

APPENDIX N

APPENDIX N DIESEL GENERATION POWER REQUIREMENTS FOR YELLOWKNIFE GOLD
PROJECT



WATEROUS PROPOSAL 3008066

to

KAEHNE CONSULTING INC.

for

YELLOWKNIFE GOLD PROJECT

Main Power Generators

March 10, 2010

DESCRIPTION - GENERATOR AND ACCESSORIES

The Proposal is for three options:

Option 1: four, (4) Midwest D3600EK-9 generator sets each rated 3,600 kW for continuous service at specified site ambient. Engine employed is the Electro-Motive model 20-710G4C-T2.

Option 2: five, (5) Midwest D2865EK-9 generator sets each rated 2,865 kW for continuous service at specified site ambient. Engine employed is the Electro-Motive model 16-710G4C-T2.

Option 3: six, (6) Midwest D2150EK-9 generator sets each rated 2150 kW for continuous service at specified site ambient. Engine employed is the Electro-Motive model 12-710G4C-T2.

Power is supplied at 0.8 power factor, 900 RPM/60 hertz, 3 phase, 4160 volts.

Each genset will provide 10% overload for 2 hours in every 24 hours of continuous full load power output.

Diesel Engine: Electro-Motive Diesel Model 12, 16 or 20-710G4C-T2 "710 Series" diesel engine, 45° V-Type, 2 cycle, 9 1/16" bore by 11" stroke, displacing 710 cubic inches (11.63 litres) per cylinder. Engines feature EMDEC electronic fuel injection control.

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EMD engines are designed to operate on distillate fuels such as #2 diesel. P40 and P50 fuels are acceptable although we wish to review the fuel specifications when available.

The EMD engines are US EPA Tier 2 emissions compliant. For this project we have included for D2 Duty Cycle.

Cooling, oil filtration and other accessories are part of a unitized Accessory Rack mounted on the generator set base and pre-piped to the engine.

Alternator: KATO Engineering Inc., 8P10 type, 2/3 pitch, open dripproof, brushless, synchronous, revolving field generator with direct connected rotating brushless exciter, rated to provide the power offered, continuously at 0.8 power factor, 60/3/4, 4160 volt, wye, 900 RPM. The alternator features a single antifriction bearing design; air cooling with integral fan; Class "F" insulation with 80°C temperature rise in 40°C ambient. The alternator is fully capable of 10% overload for two hours in every twenty four hours of full load operation.

Generator accessories and support components include the following:

- Permanent Magnet Generator to enable sustaining a 300% fault for 10 seconds
- Automatic Voltage Regulator
- Strip heater, 120 volt single phase operation
- Resistance temperature detectors, platinum, 100 ohm, 2 per phase winding and one per bearing, brought out to a common junction box
- Three current transformers with a ratio of 1200:5 installed, 2 sets of 3 shipped loose
- Connection box with surge capacitor, lightning arrestor

Baseplate: Steel skid mounting sub-base, 24" wide flange channel of cold rolled steel sections, on which is mounted the engine, accessory rack, and generator. Base is complete with lifting eyes and provision for jacking.

Steel spring anti-vibration isolators are included for installation between the base and the enclosure floor.

Exhaust system:

- Sectional exhaust manifold with expansion joints between sections and heat shields covering the manifold assembly
- Flexible exhaust section for engine outlet
- Exhaust adapter for 90° outlet to the side
- Spark arresting, residential grade, vertical exhaust silencer

Air Intake system:

- Disposable, fibreglass cell type, air filter, mounted on alternator
- Air restriction indicator
- Turbocharger
- Combustion air intake is from power house

Governor:

- EMDEC III – Electro Motive Diesel Electronic Control

Block Heater:

- 600 volt, 15 kW, coolant heater – heats jacket water and lube oil at the same time

Starting:

- two 600 volt electric motor driven and one diesel engine driven, 40 CFM, 150 psi air compressors complete with three, 1.5 cu.m. air receivers
- Compressed air starting motors (two), 150 psi
- "Y" strainer, lubricator, Solenoid valve, Manual bypass valves and Flex connector

Fuel System accessories:

- Flex fuel connectors, NPT
- duplex, replaceable element fuel filter
- Electric fuel priming pump
- Engine driven, positive displacement type fuel supply pump
- Fuel suction strainer
- EMD needle valve type, Electronic Unit Injectors (EUI)
- Removable double wall fuel day tank in base, with containment and level controls (approx 2000 l capacity)
- Fuel inlet solenoid

Lube oil system:

- Three lube oil pumps - scavenging, bearing pressure, and piston cooling - all engine driven, helical gear positive displacement type.
- Oil drain piping with steel ball valve and flex connector
- Crankcase oil vapour extractor assembly
- Crankcase pressure detector and alarm contactor
- Electric priming / post lube oil pump 1/2 HP, 60/3/575 volt. This pump is arranged to pump oil for sump filling and emptying
- Low lube oil level switch
- Lubricating oil cooler
- Lubricating oil filter, multiple element
- Oil fill tube with cap and dipstick
- Lube oil heating is via the jacket water pre-heating system

Cooling System: the dual circuit coolant system (one for jacket and lube oil heat and one for aftercooler heat) for each engine includes:

- Centrifugal engine driven engine coolant pumps (two) for jacket water and aftercooler water
- Engine coolant expansion tank, complete with sight glass, filler and pressure cap, and low coolant level switch.
- Automatic jacket water temperature regulating valve (Amot) - 195°F.
- Engine is arranged for cooling via heat dump radiators. Two radiator cores are required for the engine cooling. Radiators are remote mounting, Stromart Model SVA-027443 units featuring, each featuring:
 - Horizontal cores
 - Two 48 inch fans, each with 480 volt, 10 HP direct drive motors
 - Expansion tank with level switch and sight glass
- Flex connectors for engine and radiator coolant connections

Instrumentation and Controls:

- Freestanding Local Engine Control Panel mounted on enclosure floor
 - Woodward DSLC synchronizing and load sharing control
 - Basler SSR-125 automatic voltage regulator
 - Modicon PLC control with Magellis touchscreen
 - Interior service light
 - Engine mounted transducers and transmitters to provide data not already available through EMDEC
 - Engine start/stop push buttons
 - Emergency stop push button
 - Local/remote selector switch and indicating lamps
 - Running status indicating lamps
 - Idle speed/run speed selector switch
 - Genset lockout relay and indicating lamp

Displayed Information

- Genset status (off, cranking, warmup idling, running, cooldown idling)
- Generator breaker status, signal by others (open, closed, unknown)
- Generator breaker position, signal by others (racked in, racked out)
- Turbocharger boost pressure
- Turbocharger boost temperature
- Pressure drop across air filter
- Oil pressure
- Oil temperature (into engine)
- Oil temperature (out of engine)
- Oil prelube pressure
- Coolant pressure
- Coolant temperature, two circuits (into engine)
- Coolant temperature, two circuits (out of engine)
- Fuel pressure
- Fuel level of in base tank
- Fuel oil temperature
- Cylinder exhaust temperatures
- Exhaust temperature (before turbocharger)
- Exhaust temperature (after turbocharger)

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- Engine speed
- Starting air pressure
- Generator winding temperature (3)
- Generator bearing temperature (1)
- Electrical data (obtained from owners equipment)
 - Voltages (AB,BC,CA)
 - Currents (A,B,C)
 - Real power (kW)
 - Reactive power (kVAR)
 - Apparent power (kVA)
 - Power factor
 - Frequency
- Engine hours
- Number of start attempts
- Faults (listed below)
- Alarms (listed below)

Faults (shutdown)

- Low low oil pressure
- High high coolant temperature
- Low low coolant level
- High high crankcase pressure
- Low low fuel level
- High high generator winding temperature (3)
- High high generator bearing temperature
- Overspeed
- Overcrank
- Emergency stop
- Genset lockout tripped
- SR489 or equal, electrical fault from Owner's equipment

Alarms

- Low oil pressure
- Low sump level
- High sump level
- Low soakback pressure
- Low oil temperature
- High oil temperature
- High inlet air temperature

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- High coolant temperature
- High aftercooler water temperature
- Low coolant level
- Low fuel pressure
- High fuel level
- Low fuel level
- Fuel in containment tank
- Low start air pressure
- High generator winding temperature (3)
- High generator bearing temperature
- Unknown breaker status
- SR489 relay or equal, failed, from Owner's equipment
- SR489 or equal, electrical alarm, from Owner's equipment
- PLC module status
- PLC battery alarm

Please note that some of the above monitoring points are optional or may require data from the Owner's supplied equipment.

Spares:

Quoted price includes spares for ONE genset for 16,000 hours/two years operation.

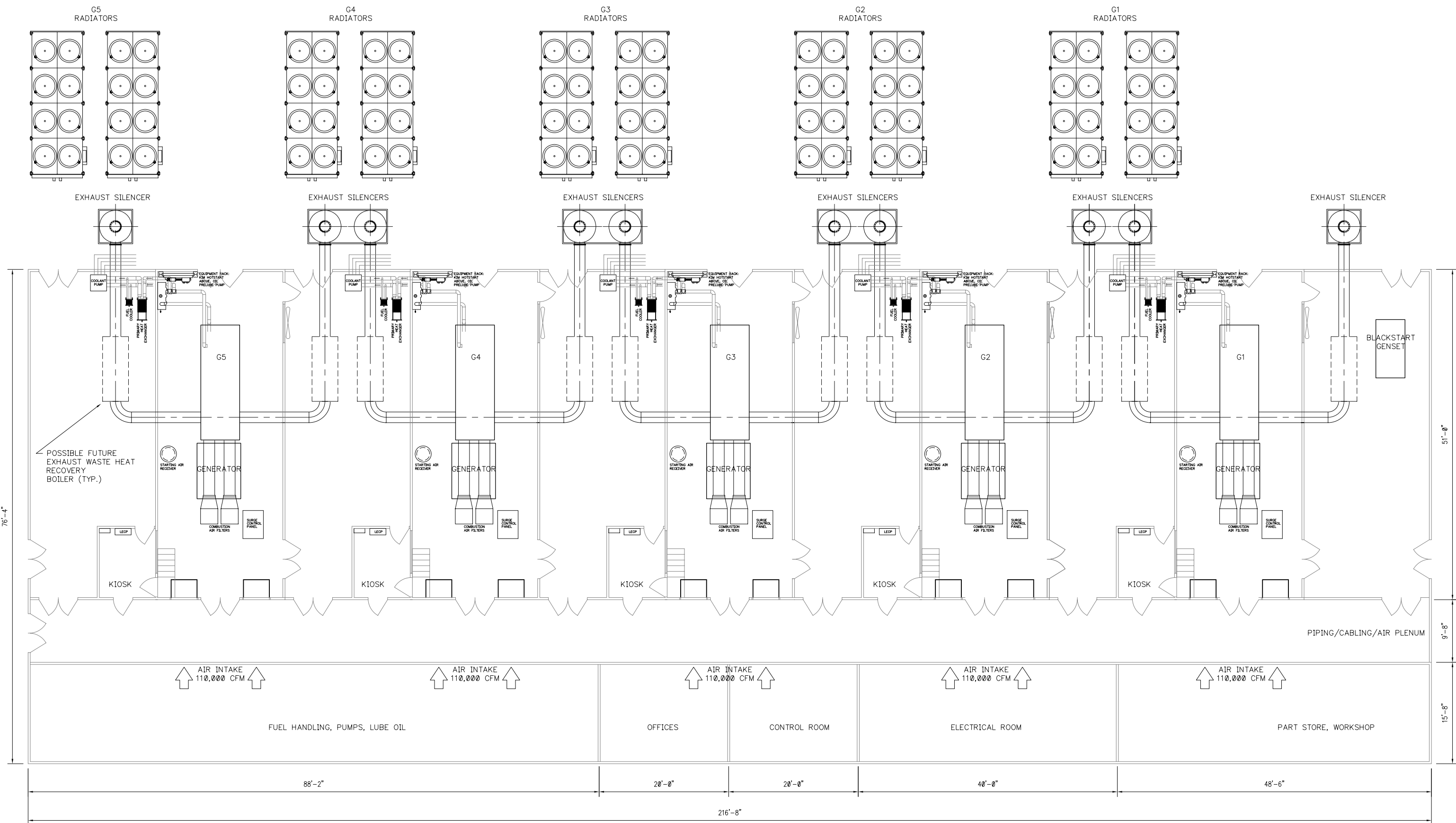
Commissioning and Start Up Assistance:

Quoted price includes the services, transportation - but not the room and board - for two Waterous Technicians for a period of three months.

Miscellaneous Engine Accessories:

- Crankcase doors with explosion relief valves and associated top deck cover latching
- Coolant and lube oil thermometers mounted on unit piping to read temperature in and out of engine.
- Flexible connectors for all pipe connections to generator set
- Engine service ramps
- Thick disc type coupling and "D" bolts.

END



PLAN

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