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SYSTEM OVERVIEW

Offshore Rig or Ship DP2 Package
☑ Containered CAT 3516B Generator sets.
☑ Alstom Duplex DP2 System with VS Drives.

Generators and DP2 System are Lloyds Marine Certified Complete with all Controls and Switchgear.
All Units are NEW 2008, never put into service, warranty transferable.

Product as follows:
☑ 8 / ea. Units 3516B rated @ 1,840-kW cont. 690 volt 60 Hz @ 1,800 rpm Hyundai Generators
☑ 3 / ea. Units 3516B rated @ 1,840-kW cont. 440 volt 60 Hz @ 1,800 rpm Hyundai Generators
☑ 1 / ea. Unit 3412C rated @ 500-kW emergency standby 440 volt 60 Hz @ 1,800 rpm CAT SR4B Generator
☑ 1 / ea. NEW CAT Synchro System for Gensets.
☑ 8 / ea. NEW Alstom MSV 3000 VSD Drives provided.
☑ Not provided or included - 8 / ea. Wartsila FP Retractable Thrusters 1.6MW
☑ 8 / ea. NEW Hyundai Thruster Motors 1.6MW provided.
☑ 1 / ea. Complete Alstom DP2 Duplex System provided, all controls, drawings and certs available.
☑ 1 / ea. Hatenboer Fresh Water Osmosis System
☑ 1 / ea. Atlas Copco Air Compressors Model LT3-10 KE (10 bar (g) pressure)

General description of CAT / Hyundai Package Containerized Generator sets:
☑ Main Engines:
8 / ea. 1,840-KW Prime 690 Volt Caterpillar Diesel Hyundai Generator Skids, Containerized equipped with ventilation insulation and exhaust for supply of power to the Azimuth Retractable Thrusters.

☑ Auxiliary Systems:
3 / ea. 1,840-kW Prime 440 Volt Caterpillar Diesel Hyundai Generator Skids, Containerized equipped with ventilation insulation and exhaust for the supply of 440 volt for auxiliary systems to be transformed to 230VAC 1 phase + neutral.

☑ Emergency Systems:
1 / ea. 500-kW Prime 440 Volt Cat Diesel Cat Generator Skid, Containerized equipped with ventilation insulation and exhaust for the supply of 440 volt for emergency systems to be transformed to 230VAC 1 phase + neutral and 24VAC 1 phase.

Main Generator Diesel Skid:
☑ Free access distance between engine/generator and container walls to be preferable 600mm.
☑ Each Container shall have Two [2] A-0 Sliding Doors. One door installed on each side of the container. When the containers are placed alongside each other, the sliding doors to meet for entering from one container to the next one. The doors are not to protrude outside the container.
☑ Each Container has a Ventilation System with registers in and out.
☑ Lifting Eyes for Chain Blocks are installed above all Diesel Engines in container for maintenance work such as lifting in/out pistons or cylinder liners.
☑ All of the Containers are supplied with One [1] set of Standard Tools for maintenance of the Diesel Engines. Tools are located at wall-mounted Tool Panel inside the containers.
☑ All the Containers are equipped with heating according to Class notation. This is to prevent frost damage of all installed equipment during lay up in winter season with an outside temperature of 20degC.

Main Generator Diesel Engines:
☑ A standard built-on factory supplied Fresh Water Cooling System based on Air-Cooled Radiator System with Fresh Water Pump, Radiator (in machinery space) with Electrical Driven Cooling Fans, Electrical Water Heater with Circulation Pump. (Flexible pipe connections to engine)

The Fuel Oil System includes:
- Internal separate A60 insulated Fuel Tank in each container for 8-hours running at 100% load. Internal A60 insulated Fuel Tank for 18-hours running at 100% load installed in the Emergency Diesel Generator Container.
- A standard built-on factory supplied Lube Oil System consisting of direct-driven Lube Oil Pump, Duplex Lube Oil Filter, Bypass Lube Oil Filter, Lube Oil Cooler, Electrical Lube Oil Priming Pump, also prepared to drain the Oil Sump, Starter Cabinets.
- A standard built-on factory supplied dry Exhaust Gas System equipped with Air Inlet Filters, Turbocharger, Charging Air Cooler, insulated Exhaust-Manifold, flexible Expansion Joints, and Exhaust Silencer 35 dBA with Spark Arrestors. Combustion Air Intake is arranged outside.
- Turning Motor or Turning Gear with handle.
- Flexible high elastic coupling fitted to Engine Flywheel and Generator Shaft
- The power stated is valid for conditions in accordance with ISO 3046/1
- Lifting Eyes for transport and installation
- A standard built-in on factory supplied Starting System consisting of Electrical Starting Motors, Charging Rectifier, Starting Batteries in battery boxes separate starting system for each engine.

The Diesel Engines have a starting battery capacity for a minimum of 3 starts of each engine. The Emergency Generator has a minimum starting battery capacity for a minimum of 6 automatic starting attempts and 3 manual starting attempts.

**Instrument, Alarms and Automatic Start/Stop System**

**Main Generator Diesel Control Panel:**

**Alarm Sensor for:**
- Low Lube Oil Pressure
- High Lube Oil Temperature
- High Diff. Pressure over Lube Oil Filter
- High Water Temperature
- Low Cooling Water Flow
- Fuel leaks in double walled Fuel Lines
- Low Cooling Water Level in Expansion Tank
- Charging Air Pressure
- High Exhaust Gas Temperature after Turbocharger

**Auto-Stop Device for:**
- Low Lube Oil Pressure
- High Water Temperature
- Over Speed

**Automatic Start and Shut Down System with following functions:**
- LCD display showing voltage, rpm, oil pressure and temperature, water temperature, Charge air pressure and exhaust temperature after turbo.
- Automatic start attempts according to class requirement.
- Automatic shutdown for low oil pressure, high water temperature and over speed
- Start Switch
- Stop Switch
- Hour Meter
- Converter for serial communication
- Common Alarm and Shutdown Alarm
- Stop System
- 24 V Stop Solenoid Valve. The Control System includes interface prepared for a Dynamic Position Keeping System and a Power Management System arranged according to Lloyds Rules & Regulations.

-Additional Information:-

**Diesel Oil:**
The Diesel Engine complyes with conditions in accordance with ISO 3046/1
**Lubricating Oil:**
Lubricating oil shall comply with the Diesel Engine manufacturer’s recommendation.
Viscosity Class SAE 40 (ISO VG 150).
Content of additives should meet the requirements of MIL-L-2104 C or API Service CD.

**Turbocharger:** The oil may be mineral oil or synthetic oil having a viscosity of 30-55 cSt/50deg.C.

**Output particulars:**
8 / ea. Engines are dedicated to the Thruster Power:
Engine output Min 1,920-kW
Output speed: 1,800 rpm

3 / ea. Engines are dedicated to the Auxiliary Power Systems:
Engine output Min 1,920-kW
Output speed: 1,800 rpm

**Main Generators:**
All the Generators are supplied with:
- Automatic Voltage Regulator
- Equipment for parallel operation
- Anti Condense Heater
- PT-100 temperature sensors in windings
- PT-100 temperature sensors in bearings
- MCT Brattberg cable entry in container
- Termination Box for power cables
- Foundations.

All Auxiliary Engines and Emergency Generator are as follows:
- Engines and Generators are lined up on a common steel frame (skid), designed for being lifted in/out of machinery space for transport ashore in case of engine/generator breakdown.
- Vibration Dampers for mounting between skid frame and container floor. This to avoid vibrations in supporting structures.

Hyundai made Generators to the Diesel Engines are summarized:
- Eight [8] Generators for thrusters power 690 Volt Application Type: Brushless Self-Exit
- Location: Indoors
- Electrical Rating: 1,840-kW
- Speed: 1,800 rpm
- Frequency: 60 Hz
- Power Factor: 0.8
- No of phase: 3 ph
- Supply Voltage: 690 V
- Excitation: Self excited
- AVR: included
- Mounting / Enclosure
- Protection: IP 23
- Bearings: Re-greaseable
- Cooling: Air Cooled
- Accessorys / Fittings
- Temp sensing: 6 off stator RTD (PT 100) in windings
- 1 off RTD (PT 100) per bearing
- 1 off RTD Cooling air in
- 1 off RTD Cooling air out
- Anti Condensation Heater: 2 x 100 W, 220 V, 1 ph
- Water leakage detection: included

**Instrumentation & Control:**
Interfaces are realized by means of distributed I/O modules communicating over a redundant bus system. Local Control of all main functions for the engines with Auxiliary Systems is included.

The Control System is laid out also to monitor and interface all critical failures and alarm situations for the Engines, Generators and Auxiliary Systems.

**Electrical System:**
The Thruster Power Distribution Systems are laid out for 690 VAC, 440VAC and 230 VAC/60Hz systems and 24 VDC Systems and to be controlled from the ICS Operating Stations.

### Containerized Diesel Generator Sets

**Item List Diesel Generator Sets:**
- [1] off 440 Volt CAT Diesel - CAT Generator Skid. Containerized equipped with ventilation insulation and exhaust for the supply of 440 Volts for Emergency Systems to be transformed to 230 VAC 1-Phase + neutral and 24 VAC 1-Phase.
Power Distribution and Control:

- Items List
  Eight (8) off - Main Power Distribution Boards
  Eight (8) off - Variable Speed Drive Cabinets

BLOCK DIAGRAM - MAIN POWER DISTRIBUTION

SYSTEMS FOR MACHINERY COMPONENTS
Fuel Oil System (Tanks, Supply, Pumps, Transfer Pumps and Piping):
Eight [8] Control Panels for Retractable Azimuth Thruster (speed control), each with:
■ Combined lever for Thruster speed and Azimuth control
■ Buttons and Status Lamps:
  - Start/Stop/Running
  - Thruster Hoist/Lower
  - Alarm/Fault
  - Command Transfer (Local/WH)
  - Emergency Stop
■ Buzzer
■ Bus communication to Thruster Controller
■ Indicating Instruments:
  - Azimuth Indication
  - Rpm Indication
  - Power Indication

Lubrication Oil System for Thrusters:
Eight [8] TC-96 Thruster Controller (each max. 96 I/O), each with the following:
■ Wall Mount Cabinet
■ Single Real Time Processor, RCU510
■ 64 multi-functional input/output embedded
■ Dual Set Interface
■ Lever Communication Link incl. HUB
■ Serial Interfaces RS232/422/485
■ Input Power - 24VDC from UPS (included)

NOTE:
Each Thruster Controller is integrated with the Local Control Panel of its corresponding Thruster.
Fresh Water Cooling System (Box Coolers, VSD Coolers and Expansion Tanks):
Each of the Eight [8] VSD Cabinets arranged with a separate Fresh Water Cooling System, which requires minimum maintenance during operation. The closed circuit of the Fresh Water Cooling System shall be means of a Pump circulate fresh water through the built-in VSD Cabinet Cooler and the Cooling Radiator.

Variable Speed Drives, UPS’s and Frequency Converters:
Eight [8] Variable Speed Drive Units, each with the following features:
■ Floor-Mounted Cabinet
■ Water Cooled

Switchboards:
Thruster Main 690V Power Distribution Panel:
■ Floor-Mounted
**Emergency 440V Power Distribution Panel:**
- Floor-Mounted Cabinet

**EMERGENCY POWER DISTRIBUTION PANEL - 440V**
Thruster Auxiliary 440V Power Distribution Panel:

The Distribution Boards provide power to the equipment listed and shown in the Auxiliary Power Distribution Block Diagram.
AZIMUTH THRUSTER MV3000 DRIVE NETWORKS TO DP SYSTEM
COLUMN C3 - 230V AC SUPPLY DISTRIBUTION FOR SENSORS

Legend:
- UPS: Uninterruptible Power Supply
- FS: Field Station
- WS: Workstation
- CC: Control Cabinet
- PME: Position Measuring Equipment
- PSU: Power Supply Unit
- ATC: A Series Thruster Controls
- AJS: A Series Joystick Controls
- VRU: Vertical Reference Unit

Bridge Control Module Located on Column C3
The A Series Thruster Control (ATC) Desk is double width. The A Series Joystick Control (AJS) is mounted on the front of the right hand side of the desk.
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