

**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.

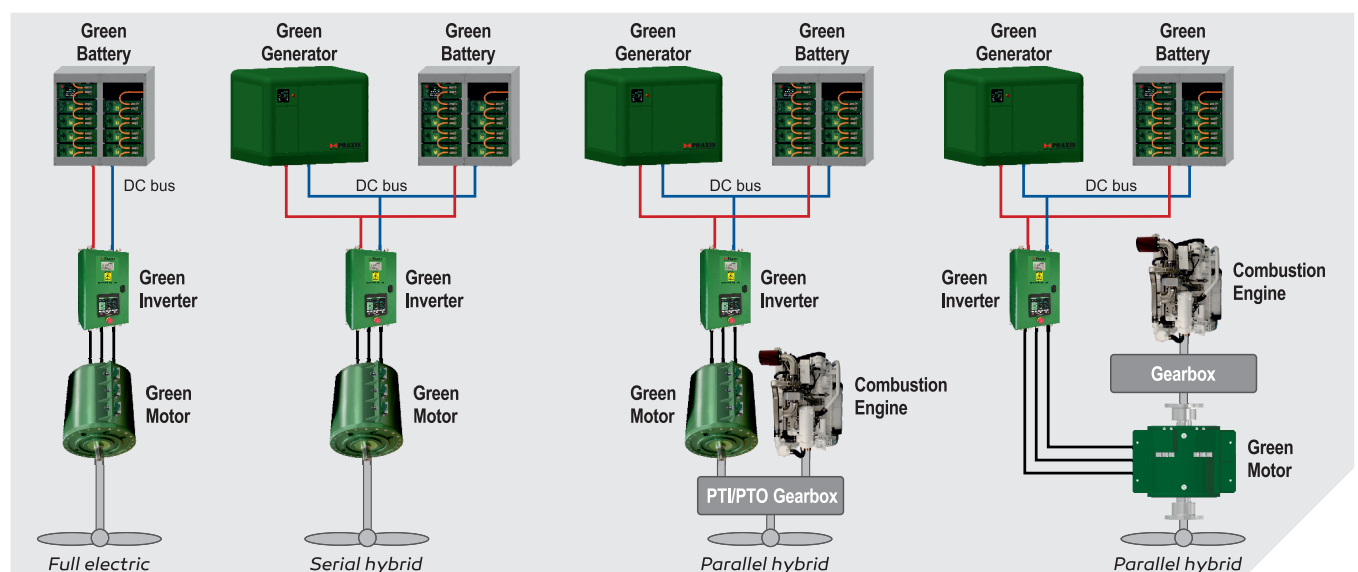
GreenMotor is controlled by other Mega-Guard products: GreenInverter, Propulsion Control System, Energy Management System and/or GreenGenerator. Various sizes of GreenMotor are available to suit all projects for full electric, serial hybrid or parallel hybrid propulsion.



## Sizes and options

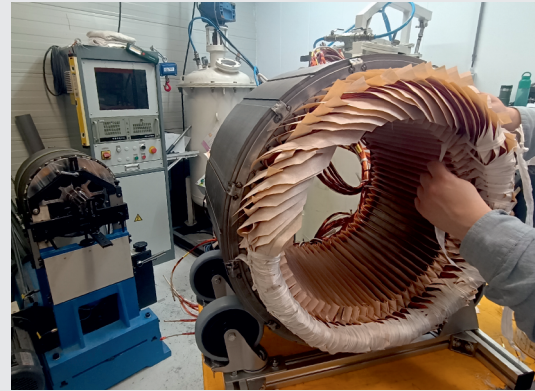
Mega-Guard GreenMotor is available in 4 different diameters and with variable length in order to suit propulsion applications ranging from 450Nm to 82700Nm (70kW to 3050kW depending on nominal RPM).

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	Marine propulsion and power generation: <ul style="list-style-type: none"> <li>- Low speed direct propeller drive</li> <li>- Medium speed hybrid gearbox drive (motor and generator)</li> <li>- Medium speed generator</li> <li>- Low speed direct propeller drive with high speed motor with built-in planetary gear</li> <li>- Low speed hybrid direct propeller drive with hollow shaft and mounted inline between propeller and combustion engine</li> </ul>
Type	Permanent magnet synchronous machine Torque motor/generator supporting sensor less control with nominal torque delivered in between 0 and maximum RPM
Construction	Lightweight due to efficient design and strong aluminium housing Aluminium alloy: 6082-T6 Finishing with green coating
Power ranges	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
Duty rating	Continuous
Cooling	Liquid cooled water/glycol. Maximum Inlet temperature: 40°C
Output shaft and bearings	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
Mounting	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.
Connection	Connection Box mounted on rear side AC cabling: A 95mm <sup>2</sup> EMC cable gland is installed for each 250A current in parallel IO cabling: EMC cable glands
Voltage Range	From 566VAC up to 700VAC supporting DC bus voltages from 768VDC to 960VDC Designed for a string of 8 or 10 GreenBatteries
Windings	Isolated windings: isolation test voltage > 2kV Thermal class H Each winding equipped with 2 temperature sensors Maximum winding temperature: 155°C
Heater	Optional heating element on drive side and non drive side
Testing	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
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



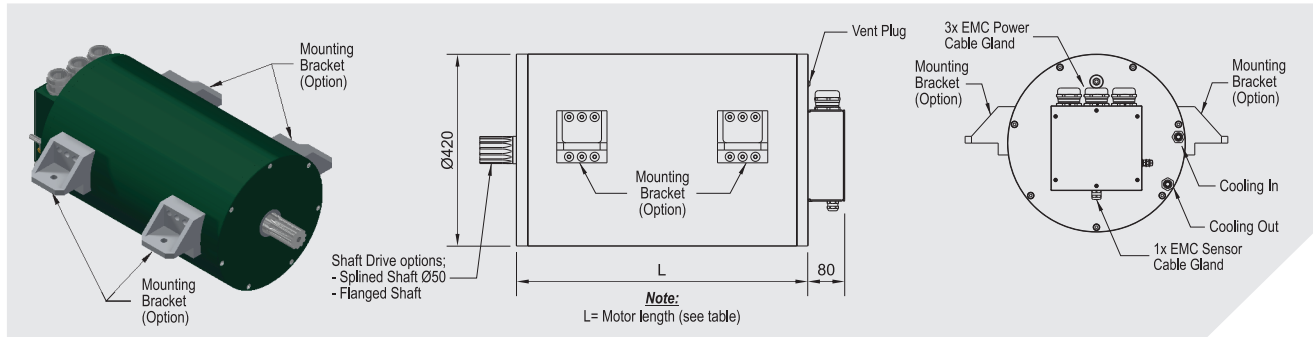
GreenMotor cooling tube milling



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	1000	58	551	528	757	74	94,3	HPI-225A
Weight: approx. 125kg	1740	97	534	528	760	122	96,3	HPI-225A
Cooling liquid flow: 16l/min	2500	134	512	524	757	167	97,0	HPI-225A
Cooling liquid Inlet temp.: max. 40°C	3540	177	476	522	758	217	97,5	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	124	1181	526	749	159	95,4	HPI-225A
Weight: approx. 198kg	1740	211	1158	529	756	265	96,9	HPI-450A
Cooling liquid flow: 16l/min	2500	283	1080	524	754	353	97,5	HPI-450A
Cooling liquid Inlet temp.: max. 40°C	3530	344	930	516	750	424	97,7	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	164	1738	519	741	212	95,6	HPI-225A
Weight: approx. 343kg	1650	294	1704	524	750	371	97,2	HPI-450A
Cooling liquid flow: 16l/min	2600	423	1552	521	751	525	97,8	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	3400	517	1452	523	759	631	97,9	HPI-1000A

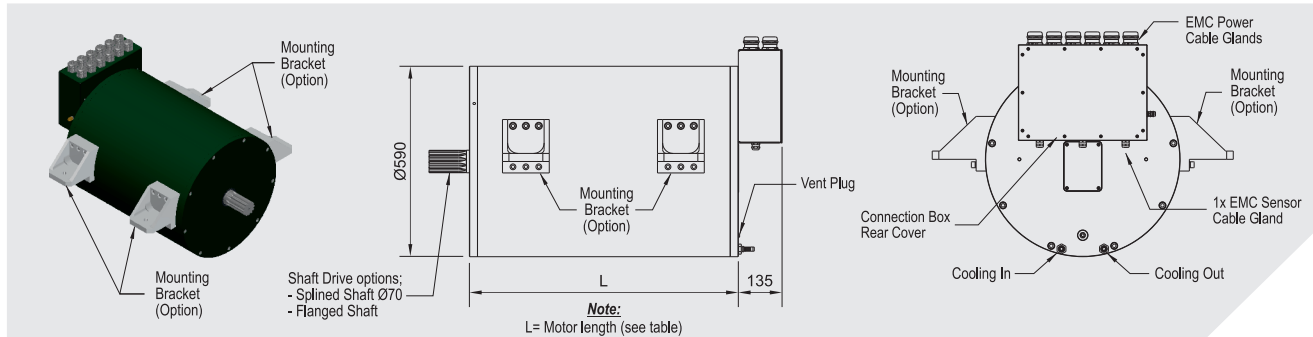
Specification EMG-420d-557l	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=557mm	960	220	2185	524	752	277	96,2	HPI-450A
Weight: approx. 417g	1720	385	2137	514	740	488	97,4	HPI-1000A
Cooling liquid flow: 16l/min	2200	456	1977	519	751	563	97,7	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	3000	559	1780	522	760	676	97,7	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	1200	339	2698	455	653	493	96,9	HPI-1000A
Weight: approx. 490g	1740	466	2555	520	751	583	97,5	HPI-1000A
Cooling liquid flow: 16l/min	2340	581	2372	518	751	721	97,7	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	3540	703	1897	507	740	865	97,6	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	381	3167	523	754	477	97,1	HPI-1000A
Weight: approx. 564kg	1670	526	3007	523	756	653	97,6	HPI-1000A
Cooling liquid flow: 16l/min	2350	712	2894	521	755	880	97,9	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	2950	808	2617	516	751	994	97,9	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-350I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	(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-395I	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-440I	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-530I	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-620I	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

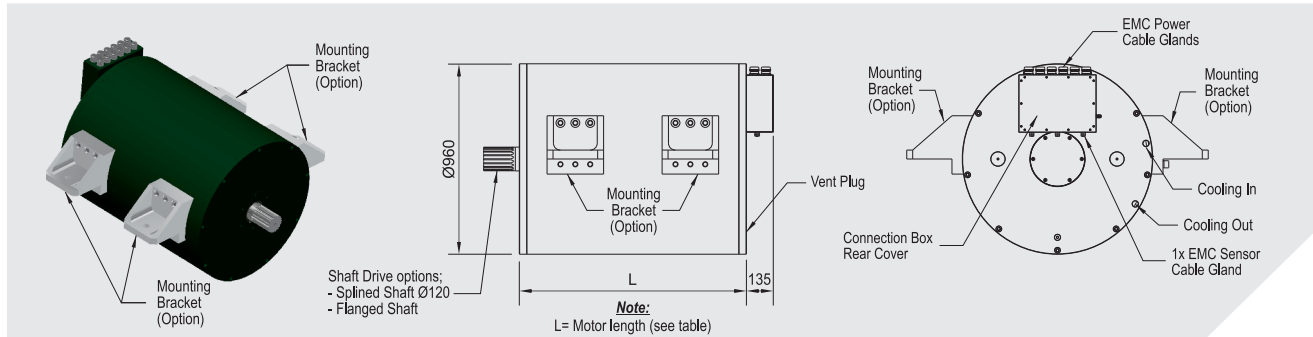
Specification EMG-590d-710I	Speed (RPM)	Cont. Motor Power (kW)	Cont. Torque (Nm)	Nom. Voltage (Vrms)	(Vdc)	Nom. Current (Arms)	Efficiency (%)	GreenInverter (Model)
Motor length: L=710mm	850	349	3918	524	757	415	97,5	HPI-450A
Weight: approx. 838kg	1000	404	3861	527	761	477	97,7	HPI-1000A
Cooling liquid 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-800I	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

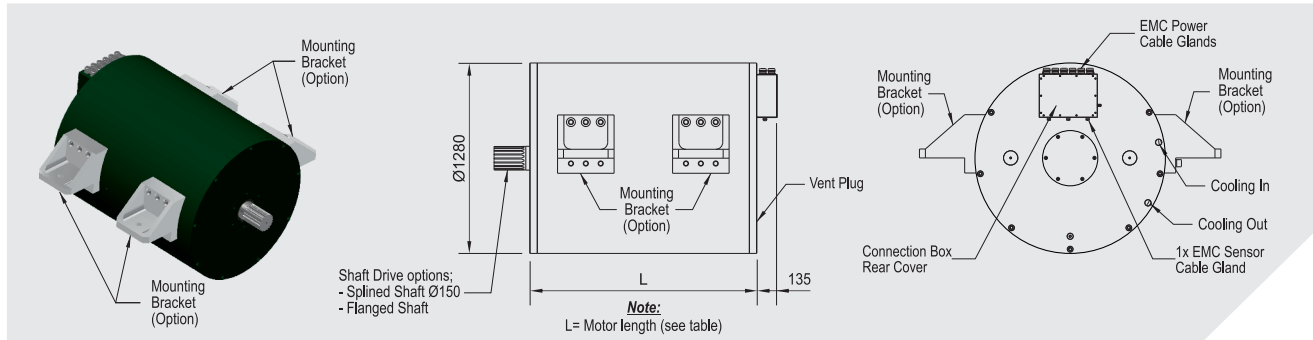
## Features EMG-960d series: 3600Nm to 30500Nm



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	290	118	3899	522	748	165	93,8	HPI-450A
Weight: approx. 1153kg	760	298	3740	531	761	396	96,9	HPI-450A
Cooling liquid flow: 50l/min	1145	446	3720	530	759	591	97,5	HPI-1000A
Cooling liquid Inlet temp.: max. 40°C	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	290	248	8164	516	742	348	95,6	HPI-450A
Weight: approx. 1701kg	735	600	7791	511	735	827	97,6	HPI-1000A
Cooling liquid flow: 50l/min	1140	903	7566	524	752	1203	97,9	HPI-2000A
Cooling liquid Inlet temp.: max. 40°C	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	370	454	11725	517	742	622	96,9	HPI-1000A
Weight: approx. 2228kg	760	927	11643	526	756	1236	97,9	HPI-2000A
Cooling liquid flow: 50l/min	1040	1149	10549	531	756	1484	98,0	HPI-2000A
Cooling liquid Inlet temp.: max. 40°C	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	280	469	15996	525	754	638	96,5	HPI-1000A
Weight: approx. 2826kg	750	1195	15209	517	741	1612	98,0	HPI-2000A
Cooling liquid flow: 50l/min	1140	1621	13578	514	731	2146	98,0	HPI-3000A
Cooling liquid Inlet temp.: max. 40°C	-	-	-	-	-	-	-	-
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	220	461	19998	517	742	638	96,1	HPI-1000A
Weight: approx. 3383kg	610	1185	18546	523	749	1569	97,9	HPI-2000A
Cooling liquid flow: 50l/min	910	1665	17469	515	733	2211	98,0	HPI-3000A
Cooling liquid Inlet temp.: max. 40°C	-	-	-	-	-	-	-	-
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	185	454	23458	521	746	622	95,9	HPI-1000A
Weight: approx. 3941kg	360	900	23869	502	721	1268	97,4	HPI-2000A
Cooling liquid flow: 50l/min	500	1195	22824	517	741	1612	97,8	HPI-2000A
Cooling liquid Inlet temp.: max. 40°C	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	210	628	28579	519	745	869	96,3	HPI-1000A
Weight: approx. 4498kg	425	1214	27284	515	740	1654	97,7	HPI-2000A
Cooling liquid flow: 50l/min	650	1712	25151	517	738	2276	98,0	HPI-3000A
Cooling liquid Inlet temp.: max. 40°C	-	-	-	-	-	-	-	-
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	220	736	31931	514	739	1018	96,6	HPI-1000A
Weight: approx. 5056kg	375	1195	30440	518	742	1612	97,6	HPI-2000A
Cooling liquid flow: 50l/min	565	1747	29524	516	738	2341	98,0	HPI-3000A
Cooling liquid Inlet temp.: max. 40°C	-	-	-	-	-	-	-	-

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

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



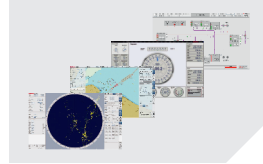
Ship Performance Monitor



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



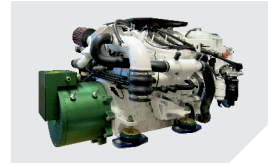
Energy Management System



GreenAzithruster



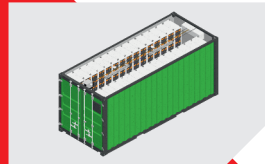
GreenGenerator



GreenInverter



GreenBattery Container



GreenBattery



GreenMotor



*Ship automation,  
navigation and  
electric propulsion*