3x3850KW WARTSILA Diesel Gensets/Power Plant

Engine type.....3 x Wartsila 8L32
Max cont. rating (MCR).....3840 kW,
Engine speed.....720 rpm
Fuel type HFO..... 380 cSt (50°C)

1.0 Power generation machinery	
1.1.1 Wartsila 8L32	6
1.2 Fuel oil system 1 for 3 x Wartsila 8L32	
1.2.1 Feeder/Booster unit	1
1.2.2 Overflow valve (HFO/MDF)	1
1.2.3 Suction strainer (MDF)	1
1.2.4 Separator unit (HFO) common	1
1.2.5 Circulation pump	3
1.2.6 Safety filter (HFO)	3
1.3 Fuel oil system 2 for 3 x Wartsila 8L32	
1.3.1 Feeder/Booster unit	1
1.3.2 Overflow valve (HFO/MDF)	1
1.3.3 Suction strainer (MDF)	1
1.3.4 Circulation pump	3
1.3.5 Safety filter (HFO)	3
1.4 Lubricating oil system	
1.4.1 Separator unit (steam)	5
1.5 Compressed air systems 1 for 3 x Wartsila 8L32	
1.5.1 Starting air vessel	2
1.5.2 Starting air compressor unit (water cooled)	1
1.6 Compressed air systems 2 for 3 x Wartsila 8L32	
1.6.1 Starting air vessel	2
1.6.2 Starting air compressor unit (Water cooled)	1
1.7 Cooling water systems 1 for 3 x Wartsila 8L32	
1.7.1 Temperature control valve (heat recovery)	1
1.7.2 Preheating unit	1
1.7.3 Central cooler	2
1.8 Cooling water systems 2 for 3 x Wartsila 8L32	
1.8.1 Temperature control valve (heat recovery)	1
1.8.2 Preheating unit	1
1.8.3 Central cooler	2

1.9 Combustion air and exhaust gas systems

1.10 Control and monitoring systems

1.10.1 Power Unit	6

1.11 Electric motor starters

1.11.1 Starters for electric motor driven pumps	12
1.11.2 Starter for engine turning gear	6

1.12 Foundation

1.12.1 Flexible pipe connections spare set	**1**
1.12.2 Flexible pipe connections	6
1.12.3 Common base frame	6

1.13 Power transmission

1.13.1 Flexible coupling (flywheel)	6

1.14 Tools and spare parts

1.14.1 Tools (engine)	1
1.14.2 Spare parts (engine)	1

1.15 Packing and transportation

1.15.1 VCI-coating	6
1.15.2 Tarpaulin	6

1.16 Technical documentation

1.16.1 Engine manuals	6

TECHNICAL SPECIFICATION

WARTSILA GENSET PACKAGE

TABLE OF CONTENTS

1.0 Power Generation Machinery

General

Ambient conditions

The equipment is designed for the following conditions:

Maximum ambient air temperature.....45°C
Maximum LT cooling water temperature before engine.....38°C
Maximum sea water temperature.....32°C

Classification

The equipment meets the requirements of LR for unrestricted service at the date of quotation.

Warranty

As is. Buyer may obtain a guarantee from Wartsila for a certain price.

Validity of classification and other rules

The Equipment shall be delivered according to the valid edition of the mentioned rules, regulations and requirements of the Classification Society and Authority or Marine Organization as was applicable at the time of purchase.

Electric power supply

If not specially mentioned, all electrical equipment delivered with the engine is designed to operate with:

Main voltage 3x440.....V
Frequency 60.....Hz
Control voltage 24.....VDC

Fuel oil quality

The equipment is specified for fuel according to ISO 8217:2005 (E) with a viscosity of max. 380 cSt/50°C.

HFO

The following conditions, not specified in the ISO standard also apply:
Viscosity min., before injection pumps.....16 cSt
Viscosity max., before injection pumps.....24 cSt
CCAI, max 870
Water before engine, max0.3 % volume
Sodium before engine, max30 mg/kg
Aluminium + Silicon before engine, max.....15 mg/kg
Asphaltenes, max 14 % mass

MDF

The following conditions, not specified in the ISO standard also apply:
Viscosity min., before injection pumps.....2.0 cSt
Viscosity max., before injection pumps.....24 cSt
Sodium before engine, max30 mg/kg
Aluminium + Silicon before engine, max.....15 mg/kg
Flash point (PMCC), min 60 °C
Pour point, max 0-6 °C

Water quality

Fresh cooling water shall be treated with approved products.

Lubricating oil quality

Only approved oils shall be used for the equipment.

1.1 Diesel Engine(s)

1.1.1 Wärtsilä 8L32

Application

Engine driving a generator at constant speed.

Main particulars

Max continuous rating (MCR)	3840 kW
Speed	720 rpm
Configuration	In-line engine
Number of cylinders	8
Cylinder bore	320 mm
Stroke	400 mm
Swept volume per cylinder	32.2 dm^3
Mean piston speed	9.6 m/s
Mean effective pressure	24.9 bar
Direction of rotation, looking at driving end	Clockwise

The max continuous rating (MCR) is valid at ambient conditions mentioned above.

Fuel oil consumption (SFOC)

Fuel consumption at shaft according to ISO 3046/1 without engine driven pumps using HFO and corrected to a net calorific value of 42,700 kJ/kg:

85 % load	176 g/kWh
Tolerance	± 5 %

Lubricating oil consumption

85 % load	0.5 g/kWh
Tolerance	0.3 g/kWh

Lubricating oil consumption does not include treatment losses or oil changes.

NOx Emissions

The standard engine complies with the maximum permissible NOx emission according to MARPOL 73/78 ANNEX VI valid at the time of purchase.

Testing

The engines have been tested at the max continuous rating (MCR) in makers workshop in accordance with the requirements of the classification society and maker's own standard specification. The fuel oil used during the test run is closest to the actual specification. After test run the fuel rack position has been been limited to 110 % MCR.

Engine specification

The engine is a four-stroke, turbocharged and intercooled diesel engine. The following equipment is mounted on the engine:

Fuel system

- One injection pump per cylinder
- Spring loaded control valve in the return pipe -

Fuel oil pulse dampers (supply & return)

Lubricating oil system

- Direct driven lubricating oil pump with built-in safety valve and pressure regulating valve, without stand-by connections
- Electric motor driven pre-lubricating oil pump with built-in safety valve
- Automatic lubricating oil filter of back flushing type equipped with a differential pressure sensor
- Centrifugal filter mounted in the back flushing line
- Lubricating oil cooler of tube type
- Lubricating oil thermostatic valve
- Wet oil sump
- Separator connections including shut off valves

Starting air system

- Starting air master valve
- Blocking valve for turning gear
- Control air container
- None return valve
- Starting air distributor
- Starting air valve in each cylinder head
- Flame arrestor

Cooling water system

- Engine driven HT-cooling water pump without stand-by connection -

HT thermostatic valve, direct acting type

- Engine driven LT-cooling water pump without stand-by connection -

LT thermostatic valve, direct acting type

Combustion air and exhaust gas system

- Turbocharger(s) with air filter and silencer at free end of engine
- Exhaust gas outlet(s) orientation, 0° from vertical
- Single-stage charge air cooler(s)
- Connection(s) for cleaning device of turbine
- Cleaning device for compressor(s), manually operated
- Exhaust gas waste gate

Control and monitoring equipment on engine

- Fuel rack actuator for electronic speed control
- Two speed pickups for electronic speed control
- Electro-pneumatic shutdown system independent of the governor
- Microprocessor based distributed real time system for engine control and monitoring

Main components:

- Engine safety module for shutdown of engine acc. to class requirements
- Main control module for internal engine control functions
- Input /output modules for handling of sensor data

Main functions:

- shutdowns (e.g. lubricating oil pressure, overspeed)
- start blockings (e.g. lubricating oil pressure, turning gear)
- measuring of engine and turbocharger speed
- normal start and stop of the engine
- engine speed control
- other internal engine control functions as applicable
- signal processing of engine monitoring and alarm sensors
- data communication with ships alarm & monitoring system through Ethernet Modbus TCP/IP or RS-485 serial link/Modbus RTU
- hardwired interface with external systems for control functions such as remote start and stop

Operator interface

The operator interface consists of a local control panel (LCP) with backup indications, control switches and buttons, as well as a local display unit (LDU).
Both are built on the engine. The local display unit shows all engine measurements (e.g. temperatures and pressures) and provides various engine status indications as well as an event history.

Independent indications on the local control panel:

- Engine rpm
- Turbocharger rpm
- Running hours
- HT water temperature
- Lubricating oil pressure

Control switches and pushbuttons on the local control panel:

- BLOW/BLOCKED/LOCAL/REMOTE control mode switch -

Local START/STOP pushbuttons

- Shutdown RESET pushbutton
- Emergency stop pushbutton

Sensors

- Alarm, safety and measuring sensors according to maker and class requirements as per enclosed sensor list A01887215.

- Connections for testing of pressure sensors -

Additional FAKS sensors

- Sensors are wired to the engine mounted I/O- and control modules

Miscellaneous

- Flywheel with a gear ring for turning
- Electrical turning device
- Crankcase explosion valves
- Safety valve in each cylinder head
- Indicator valve in each cylinder head
- Nameplates in English
- Counter flanges, gaskets, bolts and nuts
- Torsional vibration damper or tuning mass in case needed

Painting

- The generating set will be painted with acrylic-based paint in colour Munsell no 7,5 BG 7/2

1.2 Fuel oil system 1, for 3 x Wärtsilä 8L32

1.2.1 Feeder/Booster unit 1

A self-contained skid equipped with a drip-tray comprising the following main components:

- Suction strainer
- Feed pumps, 2 pcs (duty and stand-by) of screw type with safety valves -

Pressure control valve

- An automatic filter with a manual by pass filter and differential pressure indicator with alarm contact.
- Flow meter with local indication
- Pressurized de-aeration tank provided with:
  - Level switch
  - Safety valve
  - Vent valve
- Circulating pumps. 2 pcs (duty and stand-by) of screw type with safety valves
- Steam heaters (2 pcs) with shut-off valves and safety valves
- Viscosity control system
- Starters with stand-by automatics
- Local control panels with individual alarm indications and group alarm contacts
- Pressure gauges and thermometers

The fuel pipes are equipped with steam trace heating, insulated and covered with steel plate.

1.2.2 Overflow valve (HFO/MDF) 1

Spring loaded overflow valve

1.2.3 Suction strainer (MDF) 1

Duplex filter with differential pressure indicator with alarm contact. The inserts can be exchanged with engine running.

1.2.4 Separator unit (HFO) common 1

The main components mounted on a steel frame are:

- Two separator(s) of automatic discharge type
- Suction strainer
- Electrically driven separator feed pump
- Steam heater with safety valve
- Sludge tank with heating coils
- Sludge pump
- Motor starters

Local control panel including temperature control, sequencing, individual alarm indication and group alarm contact

1.2.5 Circulation pump 3

Electric motor driven screw pump with safety valve

1.2.6 Safety filter (HFO) 3

Duplex filter with differential pressure indicator with alarm contact. The inserts can be exchanged with engine running.

1.3 Fuel oil system 2, for 3 x Wärtsilä 8L32

1.3.1 Feeder/Booster unit 1

A self-contained skid equipped with a drip-tray comprising the following main components:

- Suction strainer
- Feed pumps, 2 pcs (duty and stand-by) of screw type with safety valves -

Pressure control valve

- An automatic filter with a manual by pass filter and differential pressure indicator with alarm contact.
- Flow meter with local indication
- Pressurized de-aeration tank provided with:
  - Level switch
  - Safety valve
  - Vent valve
- Circulating pumps. 2 pcs (duty and stand-by) of screw type with safety valves
- Steam heaters (2 pcs) with shut-off valves and safety valves
- Viscosity control system
- Starters with stand-by automatics
- Local control panels with individual alarm indications and group alarm contacts
- Pressure gauges and thermometers

The fuel pipes are equipped with steam trace heating, insulated and covered with steel plate.

1.3.2 Overflow valve (HFO/MDF) 1

Spring loaded overflow valve

1.3.3 Suction strainer (MDF) 1

Duplex filter with differential pressure indicator with alarm contact. The inserts can be exchanged with engine running.

1.3.4 Circulation pump 3

Electric motor driven screw pump with safety valve

1.3.5 Safety filter (HFO) 3

Duplex filter with differential pressure indicator with alarm contact. The inserts can be exchanged with engine running.

1.4 Lubricating oil system

1.4.1 Separator unit 5

The main components mounted on a steel frame are:

- Separator of automatic discharge type
- Suction strainer
- Electrically driven separator feed pump
- Steam heater with safety valve
- Operating water tank
- Sludge tank with heating coils
- Sludge pump
- Motor starters
- Local control panel including temperature control, sequencing, individual alarm indication and group alarm contact

1.5 Compressed air systems 1, for 3 x Wärtsilä 8L32

1.5.1 Starting air vessel 2

The total air volume of the starting air vessels are calculated for 12 starts (estimation).

Starting air vessel (0.500 m^3) for vertical mounting with:

- Valve head assembly with inlet, outlet, drain and safety valves
- Counter flanges, gaskets, bolts and nuts

Starting air vessel size to be confirmed by customer, since the approval discussions are carried out between system designer and classification society.

1.6 Compressed air systems 2, for 3 x Wärtsilä 8L32

1.6.1 Starting air vessel 2

The total air volume of the starting air vessels are calculated for 12 starts (estimation).

Starting air vessel (0.500 m^3) for vertical mounting with:
- Valve head assembly with inlet, outlet, drain and safety valves
- Counter flanges, gaskets, bolts and nuts

Starting air vessel size to be confirmed by customer, since the approval discussions are carried out between system designer and classification society.

1.7 Cooling water systems 1, for 3 x Wärtsilä 8L32

1.7.1 Temperature control valve (heat recovery) 1

Temperature control valve of Direct type.

1.7.2 Preheating unit 1

HT cooling water preheating unit with:
- Electric heater
- Circulating pump
- Control cabinet for heater and pump
- The unit is dimensioned to maintain a hot engine warm or to heat the engine block from 15°C to 60°C within 24 h, excluding losses in the external system

1.7.3 Central cooler 2

Combined HT/LT fresh water central cooler of plate type for cooling of engines. Two coolers are designed for cooling of 3x Wärtsilä 8L32.

1.8 Cooling water systems 2, for 3 x Wärtsilä 8L32

1.8.1 Temperature control valve (heat recovery) 1

Temperature control valve of Direct type.

1.8.2 Preheating unit 1

HT cooling water preheating unit with:
- Electric heater
- Circulating pump
- Control cabinet for heater and pump
- The unit is dimensioned to maintain a hot engine warm or to heat the engine block from 15°C to 60°C within 24 h, excluding losses in the external system

1.8.3 Central cooler 2

Combined HT/LT fresh water central cooler of plate type for cooling of engines. Two coolers are designed for cooling of 3x Wärtsilä 8L32.

1.9 Combustion air and exhaust gas systems

1.9.1 Turbocharger cleaning device 2

Turbocharger water cleaning device for turbocharger turbine side:
- Dosing unit
- 10 meter hose with quick couplings

1.9.2 Exhaust gas bellows 6

Flexible expansion bellows after turbocharger.

- Counter flanges, gaskets, bolts and nuts

1.9.3 Exhaust gas silencer, with spark arrestor 6

Uninsulated exhaust gas silencer with spark arrestor with approximately 25 dB(A) noise reduction.

- Counter flanges, gaskets, bolts and nuts

1.9.4 Connection piece 6

Conical transition piece after the exhaust gas bellows on the turbocharger.

1.10 Control and monitoring systems

1.10.1 Power Unit 6

Power unit for supply of isolated and duplicated 24VDC to the engine.
Cabinet for bulkhead mounting, protection degree: IP44

Main components

- 230VAC/24VDC power supply converter
- 24VDC/24VDC power supply converter
- Miniature Circuit Breakers (MCBs) and terminals

The converters are dimensioned for 100% load and redundant. Failure of one supply will cause automatic takeover by the second supply.

Required power supply from ship's system:

- Main: 220VAC / abt. 150W
- Backup: 24VDC/ abt. 150W.

At least one of these must be connected to UPS or battery backup on ship's side.

1.11 Electric motor starters

1.11.1 Starters for electric motor driven pumps 12

Motor starters included:

- engine built on pre lubricating oil pump (6 pcs)
- HFO/MDF Circulating pump (6 pcs)

Features of the starters:

- local start and stop control
- standby-, remote- or automatic mode as applicable

1.11.2 Starter for engine turning gear 6

Starter for electric driven turning gear with a cable of 15 meters and handheld control unit.

1.12 Foundation

1.12.1 Flexible pipe connections, spare set 1

Spare set of flexible hoses including one for each type of pipe connections on engine(s).

1.12.2 Flexible pipe connections 6

Flexible hoses for the pipe connections on engine(s).

1.12.3 Common base frame 6

Foundation for the engine and the alternator:

- Common base frame of welded steel
- Flexible mounts for common base frame
- The generator and engine will be mounted on the common base frame.
- Alternator fittings materials are included.
- Flywheel cover between engine and alternator

1.13 Power transmission

1.13.1 Flexible coupling (flywheel) 6

The final choice of flexible coupling will be based on the torsional vibration calculations (made after the order).
Bolts for connecting the coupling to the flywheel

1.14 Tools and spare parts

1.14.1 Tools (engine) 1

Tools for the engine.

1.14.2 Spare parts (engine) 1

Spare parts according to the recommendations of the IACS.

1.15 Packing and transportation

1.15.1 VCI-coating 6

The engine is protected during transportation by a plastic VCI-film (Volatile Corrosion Inhibitor).

1.15.2 Tarpaulin 6

The engine is protected during transportation by a tarpaulin.

1.16 Technical documentation

Installation Planning Instructions

Delivery includes, in English, Installation Planning Instructions (IPI) necessary for Buyer's installation work of equipment in Wärtsilä scope of supply.

1.16.1 Engine manuals 6

Set of engine Operating & Maintenance manuals (O & M manuals) and spare parts catalogues per ship set for the equipment included in Wärtsilä scope of supply.

Operating & Maintenance manuals

Operating & Maintenance manuals cover instructions and descriptions by text and pictures of the main actions and cautions needed when operating the delivered equipment. The engine Operating & Maintenance manual are made specific for the delivered engine(s).

Spare Parts Catalogues

Spare Parts Catalogues contain the needed pictures for identification of spare parts to be ordered, stored or installed. The Spare Parts Catalogue furthermore contains Wärtsilä specific Spare Part Numbers, which shall be used when ordering parts. The Spare Parts Numbers are connected to Wärtsilä's unique Code Resolution system, enhancing the precision of spare parts processing and minimizing the need for updating at the customer's side.

Type	Media	Language	Qty
O & M manual (Wärtsilä 8L32)	A4 binder	English	3
Spare parts catalogue (Wärtsilä 8L32)	A4 binder	English	3

ber:

Technical Specification

for

Three Phase Synchronous Generator

1. Technical Specification

1.1 General

1)Maker/Model : HHI/HSJ7 809-10

2)Quantity : 6set / Ship

3)Type of excitation: Brushless and self excited with AVR, rotating field, with damper winding

4) Parallel operation : Yes

5)Ambient temperature: 45℃

6)Applicable standards: IEC, VDE AND DIN

7)Class Society: DNV certificates included

8)Quality system : ISO 9001

1.2 Rating

1) Time rating : Continuous

2) Rated output: 4,600KVA / 3,680KW

3) Rated voltage : 6,600V

4) Rated speed : 720RPM

5)Rated frequency : 60 HZ

6)Winding connection: Star (Y)

7)Number of phase : Three (3)

8)Number of poles : Ten (10)

9)Power factor : 0.8 Lagging

1.3 Specifications

1)Insulation class : F Class

2)Temperature rise : F Class

3)Construction : B 3

4)Protection degree : IP44

5)Radio interference suppr. : "N" ACC. TO VDE0875

6)Voltage regulation: Within ± 2.5% From no Load to rated full load

7)Voltage adjustment: ± 5% of the rated of voltage

8)Anti condensation heater : AC230V single phase

9)Cooling method: Air to cooler with double tube type cooler

10)Type of bearing & lub: Bracket type, single sleeve bearing & self lubraction.

11)Accessories (per 1set)

- Automatic voltage regulator
- Reference value setter
- Space heater
- Rod type thermometer for bearing
- Stator winding temp. detector of pt100ohm(2ea/phase)
- Bearing temp. detector of pt100ohm(1ea/bearing)
- Double tube type cooler
- Water leakage detector for cooler
- Diff. C/T shall be supplied by the alternator maker (6ea/gen)

12)Spare parts (per ship)

- Rotating rectifier 1set
- Steady diode 1ea