From: Travis Ritchie
To: Elizabeth.Barker
Subject: RE: [EXT] Request for Approval Under Air Emissions Permit 60-010-01 Faro Rapids Generating Station
Date: January 10, 2024 8:27:35 AM
Attachments: image006.png
image007.png
image008.png
image009.png
image010.png
image011.png

Hi Liz,

Thanks for your email.

We are not asking for more capacity. Recall that we meet our site capacity threshold of 15.5 MW how ever we can with the units we have outlined will be on site. In this case, replacement of the FD1 capacity with the new Tier 4 units will supplant the 2.4 MW of FD1 rated capacity before retirement, plus the balance of the 5.15 MW that is currently being met by the YMs (i.e., FD1 is decommissioned and we will need fewer YMs after the replacement units are installed). As such 5.15 MW of pre-Tier and Tier 2 capacity will now be met mostly with the new Tier 4 units. We are not asking to increase the assessed site capacity of 15.5 MW, just swapping capacity around to meet operational needs.

Hope this helps with your review process.

Regards,

Travis

From: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Sent: January 8, 2024 4:37 PM
To: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Subject: RE: [EXT] Request for Approval Under Air Emissions Permit 60-010-01 Faro Rapids Generating Station

Good Afternoon Travis,
I've reviewed the attached request and have a couple thoughts. In the 2021-0115 Faro YESAA assessment, FD1 was assessed using the de-rated capacity of 2.4MW and the air emissions permit was issued on that basis. As a result, the 5.15MW capacity you have listed for FD1 in the attached request is not representative of the assessed project scope. You are technically asking for a "replacement" that would add an extra 2.5MW of capacity that was not included in the 2021 assessment.

That being said, I recognize the new generators have a US EPA Tier 4 rating, which is higher than any other generator installed onsite. From an air emissions point of view, this replacement is beneficial and addresses concerns that were raised in the YESAA assessment regarding air quality.

I need to dig deeper on this one but I'll be in touch once I have more information.

Elizabeth Barker
Environmental Protection Analyst
Environment | Standards & Approvals
T 867-667-5456 | Yukon.ca

From: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Sent: December 12, 2023 12:16 PM
To: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Cc: admin-faro@faroyukon.ca; lorraine.sterriah@rrdc.ca; Lisa Wiklund <lisa.wiklund@yec.yk.ca>
Subject: [EXT] Request for Approval Under Air Emissions Permit 60-010-01 Faro Rapids Generating Station

Hello Liz,

Please see the attached request for approval. If you have any difficulties with the file please let me know.

Thank you.

Regards,

Travis

Travis Ritchie
Director, Risk & Compliance

yukon energy

Telephone: 867-393-5350 | Mobile: 867-333-0300

SustainableElectricityCompany™

From: Travis Ritchie
To: Elizabeth.Barker
Subject: RE: [EXT] RE: Faro Station Modifications
Date: February 20, 2023 9:53:31 AM
Attachments: image002.png
image003.png
image004.png
image005.png
image006.png
image007.png

Hi Liz,

Thanks for that info. Appreciate it.

We'll get the modification proposal to you as soon as we can. Likely next month or in April once our engineering team solidifies the draft plan.

Regards,

Travis

From: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Sent: February 20, 2023 9:17 AM
To: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Subject: RE: [EXT] RE: Faro Station Modifications

Hi Travis,
I appreciate the additional context around YEC's operations. It's good to hear the permit capacity is built into the system controls.

I'd like to let you know that based on the information received to date, the proposed changes to the Faro station are not considered YESAB assessable. We will further evaluate and confirm this decision once we're received formal notification and more details from YEC.

Thanks,
Liz

Elizabeth Barker
Environmental Protection Analyst
Environment | Standards and Approvals
T 867-667-5456 | Yukon.ca

From: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Sent: Thursday, February 16, 2023 10:00 AM
To: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Subject: RE: [EXT] RE: Faro Station Modifications

Hi Liz,

Thanks for your note.

For context, we are still responding to evolving operational needs and community concerns in Faro, so are only in the planning phase of any potential changes. Recent dialogue with the municipal government and residents in the Town of Faro is part of the engagement we are undertaking during this phase. Once we have a draft plan crystallized we had planned to engage your team for review and approval of the potential changes, so we will make sure Part 2, Item 5 of the permit is followed once we reach that point.

Regarding permitted operational capacity I wanted to share that the System Operators are familiar of our permit thresholds and have these rules built directly into their system controls. Any attempt to dispatch more generation at a facility beyond its permitted capacity prompts an alarm that annunciates to the Operator so that we maintain compliance with this permit requirement. As you may know, YEC maintains installed capacity at several of its thermal generating stations that exceeds the operational thresholds allowed by the air emissions permits. This redundancy ensures if any units fail to start when called upon, that we have sufficient back-up resources to meet system demands. In any extraordinary circumstances where we may have an emissions exceedance we would notify your office and that of the Compliance and Inspections Unit forthwith.

Hope this additional context is helpful.

Thanks again.

Regards,

Travis

From: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Sent: February 16, 2023 8:37 AM
To: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Subject: RE: [EXT] RE: Faro Station Modifications

Hi Travis,
Thanks very much for the responses. While I recognize that you have provided information about the proposed modification below, I'll still ask that prior to making any modifications at the Faro station, please send me an official notification and wait until we have approved the modifications before proceeding with them, as per Part 2.5 of the current permit as shown below.

5. The permittee shall obtain approval from an environmental protection analyst prior to:
a) any addition, modification, removal or replacement of any equipment or components related to the release, abatement, control or treatment of air emissions; or
b) any change in location of the source(s).

Additionally, as you are aware, the Faro station was assessed and permitted for a capacity of 15.5MW. Operation above a capacity of 15.5MW will result in non-compliance and could result in further enforcement action.

Thanks again for the quick response and I'll be in touch regarding the complaint management plan.

Cheers,
Liz

From: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Sent: February 14, 2023 2:47 PM
To: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Cc: Lisa Wiklund <lisa.wiklund@yec.yk.ca>
Subject: RE: [EXT] RE: Faro Station Modifications

Hi Liz,

Sorry for the delay. Please see my response embedded below.

Please let me know if you need anything further or would like to discuss.

Regards,

Travis

From: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Sent: February 14, 2023 1:54 PM
To: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Cc: Lisa Wiklund <Lisa.Wiklund@yec.yk.ca>
Subject: RE: [EXT] RE: Faro Station Modifications

Hi Travis,
I need to write a response this week and I was hoping you could answer the following questions?
Are all of the following modifications going to occur at the Faro station: **RESPONSE: Yes**

- Decommissioning FD1 – Mirrlees KV16 Generator
- Adding two new "permanent" generators, FD8 and FD9.
- Moving 3 "temporary" rental generators and infrastructure to a different location in the facility.
- Removing 2 "temporary" rental generators.
- Possible addition of sound barriers around FD7 and/or two of the rentals

If yes…
What is the nameplate capacity and tier of FD8 and FD9?

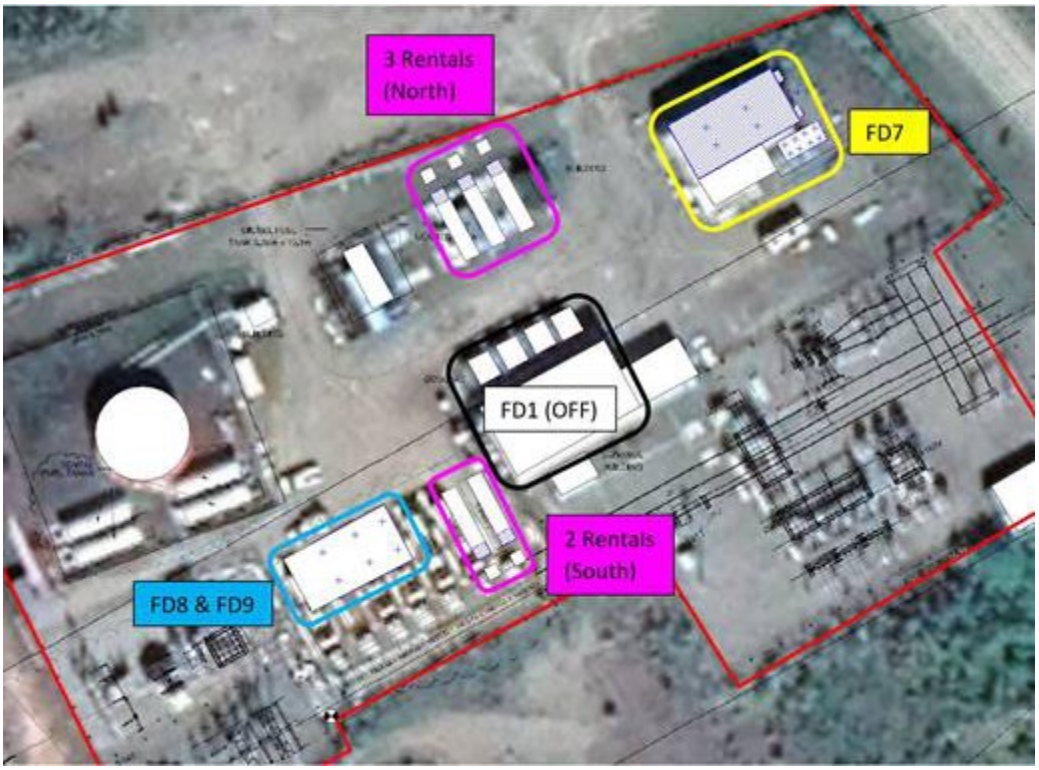
RESPONSE: FD1 is now end of life and we are planning to replace that permitted capacity with 2 x ~2.5 MW EPA Tier 4 and CARB certified diesel generators. This represents an investment by YEC in 'best available technology' and will result in reduced noise and criteria air contaminant (CAC) emissions from the existing Pre-Tier FD1 unit (1960's technology). FD1 represents 5.15 MW of the capacity at the FGS.

Which temporary generators are being removed?

RESPONSE: A portion of the capacity installed at the FGS is made up of rental units (currently 7 x 1.8 MW) that are in place as backup in case any other unit fails to start or is down for planned/unplanned maintenance or repair when the capacity is needed. We anticipate that with the installation of FD8 and FD9, to replace the less reliable FD1, this will allow us to remove two (2) of the seven (7) rental units of this redundant capacity at site in the near term. The temporary rental generators are as described in our previous assessment and permitting documentation (i.e., Caterpillar XQ2000/3516C, EPA Tier 2 and CARB certified units). With the revised configuration we will have approximately 2 MW of back up capacity available at site to complement the operating/production capacity of 15.5 MW allowed under our AEP.

Which rental generators are being moved?

RESPONSE: Due to noise complaints we are planning to relocate 3 of the remaining 5 rental units to a location approximately 45 metres northwest of their current location. This will allow the existing FD1 building to provide some sound attenuation during their operation. We are evaluating the feasibility of additional sound attenuation for the remaining rental units as part of our planning, but don't have an engineering assessment or cost estimate completed yet. See draft site sketch below for planned locations of units.



How far from their current location? A figure would be ideal. **RESPONSE: See above and attached.**

On a side note, I received your response in regards to the Faro Station Complaint Management System and will get back to you as soon as I can so we can finalize that plan.

Thanks and have a great day,
Liz

From: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Sent: February 9, 2023 9:04 AM
To: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Cc: Lisa Wiklund <lisa.wiklund@yec.yk.ca>
Subject: [EXT] RE: Faro Station Modifications

Hi Liz,

Thanks for reaching out.

As part of the presentation in Faro recently we also received several questions from a member of the public and are working on responses. I will try to get our responses over to you shortly for your consideration. If after reviewing, you have any follow up questions or concerns with our responses please feel free to reach out to me. Overall, I hope that what we share makes sense and is

appropriate from your perspective, so I appreciate you connecting with me on this.

Regards,

Travis

Travis Ritchie
Manager - Environment, Assessment, & Licensing
Telephone: 867-393-5350 | Mobile: 867-333-0300

From: Elizabeth.Barker <Elizabeth.Barker@yukon.ca>
Sent: February 9, 2023 8:08 AM
To: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Subject: Faro Station Modifications

Good Morning Travis,
Our minister received a message with some questions from a member of the public asking about proposed modifications to the Faro plant, as presented on January 24th by Paul Murchison and Ed Peake. The modifications described are as follows:

- Decommissioning FD1 – Mirrlees KV16 Generator
- Adding two new “permanent” generators, FD8 and FD9.
- Moving 3 “temporary” rental generators and infrastructure to a different location in the facility.
- Removing 2 “temporary” rental generators.
- Possible addition of sound barriers around FD7 and/or two of the rentals
- YEC has stated that these modifications will change sound emissions from the

FGS

I'd like to respond as soon as possible so I'm just looking for confirmation that these modifications are being planned and that we will receive notification prior to any work as per Part 2.5 of the Faro permit.

Thanks very much,
Liz

Yukon

Elizabeth Barker
Environmental Protection Analyst
Environment | Standards & Approvals
T 867-667-5456 | Yukon.ca

From:	Sarah.Preiksaitis
To:	Sarah.Chan; Jennifer.Dagg
Cc:	Amanda.Janssens; Mitch.Heynen
Subject:	RE: Faro Generating Station Air Emission Permit
Date:	January 10, 2022 3:48:22 PM
Attachments:	image001.png image002.png image003.png image004.png image005.png

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Thanks for that info Sarah. I've had no contact with YEC since mid-November. I'll wait for our meeting tomorrow before responding.

From: Sarah.Chan <Sarah.Chan@yukon.ca>
Sent: January 10, 2022 3:41 PM
To: Sarah.Preiksaitis <Sarah.Preiksaitis@yukon.ca>; Jennifer.Dagg <Jennifer.Dagg@yukon.ca>
Cc: Amanda.Janssens <Amanda.Janssens@yukon.ca>; Mitch.Heynen <Mitch.Heynen@yukon.ca>
Subject: RE: Faro Generating Station Air Emission Permit

Maybe we could loop Mitch in to this discussion (which is related but separate to the meeting on the casework). As an FYI, DBs shouldn't generally be engaging in dialogue with a proponent while a decision is being drafted, so if you have any further communication with Travis, just be aware that we're still in the decision-making phase.

Thanks,
Sarah

From: Sarah.Preiksaitis <Sarah.Preiksaitis@yukon.ca>
Sent: January 10, 2022 3:34 PM
To: Sarah.Chan <Sarah.Chan@yukon.ca>; Jennifer.Dagg <Jennifer.Dagg@yukon.ca>
Cc: Amanda.Janssens <Amanda.Janssens@yukon.ca>; Mitch.Heynen <Mitch.Heynen@yukon.ca>
Subject: FW: Faro Generating Station Air Emission Permit

Hi Sarah & Jenn,

Curious to hear your perspective on this at tomorrow's meeting. The proponent is asking to remove a monitoring requirement in the decision document.

Thank you,
Sarah

From: Travis Ritchie <Travis.Ritchie@yec.yk.ca>
Sent: January 10, 2022 3:03 PM
To: Sarah.Preiksaitis <Sarah.Preiksaitis@yukon.ca>
Subject: Faro Generating Station Air Emission Permit

Hello Sarah,

Happy New Year!

I wanted to follow up with you regarding the proposed amendment to our air emissions permit for the Faro Generating Station pursuant to YESAA Project Assessment 2021.0115.

I will prepare an application to amend the permit and send it your way this week, but I first wanted check in regarding the decision document. Yukon Energy noted that the YESAB Designated Office's recommendation contains a requirement for continuous air quality monitoring. This condition was included in the evaluation report despite the evidence presented by YEC in its project proposal and during the assessment regarding the very low likelihood/probability of any YAAQS exceedances in the community arising from its operations and the even lower likelihood of significant adverse effects to human health to arise from our operations. I know this is a matter of course for Decision Bodies, but before YG issues its decision document for this project we would only ask that this condition of the Designated Office's recommendation be examined very closely considering the evidence provided during the assessment. If there are any questions regarding the Project that YG would like to explore as part of its deliberations on the Decision Document and/or issuing an amended air emissions permit please feel free to contact me at anytime.

Thank you for your time and consideration.

Regards,

Travis

Travis Ritchie P.Biol.
Manager - Environment, Assessment, & Licensing
Telephone: 867-393-5350 | Mobile: 867-333-0300

SustainableElectricityCompany™

#2 Miles Canyon Road
Box 5920, Whitehorse
Yukon Y1A 6S7
yukonenergy.ca

December 12, 2023 File: 2515.03.01

Elizabeth Barker, Environmental Protection Analyst
Yukon Government, Department of Environment, Standards & Approvals Section
Box 2703
Whitehorse, Yukon Y1A 2C6

(via email to: elizabeth.barker@yukon.ca)

Dear Ms. Barker,

RE: AIR EMISSIONS PERMIT NO. 60-010-01 FARO GENERATING STATION – PART 2, CLAUSE 5 – REQUEST FOR APPROVAL OF CAPACITY REPLACEMENT

Pursuant to Part 2, Clause 5 of the above referenced permit Yukon Energy is requesting approval to complete a capacity replacement at the Faro Generating Station. As part of Yukon Energy's Thermal Replacement Project, the Corporation is replacing end of life diesel generators with new diesel capacity. In this case, Faro Diesel No. 1 or FD1 (nameplate capacity 5.15MW) reached end of life after nearly 50 years of service and was retired. Yukon Energy is working to complete a replacement of the generating capacity represented by this unit with two new 2.5 MW generators.

The new generators will meet the EPA's Tier 4 emission standards for non-road diesel engines, replacing the FD1's Pre-Tier emissions. As part of its Thermal Replacement Project, Yukon Energy is making this investment in all *new permanent* diesel generation it installs across the grid, which will result in a decrease in emissions of particulate matter (PM) and oxides of nitrogen (NOx) of approximately 90% from EPA Tier 2 levels. The emissions controls on the units will also reduce noise emissions as compared to the unit being replaced. The new generators will be enclosed in modular containers and, as such, will not require a building to house them. Specifications for the replacement generators and the selective catalytic reduction (SCR) exhaust aftertreatment system are attached to this request for approval.

Yukon Energy expects to complete the installation in Q3 2024, after which it will begin commissioning and load testing units, thereby initiating emissions from the units.

Please contact me by telephone at 867.393.5350 or by email: travis.ritchie@yec.yk.ca if you have any questions, comments, or concerns with this request.

Thank you for your time and consideration in this matter.

Yours Sincerely,

Travis Ritchie
Manager – Environment, Assessment, & Licensing

Attachment: Specifications Caterpillar C175-16 Engine/Generator and ECOCUBE SCR Exhaust Aftertreatment

c. Larry Baran, Chief Administrative Officer – Town of Faro, Yukon Territory (via email)
Lorraine Sterriah, Manager – Heritage, Lands, and Resources – Ross River Dena Council (via email)

PRODUCT SPECIFICATIONS FOR C175-16 (60 HZ)

GENERATOR SET SPECIFICATIONS

Standby Rating	3365(no fan)/3250/3100(no fan)/3000 ekW
Prime Power Rating	3115(no fan)/3000/2825(no fan)/2725 ekW
Emissions/Fuel Strategy	Low Fuel, Tier 2
Voltage	480 to 13800 Volts
Frequency	60 Hz
Speed	1800 RPM
Duty Cycle	Standby, Mission Critical, Prime, Continuous
Maximum Rating	3365 ekW
Minimum Rating	2500 ekW

ENGINE SPECIFICATIONS

Engine Model	C175-16 SCAC, V-16, 4-Stroke Water-Cooled Diesel
Bore	6.89 in
Stroke	8.66 in
Displacement	6456.31 in^3
Compression Ratio	16.7:1
Aspiration	Turbo Aftercooled
Fuel System	Common Rail
Governor Type	ADEM A4

GENERATOR SET DIMENSIONS

Length - Minimum	241.6 in
Length - Maximum	312.9 in
Width - Minimum	83.1 in
Width - Maximum	113.7 in
Height - Minimum	87 in
Height - Maximum	134.3 in
Dry Weight - Genset (minimum)	42750 lb
Dry Weight - Genset (maximum)	50500 lb

C175-16 (60 HZ) STANDARD EQUIPMENT

AIR INLET SYSTEM

4 x Single element canister with service indicator(s).

CONTROL PANEL

2 Programmable relay outputs (Form C)
Low coolant level
Over/under voltage
Coolant temperature
Serial annunciator module data link
Alarm acknowledge
Text alarm/event descriptions
Volts (L-L & L-N)
Reverse power
Over/under frequency
Environmental sealed front face
Programmable protective relaying functions
Speed adjust
Generator phase sequence
Low coolant temperature
Generator mounted - rear facing
Overspeed
Controls

Frequency (Hz)
Engine cycle crank
Engine cool-down timer
Warning/shutdown Indicators:
Lamp test
2 Programmable digital outputs
6 Programmable digital inputs
High coolant temperature
Customer data link (Modbus RTU)
Auto/start/stop control
Emergency stop pushbutton
RPM
Digital Indicators
Communications
Accessory module data link
Oil pressure (psi, kPa or bar)
Low oil pressure
Overcurrent
Emergency stop
24 Volt DC operation
4 Programmable relay outputs (Form A)
Failure to start (overcrank)
True RMS AC metering, 3-phase, +/-2% accuracy
Power factor (per phase & average)
Operating hours
DC volts
Amps (per phase & average)
Cat ECS 100
Reverse reactive power

EXHAUST SYSTEM

Bolted flange, with bellow for each turbo
Exhaust flange outlet

FUEL SYSTEM

Engine mounted filters #REF!
Filters x 3
10 Micron spin on yype
Secondary/tertiary fuel filters
4 Micron spin on type
Primary fuel filter water/fuel water separator

GENERATORS AND ATTACHMENTS

Right side extension box, bottom cable entry
IEC platinum stator RTDs
Reactive droop capability
3 Phase voltage sensing

(MV) Busbar connections, right side extension box, bottom cable entry
Class F temperature rise at 40C ambient
Anti-condensation space heater
NEMA Class H insulation
6 Leads
Class H temperature rise at 40C ambient
Voltage regulator
Exciter diode monitor
Form wound
RFI suppression
(LV) Busbar connections, top/center mounted, top cable entry
3 Phase brushless
60 Hz models: NEMA standard hole pattern
Permanent magnet excitation (PMG)
Min / max exciter limiter
Salient pole

GOVERNING SYSTEM

Redundant shutdown (Overspeed protection through a duplicate speed sensing system)
ADEM A4

LUBE SYSTEM

Oil filter, filler and dipstick
Integral lube Oil cooler
Oil drain lines and valve
Fumes disposal
Lubricating oil
Prelube - required with prime, continuous, and standby
Gear type lube oil pump

MOUNTING SYSTEMS

Rails - Engine/generator
Rubber anti-vibration mounts - shipped loose
Dual 24 volt electric starting motors
Battery disconnect switch
Batteries and battery rack w/cables

POWER TERMINATION

Busbar

SERVICE INSTRUCTIONS

Two PM inspections

GENERAL

Paint - Caterpillar yellow with high gloss black rails & radiator

SAE standard rotation
LH Service
Flywheel and flywheel housing-SAE No. 00

C175-16 (60 HZ) OPTIONAL EQUIPMENT

AIR INLET SYSTEM

Air inlet adapters
Dual element air cleaner
Single element air cleaner
Air inlet protection

CONTROL PANEL

Package mounted radiator
Automatically selected ground
Customer AC-DC connection mounting location - LV/MV
Load share governor
EMCP 4.4
E-Stop
Frame boxes
Annunciator modules
Load share module / auxiliary plate and auxiliary box (LV)
Fuel cooler
Controller mounting location - LV/MV
Modbus monitoring of packages
Customer interface options
EMCP 4.4 optional harness
Controller voltage and current sensing groups
Remote radiators
Generator harness
Interconnect harness
Speed adjust
Controller and MV and HV power connection locations
Raise lower switch

CRANKCASE SYSTEMS

Explosive relief valves
Crankcase ventilation system

EXHAUST SYSTEM

Mufflers
Exhaust support group
Weld flanges
Exhaust collectors/manifold
Front housing - Prime or continuous
Front housing - Standby or mission critical

Aftercooler drain

FUEL SYSTEM

Primary fuel filter

GENERATORS AND ATTACHMENTS

Low voltage - 1800 and 3000 Frames - 60 Hz, 3 phase, 1800 rpm, FW, PM, No of leads=6, Pitch 0.6667
Medium voltage - 1800 and 3000 Frames - 60 Hz, 3 phase, 1800 rpm, FW, PM, No of leads=6, Pitch 0.6667
Conversion GP - Top cable entry
Low voltage - 1800 and 3000 Frames - 50 Hz, 3 phase, 1500 rpm, FW, PM, No of leads=6, Pitch 0.6667
Differential current transformers
Space heater kit
Medium voltage - 1800 and 3000 Frames - 50 Hz, 3 phase, 1500 rpm, FW, PM, No of leads=6, Pitch 0.6667
Thermostat for space heater
Generator air intake

INSTRUMENTATION

Pyrometer and thermocouples

LUBE SYSTEM

Drain group oil pans
Oil filters
Lube oil heater
Electric prelube pumps
Lubricating oil

MOUNTING SYSTEMS

IBC vibration isolators - Shipped loose
Spring type linear vibration isolators
Rubber anti-vibration mounts

POWER CONNECTIONS

Low voltage connection cable
Center post busbarss (LV)
1800 Frame generator side / rear mounted busbars (MV)
Enclosures - Control packaging (LV)
Paralleling circuit breakers
1800 Frame generators Circuit breaker
Neutral ground (LV)
Neutral ground (MV)
Cable entry options (LV)
Cable entry options (MV)
Masterpack breakers
Power connection covers (LV)
Harnesses (Breaker)

Masterpack breaker connections
Side/rear mounted busbars (LV)

SPECIAL TESTS / REPORTS

IBC seismic Certification
Special test charge - Engine only
PGS Test report @ 0.8 power factor
Genset fuel consumption test
Standard genset TVA (Torsional Vibration Analysis) report
PGS Test report @ 1.0 power factor
OSCOSH1 seismic Certification
Custom generator TVA report
Generator test report
Standard engine test charge

STARTING / CHARGING SYSTEM

Heavy duty battery sets with rack
Charging alternators - Dry
Air pressure regulator
Starter location covers
24 Volt power distribution box
24 Volt electric starting motor
35 Amp Battery chargers
24 Volt battery set - Dry
20 Amp Battery chargers
Jacket water heaters
50 Amp Battery chargers
Air starting motor
Jacket water heater wiring groups

GENERAL

Special paint colors
Control GP - air powered bar group
Barring group manual
Service tools - Engine barring group
Engine barring air powered

TABLE 'A'

ecoCUBE ® CONFIGURATION	ENGINE MODEL	EST. WEIGHT (lbs)	EST. PRESSURE DROP (inH2O +/- 10%)	EST. 32.5% UREA CONSUMPTION (L/h +/- 10%)	EXHAUST TEMPERATURE (deg C)
Series 5	CAT C175-16	12500	17.0	39.3	444

TABLE 'B' - FULL LOAD EMISSION PERFORMANCE

ecoCUBE ® CONFIGURATION	INLET NOX (g/HP-h)	OUTLET NOX (g/HP-h)	INLET CO (g/HP-h)	OUTLET CO (g/HP-h)	INLET VOC (g/HP-h)	OUTLET VOC (g/HP-h)	INLET PM (g/HP-h)	OUTLET PM (g/HP-h)
Series 5	6.07	0.50	0.50	< 0.50	0.04	< 0.04	0.04	0.02

The DPF will provide an 85% PM reduction. Please note that if the level of PM that will result post-DPF for a given load point is less than 0.018 g/bhp-hr, the measurement will likely be within the error bars of EPA Method 5/202 (i.e. Method 5/202 will have difficulty accurately measuring this amount of PM as it is so low). As a result, measurements should be taken as per ISO method 8178-4 or 40 CFR 1065.

TABLE 'C' - EXHAUST SOUND ATTENUATION

ecoCUBE ® CONFIGURATION	FREQUENCY (Hz)	62.5	125	250	500	1000	2000	4000	8000
Series 5	MAXIMUM ATTENUATION (dB)		26	29	38	37	41	39	44

TABLE 'D' - BREAKOUT SOUND ATTENUATION

ecoCUBE ® CONFIGURATION	FREQUENCY (Hz)	62.5	125	250	500	1000	2000	4000	8000
Series 5	MAXIMUM ATTENUATION (dB)		26	26	35	35	39	41	40

All stated sound reductions assume 1/1 octave band resolution, from 63 Hz to 8000 Hz.
If engine datasheet does not include complete sound data from the 63 Hz to 8000 Hz frequency range, then the above analysis and guarantee is limited to the frequency range that was provided.
Insertion loss (IL) measured based on ISO 6798-1995 in a survey grade 3 environment.
SPL predictions assume hemispherical sound propagation; it does not account for site-specific conditions.
For outdoor or enclosure mounted ecoCUBE®s, acoustic measurement point is assumed to be at least 7 meters laterally from the enclosure wall (or SCR wall if no enclosure), at a height of 1.5 meters above ground.
For indoor ecoCUBE®s, acoustic measurement point is assumed to be to be at least 7 meters from the edge of the stack opening, perpendicular to the axis of the stack.

NOTE 'A': SYSTEM SPECIFICATIONS

1. REFER TO TABLE 'A' FOR SYSTEM SPECIFIC SPECIFICATIONS & TABLE 'B' FOR EMISSIONS PERFORMANCE.
2. INLET/OUTLET LOCATIONS ARE FIXED. SEE APPROVED SHOP DRAWING FOR FINAL.
3. ecoCUBE® IS INSULATED PER PROJECT PROPOSAL TYPICALLY WITH MINERAL WOOL INSULATION AND METAL CLADDING. MINIMUM AIR FLOW OF 4.0 M/S AROUND ecoCUBE® REQUIRED TO MAINTAIN TOUCH SAFE TEMPERATURE.
4. ecoCUBE® with SILENCING INCLUDED. REFER TO TABLE 'C' AND 'D'.
5. ecoCUBE® UREA CONSUMPTION AND EMISSIONS REDUCTION ARE CALCULATED FROM SPECIFICATIONS ON ENGINE DATASHEET.
6. ecoCUBE® IS FACTORY PRESSURE TESTED TO MEET THE PRESSURE WITHSTAND LEVELS IN CSA B139.1.0:19 S 13.7.
7. ecoCUBE® MEETS THE TEMPERATURE WITHSTAND LEVELS IN CSA B139.1.0:19 S 12.3.
8. SYSTEMS WITH DIESEL PARTICULATE FILTERS (DPFS) MUST BE OPERATED WITH ULSD ONLY. IN ORDER TO PROPERLY REGENERATE DPFS, OPERATING TEMPERATURE MUST BE ABOVE 280ºC FOR 30% OF ENGINE OPERATING TIME AND GREATER THAN 40% ENGINE LOAD.
9. ACCESS CONSIDERATIONS SHOULD BE MADE FOR SERVICING OF THE ecoCUBE® COMPONENTS. IF THE ecoCUBE® REACTOR IS PLACED ON A ROOF OR PLATFORM, EITHER A WALK WAY OR FALL ARREST TIE OFF POINTS SHOULD BE PROVIDED BY OTHERS.
10. UREA QUALITY AND STORAGE IN ACCORDANCE TO ISO22241.
11. OPERATING REACTOR ABOVE 950 DEG F WILL VOID ALL WARRANTIES.
12. INSTALLATION CONTRACTOR TO ENSURE GENERAL PUBLIC SHALL NOT HAVE ACCESS TO REACTORS OR CONTROL PANELS.

NOTE 'B': ecoCUBE® SEISMIC RESTRAINT/MOUNTING (BY OTHERS)

1. MATERIAL: 304 SS
2. USE A HEAVY 6mm WASHER PLATE OVER THE SLOT OR HOLE IN THE SLIDING SUPPORTS AND ADJUST BOLTS TO THE LISTED TORQUE SPECS ON DRAWINGS DM-01.
3. FOR ecoCUBEs INSTALLED IN SEISMICALLY ACTIVE AREAS, ecoCUBE® MOUNTING INFRASTRUCTURE (BY OTHERS) MUST BE SUITABLE.

NOTE 'D' - ADDITIONAL NOTES FOR ENCLOSURE MOUNTED SYSTEMS

1. CLIENTS' INLET DUCT MUST HAVE MINIMUM 7 GA WALL THICKNESS.
2. NO SUDDEN EXPANSION UPSTREAM OF ecoCUBE® INLET. EXPANSION CONE CONE ANGLE NEEDS TO BE LESS OR EQUAL TO 20 DEGREES.
3. FOR SITES REQUIRING ACOUSTIC REDUCTION IN EXCESS OF 35 DBA, ENSURE ALL EXPANSION JOINTS MEET THE REQUIREMENTS AS FOLLOW:
   a) CORRUGATED MULTI-PLY BELLOWS ELEMENT, TYPE T304/T321 SS.
   b) T304/T321 STAINLESS STEEL FLOW LINER.
   c) SHIPPED WITH RETENTION BARS HOLDING JOINT AT NON-COMPRESSED LENGTH.
   d) CONFORM TO EJMA STANDARD OR MIN. 3000 CYCLES FOR ANY ONE MOVEMENT.
   e) MIN. AXIAL COMPRESSION OF 3 IN.
   f) MIN. AXIAL EXPANSION OF 0.5 IN.
   g) MIN LATERAL OFFSET OF 0.5 IN.
   h) MAX. AXIAL SPRING RATE OF 125 LB/IN.
4. ENSURE THIMBLES USED ARE UL/ULC LISTED.
5. ENSURE INLET VELOCITY LESS THAN 7,250 FT/MIN.
6. IF UPSTREAM PIPING IS SMALLER THAN SCR INLET DIAMETER, THE TRANSITION MUST BE 3 X SCR INLET DIAMETER OR MORE.

NOTE 'E' - ENGINE START UP

1. FOR ecoCUBE® SYSTEM EQUIPED WITH DPF AND SCR CATALYST, YELLOW SMOKE MAY APPEAR FOR A BRIEF TIME PERIOD DURING ENGINE START UP. PLEASE SEE SAFETY POWER WHITEPAPER FOR MITIGATION MEASURES TO BE IMPLEMENTED BY INSTALLER: https://safetypower.ca/news/#Yellow

NOTE 'F' - LINEAR OR SPLITTED REACTORS

1. EXHAUST COMPONENTS BETWEEN DPF AND SCR REACTORS NEED TO BE STAINLESS 304/316.

NOTE 'G' - WIND LOADING

1. OUTDOOR REACTOR WITH HEIGHT MORE THAN 72 INCHES MUST HAVE WIND LOADING STUDY DONE BY OTHERS.

NOTE 'C' - INSTALLATION DETAIL FOR CLIENTS AND INSTALLATION CONTRACTORS

1. CLIENTS' INLET DUCT MUST BE SUPPORTED INDEPENDENTLY OF SPI.
2. CLIENT MUST MAKE SURE THERE IS NO ABSORPTIVE SILENCER UPSTREAM OF ecoCUBE®.
3. MAXIMUM AXIAL LOADING ON INLET/S AND OUTLET/S OF REACTOR IS 500 LBS. CONSULT SAFETY POWER IF OTHER LOADS ARE EXERTED ON THE INLET/S AND OUTLET/S.
4. UREA LINES TO BE INSULATED AND HEAT TRACED (SEE PI-02). UREA LINES TO BE 1/4" SS UNLESS GREATER THAN 75 FEET OF HEAD. IF GREATER THAN 75 FEET THEN CONSULT SAFETY POWER.
5. CONTRACTOR TO ENSURE FIXED POINTS OF REACTOR ARE RIGIDLY CONNECTED TO BUILDING STRUCTURE. DO NOT WELD REACTOR TO BUILDING STRUCTURE.
6. CONTRACTOR TO ENSURE ecoCUBE® FLANGES ARE NOT SUBJECTED TO LOAD DURING TRANSPORTATION, STORAGE & INSTALLATION.
7. ENSURE FLOOR MOUNTED ecoCUBE® IS MOUNTED AT LEAST 18" OFF OF FLOOR TO ALLOW FOR INSTALLATION OF FLOATING COLLAR AT INLET.
8. ALL CONDUIT AND WIRING MUST NOT COME IN CONTACT WITH THE REACTOR AND ITS SUPPORTING ELEMENTS.
9. CLIENTS TO SUPPLY DRAINAGE VALVES FOR DRAINAGE BUNGS LOCATED AT THE BOTTOM OF ecoCUBE® AND PIPED TO A LOCATION THAT ALLOWS OPERATOR EASY ACCESS FROM FLOOR LEVEL.
10. ALL OPENINGS ON THE REACTOR MUST BE SECURELY COVERED BEFORE TRANSPORTATION.
11. CLIENT MUST USE ENGINE LUBE OIL APPROVED BY MANUFACTURER FOR USE WITH DOWNSTREAM CATALYSTS.
12. CLIENT ENGINE MUST BE EQUIPPED WITH EXHAUST TEMPERATURE SENSOR AND ALARM.
13. ON ecoCUBE® EQUIPPED WITH OXIDATION CATALYSTS IT IS IMPORTANT THAT THE ENGINE CONTROL UNIT HAVE AN OVERRIDE TO PREVENT OVER FUELLING AN ENGINE WHICH IS UNABLE TO DELIVER ITS REQUESTED LOAD. FAILURE TO HAVE THIS OVERRIDE CAN RESULT IN EXCESS POST COMBUSTION IN THE OXIDATION CATALYSTS. SUCH EXCESS POST COMBUSTION WILL DAMAGE THE OXIDATION CATALYSTS AND VOID ANY ASSOCIATED WARRANTY.
14. PRIOR TO INSTALLATION CONTACT DESIGNATED SAFETY POWER PROJECT MANAGER FOR INSTALLATION OVERVIEW.
15. RECOMMENDED MINIMUM STACK HEIGHT IS 3 DIAMETER OF ecoCUBE® OUTLET.
16. REFER TO DIMENSIONAL DRAWING DM-01 FOR DETAILED VIEWS, ANCHOR POINTS AND SENSOR LOCATIONS.
17. STRUCTURAL CROSS BRACE MUST BE INSTALLED AT FIXED POINTS FOR CEILING MOUNT REACTOR.
18. CONTRACTOR TO ENSURE NO CONDUITS ENTER ANY OF THE SAFETY POWER CONTROL AND JUNCTION BOXES FROM THE TOP.
19. IF EXHAUST TEMPERATURE EXCEEDS THE DESIGN TEMPERATURE AS STATED IN THE SPI PROPOSAL THEN THE CATALYST WARRANTY IS REDUCED. EXCESSIVE ENGINE EXHAUST TEMPERATURE WITHOUT SAFETY POWER'S CONSENT WOULD VOID WARRANTY OF THE SCR CATALYST.
20. MAXIMUM THERMAL EXPANSION OF UP TO 1.5" ON ALL DIRECTIONS AWAY FROM FIXED ANCHOR POINT. DO NOT USE REACTOR FLANGES AS ANCHOR POINTS.
21. REFERENCE KINETIC NOISE DOCUMENT WITH LATERAL SUPPORTS AND SPRING HANGERS FOR CEILING HUNG ecoCUBE® REACTOR.
22. ENSURE UPSTREAM PIPING GASKETS ARE RATED FOR APPROPRIATE TEMPERATURE. DECOMPOSITION OF GASKET MATERIAL MAY POISON CATALYST AND VOID WARRANTY.
23. INSTALLATION CONTRACTOR MUST NOT INSULATE OVER SENSOR AND INSTRUMENT PORTS
24. FOR OUTDOOR APPLICATIONS, CONTRACTOR TO INSULATE ecoCUBE® INLET COLLAR AND UPSTREAM EXHAUST COMPONENTS. ROOF PENETRATION MUST BE ACOUSTICALLY INSULATED TO PREVENT BREAKOUT NOISE.
25. ENSURE THAT ECOCUBE NOT INSTALLED DOWNWIND OF COOLING TOWERS AS PHOSPHATES WILL DE-ACTIVATE SCR CATALYST.
26. THE FOLLOWING CONDITIONS CAN VOID CATALYST WARRANTY: (1) ENGINES THAT USE LUBE OIL WHICH IS NOT RATED FOR USE WITH DOWNSTREAM CATALYSTS (2) ENGINES WITH DATA SHEET EXHAUST TEMPERATURES IN EXCESS OF 480 DEG C CANNOT USE WIPA ECOSYN OILS EVEN THOUGH THEY ARE RATED FOR DOWNSTREAM CATALYST USE
27. SAFETY POWER HAVE NO DIRECT OR CONTINGENT LIABILITY FOR DAMAGE CAUSED BY A THERMAL EXCURSION CREATED BY THE ENGINE'S CONTROL UNIT INJECTING EXCESS FUEL THAT COMBUSTS DOWNSTREAM OF THE ENGINE'S COMBUSTION CHAMBER.
28. UREA TANK MUST NOT BE INSTALLED HIGHER THAN ecoCUBE® REACTOR. CONSULT SAFETY POWER FOR UREA TANK PLACEMENT.
29. DO NOT INSTALL ANY ELECTRONICS BELOW CP100 PANEL.
30. PROPER WEATHER PROTECTION NECESSARY DOWNSTREAM OF ecoCUBE®.
31. ecoCUBE® CANNOT BE INSTALLED IN AN ENCLOSED UN-VENTILATED ENVIRONMENT UNLESS REVIEWED BY SPI.
32. FOR INDOOR INSTALLATIONS, ENSURE THAT ADEQUATE LIGHTING IS AVAILABLE WHERE ecoCUBE® IS INSTALLED.
33. MODBUS POLLING RATE MUST NOT BE MORE THAN ONCE EVERY 10 SECONDS.
34. UPSTREAM PIPING NEEDS TO BE THERMALLY INSULATED.
35. INJECTION LANCE FLEX HOSE MUST NOT SUPPORT WEIGHT OF UREA/AIR LINES OR BUNDLE.
36. IF SYSTEM HAS A BLOWER ENSURE SUCTION SIDE CONNECTED TO OUTSIDE AIR.
37. INSTALLER SHALL PROVIDE CLEARANCE AND ACCESS TO ecoCUBE® WITH NECESSARY MAN LIFTS, SCAFFOLDING AND/OR LADDER.
38. FOR ENCLOSURE APPLICATION, PACKAGER TO STRAP AIR COMPRESSORS WITH VERTICAL RECEIVERS PRIOR TO SHIPMENT TO SITE
39. ENSURE EXHAUST PRESSURE RELIEF VALVE/S ARE INSTALLED VERTICALLY.
40. MOUNTING FEET ON ecoCUBE® REACTOR, UREA TANK, COMPRESSOR W/ RECEIVER TANK ARE DESIGNED FOR STATIONARY APPLICATION. CONTACT SPI FOR PROPER PACKAGING INSTRUCTIONS PRIOR TO SHIPPING.
41. PHOTO VERIFICATION OF COMPLETE INSTALLATION MUST BE SUBMITTED TO SAFETY POWER BEFORE COMMISSIONING CAN BE SCHEDULED.

FOR CUSTOMER APPROVAL

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safety POWER