

WARTSILA 20 MW POWER PLANT

DESCRIPTION

NEVER USED, NEVER ASSEMBLED – This is a 20 MW modular power plant with 2 Wärtsilä 20V32TS engines as the prime movers for the 2 ABB AMG 1120LT08 DSE Generators installed on 2 common base frames.

The 2 Wärtsilä 32TS Engines are four-stroke engines designed for continuous operation on heavy fuel oil (HFO) and can be started and stopped on HFO if the fuel is heated to the operating temperature. Light fuel oil (LFO) is a back up fuel.

The 2 ABB generators are synchronous, 3 phase, brushless and salient pole units.

MAIN COMPONENTS FOR 2 GENSET SYSTEMS INCLUDE:

- Wärtsilä 20V32TS Engines
- Common Base Frames
- Flexible Connections
- Gen-Set Assemblies
- Sets of Steel Springs
- ABB AMG 1120LT08-DSE, 15,000 v Generators
- Flexible Couplings
- Flywheel Covers
- External Enclosure
- And more! SEE EQUIPMENT LIST AND PACKING LIST FOR MORE INFORMATION

APPENDICES ATTACHED:

- APPENDIX A – PICTURES
- APPENDIX B – WARTSILA ENGINE DATA SHEETS
- APPENDIX C – ABB GENERATOR DATA SHEETS
- APPENDIX D – GENERAL EQUIPMENT LIST and THREE PACKING LIST BY LOCATION



I.D.	17C-KT01
QUANTITY	(2) 10MW GEN-SETS
OEM (ENGINE)	WÄRTSILÄ
ENG MODEL	20V32TS
SERIAL NOS	PAAE-343026 PAAE-343027
OEM (GENERATOR)	ABB
GEN MODEL	AMG 1120LT08 DSE
SERIAL NOS	267589 267590
YOM	2018
LOCATION	VASSA, FINLAND RAUMA, FINLAND MUMBAI, INDIA
CONDITION	NEVER USED
CARE AND MAINTENANCE	YES – BY WARTSILA

PRIMARY	SPECIFICATIONS
FUEL	HFO / LFO
GROSS OUTPUT (kW)	10,150 Each
GEN POWER (kVA)	12,688 Each
VOLTAGE	15,000 V
FREQUENCY	50 Hz
RATED CURRENT (In)	488 A
SPEED	750 RPM
COOLING METHOD	Air Cooled
ENCLOSURE	IP23



YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

Pre-Owned Mining, Processing & Construction Equipment Since 1979

APPENDIX A

WARTSILA 20 MW POWER PLANT

PICTURES

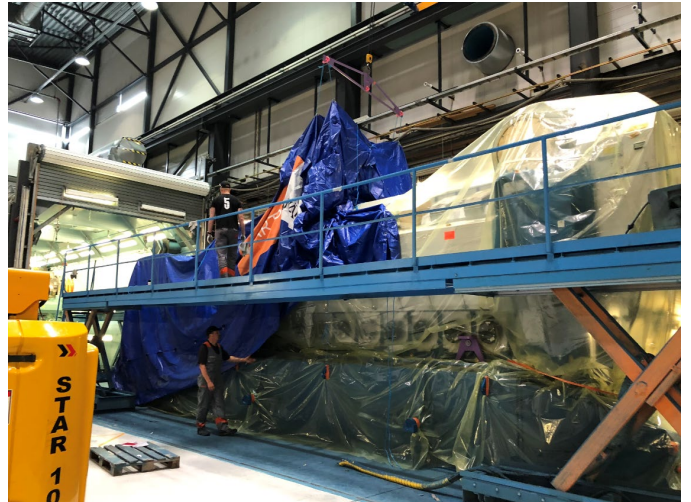
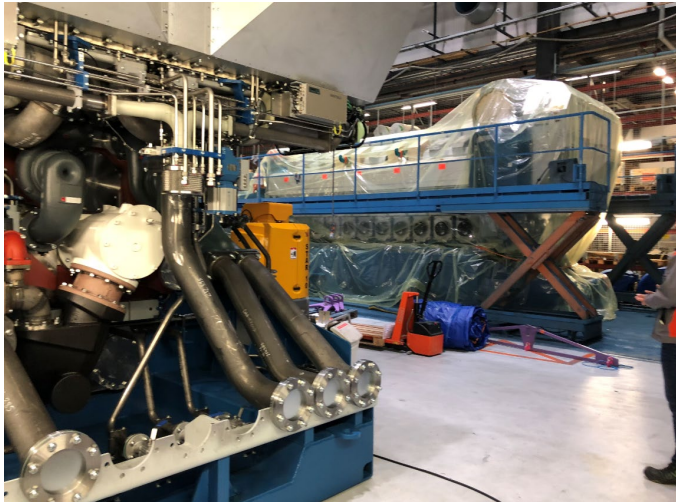


YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

WARTSILA 20 MW GENERATOR SET

PICTURES



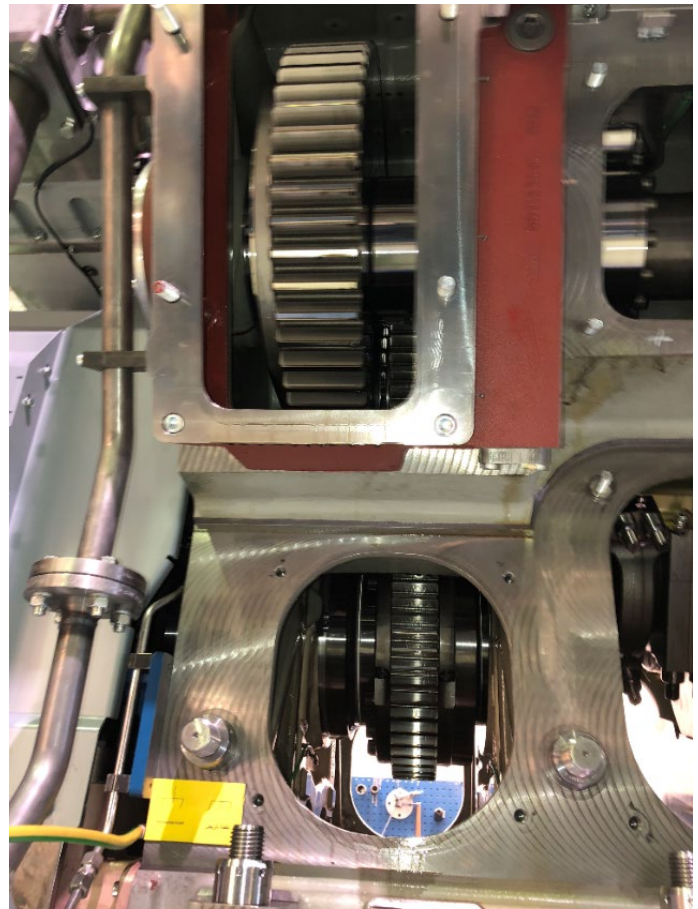
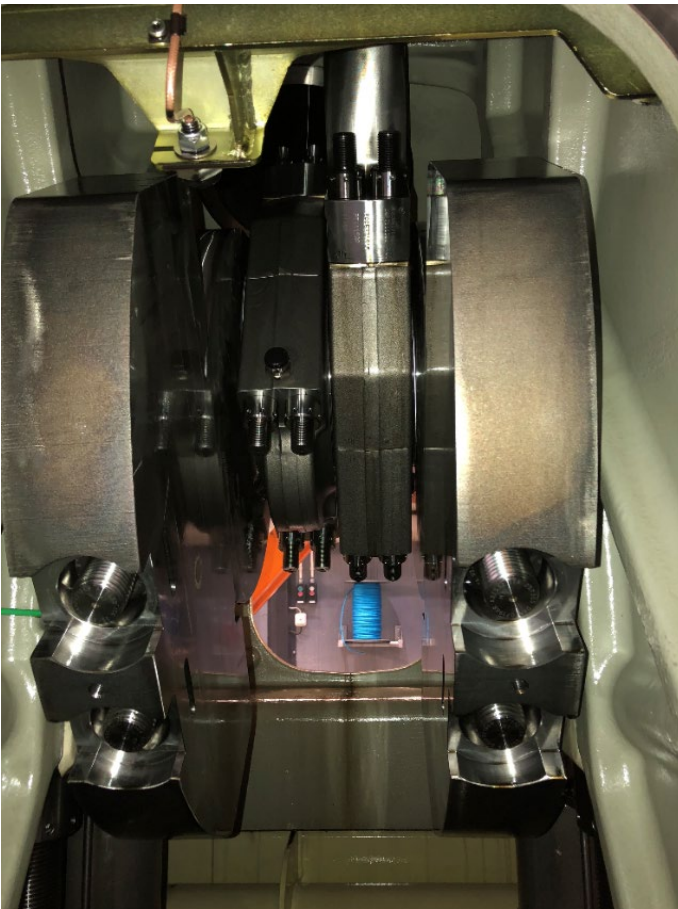
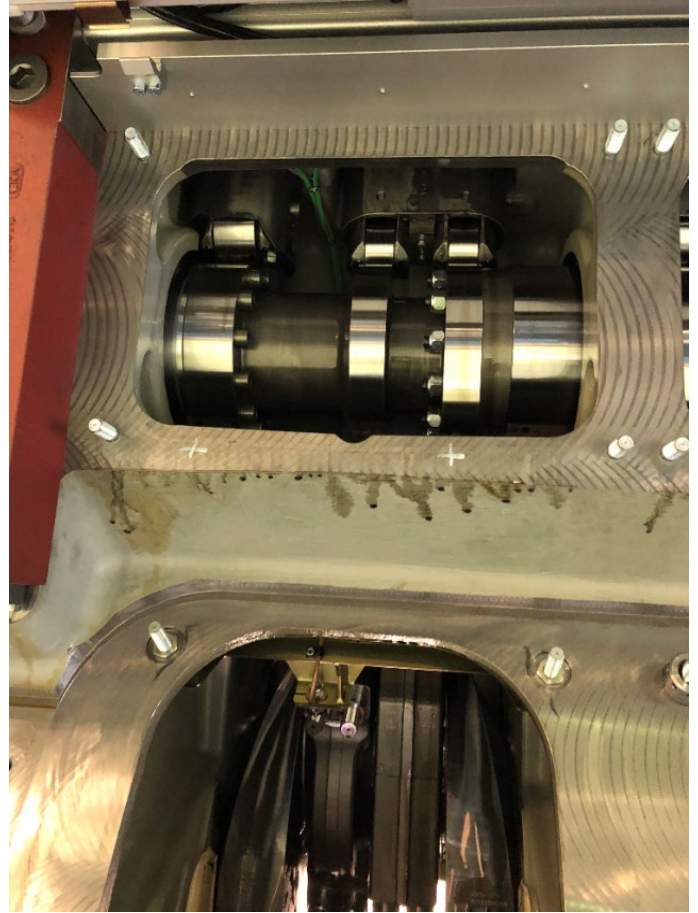
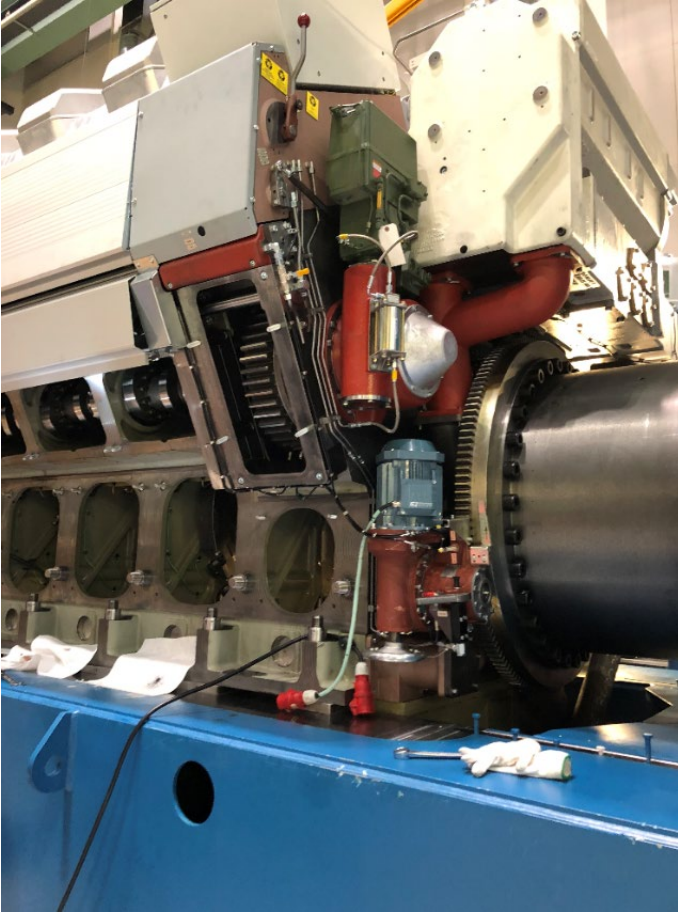
YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

Pre-Owned Mining, Processing & Construction Equipment Since 1979

WARTSILA 20 MW GENERATOR SET

PICTURES



APPENDIX B

WARTSILA 20 MW POWER PLANT

DATA SHEETS



YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

WARTSILA 20 MW POWER PLANT

DATA SHEET

WARTSILA ENGINES AND GENERATOR DATA SHEET				
1	MAJOR EQUIPMENT IDENTIFICATION		DATA	
1,01	RECIPROCATING ENGINE			
1,02		TYPE	4 STROKE, TURBOCHARGED HFO/LFO	
1,03				
1,04		MANUF.	WARTSILA	
1,05		MODEL NO.	20V32TS	
1,06	GENERATOR			
1,07		QUANTITY	2	
1,08		MANUF.	ABB	
1,09		MODEL NO.	AMG1120LT08DSE	
2,01	ENGINE GENERATING UNIT GUARANTEED PERFORMANCES (PER ENGINE)		HFO FUEL	LFO FUEL
2,02	CAPACITY FACTOR @ NOL	(% of full load)	100	100
2,03	GROSS ELECTRICAL OUTPUT AT GENERATOR TERMINAL	(kW)	10151	10150
2,04	GROSS HEAT RATE @ ENGINE	(kJ/kWh - HHV)	8235 kJ/kW	8324 kJ/kW
2,05	LUBRICATING OIL CONSUMPTION PER ENGINE	(kg / h)	3.6kg/h	3.6kg/h
2,06	NOX EMISSIONS	(mg / Nm3)	1460	1460
2,07	SO2 EMISSIONS	(mg / Nm3)	1170	127
2,08	PM10 EMISSIONS	(mg / Nm3)	85	31
3	RATINGS AND PERFORMANCE DATA		DATA	
3,01	RATED GENERATING VOLTAGE	(kV)	15	
3,02	RATED GENERATED FREQUENCY	(Hz)	50	
3,03	RATED ENGINE SPEED	(RPM)	750	
3,04	RATED GENERATOR POWER FACTOR	(LAG)	0,8	
3,05	OVERLOAD CAPABILITIES	(% / duration)	No overload	
3,06	OVERSPEED CAPABILITIES	(% / duration)	No overspeed	
3,07	STARTING TIME (INITIATING SIGNAL TO OPERATING SPEED & VOLTAGE	(sec.)	60s normal start	



YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

Pre-Owned Mining, Processing & Construction Equipment Since 1979

WARTSILA 20 MW POWER PLANT

DATA SHEET

4	BASIC ENGINE DETAILS		DATA
4,01	CONFIGURATION		4-stroke, turbocharged HFO / LFO generator
4,02	NUMBER OF CYLINDERS / CONFIG		20 V
4,03	CYLINDER BORE	(mm)	320
4,04	STROKE	(mm)	400
4,05	SPEED	(rpm)	750
4,06	MEAN PISTON SPEED	(m/s)	10
4,07	MEAN EFFECTIVE PRESSURE	(bar)	23
4,08	DISPLACEMENT	(liters)	32
4,09	COMPRESSION RATIO		16
4,1	NUMBER OF INLET VALVES		40
4,11	NUMBER OF OUTLET VALVES		40
4,12	DIRECTION OF ROTATION FACED TOWARDS FLYWHEEL		Clockwise
4,13	TOTAL INERTIA OF SHAFT WITH FLYWHEEL, GENERATOR AND EXCITER	(kg/m2)	To be defined during Design Stage
4,14	MATERIALS OF CONSTRUCTION		Cast, alloy steel, nodular cast iron
4,15	OIL SUMP		5m3
4,16	CRANKSHAFT MATERIAL		Forged steel
4,17	STARTER TYPE		Compressed air
4,18	TURBOCHARGER (NUMBER, TYPE,		2 stage turbocharger ABB
4,19	SPEED CONTROL		2 speed sensors located on the camshaft. independent secondary overspeed protection based on two back-up speed sensors.
4,2	MAXIMUM SOUND LEVEL	(dBA)	120 dBA
4,21	VIBRATION ISOLATION		Spring boxes
4,22	ENGINE FUEL CONSUMPTION AT:		HFO FUEL LFO FUEL
4,23	50% LOADING	(kg / kwh)	213 204
	60% LOADING	(kg / kwh)	208 200
	70% LOADING	(kg / kwh)	205 194
	80% LOADING	(kg / kwh)	202 194
	90% LOADING	(kg / kwh)	202 195
	100% LOADING	(kg / kwh)	200 191
5	ENGINE GOVERNOR		DATA
5,01	GOVERNOR TYPE/ MAKE		UNIC / Wartsila



YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

Pre-Owned Mining, Processing & Construction Equipment Since 1979

WARTSILA 20 MW POWER PLANT

DATA SHEET

6	GENERATOR		DATA	
6,01	MAKE AND MODEL		ABB AMG 1120LT08 DES	
6,02	SUPPLY MANUFACTURER'S DATASHEET		Yes, supplied	
6,03	POWER FACTOR RANGE		P-Q Diagram supplied. 0.4 - 1	
6,04	RATED VOLTAGE	(kV)	15 kV	
6,05	PHASES		3	
6,06	FREQUENCY	(Hz)	50	
6,07	100% LOAD	(%)	0.8 PF = 97.6%	
6,08	75% LOAD	(%)	0.8 PF = 97.5%	
6,09	50% LOAD	(%)	0.8 PF = 97.02%	
7	EXCITATION & AVR		DATA	
7,01	MAKE		ABB	
7,02	TYPE		UNITROL 1020	
7,03	REGULATION RANGE & ACCURACY			
7,04	MODEL		UNITROL 1020	
7,05	SUPPLY MANUFACTURER'S			
8	LUBRICATING OIL		NOMINAL	MAXIMUM
8,01	VISCOSITY CLASS		SAE 40	
8,02	VISCOSITY INDEX		Minimum 95	
8,03	ALKALINITY (BN)5, LFO OPERATION	mg KOH/g	10-30	
8,04	ALKALINITY (BN)5, HFO OPERATION	mg KOH/g	30-55	
9	ENGINE COOLING WATER		NOMINAL	MAXIMUM
9,01	TOTAL FLOW	(m³/h)	0,723	
9,02	MAKE-UP REQUIREMENTS	(m³/h)	0,275	
9,03	pH at 25°C		>6.5	
9,04	CONDUCTIVITY AT (TURBINE WASHING ONLY)	mS/m	<100	
9,05	TOTAL HARDNESS Ca2+ + Mg2+	°dH	<10	
9,06	SILICA AS SiO2	mg/l	<50	
9,07	CHLORIDES Cl	mg/l	<80	
9,08	SULPHATES AS SO4	mg/l	<150	



YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

Pre-Owned Mining, Processing & Construction Equipment Since 1979

APPENDIX C

WARTSILA 20 MW POWER PLANT

ABB GENERATOR DATA SHEETS



YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

1 PERFORMANCE DATA (Calculated values)

TYPE

Type designation: AMG 1120LT08 DSE

RATINGS

Output:	12649	kVA	Direction of rotation		
Duty:	S1		(Facing drive end):	CCW	
Voltage:	15000	V	Weight:	34000	kg
Current:	487	A	Inertia:	3000	kgm ²
Power factor:	0,80		Protection by enclosure:	IP23	
Frequency:	50	Hz	Cooling method:	IC0A1	
Speed:	750	rpm	Mounting arrangement:	IM1101	
Overspeed:	900	rpm			

STANDARDS

Applicable standard:	IEC 60034-1
Marine classification:	None
Hazardous area classification:	None
Temperature rise stator / rotor:	F/F
Insulation class:	F

ENVIRONMENTAL CONDITIONS (max. values)

Ambient temperature:	45	°C	Altitude:	1000	masl
Coolant temperature:		°C			

ASSUMED DATA

Driving equipment:	Wärtsilä 20V32F
Approx. mech. power:	10370 KW

EFFICIENCY in % AT 115 °C, guaranteed efficiency at 100% load and power factor 0,80

	load:	110	%	100	%	75	%	50	%	25	%
Efficiency @ power factor	0,80	97,59		97,60		97,50		97,02		95,10	
Efficiency @ power factor	0,90	97,91		97,91		97,81		97,38		95,66	
Efficiency @ power factor	1,00	98,23		98,23		98,13		97,74		96,17	

REACTANCES in %

XD (U):	170,1	XD' (S):	23,3	XQ" (S):	16,6	X0 (U):	8,5
XQ (U):	84,7	XD" (S):	14,5	X2 (S):	15,5	XP (S):	19,2
X1 (U):	12,1	(S) = Saturated value, (U) = Unsaturated value					

TIME CONSTANTS (sec.) AT 75 °C

TD0':	4,882	TD':	0,735	TQ0'':	0,2322	TA:	0,113
TD0'':	0,04018	TD'':	0,02616	TQ'':	0,0500		



ABB Oy / Motors and Generators

Document identification

Lang.

en

Rev. ind.

B

Sheet

2

RESISTANCES AT 20 °C

Stator winding:	0,0701	Ω	Field winding:	0,9583	Ω
Excitation winding:	5,7	Ω			

SHORT CIRCUIT

Short circuit ratio:	0,67	
Sustained short circuit current:	1,6	p.u. (rated excitation)
	> 2.5	p.u. (voltage regulator)
Sudden short circuit current:	3350	A (symmetric RMS)
	8550	A (peak value)

VOLTAGE VARIATION

Maximum allowed amount of starting load:

Maximum voltage drop	Power factor	Load
15 %	0.1	7600 kVA
15 %	0.4	8350 kVA
15 %	0.8	13750 kVA
20 %	0.1	10650 kVA
20 %	0.4	11650 kVA

Voltage drop at sudden increase of rated load:	14	%
Voltage rise at sudden drop of rated load:	18	%

REACTIVE LOADING

Steady state reactive loading at rated excitation:	10400	KVAR (lagging)
Steady state reactive loading at zero excitation:	5650	KVAR (leading)

TORQUE

Rated load torque (Calculated of rated output in kVA):	161100	Nm
The peak values of sudden short circuit air gap torques:		
2-phase short circuit:	865	%
3-phase short circuit:	635	%

BEARINGS

D-end: Sleeve, self lubricated, locating	N.D-end: Sleeve, self lubricated, free
D-end oil viscosity: ISO VG 46	N.D-end oil viscosity: ISO VG 46

TERMINAL CONNECTIONS (Viewed facing drive end)

Direction of main connection:	Right down
Direction of zero connection:	Left down

EXCITATION

	Exciter field			
No load:	4,1	A	29,7	V
Rated load:	9,0	A	65,4	V

OTHER

Stored energy constant (rotational energy divided by rated effect):	0,73	s
---	------	---



ABB Oy / Motors and Generators

Document identification

Lang.

en

Rev. ind.

B

Sheet

3

TEMPLATE: TECHNICALSPECIFICATION.DOTX; FILENAME: B203RS_101_B_TECHSPEC.DOCX; PRINTDATE: 2/29/2016 4:10:00 PM; SAVEDATE: 2/29/2016 4:10:00 PM

Earth capacitance (1-phase): 0,11 μF

2 CONFIGURATION AND SCOPE OF SUPPLY

GENERAL

The generator is designed to operate together with a diesel or a gas engine. Compliance with the maximum vibration level of the genset to be verified by the genset manufacturer who is responsible for the full compatibility of all components of the genset according to ISO 8528-5:2005, §15.10.

CONSTRUCTION

The stator frame is a rigid welded steel structure construction. The stator core is built of thin electric sheet steel laminations which are insulated on both sides with heat-resistant inorganic resin. The radial cooling ducts in the stator core ensure uniform and effective cooling of the stator.

The rotor consists of a shaft and poles fixed on the shaft, exciter and a fan(s). The shaft is machined of steel forging. The poles are manufactured of 2 mm sheet steel and bolted from the top to the shaft. The pole laminations are pressed together with steel bars which are welded to the end plates. The exciter rotor and the fan are shrink fitted onto the shaft and secured with a key.

All windings are completely vacuum pressure impregnated with high quality epoxy resin. The windings are provided with very strong bracing which withstands all expected mechanical and electrical shocks and vibrations as well as chemicals. For more information ask for brochure "MICADUR-Compact Industry Insulation System".

The stator frame, core support and end-shields are made of fabricated steel and welded together. The stator frame is closed with steel panels that guide the ventilation air and provide the degree of protection required. The flange mounted bearings are bolted to the end-shields.

According to IM1101 the machine has 2 endshield bearings. The feet are raised. The shaft end is cylindrical.

FOUNDATION

The machine can be mounted using shimming, machined blocks, chock fast or on grouted sole plates or bed plate. Before using other mountings, contact us.

COOLING

The machine has a shaft mounted fan inside. The surrounding air is used for cooling. The cooling air is drawn in through air filters (self charging electrostatic panels) and blown out to the surrounding environment.

CONTROL SYSTEMS

A three phase transformer supplies the excitation power to the field winding of the shaft driven three phase exciter under the control of the digital automatic voltage regulator (AVR) type ABB UNITROL UN1020. A three phase voltage feedback is supplied by the voltage transformer. A current feedback is provided by the current transformer. The transformers are installed in the generator.

Thanks to a permanent magnet pole in the exciter no external power source is required for

 ABB Oy / Motors and Generators	Document identification	Lang. en	Rev. ind. B	Sheet 5
---	-------------------------	-------------	----------------	------------

TEMPLATE: TECHNICALSPECIFICATION.DOTX; FILENAME: B203RS_101_B_TECHSPEC.DOCX; PRINTDATE: 2/29/2016 4:10:00 PM; SAVEDATE: 2/29/2016 4:10:00 PM

initial excitation at start-up. The permanent magnet pole is already magnetized by the generator manufacturer. Should the re-magnetization of the permanent magnet be necessary, rated values for re-magnetization given on the main connection diagram of the generator are used. Thanks to Soft Start function it is possible to avoid over shooting at start-up.

Excitation power at short circuit is supplied by the CTs through rectifier. At nominal voltage the contactor is shorting the output of CTs (and preventing over excitation from these CTs). At a line short circuit AVR will notice the voltage drop and connect CTs to give full short circuit excitation. ECL-10 current limiter limits sustained short circuit current approx. 250 - 300 % of rated current.

The circuit breaker protects the field circuit and the AVR against thermal overload and short circuit. The over voltage relay will trip the circuit breaker in excess of pre-set limit of over voltage and thus interrupt the supply of the excitation power to the AVR.

Auxiliary supply can be 9 to 300 Vac (3-phase), 16 to 300 Vac (1-phase) or 18 to 300 Vdc.

UNITROL 1020 AVR can be operated using digital and analogue I/O signals, from local panel or with CMT1000 PC software. CMT1000 is a commissioning and maintenance tool running under Microsoft Windows. With CMT1000 the tuning of the AVR can be done easily, also by using preset parameter files. The operation of a synchronous machine can be monitored and controlled by an on-line power chart, four channel oscilloscope and by several measurements and status indications with trending and memory functions. Measured data and parameters can be saved to a file for future use and analysis.

UNITROL 1020 single channel AVR plate (dimensions: 334x570mm) includes:

- UNITROL UN1020 AVR
- Excitation breaker (ac) and MCB for Upwr supply
- Over voltage relay (stator over voltage protection)
- Boost circuit with ECL-10 current limiter
- Standard software functions as per UNITROL UN1020 brochure, including
 - AVR/FCR/PF/VAR
 - Limiters
 - Modbus TCP
- Rotating diode monitoring
 - Voltage matching prior to synchronizing
 - VDC mode
 - Synchronization
 - Event logger
 - Data logger
 - Real time clock
 - PSS (option)
- Interface for I/O signals:
Inputs
 - Excitation On/Off
 - Gen CB status
 - Setpoint Increase
 - Setpoint Decrease
 - PF mode enable
 - VDC (reactive load sharing by digital RS-485 bus)
 - PWG status
 - Remote SP enable (for analogue for PF setpoint)
 - 4..20 mA analogue input for PF setpoint
 - Line charging

 ABB Oy / Motors and Generators	Document identification	Lang. en	Rev. ind. B	Sheet 6
---	-------------------------	-------------	----------------	------------

TEMPLATE: TECHNICALSPECIFICATION.DOTX; FILENAME: B203RS_101_B_TECHSPEC.DOCX; PRINTDATE: 2/29/2016 4:10:00 PM; SAVEDATE: 2/29/2016 4:10:00 PM

- Secondary Net 1
- Secondary Net 2
- Outputs
 - Synchronize
- FRT output
 - Diode trip
 - Close CB command output
 - Over voltage
- Excitation On/Off Status
 - Free programmable
- CMT 1000 Commissioning and maintenance tool
- PID setting calculation tool

TESTING

Testing is according to Wärtisilä Generator testing instruction DBAC850148A, IEC and ABB internal requirements. Test items are listed below. The test may be observed by the customer without extra charges. The test procedures are described in Machine Description Document 8006327, available upon request. Other tests to be agreed separately.

ROUTINE TESTS

1. Visual inspection *
2. Air gap measurement and bearing clearance *
3. Insulation resistance measurement *
4. Resistance measurement of windings and elements *
5. Direction of rotation
6. First running: checking of bearings *
7. No-load curve, $U_1 = f(I_m)$, $n = n_N$
8. Short-circuit curve, $I_1 = f(I_m)$, $n = n_N$
9. Tests with voltage regulator
 - adjusting of basic settings
 - initial voltage build-up and voltage regulation speed at no-load
 - setting of under frequency limit and function testing
 - measuring of sustained short-circuit current
 - measuring of remanence voltage
10. Overspeed test, $t = 2 \text{ min}$, $n = 1.2 * n_N$
11. Vibration measurement at no-load, $U_1 = U_{1N}$, $n = n_N$
12. High voltage test:
 - stator winding
 - rotor winding
 - field winding
 - space heaters
 - Pt-100 (stator)
 - Pt-100 (others)
13. Insulation resistance measurement
 - polarization index 10/1 min for stator windings

* Tests to be completed before witness tests
(Performing order of the tests may differ from the listed above.)

SURFACE TREATMENT

 ABB Oy / Motors and Generators	Document identification	Lang. en	Rev. ind. B	Sheet 7
---	-------------------------	-------------	----------------	------------

TEMPLATE: TECHNICALSPECIFICATION.DOTX; FILENAME: B203RS_101_B_TECHSPEC.DOCX; PRINTDATE: 2/29/2016 4:10:00 PM; SAVEDATE: 2/29/2016 4:10:00 PM

Colour: RAL 5019

Grade: C3, Special color

Surface treatment C3 according to the ISO 12944 standard, for standard industrial environment.



ABB Oy / Motors and Generators

Document identification

Lang.
en

Rev. ind.
B

Sheet
8

TEMPLATE: TECHNICALSPECIFICATION.DOTX; FILENAME: B203RS_101_B_TECHSPEC.DOCX; PRINTDATE: 2/29/2016 4:10:00 PM; SAVEDATE: 2/29/2016 4:10:00 PM

3 ACCESSORIES

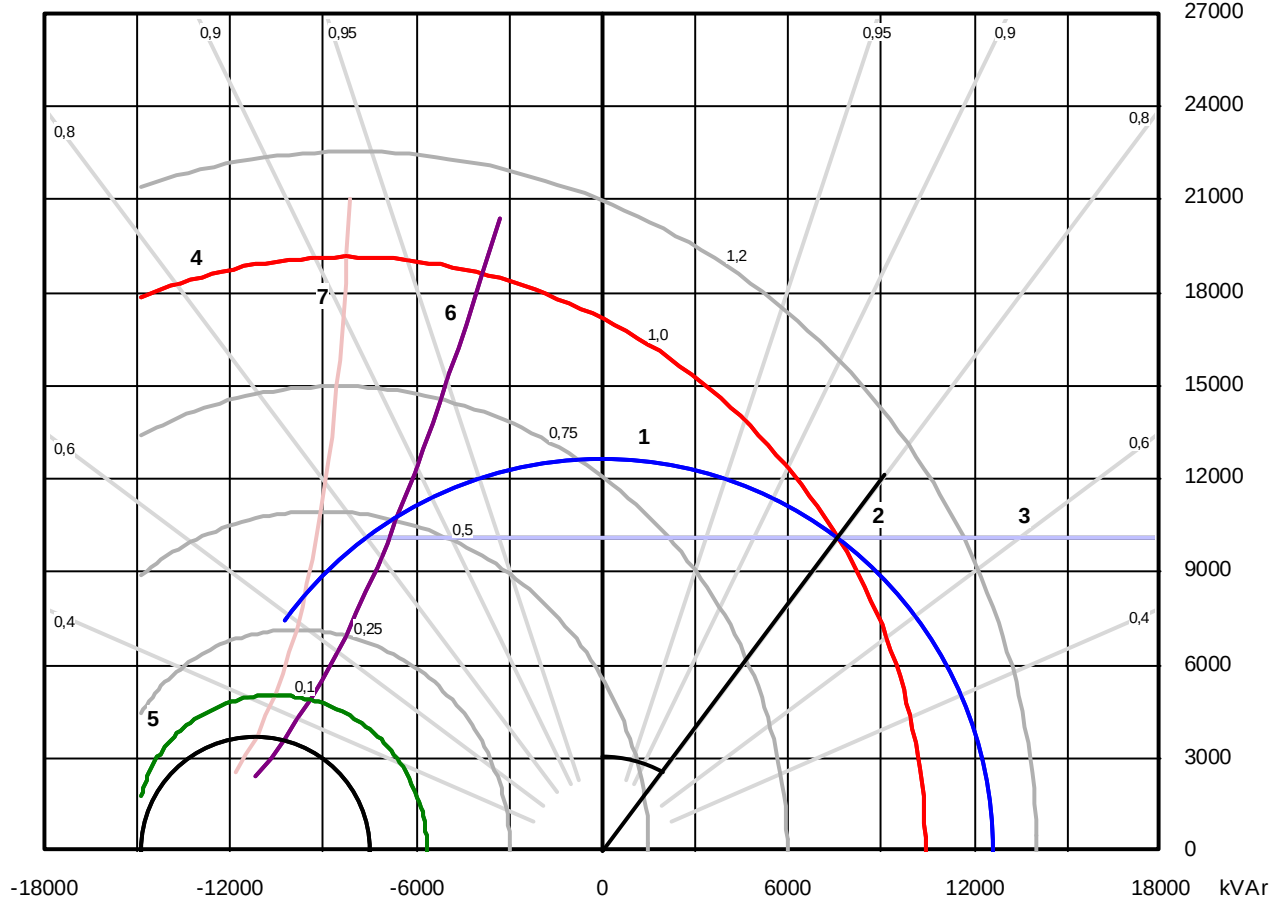
No pc/pcs	Item
6	PT100 for stator winding
1	PT100 for cold cooling air L=50 mm
1	PT100 for warm cooling air L=50 mm
2	PT100 for sleeve bearings (radial bearing surface) Resistance temperature detector for sleeve bearings, insulated, quick connector
1	Automatic Voltage Regulator system
1	1PT - Voltage transformer for exc.power & actual value meas.
3	3CT - Current transformer for short circuit exc.power
1	2CT - Current transformer for actual value measurement
3	4CT - Current transformer for differential protection
1	Top mounted direct air cooling unit incl. air filter
6	Inlet Air Filters
2	Anticondensation heater
1	Auxiliary terminal box B3A
1	Multidiameter cable entry system for main cables
1	Drive-end sleeve bearing
1	Non-drive-end sleeve bearing
1	Standard halogen free cables
1	Special test for one machine:Sust SC and excitation values
1	Welding inspection record for the frame



5.1 P/Q diagram at rated voltage

P / Q -DIAGRAM

- kW



5.2 P/Q diagram at 95% voltage

ABB				Motors and Generators				
Type: AMG 1120LT08 DSE								
Sn:	12649	kVA	cos:	0.80	Tn:	161052	Nm	
U:	14250	V	n:	750	rpm	In:	512,5	A
f:	50	Hz						

P / Q -DIAGRAM

1. Stator current at rated load
2. Nominal working point
3. Active power limit
4. Rated rotor current
5. Minimum excitation limit
6. Stability limit
7. Theoretical stability limit

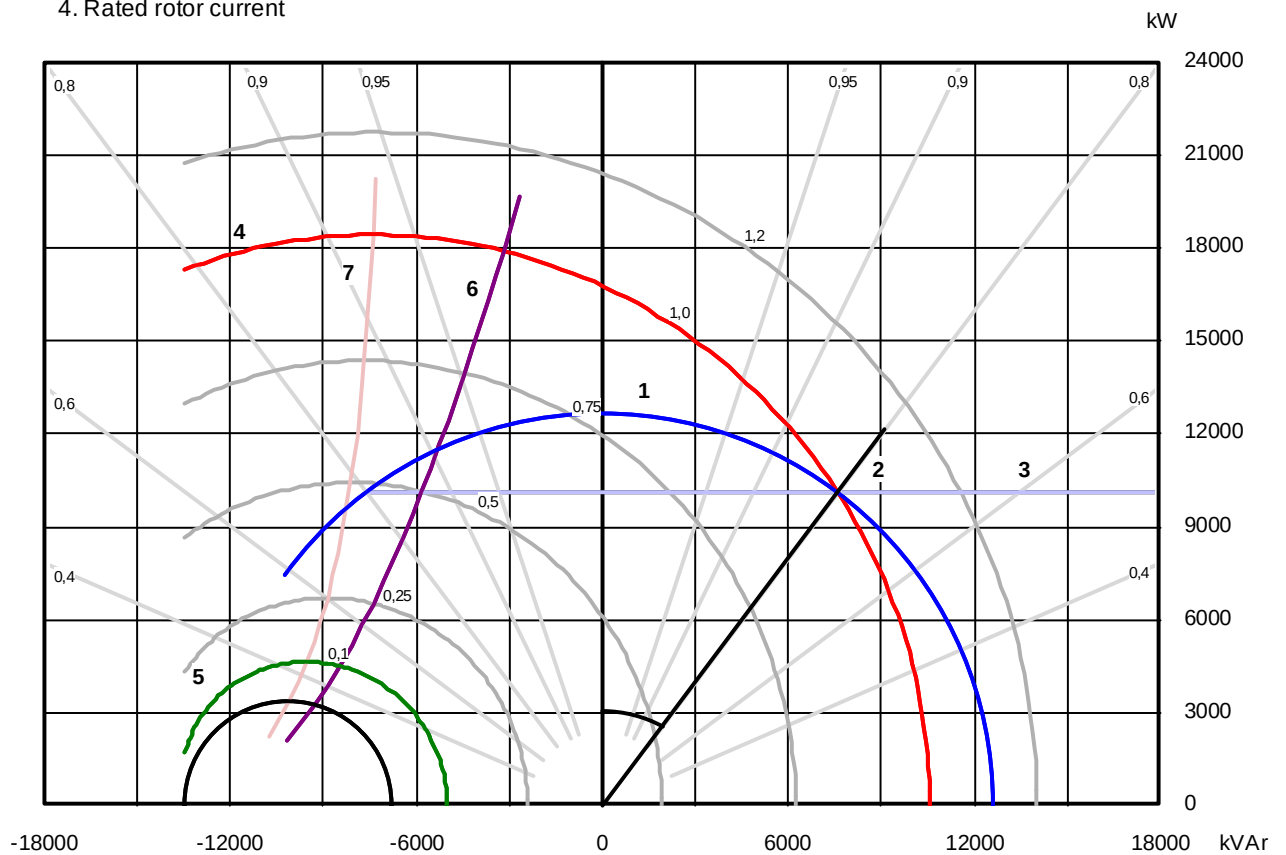


ABB Oy / Motors and Generators

Document identification

Lang.
en

Rev. ind.
B

Sheet
12

TEMPLATE: TECHNICALSPECIFICATION.DOTX; FILENAME: B203RS_101_B_TECHSPEC.DOCX; PRINTDATE: 2/29/2016 4:10:00 PM; SAVEDATE: 2/29/2016 4:10:00 PM

5.3 P/Q diagram at 105% voltage

ABB				Motors and Generators				
Type: AMG 1120LT08 DSE								
Sn:	12649	kVA	cos:	0.80	Tn:	161052	Nm	
U:	15750	V	n:	750	rpm	In:	463,7	A
f:	50	Hz						

P / Q -DIAGRAM

1. Stator current at rated load

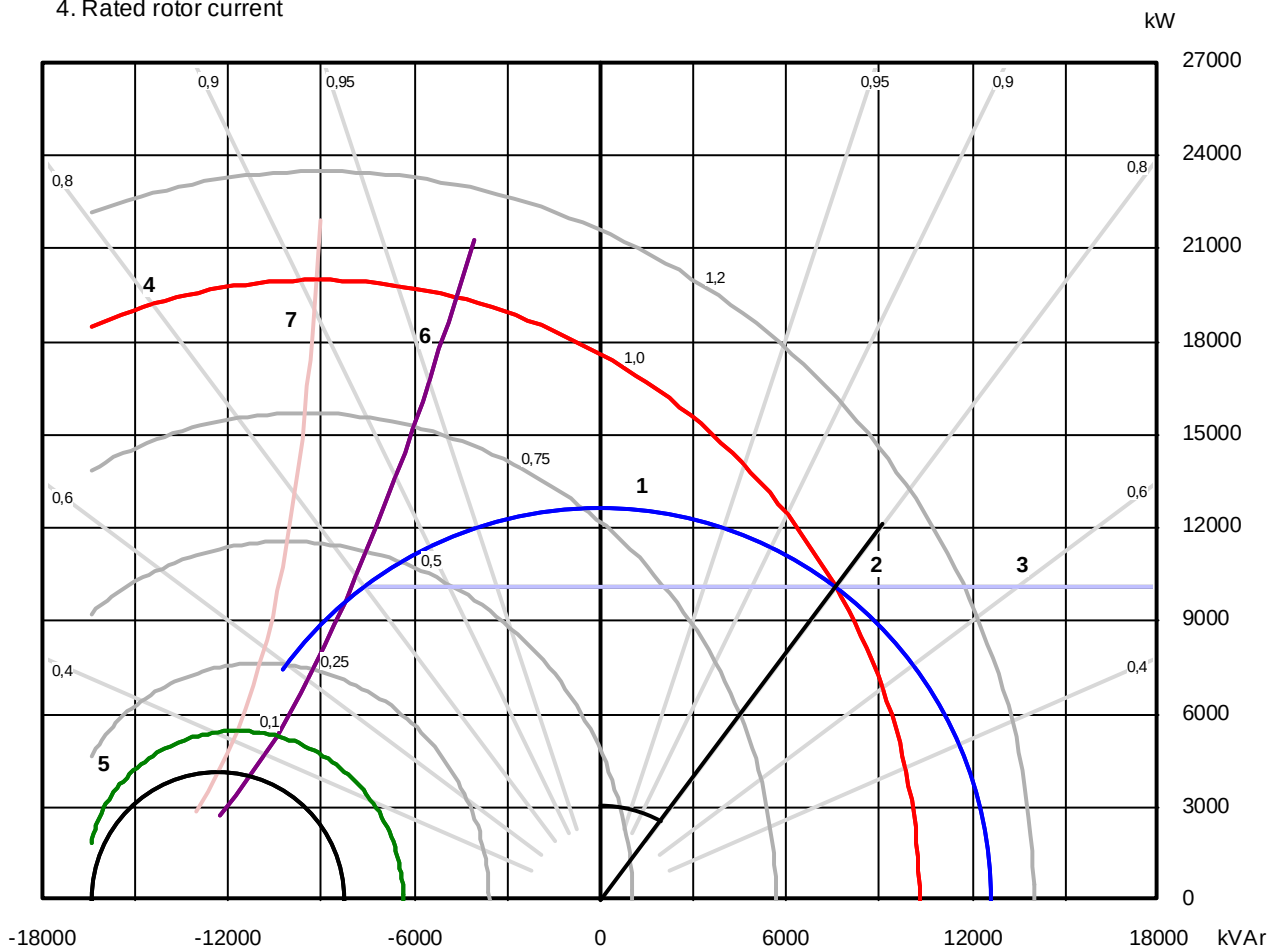
2. Nominal working point

3. Active power limit

4. Rated rotor current
5. Minimum excitation limit

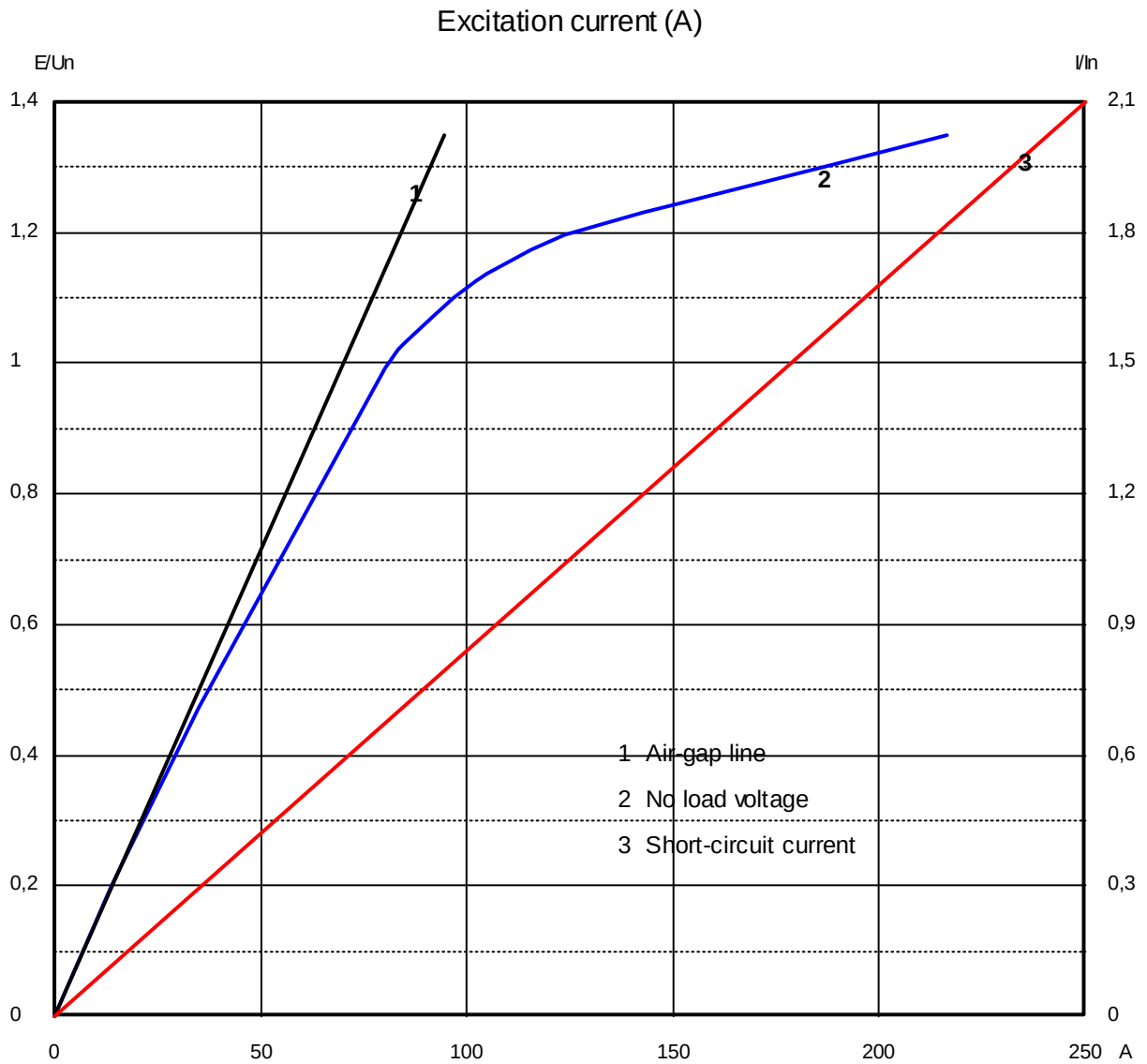
6. Stability limit

7. Theoretical stability limit



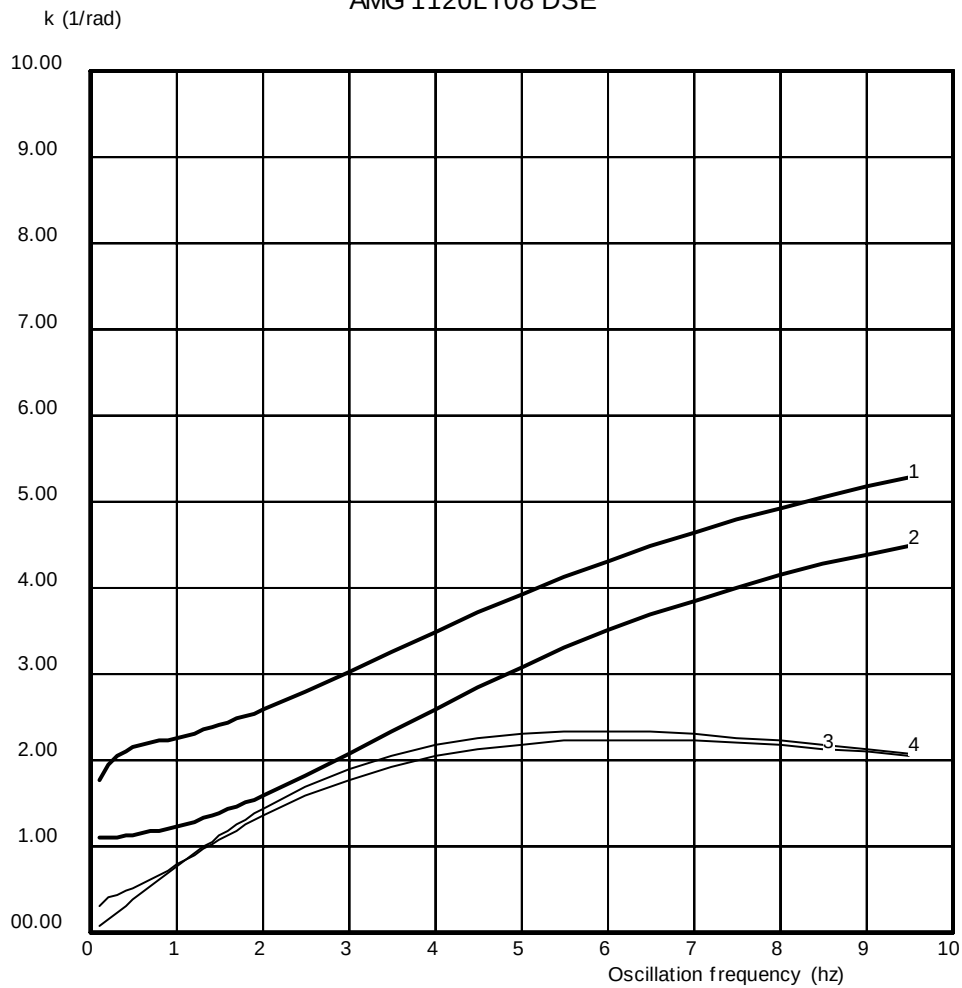
6 NO LOAD AND SHORT-CIRCUIT CURVE

ABB					Motors and Generators			
Type: AMG 1120LT08 DSE								
Sn:	12649	kVA	cos:	0.80	Tn:	161052	Nm	
Un:	15000	V	n:	750	rpm	In:	486,9	A
f:	50	Hz						



7 COMPLEX SYNCHRONIZING COEFFICIENT

Complex synchronizing coefficient AMG 1120LT08 DSE



- 1 = Synch. factor at rated load
- 2 = Synch. factor at no load
- 3 = Damping factor at rated load
- 4 = Damping factor at no load

REFERENCE: Dieter Rumpel: Das Drehmomentverhalten von Drehstromgeneratoren bei sinusförmigen Pendelungen, MTZ, 26. Jahrgang Heft 2 1965 s. 35-42

$$\Delta M / M = k * d \quad (9)$$

$$k = \Delta M / M / d * (\cos(e) + j \sin(e)) \quad (10)$$

k = complex synchronizing coefficient,

the real part is synchronizing (or elastic) factor,

the imaginary part is damping factor

d = the oscillating part of rotor angle in electrical radians

d = p * dm, where

p = the number of polepairs and

dm = the angle in mechanical radian

M = the base torque of generator 161060 Nm

e = the phase difference angle between the oscillating

rotor angle and the corresponding torque



ABB Oy / Motors and Generators

Document identification

Lang.

en

Rev. ind.

B

Sheet

16

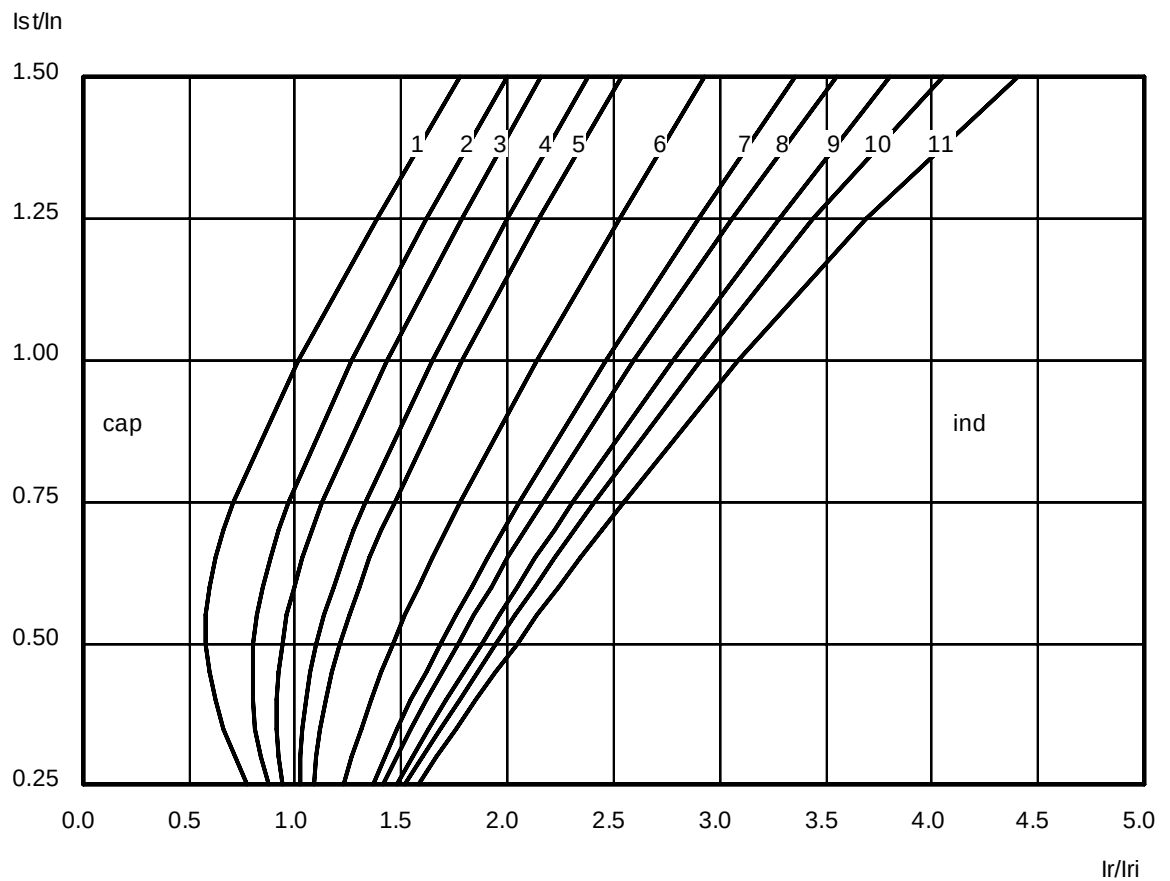
8 DYNAMIC V-CURVES

Ist-Ir Curves

29.02.2016

AMG 1120LT08 DSE

U = UN



- 1: pf 0.50 cap 4: pf 0.90 cap 7: pf 0.95 ind 10: pf 0.70 ind
2: pf 0.70 cap 5: pf 0.95 cap 8: pf 0.90 ind 11: pf 0.50 ind
3: pf 0.80 cap 6: pf 1.00 9: pf 0.80 ind



ABB Oy / Motors and Generators

Document identification

Lang.
en

Rev. ind.
B

Sheet
17

TEMPLATE: TECHNICALSPECIFICATION.DOTX; FILENAME: B203RS_101_B_TECHSPEC.DOCX; PRINTDATE: 2/29/2016 4:10:00 PM; SAVEDATE: 2/29/2016 4:10:00 PM

APPENDIX D

WARTSILA 20 MW POWER PLANT

GENERAL EQUIPMENT LIST

VAASA, FINLAND PACKING LIST

RAUMA, FINLAND PACKING LIST

MUMBAI, INDIA PACKING LIST



YOU MINE. WE SELL.

+1 (530) 534-7965
info@amking.com

Wärtsilä General Equipment List for Sale

Section Description		Quantity for Sale 2xW20V32TS
A	POWER GENERATION EQUIPMENT	
A1	GENERATING SET	
A1.1	ENGINE	
	Wärtsilä 20V32TS engine	2
	Common base frame	2
	Generating set assembly	2
	Set steel springs	2
A1.2	GENERATOR	
	Generator - 15000 V	2
	Flexible coupling	2
	Flywheel cover	2
	External enclosure incl. surge capacitors and lightning arresters	2
A2	MECHANICAL AUXILIARY SYSTEMS	
A2.1	AUXILIARY MODULES	
	Engine auxiliary module - W32 3.0 1-C S HFO	2
	EAM appendix	2
	Exhaust gas module - W32 EGM 1-C	2
A2.2	FUEL SYSTEM	
A2.2.3	HEAVY FUEL OIL SYSTEM	
	W32 Engine fuel booster 3.0 - HFO S	2
A2.3	LUBRICATING OIL SYSTEM	
	LO storage tank - horizontal, 10 m ³	1
	LO separator unit - PAF636	2
	Oil mist separator - double, high efficiency	2
	LO heat exchanger (mounted on the engine)	2
	LO thermostatic valve (mounted on the engine)	2
A2.4	COMPRESSED AIR SYSTEM	
	Starting air bottle - 4.8 m ³	1
A2.5	COOLING SYSTEM	
	Set radiator - low noise	2
	LT expansion vessel (mounted on the EGM) - 600 l	2
	HT preheating unit (mounted on the EAM) - steam, 240 kW	2
	LT thermostatic valve (mounted on the EAM)	2
	HT thermostatic valve (mounted on the EAM)	2

A2.6	INTAKE AIR SYSTEM	
	Charge air filter	2
	Rain hood for charge air filter	2
	Charge air silencer (mounted on the EGM) - 35 dB(A)	4
A2.7	EXHAUST SYSTEM	
	Exhaust gas branch pipe (mounted on the EGM)	2
	Exhaust gas silencer - 35 dB(A)	2
A3	HEAT RECOVERY SYSTEM	
A3.1	STEAM GENERATION SYSTEM	
A3.1.1	STEAM GENERATION SYSTEM FOR FUEL HEATING	
	Own consumption exhaust gas boiler - HU-2A	2
	Boiler washing water tank - with pump, 10 m ³	1
A6	ELECTRICAL SYSTEMS	
A6.1	CONTROL SYSTEM	
A6.1.2	CONTROL PANELS	
	Central generating set control panel	2
	Local generating set control panel	2
	Auxiliary module panel (mounted on the EAM)	2
A6.2	MEDIUM VOLTAGE SYSTEM	
	Generator neutral point cubicle - 5 A	2
A6.3	LOW VOLTAGE SYSTEM	
	Frequency converter - cooling radiator, 132 kW, 261 A	2

Case Specification

ENERGY BUSINESS

Items stored in **VAASA, FINLAND**

Project number	P/17046
Project name	Tasiast Phase 2 Power Plant
Delivery term	FOB
Forwarders	
Departure port	Blomberg Stevedoring Oy Ab/ Vaasa PORT ETS:
Arrival	
Status:	

Case number	Purchase order	Supplier	Description	Container number	Package type	Net weight (kg)	Gross weight (kg)	Length (cm)	Width (cm)	Height (cm)	Volume (m³)
C - Break bulk											
6	4503919578	Wärtsilä Finland Oy .	EG-SET PAAE343026		Tarpaulin	148200	149000	1280	375	474	227.52
7	4503919578	Wärtsilä Finland Oy .	EG-SET PAAE343027		Tarpaulin	148800	149600	1280	375	474	227.52
12	4503919578	Wärtsilä Finland Oy .	CYL.HEAD COVERS		Wooden box	160	255	150	110	95	1.568
13	4503919578	Wärtsilä Finland Oy .	CYL.HEAD COVERS		Wooden box	160	255	150	110	95	1.568
19	4503919578	Wärtsilä Finland Oy .	AIR BEND		Wooden box	120	210	150	110	95	1.568
20	4503919578	Wärtsilä Finland Oy .	AIR BEND		Wooden box	120	210	150	110	95	1.568
302	4503945754	Kelvion S.A.S.	Batch 3 module 17		Wooden box	4400	6520	1000	295	180	53.1
303	4503945754	Kelvion S.A.S.	Batch 3 module 18		Wooden box	4400	6520	1000	295	180	53.1
304	4503945754	Kelvion S.A.S.	Batch 3 module 19		Wooden box	4400	6520	1000	295	180	53.1
305	4503945754	Kelvion S.A.S.	Batch 3 module 20		Wooden box	4400	6520	1000	295	180	53.1
306	4503945754	Kelvion S.A.S.	Batch 3 module 21		Wooden box	4400	6520	1000	295	180	53.1
307	4503945754	Kelvion S.A.S.	Batch 3 module 22		Wooden box	4400	6520	1000	295	180	53.1
308	4503945754	Kelvion S.A.S.	Batch 3 module 23		Wooden box	4400	6520	1000	295	180	53.1
309	4503945754	Kelvion S.A.S.	Batch 3 module 24		Wooden box	4400	6520	1000	295	180	53.1
485	4503963238	Alfa Laval Nordic Oy	LO separator		Wooden box	1075	1625	200	170	265	9.01
486	4503963238	Alfa Laval Nordic Oy	LO separator		Wooden box	1075	1625	200	170	265	9.01
721	4503967648	AAF S.A.	NGA 090 B001 - Jet pulse filter - AAF 054889		Wooden box	2820	3810	428	252	328	35.377

722	4503967648	AAF S.A.	NGA 100 B001 - Jet pulse filter - AAF 054889	Wooden box	2820	3810	428	252	328	35.377
Total					340550	362560	18			974.884
Grand total					340550	361350	Break bulk 18 Units			974.884

Case Specification

ENERGY BUSINESS

Items stored in RAUMA, FINLAND

Project number	P/17046
Project name	Tasiast Phase 2 Power Plant
Delivery term	FOB
Forwarders	
Departure port	Blomberg Stevedoring Oy Ab/ Vaasa PORT ETS:
Arrival	
Status:	

Case number	Purchase order	Supplier	Description	Container number	Package type	Net weight (kg)	Gross weight (kg)	Length (cm)	Width (cm)	Height (cm)	Volume (m³)
C - Break bulk											
349	4504006759	Escarmat Oy Ltd	BLP092/093		Wooden box	90	170	140	140	62	1.215
350	4504006759	Escarmat Oy Ltd	BLP102/103		Wooden box	90	170	140	140	62	1.215
397	4503973947	Uwira Oy	Starting air bottles 4800L		Crate	2060	2760	522	168	155	13.593
553	4503983275	Vientipakkaus Heikki Laine Oy	LFO Cooler AC-MS11		Plywood box	507	634	145	105	255	3.882
554	4503983275	Vientipakkaus Heikki Laine Oy	LFO Cooler AC-MS11		Plywood box	507	634	145	105	255	3.882
808	4503957628	ABB Oy Motors and Generators	EXTERNAL TERMINAL BOXES B4E		Wooden box	300	390	158	104	121	1.988
809	4503957628	ABB Oy Motors and Generators	EXTERNAL TERMINAL BOXES B4E		Wooden box	300	390	158	104	121	1.988
866	4504029251	VEO Oy	CFE091		Plywood box	210	315	110	82	220	1.984
867	4504029251	VEO Oy	CFE101		Plywood box	210	315	110	82	220	1.984
872	4504029251	VEO Oy	BJA091		Plywood box	318	436	150	82	220	2.706
873	4504029251	VEO Oy	BJA101		Plywood box	318	436	150	82	220	2.706
1039	4504006724	Vacon PLC	Frequency Converters		Plywood box	304	384	244	75	80	1.464
1040	4504006724	Vacon PLC	Frequency Converters		Plywood box	304	384	244	75	80	1.464
1405	4504025068	M.S. Resistances S.A.S.	Neutral earthing resistor		Wooden box	340	430	155	135	165	3.453
1406	4504025068	M.S. Resistances S.A.S.	Neutral earthing resistor		Wooden box	340	430	155	135	165	3.453
1534	4503980563	Vibratec Akustikprodukter Ab	Spring Package		Plywood box	349	379	84	47	72	0.284
Total						6547	8657	16			47.263
S - Shipper owned container											
204	4503945971	Alfa Laval Aalborg Oy	Exhaust Gas Boiler & Damper	GATU8719263	40' HC		18080	1220	244	289	86.03
205	4503945971	Alfa Laval Aalborg Oy	Exhaust Gas Boiler & Damper	TGHU8604576	40' HC		18070	1220	244	289	86.03

373	4503979056	JTK Power Oy/ Metalli-Jokela	EXHAUST GAS SILENCER 18481	FSCU6892027	40' HC	8680	1220	244	289	86.03
374	4503979056	JTK Power Oy/ Metalli-Jokela	EXHAUST GAS SILENCER 18482	INKU6242678	40' HC	8680	1220	244	289	86.03
398	4503992278	Saarijärven Säiliövalmiste Oy	Boiler washing water tank + Clean Lube Oil Tanks	MCLU4033719	40' DC	6080	1220	244	259	77.099
440	4503979056	JTK Power Oy/ Metalli-Jokela	EXHAUST GAS SILENCER 18475 18476 + CHARGE AIR SILENCER 18299	18302	TDTU5453903	40' HC	9870	1220	244	86.03
					Total	0	69460	6	289	507.247

						Break bulk 16 Units Shipper owned container 6				
Grand total						6547	77996 Units	554.51		

Case Specification

ENERGY BUSINESS

Items stored in **MUMBAI, INDIA**

Project number	P/17046
Project name	Tasiast Phase 2 Power Plant
Delivery term	FOB
Forwarders	
Departure port	Nhava Sheva ETS:
Arrival	
Status:	

Case number	Purchase order	Supplier	Description	Container number	Package type	Net weight (kg)	Gross weight (kg)	Length (cm)	Width (cm)	Height (cm)	Volume (m³)
S - Shipper owned container											
1231	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EAM-3RD SET	BSIU201033(0)	20' DC	3390	5670	605	244	259	38.234
-1276	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EAM+MCA HW		Wooden box	145	145	115	45	55	0.285
-1272	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EAM+MCA		Skid	3245	3245	518	194	218	21.907
1232	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EAM-3RD SET	TTNU218024(0)	20' DC	3390	5620	605	244	259	38.234
-1277	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EAM+MCA HW		Wooden box	145	145	115	45	55	0.285
-1273	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EAM+MCA		Skid	3245	3245	518	194	218	21.907
1237	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EFB-3RD SET	MOAU072886(4)	20' DC	2595	4865	605	244	259	38.234
-1288	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EFB HW		Wooden box	110	110	115	45	55	0.285
-1283	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EFB		Skid	2485	2485	512	166	221	18.783
1238	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EFB-3RD SET	XINU113750(8)	20' DC	2595	4780	605	244	259	38.234
-1289	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EFB HW		Wooden box	110	110	115	45	55	0.285
-1284	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EFB		Skid	2485	2485	512	166	221	18.783
1239	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM-3RD SET	TRLU822945(4)	40' HC	3790	7650	1220	244	289	86.03
-1293	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM HW		Wooden box	215	215	115	45	55	0.285
-1292	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM PALLET 2		Pallet	735	735	305	230	200	14.03
-1291	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM PALLET1		Pallet	630	630	305	230	200	14.03
-1290	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM		Skid	2210	2210	374	229	235	20.127

1240	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM-3RD SET	GESU461840(8)	40' HC	3790	7570	1220	244	289	86.03
-1309	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM HW		Wooden box	215	215	115	45	55	0.285
-1304	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM PALLET 2		Pallet	735	735	305	230	200	14.03
-1299	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM PALLET 1		Pallet	630	630	305	230	200	14.03
-1294	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EGM		Skid	2210	2210	374	229	235	20.127
1599	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	SMALL UNITS	CSQU309960(2)	20' DC	1760	4040	605	244	259	38.234
-1264	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EXP VESSEL 600 L		Pallet	320	320	120	120	200	2.88
-1255	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	OMS FRAME		Pallet	310	310	140	100	120	1.68
-1265	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	EXP VESSEL 600 L		Pallet	320	320	120	120	200	2.88
-1259	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	OMS SPARES		Wooden box	145	145	180	80	60	0.864
-1260	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	OMS SPARES		Wooden box	145	145	180	80	60	0.864
-1254	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	OMS FRAME		Pallet	310	310	140	100	120	1.68
-1600	4503972296	Wärtsilä India Pvt Ltd. (Khopoli)	BOILER WASHING UNIT		Pallet	210	210	120	120	200	2.88
Total						21310	40195	7	363.227		
Grand total								21310	40195	Shipper owned container 7 Units	363.227