10.5 MW  3 x CAT 3616 Diesel Power Plant, HFO Plant

General Information

- (3) x 3500 kW Caterpillar 3616 Diesel Generator Sets, 6.6 kV, 50 Hz
- (2) ran continuous at 85 % loading and (1) kept as standby until 1999.
- Plant is in perfect working order and now runs only in grid power outages.
- D.G. Sets are designed for operation on Heavy Fuel Oil (Bunker "C")
- Average gross kWh/liter of Bunker C as fuel achieved was 4.05 during continuous operation.
- Power Plant is equipped with: Associated Auxiliaries
  - Electrical Control
  - Power Switchgear with adequate standby units for reliable operation.
- Plant does not have Waste Heat Recovery System although possible to install.
- All scheduled Maintenance, minor & major, were carried out under the supervision of authorized manufacturer representatives.
- Set 1 (11881 hrs), Set 2 (18724 hrs), Set 3 (24909 hrs)
- Tools & Tackles required for Maintenance are available
- Manual for Operation & Maintenance, Specifications of all Equipments available

Engines (3 nos.)

- Make : CATERPILLAR
- Model : 3616
- Year of Manufacture : 1994
- Year of Installation : 1995
- Power : 4828 Hp, 3600 KW
- Fuel Timing : 119.08 mm
- Operating Speed : 750 rpm
- Idle Speed : 350 rpm
- Number of Cylinders : 50 degrees, Vee-16
- Bore : 280 mm
- Stroke : 300 mm
- Type : 4-stroke, Cycle Turbocharged-Aftercooled
- Compression Ratio : 13 : 01
- Displacement : 296 L (18,036 cubic inches)
- Rotation (Viewed from Flywheel ) : CW Optional
- Injection Method : Unit Injectors
- Fuel : Diesel/ Bancker C
- Cooling System : Two Gear Driven Pumps separate Circuit
- Coolant Static Head : 7 m, H2O ext. restriction @ 900 rpm
- Allowable Exhaust : 250 mm, H2O
- System Back Pressure
- Maximum Inlet System Restriction : 380 mm, H2O
- Air Cleaners : Remote Unit
- Engine Weight : 29982 kg (Dry with Attachments)
- Engine Weight : 31 615 kg (With Fluid & Attachments )
- Displacement : 18.47 L
• Cylinder : 1,127.3 cubic inches  
• Mean Piston Velocity : 9 m/s  
• Total Hours logged till Date : 11870 / 18687 / 24876 Hours.(D.G.no No 1, 2, 3 respectively)  
• Last Major Maintenance : 6196 / 15865 / 1465 Hours (D.G No 1, 2, 3 respectively)

Alternators (3 nos.)

• Make : LEROY SOMER  
• Type : LSA 56, VL 10/8P  
• Year of Manufacture : 1996, 1994, 1994 (Set no 1, 2, 3 respectively)  
• Synchronous : 3 Phases  
• No of Pole : 8  
• Connections : Star  
• Rated Output : 4375 kVA  
• Voltage : 6600 V  
• Frequency : 50 Hz  
• Power Factor : 0.8  
• Speed : 750 Tr / min  
• Protection : IP 23  
• Inlet Filters : Yes  
• Insulation : Cl : F  
• Temperature Rise : Cl : F  
• Ambient Temperature : 40 °C  
• Cooling : IC 01  
• Excitation : Brushless  
• Voltage Regulation : R.B.S.  
• Equipment Plate : Short Circuit Comp.  
• Construction Type : Double Bearing  
• Bearing Type : Sleeve Bearing  
• Weight of Rotor : 6275 kg  
• Total Weight : 15300 kg  
• Stator Heat Protection : SME 202 (Quantity : 6)  
• Bearing Heat Protection : SME 202 (Quantity : 1)

Purifier Lun Oil (3 nos.)

• Make : ALFA-LAVAL  
• Rated Capacity throughput : 2900 l/hr  
• Lub Oil throughput R&O Type : 1000 l/hr  
• Running up Time : approx. 2 min  
• Stopping Time : approx. 15-20 min  
• Electric Motor : 3 kW  
• Speed:  
  - Drive Motor : 3000 rpm  
  - Bowl Spindle : 9510 rpm  
• Sludge & Water Space : 1.05 litres  
• Power Consumption:  
  - Idling : 0.9 kW  
  - Running (HFO) : 1.8 kW
- Running (MDO) : 2.0 kW
- Operating Water:
  - Pressure : 150 - 600 kPa (1.5 - 6 Bar)
  - Total Consumption : 3 l (per Discharge)

**Injector Tip Module**
- Make : ALFA-LAVAL
- Motor : 2.2 kW
- Max Work Pressure : 10 Bar

**Purifier Bunker C (2 nos.)**
- Make : ALFA-LAVAL
- Throughput Rated Capacity : 5600 l/h
- Heavy Fuel Oil : 3500 l/h (throughput Capacity at Viscosity cSt/30°C)
- Speed @50 Hz:
  - Drive Motor : 1420-1500 rpm
  - Bowl Spindle : max.7605 rpm
- Starting-up/Stopping Time:
  - Starting Time : approx. 2 minutes
  - Stopping Time : > 4 minutes
- Sludge & Water Space : 1.3 litres
- Built-on Feed Pump Capacity : 2420 l/h
- Suction Lift : max. 40 kPa
- Delivery Head : max. 150 kPa
- Built in Oil Outlet Disc Pump:
  - Electric Motor (at 50 Hz) : min. Size 4 kW
  - Power Consumption : 2.4 kW (running, Heavy Fuel Oil)
- Total Water Consumption : 6 litres (per Discharge)

**Cooling System (3 nos.)**
- Cooling Tower : CMB-W-300, COOLING MAN make
- Motor : 10 HPX 4 Pole
- Fan Ass'y : 2400 mm Dia. X 4 Blades
- Sprinkler Head : CSH-200
- Air Volume : 2200 mm /min (CFM)
- Nominal Water Flow : 3900 l/min
  - Raw Water Pump

**Booster Module (1 no.)**
- Make : ALFA-LAVAL
- Module Type : SBM 45N-25N EE
- Alfa Laval Oy Module No. : 280860-65
- Total Power : 7400 kW
- Max Fuel Consumption : 1600 l/h
- Heavy Fuel Viscosity : 280 cSt/50°C
- Heavy Fuel Day Tank Temp. : 60 °C
- Heavy Fuel Flow to Engines : 8260 l/h
• Electric Power Supply : 380 V / 50 Hz
• Heating Medium : Electrical
• EL. Consumption : 72 kW

Viscochief:
• Make : ALFA-LAVAL
• Model : EVT-10C
• Power Supply : 24/48VAC
• Power Consumption : maximum 8VA
• Ambient Temperature : maximum 70 °C
• Working Pressure : maximum 4 Mpa (40 Bar)
• Testing Pressure : maximum 6 Mpa (60 Bar)
• Enclosure : IP55
• Output : 4-20 mA
• Measuring Range : 0-50cSt
• Material : Housing-Modular Cast Iron
• Mounting Style : Avoid Air Pocket
• Flange Connections : according to DIN2633 or JIS B2210(20K)

Viscosity Control Unit (Remote/Local):
• Make : ALFA-LAVAL
• Model : VCU-160 R/L
• Power Supply : 110, 127, 220 VAC; 50/60 Hz
• Power Consumption : maximum 75 VA
• Ambient Temperature : 55 °C
• Enclosure : VCU-160 R:IP20, VCU-160 l:IP54

Electric Preheate:
• Make : A/S VESTA
• Model : EO 72
• Working Pressure Shell : 10 Bar
• Working Temperature Shell : 150 °C
• Power Rate : 72 kW
• Power Supply : 3 x 380 V, 50 Hz
• Intended for : Alfa-Laval ind.PL-51 SF-02271-Espoo Phu

Air Compressors
• Electric Compressor : ATLAS COPCO, Type.LT55 30U, S/N.AIW046442, 1500 rpm, 5.5 kW, 30 Bar
• Electric Driven : LELOY SOMER Motor, S/N.756501JA014, 5.5 kW, 380 V, 50 Hz, 1420 rpm
• Egine Compressor : ATLAS COPCO, Type.LT730, S/N.AM295298, 1800 rpm, 30 Bar
• Engine Driven : YANMAR Engine, Model.TF110, S/N.014188, 7.5 kW, 2400 rpm

Auxiliary Tank Capacity
• Daily Tank : 20000 liters
• Setting Tank No.1 : 20000 liters  
• Setting Tank No.2 : 20000 liters  
• Setting Tank No3 : 20000 liters  
• Diesel Tank : 5000 liters  
• Lube oil Tank : 5000 liters  
• Air Compressor Tank No.1, 2, 3 : 30 Bar  
• Lube Oil Injector : 600 liters

**Control Panel**

**Generator Control Panel:** UNILIB make (3 nos.)

• The Panel have full Protection Device:  
  • Deferential Transformer : Basler Electric Model.BE1-87T  
  • Deferential Alternator : Basler Electric Model.BE1-87G  
  • Ground Fault : Basler Electric Model.BE1-50G  
  • Reverse Power : Basler Electric Model.BE1-32R  
  • Reverse Reactive Power : Basler Electric Model.BE1-32R  
  • Under/Over Voltage : Basler Electric Model.BE1-27/59  
  • Over Current on each Phase : Basler Electric Model.BE1-50/51B-103  
  • Frequency Relay : Type.252-Phuw, CROMPTON make  
  • The Control is by PLC : Idec FA-2 Junior  
  • Governor : KG30-04-FB, FRITZ HEINZMANN make, Range 1500-4250 Hz, 24V.  
  • Synchronizer Load Sharing : LMG03, FRITZ HEINZMANN make, Range 115/220 V, STG30-01  
  • Actuator : STG30-01, FRITZ HEINZMANN make  
  • Automatic Voltage Regulator : RBS600, LEROY SOMER make, 3 phase,100 W, 380/400-100/110V , 50/60Hz  
  • Fault/Alarm Annunciator : 38 Nos

**Master Control Panel** : UNILIB make (1 no.)

• Over Current : Basler Electric Model.BE1-50/51B-103  
• Frequency Relay : Type.252-Phuw, CROMPTON make  
• The Control is by PLC : Idec FA-2 Junior  
• Fault/Alarm Annunciator : 33 Nos

**Switchgear**

• Generator Switchgear (3 Nos):  
  • ABB make  
  • SF6 CB  
  • 1250 A, 25 kA , 24 kV, 50 Hz  
  • Sace Ha2/ZC-24-12-25 ABB  
  • O/V Relay  
  • K2CA-D03-R2 Omron  
  • Feeder Switchgear (1 No):  
  • ABB make  
  • SF6 CB  
  • 1250A,25 KA ,24 kV, 50 Hz  
  • Sace Ha2/ZC-24-12-25 ABB, O/V Relay
• K2CA-D03-R2 Omron
• Station Switchgear (1No):
  • ABB Make
  • Load Break SW. 16 kA, 630 A

**Battery Charger**

110 VDC Battery: Valve regulated Lead Acid Battery, NP65-12, 12 V, 65AH, YUASA make, 9 Nos
24 VDC Battery: Valve regulated Lead Acid Battery, NP65-12, 12 V, 65AH, YUASA make, 2 Nos

**Transformer**

**Step up transformer:**

- Make: TIRA THAI
- Rating: 4500 kVA
- Primary Voltage: 6600 V
- Secondary Voltage: 22000 V
- Cooling: ONAN
- Connection: Yd1

**Auxiliary Transformer (Step down)**

- Make: TIRA THAI
- Rating: 800 kVA
- Primary Voltage: 22000 V
- Secondary Voltage: 400/230 V
- Cooling: ONAN
- Connection: Dyn11

**MDB**

**Feeder List:**

- Cooling Pump Starter: 160 A, 4 nos.
- Heater: 80 A, 3 nos.
- Water Booster Pump Starter: 15 A, 1 no.
- Cooling Fan Starter: 63 A, 4 nos.
- Lube Oil Pump Starter: 15 A, 4 nos.
- Air Compressor: 25 A, 2 nos.
- Ventilation Fan Starter: 25 A, 4 nos.
- Vokes Filter: 25 A, 4 nos.
- Jecket Water Heater: 80 A, 4 Nos.
- Lub Oil Module: 25 A, 4 nos.
- Tip Cooling Module: 15 A, 4 nos.
- HFO Booster: 200 A, 1 no.
- HFO Separator: 250 A, 1 no.
- Lighting Panel: 250 A, 1 no.
• Spare: 250 A, 2 nos.

**CT/PT Panel**

• Potential Transformer (PT): 6.6 kV/110 V, 200 VA, MITSUBISHI make
• Diff Transformer CT: 500/5 A, 20 VA, Class 1, NITECH make
• Diff Gen CT: 500/5 A, 20 VA, Class 1, NITECH make
• CT Rod: 1250 A, ABB make

**Registor Panel (3 nos.)**

• Neutral Grounding Resistor
• System Voltage: 6.3 kV
• Line to Neutral Voltage: 3637 V
• Initial Amp: 300 A
• Max Time on: 10 °C
• Ohms @25°C: 12.1 Ohms
• Max Temperature Rise: 750 °C
• Ground CT: 60/5 A, 15 VA, 5P5
• Protection/Metering CT: 500/5 A, 40 VA, 5P10
• Diff Gen CT: 500/5A 20VA Class 1

**Earth Box**

• Ground CT: 60/5 A, 15 VA, 5P5, NITECH make