

## **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 Manufactue : 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 : CI : F
- Temperatue Rise : CI : 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 I: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
- Engine 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-2Junior
- 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.
- HFO Pump Starter : 63 A, 2 nos.
- 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.
- Jacket 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 : 1250A, 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, 40VA, 5P10
- Diff Gen CT : 500/5A 20VA Class1

#### **Earth Box**

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