	5.01E-08
Benzene	71-43-2	4.40E-03 lb/Mgal	e	8.33E-03	2.00E-01	1.10E-01	5.49E-05
Benzo(b,k)fluoranthene	BK	1.48E-06 lb/Mgal	d	2.80E-06	6.72E-05	3.69E-05	1.85E-08
Benzo(g,h,i)perylene	191-24-2	2.26E-06 lb/Mgal	d	4.28E-06	1.03E-04	5.64E-05	2.82E-08
Chlorobenzene	108-90-7	2.00E-04 lb/Mgal	e	3.79E-04	9.09E-03	4.99E-03	2.50E-06

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Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Chrysene	218-01-9	2.38E-06 lb/Mgal	d	4.51E-06	1.08E-04	5.94E-05	2.97E-08
Dibenz(a,h)anthracene	53-70-3	1.67E-06 lb/Mgal	d	3.16E-06	7.59E-05	4.17E-05	2.08E-08
Ethylbenzene	100-41-4	2.00E-04 lb/Mgal	e	3.79E-04	9.09E-03	4.99E-03	2.50E-06
Fluoranthene	206-44-0	4.84E-06 lb/Mgal	d	9.16E-06	2.20E-04	1.21E-04	6.04E-08
Fluorene	86-73-7	4.47E-06 lb/Mgal	d	8.46E-06	2.03E-04	1.12E-04	5.58E-08
Formaldehyde	50-00-0	3.51E-01 lb/Mgal	e	6.64E-01	1.59E+01	8.75E+00	4.38E-03
Hexane	110-54-3	3.50E-03 lb/Mgal	e	6.63E-03	1.59E-01	8.74E-02	4.37E-05
Hydrogen Chloride	7647-01-0	1.86E-01 lb/Mgal	e	3.53E-01	8.46E+00	4.65E+00	2.33E-03
Indeno(1,2,3-cd)pyrene	193-39-5	2.14E-06 lb/Mgal	d	4.05E-06	9.72E-05	5.34E-05	2.67E-08
Naphthalene	91-20-3	5.30E-03 lb/Mgal	e	1.00E-02	2.41E-01	1.32E-01	6.62E-05
OCDD	3268-87-9	3.10E-09 lb/Mgal	d	5.87E-09	1.41E-07	7.74E-08	3.87E-11
PAHs (including Naphthalene)	PAH	4.98E-02 lb/Mgal	e	9.43E-02	2.26E+00	1.24E+00	6.22E-04
Phenanthrene	85-01-8	1.05E-05 lb/Mgal	d	1.99E-05	4.77E-04	2.62E-04	1.31E-07
POM	POM	3.30E-03 lb/Mgal	d	6.25E-03	1.50E-01	8.24E-02	4.12E-05
Propylene	115-07-1	1.00E-02 lb/Mgal	e	1.89E-02	4.54E-01	2.50E-01	1.25E-04
Pyrene	129-00-0	4.25E-06 lb/Mgal	d	8.05E-06	1.93E-04	1.06E-04	5.30E-08
Toluene	108-88-3	6.20E-03 lb/Mgal	d	1.17E-02	2.82E-01	1.55E-01	7.74E-05
Xylene, -o	95-47-6	1.09E-04 lb/Mgal	d	2.06E-04	4.95E-03	2.72E-03	1.36E-06
Xylenes	1330-20-7	1.60E-03 lb/Mgal	e	3.03E-03	7.27E-02	3.99E-02	2.00E-05
Arsenic	7440-38-2	1.60E-03 lb/Mgal	e	3.03E-03	7.27E-02	3.99E-02	2.00E-05
Beryllium	7440-41-7	3 $lb/10^{12}$ Btu	d	7.78E-04	1.87E-02	1.03E-02	5.13E-06
Cadmium	7440-43-9	1.50E-03 lb/Mgal	e	2.84E-03	6.81E-02	3.74E-02	1.87E-05
Chromium, hexavalent	18540-29-9	1.00E-04 lb/Mgal	e	1.89E-04	4.54E-03	2.50E-03	1.25E-06
Chromium, total	7440-47-3	6.00E-04 lb/Mgal	e	1.14E-03	2.73E-02	1.50E-02	7.49E-06
Copper	7440-50-8	4.10E-03 lb/Mgal	e	7.76E-03	1.86E-01	1.02E-01	5.12E-05
Lead	7439-92-1	8.30E-03 lb/Mgal	e	1.57E-02	3.77E-01	2.07E-01	1.04E-04
Manganese	7439-96-5	3.10E-03 lb/Mgal	e	5.87E-03	1.41E-01	7.74E-02	3.87E-05
Mercury	7439-97-6	2.00E-03 lb/Mgal	e	3.79E-03	9.09E-02	4.99E-02	2.50E-05
Nickel	7440-02-0	3.90E-03 lb/Mgal	e	7.38E-03	1.77E-01	9.74E-02	4.87E-05
Selenium	7782-49-2	2.20E-03 lb/Mgal	e	4.16E-03	9.99E-02	5.49E-02	2.75E-05
Zinc	7440-66-6	2.24E-02 lb/Mgal	e	4.24E-02	1.02E+00	5.59E-01	2.80E-04
Hazardous Air Pollutants, total	HAP	-- --		2.56E+00	61.40	33.74	1.69E-02

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Notes:

a. Usage rates to calculate emissions for diesel combustion from the boilers is estimated collectively from the sum of hourly ratings for the boilers converted to gallons using standard conversion facors taken from EPA AP-42 Section 3.4 Large Stationary Diesel and All Stationary Duel-fuel Engines (Oct. 1996), Table 3.4-1, footnote 'a'. Total potential annual usage is based on the maximum historical fuel usage from 2018 thorugh 2022, multiplied by 200% of historical max. for each respective boiler.

b. Emission factors from EPA AP-42, Section 1.3 Fuel Oil Combustion (Sep. 1999), Tables 1.3-1 and 1.3-3 for distillate oil fired boilers < 100 MMBtu/hr. Assumes ultra-low sulfur diesel (ULSD) sulfur content of 0.0015%. Conservatively assumes that PM_{10} and $PM_{2.5}$ emission factors equal the total filterable PM emission factor.

c. CO_2 emission factor is from 40 CFR, Part 98, Subpart C, Table C-1 for distillate fuel oil No. 2. CO_2e is calculated based on the global warming potential (GWP) for each greenhouse gas as per 40 CFR, Part 98, Subpart A: CO_2 = 1; CH_4 = 25; N_2O = 298.

Emission factors for Toxic Air Pollutants (TAPs) and Hazardous Air Pollutants (HAPs) is the highest emission factor between the following sources:

d. EPA AP-42 Section 1.3 Fuel Oil Combustion (Sep. 1999), Table 1.3-8 for distillate oil fired boilers, Table 1.3-9 for residual oil fired boilers, and Table 1.3-10 for distillate oil fired boilers. Assumes that emission factors for Benzo(b)fluoranthene and Benzo(k)fluoranthene are each equal to the emission factor for Benzo(b,k)fluoranthene.

e. Ventura County Air Pollution Control Disctrict (VCAPCD) AB 2588 Diesel Combustion Factors for external combustion.

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Emissions from Natural Gas-Fired Boilers

Parameters				Notes
Natural Gas-Fired Boilers with a Rating of <10 MMBtu/hr	B1, B6, B7, B13, B14, B15, B16, B17, B18, B19, B20, B21, B22, B23			
Natural Gas-Fired Boilers with a Rating of 10-100 MMBtu/hr	B2, B3, B4, B5			
Maximum Hourly Rate	2.98E-01	MMscf/hr	(all)	a
	1.12E-02	MMscf/hr	(<10 MMBtu/hr)	
	2.87E-01	MMscf/hr	(10-100 MMBtu/hr)	
Maximum Daily Usage	24	hr/day		
Maximum Annual Usage	200%	of Historical Max.		a
	623	MMscf/yr	(all)	a
	50	MMscf/yr	(<10 MMBtu/hr)	
	573	MMscf/yr	(10-100 MMBtu/hr)	

Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Criteria Pollutants							
CO	CO	84 lb/MMscf	b	25.06	601	52,333	26.17
NO_X	NOX	100 lb/MMscf	b	29.83	716	62,302	31.15
PM	PM	7.6 lb/MMscf	c	2.27	54.41	4,735	2.37
PM_{10}	PM10	7.6 lb/MMscf	c	2.27	54.41	4,735	2.37
$PM_{2.5}$	PM2.5	7.6 lb/MMscf	c	2.27	54.41	4,735	2.37
SO_2	SO2	0.6 lb/MMscf	c	0.18	4.30	374	0.19
VOC	VOC	5.5 lb/MMscf	c	1.64	39.38	3,427	1.71
Greenhouse Gas Pollutants							
CO_2	CO2	120,000 lb/MMscf	c	35,799	859,166	74,761,860	37,381
CH_4	CH4	2.3 lb/MMscf	c	6.86E-01	16.47	1,433	0.72
N_2O (uncontrolled)	N2O	2.2 lb/MMscf	c	6.56E-01	15.75	1,371	0.69
CO_2e	CO2e	120,713 lb/MMscf	d	36,011	864,272	75,206,132	37,603
Toxic Air Pollutants/Hazardous Air Pollutants							
Acenaphthene	83-32-9	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Acenaphthylene	208-96-8	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Acetaldehyde	75-07-0	8.87E-03 lb/MMscf	g	2.65E-03	6.35E-02	5.52E+00	2.76E-03
Acrolein	107-02-8	2.70E-03 lb/MMscf	f	8.05E-04	1.93E-02	1.68E+00	8.41E-04
Anthracene	120-12-7	2.40E-06 lb/MMscf	e	7.16E-07	1.72E-05	1.50E-03	7.48E-07
Arsenic	7440-38-2	2.00E-04 lb/MMscf	e	5.97E-05	1.43E-03	1.25E-01	6.23E-05
Benz(a)anthracene	56-55-3	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Benzene, total including:	71-43-2	-- --		1.75E-03	4.21E-02	3.72E+00	1.86E-03
Benzene (<10 MMBtu/hr)		*8.00E-03 lb/MMscf*	f	*8.96E-05*	*2.15E-03*	*3.99E-01*	*1.99E-04*
Benzene (10-100 MMBtu/hr)		*5.80E-03 lb/MMscf*	f	*1.67E-03*	*4.00E-02*	*3.32E+00*	*1.66E-03*

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Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Benzo(a)pyrene	50-32-8	1.20E-06 lb/MMscf	e	3.58E-07	8.59E-06	7.48E-04	3.74E-07
Benzo(b)fluoranthene	205-99-2	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Benzo(g,h,i)perylene	191-24-2	1.20E-06 lb/MMscf	e	3.58E-07	8.59E-06	7.48E-04	3.74E-07
Benzo(k)fluoranthene	207-08-9	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Beryllium	7440-41-7	1.20E-05 lb/MMscf	e	3.58E-06	8.59E-05	7.48E-03	3.74E-06
Cadmium	7440-43-9	1.10E-03 lb/MMscf	e	3.28E-04	7.88E-03	6.85E-01	3.43E-04
Chromium (total)	7440-47-3	1.40E-03 lb/MMscf	e	4.18E-04	1.00E-02	8.72E-01	4.36E-04
Chrysene	218-01-9	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Cobalt	7440-48-4	8.40E-05 lb/MMscf	e	2.51E-05	6.01E-04	5.23E-02	2.62E-05
Copper	7440-50-8	8.50E-04 lb/MMscf	e	2.54E-04	6.09E-03	5.30E-01	2.65E-04
Dibenzo(a,h)anthracene	53-70-3	1.20E-06 lb/MMscf	e	3.58E-07	8.59E-06	7.48E-04	3.74E-07
Dichlorobenzene (mixture)	25321-22-6	1.20E-03 lb/MMscf	e	3.58E-04	8.59E-03	7.48E-01	3.74E-04
7,12-Dimethylbenz(a)anthracene	57-97-6	1.60E-05 lb/MMscf	e	4.77E-06	1.15E-04	9.97E-03	4.98E-06
Ethylbenzene	100-41-4	-- --		2.09E-03	5.01E-02	4.43E+00	2.21E-03
Ethylbenzene (<10 MMBtu/hr)		*9.50E-03 lb/MMscf*	f	*1.06E-04*	*2.55E-03*	*4.73E-01*	*2.37E-04*
Ethylbenzene (10-100 MMBtu/hr)		*6.90E-03 lb/MMscf*	f	*1.98E-03*	*4.75E-02*	*3.96E+00*	*1.98E-03*
Fluoranthene	206-44-0	3.00E-06 lb/MMscf	e	8.95E-07	2.15E-05	1.87E-03	9.35E-07
Fluorene	86-73-7	2.80E-06 lb/MMscf	e	8.35E-07	2.00E-05	1.74E-03	8.72E-07
Formaldehyde	50-00-0	2.21E-01 lb/MMscf	g	6.61E-02	1.59E+00	1.38E+02	6.90E-02
Hexane	110-54-3	1.80E+00 lb/MMscf	e	5.37E-01	1.29E+01	1.12E+03	5.61E-01
Indeno(1,2,3-cd)pyrene	193-39-5	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Lead	7439-92-1	5.00E-04 lb/MMscf	e	1.49E-04	3.58E-03	3.12E-01	1.56E-04
Manganese	7439-96-5	3.80E-04 lb/MMscf	e	1.13E-04	2.72E-03	2.37E-01	1.18E-04
2-Methylnaphthalene	91-57-6	2.40E-05 lb/MMscf	e	7.16E-06	1.72E-04	1.50E-02	7.48E-06
3-Methylchloranthrene	56-49-5	1.80E-06 lb/MMscf	e	5.37E-07	1.29E-05	1.12E-03	5.61E-07
Mercury	7439-97-6	2.60E-04 lb/MMscf	e	7.76E-05	1.86E-03	1.62E-01	8.10E-05
Naphthalene	91-20-3	6.10E-04 lb/MMscf	e	1.82E-04	4.37E-03	3.80E-01	1.90E-04
Nickel	7440-02-0	2.10E-03 lb/MMscf	e	6.26E-04	1.50E-02	1.31E+00	6.54E-04
Polycyclic Aromatic Compounds (including Naphthalene)	PAH	4.00E-04 lb/MMscf	f	1.19E-04	2.86E-03	2.49E-01	1.25E-04
Phenanathrene	85-01-8	1.70E-05 lb/MMscf	e	5.07E-06	1.22E-04	1.06E-02	5.30E-06
Propylene	115-07-1	-- --		1.60E-01	3.85E+00	3.40E+02	1.70E-01
Propylene (<10 MMBtu/hr)		*7.31E-01 lb/MMscf*	f	*8.18E-03*	*1.96E-01*	*3.64E+01*	*1.82E-02*
Propylene (10-100 MMBtu/hr)		*5.30E-01 lb/MMscf*	f	*1.52E-01*	*3.65E+00*	*3.04E+02*	*1.52E-01*
Pyrene	129-00-0	5.00E-06 lb/MMscf	e	1.49E-06	3.58E-05	3.12E-03	1.56E-06
Selenium	7782-49-2	2.40E-05 lb/MMscf	e	7.16E-06	1.72E-04	1.50E-02	7.48E-06
Toluene	108-88-3	-- --		8.02E-03	1.92E-01	1.70E+01	8.51E-03
Toluene (<10 MMBtu/hr)		*3.66E-02 lb/MMscf*	f	*4.10E-04*	*9.83E-03*	*1.82E+00*	*9.12E-04*
Toluene (10-100 MMBtu/hr)		*2.65E-02 lb/MMscf*	f	*7.61E-03*	*1.83E-01*	*1.52E+01*	*7.59E-03*
Vanadium	7440-62-2	2.30E-03 lb/MMscf	e	6.86E-04	1.65E-02	1.43E+00	7.16E-04

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Pollutant	ID/CAS No.	Emission Factor		Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Xylenes	1330-20-7	--	--		5.96E-03	1.43E-01	1.26E+01	6.32E-03
Xylenes (<10 MMBtu/hr)		*2.72E-02*	*lb/MMscf*	f	*3.05E-04*	*7.31E-03*	*1.36E+00*	*6.78E-04*
Xylenes (10-100 MMBtu/hr)		*1.97E-02*	*lb/MMscf*	f	*5.66E-03*	*1.36E-01*	*1.13E+01*	*5.65E-03*
Hazardous Air Pollutants, total	HAP	--	--		6.27E-01	15.04	1,310	6.55E-01

Notes:

a. Usage rates to calculate emissions for natural combustion from the boilers is estimated collectively from the sum of hourly fuel use ratings for the boilers. Total usage rates are separated out by different size, <10 MMBtu/hr or 10-100 MMBtu/hr, as some emission factors are different between the sizes. Total potential annual usage is based on the maximum historical fuel usage from 2018 through 2022, multiplied by 200% of historical max. for each respective boiler.

b. Emission factors from EPA AP-42, Section 1.4 Natural Gas Combustion (Jul 1998), Table 1.4-1 for Small Boilers (<100 MMBtu/hr input),

c. Emission factors from EPA AP-42, Section 1.4 Natural Gas Combustion (Jul 1998), Table 1.4-2. Conservatively assume that PM_{10} and $PM_{2.5}$ emission factors equal the total PM emission factor.

d. CO_2e is calculated based on the global warming potential (GWP) for each greenhouse gas as per 40 CFR, Part 98, Subpart A: CO_2 = 1; CH_4 = 25; N_2O = 298.

Emission factors for Toxic Air Pollutants (TAPs) and Hazardous Air Pollutants (HAPs) is the highest emission factor between the following sources:

e. EPA AP-42, Section Section 1.4 Natural Gas Combustion (Jul 1998), Tables 1.4-3 and 1.4-4.

f. Ventura County Air Pollution Control Disctrict (VCAPCD) AB 2588 Combustion Emission Factors for Natural Gas Fired External Combustion Engines.

g. California Air Toxics Emission Factor Data (CATEF) mean emission factors for CATEF group "Boilers, Natural Gas."

Attachment 2
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Ellensburg, Washington

Emissions from Natural Gas-Fired Generators

Parameters		Notes
Natural Gas-Fired Generators	G10, G11	
Natural Gas Heating Value	1,020 Btu/scf	
Maximum Hourly Rate	1,574 cf/hr	a
Maximum Daily Usage	24 hr/day	
Maximum Annual Usage	200% of historical max.	a
	120,001 cf/yr	a

Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Criteria Pollutants							
CO	CO	3,580 lb/MMscf	b	5.63	135.21	430	0.21
NO_X	NOX	2,315 lb/MMscf	b	3.64	87.44	278	0.14
PM	PM	10.11 lb/MMscf	b	0.02	0.38	1.21	6.06E-04
PM_{10}	PM10	9.69 lb/MMscf	b	0.02	0.37	1.16	5.81E-04
$PM_{2.5}$	PM2.5	9.69 lb/MMscf	b	0.02	0.37	1.16	5.81E-04
SO_2	SO2	0.60 lb/MMscf	b	0.00	0.02	0.07	3.60E-05
VOC	VOC	30.19 lb/MMscf	b	0.05	1.14	3.62	1.81E-03
Greenhouse Gass Pollutants							
CO_2	CO2	112,200 lb/MMscf	b	177	4,237	13,464	6.73
CH_4	CH4	235 lb/MMscf	b	3.69E-01	8.86	28.15	1.41E-02
CO_2e	CO2e	118,065 lb/MMscf	c	186	4,459	14,168	7.08
Toxic Air Pollutants/Hazardous Air Pollutants							
1,1,2,2-Tetrachloroethane	79-34-5	2.58E-02 lb/MMscf	b	4.06E-05	9.75E-04	3.10E-03	1.55E-06
1,1,2-Trichloroethane	79-00-5	1.56E-02 lb/MMscf	b	2.46E-05	5.89E-04	1.87E-03	9.36E-07
1,1-Dichloroethane	75-34-3	1.15E-02 lb/MMscf	b	1.81E-05	4.35E-04	1.38E-03	6.92E-07
1,2-Dichloroethane	107-06-2	1.15E-02 lb/MMscf	b	1.81E-05	4.35E-04	1.38E-03	6.92E-07
1,2-Dichloropropane	78-87-5	1.33E-02 lb/MMscf	b	2.09E-05	5.01E-04	1.59E-03	7.96E-07
1,3-Butadiene	106-99-0	6.76E-01 lb/MMscf	b	1.06E-03	2.55E-02	8.12E-02	4.06E-05
1,3-Dichloropropene	542-75-6	1.30E-02 lb/MMscf	b	2.04E-05	4.89E-04	1.55E-03	7.77E-07
Acetaldehyde	75-07-0	2.85E+00 lb/MMscf	b	4.48E-03	1.07E-01	3.41E-01	1.71E-04
Acrolein	107-02-8	2.68E+00 lb/MMscf	b	4.22E-03	1.01E-01	3.22E-01	1.61E-04
Benzene	71-43-2	1.61E+00 lb/MMscf	b	2.54E-03	6.09E-02	1.93E-01	9.67E-05
Butyr/Isobutyraldehyde	539-90-2	4.96E-02 lb/MMscf	b	7.80E-05	1.87E-03	5.95E-03	2.97E-06
Carbon Tetrachloride	56-23-5	1.81E-02 lb/MMscf	b	2.84E-05	6.82E-04	2.17E-03	1.08E-06
Chlorobenzene	108-90-7	1.32E-02 lb/MMscf	b	2.07E-05	4.97E-04	1.58E-03	7.89E-07
Chloroform	67-66-3	1.40E-02 lb/MMscf	b	2.20E-05	5.28E-04	1.68E-03	8.38E-07
Ethane	74-84-0	7.18E+01 lb/MMscf	b	1.13E-01	2.71E+00	8.62E+00	4.31E-03
Ethylbenzene	100-41-4	2.53E-02 lb/MMscf	b	3.98E-05	9.55E-04	3.04E-03	1.52E-06
Ethylene Dibromide	106-93-4	2.17E-02 lb/MMscf	b	3.42E-05	8.21E-04	2.61E-03	1.30E-06

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Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Formaldehyde	50-00-0	2.09E+01 lb/MMscf	b	3.29E-02	7.90E-01	2.51E+00	1.25E-03
Methanol	67-56-1	3.12E+00 lb/MMscf	b	4.91E-03	1.18E-01	3.75E-01	1.87E-04
Methylene Chloride	75-09-2	4.20E-02 lb/MMscf	b	6.61E-05	1.59E-03	5.04E-03	2.52E-06
Naphthalene	91-20-3	9.90E-02 lb/MMscf	b	1.56E-04	3.74E-03	1.19E-02	5.94E-06
Polycyclic Aromatic Compounds (including Naphthalene)	PAH	1.44E-01 lb/MMscf	b	2.26E-04	5.43E-03	1.73E-02	8.63E-06
Styrene	100-42-5	1.21E-02 lb/MMscf	b	1.91E-05	4.58E-04	1.46E-03	7.28E-07
Toluene	108-88-3	5.69E-01 lb/MMscf	b	8.96E-04	2.15E-02	6.83E-02	3.41E-05
Vinyl Chloride	75-01-4	7.32E-03 lb/MMscf	b	1.15E-05	2.77E-04	8.79E-04	4.39E-07
Xylenes	1330-20-7	1.99E-01 lb/MMscf	b	3.13E-04	7.51E-03	2.39E-02	1.19E-05
Hazardous Air Pollutants, total	HAP	-- --		5.19E-02	1.25	3.96	1.98E-03

Notes:

a. Usage rates to calculate emissions for natural gas-fired generators is estimated collectively from the sum of hourly fuel use ratings of the engines. Total potential annual usage is based on the maximum historical usage hours from 2018 through 2022, multiplied by 200% for each generator.

b. Emission factors from EPA AP-42, Section 3.2 Natural Gas-Fired Reciprocating Engines (Aug. 2000), Table 3.2-3 for 4-stroke, rich-burn engines. Because these are emergency generators, it assumes that the engines are running at loads less than 90 percent. The emission factors were converted from lb/MMBtu to lb/MMscf using the natural gas heat content of 1,020 Btu/scf.

c. CO_2e is calculated based on the global warming potential (GWP) for each greenhouse gas as per 40 CFR, Part 98, Subpart A: CO_2 = 1; CH_4 = 25; N_2O = 298.

Attachment 2
Central Washington University
Ellensburg, Washington

Emissions from Diesel-Fired Generators

Parameters			Notes
Diesel-Fired Generators	G2, G3, G4, G5, G6, G7, G8, G9		
Diesel Heating Value	19,300	Btu/lb	a
Diesel Density	7.37	lb/gal	a
Maximum Hourly Rate	165	gal/hr	a
	23.50	MMBtu/hr	a
Maximum Daily Usage	24	hr/day	
Maximum Annual Usage	200%	of historical max.	a
	29,276	gal/yr	a
	4,164	MMBtu/yr	a

Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Criteria Pollutants							
CO	CO	0.95 lb/MMBtu	b	22.33	535.89	3,956	1.98
NO_X	NOX	4.41 lb/MMBtu	b	103.65	2,487.65	18,364	9.18
PM	PM	0.31 lb/MMBtu	b	7.29	174.87	1,291	0.65
PM_{10}	PM10	0.31 lb/MMBtu	b	7.29	174.87	1,291	0.65
$PM_{2.5}$	PM2.5	0.31 lb/MMBtu	b	7.29	174.87	1,291	0.65
SO_2	SO2	0.29 lb/MMBtu	b	6.82	163.59	1,208	0.60
VOC	VOC	0.36 lb/MMBtu	b	8.46	203.07	1,499	0.75
Greenhouse Gass Pollutants							
CO_2	CO2	22.50 lb/gal	c	3,718	89,235	658,742	329
CH_4	CH4	9.13E-04 lb/gal	c	1.51E-01	3.62	26.72	1.34E-02
N_2O	N2O	1.83E-04 lb/gal	c	3.02E-02	0.72	5.34	2.67E-03
CO_2e	CO2e	22.58 lb/gal	c	3,731	89,542	661,003	331
Toxic Air Pollutants/Hazardous Air Pollutants							
1,3-Butadiene	106-99-0	0.2174 lb/Mgal	e	3.59E-02	8.62E-01	6.36E+00	3.18E-03
Acetaldehyde	75-07-0	0.7833 lb/Mgal	e	1.29E-01	3.11E+00	2.29E+01	1.15E-02
Acrolein	107-02-8	0.0339 lb/Mgal	e	5.60E-03	1.34E-01	9.92E-01	4.96E-04
Ammonia	7664-41-7	4.8461 lb/Mgal	f	8.01E-01	1.92E+01	1.42E+02	7.09E-02
Arsenic	7440-38-2	0.0016 lb/Mgal	e	2.64E-04	6.35E-03	4.68E-02	2.34E-05
Benzene	71-43-2	0.1863 lb/Mgal	e	3.08E-02	7.39E-01	5.45E+00	2.73E-03
Benz[a]anthracene	56-55-3	0.0011 lb/Mgal	f	1.79E-04	4.29E-03	3.17E-02	1.58E-05
Benzo[a]pyrene	50-32-8	0.0012 lb/Mgal	f	1.93E-04	4.64E-03	3.42E-02	1.71E-05
Benzo[b]fluoranthene	205-99-2	0.0018 lb/Mgal	f	2.90E-04	6.95E-03	5.13E-02	2.56E-05
Benzo[k]fluoranthene	207-08-9	0.0017 lb/Mgal	f	2.85E-04	6.83E-03	5.04E-02	2.52E-05
Cadmium	7440-43-9	0.0015 lb/Mgal	e	2.48E-04	5.95E-03	4.39E-02	2.20E-05
Chlorobenzene	108-90-7	0.0002 lb/Mgal	e	3.30E-05	7.93E-04	5.86E-03	2.93E-06
Chromium, hexavalent	18540-29-9	0.0001 lb/Mgal	e	1.65E-05	3.97E-04	2.93E-03	1.46E-06

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Pollutant	ID/CAS No.	Emission Factor	Notes	Hourly Emissions (lb/hr)	Daily Emissions (lb/day)	Annual Emissions (lb/yr)	Annual Emissions (ton/yr)
Chromium, total	7440-47-3	0.0006 lb/Mgal	e	9.91E-05	2.38E-03	1.76E-02	8.78E-06
Chrysene	218-01-9	0.0010 lb/Mgal	f	1.61E-04	3.86E-03	2.85E-02	1.42E-05
Copper	7440-50-8	0.0041 lb/Mgal	e	6.77E-04	1.63E-02	1.20E-01	6.00E-05
Dibenz[a,h]anthracene	53-70-3	0.0009 lb/Mgal	f	1.53E-04	3.68E-03	2.72E-02	1.36E-05
Diesel engine exhaust particles	DEEP	0.3100 lb/MMBtu	b	7.29	174.87	1,291	0.65
Ethylbenzene	100-41-4	0.0109 lb/Mgal	e	1.80E-03	4.32E-02	3.19E-01	1.60E-04
Formaldehyde	50-00-0	1.7261 lb/Mgal	e	2.85E-01	6.85E+00	5.05E+01	2.53E-02
Hydrogen chloride	7647-01-0	0.1863 lb/Mgal	e	3.08E-02	7.39E-01	5.45E+00	2.73E-03
Indeno[1,2,3-cd]pyrene	193-39-5	0.0009 lb/Mgal	f	1.52E-04	3.65E-03	2.69E-02	1.35E-05
Lead	7439-92-1	0.0083 lb/Mgal	e	1.37E-03	3.29E-02	2.43E-01	1.21E-04
Manganese	7439-96-5	0.0031 lb/Mgal	e	5.12E-04	1.23E-02	9.08E-02	4.54E-05
Mercury	7439-97-6	0.0020 lb/Mgal	e	3.30E-04	7.93E-03	5.86E-02	2.93E-05
Naphthalene	91-20-3	0.0357 lb/Mgal	f	5.90E-03	1.42E-01	1.04E+00	5.22E-04
n-Hexane	110-54-3	0.0269 lb/Mgal	e	4.44E-03	1.07E-01	7.88E-01	3.94E-04
Nickel	7440-02-0	0.0039 lb/Mgal	e	6.44E-04	1.55E-02	1.14E-01	5.71E-05
Propylene	115-07-1	0.4670 lb/Mgal	e	7.72E-02	1.85E+00	1.37E+01	6.84E-03
Selenium	7782-49-2	0.0022 lb/Mgal	e	3.64E-04	8.72E-03	6.44E-02	3.22E-05
Toluene	108-88-3	0.1054 lb/Mgal	e	1.74E-02	4.18E-01	3.09E+00	1.54E-03
Xylenes (m-, o-, p-xylene)	1330-20-7	0.0424 lb/Mgal	e	7.01E-03	1.68E-01	1.24E+00	6.21E-04
m-Xylene	108-38-3	0.0216 lb/Mgal	f	3.57E-03	8.56E-02	6.32E-01	3.16E-04
o-Xylene	95-47-6	0.0209 lb/Mgal	f	3.45E-03	8.28E-02	6.12E-01	3.06E-04
Hazardous Air Pollutants, total	HAP	-- --		5.60E-01	1.34E+01	99.15	4.96E-02

Notes:

a. Usage rates to calculate emissions for diesel-fired generators is estimated collectively from the sum of hourly fuel use ratings of the engines. Total potential annual usage is based on the maximum historical usage hours from 2018 thorugh 2022, multiplied by 200% for each respective generator. The listed diesel heating value and density were used to convert usage rates from gallons to MMBtu.

b. Emission factors from EPA AP-42, Section 3.3 Gasoline and Diesel Industrial Engines (Oct. 1996), Table 3.3-1 for diesel fuel engines. Conservatively assumes PM10 = PM2.5 = PM. Assumes PM = DEEP. The emission factor for total organic compounds (TOC) is used for VOC emissions.

c. Emission factors from 40 Code of Federal Regulations (CFR) Part 98 Mandatory Greenhouse Gas Reporting, Subpart C General Stationary Fuel Combustion Sources, Tables C-1 and C-2. Values are converted from kg/MMBtu to lb/gal using the default high heat value for Petroleum Products - Distillate Fuel Oil No. 2 of 0.138 MMBtu/gal. CO2e is calculated based on the global warming potential (GWP) for each greenhouse gas as per 40 CFR, Part 98, Subpart A: CO_2 = 1; CH_4 = 25; N_2O = 298.

Emission factors for Toxic Air Pollutants (TAPs) and Hazardous Air Pollutants (HAPs) is the highest emission factor between the following sources:

d. Emission factors from EPA AP-42, Section 3.3 Gasoline and Diesel Industrial Engines (Oct. 1996), Table 3.3-2.

e. Emission factors from Ventura County Air Pollution Control Disctrict (VCAPCD) AB 2588 Diesel Combustion Factors for internal combustion.

f. Emission factors from California Air Toxics Emission Factor Data (CATEF) for CATEF group "ICE, Diesel." Values are averages of the mean emission factors.

ATTACHMENT 3

Proposed Permit Limits

Attachment 3
Central Washington University
Ellensburg, Washington

Proposed Permit Limits

Equipment IDs	Equipment Type	Maximum Hourly	Maximum Daily	Permit Limit	Basis of Determination
B1, B6, B7, B13, B14, B15, B16, B17, B18, B19, B20, B21, B22, B23	Natural Gas-Fired Boilers	0.30 MMscf/hr	24 hr/day	**623 MMscf/yr**	Annual maximum takes the maximum historical usage in ccf/yr or gal/yr from 2018 through 2022 for each boiler(s) at each location, multiplies by 200%, and sums for all natural gas and all diesel boilers.
B2, B3, B4	Diesel-Fired Boilers	1,893 gal/hr	24 hr/day	**24,964 gal/yr**	
G10, G11	Natural Gas-Fired Generators	1,574 cf/hr	24 hr/day	**120,001 cf/yr**	Annual maximum takes the maximum historical usage in hrs/yr from 2018 through 2022 for each generator, multiplies by 200%, multiplies by rated fuel use in gal/hr or cf/hr, and sums for all diesel and all natural gas generators.
G2, G3, G4, G5, G6, G7, G8, G9	Diesel-Fired Generators	165 gal/hr	24 hr/day	**29,276 gal/yr**	

ATTACHMENT 4

New Source Review Exemptions

From: Vicente, Ryan (ECY)
To: Aimi Tanada
Cc: Jeremiah Eilers; Stuart Thompson; Mark Brunner; Palmer, Delano (CWU); Baldwin, Karin K. (ECY)
Subject: RE: CWU Categorical Exemption Request
Date: Tuesday, September 24, 2024 4:02:41 PM
Attachments: image001.png

Hello Aimi,

Today, I met with some peers and the Engineering and Permitting Section manager. The group agreed to accept the proposed exemption proposals for the emission units in question, for all three exemption classes (maintenance/construction, combustion, and laboratory equipment).

That should make a big difference in wrapping up the application :)

Cheers

-Ryan

From: Aimi Tanada <ATanada@landauinc.com>
Sent: September 19, 2024 15:15
To: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>; Baldwin, Karin K. (ECY) <KBAL461@ECY.WA.GOV>
Cc: Jeremiah Eilers <Jeremiah.Eilers@cwu.edu>; Palmer, Delano (CWU) <Delano.palmer@cwu.edu>; Stuart Thompson <Stuart.Thompson@cwu.edu>; Mark Brunner <mbrunner@landauinc.com>
Subject: CWU Categorical Exemption Request

External Email

Ryan and Karin,

Thank you for taking time to meet with us Monday to further review permitting pathways for CWU.
As we discussed in the meeting, we have put together a list of exemption categories under WAC 173-400-110 New Source Review that we would like to have considered for some of the equipment at CWU.
Attached is a list of equipment with brief descriptions and justifications for each NSR exemption category they may apply to.
Please review and let us know Ecology's thoughts on the permitting path for these equipment.

Thank you,

Aimi Tanada (she/her/hers)
SENIOR STAFF SCIENTIST

(425) 329-0306 | atanada@landauinc.com

LANDAU ASSOCIATES

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CATEGORICAL EXEMPTIONS FOR CWU EQUIPMENT

Equipment List

CWU is in the process of incorporating the following listed equipment into the existing permit, Notice of Construction Approval Order No. 10AQ-C147. A temporary identification number is noted in parentheses following each listed piece of equipment for reference purposes.

Paint Booths

Emission Unit	Estimated Actual Operating Time
Global Finishing Solutions Paint Booth in Randall Hall (PB2)	13 hrs/yr reported usage in 2022
Paasche Spray Booth in Randall Hall (PB3)	45 hrs/yr reported usage in 2022
Col-met Paint Booth in Hogue Hall (PB4)	217 hrs/yr reported usage in 2022

Dust Collectors

Emission Unit	Estimated Actual Operating Time
Donaldson Torit Dust Collector in Jongeward Shops (DC1)	
Sternvent Woodworking Dust Collector in Hogue Hall (DC2)	One class per year; max. 5 hrs/week, 40 weeks/yr
United Air Specialists Metallurgy Dust Collector in Hogue Hall (DC3)	Two classes per year; max. 6 hrs/week, 40 weeks/yr
Sternvent Woodworking Dust Collector in McConnell Hall (DC4)	
Sternvent Woodworking Dust Collector in Randall Hall (DC5)	Max. 1,500 hrs/yr
Sternvent Glaze Mixing Dust Collector in Randall Hall (DC6)	Max. 300 hrs/yr

Kilns

Emission Unit	Estimated Actual Operating Time
Bailey Natural Gas Kiln in Randall Hall (K1)	Fired 2-3 times per quarter; max. 24 hrs/firing, 72 hrs/yr
Geil Natural Gas Kiln in Randall Hall (K2)	Fired 2-3 times per quarter; max. 24 hrs/firing, 72 hrs/yr
MiFCo Natural Gas Melting Furnace in Hogue Hall (K3)	Rarely used; no records of usage in the past 4 years; max. 24 hrs/yr
Hand-built Brick Wood-Fired Kiln outside Randall Hall (K4)	Fired 2-3 times per year; max. 24 hrs/firing, 72 hrs/yr

Categorical Exemptions for New Source Review

WAC 173-400-110(4) lists emission unit and activity exemptions from New Source Review. The following exemption categories are being considered for the equipment:

WAC 173-400-110(4)(a) Maintenance/Construction

WAC 173-400-110(4)(a)(v) notes exemption of "Plant maintenance and upkeep activities (grounds keeping, general repairs, housekeeping, plant painting, welding, cutting, brazing, soldering, plumbing, retarring roofs, etc.)."

CWU is proposing to claim this exemption for DC1. DC1 is located in Jongeward Shops, which is the maintenance facility for CWU. Access is restricted to university maintenance personnel. DC1 is used sparingly for a few hours per day as needed for general maintenance such as construction or repair of cabinetry of university facilities.

WAC 173-400-110(4)(c) Combustion Units

WAC 173-400-110(4)(c)(v) notes exemption of "New or modified emission units with combined aggregate heat inputs to combustion units (excluding emergency engines exempted by subsection (4)(h)(xxxix) of this section), less than or equal to […] ≤ 4,000,000 Btu/hr using natural gas, propane, or LPG."

CWU is proposing to claim this exemption for K1, K2, and K3. Table 1 below lists the rated maximum heat input and installation year of the equipment. Assuming that each project includes all equipment installed in the same single year, two other natural gas combustion devices were installed in the same year as one of the kilns. The details of those two combustion equipment are also listed in Table 1. Based on the combined heat input of each of the three separate projects, each project meets the 4.0 MMBtu/hr categorical exemption threshold for combustion units.

Table 1: Kiln and Related Combustion Units

ID	Equipment	Rating	Installation Year
K1	Bailey Natural Gas Kiln in Randall Hall	0.36 MMBtu/hr	2004
K2	Geil Natural Gas Kiln in Randall Hall	0.20 MMBtu/hr	2008
K3	MiFCo Natural Gas Melting Furnace in Hogue Hall	0.75 MMBtu/hr	2011
B11	NG Boiler in Getz Short (decommissioned)	0.75 MMBtu/hr	2011
B12	NG Boiler in Getz Short (decommissioned)	0.75 MMBtu/hr	2011

Additionally, WAC 173-400-110(4)(c)(iii) notes exemption of "New or modified emission units with combined aggregate heat inputs to combustion units (excluding emergency engines exempted by subsection (4)(h)(xxxix) of this section), less than or equal to […] ≤ 400,000 Btu/hr using wood waste or paper." CWU is proposing to claim this exemption for K4, which burns wood as fuel. Based on

conservative assumptions of 36.6 MMBtu/cord heating value of firewood,[1] 1,330 kg/m³ density of firewood,[2] and 3 kg/hr burn rate of firewood,[3] the calculated maximum heat input of a wood-fired brick kiln is 0.0228 MMBtu/hr, or 22,777 Btu/hr. The brick kiln was first built in 2022. Based on this information, K4 may meet the categorical exemption threshold for combustion units.

$$Heat\ Input = \frac{36.6\ MMBtu}{1\ cord} \times \frac{1\ cord}{3.6246\ m^3} \times \frac{1\ m^3}{1{,}330\ kg} \times \frac{3\ kg}{1\ hr} \times \frac{10^6 Btu}{1\ MMBtu} = 22{,}777\ Btu/hr$$

WAC 173-400-110(4)(f) Laboratory Equipment

WAC 173-400-110(4)(f)(iv) notes exemption of "Laboratory research, experimentation, analysis and testing at sources whose primary purpose and activity is research or education. To be exempt, these sources must not engage in the production of products, or in providing commercial services, for sale or exchange for commercial profit except in a de minimis manner. Pilot-plants or pilot scale processes at these sources are not exempt."

CWU is proposing to claim this exemption for PB2, PB3, PB4, DC2, DC3, DC4, DC5, DC6, K1, K2, K3, and K4, which are all equipment that are used primarily for educational purposes. The equipment is used as part of an educational curriculum for art subjects such as woodworking, metal-working, painting, sculptures, ceramics, and engineering subjects such as material properties. Each piece of equipment is expected to operate intermittently during classroom hours.

[1] https://worldforestindustries.com/forest-biofuel/firewood/firewood-btu-ratings/

[2] https://www.engineeringtoolbox.com/wood-density-d_40.html

[3] https://www.epa.gov/sites/default/files/2020-09/documents/residential_wood_combustion_technology_review.pdf

Jeremiah Eilers

From: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Sent: Wednesday, January 11, 2023 8:39 AM
To: Jeremiah Eilers
Cc: Gary Gleason; Delano Palmer; Scott Carlson; Nolph, Shawn (ECY)
Subject: RE: General Order 08-AQG-003

Jeremiah,

Since the units are exempt, no paperwork is needed per WAC 173-400-110(2)(a). We can role list the replaced units in the permit the next time it's revised (as exempt, but present units). Please do let us know if the projects/plans change and either don't fall under the exemption threshold.

For registration purposes, please do update Shawn with the new information, as I believe the units will still be registration applicable.

Cheers

-Ryan

From: Jeremiah Eilers <Jeremiah.Eilers@cwu.edu>
Sent: January 11, 2023 8:28
To: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Cc: Gary Gleason <Gary.Gleason@cwu.edu>; Palmer, Delano <Delano.palmer@cwu.edu>; Scott Carlson <Scott.Carlson@cwu.edu>; Nolph, Shawn (ECY) <snol461@ECY.WA.GOV>
Subject: RE: General Order 08-AQG-003

Ryan,

That sounds like a plan for B11, B12 at Getz Short and B8, B9, B10 at Student Union. Do we need to complete any paperwork for review? Or do we just update Shawn with new information as we get them replaced?

Thanks,

Jeremiah

Jeremiah Eilers
Capital Planning & Projects
400 E. University Way M.S. 7523
O: 509-963-2357 C: 509-859-2070

From: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Sent: Tuesday, January 10, 2023 5:12 PM
To: Jeremiah Eilers <Jeremiah.Eilers@cwu.edu>
Cc: Gary Gleason <Gary.Gleason@cwu.edu>; Delano Palmer <Delano.Palmer@cwu.edu>; Scott Carlson <Scott.Carlson@cwu.edu>; Nolph, Shawn (ECY) <snol461@ECY.WA.GOV>
Subject: RE: General Order 08-AQG-003

Jeremiah,

Regarding the lack of ultra-low NO_X (ULN) burner boilers in that size range, I am sorry to hear that. I have not done a deep dive on units in that size range; this is because, individually, they would be exempt. When I was looking at your previous project, I saw that there are residential water heaters with ULN burners available up to at least the 75,000 Btu/hr range. My course of action would be to look at the California market, or another area in non-attainment with the NAAQS; that is where the pressure and requirements to emit the least air pollution occur.

However, reading through your narrative, the replacement of B11 and B12 sound like they are prompted by equipment failure, rather than a planned project. As such, I am confident that they would classify as their own project (rather than being grouped with other units). In that case, they are natural gas-fired units with an aggregate heat input of ≤ 4 MMBtu/hr and are exempt from minor new source review (air permitting) under WAC 173-400-100(4)(c)(v).

Similarly, it sounds like replacement of B8, B9, and B10 would, with an aggregate rating of 3.75 MMBtu (assuming replacements at same rating or less than existing), be below the exemption threshold. To be clear, I am not trying to get you an exemption for you guys; that is just the way it appears based on your description. If another boiler was thrown into the current or future project, and either aggregate was above the 4 MMBtu/hr threshold, the project would trigger minor new source review. Similarly, if there are plans to replace more boilers in the next 2-3 years, I would want to review the timing and I might push that they be aggregated into one project.

To answer your last question, if the project did trigger minor new source review, yes a new application would need to be submitted.

Hope this helps!

-Ryan

From: Jeremiah Eilers <Jeremiah.Eilers@cwu.edu>
Sent: January 10, 2023 13:33
To: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>; Nolph, Shawn (ECY) <snol461@ECY.WA.GOV>
Cc: Gary Gleason <Gary.Gleason@cwu.edu>; Palmer, Delano <Delano.palmer@cwu.edu>; Scott Carlson <Scott.Carlson@cwu.edu>
Subject: General Order 08-AQG-003

Ryan and Shawn,

After doing a tremendous amount of research and having vendors do the same, it turns out that no one can find a manufacture that creates a .75 MMBTU boiler that meets the requirement of the General Order 08-AQG-003. My hope was to use this General Order that we had previously discussed in CWU/ECY meetings for the replacement of B11&B12 on the permit. These two boilers feed the only heating water to one of our 60+ bed residence halls. One of them failed and filled the Mechanical Room and an occupant room with CO, it has been deemed unrepairable by our Maintenance Teams.

I reviewed a tremendous amount of EPA Documents per Shawn's recommendation and though they have specifications for diesel motors that meet different Nox requirements, they do not seem to have any for boilers.

Any boilers that meet the 9 PPM @ 3% Nox do not meet the CO and/or CO2 requirements. See the G.O. Chart Table Below.

Ryan,

Assuming none of the vendors find a boiler that meets the G.O. specifications, can you please give us direction forward on the permitting process for the replacement boilers? If we file an additional N.O.C. do we just have Landua and Associates fill out a whole new application or what are you thinking? We are also getting funding put together to fund the replacement of B8, B9 , B10 in the near future.

Thanks,

Jeremiah

Nitrogen oxides limitation	• Natural gas, compressed natural gas, and LPG: 9 parts per million by volume (ppmv) @ 3% O_2 • Propane: 30 ppmv @ 3% O_2 • Diesel : 35 ppmv @ 3% O_2
Carbon monoxide limitation	• Natural gas, compressed natural gas, and LPG: 50 ppmv @ 3% O_2 • Propane, diesel, : 100 ppmv @ 3% O_2
Sulfur dioxide limitation	• Natural gas, compressed natural gas, and LPG • Not greater than 8.1 grains sulfur per 100 cubic feet propane. • On-road quality diesel as defined in 40 CFR 80.2(y) with standards described in 40 CFR 80.520.

Jeremiah Eilers
Capital Planning & Projects
400 E. University Way M.S. 7523
O: 509-963-2357 C: 509-859-2070

ATTACHMENT 5

New Generator Manufacturer's Quote and Specifications

Proposal

Project: CWU 400kW Generator **Date: 03/28/2024** **Quote: D400GC-Zstock**

Attn: Gary Gleason, CWU **Valid: 10 days** **From: Brant Briody**

Generator Set:

Manufacturer: Caterpillar **Model:** D400GC **KW:** 400 **Rating:** Standby **Fuel:** Diesel **Voltage:** 277/480 3 ph 4 wire
Frequency: 60 hz **UL2200 Listed:** Yes **Misc Items:**

Controls:

Control Panel: GCCP1.2 **Speed Control:** Electronic Isochronous **Remote Alarm Panel:** Included NFPA 110 Qty 1 **Alarm Panel Mounting:** Flush Mount **Remote Emergency Stop:** 1 - Shipped Loose **Remote Communications:** Modbus RS-485 **Misc Items:**

Accessory Systems:

Coolant Heater: Yes 208/240 vac **Battery Heater:** None **Alternator Heater:** Yes, 208/240 vac **Battery Charger:** 10 amp NFPA110 **Battery System:** Wet Battery, Rack and Cables 24 vdc **Misc Items:**

Alternator / Breaker:

Excitation System: PMG Brushless **Voltage Regulator:** Cat standard **Ground Fault:** Not required **Circuit Breaker # 1:** 600A LS/I 100% rated with adjustable trip **Misc Items:**

Packaging:

Enclosure: Sound Attenuated **Sound Level:** Level 2 **Fuel Tank:** 24 Hr **Fuel Tank Type:** Double Wall UL142 **Exhaust System:** Interior Mounted **Enclosure Color:** White **Electrical Package:** 1 - GFI Receptacle **Misc Items:**

Total price for above package *$101,432.90 includes crane service adder*

- See attached quote from Rhodes/Duncan crane service. Western States will add 15% gross profit to all costs incurred and invoice CWU accordingly. Or CWU is welcome to hire the crane service directly and save the 15% profit Western States will add.

Included:

Startup: PS-Specialist
Maintenance Program: Available
Spare parts kit: No
Warranty Genset: 60 month
Warranty ATS: N/A
Freight: Included to first destination
Site Load test: 100% available building load
Factory Test: 100% load
Owner training: Yes
Offloading at Jobsite

Not included:

Installation
Taxes / Permits of any kind / Any engineering
Coordination Studies
Any fuel or fuel piping
Anchors and anchor calculations
Third party testing

Notes and clarifications:

- Quoted per Caterpillar's Sourcewell Contract # 092222-CAT specifically for CWU- Sourcewell account # 38094
- At time of start-up, Western States will adjust the generator's control system so that it will not produce greater than 300kW of power. A special label will be affixed to the generator to note this adjustment.

Terms:

100% of payment is required prior to startup and testing on the jobsite.
Payment terms are in accordance with WSECO Standard terms upon approved account.
No retainer is allowed unless specifically agreed to in writing prior to order placement.
Cancellation charges minimum of 25% once released. No return on manual transfer switches.
No Liquidated Damages of any type, unless specifically agreed to in writing prior to order.
For complete terms and conditions please visit: https://www.westernstatescat.com/wp-content/uploads/2022/07/Sales-Agreement-Terms-and-Conditions-Equipment.pdf

Thank you for the opportunity to quote quality Caterpillar products and services. Please let me know how we can be of assistance.

Sincerely,

Brant Briody
Power System Sales
Spokane: 509-535-1744
Pasco: 509-547-9541
Lewiston: 208-746-3301

Accepted By:

_____
Signature:

_____
Company:

Mark Brunner

From: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Sent: Monday, March 18, 2024 9:57 AM
To: Jeremiah Eilers
Cc: Palmer, Delano (CWU); Gary Gleason; Mark Brunner
Subject: RE: CWU- Generator Question (G1)

Categories: Filed in TonicDM, 2149001.020 Air Quality Permitting Services Central Washington University Ellensburg Washington

Hello Jeremiah,

It looks like they are accomplishing the de-tuning through restriction of fuel through the ECM. Given the spec sheet attached to your email, it sounds like the emissions of the lower loads (those with fuel consumption rates below the fuel restriction) will not increase.

If that's the case, I would consider the de-tuned engine to be exempt.

Cheers

-Ryan

From: Jeremiah Eilers <jeremiah.eilers@cwu.edu>
Sent: March 18, 2024 9:12
To: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Cc: Palmer, Delano (CWU) <Delano.palmer@cwu.edu>; Gary Gleason <Gary.Gleason@cwu.edu>; Mark Brunner <mbrunner@landauinc.com>
Subject: RE: CWU- Generator Question (G1)

External Email

Ryan,

Attached is example of the technical performance data sheet they would provide. My understanding is that it is that CAT already has percentage-based load calculations for the C13 engine and by reducing the EKW and BHP via tuning, it will just fall lower on the already calculated emission calculation table found on page 3 of 6 in the attached document.

They would either provide the exact data for the new generator maximum output or, if not possible, we would select an exact output that CAT has existing data for similar to that highlighted in this data sheet.

Let me know what you think.

Jeremiah

JEREMIAH EILERS
Capital Planning and Projects
400 East University Way Campus Mail
Stop: 7523 Ellensburg WA, 98926
O: 509-963-2357 C: 509-859-2070

From: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Sent: Wednesday, March 13, 2024 4:38 PM
To: Jeremiah Eilers <jeremiah.eilers@cwu.edu>
Cc: Delano Palmer <Delano.palmer@cwu.edu>; Gary Gleason <gary.gleason@cwu.edu>; Mark Brunner <mbrunner@landauinc.com>
Subject: RE: CWU- Generator Question (G1)

Hello Jeremiah,

Apologies for the delay in getting back to you. We are preparing for interviews to fill Shawn's old position tomorrow and Friday. As you might imagine, things are busy!

I am prepared to recommend that the de-tuned/de-rated engine be considered exempt so long as there's a guarantee that the emissions profile of the engine will not increase as a result of the de-tuning. I imagine that this is the case with an approximate 17% de-tune. I wonder it the manufacturer has anything like a white paper that speaks to de-tuning?

Please let me know if you have any questions.

Cheers

-Ryan

From: Jeremiah Eilers <jeremiah.eilers@cwu.edu>
Sent: March 11, 2024 15:34
To: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Cc: Palmer, Delano (CWU) <Delano.palmer@cwu.edu>; Gary Gleason <Gary.Gleason@cwu.edu>; Mark Brunner <mbrunner@landauinc.com>
Subject: RE: CWU- Generator Question (G1)

External Email

Ryan,

This sounds perfect!

Thank you!

JEREMIAH EILERS
Capital Planning and Projects
400 East University Way Campus Mail
Stop: 7523 Ellensburg WA, 98926
O: 509-963-2357 C: 509-859-2070

From: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Sent: Monday, March 11, 2024 3:33 PM
To: Jeremiah Eilers <jeremiah.eilers@cwu.edu>
Cc: Delano Palmer <Delano.palmer@cwu.edu>; Gary Gleason <gary.gleason@cwu.edu>; Mark Brunner <mbrunner@landauinc.com>
Subject: RE: CWU- Generator Question (G1)

Hello Jeremiah,

Ah, yes I got an email from Rob about the permitting requirements for a 600 bhp engine earlier today. He said it was in Ellensburg, but I didn't think about it being for you guys, haha.

I have reached out to a peer about this, who operates out of our office in Spokane. She hasn't had this question come up, but they are talking about de-rated engines for another project tomorrow. I hope to chat with them as well, if you can wait that long for an answer.

Cheers

-Ryan

From: Jeremiah Eilers <jeremiah.eilers@cwu.edu>
Sent: March 11, 2024 14:29
To: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Cc: Palmer, Delano (CWU) <Delano.palmer@cwu.edu>; Gary Gleason <Gary.Gleason@cwu.edu>; Mark Brunner <mbrunner@landauinc.com>
Subject: RE: CWU- Generator Question (G1)

External Email

Ryan,

Another quick question.

There is a new Caterpillar 400KW genset available on demand in Spokane Washington from Western States CAT. 400KW puts us over the 500BHP rating. Western States offered to de-tune the engine and put an additional Western States Tag that notes the new engine de-rated BHP.

Does this still meet the requirements of 500BHP exemption?

Thank you!

Jeremiah

JEREMIAH EILERS
Capital Planning and Projects
400 East University Way Campus Mail
Stop: 7523 Ellensburg WA, 98926
O: 509-963-2357 C: 509-859-2070

From: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Sent: Friday, March 8, 2024 8:46 AM
To: Jeremiah Eilers <jeremiah.eilers@cwu.edu>
Cc: Delano Palmer <Delano.palmer@cwu.edu>; Gary Gleason <gary.gleason@cwu.edu>; Mark Brunner <mbrunner@landauinc.com>
Subject: RE: CWU- Generator Question (G1)

Hello Jeremiah,

That sounds like an unplanned change to me, so I don't see any problem keeping it separate from any other changes. Your reading of the rules are correct for that exemption threshold for emergency generators. Good luck on getting that changed out soon.

Kind regards

-Ryan

From: Jeremiah Eilers <Jeremiah.Eilers@cwu.edu>
Sent: March 8, 2024 8:41
To: Vicente, Ryan (ECY) <rvic461@ECY.WA.GOV>
Cc: Mark Brunner (mbrunner@landauinc.com) <mbrunner@landauinc.com>; Palmer, Delano (CWU) <Delano.palmer@cwu.edu>; Gary Gleason <gleasong40@yahoo.com>
Subject: CWU- Generator Question (G1)

Ryan,

Our (G1) Generator recently through a fan through the radiator, overheated and we just found out the parts cannot be made so the manufacture refunded us for the parts, and told us it needs to be replaced. It is 490BHP. My understanding per the below WAC 173-400-110(4)(h)(xxxix) is that as long as the replacement is less than or equal to 500 BHP it is an exempt stationary source. My question to you is… With all of the permit modifications we are looking at, does this exemption still apply as long as we are not adding any additional gensets at the time of the project?

This generator is the ONLY source of backup for the main heating and cooling plant that heats a majority of the entire campus. Because of that we are paying United Rentals over $10K a month for a genset of lesser size on a trailer to ensure our campus does not go without heat.

(xxxvi) Dip coating operations, using materials less than 1% VOCs (by weight) or ≤ 1% (by weight) toxic air pollutant
(xxxvii) Abrasive blasting performed inside a booth or hangar designed to capture the blast grit or overspray.
(xxxviii) For structures or items too large to be reasonably handled indoors, abrasive blasting performed outdoors being blasted with tarps and uses either steel shot or an abrasive containing less than one percent (by mass) which woul
(xxxix) Stationary emergency internal combustion engines with an aggregate brake horsepower that is less than o
(xl) Gasoline dispensing facilities with annual gasoline throughputs less than those specified in WAC **173-491-040** (pollutant analysis pursuant to chapter **173-460** WAC.
(5) **Exemptions based on emissions.**
(a) Except as provided in this subsection:

Thank you!

Jeremiah

JEREMIAH EILERS
Capital Planning and Projects
400 East University Way Campus Mail
Stop: 7523 Ellensburg WA, 98926
O: 509-963-2357 C: 509-859-2070