

MarPower® SPC-II Shore Power Converters System Description

SAFEGUARDING ENERGY TO CRUISE THE WORLD



TOWER Model 36kVA
Dim.: 820 x 290 x 660 mm (HxWxD)
Weight: 110kg



DESKTOP model
120kVA + Interface module
Dim.: 1465x 800 x 660mm (HxWxD)
Total Weight: 490kg.



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1. Introduction to the MarPower SPC-II

Purpose This chapter introduces the MarPower SPC-II, and briefly describes highlights of the current release.

Overview The MarPower SPC-II is a highly flexible and ultra-compact system that converts worldwide available shore power supply into a reliable power source to safeguard quality of power aboard of yachts and mega yachts.

MarPower SPC-II Benefits **Ultra compact and lightweight**

A luxury yacht is not designed to be an engine room only. Therefore all equipment installed aboard serve purposes of convenience, comfort, safety, speed, etc. Electrical systems in particular are meant to fulfill these requirements and should therefore consume as little space as possible and should contribute to the weight as little as possible.
MarPower Shore Power Converter is an ultra compact and lightweight solution.

Proven technologies

Building a luxury yacht means striving for perfection. High quality of all onboard equipment is therefore a must.
MarPower Shore Power Converter uses components with the highest possible quality and proven technologies.

Plug-and-play modular design

Every square inch counts on a luxury yacht. Therefore electrical systems should be able to be installed flexibly without the need for more cables than necessary.
MarPower Shore Power Converter can be installed easily, quickly, and flexibly.

Instant upgrade path

During or after the construction phase of a luxury yacht power requirements grow. Sometimes structural, sometimes temporary. Nevertheless, more power should be able to be installed easily to fulfill the new power needs.
MarPower Shore Power Converter can be upgraded instantly through its modular design.

MarPower SPC-II Highlights

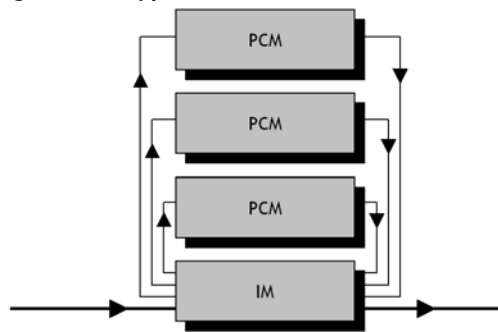
The highly reliable and modular plug-and-play design of the MarPower SPC-II helps to easily and flexibly install, operate and maintain shore power converter solutions. It allows economical growth plans in terms of supported power and functionality. Additionally, the MarPower SPC-II provides the following benefits:

- Provides power conditioning of input power;
- Provides galvanic isolation for optimal safety;
- Supports multiple shore cords from different dockside supplies;
- Supports a wide variety of input voltages and frequencies;
- Supports up to 150 kW / 187 kVA from a single system;
- Incorporates a modular design that easily expands with growth requirements;
- Incorporates a modular design to contribute to overall system reliability and availability;
- Low heat dissipation;
- Supports a variety of applications, including parallel operation with onboard generators (optionally);
- Supports single phase input operation (future planned option);

Diagram of Typical System

MarPower Shore Power Converter is a flexible and modular solution. Figure 1-1 shows a basic conversion system with a single shore cord input and a single connection towards the vessel.

Figure 1-1: Typical MarPower Shore Power Converter (SPC-II)



MarPower SPC-II PCM

The MarPower SPC-II Power Converter Module (PCM) is the core of the MarPower SPC-II. The PCM converts a wide variety of voltages and frequencies into electrical characteristics that are compatible with the vessel’s requirements. It also conditions incoming power to provide a clean and stable output. Refer to Paragraph 3, “ 3.2 *MarPower SPC-II Power Converter Module (PCM)*” for details on the Power Converter Module.

MarPower SPC-II IM

The MarPower SPC-II Interface Module (IM) allows system configurations consisting of more than one PCMs. It provides a safe and reliable way to distribute incoming power over individual PCMs and combines output power levels. When equipped with IM1 or IM1H the MarPower SPC-II supports single shore cord application. When equipped with IM2 or IM2H MarPower SPC-II supports two shore cord inputs. Flexible shore cord applications are supported with the IM12 Interface Module. Refer to Paragraph 3, “ 3.3 *MarPower SPC-II Interface Module (IM)*”, for details on the Interface Module.

2. Features

Purpose This chapter provides information on new MarPower SPC-II features as well as standard system features and functionality.

2.1 Standard Features of MarPower SPC-II

Voltage / Frequency Conversion	MarPower SPC-II converts a wide range of input voltages and frequencies into vessels' specific requirements.
Phase Rotation	MarPower SPC-II takes care of incorrect phase sequence coming from the shore.
Power Conditioning	Fluctuations in voltages and frequencies can potentially damage sensitive equipment aboard of the vessel. MarPower SPC-II stabilizes incoming power and provides a pure sine wave that protects equipment from damaging. Incoming power can either come from dock supply or from onboard generators during sea operation (optionally).
Galvanic Isolation	Adequate earthing provisions are essential to comply with safety regulations. Especially for non-ferro hull constructions proper earthing and grounding aspects are of major importance to prevent the hull from corrosion. With the application of high quality transformers in the PCM modules isolation between the shore and yacht is achieved.
Multiple cords	The MarPower SPC-II converts the variety of worldwide available voltages and frequencies from the shore into reliable power that is compatible with the vessel's infrastructure. When the available shore power from one outlet is not sufficient to fulfill the power requirements aboard, a second shore cord can be connected. These two shore cords do not need to be connected to the same shore power supply, but can come from different independent supplies.
Pre settable input current overload warning	In case shore power comes from an outlet with insufficient current rating a warning signal can be generated by the system if shore current exceeds a pre settable current level. By means of this warning signal loads can be "managed" (by the power management system) preventing shore fuses from tripping.
Output voltage trim	A control facility is provided to trim the output voltage within the range of: +15V / -10V.
MOD-bus	Remote management and control facilities are provided via the RS-485 interface supporting Modbus protocol.
Seamless Power Transfer	MarPower SPC-II support Seamless Power Transfer that takes care of controlling load transfers between generator and converters without power supply interruptions. The intelligent Seamless Power Transfer feature does not require extensive power management systems.
Parallel System Operation	MarPower SPC-II systems can be placed in parallel to enhance power levels aboard. It provides optimal system redundancy in case of an event and does not need additional wiring between individual systems.
Upgrade Path	Start-up costs and growth issues are addressed in the MarPower SPC-II modular design. Customers can purchase a cost-effective customized system that satisfies current power needs. The MarPower SPC-II expands to bring additional power capacity without increased footprint.

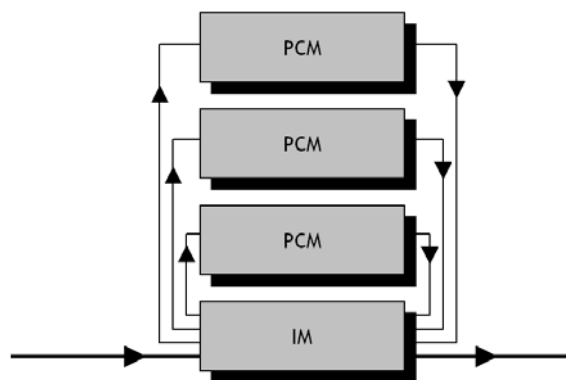
3. System Description

Purpose This chapter provides information on the functional theory of various operations and system components. The system functions and modules are described following the description of the system architecture and the physical design.

3.1 Basic MarPower SPC-II functional architecture

Simplified Block Diagram MarPower Shore Power Converter is a flexible and modular solution. Figure 3-1 shows a basic conversion system with a single shore cord input and a single connection towards the vessel.

Figure 3-1: Typical MarPower Shore Power Converter (SPC-II)



3.2 MarPower SPC-II Power Converter Module (PCM)

PCM Function MarPower SPC-II Power Converter Modules (PCMs) are required to interface electrical power between shore power supplies and the vessel's distribution systems. MarPower SPC-II PCMs convert the shore power characteristics to a clean signal before going to the vessel's distribution system.

MarPower SPC-II Power Converter Modules provide:

- Frequency conversion and stability;
- Voltage conversion and stability;
- Phase rotation capabilities;
- Galvanic isolation.

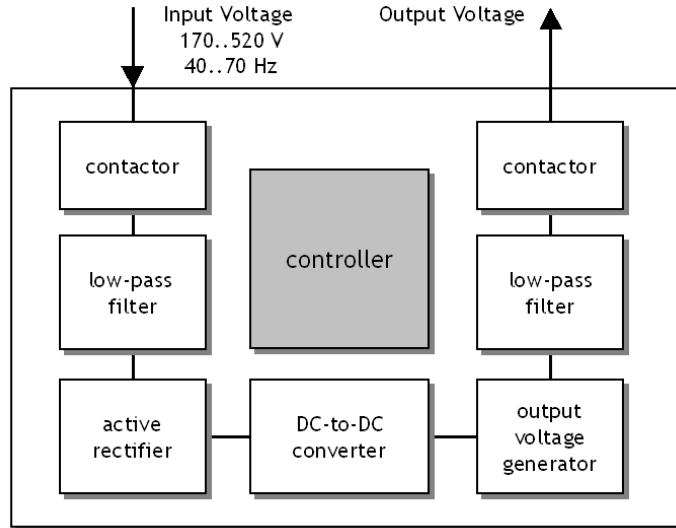
Types of PCM Modules MarPower SPC-II PCM modules are described below:

- *PCM20* supports three-phase inputs and provides 20kW of high quality three-phase output power.
- *PCM25* supports three-phase inputs and provides 25kW of high quality three-phase output power.
- *PCM30* supports three-phase inputs and provides 30kW of high quality three-phase output power.
- The available output voltages are for all modules 120V/208V (60Hz), 220V/380V (50Hz), 230V/400V (50Hz), and 240V/415V (50Hz).
- *Single-phase input is a future planned option.*

Functional Block Diagram

Figure 3-2, “Functional Block Diagram - PCM20, PCM25, and PCM30” shows a functional block diagram of the MarPower SPC-II Power Converter Module.

Figure 3-2: Functional Block Diagram - PCM20, PCM25, and PCM30



PCM Operation

Incoming power from the shore outlet or onboard generator passes a filter to minimize high frequency components. The AC signals supplied to the rectifier section are converted into DC power. After passing the DC-to-DC converter the DC power is again converted back into AC signals. Finally, the AC signal is again filtered to provide a pure sine wave to the vessel’s infrastructure.

The DC-to-DC converter of supreme quality provides galvanic isolation to secure the separation between input and output section of the converter module.

A centralized digital controller supervises the module and performs integrity checks.

Both the input and the output section are equipped with contactors.

Cooling fans are included to perform forced air-cooling.

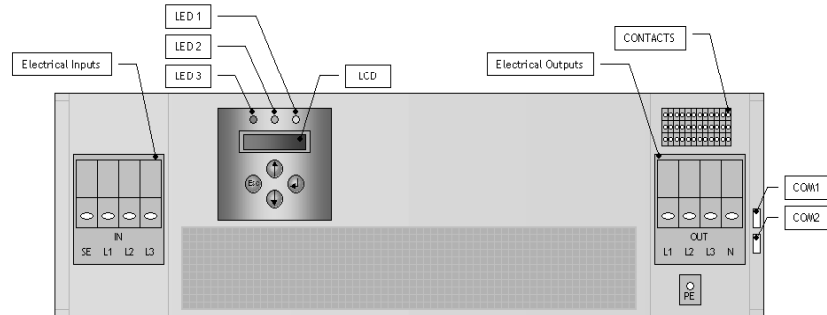
With a minimum of high quality “power conversion steps” overall system efficiency is optimized resulting in very low heat dissipation from no-load condition up to maximum-load conditions.

Maximum system efficiency is reached in the range from 70% - 80% of output power.

PCM Front Panel

Figure 3-3, “Front Panel - PCM20, PCM25, and PCM30” shows the front panel of the MarPower SPC-II Power Converter Module. Note that this figure shows the front after the removal of the front cover.

Figure 3-3: Front Panel - PCM20, PCM25, and PCM30



The figure depicted above shows the following items:

Electrical Interfaces

Cable connection interfaces for either towards the shore and vessel infrastructure or towards the MarPower Interface Module.

Remote Communications Interfaces

Although MarPower SPC-II operates autonomous communication with an external management system can be established via a Modbus-protocol transported over an RS-485 interface. Volt free contacts are also available for interfacing with onboard management systems.

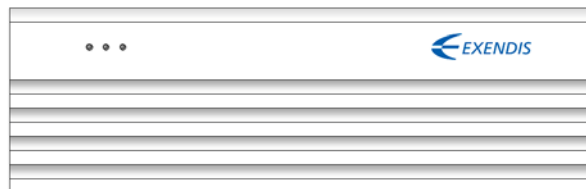
Local Communication Interfaces

LCD display for operational and maintenance purposes;
Three LED indicators providing status and alarm conditions.

PCM Front Cover

Figure 3-4, “Front Cover - PCM20, PCM25, and PCM30” shows the front cover of the MarPower SPC-II Power Converter Module.

Figure 3-4: Front Cover - PCM20, PCM25, and PCM30



The figure depicted above shows the following items:

- Three LED indicators proving status and alarm conditions;
- Air inlets;

3.3 MarPower SPC-II Interface Module (IM)

IM Function MarPower SPC-II Interface Modules (IMs) are the solution to distribute incoming power from one or two shore cords over multiple PCMs and to combine output power from multiple PCMs onto one system output cable.

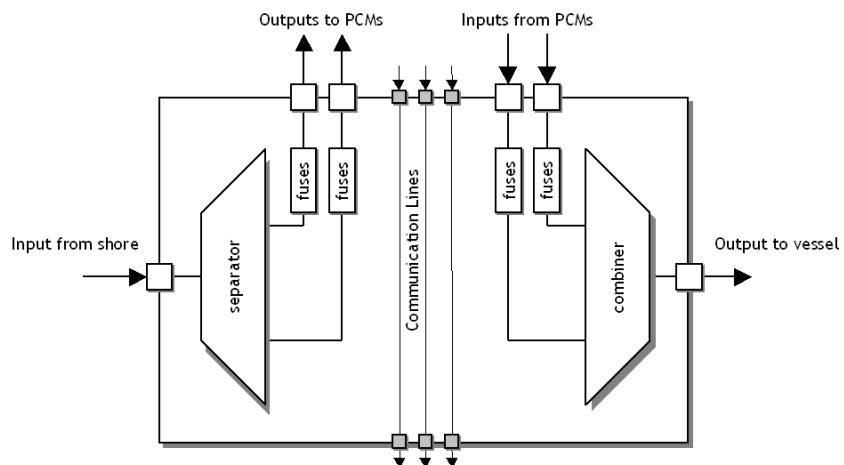
Types of IM Modules The MarPower SPC-II includes IM modules IM1, IM1H, IM2, IM2H, and IM12. These Interface Modules are described below:

- *IM1* and *IM1H* support a single cable input connection and support interconnections with up to three and five Power Converter Modules respectively;
- *IM2* and *IM2H* support dual cable input connections and support interconnections with up to three and five Power Converter Modules respectively;
- *IM12* supports both single and dual input cable connections (selectable by means of a switch) and support interconnections with up to three Power Converter Modules;

Note: All Interface Modules provide single secondary connections towards the vessel's installation.

Functional Block Diagram Figure 3-5, "Functional Block Diagram - IM1 supporting two PCMs" shows a functional block diagram of a typical MarPower SPC-II Interface Module. The Interface Module shown in this figure supports one shore connection cable, one connection towards the vessel's infrastructure, and two Power Converter Modules.

Figure 3-5: Functional Block Diagram - IM1 supporting two PCMs



IM Operation MarPower SPC-II IM modules provide internal electrical interfaces for interconnecting multiple Power Converter Modules and the possibility to disconnect (separate) each individual PCM from the system. This is especially handy for maintenance or service purposes.

The IM module operates without cooling.

The IM module can be installed in a early construction stage of the vessels and (when equipped with a input-output bypass) dockside power can be distributed

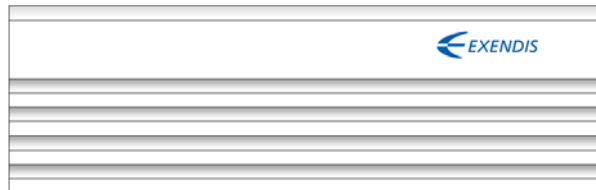
to vessels electrical systems.

Power Converter Module(s) can be installed in a later construction stage.

**IM Front Cover
IM1, IM2, IM12**

Figure 3-6, “*Front Cover - IM1, IM2, and IM12*” shows the front panel of the MarPower SPC-II Interface Module, IM1, IM2 and IM12.

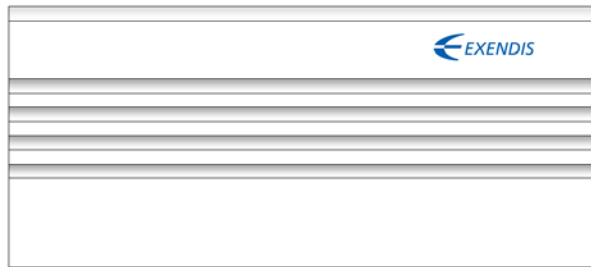
Figure 3-6: Front Cover - IM1, IM2, and IM12



**IM Front Cover
IM1H and IM2H**

Figure 3-7, “*Front Cover - IM1H and IM2H*” shows the front panel of the MarPower SPC-II Interface Module, IM1H and IM2H.

Figure 3-7: Front Cover - IM1H and IM2H



3.4 System control and management

Local Interfaces

Each MarPower SPC-II Power Converter Module provides information on the status of the module and relevant characteristics through an LCD display and three Light Emitting Diodes (LED).

The three supported Light Emitting Diodes located at the front of the PCM indicate the following information:

- System ON/OFF;
- Shore Power Available;
- Error indication.

The LCD display, implemented for local control for service and maintenance purposes, provides information on electrical input and output characteristics as well as information on the status of the system.

External Interfaces

Local and remote management and control facilities are provided via the RS-485 interface supporting Modbus protocol and potential free contacts.

4. Basic Configurations

- Purpose** This chapter provides information on the basic MarPower SPC-II configurations.
- Single Modules** MarPower SPC-II PCM modules as described in Paragraph: “3.2 MarPower SPC-II Power Converter Module (PCM)” can be purchased and installed as separate Shore Power Converter systems. These systems do not require to be installed in racks or cabinets but function as stand-alone systems. MarPower SPC-II PCM modules come with a modern front cover to cover up cables and connections and a converter mounting base. Single MarPower SPC-II PCM modules can be purchased as desktop or tower models.
- Combining Modules** All MarPower SPC-II modules as described in Paragraph: “3.2 MarPower SPC-II Power Converter Module (PCM)” and “ 3.3 MarPower SPC-II Interface Module (IM)” can be combined to configure converter systems providing the required output power levels above 30kW. These systems do not require to be installed in racks or cabinets but function as stand-alone systems. MarPower SPC-II PCM modules come with a modern front cover to cover up cables and connections and a converter mounting base.
- All supported modules can be mounted on top of each other and are mechanically Interconnected firmly to create a solid construction.
- Refer to Table 4-1 for factory Pre Configured MarPower SPC-II systems.

Table 4-1: Factory Pre Configured MarPower SPC-II systems

Configuration	System Capacity *	PCM	IM
MarPower SPC-II 20	20 kW	PCM20 (1)	IM1
MarPower SPC-II 25	25 kW	PCM25 (1)	IM1
MarPower SPC-II 30	30 kW / 37 kVA	PCM30 (1)	IM1
MarPower SPC-II 40	40 kW / 50 kVA	PCM20 (2)	IM1
MarPower SPC-II 50	50 kW / 62 kVA	PCM25 (2)	IM1 or IM2 or IM12
MarPower SPC-II 60	60 kW / 75 kVA	PCM30 (2)	IM1 or IM2 or IM12
MarPower SPC-II 75	75 kW / 93 kVA	PCM25 (3)	IM1 or IM2
MarPower SPC-II 90	90 kW / 112 kVA	PCM30 (3)	IM1 or IM2
MarPower SPC-II 120	120 kW / 150 kVA	PCM30 (4)	IM1H or IM2H
MarPower SPC-II 150	150 kW / 187 kVA	PCM30 (5)	IM1H or IM2H

* kVA rating @ $\cos \phi 0.8$ and $\geq 220V / 380V$, 3-phase output

- Note:** MarPower SPC-II systems with output power levels up to 30kW do only require Interface Modules IM1 to secure future upgrade capabilities. Although factory Pre Configured systems cover most applications Power Converter Modules and Interface Modules can be purchased separately.
- Note:** MarPower SPC-II providing 90kW can be equipped with Interface Modules IM1H, IM2H or IM12H to secure future upgrade capabilities.

5. Applications

Purpose This chapter contains the applications for the MarPower SPC. These topologies are available to users of the MarPower Shore Power Converter Series II.

Applications The MarPower SPC-II provides shore power supply conversion in support of various configurations. The applications of the MarPower SPC-II as described in this chapter are:

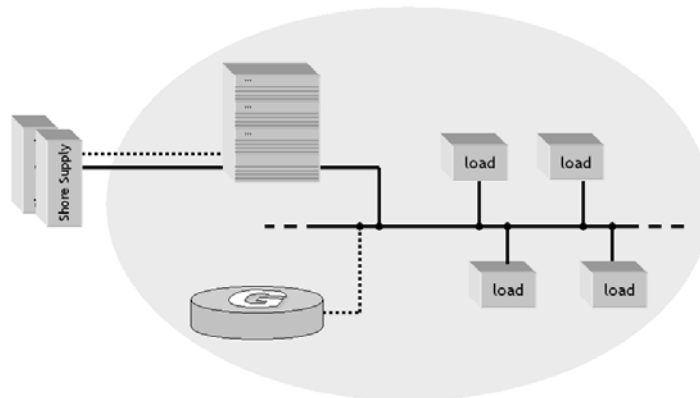
- Single System Operation
- Parallel System Operation
- Seamless Power Transfer

5.1 Single System Operation

Description

Figure 5-1, “Single MarPower SPC-II System Operation” shows a typical electrical installation on board of a yacht. The set up consists of one or more generators providing the vessel with power during sailing operation.

Figure 5-1: Single MarPower SPC-II System Operation



Note that for convenience reasons the second generator has been left out from the diagram.

During sailing operation the main busbar is provided with power from the onboard generators supplying the user loads of the required power. While hooked up with shore power the vessel electrical infrastructure is provided with power from one or more shore outlets.

The MarPower SPC-II converts the variety of worldwide available voltages and frequencies from the shore into reliable power that is compatible with the vessel’s infrastructure. When the available shore power from one outlet is not sufficient to fulfill the power requirements aboard, a second shore cord can be connected. These two shore cords do not need to be connected to the same shore power supply, but can come from different independent supplies.

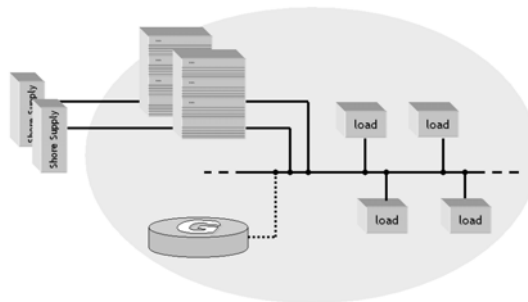
Incoming power is distributed internally over the individual MarPower Power Converter Modules (PCM) through the MarPower Interface Module (IM).

5.2 Parallel System Operation

Description

Figure 5-2, “Parallel MarPower SPC-II System Operation” shows a typical electrical installation on board of a yacht with high power requirements. Multiple MarPower SPC-II systems can be placed in parallel to enhance overall output power levels and to provide additional redundancy.

Figure 5-2: Parallel MarPower SPC-II System Operation



For installation purposes, i.e. from black-ship situation, one of the installed MarPower SPC-II Power Converter Module (PCM) is assigned as ‘Master’. After startup of the first MarPower SPC-II PCM all other PCM modules synchronize to the busbar voltage and frequency.

Under normal circumstances, i.e. when the busbar is powered up by generators Or one or more MarPower SPC-II PCM modules, each individual MarPower SPC-II act as a standalone system. Each individual MarPower SPC-II PCM can be connected or disconnected from the vessel’s infrastructure independently, even if the specific PCM module has been assigned as ‘Master’. The advantages of this feature are that:

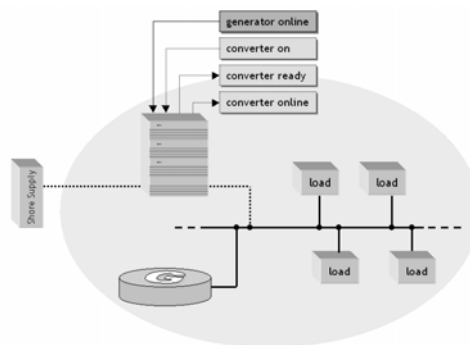
- paralleled MarPower SPC-II do not need interconnection wiring;
- failure of one MarPower SPC-II PCM does not affect the operation of the remaining modules (even in case of failure of the ‘Master’ PCM module).

5.3 Seamless Power Transfer

Sailing Operation

The Seamless Power Transfer feature enables yacht operators to transfer User power loads between generator(s) supply and shore supply without power interruptions. Figure 5-3, “*Seamless Power Transfer - Generator online*” shows the situation in which the generator provides the vessel with power. Also the appropriate I/O signals are given for the Seamless Power Transfer operation.

Figure 5-3: Seamless Power Transfer - Generator online

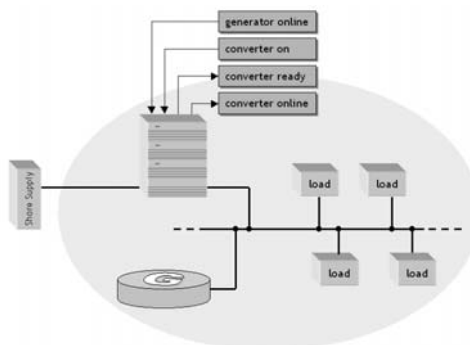


During sailing operation the MarPower SPC-II is notified that the generator supplies the required power load by the ‘generator online’ I/O signal. While docked the shore cords can be connected with the shore power outlets.

Temporary Parallel Operation

Figure 5-4, “*Seamless Power Transfer - Parallel operation*” shows the activated I/O signals and user commands during the second stage of the seamless power transfer operation.

Figure 5-4: Seamless Power Transfer - Parallel operation

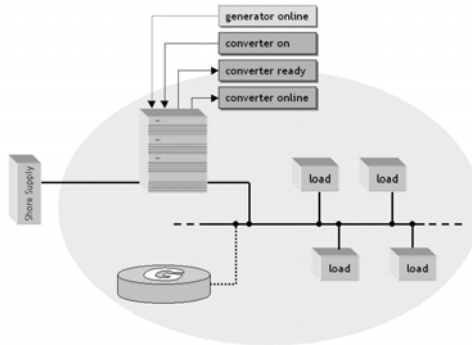


After the shore cord(s) have been connected with the Shore Supply outlet(s), the MarPower SPC-II activates the ‘converter ready’ signal. To be able to transfer the load from generator to the MarPower SPC-II the command ‘converter on’ has to be given by the yacht operator. This indicates the start of a temporary parallel operation phase during which both the generator and MarPower SPC-II provide power to the infrastructure. When the MarPower SPC-II has been able to synchronize with the generator voltage and frequency the load will be gradually transferred to the MarPower SPC-II and the ‘converter online’ signal is activated.

Shore Supply Operation

Figure 5-5, “Seamless Power Transfer - MarPower SPC-II online” shows the activated I/O signals and user commands during the final stage of the seamless power transfer operation.

Figure 5-5: Seamless Power Transfer - MarPower SPC-II online



The Seamless Power Transfer operation has been completed after the yacht operator has deactivated the ‘generator online’ command.

Note:

Seamless Power Transfer operation as described above is applicable to the situation user loads are transferred from the generator to the MarPower SPC-II system. Transferring user loads from the MarPower SPC-II to the generator can also be achieved seamlessly.

6. Technical Data

Purpose This chapter contains the technical specifications for the MarPower SPC.

6.1 Standards, Rules and Regulations

Standards EXENDIS MarPower SPC-II products are designed according to the relevant sections of the following standards:

IEC 60092 series	Electrical installations in ships
IEC 60529	Degrees of protection provided by enclosures
EN 50160	Voltage characteristics of electricity supplied by public distribution systems
EN 50091-2	Uninterrupted Power Systems (UPS); Part 2: EMC Requirements
ANSI C84.1	Electric Power Systems and Equipment - Voltage Ratings (60 Hz)
IEC 50178	Electronic equipment for use in power installations
IEC 945	Marine navigational equipment; General requirements; Methods of testing and required test results
IEC 61000-3-3	Electromagnetic compatibility (EMC); Part 3-3: Limits; Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
EN 61000-3-4	Electromagnetic compatibility (EMC); Part 3-4: Limits; Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A
IEC 61000-4-3	Electromagnetic compatibility (EMC); Part 4-3: Testing and measurement techniques; Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-2	Electromagnetic compatibility (EMC); Part 4-2: Testing and measurement techniques; Electrostatic discharge immunity test

Regulations EXENDIS MarPower SPC-II products are designed according to the relevant sections of the following regulations:

Rules and Regulations for the Classification of Ships from Lloyd's Register

6.2 Technical specifications

Purpose This section provides detailed technical specifications for the MarPower SPC-II including electrical, physical, data interface, reliability, environmental, and EMC specifications.

6.2.1 Electrical Specifications

MarPower PCM20, PCM25, PCM30 Refer to Table 6-1 for the electrical specifications for MarPower Power Converter Modules PCM20, PCM25, PCM30

Table 6-1: Electrical specifications for PCM20 - PCM25 - PCM30 modules

Characteristic	Value/Range 20kW / 25kVA	Value/Range 25kW / 31kVA	Value/Range 30kW / 37 kVA
Input voltage range	170 V to 520 V (3-phase) **		
Input frequency range	40 Hz to 70 Hz		
Output power	20 kW / 25 kVA *	25 kW / 31 kVA *	30 kW / 37 kVA *
Output voltage	Nominal voltages are from 120 V / 208 V 3ph. /N /PE to 240 V / 415 V 3ph. /N /PE Values are $\pm 1\%$ ***		
Output frequency	Nominal frequencies are 50 Hz or 60 Hz. Values are $\pm 0,1$ Hz ***		
Efficiency	Typical 92%	Typical 93%	Typical 94%
Power Factor	No restrictions		
Overload capabilities	120% during 15 min.		

* @ $\cos \varphi 0.8$ and $\geq 220V / 380V$, 3-phase output.

** power derating @ 170 - 190V input.

*** excluding the voltage and frequency droop.

6.2.2 Power Converter Module Output Voltages

Output Voltages Refer to Table 6-2 for the supported output voltages for MarPower Power Converter Modules PCM30.

Table 6-2: Supported nominal output voltages for PCM[XY] modules

Code	Single Phase	Three Phase
PCM[XY]01	120 V	208 V
PCM[XY]02	220 V	380 V
PCM[XY]03	230 V	400 V
PCM[XY]04	240 V	415 V

Electrical Specifications Refer to Table 6..1 "Electrical Specifications".
These output power levels in kW and kVA is met for all supported output voltages $\geq 220V / 380V$, 3-phase output @ $\cos \varphi 0.8$.

For a 120V / 208V output the kW and kVA rating is equal, meaning 20kW / 20kVA, 25kW / 25kVA or 30kW / 30kVA.

Note: The vessel's electrical infrastructure determines the power factor, which is the quotient between the apparent and active power measured in kVA and kWatt respectively. For electrical installations comprising of a relatively large amount of motor driven equipment, the power factor drops to values as low as 0.80. Whereas for clean installations the power factor comes close to unity. Regardless of the power factor of the onboard electrical installation and the output voltage, the output power equals the value as specified in the relevant section mentioned above.

6.2.3 Physical Dimensions and Weight

MarPower PCM20,
PCM25, PCM30

Refer to Table 6-3 for the physical dimensions and specifications for MarPower Converter Modules PCM[xy].

Table 6-3: Physical dimensions and specifications for PCM20 - PCM25 - PCM30 modules

Parameter	Value
Width	800 mm (31.50 inch)
Depth *	600 mm (23.62 inch)
Height	255 mm (10.04 inch)
Weight	110 kg (242 lb)

MarPower IM1, IM2,
IM12

MarPower SPC-II Interface Modules IM1, IM2, and IM12 support interconnections with up to three Power Converter Modules.

Refer to Table 6-4 for the physical dimensions and specifications for MarPower Interface Modules IM1, IM2, and IM12.

Table 6-4: Physical dimensions and specifications for IM1, IM2, and IM12 modules

Parameter	Value
Width	800 mm (31.50 inch)
Depth *	600 mm (23.62 inch)
Height	255 mm (10.04 inch)
Weight	30 kg (66 lb)

MarPower IM1H, IM2H

MarPower SPC-II Interface Modules IM1H, IM2H, and IM12 support interconnections with up to five Power Converter Modules. Refer to Table 6-5 for the physical dimensions and specifications for MarPower Interface Modules IM1H and IM2H.

Table 6-5: Physical dimensions and specifications for IM1H and IM2H modules

Parameter	Value
Width	800 mm (31.50 inch)
Depth *	600 mm (23.62 inch)
Height	350 mm (13.78 inch)
Weight	40 kg (88 lb)

* Dimension without front cover.

MarPower pedestal and
Top Cover

MarPower SPC-II Pre Configured Systems are equipped with a Pedestal and Top Cover(s) . Refer to Table 6-6 for the physical dimensions and specifications for MarPower Pedestal and Cover(s).

Table 6-6: Physical dimensions for Pedestal and Top Cover

Parameter	Value
Width Pedestal	800 mm (31.50 inch)
Top Cover	dito
Depth Pedestal	600 mm (23.62 inch)
Top Cover	dito
Height Pedestal	60 mm (2.36 inch)
Top Cover	35 mm (1.38 inch)
Weight Pedestal + Top Cover	10 kg (22 lb)

6.2.4 Environmental Specifications

Operating Conditions Refer to Table 6-7 for the normal environmental conditions under which the MarPower SPC-II is designed to operate.

Table 6-7: MarPower SPC-II Environmental Operating Conditions

Parameter	Specification
Normal Operating Temperature Range	0 °C to +45 °C (+32 °F to +113 °F)
Short-term Operating Temperature Range	0 °C to +50 °C (+113 °F to +122 °F)
Normal Operating Humidity Range	<99% non-condensing

6.2.5 Handling and Transportation Specifications

Handling and Transportation Refer to Table 6-8, “MarPower SPC-II Handling and Transportation Conditions” for the handling and transportation conditions that apply to the MarPower SPC-II.

Table 6-8: MarPower SPC-II Handling and Transportation Conditions

Parameter	Specification
Vibration and Shock	Compliant with Lloyds
Temperature (Storage)	-25 °C to +70 °C (-13 °F to 158 °F)
Humidity (Storage)	<99% non-condensing

6.2.6 Power Dissipation

Power Dissipation Refer to Table 6-9, “MarPower SPC-II Module Power Dissipation” for the power dissipations of the MarPower SPC-II modules. These values are based on module power dissipations for normal operating temperature and average and full activity respectively.

Table 6-9: MarPower SPC-II Module Power Dissipation

Module	Power Dissipation (Watts)		
	No-load	Average (70% - 80%)	Full
PCM20	700	1025	1700
PCM25	700	1200	1850
PCM30	700	1375	2000
IM	2	7	12

6.2.7 Reliability Specifications

Module Failure Rates Refer to Table 6-10, “MarPower SPC-II Module Failure Rates” for MarPower SPC-II module failure rates.

Table 6-10: MarPower SPC-II Module Failure Rates

Module	MTBF (hrs)
PCM20	30,000
PCM25	30,000
PCM30	30,000
IM1, IM2, IM12	100,000
IM1H, IM2H	100,000

Appendix 1: Pre-Configured MarPower SPC-II Systems - Physical Dimensions

Physical Dimension Refer to Table A for an overview of the physical dimensions and specifications of MarPower SPC II System Description V3.1_041006.doc

the pre-configured MarPower SPC-II systems.

Table A: Physical Dimensions and Specifications Pre-Configured MarPower SPC-II Systems

Pre-configured MarPower Shore Power Converter systems					
Configuration	Power (kW / kVA ^{***})	Model	Input Cords	Dimensions H x W x D (mm)	Weight (kg)
MarPower SPC-II 20					
MP20C1S1 (1) MarPower PCM20	20 / 25	Tower	1	820 x 290 x 660	110
MP20C2S1 * (1) MarPower PCM20 (1) MarPower IM1	20 / 25	Desktop	1	605 x 800 x 660	150
MarPower SPC-II 25					
MP25C1S1 (1) MarPower PCM25	25 / 31	Tower	1	820 x 290 x 660	110
MP25C2S1 * (1) MarPower PCM25 (1) MarPower IM1	25 / 31	Desktop	1	605 x 800 x 660	150
MarPower SPC-II 30					
MP30C1S1 (1) MarPower PCM30	30 / 37	Tower	1	820 x 290 x 660	110
MP30C2S1 * (1) MarPower PCM30 (1) MarPower IM1	30 / 37	Desktop	1	605 x 800 x 660	150
MarPower SPC-II 40					
MP40C2S1 (2) MarPower PCM20 (1) MarPower IM1	40 / 50	Desktop	1	860 x 800 x 660	260
MP40C2S2 (2) MarPower PCM20 (1) MarPower IM12 or IM2	40 / 05	Desktop	1 / 2	860 x 800 x 660	260
MarPower SPC-II 50					
MP50C2S1 (2) MarPower PCM25 (1) MarPower IM1	50 / 62	Desktop	1	860 x 800 x 660	260
MP50C2S2 (2) MarPower PCM25 (1) MarPower IM12 or IM2	50 / 62	Desktop	1 / 2	860 x 800 x 660	260
MarPower SPC-II 60					
MP60C2S1 (2) MarPower PCM30 (1) MarPower IM1	60 / 75	Desktop	1	860 x 800 x 660	260
MP60C2S2 (2) MarPower PCM30 (1) MarPower IM12 or IM2	60 / 75	Desktop	1 / 2	860 x 800 x 660	260
MarPower SPC-II 75					
MP75C3S1 (3) MarPower PCM25 (1) MarPower IM1	75 / 93	Desktop	1	1115 x 800 x 660	370
MP75C3S2 (3) MarPower PCM25 MarPower IM12 or IM2	75 / 93	Desktop	1 / 2	1115 x 800 x 660	370

Pre-configured MarPower Shore Power Converter systems (continued)					
Configuration	Power (kW / kVA ^{***})	Model	Input Cords	Dimensions H x W x D (mm)	Weight (kg)
MarPower SPC-II 90					
MP90C3S1 (3) MarPower PCM30 (1) MarPower IM1	90 / 112	Desktop	1	1115 x 800 x 660	370
MP90C3S2 (3) MarPower PCM30 (1) MarPower IM12 or IM2	90 / 112	Desktop	1 / 2	1115 x 800 x 660	370
MarPower SPC-II 120					
MP120C4S1 (4) MarPower PCM30 (1) MarPower IM1H	120 / 150	Desktop	1	1465 x 800 x 660	490
MP120C4S2 (4) MarPower PCM30 MarPower IM2H	120 / 150	Desktop	2	1465 x 800 x 660	490
MarPower SPC-II 150					
MP150C5S1 (5) MarPower PCM30 (1) MarPower IM1H	150 / 187	Desktop	1	1720 x 800 x 660	600
MP150C5S2 (5) MarPower PCM30 (1) MarPower IM2H	150 / 187	Desktop	2	1720 x 800 x 660	600
*** @ cos phi 0,8 ≥ 220V /380V, 3 phase output					

* For future upgrade purposes

Note: the pre-configured MarPower Shore Power Converter systems as described in the table above are based on one (1) or (2) two input cords and (1) output connection towards the yacht's switch board. Please inquire about alternative and vessel specific applications requiring more than two (2) input connections (applicable for systems of 90kVA and above) or more than (1) output connection (applicable for systems of 60kVA and above).

Appendix 2: Pre-Configured MarPower SPC-II Systems - Installation Specification

Installation Specifications Refer to Table B for an overview of the application specifications of the pre-configured MarPower SPC-II systems.

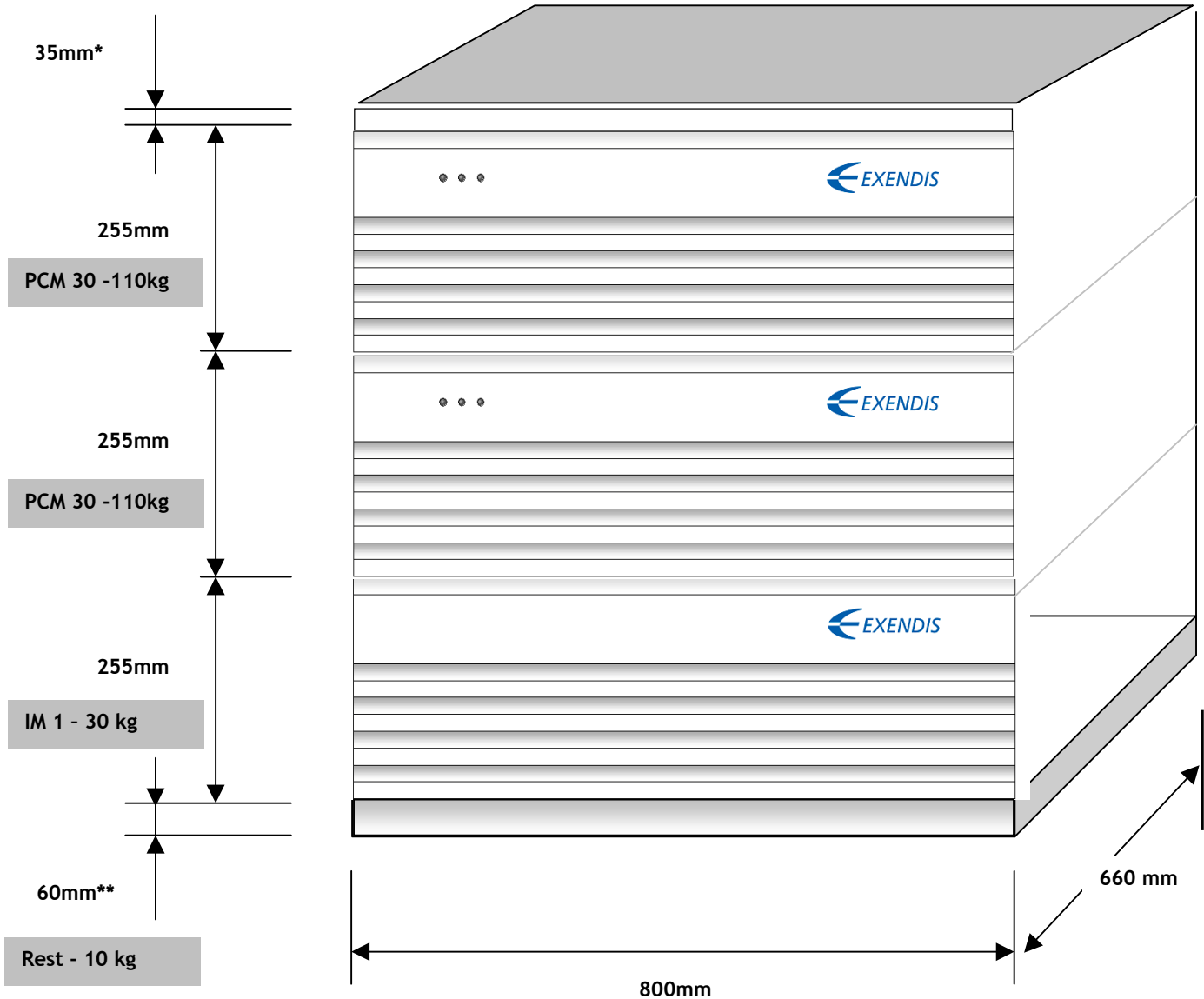
Table B: Input Currents and Environmental Specifications Pre-Configured MarPower SPC-II Systems

Pre-configured MarPower Shore Power Converter systems				
Configuration	Maximum Input Current	Cooling Air Volume (m³/h)	Minimum air inlet/outlet (cm²)	Clearance distance rear / front (cm)
MarPower SPC-II 20				
MP20C1S1	62A @ 208V	370	400	15 / 15
(1) MarPower PCM20	32A @ 400V			
MP20C2S1 *	62A @ 208V	370	400	15 / 15
(1) MarPower PCM20	32A @ 400V			
(1) MarPower IM1				
MarPower SPC-II 25				
MP25C1S1	77A @ 208V	370	400	15 / 15
(1) MarPower PCM25	40A @ 400V			
MP25C2S1 *	77A @ 208V	370	400	15 / 15
(1) MarPower PCM25	40A @ 400V			
(1) MarPower IM1				
MarPower SPC-II 30				
MP30C1S1	92A @ 208V	370	400	15 / 15
(1) MarPower PCM30	46A @ 400V			
MP30C2S1 *	92A @ 208V	370	400	15 / 15
(1) MarPower PCM30	46A @ 400V			
(1) MarPower IM1				
MarPower SPC-II 40				
MP40C2S1	128A @ 208V	750	800	15 / 15
(2) MarPower PCM20	64A @ 400V			
(1) MarPower IM1				
MP40C2S2	128A @ 208V	750	800	15 / 15
(2) MarPower PCM20	64A @ 400V			
(1) MarPower IM2				
MarPower SPC-II 60				
MP60C2S1	184A @ 208V	750	800	15 / 15
(2) MarPower PCM30	92A @ 400V			
(1) MarPower IM1				
MP60C2S2	184A @ 208V	750	800	15 / 15
(2) MarPower PCM30	92A @ 400V			
(1) MarPower IM2				
MarPower SPC-II 75				
MP75C3S1	239A @ 208V	1200	1200	15 / 15
(3) MarPower PCM25	120A @ 400V			
(1) MarPower IM1				
MP75C3S2	239A @ 208V	1200	1200	15 / 15
(3) MarPower PCM25	120A @ 400V			
(1) MarPower IM2				

Pre-configured MarPower Shore Power Converter systems					(Continued)
MarPower SPC-II 90					
MP90C3S1	276A @ 208V	1200	1200	15 / 15	
(3) MarPower PCM30	138A @ 400V				
(1) MarPower IM1					
MP90C3S2	276A @ 208V	1200	1200	15 / 15	
(3) MarPower PCM30	138A @ 400V				
(1) MarPower IM2					
MarPower SPC-II 120					
MP120C4S1	368A @ 208V	1400	1600	20 / 20	
(4) MarPower PCM30	184A @ 400V				
(1) MarPower IM1H					
MP120C4S2	368A @ 208V	1400	1600	20 / 20	
(4) MarPower PCM30	184A @ 400V				
(1) MarPower IM2H					
MarPower SPC-II 150					
MP150C5S1	460A @ 208V	1900	2000	25 / 25	
(5) MarPower PCM30	230A @ 400V				
(1) MarPower IM1H					
MP150C5S2	460A @ 208V	1900	2000	25 / 25	
(5) MarPower PCM30	230A @ 400V				
(1) MarPower IM2H					

Note: the pre-configured MarPower Shore Power Converter systems as described in the table above are based on one (1) or (2) two input cords and (1) output connection towards the yacht's switch board. Please inquire about alternative and vessel specific applications requiring more than two (2) input connections (applicable for systems of 90kVA and above) or more than (1) output connection (applicable for systems of 60kVA and above).

Appendix 3: Dimension example of Pre-Configured MarPower SPC-II Systems



MarPower ® SPC II 75 kVA system ***

*Cover height: 35 mm
 **Pedestal: height: 60 mm.
 *** @ cos phi 0,8 ≥ 220V /380V, 3-phase output