

GreenMotor



GreenMotor

Features

Mega-Guard GreenMotor is a highly efficient permanent magnet motor for ship's propulsion and generator applications. GreenMotor is able to directly drive the propeller shaft in full electric or serial hybrid projects. Mega-Guard GreenMotor can also be used in combined motor and generator applications where GreenMotor is connected to a hybrid gearbox of a combustion engine or directly inline with the propeller shaft. In this parallel hybrid application Mega-Guard GreenMotor can be used as a propulsion motor (discharging the batteries) with stopped combustion engine and it is used as a generator (charging the batteries) when the combustion engine is powering the propeller.

Electric propulsion is applied in case of requirements regarding zero emission, better manoeuvrability and/or less fuel consumption for vessels with large difference in sailing profile. Silent running is another application of electric propulsion in combination with Mega-Guard GreenBatteries electric energy storage.

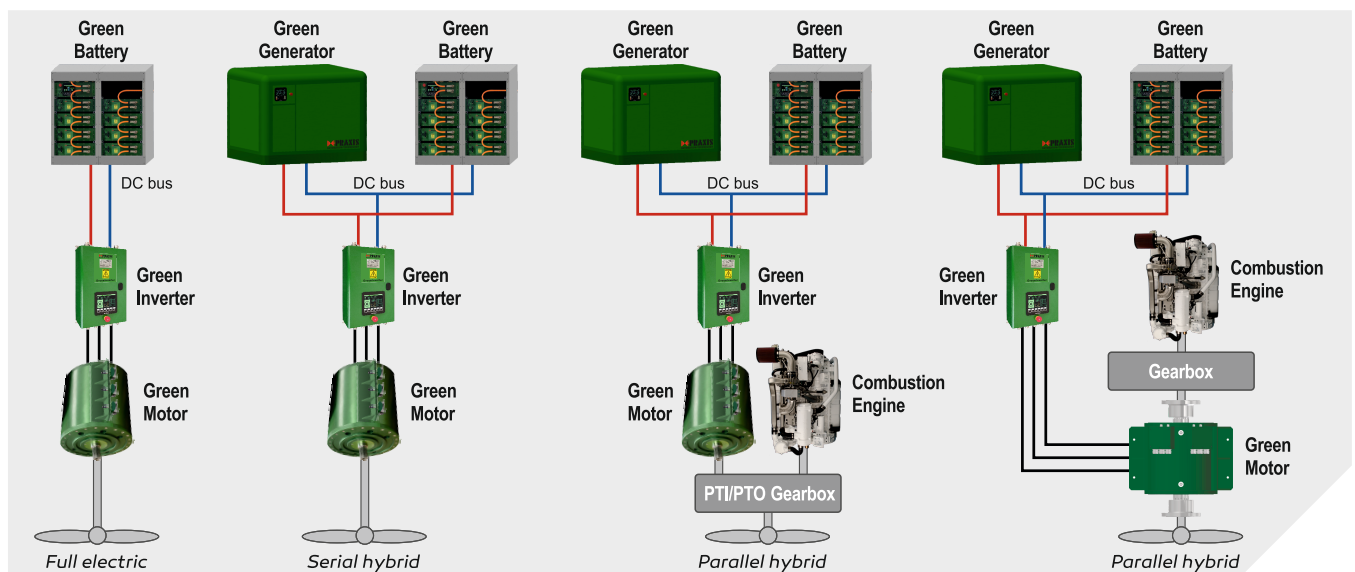
GreenMotor is controlled by other Mega-Guard products: GreenInverter, Propulsion Control System, Energy Management System and/or GreenGenerator. Various sizes of GreenMotor are available to suit all projects for full electric, serial hybrid or parallel hybrid propulsion.



Sizes and options

Mega-Guard GreenMotor is available in 4 different diameters and with variable length in order to suit propulsion applications ranging from 450Nm to 82700Nm (70kW to 3050kW depending on nominal RPM).

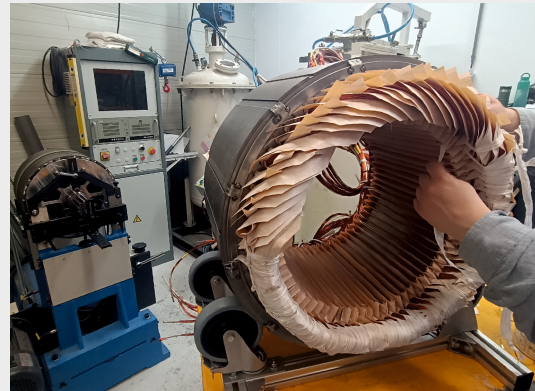
Multiple options are available for GreenMotor. For the shaft there is a choice of a splined output as standard and optional a flanged shaft connection is available. Also sensors for bearing temperature and the use of a built-in heater are options for the GreenMotor. Class approval for GreenMotor are also available like LRS, DNV-GL, BV, ABS, CCS and Komsa/KR.



Specification

GreenMotor Specifications

Application	<p>Marine propulsion and power generation:</p> <ul style="list-style-type: none"> - Low speed direct propeller drive - Medium speed hybrid gearbox drive (motor and generator) - Medium speed generator - Low speed direct propeller drive with high speed motor with built-in planetary gear - Low speed hybrid direct propeller drive with hollow shaft and mounted inline between propeller and combustion engine
Type	<p>Permanent magnet synchronous machine Torque motor/generator supporting sensor less control with nominal torque delivered in between 0 and maximum RPM</p>
Construction	<p>Lightweight due to efficient design and strong aluminium housing Aluminium alloy: 6082-T6 Finishing with green coating</p>
Power ranges	<p>Up to 3170Nm ; motor diameter 420mm and motor length up to 753mm Up to 4520Nm ; motor diameter 590mm and motor length up to 800mm Up to 30500Nm ; motor diameter 960mm and motor length up to 1506mm Up to 82700Nm ; motor diameter 1280mm and motor length up to 1740mm</p>
Duty rating	Continuous
Cooling	<p>Liquid cooled water/glycol. Maximum Inlet temperature: 40°C</p>
Output shaft and bearings	<p>Splined output shaft according DIN 5480 or flanged output shaft according ASTM-A 182 Drive side equipped with isolated bearing Non drive side equipped with non isolated bearing and shaft grounding Maintenance free bearings Optional: bearing temperature sensors</p>
Mounting	<p>Side mounting brackets with vibration dampers Front flange mounting according SAE sizing; SAE flange mounting is only available when the motor length is smaller than the motor diameter.</p>
Connection	<p>Connection Box mounted on rear side AC cabling: A 95mm² EMC cable gland is installed for each 250A current in parallel IO cabling: EMC cable glands</p>
Voltage Range	<p>From 566VAC up to 700VAC supporting DC bus voltages from 768VDC to 960VDC Designed for a string of 8 or 10 GreenBatteries</p>
Windings	<p>Isolated windings: isolation test voltage > 2kV Thermal class H Each winding equipped with 2 temperature sensors Maximum winding temperature: 155°C</p>
Heater	<p>Optional heating element on drive side and non drive side</p>
Testing	<p>Maximum RPM = 110% of nominal RPM Maximum torque = 150% of nominal torque for 15 seconds Duration test at nominal power and nominal RPM on test bench</p>
Protection	IP65
Ambient temperature	0 - 55°C
Environmental conditions	IEC60945
Class approval	LRS, DNV-GL, ABS, BV, CCS, Komsa/KR when required



GreenMotor stator assembly



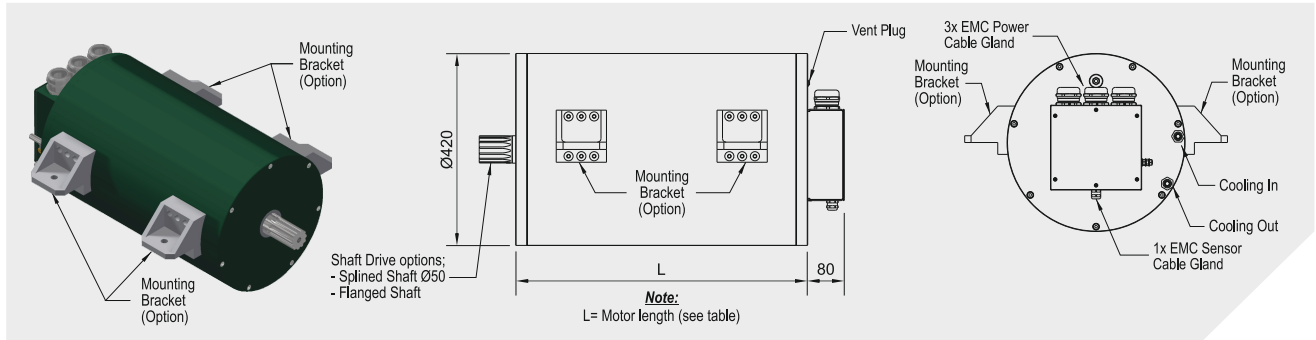
GreenMotor cooling tube milling



CNC machine for GreenMotor

Permanent Magnet Motor Generator

Features EMG-420d series: 470Nm to 3170Nm



Specification EMG-420d-263l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	(Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=263mm	1020	44	417	515	749	56	95,5	HPI-225A
Weight: approx. 125kg	1740	77	423	510	744	96	96,8	HPI-225A
Cooling liquid flow: 16l/min	2500	108	414	509	743	135	97,3	HPI-225A
Cooling liquid Inlet temp.: max. 40°C	3540	140	378	507	741	172	97,6	HPI-225A

Specification EMG-420d-361l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=361mm	1000	93	892	503	731	119	96,3	HPI-225A
Weight: approx. 198kg	1740	159	874	508	740	199	97,5	HPI-225A
Cooling liquid flow: 16l/min	2500	217	827	506	738	269	97,9	HPI-450A
Cooling liquid Inlet temp.: max. 40°C	3530	279	756	503	735	345	98,0	HPI-450A

Specification EMG-420d-459l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=459mm	900	124	1313	498	724	159	96,5	HPI-225A
Weight: approx. 343kg	1650	220	1285	504	734	278	97,6	HPI-450A
Cooling liquid flow: 16l/min	2600	330	1210	504	736	408	98,0	HPI-450A
Cooling liquid Inlet temp.: max. 40°C	3400	365	1025	503	734	445	98,0	HPI-450A

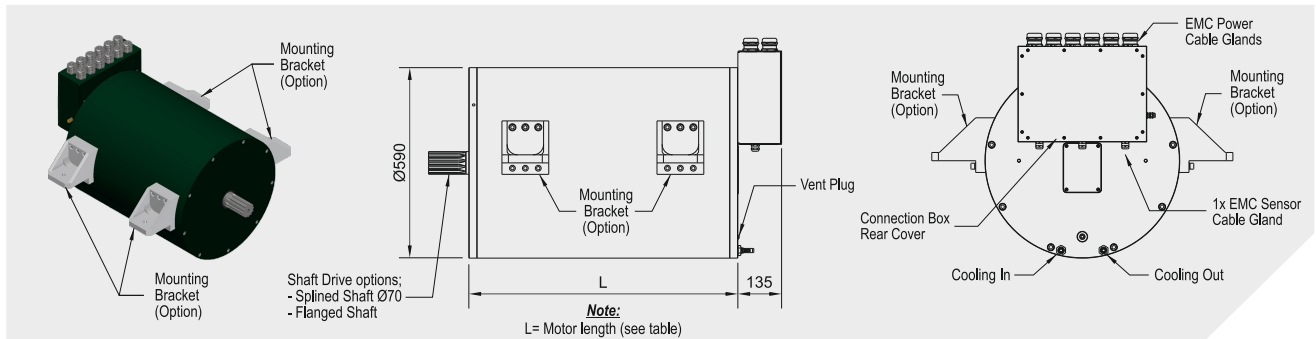
Specification EMG-420d-557l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=557mm	850	156	1750	501	728	199	96,5	HPI-450A
Weight: approx. 417g	1750	310	1690	507	739	384	97,8	HPI-450A
Cooling liquid flow: 16l/min	2250	369	1565	516	753	445	98,0	HPI-450A
Cooling liquid Inlet temp.: max. 40°C	2950	440	1424	501	731	541	98,0	HPI-1000A

Specification EMG-420d-655l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=655mm	1000	217	2072	514	747	269	97,1	HPI-450A
Weight: approx. 490g	1400	310	2113	512	745	384	97,6	HPI-450A
Cooling liquid flow: 16l/min	2000	418	1998	507	738	520	97,9	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	2900	530	1745	516	751	636	98,0	HPI-1000A

Specification EMG-420d-753l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=753mm	1150	308	2562	509	741	384	97,4	HPI-450A
Weight: approx. 564kg	1670	424	2423	512	746	520	97,8	HPI-1000A
Cooling liquid flow: 16l/min	2350	564	2294	510	743	689	98,0	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	2950	626	2027	505	734	762	98,0	HPI-1000A

Mentioned nominal voltages and current matches a nominal DC Bus voltage of 768VDC which corresponds to a string of 8 GreenBatteries. Nominal voltages and currents will be adapted in case of string of 6 or 10 GreenBatteries.

Features EMG-590d series: 1300Nm to 4520Nm



Specification EMG-590d-350l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=350mm	580	80	1318	519 751	103	94,6	HPI-225A
Weight: approx. 343kg	740	101	1307	520 752	128	95,6	HPI-225A
Cooling liquid flow: 16l/min	1000	142	1352	517 750	179	96,5	HPI-225A
Cooling liquid Inlet temp.: max. 40°C	1300	181	1329	510 739	231	97,2	HPI-450A

Specification EMG-590d-395l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=395mm	600	104	1657	519 750	128	95,4	HPI-225A
Weight: approx. 423kg	810	146	1716	515 745	179	96,4	HPI-225A
Cooling liquid flow: 23l/min	1080	195	1722	522 755	235	97,1	HPI-450A
Cooling liquid Inlet temp.: max. 40°C	1550	279	1721	516 746	340	97,9	HPI-450A

Specification EMG-590d-440l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=440mm	500	103	1977	520 751	127	95,0	HPI-225A
Weight: approx. 488kg	900	190	2011	521 753	229	96,9	HPI-450A
Cooling liquid flow: 25l/min	1310	276	2011	521 754	331	97,7	HPI-450A
Cooling liquid Inlet temp.: max. 40°C	1690	362	2045	523 756	433	98,0	HPI-450A

Specification EMG-590d-530l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=530mm	670	185	2642	517 748	226	96,6	HPI-450A
Weight: approx. 593kg	980	271	2641	520 751	326	97,4	HPI-450A
Cooling liquid flow: 25l/min	1280	360	2687	527 762	427	97,9	HPI-450A
Cooling liquid Inlet temp.: max. 40°C	1800	496	2631	526 761	585	98,2	HPI-1000A

Specification EMG-590d-620l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=620mm	780	266	3255	517 747	322	97,2	HPI-450A
Weight: approx. 728kg	1000	352	3358	515 745	427	97,6	HPI-450A
Cooling liquid flow: 30l/min	1400	475	3242	511 738	577	98,1	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	1800	616	3270	525 759	728	98,3	HPI-1000A

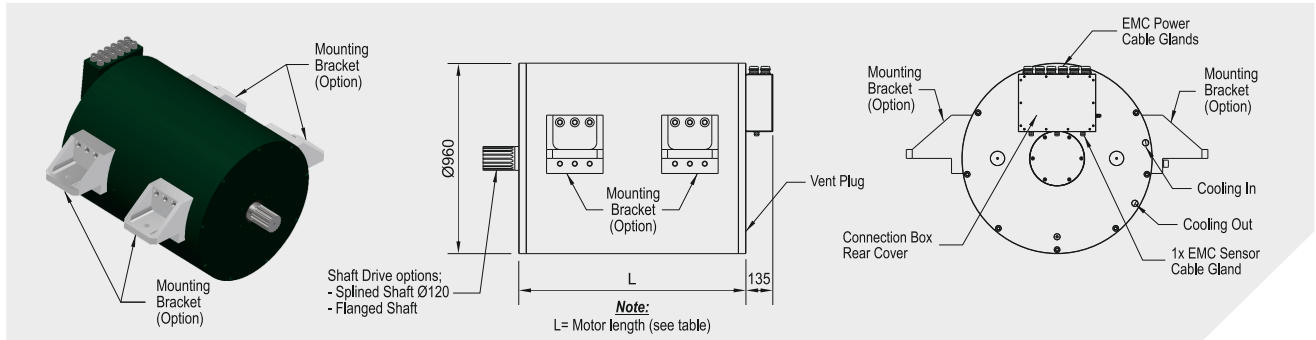
Specification EMG-590d-710l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=710mm	850	349	3918	524 757	415	97,5	HPI-450A
Weight: approx. 838kg	1000	404	3861	527 761	477	97,7	HPI-1000A
Cooling liquid flow: 30l/min	1500	617	3929	525 759	728	98,2	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	2000	830	3962	525 759	979	98,4	HPI-1000A

Specification EMG-590d-800l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=800mm	720	337	4466	517 747	406	97,3	HPI-450A
Weight: approx. 937kg	1020	467	4376	519 749	557	97,9	HPI-1000A
Cooling liquid flow: 30l/min	1280	596	4448	521 753	707	98,1	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	1720	814	4519	525 759	958	98,3	HPI-1000A

Mentioned nominal voltages and current matches a nominal DC Bus voltage of 768VDC which corresponds to a string of 8 GreenBatteries. Nominal voltages and currents will be adapted in case of string of 6 or 10 GreenBatteries.

Permanent Magnet Motor Generator

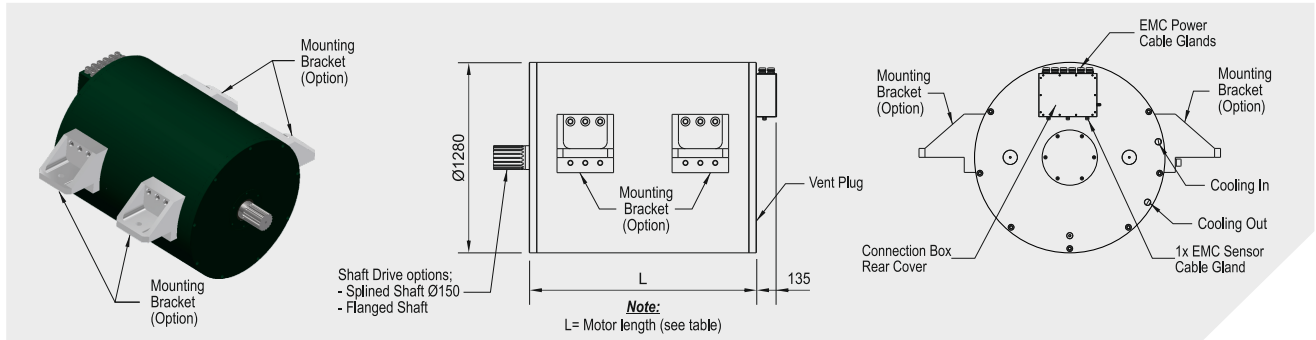
Features EMG-960d series: 3600Nm to 30500Nm



Specification EMG-960d-456l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=456mm Weight: approx. 1153kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	290	118	3899	522	748	165	93,8	HPI-450A
	760	298	3740	531	761	396	96,9	HPI-450A
	1145	446	3720	530	759	591	97,5	HPI-1000A
	1540	582	3608	530	758	763	97,7	HPI-1000A
Specification EMG-960d-606l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=606mm Weight: approx. 1701kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	290	248	8164	516	742	348	95,6	HPI-450A
	735	600	7791	511	735	827	97,6	HPI-1000A
	1140	903	7566	524	752	1203	97,9	HPI-2000A
	1520	1027	6452	511	733	1357	97,9	HPI-2000A
Specification EMG-960d-756l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=756mm Weight: approx. 2228kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	370	454	11725	517	742	622	96,9	HPI-1000A
	760	927	11643	526	756	1236	97,9	HPI-2000A
	1040	1149	10549	531	756	1484	98,0	HPI-2000A
	1500	1456	9268	500	721	1945	98,0	HPI-2000A
Specification EMG-960d-906l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=906mm Weight: approx. 2826kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	280	469	15996	525	754	638	96,5	HPI-1000A
	750	1195	15209	517	741	1612	98,0	HPI-2000A
	1140	1621	13578	514	731	2146	98,0	HPI-3000A
	-	-	-	-	-	-	-	-
Specification EMG-960d-1056l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1056mm Weight: approx. 3383kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	220	461	19998	517	742	638	96,1	HPI-1000A
	610	1185	18546	523	749	1569	97,9	HPI-2000A
	910	1665	17469	515	733	2211	98,0	HPI-3000A
	-	-	-	-	-	-	-	-
Specification EMG-960d-1206l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1206mm Weight: approx. 3941kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	185	454	23458	521	746	622	95,9	HPI-1000A
	360	900	23869	502	721	1268	97,4	HPI-2000A
	500	1195	22824	517	741	1612	97,8	HPI-2000A
	760	1762	22135	520	744	2341	98,0	HPI-3000A
Specification EMG-960d-1356l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1356mm Weight: approx. 4498kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	210	628	28579	519	745	869	96,3	HPI-1000A
	425	1214	27284	515	740	1654	97,7	HPI-2000A
	650	1712	25151	517	738	2276	98,0	HPI-3000A
	-	-	-	-	-	-	-	-
Specification EMG-960d-1506l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1506mm Weight: approx. 5056kg Cooling liquid flow: 50l/min Cooling liquid Inlet temp.: max. 40°C	220	736	31931	514	739	1018	96,6	HPI-2000A
	375	1195	30440	518	742	1612	97,6	HPI-2000A
	565	1747	29524	516	738	2341	98,0	HPI-3000A
	-	-	-	-	-	-	-	-

Mentioned nominal voltages and current matches a nominal DC Bus voltage of 768VDC which corresponds to a string of 8 GreenBatteries. Nominal voltages and currents will be adapted in case of string of 6 or 10 GreenBatteries.

Features EMG-1280d series: 9350Nm to 82700Nm



Specification EMG-1280d-480I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=480mm Weight: approx. 2182kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	235	254	10336	645	924	276	95,4	HPI-450A
	440	464	10074	658	946	482	97,3	HPI-1000A
	740	800	10320	662	951	827	98,0	HPI-1000A
	1125	1101	9344	657	954	1113	98,2	HPI-2000A
Specification EMG-1280d-660I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=660mm Weight: approx. 3371kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	220	486	21075	664	949	507	96,6	HPI-1000A
	415	888	20434	657	943	919	98,0	HPI-1000A
	675	1423	20132	663	955	1447	98,4	HPI-2000A
	1130	1912	16156	641	931	1909	98,4	HPI-2000A
Specification EMG-1280d-840I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=840mm Weight: approx. 4560kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	200	625	29846	649	941	652	97,1	HPI-1000A
	445	1472	31590	661	946	1522	98,3	HPI-2000A
	750	2226	28342	654	947	2250	98,5	HPI-3000A
	-	-	-	-	-	-	-	-
Specification EMG-1280d-1020I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1020mm Weight: approx. 5749kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	335	1478	42134	664	950	1522	98,1	HPI-2000A
	419	1847	42087	663	948	1900	98,3	HPI-2000A
	562	2360	40096	660	950	2400	98,5	HPI-3000A
	860	3047	33832	653	950	3000	98,5	HPI-3000A
Specification EMG-1280d-1200I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1200mm Weight: approx. 6938kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	190	1026	51558	660	946	1060	97,4	HPI-2000A
	450	2378	50466	661	951	2417	98,5	HPI-3000A
	680	3014	42319	646	939	3000	98,5	HPI-3000A
	-	-	-	-	-	-	-	-
Specification EMG-1280d-1380I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1380mm Weight: approx. 8127kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	205	897	41799	654	935	942	97,3	HPI-1000A
	420	1858	42252	665	952	1909	98,3	HPI-2000A
	845	2994	33834	642	933	3000	98,5	HPI-3000A
	-	-	-	-	-	-	-	-
Specification EMG-1280d-1560I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1560mm Weight: approx. 9316kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	190	1372	68943	654	941	1410	97,7	HPI-2000A
	315	2386	72335	652	934	2481	98,3	HPI-3000A
	490	3042	59291	652	947	3000	98,6	HPI-3000A
	-	-	-	-	-	-	-	-
Specification EMG-1280d-1740I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms) (Vdc)		Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=1740mm Weight: approx. 10505kg Cooling liquid flow: 60l/min Cooling liquid Inlet temp.: max. 40°C	210	1819	82697	665	951	1861	97,9	HPI-2000A
	430	3052	67777	654	950	3000	98,6	HPI-3000A
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-

Mentioned nominal voltages and current matches a nominal DC Bus voltage of 960VDC which corresponds to a string of 10 GreenBatteries. Nominal voltages and currents will be adapted in case of string of 6 or 8 GreenBatteries.

Vessel Management System



Power Management System



Fire Alarm System



CCTV Video Distribution



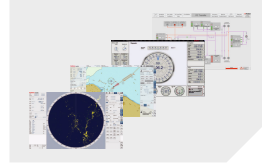
Ship Performance Monitor



Fleet Management System



Integrated Navigation System



Heading Control System



Propulsion Control System



Dynamic Positioning System



BNWAS Watch Alarm System



Navigation Light Control



Wiper Control System



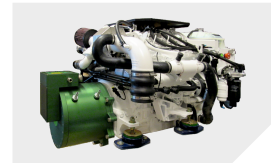
Energy Management System



GreenAzithruster



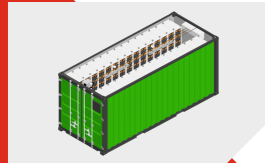
GreenGenerator



GreenInverter



GreenBattery Container



GreenBattery



GreenMotor



*Ship automation,
navigation and
electric propulsion*