


PRCTI20241387



October 23, 2024

**City of Puyallup
Building
REVIEWED
FOR
COMPLIANCE**

SKinner
12/24/2024
1:28:02 PM



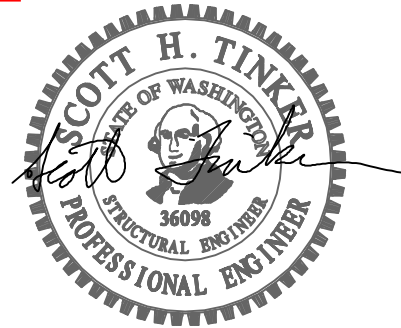
STRUCTURAL CALCULATIONS
(Permit Submittal)

**CENTERIS DATA CENTER VOLTAGE PARK
SOUTH YARD GENERATOR ANCHORAGE**
1023 39th Avenue SE
Puyallup, WA 98374

City of Puyallup Development & Permitting Services ISSUED PERMIT	
Building	Planning
Engineering	Public Works
Fire	Traffic

Calculations required to be provided by
the Permittee on site for all Inspections

Quantum Job Number: 23444.01



Prepared for:
CENTERIS DATA CENTERS
18300 Cascade Avenue S
Seattle, WA 981188

Prepared by:
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QUANTUM | CONSULTING ENGINEERS

CENTERIS SOUTH YARD

1023 39TH AVE SE
PUYALLUP, WA 38374

QUANTUM JOB NUMBER: 23444.01

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EQUIPMENT ANCHORAGE 6

Structural Design Criteria

Building Code: 2021 International Building Code
Building Department: City of Puyallup

Seismic Criteria

S_s : 1.26
 S_1 : 0.43 Seismic Soil Site Class: D
 S_{ds} : 1.01 Seismic Design Category: D
 S_{d1} : 0.50

Wind Criteria

Wind Speed: 97
 Risk Category: II
 Wind Exposure: B
 Kzt: 1

Geotechnical Criteria

Allowable Bearing Pressure 2500 PSF
 Minimum Footing Width Continuous: 18" min.
 Frost Depth 18" min.
 Soils Consultant GeoEngineers
 Soils Report Number #4565-064-09
 Soils Report Date June 14, 2024
 Active Soil Pressure (Restrained/Unrestrained) 55 PCF / 35 PCF
 Seismic Surcharge Pressure 8H PSF
 Passive Soil Pressure 300
 Coefficient of Friction 0.4

Materials Criteria

Concrete (28 Day Strength):

Foundation/Slab on Grade $F'_c = 3,000 \text{ PSI}$
 Walls and Columns $F'_c = 3,000 \text{ PSI}$

Reinforcing Steel:

Grade 60 $F_y = 60,000 \text{ PSI}$

Structural Steel:

Wide-Flange Sections: A-992 $F_y = 50,000 \text{ PSI}$
 Miscellaneous Sections: A-36 $F_y = 36,000 \text{ PSI}$
 Tube Sections: A-500 $F_y = 46,000 \text{ PSI}$
 Pipe Sections: A-53 $F_y = 35,000 \text{ PSI}$
 Welding $F_y = 70,000 \text{ PSI}$

⚠ This is a beta release of the new ATC Hazards by Location website. Please [contact us](#) with feedback.

ℹ The ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

ATC Hazards by Location

Search Information

Address: 1015 39th Ave SE Puyallup, WA 98374
Coordinates: 47.1590004, -122.2794422
Elevation: 489 ft
Timestamp: 2023-12-01T15:13:57.333Z
Hazard Type: Wind



ASCE 7-16

MRI 10-Year 67 mph
 MRI 25-Year 73 mph
 MRI 50-Year 78 mph
 MRI 100-Year 82 mph
 Risk Category I 92 mph
 Risk Category II 97 mph
 Risk Category III 104 mph
 Risk Category IV 108 mph

ASCE 7-10

MRI 10-Year 72 mph
 MRI 25-Year 79 mph
 MRI 50-Year 85 mph
 MRI 100-Year 91 mph
 Risk Category I 100 mph
 Risk Category II 110 mph
 Risk Category III-IV 115 mph

ASCE 7-05

ASCE 7-05 Wind Speed 85 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

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Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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ATC Hazards by Location

Search Information

Address: 1015 39th Ave SE Puyallup, WA 98374
Coordinates: 47.1590004, -122.2794422
Elevation: 489 ft
Timestamp: 2023-12-01T15:14:56.409Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: III
Site Class: D-default



Basic Parameters

Name	Value	Description
S _S	1.257	MCE _R ground motion (period=0.2s)
S ₁	0.433	MCE _R ground motion (period=1.0s)
S _{MS}	1.508	Site-modified spectral acceleration value
S _{M1}	* null	Site-modified spectral acceleration value
S _{DS}	1.005	Numeric seismic design value at 0.2s SA
S _{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F _a	1.2	Site amplification factor at 0.2s
F _v	* null	Site amplification factor at 1.0s
CR _S	0.914	Coefficient of risk (0.2s)
CR ₁	0.898	Coefficient of risk (1.0s)
PGA	0.5	MCE _G peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.6	Site modified peak ground acceleration
T _L	6	Long-period transition period (s)
SsRT	1.257	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.375	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.433	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.483	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGA _d	0.5	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

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QUANTUM | CONSULTING ENGINEERS

CENTERIS SOUTH YARD

1023 39TH AVE SE

PUYALLUP, WA 38374

QUANTUM JOB NUMBER: 23444.01

EQUIPMENT ANCHORAGE



Diesel Generator Set

mtu 20V4000 DS3250 43 °C

3,250 kWe/60 Hz/Standby/480 - 13,800V



System ratings

Voltage (L-L)	480V † ‡	600V ‡	4,160V	12,470V	13,200V	13,800V
Phase	3	3	3	3	3	3
PF	0.8	0.8	0.8	0.8	0.8	0.8
Hz	60	60	60	60	60	60
kW	3,250	3,250	3,250	3,250	3,250	3,250
kVA	4,062	4,062	4,062	4,062	4,062	4,062
Amps	4,886	3,909	563	188	177	170
skVA@30% voltage dip	7,061	1,028	8,171	5,297	5,936	6,488
Generator model*	941-VL60	941-VL70	941-M60	4P9.6-2400	4P9.6-2400	4P9.6-2400
Temp rise	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C
Connection	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE

* Consult the factory for alternate configuration. Generator model may end with -M or -R, depending on selection.

† UL 2200 offered

‡ CSA offered

Certifications and standards

- Emissions
 - EPA Tier 2 certified
 - South Coast Air Quality Management District (SCAQMD)
- Generator set is designed and manufactured in facilities certified to standards ISO 9001:2008 and ISO 14001:2004
- Seismic certification - optional
 - 2021 IBC certification
 - HCAI pre-approval
- UL 2200 - optional (refer to *System ratings* for availability)
- CSA - optional (refer to *System ratings* for availability)
 - CSA C22.2 No. 100
 - CSA C22.2 No. 14
- Performance Assurance Certification (PAC)
 - Generator set tested to ISO 8528-5 for transient response
 - Verified product design, quality, and performance integrity
 - All engine systems are prototype and factory tested
- Power rating
 - Accepts rated load in one step per NFPA 110
 - Permissible average power output during 24 hours of operation is approved up to 85%.

Standard features*

- Single source supplier
- Global product support
- Two (2) Year/3,000 Hour Basic Limited Warranty
- 20V4000 diesel engine
 - 95.4 liter displacement
 - Common rail fuel injection
 - 4-cycle
- HVO and GtL fuels meeting fuel specification EN15940
- Complete range of accessories
- Cooling system
 - Integral set-mounted
 - Engine-driven fan
- Generator
 - Brushless, rotating field generator
 - 2/3 pitch windings
 - Permanent Magnet Generator (PMG) supply to regulator
 - 300% short circuit capability
- Digital control panel(s)
 - UL recognized, CSA certified, NFPA 110
 - Complete system metering
 - LCD display

Standard equipment*

Engine

- Air cleaners
- Oil pump
- Oil drain extension and shut-off valve
- Full flow oil filter
- Closed crankcase ventilation
- Jacket water pump
- Inter cooler water pump
- Thermostats
- Blower fan and fan drive
- Radiator - unit mounted
- Electric starting motor - 24V
- Governor - electronic isochronous
- Base - structural steel
- SAE flywheel and bell housing
- Charging alternator - 24V
- Battery box and cables
- Bulkhead fuel connectors
- Flexible exhaust connection
- EPA certified engine

Generator

- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting
- Sustained short circuit current of up to 300% of the rated current for up to 10 seconds
- Self-ventilated and drip-proof
- Superior voltage waveform
- Digital, solid state, volts-per-hertz regulator
- Brushless alternator with brushless pilot exciter
- 4 pole, rotating field
- 130 °C maximum standby temperature rise
- 2-bearing, sealed
- Flexible coupling
- Full amortisseur windings
- 125% rotor balancing
- 3-phase voltage sensing
- $\pm 0.25\%$ voltage regulation no load to full load
- 5% maximum total harmonic distortion

Digital control panel(s)

- Digital metering
- Engine parameters
- Generator protection functions
- Engine protection
- CANBus ECU communications
- Windows®-based software
- Multilingual capability
- Communications to remote annunciator
- Programmable input and output contacts
- UL recognized, CSA certified, CE approved
- Event recording
- IP 54 front panel rating with integrated gasket
- NFPA 110 compatible

Application data

Engine

Manufacturer	mtu
Model	20V4000G94S
Type	4-cycle
Arrangement	20-V
Displacement: L (in ³)	95.4 (5,822)
Bore: cm (in)	17 (6.69)
Stroke: cm (in)	21 (8.27)
Compression ratio	16.4:1
Rated rpm	1,800
Engine governor	electronic isochronous (ADEC)
Maximum power: kWm (bhp)	3,490 (4,680)
Steady state frequency band	± 0.25%
Air cleaner	dry

Liquid capacity

Total oil system: L (gal)	390 (103)
Engine jacket water capacity: L (gal)	205 (54.2)
After cooler water capacity: L (gal)	50 (13.2)
System coolant capacity: L (gal)	860 (227)

Electrical

Electric volts DC	24
Cold cranking amps under -17.8 °C (0 °F)	4,200
Batteries: group size	8D
Batteries: quantity	6

Fuel system

Fuel supply connection size	-16 JIC 37° female 1" NPT adapter provided
Fuel return connection size	-16 JIC 37° female 1" NPT adapter provided
Maximum fuel lift - cranking: m (ft)	1 (3.3)*
Maximum fuel lift - running: m (ft)	3.1 (10)
Recommended fuel	diesel #2/HVO
Total fuel flow: L/hr (gal/hr)	1,620 (428)

* Fuel lift pump for cranking increases lift to: m (ft) 3.1 (10)

Fuel consumption

At 100% of power rating: L/hr (gal/hr)	844 (223)
At 75% of power rating: L/hr (gal/hr)	644 (170)
At 50% of power rating: L/hr (gal/hr)	447 (118)

Cooling - radiator system

Ambient capacity of radiator: °C (°F)	43 (108)
Maximum restriction of cooling air: intake and discharge side of radiator: kPa (in. H ₂ O)	0.12 (0.5)
Water pump capacity: L/min (gpm)	1,567 (414)
After cooler pump capacity: L/min (gpm)	567 (150)
Heat rejection to coolant: kW (BTUM)	1,300 (73,929)
Heat rejection to after cooler: kW (BTUM)	970 (55,163)
Heat radiated to ambient: kW (BTUM)	237 (13,472)
Fan power: kW (hp)	60.6 (81.3)

Air requirements

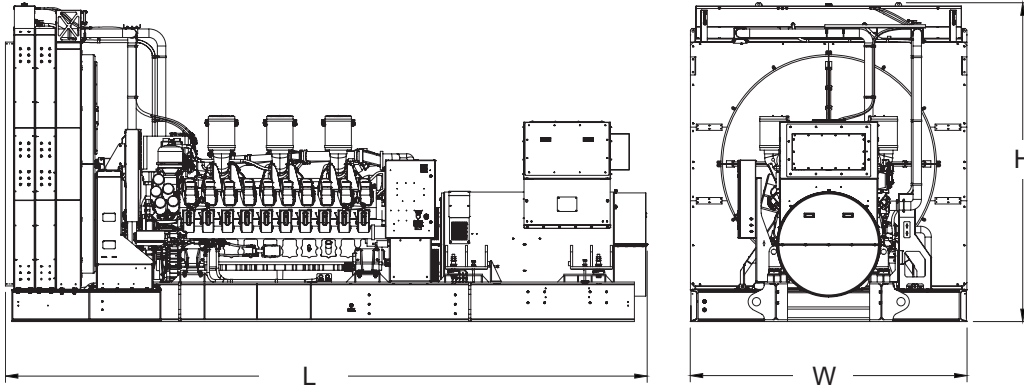
Aspirating: *m ³ /min (SCFM)	264 (9,323)
Air flow required for radiator cooled unit: *m ³ /min (SCFM)	3,082 (108,843)
Remote cooled applications; air flow required for dissipation of radiated generator set heat for a maximum of 25 °F rise: *m ³ /min (SCFM)	866 (30,384)

* Air density = 1.184 kg/m³ (0.0739 lbm/ft³)

Exhaust system

Gas temperature (stack): °C (°F)	525 (977)
Gas volume at stack temperature: m ³ /min (CFM)	702 (24,791)
Maximum allowable back pressure at outlet of engine, before piping: kPa (in. H ₂ O)	8.5 (34.1)

Weights and dimensions



Drawing above for illustration purposes only, based on standard open power 480 volt generator set. Lengths may vary with other voltages. Do not use for installation design. See website for unit specific template drawings.

System	Dimensions (L x W x H)	Weight
Open Power Unit (OPU)	7,756 x 3,072 x 3,590 mm (305.4 x 120.9 x 141.3 in)	27,340 kg (60,284 lb)

Weights and dimensions are based on open power units and are estimates only. Consult the factory for accurate weights and dimensions for your specific generator set.

Sound data

Unit type	Standby full load
Level 0 (OPU): dB(A)	95.1

Sound data is provided at 7 m (23 ft). Generator set tested in accordance with ISO 8528-10 and with infinite exhaust.

Emissions data

NO _x + NMHC	CO	PM
5.1	0.6	0.03

– All units are in g/hp-hr and shown at 100% load (not comparable to EPA weighted cycle values). Emission levels of the engine may vary with ambient temperature, barometric pressure, humidity, fuel type and quality, installation parameters, measuring instrumentation, etc. The data was obtained in compliance with US EPA regulations. The weighted cycle value (not shown) from each engine is guaranteed to be within the US EPA standards.

Rating definitions and conditions

- Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. No overload capability for this rating. Ratings are in accordance with ISO 8528-1, ISO 3046-1, BS 5514, and AS 2789. Average load factor: ≤ 85%.
- Nominal ratings at standard conditions: 25 °C and 300 meters (77 °F and 1,000 feet).
- Deration Factor:
 - Consult your local **mtu** Distributor for altitude derations.
 - Consult your local **mtu** Distributor for temperature derations.

3.25 mW Rolls Royce Generator Anchorage & Foundation Design

IBC 2021, ASCE 7-16, ACI 318-19

2.) Generator

Weight: 60.3 kips
 Total Height H: 141 in
 Total Width B: 121 in
 Total Width L: 305 in
 Center of Gravity: 88.125 in
 Snow Load: 25 psf

2) Seismic Design per ASCE 7-16 Chapter 13 Non-Structural Components

Electrical Components

ap = 1
 Rp = 2.5
 Sds = 1.01
 Ie = 1.25

Lateral Loads

Lateral resistance is provided by the Generator anchored to the concrete slab.

Fp = 12.18 kips ASCE 7-16 EQ 13.3-1
 X Fpmin = 22.83 kips ASCE 7-16 EQ 13.3-2 Controls
 Fpmax = 121.77 kips ASCE 7-16 EQ 13.3-3

EQ = 22.83 kips

Shear Connection

Number of Anchors = 2.0
 Anchor Shear = $V \cdot \Omega / \#$ = 11 kips/anchor < Capacity = 7.1 kips OK
 3/4" Titen HD Screw Anchors
 with 4 1/2" Embed

Overturning Resistance About Width

	C.O.G.	EQ	OT Moment
Generator	88.125 in	22.8 kips	168 k-ft

	Moment Arm	DL	Res. Moment
Resisting Dead Load	60.5 in	60.3 kips	304 k-ft

F.O.S. = M_R / M_{OT} = 1.8 Use Tension Capacity of Anchors

Anchor Tension = $M / d / \#$ = 16.6 kips/anchor < Capacity = 35.7 kips OK

3.25 mW Rolls Royce Generator Anchorage & Foundation Design

IBC 2021, ASCE 7-16, ACI 318-19

3) Wind Design per ASCE 7-16 Chapter 29 Non-Building Structure Procedure

Wind Speed V:	104.0	mph	ASCE 7-16 Risk Category III
Exposure Cat.	B		
Exposure Coe Kz:	0.62		Table 26.10-1 (H = 20')
Direction Coe. Kd:	0.85		Table 26.6-1
Topo Coe. Kzt:	1.00		Sec. 26.8
V_Pressure qz =	14.6	psf	EQ 26.10-1
Gust Factor G:	0.85		Sec 26.11
Af =	299	sqft	
h/d =	1.17		
Cf =	1.30		Figure 29.4-1
F =	4.82	kips	EQ 29.4-1

Shear Connection

WL < EQ Shear Connection OK By Inspection

Overturing Resistance About Width

$M_{OT} = F \cdot H / 2$	28	k-ft
$M_R = DL \cdot W / 2$	304	k-ft
F.O.S. = $M_R / M_{OT} =$	10.7	OK



Quantum Consulting Engineers LLC
1511 Third Avenue, Suite 323
Seattle, WA 98101

Project: **Centeris Data Centers**

Date: **9/3/24**

Job No: **23444.01**

Designer: **TVM**

Sheet: **2**

Client: **Centeris**

Checked:



KWIK Bolt 3 Expansion Anchor 3.3.6

Table 8 - Stainless Steel KWIK Bolt 3 Allowable Loads in Normal-Weight Concrete¹

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	$f'_c = 2000$ psi (13.8 MPa)		$f'_c = 3000$ psi (20.7 MPa)		$f'_c = 4000$ psi (27.6 MPa)		$f'_c = 6000$ psi (41.4 MPa)	
		Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
1/4 (6.4)	1-1/8 (29)	260 (1.2)	595 (2.6)	320 (1.4)	675 (3.0)	380 (1.7)	725 (3.2)	470 (2.1)	805 (3.6)
	2 (51)	540 (2.4)	675 (3.0)	625 (2.8)		705 (3.1)	805 (3.6)	910 (4.0)	
	3 (76)	685 (3)	750 (3.3)	810 (3.6)		910 (4.0)			
3/8 (9.5)	1-5/8 (41)	605 (2.7)	880 (3.9)	670 (3.0)	1110 (4.9)	730 (3.2)	1345 (6.0)	950 (4.2)	1690 (7.5)
	2-1/2 (64)	1285 (5.7)	1570 (7.0)	1430 (6.4)	1570 (7.0)	1575 (7.0)	1590 (7.1)	1940 (8.6)	1590 (7.1)
	3-1/2 (89)	1620 (7.2)	1755 (7.8)	1885 (8.4)	2035 (9.1)				
1/2 (12.7)	2-1/4 (57)	1015 (4.5)	1875 (8.3)	1230 (5.5)	2130 (9.5)	1450 (6.4)	2380 (10.6)	1620 (7.2)	2740 (12.2)
	3-1/2 (89)	1445 (6.4)	3010 (13.4)	1975 (8.8)	3010 (13.4)	2510 (11.2)	3045 (13.5)	2655 (11.8)	3045 (13.5)
	4-3/4 (121)	1990 (8.9)	2250 (10.0)	2985 (13.3)					
5/8 (15.9)	2-3/4 (70)	1650 (7.3)	2875 (12.8)	1755 (7.8)	3485 (15.5)	1860 (8.3)	4095 (18.2)	2335 (10.4)	4625 (20.6)
	4 (102)	2455 (10.9)	4625 (20.6)	2900 (12.9)	4625 (20.6)	3340 (14.9)	4625 (20.6)	4395 (19.5)	
	5-1/2 (140)	3480 (15.5)	3885 (17.3)	4290 (19.1)	6260 (27.8)				
3/4 (19.1)	3-1/4 (83)	1550 (6.9)	3945 (17.5)	1950 (8.7)	4260 (18.9)	2350 (10.5)	5645 (25.1)	2610 (11.6)	5645 (25.1)
	4-3/4 (121)	2510 (11.2)	5535 (24.6)	3250 (14.5)	5535 (24.6)	3870 (17.2)		4670 (20.8)	
	8 (203)	2930 (13.0)	3735 (16.6)	4530 (20.2)	5120 (22.9)				
1 (25.4)	4-1/2 (114)	3120 (13.9)	6080 (27.0)	3870 (17.2)	6770 (30.1)	4610 (20.5)	7470 (33.2)	4800 (21.4)	7470 (33.2)
	6 (152)	4400 (19.6)	7470 (33.2)	6400 (28.5)	7470 (33.2)	7200 (32.0)		7330 (32.6)	
	9 (229)	5600 (24.9)	8000 (35.6)	9390 (41.8)					

¹ Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.