Converse Consultants
Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

August 23, 2023

Washoe County Health District
Air Quality Management Division
1001 E. Ninth Street, Suite B171
Reno, Nevada 89512

Attn: Ms. Genine Rosa (Grosa@washoecounty.gov)
Environmental Engineer II

Subject: **POTENTIAL TO EMIT EVALUATION – RENOWN HOSPITAL MILL STREET FACILITY**
1155 Mill Street, Reno, NV
Converse Project No: 23-23187-01

Ms. Rosa,

On behalf of Renown Health, Converse Consultants (Converse) is submitting the results of a Potential to Emit (PTE) evaluation conducted at the above-referenced site (Site). This PTE evaluation was conducted at the request of the Washoe County Health District Air Quality Management Division (AQMD). Two PTE evaluations were conducted – one for the facility as it currently exists and the other for the facility as it will exist following the construction of the new central utility plant (CUP) and demolition of the existing CUP. In accordance with the AQMD's request, the emissions from fuel burning equipment on the adjacent properties that support the Site are included in the PTE evaluations. The PTE evaluations include actual emissions for the Site based on annual throughput/consumption data for the site for 2022.

The PTE calculations indicate that the potential emissions of nitrogen oxides (NOx) will exceed the Title V permit threshold of 100 ton/year. The potential emissions for the other pollutants of concern included in the PTE evaluation were well below the Title V threshold. Although the potential NOx emissions exceed the Title V threshold, the actual NOx emissions for the Site are below 20 tons/year. As such, it is our opinion that a Synthetic Minor Source Permit (SMSP) limiting NOx emissions to below the Title V threshold is appropriate for this Site.

The following documents are included in this submittal:

- SMSP application
- PTE calculations
- Stationary Source Permit applications (new boilers and generators)

- Check in the amount of $4,154 for AQMD application review fees.

Should you have any questions, please contact the undersigned at (775) 225-7655.

Respectfully submitted,

CONVERSE CONSULTANTS,

Tracy Johnston, PE, CEM
Senior Engineer

Enclosures: SMSP Application
Stationary Source Permit Applications
Check in the amount of $4,154

Distribution: Addressee (hand-delivered)
Chris Baker (Chris.Baker@renown.org)
Jason Dondero (jdondero@cumming-group.com)

Attachment 1

Synthetic Minor Source Permit Application

SYNTHETIC MINOR SOURCE PERMIT APPLICATION

Renown Health | Mill Street Facility

Washoe County Health District,
Air Quality Management Division

TRINITY CONSULTANTS
1575 Delucchi Lane
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August 2023

Project 232901.0031

Trinity Consultants

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1. EXECUTIVE SUMMARY

Renown Regional Medical Center (Renown) currently owns and operates a healthcare facility located at and around 1155 Mill Street, Reno, Nevada (the Mill Street Facility). The Facility was issued a Permit to Operate No. AAIR16-0714 (the Permit) by the Washoe County Health District, Air Quality Management Division (WCAQMD). The facility operates various boilers and emergency engines with associated generators to provide power during emergencies. Renown submitted an application to install four (4) new boilers and three (3) new emergency generators in June 2023. This application narrative has been prepared upon request by the WCAQMD to supplement the information contained in the initial June 2023 application.

Pursuant to the requirements of Washoe County District Board of Health (WCDBOH) Regulations Governing Air Quality Management (AQM), Renown is submitting this permit revision application to the Washoe County Air Quality Management Division to request a synthetic minor source permit to operate. Based on the control equipment and type of operations at the Renown, the facility will be classified as a synthetic minor source of emissions of NO_x. All other pollutants will have a potential to emit below major source thresholds.

With the submittal of this permit revision application pursuant to WCDBOH Regulations Governing AQM – 030.920 (the Application), Renown is proposing the following updates to the Facility and the Permit. Please see Section 2 for a detailed discussion of the requested updates:

- Removal of all three (3) existing boilers:
  - (1) 1,000 hp Babcock & Wilcox Boiler
  - (1) 1,000 hp Cleaver Brooks Boiler
  - (1) 800 hp Cleaver Brooks Fire Tube Boiler (m/n CBL-200-800-200)
- Removal of eight (8) existing generators:
  - (3) 350 kW Cummins (mfg. 1970)
  - (4) 1,000 kW Cummins (mfg. 1983)
  - (1) 2,000 kW CAT (mfg. 2003)
- Installation of three (3) new Cleaver Brooks CBEX-2W-200-900-150ST boilers each rated at 36.741 MMBtu/hr
- Installation of three (3) new Model Year 2023 EPA Tier 2 Caterpillar 3516C engines with associated generators each rated at 2,000 kW
- Addition of a cumulative 8.0955 MMBtu/hr of Natural Gas fired ancillary equipment associated with the Mill Street Campus but located at various addresses (901 & 1095 E 2nd, 75, 85, 225, & 309 Kirman, 975, 980, & 1000 Ryland) associated with the Facility
- Incorporation of a 99 ton per year (tpy) emission limit for Nitrogen Oxides (NO_x) to maintain the source as a Synthetic Minor facility.

Appendix A contains detailed facility-wide emission calculations for the existing emission units, the proposed emission units, and Calendar Year 2022's Actual Emissions. As such, this Application and associated appendix contain all the required information for a Synthetic Minor Source Operating Permit Revision application in addition to the previously submitted WCAQMD Forms. Additionally, enclosed with this application is a check in the amount of $3,796 for Synthetic Minor Source Operating Permit Revision with <100 tons of pollutants per year.[1]

[1] Per WCAQMD Air Quality Management Fees found at https://www.washoecounty.gov/health/resources/fees/air-quality-management-fees.php.

2. PROPOSED PERMIT REVISIONS

As part of this Revision Application, Renown is proposing to make the following changes to the Permit:

- Removal of all three (3) existing boilers:
  - (1) 1,000 hp Babcock & Wilcox Boiler
  - (1) 1,000 hp Cleaver Brooks Boiler
  - (1) 800 hp Cleaver Brooks Fire Tube Boiler (m/n CBL-200-800-200)
- Removal of eight (8) existing generators:
  - (3) 350 kW Cummins (mfg. 1970)
  - (4) 1,000 kW Cummins (mfg. 1983)
  - (1) 2,000 kW CAT (mfg. 2003)
- Installation of three (3) new Cleaver Brooks CBEX-2W-200-900-150ST boilers each rated at 36.741 MMBtu/hr
- Installation of three (3) new Model Year 2023 EPA Tier 2 Caterpillar 3516C engines with associated generators each rated at 2,000 kW
- Addition of a cumulative 8.0955 MMBtu/hr of Natural Gas fired ancillary equipment associated with the Mill Street Campus but located at various addresses (901 & 1095 E 2nd, 75, 85, 225, & 309 Kirman, 975, 980, & 1000 Ryland) associated with the Facility
- Incorporation of a 99 ton per year (tpy) emission limit for Nitrogen Oxides (NO_x) to maintain the source as a Synthetic Minor facility.

3.1 Facility Emissions Summary

This section includes the emissions calculation methodology for the existing facility and for the proposed project at the facility. Table 3-1 below provides the existing equipment's potential-to-emit (PTE) as well as the CY2022 actual emissions for the Mill Street Facility. This table demonstrates that, although the facility has a PTE of greater than 100 tons per year (tpy) for Nitrogen Oxides (NO_x), due to the hours of operation of the existing equipment, the facility did not exceed the Title V threshold of 100 tpy for NO_x. Therefore, the Mill Street Facility did not and will not require a Title V Operating permit existing or proposed operations. Table 3-2 below provides a comprehensive Facility-wide emissions summary with post-project. Detailed emission calculations are included in Appendix A.

Table 3-1. Current Emissions Summary

Pollutants	Existing Boilers	Existing Engines	Facility-wide Potential Emissions (tpy)	Existing Actual Emissions (tpy)	Title V Thresholds	Actual Emissions Exceeds?
NO_X	59.3	112.21	**171.5**	**18.03**	100	No
CO	47.1	25.57	**72.7**	**13.52**	100	No
VOC	3.1	3.59	**6.7**	**0.95**	100	No
PM	4.6	3.73	**8.3**	**1.28**	100	No
PM_{10}	4.4	3.73	**8.1**	**1.27**	100	No
$PM_{2.5}$	4.3	3.73	**8.1**	**1.27**	100	No
SO_2	32.4	0.77	**33.2**	**0.56**	100	No
CO_2e	71,138	5,300.87	**76,439**	**18,756**	--	N/A
Single HAP (hexane)	0.99	--	**1.0**	**0.21**	10	No
Total HAP	1.08	2.54	**3.6**	**0.26**	25	No

Table 3-2. Project Emissions Summary

Pollutants	Proposed Boilers	Proposed Engines	Facility-wide Potential Emissions (tpy)
NO_X	52.04	73.30	**125.34**
CO	41.39	13.36	**54.75**
VOC	2.71	1.95	**4.66**
PM	4.05	1.68	**5.73**
PM_{10}	3.87	1.68	**5.55**
$PM_{2.5}$	3.82	1.68	**5.50**
SO_2	28.24	0.05	**28.29**
CO_2e	62,116.21	4914.70	**67,031**
Single HAP (hexane)	1.11	--	**1.11**
Total HAP	1.35	2.60	**3.96**

3.2 Boiler Emission Emissions

Boiler emissions are comprised of natural gas and diesel fired external combustion equipment. Emission factors were obtained from U.S. EPA AP-42 Section 1.4, *Natural Gas Combustion*, July 1998, as well as 40 CFR Part 98 Subpart C for GHG emissions. Emissions were calculated based on maximum input capacity, maximum annual hours of operation, and established emission factors. As the boilers have the capacity to fire diesel fuel in emergency situations, such as curtailment, 500 hours of operation of the boilers while firing Diesel Fuel #2 was included. Emission factors were obtained from U.S EPA AP-42 Section 1.3, *Fuel Oil Combustion,* September 1999, as well as 40 CFR Part 98 Subpart C for GHG emissions.

3.3 Ancillary Equipment Emissions

Ancillary equipment emissions are comprised of natural gas fired external combustion equipment. Emission factors were obtained from U.S. EPA AP-42 Section 1.4, *Natural Gas Combustion*, July 1998, as well as 40 CFR Part 98 Subpart C for GHG emissions. Emissions were calculated -based on maximum input capacity, maximum annual hours of operation, and established emission factors. For convenience, the sum total of all Renown's Mill Street Campus was identified as 8.0955 MMBtu/hr from all HVAC or similar units.

3.4 Emergency Generator Emissions

Emissions from the existing stationary diesel-fired internal combustion equipment were calculated based on the maximum input rates, a maximum of 500 annual hours of operation, and emission factors. The emission factors are based on the applicable standards as contained in New Source Performance Standards (NSPS) Subpart IIII "*Standards of Performance for Stationary Compression Ignition Internal Combustion Engines.*" Emission factors for pollutants not addressed by NSPS Subpart IIII are pursuant to U.S. EPA AP-42, Section 3.3 and 3.4, *Gasoline and Diesel Industrial Engines & Large Stationary Diesel And All Stationary Dual-fuel Engines*, August 2000 & October 1996, respectively as well as 40 CFR Part 98 for greenhouse gas (GHG) emissions.

Emissions from the proposed stationary diesel-fired internal combustion equipment were calculated based on the maximum input rates, a maximum of 500 annual hours of operation, and applicable emission factors. The emission factors are based on the applicable standards as contained in NSPS Subpart IIII and vendor guaranteed emission rates at 100% load.

3.5 Adjacent Ancillary Equipment

Emissions generated by fuel burning devices from adjacent supporting properties are inclusive of the facility's PTE. Emissions generated from adjacent fuel burning sources were calculated based on maximum heat input rates, a maximum of 8,760 annual hours of operation (natural gas-fired), and natural gas emission factors. The emission factors are based on the applicable standards as contained in AP-42 Chapter 1.4, Table 1.4-1 and Table 1.4-2, respectively as well as per 40 CFR 98 Subpart A. The emission factors are based on the applicable standards as contained in NSPS Subpart IIII. Emissions derived from diesel-gas firing are non-existent as all equipment isn't configured to operate on diesel fuel at any time.

4. REGULATORY APPLICABILITY

Renown is subject to federal, state, and local air regulations. This section summarizes the air permitting requirements and the key air quality regulations that apply to the proposed updates at the Facility. Specifically addressed are Federal New Source Review (NSR), Prevention of Significant Deterioration (PSD), Class I permitting (i.e., Title V of the 1990 Clean Air Act Amendments), New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and state and local-specific requirements. Applicability to certain general provisions is not detailed in this narrative summary.

4.1 Federal Regulations

4.1.1 Non-Attainment New Source Review

The Facility is located in Washoe County, which is classified as attainment or unclassifiable for all criteria pollutants. As such Non-Attainment New Source Review does not apply.

4.1.2 Prevention of Significant Deterioration

The Facility is located in Washoe County, which is classified as attainment or unclassifiable for all criteria pollutants. As such, the Facility would potentially be subject to PSD requirements. WCAQMD has the authority to issue PSD permits under WCDBOH Regulations Governing AQM – 030.600 which incorporates by reference the federal PSD requirements. The Facility is not a major stationary source as defined in WCDBOH Regulations Governing AQM – 010.090. None of the changes proposed in this Application constitute a major stationary source in and of itself. As such, PSD requirements are not triggered.

4.1.3 Class I Operating Permit

40 CFR Part 70 establishes the major source operating permit program. The major source (i.e., Class I) thresholds for sources in attainment areas are 10 tons per year of a single HAP, 25 tpy of any combination of HAP, or 100 tpy of a criteria pollutant. Per WCDBOH Regulations Governing AQM – 010.090, fugitive emissions are to be considered in determining whether a source is a major source if the source category belongs to the "List of 28" (40 CFR 52.21(b)(1)(iii)). The Facility is not on the "List of 28" and as such, fugitive emissions need not be considered. As demonstrated in Section 3, the Facility's potential emissions are greater than the Class I thresholds defined in WCDBOH Regulations Governing AQM – 010.090 but as part of this permit application is requesting a federally enforceable facility-wide emission limit of 99 tpy NO_x. As such, the Facility is not subject to Class I permitting requirements.

4.1.4 New Source Performance Standards

NSPS apply to certain types of equipment that are newly constructed, modified, or reconstructed after a given applicability date. The proposed new boilers included in this application are covered by an NSPS.

40 CFR 60 Subpart Dc– Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

NSPS Subpart Dc is applicable to steam generating units that commenced construction, modification, or reconstruction after June 9, 1989, and which have a maximum design heat input capacity of 100 MMBtu/hr or less, but greater than or equal to 10 MMBtu/hr. All four (4) of the boilers Renown is requesting to construct and operate have a maximum heat input capacity of 36.74 MMBtu/hr, fire both natural gas and

diesel fuel #2, and will be constructed after June 9, 1989. Therefore, all four (4) boilers included in this application are subject to Subpart Dc.

The boilers will comply with NSPS Subpart Dc standards by combusting only natural gas or diesel fuel during an emergency (i.e., curtailment). Subpart Dc does not include any emission limits or standards for firing natural gas but does have emissions standards include a 0.50 lb/MMBtu SO_2 limit per 40 CFR 60.42c(d) and a 20% opacity limit excluding one – 6-minute period per hour of not more than 27 percent opacity per 40 CFR 60.43c(c) during periods of oil combustion. Both of these limits are applicable upon completion of initial performance testing. Renown plans to comply with the oil-fired SO_2 emission limit by obtaining a certification from the fuel oil supplier denoting the sulfur content of the provided oil is less than 0.5 % by weight sulfur. This sulfur content will be obtained with each shipment of fuel oil to the Facility and retained for demonstrating compliance. Particulate matter compliance is to be demonstrated by conducting a performance test while firing fuel oil.

Per 40 CFR 60.48c, the Facility will comply with the reporting requirements for a new source including dates of construction and actual startup, provide performance test data, as well as recordkeeping requirements for a facility firing diesel fuel and complying with the fuel supplier certification, and all other required records.

40 CFR 60 Subpart IIII – Compression Ignition Internal Combustion Engines

NSPS Subpart IIII applies to manufacturers, owners, and operators of stationary compression-ignition (CI) internal combustion engines (ICE) as specified in 40 CFR 60.4200(a) through (e). NSPS Subpart IIII sets emission standards for NO_X, CO, PM and hydrocarbons (HC) for certain types of CI ICE. Pursuant to 40 CFR 60.4200(a), Subpart IIII applies to stationary CI ICE with the model year being 2006 or later.

Renown plans to install three (3) diesel fuel-fired emergency generators (CI ICE) at the facility. The generators will likely be ordered by Renown in 2023, thus requiring purchase of NSPS IIII compliant engines. The three (3) generators are rated at 2,680 hp. Pursuant to 40 CFR 60.4205(b), the generators (engines) purchased by Renown must be certified by the manufacturer to meet the emissions standards in 40 CFR 1039, and the engines must be installed and configured according to the manufacturer's emission-related specifications.[2]

Owners and operators of emergency engines must comply with the emissions limitations of NSPS Subpart IIII by purchasing a certified engine with a non-resettable hour meter, performing maintenance on the engine according to the manufacturer's written instructions, and keeping records of maintenance and engine certifications on-site. Additionally, pursuant to 60.4211(f)(3), emergency engines cannot operate for more than 50 hours for non-emergency use and 100 total hours for non-emergency use, maintenance, and testing. Renown will comply with all the requirements of NSPS Subpart IIII upon the installation and operation of the proposed engines.

4.1.5 National Emission Standards for Hazardous Air Pollutants

NESHAP are emission standards for HAP and are applicable to major and area sources of HAP. A HAP major source is defined as having potential emissions in excess of 25 tpy for total HAP and/or potential emissions in excess of 10 tpy for any individual HAP. An area source is a stationary source that is not a major source. Part 63 NESHAP allowable emission limits are established on the basis of a Maximum Achievable Control Technology (MACT) determination for a particular source category. NESHAP apply to sources in specifically regulated industrial source categories (CAA Section 112(d)) or on a case-by-case basis (Section 112(g)) for

[2] 40 CFR 60.4202(a)(2)

facilities not regulated as a specific industrial source type. Potential emissions at the Facility will be below 25 tpy for total HAP and 10 tpy for all individual HAP. Therefore, the facility is an area source of HAP emissions.

40 CFR 63 Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines

Pursuant to the requirements of 40 CFR 63.6585, NESHAP Subpart ZZZZ applies to the three (3) generators that are proposed to be installed at Renown. However, pursuant to 40 CFR 63.6590(c), the requirements listed under NESHAP Subpart ZZZZ are met if the requirements of NSPS Subpart IIII or NSPS Subpart JJJJ are met. As the emergency generator engines are subject to the requirements of NSPS Subpart IIII, no further requirements apply for said engines under this part.

40 CFR 63 Subpart JJJJJJ - Industrial, Commercial, and Institutional Boilers Area Sources

NESHAP Subpart JJJJJJ, National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources, regulates industrial, commercial, and institutional boilers located at area sources of HAP. The facility is an area source and thus the boilers are potentially subject to Subpart JJJJJJ. In the scope of this application, the boilers will be constructed after June 4, 2010 (new source), are considered a gas-fired boiler, and are rated greater than 10 MMBtu/hr, the boilers are not subject to NESHAP Subpart JJJJJJ.

A gas-fired boiler is defined by the Subpart as, *"Gas-fired boiler includes any boiler that burns gaseous fuels not combined with any solid fuels and burns liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or for periodic testing, maintenance, or operator training on liquid fuel. Periodic testing, maintenance, or operator training on liquid fuel shall not exceed a combined total of 48 hours during any calendar year."*

Although the boilers have a dual-fuel capacity (both natural gas and diesel fuel), the boilers are expected to only operate on diesel gas during periods of gas curtailment, gas supply interruption, startups, or for periodic testing, maintenance, or operator training. In CY2022, the existing boilers each operated for 8 hours, demonstrating that Renown has the capability to not exceed a total of 48 hours on liquid fuel during any calendar year. Therefore, as stated above, the proposed boilers are not subject to the regulation.

4.2 WCAQMD Source Specific Requirements

In addition to federal air regulations, the WCDBOH Regulations Governing AQM – 030 provide additional state requirements at the source-level.

4.2.1 Requested Synthetic Minor Limitations

Per the WCDBOH Regulations Governing AQM – 030.905 Part B(6), a source may limit the facility emissions to levels below the major source threshold and become a synthetic minor source. Renown is requesting a federally enforceable synthetic minor limit on NO_x such that the Renown Facility will not be considered a major source with respect to the Title V Operating Permit. Renown is requesting a 99 tpy NO_x permit limit that will be controlled by limiting the generators' hours of operation and the boilers actual operation on diesel. As demonstrated in Table 3.1, actual emissions do not exceed 95 tpy for all regulated pollutants, including 70 tpy of PM_{10}, 9 tpy of any single HAP, 23 tpy of any combination of HAP, and 90% of any less threshold for a single HAP. Renown will maintain an operating log detailing the hours of operation for each generator that will be made available to WCAQMD upon request per the requirements in WCDBOH Regulations Governing AQM – 010.090 Part E.

4.3 WCAQMD Application Requirements

As stated previously in this Application, Renown is submitting this revision application pursuant to the requirements of WCAQMD. The following is a summary of the WCAQMD requirements in ***italic, bold*** text as well as Renown's action to meet each requirement in standard text.

1. Each application must contain, as a minimum:

(a) ***Name and physical address of business and other identifying information;***

(b) ***Nature of business, including products produced and processes to be used, including any applicable SIC and NAICS codes;***

(c) ***Name and phone number of agent, manager or contact person;***

Please refer to previously submitted WCAQMD forms.

(d) ***Site information, including flow diagrams, description of site, description of all insignificant activities for Part 70 permits, and all emission points in sufficient detail to determine applicability and fees;***

(e) ***Nature and quantity of emissions for all regulated pollutants on an hourly, daily or annual basis, expressed in units as necessary to determine compliance, including notation as to if the proposed modification will be a major source or modification and which pollutants the source will be major for;***

(f) ***Facilities or process equipment to be permitted or have their permit revised, including the control equipment, control measures or work practices to be utilized in emission reduction;***

(g) ***Operating times, temperatures, fuels used, raw materials consumption, production rates, or other pertinent information;***

The information shall be sufficient in scope to enable the Control Officer to make any determination pursuant to the requirements of Section 030.010 of these regulations.

Please refer to Sections 2, 3, and 4, and Appendix A of this Application for information satisfying the requirements of (d) through (g).

(h) ***Such other information or documentation requested by the Control Officer as necessary to determine compliance with all requirements and standards;***

Additional information and documentation will be supplied as requested.

(i) ***Signature of a responsible person of the firm or business;***

Please refer to previously submitted WCAQMD forms.

(j) ***A plan review fee and any other fees as set by the District Board of Health;***

(k) ***Calculations and methods used to estimate emissions.***

Please refer to Sections 3 and Appendix A of this Application.

APPENDIX A. DETAILED EMISSION CALCULATIONS

Table B-1. Facility Potential Emissions Summary (tpy)

Pollutants	Existing Boilers	Existing Engines	Facility-wide Potential Emissions (tpy)	Proposed Boilers	Proposed Engines	Facility-wide Potential Emissions (tpy)	Existing Actual Emissions (tpy)	Title V Thresholds	Actual Emissions Exceeds?
NO_X	59.3	112.21	**171.5**	52.04	73.30	**125.34**	**18.03**	100	No
CO	47.1	25.57	**72.7**	41.39	13.36	**54.75**	**13.52**	100	No
VOC	3.1	3.59	**6.7**	2.71	1.95	**4.66**	**0.95**	100	No
PM	4.6	3.73	**8.3**	4.05	1.68	**5.73**	**1.28**	100	No
PM_{10}	4.4	3.73	**8.1**	3.87	1.68	**5.55**	**1.27**	100	No
$PM_{2.5}$	4.3	3.73	**8.1**	3.82	1.68	**5.50**	**1.27**	100	No
SO_2	32.4	0.77	**33.2**	28.24	0.05	**28.29**	**0.56**	100	No
CO_2e	71,138	5,300.87	**76,439**	62,116.21	4914.70	**67,031**	**18,756**	--	N/A
Single HAP (hexane)	0.99	--	**1.0**	1.11	--	**1.11**	**0.21**	10	No
Total HAP	1.08	2.54	**3.6**	1.35	2.60	**3.96**	**0.26**	25	No

Table B-2. Boilers Criteria Pollutant Emissions

	Boilers			
Equipment Info	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
Maximum Heat Input Rate	33.475 MMBtu/hr	38.8 MMBtu/hr	54.32 MMBtu/hr	8.0955 MMBtu/hr
Diesel Fuel Consumption	239.1071429 Gal/hr	277.1428571 Gal/hr	388 Gal/hr	0 Gal/hr
Maximum Hours of Operation	8,760 hr/yr	8,760 hr/yr	8,760 hr/yr	8,760 hr/yr
Hours of Operation on NG	8,260 hr/yr	8,260 hr/yr	8,260 hr/yr	8,760 hr/yr
Hours of Operation on Diesel	500 hr/yr	500 hr/yr	500 hr/yr	0 hr/yr

Emission Factors (Natural Gas) [1]	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
NO_X	100 lb/MMscf	100 lb/MMscf	100 lb/MMscf	100 lb/MMscf
CO	84 lb/MMscf	84 lb/MMscf	84 lb/MMscf	84 lb/MMscf
VOC	5.5 lb/MMscf	5.5 lb/MMscf	5.5 lb/MMscf	5.5 lb/MMscf
PM	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
PM_{10}	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
$PM_{2.5}$	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
SO_2	0.6 lb/MMscf	0.6 lb/MMscf	0.6 lb/MMscf	0.6 lb/MMscf
CO_2	120,000 lb/MMscf	120,000 lb/MMscf	120,000 lb/MMscf	120,000 lb/MMscf
N_2O	2.2 lb/MMscf	2.2 lb/MMscf	2.2 lb/MMscf	2.2 lb/MMscf
CH_4	2.3 lb/MMscf	2.3 lb/MMscf	2.3 lb/MMscf	2.3 lb/MMscf
CO_2e^2	120,713 lb/MMscf	120,713 lb/MMscf	120,713 lb/MMscf	120,713 lb/MMscf

Emission Factors (Diesel) [3]	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
NO_X	20 lb/1000 gal	20 lb/1000 gal	20 lb/1000 gal	20 lb/1000 gal
CO	5 lb/1000 gal	5 lb/1000 gal	5 lb/1000 gal	5 lb/1000 gal
VOC	0.34 lb/1000 gal	0.34 lb/1000 gal	0.34 lb/1000 gal	0.34 lb/1000 gal
PM	2.00 lb/1000 gal	2.00 lb/1000 gal	2.00 lb/1000 gal	2.00 lb/1000 gal
PM_{10}	1.08 lb/1000 gal	1.08 lb/1000 gal	1.08 lb/1000 gal	1.08 lb/1000 gal
$PM_{2.5}$	0.83 lb/1000 gal	0.83 lb/1000 gal	0.83 lb/1000 gal	0.83 lb/1000 gal
SO_2	142 lb/1000 gal	142 lb/1000 gal	142 lb/1000 gal	142 lb/1000 gal
CO_2	22,300 lb/1000 gal	22,300 lb/1000 gal	22,300 lb/1000 gal	22,300 lb/1000 gal
N_2O	0.26 lb/1000 gal	0.26 lb/1000 gal	0.26 lb/1000 gal	0.26 lb/1000 gal
CH_4	1.26 lb/1000 gal	1.26 lb/1000 gal	1.26 lb/1000 gal	1.26 lb/1000 gal
CO_2e^2	22,409 lb/1000 gal	22,409 lb/1000 gal	22,409 lb/1000 gal	22,409 lb/1000 gal

Potential Emissions[4]	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
NO_X	14.75 tpy	17.10 tpy	23.93 tpy	3.48 tpy
CO	11.68 tpy	13.54 tpy	18.96 tpy	2.92 tpy
VOC	0.77 tpy	0.89 tpy	1.24 tpy	0.19 tpy
PM	1.15 tpy	1.33 tpy	1.87 tpy	0.26 tpy
PM_{10}	1.09 tpy	1.27 tpy	1.78 tpy	0.26 tpy
$PM_{2.5}$	1.08 tpy	1.25 tpy	1.75 tpy	0.26 tpy
SO_2	8.57 tpy	9.93 tpy	13.91 tpy	0.02 tpy
CO_2	17,597.93 tpy	20,397.31 tpy	28,556.23 tpy	4,171.56 tpy
N_2O	0.31 tpy	0.36 tpy	0.51 tpy	0.08 tpy
CH_4	0.39 tpy	0.45 tpy	0.63 tpy	0.08 tpy
CO_2e^2	17,701.10 tpy	20,516.89 tpy	28,723.64 tpy	4,196.35 tpy

Notes:

1. AP-42 Chapter 1.4, Table 1.4-1 and Table 1.4-2. Uncontrolled emission factor for NO_X assumed for U201 and Low-NO_X burner emission factor for NO_X assumed for U202.
2. GWPs: CO_2 = 1, N_2O = 298, CH_4 = 25, per 40 CFR 98 Subpart A (rule effective January 1, 2014).
3. AP-42 Chapter 1.3 Table 1.3-1 (CO, SO_2, NO_X, and PM), Table 1.3-3 (VOC), Table 1.3-8 (N_2O), and Table 1.3-12 (CO_2); for #2 Diesel Fuel
4. Annual emissions per pollutant based on maximum of natural gas combustion and diesel combustion.

Table B-3. Boilers HAP Emissions

Pollutant	HAP?	Emission Factors (Diesel)[1]		Emission Factors (Natural Gas)[2]		Diesel Emissions (tpy)			Natural Gas Emissions (tpy)			Combined HAP Emissions (tpy)		
						CB1	BW	CB2	CB1	BW	CB2	CB1	BW	CB2
Benzene	Yes	2.14E-04	lb/Mgal	2.10E-03	lb/MMscf	1.28E-05	1.48E-05	2.08E-05	2.85E-04	3.30E-04	4.62E-04	2.97E-04	3.45E-04	4.83E-04
Ethylbenzene	Yes	6.36E-05	lb/Mgal	--	lb/MMscf	3.80E-06	4.41E-06	6.17E-06	-	-	-	3.80E-06	4.41E-06	6.17E-06
Formaldehyde	Yes	3.30E-02	lb/Mgal	7.50E-02	lb/MMscf	1.97E-03	2.29E-03	3.20E-03	1.02E-02	1.18E-02	1.65E-02	1.21E-02	1.41E-02	1.97E-02
Naphthalene	Yes	1.13E-03	lb/Mgal	6.10E-04	lb/MMscf	6.75E-05	7.83E-05	1.10E-04	8.27E-05	9.58E-05	1.34E-04	1.50E-04	1.74E-04	2.44E-04
1,1,1-Trichloroethane	Yes	2.36E-04	lb/Mgal	--	lb/MMscf	1.41E-05	1.64E-05	2.29E-05	-	-	-	1.41E-05	1.64E-05	2.29E-05
Toluene	Yes	6.20E-03	lb/Mgal	3.40E-03	lb/MMscf	3.71E-04	4.30E-04	6.01E-04	4.61E-04	5.34E-04	7.48E-04	8.31E-04	9.64E-04	1.35E-03
o-Xylene	Yes	1.09E-04	lb/Mgal	--	lb/MMscf	6.52E-06	7.55E-06	1.06E-05	-	-	-	6.52E-06	7.55E-06	1.06E-05
Acenaphthene	Yes	2.11E-05	lb/Mgal	1.80E-06	lb/MMscf	1.26E-06	1.46E-06	2.05E-06	2.44E-07	2.83E-07	3.96E-07	1.51E-06	1.74E-06	2.44E-06
Acenaphthylene	Yes	2.53E-07	lb/Mgal	1.80E-06	lb/MMscf	1.51E-08	1.75E-08	2.45E-08	2.44E-07	2.83E-07	3.96E-07	2.59E-07	3.00E-07	4.20E-07
Anthracene	Yes	1.22E-06	lb/Mgal	2.40E-06	lb/MMscf	7.29E-08	8.45E-08	1.18E-07	3.25E-07	3.77E-07	5.28E-07	3.98E-07	4.62E-07	6.46E-07
Benz(a)anthracene	Yes	4.01E-06	lb/Mgal	1.80E-06	lb/MMscf	2.40E-07	2.78E-07	3.89E-07	2.44E-07	2.83E-07	3.96E-07	4.84E-07	5.61E-07	7.85E-07
Benzo(b,k)fluoranthene	Yes	1.48E-06	lb/Mgal	1.80E-06	lb/MMscf	8.85E-08	1.03E-07	1.44E-07	2.44E-07	2.83E-07	3.96E-07	3.32E-07	3.85E-07	5.39E-07
Benzo(g,h,i)perylene	Yes	2.26E-06	lb/Mgal	2.48E-08	lb/MMscf	1.35E-07	1.57E-07	2.19E-07	3.36E-09	3.90E-09	5.45E-09	1.38E-07	1.60E-07	2.25E-07
Chrysene	Yes	2.38E-06	lb/Mgal	1.80E-06	lb/MMscf	1.42E-07	1.65E-07	2.31E-07	2.44E-07	2.83E-07	3.96E-07	3.86E-07	4.48E-07	6.27E-07
Dibenzo(a,h) anthracene	Yes	1.67E-06	lb/Mgal	--	lb/MMscf	9.98E-08	1.16E-07	1.62E-07	4.89E-08	5.67E-08	7.94E-08	1.49E-07	1.72E-07	2.41E-07
Fluoranthene	Yes	4.84E-06	lb/Mgal	3.61E-07	lb/MMscf	2.89E-07	3.35E-07	4.69E-07	-	-	-	2.89E-07	3.35E-07	4.69E-07
Fluorene	Yes	4.47E-06	lb/Mgal	1.69E-06	lb/MMscf	2.67E-07	3.10E-07	4.34E-07	2.29E-07	2.66E-07	3.72E-07	4.96E-07	5.75E-07	8.05E-07
Indeno(1,2,3-cd)pyrene	Yes	2.14E-06	lb/Mgal	1.80E-06	lb/MMscf	1.28E-07	1.48E-07	2.08E-07	2.44E-07	2.83E-07	3.96E-07	3.72E-07	4.31E-07	6.03E-07
Phenanthrene	Yes	1.05E-05	lb/Mgal	1.70E-05	lb/MMscf	6.28E-07	7.28E-07	1.02E-06	2.30E-06	2.67E-06	3.74E-06	2.93E-06	3.40E-06	4.76E-06
Pyrene	Yes	4.25E-06	lb/Mgal	5.00E-06	lb/MMscf	2.54E-07	2.94E-07	4.12E-07	6.78E-07	7.86E-07	1.10E-06	9.32E-07	1.08E-06	1.51E-06
OCDD	No	3.10E-09	lb/Mgal	--	lb/MMscf	1.85E-10	2.15E-10	3.01E-10	-	-	-	1.85E-10	2.15E-10	3.01E-10
Antimony	Yes	5.25E-03	lb/Mgal	--	lb/MMscf	3.14E-04	3.64E-04	5.09E-04	-	-	-	3.14E-04	3.64E-04	5.09E-04
Arsenic	Yes	1.32E-03	lb/Mgal	2.00E-04	lb/MMscf	7.89E-05	9.15E-05	1.28E-04	2.71E-05	3.14E-05	4.40E-05	1.06E-04	1.23E-04	1.72E-04
Barium	No	2.57E-03	lb/Mgal	--	lb/MMscf	1.54E-04	1.78E-04	2.49E-04	-	-	-	1.54E-04	1.78E-04	2.49E-04
Beryllium	Yes	2.78E-05	lb/Mgal	1.20E-05	lb/MMscf	1.66E-06	1.93E-06	2.70E-06	1.63E-06	1.89E-06	2.64E-06	3.29E-06	3.81E-06	5.34E-06
Cadmium	Yes	3.98E-04	lb/Mgal	1.10E-03	lb/MMscf	2.38E-05	2.76E-05	3.86E-05	1.49E-04	1.73E-04	2.42E-04	1.73E-04	2.00E-04	2.81E-04
Chloride	No	3.47E-01	lb/Mgal	--	lb/MMscf	2.07E-02	2.40E-02	3.37E-02	-	-	-	2.07E-02	2.40E-02	3.37E-02
Chromium	Yes	8.45E-04	lb/Mgal	1.40E-03	lb/MMscf	5.05E-05	5.85E-05	8.20E-05	1.90E-04	2.20E-04	3.08E-04	2.40E-04	2.78E-04	3.90E-04
Chromium VI	Yes	2.48E-04	lb/Mgal	--	lb/MMscf	1.48E-05	1.72E-05	2.41E-05	-	-	-	1.48E-05	1.72E-05	2.41E-05
Cobalt	Yes	6.02E-03	lb/Mgal	8.40E-05	lb/MMscf	3.60E-04	4.17E-04	5.84E-04	1.14E-05	1.32E-05	1.85E-05	3.71E-04	4.30E-04	6.02E-04
Copper	No	1.76E-03	lb/Mgal	--	lb/MMscf	1.05E-04	1.22E-04	1.71E-04	-	-	-	1.05E-04	1.22E-04	1.71E-04
Fluoride	No	3.73E-02	lb/Mgal	--	lb/MMscf	2.23E-03	2.58E-03	3.62E-03	-	-	-	2.23E-03	2.58E-03	3.62E-03
Lead	Yes	1.51E-03	lb/Mgal	--	lb/MMscf	9.03E-05	1.05E-04	1.46E-04	-	-	-	9.03E-05	1.05E-04	1.46E-04
Manganese	Yes	3.00E-03	lb/Mgal	3.80E-04	lb/MMscf	1.79E-04	2.08E-04	2.91E-04	5.15E-05	5.97E-05	8.36E-05	2.31E-04	2.68E-04	3.75E-04
Mercury	Yes	1.13E-04	lb/Mgal	2.60E-04	lb/MMscf	6.75E-06	7.83E-06	1.10E-05	3.52E-05	4.08E-05	5.72E-05	4.20E-05	4.87E-05	6.81E-05
Molybdenum	No	7.87E-04	lb/Mgal	--	lb/MMscf	4.70E-05	5.45E-05	7.63E-05	-	-	-	4.70E-05	5.45E-05	7.63E-05
Nickel	Yes	8.45E-02	lb/Mgal	2.10E-03	lb/MMscf	5.05E-03	5.85E-03	8.20E-03	2.85E-04	3.30E-04	4.62E-04	5.34E-03	6.18E-03	8.66E-03
Phosphorous	No	9.45E-03	lb/Mgal	--	lb/MMscf	5.65E-04	6.55E-04	9.17E-04	-	-	-	5.65E-04	6.55E-04	9.17E-04
Selenium	Yes	6.83E-04	lb/Mgal	2.40E-05	lb/MMscf	4.08E-05	4.73E-05	6.63E-05	3.25E-06	3.77E-06	5.28E-06	4.41E-05	5.11E-05	7.15E-05
Vanadium	Yes	3.18E-02	lb/Mgal	--	lb/MMscf	1.90E-03	2.20E-03	3.08E-03	-	-	-	1.90E-03	2.20E-03	3.08E-03
Zinc	Yes	2.91E-02	lb/Mgal	--	lb/MMscf	1.74E-03	2.02E-03	2.82E-03	-	-	-	1.74E-03	2.02E-03	2.82E-03
2-Methylnaphthalene	Yes	--	lb/Mgal	2.40E-05	lb/MMscf	-	-	-	3.25E-06	3.77E-06	5.28E-06	3.25E-06	3.77E-06	5.28E-06
3-Methylchloranthrene	Yes	--	lb/Mgal	1.80E-06	lb/MMscf	-	-	-	2.44E-07	2.83E-07	3.96E-07	2.44E-07	2.83E-07	3.96E-07
7,12-Dimethylbenz(a)anthracene	Yes	--	lb/Mgal	1.60E-05	lb/MMscf	-	-	-	2.17E-06	2.51E-06	3.52E-06	2.17E-06	2.51E-06	3.52E-06
Benzo(a)pyrene	Yes	--	lb/Mgal	1.20E-06	lb/MMscf	-	-	-	1.63E-07	1.89E-07	2.64E-07	1.63E-07	1.89E-07	2.64E-07
Dichlorobenzene	Yes	--	lb/Mgal	1.20E-03	lb/MMscf	-	-	-	1.63E-04	1.89E-04	2.64E-04	1.63E-04	1.89E-04	2.64E-04
Hexane	Yes	--	lb/Mgal	1.80E+00	lb/MMscf	-	-	-	2.44E-01	2.83E-01	3.96E-01	2.44E-01	2.83E-01	3.96E-01
Total HAP (tpy)												**0.27**	**0.31**	**0.44**
Single Maximum HAP (tpy)												**0.24**	**0.28**	**0.40**

Notes:

1. AP-42 Chapter 1.3, Table 1.3-9 and 1.3-11 for Fuel Oil Combustion
2. AP-42 Chapter 1.4, Table 1.4-3 and 1.4-4 for Natural Gas Combustion

Table B-4. Ancillary NG Unit HAP Emissions

Pollutant	HAP?	Emission Factors (Natural Gas)[1]		Natural Gas Emissions (tpy) Misc Equipment
Benzene	Yes	2.10E-03	lb/MMscf	7.30E-05
Ethylbenzene	Yes	--	lb/MMscf	-
Formaldehyde	Yes	7.50E-02	lb/MMscf	2.61E-03
Naphthalene	Yes	6.10E-04	lb/MMscf	2.12E-05
1,1,1-Trichloroethane	Yes	--	lb/MMscf	-
Toluene	Yes	3.40E-03	lb/MMscf	1.18E-04
o-Xylene	Yes	--	lb/MMscf	-
Acenaphthene	Yes	1.80E-06	lb/MMscf	6.26E-08
Acenaphthylene	Yes	1.80E-06	lb/MMscf	6.26E-08
Anthracene	Yes	2.40E-06	lb/MMscf	8.34E-08
Benz(a)anthracene	Yes	1.80E-06	lb/MMscf	6.26E-08
Benzo(b,k)fluoranthene	Yes	1.80E-06	lb/MMscf	6.26E-08
Benzo(g,h,i)perylene	Yes	2.48E-08	lb/MMscf	8.62E-10
Chrysene	Yes	1.80E-06	lb/MMscf	6.26E-08
Dibenzo(a,h) anthracene	Yes	--	lb/MMscf	-
Fluoranthene	Yes	3.61E-07	lb/MMscf	1.25E-08
Fluorene	Yes	1.69E-06	lb/MMscf	5.87E-08
Indeno(1,2,3-cd)pyrene	Yes	1.80E-06	lb/MMscf	6.26E-08
Phenanthrene	Yes	1.70E-05	lb/MMscf	5.91E-07
Pyrene	Yes	5.00E-06	lb/MMscf	1.74E-07
OCDD	No	--	lb/MMscf	-
Antimony	Yes	--	lb/MMscf	-
Arsenic	Yes	2.00E-04	lb/MMscf	6.95E-06
Barium	No	--	lb/MMscf	-
Beryllium	Yes	1.20E-05	lb/MMscf	4.17E-07
Cadmium	Yes	1.10E-03	lb/MMscf	3.82E-05
Chloride	No	--	lb/MMscf	-
Chromium	Yes	1.40E-03	lb/MMscf	4.87E-05
Chromium VI	Yes	--	lb/MMscf	-
Cobalt	Yes	8.40E-05	lb/MMscf	2.92E-06
Copper	No	--	lb/MMscf	-
Fluoride	No	--	lb/MMscf	-
Lead	Yes	--	lb/MMscf	-
Manganese	Yes	3.80E-04	lb/MMscf	1.32E-05
Mercury	Yes	2.60E-04	lb/MMscf	9.04E-06
Molybdenum	No	--	lb/MMscf	-
Nickel	Yes	2.10E-03	lb/MMscf	7.30E-05
Phosphorous	No	--	lb/MMscf	-
Selenium	Yes	2.40E-05	lb/MMscf	8.34E-07
Vanadium	Yes	--	lb/MMscf	-
Zinc	Yes	--	lb/MMscf	-
2-Methylnapththalene	Yes	2.40E-05	lb/MMscf	8.34E-07
3-Methylchloranthrene	Yes	1.80E-06	lb/MMscf	6.26E-08
7,12-Dimethylbenz(a)anthracene	Yes	1.60E-05	lb/MMscf	5.56E-07
Benzo(a)pyrene	Yes	1.20E-06	lb/MMscf	4.17E-08
Dichlorobenzene	Yes	1.20E-03	lb/MMscf	4.17E-05
Hexane	Yes	1.80E+00	lb/MMscf	6.26E-02
Total HAP (tpy)				**6.56E-02**
Single Maximum HAP (tpy)				**6.26E-02**

Notes:

1. AP-42 Chapter 1.4, Table 1.4-3 and 1.4-4 for Natural Gas Combustion.

Table B-5. Engines Criteria Pollutant Emissions

Equipment Info	Ref.	Gen 1	Ref.	Gen 2	Ref.	Gen 3	Ref.	Gen 4	Ref.	Gen 5	Ref.	Gen 6
Engine Rating		469 hp		469 hp		469 hp		1340 hp		1340 hp		1340 hp
Maximum Hours of Operation[1]	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr
Emission Factors (Diesel Fuel)	**Ref.**	**Gen 1**	**Ref.**	**Gen 2**	**Ref.**	**Gen 3**	**Ref.**	**Gen 4**	**Ref.**	**Gen 5**	**Ref.**	**Gen 6**
NO_X	2	3.10E-02 lb/hp-hr	2	3.10E-02 lb/hp-hr	2	3.10E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr
CO	2	6.68E-03 lb/hp-hr	2	6.68E-03 lb/hp-hr	2	6.68E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr
VOC	2	2.51E-03 lb/hp-hr	2	2.51E-03 lb/hp-hr	2	2.51E-03 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr
PM	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr
PM_{10}	2	2.20E-03 lb/hp-hr	2	2.20E-03 lb/hp-hr	2	2.20E-03 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr
$PM_{2.5}$	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr
SO_2	2	2.05E-03 lb/hp-hr	2	2.05E-03 lb/hp-hr	2	2.05E-03 lb/hp-hr	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr
CO_2	2	1.15 lb/hp-hr	2	1.15 lb/hp-hr	2	1.15 lb/hp-hr	7	1.16 lb/hp-hr	7	1.16 lb/hp-hr	2	1.16 lb/hp-hr
CH_4	4	4.63E-05 lb/hp-hr	4	4.63E-05 lb/hp-hr	4	4.63E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr
N_2O	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr
CO_2e	6	1.15 lb/hp-hr	6	1.15 lb/hp-hr	6	1.15 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr
Potential Emissions		**Gen 1**		**Gen 2**		**Gen 3**		**Gen 4**		**Gen 5**		**Gen 6**
NO_X		3.63 tpy		3.63 tpy		3.63 tpy		8.04 tpy		8.04 tpy		8.04 tpy
CO		0.78 tpy		0.78 tpy		0.78 tpy		1.84 tpy		1.84 tpy		1.84 tpy
VOC		0.29 tpy		0.29 tpy		0.29 tpy		0.21 tpy		0.21 tpy		0.21 tpy
PM		0.26 tpy		0.26 tpy		0.26 tpy		0.23 tpy		0.23 tpy		0.23 tpy
PM_{10}		0.26 tpy		0.26 tpy		0.26 tpy		0.23 tpy		0.23 tpy		0.23 tpy
$PM_{2.5}$		0.26 tpy		0.26 tpy		0.26 tpy		0.23 tpy		0.23 tpy		0.23 tpy
SO_2		0.24 tpy		0.24 tpy		0.24 tpy		0.00 tpy		0.00 tpy		0.00 tpy
CO_2		134.84 tpy		134.84 tpy		134.84 tpy		388.60 tpy		388.60 tpy		388.60 tpy
CO_2e		135.30 tpy		135.30 tpy		135.30 tpy		390.06 tpy		390.06 tpy		390.06 tpy

Engines

Notes:

1. Annual operational limitation conservatively assumed 500 hours of emergency operation.
2. AP-42 Chapter 3.3, Table 3.3-1 (10/96). VOC emission factor based on the sum of TOC from Exhaust and Crankcase.
3. PM_{10} and $PM_{2.5}$ conservatively assumed to equal total PM.
4. Methane emission factor based on 40 CFR Part 98, Table C-2 for diesel fuel (3.0E-3 kg/MMBtu CH_4 converted to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr).
5. N_2O emission factor based on 40 CFR Part 98, Table C-2 for diesel fuel (6.0E-04 kg/MMBtu N_2O converted to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr).
6. CO_2e potential emissions were calculated using the global warming potentials (GWP) for each GHG pollutant emitted from 40 CFR 98, Subpart A, Table A-1 (rule effective January 1, 2014):
   - CO_2 1
   - CH_4 25
   - N_2O 298
7. AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large stationary diesel engines (greater than 600 hp).
8. AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large engines. VOC emission factor is calculated as the total organic carbon (TOC) emission factor multiplied by 91%, per footnote f of AP-42 Table 3.4-1. It is conservatively assumed that all non-methane TOC is VOC.
9. It is assumed that all SO_X is SO_2. The SO_2 emission factor was calculated conservatively assuming a maximum diesel sulfur content of 15 ppm, the maximum allowable sulfur content per 40 CFR 60.4207(a).
10. AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large engines. The CH_4 emission factor is calculated as the total organic carbon (TOC) emission factor multiplied by 9%, per footnote f of AP-42 Table 3.4-1.
11. EPA Tier 4 emission standards for engines of size (75 ≤ hp < 175).

Ref.	Gen 7	Ref.	Gen 8	Ref.	Gen 9	Ref.	Gen 10	Ref.	Gen 11	Ref.	Gen 12
	1340 hp		2680 hp		804 hp		2680 hp		2680 hp		2680 hp
1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr
Ref.	Gen 7	Ref.	Gen 8	Ref.	Gen 9	Ref.	Gen 10	Ref.	Gen 11	Ref.	Gen 12
7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr
7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr
8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr
7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr
2	7.00E-04 lb/hp-hr	2	7.00E-04 lb/hp-hr	2	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr
2	1.21E-05 lb/hp-hr	2	1.21E-05 lb/hp-hr	2	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr
2	1.16 lb/hp-hr	2	1.16 lb/hp-hr	2	1.16 lb/hp-hr	7	1.16 lb/hp-hr	7	1.16 lb/hp-hr	2	1.16 lb/hp-hr
10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr
5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr
6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr
	Gen 7		Gen 8		Gen 9		Gen 10		Gen 11		Gen 12
	8.04 tpy		16.08 tpy		4.82 tpy		16.08 tpy		16.08 tpy		16.08 tpy
	1.84 tpy		3.69 tpy		1.11 tpy		3.69 tpy		3.69 tpy		3.69 tpy
	0.21 tpy		0.43 tpy		0.13 tpy		0.43 tpy		0.43 tpy		0.43 tpy
	0.23 tpy		0.47 tpy		0.14 tpy		0.47 tpy		0.47 tpy		0.47 tpy
	0.23 tpy		0.47 tpy		0.14 tpy		0.47 tpy		0.47 tpy		0.47 tpy
	0.23 tpy		0.47 tpy		0.14 tpy		0.47 tpy		0.47 tpy		0.47 tpy
	0.00 tpy		0.01 tpy		0.00 tpy		0.01 tpy		0.01 tpy		0.01 tpy
	388.60 tpy		777.20 tpy		233.16 tpy		777.20 tpy		777.20 tpy		777.20 tpy
	390.06 tpy		780.11 tpy		234.03 tpy		780.11 tpy		780.11 tpy		780.11 tpy

Table B-6. HAP Emissions for Engines > 600 hp

HAPs	Ref.	Emission Factor (lb/MMBtu)[1]	Emission Factor (lb/hp-hr)[2]	Emissions (tpy)
Benzene	1	7.76E-04	5.43E-06	0.40
Toluene	1	2.81E-04	1.97E-06	0.15
Xylenes	1	1.93E-04	1.35E-06	0.10
Propylene	1	2.79E-03	1.95E-05	1.44
Formaldehyde	1	7.89E-05	5.52E-07	0.04
Acetaldehyde	1	2.52E-05	1.76E-07	0.01
Acrolein	1	7.88E-06	5.52E-08	4.08E-03
Total PAH	1	2.12E-04	1.48E-06	0.11

Notes:
1. Per U.S. EPA's AP-42, Section 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4 (Oct. 1996) for diesel fuel combustion.
2. Converted from lb/MMBtu to lb/hp-hr using an average brake-specific fuel consumption (BSFC) value of 7,000 Btu/hp-hr, per AP-42 Table 3.4-1, footnote e.

Table B-7. HAP Emissions for Engines <600 hp

HAPs	Ref.	Emission Factor (lb/MMBtu)	Emission Factor (lb/hp-hr)	Emissions (tpy)
Benzene	1	9.33E-04	6.53E-06	4.02E-02
Toluene	1	4.09E-04	2.86E-06	1.76E-02
Xylenes	1	2.85E-04	2.00E-06	1.23E-02
Propylene	1	2.58E-03	1.81E-05	1.11E-01
1,3-Butadiene	1	3.91E-05	2.74E-07	1.69E-03
Formaldehyde	1	1.18E-03	8.26E-06	5.09E-02
Acetaldehyde	1	7.67E-04	5.37E-06	3.31E-02
Acrolein	1	9.25E-05	6.48E-07	3.99E-03
Naphthalene	1	8.48E-05	5.94E-07	3.66E-03
Acenaphthylene	1	5.06E-06	3.54E-08	2.18E-04
Acenaphthene	1	1.42E-06	9.94E-09	6.13E-05
Fluorene	1	2.92E-05	2.04E-07	1.26E-03
Phenanthrene	1	2.94E-05	2.06E-07	1.27E-03
Anthracene	1	1.87E-06	1.31E-08	8.07E-05
Fluoranthene	1	7.61E-06	5.33E-08	3.28E-04
Pyrene	1	4.78E-06	3.35E-08	2.06E-04
Benzo(a)anthracene	1	1.68E-06	1.18E-08	7.25E-05
Chrysene	1	3.53E-07	2.47E-09	1.52E-05
Benzo(b)fluoranthene	1	9.91E-08	6.94E-10	4.28E-06
Benzo(k)fluoranthene	1	1.55E-07	1.09E-09	6.69E-06
Benzo(a)pyrene	1	1.88E-07	1.32E-09	8.11E-06
Indeno(1,2,3-cd)pyrene	1	3.75E-07	2.63E-09	1.62E-05
Dibenz(a,h)anthracene	1	5.83E-07	4.08E-09	2.51E-05
Benzo(g,h,i)perylene	1	4.89E-07	3.42E-09	2.11E-05

Notes:
1. HAP emission factors based on AP-42 Table 3.3-2 for organic compound emissions from diesel-fired engines. Emission factors converted from lb/MMBtu to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr.

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Table B-8. Proposed Boilers Criteria Pollutant Emissions

Boilers				
Equipment Info	**1061-0-B-01**	**1061-0-B-02**	**1061-0-B-03**	**Misc Ancillary Equipment**
Maximum Heat Input Rate	36.741 MMBtu/hr	36.741 MMBtu/hr	36.741 MMBtu/hr	8.0955 MMBtu/hr
Diesel Fuel Consumption	262.4357143 Gal/hr	262.4357143 Gal/hr	262.4357143 Gal/hr	0 Gal/hr
Maximum Hours of Operation	8,760 hr/yr	8,760 hr/yr	8,760 hr/yr	8,760 hr/yr
Hours of Operation on NG	8,260 hr/yr	8,260 hr/yr	8,260 hr/yr	8,760 hr/yr
Hours of Operation on Diesel	500 hr/yr	500 hr/yr	500 hr/yr	0 hr/yr

Emission Factors (Natural Gas)[1]	**1061-0-B-01**	**1061-0-B-02**	**1061-0-B-03**	**Misc Ancillary Equipment**
NO_X	100 lb/MMscf	100 lb/MMscf	100 lb/MMscf	100 lb/MMscf
CO	84 lb/MMscf	84 lb/MMscf	84 lb/MMscf	84 lb/MMscf
VOC	5.5 lb/MMscf	5.5 lb/MMscf	5.5 lb/MMscf	5.5 lb/MMscf
PM	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
PM_{10}[2]	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
$PM_{2.5}$[2]	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
SO_2	0.6 lb/MMscf	0.6 lb/MMscf	0.6 lb/MMscf	0.6 lb/MMscf
CO_2	120,000 lb/MMscf	120,000 lb/MMscf	120,000 lb/MMscf	120,000 lb/MMscf
N_2O	2.2 lb/MMscf	2.2 lb/MMscf	2.2 lb/MMscf	2.2 lb/MMscf
CH_4	2.3 lb/MMscf	2.3 lb/MMscf	2.3 lb/MMscf	2.3 lb/MMscf
CO_2e[3]	120,713 lb/MMscf	120,713 lb/MMscf	120,713 lb/MMscf	120,713 lb/MMscf

Emission Factors (Diesel)[4]	**1061-0-B-01**	**1061-0-B-02**	**1061-0-B-03**	**Misc Ancillary Equipment**
NO_X	20 lb/1000 gal	20 lb/1000 gal	20 lb/1000 gal	20 lb/1000 gal
CO	5 lb/1000 gal	5 lb/1000 gal	5 lb/1000 gal	5 lb/1000 gal
VOC	0.34 lb/1000 gal	0.34 lb/1000 gal	0.34 lb/1000 gal	0.34 lb/1000 gal
PM	2.00 lb/1000 gal	2.00 lb/1000 gal	2.00 lb/1000 gal	2.00 lb/1000 gal
PM_{10}[2]	1.08 lb/1000 gal	1.08 lb/1000 gal	1.08 lb/1000 gal	1.08 lb/1000 gal
$PM_{2.5}$[2]	0.83 lb/1000 gal	0.83 lb/1000 gal	0.83 lb/1000 gal	0.83 lb/1000 gal
SO_2	142 lb/1000 gal	142 lb/1000 gal	142 lb/1000 gal	142 lb/1000 gal
CO_2	22,300 lb/1000 gal	22,300 lb/1000 gal	22,300 lb/1000 gal	22,300 lb/1000 gal
N_2O	0.26 lb/1000 gal	0.26 lb/1000 gal	0.26 lb/1000 gal	0.26 lb/1000 gal
CH_4	1.26 lb/1000 gal	1.26 lb/1000 gal	1.26 lb/1000 gal	1.26 lb/1000 gal
CO_2e[3]	22,409 lb/1000 gal	22,409 lb/1000 gal	22,409 lb/1000 gal	22,409 lb/1000 gal

Potential Emissions[5]	**1061-0-B-01**	**1061-0-B-02**	**1061-0-B-03**	**Misc Ancillary Equipment**
NO_X	16.19 tpy	16.19 tpy	16.19 tpy	3.48 tpy
CO	12.82 tpy	12.82 tpy	12.82 tpy	2.92 tpy
VOC	0.84 tpy	0.84 tpy	0.84 tpy	0.19 tpy
PM	1.26 tpy	1.26 tpy	1.26 tpy	0.26 tpy
PM_{10}[2]	1.20 tpy	1.20 tpy	1.20 tpy	0.26 tpy
$PM_{2.5}$[2]	1.19 tpy	1.19 tpy	1.19 tpy	0.26 tpy
SO_2	9.41 tpy	9.41 tpy	9.41 tpy	0.02 tpy
CO_2	19,314.88 tpy	19,314.88 tpy	19,314.88 tpy	4,171.56 tpy
N_2O	0.34 tpy	0.34 tpy	0.34 tpy	0.08 tpy
CH_4	0.42 tpy	0.42 tpy	0.42 tpy	0.08 tpy
CO_2e[3]	19,428.12 tpy	19,428.12 tpy	19,428.12 tpy	4,196.35 tpy

Notes:

1. AP-42 Chapter 1.4, Table 1.4-1 and Table 1.4-2. Uncontrolled emission factor for NO_X assumed for U201 and Low-NO_X burner emission factor for NO_X assumed for U202.
2. PM_{10} and $PM_{2.5}$ conservatively assumed to be equal to total PM emissions.
3. GWPs: CO_2 = 1, N_2O = 298, CH_4 = 25, per 40 CFR 98 Subpart A (rule effective January 1, 2014).
4. AP-42 Chapter 1.3 Table 1.3-1 (CO, SO_2, NO_X, and PM), Table 1.3-3 (VOC), Table 1.3-8 (N_2O), and Table 1.3-12 (CO_2); assumes Gr/diluel emission factors are equal to No. 6 Fuel emission factors.
5. Annual emissions per pollutant based on maximum of natural gas combustion and diesel combustion.

Table B-11. Ancillary NG Unit HAP Emissions

Pollutant	HAP?	Emission Factors (Natural Gas)[1]		Natural Gas Emissions (tpy) Misc Equipment
Benzene	Yes	2.10E-03	lb/MMscf	7.30E-05
Ethylbenzene	Yes	--	lb/MMscf	-
Formaldehyde	Yes	7.50E-02	lb/MMscf	2.61E-03
Naphthalene	Yes	6.10E-04	lb/MMscf	2.12E-05
1,1,1-Trichloroethane	Yes	--	lb/MMscf	-
Toluene	Yes	3.40E-03	lb/MMscf	1.18E-04
o-Xylene	Yes	--	lb/MMscf	-
Acenaphthene	Yes	1.80E-06	lb/MMscf	6.26E-08
Acenaphthylene	Yes	1.80E-06	lb/MMscf	6.26E-08
Anthracene	Yes	2.40E-06	lb/MMscf	8.34E-08
Benz(a)anthracene	Yes	1.80E-06	lb/MMscf	6.26E-08
Benzo(b,k)fluoranthene	Yes	1.80E-06	lb/MMscf	6.26E-08
Benzo(g,h,i)perylene	Yes	2.48E-08	lb/MMscf	8.62E-10
Chrysene	Yes	1.80E-06	lb/MMscf	6.26E-08
Dibenzo(a,h) anthracene	Yes	--	lb/MMscf	-
Fluoranthene	Yes	3.61E-07	lb/MMscf	1.25E-08
Fluorene	Yes	1.69E-06	lb/MMscf	5.87E-08
Indeno(1,2,3-cd)pyrene	Yes	1.80E-06	lb/MMscf	6.26E-08
Phenanthrene	Yes	1.70E-05	lb/MMscf	5.91E-07
Pyrene	Yes	5.00E-06	lb/MMscf	1.74E-07
OCDD	No	--	lb/MMscf	-
Antimony	Yes	--	lb/MMscf	-
Arsenic	Yes	2.00E-04	lb/MMscf	6.95E-06
Barium	No	--	lb/MMscf	-
Beryllium	Yes	1.20E-05	lb/MMscf	4.17E-07
Cadmium	Yes	1.10E-03	lb/MMscf	3.82E-05
Chloride	No	--	lb/MMscf	-
Chromium	Yes	1.40E-03	lb/MMscf	4.87E-05
Chromium VI	Yes	--	lb/MMscf	-
Cobalt	Yes	8.40E-05	lb/MMscf	2.92E-06
Copper	No	--	lb/MMscf	-
Fluoride	No	--	lb/MMscf	-
Lead	Yes	--	lb/MMscf	-
Manganese	Yes	3.80E-04	lb/MMscf	1.32E-05
Mercury	Yes	2.60E-04	lb/MMscf	9.04E-06
Molybdenum	No	--	lb/MMscf	-
Nickel	Yes	2.10E-03	lb/MMscf	7.30E-05
Phosphorous	No	--	lb/MMscf	-
Selenium	Yes	2.40E-05	lb/MMscf	8.34E-07
Vanadium	Yes	--	lb/MMscf	-
Zinc	Yes	--	lb/MMscf	-
2-Methylnapththalene	Yes	2.40E-05	lb/MMscf	8.34E-07
3-Methylchloranthrene	Yes	1.80E-06	lb/MMscf	6.26E-08
7,12-Dimethylbenz(a)anthracene	Yes	1.60E-05	lb/MMscf	5.56E-07
Benzo(a)pyrene	Yes	1.20E-06	lb/MMscf	4.17E-08
Dichlorobenzene	Yes	1.20E-03	lb/MMscf	4.17E-05
Hexane	Yes	1.80E+00	lb/MMscf	6.26E-02
Total HAP (tpy)				**6.56E-02**
Single Maximum HAP (tpy)				**6.26E-02**

Notes:

1. AP-42 Chapter 1.4, Table 1.4-3 and 1.4-4 for Natural Gas Combustion.

Table B-9. Proposed Boilers HAP Emissions

Pollutant	HAP?	Emission Factors (Diesel)[1]		Emission Factors (Natural Gas)[2]		Diesel Emissions (tpy)			Natural Gas Emissions (tpy)			Combined HAP Emissions (tpy)		
						1061-0-B-01	1061-0-B-02	1061-0-B-03	1061-0-B-01	1061-0-B-02	1061-0-B-03	1061-0-B-01	1061-0-B-02	1061-0-B-03
Benzene	Yes	2.14E-04	lb/Mgal	2.10E-03	lb/MMscf	1.40E-05	1.40E-05	1.40E-05	3.12E-04	3.12E-04	3.12E-04	3.26E-04	3.26E-04	3.26E-04
Ethylbenzene	Yes	6.36E-05	lb/Mgal	--	lb/MMscf	4.17E-06	4.17E-06	4.17E-06	-	-	-	4.17E-06	4.17E-06	4.17E-06
Formaldehyde	Yes	3.30E-02	lb/Mgal	7.50E-02	lb/MMscf	2.17E-03	2.17E-03	2.17E-03	1.12E-02	1.12E-02	1.12E-02	1.33E-02	1.33E-02	1.33E-02
Naphthalene	Yes	1.13E-03	lb/Mgal	6.10E-04	lb/MMscf	7.41E-05	7.41E-05	7.41E-05	9.07E-05	9.07E-05	9.07E-05	1.65E-04	1.65E-04	1.65E-04
1,1,1-Trichloroethane	Yes	2.36E-04	lb/Mgal	--	lb/MMscf	1.55E-05	1.55E-05	1.55E-05	-	-	-	1.55E-05	1.55E-05	1.55E-05
Toluene	Yes	6.20E-03	lb/Mgal	3.40E-03	lb/MMscf	4.07E-04	4.07E-04	4.07E-04	5.06E-04	5.06E-04	5.06E-04	9.13E-04	9.13E-04	9.13E-04
o-Xylene	Yes	1.09E-04	lb/Mgal	--	lb/MMscf	7.15E-06	7.15E-06	7.15E-06	-	-	-	7.15E-06	7.15E-06	7.15E-06
Acenaphthene	Yes	2.11E-05	lb/Mgal	1.80E-06	lb/MMscf	1.38E-06	1.38E-06	1.38E-06	2.68E-07	2.68E-07	2.68E-07	1.65E-06	1.65E-06	1.65E-06
Acenaphthylene	Yes	2.53E-07	lb/Mgal	1.80E-06	lb/MMscf	1.66E-08	1.66E-08	1.66E-08	3.57E-07	3.57E-07	3.57E-07	2.84E-07	2.84E-07	2.84E-07
Anthracene	Yes	1.22E-06	lb/Mgal	2.40E-06	lb/MMscf	8.00E-08	8.00E-08	8.00E-08	2.68E-07	2.68E-07	2.68E-07	4.37E-07	4.37E-07	4.37E-07
Benz(a)anthracene	Yes	4.01E-06	lb/Mgal	1.80E-06	lb/MMscf	2.63E-07	2.63E-07	2.63E-07	3.57E-07	3.57E-07	3.57E-07	5.31E-07	5.31E-07	5.31E-07
Benzo(b,k)fluoranthene	Yes	1.48E-06	lb/Mgal	1.80E-06	lb/MMscf	9.71E-08	9.71E-08	9.71E-08	2.68E-07	2.68E-07	2.68E-07	3.65E-07	3.65E-07	3.65E-07
Benzo(g,h,i)perylene	Yes	2.26E-06	lb/Mgal	2.48E-08	lb/MMscf	1.48E-07	1.48E-07	1.48E-07	3.69E-09	3.69E-09	3.69E-09	1.52E-07	1.52E-07	1.52E-07
Chrysene	Yes	2.38E-06	lb/Mgal	1.80E-06	lb/MMscf	1.56E-07	1.56E-07	1.56E-07	2.68E-07	2.68E-07	2.68E-07	4.24E-07	4.24E-07	4.24E-07
Dibenzo(a,h) anthracene	Yes	1.67E-06	lb/Mgal	--	lb/MMscf	1.10E-07	1.10E-07	1.10E-07	-	-	-	1.10E-07	1.10E-07	1.10E-07
Fluoranthene	Yes	4.84E-06	lb/Mgal	3.61E-07	lb/MMscf	3.18E-07	3.18E-07	3.18E-07	5.37E-08	5.37E-08	5.37E-08	3.71E-07	3.71E-07	3.71E-07
Fluorene	Yes	4.47E-06	lb/Mgal	1.69E-06	lb/MMscf	2.93E-07	2.93E-07	2.93E-07	2.51E-07	2.51E-07	2.51E-07	5.45E-07	5.45E-07	5.45E-07
Indeno(1,2,3-cd)pyrene	Yes	2.14E-06	lb/Mgal	1.80E-06	lb/MMscf	1.40E-07	1.40E-07	1.40E-07	2.68E-07	2.68E-07	2.68E-07	4.08E-07	4.08E-07	4.08E-07
Phenanthrene	Yes	1.05E-05	lb/Mgal	1.70E-05	lb/MMscf	6.89E-07	6.89E-07	6.89E-07	2.53E-06	2.53E-06	2.53E-06	3.22E-06	3.22E-06	3.22E-06
Pyrene	Yes	4.25E-06	lb/Mgal	5.00E-06	lb/MMscf	2.79E-07	2.79E-07	2.79E-07	7.44E-07	7.44E-07	7.44E-07	1.02E-06	1.02E-06	1.02E-06
OCDD	No	3.10E-09	lb/Mgal	--	lb/MMscf	2.03E-10	2.03E-10	2.03E-10	-	-	-	2.03E-10	2.03E-10	2.03E-10
Antimony	Yes	5.25E-03	lb/Mgal	--	lb/MMscf	3.44E-04	3.44E-04	3.44E-04	2.98E-05	2.98E-05	2.98E-05	3.44E-04	3.44E-04	3.44E-04
Arsenic	Yes	1.32E-03	lb/Mgal	2.00E-04	lb/MMscf	8.66E-05	8.66E-05	8.66E-05	-	-	-	1.16E-04	1.16E-04	1.16E-04
Barium	No	2.57E-03	lb/Mgal	--	lb/MMscf	1.69E-04	1.69E-04	1.69E-04	1.79E-06	1.79E-06	1.79E-06	1.69E-04	1.69E-04	1.69E-04
Beryllium	Yes	2.78E-05	lb/Mgal	1.20E-05	lb/MMscf	1.82E-06	1.82E-06	1.82E-06	1.64E-04	1.64E-04	1.64E-04	3.61E-06	3.61E-06	3.61E-06
Cadmium	Yes	3.98E-04	lb/Mgal	1.10E-03	lb/MMscf	2.61E-05	2.61E-05	2.61E-05	-	-	-	1.90E-04	1.90E-04	1.90E-04
Chloride	No	3.47E-01	lb/Mgal	--	lb/MMscf	2.28E-02	2.28E-02	2.28E-02	2.08E-04	2.08E-04	2.08E-04	2.28E-02	2.28E-02	2.28E-02
Chromium	Yes	8.45E-04	lb/Mgal	1.40E-03	lb/MMscf	5.54E-05	5.54E-05	5.54E-05	-	-	-	2.64E-04	2.64E-04	2.64E-04
Chromium VI	Yes	2.48E-04	lb/Mgal	--	lb/MMscf	1.63E-05	1.63E-05	1.63E-05	1.25E-05	1.25E-05	1.25E-05	1.63E-05	1.63E-05	1.63E-05
Cobalt	Yes	6.02E-03	lb/Mgal	8.40E-05	lb/MMscf	3.95E-04	3.95E-04	3.95E-04	-	-	-	4.07E-04	4.07E-04	4.07E-04
Copper	No	1.76E-03	lb/Mgal	--	lb/MMscf	1.15E-04	1.15E-04	1.15E-04	-	-	-	1.15E-04	1.15E-04	1.15E-04
Fluoride	No	3.73E-02	lb/Mgal	--	lb/MMscf	2.45E-03	2.45E-03	2.45E-03	-	-	-	2.45E-03	2.45E-03	2.45E-03
Lead	Yes	1.51E-03	lb/Mgal	--	lb/MMscf	9.91E-05	9.91E-05	9.91E-05	5.65E-05	5.65E-05	5.65E-05	9.91E-05	9.91E-05	9.91E-05
Manganese	Yes	3.00E-03	lb/Mgal	3.80E-04	lb/MMscf	1.97E-04	1.97E-04	1.97E-04	3.87E-05	3.87E-05	3.87E-05	2.53E-04	2.53E-04	2.53E-04
Mercury	Yes	1.13E-04	lb/Mgal	2.60E-04	lb/MMscf	7.41E-06	7.41E-06	7.41E-06	-	-	-	4.61E-05	4.61E-05	4.61E-05
Molybdenum	No	7.87E-04	lb/Mgal	--	lb/MMscf	5.16E-05	5.16E-05	5.16E-05	3.12E-04	3.12E-04	3.12E-04	5.16E-05	5.16E-05	5.16E-05
Nickel	Yes	8.45E-02	lb/Mgal	2.10E-03	lb/MMscf	5.54E-03	5.54E-03	5.54E-03	-	-	-	5.86E-03	5.86E-03	5.86E-03
Phosphorous	No	9.46E-03	lb/Mgal	--	lb/MMscf	6.21E-04	6.21E-04	6.21E-04	3.57E-06	3.57E-06	3.57E-06	6.21E-04	6.21E-04	6.21E-04
Selenium	Yes	6.83E-04	lb/Mgal	2.40E-05	lb/MMscf	4.48E-05	4.48E-05	4.48E-05	-	-	-	4.84E-05	4.84E-05	4.84E-05
Vanadium	Yes	3.18E-02	lb/Mgal	--	lb/MMscf	2.09E-03	2.09E-03	2.09E-03	3.57E-06	3.57E-06	3.57E-06	2.09E-03	2.09E-03	2.09E-03
Zinc	Yes	2.91E-02	lb/Mgal	--	lb/MMscf	1.91E-03	1.91E-03	1.91E-03	2.68E-07	2.68E-07	2.68E-07	1.91E-03	1.91E-03	1.91E-03
2-Methylnaphthalene	Yes		lb/Mgal	2.40E-05	lb/MMscf	-	-	-	2.38E-06	2.38E-06	2.38E-06	3.57E-06	3.57E-06	3.57E-06
3 Methylchloranthrene	Yes	--	lb/Mgal	1.80E-06	lb/MMscf	-	-	-	1.79E-07	1.79E-07	1.79E-07	2.68E-07	2.68E-07	2.68E-07
7,12-Dimethylbenz(a)anthracene	Yes	--	lb/Mgal	1.60E-05	lb/MMscf	-	-	-	1.79E-04	1.79E-04	1.79E-04	2.38E-06	2.38E-06	2.38E-06
Benzo(a)pyrene	Yes	--	lb/Mgal	1.20E-06	lb/MMscf	-	-	-	2.68E-01	2.68E-01	2.68E-01	1.79E-07	1.79E-07	1.79E-07
Dichlorobenzene	Yes	--	lb/Mgal	1.20E-03	lb/MMscf	-	-	-				1.79E-04	1.79E-04	1.79E-04
Hexane	Yes	--	lb/Mgal	1.80E+00	lb/MMscf	-	-	-				2.68E-01	2.68E-01	2.68E-01
Total HAP (tpy)												**0.29**	**0.29**	**0.29**
Single Maximum HAP (tpy)												**0.27**	**0.27**	**0.27**

Notes:
1. AP-42 Chapter 1.3, Table 1.3-9 and 1.3-11 for Distillate Fuel Oil Combustion
2. AP-42 Chapter 1.4, Table 1.4-3 and 1.4-4 for Natural Gas Combustion.

Table B-10. Proposed and Existing Engines Criteria Pollutant Emissions

Equipment Info	Ref.	Gen 1	Ref.	Gen 2	Ref.	Gen 3	Ref.	Existing Gen 1	Ref.	Existing Gen 2	Ref.	Existing Gen 3	Ref.	Existing Gen 4
Engine Rating		2680 hp		2680 hp		2680 hp		2680 hp		2680 hp		2680 hp		804 hp
Maximum Hours of Operation[1]	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr	1	500 hr/yr
Emission Factors (Diesel Fuel)	**Ref.**	**Gen 1**	**Ref.**	**Gen 2**	**Ref.**	**Gen 3**	**Ref.**	**Existing Gen 1**	**Ref.**	**Existing Gen 2**	**Ref.**	**Existing Gen 3**	**Ref.**	**Existing Gen 4**
NO_X	7	1.01E-02 lb/hp-hr	7	1.01E-02 lb/hp-hr	7	1.01E-02 lb/hp-hr	8	2.40E-02 lb/hp-hr	8	2.40E-02 lb/hp-hr	8	2.40E-02 lb/hp-hr	8	2.40E-02 lb/hp-hr
CO	7	5.95E-04 lb/hp-hr	7	5.95E-04 lb/hp-hr	7	5.95E-04 lb/hp-hr	8	5.50E-03 lb/hp-hr	8	5.50E-03 lb/hp-hr	8	5.50E-03 lb/hp-hr	8	5.50E-03 lb/hp-hr
VOC	7	2.64E-04 lb/hp-hr	7	2.64E-04 lb/hp-hr	7	2.64E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr
PM	7	6.61E-05 lb/hp-hr	7	6.61E-05 lb/hp-hr	7	6.61E-05 lb/hp-hr	8	7.00E-04 lb/hp-hr	8	7.00E-04 lb/hp-hr	8	7.00E-04 lb/hp-hr	8	7.00E-04 lb/hp-hr
PM_{10}	3	6.61E-05 lb/hp-hr	3	6.61E-05 lb/hp-hr	3	6.61E-05 lb/hp-hr	2	7.00E-04 lb/hp-hr	2	7.00E-04 lb/hp-hr	2	7.00E-04 lb/hp-hr	2	7.00E-04 lb/hp-hr
$PM_{2.5}$	3	6.61E-05 lb/hp-hr	3	6.61E-05 lb/hp-hr	3	6.61E-05 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr
SO_2	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr	2	1.21E-05 lb/hp-hr	2	1.21E-05 lb/hp-hr	2	1.21E-05 lb/hp-hr	2	1.21E-05 lb/hp-hr
CO_2	7	1.16 lb/hp-hr	7	1.16 lb/hp-hr	7	1.16 lb/hp-hr	2	1.16 lb/hp-hr	2	1.16 lb/hp-hr	2	1.16 lb/hp-hr	2	1.16 lb/hp-hr
CH_4	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr
N_2O	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr
CO_2e	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr
Potential Emissions		**Gen 1**		**Gen 2**		**Gen 3**		**Existing Gen 1**		**Existing Gen 2**		**Existing Gen 3**		**Existing Gen 4**
NO_X		6.75 tpy		6.75 tpy		6.75 tpy		16.08 tpy		16.08 tpy		16.08 tpy		4.82 tpy
CO		0.40 tpy		0.40 tpy		0.40 tpy		3.69 tpy		3.69 tpy		3.69 tpy		1.11 tpy
VOC		0.18 tpy		0.18 tpy		0.18 tpy		0.43 tpy		0.43 tpy		0.43 tpy		0.13 tpy
PM		0.04 tpy		0.04 tpy		0.04 tpy		0.47 tpy		0.47 tpy		0.47 tpy		0.14 tpy
PM_{10}		0.04 tpy		0.04 tpy		0.04 tpy		0.47 tpy		0.47 tpy		0.47 tpy		0.14 tpy
$PM_{2.5}$		0.04 tpy		0.04 tpy		0.04 tpy		0.47 tpy		0.47 tpy		0.47 tpy		0.14 tpy
SO_2		0.01 tpy		0.01 tpy		0.01 tpy		0.01 tpy		0.01 tpy		0.01 tpy		0.00 tpy
CO_2		777.20 tpy		777.20 tpy		777.20 tpy		777.20 tpy		777.20 tpy		777.20 tpy		233.16 tpy
CO_2e		780.11 tpy		780.11 tpy		780.11 tpy		780.11 tpy		780.11 tpy		780.11 tpy		234.03 tpy

Notes:

1. Annual operational limitation conservatively assumed 500 hours of emergency operation.
2. AP-42 Chapter 3.3, Table 3.3-1 (10/96). VOC emission factor based on the sum of TOC from Exhaust and Crankcase.
3. PM_{10} and $PM_{2.5}$ conservatively assumed to equal total PM.
4. Methane emission factor based on 40 CFR Part 98, Table C-2 for diesel fuel (3.0E-3 kg/MMBtu CH_4 converted to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr).
5. N_2O emission factor based on 40 CFR Part 98, Table C-2 for diesel fuel (6.0E-04 kg/MMBtu N_2O converted to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr).
6. CO_2e potential emissions were calculated using the global warming potentials (GWP) for each GHG pollutant emitted from 40 CFR 98, Subpart A, Table A-1 (rule effective January 1, 2014):

CO_2	1
CH_4	25
N_2O	298

7. Based on Manufacturer Specifications
8. AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large engines. VOC emission factor is calculated as the total organic carbon (TOC) emission factor multiplied by 91%, per footnote f of AP-42 Table 3.4-1. It is conservatively assumed that all non-methane TOC is VOC.
9. It is assumed that all SO_X is SO_2. The SO_2 emission factor was calculated conservatively assuming a maximum diesel sulfur content of 15 ppm, the maximum allowable sulfur content per 40 CFR 60.4207(a).
10. AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large engines. The CH_4 emission factor is calculated as the total organic carbon (TOC) emission factor multiplied by 9%, per footnote f of AP-42 Table 3.4-1.
11. EPA Tier 4 emission standards for engines of size ($75 \leq hp < 175$).

Table B-5. HAP Emissions for Engines > 600 hp

HAPs	Ref.	Emission Factor (lb/MMBtu)[1]	Emission Factor (lb/hp-hr)[2]	Emissions (tpy)
Benzene	1	7.76E-04	5.43E-06	0.27
Toluene	1	2.81E-04	1.97E-06	0.10
Xylenes	1	1.93E-04	1.35E-06	0.07
Propylene	1	2.79E-03	1.95E-05	0.99
Formaldehyde	1	7.89E-05	5.52E-07	0.03
Acetaldehyde	1	2.52E-05	1.76E-07	0.01
Acrolein	1	7.88E-06	5.52E-08	0.00
Total PAH	1	2.12E-04	1.48E-06	0.07

Notes:

1. Per U.S. EPA's AP-42, Section 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4 (Oct. 1996) for diesel fuel combustion.
2. Converted from lb/MMBtu to lb/hp-hr using an average brake-specific fuel consumption (BSFC) value of 7,000 Btu/hp-hr, per AP-42 Table 3.4-1, footnote e.

Table B-6. HAP Emissions for Engines <600 hp

HAPs	Ref.	Emission Factor (lb/MMBtu)	Emission Factor (lb/hp-hr)	Emissions (tpy)
Benzene	1	9.33E-04	6.53E-06	1.53E-01
Toluene	1	4.09E-04	2.86E-06	6.72E-02
Xylenes	1	2.85E-04	2.00E-06	4.68E-02
Propylene	1	2.58E-03	1.81E-05	4.24E-01
1,3-Butadiene	1	3.91E-05	2.74E-07	6.43E-03
Formaldehyde	1	1.18E-03	8.26E-06	1.94E-01
Acetaldehyde	1	7.67E-04	5.37E-06	1.26E-01
Acrolein	1	9.25E-05	6.48E-07	1.52E-02
Naphthalene	1	8.48E-05	5.94E-07	1.39E-02
Acenaphthylene	1	5.06E-06	3.54E-08	8.32E-04
Acenaphthene	1	1.42E-06	9.94E-09	2.33E-04
Fluorene	1	2.92E-05	2.04E-07	4.80E-03
Phenanthrene	1	2.94E-05	2.06E-07	4.83E-03
Anthracene	1	1.87E-06	1.31E-08	3.07E-04
Fluoranthene	1	7.61E-06	5.33E-08	1.25E-03
Pyrene	1	4.78E-06	3.35E-08	7.86E-04
Benzo(a)anthracene	1	1.68E-06	1.18E-08	2.76E-04
Chrysene	1	3.53E-07	2.47E-09	5.80E-05
Benzo(b)fluoranthene	1	9.91E-08	6.94E-10	1.63E-05
Benzo(k)fluoranthene	1	1.55E-07	1.09E-09	2.55E-05
Benzo(a)pyrene	1	1.88E-07	1.32E-09	3.09E-05
Indeno(1,2,3-cd)pyrene	1	3.75E-07	2.63E-09	6.16E-05
Dibenz(a,h)anthracene	1	5.83E-07	4.08E-09	9.59E-05
Benzo(g,h,i)perylene	1	4.89E-07	3.42E-09	8.04E-05

Notes

1. HAP emission factors based on AP-42 Table 3.3-2 for organic compound emissions from diesel-fired engines. Emission factors converted from lb/MMBtu to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr.

Table B-12. CY2022 Actual Boilers Criteria Pollutant Emissions

Boilers				
Equipment Info	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
Actual Heat Input Rate	64204.46562 MMBtu/yr	74417.72266 MMBtu/yr	104184.8117 MMBtu/yr	8.0955 MMBtu/hr
Diesel Fuel Consumption	239.1071429 Gal/hr	277.1428571 Gal/hr	239.1071429 Gal/hr	0 Gal/hr
Maximum Hours of Operation	8,760 hr/yr	8,760 hr/yr	8,760 hr/yr	8,760 hr/yr
Hours of Operation on NG	8,752 hr/yr	8,752 hr/yr	8,752 hr/yr	8,760 hr/yr
Hours of Operation on Diesel	8 hr/yr	8 hr/yr	8 hr/yr	0 hr/yr

Emission Factors (Natural Gas)	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
NO_X	100 lb/MMscf	100 lb/MMscf	100 lb/MMscf	100 lb/MMscf
CO	84 lb/MMscf	84 lb/MMscf	84 lb/MMscf	84 lb/MMscf
VOC	5.5 lb/MMscf	5.5 lb/MMscf	5.5 lb/MMscf	5.5 lb/MMscf
PM	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
PM_{10}[2]	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
$PM_{2.5}$[2]	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf	7.6 lb/MMscf
SO_2	0.6 lb/MMscf	0.6 lb/MMscf	0.6 lb/MMscf	0.6 lb/MMscf
CO_2	120,000 lb/MMscf	120,000 lb/MMscf	120,000 lb/MMscf	120,000 lb/MMscf
N_2O	2.2 lb/MMscf	2.2 lb/MMscf	2.2 lb/MMscf	2.2 lb/MMscf
CH_4	2.3 lb/MMscf	2.3 lb/MMscf	2.3 lb/MMscf	2.3 lb/MMscf
CO_2e[3]	120,740 lb/MMscf	120,740 lb/MMscf	120,740 lb/MMscf	120,740 lb/MMscf

Emission Factors (Diesel)	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
NO_X	20 lb/1000 gal	20 lb/1000 gal	20 lb/1000 gal	20 lb/1000 gal
CO	5 lb/1000 gal	5 lb/1000 gal	5 lb/1000 gal	5 lb/1000 gal
VOC	0.34 lb/1000 gal	0.34 lb/1000 gal	0.34 lb/1000 gal	0.34 lb/1000 gal
PM	2.00 lb/1000 gal	2.00 lb/1000 gal	2.00 lb/1000 gal	2.00 lb/1000 gal
PM_{10}[2]	1.08 lb/1000 gal	1.08 lb/1000 gal	1.08 lb/1000 gal	1.08 lb/1000 gal
$PM_{2.5}$[2]	0.83 lb/1000 gal	0.83 lb/1000 gal	0.83 lb/1000 gal	0.83 lb/1000 gal
SO_2	142 lb/1000 gal	142 lb/1000 gal	142 lb/1000 gal	142 lb/1000 gal
CO_2	22,300 lb/1000 gal	22,300 lb/1000 gal	22,300 lb/1000 gal	22,300 lb/1000 gal
N_2O	0.26 lb/1000 gal	0.26 lb/1000 gal	0.26 lb/1000 gal	0.26 lb/1000 gal
CH_4	1.26 lb/1000 gal	1.26 lb/1000 gal	1.26 lb/1000 gal	1.26 lb/1000 gal
CO_2e[3]	22,682 lb/1000 gal	22,682 lb/1000 gal	22,682 lb/1000 gal	22,682 lb/1000 gal

Potential Emissions[5]	**Cleaver Brooks 1**	**Babcock & Wilcox 1**	**Cleaver Brooks 2**	**Misc Ancillary Equipment**
NO_X	3.17 tpy	3.67 tpy	5.13 tpy	3.48 tpy
CO	2.65 tpy	3.07 tpy	4.29 tpy	2.92 tpy
VOC	0.17 tpy	0.20 tpy	0.28 tpy	0.19 tpy
PM_{10}[2]	0.24 tpy	0.28 tpy	0.39 tpy	0.26 tpy
$PM_{2.5}$[2]	0.24 tpy	0.28 tpy	0.39 tpy	0.26 tpy
SO_2	0.24 tpy	0.28 tpy	0.39 tpy	0.26 tpy
CO_2	0.15 tpy	0.18 tpy	0.17 tpy	0.02 tpy
N_2O	3,798.06 tpy	4,402.23 tpy	6,149.85 tpy	4,171.56 tpy
CH_4	0.07 tpy	0.08 tpy	0.11 tpy	0.08 tpy
CO_2e[3]	0.07 tpy	0.09 tpy	0.12 tpy	0.08 tpy
	3,821.73 tpy	4,429.67 tpy	6,188.02 tpy	4,197.30 tpy

Notes:

1. AP-42 Chapter 1.4, Table 1.4-1 and Table 1.4-2. Uncontrolled emission factor for NO_X assumed for U201 and Low-NO_X burner emission factor for NO_X assumed for U202.
2. PM_{10} and $PM_{2.5}$ conservatively assumed to be equal to total PM emissions.
3. GWPs: CO_2 = 1, N_2O = 298, CH_4 = 25, per 40 CFR 98 Subpart A (rule effective January 1, 2014).
4. AP-42 Chapter 1.3 Table 1.3-1 (CO, SO_2, NO_X and PM), Table 1.3-3 (VOC), Table 1.3-8 (SO_2), and Table 1.3-12 (CO_2); assumes Gridfuel emission factors are equal to No. 6 Fuel emission factors.
5. Annual emissions per pollutant based on maximum of natural gas combustion and diesel combustion.

Table B-13. CY2022 Actual Boilers HAP Emissions

Pollutant	HAP?	Emission Factors (Diesel)[1]		Emission Factors (Natural Gas)[2]		Diesel Emissions (tpy)			Natural Gas Emissions (tpy)			Combined HAP Emissions (tpy)		
						CB1	BW	CB2	CB1	BW	CB2	CB1	BW	CB2
Benzene	Yes	2.14E-04	lb/Mgal	2.10E-03	lb/MMscf	1.28E-05	1.48E-05	1.28E-05	6.61E-05	7.66E-05	1.07E-04	7.89E-05	9.14E-05	1.20E-04
Ethylbenzene	Yes	6.36E-05	lb/Mgal	--	lb/MMscf	3.80E-06	4.41E-06	3.80E-06	-	-	-	3.80E-06	4.41E-06	3.80E-06
Formaldehyde	Yes	3.30E-02	lb/Mgal	7.50E-02	lb/MMscf	1.97E-03	2.29E-03	1.97E-03	2.36E-03	2.74E-03	3.83E-03	4.33E-03	5.02E-03	5.80E-03
Naphthalene	Yes	1.13E-03	lb/Mgal	6.10E-04	lb/MMscf	6.75E-05	7.83E-05	6.75E-05	1.92E-05	2.23E-05	3.12E-05	8.67E-05	1.01E-04	9.87E-05
1,1,1-Trichloroethane	Yes	2.36E-04	lb/Mgal	--	lb/MMscf	1.41E-05	1.64E-05	1.41E-05	-	-	-	1.41E-05	1.64E-05	1.41E-05
Toluene	Yes	6.20E-03	lb/Mgal	3.40E-03	lb/MMscf	3.71E-04	4.30E-04	3.71E-04	1.07E-04	1.24E-04	1.74E-04	4.78E-04	5.54E-04	5.44E-04
o-Xylene	Yes	1.09E-04	lb/Mgal	--	lb/MMscf	6.52E-06	7.55E-06	6.52E-06	-	-	-	6.52E-06	7.55E-06	6.52E-06
Acenaphthene	Yes	2.11E-05	lb/Mgal	1.80E-06	lb/MMscf	1.26E-06	1.46E-06	1.26E-06	5.67E-08	6.57E-08	9.19E-08	1.32E-06	1.53E-06	1.35E-06
Acenaphthylene	Yes	2.53E-07	lb/Mgal	1.80E-06	lb/MMscf	1.51E-08	1.75E-08	1.51E-08	5.67E-08	6.57E-08	9.19E-08	7.18E-08	8.32E-08	1.07E-07
Anthracene	Yes	1.22E-06	lb/Mgal	2.40E-06	lb/MMscf	7.29E-08	8.45E-08	7.29E-08	7.55E-08	8.76E-08	1.23E-07	1.49E-07	1.72E-07	1.95E-07
Benz(a)anthracene	Yes	4.01E-06	lb/Mgal	1.80E-06	lb/MMscf	2.40E-07	2.78E-07	2.40E-07	5.67E-08	6.57E-08	9.19E-08	2.96E-07	3.43E-07	3.32E-07
Benzo(b,k)fluoranthene	Yes	1.48E-06	lb/Mgal	1.80E-06	lb/MMscf	8.85E-08	1.03E-07	8.85E-08	5.67E-08	6.57E-08	9.19E-08	1.45E-07	1.68E-07	1.80E-07
Benzo(g,h,i)perylene	Yes	2.26E-06	lb/Mgal	2.48E-08	lb/MMscf	1.35E-07	1.57E-07	1.35E-07	7.81E-10	9.05E-10	1.27E-09	1.36E-07	1.57E-07	1.36E-07
Chrysene	Yes	2.38E-06	lb/Mgal	1.80E-06	lb/MMscf	1.42E-07	1.65E-07	1.42E-07	5.67E-08	6.57E-08	9.19E-08	1.99E-07	2.31E-07	1.36E-07
Dibenzo(a,h) anthracene	Yes	1.67E-06	lb/Mgal	--	lb/MMscf	9.98E-08	1.16E-07	9.98E-08	-	-	-	9.98E-08	1.16E-07	9.98E-08
Fluoranthene	Yes	4.84E-06	lb/Mgal	3.61E-07	lb/MMscf	2.89E-07	3.35E-07	2.89E-07	1.14E-08	1.32E-08	1.84E-08	3.01E-07	3.49E-07	3.09E-07
Fluorene	Yes	4.47E-06	lb/Mgal	1.69E-06	lb/MMscf	2.67E-07	3.10E-07	2.67E-07	5.32E-08	6.16E-08	8.63E-08	3.20E-07	3.71E-07	3.54E-07
Indeno(1,2,3-cd)pyrene	Yes	2.14E-06	lb/Mgal	1.80E-06	lb/MMscf	1.28E-07	1.48E-07	1.28E-07	5.67E-08	6.57E-08	9.19E-08	1.85E-07	2.14E-07	2.20E-07
Phenanthrene	Yes	1.05E-05	lb/Mgal	1.70E-05	lb/MMscf	6.28E-07	7.28E-07	6.28E-07	5.35E-07	6.20E-07	8.68E-07	1.16E-06	1.35E-06	1.50E-06
Pyrene	Yes	4.25E-06	lb/Mgal	5.00E-06	lb/MMscf	2.54E-07	2.94E-07	2.54E-07	1.57E-07	1.82E-07	2.55E-07	4.11E-07	4.77E-07	5.09E-07
OCDD	No	3.10E-09	lb/Mgal	--	lb/MMscf	1.85E-10	2.15E-10	1.85E-10	-	-	-	1.85E-10	2.15E-10	1.85E-10
Antimony	Yes	5.25E-03	lb/Mgal	--	lb/MMscf	3.14E-04	3.64E-04	3.14E-04	-	-	-	3.14E-04	3.64E-04	3.14E-04
Arsenic	Yes	1.32E-03	lb/Mgal	2.00E-04	lb/MMscf	7.89E-05	9.15E-05	7.89E-05	6.29E-06	7.30E-06	1.02E-05	8.52E-05	9.88E-05	8.91E-05
Barium	No	2.57E-03	lb/Mgal	--	lb/MMscf	1.54E-04	1.78E-04	1.54E-04	-	-	-	1.54E-04	1.78E-04	1.54E-04
Beryllium	Yes	2.78E-05	lb/Mgal	1.20E-05	lb/MMscf	1.66E-06	1.93E-06	1.66E-06	3.78E-07	4.38E-07	6.13E-07	2.04E-06	2.36E-06	2.27E-06
Cadmium	Yes	3.98E-04	lb/Mgal	1.10E-03	lb/MMscf	2.38E-05	2.76E-05	2.38E-05	3.46E-05	4.01E-05	5.62E-05	5.84E-05	6.77E-05	8.00E-05
Chloride	No	3.47E-01	lb/Mgal	--	lb/MMscf	2.07E-02	2.40E-02	2.07E-02	-	-	-	2.07E-02	2.40E-02	2.07E-02
Chromium	Yes	8.45E-04	lb/Mgal	1.40E-03	lb/MMscf	5.05E-05	5.85E-05	5.05E-05	4.41E-05	5.11E-05	7.15E-05	9.46E-05	1.10E-04	1.22E-04
Chromium VI	Yes	2.48E-04	lb/Mgal	--	lb/MMscf	1.48E-05	1.72E-05	1.48E-05	-	-	-	1.48E-05	1.72E-05	1.48E-05
Cobalt	Yes	6.02E-03	lb/Mgal	8.40E-05	lb/MMscf	3.60E-04	4.17E-04	3.60E-04	2.64E-06	3.06E-06	4.29E-06	3.62E-04	4.20E-04	3.64E-04
Copper	No	1.76E-03	lb/Mgal	--	lb/MMscf	1.05E-04	1.22E-04	1.05E-04	-	-	-	1.05E-04	1.22E-04	1.05E-04
Fluoride	No	3.73E-02	lb/Mgal	--	lb/MMscf	2.23E-03	2.59E-03	2.23E-03	-	-	-	2.23E-03	2.58E-03	2.23E-03
Lead	Yes	1.51E-03	lb/Mgal	--	lb/MMscf	9.03E-05	1.05E-04	9.03E-05	-	-	-	9.03E-05	1.05E-04	9.03E-05
Manganese	Yes	3.00E-03	lb/Mgal	3.80E-04	lb/MMscf	1.79E-04	2.08E-04	1.79E-04	1.20E-05	1.39E-05	1.94E-05	1.91E-04	2.22E-04	1.99E-04
Mercury	Yes	1.13E-04	lb/Mgal	2.60E-04	lb/MMscf	6.75E-06	7.83E-06	6.75E-06	8.18E-06	9.48E-06	1.33E-05	1.49E-05	1.73E-05	2.00E-05
Molybdenum	No	7.87E-04	lb/Mgal	--	lb/MMscf	4.70E-05	5.45E-05	4.70E-05	-	-	-	4.70E-05	5.45E-05	4.70E-05
Nickel	Yes	8.45E-02	lb/Mgal	2.10E-03	lb/MMscf	5.05E-03	5.85E-03	5.05E-03	6.61E-05	7.66E-05	1.07E-04	5.12E-03	5.93E-03	5.16E-03
Phosphorous	No	9.45E-03	lb/Mgal	--	lb/MMscf	5.65E-04	6.55E-04	5.65E-04	-	-	-	5.65E-04	6.55E-04	5.65E-04
Selenium	Yes	6.83E-04	lb/Mgal	2.40E-05	lb/MMscf	4.08E-05	4.73E-05	4.08E-05	7.55E-07	8.76E-07	1.23E-06	4.16E-05	4.82E-05	4.21E-05
Vanadium	Yes	3.18E-02	lb/Mgal	--	lb/MMscf	1.90E-03	2.20E-03	1.90E-03	-	-	-	1.90E-03	2.20E-03	1.90E-03
Zinc	Yes	2.91E-02	lb/Mgal	--	lb/MMscf	1.74E-03	2.02E-03	1.74E-03	-	-	-	1.74E-03	2.02E-03	1.74E-03
2-Methylnaphthalene	Yes	--	lb/Mgal	2.40E-05	lb/MMscf	-	-	-	7.55E-07	8.76E-07	1.23E-06	7.55E-07	8.76E-07	1.23E-06
3-Methylchloranthrene	Yes	--	lb/Mgal	1.80E-06	lb/MMscf	-	-	-	5.67E-08	6.57E-08	9.19E-08	5.67E-08	6.57E-08	9.19E-08
7,12-Dimethylbenz(a)anthracene	Yes	--	lb/Mgal	1.60E-05	lb/MMscf	-	-	-	5.04E-07	5.84E-07	8.17E-07	5.04E-07	5.84E-07	8.17E-07
Benzo(a)pyrene	Yes	--	lb/Mgal	1.20E-06	lb/MMscf	-	-	-	3.78E-08	4.38E-08	6.13E-08	3.78E-08	4.38E-08	6.13E-08
Dichlorobenzene	Yes	--	lb/Mgal	1.20E-03	lb/MMscf	-	-	-	3.78E-05	4.38E-05	6.13E-05	3.78E-05	4.38E-05	6.13E-05
Hexane	Yes	--	lb/Mgal	1.80E+00	lb/MMscf	-	-	-	5.67E-02	6.57E-02	9.19E-02	5.67E-02	6.57E-02	9.19E-02
Total HAP (tpy)												**0.07**	**0.08**	**0.11**
Single Maximum HAP (tpy)												**0.06**	**0.07**	**0.09**

Notes:

1. AP-42 Chapter 1.3, Table 1.3-9 and 1.3-11 for Fuel Oil Combustion
2. AP-42 Chapter 1.4, Table 1.4-3 and 1.4-4 for Natural Gas Combustion.

Table B-14. CY2022 Actual Engines Criteria Pollutant Emissions

Equipment Info	Ref.	Engines													
		Gen 1	Ref.	Gen 2	Ref.	Gen 3	Ref.	Gen 4	Ref.	Gen 5	Ref.	Gen 6	Ref.	Gen 7	
Engine Rating		469 hp		469 hp		469 hp		1340 hp		1340 hp		1340 hp		1340 hp	
Actual Hours of Operation[1]	1	28 hr/yr	1	28 hr/yr	1	28 hr/yr	1	2 hr/yr	1	2 hr/yr	1	2 hr/yr	1	2 hr/yr	
Emission Factors (Diesel Fue)	**Ref.**	**Gen 1**	**Ref.**	**Gen 2**	**Ref.**	**Gen 3**	**Ref.**	**Gen 4**	**Ref.**	**Gen 5**	**Ref.**	**Gen 6**	**Ref.**	**Gen 7**	
NO_X	2	3.10E-02 lb/hp-hr	2	3.10E-02 lb/hp-hr	2	3.10E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	7	2.40E-02 lb/hp-hr	
CO	2	6.68E-03 lb/hp-hr	2	6.68E-03 lb/hp-hr	2	6.68E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	7	5.50E-03 lb/hp-hr	
VOC	2	2.51E-03 lb/hp-hr	2	2.51E-03 lb/hp-hr	2	2.51E-03 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	8	6.42E-04 lb/hp-hr	
PM	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	7	7.00E-04 lb/hp-hr	
PM_{10}	2	2.20E-03 lb/hp-hr	2	2.20E-03 lb/hp-hr	2	2.20E-03 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	
$PM_{2.5}$	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	3	2.20E-03 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	3	7.00E-04 lb/hp-hr	2	7.00E-04 lb/hp-hr	
SO_2	2	2.05E-03 lb/hp-hr	2	2.05E-03 lb/hp-hr	2	2.05E-03 lb/hp-hr	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr	9	1.21E-05 lb/hp-hr	3	7.00E-04 lb/hp-hr	
CO_2	2	1.15 lb/hp-hr	2	1.15 lb/hp-hr	2	1.15 lb/hp-hr	7	1.16 lb/hp-hr	7	1.16 lb/hp-hr	2	1.16 lb/hp-hr	2	1.21E-05 lb/hp-hr	
CH_4	4	4.63E-05 lb/hp-hr	4	4.63E-05 lb/hp-hr	4	4.63E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	10	6.35E-05 lb/hp-hr	2	1.16 lb/hp-hr	
N_2O	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	5	9.26E-06 lb/hp-hr	10	6.35E-05 lb/hp-hr	
CO_2e	6	1.15 lb/hp-hr	6	1.15 lb/hp-hr	6	1.15 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	6	1.16 lb/hp-hr	5	9.26E-06 lb/hp-hr	
Potential Emissions		**Gen 1**		**Gen 2**		**Gen 3**		**Gen 4**		**Gen 5**		**Gen 6**	6	1.16 lb/hp-hr	
NO_X		0.20 tpy		0.20 tpy		0.20 tpy		0.03 tpy		0.03 tpy		0.03 tpy		**Gen 7**	
CO		0.04 tpy		0.04 tpy		0.04 tpy		0.01 tpy		0.01 tpy		0.01 tpy		0.03 tpy	
VOC		0.02 tpy		0.02 tpy		0.02 tpy		0.00 tpy		0.00 tpy		0.00 tpy		0.01 tpy	
PM		0.01 tpy		0.01 tpy		0.01 tpy		0.00 tpy		0.00 tpy		0.00 tpy		0.00 tpy	
PM_{10}		0.01 tpy		0.01 tpy		0.01 tpy		0.00 tpy		0.00 tpy		0.00 tpy		0.00 tpy	
$PM_{2.5}$		0.01 tpy		0.01 tpy		0.01 tpy		0.00 tpy		0.00 tpy		0.00 tpy		0.00 tpy	
SO_2		0.01 tpy		0.01 tpy		0.01 tpy		0.00 tpy		0.00 tpy		0.00 tpy		0.00 tpy	
CO_2		7.55 tpy		7.55 tpy		7.55 tpy		1.55 tpy		1.55 tpy		1.55 tpy		1.55 tpy	
CO_2e		7.58 tpy		7.58 tpy		7.58 tpy		1.56 tpy		1.56 tpy		1.56 tpy		1.56 tpy	

Notes:

1. Annual operation per 2022 Emission Inventory
2 - AP-42 Chapter 3.3, Table 3.3-1 (10/96). VOC emission factor based on the sum of TOC from Exhaust and Crankcase.
3 - PM_{10} and $PM_{2.5}$ conservatively assumed to equal total PM.
4 - Methane emission factor based on 40 CFR Part 98, Table C-2 for diesel fuel (3.0E-3 kg/MMBtu CH_4 converted to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr).
5 - N_2O emission factor based on 40 CFR Part 98, Table C-2 for diesel fuel (6.0E-04 kg/MMBtu N_2O converted to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr).
6 - CO_2e potential emissions were calculated using the global warming potentials (GWP) for each GHG pollutant emitted from 40 CFR 98, Subpart A, Table A-1 (rule effective January 1, 2014):

CO_2	1
CH_4	25
N_2O	298

7 - AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large stationary diesel engines (greater than 600 hp).
8 - AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large engines. VOC emission factor is calculated as the total organic carbon (TOC) emission factor multiplied by 91%, per footnote f of AP-42 Table 3.4-1. It is conservatively assumed that all non-methane TOC is VOC.
9 - It is assumed that all SO_X is SO_2. The SO_2 emission factor was calculated conservatively assuming a maximum diesel sulfur content of 15 ppm, the maximum allowable sulfur content per 40 CFR 60.4207(a).
10 - AP-42 Chapter 3.4, Table 3.4-1 (10/96) for large engines. The CH_4 emission factor is calculated as the total organic carbon (TOC) emission factor multiplied by 9%, per footnote f of AP-42 Table 3.4-1.
11 - EPA Tier 4 emission standards for engines of size (75 ≤ hp < 175).

Ref.	Gen 8
	2680 hp
1	18 hr/yr

Ref.	Gen 8
7	2.40E-02 lb/hp-hr
7	5.50E-03 lb/hp-hr
8	6.42E-04 lb/hp-hr
7	7.00E-04 lb/hp-hr
2	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
2	1.21E-05 lb/hp-hr
2	1.16 lb/hp-hr
10	6.35E-05 lb/hp-hr
5	9.26E-06 lb/hp-hr
6	1.16 lb/hp-hr

	Gen 8
	0.58 tpy
	0.13 tpy
	0.02 tpy
	0.02 tpy
	0.02 tpy
	0.02 tpy
	0.00 tpy
	27.98 tpy
	28.08 tpy

Ref.	Gen 9
	804 hp
1	12 hr/yr

Ref.	Gen 9
7	2.40E-02 lb/hp-hr
7	5.50E-03 lb/hp-hr
8	6.42E-04 lb/hp-hr
7	7.00E-04 lb/hp-hr
2	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
2	1.21E-05 lb/hp-hr
2	1.16 lb/hp-hr
10	6.35E-05 lb/hp-hr
5	9.26E-06 lb/hp-hr
6	1.16 lb/hp-hr

	Gen 9
	0.12 tpy
	0.03 tpy
	0.00 tpy
	0.00 tpy
	0.00 tpy
	0.00 tpy
	0.00 tpy
	5.60 tpy
	5.62 tpy

Ref.	Gen 10
	2680 hp
1	12 hr/yr

Ref.	Gen 10
7	2.40E-02 lb/hp-hr
7	5.50E-03 lb/hp-hr
8	6.42E-04 lb/hp-hr
7	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
9	1.21E-05 lb/hp-hr
7	1.16 lb/hp-hr
10	6.35E-05 lb/hp-hr
5	9.26E-06 lb/hp-hr
6	1.16 lb/hp-hr

	Gen 10
	0.39 tpy
	0.09 tpy
	0.01 tpy
	0.01 tpy
	0.01 tpy
	0.01 tpy
	0.00 tpy
	18.65 tpy
	18.72 tpy

Ref.	Gen 11
	2680 hp
1	12 hr/yr

Ref.	Gen 11
7	2.40E-02 lb/hp-hr
7	5.50E-03 lb/hp-hr
8	6.42E-04 lb/hp-hr
7	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
9	1.21E-05 lb/hp-hr
7	1.16 lb/hp-hr
10	6.35E-05 lb/hp-hr
5	9.26E-06 lb/hp-hr
6	1.16 lb/hp-hr

	Gen 11
	0.39 tpy
	0.09 tpy
	0.01 tpy
	0.01 tpy
	0.01 tpy
	0.01 tpy
	0.00 tpy
	18.65 tpy
	18.72 tpy

Ref.	Gen 12
	2680 hp
1	12 hr/yr

Ref.	Gen 12
7	2.40E-02 lb/hp-hr
7	5.50E-03 lb/hp-hr
8	6.42E-04 lb/hp-hr
7	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
3	7.00E-04 lb/hp-hr
9	1.21E-05 lb/hp-hr
2	1.16 lb/hp-hr
10	6.35E-05 lb/hp-hr
5	9.26E-06 lb/hp-hr
6	1.16 lb/hp-hr

	Gen 12
	0.39 tpy
	0.09 tpy
	0.01 tpy
	0.01 tpy
	0.01 tpy
	0.01 tpy
	0.00 tpy
	18.65 tpy
	18.72 tpy

Table B-5. HAP Emissions for Engines > 600 hp

HAPs	Ref.	Emission Factor (lb/MMBtu)[1]	Emission Factor (lb/hp-hr)[2]	Emissions (tpy)
Benzene	1	7.76E-04	5.43E-06	0.40
Toluene	1	2.81E-04	1.97E-06	0.02
Xylenes	1	1.93E-04	1.35E-06	0.02
Propylene	1	2.79E-03	1.95E-05	0.23
Formaldehyde	1	7.89E-05	5.52E-07	0.01
Acetaldehyde	1	2.52E-05	1.76E-07	0.00
Acrolein	1	7.88E-06	5.52E-08	0.00
Total PAH	1	2.12E-04	1.48E-06	0.02

Notes:
1 - Per U.S. EPA's AP-42, Section 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4 (Oct. 1996) for diesel fuel combustion.
2 - Converted from lb/MMBtu to lb/hp-hr using an average brake-specific fuel consumption (BSFC) value of 7,000 Btu/hp-hr, per AP-42 Table 3.4-1, footnote e.

Table B-6. HAP Emissions for Engines <600 hp

HAPs	Ref.	Emission Factor (lb/MMBtu)	Emission Factor (lb/hp-hr)	Emissions (tpy)
Benzene	1	9.33E-04	6.53E-06	4.02E-02
Toluene	1	4.09E-04	2.86E-06	1.76E-02
Xylenes	1	2.85E-04	2.00E-06	1.23E-02
Propylene	1	2.58E-03	1.81E-05	1.11E-01
1,3-Butadiene	1	3.91E-05	2.74E-07	1.69E-03
Formaldehyde	1	1.18E-03	8.26E-06	5.09E-02
Acetaldehyde	1	7.67E-04	5.37E-06	3.31E-02
Acrolein	1	9.25E-05	6.48E-07	3.99E-03
Naphthalene	1	8.48E-05	5.94E-07	3.66E-03
Acenaphthylene	1	5.06E-06	3.54E-08	2.18E-04
Acenaphthene	1	1.42E-06	9.94E-09	6.13E-05
Fluorene	1	2.92E-05	2.04E-07	1.26E-03
Phenanthrene	1	2.94E-05	2.06E-07	1.27E-03
Anthracene	1	1.87E-06	1.31E-08	8.07E-05
Fluoranthene	1	7.61E-06	5.33E-08	3.28E-04
Pyrene	1	4.78E-06	3.35E-08	2.06E-04
Benzo(a)anthracene	1	1.68E-06	1.18E-08	7.25E-05
Chrysene	1	3.53E-07	2.47E-09	1.52E-05
Benzo(b)fluoranthene	1	9.91E-08	6.94E-10	4.28E-06
Benzo(k)fluoranthene	1	1.55E-07	1.09E-09	6.69E-06
Benzo(a)pyrene	1	1.88E-07	1.32E-09	8.11E-06
Indeno(1,2,3-cd)pyrene	1	3.75E-07	2.63E-09	1.62E-05
Dibenz(a,h)anthracene	1	5.83E-07	4.08E-09	2.51E-05
Benzo(g,h,i)perylene	1	4.89E-07	3.42E-09	2.11E-05

Notes:
1 - HAP emission factors based on AP-42 Table 3.3-2 for organic compound emissions from diesel-fired engines. Emission factors converted from lb/MMBtu to lb/hp-hr using a brake efficiency of 7,000 Btu/hp-hr.

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APPENDIX B. WCAQMD PERMIT APPLICATIONS FOR NEW EQUIPMENT

HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

To be filled in by AQ Staff
Permit No.: _____
Date: _____
Accepted By: _____

GENERAL APPLICATION FOR AN AIR QUALITY STATIONARY SOURCE PERMIT TO OPERATE

Return to: Washoe County Health District
Air Quality Management Division
1001 E. Ninth Street, Suite B171
Reno, Nevada 89512
(775) 784-7200

www.OurCleanAir.com

GENERAL INFORMATION FOR ALL AIR QUALITY PERMIT TO OPERATE APPLICATIONS

- Application must be filled out completely for all items that are applicable.
- Application must be signed by a responsible person.
- **For new facilities an additional Operating Permit Fee will be assessed after completion of the air quality emissions review which will be based on potential emissions calculated for the first year.**
- A Plan Review Fee must be submitted with this Application.
  $1,278 for Minor Stationary Sources;
  $3,796 for Synthetic Minor Stationary Sources

1. **Legal Business Name** (Name Permit will be issued under):
Renown Health

Street Address: Mill Street Campus, 1155 Mill Street
City: Reno State: NV Zip Code: 89502
Parcel: 012-150-24 Process Type: Fuel burning equipment (central utility plant, support facilities, etc.)
Onsite Contact: Chris Baker Title: Director of Facilities Engineering
Telephone: (775) 982-6188 E-Mail: cbaker2@renown.org

2. **Mailing Address** (if different than above):
Street Address: 245 Liberty Street
City: Reno State: NV Zip Code: 89501
Business Representative: Chris Baker Title: Director of Facilities Engineering
Telephone: (775) 982-6188 E-Mail: cbaker2@renown.org

3. **Billing Address** (if different than above):
Street Address: _____
City: _____ State: _____ Zip Code: _____
Representative: _____ Title: _____
Telephone: _____ E-Mail: _____

4. Attach a Description of Process (include: processing times, hours of operation, batches per year, size per batch, etc.):

   ☒ Enclosed ☐ Not-Enclosed ☐ Not Applicable

5. Attach a Process Flow Diagram:

   ☒ Enclosed ☐ Not-Enclosed ☐ Not Applicable

6. Attach an Equipment list (see sample excel spreadsheet):

   ■ Enclosed ☐ Not-Enclosed ☐ Not Applicable

7. Attach a List of Materials and Estimated Quantities to be used (see sample excel spreadsheet):

   ******** **Attach ALL MSDS sheets for all materials** ********

   ☐ Enclosed ☐ Not-Enclosed ■ Not Applicable

8. Attach a Description of Emissions Control Equipment (include: manufacturer, model, serial number, flow diagrams, emission units controlled, etc.):

   ☒ Enclosed ☐ Not-Enclosed ☐ Not Applicable

Construction Start Date: 07/01/2022 Operations Start Date: 03/01/2025

NOTE: Applicant agrees to allow on-site inspection during and after construction by the Air Quality Management Division during working hours without prior notice. The operator must notify this office when the facility commences and completes construction. An official Permit to Operate will not be issued until a final inspection is made and all required test data has been forwarded to this office assuring that equipment will meet all district and state regulations.

This application is submitted in accordance with the provisions of Section 030.000, and under penalty of perjury, to the best of my knowledge the information supplied in this document is true and correct.

Responsible Party Signature — Date: 8/28/23

Chris Baker — Print Name

Director of Facilities Engineering — Title

WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

To be filled in by AQ Staff	
Permit No.:	BLD22-04198E
Date:	
Accepted By:	

APPLICATION FOR AN **INTERNAL COMBUSTION ENGINE** AIR QUALITY STATIONARY SOURCE PERMIT TO OPERATE

Return to: Washoe County Health District
Air Quality Management Division
1001 E. Ninth Street B171
Reno, Nevada 89512
(775) 784-7200

www.OurCleanAir.com

GENERAL INFORMATION FOR ALL AIR QUALITY PERMIT TO OPERATE APPLICATIONS

- Application must be filled out completely for all items that are applicable.
- Application must be signed by a responsible person.
- **For new facilities an additional Operating Permit Fee will be assessed after completion of the air quality emissions review which will be based on potential emissions calculated for the first year.**
- A Plan Review Fee of **$179** must be submitted with this Application

Legal Business Name (Name Permit will be issued under):
Renown Health

Street Address: 1155 Mill St
City: Reno State: Nevada Zip Code: 89502
Business Representative: Chris Baker Title:
Telephone: 775-400-8911 E-Mail: chris.baker@renown.org

1. Mailing Address (if different than above):
Street Address: 245 Liberty Street 4th Floor
City: Reno State: Nevada Zip Code: 89501
Business Representative: Chris Baker Title:
Telephone: 775-400-8911 E-Mail: chris.baker@renown.org

2. Billing Address (if different than above):
Street Address:
City: State: Zip Code:
Billing Representative: Title:
Telephone: E-Mail:

Construction Start Date: 07/01/2022 Operations Start Date: 03/01/2025

WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

Proposed Use of Engine: ☑ Emergency/Standby ☐ Continuous/Regular

Equipment Driven by Engine: Diesel Generator

Engine Make & Model & Size (kW or hp): Caterpillar 3516C 2000kW/2500kVA (Qty 3)

Date of Manufacture & Tier: EPA Stationary Emergency Tier 2

(Attach data sheet and EPA certificate)

Use of Air Pollution Control Apparatus: ☐ **Yes** ☑ **No**

Yes If Yes, please describe (manufacturer, model etc.): _____

Projected Maximum Operating Hours per Year: 50 ea

Typical Load to be operated (% of rated hp): 50

Type of Fuel used: ☐ Natural Gas ☑ Diesel #2 ☐ Gasoline

Sulfur Content of Fuel Oil (if applicable): 0.5997 g/BkW-hr

Amount of Fuel Consumed per year (gallons): 2,500 ea

Is this a mobile unit? ☐ **Yes** ☑ **No**

Has equipment been modified/reconstructed? If yes, when? No

Attach a list of All Internal Combustion Engines at Facility (see sample spreadsheet at www.OurCleanAir.com)

NOTE: Applicant agrees to allow on-site inspection during and after construction by the Air Quality Management Division during working hours without prior notice. The operator must notify this office when the facility commences and completes construction. An official Permit to Operate will not be issued until a final inspection is made and all required test data has been forwarded to this office assuring that equipment will meet all district and state regulations.

This application is submitted in accordance with the provisions of Section 030.000, and under penalty of perjury, to the best of my knowledge the information supplied in this document is true and correct.

Chris Baker Digitally signed by Chris Baker
DN: C=US, E=cbaker@renown.org, CN=Chris Baker
Date: 2023.06.21 10:14:01-07'00'

Responsible Party Signature — Date

Chris Baker — Director of Facilities Engineering

Print Name — Title

Revised 04/2022 - KP

AIR QUALITY MANAGEMENT
1001 East Ninth Street I Reno, Nevada 89520
AQM Office: 775-784-7200 I Fax: 775-784-7225 I OurCleanAir.com
Serving Reno, Sparks and all of Washoe County, Nevada. Washoe County is an Equal Opportunity Employer.

WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

To be filled in by AQ Staff
Permit No.: BLD22-04198E
Date:
Accepted By:

APPLICATION FOR AN AIR QUALITY STATIONARY SOURCE PERMIT TO OPERATE – FUEL BURNING

Return to: Washoe County Health District
Air Quality Management Division
1001 East Ninth Street B171
Reno, Nevada 89512
(775) 784-7200
www.OurCleanAir.com

GENERAL INFORMATION FOR ALL AIR QUALITY PERMIT TO OPERATE APPLICATIONS

- Application must be filled out completely for all items that are applicable.
- Application must be signed by a responsible person.
- **For new facilities an additional Operating Permit Fee will be assessed after completion of the air quality emissions review which will be based on potential emissions calculated for the first year.**
- A Plan Review Fee of **$179** must be submitted with this Application

Legal Business Name (Name Permit will be issued under): Renown Health

Street Address: 1155 Mill St

City: Reno State: Nevada Zip Code: 89502

Onsite Contact: Chris Baker Title:

Telephone: 775-400-8911 E-Mail: chris.baker@renown.org

1. **Mailing Address** (if different than above):

Street Address: 245 Liberty Street 4th Floor

City: Reno State: Nevada Zip Code: 89501

Business Representative: Chris Baker Title:

Telephone: 775-400-8911 E-Mail: chris.baker@renown.org

2. **Billing Address** (if different than above):

Street Address:

City: State: Zip Code:

Representative: Title:

Telephone: E-Mail:

Construction Start Date: 7/1/2022 Operations Start Date: 3/1/2025

Type of Equipment (please attach list if more than one item): See attached

WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

Hours per Day 24 Days per Year 365

Max. Aggregate input BTU/hr: 148,013,600

Type of Fuel used: ☒ Natural Gas ☐ Fuel Oil ☐ Coal ☐ Wood

Type of Back-up Fuel used: ☐ Natural Gas ☒ Fuel Oil ☐ Coal ☐ Wood

Amount of Fuel Consumed per Year: 4,723 gals.

Sulfur Content if Oil or Coal is used: _____

Use of Air Pollution Control Apparatus: ☐ Yes ☒ No

If Yes, please describe (manufacturer, model etc.): _____

Attach List of All Fuel Burning Equipment at Facility (see sample excel spreadsheet at www.OurCleanAir.com):

Any Additional Information – please include attachments if necessary:

NOTE: Applicant agrees to allow on-site inspection during and after construction by the Air Quality Management Division during working hours without prior notice. The operator must notify this office when the facility commences and completes construction. An official Permit to Operate will not be issued until a final inspection is made and all required test data has been forwarded to this office assuring that equipment will meet all district and state regulations.

This application is submitted in accordance with the provisions of Section 030.000, and under penalty of perjury, to the best of my knowledge the information supplied in this document is true and correct.

Chris Baker Digitally signed by Chris Baker DN: C=US, E=cbaker@renown.org, CN=Chris Baker Date: 2023.06.22 13:08:34-07'00'

Responsible Party Signature — Date

Chris Baker — Director of Facilities Engineering

Print Name — Title

Revised 04/2022– KP

AIR QUALITY MANAGEMENT
1001 East Ninth Street | Reno, Nevada 89520
AQM Office: 775-784-7200 | Fax: 775-784-7225 | OurCleanAir.com
Serving Reno, Sparks and all of Washoe County, Nevada. Washoe County is an Equal Opportunity Employer.

WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

Permit #

Business Name
Street Address
City, State Zip

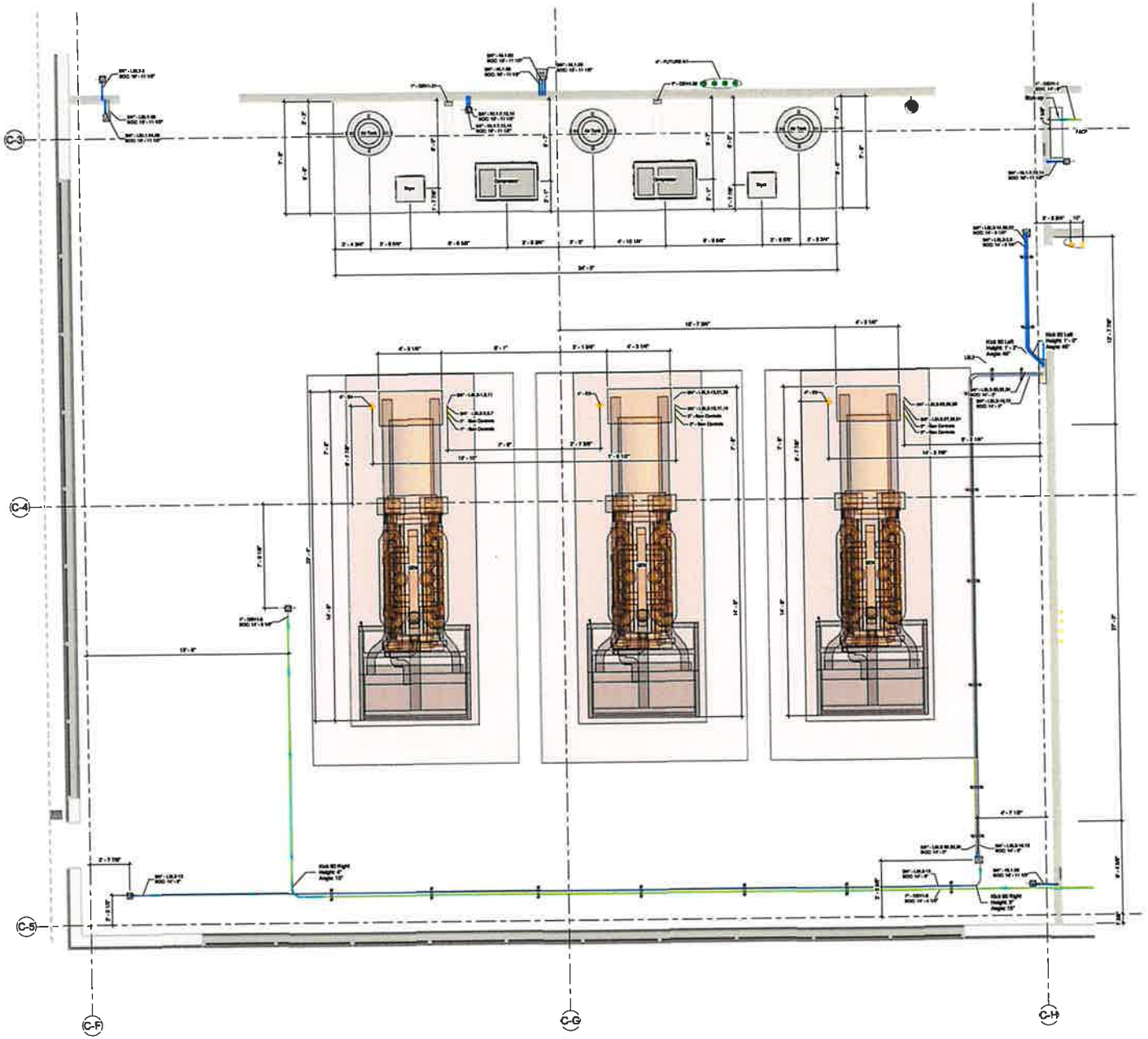
Facility Renown CUP
Fuel Type Natural Gas (primary) / Fuel Oil (backup)
Permit # (if known) BLD22-04198E
(i.e. Natural Gas or Fuel Oil, etc...)

Unit ID	Unit Type	Manuf	Qnty	Model # (if available)	Serial # (if available)	BTU in
1061-0-B-1, 2, 3, & 4	Boiler	CLEAVER BROOKS	4	CBEX ELITE-2W-200-900-150ST		36,741,000 (nat. gas) 262,400 (fuel oil)

AIR QUALITY MANAGEMENT
1001 East Ninth Street | P.O. Box 11130 | Reno, Nevada 89520
AQM Office: 775-784-7200 | Fax: 775-784-7225 | washoecounty.us/health

Public Health

APPENDIX C. SUBMITTALS FOR NEW EQUIPMENT



1 Electrical Rooms - Generator
SCALE: 3/4" = 1'-0"

ime
INTERMOUNTAIN ELECTRIC

PROJECT ADDRESS

RENOWN CUP

REV	DESCRIPTION	DATE
JOB NUMBER		
DRAWN BY		Author
CHECKED BY		Checker
ISSUE DATE		08/09/22

ISSUED FOR REVIEW

Generator Room

E103

CLARK/SULLIVAN
construction

Submittal Transmittal

Detailed, Grouped by Each Number

2115 - Renown Central Utiity Plant (CUP)
1155 Mill Street
Reno, NV 89502

Project # 2115
Tel: 775-772-8820 Fax: Manny@clarksullivan.com

Date: 5/6/2022 **Reference Number:** 102

Transmitted To:
Cory Griffin
Perkins and Will Architect
2218 Bryan Street
Suite 200
Dallas, TX 75201
Tel: 214-283-8743

Transmitted By:
Alicia Lyttle
Clark/Sullivan Construction
905 Industrial Way
Sparks, NV 89431
Tel: 775.355.8500
Fax: 775.355.8063

Qty	Submittal Package No	Description	Due Date	Package Action
1	017 - 235239 - 01	RESUBMITTAL Firetube Boilers	5/20/2022	For Approval

Transmitted For	Delivered Via	Tracking Number
Approval	Email	

Items	Qty	Description	Notes	Item Action
001	1	235239 - Firetube Boilers - Product Data		
002	1	235239 - Firetube Boilers - Shop Drawings		

Cc:	Company Name	Contact Name	Copies	Notes

Remarks

PW Response:
- Revise and Resubmit - structural calculations per Datum comments.
- Exceptions noted for other submittals included
E Vaughn 5-19-2022

A		NO EXCEPTIONS
B	X	EXCEPTIONS AS NOTED
C	X	REVISE AND RESUBMIT
D		REJECTED
E		FOR INFORMATION ONLY
F		NOT REVIEWED

SUBMITTAL REVIEW

Project No. 147439.000

Perkins&Will By: vaughne Date: 05-19-2022

Signature

Signed Date

Savage and Son

Renown Health
Regional Central Utility Plant
Job# 7464

23 52 39
Firetube Boilers

Owner:	Renown Health 1155 Mill Street Reno, NV 89502
Architect:	Perkins & Will 2218 Bryan St, Suite 200 Dallas, TX 75201
Engineer:	WSP Building Systems 425 Market Street, 17th Floor San Francisco, CA 94105
General Contractor:	Clark/Sullivan Construction 905 Industrial Way Sparks, NV 89431
Plumbing/Mechanical Contractor:	Savage and Son, Inc. 3101 Yori Avenue Reno, Nevada 89502

23 52 39 Firetube Boilers

Cleaver Brooks CBEX-2W-200-900-150ST Steam Boilers

Seismic Calculations

Cleaver Brooks CRE-36J6DS Feedwater Economizer

Cleaver Brooks A34B Blowdown Separator

Clark/Sullivan Construction
This submittal has been reviewed by Clark/Sullivan for conformance with project documents. This review does not relieve the subcontractor or material supplier from responsibility from errors or deviations from the drawings and specifications.
Reviewed by: AML
Date: 5.6.2022
Subcontractor: Savage

Savage and Son

23 52 39 Firetube Boilers

Cleaver Brooks CBEX-2W-200-900-150ST Steam Boilers

Seismic Calculations

Resubmittal Notes:

- Correct gas pressure noted.
- Additional seismic anchorage/details to be provided by contractor. Submittal to follow under Section 230548.
- Combustion air intakes as shown with louvers on Mechanical drawings.

WSP:
1. Structural engineer to review seismic calculations (pg 26-31)

PJD/SV, 05/12/2022

- ○ No Exceptions Noted
- ◉ Exceptions Noted No Resubmission Required
- ○ Exceptions Noted Resubmit For Record
- ○ Revise And Resubmit
- ○ Reviewed For Information
- ○ Not Reviewed

WSP

SUBMITTAL REVIEW

REVIEW IS SOLELY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT. THIS REVIEW DOES NOT RELIEVE THE CONTRACTOR FROM TOTAL RESPONSIBILITY FOR QUANTITIES, ERRORS, OMISSIONS OR COMPLIANCE WITH THE INTENT OF THE CONTRACT DOCUMENTS. REVIEW AND APPROVAL BY CONTRACTOR IS REQUIRED BEFORE FABRICATION, SHIPMENT OR INSTALLATION.

ANY ACTION SHOWN IS SUBJECT TO THE REQUIREMENTS OF THE PLANS AND SPECIFICATIONS. CONTRACTOR IS RESPONSIBLE FOR: DIMENSIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. ALL REVISED SUBMITTALS MUST BE RETURNED BY CONTRACTOR WITHIN 15 DAYS FROM RECEIPT OF THE ORIGINAL SUBMITTAL REVIEW.

BY: Peter-Jake Daniels DATE: 5/12/2022

REVIEW OF SHOP DRAWINGS BY ENGINEER SERVES ONLY TO CHECK GENERAL CONFORMANCE WITH CONTRACT DOCUMENTS RELATED ONLY TO THOSE STRUCTURAL ELEMENTS NOTED ON THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS. RESPONSIBILITY FOR STRICT COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS AND CORRECTNESS OF CONTRACTOR'S WORK RESTS SOLELY WITH CONTRACTOR REGARDLESS OF THE ACTION TAKEN OR NOTATIONS MADE OR NOT MADE BY THE ENGINEER ON THE SHOP DRAWINGS. ENGINEER DOES NOT ASSUME ANY RESPONSIBILITY FOR VERIFICATION OF DIMENSIONS, DETAILS, MATERIALS, OR CONSTRUCTION OR FABRICATION MEANS AND METHODS.

DATUM SUBMITTAL NO. 010
RECEIVED 05-13-2022

DATUM ENGINEERS, INC.

- NO EXCEPTIONS TAKEN ☐
- MAKE CORRECTIONS NOTED ☐
- AMEND & RESUBMIT ■
- REJECTED - SEE REMARKS ☐

By: DT
Date 05-18-2022

Datum Comments:

1. Datum's review is only in relation to structural calculations on pages 26-31 of the pdf. Datum takes no exceptions to re-submitting separate from remainder of submittal if acceptable to P&W.

2. Structural calculations shall be signed by a licensed professional engineer as per specification section 23 52 39 article 1.4.B.3.

3. Structural anchorage details signed by a licensed professional engineer as per specification section 23 52 39 article 1.4.B.3.

4. Seismic accelerations may be reduced to value shown on sheet S00C-02 of construction documents. Additionally, revise roof height to match height of roof in the project.

5. Provide calculations for required anchor embedment depth.

6. Calculations indicate design is per IBC 2012, project is per IBC 2018, confirm compliance.

Savage and Son

R.F. MacDonald Co.
your boiler & pump solutions team
- since 1956

STATEMENT OF COMPLIANCE

R.F. MacDonald Co. will furnish the following:

Designation: 1061-B-1, B2, and B3
Three (3) Cleaver-Brooks CBEX Elite-200-900-150ST firetube boiler shall be offered as a self-contained packaged forced draft horizontal firetube steam boiler rated for 900 boiler horsepower with fuel input capacities of 36,741 CFH based on gas of 1000 BTU/CFH. Burner packages will be fully automatic for firing natural gas and #2 Oil. Boiler will be designed for maximum steam pressure of 150 PSIG and have a maximum capacity of 31,050 lbs/hr.

The boiler shall be a multi-pass horizontal firetube updraft boiler with using extended heating surface per rated optimized to reduce boiler foot print. It shall be mounted on a heavy steel frame with an integrated forced draft burner and burner controls. The boilers shall be completely preassembled and fire tested at the factory. The unit shall be ready for immediate mounting on floor or simple foundation and ready for attachment of water, steam, fuel, electrical, vent and blow-down connections.

Boiler Design
The boiler shell will be constructed in accordance with ASME Boiler Code and will receive authorized boiler inspection prior to shipment. A copy of the inspection report shall be furnished to the purchaser. The boiler shall be furnished with a manhole and handholes to facilitate boiler inspection and cleaning. Two lifting eyes shall be located on top of the boiler. Front doors on the boiler shall be davited and sealed with superwool insulation and fastened tightly using locking lugs on steel studs. The rear door shall be fitted with an access plug for rear fireside inspection. The boiler tubes shall not include turbulators, swirlers or other add-on appurtenances. The exhaust gas vent shall be located at the front of the boiler and shall be capable of supporting 2,000 lbs. The boiler vent shall contain a stack thermometer. Observation ports for the inspection of flame conditions shall be provided at each end of the boiler. The boiler insulation shall consist of 2" blanket under a sectional pre-formed sheet metal lagging. The insulation must be readily removable and capable of being reinstalled if required. The entire boiler based frame and other components shall be factory painted before shipment, using a hard-finish enamel coating. The boiler shall contain a chemical feed connection.

Boiler Trim (Mounted)
- Feedwater globe and check valve
- Steam non-return valve and stop valve with ASME spool piece
- Feedwater control valve and bypass piping
- Quick and slow blowdown valves
- Surface blowoff manual stop valve and metering valve
- Surface blowdown conductivity controller
- Sample cooler mounted and piped
- Vacuum breaker

- Main and auxiliary low water cutoffs
- High water alarm
- Primary gas train
- Variable speed driver w/ bypass for blower motor
- Pilot gas train
- Main fused disconnect
- Uninterruptible power supply
- Oil train and oil pump

Boiler Trim (Shipped Loose For Field Installation)

- ASME rated pressure relief valve
- Steam stop and non-return valves
- O2 Trim
- BACnet MSTP ProtoNode
- Ladder and platforms

Note: Seismic design with calculation included. Stamp non-CA PE License.

Burner

Forced draft burner of the gun design with hinged access for inspection and service. Reversed curve fabricated aluminum blower fan. Burner shall be of the high radiant multi-port type for natural gas. Gas burner piping on all units shall include primary and secondary gas shutoff valves, motor operated with proof of closure switches and plugged leakage test connections. The main gas valves shall be wired to close automatically in the event of power failure, flame failure, low water or any safety shutdown condition.

HAWK 4000 – Advanced Burner Control System

The Hawk 4000 Advanced System integrates a programmable logic controller, touch screen graphical human-machine interface (HMI), and burner management control, used to control and monitor the complete boiler system. The system offers advanced technology and advanced features for Burner Management and monitoring, firing rate control, thermal shock protection, variable speed drive on combustion air fan, remote monitoring, building automation system monitoring interface, integrated O_2 Monitoring and Air trim. The HMI provides several user interactive screens to display and indicate the status of the boilers operation, operating parameters and integrated control such as the burner management controller.

Control Trim

- Parallel Positioning Combustion Control
- Combustion air control
- Automatic Sequencing – standby, re-purge, pilot flame, main flame, run and post purge.
- Flame proving and lockout on flame failure during pilot flame proving, main flame proving, or run.
- Low fire damper/valve position for flame ignition trials.
- Touch Screen Interface
  - 10" Panel View Plus Color HMI
- High Stack Flue Gas Temperature Monitoring
- Hot Stand By
- Dual Fuel Manual Selector Switch
- BAS System – ProtoNode – BACnet
- UL Label Panel

Emissions Guarantee

The boiler will include an emission control package designed and supplied by Cleaver-Brooks to meet a NO_x emission limit of 30 ppm and CO limit of 100 ppm each corrected to 3% O_2 while firing **natural gas only.**

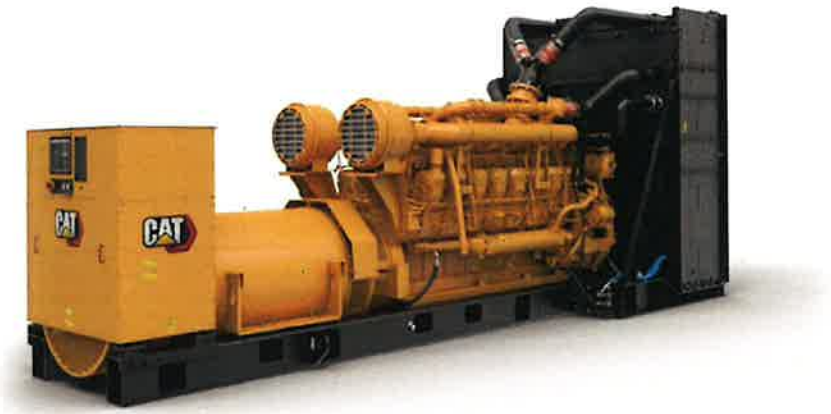
Requirements

Blower motor: 460V/3Ph/60Hz
Gas pressure: 5 PSIG
A control circuit transformer will be provided to supply 120V/1Ph/60Hz to the control circuit

RENOWN HEALTH REGIONAL CENTRAL UTILITY PLANT

ATTN: William Austin
4750 Longley Lane #105
Reno, NV 89052
(775) 850-3600

DIESEL STANDBY GENERATOR SET SUBMITTAL



*Images may not reflect actual packages

THREE (3) CAT 3516C Standby Diesel Generator Sets, Rated at 2000kW

Revision 2, Submitted: May 31, 2022

Submittal Prepared By:

Hisham Mannaa, Project Engineer
Cashman Power Solutions
3300 Saint Rose Pkwy.
Henderson, NV 89052
hmannaa@cashmanequipment.com
(725) 202-5982

Scott Rhoden, Engine Business Manager · Troy Lowe, Sales Engineer · Geoffrey Torres, Sales Engineer · Kerry Barrick, Project Coordinator · Hisham Mannaa, Project Engineer

CASHMAN Power Solutions CAT

DIESEL STANDBY GENERATOR SET SUBMITTAL

THREE (3) CAT 3516C Standby Diesel Generator Sets, Rated at 2000kW

Renown Health Regional Central Utility Plant

Approval of Submittal

Client Signature _____ Date _____

By signing above, the client confirms approval of the submitted package and all specifications therein. This includes but is not limited to dimensions, the design and all specified components.

The client understands that any changes to the order requested after this acceptance will require a formal change order. Any changes made to the approved submitted package may add time and/or cost to the production.

PROJECT NAME: RENOWN HEALTH REGIONAL CENTRAL UTILITY PLANT
SALES ENGINEER(S): TROY LOWE
GEOFFREY TORRES
PROJECT MANAGER: HISHAM MANNAA

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Renown Health Regional Central Utility Plant

Diesel Standby Generator Set Submittal

Tab 1: General Information

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1.2 Project Clarifications, Deviations & Exceptions
1.3 Installation Notes and Considerations
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CASHMAN Power Solutions CAT

RENOWN HEALTH REGIONAL CENTRAL UTILITY PLANT
CASHMAN CAT - BILL OF MATERIALS

THREE (3) Caterpillar 3516C Diesel Standby Generator Sets

Model: CAT 3516C
Rating: 2000kW @ 0.8 PF (Standby Rated)
Voltage: 4160V, 3-phase, 4-wire, 60 Hz
Control Panel: EMCP 4.2B Generator Set Controller

Generator standard equipment and options including (Qty. 1 each unless otherwise specified):

MOUNTING SYSTEM
- Spring-type vibration isolators with integral seismic restraint and external adjustment.

ENGINE
- Caterpillar Diesel Engine (both on- and off-road #2 ULSD acceptable)
- 1800 RPM rated engine speed
- Electronic Isochronous Governor

ENGINE COOLING SYSTEM
- Rated for 104°F
- Unit Mounted Radiator
- Jacket Water Heater (maintains coolant temperature at 130°F for quick engine starting)
- 50/50 Antifreeze/Water Mixture

ELECTRIC STARTING SYSTEM
- Qty. 4 – 12V CAT Engine Starting Battery Set (Qty. 4 – 153-5720)
- Heavy-Duty Dual 24VDC Electric Starting Motors (Left Hand Mounted)
- 24V, 45A Battery Charging Alternator (charges engine starting battery set only)

AIR STARTING SYSTEM
- Qty. 3 – 400 Gallon Vertical Mount Air Storage Tanks
- Qty. 2 – 40 HP Rotary Screw Air Compressors, 125 PSIG Max. Pressure, MK5 Graphic Touch Controller
- Qty. 2 – Non cycling Refrigerated Air Dryers
- Engine Mounted Pneumatic Starting Motor (Right Hand Mounted)

CERTIFICATIONS:
- Engine Meets Current EPA Tier II Emissions Requirements for Diesel Standby Generator Sets

EXHAUST SYSTEM
- Critical grade exhaust silencer system. This item ships loose for contractor installation, and includes critical silencer, flex connectors, wall thimble, and rain cap. Intermediary piping and insulation not included and is by others.

GENERATOR AND GENERATOR ATTACHMENTS
- Brushless, Revolving Field Type Generator, Permanent Magnet Excitation
- EM15 Integrated Voltage Regulator
- Dual bearing, 105°C temperature rise rating
- 1000A Buss Bar

EMCP 4.2B CONTROL PANEL
- LCD Display with adjustable contrast and backlight with auto power off AC metering: Volts, Amps, Frequency, Battery Volts, Engine Hours, Engine Jacket Water Temperature, Lube Oil Pressure, Engine Speed, and more.
- Communication: MODBUS TCP
- Local NFPA 99-110 Annunciator (factory installed on generator set control cabinet)
- Options:
- (Qty. 1) – Remote Annunciator Module (shipped loose for onsite contractor installation)
- (Qty. 1) – DIO Module (factory installed in generator control panel)

STARTUP, TESTING, & COMMISSIONING
- Startup Services with Technician (Includes Lube Oil and Coolant)
- Onsite Load Bank Test: 2-Hour Resistive (1.0 PF)
- Customer Training on Operation and Maintenance

WARRANTY
- Standard CAT Warranty

MAINTENANCE
- 2 Year Customer Service Agreement

CASHMAN Power Solutions CAT

PROJECT CLARIFICATIONS, DEVIATIONS & EXCEPTIONS

Cashman Power takes general exception to specified products, services, and attachments which are proprietary to any other manufacturer.

1. Submittal must be reviewed and approved prior to ordering of equipment.
2. All installation provided by others.
3. All nameplates, infrared scanning and coordination study provided by others.
4. CAT standard startup/commissioning services included.
5. **Section 26 32 13, 2.2.D(3):** CAT 3516C, 2000kW, 3-Phase, 4-Wire, in lieu of 3-Phase, 3-Wire Generator.
6. **Section 26 32 13, 2.3N(7):** Battery Heater is not needed for indoor system and will not be provided.

RENOWN HEALTH REGIONAL CENTRAL UTILITY PLANT
CAT GENERATOR SET
INSTALLATION SUMMARY

SYSTEM DATA

Engine Model	3516C
Engine Displacement	69 L
Generator Rating	2500kVA/2000kW
Voltage (V)	4160V
Phase	Three
Hertz	60
Fuel System	Diesel
Full Load Fuel Consumption	133.6 gal/hr.
Battery Voltage	24VDC

GENERATOR SET PACKAGE DIMENSIONS
(Approximate, not for construction use)

Height	138 in.
Width	103 in.
Length	269 in.

SYSTEM WEIGHTS

Package Weight	~43,850 lbs.
Total Package Weight	~45,390 lbs.

GENERATOR INSTALLATION CONSIDERATIONS

ACCESS
Cashman service department must be allowed adequate access to the job site for start-up and testing of equipment during normal business hours.

CONNECTIONS
Due to vibrations, all connections to the generator set should be flexible (fuel piping, exhaust piping, electrical conduit, etc.)

CONTROL WIRING
All control wiring must be run in separate conduits from any power wiring to prevent induced voltages. Stranded copper wire is required.
Pull 25% additional wire for spares
Refer to previous sheet for specific information

ELECTRICAL AND FUEL STUB UP
All stub up information can be found in the drawing information that is included in the submittal.

FOUNDATION RECOMMENDATIONS
Foundation depth should be calculated using the wet weight provided in the submittal
Foundation should extend a minimum of 12 inches beyond the generator set base rails

VIBRATION ISOLATOR PADS
Vibration isolators are installed under the generator set rails. Generator set needs to be bolted to the floor.

POWER REQUIREMENTS
Coolant heater, battery charger, day tank controls or any other ac loads required for engine to run, require emergency source normal power input. Refer to previous sheet for details on voltages and load requirements.

VENTILATION
The generator set should be located so that clean, cool air is available to the air intake. Radiator exhaust air should be free of flow restrictions. We *recommend* a minimum of 5 ft clearance on all sides. If walls are present, additional space may be required along with intake and discharge louvers added. Failure to

prevent hot air recirculation from the engine radiator and exhaust discharge could cause the genset to overheat.

UNLOADING CONSIDERATION
When off-loading equipment with cranes, spreader bars should be used to avoid damaging the equipment. Refer to the dry weight provided for offloading.

DIVISION OF RESPONSIBILITIES

CONTRACTOR'S RESPONSIBILITIES

The following work must be completed by the Contractor prior to startup of the unit per drawings and instructions included in the Contractors Submittal:

FOUNDATION
Off-load and set equipment on a foundation designed and constructed according to load requirements and soil conditions. Provide anchor calculations per local code and requirements. Vibration isolators should be adjusted prior to piping/wiring interconnection.

WIRING
Supply and terminate all interconnecting 12 or 24 VDC control wiring. Wire AC power to jacket water heater, battery charger and all auxiliary equipment including ATS and Switchgear. Wire all power cabling between generator, switchgear, ATS and auxiliary equipment.

FUEL
Provide an adequate supply of good quality fuel. Caterpillar guidelines shall be provided upon request.

CASHMAN EQUIPMENT COMPANY'S RESPONSIBILITIES

In addition to supply of equipment and delivery to the jobsite, Cashman Equipment Company will provide the following:

PROJECT ASSISTANCE
Project assistance of all equipment provided in Cashman's Scope of Supply including design information and submittal drawings. Project support and coordination, as required. Provide Operation and Maintenance Manuals, spare parts list and test reports, if required.

START-UP

Provide the services of a technician to startup and test the generator set, as required. Startup activities include check and install engine coolant and lubricating oil as necessary, install battery electrolyte, check control functions, check automatic operation and load test, if required.

Should you have any questions regarding this submittal or installation procedures, please contact:

GEOFF TORRES
Project Manager
Cashman Equipment Co.
3300 St. Rose Parkway
Henderson, NV 89052
Phone (800) 937-2326
Cell: (702) 343-0448
Email: GeoffreyTorres@cashmanequipment.com

Interconnect Requirements - Renown Health Regional Central Utility Plant					
Conduit Number	From	To	Required Wiring	Purpose	Voltage
#1	Generator Control Panel	New/Existing Switchgear	Switchgear supplier to specify requirements	Generator Load Sharing and Voltage Regulation Controls	24VDC or less
#2		Generator Remote Annunicator	Qty. (4) 14 AWG or larger THHN	24VDC Annunciator Power, Spare	24VDC or less
			Qty. (1) Belden 9841 Cable	RS-485 Communications Link for Remote Annunciator	5VDC or less
#3		SCADA/BMS System	Contractor/End-User to Specify Monitoring Protocol and Coordinate with Cashman	Communications link for SCADA/BMS Generator Monitoring	5VDC or less
#4	Panel 1061-0-LSL2	Generator Control Panel	20A, 120VAC Wiring	Auxiliary Power Distribution for Battery Charger	120V Single Phase
	Panel 1061-0-LSL2	Generator Control Panel	10A, 208VAC Wiring	Auxiliary Power Distribution for Alternator Space Heater	208V Single Phase
	Panel 1061-0-LSL2	Generator Control Panel	44A, 208VAC Wiring	Auxiliary Power Distribution for Jacket Water Heater	208V Single Phase

RENOWN HEALTH REGIONAL CENTRAL UTILITY PLANT

DIESEL STANDBY GENERATOR SET SUBMITTAL

TAB 2: SHOP DRAWINGS

2.1 CAT 3516C DIESEL STANDBY GENERATOR SET

- 2.1.1 LAYOUT/INSTALLATION DRAWINGS
- 2.1.2 WIRING DIAGRAMS/SCHEMATICS

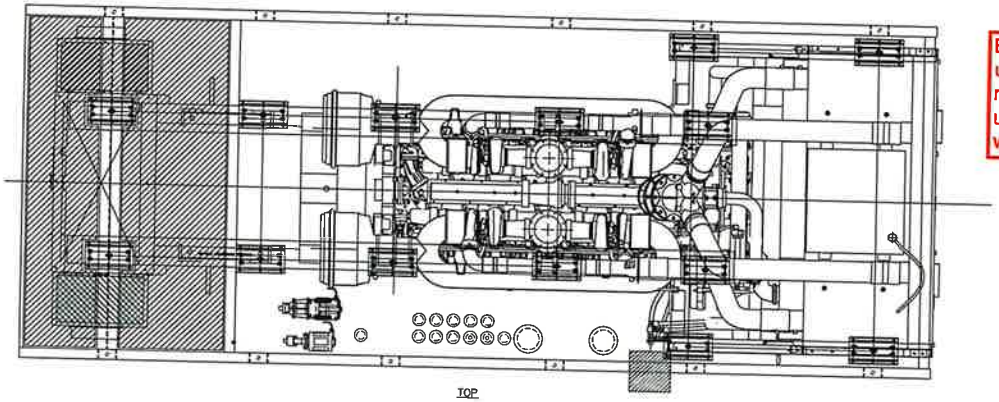
SHOP DRAWINGS

CAT 3516C DIESEL STANDBY GENERATOR SET

LAYOUT/INSTALLATION DRAWINGS

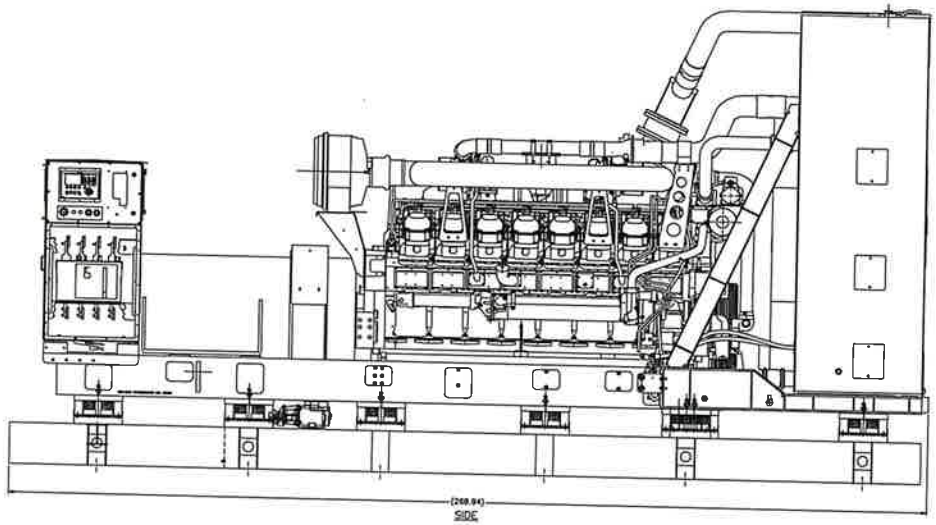
QUOTE #	TANK CAPACITY	GENSET MODEL	GENSET FOOTPRINT	TANK WEIGHT
824455 REV1	220 GAL	3516C 2000	267"L X 97"W	3,850 LBS

PRELIMINARY DRAWING

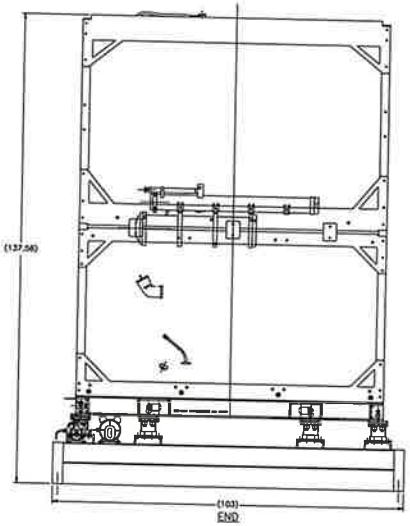


TOP

Breakers are shown on the units however breakers will not be installed on these units. Generator breakers will reside in MV Switchgear.



SIDE



END

1 – 1

REVISIONS

REV	DATE:	CHANGE MADE	BY
1	6/1/22	ADDED LEFT HAND SIDE BREAKER	BJL

REVISIONS

REV	DATE:	CHANGE MADE	BY

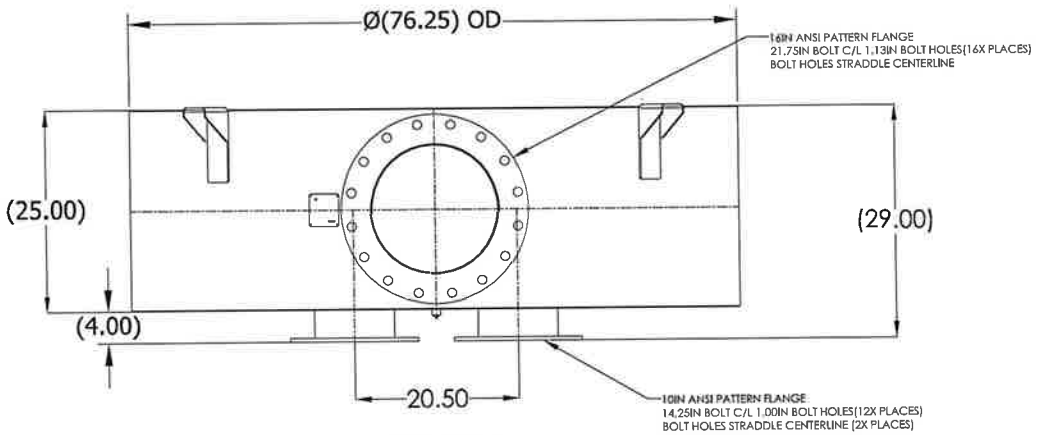
SUBBASE TANK W/ RUPTURE BASIN

CUSTOMER/ID: CASHMAN CAT
JOB REF: RENOWN MEDICAL CENTER CENTRAL PLANT
DRAWING REF: X
DWG #: 824455
DATE: 3/31/22
DRAWN BY: JDM

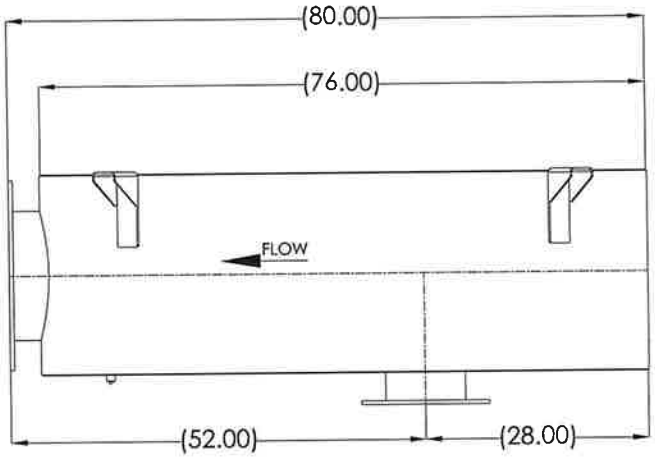
Underwriters Laboratories Inc. File No. MH18482

GLOBAL POWER COMPONENTS

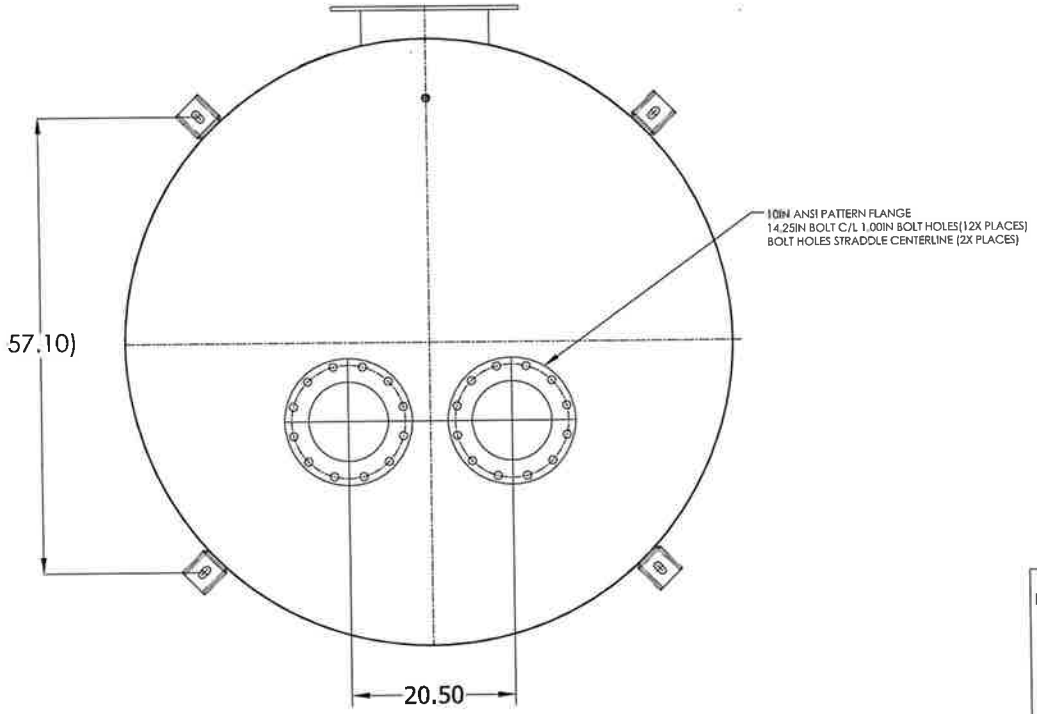
REVISIONS			
REV.	DESCRIPTION	NAME	DATE



OUTLET VIEW



SIDE VIEW



BOTTOM (INLET) VIEW

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL: ± 1/8"
TWO PLACE DECIMAL: ± .13
THREE PLACE DECIMAL: ± .125
ANGULAR: ± 2°
DIM = CRITICAL DIMENSION
(DIM) = REFERENCE DIMENSION

DRAWING TYPE: SALES OUTLINE

DRAWN	CAF	10/18/21
CHECKED	-	-

FILE NAME: -

THIRD ANGLE PROJECTION

FINISH: HIGH HEAT BLACK

MATERIAL: ALUMINIZED STEEL

GT EXHAUST / NELSON
1560 WILLIAMS DRIVE
STOUGHTON, WI 53589
PH: 608-719-1800
WWW.GTEXHAUST.COM
WWW.NELSONGP.COM

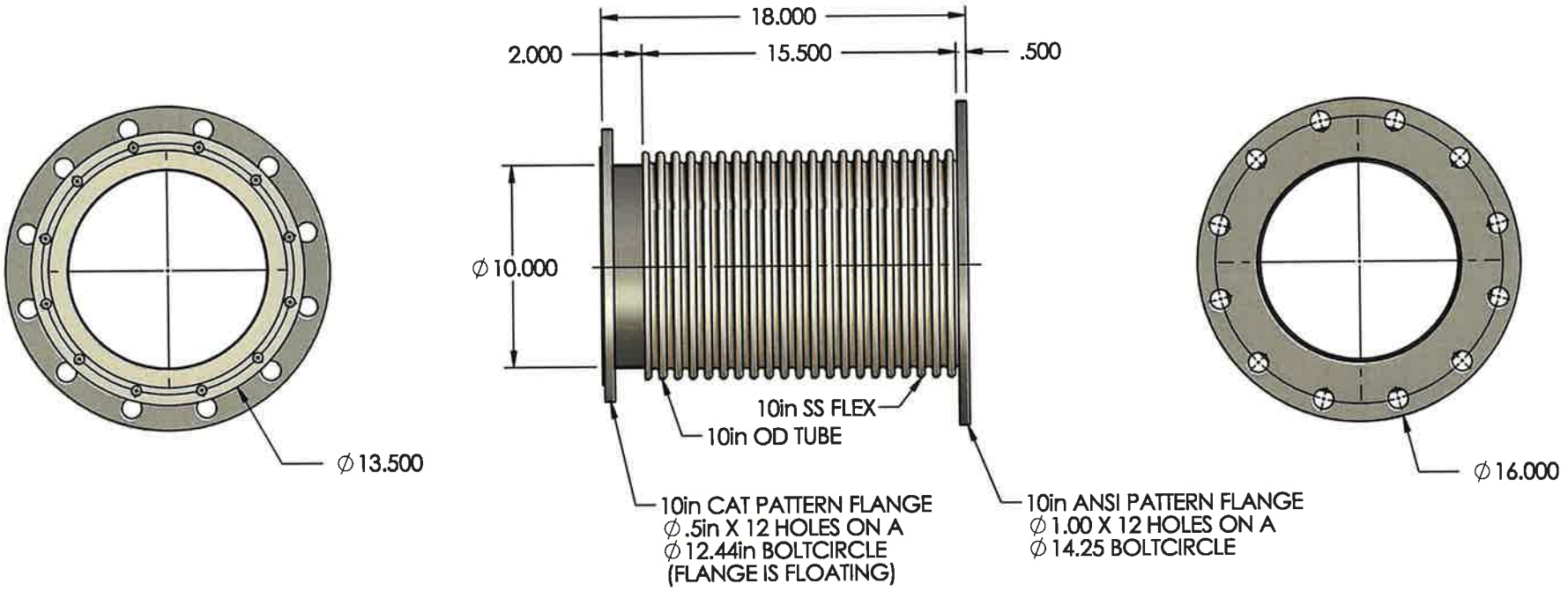
SMART / DRAWING#: GS303279

CATALOG: A416-C1-10-5116-2-TOP

TITLE: CRITICAL GRADE 16IN SERENITY Silencer STYLE 2 Dual 10IN BISO 1IN THERMAL PACKING TOP Brackets CATERPILLAR 3516

REV A

SCALE: NONE | WEIGHT: LBS | SHEET 1 OF 1



GA300079

UNLESS OTHERWISE SPECIFIED:	DRAWN	DWZ	11/13/08
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ±1/8" ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ±.13 THREE PLACE DECIMAL ±.125	CHECKED		
	ENG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:			
MATERIAL SEE BOM			
FINISH NONE			
DO NOT SCALE DRAWING			

GT EXHAUST

PART # 10-1F1-1018-CAT

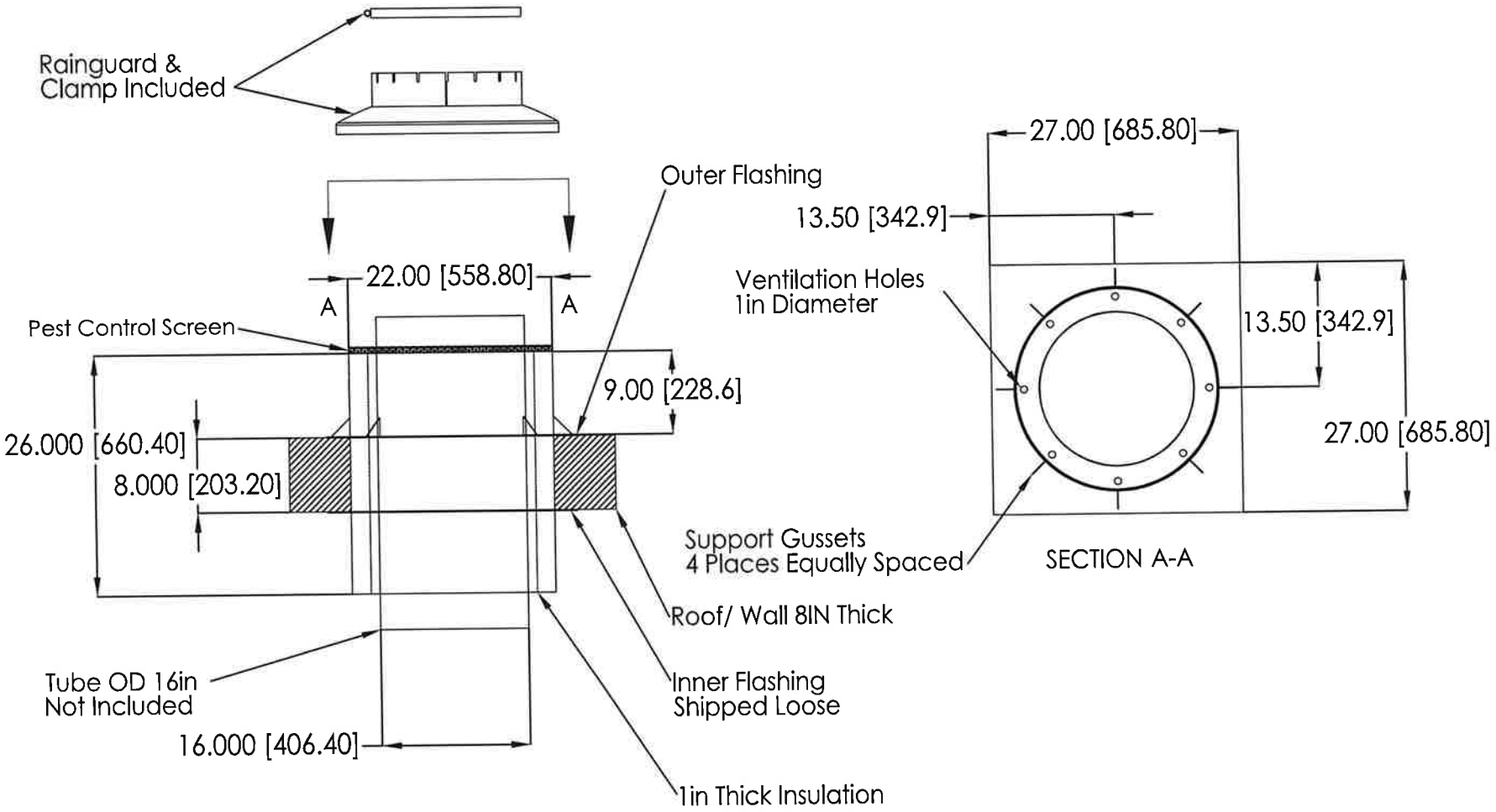
TITLE: 10" FLEX WITH A ANSI PATTERN FLANGE AND A FLOATING CAT. ENGINE FLANGE

SIZE	DWG. NO.	REV
A	10-1F1-1018-CAT	C

SCALE: 1:8 | WEIGHT: 45.8873 | SHEET 1 OF 1

5 4 3 2 1

REVISIONS			
REV.	DESCRIPTION	NAME	DATE



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ± 1/8" TWO PLACE DECIMAL: ± .13 THREE PLACE DECIMAL: ± .125 ANGULAR: ± 1° DIM = CRITICAL DIMENSION (DIM) = REFERENCE DIMENSION	DRAWING TYPE: SALES OUTLINE	GT EXHAUST / NELSON 1560 WILLIAMS DRIVE STOUGHTON, WI 53589 PH: 608-719-1800 www.GTEXHAUST.COM www.NELSONGP.COM	
	DRAWN: CAF 08/02/18	SMART / DRAWING#: GA300346	
	CHECKED: - -	CATALOG: 20-NC-1600 GA300346	
	FILE NAME: -	TITLE: THIMBLE KIT 16IN NON-Combustible STYLE Standard 8IN ROOF/WALL 26IN OAL	REV A
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF NELSON GLOBAL PRODUCTS (NGP). ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF NGP IS PROHIBITED.	THIRD ANGLE PROJECTION		
	FINISH: HIGH HEAT BLACK		
	MATERIAL: ALUMINIZED STEEL	SCALE: NONE	WEIGHT: LBS	SHEET 1 OF 1

WIRING DIAGRAMS/SCHEMATICS

SHEET	DESCRIPTION
1	SHEET INDEX 1
2	SHEET INDEX 2
3	SHEET INDEX 3
4	NOTES
5	NOTES
6	ABBREVIATIONS & SYMBOLS
7	COMPONENT LAYOUT – SHEET 1 OF 11 (MODULAR CONTROL PANEL/VR SUBPAN)
8	COMPONENT LAYOUT – SHEET 2 OF 11 (MODULAR CONTROL PANEL)
9	COMPONENT LAYOUT – SHEET 3 OF 11 (MODULAR CONTROL PANEL)
10	COMPONENT LAYOUT – SHEET 4 OF 11 (2700/941 FRAME GENERATORS)
11	COMPONENT LAYOUT – SHEET 5 OF 11 (3000 FRAME GENERATORS)
12	COMPONENT LAYOUT – SHEET 6 OF 11 (B5600H4 GENERATORS)
13	COMPONENT LAYOUT – SHEET 7 OF 11 (Y5000 GENERATORS)
14	COMPONENT LAYOUT – SHEET 8 OF 11 (RECESSED MODULAR CONTROL PANEL/EMCP 4.2B)
15	COMPONENT LAYOUT – SHEET 9 OF 11 (RECESSED MODULAR CONTROL PANEL/EMCP 4.3)
16	COMPONENT LAYOUT – SHEET 10 OF 11 (GAS MODULAR CONTROL PANEL)
17	COMPONENT LAYOUT – SHEET 11 OF 11 (GDI CONTROL PANEL)
18	CUSTOMER INTERCONNECTS SHEET 1 OF 11 (EMCP 4.2B, 4.3, 4.4)
19	CUSTOMER INTERCONNECTS SHEET 2 OF 11 (EMCP 4.2B)
20	CUSTOMER INTERCONNECTS SHEET 3 OF 11 (EMCP 4.2B, 4.3, 4.4)
21	CUSTOMER INTERCONNECTS SHEET 4 OF 11 (LOW VOLTAGE TO WALL MOUNT)
22	CUSTOMER INTERCONNECTS SHEET 5 OF 11 (2700/3000 FRAME TO WALL MOUNT)
23	CUSTOMER INTERCONNECTS SHEET 6 OF 11 (B5600H4/Y5000 TO WALL MOUNT)
24	BLANK
25	BLANK
26	CUSTOMER INTERCONNECTS SHEET 7 OF 11 (EMCP 4.3/4.4)
27	CUSTOMER INTERCONNECTS SHEET 8 OF 11 (HARDWIRED DBA & LSLD)
28	CUSTOMER INTERCONNECTS SHEET 9 OF 11 (GAS MODULAR CONTROL PANEL)
29	CUSTOMER INTERCONNECTS SHEET 10 OF 11 (GAS MODULAR CONTROL PANEL)
30	CUSTOMER INTERCONNECTS SHEET 11 OF 11 (1G1U)
31	AC SCHEMATIC – SHEET 1 OF 12 (LOW VOLTAGE 1200/1400/1600/1800 FRAMES)
32	AC SCHEMATIC – SHEET 2 OF 12 (LOW VOLTAGE CDVR OPTION)
33	AC SCHEMATIC – SHEET 3 OF 12 (MED VOLTAGE (3300–4160V) IVR OPTION)
34	AC SCHEMATIC – SHEET 4 OF 12 (MED VOLTAGE (3300–4160V) CDVR OPTION)
35	AC SCHEMATIC – SHEET 5 OF 12 (SWITCHGEAR TYPE PT AND DCT OPTION)
36	AC SCHEMATIC – SHEET 6 OF 12 (2400V 1400/1600/1800 FRAMES)
37	AC SCHEMATIC – SHEET 7 OF 12 (2700 FRAME GENERATORS)
38	AC SCHEMATIC – SHEET 8 OF 12 (3000 FRAME GENERATORS)
39	AC SCHEMATIC – SHEET 9 OF 12 (B5600H4 GENERATORS)
40	AC SCHEMATIC – SHEET 10 OF 12 (Y5000 GENERATORS)
41	AC SCHEMATIC – SHEET 11 OF 12 (LOW VOLTAGE GDI OPTION)
42	AC SCHEMATIC – SHEET 12 OF 12 (HIGH VOLTAGE GDI OPTION)

SHEET	DESCRIPTION
43	DC SCHEMATIC – SHEET 1 OF 18 (EMCP 4.2B)
44	DC SCHEMATIC – SHEET 2 OF 18 (EMCP 4.2B)
45	DC SCHEMATIC – SHEET 3 OF 18 (EMCP 4.2B)
46	DC SCHEMATIC – SHEET 4 OF 18 (EMCP 4.3/4.4)
47	DC SCHEMATIC – SHEET 5 OF 18 (EMCP 4.3/4.4)
48	DC SCHEMATIC – SHEET 6 OF 18 (EMCP 4.3/4.4)
49	DC SCHEMATIC – SHEET 7 OF 18 (CIRCUIT BREAKERS)
50	DC SCHEMATIC – SHEET 8 OF 18 (2700 FRAME GENERATORS)
51	DC SCHEMATIC – SHEET 9 OF 18 (3000 FRAME GENERATORS)
52	DC SCHEMATIC – SHEET 10 OF 18 (B5600H4 GENERATORS)
53	DC SCHEMATIC – SHEET 11 OF 18 (Y5000 GENERATORS)
54	DC SCHEMATIC – SHEET 12 OF 18 (3500 MUI)
55	DC SCHEMATIC – SHEET 13 OF 18 (3500 MUI)
56	DC SCHEMATIC – SHEET 14 OF 18 (3500 MUI)
57	DC SCHEMATIC – SHEET 15 OF 18 (G3500 GAS)
58	DC SCHEMATIC – SHEET 16 OF 18 (G3500 GAS)
59	DC SCHEMATIC – SHEET 17 OF 18 (G3500 GAS)
60	DC SCHEMATIC – SHEET 18 OF 18 (CIRCUIT BREAKER EMAX2)
61	CAT CONNECT
62	COMMUNICATIONS – CAN1
63	COMMUNICATIONS – CAN2
64	AC OPTIONS – SHORE POWER SHEET 1 OF 5 (1200,1200/1400,1600,1800 FRAMES)
65	AC OPTIONS – SHORE POWER SHEET 2 OF 5 (2700 FRAME GENERATORS)
66	AC OPTIONS – SHORE POWER SHEET 3 OF 5 (3000 FRAME GENERATORS)
67	AC OPTIONS – SHORE POWER SHEET 4 OF 5 (B5600H4 GENERATORS)
68	AC OPTIONS – SHORE POWER SHEET 5 OF 5 (Y5000 GENERATORS)
69	SPEED AND VOLTAGE CONTROL
70	3516C/E 50 HZ LOW EMISSIONS (GEARBOX WIRING)
71	MGDL NETWORK – SHEET 1 OF 4
72	MGDL NETWORK – SHEET 2 OF 4
73	MGDL NETWORK – SHEET 3 OF 4
74	MGDL NETWORK – SHEET 4 OF 4
75	12V COMMON ENCLOSURE – AC SCHEMATIC
76	12V COMMON ENCLOSURE – DC SCHEMATIC – SHEET 1 OF 2 (EMCP 4.2B)
77	12V COMMON ENCLOSURE – DC SCHEMATIC – SHEET 2 OF 2 (EMCP 4.3/4.4)
78	12V COMMON ENCLOSURE – CONDUIT – SHEET 1 OF 2
79	12V COMMON ENCLOSURE – CONDUIT – SHEET 2 OF 2
80	ENGINE INTERFACE HARNESS SHEET 1 OF 17 (ON PACKAGE CONTROLS (3500))
81	ENGINE INTERFACE HARNESS SHEET 2 OF 17 (OFF PACKAGE CONTROLS (3500))
82	ENGINE INTERFACE HARNESS SHEET 3 OF 17 (ON PACKAGE CONTROLS (C27/C32))
83	ENGINE INTERFACE HARNESS SHEET 4 OF 17 (OFF PACKAGE CONTROLS (C27/C32))
84	ENGINE INTERFACE HARNESS SHEET 5 OF 17 (ON PACKAGE CONTROLS (3500 MUI))

METRIC 521–9364

SHEET INDEX 1
CATERPILLAR: CONFIDENTIAL GREEN

1E5167A	INT–PROP	
1E2733	DRAWING – AUTOCAD	
1E0198W	BRAND MARKINGS	
1E0013G	CONFIDENTIALITY	
1E0012A	INTERPRETATION	
1E0011	INTPR & TOL	

	NAME	DATE
DSN	ARUN GOPAL	
CHK	LYLE SEWALL	
APPD	J.D. ELDER	

RECORDS

01	23AUG19	
00	11JUL18	

CATERPILLAR INC.

DIAGRAM – WIRING
MODULAR CONTROLS
521–9364 W944 D

SHEET	DESCRIPTION
85	ENGINE INTERFACE HARNESS SHEET 6 OF 17 (OFF PACKAGE CONTROLS (3500 MUI))
86	ENGINE INTERFACE HARNESS SHEET 7 OF 17 (ON PACKAGE CONTROLS (3500 DGB))
87	ENGINE INTERFACE HARNESS SHEET 8 OF 17 (ON PACKAGE CONTROLS (C175-16))
88	ENGINE INTERFACE HARNESS SHEET 9 OF 17 (ON PACKAGE CONTROLS (C175-16 T4I))
89	ENGINE INTERFACE HARNESS SHEET 10 OF 17 (OFF PACKAGE CONTROLS (C175-16))
90	ENGINE INTERFACE HARNESS SHEET 11 OF 17 (ON PACKAGE CONTROLS (GAS-G3500 C/E))
91	ENGINE INTERFACE HARNESS SHEET 12 OF 17 (ON PACKAGE CONTROLS (GAS-G3500 STANDBY))
92	ENGINE INTERFACE HARNESS SHEET 13 OF 17 (ON PACKAGE CONTROLS (GAS-G3500 A))
93	ENGINE INTERFACE HARNESS SHEET 14 OF 17 (ON PACKAGE CONTROLS (GAS-G3500 B))
94	ENGINE INTERFACE HARNESS SHEET 15 OF 17 (ON PACKAGE CONTROLS (GAS-G3500 H GEARBOX))
95	ENGINE INTERFACE HARNESS SHEET 16 OF 17 (OFF PACKAGE CONTROLS (GAS-G3500 H))
96	ENGINE INTERFACE HARNESS SHEET 17 OF 17 (ON PACKAGE CONTROLS (GAS-G3500H))
97	ENGINE INTERFACE HARNESS SHEET (3516/C175 CEM/AFTERTREATMENT CONNECTIONS)
98	ENGINE SCHEMATIC - SHEET 1 OF 4 (C27/C32 ENGINE)
99	ENGINE SCHEMATIC - SHEET 2 OF 4 (C27/C32 ENGINE)
100	ENGINE SCHEMATIC - SHEET 3 OF 4 (C27/C32 ENGINE)
101	ENGINE SCHEMATIC - SHEET 4 OF 4 (C27/C32 ENGINE)
102	ENGINE SCHEMATIC - SHEET 1 OF 2 (3500 EUI ENGINE)
103	ENGINE SCHEMATIC - SHEET 2 OF 2 (3500 EUI ENGINE)
104	ENGINE SCHEMATIC - SHEET 1 OF 2 (3500 MUI ENGINE)
105	ENGINE SCHEMATIC - SHEET 2 OF 2 (3500 MUI ENGINE)
106	ENGINE SCHEMATIC - SHEET 1 OF 5 (3516 DGB ENGINE)
107	ENGINE SCHEMATIC - SHEET 2 OF 5 (3516 DGB ENGINE)
108	ENGINE SCHEMATIC - SHEET 3 OF 5 (3516 DGB ENGINE)
109	ENGINE SCHEMATIC - SHEET 4 OF 5 (3516 DGB ENGINE)
110	ENGINE SCHEMATIC - SHEET 5 OF 5 (3516 DGB ENGINE)
111	ENGINE SCHEMATIC - SHEET 1 OF 3 (C175-16/20 ENGINE)
112	ENGINE SCHEMATIC - SHEET 2 OF 3 (C175-16/20 ENGINE)
113	ENGINE SCHEMATIC - SHEET 3 OF 3 (C175-16/20 ENGINE)
114	ENGINE SCHEMATIC - SHEET 1 OF 5 (G3500 C/E)
115	ENGINE SCHEMATIC - SHEET 2 OF 5 (G3500 STANDBY)
116	ENGINE SCHEMATIC - SHEET 3 OF 5 (G3500 A)
117	ENGINE SCHEMATIC - SHEET 4 OF 5 (G3500 B)
118	ENGINE SCHEMATIC - SHEET 5 OF 5 (G3500 H)
119	ENGINE SCHEMATIC - (GAS-G3500) SERIES

METRIC 521-9364

1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
1E0011 INTPR & TOL

DSN ARUN GOPAL
CHK LYLE SEWALL
APPD J.D. ELDER
RECORDS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM [INCHES] DIMENSIONS W/O TOL ARE BASIC

SCALE: NONE
SHEET 2 OF 119

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CATERPILLAR INC.

DIAGRAM - WIRING
MODULAR CONTROLS
521-9364 - W944 D

SHEET INDEX 2
CATERPILLAR: CONFIDENTIAL GREEN

ENGINE TYPE	GENERATOR	VOLTAGE	CONTROLLER	SUGGESTED PRINT LIST
C27 / C32	1200/1400 FRAME	LV(<1000V)	EMCP 4.3/4.4	1–7 9 18 20 21 24 26 27 31 46–49 61–64 69 71–74 82 83 98–101
C32	1400 FRAME	MV(1000–5000V)	EMCP 4.3/4.4	1–7 9 18 20 26 27 32 33 46–48 61–64 69 71–74 82 83 98–101
C32	2700 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 9 9 18 20 22 26 27 37 46–48 50 61–63 65 69 71–74 83 98–101
3512MUI/3516MUI	1400/1600/1800 FRAME	LV(<1000V)	EMCP 4.3/4.4	1–7 9 18 20 21 24 26 27 32 33 46–49 54–56 61–64 69 71–74 84 85 104 105
3512MUI/3516MUI	1400/1600/1800 FRAME	MV(1000–5000V)	EMCP 4.3/4.4	1–7 9 18 20 26 27 32 33 46–48 54–56 61–64 69 71–74 84 85 104 105
3512MUI/3516MUI	2700 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 9 9 18 20 22 26 27 37 46–48 50 54–56 61–63 65 69 71–74 85 104 105
3512EUI/3516EUI	1400/1600/1800	LV(<1000V)	EMCP 4.3/4.4	1–7 9 18 20 21 24 26 27 31 46–49 61–64 69 71–74 80 81 102 103
3512EUI/3516EUI	1400/1600/1800	MV(1000–5000V)	EMCP 4.3/4.4	1–7 9 18 20 26 27 32 33 46–48 61–64 69 71–74 80 81 102 103
3512EUI/3516EUI	2700 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 9 9 18 20 22 26 27 37 46–48 50 61–63 65 69 71–74 81 102 103
3516EUI	Y5000 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 9 13 18 20 23 26 27 40 46–48 53 61–63 68 69 71–74 81 102 103
3516EUI	B5600H4 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 9 12 18 20 23 26 27 39 46–48 52 61–63 67 69 71–74 81 102 103
3516EUI	3000 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 9 11 18 20 22 26 27 38 46–48 51 61–63 66 71–74 81 102 103
C175–16	1800 FRAME	LV(<1000V)	EMCP 4.3/4.4	1–7 9 18 20 21 24 26 27 31 46–49 61–64 69 71–74 87 89 111 112 113
C175–16	1800 FRAME	MV(1000–5000V)	EMCP 4.3/4.4	1–7 9 18 20 26 27 32 33 46–48 61–64 69 71–74 87 89 111 112 113
C175–16/C175–20	3000 FRAME	MV–HV(>1000V)	EMCP 4.3/4.4	1–7 9 11 18 20 22 26 27 38 46–48 51 61–63 66 71–74 89 111 112 113
G3500A	1400 FRAME	LV(<1000V)/MV–HV(>1000V)	EMCP 4.3/4.4	1–7 16–18 20–22 26–35 41 49 57–64 69–74 92 116 119
G3500C/E	1600/1800 FRAME	LV(<1000V)/MV–HV(>1000V)	EMCP 4.3/4.4	1–7 16–18 20–22 26–35 41 49 57–64 69–74 90 114 119
G3500C/E	2600/2700 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 10 16–18 20 22 26–30 37 42 50 57–63 65 69 71–74 90 114 119
G3500H	1600/1800 FRAME	LV(<1000V)/MV–HV(>1000V)	EMCP 4.3/4.4	1–7 16–18 20–22 26–35 41 49 57–64 69–74 94–96 118 119
G3500H	2700 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 10 16–18 20 22 26–30 37 38 42 50 57–63 65 69 71–74 94–96 118 119
G3500H	3000 FRAME	HV(>5KV)	EMCP 4.3/4.4	1–7 11 16–18 20 22 26–30 37 38 42 51 57–63 66 69 71–74 94–96 118 119
G3500B	1600 FRAME	LV(<1000V)/MV–HV(>1000V)	EMCP 4.3/4.4	1–7 16–18 20–22 26–35 41 49 57–64 69 71–74 93 117 119
G3500 STANDBY	1400/1600/1800 FRAME	LV(<1000V)/MV–HV(>1000V)	EMCP 4.3/4.4	1–7 16–18 20–22 26–35 41 49 57–64 69 71–74 91 115 119
C27	1200/1400 FRAME	LV(<1000V)	EMCP 4.2B	1–8 18–21 24 31 43–45 61–64 69 82 83 98–101
C32	1200/1400 FRAME	LV(<1000V)	EMCP 4.2B	1–8 18–21 24 31 43–45 49 61–64 69 82 83 98–101
C32	1400 FRAME	MV(1000–5000V)	EMCP 4.2B	1–8 18–20 33 36 43–45 61–64 69 82 83 98–101
C32	2700 FRAME	HV(>5KV)	EMCP 4.2B	1–8 10 18–20 22 37 43–45 50 61–63 65 69 83 98–101
3512MUI/3516MUI	1400/1600/1800 FRAME	LV(<1000V)	EMCP 4.2B	1–8 18–20 33 36 43–45 54–56 61–64 69 84 85 104 105
3512MUI/3516MUI	1400/1600/1800 FRAME	MV(1000–5000V)	EMCP 4.2B	1–8 18–21 24 31 43–45 49 54–56 61–64 69 84 85 104 105
3512MUI/3516MUI	2700 FRAME	HV(>5KV)	EMCP 4.2B	1–8 10 18–20 22 37 43–45 50 54–56 61–63 65 69 85 104 105
3512EUI/3516EUI	1400/1600/1800 FRAME	LV(<1000V)	EMCP 4.2B	1–8 31 43–45 49 61–64 69 80 81 102 103 104 105
3512EUI/3516EUI	1400/1600/1800 FRAME	MV(1000–5000V)	EMCP 4.2B	1–8 18–20 33 36 43–45 61–64 69 80 81 102 103
3512EUI/3516EUI	2700 FRAME	HV(>5KV)	EMCP 4.2B	1–8 10 18–20 22 37 43–45 50 61–63 65 69 81 102 103
3516EUI	Y5000 FRAME	HV(>5KV)	EMCP 4.2B	1–8 13 18–20 23 40 43–45 53 61–63 68 69 81 102 103
3516EUI	B5600H4 FRAME	HV(>5KV)	EMCP 4.2B	1–8 12 18–20 23 39 43–45 52 61–63 67 69 81 102 103
3516EUI	3000 FRAME	HV(>5KV)	EMCP 4.2B	1–8 11 18–20 22 38 43–45 52 61–63 66 69 81 102 103
C175–16	1800 FRAME	LV(<1000V)	EMCP 4.2B	1–8 18–21 24 31 43–45 49 61–64 69 87 89 111 112 113
C175–16	1800 FRAME	MV(1000–5000V)	EMCP 4.2B	1–8 18–20 33 36 43–45 61–64 69 87 89 111 112 113
C175–16/C175–20	3000 FRAME	MV–HV(>1000V)	EMCP 4.2B	1–8 11 18–20 22 38 43–45 52 61–63 66 69 89 111 112 113

SHEET INDEX 3
CATERPILLAR: CONFIDENTIAL GREEN

METRIC 521-9364

1E5167A	INT-PROP
1E2733	DRAWING – AUTOCAD
1E0198W	BRAND MARKINGS
1E0013G	CONFIDENTIALITY
1E0012A	INTERPRETATION
1E0011	INTPR & TOL

ARUN GOPAL
LYLE SEWALL
J.D. ELDER
RECORDS

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CATERPILLAR INC.

DIAGRAM – WIRING
MODULAR CONTROLS
521-9364 W944 D

SHEET 43,44,46,49 55,18,60,77 NOTE A: SEE LEBE0049 TO PROGRAM EMCP 4.2B INPUTS AND OUTPUTS.

SHEET 43,46,54,18,21,22,23 NOTE B: REMOVE JUMPER BAR BETWEEN ESTOP-A AND ESTOP-B TERMINAL BOARD POINTS AFTER INSTALLATION OF C27/C32 ENCLOSURE OR ENGINE MOUNTED EMERGENCY STOP. REMOVE THE JUMPER WIRE FROM BTRY NEG AND ESTOP-A WITH THE INSTALLATION OF THE CUSTOMER SUPPLIED ESTOP. (CUSTOMER ESTOP IS CONNECTED ACROSS TERMINALS BTRY NEG AND ESTOP-A.)

SHEET 18,19 NOTE C: CUSTOMER LOADING FROM TERMINAL STRIP SHOULD BE LIMITED TO 5A RESISTIVE ONLY AND

SHEET 44,56,18,21,22 FOR EXCESS DEMAND USE BATTERY CONNECTION.

23,71,72,73,74 NOTE D: SEE LEBE0010 FOR EMCP 4 SCADA DATA LINKS.

SHEET 44,56,18,21,22,23 NOTE E: SEE SHEET "CUSTOMER INTERCONNECTS SHEET 3 OF 12" FOR CONNECTION TO REMOTE DEVICES.

SHEET 45,20 NOTE F: SEE LEBE0049 TO PROGRAM DISCRETE I/O MODULE INPUTS AND OUTPUTS.

SHEET 64 NOTE G: WHEN THE ENGINE IS RUNNING, THE EMCP ENERGIZES THE SPDR, CR1, CR21 & CR22 RELAYS TO DISABLE AC SHORE POWER.

SHEET 48,64,65,66,19,21,22,23 NOTE H: AMPACITY OF SHORE POWER CUSTOMER WIRING SHOULD BE DETERMINED BY OPTIONS INSTALLED.

SHEET 48,20 NOTE J: USE THE EXISTING RESISTOR ON THE DC TERMINAL BLOCK.

SHEET 48,27 NOTE K: DIODE 1 IS USED FOR BEST BATTERY CIRCUIT. SEE LEBE0007 (EMCP 4.3, 4.4 GENERATOR SET CONTROL A&I GUIDE) AND MANUAL UENR1210 (SYSTEMS OPERATION TROUBLESHOOTING TESTING AND ADJUSTING – SOTTA) FOR CONNECTIONS DETAILS.

SHEET 49,60 NOTE L: REFERENCE 524-1257 FOR CIRCUIT BREAKER INSTALLATION DRAWINGS.

SHEET 44,49,55,18,60 NOTE M: DIGITAL INPUT 3 IS ONLY AVAILABLE ON PACKAGES WITHOUT A CIRCUIT BREAKER. DIGITAL INPUT 5, 6 ARE USED BY THE FACTORY FOR THE C175 GENSET.

SHEET 44,55,18,22,23 NOTE N: ANALOG INPUT (–)'S MUST BE REFERENCED TO BATTERY (–).(EMCP 4.2B)

SHEET 19 NOTE P: CIRCUIT BREAKER TERMINAL LABELS ARE LOCATION BASED, LF=LEFT, RT=RIGHT, RR=REAR.

SHEET 18,21,22,23 NOTE R: RECOMMENDED WIRING FOR ACTIVE SENSORS.

SHEET 18,21,22,23 NOTE S: RECOMMENDED WIRING FOR RESISTIVE SENSORS.

SHEET 48,71,72,73,74 NOTE U: THE EMCP 4.4 MULTIPLE GENSET DATA LINK (MGDL) FEATURE IS AN ETHERNET DATA LINK USED BETWEEN ENGINE/GENERATOR SETS FOR ON-PACKAGE PARALLELING AND CONTROL.THE EMCP 4.4 MGDL FEATURE DOES NOT EMPLOY A MASTER CONTROLLER STRATEGY FOR PARALLELING OPERATION. THE EMCP 4.4 CONTROLLER USES A PROPRIETARY PROTOCOL TO COMMUNICATE INFORMATION BETWEEN GENERATOR SETS TO CONTROL PARALLELING FEATURES LIKE DEAD BUS ARBITRATION, SYNCHRONIZING, LOAD SHARING AND LOAD SEQUENCING. THE EMCP 4.4 IS NOT DESIGNED OR INTENDED TO CONNECT TO THIRD-PARTY PRODUCTS OVER THIS DATA LINK. SEE LEBE0031 (EMCP 4.4 MULTIPLE GENSET DATA LINK) FOR DETAILED CONFIGURATION AND OPERATION GUIDE.

SHEET 48,71,72,73,74 NOTE V: LEBE0032 (EMCP 4.4 MULTIPLE GENSET DATA LINK QUICK START GUIDE) PROVIDES INFORMATION NECESSARY TO SET UP THE MULTIPLE GENSET DATA LINK (MGDL) FEATURE FOR OPERATION ON CAT GENERATOR SETS. THIS QUICK START GUIDE IS NOT A DETAILED CONFIGURATION AND OPERATION GUIDE. FOR STEPS TO PROPERLY SETUP MGDL HARDWARE, SETPOINT CONFIGURATION, AND ALL MGDL PARALLELING FEATURE OPERATION REVIEW THE EMCP MULTIPLE GENSET DATA LINK CONIFIGURATION & OPERATION GUIDE.

SHEET 71,72,73,74 NOTE W: ETHERNET NETWORK TOPOLOGY SHOWN USING 6-PORT ETHERNET SWITCH. ETHERNET SWITCH AND CABLES SUPPLIED BY OTHERS.

SHEET 27 NOTE X: ONE, AND ONLY ONE, UNIT MUST BE DESIGNATED AS THE LEAD UNIT. THIS IS ACCOMPLISHED BY CONNECTING THE BEST BATTERY POSITIVE LINE OF A UNIT TO THE HWDBA 3 INPUT OF THAT SAME UNIT. IF BREAKER CONTROLS ON A GENSET ARE WIRED TO THE EMCP 4.4 INPUTS, THE BREAKER WILL NOT CLOSE IF THE CLOSE CONTROL IS ACTIVATED UNLESS HWDBA IS ENABLED AND THE LEAD UNIT CONNECTION IS INSTALLED.

SHEET 22,23 NOTE Y: USE 169-8670 CONNECTOR WITH 155-2276 WEDGE

SHEET 33,34,35,42 NOTE Z: FUSES ARE DEDICATED TO EMCP VOLTAGE SENSING ONLY, NOT FOR OTHER USES.

SHEET 57,58 NOTE AA: REFER BELOW TABLE FOR MODEL AND SERIAL NUMBER PREFIX TO IDENTIFY RELEVANT CIRCUIT

MODEL	SERIAL NO PREFIX
C175-16	TEB , TBB
C175-20	TZB
3516 MUI	YL2 , JCG , SNC
3516	LY3 , LY4 , ZNT , LY5 , LY6 , LYM , JD7 , JCH , JCN , JCB , PXY , LNW , LNZ , SNE , SN7 , JGX , N7N , F3B
3512 MUI	LY7 , JM2 , LNF , TLL
3512	LY8 , LY9 , LYH , LYP , JM3 , JM4 , LNJ , LNM , TLN , TLT
3516 GEARBOX	GBZ
C32	JSJ , TZJ
C27	2A3
G3516 B	XBC , EGT
G3516 A	ZAZ , ZBA
G3512 STANDBY	E2X , E2P , E2T , E2N
G3512 E	NWC
G3520 E	GZE
G3512 H	GF5 , GF4
G3516 H	NWH , NWJ
G3512 H	GFP , GFR
G3516 C	NWD , NWF , NWE
G3520 C	RLP , LGS , GZB , GZA , GZJ

ALL CUSTOMER WIRE SIZES ARE 16 AWG/1.0sq mm MINIMUM, 600V STRANDED WIRE, UNLESS OTHERWISE SPECIFIED.

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 491-3960/02 (MODULAR CONTROLS)

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 237-9000/03 (3500 EUI) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 533-6559/01 (3516B DGB) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 415-1146/04 (3500 MUI) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 420-8316/02 (C175-16) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 420-8317/00 (C175-20) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 260-9515/06 (C27/C32) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 324-7474/07, 292-5340/03, 329-4396/09, 324-7475/05 (G3500 C&E) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 550-1000/01 (G3500 STAND BY) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 384-1372/03 (G3500 A) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 237-5810/04 (G3500 B) ENGINE

THIS SCHEMATIC REPRESENTS DIAGRAM-WIRING 358-6954/09, 533-7000/02 (G3500 H) ENGINE

NOTES
CATERPILLAR: CONFIDENTIAL GREEN

METRIC 521-9364

	1ES167A	INT-PROP
	1E2733	DRAWING – AUTOCAD
	1E0198W	BRAND MARKINGS
	1E0013G	CONFIDENTIALITY
	1E0012A	INTERPRETATION
	1E0011	INTPR & TOL

DSN ARUN GOPAL
CHK LYLE SEWALL
APPD J.D. ELDER
RECORDS
SCALE: NONE
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CATERPILLAR INC.
DIAGRAM – WIRING
MODULAR CONTROLS
521-9364 – W944 D

METRIC 521-9364

EMCP 4.3/4.4 I/O DEFAULT CONFIGURATION

DESCRIPTION	RELAY	3500-EUI	C175-16/C175-20	C27 & C32	G3500
ESTOP (DEDICATED DI-1)		E-STOP (DEDICATED)	E-STOP (DEDICATED)	E-STOP (DEDICATED)	E-STOP (DEDICATED)
START (DEDICATED DI-2)		REMOTE INITIATE (DEDICATED)	REMOTE INITIATE (DEDICATED)	REMOTE INITIATE (DEDICATED)	REMOTE INITIATE (DEDICATED)
PROG. DI-01		SPARE	SPARE	FUEL LEAK (ENCLOSURE)	SPARE
PROG. DI-02		SPARE	SPARE	AC BATTERY CHARGER FAILURE (ENCLOSURE)	SPARE
PROG. DI-03		52G#1 OPEN (OPTIONAL)	52G#1 OPEN (OPTIONAL)	52G#1 OPEN (OPTIONAL)	52G#1 OPEN (OPTIONAL)*
PROG. DI-04		52G#2 OPEN (OPTIONAL)	52G#2 OPEN (OPTIONAL)	52G#2 OPEN (OPTIONAL)	52G#2 OPEN (OPTIONAL)*
PROG. DI-05		GEAR OIL PRESSURE SWITCH(GEARBOX)	JACKET WATER COOLANT LEVEL ALARM	SPARE	SPARE
PROG. DI-06		SPARE	SCAC COOLANT LEVEL ALARM	SPARE	SPARE
PROG. DI-07		SPARE	SPARE	SPARE	SPARE
PROG. DI-08		SPARE	SPARE	SPARE	SPARE
ISOLATED DI-01		SPARE	SPARE	SPARE	SPARE
ISOLATED DI-02		SPARE	SPARE	SPARE	SPARE
ISOLATED DI-03		SPARE	SPARE	SPARE	SPARE
ISOLATED DI-04		SPARE	SPARE	SPARE	SPARE
ANALOG INPUT-1		GEAR OIL TEMPERATURE (GEARBOX)	SPARE	SPARE	SPARE
ANALOG INPUT-2		SPARE	SPARE	SPARE	SPARE
ANALOG INPUT-3		SPARE	SPARE	SPARE	SPARE
ANALOG INPUT-4*		SPARE	SPARE	SPARE	SPARE
DO-1	R1	STARTER MOTOR MAG RELAY	SPARE	SPARE	STARTER MOTOR MAG RELAY
DO-2	R2	SPARE	SPARE	SPARE	START(FUEL ENABLE)
DO-3	R3	SPARE	SPARE	DISABLE AUX AC SUPPLY (ENCLOSURE)	ECU FAULT RESET
DO-4		SPARE	SPARE	SPARE	SPARE
DO-5		SPARE	SPARE	SPARE	SPARE
DO-6		COMMON SHUTDOWN	COMMON SHUTDOWN	COMMON SHUTDOWN	COMMON SHUTDOWN
DO-7		SPARE	SPARE	SPARE	SPARE
DO-8		SPARE	SPARE	SPARE	SPARE
DO-9		SPARE	SPARE	SPARE	SPARE
DO-10		SPARE	SPARE	SPARE	SPARE
DO-11		SPARE	SPARE	SPARE	SPARE
DO-12	R12	SPARE	SPARE	SPARE	COMMON SHUTDOWN
DO-13	R13	SPARE	IDLE SPEED COMMAND	IDLE SPEED COMMAND	GSOV*
DO-14	R14	PRELUBE	SPARE	SPARE	RATED/IDLE SPEED*
DO-15	R15	DISABLE AUX AC SUPPLY	DISABLE AUX AC SUPPLY	DISABLE AUX AC SUPPLY	DISABLE AUX AC SUPPLY
DO-16	R16	SPARE	SPARE	SPARE	GOVERNOR 24VDC*
DO-17*		SPARE	SPARE	SPARE	SPARE
DIDI 1*		GROUP START	GROUP START	GROUP START	GROUP START
DIDI 2*		CIRCUIT BREAKER OVERCURRENT ALARM	CIRCUIT BREAKER OVERCURRENT ALARM	CIRCUIT BREAKER OVERCURRENT ALARM	CIRCUIT BREAKER OVERCURRENT ALARM
DIDI 3*		MANUAL CIRCUIT BREAKER OPEN	MANUAL CIRCUIT BREAKER OPEN	MANUAL CIRCUIT BREAKER OPEN	MANUAL CIRCUIT BREAKER OPEN
DIDI 4*		MANUAL CIRCUIT BREAKER CLOSE	MANUAL CIRCUIT BREAKER CLOSE	MANUAL CIRCUIT BREAKER CLOSE	MANUAL CIRCUIT BREAKER CLOSE
DDO 1*	R17	DEAD BUS ARBITRATION RELAY	DEAD BUS ARBITRATION RELAY	DEAD BUS ARBITRATION RELAY	DEAD BUS ARBITRATION RELAY
DDO 2*	R20	CIRCUIT BREAKER CLOSE	CIRCUIT BREAKER CLOSE	CIRCUIT BREAKER CLOSE	CIRCUIT BREAKER CLOSE
DDO 3*	R19	CIRCUIT BREAKER OPEN	CIRCUIT BREAKER OPEN	CIRCUIT BREAKER OPEN	CIRCUIT BREAKER OPEN

* EMCP 4.4 ONLY
# G3500A SERIES GAS PACKAGES ONLY
* EMCP 4.3 ONLY

EMCP 4.2B I/O DEFAULT CONFIGURATION

DESCRIPTION		3500-EUI	3500-MUI	C175-16/C175-20	C27 & C32
RELAY 01	(R01)	SMMS	SMMS	SPARE	SPARE
RELAY 02	(R02)	SPARE	SPARE	SPARE	SPARE
RELAY 03	(R03)	SPARE	SPARE	SPARE	DISABLE AUX AC SUPPLY (ENCLOSURE)
RELAY 04	(R04)	SPARE	FUEL ENABLE	SPARE	SPARE
RELAY 05	(R05)	PRELUBE	IDLE/RATED SPEED	SPARE	SPARE
RELAY 06	(R06)	COMMON SHUTDOWN	COMMON SHUTDOWN	COMMON SHUTDOWN	COMMON SHUTDOWN
RELAY 07	(R07)	LOW IDLE SPEED	SPARE	LOW IDLE SPEED	LOW IDLE SPEED
RELAY 08	(R08)	SPARE	SPARE	SPARE	SPARE
DIGITAL OUTPUT #1	(DO1)	DISABLE AUX AC SUPPLY	DISABLE AUX AC SUPPLY	DISABLE AUX AC SUPPLY	DISABLE AUX AC SUPPLY
DIGITAL OUTPUT #2	(DO2)	CONTROL SIGNAL TO IVR (DEDICATED)	CONTROL SIGNAL TO IVR (DEDICATED)	CONTROL SIGNAL TO IVR (DEDICATED)	CONTROL SIGNAL TO IVR (DEDICATED)
DIGITAL INPUT E-STOP	(E-STOP)	E-STOP (DEDICATED)	E-STOP (DEDICATED)	E-STOP (DEDICATED)	E-STOP (DEDICATED)
DIGITAL INPUT START	(START)	REMOTE INITIATE (DEDICATED)	REMOTE INITIATE (DEDICATED)	REMOTE INITIATE (DEDICATED)	REMOTE START (DEDICATED)
DIGITAL INPUT #1	(DI1)	SPARE	SPARE	SPARE	FUEL LEAK (ENCLOSURE)
DIGITAL INPUT #2	(DI2)	SPARE	SPARE	SPARE	AC BATTERY CHARGER FAILURE (ENCLOSURE)
DIGITAL INPUT #3	(DI3)	52G#1 OPEN (OPTIONAL)	52G#1 OPEN (OPTIONAL)	52G#1 OPEN (OPTIONAL)	52G#1 OPEN (OPTIONAL)
DIGITAL INPUT #4	(DI4)	52G#2 OPEN (OPTIONAL)	52G#2 OPEN (OPTIONAL)	52G#2 OPEN (OPTIONAL)	52G#2 OPEN (OPTIONAL)
DIGITAL INPUT #5	(DI5)	GEAR OIL PRESSURE SWITCH(GEARBOX)	ENGINE COOLANT LEVEL ALARM	JACKET WATER COOLANT LEVEL ALARM	SPARE
DIGITAL INPUT #6	(DI6)	SPARE	SPARE	SCAC COOLANT LEVEL ALARM	SPARE
ANALOG INPUT #1	(AI1)	GEAR OIL TEMPERATURE (GEARBOX)	ENGINE OIL PRESSURE	SPARE	SPARE
ANALOG INPUT #2	(AI2)	SPARE	ENGINE COOLANT TEMPERATURE	SPARE	SPARE
ANALOG INPUT #3	(AI3)	SPARE	ENGINE OIL TEMPERATURE	SPARE	SPARE

NOTES
CATERPILLAR: CONFIDENTIAL GREEN

1E5167A	INT-PROP	
1E2733	DRAWING - AUTOCAD	
1E0198W	BRAND MARKINGS	
1E0013G	CONFIDENTIALITY	
1E0012A	INTERPRETATION	
1E0011	INTPR & TOL	

DSN ARUN GOPAL
DFT LYLE SEWALL
APPD J.D. ELDER
RECORDS X
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM [INCHES] DIMENSIONS W/O TOL ARE BASIC
SCALE: NONE
SHEET 5 OF 119
THIRD ANGLE PROJECTION
01 23AUG19
00 11JUL18
CHG DATE

CATERPILLAR INC.

DIAGRAM - WIRING
MODULAR CONTROLS
521-9364
SIZE D
DCS W944

METRIC 521-9364

ABBREVIATIONS

52G	GENERATOR CIRCUIT BREAKER
AC	ALTERNATING CURRENT
ADEM	ADVANCED DIESEL ENGINE MANAGEMENT
AFDPS	AIR FILTER DIFFERENTIAL PRESSURE SWITCH
ALM	ALARM
ALT	ALTERNATOR
AI	ANALOG INPUT
ARB	ARBITRATION
ASDS	AIR SHUTOFF SOLENOID
ASDR	AIR SHUTOFF RELAY
ASDSR	AIR SHUTOFF SOLENOID RELAY
ASS	AIR START SOLENOID
AUX	AUXILIARY
BAT	BATTERY
BATT-	BATTERY NEGATIVE
BATT+	BATTERY POSITIVE
BB	BEST BATTERY
BKR	BREAKER
BTRY	BATTERY
C	COMMON
CAM	CAMSHAFT
CAN	CONTROLLER AREA NETWORK
CB	CIRCUIT BREAKER
CBCPB	CIRCUIT BREAKER CLOSE PUSH BUTTON
CBOPB	CIRCUIT BREAKER OPEN PUSH BUTTON
CDL	CAT DATA LINK
CHG	CHARGER
CR	CONTROL RELAY
CS	CONTROL SIGNAL
CT	CURRENT TRANSFORMER
CW	CLOCKWISE
D	DIODE
DC	DIRECT CURRENT
DDO	DEDICATED DIGITAL OUTPUT
DI	DIGITAL INPUT
DIAG	DIAGNOSTICS
DIDI	DEDICATED ISOLATED DIGITAL INPUT
DIFF	DIFFERENTIAL
DIO	DIGITAL INPUT/OUTPUT
DO	DIGITAL OUTPUT
DTR	DATA TERMINAL READY
ECM	ELECTRONIC CONTROL MODULE
ECMR	ELECTRONIC CONTROL MODULE RELAY
EIH	ENGINE INTERFACE HARNESS
EJ	ETHERNET JACK
EM	EXCITATION MODULE
EMCP	ELECTRONIC MODULAR CONTROL PANEL
ENG	ENGINE
ES	ETHERNET SWITCH
ESPB	EMERGENCY STOP PUSH BUTTON
ESTOP	EMERGENCY STOP
EUI	ELECTRONIC UNIT INJECTOR
F	FUSE
FPP	FUEL PRIMING PUMP
FPR	FUEL PRIMING RELAY
GDI	GRID DEVICE INTERFACE
GEN	GENERATOR
GND	GROUND
GOV	GOVERNOR
GP	GROUP
GFCT	GROUND FAULT CT
HPC	HYSTAT PRESSURE CONTROL
HWDBA	HARDWIRED DEAD BUS ARBITRATION
HWLSLD	HARDWIRED LOAD SENSE LOAD DEMAND
HZ	HERTZ
I/O	INPUTS/OUTPUTS
IDI	ISOLATED DIGITAL INPUT
IE	INTERNAL EXCITATION
ISOL	ISOLATED
IVR	INTEGRATED VOLTAGE REGULATOR
JW	JACKET WATER
JWH	JACKET WATER HEATER
KW	KILOWATT
KVAR	KILOVOLT-AMPERE REACTIVE
L	LAMP
LH	LEFT HAND
LHASOCB	LEFT HAND AIR SHUTOFF CIRCUIT BREAKER
LS	LAMP SWITCH
LSM	LOAD SHARE MODULE
LV	LOW VOLTAGE
LVL	LEVEL
MAG	MAGNETIC
MBUS	MODBUS
MGDL	MULTIPLE GENSET DATA LINK
MPU	MAGNETIC PICKUP
MUI	MECHANICAL UNIT INJECTOR
MV	MEDIUM VOLTAGE
N	NEUTRAL
NC	NORMALLY CLOSED
NEG	NEGATIVE
N/C	NO CONNECTION
NFPA	NATIONAL FIRE PROTECTION AGENCY
NO	NORMALLY OPEN
OPT	OPTIONAL
P	PUMP
PB	PUSH BUTTON
PIO	PARALLELING INPUT OUTPUT
PM	PRELUBE MOTOR
PMG	PERMANENT MAGNET GENERATOR
POS	POSITIVE
POT	POTENTIOMETER
PPRM	PRELUBE PRESSURE RELAY MAINTAINED
PPRS	PRELUBE PRESSURE RELAY START
PPS	PRELUBE PRESSURE SWITCH
PR	PRELUBE RELAY
PROG	PROGRAMMABLE
PS	POWER SUPPLY
PT	POTENTIAL TRANSFORMER
PWM	PULSE WIDTH MODULATION
PWR	POWER
R	RELAY
REF	REFERENCE
RES	RESISTOR
RH	RIGHT HAND
RHASOCB	RIGHT HAND AIR SHUTOFF CIRCUIT BREAKER
RLY	RELAY
RO	RELAY OUTPUT
RTD	RESISTANCE TEMPERATURE DETECTOR
RTN	RETURN
RXD	RECEIVE DATA
SCAC	SEPARATE CIRCUIT AFTER COOLER
SH	SHIELD
SHNT	SHUNT
SNMS	STARTER MOTOR MAGNETIC SWITCH
SNSR	SENSOR
SPD	SPEED
SPDR	SHORE POWER DISCONNECT RELAY
ST	SERVICE TOOL
STR	START
SR	STARTER RELAY
STR	SHUNT TRIP RELAY
STRTR	STARTER
SW	SWITCH
TB	TERMINAL BOARD
TDC	TOP DEAD CENTER
TEL	TELEMATICS
TEMP	TEMPERATURE
TMG	TIMING
THRT	THROTTLE
TXD	TRANSMIT DATA
UV	UNDERVOLTAGE RELEASE
V	VOLTS
VA	VOLT AMPERES
VR	VOLTAGE REGULATOR
VS	VOLTAGE SUPPLY
XFMR	TRANSFORMER

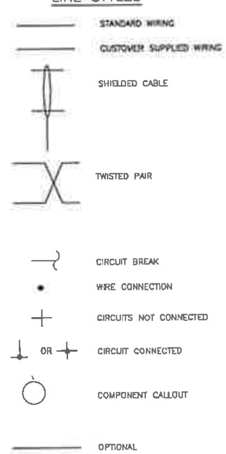
WIRE COLOR

RD	RED
WH	WHITE
OR	ORANGE
YL	YELLOW
CL	CLEAR
BK	BLACK
GY	GRAY
CU	COPPER
BR	BROWN
GN	GREEN
BU	BLUE
GN_YL	GREEN/YELLOW
VI	VIOLET
BK_WH	BLACK/WHITE

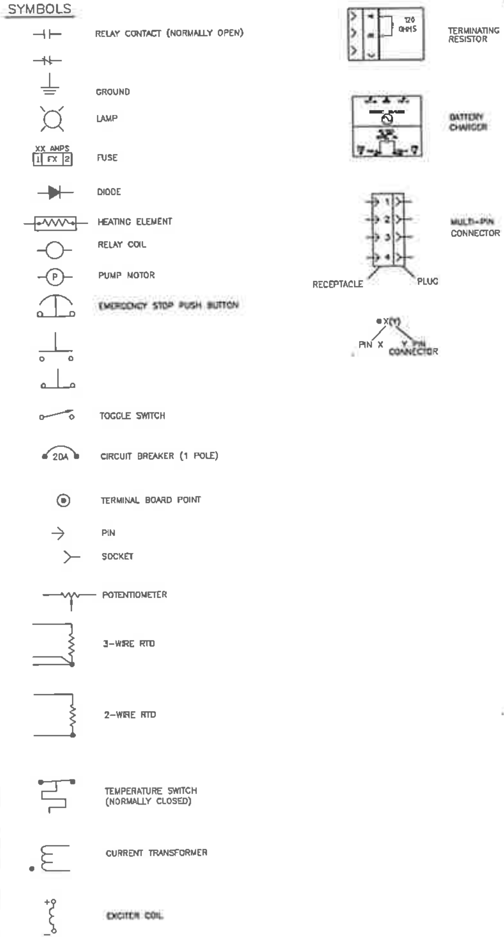
LAMP COLOR

R	RED
G	GREEN
Y	YELLOW
A	AMBER
W	WHITE
O	ORANGE
B	BLUE

LINE STYLES



SYMBOLS



ABBREVIATIONS & SYMBOLS
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

1E5167A	INT-PROP
1E2733	DRAWING - AUTOCAD
1E0198W	BRAND MARKINGS
1E0013G	CONFIDENTIALITY
1E0012A	INTERPRETATION
1E0011	INTPR & TOL

DSN ARUN GOPAL
CHK LYLE SEWALL
APPD J.D. ELDER
RECORDS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM (INCHES) DIMENSIONS W/O TOL ARE BASIC

SCALE: NONE
SHEET 8 OF 119

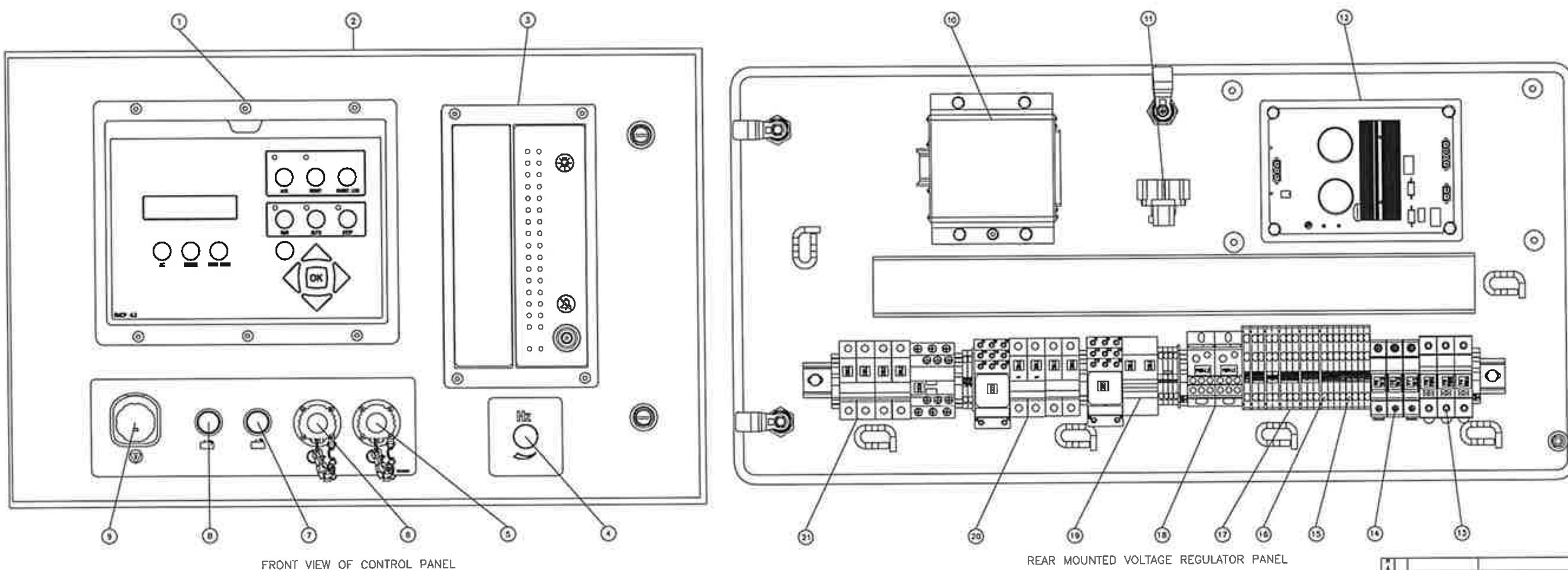
CHG	DATE
01	23AUG19
00	11JUL18

CATERPILLAR INC.

DIAGRAM - WIRING
MODULAR CONTROLS

521-9364 - W944 D

METRIC 521-9364



1. EMCP 4
2. EMCP 4 PANEL
3. RS-485 ANNUNCIATOR (OPTIONAL)
4. SPEED/Hz ADJUST (OPTIONAL)
5. SERVICE TOOL CONNECTOR #2 (CAN2: EXPANSION MODULES, RTD AND DIO)
6. SERVICE TOOL CONNECTOR #1 (CDL& CAN1: ADEM, EMCP, THERMOCOUPLE, CAT CONNECT)
7. CIRCUIT BREAKER CLOSE PUSH BUTTON (RED LIGHT) (EMCP 4.4 ONLY)
8. CIRCUIT BREAKER TRIP PUSH BUTTON (GREEN LIGHT) (EMCP 4.4 ONLY)
9. EMERGENCY STOP PUSH BUTTON
10. RTD MODULE (OPTIONAL)
11. CAN 2 TEE CONNECTOR
12. IVR MODULE (EM10/EM15)
13. PMG/IE FUSING
14. VOLTAGE SENSING FUSING
15. CURRENT SENSING
16. PWM (IVR MODULE CONTROL SIGNAL)
17. 24VDC TERMINAL STRIP
18. CUSTOMER SHORE POWER CONNECTION
19. SPACE HEATER CONTROLS (OPTIONAL)
20. JACKET WATER HEATER CONTROLS (OPTIONAL)
21. GEARBOX COMPONENTS (3516 ONLY) OR 12V COMMON ENCLOSURE BATTERY CHARGER COMPONENTS (C27/C32 ONLY)

COMPONENT LAYOUT - SHEET 1 OF 11
MODULAR CONTROL PANEL/VR SUBPAN
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

1E5167A	INT-PROP
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DRN ARUN GOPAL
CHK LYLE SEWALL
APPD J.D. ELDER
RECORDS

01	23AUG19
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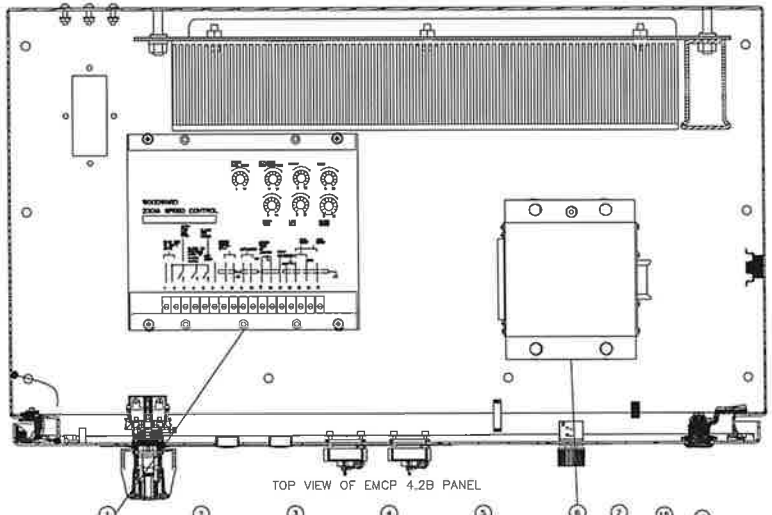
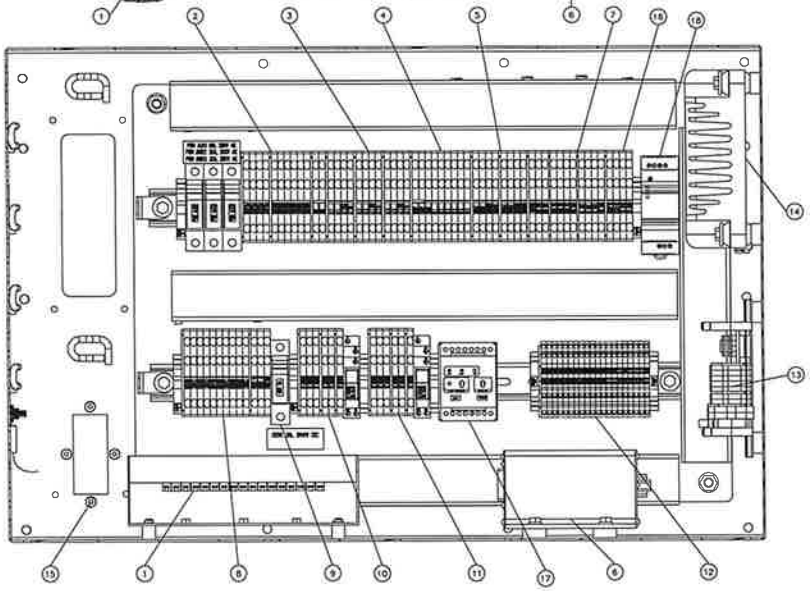
CATERPILLAR INC.
DIAGRAM - WIRING
MODULAR CONTROLS
521-9364 - W944 D

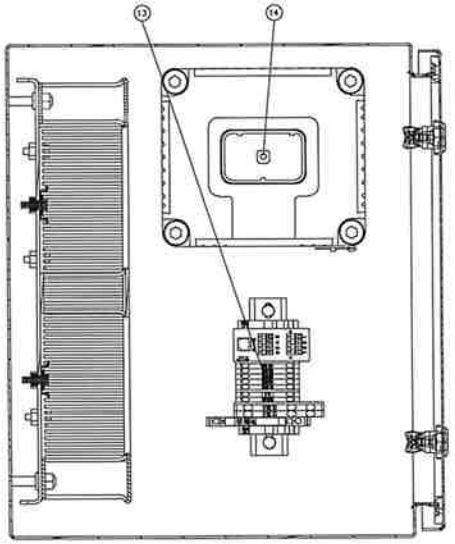
METRIC 521–9364



TOP VIEW OF EMCP 4.2B PANEL



FRONT VIEW OF EMCP 4.2B PANEL (DOOR REMOVED)



LEFT SIDE VIEW OF EMCP 4.2B PANEL

1. 2301A GOVERNOR (3500 MUI ONLY)
2. 24VDC TERMINAL STRIP
3. ANALOG INPUTS
4. DIGITAL INPUTS
5. RS485 REMOTE ANNUNCIATOR TERMINAL BOARD POINTS
6. DIO MODULE (OPTIONAL)
7. VOLTAGE AND CURRENT SENSING
8. RELAY OUTPUTS
9. 2301A GOVERNOR DC FUSE (3500 MUI ONLY)
10. CIRCUIT BREAKER 1 CONTROLS (OPTIONAL)
11. CIRCUIT BREAKER 2 CONTROLS (OPTIONAL)
12. DIO MODULE TERMINAL STRIP (OPTIONAL)
13. CAT CONNECT TERMINAL STRIP
14. CAT CONNECT CONTROLLER
15. ENGINE INTERFACE HARNESS CONNECTION
16. CIRCUIT BREAKER INTERFACE TERMINALS
17. GROUND FAULT RELAY (OPTIONAL)
18. 24V TRIP UNIT POWER SUPPLY

COMPONENT LAYOUT – SHEET 2 OF 11
MODULAR CONTROL PANEL
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

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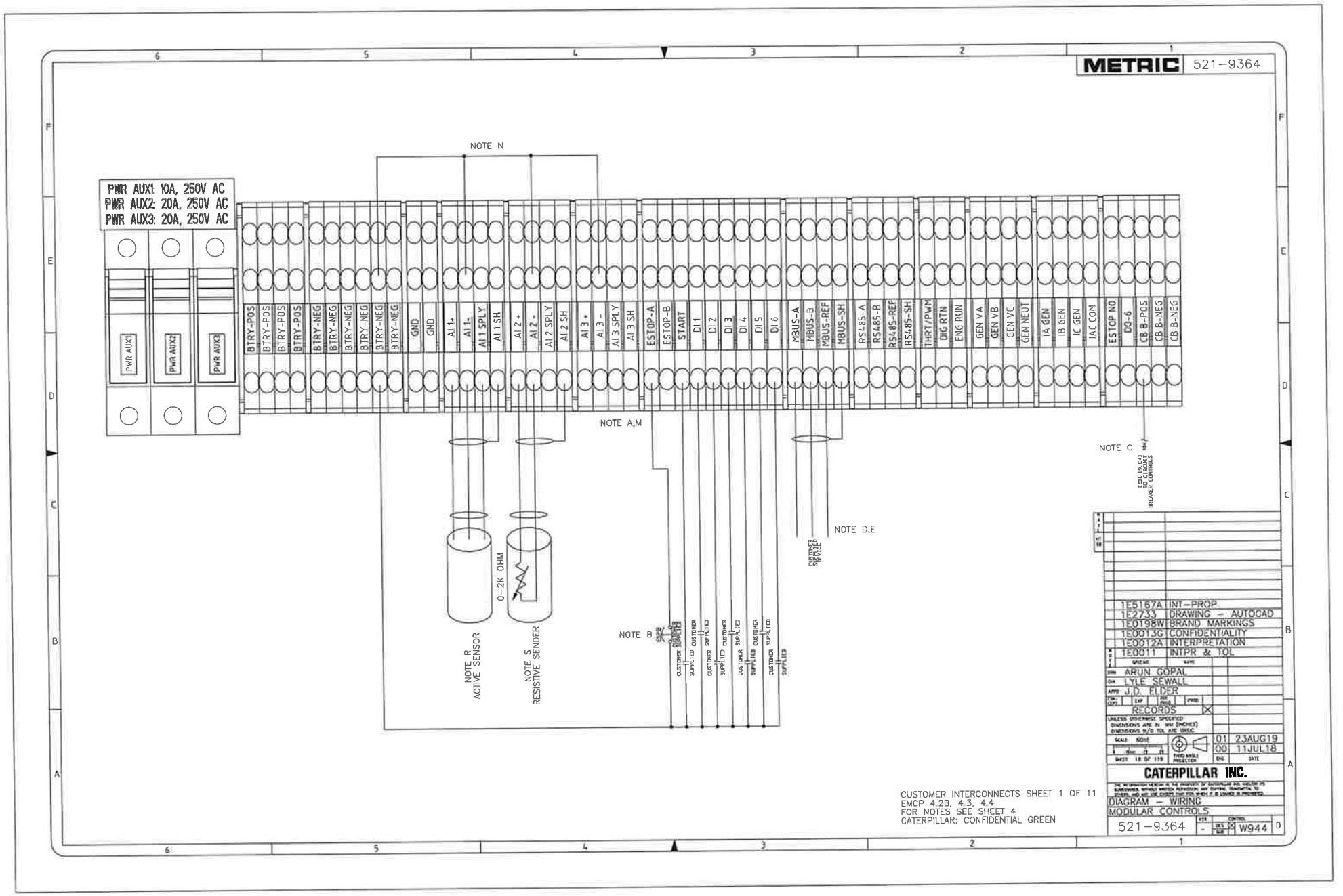
1E2733	DRAWING – AUTOCAD
1E0198W	BRAND MARKINGS
1E0013C	CONFIDENTIALITY
1E0012A	INTERPRETATION
1E0011	INTPR & TOL

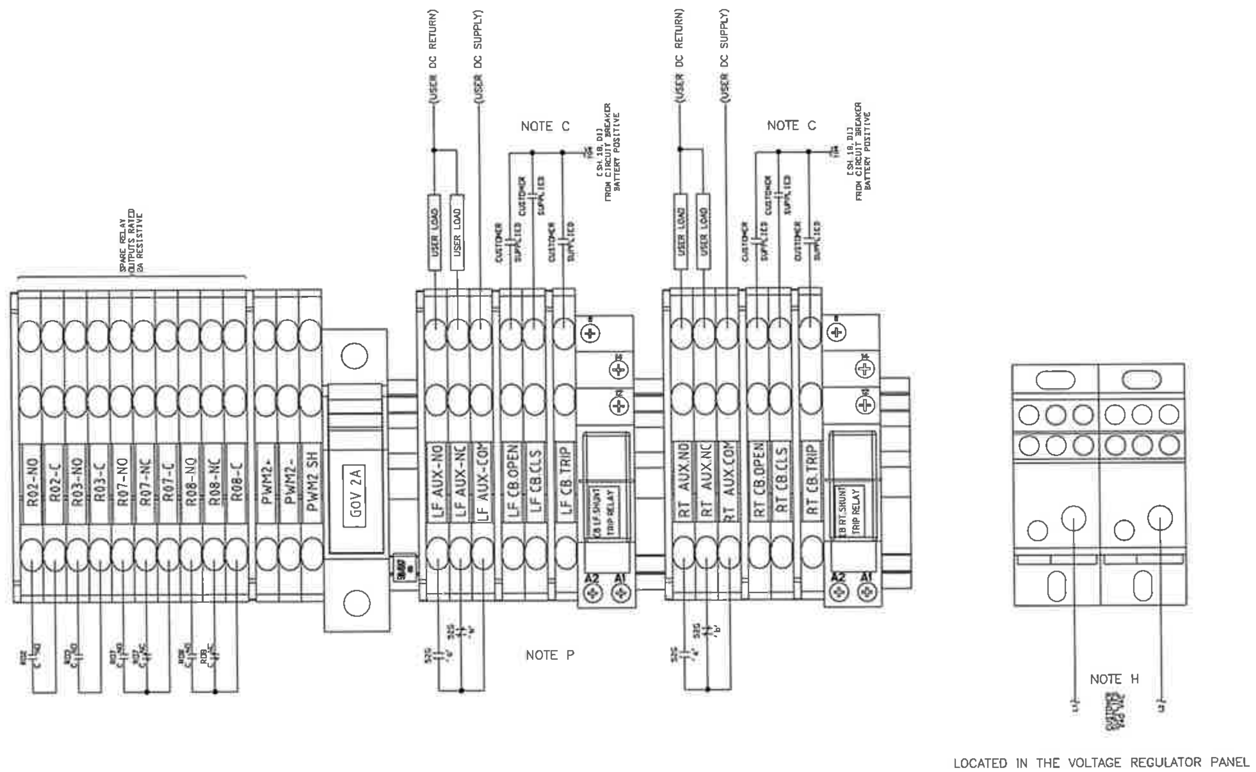
DSN: ARUN GOPAL
DWN: LYLE SEWALL
APPD: J.D. ELDER
RECORDS

01	23AUG19	
00	11JUL18	

CATERPILLAR INC.

DIAGRAM – WIRING
MODULAR CONTROLS
521–9364 W944 D


METRIC 521-9364
PWR AUX1: 10A, 250V AC
PWR AUX2: 20A, 250V AC
PWR AUX3: 20A, 250V AC
PWR AUX1
PWR AUX2
PWR AUX3
NOTE N
BTRY-POS
BTRY-POS
BTRY-POS
BTRY-POS
BTRY-NEG
BTRY-NEG
BTRY-NEG
BTRY-NEG
BTRY-NEG
GND
GND
AI 1+
AI 1-
AI 1 SPLY
AI 1 SH
AI 2+
AI 2-
AI 2 SPLY
AI 2 SH
AI 3+
AI 3 -
AI 3 SPLY
AI 3 SH
ESTOP-A
ESTOP-B
START
DI 1
DI 2
DI 3
DI 4
DI 5
DI 6
MBUS-A
MBUS-B
MBUS-REF
MBUS-SH
RS485-A
RS485-B
RS485-REF
RS485-SH
THRT/PWM
DIG RTN
ENG RUN
GEN VA
GEN VB
GEN VC
GEN NEUT
1A GEN
1B GEN
1C GEN
1AC COM
ESTOP NO
DO-6
CB B-POS
CB B-NEG
CB B-NEG
NOTE A,M
NOTE C
NOTE D,E
NOTE B
NOTE R
ACTIVE SENSOR
0-2K OHM
NOTE S
RESISTIVE SENDER
CUSTOMER SUPPLIED
1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
1E0011 INTPR & TOL
ARUN GOPAL
LYLE SEWALL
J.D. ELDER
RECORDS
SCALE NONE
01 23AUG19
00 11JUL18
CATERPILLAR INC.
DIAGRAM - WIRING
MODULAR CONTROLS
521-9364
W944
CUSTOMER INTERCONNECTS SHEET 1 OF 11
EMCP 4.2B, 4.3, 4.4
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN



CUSTOMER INTERCONNECTS SHEET 2 OF 11
EMCP 4.2B
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

1E5167A	INT-PROP
1E2733	DRAWING - AUTOCAD
1E0198W	BRAND MARKINGS
1E0013G	CONFIDENTIALITY
1E0012A	INTERPRETATION
1E0011	INTPR & TOL

ARUN GOPAL
LYLE SEWALL
J.D. ELDER
RECORDS

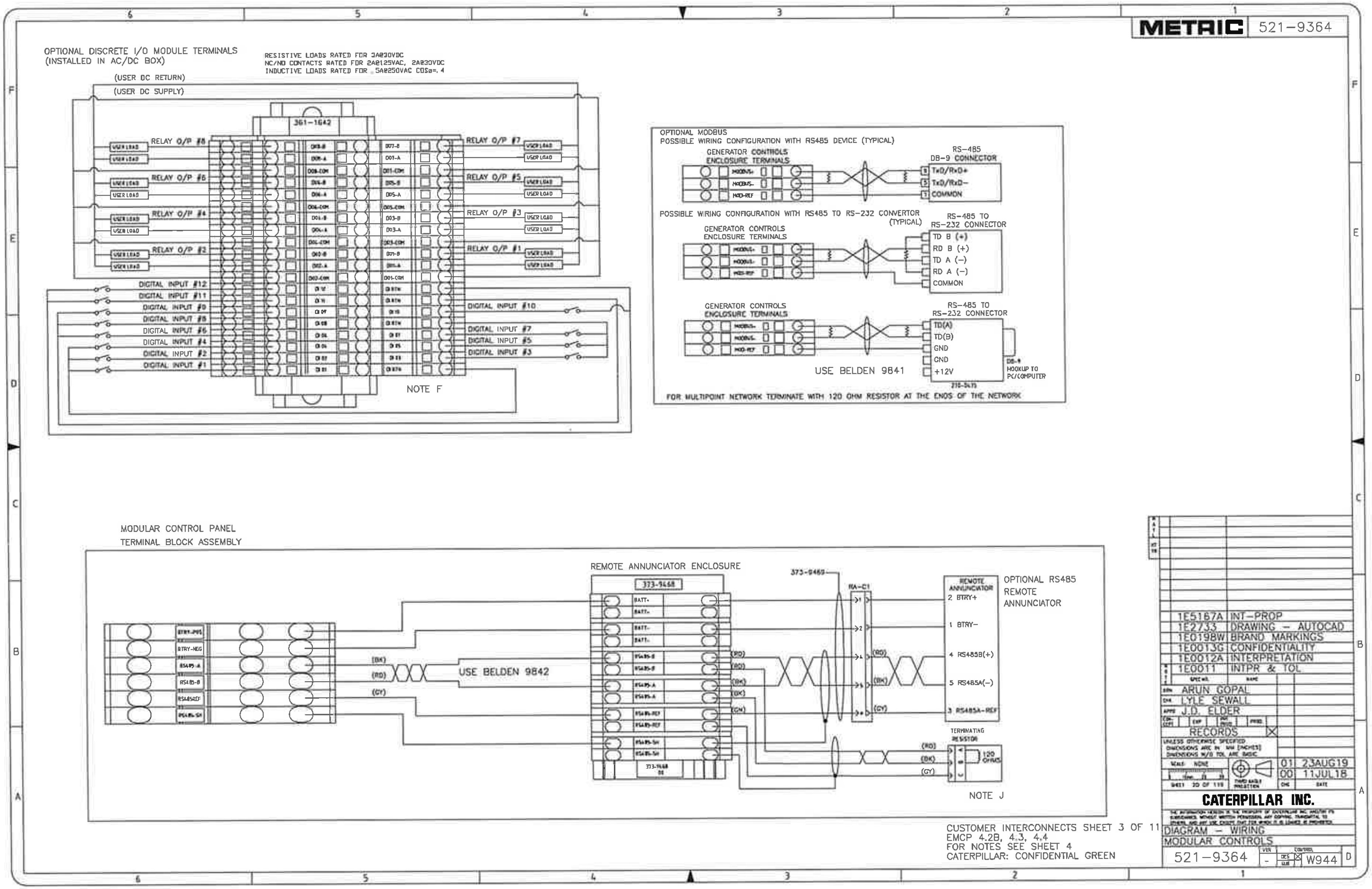
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM (INCHES) DIMENSIONS W/O TOL ARE BASIC

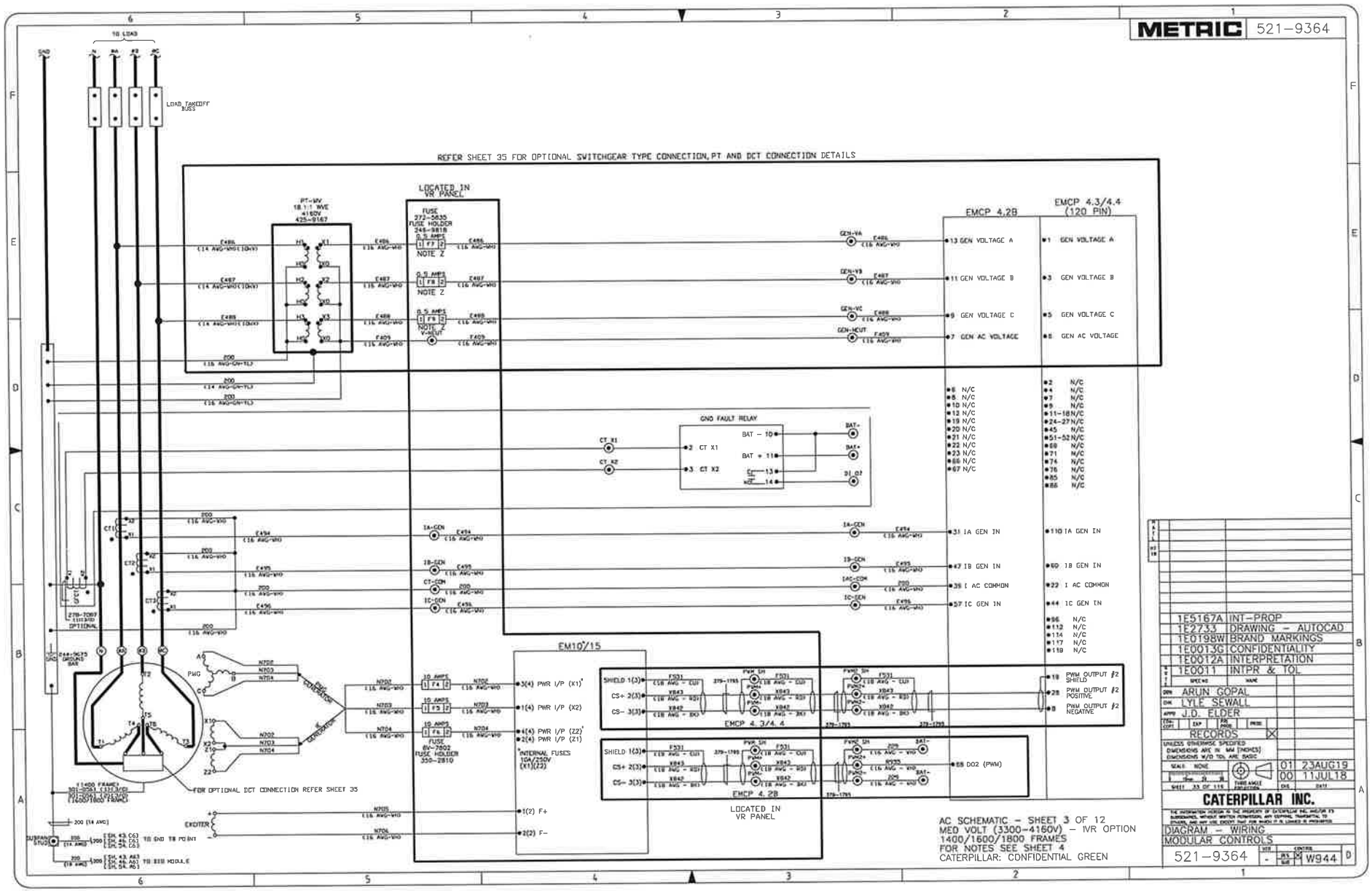
SCALE: NONE
SHEET 19 OF 119

01	23AUG19
00	11JUL18

CATERPILLAR INC.

DIAGRAM - WIRING
MODULAR CONTROLS
521-9364 - W944 D


METRIC 521-9364
OPTIONAL DISCRETE I/O MODULE TERMINALS
(INSTALLED IN AC/DC BOX)
RESISTIVE LOADS RATED FOR 3A@30VDC
NC/NO CONTACTS RATED FOR 2A@125VAC, 2A@30VDC
INDUCTIVE LOADS RATED FOR .5A@250VAC COSø=.4
(USER DC RETURN)
(USER DC SUPPLY)
361-1642
RELAY O/P #8
RELAY O/P #6
RELAY O/P #4
RELAY O/P #2
RELAY O/P #7
RELAY O/P #5
RELAY O/P #3
RELAY O/P #1
USER LOAD
DIGITAL INPUT #12
DIGITAL INPUT #11
DIGITAL INPUT #9
DIGITAL INPUT #8
DIGITAL INPUT #6
DIGITAL INPUT #4
DIGITAL INPUT #2
DIGITAL INPUT #1
DIGITAL INPUT #10
DIGITAL INPUT #7
DIGITAL INPUT #5
DIGITAL INPUT #3
NOTE F
OPTIONAL MODBUS
POSSIBLE WIRING CONFIGURATION WITH RS485 DEVICE (TYPICAL)
GENERATOR CONTROLS ENCLOSURE TERMINALS
RS-485 DB-9 CONNECTOR
TxD/RxD+
TxD/RxD-
COMMON
POSSIBLE WIRING CONFIGURATION WITH RS485 TO RS-232 CONVERTOR (TYPICAL)
RS-485 TO RS-232 CONNECTOR
TD B (+)
RD B (+)
TD A (-)
RD A (-)
COMMON
TD(A)
TD(B)
GND
GND
+12V
DB-9 HOOKUP TO PC/COMPUTER
USE BELDEN 9841
FOR MULTIPOINT NETWORK TERMINATE WITH 120 OHM RESISTOR AT THE ENDS OF THE NETWORK
MODULAR CONTROL PANEL
TERMINAL BLOCK ASSEMBLY
BTRY-POS
BTRY-NEG
RS485-A
RS485-B
RS485REF
RS485-SH
(BK)
(RD)
(GY)
USE BELDEN 9842
REMOTE ANNUNCIATOR ENCLOSURE
373-9468
373-9469
RA-C1
REMOTE ANNUNCIATOR
2 BTRY+
1 BTRY-
4 RS485B(+)
5 RS485A(-)
3 RS485A-REF
OPTIONAL RS485
REMOTE
ANNUNCIATOR
TERMINATING RESISTOR
120 OHMS
NOTE J
CUSTOMER INTERCONNECTS SHEET 3 OF 11
EMCP 4.2B, 4.3, 4.4
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN
1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
1E0011 INTPR & TOL
ARUN GOPAL
LYLE SEWALL
J.D. ELDER
RECORDS
01 23AUG19
00 11JUL18
CATERPILLAR INC.
DIAGRAM - WIRING
MODULAR CONTROLS
521-9364
W944


METRIC 521-9364
REFER SHEET 35 FOR OPTIONAL SWITCHGEAR TYPE CONNECTION, PT AND DCT CONNECTION DETAILS
LOCATED IN VR PANEL
EMCP 4.2B
EMCP 4.3/4.4 (120 PIN)
GND FAULT RELAY
EM10/15
EMCP 4.3/4.4
EMCP 4.2B
LOCATED IN VR PANEL
FOR OPTIONAL DCT CONNECTION REFER SHEET 35
AC SCHEMATIC - SHEET 3 OF 12
MED VOLT (3300-4160V) - IVR OPTION
1400/1600/1800 FRAMES
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN
1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
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DRN ARUN GOPAL
CH LYLE SEWALL
APP J.D. ELDER
RECORDS
01 23AUG19
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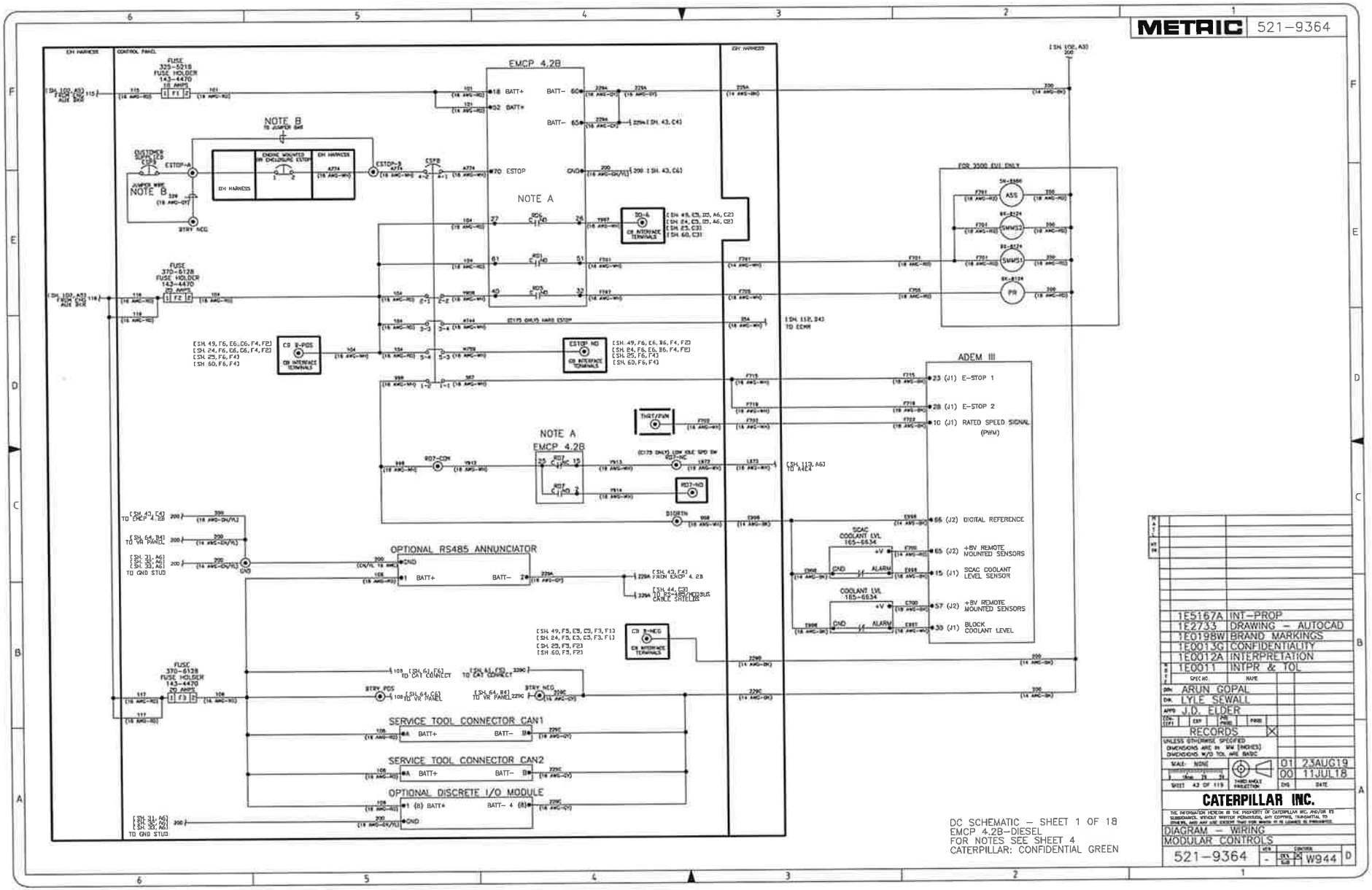
CATERPILLAR INC.
DIAGRAM - WIRING
MODULAR CONTROLS
521-9364
W944


METRIC 521-9364
EMCP 4.2B
NOTE A
NOTE B
ADEM III
OPTIONAL RS485 ANNUNCIATOR
SERVICE TOOL CONNECTOR CAN1
SERVICE TOOL CONNECTOR CAN2
OPTIONAL DISCRETE I/O MODULE
FOR 3500 EUI ONLY
DC SCHEMATIC – SHEET 1 OF 18
EMCP 4.2B–DIESEL
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN
1E5167A INT-PROP
1E2733 DRAWING – AUTOCAD
1E0198W BRAND MARKINGS
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1E0012A INTERPRETATION
1E0011 INTPR & TOL
ARUN GOPAL
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RECORDS
01 23AUG19
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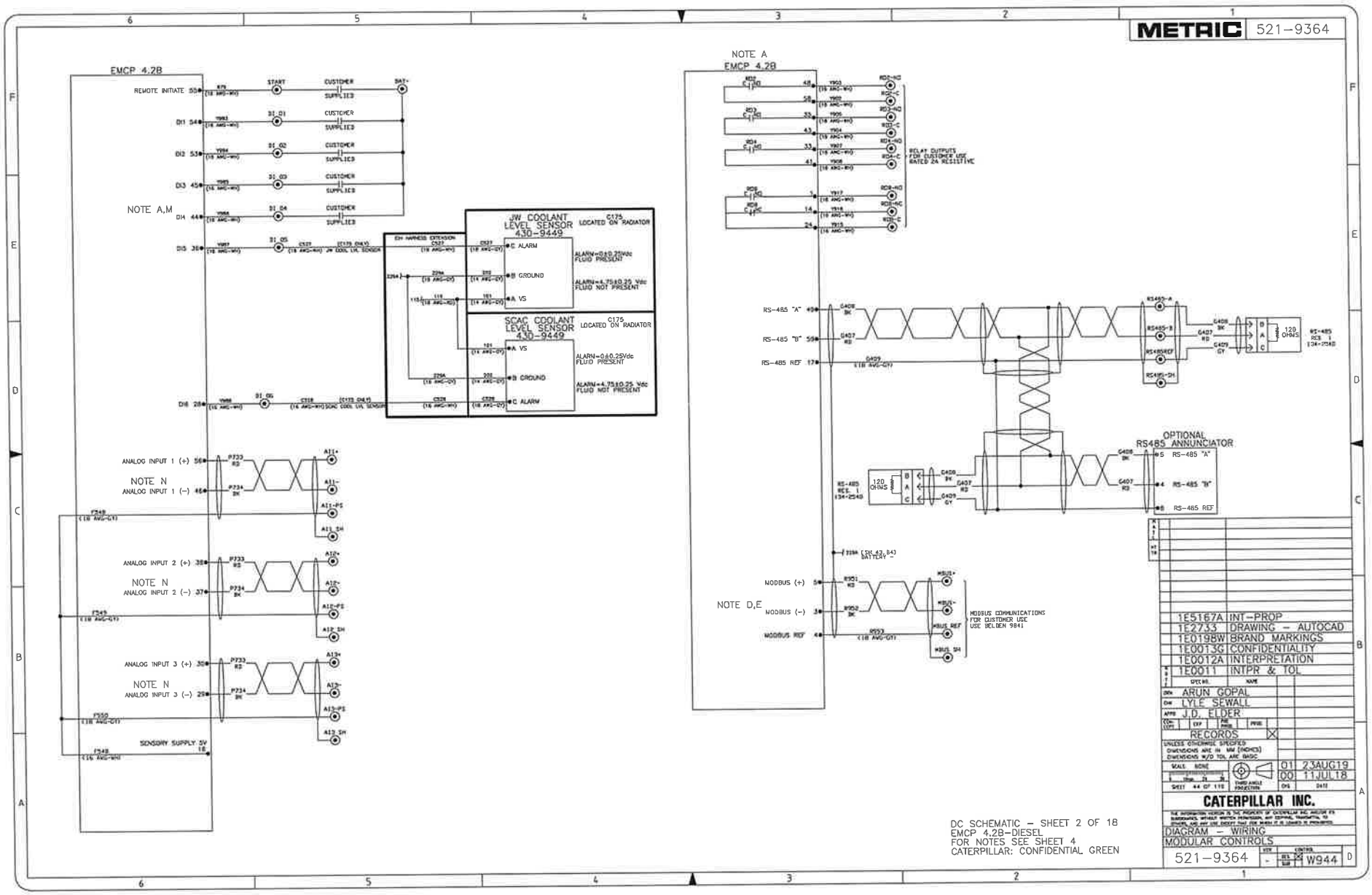
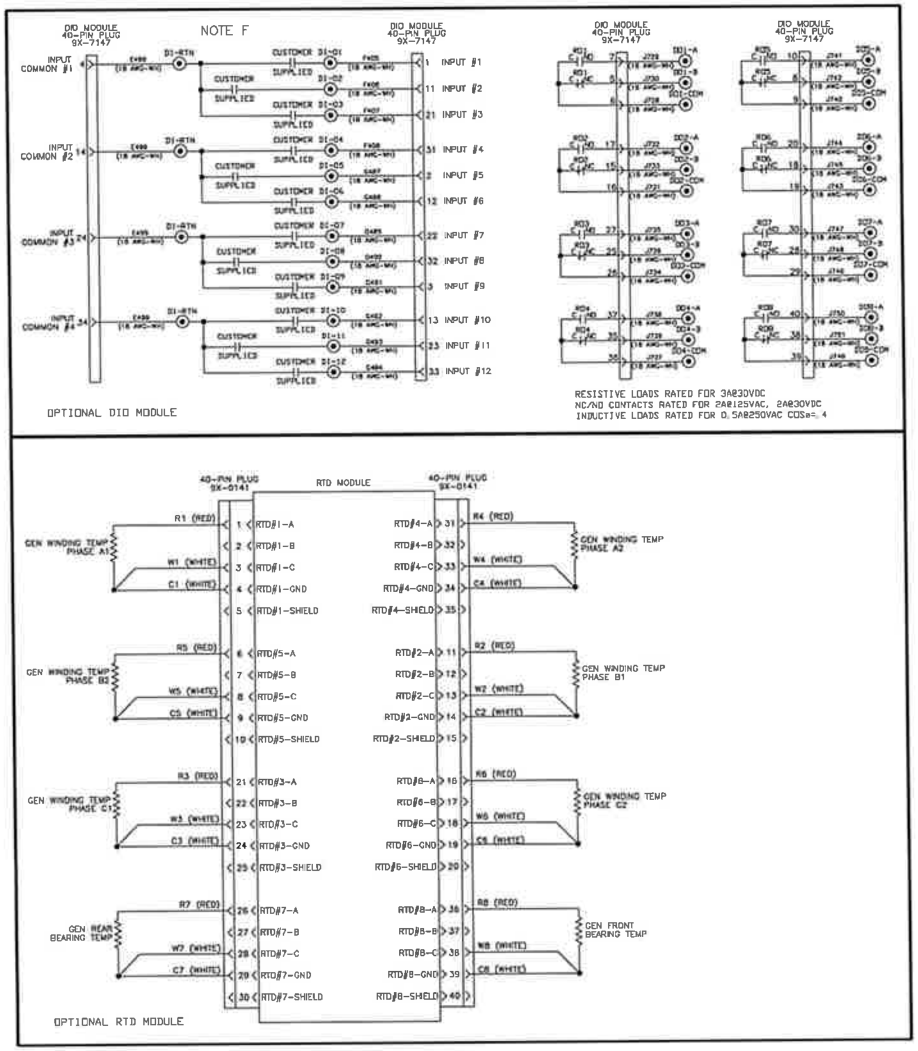
CATERPILLAR INC.
DIAGRAM – WIRING
MODULAR CONTROLS
521-9364
W944


METRIC 521-9364
EMCP 4.2B
REMOTE INITIATE
DI1
DI2
DI3
DI4
DI5
DI6
NOTE A,M
JW COOLANT LEVEL SENSOR 430-9449
SCAC COOLANT LEVEL SENSOR 430-9449
C175 LOCATED ON RADIATOR
ALARM=0±0.25Vdc FLUID PRESENT
ALARM=4.75±0.25 Vdc FLUID NOT PRESENT
ANALOG INPUT 1 (+)
ANALOG INPUT 1 (-)
NOTE N
ANALOG INPUT 2 (+)
ANALOG INPUT 2 (-)
ANALOG INPUT 3 (+)
ANALOG INPUT 3 (-)
SENSORY SUPPLY 5V
NOTE A
EMCP 4.2B
RELAY OUTPUTS FOR CUSTOMER USE RATED 2A RESISTIVE
RS-485 "A"
RS-485 "B"
RS-485 REF
120 OHMS
OPTIONAL RS485 ANNUNCIATOR
MODBUS (+)
MODBUS (-)
MODBUS REF
NOTE D,E
MODBUS COMMUNICATIONS FOR CUSTOMER USE USE BELDEN 9841
1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
1E0011 INTPR & TOL
DRN ARUN GOPAL
CHK LYLE SEWALL
APPR J.D. ELDER
RECORDS
SCALE NONE
SHEET 44 OF 110
01 23AUG19
00 11JUL18
CATERPILLAR INC.
DIAGRAM - WIRING
MODULAR CONTROLS
521-9364
W944
DC SCHEMATIC - SHEET 2 OF 18
EMCP 4.2B-DIESEL
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

METRIC 521-9364



DC SCHEMATIC – SHEET 3 OF 18
EMCP 4.2B-DIESEL
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

1E5167A	INT-PROP
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DRN ARUN GOPAL
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APPD J.D. ELDER
RECORDS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM (INCHES) DIMENSIONS W/O TOL ARE BASIC

SCALE: NONE

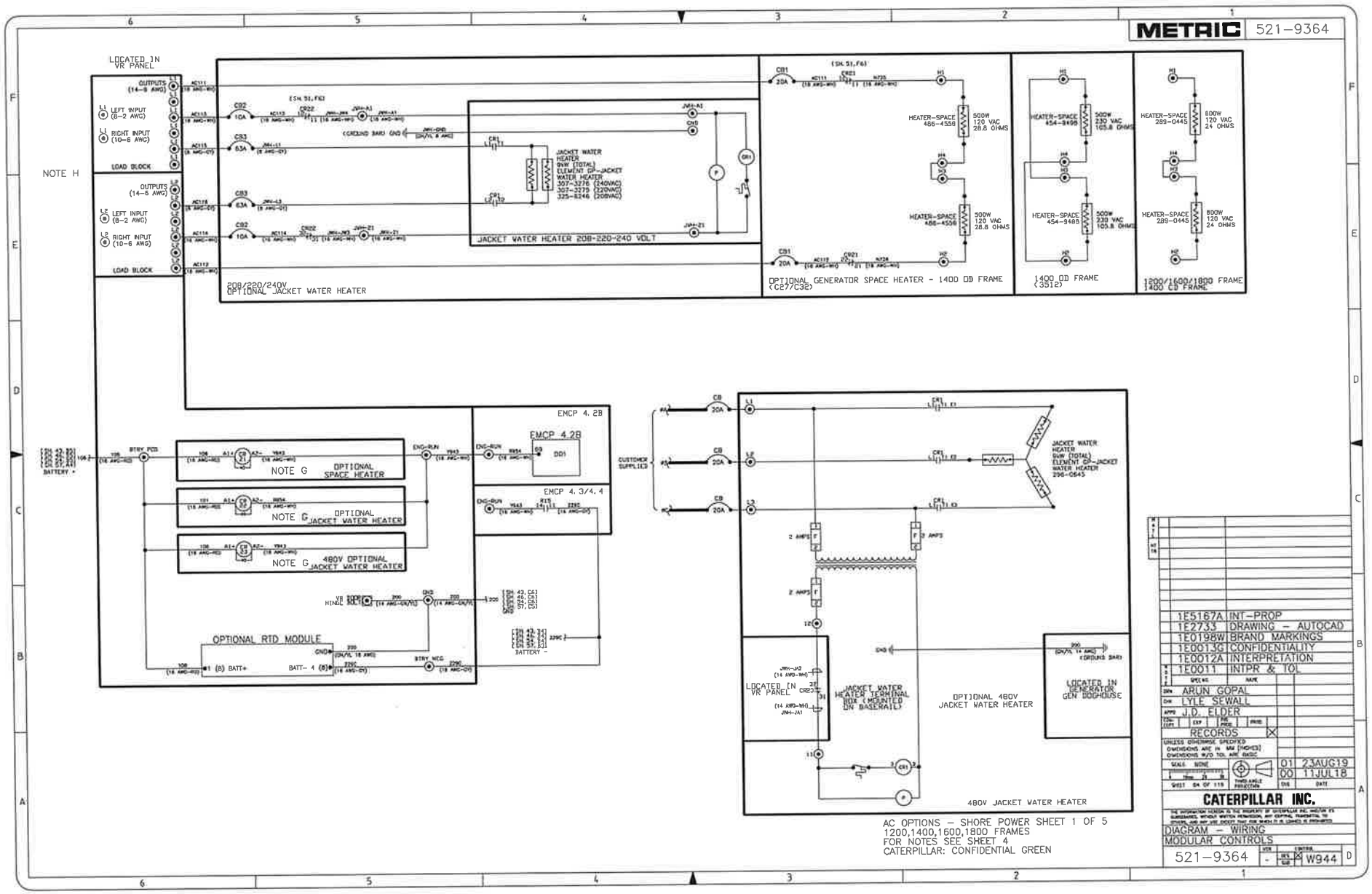
SHEET 43 OF 118

CHG	DATE
01	23AUG19
00	11JUL18

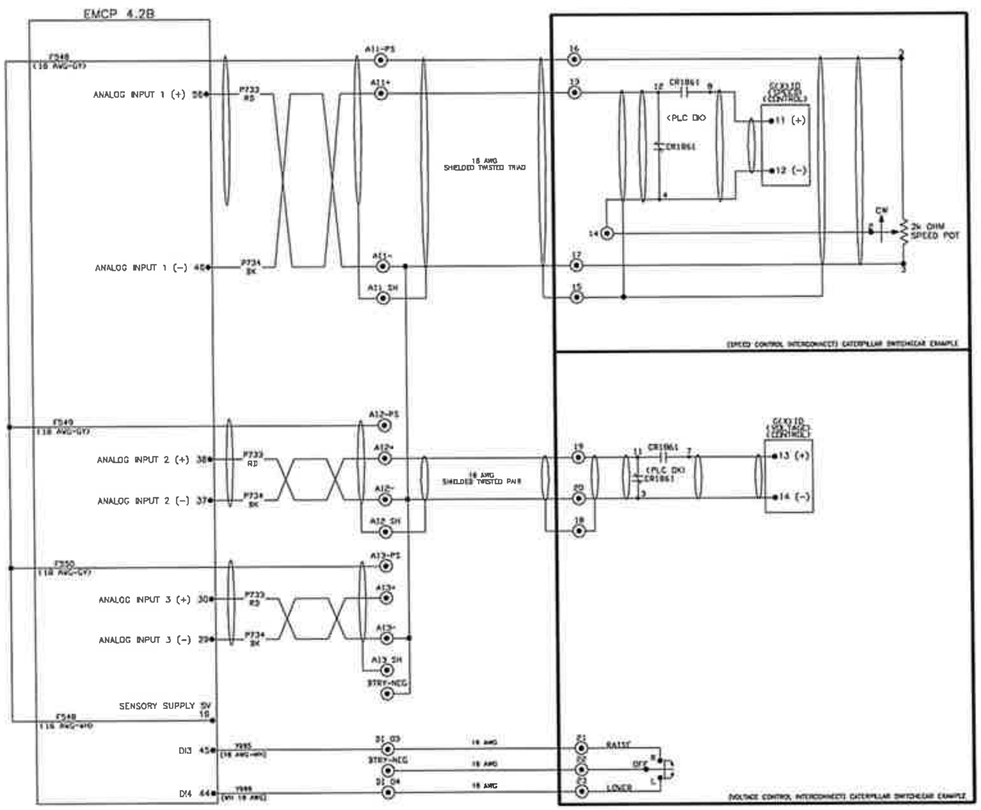
CATERPILLAR INC.

DIAGRAM – WIRING
MODULAR CONTROLS

521-9364 W944 0


METRIC 521-9364
LOCATED IN VR PANEL
OUTPUTS (14-8 AWG)
LEFT INPUT (8-2 AWG)
RIGHT INPUT (10-6 AWG)
LOAD BLOCK
OUTPUTS (14-6 AWG)
LEFT INPUT (8-2 AWG)
RIGHT INPUT (10-6 AWG)
LOAD BLOCK
NOTE H
208/220/240V OPTIONAL JACKET WATER HEATER
JACKET WATER HEATER 208-220-240 VOLT
JACKET WATER HEATER 9kW (TOTAL) ELEMENT QP-JACKET WATER HEATER 307-3276 (240VAC) 307-3275 (220VAC) 325-8246 (208VAC)
OPTIONAL GENERATOR SPACE HEATER - 1400 DD FRAME (C27/C32)
HEATER-SPACE 486-4556 500W 120 VAC 28.8 OHMS
HEATER-SPACE 486-4556 500W 120 VAC 28.8 OHMS
1400 DD FRAME (3512)
HEATER-SPACE 454-9498 500W 230 VAC 105.8 OHMS
HEATER-SPACE 454-9498 500W 230 VAC 105.8 OHMS
1200/1600/1800 FRAME 1400 CD FRAME
HEATER-SPACE 289-0445 600W 120 VAC 24 OHMS
HEATER-SPACE 289-0445 800W 120 VAC 24 OHMS
EMCP 4.2B
EMCP 4.3/4.4
NOTE G OPTIONAL SPACE HEATER
NOTE G OPTIONAL JACKET WATER HEATER
NOTE G 480V OPTIONAL JACKET WATER HEATER
OPTIONAL RTD MODULE
BATTERY +
BATTERY -
CUSTOMER SUPPLIED
JACKET WATER HEATER 9kW (TOTAL) ELEMENT QP-JACKET WATER HEATER 296-0645
LOCATED IN VR PANEL
JACKET WATER HEATER TERMINAL BOX (MOUNTED ON BASERAIL)
OPTIONAL 480V JACKET WATER HEATER
LOCATED IN GENERATOR GEN DOGHOUSE
480V JACKET WATER HEATER
AC OPTIONS - SHORE POWER SHEET 1 OF 5
1200,1400,1600,1800 FRAMES
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN
1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
1E0011 INTPR & TOL
DRN ARUN GOPAL
CHK LYLE SEWALL
APPD J.D. ELDER
RECORDS
SCALE NONE
01 23AUG19
00 11JUL18
CATERPILLAR INC.
DIAGRAM - WIRING
MODULAR CONTROLS
521-9364
W944
D

METRIC 521-9364



Using an available analog input, configure in ET (AI#1, #2, or #3) or display (#3) an analog input for Desired Engine Speed Command. Program the Analog Input Signal Range for 0 to 5V. The physical range is then mapped to a change in speed using the Minimum Data Range and Maximum Data Range. Keep in mind this value is a bias, so if you desire to change the speed from 1710 rpm to 1890 rpm, values of -90 for Minimum Data Range and +90 for Maximum Data Range would be used. (Based on 1800 RPM = Rated)

Voltage adjustments are categorized into two types: Manual biasing and Analog biasing.
Manual voltage adjustment includes fine tuning the generator output voltage via digital input, EMCP display or SCADA (Modbus). Analog voltage adjustment is performed via programmable analog inputs to the EMCP and provide a voltage control interface for external potentiometers or external control systems (such as switchgear).
It is important to note that the setpoint Gen Maximum Voltage Bias Percentage must be correctly configured to be greater than the expected bias range, otherwise it may not be possible to achieve the required voltage bias. The parameter Gen Maximum Voltage Bias Percentage is accessed within the CAT ET Service Tool configuration menu under Generator AC Monitor, or can be accessed from the EMCP display by navigating to the following sub-menu.
MAIN MENU
CONFIGURE
ALL SETPOINTS
GEN AC MONITOR

Note All manual voltage biasing is removed and reset to zero when the engine is stopped. Manual voltage bias levels are not carried over to the next start up after an engine shutdown.

Analog voltage adjustment is done via a programmable analog input to the EMCP configured for Generator Voltage Control. Analog inputs provide a voltage control interface for external potentiometers or external control systems (such as switchgear).
The Generator Voltage Control analog input signal is interpreted and converted by the EMCP into a voltage bias percentage of (nominal) rated voltage. For example, consider an analog input configured for a signal range of 0 to +5V and a data range of -10% to 10%. When this analog input signal value equals +3 V, a voltage bias percentage of +2.0 % of rated will be applied to the generator output voltage.

ANALOG INPUTS

The EMCP 4.1 and 4.2 support three 2-wire (plus shield) Analog Inputs. None of these inputs are dedicated to specific functions. These are individually selectable as either Voltage or Resistive Sender inputs for interface to senders, customer signals, etc. The modes of operation are described below:

- Voltage mode: 0-5 Volts with software-selectable sub-ranges

The input impedance is a minimum of 10k Ohms and a maximum of 1M Ohms. The Analog Input return signals must be tied to battery negative external to the controller.

Voltage Sender Ranges
0 to 5V
1 to 5V
0.5 to 4.5V

Any Analog Input can be configured for any one of the Data Identification parameters shown below:

- Engine Oil Pres
- Eng Coolant Temp
- Data Link □ SCADA (EMCP 4.2 only)
- Engine Oil Temp
- **Engine Speed Control**
- Engine Fuel Level
- **Generator Voltage Control**
- Ext Tank Fuel Level
- Custom Parameters

DIGITAL INPUTS

The EMCP 4.1 and 4.2 have six user-programmable Digital Inputs. The user programmable Digital Inputs are referenced to Battery (-) and will see a change in state at ~3VDC with a 1VDC hysteresis. The Digital Inputs seen on the display that are labeled "A" and "B" are reserved for E-Stop and Remote Start.

The Usage Type of COMMAND/STATUS is used to make certain system conditions be known by the EMCP 4; an example of a Command/Status parameter is:

- **Raise Speed**
- **Lower Speed**
- **Raise Voltage**
- **Lower Voltage**

Remote voltage adjustment toggle switches may be used to fine tune the generator output voltage by programming an EMCP digital input for Raise Voltage and Lower Voltage. Each activation of the digital input raises or lowers the voltage by 0.2% of rated. When the digital input is activated continuously, the voltage bias is raised or lowered by 0.2% of rated approximately every 400ms.

1E5167A	INT-PROP
1E2733	DRAWING - AUTOCAD
1E0198W	BRAND MARKINGS
1E0013G	CONFIDENTIALITY
1E0012A	INTERPRETATION
1E0011	INTPR & TOL

DRN ARUN GOPAL
CHK LYLE SEWALL
APPD J.D. ELDER
RECORDS
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM (INCHES) DIMENSIONS W/O TOL ARE BASIC
SCALE NONE
SHEET 89 OF 119
01 23AUG19
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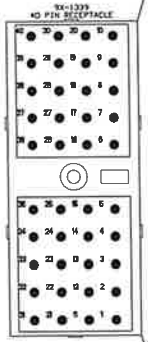
CATERPILLAR INC.

DIAGRAM - WIRING
MODULAR CONTROLS
521-9364 - W944 D

SPEED AND VOLTAGE CONTROL
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

9X-1339
40 PIN RECEPTACLE



40 PIN RECEPTACLE

DESCRIPTION	PIN#	WIRE # (COLOR AVG)
NOT USED	1	NOT USED
NOT USED	2	NOT USED
NOT USED	3	NOT USED
BATTERY +	4	115 (16 AVG-RD)
BATTERY +	5	116 (16 AVG-RD)
KEY SWITCH	18	390 (16 AVG-WH)
NOT USED	6	NOT USED
NOT USED	7	NOT USED
NOT USED	8	NOT USED
NOT USED	9	NOT USED
NOT USED	10	NOT USED
NOT USED	11	NOT USED
NOT USED	12	NOT USED
CAT DATA LINK +	13	893 (16 AVG-OR)
CAT DATA LINK -	14	892 (16 AVG-BR)
DIGITAL RETURN	15	990 (16 AVG-WH)
NOT USED	16	NOT USED
SOFT ESTOP2	17	F719 (16 AVG-WH)
SOFT ESTOP1	19	F715 (16 AVG-WH)
NOT USED	20	NOT USED
RATED SPEED - PWM	21	F702 (16 AVG-WH)
NOT USED	22	NOT USED
NOT USED	23	NOT USED
SMMS	24	F701 (16 AVG-WH)
NOT USED	25	NOT USED
NOT USED	26	NOT USED
NOT USED	27	NOT USED
NOT USED	28	NOT USED
PRELUBE MAG CONTROL	29	F705 (16 AVG-WH)
NOT USED	30	NOT USED
LOW IDLE SPD ("3516E/3516T4 ONLY")	31	L972 (16 AVG-WH)
HARD ESTOP ("3516E/3516T4 ONLY")	32	354 (16 AVG-WH)
JW COOL LVL ("3516E/3516T4 ONLY")	33	C527 (16 AVG-WH)
SCAC COOL LVL ("3516E/3516T4 ONLY")	34	C528 (16 AVG-WH)
CAN1 +	35	Y797 (YL 379-2330)
CAN1 -	36	Y798 (GN 379-2330)
CAN1 SH	38	Y799 (CU 379-2330)
BATTERY -	37	229A (16 AVG-BK)
BATTERY -	39	229B (16 AVG-BK)
BATTERY -	40	229C (16 AVG-BK)

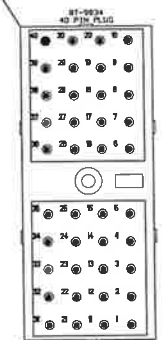
CONNECT TO ENGINE FOR 3500 EUI
OR ENGINE INTERFACE EXTENSION FOR 3516T41,3516E

40 PIN PLUG

WIRE # (COLOR AVG)	PIN#	DESCRIPTION
NOT USED	1	NOT USED
NOT USED	2	NOT USED
NOT USED	3	NOT USED
115 (16 AVG-RD)	4	F1 10 AMPS
116 (16 AVG-RD)	5	F2 20 AMPS
117 (16 AVG-RD)	6	F3 20 AMPS
NOT USED	8	NOT USED
NOT USED	9	NOT USED
NOT USED	10	NOT USED
NOT USED	11	NOT USED
NOT USED	12	NOT USED
NOT USED	16	NOT USED
NOT USED	18	NOT USED
893 (16 AVG-OR)	13	CAT DATA LINK +
892 (16 AVG-BR)	14	CAT DATA LINK -
990 (16 AVG-WH)	15	DIGITAL RETURN
NOT USED	19	NOT USED
387 (16 AVG-WH)	17	EMERGENCY STOP
NOT USED	20	NOT USED
NOT USED	22	NOT USED
F702 (16 AVG-WH)	21	RATED SPEED - PWM
NOT USED	25	NOT USED
NOT USED	26	NOT USED
F701 (16 AVG-WH)	24	SMMS
NOT USED	27	NOT USED
NOT USED	28	NOT USED
NOT USED	33	NOT USED
NOT USED	34	NOT USED
F705 (16 AVG-WH)	29	PRELUBE MAG CONTROL
NOT USED	37	NOT USED
F705 (16 AVG-WH)	7	LOW IDLE SPD SW (3516E/3516 T4 ONLY)
354 (16 AVG-WH)	23	EMERGENCY STOP
C527 (16 AVG-WH)	39	DIGITAL INPUT 5
C528 (16 AVG-WH)	40	DIGITAL INPUT 6
Y797 (YL 379-2330)	35	CAN1 +
Y798 (GN 379-2330)	36	CAN1 -
Y799 (CU 379-2330)	38	CAN1 SH
229A (16 AVG-BK)	30	BATTERY -
229B (16 AVG-BK)	31	BATTERY -
229C (16 AVG-BK)	32	BATTERY -

CONNECT TO MODULAR CONTROL PANEL

8T-9834
40 PIN PLUG



METRIC 521-9364

1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
1E0011 INTPR & TOL

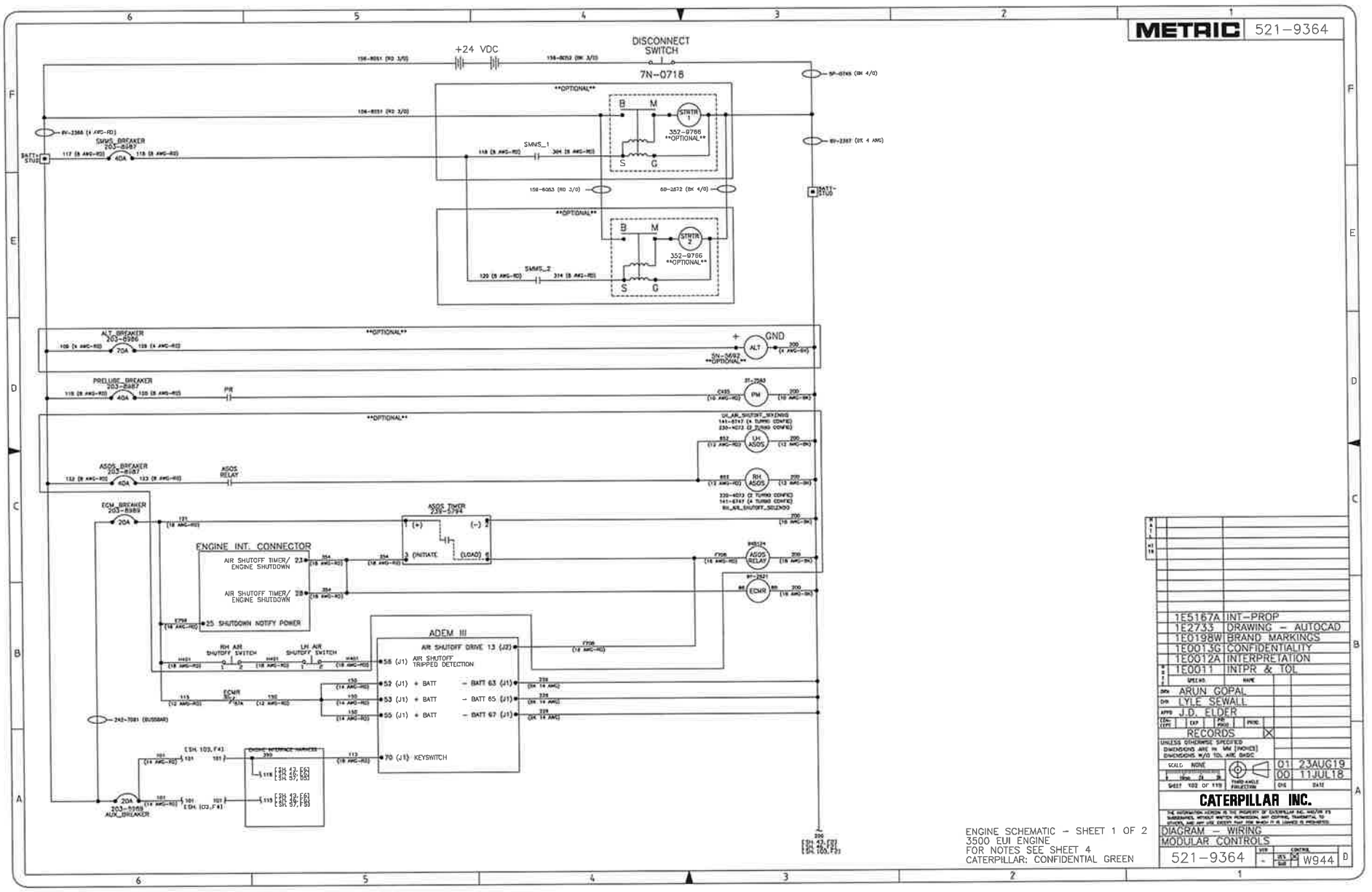
DRN ARUN GOPAL
CHK LYLE SEWALL
APPD J.D. ELDER
RECORDS

01 23AUG19
00 11JUL18

CATERPILLAR INC.

DIAGRAM - WIRING
MODULAR CONTROLS
521-9364 - W944 D

ENGINE INTERFACE HARNESS SHEET 1 OF 17
ON PACKAGE CONTROLS-3500 EUI
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN



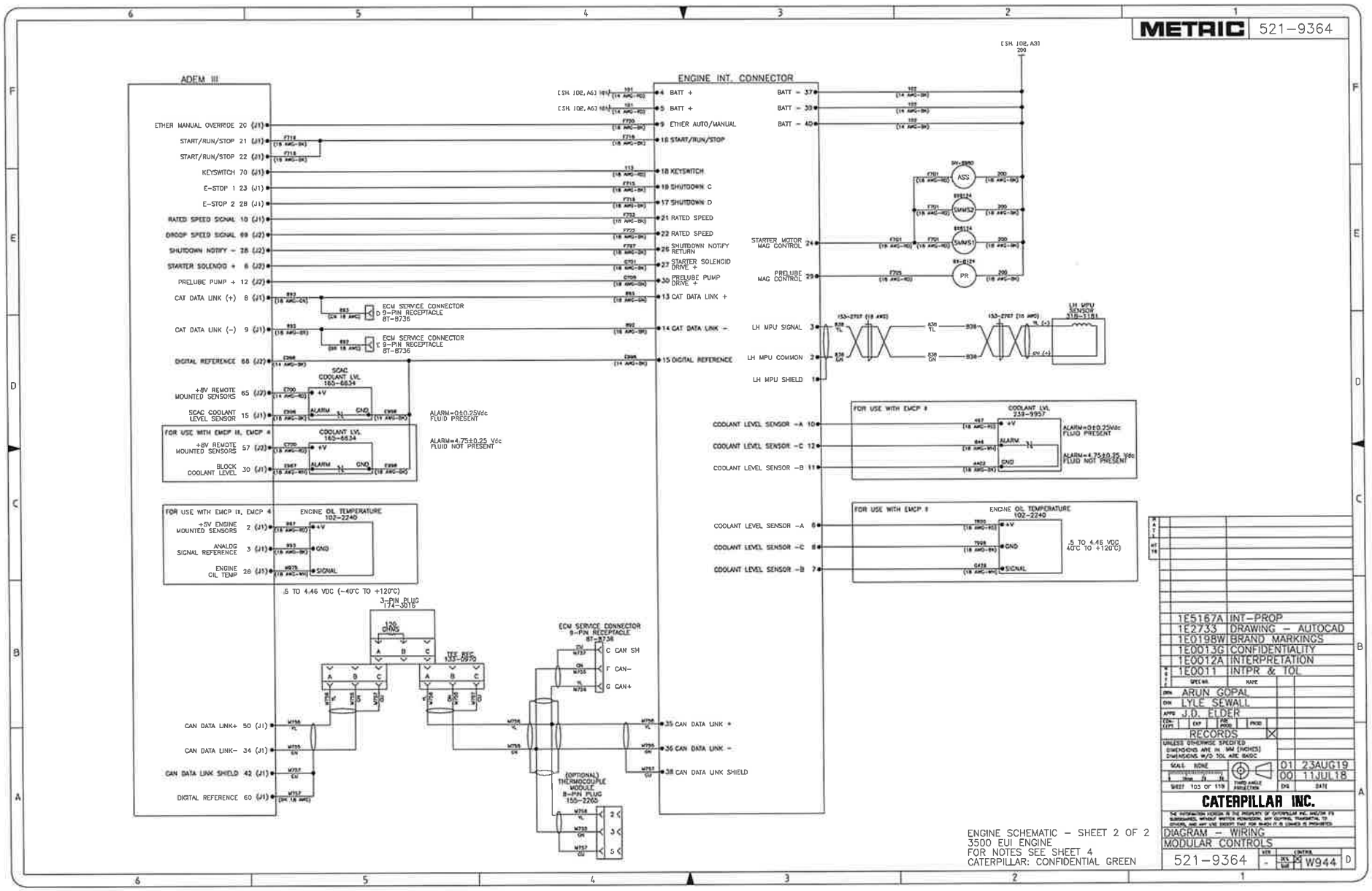
ENGINE SCHEMATIC – SHEET 1 OF 2
3500 EUI ENGINE
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN

1E5167A	INT-PROP
1E2733	DRAWING – AUTOCAD
1E0198W	BRAND MARKINGS
1E0013G	CONFIDENTIALITY
1E0012A	INTERPRETATION
1E0011	INTPR & TOL

DSN ARUN GOPAL
DR LYLE SEWALL
APPD J.D. ELDER
RECORDS X
SCALE NONE
SHEET 102 OF 119
01 23AUG19
00 11JUL18

CATERPILLAR INC.

DIAGRAM – WIRING
MODULAR CONTROLS
521-9364 W944 D


METRIC 521-9364
ADEM III
ENGINE INT. CONNECTOR
ETHER MANUAL OVERRIDE 20 (J1)
START/RUN/STOP 21 (J1)
START/RUN/STOP 22 (J1)
KEYSWITCH 70 (J1)
E-STOP 1 23 (J1)
E-STOP 2 28 (J1)
RATED SPEED SIGNAL 10 (J1)
DROOP SPEED SIGNAL 69 (J2)
SHUTDOWN NOTIFY - 25 (J2)
STARTER SOLENOID + 6 (J2)
PRELUBE PUMP + 12 (J2)
CAT DATA LINK (+) 8 (J1)
CAT DATA LINK (-) 9 (J1)
DIGITAL REFERENCE 66 (J2)
+8V REMOTE MOUNTED SENSORS 65 (J2)
SCAC COOLANT LEVEL SENSOR 15 (J1)
FOR USE WITH EMCP III, EMCP 4
+8V REMOTE MOUNTED SENSORS 57 (J2)
BLOCK COOLANT LEVEL 30 (J1)
COOLANT LVL 165-6634
ALARM=0±0.25Vdc FLUID PRESENT
ALARM=4.75±0.25 Vdc FLUID NOT PRESENT
FOR USE WITH EMCP III, EMCP 4
ENGINE OIL TEMPERATURE 102-2240
+5V ENGINE MOUNTED SENSORS 2 (J1)
ANALOG SIGNAL REFERENCE 3 (J1)
ENGINE OIL TEMP 28 (J1)
.5 TO 4.46 VDC (-40°C TO +120°C)
3-PIN PLUG 174-3015
TEE REC 155-0870
ECM SERVICE CONNECTOR 8-PIN RECEPTACLE 8T-8736
CAN DATA LINK+ 50 (J1)
CAN DATA LINK- 34 (J1)
CAN DATA LINK SHIELD 42 (J1)
DIGITAL REFERENCE 60 (J1)
(OPTIONAL) THERMOCOUPLE MODULE 8-PIN PLUG 155-2265
BATT + 4
BATT + 5
ETHER AUTO/MANUAL 9
START/RUN/STOP 18
KEYSWITCH 18
SHUTDOWN C 18
SHUTDOWN D 17
RATED SPEED 21
RATED SPEED 22
SHUTDOWN NOTIFY RETURN 25
STARTER SOLENOID DRIVE + 27
PRELUBE PUMP DRIVE + 30
CAT DATA LINK + 13
CAT DATA LINK - 14
DIGITAL REFERENCE 15
BATT - 37
BATT - 39
BATT - 40
STARTER MOTOR MAG CONTROL 24
PRELUBE MAG CONTROL 29
ASS
SWMS2
SWMS1
PR
LH MPU SENSOR 318-3181
LH MPU SIGNAL 3
LH MPU COMMON 2
LH MPU SHIELD 1
FOR USE WITH EMCP II
COOLANT LVL 239-9957
COOLANT LEVEL SENSOR -A 10
COOLANT LEVEL SENSOR -C 12
COOLANT LEVEL SENSOR -B 11
ALARM=0±0.25Vdc FLUID PRESENT
ALARM=4.75±0.25 Vdc FLUID NOT PRESENT
FOR USE WITH EMCP II
ENGINE OIL TEMPERATURE 102-2240
COOLANT LEVEL SENSOR -A 6
COOLANT LEVEL SENSOR -C 8
COOLANT LEVEL SENSOR -B 7
.5 TO 4.46 VDC 40°C TO +120°C)
ENGINE SCHEMATIC - SHEET 2 OF 2
3500 EUI ENGINE
FOR NOTES SEE SHEET 4
CATERPILLAR: CONFIDENTIAL GREEN
1E5167A INT-PROP
1E2733 DRAWING - AUTOCAD
1E0198W BRAND MARKINGS
1E0013G CONFIDENTIALITY
1E0012A INTERPRETATION
1E0011 INTPR & TOL
ARUN GOPAL
LYLE SEWALL
J.D. ELDER
RECORDS
SCALE NONE
SHEET 103 OF 119
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CATERPILLAR INC.
DIAGRAM - WIRING
MODULAR CONTROLS
521-9364
W944

RENOWN HEALTH REGIONAL CENTRAL UTILITY PLANT

DIESEL STANDBY GENERATOR SET SUBMITTAL

TAB 3: CAT 3516C DIESEL STANDBY GENERATOR SET PRODUCT DATASHEETS/CUTSHEETS

3.1 CAT 3516C DIESEL STANDBY GENERATOR SET
- 3.1.1 1822 FRAME GENERATOR TECHNICAL DATA

3.2 AUXILIARY EQUIPMENT
- 3.2.1 EMCP 4.2B GENERATOR SET CONTROLLER
- 3.2.2 LOCAL ANNUNCIATOR MODULE
- 3.2.3 REMOTE ANNUNCIATOR MODULE
- 3.2.4 DIO MODULE
- 3.2.5 CAT ENGINE STARTING BATTERIES
- 3.2.6 BATTERY CHARGER
- 3.2.7 JACKET WATER HEATER

3.3 IBC SEISMIC CERTIFICATE

PRODUCT DATASHEETS AND CUTSHEETS

CAT 3516C DIESEL STANDBY GENERATOR SET

Cat® 3516C
Diesel Generator Sets

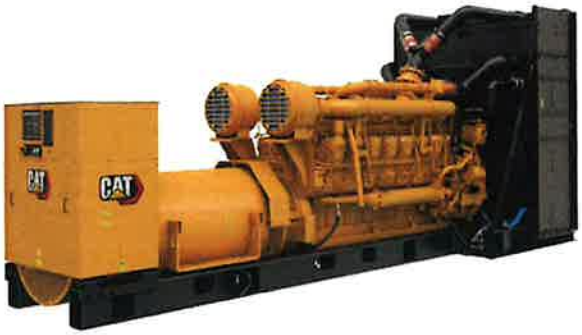


Image shown may not reflect actual configuration

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

Standby 60 Hz ekW (kVA)	Mission Critical 60 Hz ekW (kVA)	Prime 60 Hz ekW (kVA)	Continuous 60 Hz ekW (kVA)	Emissions Performance
2000 (2500)	2000 (2500)	1825 (2281)	1650 (2063)	U.S. EPA Stationary Emergency Use Only (Tier 2)

Features

Cat® Diesel Engine
- Meets U.S. EPA Stationary Emergency Use Only (Tier 2) emission standards
- Reliable performance proven in thousands of applications worldwide

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

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

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

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

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

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

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

Standard and Optional Equipment

Engine

Air Cleaner
- ☐ Single element
- ☑ Dual element

Muffler
- ☑ **Critical Grade Silencer (ships loose)**

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

Alternator

Output voltage

☐ 380V	☐ 6300V
☐ 440V	☐ 6600V
☐ 480V	☐ 6900V
☐ 600V	☐ 12470V
☐ 2400V	☐ 13200V
☑ 4160V	☐ 13800V

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

Winding type
- ☐ Random wound
- ☑ Form wound

Excitation
- ☐ Internal excitation (IE)
- ☑ Permanent magnet (PM)

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

Power Termination

Type
- ☑ Bus bar
- ☐ Circuit breaker

Differential CTs provided. Switchgear supplier to coordinate differential CTs on the switchgear side of the generator feeders to coordinate stator differential (87G) protections.

- ☐ LSIG-P

Control System

Controller
- ☑ EMCP 4.2B
- ☐ EMCP 4.3
- ☐ EMCP 4.4

Attachments
- ☑ Local annunciator module
- ☑ Remote annunciator module
- ☑ Expansion I/O module
- ☐ Remote monitoring software

Charging
- ☐ Battery charger – 10A
- ☑ Battery charger – 20A
- ☐ Battery charger – 35A

Vibration Isolators
- ☐ Rubber
- ☑ Spring
- ☑ Seismic rated

Cat Connect

Connectivity
- ☐ Ethernet
- ☐ Cellular

Extended Service Options

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

Coverage
- ☐ Silver
- ☐ Gold
- ☐ Platinum
- ☐ Platinum Plus

Ancillary Equipment
- ☐ Automatic transfer switch (ATS)
- ☐ Paralleling switchgear
- ☐ Paralleling controls

Certifications
- ☐ UL 2200 Listed
- ☐ CSA
- ☑ IBC seismic certification
- ☐ OSHPD pre-approval

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

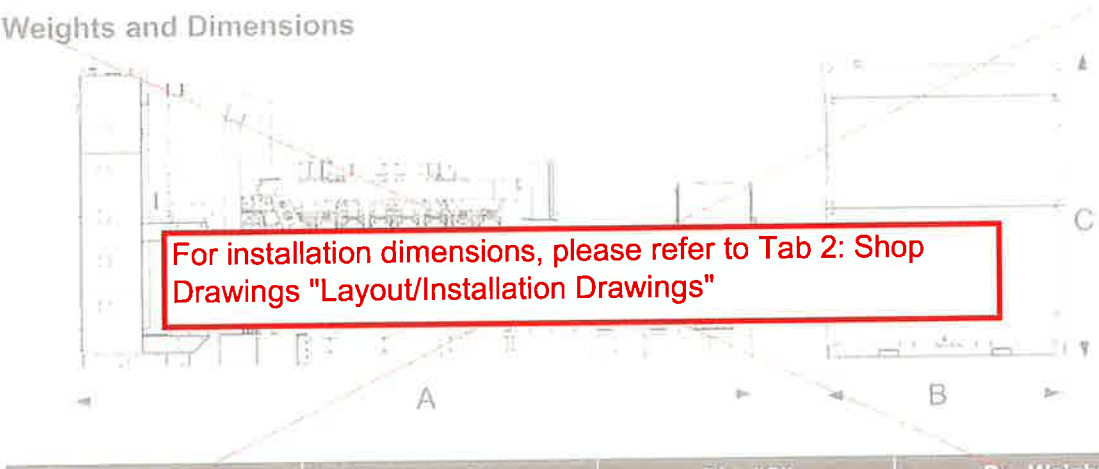
Package Performance

Performance	Standby		Mission Critical		Prime		Continuous	
Frequency	60 Hz		60 Hz		60 Hz		60 Hz	
Gen set power rating with fan	2000 ekW		2000 ekW		1825 ekW		1650 ekW	
Gen set power rating with fan @ 0.8 power factor	2500 kVA		2500 kVA		2281 kVA		2063 kVA	
Emissions	EPA ESE (TIER 2)		EPA ESE (TIER 2)		EPA ESE (TIER 2)		EPA ESE (TIER 2)	
Performance number	EM1896-03		EM1897-03		DM8264-06		DM8265-05	
Fuel Consumption								
100% load with fan – L/hr (gal/hr)	505.8	(133.6)	505.8	(133.6)	465.6	(123.0)	427.9	(113.0)
75% load with fan – L/hr (gal/hr)	393.9	(104.1)	393.9	(104.1)	366.7	(96.9)	338.3	(89.4)
50% load with fan – L/hr (gal/hr)	284.2	(75.1)	284.2	(75.1)	261.3	(69.0)	238.3	(63.0)
25% load with fan – L/hr (gal/hr)	164.3	(43.4)	164.3	(43.4	154.2	(40.7)	144.1	(38.1)
Cooling System								
Radiator air flow restriction (system) – kPa (in. water)	0.12	(0.48)	0.12	(0.48)	0.12	(0.48)	0.12	(0.48)
Radiator air flow – m³/min (cfm)	2204	(77834)	2204	(77834)	2204	(77834)	2204	(77834)
Engine coolant capacity – L (gal)	233.2	(61.6)	233.2	(61.6)	233.2	(61.6)	233.2	(61.6)
Radiator coolant capacity – L (gal)	180.0	(47.6)	180.0	(47.6)	180.0	(47.6)	180.0	(47.6)
Total coolant capacity – L (gal)	413.2	(109.2)	413.2	(109.2)	413.2	(109.2)	413.2	(109.2)
Inlet Air								
Combustion air inlet flow rate – m³/min (cfm)	185.5	(6548.9)	185.5	(6548.9)	180.0	(6357.6)	174.3	(6155.8)
Exhaust System								
Exhaust stack gas temperature – °C (°F)	400.1	(752.1)	400.1	(752.1)	382.8	(721.1)	370.7	(699.3)
Exhaust gas flow rate – m³/min (cfm)	433.1	(15292.8)	433.1	(15292.8)	408.1	(14410.4)	385.3	(13605.7)
Exhaust system backpressure (maximum allowable) – kPa (in. water)	6.7	(27.0)	6.7	(27.0)	6.7	(27.0)	6.7	(27.0)
Heat Rejection								
Heat rejection to jacket water – kW (Btu/min)	759	(43150)	759	(43150)	715	(40666)	673	(38277)
Heat rejection to exhaust (total) – kW (Btu/min)	1788	(101696)	1788	(101696)	1645	(93554)	1522	(86577)
Heat rejection to aftercooler – kW (Btu/min)	672	(38240)	672	(38240)	612	(34784)	553	(31421)
Heat rejection to atmosphere from engine – kW (Btu/min)	133	(7564)	133	(7564)	127	(7230)	123	(6983)
Heat rejection from alternator – kW (Btu/min)	96	(5464)	96	(5464)	86	(4895)	76	(4326)
Emissions* (Nominal)								
NOx mg/Nm³ (g/hp-h)	2754.3	(5.46)	2754.3	(5.46)	2488.9	(5.05)	2202.3	(4.37)
CO mg/Nm³ (g/hp-h)	143.3	(0.30)	143.3	(0.30)	129.7	(0.27)	112.3	(0.24)
HC mg/Nm³ (g/hp-h)	44.7	(0.11)	44.7	(0.11)	55.6	(0.13)	67.4	(0.16)
PM mg/Nm³ (g/hp-h)	10.4	(0.03)	10.4	(0.03)	10.9	(0.03)	12.0	(0.03)
Emissions* (Potential Site Variation)								
NOx mg/Nm³ (g/hp-h)	3305.2	(6.56)	3305.2	(6.56)	2986.6	(6.06)	2642.7	(5.24)
CO mg/Nm³ (g/hp-h)	258.0	(0.54)	258.0	(0.54)	233.4	(0.49)	202.1	(0.43)
HC mg/Nm³ (g/hp-h)	59.5	(0.14)	59.5	(0.14)	73.9	(0.18)	89.6	(0.22)
PM mg/Nm³ (g/hp-h)	14.6	(0.04)	14.6	(0.04)	15.3	(0.04)	16.8	(0.04)

**mg/Nm³ levels are corrected to 5% O_2. Contact your local Cat dealer for further information.*

3516C Diesel Generator Sets
Electric Power

Weights and Dimensions



Dim "A" mm (in)	Dim "B" mm (in)	Dim "C" mm (in)	Dry Weight kg (lb)
6542 (257.6)	2339 (92.1)	2997 (118.0)	16 275 (35,880)

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

Ratings Definitions

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

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

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

Continuous
Output available with non-varying load for an unlimited time. Average power output is 70-100% of the continuous rated ekW. Typical peak demand is 100% of continuous rated ekW for 100% of the operating hours.

Applicable Codes and Standards
AS 1359, CSA C22.2 No. 100-04, UL 142, UL 489, UL 869, UL 2200, IBC, IEC 60034-1, ISO 3046, ISO 8528, NEMA MG1-22, NEMA MG1-33, 2014/35/EU, 2006/42/EC, 2014/30/EU and facilitates compliance to NFPA 37, NFPA 70, NFPA 99, NFPA 110.

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

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

Fuel Rates
Fuel consumption reported in accordance with ISO 3046-1, based on fuel oil of 35° API [16°C (60°F)] gravity having an LHV of 42,780 kJ/kg (18,390 Btu/lb) when used at 15°C (59°F) and weighing 850 g/liter (7.0936 lbs/U.S. gal.) All fuel consumption values refer to rated engine power.

3516 PGFL
LEHE1376-08 (07/21)

PRODUCT DATASHEETS AND CUTSHEETS

1822 GENERATOR FRAME TECHNICAL DATA

GENERATOR DATA

(AT400240)-ENGINE (BAA126422A)-CEM

NOVEMBER 03, 2021

For Help Desk Phone Numbers Click here

Selected Model

Engine: 3516	**Generator Frame:** 1822	**Genset Rating (kW):** 2000.0	**Line Voltage:** 4160
Fuel: Diesel	**Generator Arrangement:** 3723048	**Genset Rating (kVA):** 2500.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 347.0
Duty: STANDBY	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 41205 /40749 /40680 /9270

Spec Information

Generator Specification

Frame: 1822 **Type:** SR5	**No. of Bearings:** 2
Winding Type: FORM WOUND	**Flywheel:** 21.0
Connection: SERIES STAR	**Housing:** 00
Phases: 3	**No. of Leads:** 6
Poles: 4	**Wires per Lead:** 1
Sync Speed: 1800	**Generator Pitch:** 0.6667

Generator Efficiency

Per Unit Load	kW	Efficiency %
0.25	500.0	92.0
0.5	1000.0	94.9
0.75	1500.0	95.8
1.0	2000.0	95.9

Reactances	Per Unit	Ohms
SUBTRANSIENT - DIRECT AXIS X''_d	0.1264	0.8753
SUBTRANSIENT - QUADRATURE AXIS X''_q	0.1186	0.8213
TRANSIENT - SATURATED X'_d	0.1914	1.3248
SYNCHRONOUS - DIRECT AXIS X_d	3.0222	20.9204
SYNCHRONOUS - QUADRATURE AXIS X_q	1.3374	9.2580
NEGATIVE SEQUENCE X_2	0.1225	0.8480
ZERO SEQUENCE X_0	0.0100	0.0691

Time Constants	Seconds
OPEN CIRCUIT TRANSIENT - DIRECT AXIS T'_{d0}	5.0860
SHORT CIRCUIT TRANSIENT - DIRECT AXIS T'_d	0.3221
OPEN CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_{d0}	0.0075
SHORT CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_d	0.0065
OPEN CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_{q0}	0.0066
SHORT CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_q	0.0057
EXCITER TIME CONSTANT T_e	0.2580
ARMATURE SHORT CIRCUIT T_a	0.0454

Short Circuit Ratio: 0.43 | Stator Resistance = 0.0787 Ohms | Field Resistance = 0.8963 Ohms

Voltage Regulation

Voltage level adjustment: +/-	5.0%
Voltage regulation, steady state: +/-	0.5%
Voltage regulation with 3% speed change: +/-	0.5%
Waveform deviation line - line, no load: less than	3.0%
Telephone influence factor: less than	50

Generator Excitation

	No Load	Full Load, (rated) pf	
		Series	Parallel
Excitation voltage:	9.82 Volts	47.0 Volts	Volts
Excitation current	0.9 Amps	3.56 Amps	Amps

Selected Model

Engine: 3516 **Generator Frame:** 1822 **Genset Rating (kW):** 2000.0 **Line Voltage:** 4160
Fuel: Diesel **Generator Arrangement:** 3723048 **Genset Rating (kVA):** 2500.0 **Phase Voltage:** 2402
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Generator Mechanical Information

Center of Gravity

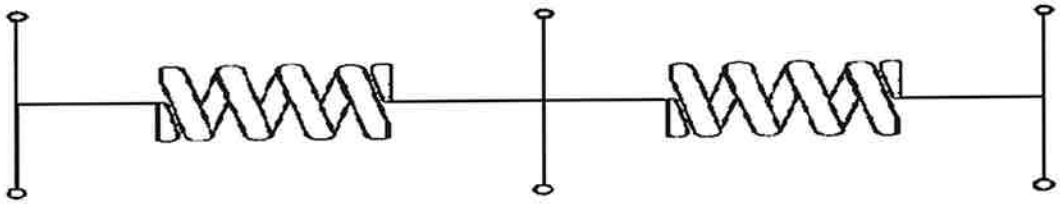
Dimension X	-1071.9 mm	-42.2 IN.
Dimension Y	0.0 mm	0.0 IN.
Dimension Z	0.0 mm	0.0 IN.

- "X" is measured from driven end of generator and parallel to rotor. Towards engine fan is positive. See General Information for details
- "Y" is measured vertically from rotor center line. Up is positive.
- "Z" is measured to left and right of rotor center line. To the right is positive.

Generator WT = 4905 kg * Rotor WT = 1778 kg * Stator WT = 2411 kg
10,814 LB 3,920 LB 5,315 LB

Rotor Balance = 0.0508 mm deflection PTP
Overspeed Capacity = 125% of synchronous speed

Generator Torsional Data



J1 = Coupling and Fan **J2 = Rotor** **J3 = Exciter End**
TOTAL J = J1 + J2 + J3

K1 = Shaft Stiffness between J1 + J2 (Diameter 1) **K2 = Shaft Stiffness between J2 + J3 (Diameter 2)**

J1	K1	Min Shaft Dia 1	J2	K2	Min Shaft Dia 2	J3
30.1 LB IN. s^2	62.0 MLB IN./rad	5.0 IN.	547.2 LB IN. s^2	57.3 MLB IN./rad	3.8 IN.	3.8 LB IN. s^2
3.397 N m s^2	7.0 MN m/rad	127.0 mm	61.82 N m s^2	6.47 MN m/rad	96.5 mm	0.43 N m s^2

Total J
581.0 LB IN. s^2
65.647 N m s^2

Selected Model

Engine: 3516 **Generator Frame:** 1822 **Genset Rating (kW):** 2000.0 **Line Voltage:** 4160
Fuel: Diesel **Generator Arrangement:** 3723048 **Genset Rating (kVA):** 2500.0 **Phase Voltage:** 2402
Frequency: 60 **Excitation Type:** Permanent Magnet **Pwr. Factor:** 0.8 **Rated Current:** 347.0
Duty: STANDBY **Connection:** SERIES STAR **Application:** EPG **Status:** Current
Version: 41205 /40749 /40680 /9270

Generator Cooling Requirements - Temperature - Insulation Data

Cooling Requirements:		**Temperature Data: (Ambient 40 ^{0}C)**	
Heat Dissipated:	85.5 kW	**Stator Rise:**	105.0 ^{0}C
Air Flow:	199.2 m^3/min	**Rotor Rise:**	105.0 ^{0}C

Insulation Class: H

Insulation Reg. as shipped: 100.0 MΩ minimum at 40 ^{0}C

Thermal Limits of Generator

Frequency:	60 Hz
Line to Line Voltage:	4160 Volts
B BR 80/40	2250.0 kVA
F BR -105/40	2563.0 kVA
H BR - 125/40	2813.0 kVA
F PR - 130/40	2813.0 kVA
H PR - 150/40	3125.0 kVA

Selected Model

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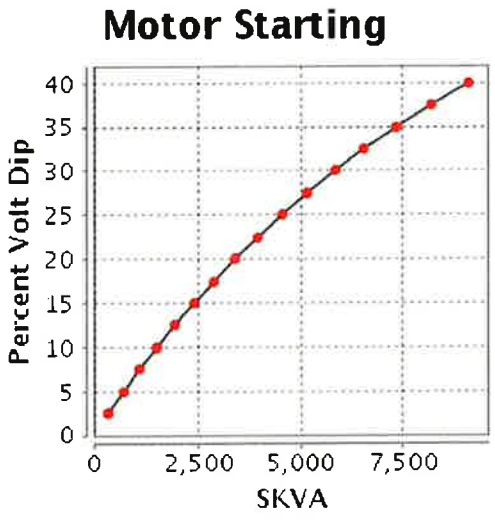
Version:
41205 /40749 /40680 /9270

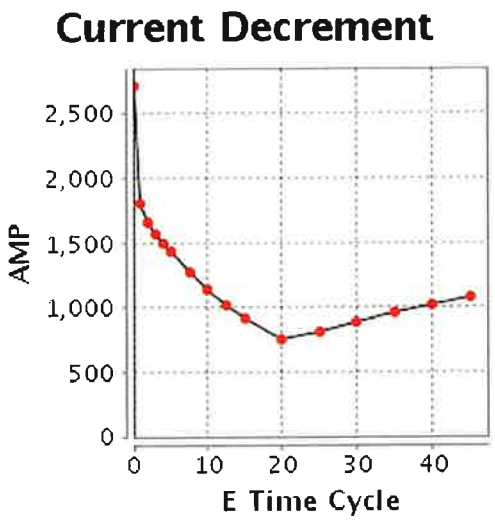
Starting Capability & Current Decrement
Motor Starting Capability (0.4 pf)

SKVA	Percent Volt Dip
349	2.5
716	5.0
1,104	7.5
1,512	10.0
1,944	12.5
2,402	15.0
2,887	17.5
3,403	20.0
3,952	22.5
4,537	25.0
5,163	27.5
5,833	30.0
6,553	32.5
7,329	35.0
8,167	37.5
9,074	40.0



Current Decrement Data

E Time Cycle	AMP
0.0	2,720
1.0	1,801
2.0	1,655
3.0	1,574
4.0	1,502
5.0	1,434
7.5	1,278
10.0	1,141
12.5	1,021
15.0	915
20.0	754
25.0	804
30.0	885
35.0	960
40.0	1,026
45.0	1,084



Instantaneous 3 Phase Fault Current: 2720 Amps **Instantaneous Line - Line Fault Current:** 2393 Amps

Instantaneous Line - Neutral Fault Current: 3985 Amps

Selected Model

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Fuel: Diesel	**Generator Arrangement:** 3723048	**Genset Rating (kVA):** 2500.0	**Phase Voltage:** 2402
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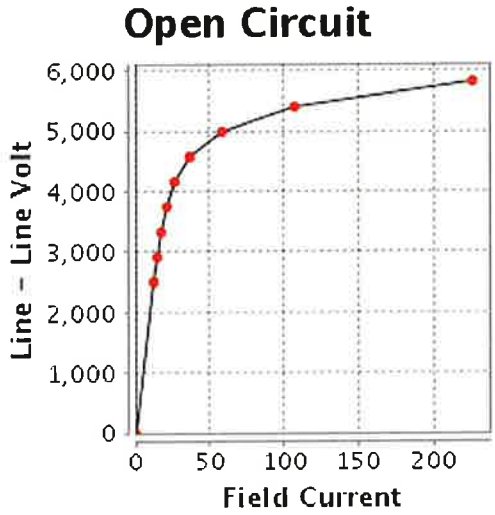
Duty: STANDBY	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version:
41205 /40749 /40680 /9270

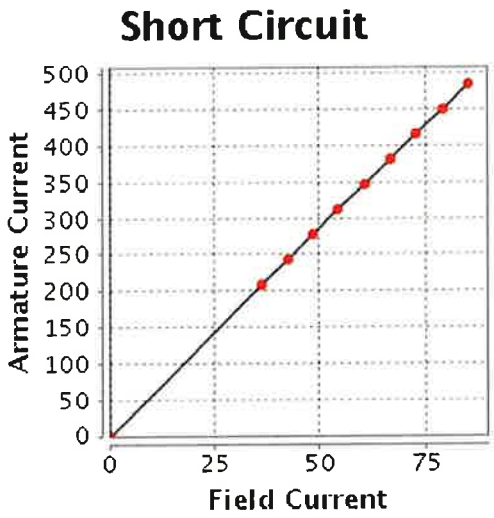
Generator Output Characteristic Curves
Open Circuit Curve

Field Current	Line - Line Volt
0.0	0
12.7	2,496
15.0	2,912
17.6	3,328
21.1	3,744
26.5	4,160
36.6	4,576
58.3	4,992
108.1	5,408
226.1	5,824



Short Circuit Curve

Field Current	Armature Current
0.0	0
36.4	208
42.5	243
48.5	278
54.6	312
60.7	347
66.7	382
72.8	416
78.9	451
85.0	486



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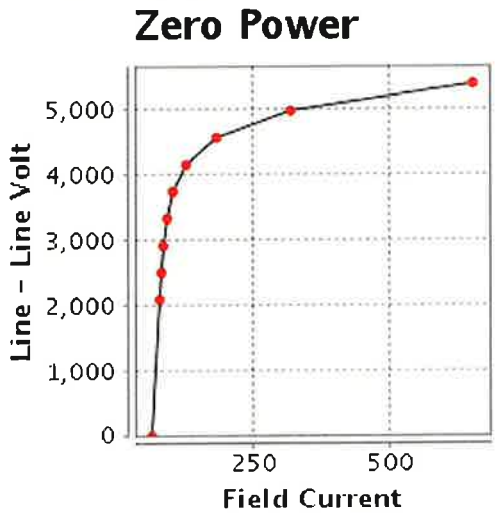
Duty: STANDBY **Connection:** SERIES STAR **Application:** EPG **Status:** Current
Version:
41205 /40749 /40680 /9270

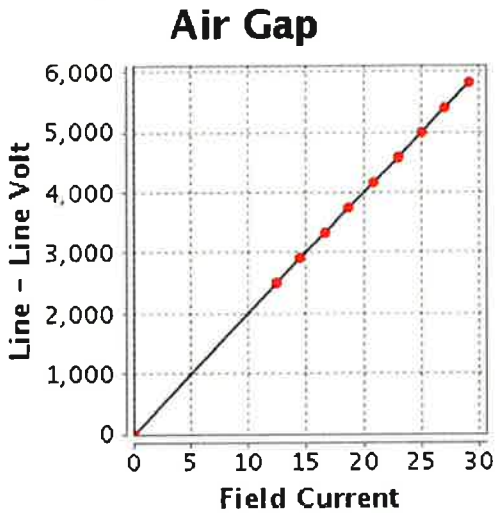
Generator Output Characteristic Curves
Zero Power Factor Curve

Field Current	Line - Line Volt
60.7	0
75.6	2,080
78.4	2,496
82.1	2,912
88.1	3,328
99.6	3,744
124.5	4,160
182.2	4,576
319.7	4,992
651.2	5,408



Air Gap Curve

Field Current	Line - Line Volt
0.0	0
12.5	2,496
14.6	2,912
16.7	3,328
18.8	3,744
20.9	4,160
23.0	4,576
25.0	4,992
27.1	5,408
29.2	5,824



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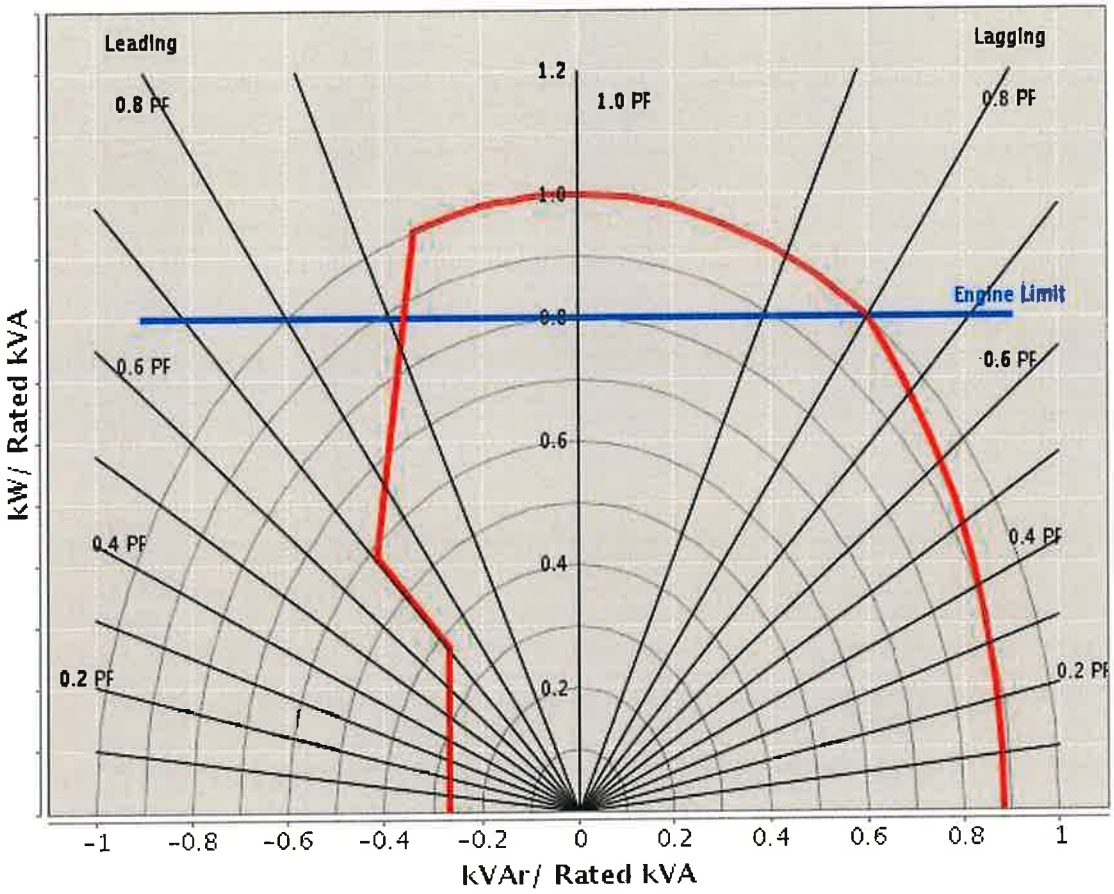
Version:
41205 /40749 /40680 /9270

Reactive Capability Curve

Operating Chart



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Version:
41205 /40749 /40680 /9270

General Information

DM7825 Caterpillar SR5 Generators (50 Hz, 60 Hz)
Data for 1400, 1600, 1700, 1800 and 1900 frames Caterpillar SR5 generators built by Leroy Somer - USA and Leroy Somer France.

Refer to DM7821 for explanation of all generator data in Technical Marketing Information (TMI) except generator efficiency for which the explanation is given below.

GENERATOR EFFICIENCY
Generator efficiency is the percentage of engine flywheel (or other prime mover) power that is converted into electrical output. The generator efficiency shown is calculated by the summation of all losses method, and is determined in accordance with the IEC Standard 60034. The efficiency considers only the generator. There is no consideration of engine or parasitic losses here.

Refer to DM7829 for low and medium voltage protective setting values a nd limits.

PRODUCT DATASHEETS AND CUTSHEETS

AUXILIARY EQUIPMENT

Attachment

EMCP 4.2B Generator Set Controller factory installed on generator set

Pi cture shown may not reflect actual configuration

EMCP 4.2B GENERATOR SET CONTROLLER

The Cat® EMCP 4.2B offers fully featured power metering, protective relaying and engine and generator control and monitoring. Engine and generator controls, diagnostics, and operating information are accessible via the control panel keypads; diagnostics from the EMCP 4 optional modules can be viewed and reset through the EMCP 4.2B.

Full range of attachments

- Wide range of system expansion attachments, designed specifically to work with the EMCP 4
- Flexible packaging options for easy and cost effective installation

World wide product support

- Cat dealers provide extensive pre and post sale support
- Cat dealers have over 1,600 dealer branch stores operating in 200 countries

Features

- A 33 x 132 pixel, 3.8 inch, white backlit graphical display denotes text alarm/event descriptions, set points, engine and generator monitoring, and is visible in all lighting conditions.
- Textual display with support for 26 languages
- Advanced engine monitoring is available on systems with an ADEM™ controller.
- Integration with the CDVR and IVR provides enhanced system performance
- Fully featured power metering, protective relaying, engine and generator parameter viewing, and expanded AC metering are all integrated into this controller.
- Real-time clock allows for date and time stamping of diagnostics and events in the control's logs as well as service maintenance reminders based on engine operating hours or calendar days. Up to 40 diagnostic events are stored in the non-volatile memory

Features

- Ability to view and reset diagnostics on EMCP 4 optional modules via the control panel removes the need for a separate service tool for troubleshooting
- Set points and software stored in non-volatile memory, preventing loss during a power outage
- Five levels of security allow for configurable operator privileges
- Programmable security levels for groups of setpoints.
- Programmable kW Relays (3)
- Programmable weekly exerciser timer
- Dealer configurable resistive maps
- Default overview screen
- Real (kW) Load histogram
- Auto mains failure
- Programmable logic functionality
- Selectable units
    - Temperature: °C or °F
    - Pressure: psi, kPa, bar
    - Fuel Consumption: Liter/hr or Gal/hr (U.S. or U.K.)

Standard Features

- Voltage (L-L, L-N)
- Current (Phase)
- Average Volt, Amp, Frequency
- kW, kVAr, kVA (Average, Phase, %)
- Power Factor (Average, Phase)
- kW-hr, kVAr-hr (total)
- Excitation voltage and current (with CDVR)
- Desired Voltage, Excitation Command, Operating Mode (with IVR)
- Generator stator and bearing temp (with optional module)
- kW load histogram

Generator Protection

- Generator phase sequence
- Over/Under voltage (27/59)
- Over/Under frequency (81 O/U)
- Reverse Power (kW) (32)
- Reverse Reactive Power (kVAr) (32RV)
- Overcurrent (50/51)
- Thermal Damage Curve

Engine Monitoring

- Coolant temperature
- Oil pressure
- Engine speed (RPM)
- Battery voltage
- Run hours
- Crank attempt and successful start counter
- Enhanced engine monitoring (with electronic engines)

Engine Protection

- Control switch not in auto (alarm)
- High coolant temp (alarm and shutdown)
- Low coolant temp (alarm)
- Low coolant level (alarm)
- High engine oil temp (alarm and shutdown)
- Low, high, and weak battery voltage
- Overspeed
- Overcrank
- Low Oil Pressure

Control

- Run / Auto / Stop control
- Speed and voltage adjust
- Local and remote emergency stop
- Remote start/stop
- Cycle crank

Inputs & Outputs

- Two dedicated digital inputs
- Three analog inputs
- Six programmable digital inputs
- Eight relay out
- Two programmable digital outputs

Communications

- Primary and accessory CAN data links
- RS-485 annunciator data link
- Modbus RTU (RS-485 Half duplex)

Language Support

Arabic, Bulgarian, Czech, Chinese, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Italian, Icelandic, Japanese, Latvian, Lithuanian, Norwegian, Polish, Portuguese, Romanian, Russian, Spanish, Swedish, Turkish

Environmental

- Control module operating temperature: -40°C to 70°C
- Display operating temperature: -20°C to 70°C
- Humidity: 100% condensing 30°C to 60°C
- Storage temperature: -40°C to 85°C
- Vibration: Random profile, 24-1000 Hz, 4.3G rms

Standards

- UL Recognized
- CSA C22.2 No.100,14, 94
- Complies with all necessary standards for CE Certification
  - 98/37/EC Machinery Directive
  - BS EN 60204-1 Safety of Machinery 89/336/EEC EMC Directive
  - BS EN 50081-1 Emissions Standard
  - BS EN 50082-2 Immunity Standard 73/23/EEC Low Voltage Directive
  - EN 50178 LVD Standard
- IEC529, IEC60034-5, IEC61131-3
- MIL STND 461

Optional Modules

CAN annunciator

The EMCP 4 CAN Annunciator serves to display generator set system alarm conditions and status indications.
The annunciator has been designed for use on the accessory communication network and may be used in either local (package mounted) or remote (up to 800 feet) application. A maximum of four annunciators may be used with a single EMCP.

RS-485 annunciator

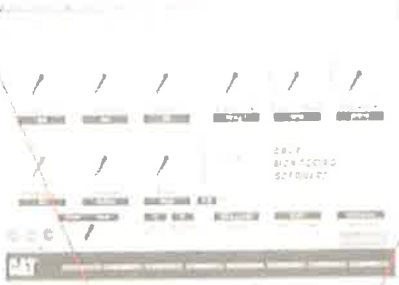
The EMCP 4 RS-485 Annunciator serves to display generator set system alarm conditions and status indications. The annunciator has been designed for use on the long distance annunciator datalink and is used for remote (up to 4000 feet) application.

The remote monitoring software allows the user to configure data monitoring and data acquisition processes for monitoring, graphing, and logging of generator set data.

Qty. (1) Local Annunciator factory installed on generator set.

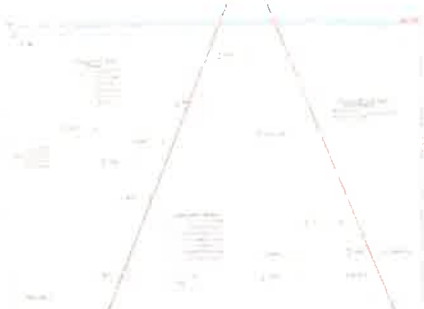
Qty. (1) Remote Annunciator ships loose for on-site contractor installation

Remote monitoring software



The EMCP remote monitoring software package is a PC based program which allows the user to monitor and control a generator set, and is capable of running on a Windows based operating system. The remote monitoring software allows the user to configure data monitoring and data acquisition processes for monitoring, graphing, and logging of generator set data.

Programmable logic software



The EMCP programmable logic software package is a PC based program which allows the configuration of the programmable logic blocks, and is capable of running on a Windows based operating system. The programmable logic software allows the user to configure logic to change the operation of the EMCP control and interfaces within a limited scope.

Optional Modules (Continued)

Digital input/output module

The Digital Input/Output (DI/O) module serves to provide expandable Input and Output event capability of the EMCP 4 and is capable of reading 12 digital inputs and setting 8 relay outputs.
The DI/O module has been designed for use on the accessory Communication Network and may be used in either local (package mounted) or remote (up to 800 feet) application.

RTD module

The RTD module serves to provide expandable generator temperature monitoring capability of the EMCP 4 and is capable of reading up to eight type 2-wire, 3-wire and 4-wire RTD inputs.

The RTD Module has been designed for use on the Accessory Communication Network and may be used in either local (package mounted) or remote (up to 800 feet) application. A maximum of one RTD Module may be used with a single EMCP 4.

Qty. (1) DI/O Module comes factory installed in generator set control panel

Qty. (1) RTD module factory installed as part of generator set

Thermocouple module

The thermocouple module serves to provide expandable engine and generator temperature monitoring capability of the EMCP 4 and is capable of reading up to twenty Type J or K thermocouple inputs.

The thermocouple module has been designed for use on the primary communication network for engine information and the accessory communication network for generator information. It may be used in either local (package mounted) or remote (up to 800 feet) application. A maximum of one thermocouple modules may be used with a single EMCP 4 on each datalink.

LEHE1208-01 (08/18)

Cat® Batteries

Cat Batteries – Greater Starting Power – Lower Maintenance – Longer Life

Cat Premium High Output (PHO) batteries are used in all Caterpillar Machines and Engine Gen-Sets. They are designed to meet stringent Caterpillar design specifications, which provide industry leading cold cranking amp (CCA) capability and maximum vibration resistance.

Maintenance Free or low maintenance designs are available in wet and dry configurations.

General Service Line batteries are available in Maintenance Free or low maintenance designs and in wet or dry configurations. Wide selections of BCI group sizes are available for automotive, light truck, bus, industrial, agricultural, marine, recreational and valve regulated (VRLA-AGM & Gel) applications.

Caterpillar. The difference counts.™

Cat Dealers define world – class product support. We offer you the right parts and service solutions, when and where you need them.

The Cat Dealer network of highly trained experts keeps your entire fleet up and running to maximize your equipment investments.

CATERPILLAR®

World's Toughest Batteries

Premium High Output – Maximum Vibration Resistance

- Vibration Resistance...five times the Industry Standard
- Exclusive "flat top" BCI group 4D & 8D batteries are Maintenance Free and have the industries highest cold cranking amps (CCA)
- Popular BCI group 31 Maintenance Free batteries with industry leading cold cranking amps...up to 1000 (CCA), for electric power, machine or on-highway truck and bus applications. Deep cycle models available for truck, marine or recreational usage

Specifications for Cat Premium High Output Batteries – Available Worldwide

BCI Group Size	Part No.	Cold Cranking Amps"	Reserve Capacity Minutes'	Volts	Amp Hr. Capacity @ 20 Hrs.	Construction	Add Water Maintenance Check Hours	BCI Overall Dimensions Length In (mm)	Width In (mm)	Height In (mm)	Nominal Weight Wet Lb (kg)	Dry Lb (kg)	Nominal Acid to Fill Qt (liter)
8D	153-5720	1500	465	12	210	C	MF	20.47 (520)	10.8 (275)	9.76 (248)	132 (60)	–	–

Qty. (4) wired in series-parallel arrangement

Construction Notes:
LAC = Low Maintenance, Hybrid Construction
C = Calcium Lead Alloy Grid Design
MF = Maintenance Free
MFA = Maintenance Free with Accessible Vent Caps
S = Stud Terminals
+ = Shipped Dry Only
* = Side Terminals
** = Starting and Deep Cycle Battery
*** = Deep Cycle and Starting Battery
" = For 30 seconds at 0° F (-18° C)
' = Minimum of 25 amp output at 80° F (27° C)
SAE = Uses SAE Posts
SDT = Dual, Top mounted Terminals, Stud and SAE Post, Marine Deep Cycle/Starting Battery
SC = Silver (Ag) Calcium Alloy Grids for resistance to high underhood temperatures

Rugged Design – Built Tough – Reliable Starting

- Positive and Negative plates are anchored to container bottom and locked at the top of cell element for maximum vibration resistance.
- Heavy-duty forged terminal post bushings provide maximum strength and resistance to acid seepage.
- Hefty full-frame grids, no sharp edges, optimum acid/paste combination provides better charge acceptance after deep discharge.
- Manifold vented cover with built-in Flame Arrestor…a safety feature that directs corrosive gases away from the battery and hold-downs.
- Thick, robust container resists rugged treatment typical of heavy-duty commercial use. Embossed part number & descriptors for easy serviceability.

2022 EPA Tier 2 Exhaust Emission Compliance Statement
500DFEK
Stationary Emergency
60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with Tier 2 emissions limit of U.S. EPA New Source Performance Standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart IIII.

Engine Manufacturer:	Cummins Inc.
EPA Certificate Number:	NCEXL015.AAJ-051
Effective Date:	09/03/2021
Date Issued:	09/03/2021
EPA Engine Family (Cummins Emissions Family):	NCEXL015.AAJ

Engine Information:

Model:	QSX/QSX15/QSX15-G/QSX15-G9	Bore:	5.39 in. (137 mm)
Engine Nameplate HP:	755	Stroke:	6.65 in. (169 mm)
Type:	4 Cycle, In-line, 6 Cylinder Diesel	Displacement:	912 cu. in. (15 liters)
Aspiration:	Turbocharged and CAC	Compression ratio:	17.0:1
Emission Control Device:	Electronic Control	Exhaust stack diameter:	8 in. (203 mm)

Diesel Fuel Emission Limits

D2 Cycle Exhaust Emissions

	Grams per BHP-hr			Grams per kWm-hr		
	NO_X + NMHC	CO	PM	NO_X + NMHC	CO	PM
Test Results	4.3	0.4	0.10	5.7	0.6	0.13
EPA Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20

Test methods: EPA emissions recorded per 40 CFR Part 60, 89, 1039, 1065 and weighted at load points prescribed in the regulations for constant speed engines.

Diesel fuel specifications: Cetane number: 40-50, Reference: ASTM D975 No. 2-D, 300-500 ppm Sulfur

Reference conditions: Air Inlet Temperature: 25 °C (77 °F), Fuel Inlet Temperature: 40 °C (104 °F). Barometric Pressure: 100 kPa (29.53 in Hg), Humidity: 10.7 g/kg (75 grains H2O/lb) of dry air; required for NOx correction, Restrictions: Intake Restriction set to a maximum allowable limit for clean filter; Exhaust Back Pressure set to a maximum allowable limit..

Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

Exhaust Emission Data Sheet
500DFEK
60 Hz Diesel Generator Set
EPA NSPS Stationary Emergency

Engine Information:

Model:	Cummins Inc. QSX15-G9 NR 2	Bore:	5.39 in. (137 mm)
Nameplate BHP @ 1800 RPM:	755	Stroke:	6.65 in. (169 mm)
Type:	4 cycle, in-line, 6 cylinder diesel	Displacement:	912 cu. in. (14.9 liters)
Aspiration:	Turbocharged with air-to-air charge air cooling		
Compression Ratio:	17:1		
Emission Control Device:	Turbocharged with charge air-cooled		

Performance Data	1/4 Standby	1/2 Standby	3/4 Standby	Full Standby	Full Prime
Engine HP @ Stated Load (1800 RPM)	202	379	555	732	668
Fuel Consumption (gal/Hr)	11.3	18.7	25.8	34.7	30.6
Exhaust Gas Flow (CFM)	1400	2150	2730	3625	3160
Exhaust Gas Temperature (°F)	745	830	820	900	880
Exhaust Emission Data					
HC (Total Unburned Hydrocarbons)	0.24	0.09	0.07	0.14	0.12
NOx (Oxides of Nitrogen as NO_2)	3.24	3.65	4.64	4.43	4.04
CO (Carbon Monoxide)	0.57	0.34	0.40	0.39	0.36
PM (Particulate Matter)	0.09	0.05	0.05	0.02	0.02
Smoke (Pierburg)	0.52	0.44	0.42	0.21	0.20

All values (except smoke) are cited: g/BHP-hr

Test Methods and Conditions

Steady-state emissions recorded per ISO8178-1 during operation at rated engine speed (+/- 2%) and stated constant load (+/- 2%) with engine temperatures, pressures and emission rated stabilized.

Fuel specification:	40-48 Cetane Number, 0.05 Wt.% max. Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.
Air Inlet Temperature:	25 °C (77 °F)
Fuel Inlet Temperature:	40 °C (104 °F)
Barometric Pressure:	100 kPa (29.53 in Hg)
Humidity:	10.7 g/kg (75 grains H_2O/lb) of dry air (required for NOx correction)
Intake Restriction:	Set to maximum allowable limit for clean filter
Exhaust Back Pressure:	Set to maximum allowable limit

Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Tests conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results.

Renown Regional Medical Center
1155 Mill Street
Reno, NV 89502

Gas Fired Equipment

Unit ID	Unit Type	Manuf	Qnty	Model # (if available)	BTU in	BTU Tot
	Kitchen	Baker Flat Top Grill	2		160000	320,000
		Rational	6		106500	639,000
		Blodget	2		50000	100,000
		Groen	1		144000	144,000
		Rational	1		303000	303,000
		Rational	2		170000	340,000

Gas Fired Equipment

Unit ID	Unit Type	Manuf	Qnty	Model # (if available)	BTU in	BTU Tot
	Kitchen	Vulcan Grill	1		66000	66,000
		Vulcan Stove Top	1		12000	12,000
						-
						-
						-
						-

Gas Fired Equipment

Unit ID	Unit Type	Manuf	Qnty	Model # (if available)	BTU in	BTU Tot
						-
						-
						-
						-
						-
						-

Facility **Renown (1495 Mill Street)**

Fuel Type Natural Gas

Unit ID	Unit Type	Manuf	Qnty	Model # (if available)	Serial # (if available)	BTU in	BTU Total
WHUK-001&2	Hot Water Heating Boiler	Lochinvar	2	AWN400PN		399,999	799,998
New roof top nuits 3 years old							
RTU-15	Roof top units HVAC	Aaon roof top package unit	1	RN009-3-0-5F2		195,000	195,000
RTU-9	Roof top units HVAC	Aaon roof top package unit	1	RN011-3-0-CB02		292,500	292,500
RTU-10,11,13,14	Roof top units HVAC	Aaon roof top package unit	4	RN013-3-0-KB09		248,000	992,000
RTU-7,8	Roof top units HVAC	Aaon roof top package unit	2	RN015-3-0-KB09		292,500	585,000
Seven old Aaon unit mark tobe replace in the next two years							
RTU-12	Roof top units HVAC	Aaon roof top package unit	1	RE08-3-20-321		182,000	182,000
RTU-3	Roof top units HVAC	Aaon roof top package unit	1	RE08-3-20-322		228,000	228,000
RTU-4,5,6	Roof top units HVAC	Aaon roof top package unit	3	RE10-3-20-322		228,000	684,000
RTU-1	Roof top units HVAC	Aaon roof top package unit	1	RE10-3-20-322		228,000	228,000
RTU-2	Roof top units HVAC	Aaon roof top package unit	1	RE10-3-20-322		228,000	228,000
Kitchen Equipment							
1		Cleveland Steamer	2	24CGA10		125,000	250,000
2		Frymaster Fryer	1	GF14SC		100,000	100,000
3		Convection Oven	2	VC4GD-11D1		50,000	100,000
4		Royal Range	1	RR-6		60,000	60,000
5		Valcan Griddle	1	MSA36-101		81,000	81,000
6		APW Wyott Charboiler	1	GCB-36S		90,000	90,000
							5,095,498