Std	Opt	Q'ty/plant	Ins	Description	Specification
				Basic Diesel Engine	
X		12	B	Standard diesel engine	18V32/40
X		12	B	Rigid mounting by resin chock of common base frame	
	-		E	Holding down bolts, nuts and side chock for rigid mounting	
				Common bed + engine : resilient mounting Common bed + generator : rigid mounting Common bed + ship : resin chock mounting	
X		12	B	Flexible coupling between flywheel and generator	
X		12	B	Protection cover for flywheel	
	-		B	Gallery with hand rail	
X		12	B	Torsional vibration damper	According to T.V calculation
X		12	B	Engine rotation clockwise, seen from flywheel	
	-		B	External flanges without counter flanges, gaskets, bolts.	
			E	External flanges with counter flanges, gaskets, bolts.	
X		12	B	All external flanges connections acc. to standard DIN or JIS ** Exhaust gas outlet acc. to standard DIN 86044*	
	-		E	Counter flange for exhaust gas outlet incl. gasket and flange acc. to standard DIN 86044	

Std	Opt	Q'ty/plant	Ins	Description	Specification

Fuel Oil System

☐			B	FO system complete for MGO (low sulphur fuel oil) operation ** According to : ISO 8217, class DMA (2~6 cSt/40 ℃)*	
☐			B	FO system complete for MDO operation ** According to : ISO 8217, class DMC (12~12 cSt/40 ℃)*	
☒			B	FO system complete for HFO operation *- start/stop at cold(initial) condition & low load running :* *- start/stop at normal condition & normal operation :*	*MDO (12 cSt / 40 ℃)* *HFO (700 cSt / 50 ℃)*
☒		12 x 18	B	Injection pump for each cylinder	
☐		____	S	Nozzle cooling water unit with starter panel	*for HFO operation*
☐		____	E	FO duplex filter (for safety) - FO duplex filter differential press. switch (1PDSH5068)	 remote alarm, incl. filter
☐		____	E	Leakage alarm box for waste oil (LAH 42) - FO leakage tank level switch (1LSH5080)	 remote alarm, incl. tank
☒		12	B	Protection cover of FO inlet/outlet pipe connection where flange joint	
☒		12	B	Thermal insulation of fuel oil in/outlet pipe	
☐		____	S	MDO or MGO feed pump by motor driven - pump with el-motor	m3h X 5 bar , To be confirmed late AC 690 V, 50Hz
☐		____	S	Emergency MDO pump unit - pump with air motor - solenoid valve - air conditioning unit - suction filter (fineness : 100㎛)	m3h X 6 bar, To be confirmed later air cons: m3/h, air source : 6~7 bar DC 24V incl. air filter, lubricator & press. gauge type : ☐ simplex ☒ duplex
☐		____	S	Only emergency MDO pump with air motor	0.8 m3h X 6 bar, 1900 rpm air cons : m3h, air source : 6~7 bar
☐		____	E	HFO/MDO 3-way ball valve (size : A) incl. limit switches, manually operated	Low load limitation : 20% MCR
☐		____	E	HFO/MDO 3-way ball valve (size : A) incl. solenoid valve & limit switches, pneumatically activated	DC 24V energized open type solenoid airless : MDO position & air supply : HFO position
☐		____	S	HFO supply press regulating valve for press control at engine outlet	type : direct sensing type set point : 5 bar, size :
☐		____	S	HFO press regulating valve, for press control at engine inlet	type : direct sensing type set point : 7 bar, size :
☐		____	S	MDO press regulating valve, for press control at engine inlet	type : direct sensing type set point : 6 bar, size :
☐		____	S	MDO press regulating valve, for press control at engine outlet	type : direct sensing type set point : bar, size :
☐		____	S	Fuel oil cooler (for MDO running)	

Std	Opt	Q'ty/plant	Ins	Description	Specification

Lubricating Oil System

X		12	B	Lub. oil viscosity	SAE 40
X		12	B	Common frame wet system	
X		12	B	Oil pan with horizontal L.O outlet at stern and fore side each	
X		12	B	Lub. oil pump, engine driven	at free end
	⊟		E	Lubricating oil cooler, plate type	Stainless steel plate
	⊟		E	Prelubricating pump, elec-motor driven Voltage : AC V	
X			E	Lube oil filter	
	⊟		E	Lube oil temp. control valve, wax type (TCV-001)	Wax type
X		12	B	Connection for LO to/from purifier at sump tank	
	⊟		B	Connection for LO to/from alternator	
	⊟		B	Pressure lubricating to alternator bearing(s) * *Reference* - Engine LO temp. : 70 ℃ - Engine LO pressure : 3~5 bar	Accessories such as orifices, pressure gauge, thermometer, etc to be supplied by Gen. Maker
	⊟		B	Installation on base frame and piping arrangement of Lub. oil cooler for alternator bearing(s)	Supplied by Gen. Maker, If necessary
X		12	B	Cylinder lub. oil system, incl. el-motor driven pump Voltage : AC 440 V	
X		12	B	Protection cover of LO inlet/outlet pipe connection where flange joint	
	⊟		B	Lube oil sealing system for fuel injection pumps	*For MDO/MGO operation*

Std	Opt	Q'ty/plant	Ins	Description	Specification

Cooling Water System

☒		12	B	Lub. oil and charge air cooler cooled by fresh water *(Stainless steel plates in lub. oil cooler)*	
☒		12	B	Two string central cooling water system *(LT and HT cooling water : fresh water)*	
☒		12	B	Engine-driven pump for HT system	
	☐		E	Temperature control valve for HT water (MOV-002)	Electrically activated
☒		12	B	Engine-driven pump for LT system	
	☐		E	Charge air temperature control valve	Electrically activated
☒		12	B	Branches for external preheating	F5 / F6 connection
	☐		S	Jacket FW preheating unit - ☐ Electric heater ☐ Steam - 2 Circulating pump by motor - Pressure gauge & thermometer - Control panel	To be confirmed later kW, AC 690V, 3Φ, 50Hz m3/h, 2 bar, inlet/outlet conn. : A / A
	☐		E	Cooling LT auto shut-off valve, (loose supply)	Electric type (normal close : engine stop
	☐		E	Cooling HT auto shut-off valve, (loose supply)	Electric type (normal close : engine stop
	☐		E	Jacket water preheater auto shut-off valve, (loose supply)	Electric type (normal open : engine stop

Compressed Air System

☒		12	B	Starting piston valve, local/remote start and stop	
☒		12	B	Turning device, el-motor driven	
	☐		B	Slow turnning device	Standard for electrical propulsion
	☐		S	Starting air tank	liter X 30 bar X bottle(s)
				- Painting color : white	valve mounting : ☐ on top ☐ front type : ☐ vertical ☐ horizontal

Std	Opt	Q'ty/plant	Ins	Description	Specification

Combustion Air System

☒		12 x 2	B	Turbocharger	NR34/S type
☒		12 x 2	B	Two stage charge air cooler	
☒		12 x 2	B	Container for water washing of turbocharger compressor side	Mounted on engine
	☐		B	Jet assistance system	
	☐		B	Charge air shut off flap device (Rig-saver) - Gas detector shall be provided by shipyard	

Exhaust Gas System

	☐		B	Water washing connection of turbocharger turbine	
	☐		B	Dry cleaning connection of turbocharger turbine with blow gun	
	☐		S	Water washing device with flexible hose(20 m), quick coupling, reducing valve and pressure gauge	Yard connction type : JIS M42 male
☒		12 x 2	B	Exh. gas outlet for pipe connection away from engine	☒ 22.5° ☐ 30° ☐ 45° ☐ 60°
	☐		E	Expansion bellows after turbocharger	☐ DN 600 ☒ DN 700
	☐		E	Transition socket after turbocharger	
	☐		E	Intermediate plate after turbocharger outlet flange	☐ DN 600 ☒ DN 700

Speed Control System

☒			B	Heinzmann governor actuator	STG180
	☐		E	Governor Controller (loose supply) ** Controller build-in governor panel*	
	☐		S	Governor programmer (loose supply)	

Std	Opt	Q'ty/ship	Ins	Description	Specification

Monitoring Equipment

[X]		12	B	Standard thermometers	
				- HT fresh water, engine inlet (TI 3170)	Bar type
				- Lub. oil, engine inlet (TI 2170)	Bar type
				- Charge air, air cooler outlet (TI 6180)	Bar type
[X]		12	B	Standard instrument panel incl. pressure gauge	
				- Lub. oil, engine inlet (PI 2170)	0~10 bar
				- Lub. oil, T/C inlet (PI 2570)	0~ 6 bar
				- HT fresh water, engine inlet (PI 3170)	0~ 6 bar
				- LT fresh water, engine inlet (PI 4170)	0~ 6 bar
				- Fuel oil, engine inlet (PI 5070)	0~10 bar
				- Charge air after cooler (PI 6180)	0~ 6 bar
				- Starting air engine inlet (PI 7170)	0~40 bar
				- Control air engine inlet (PI 7400)	0~10 bar
				- Engine tachometer (1SI1000)	0 ~ 1200 rpm
				- Temp. monitor for exh. gas(1TI6570)	cyl. outlet, T/C in/outlet
				- Select switch for speed setting(1HS1010)	
				- P/B for engine start/stop(1HS1011/1HS1012)	
				- P/B for engine emergency stop(1HOZ1012)	
				- Change-over s/w for control position(1HS1012)	local-remote
	[X]			* Nozzle cooling water, engine inlet (PI3470)	oil filled type, only for HFO operation
[X]		12	B	**Pressure transmitters & switches(standard) for :**	
				- Lub. oil, engine inlet(1PT2170)	remote ind. & alarm
				- Lub. oil, turbocharger inlet(1PT2570)	remote ind. & alarm
				- HT cooling water, engine inlet(1PT3170)	remote ind. & alarm
				- LT cooling water, air cooler inlet(1PT4170)	remote ind. & alarm
				- Fuel oil, engine inlet(1PT5070)	remote ind. & alarm
				- Suction air, engine inlet(1PT6100)	remote ind.
				- Charge air, engine inlet(1PT6180)	digital governor system
				- Starting air, engine inlet(1PT7170)	remote ind. & alarm
				- Control air, engine inlet(1PT7400)	remote ind. & alarm
				- Emergency air, engine inlet(1PT7180)	remote ind. & alarm
	[ ]			- Nozzle cooling water, engine inlet (1PT3470)	remote indication, only for HFO operatio
				Extra pressure transmitters & switches for :	
[ ]			B	- Lub. oil, engine inlet(2PT2170)	reduce or shutdown
[ ]			B	- Lub. oil, engine inlet(2PSZLT2170), switch	shutdown
[ ]			B	- Lub. oil, turbocharger inlet(2PT2570)	reduce or shutdown
[ ]			B	- HT cooling water, engine inlet(2PT3170)	reduce or shutdown
[ ]			B	- Charge air, engine inlet(2PT6180)	remote indication
[ ]			B	- Lub. oil , in lube oil sump tank (1PT2310)	alarm
[X]		12	B	**Exh. gas thermocouples(standard) for :**	
				- Exh. gas cylinder outlet(TE6570)	remote ind. & alarm/reduce
				- Exh. gas turbocharger inlet(TE6575)	remote indication & alarm
				- Exh. gas turbocharger outlet(TE6580)	remote indication & alarm

Std	Opt	Q'ty/ship	Ins	Description	Specification
[X]		12	B	**Resistance bulbs(standard) for :**	
				- Lub. oil, engine inlet(1TE2170)	remote indication & alarm
				- Lub. oil, turbocharger outlet(1TE2580)	remote indication & alarm
				- HT cooling water, engine inlet(1TE3170)	remote indication & alarm
				- H.T cooling water, engine outlet(1TE3180)	remote indication & alarm
				- HT cooling water, air cooler inlet(1TE3168)	remote indication
				- LT cooling water, air cooler inlet(1TE4170)	remote indication & alarm
				- Fuel, engine inlet(1TE5070)	remote indication & alarm
				- Intake air(1TE6100)	remote indication
				- Charge air, compressor outlet(1TE6170)	remote indication
				- Charge air, engine inlet(1TE6180)	remote indication & alarm
	[-]			- Nozzle cooling water, engine inlet(1TE3470)	remote indication, only for HFO operatio
				Extra resistance bulbs for :	
[X]		12	B	- Lub. oil, engine inlet(2TE2170)	reduce or shutdown
[X]		12	B	- Lub. oil, turbocharger outlet(2TE2580)	reduce or shutdown
[X]		12	B	- HT cooling water, engine outlet(2TE3180)	reduce or shutdown
				Extra resistance bulbs for temp control :	
[-]			S	- HT cooling water, control valve outlet(1TE3165)	HT temp. control
[X]		12	B	- Charge air, engine inlet(2TE6180)	charge air temp. control
[-]			S	- Ambient air(1TE6000)	charge air temp. control (loosely supply)
				limiter switches for :	
[-]			B	- Cylinder lub. oil flow switch(1FE2470)	remote alarm
				Engine speed transmitters for :	
[X]		12	B	- Control system(1SE1000)	
[X]		12	B	- Safety system(2SE1000)	
[X]		12	B	- Digital governor system(3/4SE1000)	
[-]			B	- Slow turning(5SE1000)	
				Turbocharger transmitter for :	
[X]		12	B	- Speed monitoring(1SE1004)	
[-]			B	- Fuel rack transmitter (2GT1022)	
[X]			B	Oil mist detector	Type : VN115/87 PLUS

Std	Opt	Q'ty/plant	Ins	Description	Specification
☐		____	B	PT-100 (R/B) for main bearing temperature with indication and alarm (TE1064)	
☐		____	B	PT-100 (R/B) for splash oil temperature with indication and alarm (TE2880)	

Flexible hoses

Std	Opt	Q'ty/plant	Ins	Description	Specification
☐		____	B	flexible hoses for water, lube oil, fuel oil, compressed air	

Spare parts

Std	Opt	Q'ty/plant	Ins	Description	Specification
☐		____	E	Standard spare parts in accordance with requirement maker's standard	
☐		____	S	One(1) set of each type thermometer ** to be submitted separately and incl. In the drawing*	
☐		____	S	One(1) set of each type sensors ** to be submitted separately and incl. In the drawing*	
☐		____	S	Spare parts for flexible hose	
☐		____	S	Additional wearing parts for _____ years operation	
☐		____	S	Additional spare parts on request	

Tools for maintenance

Std	Opt	Q'ty/plant	Ins	Description	Specification
☐		____	S	Standard tools for normal maintenance	incl. Inj. Nozzle tester
☐		____	S	Additional tools on request	
	☐			P-max indicator : ____ EA / ship	
	☐			Inter piece for pressure test : ____ EA / ship	
	☐			Valve cone grinding machine : ____ EA / ship	
	☐			Valve seat refacing device : ____ EA / ship	
	☐			Cylinder liner honing machine : ____ EA / ship	
	☐			Cylinder head mounting device : ____ EA / ship	
	☐			Air cooler removal & fitting device : ____ EA / ship	
☐		____	S	Lifting tools for genset	

Generator

Std	Opt	Q'ty/plant	Ins	Description	Specification
☐			B	Generator supplied by customer	Efficiency : Min. %
☒		12	B	Generator supplied by STX Engine Maker shall be decided by STX Engine	
				- Manufacturer	
				- Capacity	8640 kW, 750 rpm, AC 11kV 50 Hz, 3 phase, 8 poles
				- Bearing type	☐ single bearing(B16), rigid couple ☒ double bearing(B20), flexible couple
					☒ End bracket type ☐ Maker's standard :
				- Rotation	Anti-clockwise, seen from flange/shaft end
				- Enclosure	☒ IP 23 ☐ IP 43 ☐ IP 44
				- Insulation class	☐ H ☒ F
				- Temp. rise class	☐ B ☒ F
				- Ambient temp	☒ 45℃ ☐ 50℃
				- Cooling method	☒ air cooled with fan self ventilated type ☐ water cooled
				- Bearing lubrication	☒ self lubrication ☐ forced lubrication from engine
				- Position of terminal box (seen from flange/shaft end)	☐ on right side ☒ on left side ☒ bottom side
				- AVR	loose supply for MSBD mounting
				- VR (voltage regulator)	loose supply for MSBD mounting
				- Local thermometer for bearing	bar type
				- Space heater voltage	☒ AC 230V, 1Φ ☐ AC 110V, 1Φ
				☒ Temp sensor (PT-100) for bearing	
				☒ Temp sensor for windings	☐ PT-100 X 3 ☒ PT-100 X 6 (including spare)
				☒ Air intake filter	
				☒ Parallel running	

Std	Opt	Q'ty/plant	Ins	Description	Specification

Electrical control panels

[X]			B	Control station - Engine-rpm - Push button for start/stop - Exh. Gas temp. monitor - Speed setting	
[X]			B	Main terminal box	
[-]			E	Engine Safety and Control System - Engine safety - Engine control - HMI	
[-]			S	GCP	
[-]			E	Heinzmann governor panel	
				- Protection grade	[ ] IP 23 [X] IP 44
				- Mounting type	[X] wall mounting [ ] self standing
				- Others	maker's standard
[-]			S	LO priming pump starter	
				- Composition	[X] one panel/eng [ ] group panel
				- Protection grade	[ ] IP 23 [X] IP 44
				- Mounting type	[ ] wall mounting [X] self standing
				- Others	maker's standard
[-]			S	Cylinder LO pump starter	Incorporated into LO piming pump starte
				- Composition	[X] one panel/eng [ ] group panel
				- Protection grade	[ ] IP 23 [X] IP 44
				- Mounting type	[ ] wall mounting [ ] self standing
				- Others	maker's standard
[X]			B	Turning device starter incl. remote control witch	
				- Composition	[X] one panel/eng
				- Protection grade	[ ] IP 23 [X] IP 44
				- Mounting type	[X] Baseframe mounting [ ] self standing
				- Others	maker's standard